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Editors of the original Russian texts
N.M. Andjievskaya
T.V. Romanenko

Issuing Editor
Y.A. Zhuravleva

Designer
I.P. Gemueva

Russian texts translated by
V.A. Baranov
A.A. Evteev
E.Y. Pankeyeva
V.S. Peysakhovich

English texts revised by
L. Baranova
P. Magnussen

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V.S. Zykina[1], V.S. Zykin[1, 2], A.O. Volvakh[1], L.G. Smolyaninova[1], and I.Y. Ovchinnikov[1]

[1]Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia
E-mail: zykina@igm.nsc.ru; zykin@igm.nsc.ru; sizikova@igm.nsc.ru; smol@igm.nsc.ru; ivovchinnikov@igm.nsc.ru
[2]Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia

The Loess-Paleosol Sequence at the Krasnogorskoye Section, the Low-Hill Zone of the Northeastern Altai Mountains

The loess-paleosol sequence of the Krasnogorskoye section in the low-altitude area of the northeastern Altai Mountains can provide a yardstick for estimating the age of the Paleolithic sites, and reconstructing environmental and climatic changes. Its correlation with the similar sequence of the southern part of the West Siberian Plain is evaluated. Five pedocomplexes are studied in detail, evidencing the evolution of the Middle and Late Pleistocene soil formation from the Shadrikha interglacial to the Karga interstadial. Buried soils of the Shadrikha, Shipunovo, Koinikha, and Kazantsevo warm stages were formed under a climate that was warmer and more humid than today's. After the Kazantsevo interglacial, both the range and the frequency of climatic oscillations show marked changes. It is demonstrated that the warm stages of this interval differ from the earlier ones by lesser warming and shorter duration, by a cooler and more arid climate. Seven loess horizons dividing pedocomplexes are established. Nonmetric and metric analyses of quartz sand grains support the eolian origin of loess horizons under cryoarid conditions. The size of grains in the Late Pleistocene portion of the Krasnogorskoye section attests to the intensification of the loess processes. Higher magnetic susceptibility during the cool stages, and higher frequency-dependent susceptibility during the warm stages evidence marked climatic oscillations. After the Kazantsevo interglacial, the amplitude diminishes, and the pattern of paleoclimatic signal recorded by the magnetic properties of loess and paleosol in the section is close to the "Alaskan" type.

Keywords: *Loess-paleosol sequence, Western Siberia, paleosols, Pleistocene, paleoclimate, stratigraphy.*

Introduction

The discovery of chronologically diverse archaeological sites in the Altai Mountains makes the study of Quaternary deposits in that region highly relevant in the archaeological context. The most complete and widely distributed among these are loess deposits. Their analysis helps to evaluate the chronology of Paleolithic sites and to assess the environmental and climatic changes affecting Paleolithic society and its culture (Derevianko, Shunkov, Bolikhovskaya et al., 2005; Derevianko, Markin, Zykin et al., 2013; Zykin et al., 2005; Zykina, Zykin, 2012).

In the piedmont and low-hill areas of the northeastern Altai Mountains, loess-soil sediments have been studied along the Katun and Biya rivers, their tributaries,

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and on mountain slopes. On mountain slopes, the thickness of these formations varies from 6 to 16 m, while on terraces it reaches 26 m. Stratigraphic subdivision and paleogeographic reconstructions were based on the results of multidisciplinary studies, including paleopedology, sedimentology, geomorphology, and radiocarbon and paleomagnetic analyses. Krasnogorskoye section (Fig. 1) is the most representative among the examined loess-soil sections of the Altai Mountains. Five pedocomplexes and seven loess horizons underlying modern soil have been recorded there. A consistent correlation of Krasnogorskoye pedocomplexes and loesses with horizons of the reference loess sequence of Western and Central Siberia (Zykina, Zykin, 2012) in the respective morpho-typological indicators has allowed us to single out the Iskitim (MIS 3) and Berdsk (MIS 5c, e) pedocomplexes of the Upper Pleistocene, and Koinikha (MIS 7), Shipunovo (MIS 9), and Shadrikha (MIS 11) pedocomplexes as representing the Middle Pleistocene.

For the first time, the Krasnogorskoye section was correlated with that of Dolní Věstonice, Moravia, to address the issue of opposite models of magnetic susceptibility and to evaluate nonmagnetic pedological indicators in the loess and soil sequence (Babek, Chlachula, Grugar, 2011). Stratigraphic subdivision of the section was considered within the range of the Late (MIS 2 to MIS 5) and Middle (MIS 6) Pleistocene on the analogy with the Dolní Věstonice section. Our studies have provided important information on the structure of the section, allowing us to reconstruct the formation of loesses and soils, to estimate the age of the Upper Pleistocene soil unit (MIS 3), and to assess the magnetic susceptibility of the deposits.

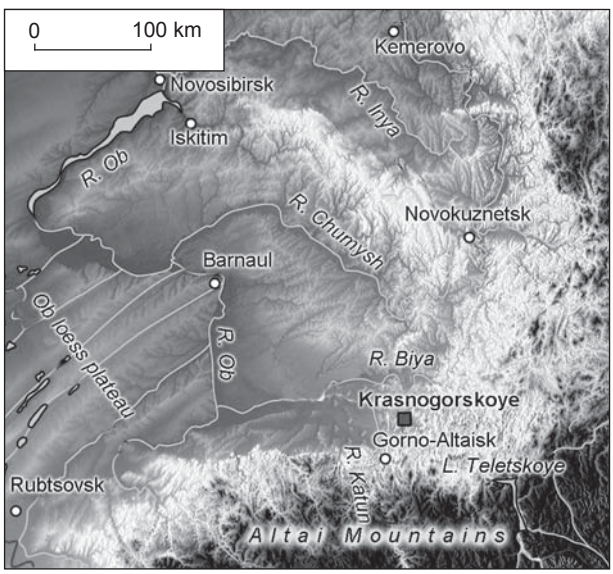

Fig. 1. Map showing the location of the Krasnogorskoye section in the low-hill zone of the Altai Mountains, in the south of Western Siberia.

Genetic horizons of paleosols were indexed in accordance with the soil classification currently used in Russia (Egorov et al., 1977; Shishov et al., 2004). Subdivision of sediments was conducted following the International Chronostratigraphic Chart (ICC) for the Quaternary (implying division of the Pleistocene into Lower, Middle, and Upper stages), and placing its base at 2.588 Ma BP (Head, Gibbard, Salvador, 2008). The Lower/Middle Pleistocene boundary is put at 0.78 Ma BP.

Geological structure of the section

The section is located in a former brickyard quarry, near the northern periphery of the Krasnogorskoye settlement, Krasnogorsky District of the Altai Territory. Five profiles located on the western wall of the quarry and descending successively the slope to the Barda River (Fig. 2) (52°18′36.8″ N; 086°11′28.4″ E; 300 m asl) were examined. We leveled the quarry's western wall, running perpendicularly to the river, described the profiles in detail, divided the section into stratigraphic units, and conducted paleopedological and lithological studies (Fig. 3). All the horizons of loesses and paleosols are deposited horizontally. The thickness of the section totals 24.5 m. The following Upper and Middle Pleistocene horizons (Fig. 3, 4) underlie modern chernozem soil:

1. The Bagan loess (**bg**) is loess-like loam 0.9 m thick, grayish-brown, dense, porous, with carbonate pseudomycelium. The second half of the horizon contains neoformations of iron as stripes and small spots. Rare manganese specks are visible.

2. The Eltsovka loess (**el**) is loess-like loam 1.5 m thick. Its upper portion is grayish-yellow; the coloration of the lower portion is variegated, owing to alternating grayish-light-brown and grayish-yellow-whitish streaks. The deposit is porous and dense. It contains loose carbonate concretions up to 2.0 cm in size, and numerous neoformations of iron as spots, stripes, and encrusted pores and root channels.

3. The Iskitim pedocomplex (**is_1–is_2**) is 1.9 m thick. It is composed of two paleosols separated by loess-like loam (0.3 m thick) representing the BCca horizon of the upper soil.

The profile of the upper soil contains the AUca and BCca horizons. The humus horizon (AUca) is 0.6 m thick. It is composed of loam that is dark gray with

Fig. 2. Lateral profile of the Krasnogorskoye section.

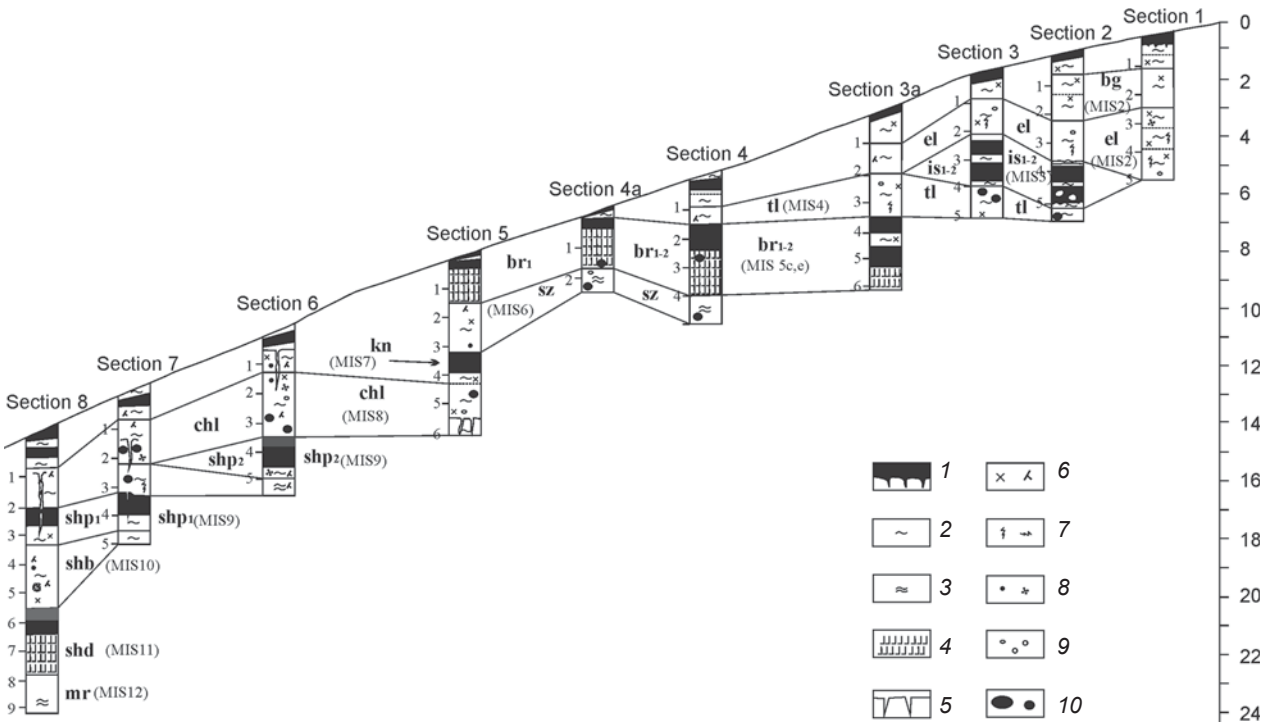

Fig. 3. Correlation between the horizons based on the Krasnogorskoye section.
1 – humus horizon; *2* – loam; *3* – heavy loam; *4* – illuvial horizon; *5* – shrinkage cracks; *6* – carbonate neoformations; *7* – ferruginization; *8* – manganese specks; *9* – gleying; *10* – burrows.

a brown tint, containing a few grains of clayey sand, carbonates as pseudomycelium and encrusted root channels, as well as rare pieces of coal, and specks of manganese. The borders of the horizon are undulate; its coloration transits into the underlying horizon. The brownish-yellow, porous loam (BCca) separating horizons of humified soil is 0.3 m thick. It is dense, and contains carbonate pseudomycelium, and pores and root channels encrusted by carbonate. Small pieces of coal are few in number.

The lower soil consists of the AU and BCA horizons. The humus horizon (AU) is 0.5 m thick. It is composed of brownish-dark-gray, porous, dense, and noncarbonate loam, containing rare grains of clayey sand, small pieces of coal, and burrows up to 7 cm in diameter. Humified ovals and small wedges are visible along its lower margin. The BCA horizon belongs both to the lower soil and to the upper portion of Tulino loess. It consists of light brownish-yellow, porous, and dense loam 0.5 m thick. This horizon

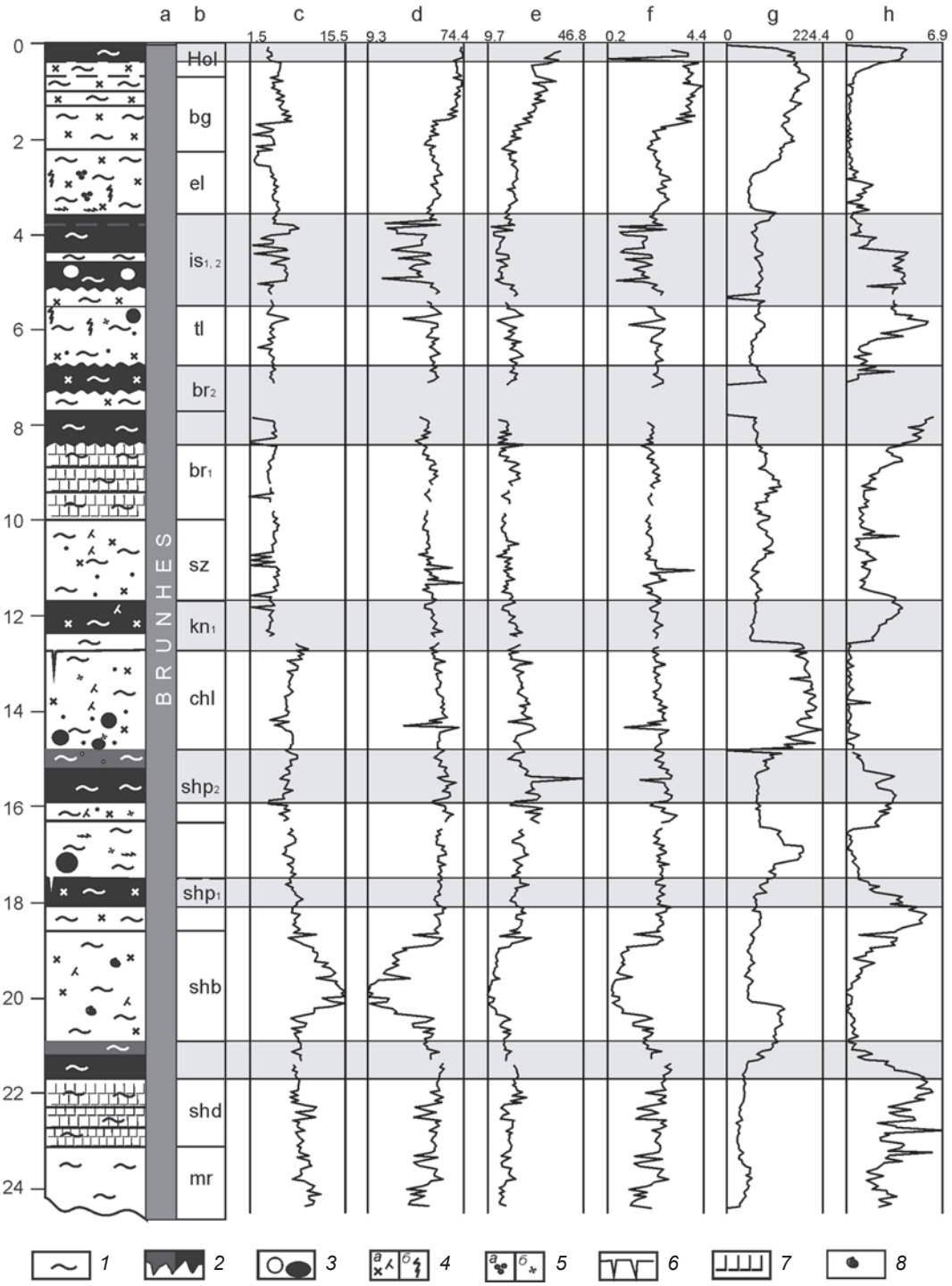

Fig. 4. Geological structure, grain size and petromagnetic characteristics of the combined Krasnogorskoye section.
a – paleomagnetic epoch; b – horizon index; c – clay fraction (< 2 μm), %; d – coarse silt fraction (16–63 μm); %; e – mean grain size, μm; f – U-ratio (=16–44 μm/5.5–16.0 μm); g – LF MS; h – FD MS.
1 – loam; *2* – humus horizon; *3* – burrows; *4*: *a* – carbonate neoformations, *b* – ferruginization; *5*: *a*– gleying, *b* – manganese specks; *6* – shrinkage cracks; *7* – clay-illuvial and structural-metamorphic horizons; *8* – mollusk shells. Pedocomplexes: Hol – modern Holocene soil; is – Iskitim; br – Berdsk; kn – Koinikha; shp – Shipunovo; shd – Shadrikha. Loesses: bg – Bagan; el – Eltsovka; tl – Tulino; sz – Suzun; chl – Chulym; shb – Shibayevo; mr – Morozovo.

comprises root channels and carbonate neoformations represented by pseudomycelium and encrusted root channels. Burrows are numerous, and their diameter varies from 7 to 10 cm.

4. The Tulino loess (**tl**) is grayish-light-brown, slightly dense, loess-like loam whose thickness varies from 1.1 to 2.0 m. The deposit contains loose carbonate concretions up to 0.8 cm in size, and pseudomycelium. It abounds in hollow root channels, manganese specks, spots and strips of ferruginization, and burrows up to 7 cm in size. The lower boundary is uneven.

5. The Berdsk pedocomplex (**br_1–br_2**) is composed of two soils separated by loess-like loam (0.4 m thick) representing the BCca horizon of the upper soil.

In the upper soil (**br_2**), the AUca and BCca horizons are clearly visible. The humus horizon (AUca) is 0.4 m thick. It consists of dark gray with a brownish tint, dense loam of low porosity. It contains hollow root channels and pseudomycelium. The underlying loam is 0.3 m thick, grayish-light-brown in color, dense, and low-porous. It comprises carbonate pseudomycelium, root channels, and small iron spots. This deposit forms BCca horizon.

The profile of the lower soil (**br_1**) is composed of humus (AU) and clayey-illuvial (BI) horizons. The AU horizon is 0.8 m thick. It contains brown-dark-gray, heavy, dense, low-porous, noncarbonate loam characterized by fine, nutty, grumous structure, and by manganese specks and ferrous pellets. The underlying clayey-illuvial (BI) horizon differs in color and structure. It is 1.6 m thick and comprises dense, heavy, low-porous, noncarbonate loam grayish-light-brown in color. The loam has a nutty-prismatic structure enlarging downward. Clayey films are visible on faces of structural elements. Burrows 7–10 cm in diameter can be encountered in the lower portion of the horizon.

6. The Suzun loess (**sz**) consists of light brown, dense, low-porous loam 1.7 m thick. The deposit has fissures running from its surface to the depth of 40 cm. They are filled with plate-like and tubular carbonate concretions. At the base of this deposit, roundish concretions (2 × 3 cm) are horizontally concentrated. Even lower, carbonate pseudomycelium, manganese pellets, and iron-encrusted root channels are present. The loess has a distinct lower boundary.

7. The Koinikha pedocomplex (**kn_1**) consists only of the lower soil of the pedocomplex, consisting of AUca and Bca horizons. The humus horizon (AUca) is 0.7 m thick. It consists of dark-gray-brown, dense, porous loam with root channels, carbonate pseudomycelium, and small white dots. Manganese specks, small (0.2 cm) manganese pellets, and iron-encrusted root channels are visible everywhere. The illuvial horizon (Bca) is 0.5 m thick. It is composed of grayish-light-brown, dense, porous loam containing carbonate pseudomycelium, carbonate-encrusted pores and root channels, small manganese pellets, and iron-encrusted pores. Clayey sand and burrows 5–7 cm in diameter occur there.

8. The Chulym loess (**chl**) is 1.45 m thick. It is composed of light yellowish-gray slightly greenish, dense, low-porous loam. Some of the root channels are encrusted by carbonates. Rare carbonate concretions (0.5–1.0 cm), pseudomycelium, and manganese pellets are present. The upper surface is undulate; in some places, it is oviform. The surface is broken by rare sinuous fissures 2 cm wide and up to 60 cm deep, which are filled with carbonate concretions. The deposit contains numerous burrows 5–7 cm in diameter. The lower boundary is distinct.

9. The Shipunovo pedocomplex (**shp_1–shp_2**) comprises two soils separated by loess-like loam belonging to the BCca horizon of the upper soil. The upper soil (**shp_2**) includes cumulative (AU), illuvial (Bmt), and BCca horizons. The humus horizon is 0.7 m thick. It is composed of brownish-gray, dense, low-porous, noncarbonate loam containing hollow root channels and numerous small (0.3 cm) and large (up to 0.6 cm) ferromanganese pellets. Dense carbonate concretions up to 2 cm in size occur in the upper portion of the horizon. The thickness of the Bmt horizon varies from 0.5 to 0.8 m. It consists of tawny-brown, dense, low-porous, noncarbonate loam characterized by a fine-grained, nutty structure and by the presence of clayey sand grains, carbonate concretions up to 1 cm in size, and ferromanganese pellets measuring up to 0.3 cm. The BCca horizon is 0.8–1.0 m thick. It comprises slightly greenish light gray, dense, porous loam containing manganese pellets, small ferrous spots, and thin root channels encrusted with carbonate. Isolated roundish carbonate concretions up to 3 cm in size are vertically oriented through the whole horizon. Burrows up to 7 cm in diameter are also present.

The profile of the lower soil (**shp_1**) comprises humus (AU) and illuvial (Bmt) horizons. The humus horizon is 0.7 m thick. It is composed of brownish-gray, heavy, dense, low-porous, noncarbonate loam, with hollow root channels, rare manganese pellets up to 0.3 cm in size, and grains of clayey sand. The thickness of the illuvial horizon varies from 0.5 to 0.8 m. This deposit is composed of tawny-brown, heavy, dense, noncarbonate loam with nutty and fine-prismatic structure and numerous grains of clayey

sand. Manganese pellets (up to 0.2 cm) and roundish and flattened carbonate concretions (up to 2 cm) occur in this horizon.

10. The Shibayevo loess (**shb**) is formed by yellowish-gray with a green tint loam up to 2.3 m thick. The loam is dense and low-carbonate. Small manganese pellets occur everywhere. Spots of ferrous hydroxide, small carbonate concretions, and small shells of terrestrial mollusks are rarely encountered.

11. The Shadrikha pedocomplex (**shd**) consists of paleosol composed of humus (AU) and illuvial (Bmt) horizons. The humus horizon is formed of brownish-dark-gray, dense, low-porous, noncarbonate loam 0.8 m thick. The deposit contains many grains of clayey sand and a few manganese pellets. The illuvial horizon is 1.4 m thick. It consists of tawny-brown, dense, heavy, noncarbonate loam with a nutty structure enlarging downward, and clayey films visible on faces of structural elements. The deposit contains manganese pellets.

12. The Morozovo loess (**mr**) is light brown, heavy, dense, noncarbonate loam containing manganese pellets. Its visible thickness is 1.5 m.

Stratigraphy of the loess-paleosol sequence

The 24.5-meter thick subaeral deposits at Krasnogorskoye (Fig. 3, 4), which consist of loess-like loams and soils, were correlated with those of Western and Central Siberia, using morphological indicators of soils, lithological features of loess horizons, and radiocarbon analysis (Zykina, Volkov, Dergacheva, 1981; Zykina, Zykin, 2012; Frechen et al., 2005). Since the stratigraphic horizons of the mentioned loess-paleosol sequence correspond distinctly to marine oxygen isotope stages and other global climate records, it can be used as a reliable reference scale for regional and global correlations (Dobretsov, Zykin, Zykina, 2003; Zykina, Zykin, 2003, 2008). In the Krasnogorskoye section, seven loess horizons are recognizable (from bottom to top): Morozovo (MIS 12), Shibayevo (MIS 10), Chulym (MIS 8), Suzun (MIS 6), Tulino (MIS 4), Bagan and Eltsovka (MIS 2). The section represents five pedocomplexes: Shadrikha (MIS 11), Shipunovo (MIS 9), Koinikha (MIS 7), Berdsk (MIS 5c, e), and Iskitim (MIS 3). Morphotypically, the Shadrikha, Berdsk, and Iskitim pedocomplexes are most representative. These pedocomplexes are traced over large areas. The loess-paleosol section near Krasnogorskoye, then, was formed during the Middle and Late Pleistocene.

Fossil pedocomplexes

In the environs of Krasnogorskoye, the modern soil consists of leached chernozem formed in the forest-steppe zone. Two chernozems of the Iskitim pedocomplex have weakly differentiated, thin profiles, containing characteristic carbonate neoformations (pseudomycelium) and burrows. The soils are similar in organic matter content; humic acids predominate over fulvic acids. The C_{ha}/C_{fa} ratio in the humus horizon of the upper soil equals 1.07; in the lower soil it is 1.05. Differences in grain size and bulk compositions across the soil profiles are insignificant. Therefore, in spite of the weak differentiation and small thickness of the soils, the presence of characteristic carbonate neoformations and burrows goes to prove that the Iskitim soils were formed as chernozem in forest-steppe environments. The weak differentiation of the Iskitim soils, as compared to modern soils, can probably be explained by the short period of their formation, and by growing aridization of the climate in the Late Pleistocene. The radiocarbon date of 23,065 ± 420 BP (SOAN 9484) (cal BP 27,955 ± 445), generated on a sample of the humus horizon of the upper soil in the Krasnogorskoye section, supports the correlation of the pedocomplex with MIS 3. According to the radiocarbon and thermoluminescence dates, the formation of the Iskitim pedocomplex took place during the interval from 53 ± 4 to 24 ± 4 ka BP (Zykina, Volkov, Dergacheva, 1981; Zander et al., 2003; Frechen et al., 2005), corresponding to MIS 3 (Bassinot et al., 1994).

The Berdsk pedocomplex consists of two chernozems. The upper soil is characterized by an underdeveloped thin profile, whose period of formation was shorter than that of the lower soil. The organic carbon content in the humus horizon amounts to 0.67 % of the soil weight, and decreases to 0.40 % in the illuvial horizon. Humic acids and fraction associated with calcium predominate in the organic matter content. The C_{ha}/C_{fa} ratio in the humus horizon equals 1.1; in the carbonate-illuvial horizon it amounts to 0.6. Differences between the soil horizons in texture and bulk composition are insignificant. An accumulation of silicate calcium, associated with soil formation processes, can be observed in the illuvial horizon. Humus accumulation and carbonate formation operate as dominant soil forming processes. The principal pedogenetic soil properties point to growing aridization in the Late Pleistocene. The soil was formed in a forest-steppe environment during

a short, warm Early Zyryanka interstadial, which, according to thermoluminescence dates (Zykina, Zykin, 2012; Zander et al., 2003; Frechen et al., 2005), corresponds to the MIS 5c substage (Bassinot et al., 1994).

The lower soil of the Berdsk pedocomplex displays well-developed profile subdivisible into humus and illuvial horizons. The soil contains burrows. Structurally, this is a chernozem clayey-illuvial profile developed during a long period of time, in the forest-steppe zone, under conditions of warm and humid climate in the Kazantsevo interglacial, correlating with the MIS 5e substage (Ibid.). The organic carbon content in the humus horizon reaches 0.65 %; in the illuvial horizon it amounts to 0.23 %. The qualitative composition of the humus is characterized by a prevalence of humic acids. The C_{ha}/C_{fa} ratio is 1.2 in the humus horizon, and 0.5 in the illuvial horizon. Insignificant traces of eluvial-illuvial differentiation in terms of sesquioxide and grain size composition are observable in the soil profile. According to micromorphological data, the migration of the silt fraction can be clearly traced. The soil profile is leached free of carbonates. The significant thickness of the Kazantsevo soil, and its claying and well-developed profile, bring it closer to Middle Pleistocene soils, and move further from overlying Upper Pleistocene soils. According to dates obtained from the Kurtak section in Central Siberia, the chronological interval corresponding to the formation of this soil lies within 143–119 ka BP (Frechen et al., 2005; Zander et al., 2003).

The Koinikha pedocomplex consists of the lower soil, which demonstrates features of chernozem and brunizem. The morphotype of the profile, carbonate neoformations, burrows, and microstructure of the humus horizon (highly aggregated soil mass, coagulated and feebly oriented humus-clay plasma) suggest that the soil was formed by chernozem type under the conditions of a warm and humid climate. Relics of brunizem soil formation are demonstrated by a distinct brown coloration of the profile, presence of manganese specks and small pellets, light soil compaction, and enrichment with iron and aluminum hydroxides. According to P. Duchaufour (1965), brunizems are typical of regions with a less pronounced continental climate as compared to the chernozem zone. This soil type is described as transitional between chernozem and burozem (brown soil). Soil humus is humate-fulvatic in its qualitative composition; the C_{ha}/C_{fa} ratio in the humus horizon equals 0.85. Mineral mass is stable; redistribution of the silt faction and sesquioxides across the profile is not observed. In the Kurtak section, the soil of this type is dated within the range of 236–181 ka BP (Zander et al., 2003).

The Shipunovo pedocomplex is composed of two buried soils with brown coloration of their profiles. The profiles are differentiated by their types of brunizem. They are noncarbonated, but contain manganese and ferromanganese specks testifying to hydromorphism; burrows are present. The composition of the humus is humate-fulvatic; the C_{ha}/C_{fa} ratio equals 0.9. The soils are weakly differentiated in terms of bulk composition. The main soil forming processes include lessivage and agrillization, most apparent in the lower soil. The microstructure of both soils demonstrates movement of the silt fraction and ferrous hydroxides down the profiles. Judging by the types of the soils, soil formation took place under warmer and more humid climate conditions as compared to the modern ones. The structure of the pedocomplex and degree of maturity of its soil profiles correspond to MIS 9 (Zykina, Zykin, 2012).

The Shadrikha pedocomplex consists of brunizem with a profile differentiated into humus and illuvial horizons. Burrows occur in the horizons. This pedocomplex is close to chernozem in its properties. However, in distinction from chernozem, its profile is leached and lacks a carbonate horizon; reaction is subacid; a horizon of illuvial clay accumulation is available; clay forms at the expense of primary minerals. The presence of ferromanganese concretions in the profile suggests gleying processes. The humus can be characterized as humic and fulvic by its composition; the C_{ha}/C_{fa} ratio equals 0.8. The bulk composition of the soil shows that differentiation of the profile by its content of aluminum, silicon, and iron is weak; SiO_2/R_2O_3 ratios change insignificantly across the profile. In terms of microstructure, the illuvial horizon contains ferrous-clay cutans, formed along pores and faces of structural elements. According to the obtained data, the main processes responsible for the formation of brunizem were humus accumulation, agrillization, and lessivage. The availability of a deposit of mature soil suggests that the soil was formed over a long period of time in a climate rather humid and warmer than at present, during the Shadrikha warm interglacial, corresponding to MIS 11 (Bassinot et al., 1994). Brown forest soils of the early stage of the Shadrikha interglacial in Western Siberia may serve as an analog for this soil (Zykina, Zykin, 2012).

Grain size composition of loess-like loams

The grain size analysis assesses the proportion of dimensional fractions in the section and reveals their dynamics. One of the principal challenges of this analysis is to gain a greater understanding of the environment in which the deposits were accumulated.

Grain size composition was determined with the aid of Laser Particle Sizer Fritsch Analysette 22 MicroTec, with the measuring range of 0–1000 μm. The analysis was conducted in the Laboratory for the Cenozoic Geology, Paleoclimatology, and Mineralogical Indicators for Climate, in the Sobolev Institute of Geology and Mineralogy SB RAS. Samples were taken successively from the shielding surface down to the base of the section, with 5 cm spacing. Clay (< 2 μm; Fig. 4, c) and coarse silt (16–63 μm; see Fig. 4, d) fractions, and mean grain size (Fig. 4, e) were selected as the most representative indicators reflecting the formation of the deposits. In addition, the U-ratio (the ratio of 16–44 and 5.5–16.0 μm fractions) was calculated (Fig. 4, f). This parameter disregards fine-grained clay particles accumulated mostly by secondary processes, and coarse particles probably deposited by saltation (Vandenberghe, 1985; Nugteren et al., 2004). Thus, the U-ratio reflects the course of sedimentation, without secondary processes, and provides evidence of wind flow strength.

Grain size analysis of the Middle and Upper Pleistocene deposits revealed a predominance of coarse silt fraction (Fig. 4), typical of loess sediments. As compared to Upper Pleistocene loess-soil deposits of the Ob loess plateau (Sizikova et al., 2015), contemporaneous horizons of the Krasnogorskoye section contain a somewhat greater quantity of coarse silt. In general, a trend towards a decrease in quantity of clay fraction from MIS 12 to MIS 2 is clearly observed across the profile: the content of clay is 1.5 to 2 times greater in the Middle Pleistocene horizons than in Upper Pleistocene ones. However, an increase in the quantity of coarse-silt fraction and, consequently, in grain size is evident in the Upper Pleistocene horizons. In this case, it can be explained by the presence of numerous ferromanganese neoformations, rather than by strength of wind flow. The scatter of grain size values mirrors the fluctuations of wind velocity at each stage of loess accumulation. In the Upper Pleistocene portion of the section, a trend towards an increase in mean grain size can be observed (Fig. 4, e). Values of the U-ratio also become greater (see Fig. 4, f), especially in Eltsovka and Bagan loesses. Therefore, our earlier conclusion about the greater intensity of loess accumulation in the Late Pleistocene is supported with regard to the Barnaul (Sizikova et al., 2015) and Novosibirsk (Sizikova, Zykina, 2015) parts of the Ob region and to the plain adjoining the Altai.

Morphoscopy of quartz sand grains

The morphoscopy and morphometry of quartz sand grains make it possible to determine the processes prevailing during sedimentation, and to describe the paleogeographic conditions accompanying them. Well-rounded grains with a coefficient of roundness of 50–70 % are typical of eolian sediments (Velichko, Timireva, 1995).

Quartz grains of the medium sand fraction (0.25–0.5 mm) were examined under Altami CM0870-T binocular microscope, according to the methodology elaborated in the Institute of Geography RAS, Moscow (Ibid.). Second electron images (SEI) of grains were obtained using a JEOL JSM-6510LV scanning electron microscope in the Center for Multielement and Isotope Analyses in the Sobolev Institute of Geology and Mineralogy SB RAS. The roundness of grains was determined by comparison with the template by L.B. Rukhin (1969) and by the five-class characterization of A.B. Khabakov (1946). Then, coefficients of roundness and degree of dullness (Velichko, Timireva, 1995) were calculated for each sample. The dullness of grains was visually inspected and classified from glossy to matte. This method had previously been used for studying loess deposits in the south of Western Siberia: in the Novosibirsk (Sizikova, Zykina, 2015) and Barnaul (Sizikova et al., 2015) parts of the Ob basin. On the plain bordering the Altai, this method was applied for the first time.

In this article, we present data on the morphoscopy of sand grains from loess horizons only, since most quartz grains from paleosols were badly damaged by chemical weathering; so their surfaces mostly display traces of silica dissolution, etching along microcavities, and dissolution of the grain surface.

Loess horizons of the Krasnogorskoye section are similar in terms of shape, degree of roundness, and the main elements of surface. All the horizons are dominated by grains of the III and IV classes of roundness, with matte or semi-matte surfaces. Grains of the II class are less numerous; grains of the I class are rare. The coefficients of roundness calculated for each horizon of the section are between 60 % and 70 %; the degree of dullness varies from 68.5 % to 80 %. Lower values are typical of the Upper Pleistocene loesses

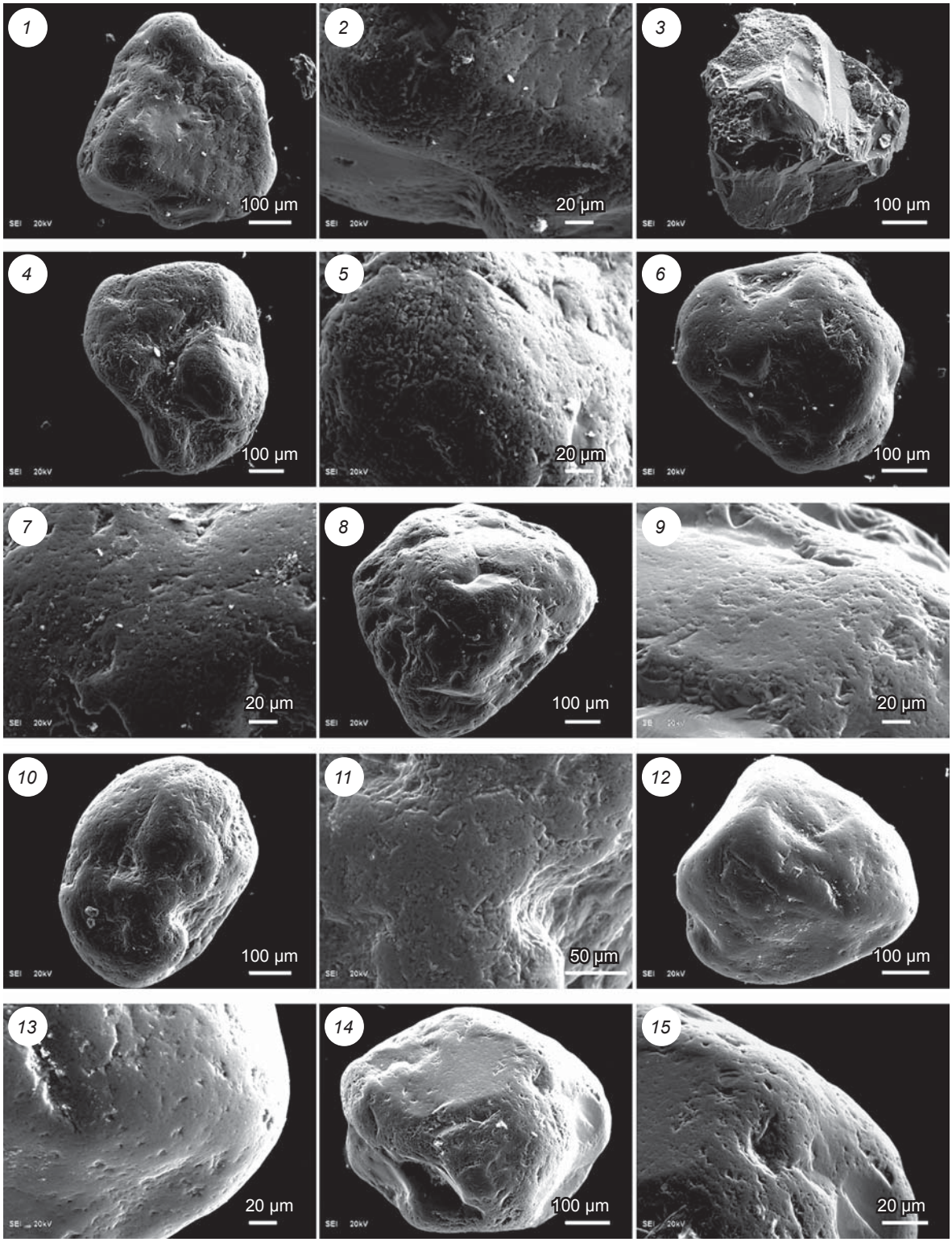

Fig. 5. Morphoscopy of quartz sand grains from loess horizons of the Krasnogorskoye section.
1, *2*, *3* – Bagan; *4*, *5* – Eltsovka; *6*, *7* – Tulino; *8*, *9* – Suzun; *10*, *11* – Chulym; *12*, *13* – Shibayevo; *14*, *15* – Morozovo.

(Bagan, Eltsovka, and Tulino). Micropits forming a specific surface are the main element of microrelief (Fig. 5, *1*, *2*, *4–15*). Such a pitted surface may be caused by the collision of grains in air flow (Velichko, Timireva, 2002). Micropits formed in cavities (Fig. 5, *2*, *5*, *10*, *13*) are indicative of a long stay of the grains in air-flow. In addition to micropits, large saucer-shaped and groove-shaped "pits" are visible. Some grains, especially in the Upper Pleistocene loesses, display a conchoidal fracture (Fig. 5, *3*), which can be explained by frost-induced weathering (Ibid.). Some grains, mostly from Middle Pleistocene loesses, demonstrate features of chemical processes, such as dissolution of grain surface or etching of cavities (Fig. 5, *10*, *11*), although these are far less pronounced than on grains from paleosol horizons.

Magnetic properties of the sediments

The Krasnogorskoye section is homogenous in terms of magnetostratigraphy. The magnetic cleaning of specimens has divided natural magnetization into viscous and detrital components. The viscous component is unstable, and can be removed by heating to 200 °C. The detrital component carries primary magnetization; the magnetization vectors retain their direction when heated to 600 °C. The statistical analysis of residual magnetization vectors for the viscous and primary components suggests that both had formed under the same positive polarization (Fig. 4, a), matching the modern condition.

Petromagnetic characteristics, such as magnetic susceptibility (χ) and frequency dependent magnetic susceptibility (*FD*), depend largely both on regional and global climatic parameters. In the paleosol horizons of Krasnogorskoye, *FD* values are higher than those in loesses, where they approximate zero (see Fig. 4, g). On the contrary, magnetic susceptibility in loesses is greater than in paleosols (see Fig. 4, h).

Significant increase of *FD* values in soils suggests that intense formation of fine superparamagnetic and single-domain magnetic materials resulted from pedogenesis, which took place during warm and humid periods. However, at that time, χ values were lower than in cold periods. This can probably be attributed to high wind activity in cold and dry periods, resulting in the transport of large masses of weathered detritus.

The oscillations of magnetic susceptibility in the section correspond to "Alaskan" model (Westgate, Stemper, Pewe, 1990); however, high *FD* values (reaching 7 %) do not fit this model completely. This finding evidently indicates a greater climatic fluctuation range as compared to those of the northern ("Alaskan") and southern ("Chinese") (Liu et al., 1993) regions. This is especially true for sediments corresponding to MIS 7 – MIS 12.

Conclusions

Stratigraphic, paleopedological, lithological, and paleomagnetic data, combined with the results of radiocarbon analysis obtained for the Krasnogorskoye section, made it possible to determine the chronological intervals during which the loess-paleosol sequence had been formed in the Middle and Late Pleistocene. Morozovo loess at the base of the section correlates to MIS 12 (Zykina, Zykin, 2008, 2012). The structure of the Pleistocene pedocomplexes of the Altai Mountains is similar to that of the pedocomplexes in the southern part of the West Siberian Plain. It clearly reflects odd warm stages of continuous global sequences. The reconstruction of a sufficiently complete loess-paleosol sequence in the low-altitude zone of the Altai Mountains at Krasnogorskoye (including five pedocomplexes and seven loess horizons), and the finding that pedogenesis in the Middle Pleistocene followed the brunizem type, have enabled us to reveal a distinct tendency of soil formation during the interglacial stages from the Middle to the Late Pleistocene: the climate became more and more arid. The Brunizem type of soil formation of the Shadrikha and Shipunovo warm stages, the brunizem-chernozem type of the Koinikha stage, and the chernozem type of Kazantsevo stage taking place under a climate that was warmer and more humid than today's, were all changed by a chernozem forest-steppe type of soil formation under the colder and more arid climate of the Early Zyryanka and Karga interstadials. The predominant tendency was the aridization of climate. The amplitude and frequency of climate oscillations changed significantly after the Kazantsevo interglacial. This caused lesser warming, and a shorter duration of warm stages. The climate became cooler and more arid, as mirrored by a simpler structure of soil profiles and their decreased thickness. During the warm interglacial stages of the Middle Pleistocene, the climate in the low and medium-high mountain regions of the Altai Mountains was more humid than in the adjoining West Siberian Plain.

The grain size analysis of the Krasnogorskoye samples indicates a trend of increase in loess accumulation during the Late Pleistocene. The high

coefficients of roundness and the degree of dullness, as well as numerous micropits on grain surfaces in all loess horizons, point to the eolian origin of loess horizons under cryoarid conditions. We also found traces of frost-induced weathering, and chemical processes on grains.

Paleomagnetic analysis has demonstrated that all the sediments in the section were formed during the Brunhes normal epoch. Petromagnetic data generally support the above inferences. Higher magnetic susceptibility during the cold stages, and higher frequency-dependent susceptibility during the warm stages, evidence marked climatic oscillations. After the Kazantsevo interglacial, the amplitude diminishes, and the pattern of paleoclimatic signal recorded by the magnetic properties of loess and paleosol in the section is close to the "Alaskan" type.

The structure and composition of the loess-paleosol sequence in the Krasnogorskoye section testify to a varying intensity of atmospheric circulation during the cold glacials, warm interstadials, and interglacials of the Pleistocene. Cold stages were characterized by climate aridization, and a greater intensity of circulation of the atmosphere, which became saturated with dust, causing the growth of loess horizons during sedimentation. These processes led to the expansion of cold deserts, and to the formation of large deflation surfaces and closed deflation hollows varying in size (Zykin, Zykina, Orlova, 2003). During warm stages of the Middle and Late Pleistocene, soil horizons were formed in the Krasnogorskoye section.

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V.I. Molodin[1], D.A. Nenakhov[1], L.N. Mylnikova[1], S. Reinhold[2], E.V. Parkhomchuk[1, 3], P.N. Kalinkin[3], V.V. Parkhomchuk[3, 4], and S.A. Rastigeev[4]

[1]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: molodin@archaeology.nsc.ru; nenaxoffsurgut@mail.ru; l.mylnikiva@yandex.ru; ekaterina@catalysis.ru
[2]German Archaeological Institute, Im Dol 2-6, Berlin, D 14195, Germany
E-mail: sabine.reinhold@dainst.de
[3]Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia
E-mail: p.kalinkin@g.nsu.ru
[4]Budker Institute of Nuclear Physics, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 11, Novosibirsk, 630090, Russia
E-mail: parkhomchuk@inbox.ru; S.A.Rastigeev@inp.nsk.su

The Early Neolithic Complex on the Tartas-1 Site: Results of the AMS Radiocarbon Dating

AMS radiocarbon dating was applied to seven samples from Tartas-1, an Early Neolithic site in the Barabinskaya forest-steppe, southwestern Siberia: four from pit 938, one from pit 990, and two from structure 6. Pits had been destined for fermenting fish, and contained offerings, such as corpses of animals (fox, hare, wolverine, dog), stone and bone artifacts, and flat-bottomed clay vessels. On the basis of these finds, the Barabinskaya culture was described. The results of the AMS radiocarbon analysis support the previous conclusion regarding the date of the complex—7th millennium BC. A series of dates generated at the Curt Engelhorn Center for Archaeometry in Mannheim, Germany, for the Neolithic materials from Tartas-1 mostly fall within the 7th millennium, and the same applies to the dates relating to the Neolithic site of Vengerovo-2. The dates for structure 6 from Tartas-1 were generated at the Institute of Nuclear Physics SB RAS in Novosibirsk as well, agreeing with those from the Mannheim Center (for two samples, the results being virtually identical). In sum, the data obtained confirm the correctness of dating the Early Neolithic complex from Tartas-1 to the 7th millennium BC. The Barabinskaya culture is also dated to this time.

Keywords: *Barabinskaya forest-steppe, Neolithic, radiocarbon analysis, Barabinskaya culture.*

Introduction

Distinguishing new archaeological cultural formations always requires thorough justification. This is especially important for well studied regions, where materials of archaeological sites have already been attributed to a certain culture. A unique complex has been discovered at the multi-layered site of Tartas-1 (Fig. 1) by the

Archaeology, Ethnology & Anthropology of Eurasia 47/1 (2019) 15–22 E-mail: Eurasia@archaeology.nsc.ru

Fig. 1. Location of the Tartas-1 site.

West Siberian team of the Institute of Archaeology and Ethnography SB RAS in 2015. The complex consisted of two residential structures, and several peculiar pits for fermenting fish (Fig. 2–4). The latter showed manifestations of ritual activities: corpses of animals had been placed there as offerings (Molodin, Kobeleva, Mylnikova, 2017a, b; Molodin, Nenakhov, Nesterova et al., 2017; Molodin, Hansen, Mylnikova et al., in press; Molodin, Hansen, Nenakhov et al., 2016). Studying the Neolithic assemblages containing various stone and bone artifacts, as well as flat-bottomed clay vessels, discovered at the Tartas-1 site, allowed us to suggest the existence of a specific Early Neolithic Barabinskaya culture in the southern part of the West Siberian Plain (Molodin, Kobeleva, Durakov et al., 2017; Molodin, Kobeleva, Mylnikova, 2017b; Molodin, Reinhold, Mylnikova et al., 2018). A series of radiocarbon dates generated at the Curt Engelhorn Center for Archaeometry in Mannheim, Germany fall mostly within the period from the late 8th to early 6th millennium BC (Molodin, Reinhold, Mylnikova et al., 2018). The said definitions have been confirmed by the results of dating the samples from the Neolithic site of Vengerovo-2 at the same center: for 1 σ—6426–6385 BC, for 2 σ—6440–6266 BC (Ibid.: 47). They correspond to the time of Neolithic complexes at Tartas-1. Currently, a few more samples taken from the Neolithic features at Tartas-1 are under scientific scrutiny at the Curt Engelhorn Center for Archaeometry.

The problem of dating the identified Early Neolithic Barabinskaya culture has not so far been resolved. Some specialists consider that the chronological and cultural attribution of the Neolithic complexes at Tartas-1 is debatable (Bobrov, Marochkin, 2018: 11) and attribute the said features to the Boborykino culture (Bobrov, Marochkin, 2013; Bobrov, Marochkin, Yurakova, 2012a, b; Bobrov, Yurakova, 2014; Yurakova, 2017; Zakh, 2018). Therefore, an additional series of samples from the Neolithic features of the Tartas-1 site was transferred to the Laboratory of Sample Preparation and Isotope Analysis of the *Cenozoic Geochronology* Center for Collective Use of the Institute of Archaeology and Ethnography SB RAS, to conduct dating using a unique research installation, the "Accelerator Mass-Spectrometer of the INP SB RAS". Samples were taken from structure 6, and from pits for fermenting fish and performing ritual actions*.

Preparation of bone samples

Isolation of collagen from bone samples was conducted at the Laboratory of Sample Preparation and Isotope Analysis of the *Cenozoic Geochronology* Center for Collective Use of the IAET SB RAS by chemical treatment of samples. A bone sample was cleaned, washed out, and ground to powder. Then, 2–3 g of the sample were placed into a glass, following which 20–30 ml of dichloromethane were poured therein, and held at room temperature while stirring for 12 hours. After this, the solution was poured out, the residual matter was dried first at room temperature, and then at 70 °C for 10 and 5 minutes, consecutively. The resulting dry powder was covered with 20 ml of 1 mol/L HCl solution and stirred for 30 minutes at room temperature; in so doing, the acidity of solution was brought to pH = 2–3 by means of solution replacement, if necessary. Following that, the mixture was centrifuged for 3 minutes, then the solution was poured out, and the residual matter was washed out with distilled water up to a value of pH = 7. The resulting residual matter was mixed with 20 ml of 1 mol/L NaOH solution and held for 20 minutes while stirring; in so doing, the acidity of solution was brought to pH = 9–10 by means of alkali solution replacement, if necessary. Next, the residual matter was washed out with distilled water up to pH = 7–8, covered with 20 ml of 1 mol/L HCl solution again, and held for 15 minutes while stirring; then it was washed out with distilled water

*After finalization of the article, the following date was also obtained for a bone sample from pit 1383 at Tartas-1: MAMS 38065 for 1 σ—7583–7553; for 2 σ—7589–7537 BC.

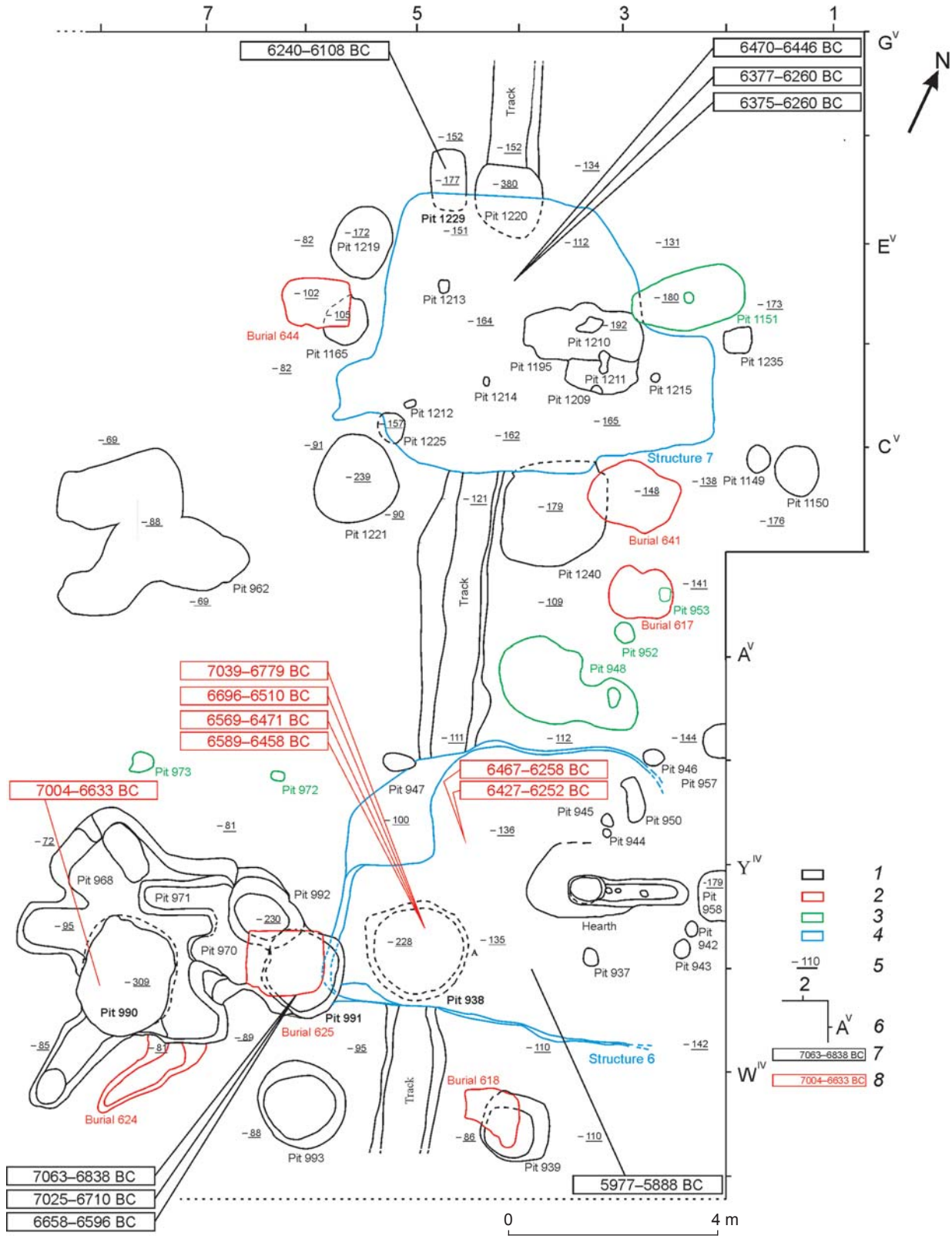


Fig. 2. Plan of the excavation area with Neolithic complex at Tartas-1.

1 – Neolithic pits; *2* – burials belonging to the Andronovo (Fedorovka) culture; *3* – Bronze Age artifacts; *4* – Neolithic structures; *5* – bench-marks; *6* – excavation boundary; *7* – ^{14}C-date obtained at the Curt Engelhorn Center for Archaeometry; *8* – ^{14}C-date obtained at the INP SB RAS laboratory (*7*, *8* – dates are given for 1 σ).

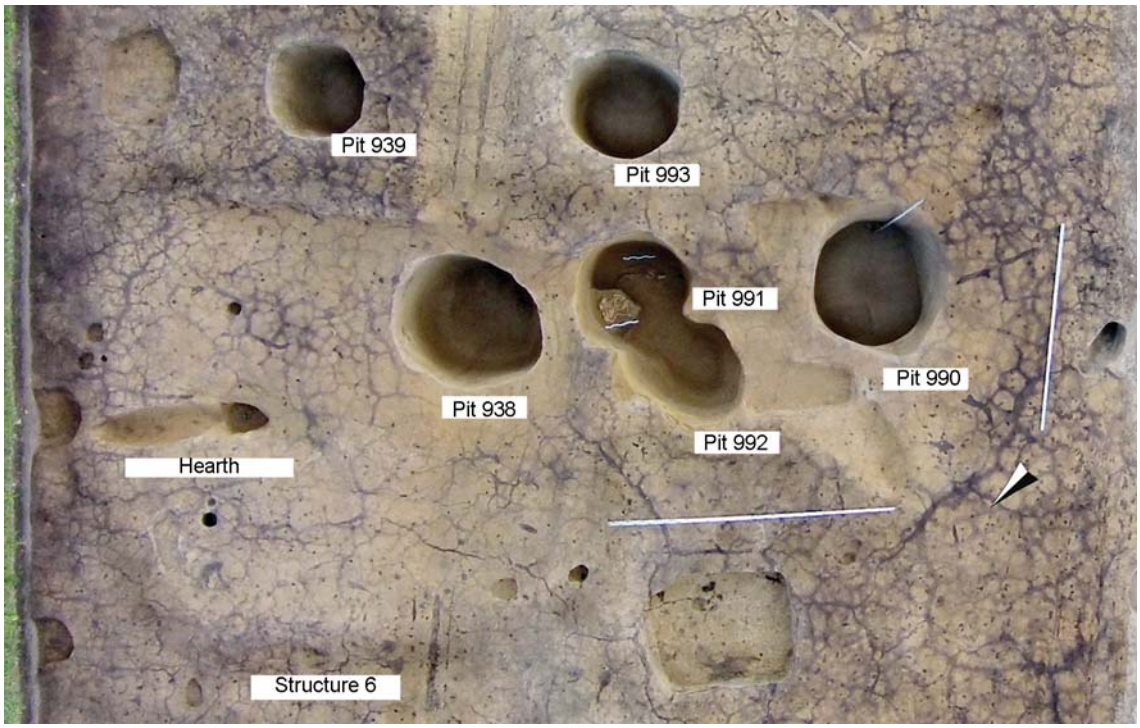


Fig. 3. Structure 6 and adjacent Neolithic pits.

Fig. 4. Pit 1220. Studying the stratigraphic section during excavation of the filling.

to produce a suspension with pH = 3. The suspension was thermostated at 70 °C for 24 hours. Then, the solution was separated from the residual matter by centrifuging and, purified in such a way, it was dried up at 70 °C to produce collagen powder.

Carbonizaton of the resulting collagen for further analysis at the accelerator mass-spectrometer AMS was performed at the NSU radiocarbon laboratory, using an absorption catalytic unit. The procedure included stages of combustion, sorption of carbon dioxide at selective sorbent, desorption, and catalytic reduction of CO_2 with nitrogen (Lysikov et al., 2018). A carbon-containing sample (4–10 mg) was burnt with the IKT-12-8 catalyst at 900 °C. Adsorption using the CO_2 (CaO) sorbent was conducted at a temperature of 550 °C, then the line was evacuated, and desorption of CO_2 was carried out at 920 °C. Isolated CO_2 was frozen out in a quartz or pyrex tube containing 7–8 mg of α-Fe (Aldrich-325 mesh) powder, gas pressure was measured, the required stoichiometric amount of hydrogen was injected, and carbonizaton was conducted at 550 °C and the total pressure of ca 1.2 bar for 5–6 hours. The cold zone of the carbonizaton tube contained drying agent (magnesium perchlorate) to remove the resulting water and to shift equilibrium towards formation of elemental carbon. After completion of the process, the powder, containing 2–3 mg of carbon, was pressed to form tablets and delivered to the AMS-analysis. Apart from the samples under investigation, the carbonizaton procedure was applied to standard samples of ethane diacid, such as OxI and SRM 4990C (OxII). The content ratio of radiocarbon $^{14}C/^{13}C$ in the samples was normalized to the content of $^{14}C/^{13}C$ in modern carbon, determined according to standard samples. The radiocarbon content was determined using the research installation "Accelerator Mass-Spectrometer of the INP SB RAS" (Parkhomchuk, Rastigeev, 2011).

Discussion

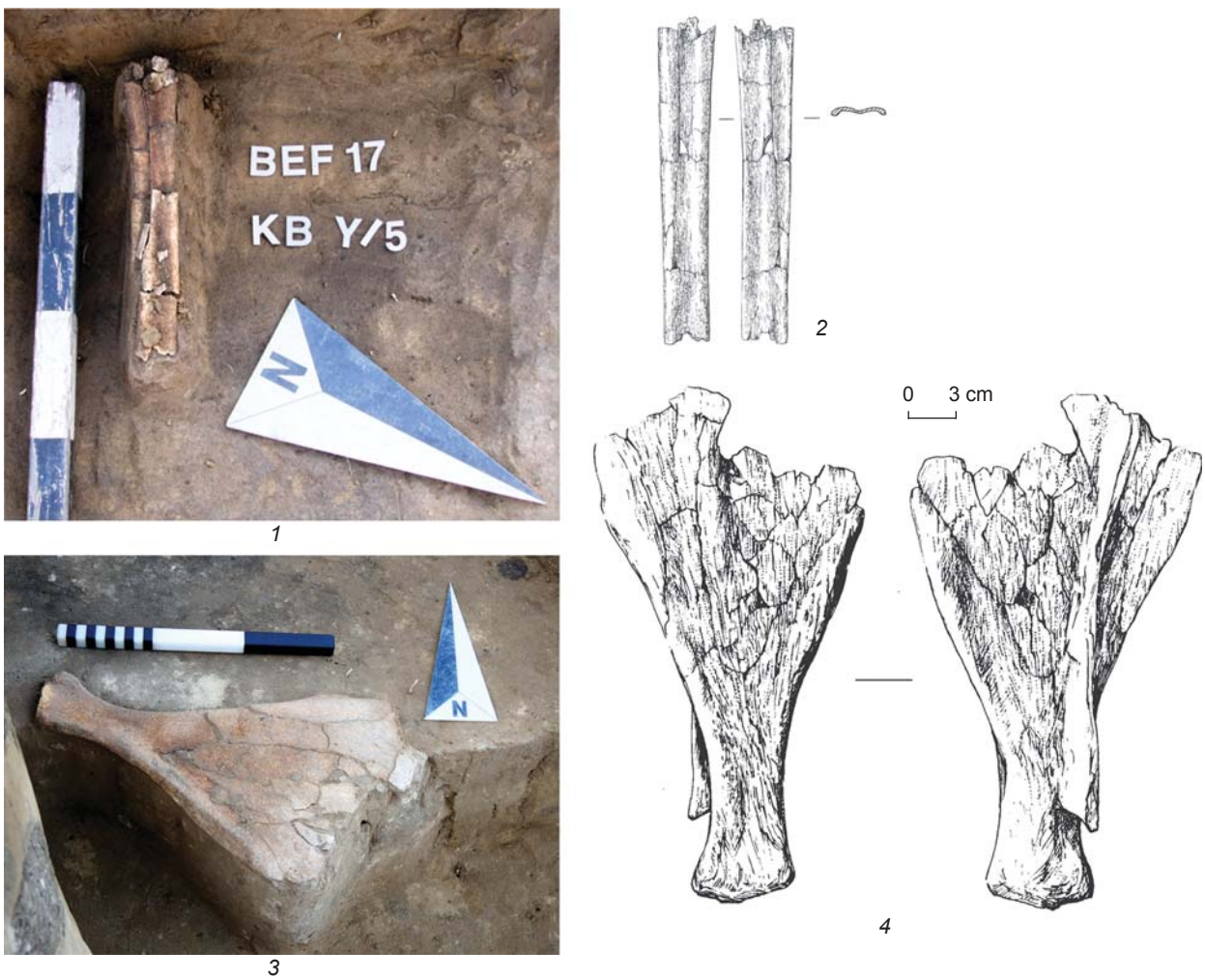
As a result of study of materials from the Neolithic complexes of the Tartas-1 site, data for seven samples from three features were obtained (Table 1). Four samples date pit 938, one sample pit 990, and two of them structure 6 (see Fig. 2, 3). For dating the pits, the bones of birds and animals were used (definitions were made by S.K. Vasiliev), while structure 6 was dated using two bone tools from its filling (Fig. 5). For structure 6, a date established at the Curt Engelhorn Center for Archaeometry is also available, which allows us to compare the results obtained in different laboratories.

Comparison of the stratigraphic positions of pit 938 and structure 6 suggests that the structure was built after the pit had stopped functioning and had been fully filled with soil. The spread in values of samples 4–7 from pit 938 is within the limits of approximately 300 years, and corresponds to the 8th millennium BC; however, taking the possible corrections into account (Table 1), this variation may be smaller.

Table 1. **Results of radiocarbon dating of samples from Tartas-1**

Sample No.	Sample code	Radiocarbon age, BP
1	NSKA 01644	7875 ± 81
2	NSKA 01645	7532 ± 97
3	NSKA 01646	7479 ± 92
4	NSKA 01647	7972 ± 70
5	NSKA 01648	7803 ± 66
6	NSKA 01649	7702 ± 71
7	NSKA 01650	7670 ± 73

According to the data on the burial depth of the finds, the last of these were separated only by 18 cm. The ^{14}C-age



1 *2* *3* *4*

Fig. 5. Tools from the Neolithic complex at Tartas-1.
1, *2* – from the elk bone, structure 6; *3*, *4* – scapula of elk (?) with traces of working, pit 1229.

Table 2. **Radiocarbon dates of samples from the Early Neolithic features (the Barabinskaya Neolithic culture) of Tartas-1**

Feature	Samples	Sample code	Radiocarbon age, BP	Calendar date, BC		Research laboratory
				1 σ	2 σ	
Pit 938	Ermine bone	NSKA 01647	7972 ± 70	7039–6779	7061–6661	INP SB RAS
	Fox bone 2	NSKA 01648	7803 ± 66	6696–6510	6982–6469	″
	Fox bone 1	NSKA 01649	7702 ± 71	6596–6471	6655–6433	″
	Hare (white) bone	NSKA 01650	7670 ± 73	6589–6458	6645–6418	″
Pit 990	Bird bone	NSKA 01644	7875 ± 81	7004–6633	7046–6535	″
Pit 991	Bones from the layer	MAMS 26158	8034 ± 36	7063–6838	7071–6825	Curt Engelhorn Center for Archaeometry
	Dog	MAMS 26156	7804 ± 37	6658–6596	6696–6509	″
	Wolverine	MAMS 26157	7946 ± 37	7025–6710	7031–6695	″
Pit 1229	Elk scapula (tool?)	MAMS 29407	7344 ± 24	6240–6108	6249–6093	″
Structure 6	Fragment of elk bone (article)	NSKA 01645	7532 ± 97	6467–6258	6593–6220	INP SB RAS
	″	NSKA 01646	7479 ± 92	6427–6252	6486–6100	″
	Animal bone	MAMS 29405	7019 ± 23	5977–5888	5982–5846	Curt Engelhorn Center for Archaeometry
Structure 7/1, horizon	Animal rib (elk)	MAMS 29402	7621 ± 22	6470–6446	6492–6435	″
Structure 7/2, horizon	″	MAMS 29403	7449 ± 23	6377–6260	6391–6249	″
Structure 7/3, horizon	″	MAMS 29404	7446 ± 23	6375–6260	6390–6248	″

of the most ancient find (ermine bone, NSKA 01647) from a depth of 320 cm* is 7972 ± 70 BP. A hare bone was buried higher by 5 cm (at a depth of 315 cm). Its (NSKA 01650) ^{14}C-age (7670 ± 73 BP) is in good agreement with the previous estimate. Even higher, at a depth of 304 cm, a fox bone (NSKA 01648) taken for analysis was located. Its date is 7803 ± 66 BP, i.e. this find is somewhat older than the previous one, and also than the date obtained from the fox bone (NSKA 01649) found higher by another 2 cm (7702 ± 71 BP). However, if possible corrections are taken into consideration, it becomes apparent that the two last dates, corresponding to the samples separated by 2 cm, belong to the same period, while time differences should be attributed to the imperfection of the method. It is also obvious that the more ancient date correlates to the earliest date in terms of the epoch.

*All measurements were made from a single reference point.

The date 7875 ± 81 of pit 990 (NSKA 01644) coincides with the date of sample NSKA 01648 from the above-described pit 938 (7803 ± 66 BP), which is indicative of their contemporaneousness.

Two following dates for structure 6 are absolutely coincident: NSKA 01645 – 7532 ± 97 BP, NSKA 01646 – 7479 ± 91 BP (Table 2). They are separated by only 53 years, which can be neglected when taking into account possible corrections. These dates are not fully correlated with the date of structure 6 obtained at the Curt Engelhorn Center for Archaeometry (7019 ± 23 BP); they are older by more than 400 years, but the total spread in dates obtained in this center (Molodin, Reinhold, Mylnikova et al., 2018: Tab. 1) reaches ca 1 thousand years.

Calibration of the obtained series of dates for 1 σ and 2 σ (Table 2) demonstrates total correlation with the dates submitted by the Curt Engelhorn Center. Meanwhile, some of them are identical. For example, the date of the animal bone (a tool?) that was discovered in one of the

utility pits (No. 1229) that surrounded structure 7 (see Fig. 2, 3) is 7344 ± 24 BP. Since the lowest date of structure 7 itself is 7449 ± 23 BP, it can be assumed that the pit and structure 7 functioned around the same time. This circumstance "narrows the distance" between pit 1229 and pit 938 in structure 6. Most probably, the utility pits were located not far from the structures. As a result of frequent rebuilding, renovation of walls, displacement and reconstruction of the hearth (judging by the planigraphy of structures), the trench, shifting sideways, covered the pits that did not function by this time.

Conclusions

The results of radiocarbon dating of samples from the Early Neolithic complexes at Tartas-1 in the laboratory of the Institute of Nuclear Physics SB RAS, using the unique research installation "Accelerator Mass-Spectrometer of the INP SB RAS", are almost completely coincident with the dates obtained earlier at the Curt Engelhorn Center for Archaeometry*. Notably, the two dates were determined in different laboratories, for bone tools from the filling of structure 6. Their identity confirms the correctness of the conclusions: the earlier distinguished Barabinskaya Neolithic culture can be confidently attributed to the 7th millennium BC.

During excavation of a Neolithic site at Tartas-1 in 2018 and as a result of study of the Ust-Tartas-1 complex discovered in 2017 (Molodin, Kobeleva, Mylnikova, 2017b; Molodin, Hansen, Mylnikova et al., 2018), new materials were obtained, which holds out a hope of clarifying the chronological framework of the Barabinskaya Early Neolithic culture in future.

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K. Nordqvist[1], V.-P. Herva[2], and S. Sandell[3]
[1]University of Helsinki,
Helsingin yliopisto
Fabianinkatu, 24, Helsinki, 00014, Finland
E-mail: kerkko.nordqvist@helsinki.fi
[2]University of Oulu,
Oulun yliopisto
Pentti Kaiteran Katu, 1, Oulu, 90014, Finland
E-mail: vesa-pekka.herva@oulu.fi
[3]Helsinginkatu, 14, Helsinki, 00500, Finland
E-mail: sarita.sandell@gmail.com

Water and Cosmology in the Stone Age of Northeastern Europe

This paper explores water and watery places as sacred elements among the cultures of the northern boreal zone during the Stone Age, and especially the Neolithic period, through materials deriving from Northwestern Russia and Fennoscandia. The peculiarity and importance of water and certain watery environments, like rivers, lakes, bogs, waterfalls, and rapids, are discussed through depositional practices of material culture, mainly lithic artifacts. Rock-art provides further tools for approaching the topic, not only through its locations in the landscape but also through its motifs, which allow parallels to be drawn to later ethnographical sources and folklore, too. Finally, the paper briefly touches upon the rationality behind making a strict separation between "sacred" and "mundane" when interpreting prehistoric cultural phenomena. Water was integral to human life in many different ways, but bodies of water and watery places could also be threatening and unpredictable. Therefore water would have been an ambivalent element, probably invested with significant cultural meanings in the Stone Age world.

Keywords: *Animism, cosmology, material culture, relational ontology, rock-art, Stone Age.*

Introduction

Water is a sacred element in many cultures and religions and was presumably assigned "special" properties also during the Stone Age. Water is vital to human physiology and metabolism, and as such an everyday necessity, but also associated with danger and death. The element of water was present in various ways in the daily life of Stone Age hunter-gatherers, not least because the hunter-gatherer settlement in our area of interest is generally considered to have been shore-bound. This idea is based on the reasoning that proximity to water was important in terms of subsistence, as well as of transportation and mobility. Subsistence-related activities are usually also considered as an explanation to why certain types of artifacts (such as perforated stones) are found on "too low" elevations, i.e. elevations that were still under water during the estimated time of deposition (Edgren H., 1978: 1, 110). Accidents, such as capsized boats or falling through weak ice, are another common explanation; perhaps the most famous case is the Antrea net find on the Karelian Isthmus (Pälsi, 1920). Also a few whole pots found in lakes and bogs have been explained this way (Edgren T., 1982: 44).

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On the other hand, many artifacts found in water, or originally assumed to have been deposited in water, are given ritual explanations. These are seen as sacrifices, offerings, or votive gifts or deposits, placed in specific (wetland) locations in order to gain certain benefits or to secure certain goals, such as luck in hunting (Huurre, 1991: 293). Water, and especially the shoreline, islands, rapids, cascades, and springs, may have been seen as supernatural and liminal spaces (Goldhahn, 2002; Westerdahl, 2005; Rainbird, 2007: 12–13; Herva, Ylimaunu, 2014). For instance, seasonality and change are very evident on the banks of rivers and shores of reservoirs. Flooding is an obvious example, but long-term changes related to the shore displacement and transgressions/regressions are also first visible here. Thus, part of the depositional and other practices connected with water may have been one way to cope with these changes.

This paper explores water and watery places as sacred elements during the Stone Age, and especially during the Neolithic* (the 5th to 3rd millennia BC; for periodization, see (Nordqvist, 2018: Ch. 3)), through archaeological materials deriving mainly from Northwestern Russia, but also more widely from Northeastern Europe (Fennoscandia). The peculiarity and importance of water and watery environments are discussed through depositional practices, mainly of lithic artifacts. Rock-art will provide further tools for approaching the topic, not only through its locations and placing in the landscape but also through its motifs. In addition to archaeological material, later ethnographical sources and folklore will be used to give meaning to water and wetlands. Finally, we will briefly discuss the problems of labeling things as "sacred" or "mundane" when interpreting prehistoric cultural phenomena.

Artifacts from rivers and lakes

Stone Age stray finds collected from the Karelian Isthmus (Leningrad Region, Russian Federation) in the late 19th and early 20th century (stored in the National Museum of Finland, Helsinki) provide one way of approaching the cultural meanings assigned to watery contexts. The finds made in the surroundings of the rapids in Losevo (Kiviniemi) and the environs of Lake Sukhodolskoye (Suvanto) between the Vuoksa River (Vuoksi) and Lake Ladoga are presented here as an example. During the Stone Age, the white waters in Losevo connected the ancient lake in the valley of Vuoksa and the large lake (originally a bay of Lake Ladoga) located in the basin of the present Lake Sukhodolskoye. However, 19th-century human activities caused significant changes (reduction) in the extent of these bodies of water, and also altered their directions of flow (Saarnisto, 2008: 137). These works, and the consequent clearing of fields in the newly exposed areas, brought to light also a great number of stray Stone Age finds.

All in all, ca 190 Stone Age finds are known from the villages located on the shores of Lake Sukhodolskoye; of these, ca 50 are said to derive either from the water or from the exposed lake bottom (Table 1). The finds include mostly polished stone tools (axes and adzes) and fragments thereof. Other finds are just solitary curiosities; pottery is basically not present. However, this material does not stand in any stark contrast with the other 19th- and early-20th-century accidental finds, which usually comprise only large stone tools.

The stray finds certainly include artifacts that were simply lost in the water during everyday activities, but also ones deposited as a result of "irrational" forms of human behavior. Even if large stone tools are found at settlement sites, they are usually not encountered in large numbers. Thus, the substantial number of finds of large lithic artifacts, together with the elevations of find locations, suggest that also other kinds of depositional practices were significant—the intentional deposition of artifacts into water was likely a fairly common occurrence. This, of course, is not a phenomenon peculiar to our research area only. For example, deposition into water and watery places was practiced from the Stone Age to the Early Middle Ages and beyond in northern Europe and Russia (Larsson, 2011; Fredengren, 2015; Serikov, 2015).

Deposition of stone tools in rapids and rivers seems to have taken place in the research area, too. From the Losevo region, altogether 31 stray finds have been collected; of these, five finds are mentioned as deriving directly by or in the Losevo rapids. Again, most finds are stone axes and adzes; but also, some pieces of pottery and other material are present. In general, this area has clearly attracted human presence: after a recent survey a total of eight Stone Age sites are known within a few kilometers' radius around the rapids (Nordqvist, 2013: 17–20). Another example that can be mentioned, is the other major white waters in the Vuoksa River, the Tiversk (Tiuri) Rapids, ca 20 km north-west of Losevo. Here two artifacts (an adze and a weight stone) are reported to have been found in the rapids, and a few more axes and adzes from water in the surroundings; finds from the whole Tiversk village around the rapids total almost 60 specimens. Further, over 20 lithic artifacts were encountered while clearing other rapids and rivers on the Karelian Isthmus ca 100 years ago, including, among others, the Volchya (Saijanjoki), Veselaya (Konnitsanjoki), Petrovka (Kilpeenjoki), Gusiniy (Hanhioja), and Kozlovka (Kuhajoki) rivers.

*The report on this topic was presented at the scientific conference "Archaeology of Russian Ritual Sites" (Solovki, September 7–12, 2016) (Nordqvist, Herva, Sandell, 2016).

Table 1. **Finds of Stone Age artifacts made in the environs of Lake Sukhodolskoye**

Collection	Find type	Find location	Year
1	2	3	4
KM 263	Stone ring	Losevo (Kiviniemi), by the rapids	1857
KM 782	Adze	″	1857
KM 1062	″	″	1869
KM 1922:29	Gouge	Non-locatable village in the Lake Sukhodolskoye area, by an estuary	1878
KM 1922:31	″	Non-locatable village, the shore of Lake Sukhodolskoye	1878
KM 1922:33	″	Zaporozhskoye (Koukkuniemi), the shore of Lake Sukhodolskoye	1878
KM 1922:34	″	″	1878
KM 1922:35	Adze	″	1878
KM 1922:36	″	″	1878
KM 1922:37	″	″	1878
KM 2298:141	Axe	Zaporozhskoye (Kosela), the former bottom of Lake Sukhodolskoye	1884
KM 2298:142	Adze	″	1884
KM 2298:143	″	″	1884
KM 2668:13	″	Zaporozhskoye (Kosela Eevala), the former bottom of Lake Sukhodolskoye	1889
KM 2668:14	″	″	1889
KM 2668:15	″	″	1889
KM 2668:16	″	″	1889
KM 2668:17	Gouge	″	1889
KM 2668:18	″	″	1889
KM 2668:19	″	″	1889
KM 2668:22	Adze	Gromovo (Sakkola), the former bottom of Lake Sukhodolskoye	1889
KM 2668:23	″	″	1889
KM 2668:27	″	Zaporozhskoye (Uusanlampi), the former bottom of Lake Sukhodolskoye	1889
KM 2668:29	″	″	1889
KM 2668:33	″	″	1889
KM 2668:34	″	″	1889
KM 2668:35	″	″	1889
KM 2668:36	″	″	1889
KM 2668:61	Stone tool	Pyatirechye (Saaroinen), by the River Vyun (Viisjoki)	1889
KM 2836:4	Double-bladed adze	Losevo (Kiviniemi), from the rapids	1892
KM 4912:1	Gouge	Lugovoye (Vaskela), the former bottom of Lake Sukhodolskoye	1907
KM 4912:2	Adze	″	1907
KM 5608:1	Boat axe	Lugovoye or Zaporozhskoye (Vaskela or Kosela), the former bottom of Lake Sukhodolskoye	1910
KM 5608:2	Cradle-runner-shaped pickaxe	Non-locatable village, the former bottom of Lake Sukhodolskoye	1910

Table 1 (end)

1	2	3	4
KM 5650:4	Gouge	Gromovo (Sakkola) (?), inundated shore field	1910
KM 5685:1	Perforated (weight) stone	Udaltsovo (Riiska), the shore of Lake Sukhodolskoye	1910
KM 5707:1	Double-bladed adze	Zaporozhskoye (Koukkuniemi), the former bottom of Lake Sukhodolskoye	1910
KM 6008	Shaft-hole axe	Lugovoye or Zaporozhskoye (Vaskela or Kosela), the former bottom of Lake Sukhodolskoye	1912
KM 6068	Knife	Zaporozhskoye (Koukkuniemi), the shore of Lake Sukhodolskoye	1912
KM 6086	Adze	Lugovoye or Zaporozhskoye (Vaskela or Kosela), the former bottom of Lake Sukhodolskoye	1912
KM 6376	″	Lugovoye (Vaskela), the former bottom of Lake Sukhodolskoye	1913
KM 6381	Axe	Zaporozhskoye (Koukkuniemi), the shore of Lake Sukhodolskoye	1913
KM 6621:1	Gouge	Lugovoye (Vaskela), the former bottom of Lake Sukhodolskoye	1914
KM 6874	Claw-shaped adze	″	1915
KM 6919:1	Adze	Non-locatable village, the shore of Lake Sukhodolskoye	1915
KM 6969:1	Axe	Zaporozhskoye (Kosela), the former bottom of Lake Sukhodolskoye	1915
KM 7091:1	Gouge	Zaporozhskoye (Koukkuniemi), the former bottom of Lake Sukhodolskoye	1916
KM 7754:2	Double-bladed axe	Solovievo (Terenttilä), the former bottom of Lake Sukhodolskoye	1920
KM 7754:3	Narrow adze	″	1920
KM 7901:66	Perforated (weight) stone	Olkhovka (Lapinlahti), among rocks on the shore	1920
KM 8114	″	Udaltsovo (Riiska), field by the shore	1922
KM 10826	Pottery sherds	Losevo (Kiviniemi), by the rapids	1938
KM 11410	Shaft-hole axe	Gromovo (Sakkola), the shore of Lake Sukhodolskoye	1944

Note. Only the finds said to derive either directly from the water or from the exposed lake bottom are listed. KM – National Museum of Finland (Helsinki).

The number may seem small but it should be taken into consideration that the finds were made only accidentally, in connection with non-archaeological works, and may not include all artifacts originally present at these locations. On the other hand, the clearing works of the Pchelinka (Kannilanjoki) River, in Klimovo (Kuusaa), in the 1930s revealed over 40 finds, including again stone axes and adzes but also some pottery, whetstones, and bone items, even some Iron Age finds (Takala, 2005: 88–104). Further references to numerous lithic artifacts found from rapids may be found in the research literature. For example, in Satakunta province, western Finland, over 100 stone tools have been reported to have been found in ca 50 rapids (Huurre, 1991: 293).

Waterfalls can be presented as a special case. One of the most famous cascades of Northwestern Russia is Kivach (Kivatsu, Kivačču), in the River Suna (Suunu) water system, in the Karelian Republic. This rocky gully, with a drop of almost 11 m, clearly stands out from its environment, and obviously also enticed Stone Age people (Fig. 1). In expeditions by Finnish scholars in the late 19th century, altogether 18 lithic artifacts were recovered from the Kivach area (Pääkkönen, 1898; Nordqvist, Seitsonen, 2008), in addition to which Russian sources mention seven specimens originating somewhere in this region (Bryusov, 1940: 221; Kochkurkina, 2007: 51). As a curiosity, the "ritual" use of many artifacts was also continued later on: five of the specimens were used as magic charms (thunderbolts) in the 19th century (Table 2). The number of finds from Kivach is quite large. In 19th-century Karelia, similar numbers of artifacts were usually collected only from the

Fig. 1. The upper part of Kivach waterfalls in the Suna River. Photograph by K. Nordqvist.

Table 2. **Stone tools recovered as stray finds from the area of Kivach**

Collection	Find type	Find location	Year of find
1	2	3	4
GE	Gouge	Kivach	19th century
GIM	Arrowhead	″	19th century
″	″	″	19th century
″	Axe	″	19th century
″	″	″	19th century
″	Stone tool	″	19th century
″	Unfinished axe	″	19th century
KM 3309:257	Adze	Kivach, shore	1896
KM 3309:258	Perforated (weight) stone	″	1896
KM 3309:259	Cradle-runner-shaped pickaxe*	Kivach, forest	1896
KM 3309:260	Adze*	Kivach, shore	1896
KM 3309:261	Cradle-runner-shaped pickaxe*	″	1896
KM 3309:262	Adze	Kivach, field	1896
KM 3309:263	″	Kivach, forest	1896
KM 3309:264	″	″	1896
KM 3309:265	Stone tool	Kivach, shore	1896

Table 2 (end)

1	2	3	4
KM 3309:266	Cradle-runner-shaped pickaxe	Kivach, shore	1896
KM 3309:267	Axe	″	1896
KM 3309:268	″	″	1896
KM 3309:269	Axe*	Kivach, field	1896
KM 3309:270	Cradle-runner-shaped pickaxe	Kivach, shore	1896
KM 3309:271	″	″	1896
KM 3309:272	Cradle-runner-shaped pickaxe*	″	1896
KM 3309:273	Cradle-runner-shaped pickaxe	″	1896
KM 4259	Axe	Kivach, near the waterfalls	1903

Note. KM – National Museum of Finland (Helsinki), GE – the State Hermitage Museum (St. Petersburg), GIM – the State Historical Museum (Moscow). Artifacts used later as magic charms (thunderbolts) are marked with an asterisk.

territories of large parishes or from villages located on the shores of lakes, which today are known to be rich in Stone Age settlement sites (e.g. Syamozero/Säämäjärvi). At least 12 items out of the 18 have been discovered on the shore or in water. Thus, it seems obvious that at least some of these artifacts were originally placed in water intentionally.

The area of the waterfall was for a long time archaeologically unexplored, but during recent years, fieldworks have revealed 20 new sites in the vicinity dating to the Mesolithic–Eneolithic (German, Melnikov, 2017). Apart from one site located a bit upstream, the settlements are situated some kilometers south of the cascades, on ancient shore terraces of Lake Onega. Even if some stray finds may derive from these sites (no information exists, however), most are still likely related to the waterfalls, especially the ones found in water.

The rocky area of the cascade is not really a potential or likely place for ordinary settlement. The reason that the artifacts were deposited into the cascade is not self-evident, but there seems to have been a specific meaning behind the activities. It may well have been that this exceptional location in the natural environment attracted people, somehow resonated with their wider worldview and ambitions, and provoked ritual activities. As waterfalls can be understood as liminal places between "this world" and the "otherworld" of supernatural beings and powers, and as they also provided visitors with various sensory stimuli, cascades may have been ascribed very different meanings than, for example, "ordinary" rivers or rapids. Such sensory stimuli (visual, aural, and other) have also been presented as an important reason as to why some North-European waterfalls contain rock-art (Goldhahn, 2002: 49).

Water, islands, and shores— rock-art and burials

Water has been a central element in the traditional cosmologies and mythologies in Fennoscandia and Northwestern Russia for centuries and millennia. The conceptual ordering of the world around the land-sea opposition has even been proposed as a key cosmological principle in the northern Baltic Sea region from the Stone Age to the recent past (Westerdahl, 2005). Water does feature prominently in Finno-Ugric (and in many other northern peoples') cosmogonic myths: one version attributes the birth of the world to a duck, which dives to the bottom of the world sea and brings up mud, from which the land is made; whereas another version holds that the world was born from a waterfowl's egg on a mythical island on the world sea (Kuusi, Bosley, Branch, 1977: 522–523; Berezkin, 2010). The cosmogonic myths have interesting links to rock-art: a similar idea of the world coming into being from a bird's egg seems to be represented in a rock carving on the Island of Bolshoy Guri, in the eastern Lake Onega area (Lahelma, 2012: 27–28). Importantly, the rock carving in question is located on a rocky island of smooth, rounded, and shiny bedrock that makes the island look as it was made of gigantic fragment of eggshell. Discussing these and other features of the Onega rock-art and its context, A. Lahelma has put forward the interpretation that "the egg-shell shaped cliffs and islands would have actualized the myth" wherein the world is born from an egg, and that "the cliffs may have been viewed as a place where the world was created" (Ibid.).

It is interesting to note that the idea of the world emerging from a primordial sea would have resonated, in the Stone Age Northeastern Europe at least, with actual

post-glacial changes in coastal environments. Owing to land uplift, islands could be seen to emerge from the sea, grow larger, become joined with the mainland, and gradually rise on the higher ground to become more or less pronounced hills in the landscape. Furthermore, as water and watery places have associations with the underworld and the supernatural, it is not surprising that islands have frequently been used as burial sites, and associated with death in various cultures (Bradley, 2000: 5; Rainbird, 2007: 12–15). The first known examples of such practice in the research area derive from the Late Mesolithic, the most notable example being the Yuzhny Oleny Island on Lake Onega (Gurina, 1956). It has also been proposed that some of the Stone Age people had been buried in water, which would explain their general absence in the archaeological record. Water-related depositional practices of human remains from the Late Mesolithic have recently been revealed in Motala, central Sweden (Hallgren, 2011). Water and watery places have been connected with death and body disposal also in later times, as exemplified by the Iron Age bog bodies of Northern Europe (Aldhouse-Gren, 2002), or the Finnish burial site of Levänluhta, in Southern Ostrobothnia (Wessman, 2009). Numerous examples of island burials can also be found in Northeastern Europe up until the recent past (Sarmela, 1994: 57; Shumkin, Kolpakov, Murashkin, 2006; Ruohonen, 2010).

In addition to cosmological elements, rock-art contains other features that connect it with water. For example, boats are a common theme, as well as scenes of maritime hunting in some areas. These have been considered by some scholars as depictions of everyday activities, but just like other motifs in rock-art they can also be seen as symbols that depict something beyond the illustrated objects themselves (Zhulnikov, 2006: 113–115; Lahelma, 2008: 56–57; Gjerde, 2010: 145–150). The rock-art locations themselves also indicate that special ritual meanings were attributed to water. For instance, rock-art was often placed near the waterline. This was a liminal zone, where different worlds (associated with the sky, earth, and water) met, and images thus "traveled" between the worlds when water levels changed (Helskog, 1999). In other words, it is possible that some of the images were originally intentionally placed so that water washed or covered them at times; this would have given the images part of their meaning (Gjerde, 2010: 100–101).

Images may also have been considered as an "interface" between the worlds in another sense: that is, they can be understood as "membranes" between different dimensions of reality (Lewis-Williams, Dowson, 1990; Lahelma, 2008: 59–60). For example, some images in Finnish rock paintings appear to represent shamanistic experiences, wherein a shaman figure is associated with a fish, indicating that places visited during altered consciousness were associated with an underwater world (Lahelma, 2008: 52–56), which represented one level of the three-tiered world in northern shamanistic thinking. It is also worth noticing that in Finno-Ugric folklore and traditional cosmology, lakes and other bodies of water could be inhabited by spiritual beings. For example, for Sámi people certain lakes and ponds, called *sáiva*, were considered to be sacred, inhabited by spirits, and also at times envisaged as double-bottomed passages providing access to the netherworld (Sarmela, 1994: 58; Pentikäinen, 1995: 146–149; Serikov, 2015: 444–445).

The idea that water was inhabited by spirits on the one hand, and provided a connection between different dimensions of reality on the other, makes it possible to construct a bridge between rock-art and artifact deposits made in water. In fact, there are artifact depositions by some rock paintings—in water. Perhaps the most well-known examples of this are the three human-faced amber pendants found in water right in front of the Astuvansalmi rock-art panel in eastern Finland (Grönhagen, 1994). Another Finnish rock-art site, where evidence of offerings has been recovered (although on dry land and dating to the Early Metal Period), is Valkeisaari on Lake Saimaa. On the basis of finds that indicate communal consumption of food, parallels to historically recorded Sámi practices at sacred *sieidi* sites have been drawn (Lahelma, 2006: 17) (Fig. 2). But there are also many other signs of human activities taking place in the vicinity of northeast-European rock-art sites: in the Lake Onega and White Sea areas, many rock-art panels are accompanied by indications of human activities spanning several millennia (Savvateev, 1977: 309–311; Lobanova, Filatova, 2015: 195–196).

Conclusions: ambiguous water—ritual and mundane

The opposition between the "sacred" and the "profane" is first and foremost a product of post-Enlightenment western thinking, and its projection on prehistoric (or other non-Western) cultures is deeply problematic—most likely, prehistoric people would not have understood the sacred and the profane as we do today. Within the broadly animistic-shamanistic cosmology of that time, "ritual" and "rational" were intertwined, because the world and its works were understood differently from modern times. One way of reconceptualizing Neolithic worldview is to understand the Stone Age world as one inhabited not only by people but also by spiritual or other non-human beings with which people interacted in various "ritual" and other ways (Bird-David, 1999; Brown, Walker, 2008; Herva, 2009; Holbraad, 2009). Extraordinary properties were attributed not only to water and watery places but also to

Fig. 2. Sacred site of the Sámi: the *sieidi* of Taatsi by Lake Taatsinjärvi in Kittilä, northern Finland. Photograph by K. Nordqvist.

forest, soil, the elements, various materials and artifacts, and so on. Therefore, straightforward divisions between subjects and objects, culture and nature, or natural and supernatural cannot be drawn; this is also typical for later, traditional northern cosmologies. The world was ultimately reciprocal and came constantly into being through the interaction and relations between the humans and the non-humans.

The Stone Age beliefs and ritual practices associated with water and watery places should not be seen as isolated beliefs or misinformed superstition, but instead as arising from a certain way of perceiving and interacting with the world in general. Even if deposition of artifacts in water may seem deeply ritualized (and even nonsensical) to us, it may have been the normal way to prepare oneself for the present and the future. It is also important to underline that there was not necessarily a drastic difference between ordinary everyday activities and "rituals" in the first place; rather, these can be seen as two sides of the same coin. The discarding and deposition of material culture, including the practices directed towards water, may have been utilitarian, small-scale events, which were still governed and directed by social rules and cosmological concepts (Chadwick, 2012).

Part of the meaning assigned to water arises from its physiological necessity: the human body cannot function without water. Bodies of water also provided a significant portion of the subsistence for many northern Stone Age people, and waterways (open or frozen) formed central routes of transportation in many areas. Water is also almost trans-culturally seen as a purifying, cleansing element—this can be understood not only literally, but also metaphorically. On the other hand, storms, floods, and the like clearly epitomize the destructive, potentially lethal aspects of water; for example, myths of a Deluge are known around the Globe. Other negative properties also have been connected with the watery places. As mentioned above, in Finno-Ugric and other northern folklore and mythology, many watery locations, such as bogs, rivers, springs, lakes, and ponds were considered portages to the netherworld or afterworld (Siikala, 1992: 163–164, 182; Serikov, 2015: 444–445). In addition to being seen as portages to another dimension, watery places and wetlands have been perceived as places of punishment or banishment: unwanted persons or things may have been deposited or deported there, either concretely or figuratively speaking (Siikala, 1992: 157–158). According to historical folklore and sources, people who had suffered "bad death" (e.g. through suicide, execution, a drunken fight, infanticide, or drowning) were buried into the least-valued parts of the churchyard, or left outside the consecrated land, on bare ground or in wetlands. Further, in some regions it was believed that the spirits of the drowned remained eternally as wandering restless souls (Sarmela, 1994: 60, 172–175; Pentikäinen, 1995: 215–216). Thus, the negative aspects of water had

not only the potential to harm one's physical health but were equally dangerous to one's soul. Northern folklore includes a vast array of spirits, "water people", which further illustrates the ambivalent nature of this element. Some of the spirits are benevolent, many malevolent, and some ambivalent both in their intentions, habitus, and gender, such as the Water Fey (Siikala, 1992: 182; Sarmela, 1994: 165–168).

Of course, the examples provided by folklore and historical mythology cannot be taken as direct analogies to how the world was perceived and understood during the Stone Age, but insights gained from ethnographically informed approaches provide useful ideas for canvassing the possible meanings behind prehistoric practices. We have not tried to imply that the meanings and practices connected with water and watery places were identical in all areas and at all times. Our aim here is simply to outline an alternative frame of reference, within which these finds and phenomena could be interpreted.

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V.B. Kovalevskaya
Institute of Archaeology, Russian Academy of Sciences,
Dm. Ulyanova 19, Moscow, 117036, Russia
E-mail: ver.kov@mail.ru

Turning Points in Horse Breeding in the Eurasian Steppes and the Near East

This article discusses the pivotal points in horse domestication on the Eurasian steppes and the Near East in the 5th to 2nd millennia BC, from the initial time and place of the domestication of horses to the emergence of various types of horse harnesses. On the basis of 5th and 4th millennia BC Eurasian horse-headed scepters, the means for handling horses are reconstructed. Six types of head harnesses are described, and their evolution is traced from simple muzzles (type 1) and more complex ones (types 2 and 3) to those supplemented with drop nosebands (type 4) and snaffle (type 5) and non-snaffle bridles (type 6). A unique 3rd millennium BC document—an Elamite clay tablet from Susa, listing horse farms, has made it possible to assess the structure of each farm, and evaluate the size of the domestic horse population in Elam. Training techniques of chariot horses were described by the "master horse trainer Kikkuli of Mitanni". These techniques were further developed by the proto-Indo-Aryans on the Eurasian steppes in the early 2nd millennium BC, and became known to the Hittites and Assyrians via the Mitanni horse breeders. On the basis of the Rigveda, the type and exterior of those swift horses with which the Indo-Aryans spread over Asia are characterized.

Keywords: *Horse breeding, domestication, horse harness, Eurasian steppes, Near East, 5th to 2nd millennia BC.*

Introduction

The problem of the time and place of horse domestication seemed much more resolved fifty years ago than it does today. At that time, the discoveries of "horse-breeding" tribes of the 4th to 3rd millennia BC by archaeologists in the Ukraine and later in the Urals and Kazakhstan, and the study of bone evidence from the early settlements by Russian paleozoologists testified to domestication of horses in the Eurasian steppes in that period. Today, using all the available evidence, scholars are coming to the conclusion that horses were domesticated in the Neolithic-Chalcolithic cultures of the Middle Volga region (Petrenko, 2007: 25–29). A society with a producing economy emerged in that region; this society used horses not only (and not so much) as animals for meat, but also as riding animals for hunting, quick transportation and gradual mastering of the surrounding space, as well as the symbol of an elite status, confirmed by the appearance of horse-headed scepters. According to the genetic data, 77 independent female lines are distinguished in the present-day population of domestic horses. Scholars thus conclude that the genetic material of wild horses was added many times in various territories and among various peoples since the first time the horses were domesticated (Levine, 2006).

Another approach to the study of domestication and dissemination of horse breeding skills in Eurasia is the study of linguistics. A recent study of linguistic evidence by S.V. Kullanda associated with the designation of the horse (*ek'vo-s) in Indo-European languages is significant. The name, horse, belongs to common and the earliest Indo-European lexemes. On the basis of the linguistic formulations by S.A. Starostin, Kullanda emphasized that "the Proto-Indo-European language

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was superimposed on the Northern Caucasian substrate in its ancestral homeland, which means that the proto-Indo-Europeans assimilated a certain group of Northern Caucasians, adopting a number of terms relating to the most diverse areas of life from them" (2008: 672), including terms associated with the horse. Based on the glottochronological evidence in the form amended by Starostin, this borrowing occurred at the turn of the 6th and 5th millennia BC. Thus, we obtain an equation with three unknowns (the areas of the proto-Indo-European and proto-Northern Caucasian languages and the areas of wild and/or domestic horses at that period of time), which can be solved when it becomes possible to establish the above areas within Eurasia. It is important for the emergence of domesticated horses in the Middle East that the designation of horse in the Sumerian language was also borrowed from the proto-Northern Caucasian language (Ibid.), and not from the Indo-European, as had been previously thought. The name itself meaning "donkey from the mountains" or "donkey from the east", speaks of the territory from which domesticated horses came to Mesopotamia. This is the Armenian or Iranian Highlands, and the time was evidently the 4th millennium BC according to the analysis of bone remains and written sources. Yet in general, it should be noted that information on the domestication of horses in different areas of the Old World creates a picture full of blank spots, which can be filled with new facts and interpretations as information accumulates in various fields of knowledge, including archaeology, paleozoology, ancient history of the East, linguistics, and paleogenetics of equids. This will be the key to the refinement and development of our knowledge about domestication and forms of using horses in the Old World.

Earliest devices for harnessing horses

The problem of using horses for carrying packs or riding raises the question on the means of controlling the horse. Archaeological finds contain no other evidence except for the psalia of the Sredny Stog culture, on which specialists do not have a unanimous opinion. However, such an important source of information as representations of horse harnesses on horse-headed scepters has so far remained unused by the scholars. This category of finds is represented by almost 40 artifacts from burials, settlements, and random discoveries. The area of their distribution extends from the Middle Volga region to Ciscaucasia and the Danube region. The time when they were in use (according to the calibrated dates) is the 5th to 4th millennia BC. The number of specialized articles and monographs devoted to horse-headed scepters is very large (for the latest, most complete summary see (Dergachev, 2007)).

The first identification of images on stone scepters with horses belongs to V. Dumitrescu (in the middle of the last century) and D. Birch (in 1954) (Ibid.: 76–77). Different scholars have described the elements of the head harness, which were rendered by relief, polishing, or engraving on horse heads in different ways, but limited themselves to indicating that horses were "bridled" or that muzzles or frenteras of halters were represented. Yet no one attempted to reconstruct the shape, type of head harness, and method of controlling the horse. This article will focus on these aspects, since an analysis of the iconographic features of head harnesses depicted on horse-headed scepters makes it possible to reconstruct the very first steps in controlling horses at the early stage of their domestication in the Neolithic-Chalcolithic period. As we will show below on a series of reconstructions (Fig. 1), the method that was created at that time was sufficient for a person to lead a horse, hold it, tie it up, and use the horse for carrying packs or riding.

Specialized literature pays significant attention to the ability to control the horse when riding through the impact of the rider's weight, whip, the rider's shins, or pressure on the nasal cartilage with a drop noseband (Kovalevskaya, 1977: 11–18; Anderson, 2006: 63). The latter method was also used for controlling chariot horses, as M. Littauer (1969: 291), one of the greatest specialists in the use of horses in ancient times, wrote already in 1969. Judging by the representations of chariot horses in Egypt (2nd millennium BC), they were controlled with the help of a drop noseband without a bridle bit in the mouth. This is confirmed by archaeological finds—bridles without snaffle bits (mouthpieces), indicated by J. Anderson (1961: Pl. 2), and studied in detail by Littauer (1969: 291, 292). Representations of equids with a muzzle and nose ring in the Middle East are separated from the Egyptian images by millennia, but it should be noted that whether they were bridles without snaffle bits or muzzles, in all cases cheekpieces and crownpieces were used, and sometimes additional browbands and nosebands.

Only one terracotta from Syria (Fig. 1, *19*), supposedly dated to the 3rd or 2nd millennium BC (Littauer, Crouwel, 1979: Fig. 22), shows the same type of muzzle combined with a drop noseband, which is connected to the crownpiece with wide upper and lower straps (possibly low-lying cheekpieces), as means for handling horses in the European steppe and forest-steppe during the Chalcolithic. Evidently, they must have been genetically related.

The use of muzzles of types 1–4 (Fig. 1, *1–4*) was a method of harnessing horses. Precisely that method best fits the common Indo-European term that is associated with the first steps to tame a horse and exercise active control over it. This is the Old Indian "tame"/"subdue"/"force", Ossetian "tame"/"wear down",

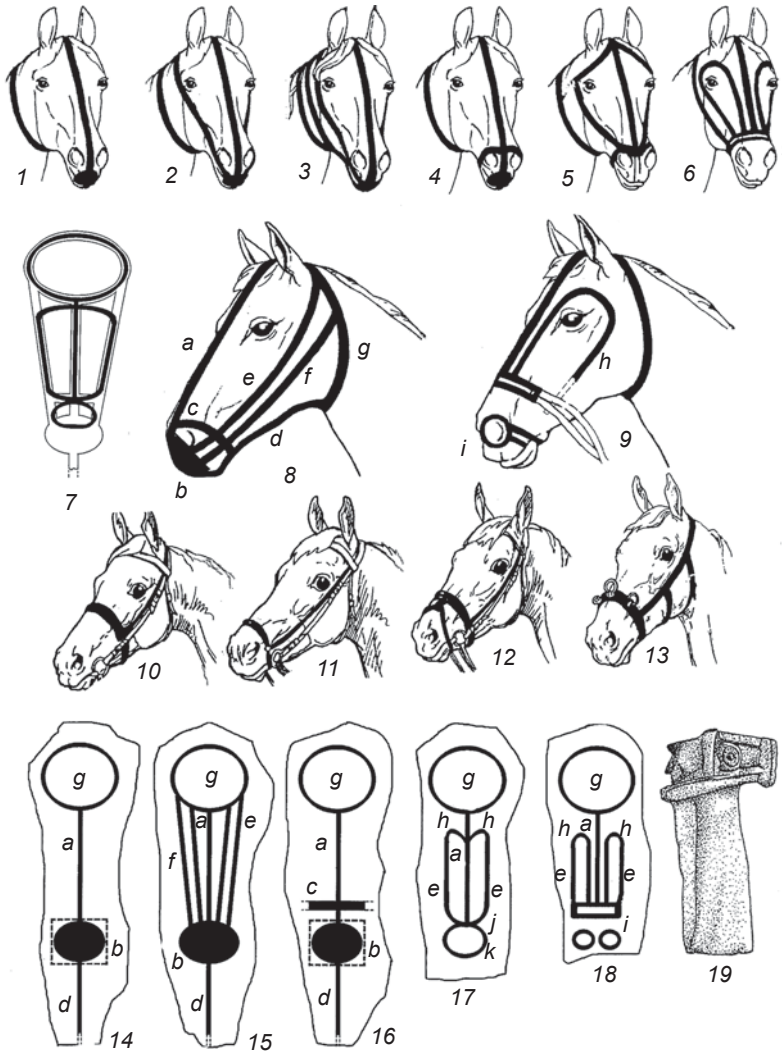

Fig. 1. Reconstruction of muzzles and bridles of the 5th–4th millennia BC based on representations on horse-headed scepters. *1–6* — types 1–6; *7* – cut of the bridle of type 5; *8* – muzzle bands: *a* – long frentera, *b* – muzzle, *c* – drop noseband, *d* – lower connecting strap, *e*, *f* – cheekpieces, *g* – throat latch; *9* – bands of the head harness: *h* – bent cheekpiece, *i* – ring-shaped, spectacle-like drop band above the nostrils; *10–13* – present-day halters: *10* – regular, *11* – Hannover, *12* – Irish, *13* – kaptzug (after (Gurevich, Rogalev, 1991)); *14–18* – cuts of muzzles and bridle (*a–i* – see *8*, *9*; *j* – bent lower part of the frentera-cheekpiece, *k* – oval leather mouthpiece): *14* – type 1, *15* – type 3, *16* – type 4, *17* – type 5, *18* – type 6; *19* – terracotta from Selenkahiye (after: (Littauer, Crouwell, 1979: Fig. 22)).

and only Homer used "break in by riding" (Gamkrelidze, Ivanov, 1984: 483). The muzzle and drop noseband are means of "subduing", "forcing", and "wearing down" the horse, because they make breathing difficult, and do not allow the horse to eat and drink. The horse tamed with the help of such a muzzle can be used by man for work, carrying heavy loads on its back, or riding.

Any horse equipment consists of longitudinal and transverse straps, which are joined with each other. Judging by the available images, we may assume that muzzles were cut out of a single piece of leather measuring approximately 120 to 140 × 30 to 40 cm (Fig. 1, *14–18*). Straps could be 4–5 cm wide or even wider. With this cut, there is a single knot in the muzzle: the connecting (lower) strap is tied to the throat latch under the jowls of the horse. The muzzle could be made in such a way that due to the treatment of the rawhide it might have a rounded convex-concave shape, and lie on the end of the horse's nose.

According to the earlier study by this author (Kovalevskaya, 2014), five types of muzzles (types 1–4, 6) and one type of bridle (type 5) can be distinguished on the basis of representations of halters on scepters. The latter type is a reconstruction made from the pommel of the scepter from Suvodol (Dergachev, 2007: Fig. 6). According to V.A. Dergachev, its small size indicates that it is the earliest among the pommels of stage D. All bands of the head harnesses, including the mouthpiece in the mouth (most likely, an oval band made of rawhide), are carefully represented on the pommel in low relief (Fig. 1, *5*, *7*, *17*). The bridle (in this case, we have reason to use this name for the first time) consists of a frentera (upper band) starting from the very end of the horse's nose and connecting beyond the ears with the crownpiece, making a single whole with it (Fig. 1, *17*). A slanting nosepiece runs obliquely from the central frentera, bends and passes into a long cheekpiece, which, in turn, bends and passes into a semi-oval browband, connected to the frentera. From the middle of the nose parallel to the upper nosepiece, passes a lower strap, extending into the mouth. How can this be understood? If we turn to the muzzles of types 1–4, it can be clearly seen that this snaffle bridle is a reduced version of the muzzle with the noseband. First, it is put on the horse's head with the closed crown-and-throat band, then the small snaffle band is inserted into the mouth, and finally the frentera together with the nosepiece, cheekpieces, and browband are pulled on the head for a snug fit of the head harness. Somewhat analogous to this bridle is the modern Irish noseband (Fig. 1, *12*).

In the settlement of Botai, osteological materials were mainly represented by horse bones. In this settlement, meat, skin, tendons, animal bones, and horse hair were utilized (Olsen, 2003: 83, 100). S. Olsen stressed that the harnesses for Botai riding horses used for hunting

wild horses could have been made of horsehide, which anticipated the conclusions about manufacturing halters considered in this article.

Interestingly, making bridles of type 5 required significantly smaller pieces of leather. Fig. 1, *7* shows how this bridle can be overlaid on a pattern of the type 4 muzzle with two cheekpieces. The central frentera and the crownpiece (in the form of an oval or ring) remain in the same place; the cheekpieces are superimposed on the cheekpieces; the nosepiece is superimposed on the drop noseband of the type 4 halter. The oval of the muzzle turns into a leather band; its upper part lies on the cartilage of horse's nose, while its lower part lies in the mouth on the tongue and in the toothless edge of the jaw. It can be said with certainty that the horse would very quickly chew this leather, so it should be wrapped in a spiral with a rawhide strap or horsehair rope, the ends of which, coming out of the corners of the mouth, would serve as reins.

The designs of the muzzles are standardized: the long central frentera is necessarily present, being the central link of the head harness; all other pieces are attached to it (or rather, run from it): the nosepiece, browband, and crown-and-throat band. It is interesting that the cut of the halter repeats the configuration of the "tree of life", an important symbol in the cults of many ancient peoples (Fig. 1, *15*). Another feature is the occasional use of two additional shortened cheekpieces, which turn into the browband (type 6). The curved line of the browband smoothly passing into the cheekpiece (types 5 and 6) is also a specific feature. These features are determined by the fact that the head harness was not made of separate bands, intersecting at right angles with each other (as was the case in the Middle East in the 3rd to 1st millennia BC or in the present-day horse equipment), but were cut of one piece of leather (Fig. 1, *14–18*). Therefore, it is of great interest to search for such features in iconographic or archaeological materials associated with the equestrian equipment in the areas where domesticated horses from the European steppes were spread: to the west in the Balkans, Central Europe, and Britain, to the east in Asia, and to the south in the Caspian region and the Caucasus. It may also be productive in this respect to work with cultural vocabulary associated with equestrian equipment in Indo-European and other languages.

One such halter appears on the representation of the famous Trundholm horse harnessed to a sun chariot from the 2nd millennium BC—one of the most famous exhibits of the National Museum of Denmark (Copenhagen). Without raising the question of whether it is an example of the earliest image of a metal crownpiece-shaffron (for more details see (Littauer, Crouwel, 1991)), we may note that its ornamental decoration emphasizes a long upper frentera, lower throat latch, and semi-oval browband, that is, specific elements of muzzles and bridles of the Chalcolithic.

The horse leather muzzle from the 1st Pazyryk burial mound—the mask with deer antlers, widely known to archaeologists (Poltsarstva za konya…, 2006: 3, No. 30 according to the catalog)—is an example of morphological similarity. However, since it has not been studied by the present author, it is difficult to say how great this similarity is. In order to consider it possible to link the Pazyryk mask with the Chalcolithic muzzles, it is necessary to have similar finds chronologically linking these artifacts, which unfortunately are not available. Both of the examples, which are from different periods, raise the question of spatial analysis of the distribution of horse-headed pommels and the area of steppe and forest-steppe sites, which testify to the role of horses in the life of the population (Dergachev, 2007: Map 1, 2, 7–10). This topic is closely related to the debated and complex problem of the ancestral homeland of the Indo-Europeans and their further settlement, which this article does not have the place and time to consider. Yet, it is impossible to ignore this problem, since most scholars of European Chalcolithic sites rightly believe that the distribution of domesticated horses from Eastern Europe (as well as the area of horse-headed pommels) reflects the first movements of the Indo-Europeans in the 5th to 4th millennia BC (Ibid.: Map 1, 2; p. 39, tab. 11).

The map presented by Dergachev (Ibid.: Map 2) clearly shows the center of concentration of the pommels in the Middle Volga region and the southern and southeast vectors of their distribution (the pommel from Arkaim indicates the eastward direction). The main conclusion that follows from this map is the advancement of the Volga and Dnieper-Don population with their mobile cattle breeding, riding and pack carrying horses, cult of the horse, and funeral ritual of kurgan burying to the Northern Caucasus already in the 5th millennium BC (Korenevskiy, 2006).

Horse breeding in Elam in the 3rd millennium BC

According to specialists, domestication can be proven by the purposeful breeding of horses, the data of which usually do not reach us. Therefore, of great interest is the Elamite clay tablet from Susa of the early 3rd millennium BC (for more details see (Kovalevskaya, 2008)), which since the beginning of the last century has been viewed by specialists as a list of horse breeding farms or a pedigree table. In as early as 1982, the well-known orientalist I.M. Dyakonov wrote that the ideograms on this tablet undoubtedly depicted the horse (1997: 461, nt. 29).

Thanks to the help of a leading specialist in proto-Sumerian and proto-Elamite writing A.A. Vaiman, it became possible to decipher all numerical indicators, fill

the lacunae, and obtain data for all individual farms. Six lines (the first line was defaced) read from top to bottom and from right to left, and contain pictographic signs, images of horse heads turned to the left, and numbers in the decimal numerary system on the face of the tablet (Fig. 2, *1*). Imprinted double lines with a crossbar correspond to the ones; circles to the tens; and figures shaped like an hourglass correspond to the hundreds. Earlier, scholars determined that the representation of the mane with a downward slope indicates a mare, the mane with an upward slope a stallion, and the absence of a mane indicates colts. Sums of the numbers and seals in the form of gazelles and goats, which according to scholars testifies to the official nature of the document, appear on the back of the tablet.

The text is continuous. Work on its reconstruction consisted in presenting information in a table of conventional form, so it would be possible to check the shares of mares and stallions, which are important from a zootechnical point of view, as well as the output of colts and the possible general amount of horses in Elam in the early 3rd millennium BC (see *Table*). Each sequence (mares, suckling colts, stallions, and colts) begins with a tamga-like symbol, which divides them up. This makes it possible to restructure the text by selecting the lines in accordance with individual farms (Fig. 2, *2*). In our table, the sequences are represented by columns (3–6); in column 2 the sum for each of the sequences is added, and the tamgas of various farms in column 1 are replaced by conventional sequence numbers.

The quantitative indicators of the first and largest farm, which can be hypothetically regarded as a double farm, are obtained in the following way. For the third to the eighth farm, the number of horses was calculated for each position and subtracted from

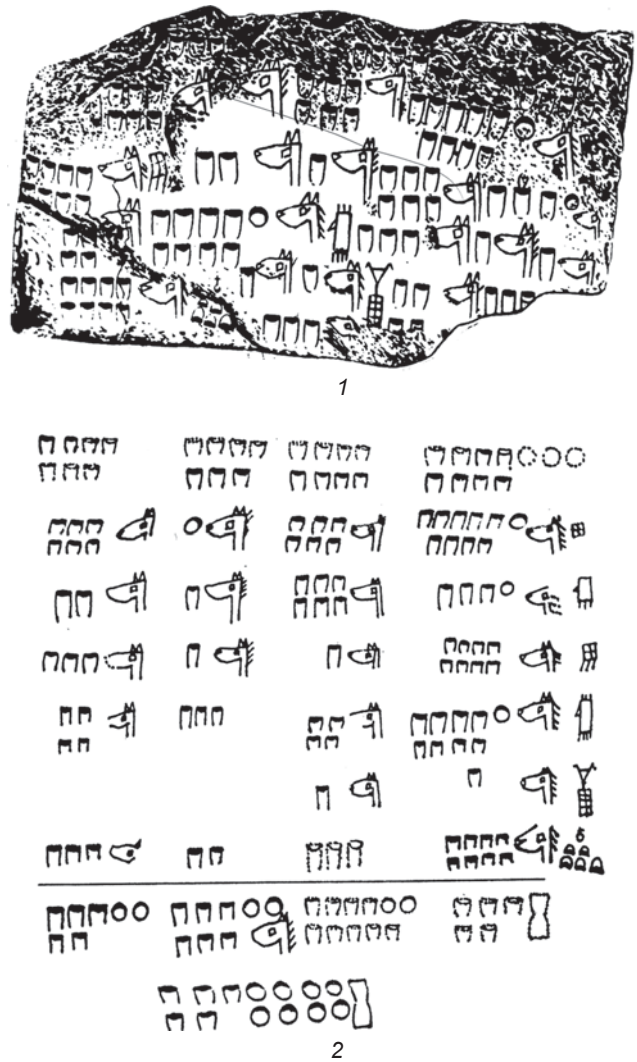

Fig. 2. The Elamite clay tablet of the 3rd millennium BC from the Louvre collection listing horse breeding farms (*1*), and a reconstruction of text lines for individual farms of Elam (*2*).

Reconstructed list of horse breeding farms in Elam in the 3rd millennium BC

6	5	4	3	2	1
Colts	Stallions	Suckling colts	Mares	In total	Farm
7	9	8	38	62	1, 2
6	10	6	19	41	3
2	1	6	13	22	4
3	1	1	8	13	5
4	3	4	18	29	6
–	–	1	1	2	7
3	2	3	8	16	8
25	26	29	105	185	

the total sum that appeared on the back of the tablet. Therefore, the drawing with the restructured tablet (Fig. 2, *2*) indicates seven surviving marks for the stallions from the first farm, and our Table contains nine as the result of the calculation.

Each reconstructed line is the composition of one horse breeding farm (from right to left): the number of mares, suckling colts (by analogy with the present-day form of accounting), stallions, and colts—as we believe, weaned animals of the previous year, which are kept separately in any horse breeding farm. Some information about maintenance of horses can be derived from this form of record. Mares with suckling colts were kept in separate pens and could have been grazed separately. Stallions, most likely, were kept in stables, while weaned colts could have been kept in separate pens or grazed separately in herds.

We are offering an analysis of the tablet data from a zootechnical point of view, in order to determine the structure of each farm, and evaluate the producing composition in comparison to materials of a similar nature, especially since the tablet has not been previously considered from this point of view. Comparative data were taken from the Akhal-Teke horse breeding farms of the Caucasus and Central Asia (data by T.N. Ryabova from 1981–1982), which correspond to traditional equestrian farms (Akhaltekinskaya poroda…, 1981: 3–45; Akhaltekinskaya poroda…, 1982: 1–44).

The ratio of mares and suckling colts was different in the farms appearing in the tablet. Only in one of them (No. 7) was it 1:1. In other farms, one suckling colt corresponded to three mares (No. 3), or two suckling colts to five mares (No. 8), or the same as the rate of the previous year (No. 5). These figures indicate the existence of expanded reproduction in Elamite horse breeding, since it can be assumed (according to the present data) that during the reproductive period each female horse could produce on average from three to five colts. The share of stallions (14.1 %) is very close to the share typical of the Akhal-Teke breed (12.8 % for 1982) (Akhaltekinskaya poroda…, 1982: 3–17). The ratio of stallions and mares varied greatly: from one to two (farm No. 3), to one to 4, 6, 8, 9, and even 13, with one stallion for 8 or 13 mares in two farms (No. 4 and 5). The analysis of the data examined indicates sufficiently developed breeding work, when the horse-breeding farm had a correct ratio between the number of mares and stallions, which contributed to a good yield of colts. Data on the livestock producing composition (131 horses) make it possible to estimate the total number of horses in Elam, which is usually 3–4 times higher than the producing composition, thus amounting to about 400–500 heads (and in fact, we have no reason to believe that this number characterized all of Elam; possibly only some region).

The official nature of the document indicates the interest on the part of the central authorities of Susa in controlling the livestock of horses, since long afterwards, the possession of horses and horse breeding farms, as well as supplying soldiers with horses, were the prerogative of royal power. This Elamite tablet is a most unique source, making it possible to get an idea of the level of horse breeding in ancient times, and compare it with data from the recent past.

Horse training by Kikkuli of Mitanni

The 3rd to 2nd millennia BC were the prime of warfare and cult chariots in the Eurasian steppes and Western Asia. We do not intend to engage in a long-going discussion of whether the chariots appeared in these territories independently or in one of them earlier than in the other. The treatise of Kikkuli of Mitanni (a unique text about a seven-month long, well-elaborated training of chariot horses for their use in combat) is of great interest regarding that problem. The presence of "fossilized glosses" of Indo-Aryan origin in this text and the opportunity for understanding many features of this training by comparing it to the Turkmen horse training make it possible to see the connections between the Middle East and Eurasian steppes in the 2nd millennium BC in their specific manifestations (Kovalevskaya, 2005; 2010: 51–58). Undoubtedly, the horse training system among the proto-Mitannians emerged at the time of their stay on the Eurasian steppes; according to Asko Parpola, it was in the area of the Poltavka, Abashevo, and Sintashta-Arkaim archaeological cultures, from where the Mitannians advanced along the eastern coast of the Caspian Sea through the territory of the Bactria-Margiana Archaeological Complex to Syria, where they were known in the 16th–13th centuries BC (Parpola, 2014: 58). This proposition, however, does not seem to be valid. Based on the studies of S.V. Kullanda, according to which the name of Mitanni was convincingly correlated with the name of the Meotians (2016: 154), and taking into account the territory of the Meotian settlement in the 1st millennium BC in the Northwestern Caucasus, we believe that the Mitannians could have moved through the Greater Caucasus, eastern coast of the Black Sea, and reached as far as Upper Mesopotamia.

Discussion has been held for a long time regarding the seven-month training of Kikkuli: whether it should be considered as preparation for competitions (there is no information on competitions among the Hittites, but if one takes into account the Indo-Iranian tradition, they could have well taken place) or training for use in warfare. Most likely, it was the latter. The manual was not compiled for a horse-breeding farm, since it began not with a gradual

beginning of the work, but with a "trial run", where all the capacities of the horse became apparent.

In the known studies, including A. Kammenhuber's comprehensive monograph "Hittite Hippology" (1961), the authors, while trying to systematize the horse training, followed the path of assigning days with the same training into a single type. Instead, one should consider the changes over time and the system behind various loads, which is distinguished by harmony and forethought. In horse training, several periods can be identified, which in their nature and sequence coincide with the present-day training of Akhal-Teke horses by the Turkmen *seyis* horse breeders (see the distribution of loads for chariot horses when trotting and galloping over six stages for each day in (Kovalevskaya, 1977: 52)).

The first stage was the so-called test run—checking all horses that ended up in the hands of the trainer for the training period primarily for endurance. The culmination point was reached on the morning of the fourth day, when horses in the chariot were supposed to trot 12 km and gallop the same distance without food. Interestingly, in the future, with a gradual increase in load, such work (24 km of running) would be offered to the horses only after five months of daily training.

The second stage (a ten-day cycle of physical training of the horse, its enhanced "sweating") began after the "trial run". The purpose of this stage, just as in the 19th century, was to lose weight, "to dry" the horse, and align its breathing. After such a heavy load on the body, rest was provided in all training sessions. It was the same in the Hittite training: the third stage was rest. Starting from the fourth stage, a daily, ever-increasing trotting training session was carried out up to the sixth stage, when the horse trotted 84 km a day. During the whole training time, not counting the rest period, there was not a single day when the horse was completely freed from work.

The third to fifth months of training, which apparently took place at the hottest time of the year, included the main work with long repeated trotting at night. However, in the days of testing galloping, training was conducted in the mornings and evenings. By the second half of the fourth month, the work on trotting reached its maximum. After a test galloping of 2800 m (upon 16.2 km of trotting), the horses trotted for 42 km upon galloping for 420 m for six nights, then 84 km in one night, and eight nights again trotting for 42 km upon galloping for already 480 m. In our times, such a load is given only to horses that are aiming to break records.

The result of the Hittite training was an amazing endurance of horses adapted for fast movements with daily use. It can be assumed that not only domesticated horses were spread from the Eurasian steppe belt, but also the means of handling them, which were created there (muzzles of various types, bridles with and without the snaffle), and effective training of chariot horses.

Horses of the 2nd millennium BC and ancient texts

There is a large amount of archaeological data on the use of horses in the 2nd millennium BC as a chariot and cultic animal. In steppe burial mounds of that time, numerous remains of horse sacrifices were found, including skulls or lower jaws, skulls and leg bones, or complete skeletons, found in the burial structure or above the burial. There are many hundreds of such kurgans in the Eurasian steppes, and the number of horse remains in each of them ranges from 1–2 to 40 and more. We can reconstruct the rite based on the hymns "The Horse" in the Rigveda, since "the strong Steed, God-descended", "covered with trappings and with wealth…" (I, 162.1, 2) was offered as a sacrifice.

Based on the Rigveda, we can reconstruct the type, exterior appearance, height, nature of movements, and temperament of the horses that the proto-Indo-Iranians saw in front of themselves and that we know today as Akhal-Teke horses. The hymns of the Rigveda emphasize their capacity for fast trotting ("high-spirited", like a "swirling river", a "true runner, running fast like a bird"), harmonious build ("with beautiful members", "with a straight back", "broad-chested", "with filled girth"), and great strength ("mighty", "courageous"), temperament ("roaring, neighing, snorting"), and height ("huge"); the attitude towards the owner ("devoted") was also emphasized (III, 49.1). These descriptions make it possible to envision the exterior appearance of those horses with which the proto-Indo-Iranians, on a "swift mover like a warhorse" (III, 49.3), running in swift career "on your lightning laden cars, sounding sweet songs, armed with lances and winged with steeds!" (I, 88.1), captured the vast Asian expanses.

Conclusions

Considering the problems associated with the domestication and use of horses in the 5th to 3rd millennia BC in Eurasia, scholars have come to the conclusion that horses were domesticated for the first time in the Neolithic-Chalcolithic cultures of the Middle Volga region. During the 5th to 3rd millennia BC, domestic horses gradually spread to the west (the Lower Danube region, Central Europe up to Scandinavia, Britain and Ireland), according to N. Benecke (2006), to the south through the Greater Caucasus, and to the east to Siberia.

During this period, means for restraining horses (muzzles, bridles with and without snaffle rings) were created for the first time. Their features point to a gradual development of horse harnesses. According to the representations on horse-headed scepters, six types can be identified. Notably, a certain line of development

of muzzles from simple (type 1) to more sophisticated (types 2 and 3) can be traced in the Chalcolithic in the Eurasian steppe, ending with muzzles with the drop noseband (type 4). They appear both among stylized and realistic representations on the pommels, while the bridle with a leather snaffle bit (type 5) appears only on realistic images. This means of bridling a horse, reconstructed according to horse-headed scepters of the 5th–4th millennia BC, was the earliest and Indo-European in its origin. Together with domesticated horses, it spread throughout the entire Old World.

There are almost no available data on purposeful breeding of horses in ancient times. The earliest evidence on horse-breeding farms is known only from the Assyrian documents about the wars in Urartu. Therefore, the Elamite clay tablet from Susa belonging to the very beginning of the 3rd millennium BC with a list of horse breeding farms is of great interest. This document makes it possible to establish the structure of each farm, assess the their composition on the basis of comparison to evidence of similar nature, and make an assumption about the total number of horses in Elam (or possibly only in one of its regions) as approximately 400–500 heads. Each year, 15–20 young colts from these eight farms could enter training and become available for military needs, so the mares would remain for breeding.

The 2nd millennium BC was the time when chariots emerged and began to be widely used in the Eurasian steppes, the Middle East, and Egypt. Vast spaces became available to people thanks to the swiftness of chariots, since it became possible to move five times faster than riding on bulls and equids (150 instead of 30 km per day). Horses were well trained, fast, and resilient; they were trained according to a well-designed and highly professional system; they participated in competitions and military operations. Strict bits with leather or bronze mouthpieces and sometimes with psalia with internal studs were used as means of control. Light maneuverable battle chariots and gold multicolored ceremonial chariots decorated with pearls, with high wheels, were created with the latest technological advances. Innovations which were introduced in one land immediately became known throughout the entire civilized world. This was the case with the training system known from the treatise of Kikkuli of Mitanni: designed by the proto-Indo-Aryans in the Eurasian steppes in the first half of the 2nd millennium BC, by the 14th–13th centuries BC it reached Western Asia.

On the basis of written sources and ancient representations, we can imagine the external appearance of horses in the 5th to 2nd millennia BC. At that time, the light "noble eastern horse", close to the present-day Akhal-Teke breed, emerged and spread. The problem of the origin of this breed was posed by V.O. Vitt over 80 years ago, but has not yet been considered in detail. Meanwhile, today it is already possible to closely approach its solution thanks to the body of paleozoological evidence, collected in the repositories of museums and scientific institutions, and the presence of a huge systematized database on the genetics of modern horse breeds, including the Akhal-Teke breed (2041 genetic analyses in the All-Russian Research Institute for Horse Breeding of the Russian Academy of Agricultural Sciences). Analysis of the available data on the role of eastern horses in ancient horse breeding of the world will make it possible to solve the problem using an interdisciplinary approach and comparison with historical evidence. The only prerequisite is for numerous scholars of various fields to unite their efforts in solving this problem.

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R. Rezalou, Y. Ayremlou, N. Hariri, and S.F. Eisvand
University of Mohaghegh Ardabili,
Daneshgah Street, 56199-11367, Ardabil, Iran
E-mail: r_rezaloo@uma.ac.ir; yahya_ayramlou@uma.ac.ir;
hariri.nemat@gmail.com; Samanehfarokhii@gmail.com

The Study of Middle Bronze Age Interments at Khanghah Gilavan: Tentative Results

We give a detailed description of burials 14 and 24, typical of the Khanghah Gilavan cemetery, discovered in 2006 near Khalkhal, in the Ardabil Province, northwestern Iran. Parallels to the finds are discussed, mostly suggesting the Middle Bronze Age, although similar handmade vessels, hairpins, and daggers had been common in the region since the Early Bronze Age. The most illustrative examples are Nakhchivan-type vessels, the two handles of which are decorated with buttons. The burials indicate cultural changes over the Early and Middle Bronze Ages, despite the continuity of the ceramic manufacturing tradition.

Keywords: *Northwestern Iran, Gilavan cemetery, Middle Bronze Age, burial, ceramic manufacturing technology.*

Introduction

The chronology of northwestern Iran is based mainly on the excavation data obtained from the sites that are located on Lake Urmia (which is a watery plain area), and the results of these excavations are generalized to the entire region of northwestern Iran. However, northwestern Iran has varying geographical features, such as plains, low-water areas, and mountainous areas. Most of this part of the country has not, as yet, been covered by systematic archaeological studies.

In May 2006, during the construction of a road in Ardabil Province, the remains of some ancient burials were discovered. In August 2006, an excavation, under the supervision of R. Rezalou, was performed at this site. During the first season of excavations, sixteen graves were excavated. The excavations conducted at Gilavan cemetery showed the continuity of the ceramic and burial traditions of the Bronze Age into the Iron Age without any cultural dynamics. Khanghah Gilavan cemetery is one of the ancient sites peculiar to Iran, with a size of 2000 ha, which shows a remarkable diversity of burial practices.

Gilavan cemetery is located 48°46′39.7″ E and 37°17′39.9″ N, at the northwestern edge of Khanegah village, about 60 km southeast of Khalkhal city, in Shahrud County, and about 180 km south of Ardabil Province (Fig. 1–3). The site is located in the verdant valley across the Talesh Mountains. The River Gilavan flows along this valley. Thanks to the river, abundant gardens can be seen in the valley, with most of their trees being walnut, upon which the major economy of the region relies. This river finally joins the River Shahrud, which is one of the Ghizil Uzan River's branches. The climate of this area is a variety of the temperate highland climate (see Fig. 1, 2).

Ceramics of the Middle Bronze Age in northwestern Iran

The end of the Early Bronze Age and the beginning of the Middle Bronze Age in southern Caucasia was

distinguished by the disappearance of the Kura-Araxes culture and its numerous settlement societies. In the Middle Bronze Age, settlement patterns changed as a result of the advent of new ethnic elements and groups whose economic subsistence was based on animal husbandry and a nomadic lifestyle (Badaliyan et al., 2003). Of the most notable changes in this period, the development of metallurgy and the manufacture of beautiful gold and silver vessels, may be pointed out. Also, the advent of new interments (kurgans), using four-wheeled chariots, and changing the settlement patterns, including the use of highland areas for cattle-grazing in summer, should be mentioned (Puturidze, 2003: 114). However, there are very few archaeological sites representing this period: Uzarlik Tepe, Shah Takhti, Kül Tepe, Haftavan Tepe, and Geoy Tepe (Ozfirat, 2001: 117). A major part of the archaeological remains related to the Middle Bronze Age has been obtained from the graves (Kohl, 1993: 128).

During the Middle Bronze Age, there were five local cultures in the Caucasus region: western Transcaucasia, Trialeti, Karmirberd, Uzarlik, and Ghizil Vanak (Kushnareva, 1997: 84). According to the given chronology, two ceramic traditions existed in the Middle Bronze Age in northwestern Iran. One of these, named

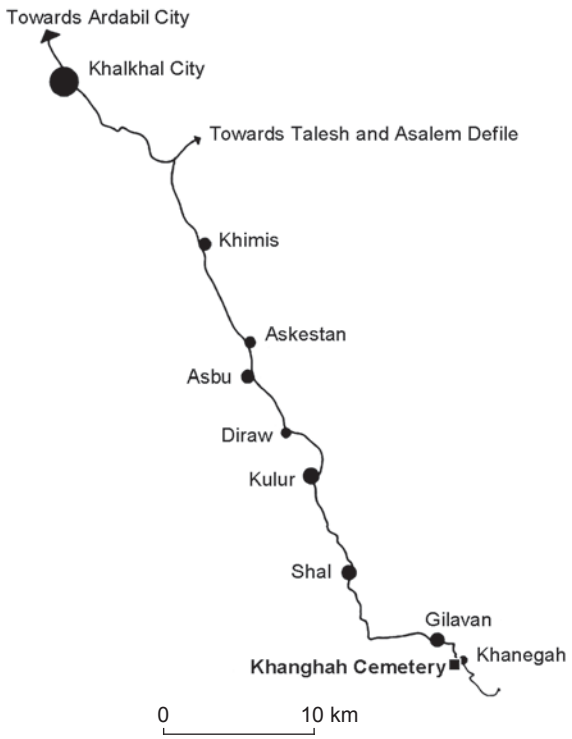

Fig. 1. The access path to the Khanghah Gilavan cemetery.

Fig. 2. A view of the cemetery.

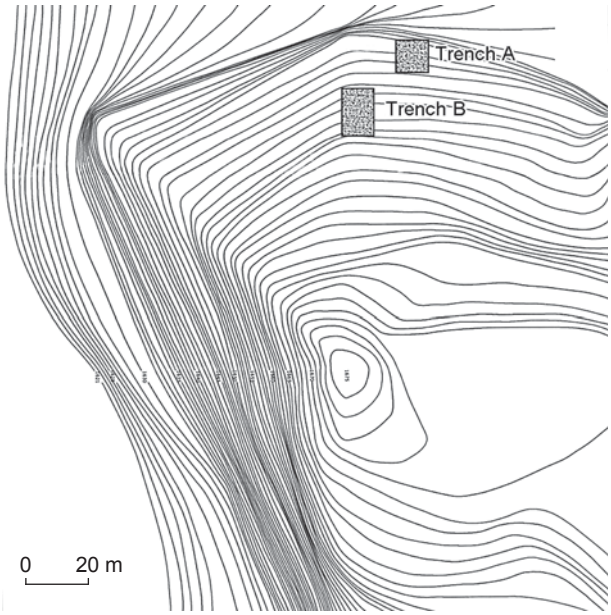

Fig. 3. The topographic map of Khanghah Gilavan cemetery and the excavated trenches.

Urmia wares, obtained from Haftavan VIb, was described by Edwards (1981: 106; 1983: 72; 1986: 65). These vessels, with monochrome and polychrome motifs, were found in Geoy Tepe C and D (Dyson, 1968: 18) and in a disturbed layer relating to the Late Bronze Age at Dinkha Tepe (Rubinson, 1994: 199). Similar wares are also known outside of Iran: in Azerbaijan (Abibullaev, 1982: 4–6; Aliev, 1967: 117) and in eastern Turkey (Cilingiroglu, 1986: 312; 1987: 121). There are some wares kept in Turkish museums, whose place of discovery is not known yet (Cilingiroglu, 1986: 312; 1987: 121; 1984: 131). Pottery finds from Haftavan VI are divided into those from three smaller periods: VIc, VIb, and VIa (from early to late). The classification criterion of the VIa finds placed on top of the VIb (the layer in which the Urmia-type wares have been found) was the presence of roughly painted wares obtained only at the eastern edge of Tepe (jx). These vessels are rough and unburnished, unlike the wares from the earlier period (VIb), which were burnished. For this reason, these wares were considered later; the studies revealed that they belong to one of the varieties of local ceramics identified at Haftavan VIb (Burney, 1994: 54). For Haftavan VIb, there is an absolute radiocarbon date of 1772 BC (Burney, 1975: 161). According to the recent excavations conducted in Armenia, this culture has been dated to between 2400–1600 BC. V.B. Bakhshalief and A. Seidov proposed a dating between 2300–1600 BC (Ozfirat, 2001: 122–123). Using the data obtained at Haftavan Tepe, M.R. Edwards dated this period to 1950–1350 BC, i.e. from the end of the Transcaucasian culture to the beginning of the Iron Age (1981: 102). With given chronologies, it can be stated that Transcaucasia culture is one of the important Middle Bronze Age cultures in the northwestern Iran, where 24 pieces of its wares have been found, brought to this place by merchants (Rubinson, 2004: 666). Evidences of this culture before the beginning of the Iron Age are few.

Another ceramic tradition of the Middle Bronze Age in northwestern Iran is known as Khabur. The Khabur wares culture has been identified from the finds in Hasanlu VI and Dinkha Tepe IV, and has been thoroughly studied in Dinkha Tepe. In general, the advent of this culture is indicative of the influence of a new culture in northwestern Iran, since Khabur wares are not related to the wares of the previous period. This type of ceramics was prevalent in northern Mesopotamia (Kül Tepe, Chghar Bazar, Tel Alrimeh, and Nuzi) (Hamlin, 1974: 129–130) between 1900–1600 BC. It emerged in this region as a result of trade communications. Six pieces of Khabur ware have been dated by the TL method to between 2106 ± 68 and 1684 ± 58 BC.

Finds from burial No. 14

This burial is located in Trench B. It is a pit grave with no special architectural form. The grave cut had been excavated in accordance with the status of the deceased. The form of the grave depended on the situation of the burial, and the amount of space needed to place the grave goods. To identify the grave after the interment, chipped stones and rubble, pebbles, pieces of rock, and boulders were placed upon the mound. These stones were originally used as a marker for the grave. The largest boulder was 52 × 33 × 21 cm in size. According to the shape of the stone mound, the burial pit was roughly oval. The soil spilled on the grave was dark brown, and its texture was somewhat loose and soft, with inclusions of small, large, and medium-sized grains with gravel and rubble.

It was a standard perfect grave oriented along the NW-SE line, with dimensions of 175 × 170 × 100 cm. Owing to the high humidity inside, and the pressure from the stones, the skeleton was partially destroyed. It belonged to a female, aged 30–35. The deceased was oriented with her head to the SW, and her legs to the SE. The skull was turned to the left, and its face to NW. The upper part of the body was in a supine position. The right humerus was placed along the body, and the right palm was bent upward. The left humerus had been placed in the direction of the body, with the forearm upward (the northeast) from elbow and wrist, bending toward the body. The legs were closed, and the right leg was put on top of the left leg.

In the western part of the grave, approximately 15 cm from the skeleton, the bones of a ruminant, likely those of a sheep (ram), were revealed. On the skeleton, traces

of ocher can be seen, which the body of the deceased was probably covered with before the funeral (Fig. 4).

Grave goods were placed at the edges of the burial, and included the following items:

– Light-gray open-mouthed hand-made vessel with two handles (No. 1, Fig. 5). Similar items were found in the Maykop kurgans and dated to the end of the Early Bronze Age (Lyonnet, 2000: Fig. 3, *4*), and in Geoy Tepe C, dated to the Middle and Late Bronze Age (Burton Brown, 1951: Fig. 30, *950*). Apparently this was the prevalent form of vessels in the Early Bronze Age. Comparable vessels from this time period were discovered at Yanik Tepe (Summers, 1982: Fig. 42, *5*);

– Brown open-mouthed hand-made vessel with two handles (No. 2, Fig. 5). Similar items from the Middle Bronze Age were found in Geoy Tepe C (Burton Brown, 1951: Fig. 30, *961*) and at Yanik Tepe (Summers, 1982: Fig. 42, *6*);

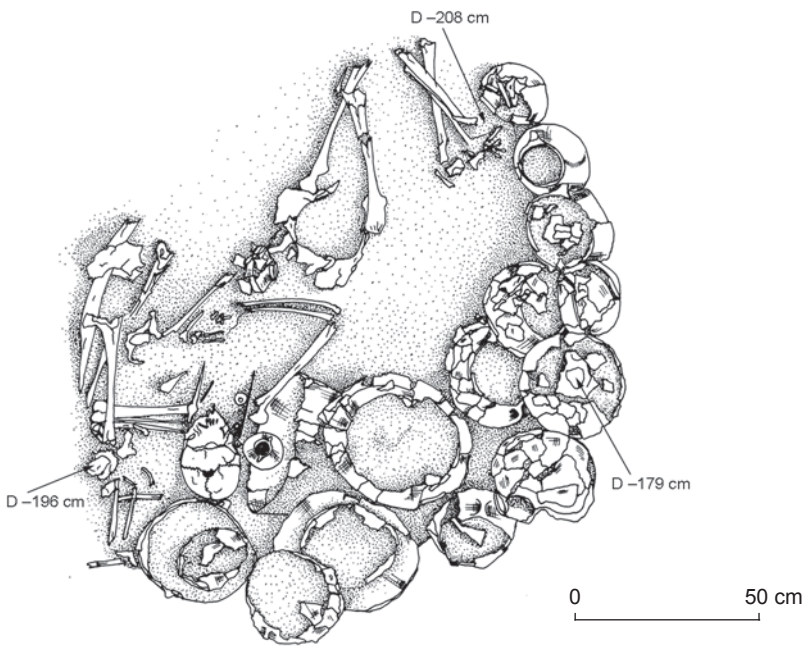

Fig. 4. Skeletal bones and grave goods in burial No. 14.

– Dark-brown open-mouthed hand-made vessel with two handles (No. 3, Fig. 5). Similar items were found in Geoy Tepe D (Burton Brown, 1951: Fig. 23, *182*);

– Light-gray open-mouthed hand-made vessel with two handles (No. 4, Fig. 5). Similar items were found in Haftavan VI B (Edwards, 1981: Fig. 13, *14*) and Sos Hüyük VI (Sagona, 2000: Fig. 23, *5*);

– Dark-gray open-mouthed hand-made vessel with two handles (No. 5, Fig. 5). Similar items were found in Haftavan VIb (Edwards, 1981: Fig. 13, *14*) and Sos Hüyük IVb (Sagona, 2000: Fig. 23, *5*);

– Light-gray open-mouthed hand-made vessel with a handle (No. 6, Fig. 5). Such handles of Nakhchivan type have been known from the finds from the Middle Bronze Age at Sos Hüyük IVa (Ibid., 2000: Fig. 17, *1*), Geoy Tepe D (Burton Brown, 1951: Fig. 21, *882*), Haftavan VIb (Edwards, 1981: Fig. 11, *15*), and Dinkha Tepe IV (Hamlin, 1974: Fig. 1, *1*). Also, similar items are known in the grave goods from early kurgans excavated in Georgia, dated to the end of the Early Bronze Age (Kushnareva, 1997: Fig. 34, *13*). This shape for vessels was apparently prevalent in the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 9, *8*);

– Dark-brown open-mouthed hand-made vessel with a handle (No. 7, Fig. 5). Similar items were found in Geoy Tepe D (Burton Brown, 1951: Fig. 19, *846*), Haftavan VIb (Edwards, 1981: Fig. 16, *19*), and Sos Hüyük Vc (Sagona, 2000: Fig. 10, *6*);

– Dark-gray open-mouthed hand-made vessel with a handle (No. 8, Fig. 5). Similar items are known in Geoy Tepe D (Burton Brown, 1951: Fig. 25) and Haftavan VIb (Edwards, 1981: Fig. 18, *11*);

– Dark-gray open-mouthed hand-made vessel with a handle (No. 9, Fig. 5). Similar items were found in Geoy Tepe D (Burton Brown, 1951: Fig. 20, *809*), Haftavan VIb (Edwards, 1981: Fig. 16, *24*), Dinkha Tepe IV (Rubinson, 1991: Fig. 27, *g*), and Sos Hüyük IVb (Sagona, 2000: Fig. 18, *7*). Vessels of this shape were common in the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 65, *1*);

– Dark-gray open-mouthed hand-made vessel with a pedestal-base and a handle (No. 10, Fig. 5). Similar items were found in Dinkha Tepe IV (Hamlin, 1974: Fig. 4, *36*) and Sos Hüyük IV, and dated to the Middle Bronze Age (Sagona, 2000: Fig. 11, *1*);

– Dark-gray hand-made vessel with a vertical rim and two handles (No. 11, Fig. 6). Two bosses can be seen on the handles. Similar prominent buttons can be seen on the wares from Trialeti (Georgia), dated to the Middle Bronze Age (Schaeffer, 1948: Fig. 289, *2*), Sos

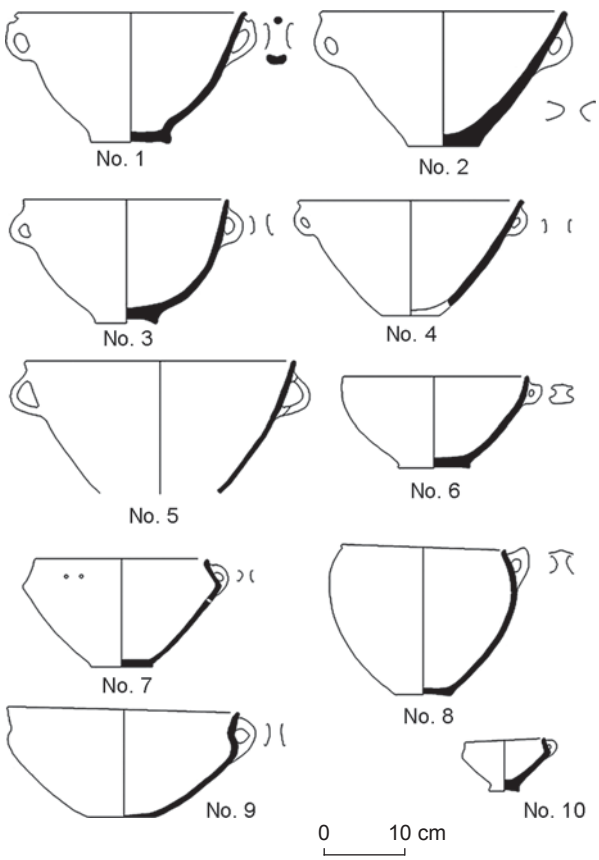

Fig. 5. Pottery from burial No. 14.

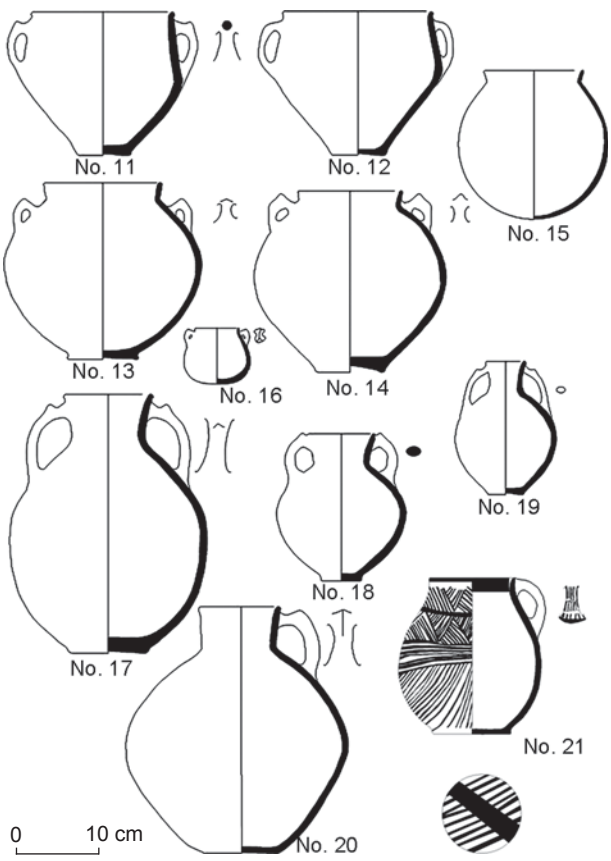

Fig. 6. Pottery from burial No. 14.

Hüyük IVa (Sagona, 2000: Fig. 17, *1*), and Dinkha Tepe (Hamlin, 1974: Fig. 5, *43*). Vessels of this shape were widespread in the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 53, *7*);

– Dark-gray hand-made vessel with a vertical rim and two handles (No. 12, Fig. 6). Analogs are present in the collection from Haftavan VIb (Edwards, 1981: Fig. 19, *12*);

– Dark-gray medium-necked hand-made vessel with two handles (No. 13, Fig. 6), decorated with prominent buttons. Similar items dated to the Middle Bronze Age were discovered in Trialeti (Schaeffer, 1948: Fig. 289, *2*). The other comparable vessels, relating to the Early Bronze Age, can be seen in materials from Geoy Tepe C (Burton Brown, 1951: Fig. 30, *51*) and Sos Hüyük V (Sagona, 2000: Fig. 11, *1*);

– Dark-gray short-necked hand-made vessel with two handles (No. 14, Fig. 6). Its parallels are known from Geoy Tepe D (Burton Brown, 1951) and Dinkha IV (Hamlin, 1974: Fig. 1, *2*), as well as in the Early Bronze Age kurgans excavated in Georgia (Kushnareva, 1997: Fig. 36, *48*). Vessels of this shape were widespread in the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig 4, *33*);

– Brown short-necked wheel-made vessel (No. 15, Fig. 6);

– Dark-gray closed-mouth hand-made vessel with two handles (No. 16, Fig. 6);

– Dark-gray long-necked hand-made vessel with two handles (No. 17, Fig. 6). Similar items dated to the Middle Bronze Age are known in Geoy Tepe C and Haftavan VIb (Burton Brown, 1951: Fig. 20, *766*) (Edwards, 1981: Fig. 11, *7*). Vessels of this shape had been widespread since the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 86, *12*);

– Dark-gray medium-necked hand-made vessel with two handles (No. 18, Fig. 6). Its parallels were discovered in Trialeti burials (Schaeffer, 1948: Fig. 289, *3*) and Geoy Tepe D (Burton Brown, 1951: Fig. 20, *768*);

– Brown long-necked hand-made vessel with two handles (No. 19, Fig. 6). Its parallels are known from kurgan 5 in the Trialeti burials, dated to the Middle Bronze Age (Schaeffer, 1948: Fig. 289, *5*), Geoy Tepe D, and Sos Hüyük IVa (Sagona, 2000: Fig. 17, *5*). Vessels of this shape had been widespread since the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 1, No. 13);

– Light-gray medium-necked hand-made vessel with a handle (No. 20, Fig. 6). Similar items, decorated with prominent buttons, were found in the Trialeti kurgans dated to the Middle Bronze Age, and Dinkha Tepe IVd (Hamelin, 1974: Fig. 5, *41*). Such handles of Nakhchivan type are known from the finds in Haftavan VII (Summers, 1982: Fig. 48, *41*);

– Red medium-necked hand-made vessel with a handle (No. 21, Fig. 6). The vessel shows black geometric motifs. The lower part of it is decorated with parallel and oblique lines; the upper part and neck are decorated with alternating cross-hatched triangles, which are separated from the lower part by straight horizontal lines. The bottom is ornamented. Parallels are known from Geoy Tepe D (Burton Brown, 1951: Fig. 20, *802*) and Haftavan Tepe VIb (Edwards, 1981: Fig. 11, *14*);

– Three bronze hairpins (No. 22–24, Fig. 7a). These were discovered on the skeleton of a ruminant in the

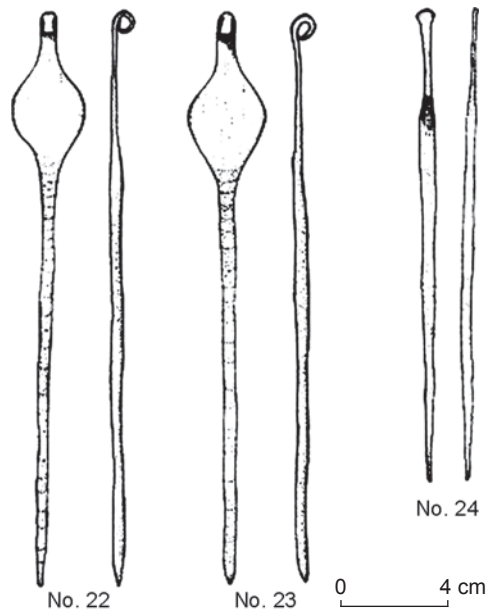

Fig. 7. Hairpins from burial No. 14.

Fig. 8. Dagger from burial No. 14.

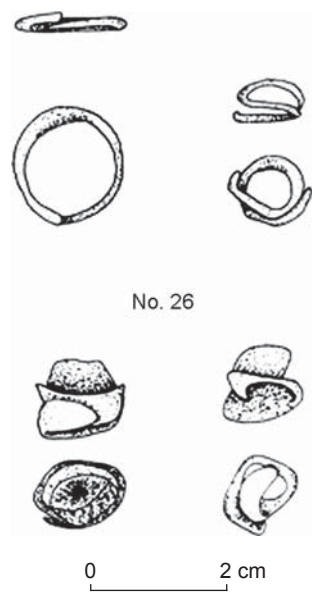

Fig. 9. Earrings from burial No. 14.

Table 1. **Features of the potteries at burial 14**

Vessel No.	Making method	Color			Firing grade	Temper	Finish				Making quality	
							primary		engobe**			
		inner	pulp	outer			inner	outer	inner	outer	inner	outer
1	Hand made	Light gray	Dark gray	Light gray	Complete	Sand + mica*	Polishing	Polishing	Wash	Wash	Medium	Fine
2	″	Brown	Dark	Brown	Low	″	″	″	″	″	Fine	″
3	″	Dark gray	Dark brown	Dark brown	″	″	″	″	″	″	″	″
4	″	Light gray	Light gray	Light gray	Complete	″	″	″	″	″	Low fine	Low fine
5	″	Dark gray	Dark gray	Dark gray	″	Medium sand	″	″	″	″	Fine	Fine
6	″	Light gray	Light gray	Light gray	″	Sand + mica inclusions	″	″	″	″	″	″
7	″	Dark brown	Dark brown	Dark brown	″	Sand + mica	″	″	″	″	″	″
8	″	Dark gray	Dark gray	Dark gray	″	Sand	″	″	″	″	″	″
9	″	″	Brown	″	Low	Medium sand	″	″	″	″	″	″
10	″	″	Dark gray	″	Complete	Sand + mica	″	″	″	″	Low fine	Low fine
11	″	″	″	″	″	″	″	″	″	″	Fine	Fine
12	″	″	″	″	″	″	″	″	″	″	″	″
13	″	″	″	″	″	″	″	″	″	″	Low fine	″
14	″	″	″	″	″	″	–	Partial polishing	″	″	Medium	Low fine
15	Wheel made	Brown	Brown	Brown	″	Small sand	–	Polishing	″	″	″	″
16	Hand made	Dark gray	Dark gray	Dark gray	″	″	–	Partial polishing	″	″	″	″
17	″	″	″	″	″	Large sand + mica	–	Polishing	″	″	Low fine	″

18	"	"	"	"	"	Sand + mica	–	"	"	"	Medium	Medium
19	"	Brown	Brown	Brown	Low	Small sand	–	Partial polishing	"	"	"	Low fine
20	"	Light gray	Light gray	Light gray	Complete	Large sand + mica	–	–	"	"	"	Medium
21	"	Red	Red	Red	"	Sand + mica	Polishing	Polishing	Slip (red)	Slip (red)	Fine	Fine

*Mica – gold yellow and silvery particles, natural components of temper.
**Wash cover is similar in color to that of pottery paste; slip cover is different in color. This is determined visually.

western part of the grave. Similar pins from the end of the Early Bronze Age are known from the Trialeti kurgans (Schaeffer, 1948: Fig. 291, *9*) and Velikent (Dagestan) (Kohl, 2001: Fig. 9, *269*);

– Bronze dagger (No. 25, Fig. 8). It was found on the skeleton of a ruminant in the southern part of the grave. Similar daggers are present in the grave goods from the early kurgans of Caucasus (Kushnareva, 1997: Fig. 34, *13*) and Velikent, dated to the end of the Early Bronze Age (Kohl, 2001: Fig. 9, *186*);

– Three bronze crescent-shaped earrings (No. 26, Fig. 9). These were located to the left of a human skull. The first earring is comparable to those from the early kurgans of Caucasus (Kushnareva, 1997: Fig. 34, *13*), from grave No. 11 in Velikent, dated to the end of the Early Bronze Age (Kohl, 2001: Fig. 6, *344*), and Dinkha Tepe IV (Rubinson, 1991: Fig. 27, *14*). The second is comparable to the earrings found in the early kurgans of Caucasus (Kushnareva, 1997: Fig. 34, *7*), from Early Bronze Age grave No. 11 in Velikent (Kohl, 2001: Fig. 6, *345*), and Geoy Tepe D (Burton Brown, 1951: Fig. 29, *1289*). The third earring has analogs among the goods from the Middle Bronze Age grave at Sos Hüyük (Hopkins, 2003: Fig. 28, *3*), the grave in Velikent, related to end of the Early Bronze Age (Kohl, 2001: Fig. 6, *156*), and from Geoy Tepe D (Burton Brown, 1951: Fig. 29, *1288*).

The pottery collection obtained at burial No. 14 can be classified into three groups on the basis of color: gray (67 %), brown (25 %), and red (8 %). 87 % of the total wares are hand-made, and 13 % wheel-made. The temper of 57 % of the vessels is fine sand, 33 % is medium sand, and 10 % is coarse sand. The quality of the exterior surface structure of 71 % of the vessels is fine, and that of 29 % is medium. The temperature in 67 % of the wares is sufficient, and in 33 % is insufficient. Furthermore, 33 % of the wares are necked, 50 % are closed-mouth, and 8.5 % have vertical rims (Table 1).

Finds from burial No. 24

This burial was located in Trench B. The deceased had been buried in a pit. The mound was formed with chipped stones and rubble, pebbles, pieces of rock, and boulders. These stones were originally worked as a marker for the tomb on it. According to the shape of the mound, the grave was roughly oval. The spilled soil in the grave was dark brown, loose and soft, with inclusions of small, large, and medium-sized grains and sand with gravel, rubble, and pieces of boulders.

This grave was non-standard. Its dimensions were 110 × 100 × 85 cm. This was probably a secondary burial. Owing to the high humidity inside, and the pressure from stones, the skeleton was partially destroyed. Only fragments of a skull and foot-bones

were discovered. The remains belonged to a male, aged 15–20. According to the remaining skeletal parts, the burial was oriented along the NW-SE line. The skull-fragments were in the northwestern part, and the feet bones in the southeastern. The skull was on the left. It was deformed; the facial part wasn't preserved, but was probably directed to the east (Fig. 10). Foot-bones seem to have been directed to the NE.

Grave goods consisted of the following items:

– Dark-gray open-mouthed hand-made vessel with upright rim (No. 1, Fig. 11). Similar items are available in the collection from Geoy Tepe D (Burton Brown, 1951: Fig. 19, *846*), Haftavan VIb (Edwards, 1981: Fig. 16, *19*), and Sos Hüyük Vc (Sagona, 2000: Fig. 10, *6*);

– Dark-gray open-mouthed hand-made vessel with upright rim (No. 2, Fig. 11). Similar items were found in

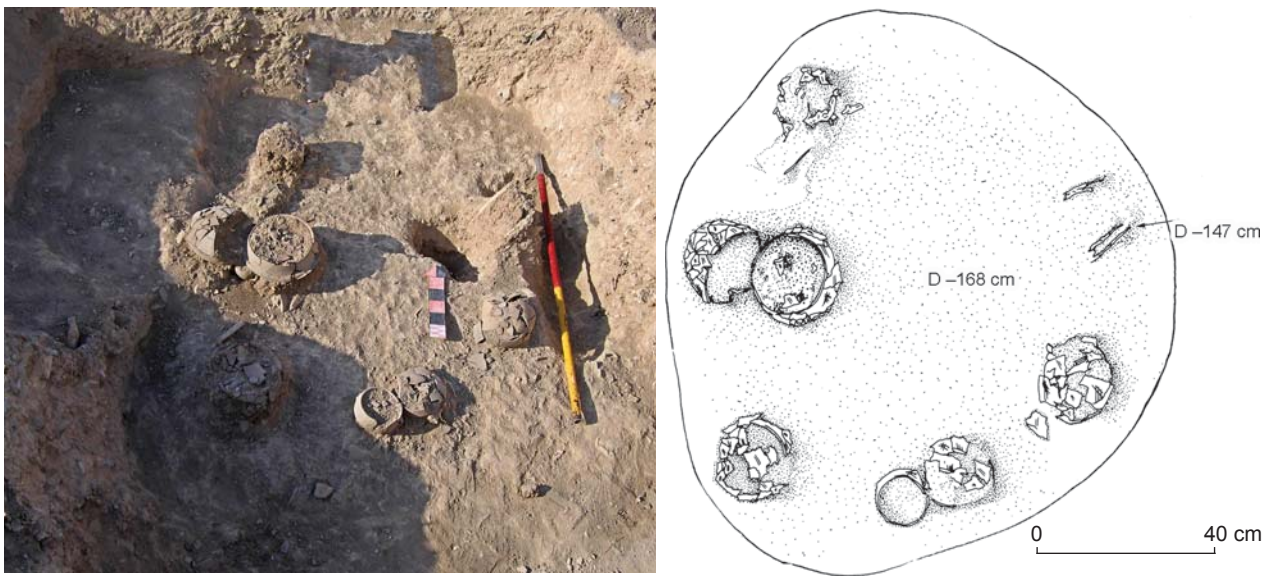

Fig. 10. Skeleton bones and grave goods in burial No. 24.

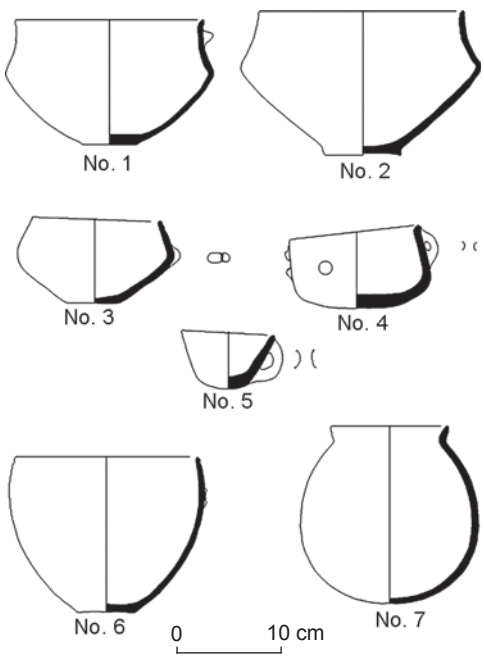

Fig. 11. Pottery from burial No. 24.

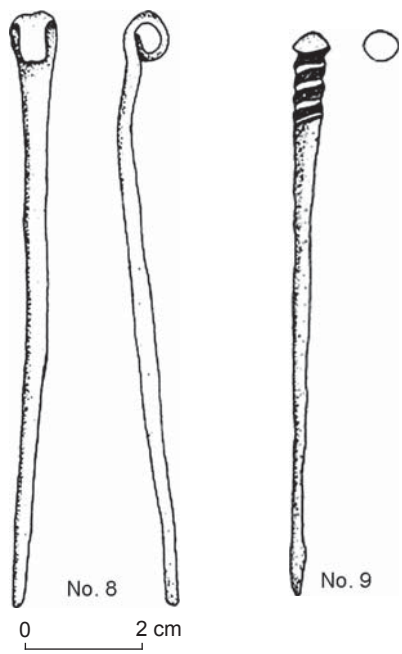

Fig. 12. Metal items from burial No. 24.

Geoy Tepe D (Burton Brown, 1951: Fig. 20, *809*), Haftavan VIb (Edwards, 1981: Fig. 16, *24*), and Sos Hüyük IVb (Sagona, 2000: Fig. 18, *7*). Apparently this was the prevalent form of vessels in the Early Bronze Age (Yanik Tepe) (Summers, 1982: Fig. 65, *1*);

– Dark-brown open-mouthed hand-made vessel with upright rim (No. 3, Fig. 11). Similar items are available in the materials from Geoy Tepe D (Burton Brown, 1951: Fig. 21, *54*), Haftavan VIb (Edwards, 1981: Fig. 18, *8*), Dinkha Tepe IV (Hamlin, 1974: Fig. 5, *42*), and among the gifts from the Alar cemetery (from the Middle Bronze Age) that was excavated in Georgia (Kushnareva, 1997: Fig. 43, *20*);

– Light-gray open-mouthed hand-made vessel with upright rim and two handles (No. 4, Fig. 11). Similar items are available in the collection from Geoy Tepe D (Burton Brown, 1951: Fig. 7, *1626*), Haftavan VIb (Edwards, 1981: Fig. 18, *29*), and among the Alar cemetery gifts (Kushnareva, 1997: Fig. 43, *17*). Apparently this was the prevalent form of vessels in the Early Bronze Age. This is confirmed by the artifacts from the Early Bronze Age site of Yanik Tepe (Sagona, 2000: Fig. 9, *6*). The circular notch on this ware has parallels in Haftavan VII and VIII of the Early Bronze Age (Summers, 1982: Fig. 148, *149*) and Sos Hüyük I (Hopkins, 2003: Fig. 29, *3*);

– Dark-brown open-mouthed hand-made vessel with a handle (No. 5, Fig. 11). Similar vessels are available in the collection from Dinkha Tepe IV (Hamlin, 1974: Fig. 4, *32*);

– Dark-gray open-mouthed hand-made vessel with a handle (No. 6, Fig. 11). This carinated vessel has a shallow groove under the rim. Similar vessels are available in the collection from Haftavan VIb (Edwards, 1981: Fig. 15, *13*) and Sos Hüyük IVb (Sagona, 2000: Fig. 21, *7*);

– Brown short-necked hand-made vessel with a handle (No. 7, Fig. 11). Similar vessels were obtained from Sos Hüyük IV (Sagona, 2000: Fig. 17, *5*);

– Bronze hairpin, with one end decorated with a spherical ring-handle (No. 8, Fig. 12). It was found to the south of the skull. Parallels to such hairpins with twisted ends are known in materials from Ugarit 2 (1750–1900 BC). Hammered hairpins were widespread in western Caucasia. The center of their production was probably situated in this region (Burney, Lang, 1972: 117). Parallels to such hairpins are available in the collections from Geoy Tepe D

Table 2. **Features of the potteries at burial 24**

Vessel No.	Making method	Color			Firing grade	Temper	Finish				Making quality	
		inner	pulp	outer			primary		engobe		inner	outer
							inner	outer	inner	outer		
1	Hand made	Brick red	Brick red	Dark gray	Low	Small sand + mica	Partial polishing	Partial polishing	Wash	Wash	Low fine	Low fine
2	"	"	"	"	"	Small sand	–	Polishing	"	"	Medium	"
3	"	Dark Brown	Dark Brown	Dark Brown	Complete	"	Partial polishing	"	"	"	Low fine	Fine
4	"	Light gray	Light gray	Light gray	"	Medium sand + mica	–	–	Wet	Wet	Medium	Medium
5	"	Dark Brown	Black	Brown	Low	"	–	–	Wash	Wash	"	"
6	"	Red	Dark gray	Dark gray	"	Small sand + mica	Polishing	Polishing	"	"	Low fine	Low fine
7	Wheel made	Brown	Brown	Brown	Complete	Medium sand + mica	–	–	"	"	Medium	Medium

(Burton Brown, 1951: Fig. 29, *1277*), Dinkha Tepe IV, dated to the Middle Bronze Age (Rubinson, 1991: Fig. 21, *a*), and Velikent Tepe III, burial No. 11, dated to the end of the Early Bronze Age (Kohl, 2001: Fig. 6, *353*);

– Bronze hairpin (No. 9, Fig. 12). It was found in the southern part of the grave, to the right of the skull. Similar pins are known in collections from Geoy Tepe D (Burton Brown, 1951: Fig. 29, *1213*) and Dinkha Tepe IV (Rubinson, 1991: Fig. 21, *c*).

The pottery collection from burial No. 24 can be classified into two groups based on their color: gray (53 %) and brown (47 %). 86 % of the total wares are hand-made, and 14 % are wheel-made. The temper of 57 % is fine sand, and 43 % medium sand. The quality of the exterior surface in 43 % of vessels is fine, and in 57 % medium. In terms of finishing, 57 % of the wares are burnished, and 43 % unburnished. The firing-temperature in the 14 % of the wares was sufficient, and in 86 % insufficient. Finally, 14 % of the vessels are necked, and 86 % open-mouthed (Table 2).

Conclusion

The excavations conducted at Khanghah Gilavan cemetery indicate that the ceramic traditions of the Early Bronze Age continued into the Middle Bronze Age. The above-mentioned changes in the shapes of handles, for example, in vessels from burial No. 14, point to the development of these Nakhchivan-type elements, which appeared in the Early Bronze Age. This was probably because of changes in subsistence patterns after transition to the nomadic lifestyle. This assumption is supported by the low number of settlement sites, as contrasted with the numerous cemeteries belonging to the Middle Bronze Age.

Some vessels and bronze items found in the described burials are comparable with the samples obtained from the Early Bronze Age sites, such as Haftavan VII and VIII, Yanik Tepe, Sos Hüyük Vb and Vc, Velikent, early kurgans in Georgia, and Maykop kurgans. Also, these materials may be compared to artifacts relating to the Middle Bronze Age, obtained from the sites of Haftavan IVB, Dinkha Tepe IV, Sos Hüyük IVb, Geoy Tepe C and D, Alar, and Trialeti.

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R. Krause[1], A.V. Epimakhov[2], E.V. Kupriyanova[3], I.K. Novikov[4], and E. Stolarczyk[1]

[1]Goethe-Universität,
Campus Westend, Norbert-Wollheim-Platz 1, Frankfurt am Main, 60323, Germany
E-mail: R.Krause@em.uni-frankfurt.de; Stolarczyk@em.uni-frankfurt.de
[2]South Ural Department of the Institute of History and Archaeology, Ural Branch, Russian Academy of Sciences,
South Ural State University,
Pr. Lenina 76, Chelyabinsk, 454080, Russia
E-mail: eav74@rambler.ru
[3]Chelyabinsk State University,
Bratyev Kashyrinykh 129, Chelyabinsk, 454001, Russia
E-mail: dzdan@mail.ru
[4]Kurgan State University,
Sovetskaya 63, bldg. 4, Kurgan, 640020, Russia
E-mail: sherlock2479@yandex.ru

The Petrovka Bronze Age Sites: Issues in Taxonomy and Chronology

This article introduces a series of AMS radiocarbon dates for the Bronze Age Petrovka cemeteries in the Trans-Urals. The results of the AMS ^{14}C-dating of animal and human bones indicate a very high degree of concordance in the 19th and 18th centuries cal BC time range. The previously obtained AMS datings clearly fit into the same chronological interval. Specifically, 17 of 36 analyses of the Petrovka series yielded very similar results. In other cases, where dating was based on wood and charcoal, the results are highly inconsistent, even within the same burial. Before the verification of these results, the short interval based on AMS dates should be preferred. Its comparison with intervals for other cultures of the Trans-Urals demonstrates marked similarity: in fact, complete coincidence of some of them. At the same time, stratigraphic and typological evidence suggests that the Sintashta, Petrovka, and Alakul traditions are stages of a sequence. Additional arguments are features of continuity in the material culture and the practice of using the burial mounds of a previous culture for new graves, without destroying the older ones. In our view, the only explanation is provided by a dynamic scenario of cultural change spanning two centuries, from the migration of the Sintashta people to Southern Urals until the formation of the Alakul culture. The resolution of the radiocarbon method does not suffice to detect such rapid changes. If this explanation is correct, the Petrovka sites should be considered an early stage of the Alakul culture, rather than a separate culture.

Keywords: *Bronze Age, Petrovka sites, AMS radiocarbon dating.*

Introduction

More than 40 years have passed since the Petrovka sites were distinguished as an independent cultural group (Zdanovich, 1973). However, they still remain a subject of discussion as regards a number of key aspects of the Bronze Age archaeology of the Eurasian Steppe related to the Andronovo

cultural and historical community. In this paper, we intend to consider only the data on the absolute chronology on the Trans-Uralian Petrovka group as arguments in favor of selecting one of the alternatives to cultural attribution and taxonomic status. Unfortunately, this cannot be done for the territory of northern and central Kazakhstan. The designation of this group as the Nurtai culture has been proposed for this region (Tkachev A.A., 2002) of Kazakhstan, but there is a lack of radiocarbon dates. In our opinion, disagreements between the authors are caused by the rather small amount of initial archaeological data in general. Although significant steps have been made towards that goal in recent years (Vinogradov, 2003; Drevneye Ustye, 2013; Multidisciplinary Investigations…, 2013; Kupriyanova, Zdanovich, 2015; Vinogradov et al., 2017; and others), not all sites were analyzed and described in the proper way. This assertion also concerns the Kazakhstan data, without which the conclusions will inevitably have a preliminary character.

The controversy among researchers can be reduced to several key aspects. First, some authors consider the Petrovka antiquities as manifestations of an independent archaeological culture, and they even distinguish the stages of development (Zdanovich, 1988: 132–139; Matveev, 1998: 325–329), while others suppose that this cultural type was just the initial stage of the Alakul traditions (Vinogradov, 2011: 143–146; 2017; and others). Second, the issue of relationship to the Sintashta artifacts is decided in different ways: from full (or partial) synchronization to strict continuity along the "Sintashta-Petrovka" line (Kukushkin et al., 2016). Third, the previous issue implies the problem of the genesis of the Petrovka culture (Tkachev V.V., 1998; Grigoriev, 2016; and others). Finally, there is a divergence in the definitions of key cultural features of Petrovka range of sites. Although the parties have not run out of arguments for their own versions yet (for example, working with collections from settlements), the situation is close to a deadlock. New analytical data can give impetus to the discussion and reduce the number of variants. In our opinion, radiocarbon dating can bring certainty to the issue of the absolute chronology of the Petrovka sites, which will be an important step in this direction.

Material and methods

The area of the Petrovka sites is tremendous, but the Trans-Uralian part under consideration (Fig. 1) was obviously of paramount importance in the development and functioning of the Petrovka traditions. For this territory, reliable stratigraphic evidence for determining the "Sintashta"–"Petrovka"–"Alakul" sequence was obtained (the Ustye I and Kamenniy Ambar fortified settlements, the Krivoye Ozero, Stepnoye VII, and Troitsk-7 burial grounds, and the Kulevchi III settlement). However, it should be made clear that the Petrovka sites in the Trans-Urals are noticeably less than the Sintashta and especially the Alakul sites in terms of quantity.

Burial sites in the Tobol River basin located in the southern part of the forest-steppe zone and at the boundary of the steppe zone were selected for analysis. This is the place where over the last decades the largest cemeteries were discovered and studied, four of which are included in our selection (Krivoye Ozero, Ozerny-1, Stepnoye VII, Troitsk-7). Preference was given to this type of sites because it was possible to make distinct cultural attributions of samples as compared to settlements.

In all cases, this implies the kurgan funerary rite. However, at the Stepnoye VII and Troitsk-7 cemeteries, the relief of the terrain proved to

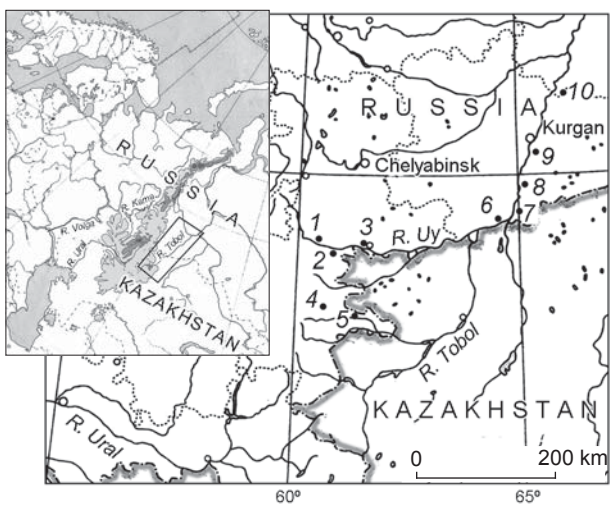

Fig. 1. Locations of the Petrovka sites with radiocarbon dates in the Trans-Urals.
1 – Stepnoye VII; *2* – Krivoye Ozero; *3* – Troitsk-7; *4* – Ustye I; *5* – Kulevchi VI; *6* – Ozerny-1; *7* – Verkhnyaya Alabuga; *8* – Raskatikha; *9* – Tsarev Kurgan; *10* – Chistolebyazhsky.

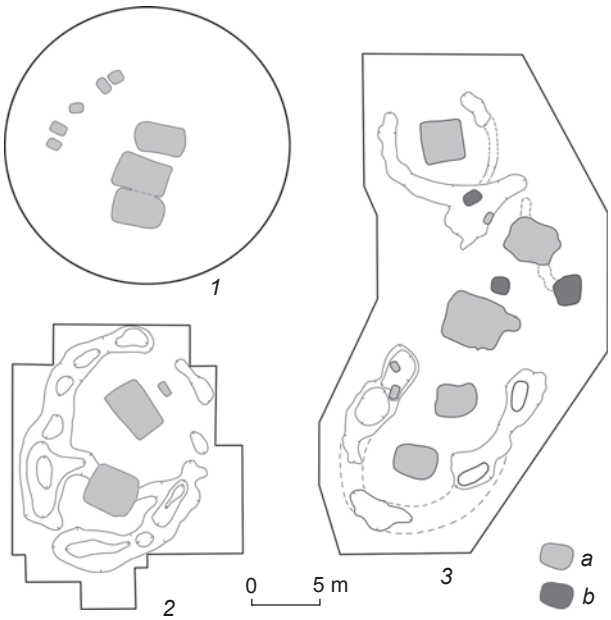

Fig. 2. Variants in the design of the inner space of a kurgan at Petrovka cemeteries.
1 – Krivoye Ozero (kurgan 1); *2* – Stepnoye VII (assemblage 8); *3* – Troitsk-7 (kurgan 7 (southern part) and 8 (northern part)). *a* – burial pits; *b* – assemblages of sacrifices.

have been strongly leveled by human-induced impact. As a rule, kurgans within cemeteries include a large number of graves, and in some cases these reliably contain collective burials of people of different ages and sexes. The center is marked by large graves, while children's burials (usually individual) were recorded on the periphery. Differences in the funerary architecture are related only to the presence or absence of small ditches, contouring the kurgan's grounds, and to the number of burials under one mound (Fig. 2). The Stepnoye VII and Troitsk-7 burial grounds, where stratigraphically late Alakul features (burials and sections of ditches) were constructed taking the existing Petrovka ones into account, are particularly similar with respect to the arrangement of the inner space of the kurgan. The practice of offering sacrifices of domestic animals was common. Some sacrificial assemblages are related to burial pits (Fig. 3, *1*); others, on the contrary, constitute independent features in the kurgan's ground.

The cultural attribution of specific burial complexes was determined by the typifying appearance of ceramics (Fig. 4), whose typology was defined by N.B. Vinogradov (2011: 104–107) and S.E. Panteleeva (2017)*. In certain cases, traits of the ceramic assemblages of kurgans in general provided a basis for cultural attribution**.

When selecting samples, preference was given to the bones of domestic animals (11 spec., excluding the Alakul assemblages), since these materials are the least susceptible to distortions[3]*, and humans (3 spec.). In order to improve the reliability of conclusions, a relatively small number of sites (four) and kurgans (nine, excluding Alakul sites) have been dated, and matched samples from the same assemblages were used twice for a cross-check. A total of 12 Petrovka closed assemblages (burial and sacrificial pits) were covered.

Results of dating and discussion

The presented samples were analyzed in compliance with the standard requirements, using acceleration technologies[4]*, along with the determination of the amount of collagen and the nitrogen-to-carbon ratio. An amount of collagen was close to the critical threshold[5]* found in one sample (MAMS-32165), which demonstrates a serious deviation from the main series. Another sample (MAMS-32159) is obviously defective, since it yielded a date of the 17th–18th centuries AD. The only explanation in the last case could be storage-related problems, since the second sample from this assemblage strictly meets expectations, and the obtained result virtually coincides with the others. The same two samples have the lowest $\delta^{13}C$ readings. These data are excluded from further calculations in the general summation of results (see *Table*). Thus, 12 results and the only pair of values obtained from the samples

*Unfortunately, the publication format makes it impossible to present the material in its entirety.

**Such features did not contain alien cultural inclusions: Troitsk-7 (kurgan 7), Ozerny-1 (kurgan 5).

[3]*The species composition is traditional for Petrovka sacrifices and includes cattle, small ruminants, and a horse. Definitions are given by P.A. Kosintsev (Institute of Plant and Animal Ecology, Ural Branch of the Russian Academy of Sciences), D.I. Razhev (Tyumen Scientific Center, Siberian Branch of the Russian Academy of Sciences), L.L. Gayduchenko (Chelyabinsk State University).

[4]*The Klaus-Tschira-Laboratory at Curt-Engelhorn-Centre Archaeometry gGmbH, Mannheim.

[5]*We accepted a value < 1 % as a threshold (Kuzmin, 2017: 181).

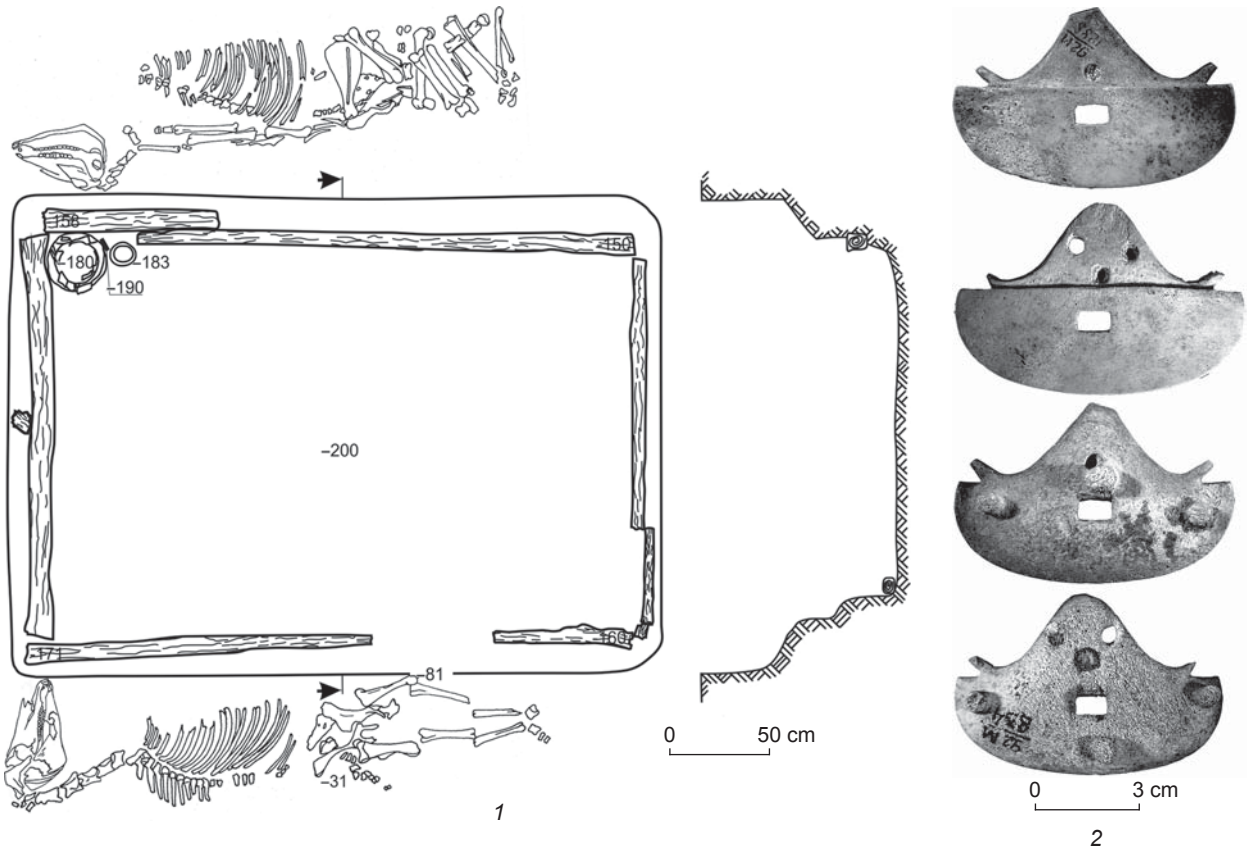

Fig. 3. Petrovka chariot-complex.
1 – layout of grave 1, kurgan 8, the Ozerny-1 cemetery; *2* – cheek-pieces from grave 1, kurgan 1, the Krivoye Ozero cemetery (after (Vinogradov et al., 2017: 25, 29)).

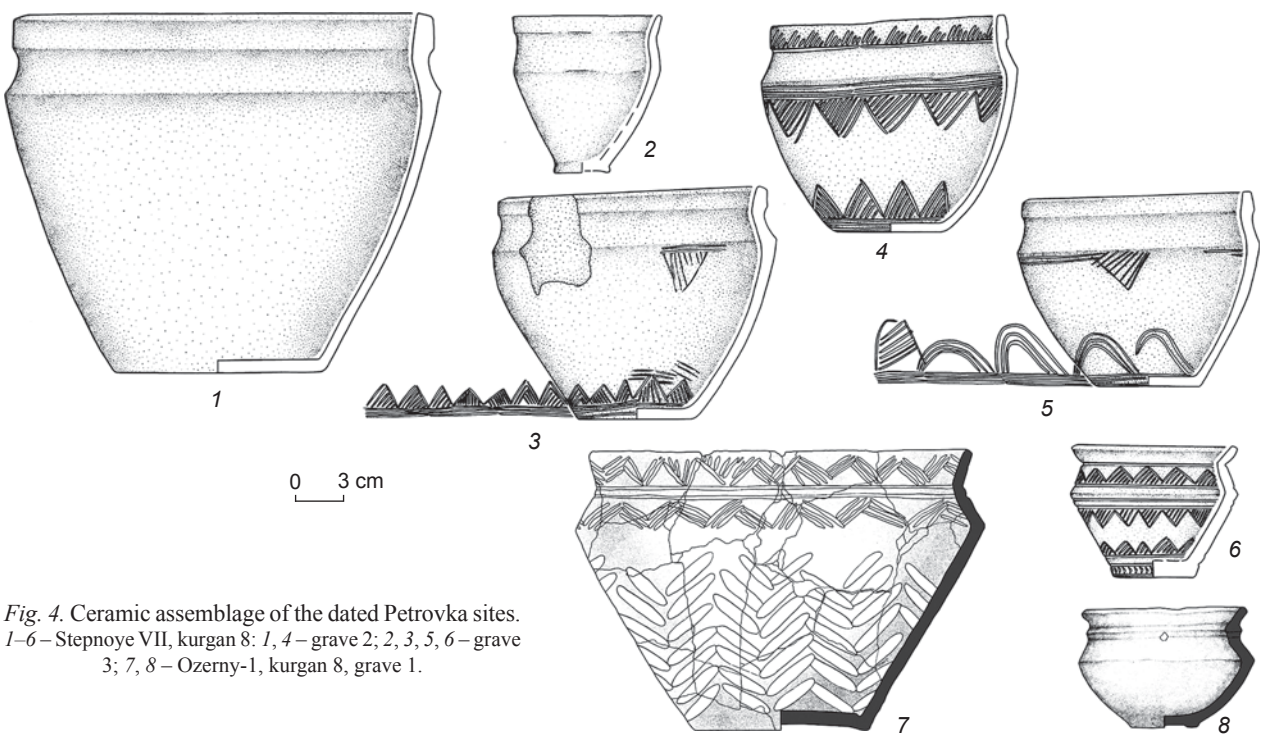

Fig. 4. Ceramic assemblage of the dated Petrovka sites.
1–6 – Stepnoye VII, kurgan 8: *1*, *4* – grave 2; *2*, *3*, *5*, *6* – grave 3; *7*, *8* – Ozerny-1, kurgan 8, grave 1.

The results of ^{14}C dating of the Petrovka and Alakul sites in the Trans-Urals

Site	Complex	Lab code	Material	^{14}C BP	Calibrated values, years BP		$\delta^{13}C$, ‰	C : N	C, (%)	Collagen, %
					1 σ	2 σ				
Petrovka sites										
Stepnoye VII	Kurgan 8, grave 2	MAMS-32154	Human bone	3473 ± 25	1876–1747	1882–1699	–21.5	3.0	38.3	3.1
"	Kurgan 8, grave 2	MAMS-32155	Animal bone	3453 ± 24	1869–1696	1877–1691	–21.3	3.0	37.4	9.1
"	Kurgan 4, grave 17	MAMS-32156	"	3472 ± 24	1875–1747	1881–1699	–21.7	2.9	24.7	2.4
Krivoye Ozero	Kurgan 1, grave 1	MAMS-32158	Human bone	3528 ± 23	1905–1779	1928–1771	–22.9	3.2	39.0	6.0
"	*Kurgan 1, grave 1*	*MAMS-32159*	"	*228 ± 25*	1652–1795 AD	1644–1950 AD	–24	3.2	35.5	3.0
Ozerny-1	Kurgan 5, grave 6	MAMS-32160	Animal bone	3438 ± 24	1768–1692	1875–1666	–21.1	3.2	34.0	7.1
"	Kurgan 5, grave 7	MAMS-32161	"	3492 ± 24	1878–1771	1887–1746	–20.3	2.8	24.9	10.3
"	Kurgan 8, grave1	MAMS-32162	"	3483 ± 25	1876–1755	1885–1702	–20	2.8	25.2	3.6
"	Kurgan 6, grave 1	MAMS-32163	"	3517 ± 24	1890–1776	1916–1760	–23	3.0	31.5	9.5
Troitsk -7	Kurgan 6, grave 1	MAMS-32164	"	3483 ± 24	1876–1755	1884–1703	–21.5	3.0	31.0	1.1
"	*Kurgan 7, grave 4*	*MAMS-32165*	"	*3130 ± 25*	1434–1325	1490–1304	–29.1	3.4	6.7	0.6
"	Kurgan 8, grave 1	MAMS-32166	"	3422 ± 25	1749–1688	1868–1642	–21.8	2.7	20.0	2.2
"	Kurgan 7, grave 5	MAMS-32167	"	3472 ± 26	1876–1746	1882–1698	–18.2	2.8	25.6	3.9
"	Kurgan 7, grave 10	MAMS-32169	"	3447 ± 25	1866–1694	1877–1688	–21.9	2.8	20.4	4.1
Alakul sites										
Stepnoye VII	Kurgan 4, grave 33	MAMS-32157	Animal bone	3402 ± 24	1740–1665	1750–1632	–23.5	3.4	16.8	0.5
Troitsk-7	Kurgan 14, grave 1	MAMS-32168	"	3474 ± 24	1875–1748	1881–1700	–21.9	2.8	20.4	4.1

Note. The italicized results are excluded from the procedure of summation of probabilities.

found in the same assemblage (Stepnoye VII, kurgan 8, sacrificial pit 2) remained at our disposal: animal (horse) and human bones. These values proved to be nearly identical; therefore, we cannot rule out the influence of a reservoir effect in this case. Statistical verification of their consistency was conducted***, which confirmed the high degree of validity of the obtained results.

For assemblage 4 of the Stepnoye VII burial ground, we obtained two dates: 3472 ± 24 BP (MAMS-32156) and 3402 ± 24 BP (MAMS-32157) for Petrovka burial 17 and Alakul pit 33, respectively. Their positions on the chronological scale meets expectations, i.e. the first one proved to be earlier. However, according to the site's researchers, the second feature functioned throughout the duration of the Petrovka and Alakul phases of this complex (Kupriyanova, Zdanovich, 2015: 30).

The summation of probabilities for the sites (Fig. 5) and for the series in general (Fig. 6) has become the format for the generalization of dates. Both yielded very similar results within the 19th–18th centuries BC. In any case, it makes no sense to discuss the position of each site in the classification of Petrovka antiquities. It is impossible to narrow the probability intervals within the specified procedures. All that remains is to correlate our results with those obtained earlier (Hanks, Epimakhov, Renfrew, 2007; Molodin, Epimakhov, Marchenko, 2014), even more so in view of the critical comments expressed with regard to previous conclusions (Grigoriev, 2016). Taking into account the series currently being published, we have 36 dates (almost half of them AMS-dates), with a very wide scatter of values (for the summary report see (Epimakhov, 2016)). The most doubtful are the results from dating the Chistolebyazhsky and Verkhnyaya Alabuga burial grounds, not only owing to serious aging in a number of cases, but also in view of the inconsistency of the data*. It is fair to say that very ancient dates are encountered beyond these cemeteries as well. All results of this kind have been obtained without using acceleration technologies, and with dating based on wood and charcoal. A generalization of these values without critical analysis would only distort our understanding of the actual situation.

The AMS-dates obtained from human and animal bones in the Oxford and Mannheim laboratories are in complete contrast with the above results. Except for the admittedly erroneous dates mentioned, other dates are not only close, but are even identical in some cases. The generated interval actually stays within the 19th–18th centuries BC, which is fully consistent with the earlier assumption about the chronology of Petrovka antiquities, formulated on the basis of a much smaller series*.

To answer the questions raised in the beginning of this paper, we should consider the interval obtained in the system of other dates for Bronze Age sites in the region. Without going into detail, it should be noted that very close values are demonstrated by Sintashta antiquities (Epimakhov, Krause, 2013), as well as by those of the Seima-Turbino culture in the Urals (Chernykh, Korochkova, Orlovskaya, 2017). Does the conclusion about their synchronization follow from this? This is doubtful with regard to Sintashta and Petrovka artifacts, since there is stratigraphic evidence suggesting the priority of the former with respect to Petrovka material (see above). In addition, it is difficult to imagine the simultaneous existence in the same territory of two groups whose cultures differed**. It is a different matter that the two traditions are chronologically very close, which implies a considerable overlap of the intervals.

However, a synchronization with the Seima-Turbino antiquities seems to be more plausible (taking the differences in distribution areas into account). This is additionally confirmed by the presence of typical Seima-Turbino artifacts in Petrovka assemblages, kurgan 8 at Stepnoye VII being one of the recent finds (Kupriyanova, 2017: 34). This conclusion cannot be extended to other

*Calibration and other procedures were made using the OxCal 4.3 program (Bronk Ramsey, 2009) and the IntCal 13 calibration curve (Reimer et al., 2013).

**There are also examples where the standard deviation is 120 or 270 (!) years. It is clear that an interval cannot be meaningfully interpreted after calibration.

*Close results have been obtained for the Petrovka assemblage of Novoilyinovka in the Upper Tobol Region (excavations by E.R. Usmanova), in the neighborhood of Lisakovsk city (Kostanay Region, Republic of Kazakhstan).

**Along with distinctions in the appearance of ceramics, the differences in the funerary rites (Berseneva, 2017) and the typology of the assemblages have been well observed. In our series, the Petrovka traditions are represented, for example, by a chariot complex: the arrangement of a pair of horse-skeletons at the edge of the grave (Ozerny-1), and typical Petrovka cheek-pieces (Krivoye Ozero) (see Fig. 3).

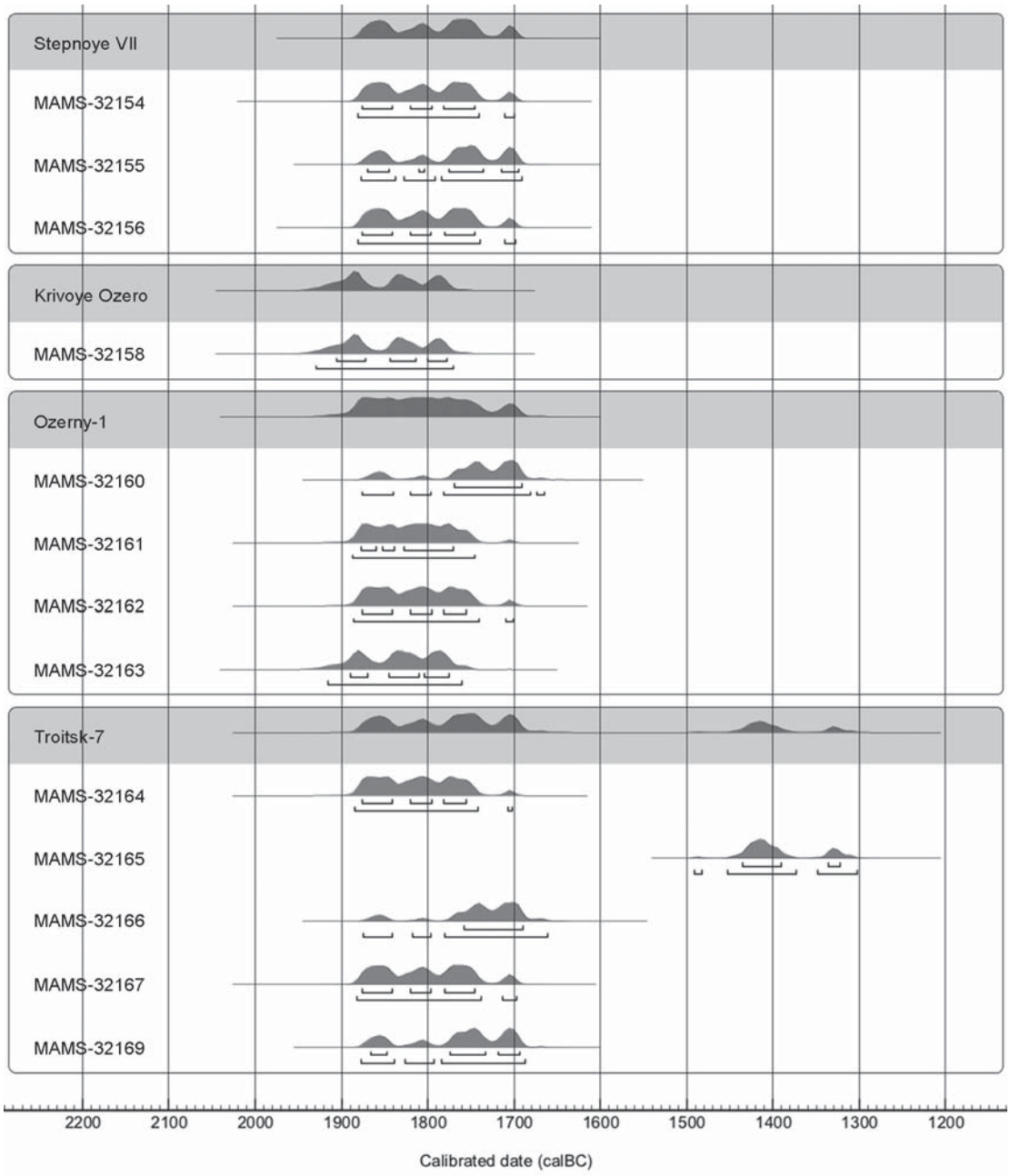

Fig. 5. Radiocarbon chronology of Petrovka cemeteries: results of the summation of probabilities of four sites.

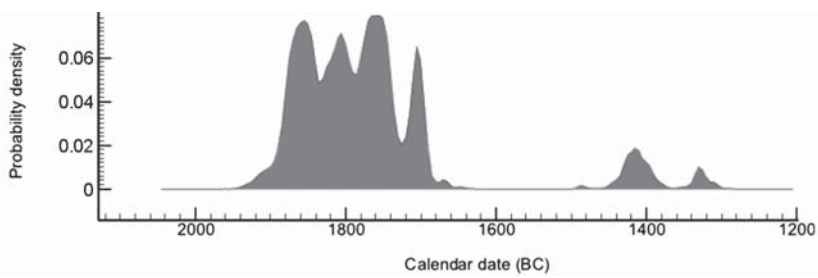

Fig. 6. Radiocarbon chronology of Petrovka sites: results of the summation of probabilities for the published series of dates.

regions where Seima-Turbino bronze artifacts were found, since arguments in favor of an earlier position of the eastern area are gradually increasing (Marchenko et al., 2017).

In an attempt to solve the second debatable issue (regarding the relationship between the Petrovka and Alakul traditions), various authors refer to various kinds of information. On the one side, there is the precedence of Petrovka sites to the "classical" Alakul*. This is based on stratigraphic and typological evidence. On the other side, almost half of the Alakul series of dates consists of very early ones (Epimakhov, 2016), which allows S.A. Grigoriev (2016) to defend the proposal of partial contemporaneity of Sintashta (in steppe) and Alakul (in forest-steppe) artifacts. Also, with regard to evidence, the resemblance of the Alakul ceramics to ceramics from the Middle Bronze Age in the Volga Region is emphasised. It is notable that the available "radiocarbon argument" is weak: about one-third of the Alakul dates are much earlier than the Sintashta dates. They do not even fall within the hypothesis of the very early history of the Alakul community, whose origins are in any case related to Sintashta traditions.

The debate is still far from over, as partially confirmed by our materials. For the Alakul assemblages of the Troitsk-7 and Stepnoye VII cemeteries, we have obtained two dates that are nearly identical to those of the Petrovka series: 3474 ± 24 BP (MAMS-32168) and 3402 ± 24 BP (MAMS-32157). As was pointed out earlier, the Alakul people arranged their burials with regard to already-existing Petrovka funerary structures. The most telling illustrations of this are an extension of an additional ditch section for new graves, and the conduction of sacrifices and burials within the boundaries of Petrovka kurgans. Thus, it is hardly possible to talk about a break with the tradition. On the contrary, here we can see an example of a foreign ritual space being mastered without destruction to preceding structures. Currently, there is reliable information about the "supplementation" of Sintashta funerary complexes with Petrovka features, and the latter in turn with Alakul features, which points to the sequence of these cultures. In fact, researchers agree on the issue of evolution of the Alakul ceramic assemblage towards the "elimination" of Petrovka traits.

It may appear as though the summary of facts presented here is logically inconsistent within a unified scheme. In our view, the solution to this problematic situation is to recognize that there must have been very high-speed and intense cultural and genetic evolutionary processes. The resolution of the radiocarbon chronology does not yet suffice to detect such rapid changes. In other words, the main events in the region under study took place within an interval outlined by a probability interval of the 19th–18th centuries BC, which is not so short (at least two centuries!). This version would stay within the interpretation of Petrovka antiquities as an early phase of the Alakul culture, as defended by N.B. Vinogradov. This is also indirectly confirmed by the mentioned relatively small number of Petrovka sites*.

Conclusions

New data on the chronology of Petrovka sites in the Trans-Urals have considerably increased the validity of previous conclusions about the chronological framework and succession of cultures in the region, but also require critical rethinking and detailing of the scheme of cultural genesis. The array of AMS-dates, which seems to be maximally reliable from our point of view, indicates that the Petrovka sites functioned within the 19th–18th centuries BC. We think the abandonment of these dates—until verification by repeated dating of these complexes is conducted—will be the only reasonable solution with respect to other analyses that demonstrate a great variation in values and inherent contradictions. The designated boundaries are no more than a statistically significant time interval, within which the events of interest took place. They do not record (and cannot record, owing to the method's specifics!) the actual duration of the existence of Petrovka traditions. This fact, along with stratigraphic and typological observations that determine the progression in the "Sintashta"–"Petrovka"–"Alakul" sequence, should be taken into consideration when

*This group is marked by ceramic ware with stepped shoulders, which is abundant at the eponymous site.

*Unfortunately, it is impossible to assess this parameter for the territory of northern and central Kazakhstan due to the absence of current data for this region.

working out a solution. Besides, the Petrovka people often continued to use the grounds (and sometimes the structures) of Sintashta settlements and cemeteries, while the Alakul population utilized Petrovka kurgans by extending their architectural elements and making burials on their peripheries*.

In our view, the only method of the noncontradictory reconciliation of these facts is to recognize such a high rate of cultural evolution that cannot be detected by radiocarbon dating methods. In this case, some early Alakul dates, whose calibrated intervals proved to be similar and even identical to Sintashta and Petrovka ones, are not an error in age determination, but illustrate a real historical situation in which a tradition was formed dynamically. As for the Petrovka antiquities, these represent a rather short initial episode in the long history of the Alakul community.

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*Importantly, we do not know of reliable examples of reverse stratigraphy, which would be evidence for full synchronization of some sequence pairs.

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O.A. Ulchitsky, E.K. Bulatova, E.K. Kazaneva, and O.M. Veremey
Nosov Magnitogorsk State Technical University,
Pr. Lenina 38, Magnitogorsk, 455000, Russia
E-mail: archi-mgtu@mail.ru; bulatova_ek@bk.ru; mgnket@mail.ru; o.veremey@mail.ru

A Comparative Study of the Layout of Bronze Age Fortified Settlements in the Southern Urals (3rd to 1st Millennia BC)

The earliest (Bronze Age) fortified settlements in the Southern Urals are described with regard to their defensive function, as well as their production and residential quarters. Their parallels are discussed. The article focuses on the architecture of the earliest Indo-European forts and compares it to that of their later Eurasian counterparts. The relations between the layout of the Sintashta-Petrovka forts and the architecture of Central Asia and of the early Indo-European states are revealed. Bronze Age fortified settlements of the Southern Urals, Northern Kazakhstan, and Central Asia are compared on a unified scale with reference to their function. The results can be used in future research on ancient architecture.

Keywords: *Fortified settlements, Southern Urals, comparative method, Bronze Age.*

Introduction

The results of historical, archaeological, ethnographic, and other studies in the Southern Urals (Aleksashenko et al., 1973; Zdanovich, 1988; Saveliev, Yaminov, 2004; Zdanovich, Batanina, 2007; Vinogradov, 2007; Epimakhov, Chuev, 2011; Koryakova et al., 2011; Fedorova, Noskevich, 2012; Bakhshiev, Nasretdinov, 2016) show that the general concepts concerning typology and genesis of the ancient structures in that region are still not sufficiently objective. Multiple scholarly interpretations of this issue have triggered the need for considering the available evidence about the fortified settlements of the Bronze Age in the Southern Urals using the comparative method.

In the period between 1969 and 2013, the ruins of over 20 fortified settlements of the Bronze Age were found in the Chelyabinsk and Orenburg regions, the Republic of Bashkortostan, and Northern Kazakhstan, including Alandskoye, Andreevskoye, Arkaim (Aleksandrovskoye) (Zdanovich, 1988: 8–23), Bakhta (Batanina, 2004), Bersuat (Yagodny Dol), Zhurumbai, Isinei-1 and -2, Kamysty, Kizil-Chilik (Parizh) (Batanina, 2004), Kizilskoye, Konoplyanka, Kuisak, Olgino (Kamenny Ambar) (Koryakova et al., 2011: 71–74), Rodniki, Sarym-Sakly (Sharapov, 2017: 51), Sintashta-1 (Gening V.F., Zdanovich, Gening V.V., 1992: 17–43), Sintashta-2 (Levoberezhnoye) (Petrov et al., 2017), Stepnoye, Ustye, Chernorechye III (Vinogradov, 1995), Chekatai, Shikurtau (Batanina, 2004); Ulak-1 (Saveliev, Yaminov, 2004), Selek (Usmanov et al., 2013), Streletskoye, Shibaevo-1, Kamenny Brod, and Zarechnoye (Chechushkov, 2018: 11–18) (Fig. 1). The best known and explored fort is Arkaim, originally the Aleksandrovskoye fortified settlement (Aleksashenko et al., 1973: 15) (after the

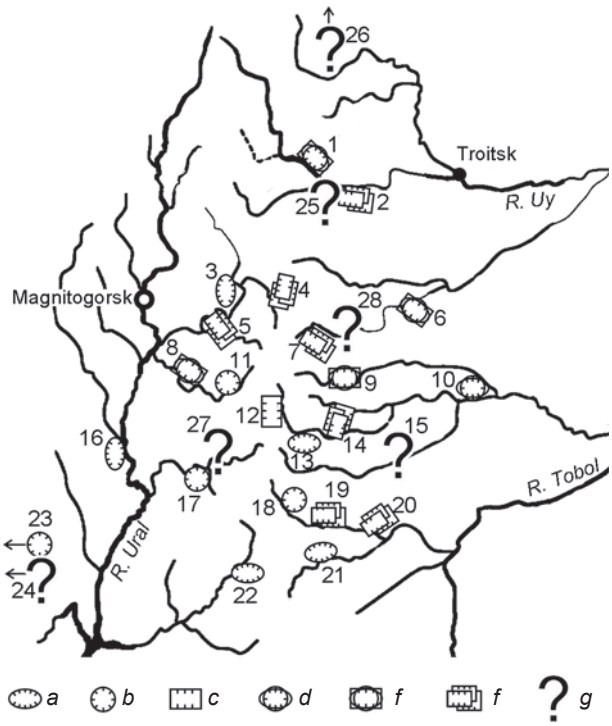


Fig. 1. Location of fortified settlements of the Bronze Age (18th–16th centuries BC) in the Southern Urals.
1 – Stepnoye; 2 – Chernorechye III; 3 – Shikurtau; 4 – Parizh (Kizil-Chilik); 5 – Bakhta; 6 – Chekatai; 7 – Ustye; 8 – Kuisak; 9 – Rodniki; 10 – Isinei; 11 – Sarym-Sakla; 12 – Konoplyanka; 13 – Zhurumbai; 14 – Kamenny Ambar (Olgino); 15 – Kamysty; 16 – Kizilskoye; 17 – Arkaim (Aleksandrovskoye); 18 – Sintashta I; 19 – Sintashta II (Levoberezhnoye); 20 – Andreevskoye; 21 – Bersuat (Yagodny Dol); 22 – Alandskoye; 23 – Ulak I; 24 – Selek; 25 – Streletskoye; 26 – Shibaevo I; 27 – Kamenny Brod; 28 – Zarechnoye.
a – oval, "Early Sintasta" type 1; *b* – circle, "Sintashta" type 2; *c* – rectangle, "Late Sintashta" type 3 or "Petrovska" type 4; *d* – two-layered, type 1/2; *e* – multilayered, mixed type 1/2/3; *f* – multilayered, type 3/3 (with habitable walls) or 3/4 (with continuous building pattern); *g* – structure and shape are not identified or no data.

name of the nearby village). Currently, archaeological works on ancient settlements have been conducted in the south of the Chelyabinsk Region and in the adjacent areas of the Eastern Orenburg region, Bashkortostan, and Northern Kazakhstan.

The main factors that influenced the emergence, development, and decline of fortified settlements in the Southern Urals have been identified and substantiated using scholarly methods (after dissertation research (Ulchitsky, 2006: 10–11)). These factors include: 1) the availability of copper ore deposits located near the surface and accessible for mining by primitive methods (Zdanovich et al., 2003: 140–141), and 2) specific features of the geographical environment of the region in the Middle Bronze Age, which influenced the formation of settlement systems. Early territorial formations typically manifest a symbiosis of nomadic (or semi-nomadic) and sedentary settlements. These factors resulted in a territorial relationship: mine – fortified settlement – unfortified settlements.

A set of planning and constructing methods, as well as presence of religious and funeral features, correspond to each fortified settlement. The area of a single structure within the defensive walls ranged from 8 (Isinei) to 34,000 m^2 (Chernorechye). Fortified settlements served as territorial centers, strongly resembling the Early Medieval citadels "akr" and "kale" in the towns of Central Asia and Iran (Lavrov, 1950: 264–268). In the Southern Urals, such centers were located approximately at a distance of 20–40 km from each other, and were often placed in river floodplains.

Despite the fact that fortified settlements were built according to a single model, which can be traced in their planning structure, three main types had been previously determined (Ulchitsky, 2006: 11): the Early Sintashta type, "classic" Sintashta type, and Petrovka type. Currently, after analysis of the Sintashta-Petrovka fortified settlements in the Southern Urals (Ulchitskiy et al., 2016), four types have been determined: three types with habitable walls—the Early Sintashta, Sintashta, and Late Sintashta types, and the fourth with a continuous housing pattern—the Petrovka type (Fig. 1). Their subsequent influence on the settlements that were concentrated on the territory of present-day Kazakhstan and Central Asia has also been established. Gradually, the Petrovka type was transformed into a linear regular Sargary-Alekseevka building pattern.

The multilayered nature of the features under study has been established using stratigraphy and planigraphy, based on aerial photographs and layer-by-layer records in excavation pits. There were cases when a later fortified settlement partially overlapped an earlier settlement, and the configuration of the fortifications in the earlier settlement was not taken into account in the construction of the later settlement (Isinei-1 – Isinei-2, Stepnoye-1 – Stepnoye-2, etc.). There were also instances when settlement outlines in plan view completely overlapped the earlier outlines (see Fig. 1).

Reasons, which cannot be reliably established, led to active population movements and emergence of new building traditions in the Alakul and Fedorovka cultures. These traditions typically manifest a chaotic building pattern and large semi-dugout structures, of which traditionally two types are identified: "a farmer's house" and "a potter's house" (Zdanovich, 1988: 146).

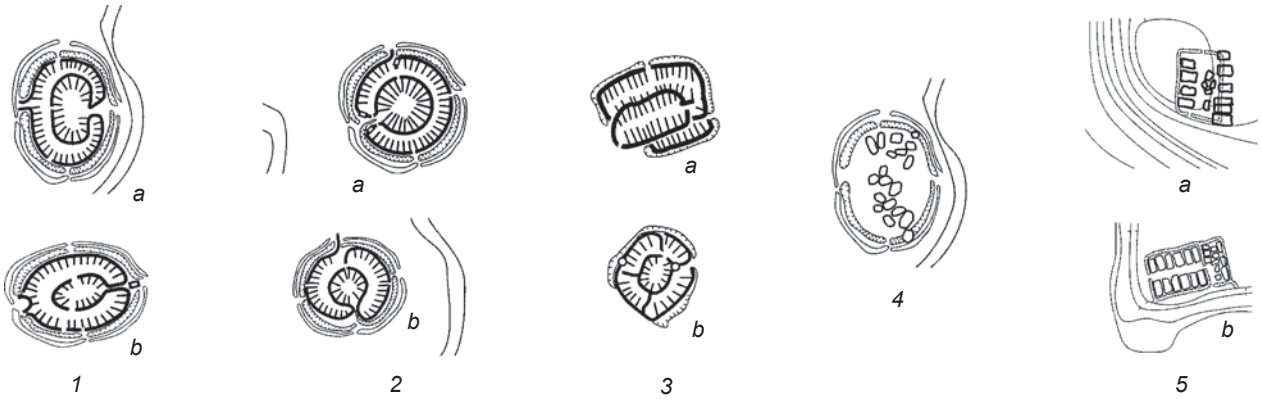


Fig. 2. Layouts of fortified settlements and residential areas of the Bronze Age in the Southern Urals and Northern Kazakhstan. *1* – "Early Sintashta" type, late 3rd to early 2nd millennium BC: *a* – Kizilskoye, *b* – Bersuat; *2* – "classic" Sintashta type, 18th–16th centuries BC; *a* – Arkaim, *b* – Sarym-Sakly; *3* – "Late Sintashta" (Petrovka) type, 17th–15th centuries BC: *a* – Andreevskoye, *b* – Kuisak; *4* – the Alakul and Fedorovka settlements at the sites of the former Sintashta fortified settlements, 15th–12th centuries BC (Kizilskoye); *5* – the Petrovka, Alakul, Fedorovka, and Sargary settlements in Kazakhstan, 17th–9th centuries BC: *a* – Novonikolskoye I, *b* – Petrovka II.

The architecture of fortified settlements reflected specific aspects of social organization and the geographical environment. The difficulty in determining the genesis of the Sintashta-Petrovka culture is that its range is not geographically related to the borders of the early Indo-European states, and there are no written sources.

The purpose of this study is to expand the knowledge on typology and genesis of fortified settlements of the Bronze Age in the Southern Urals based on a historical and comparative analysis of monuments of the Sintashta-Petrovka culture of the 18th to 16th centuries BC.

This study has the following objectives:

– To clarify the typological attribution of the fortified settlements under consideration;

– To analyze their planning structures and compare them with the parallels;

– To consider possible interrelationships of architectural and building traditions of the Sintashta-Petrovka culture with the ancient town-planning traditions of Central Asia and early Indo-European states, and

– To identify the directions for further research into the objects of ancient fortification and the territories where they were located.

On the basis of the results obtained, a hypothesis about the connection of early fortification architecture of the Bronze Age in the Southern Urals with the traditions of ancient states of Eurasia has been formulated. A new form of systematization of the features under study according to their structural and typological traits has been proposed.

Research methods

This study uses the comparative historical method, which received the greatest development in the works of art historians. It seems to be the most expedient method for studying architectural and archaeological structures, their genesis, and connections with parallels. The comparative method in the study of architecture was first used by a member of the Royal Institute of British Architects Professor B. Fletcher (1896). As applied to ancient architecture, it is constitutive for searching the links between the features under study and the earlier or later parallels based on similarities of space-planning patterns.

Recent studies in the history of architecture using the comparative method were conducted by G. Curinschi-Vorona (1991), who formulated a scholarly conceptual framework for comparative architectural studies. On the basis of his comparative models as the most productive for ancient ruined monuments, one can put forward a working hypothesis regarding the architecture of the fortified settlements of the Bronze Age in the Southern Urals.

This article employs the comparative method as the basis for research methodology, which mainly relies on the concepts of the Russian scholar and architectural historian N.I. Grekov, who distinguished three main aspects in the study of ancient habitation areas (1985: 23). These are the shape of ancient structures as one of the most important historical sources; specific social features (number of structures, sizes, degree of development, etc.); and chronology.

For historical and comparative analysis of planning structures of fortified settlements of the Bronze Age in the Southern Urals, and their comparison to other ancient structures, it is proposed to consider two groups of parallels:

1) objects of historical architecture and town planning, which have a distinctive nature and are relatively close (geographically, culturally, and chronologically) to the archaeological monuments under consideration;

2) objects of architecture and town planning, similar in structure, but belonging to different cultures, which do not intersect geographically and chronologically with the monuments under consideration.

We limit ourselves to the parallels that are the best typologically suitable for the Sintashta-Petrovka fortified settlements under consideration, that is, religious structures and habitable fortifications. It is also necessary to identify the main criteria for comparison:

– morphological: general planning structure and the structure of individual elements of the housing system;

– historical: dating, layer-by-layer record of object formation, and

– geographical: geographical location of the object.

The comparative historical method has a certain advantage only in the case of complete or partial lack of historical evidence (including written sources) about the object of research, which is in ruins. Such a category includes the architectural monuments of the Petrovka-Sintashta culture. Notably, the comparative historical method has certain drawbacks: it does not give accurate results, and the conclusions drawn solely on its basis may be erroneous. To minimize the risk of false scholarly conclusions, it is necessary to use auxiliary means of research. The development and enrichment of the comparative historical method will make it possible to elaborate a basic model of a comprehensive methodology for researching prehistoric features.

In this study, it is proposed to supplement the comparative historical method with a graphical comparative analysis of planning patterns. This would make it possible to visualize the planning organization (type of planning pattern), specificity of form making, and typical sizes of the features of the ruins.

Results

For examining the parallels to the fortified settlements of the Bronze Age in the Southern Urals, we should first turn to well-known Asian and Indo-European structures, since in this case the geographical criterion acts as a referential criterion. Analyzing planning structures of a certain type, it is possible to build a unified concept of planning traditions from the Sintashta-Petrovka (see Fig. 2) to later Central Asian traditions, which are presumably successive (Fig. 3).

The Khwarazm settlements on the right and left banks of the Amu Darya River give an idea of the pattern of fortified settlements marked as "clan-oriented" (Tolstov, 1948: 18) (communities shifting to the settled life), and sedentary settlements of the 6th to 4th centuries BC. The most archaic type of settlements known in the history of the towns of Central Asia are the so-called fortifications with habitable walls (Tolstov, 1946: 9) Kyuzeli-Gyr and Kalaly-Gyr (6th to 3rd centuries BC). These relatively large settlements also have non-residential, presumably religious buildings or buildings intended for economic purposes. Fortifications of Kalaly-Gyr were quite sophisticated for the fortresses of that time: numerous towers were located along the walls, and there were gates with complex entrance "labyrinths" in the center of each wall. Another type were fortified settlements with a continuous building pattern ("tepe"), known throughout all of Central Asia. The earliest of such settlements with mud-brick buildings were found in Turkmenistan on Anau Hill. They may include a large fortified communal house in the vicinity of Bazar-Kala (the ancient Khwarazm). The patterns of continuous housing have also been observed at the sites of Ak-Tepe (near Ashgabat) and Namazga-Tepe (near Kaakhk). They existed in Central Asia from the late third millennium BC to the 8th century AD, which can be explained by stable cultural traditions in the region.

The study by D.A. Akhundov on the ancient architecture of Azerbaijan contained a drawing reconstruction of multi-room dwelling houses of the 2nd to 1st millennium BC—doubled rectangular and round structures in plan view. The study also included a plan of an ancient settlement of the 3rd millennium BC, consisting of "one round multi-room house and a group of single-room round houses" (Akhundov, 1986: 44).

The structure of the settlement of Dzhanbas-Kala represents the pattern of fortified settlements with continuous housing. Initially, it was a single compact complex of dwellings belonging to a single clan, and later, with disintegration of the clan-oriented organization, the complex also split into a number of quarters-dwellings populated by families (Tolstov, 1946: 15). Noteworthy is the parallel development of town planning traditions in various regions. For

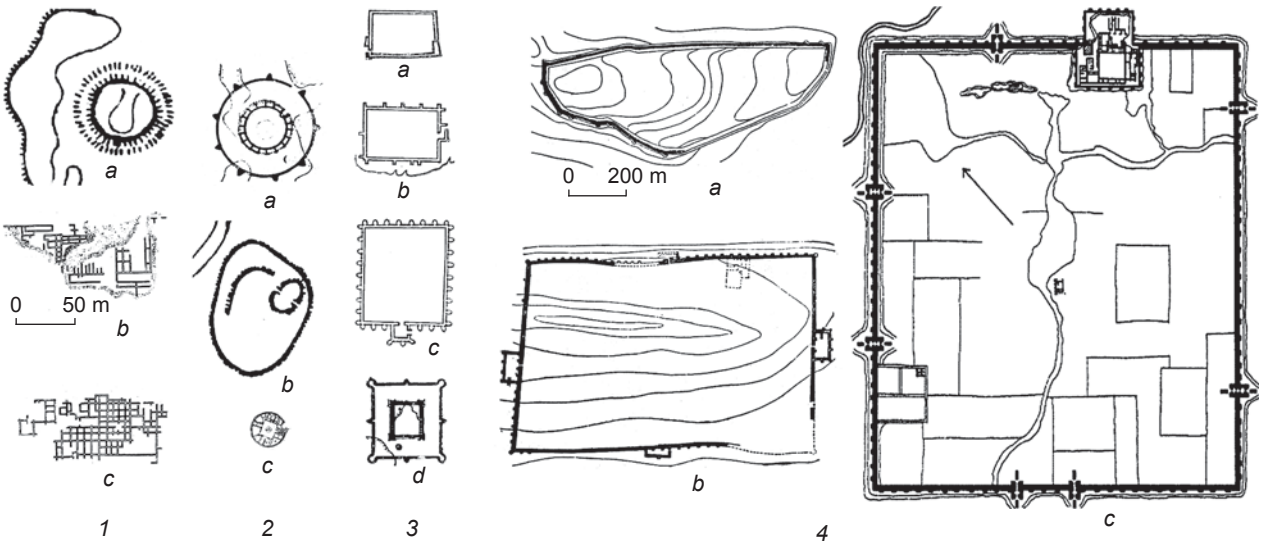


Fig. 3. Layouts of settlements and residential areas in the period from the Late Bronze Age to the Middle Ages in Central Asia (ancient Khwarazm).

1 – early fortresses and residential areas of the Bronze Age: *a* – Ak-Tepe fortress, late 4th to second half of the 3rd millennium BC, *b* – residential area of Ayaz-Kala, late 3rd millennium BC, *c* – residential area of Dzhanbas-Kala, late 3rd millennium BC; *2* – late fortresses of the Iron Age and the Middle Ages: *a* – Koi-Krylgan-Kala, 6th–3rd centuries BC, *b* – Shash-Tepe, 6th–1st centuries BC, *c* – Deu-Kala, 12th–13th centuries AD; *3* – fortified settlements with continuous housing pattern, 6th–3rd centuries BC: *a* – Kurgashin-Kala, *b* – Ata-Tyurk-Kala, *c* – Ayaz-Kala, *d* – Teshik-Kala; *4* – fortified settlements with habitable walls: *a* – Kyuzeli-Gyr, 6th–3rd centuries BC, *b* – Kalaly-Gyr-1, 6th–3rd centuries BC, *c* – Dzhanbas-Kala, 9th century BC to 1st century AD (image scale reduced 2x).

example, similar groups of dwellings existed in the countries of the East and in Sumer-Akkad in the 2nd millennium BC. However, the so-called southern type of dwellings, common in Babylonia, was most similar to ancient settlements with habitable walls of the northern type, known on the territory of the future Assyria, Kazakhstan, and the Urals. At the same time, settlements with the continuous building pattern began to appear. The Khwarazmian settlements with habitable walls were closed fortifications. Dwellings in several rows were placed along the walls. Fortifications simultaneously served as the walls of the outer row of dwellings. The internal free space was intended for communal cattle.

In their structure, the settlements with the continuous housing pattern cannot yet be called towns; they were only large houses located in random order, for which S.P. Tolstov used the term "complex of houses" (1948: 10). Further, they were united inside the fortress walls, forming groups-quarters typical of ancient towns. An architectural and planning basis for the "fortified settlements with habitable walls" was used in the formation of Central Asian towns of the ancient period for arrangement of the structure of fortress walls combined with dwellings.

The last structure that may serve as a parallel to the fortified settlements of the ancient Urals was the medieval fortress of Deu-Kala dated to the 12th–13th centuries AD. "It is a small round fort (51.5 m in diameter) surrounded by a powerful (up to 2 m thick) wall of huge (up to 96 × 53 cm, with a thickness of 16 cm) slabs of ashlar. A courtyard with a well was in the middle, surrounded by living quarters for a garrison made of stone. The location of Deu-Kala makes it possible to perceive it as the outpost of military expansion of the rising Khwarazm against the Central and Western Khorasan" (Ibid.: 21). That fortress reflects the functional typology of ancient fortified settlements, and can be juxtaposed with the structures of the Southern Urals under study, which are the same, but earlier than Deu-Kala. Possibly, these represent one of the earliest forms of garrison forts in Eurasia.

Thus, for the development of a working hypothesis, the location of the fortified settlements of the Petrovka-Sintashta culture must have definite boundaries and a vector of their territorial expansion. However, this is not yet confirmed, since the emergence of the structures was confined to the oecumene of the Ural northern steppe, with the exception of the Isinei fortified settlement, which is located more to the east, and the Alandskoye fortified settlement with individual barrows, located along the southern fringe of the Ural Mountains.

Scholars have observed that at the early stages of the town-planning culture of Central Asia, two types of volume-planning structure with circular and rectangular plan stand out, corresponding to two main architectural and planning techniques: the ring building pattern around an open courtyard, and continuous building pattern created by adjacent premises (typical of the ancient settlements of Kazakhstan).

The question of the continuity and echoes of the Sintashta building traditions in other cultures, in particular, those with developed statehood, still remains open at the present time.

Discussion

The fortified settlements of the Southern Urals can be discussed not only in terms of their belonging to a certain culture or ethnic group, but also to a specific developed civilization with a certain form of state system. By today, there is no agreement among scholars regarding the genesis of the Petrovka-Sintashta culture.

Discussing this issue, we cannot ignore the fact that one and a half millennia later, the Great Silk Road passed through the territory of the fortified settlements of the Southern Urals. A caravan or trade route could have passed through this territory much earlier, building up trade and exchange relations between the nomadic and sedentary tribes.

The agglomeration of fortified settlements demonstrates the presence of a certain territorial cluster or separate trading posts throughout the emerging "oasis of settlements", from which bronze or products made of bronze may have been exported to Mesopotamia, Egypt, or the Indian lands. If we adhere to our working hypothesis, the territory of the fortified settlements of the Southern Urals functioned as a distant trading post of a certain society with a developed state system.

Based on the Central Asian typological parallels of the 1st millennium BC or later parallels of the 12th–13th centuries AD, which had morphological similarities with the fortified settlements of the Bronze Age in the Southern Urals, it can be assumed that the inhabitants of these settlements led a "garrison" way of life. The functional structure of fortified settlements in the Southern Urals, in fact, differed little from that of the Central Asian fortified settlements. At any time, people could stand up to defend their fortress or move farther inland. Such methods of placing fortifications on the terrain, in floodplains and bends of rivers, in a favorable defensive position, can only be compared to the garrison type of settlement, or purposeful creation of trading posts or oases, where people can gain a foothold for dozens and hundreds of years on a territory developed for the particular purposes of a society showing features of the state system. Such goals could have been both territorial and economic expansion, procurement of resources for the treasury of the state, and long-term military expeditions. This point can be supported by several historical and archaeological facts, for example, the presence of chariot remains in the burials of the 17th–16th centuries BC at the Sintashta cemeteries and in the mound complex of the fortified settlement of Olgino (Kamenny Ambar). The average age of the persons buried in these graves was 35–45 years. Unfortunately, little is known about the causes of their death, and information is insufficient for making any definitive conclusions. Research in this direction is just beginning (Zdanovich G., Zdanovich D., 2010).

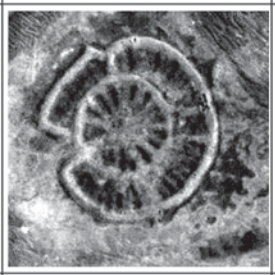
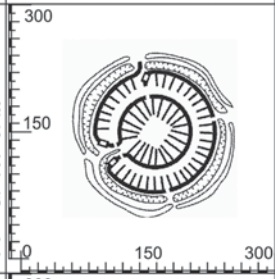
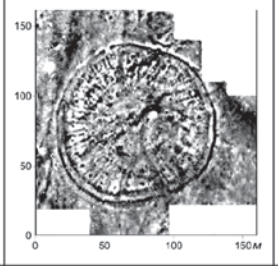
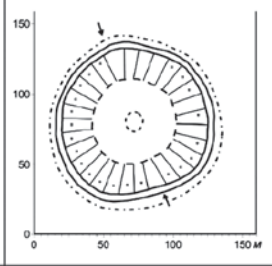
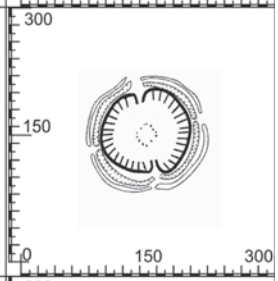
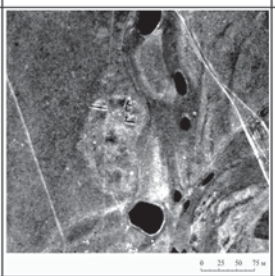
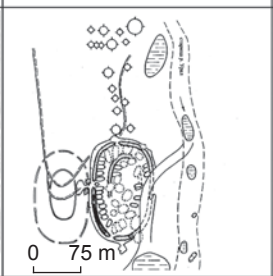
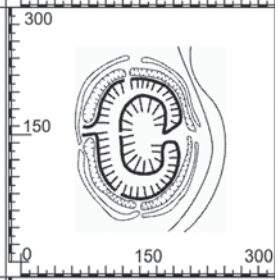
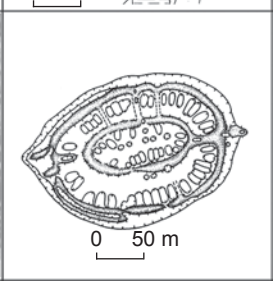
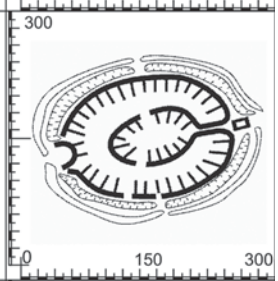
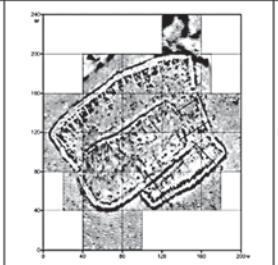
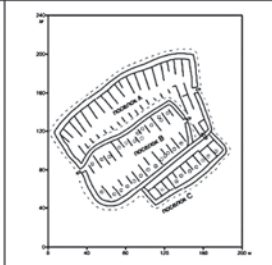
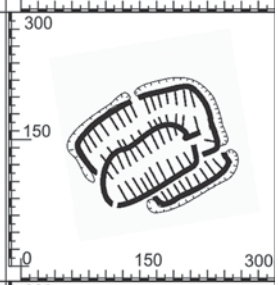
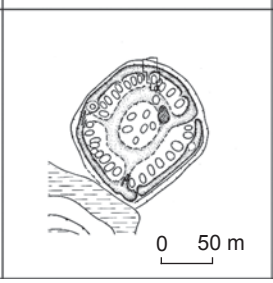
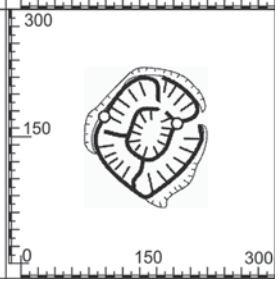
Owing to the isolation from civilization, in field conditions, chariot driving could have not fully develop as an institution for training organized troops. Chariots and harnesses were not produced in large quantities in the Southern Urals, but were probably imported, which can describe the phenomenon of chariots in this territory as "foreign". The remains of chariots or harnesses, with rare exceptions (bone psalia, wheel imprints in the soil of burial chambers: Sintashta cemetery, graves 28–30 (Gening V.F., Zdanovich, Gening V.V., 1992: 200–219), cemeteries near the village of Berlik (Zdanovich, 1988: 71–78)), have not yet been found.

According to archaeological atlases, the territory of the Southern Urals and Kazakhstan since the Neolithic period has been evenly settled along the rivers. By the 16th century BC, the traditions of construction underwent significant changes, but settlements continued to be formed regardless of the developmental stages of the Sintashta fortifications. In some cases, the sites of ruined fortified settlements (for example, Kizilskoye on the Ural River) were used for the Alakul and Fedorovka settlements in the 14th–13th centuries BC (Zdanovich et al., 2003: 20–22).

Conclusions

The study of typology and genesis of fortified settlements of the Bronze Age in the Southern Urals have yielded definite scholarly results. The analysis of planning parallels has made it possible to identify typological and morphological similarities of

Example of comparative analysis of settlement layouts

Designation on Fig. 1	Name, type, planning structure	Aerial survey or magnetic measurements	Plan deciphering	Morphology of the plan in the unified scale
17 	Arkaim, type 2, circle, with habitable walls, single-layered			
11 	Sarym-Sakly, type 2, circle, with habitable walls, single-layered			
16 	Kizilskoye, type 1, oval, with habitable walls, single-layered			
21 	Bersuat, type 1, oval, with habitable walls, single-layered			
20 	Andreevskoye, type 3/3, rectangle, with habitable walls, multilayered			
8 	Kuisak, type 1/2/3, mixed, with habitable walls, multilayered			

structures and continuity of building traditions in the territories with developed statehood. The typology of fortified settlements of the Bronze Age in the Southern Urals has been largely determined and substantiated by the method of comparative historical analysis; it is directly related to fortifications with residential and production-artisan function. Such facilities were typical of remote trading posts with a garrison form of human settlement.

A graphical comparative analysis of the planning structures substantially supplemented the methodology for studying fortified settlements of the Bronze Age in the Southern Urals and brought the comparative method to a new level (see *Table*). The similarity between the plans of these features and planning parallels from other cultures in terms of structure, shape, size, and organization techniques (see Fig. 2, 3) has been clearly demonstrated.

The results of this work make it possible to speak about the genesis of the Sintashta-Petrovka town-forming fortification system and its hereditary and successive interrelations with ancient architectural and town-planning traditions of Central Asia in the early stages of formation of the Indo-European states. This study has contributed to the promotion and improvement of historical and architectural science in the field of historical reconstruction of archaeological features and comparative-historical analysis of monuments of ancient architecture and urban planning.

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N.P. Matveeva
Tyumen State University,
Volodarskogo 6, Tyumen, 625003, Russia
E-mail: nataliamatveeva1703@yandex.ru

Early Iron Age Pyramidal Kurgans in Western Siberia

Ditches encircling the Early Iron Age Sargatka kurgans in the Western Siberian forest-steppe are described. Most of these are nonagonal, decagonal, or dodecagonal; but hexagonal, heptagonal, octagonal, and those with 14 angles occur as well. The kurgans' shapes are not correlated with size, platform diameter, or number of graves. The analysis of data regarding the microrelief of kurgans' surfaces, as well as of sources relevant to early nomadic religion, enables us to interpret various types of ditches. The hexa- or heptagonal type encircled a wooden and earthen pyramid, presumably symbolizing the World Mountain. Those with 9, 12, and 14 angles result from a proportionally larger size of elite kurgan. Indeed, inside such kurgans, hexa- or heptagonal wooden platforms are found. Unclosed ditches likely indicate unfinished kurgans, and 11-angled and 13-angled fences are interpreted as distortions of the initial layout by secondary burials. Ditches are associated only with male burials, and were apparently meant to protect against evil forces and against the possible intrusion of potentially hostile ancestors, whose cult was reconstructed on the basis of the offerings in elite burials. The architecture of the Sargatka kurgans evidences remnants of Indo-European myths transformed by inter-ethnic contacts and cultural innovations on the periphery of the Scytho-Siberian world.

Keywords: *Early Iron Age, Sargatka culture, Scytho-Siberian nomads, kurgan architecture, polygonal ditches, semantics.*

Introduction

The idea of viewing the burial mound (kurgan) as an architectural structure is not new; it was expressed as early as the 19th century, and was followed up by M.P. Gryaznov (1961), his student M.P. Chernopitsky (1979, 1984), and other scholars. Extensive literature is devoted to the origins, evolution, and semantics of the kurgan tradition (Gimbutas, 1970; Shilov, 1995; Smirnov, 1997; Olkhovsky, 1999; and others). However, the structural system of burial sites has its own specific features in every archaeological culture, and these features should be considered in their own right. In particular, kurgans of the Early Iron Age in the forest-steppe zone of Western Siberia (Fig. 1, *1*), on the northern periphery of the Scytho-Siberian world, typically have a variety of ditches: concentric, arcuate, elliptical, and polygonal in plan view, both with sides of different lengths and with sides of equal lengths.

Ditches polygonal in plan view around the burials of the Sargatka culture were discovered in the early 1960s (Moshkova, Gening, 1972: Fig. 2). During the earlier archaeological studies, these were not completely unearthed. Excavations performed by the Tyumen Archaeological Expedition in the 1980s in elite kurgans on high floodplain terraces of the Tobol, Ishim, and Iset, and also on ridges and watersheds (all mainly on clay soils), have yielded a whole series of such observations (Matveeva, 1993: 13–43; 1994: 14, 26, 33, 47, 58, 70, 72, 81, 87). The initial explanation for the construction, by

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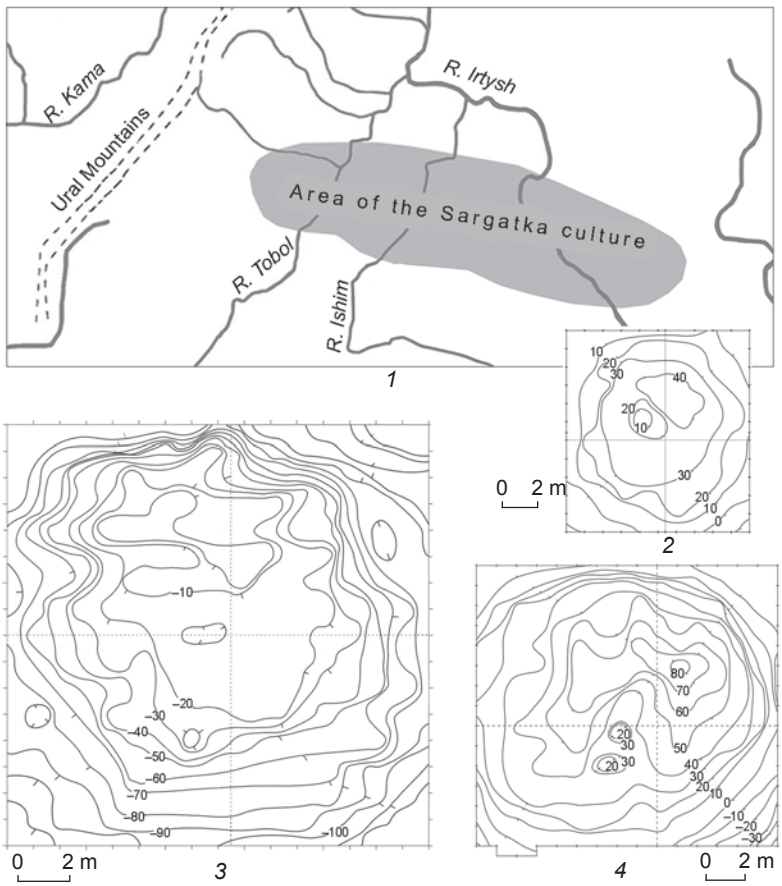

Fig. 1. Location of sites of the Sargatka culture (*1*), and microrelief of the surface of kurgans 2 (*2*), 3 *(3*), and 6 (*4*) at the Gilevo-2 cemetery.

the Sargatka people, of the ditches polygonal in plan view was based on another very early observation concerning the structure of mounds over large kurgans (3–4 m high): these contained polygonal platforms of logs placed over the entire ground of the kurgan, on top of the buried soil, as a kind of structural variation of the Arzhan kurgan (Gryaznov, 1980: Ins.). Therefore, it was concluded that the ditches were dug out after the construction of such a platform, and surrounded it, protecting the entrance into the funeral space. The tomb of logs stayed open while the secondary burials were made in the kurgan, as evidenced by the location of discharged soil from the side-graves on the buried soil. Only later, when the related family group prepared to move away or achieved a different status, was this structure completed by the cover of sod bricks, and a new structure started (Matveeva, 1993: 135–136; 2000: Fig. 92).

The original appearance of the mound is unknown, but the reconstruction of the Kenes kurgan left by the early nomads in Northern Kazakhstan (Zdanovich, Ivanov, Khabdulina, 1984: Fig. 4) shows a stepped truncated cone made of sod blocks with clay crepidoma, which increased in diameter and decreased in height as the mound flattened with time. L.N. Koryakova is of the same opinion concerning the Sargatka kurgans (1988: 47). According to a series of research reconstructions, a Scythian kurgan constituted a sophisticated ensemble of a truncated conical mound erected from soil briquettes, with a menhir on top, crepidoma, ditch, stone rows, and accompanying commemorative structures (Olkhovsky, 1999: 125–126).

The Sargatka kurgans were also built of sod blocks cut around the burial space, as confirmed by the observations of differences in the thickness of buried soil inside and outside the burial ground. Initially, we described the appearance of the previously discovered Sargatka kurgans as a segment of a sphere, without focusing on details. Some deviations from the hemispherical shape were explained by the activities of grave-robbers. Moreover, Chernopitsky showed earlier that domed surfaces emerge naturally, under the influence of destructive forces transforming the initial body of the mound: in particular, the gravitational effect (1987: 60). However, the discovery of mounds with a truncated-pyramidal form (Matveeva, Zelenkov, Tretyakov, 2018: 46) makes the answer to the question of the external appearance of kurgans less obvious.

The goal of this study is to describe the elements of the Sargatka burial structures with ditches, and to identify the semantically significant relationships. We proceed from the understanding of a kurgan as a multi-functional structure, not only as a tomb, but also a memorial and ritual center reflecting the archaic system of world perception by means of objectified elements of the myth.

Sources

Currently, over 150 ordinary and elite kurgans have been excavated. Most of these were excavated as early as the 19th to the first half of the 20th century, when no observations were made on their structural system. The experience of excavating the Sargatka kurgans makes it possible to ascertain with confidence that there were almost no geometrically regular arcuate ditches. Such ditches occurred extremely rarely, usually in sandy soils, and were the results of the destruction of the original earth fences. In terms of the chronology of the burial structures, the ditches polygonal in plan view appear both at the earliest and the latest burial grounds (see *Table*; Fig. 2–4).

Quantitative indicators of the Sargatka kurgans

Site	Region	Period	Initial size of the ground, m*	Initial shape of the ditch in plan view: number of sides	Number of graves	Changed size of the ground, m	Changed shape of the ditch in plan view: number of sides
1	2	3	4	5	6	7	8
Iskrovsky	Tobol	Early	20	11	1	–	–
Suerka	″	″	11	11	1	–	–
Krasnogorsky-1, kurgan 3	″	″	17	14	1	–	–
″ kurgan 12	″	″	20	9	2	–	–
″ kurgan 17	″	Late 5th to 4th century BC	26	14	1	–	–
Dolgy Bugor	″	″	20	12	2	–	–
Rafailovsky	″	Early	15	11	3	–	–
Krasnogorsky Borok, kurgan 1	″	″	10	9	3	–	–
″ kurgan 2	″	″	13	12	2	–	–
Tyutrino, kurgan 6	″	″	22	13	3	–	–
″ kurgan 7	″	Middle	20	14	4	–	–
″ kurgan 8	″	″	16	12	4	–	–
″ kurgan 9	″	″	22	9	1	–	–
″ kurgan 10	″	″	12	8	4	17	10
Savinovo, kurgan 1	″	″	14	13	3	–	–
″ kurgan 2	″	″	10	12	1	–	–
″ kurgan 3	″	″	31	10	?	–	–
″ kurgan 6	″	″	18	9	2	–	–
Krasnogorsky-2, kurgan 1	″	″	33	8	5	–	–
Gilevo-2, kurgan 6	″	1st to 3rd centuries AD	24	8	3	–	–
Ust-Tartas, kurgan 7	Baraba	2nd to 1st centuries BC	10	9	4	14	9
Markovo-1, kurgan 8	″	″	11	12	7	–	–
″ kurgan 25	″	″	8	9	1	–	–
Abatsky-1, kurgan 2	Ishim	1st century BC to 1st century AD	17	9	9	–	–
″ kurgan 1	″	″	14	11	10	–	–
″ kurgan 3	″	1st to 3rd century AD	18	10	11	–	–
″ kurgan 4	″	Turn of the eras	16	12	6	–	–
″ kurgan 5	″	1st to 3rd century AD	15	10	10	–	–
Abatsky-3, kurgan 1	″	Late	27	11	5	–	–
″ kurgan 2	″	″	13	11	11	22	14
″ kurgan 3	″	″	8	9	2	15	10
″ kurgan 4	″	″	10	12	9	14; 20**	12
″ kurgan 5	″	2nd to 3rd century AD	10	10	8	15	12

Table (end)

1	2	3	4	5	6	7	8
Tyutrino, kurgan 5	Tobol	2nd to 3rd century AD	10	7	2	13	7
Abatsky-3, kurgan 6	Ishim	″	23	14	10	–	–
Tyutrino, kurgan 1	″	″	14	12	3	13	11
″ kurgan 2	″	″	18	8	2	20	8
″ kurgan 3	″	″	19	12	7	–	–
″ kurgan 4	″	Late	15	12	4	–	13; 14**
Savinovo, kurgan 7	Ishim	Late	19	13	2	–	–
″ kurgan 5	″	″	14	8	5	21	10
Gaevsky-1, kurgan 3	Tobol	Early–Late	14	9	5	18	11
″ kurgan 4	″	″	15	10	3	–	–
″ kurgan 5	″	″	19	11	3	–	–
″ kurgan 6	″	″	14	11	6	–	–
Nizhneingalsky-1	″	Middle	13	11	3	–	–
″	″	Late	27	14	1	–	–
Starolybaevo-4, kurgan 31	″	″	10	9	11	11	12
″ kurgan 33	″	″	13	12	6	14; 15**	12
″ kurgan 34	″	″	14	8	2	–	–
″ kurgan 35	″	″	13	11	1	–	–
″ kurgan 39	″	″	12	9	2	–	–
Sidorovka, kurgan 1	Irtysh	″	20	11	2	24	12
″ kurgan 2	″	″	22	14	3	–	–
″ kurgan 3	″	″	24	11	3	–	–
″ kurgan 5	″	″	15	9	6	–	–
Isakovka-3, kurgan 1	″	Middle	19	10	1	–	–
″ kurgan 2	″	″	10	11	7	–	–
Yavlenka, kurgan 1	Ishim	Early	17	6	1	–	–
Tatarka, kurgan 1	Irtysh	″	55	7	2	–	12
Kokonovka, kurgan 2	″	4th to 3rd century BC	10	9	1	–	–
″ kurgan 3	″	″	10	10	3	–	–
″ kurgan 10	″	″	14	9	1	–	–
″ kurgan 11	″	″	10	10	1	–	–
″ kurgan 13	″	″	10	10	1	–	–

*Sizes of grounds in kurgans are approximated to the whole numbers; in the cases when oval shape was observed, it is approximated to a circle, and the diameter of the inscribed circle is given.

**The size of the ground and shape of the ditch have been changed twice.

They have typically been found in cemeteries in the form of chains: that is, architectural ensembles with certain intervals and orientation, united by a single plan (for example, Tyutrino or Abatsky-3); they also appear at the burial grounds with compact planning, where several lines depart from the dominant kurgan (for example, Savinovo or Krasnogorsky-1, -2).

The exception to the majority of domed mounds was kurgan 1 at the Onufrievo cemetery on the Iset River, which has retained the shape of a truncated pyramid on the side opposite to the prevailing winds (Matveeva, 1982: 28), a height of 2 m, and a diameter of 30 m. However, by the time of excavation, its body had been demolished by bulldozers, and was used for

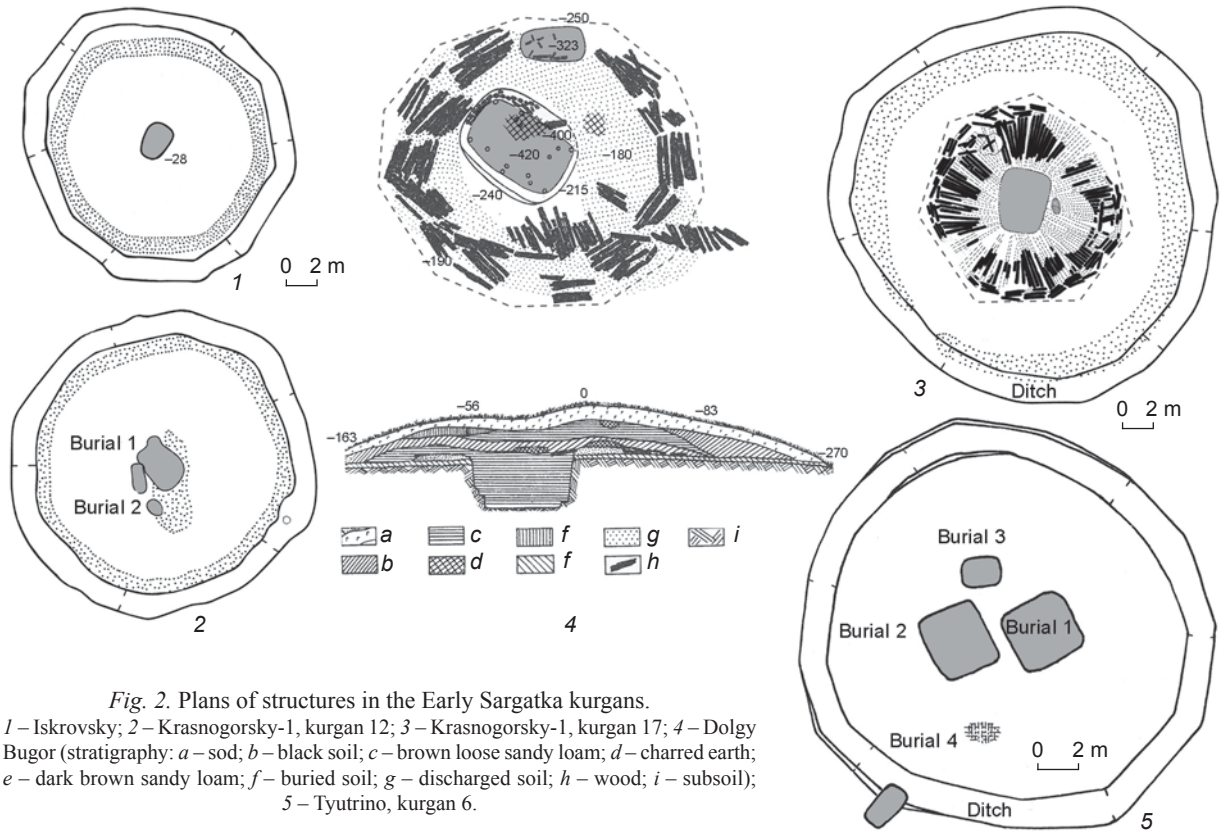

Fig. 2. Plans of structures in the Early Sargatka kurgans.
1 – Iskrovsky; *2* – Krasnogorsky-1, kurgan 12; *3* – Krasnogorsky-1, kurgan 17; *4* – Dolgy Bugor (stratigraphy: *a* – sod; *b* – black soil; *c* – brown loose sandy loam; *d* – charred earth; *e* – dark brown sandy loam; *f* – buried soil; *g* – discharged soil; *h* – wood; *i* – subsoil); *5* – Tyutrino, kurgan 6.

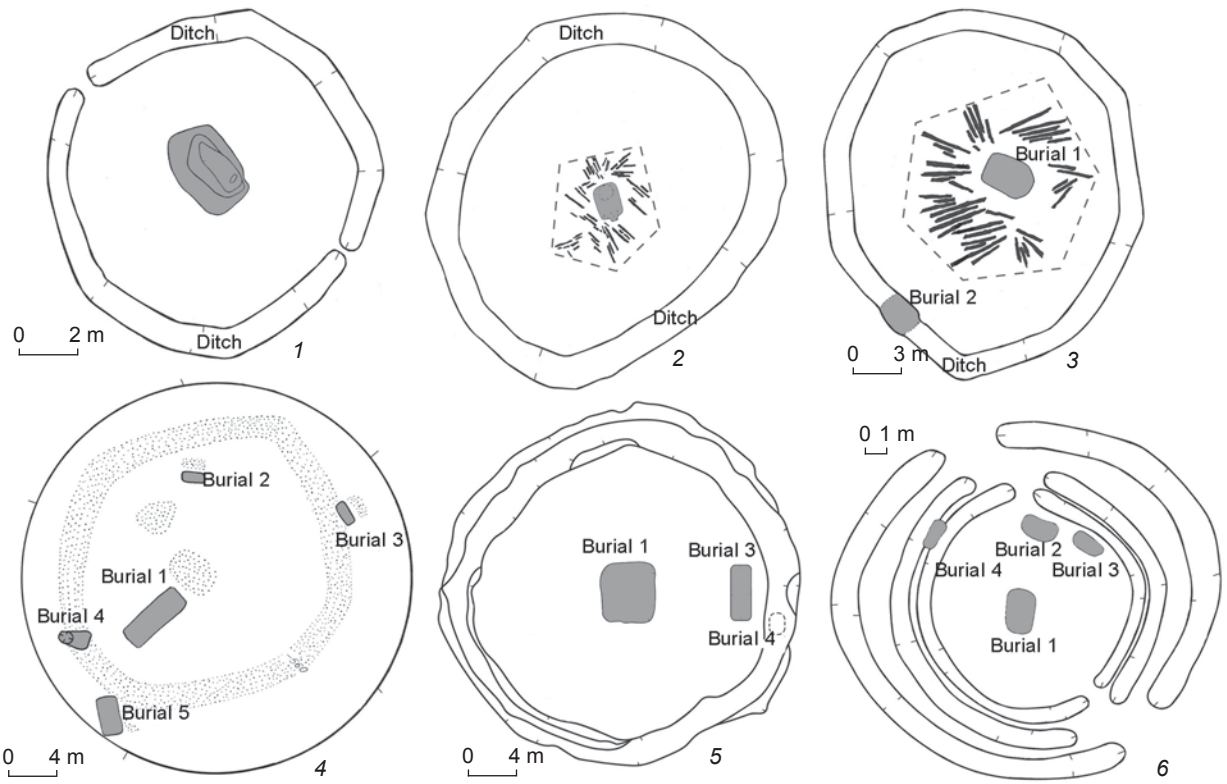

Fig. 3. Ground plans of structures in the Middle Sargatka kurgans.
1–3 – Savinovo: *1* – kurgan 2, *2* – kurgan 3, *3* – kurgan 6; *4* – Krasnogorsky-2, kurgan 1; *5* – Gilevo-2, kurgan 6; *6* – Ust-Tartas, kurgan 7.

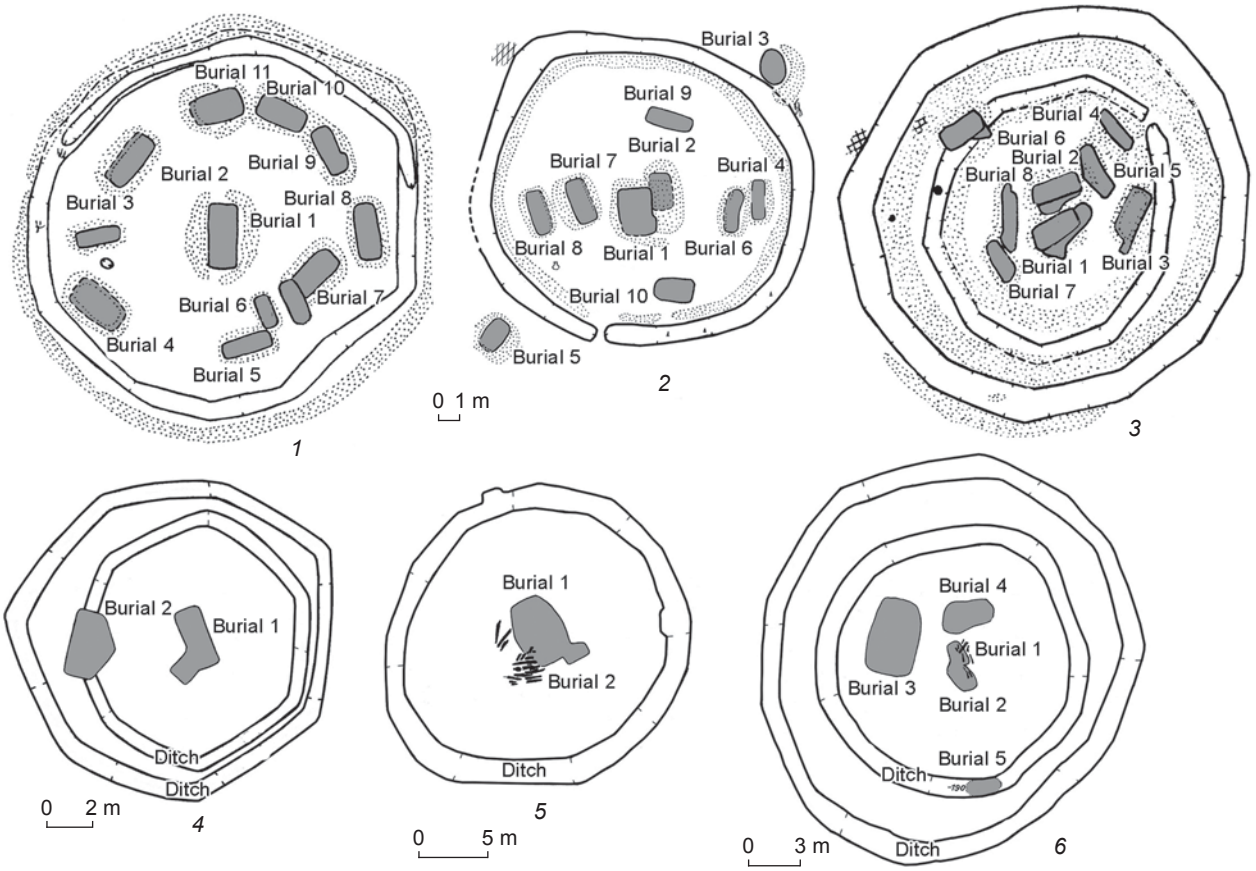

Fig. 4. Ground plans of structures in the Late Sargatka kurgans.
1 – Abatsky-1, kurgan 3; *2* – Abatsky-1, kurgan 5; *3* – Abatsky-3, kurgan 5; *4* – Tyutrino, kurgan 5; *5* – Savinovo, kurgan 7; *6* – Savinovo, kurgan 5.

filling the roadway; therefore, the microrelief of the surface could have not been recorded. While unearthing at the subsoil level, two concentric ditches polygonal in plan view (with no less than 10–12 angles; the exact shape could not be established, owing to the damage from construction works), with diameters of the circumscribed circles of 22 and 40 m, were discovered around the graves of this kurgan (Matveeva, 1993: 134). Only in 2017 did we manage to find several more truncated pyramidal kurgans at the Gilevo-2 cemetery, on the right bank of the Tobol River, near Zavodoukovsk (see Fig. 1, *2–4*). Leveling of the excavations by 1 m before beginning to study three of them revealed the relief of the surface. All mounds were hexahedral. We may explain the relatively better preservation of the bodies of these kurgans (as compared to those located on arable land) by their location at the southern edge of the forest, which protected them from the prevailing winds, as well as the "phyto-factor" that created the "wire-mesh reinforcement" of the root system of shrubs and trees.

Interestingly, in one kurgan of Gilevo-2, a closed ditch octagonal (8-angled) in plan view was found (see Fig. 3, *5*); in another kurgan, an unclosed ditch; and in the third kurgan, there was no ditch, although the unearthed area was considerably larger than the mound, and an exploratory trench was made. Despite the clayish underlayer and the mound of dense black soil, the remains of log structures have not survived in the Gilevo kurgans. It turns out that the original shape of the mounds was determined by some other factors apart from the outlines of the platforms.

Let us consider a sample of kurgans with well-recorded fences (65 units) from all local areas of the forest-steppe of Western Siberia, according to the published overviews (Moshkova, Gening, 1972: Fig. 1–2; Mogilnikov, 1972a: Fig. 2, 4, 6, 7; Polosmak, 1987: Fig. 4, 5, 8; Koryakova, 1988: Fig. 6–8; Kultura…, 1997: Fig. 2, 8, 11, 15; Matveeva, 1993; 1994; Matveeva, Volkov, Ryabogina, 2003: Fig. 36, 45, 50, 53, 56, 57; Matyushchenko, Tataurova, 1997: Fig. 3, 33, 41, 65; Pogodin, Trufanov, 1991: Fig. 1, 2), without claiming an exhaustive sampling of the source-base (see *Table*).

Discussion

Very few burial grounds have been excavated entirely or almost entirely; but in long-functioning kurgan ensembles, it was possible to establish the presence of cult structures, and see the places of ritual actions. This makes it possible to agree with Chernopitsky, who substantiated the idea of cult multi-functionality of kurgans (1979: 26). If the primary idea of enclosing the place of funeral rituals was embodied in the shapes of kurgan grounds, ditches, embankments, and mound structures, these shapes would have shown similarity, which generally has not been observed. In addition, kurgans erected on individual hills were not surrounded by ditches, as was the case with the Dolgy Bugor kurgan (see Fig. 2, *4*) at the Krasnogorsky-1 burial ground, and kurgan 1 at Krasnogorsky-2 (see Fig. 3, *4*), located in the Ugory locality, on separate hills, at a height of about 50–60 m above the river floodplain (Matveeva, 1993: 39–40). Ancient people might have assumed a natural protection in such cases. Yet, the idea of a polygonal structure under the mound is embodied in the first case in a dodecagonal (12-angled) log platform, and in the second case in the octagonal (8-angled) outlines of the embankment around the graves (there was no ditch at a distance of 4 m from the embankment, but it cannot be ruled out that it was located farther away and has not been unearthed).

Let us try to determine whether there is a relationship between the number of angles in the ditch and the diameter of the ground or log structure, as well as relationship between the number of burials and the shape of the ditch. We have analyzed the specific features of ditches and kurgans in our sample on the basis of observations of their initial sizes, using Statistica.10 software. The correlation analysis has not revealed any dependencies between them (for example, the correlation coefficient between the number of angles in the ditch and the number of graves in the entire sample was 0.08, and –0.17 in the Tobol regional sample). Moreover, quantitative indicators were not distributed normally, which means that the sample was not random, but was dominated by the elite kurgans of the Tobol region, with their locally specific features. In the Tobol sample, just as in the general totality, the shape of kurgan grounds was regulated by some canons. The most common 9-, 10-, and 12-angled ditches in plan view were found in all areas and at all scales of construction work (Fig. 5). They might have embodied the idea of a quantitative aspect in the structural elements of the universe. Numbers divisible by two, three, and five were probably the most important as the most archaic, going back to natural units of counting; they appear in all ancient cultures. The predominant Eastern Iranian ethno-linguistic component in the Sargatka culture has been substantiated by a number of scholars, including the author of this study, by specific features of the funeral

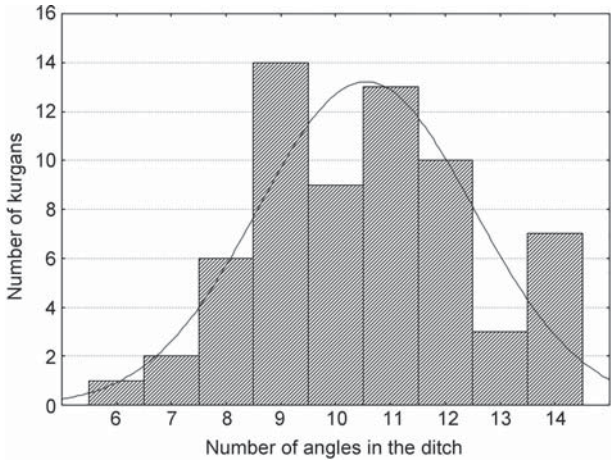

Fig. 5. Distribution of the Sargatka kurgans according to the shape of the ditch.

rite and elements of the material culture (adornments and outfits) (Matveeva, 2000: 255–256). Therefore, we should point out that the most commonly used values in architectural structures, namely, multiples of three, four, five, and eight, symbolize the supreme deity, the creator of the world, and his main creations in the core of Indo-European religious beliefs (Toporov, 1994a).

We should pay attention to hexagonal and heptagonal ditches in plan view, typical of single-grave kurgans (see Fig. 4, *4*). In our opinion, these reflect a clearly expressed initial idea of ancient people about the shape of the structure above the grave as a six- or seven-sided truncated pyramid, symbolizing the mythological mountain, the entrance to the Lower or Upper World, or something of the kind (Toporov, 1994c: 313). These ideas possibly go back to Indo-Iranian mythology, in which the four-part horizontal structure and the three-part vertical structure of the universe by summation or multiplication constitute the sacred numbers of 7 and 12 (Toporov, 1994b: 532). It cannot be excluded that in semantic terms, the ditch surrounding the hill above the grave resembled the serpent connecting and separating heaven and earth, as in archaic cosmogony myths, or guarding the entrance to the underworld as a chthonic symbol (Ivanov, 1994: 469).

Subsequently, with the increase in the size of the entire structure, in order to emphasize the higher status of the persons buried in the kurgans, the initial values of 5, 6, and 7 were doubled. The doubling of the initial proportions can probably be explained by the desire to express the planning unity of the architectural structure in all of its elements. For example, in kurgan 17 at Krasnogorsky-1, the log platform had seven sides, while the ditch, which was at a distance of twice the platform's radius, had a 14-angled shape (see Fig. 2, 3). In kurgan 3 at Savinovo, the disintegrated logs' placement can be reconstructed as pentagonal, judging by the outlines of

sectors with relatively equal areas, formed by decayed wood, and the ditch can be reconstructed as decagonal in plan view (see Fig. 3, *2*). In kurgan 6 of the same burial ground, the platform had six sides, and the ditch was made at a distance twice as large as the platform's radius to the west, and 1.5 times as large to the east, forming a 9-angled figure (see Fig. 3, *3*).

The transition to multiple graves in the burial complexes of the Late Sargatka period has already been noted in the literature (Mogilnikov, 1972b: 71). This process led to the original planning of a structure as a single "burial vault" for a group of persons of varying status. Therefore, two trends can be discerned in the architectural and planning solutions of the Middle and Late Sargatka periods. One trend was to maintain the original area and configuration of the burial site, as was the case, for example, at Tyutrino, Gilevo-2, Ust-Tartas, and Abatsky-1, embodied in renewing the ditch or repeating the previous shape with new fences (see Fig. 2, *5*; 3, *5*, *6*; 4, *1*, *2*). The other trend maintained the tradition of demonstrating the status of an outstanding personality in labor costs for construction, and was expressed in increasing the site and surrounding it with a new ditch, which might have resulted from additional filling of the mound. The latter trend can be recorded only in unplowed above-the-grave structures. For example, in kurgan 5 at Abatsky-3, the initial 10-angled fence was replaced by a 12-angled fence; in kurgan 5 at Savinovo, the 8-angled ditch in plan view was supplemented with a 10-angled ditch with a diameter 1.5 times as large as the inscribed circle (see Fig. 4, *3*, *6*).

How did the 11-angled and 13-angled configurations, which are also common, come about? We dare to assume that there could have been a deliberate summation of particularly important numbers of 5 and 6, as well as 6 and 7, which had been incorporated into the initial architectural design; but most likely there was a deviation from the plan due to the changes in the appearance of the structure and its purpose during use. For example, the ditch around the single-grave Iskrovsky kurgan forms an irregular 11-angled figure, in which two opposite sides (northern and southern) are 2–3 times shorter than other sides (see Fig. 2, *1*). This could have resulted from the removal of two symmetrical bulkheads, which were initially left for entering the 9-angled ground of the burial, after the completion of construction. The ditch of kurgan 6 at Gaevsky-1 also has an 11-angled shape in plan view and short walls opposite to the late burials 2 and 3, located along the NE-SW line (Fig. 6, *2*), possibly in the places of the previous gaps in the fence for entering the space under the mound, for performing secondary burials (Kultura…, 1997: Fig. 15). One short side on the southeast in the 11-angled configuration of the ditch in kurgan 5 of the same necropolis may indicate that the entry to the 10-angled kurgan's ground once existed there, since a pot stood at each of the three graves located along the NE-SW line; at the extreme graves, the pots stood in the area of the ditch, which was deepened, closest to the graves (Fig. 6, *1*). The fence in kurgan 1 at Savinovo seems to be an example of an unfinished construction. This is a 13-angled fence with three bulkheads on the northwest, southeast, and south, in approaches to the graves (Matveeva, 1993: Fig. 3). Moreover, if the entrance to the ground had to be closed, then two narrow gaps would have been dug off along a straight line, and for connecting the ends of the ditch in place of a wide bulkhead, it would have been necessary to make a turn, which would have given the ditch the 14-angled shape in plan view.

Ditches surrounding the burial space, including those with several gaps, are known from the Don region and Volga region of the Early and Middle Bronze Age (Medvedev, 2017: 116), and the Urals and Siberia of the Late Bronze Age (Arkaim…, 2002: Fig. 7; Mikhailov, 2001: 191–193, pl. 32). Specialists have interpreted them as a reflection of the mythological serpent (Shilov, 1995: 565) or manifestations of the solar cults (Medvedev, 2017: 115).

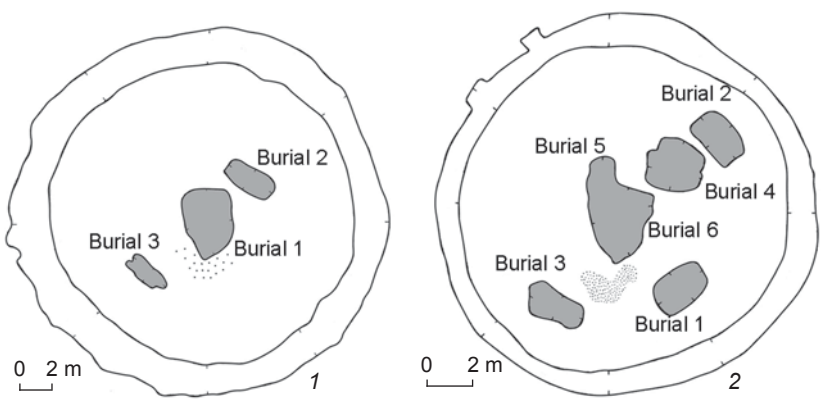

Fig. 6. Ground plans of kurgans 5 (*1*) and 6 (*2*) at Gaevsky-1.

Using representative Scythian sources, V.S. Olkhovsky has convincingly shown that the structure of burial mounds among the early nomads of the Eurasia steppe was a canonized model of the universe's structure, using strictly prescribed architectural elements, which were considered to be the procedural steps of the ritual, symbolically embodying the obstacles on the way of the deceased to the afterlife (1999: 123–125). Olkhovsky has found the Indo-European conceptual basis in the core of this myth, supplemented by an emerging epic tradition reflected in ritual acts (Ibid.: 119). The common Scythian links, similar to the myths of the Sargatka population, included the World Mountain; concentric zones in the kurgan space, dividing the "horizontal world"; the ditch; and the remains of sacrifices, including dependent people and horses at the hitching posts (Matveeva, 2000: 179, 229, 266). The vertical axis of the entire complex was probably marked by a giant pillar set in the mound or in the central pit, and sticking out to the surface, as was discovered in kurgan 3 at Savinovo (Matveev, Matveeva, 1991: 39). A sign of the mythological understanding of construction activities, and their assimilation to creation, was the custom of burying woodworking tools (celts, adzes) in the Sargatka graves. This practice finds its parallels among the early nomads of the Semirechye (Akishev, 1984: 10).

Important differences in structural design and sacrifices in the Scythian and Sargatka cultures can be explained by local interpretations of the common myth in remote parts of Eurasia, and local building traditions based entirely on wood in the absence of stone materials. For example, values relating to the length of log blanks used in residential architecture began to be used (Matveeva et al., 2005: 111, 113); the rituals involving horses also underwent significant changes.

The number of graves in a kurgan, as is known, was determined by the factors of social hierarchy and duration of residence of the family-related groups in the same place (Matveeva, 2000: 132–133). In their study, V.I. Matyushchenko and L.V. Tataurova proposed the idea that several ditches (or the renewal of the initial ditch with a change in its shape) were associated with successive secondary burials of high-status adult men in the kurgan (1997: 95–96). However, it was not possible to confirm this hypothesis, owing to the lack of sex- and age-definitions of skeletons from the graves, as well as of detailed data on the relief of the ditches at many Sargatka sites. In addition, there are cases of burials of high-status women in the centers of kurgans, with weaponry, cult items, precious implements, and adornments. We believe that the interpretation of ditches as a protective fence against the powerful forces of death, and possible magical harmful effects of the hero, who had become a member of influential ancestors, will be confirmed by facts in the future. This interpretation is consistent with the archaeological evidence of the Sargatka culture, testifying to the elevation of chiefs and legendary warriors, such as elite kurgans, adornments remaining from outfits of the "golden man" found in them, large sets of weaponry, precious sets of dishware, felt carpets and cauldrons as symbols of military feasts for the members of the retinue, and the subjects of representations on the items of the Siberian Collection of Peter I with the feats of mighty warriors (Matveeva, 2000: 238, 266). This interpretation also correlates with the idea of the hero's afterlife journey, repeating the actions of the ancestors.

Conclusions

The preservation of some elements of the early Indo-European mythology in the kurgan architecture of the Early Iron Age in Western Siberia, including the concepts of the World Mountain, the myth of fighting with the serpent with the participation of Indra, or the posthumous journey would have been very doubtful if it were not for numerous evidences on the emergence of the Sargatka culture on the basis of the Late Bronze cultures of the Andronovo sequence, and the toponymic evidence of the Indo-European settlement in this region. Of course, there was a significant transformation of architectural tradition under the influence of factors emerging in a new chronological period. There are prospects for a detailed study of the issue described, using planigraphic and stratigraphic evidence from the most thoroughly performed excavations.

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N.V. Polosmak[1], S.S. Shatskaya[2], M.V. Zadorozhnyy[3], L.P. Kundo[1], and E.V. Karpova[4, 5]

[1]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: polosmaknatalia@gmail.com; kundoludmila@ngs.ru
[2]Institute of Solid State Chemistry and Mechanochemistry, Siberian Branch, Russian Academy of Sciences, Kutateladze 18, Novosibirsk, 630128, Russia
E-mail: shatskaya@solid.nsc.ru; lana46@ngs.ru
[3]Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia
E-mail: zador@igm.nsc.ru
[4]Vorozhtsov Novosibirsk Institute of Organic Chemistry, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 9, Novosibirsk, 630090, Russia
[5]Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia
E-mail: karpovae@nioch.nsc.ru

The Xiongnu Gold from Noin-Ula (Mongolia)

This article presents the results of interdisciplinary studies of gold artifacts from the elite Xiongnu burials at Noin-Ula (Noyon Uul, Mongolia, early 1st millennium AD), excavated by the Russian-Mongolian expedition in 2006–2012. Using scanning electron microscopy, atomic absorption spectroscopy, and inductively coupled plasma mass spectrometry, as much as 17 artifacts were analyzed. These include ornaments from coffins and clothes, made by Chinese artisans. Results suggest that they were all made of native gold, similar to that from the known deposits of Mongolia as far as the elemental composition is concerned (we used an electronic database containing information on 3338 samples of Mongolian native gold, as a reference). Results of statistical tests suggest that placer deposits were the most probable source of the gold. The results do not contradict the idea that Chinese artisans used Mongolian gold. In the Han era, the Xiongnu could have been among their principal providers. The relationships between the two empires and peoples were always beneficial for the Xiongnu. Enjoying the numerous achievements of the Han civilization, they offered too little in return. One of the ways the Han dynasty could have benefited from their tumultuous neighbors was to receive native gold from them.

Keywords: *Noin-Ula, interdisciplinary studies, gold artifacts, native gold, Mongolia, Xiongnu, Western Han era.*

Introduction

Since the time when the methods of natural sciences started to be used for studying ancient metal items, the results of such studies have served for establishing the sources of raw materials from which the finds were made. This article will discuss one category of gold artifacts from Xiongnu burials.

Physicochemical analysis of archaeological finds has its own specific aspects. Previously, nondestructive methods of analysis, such as X-ray fluorescence (XRF) (Malakhov et al., 2000: 170; Revenko, 2009) and electron probe microscopic analysis (EPMA) (Mulvey et al., 1986; Spektroskopicheskiye metody…, 1979) were mainly used for studying metal items from ancient burials. These methods are indispensable in the study of surfaces and coatings, but do not always make it possible to accurately determine the composition of the alloy of which the ancient items were made.

Currently, atomic absorption spectroscopy (AAS) (Bolshakov, Ganeev, Nemets, 2006; Pupyshev, 2009) is widely used for studying alloy compositions. This method makes it possible to determine a large number of elements at the level of thousandths of a percent. The most sensitive and detectable metals with the least errors for this method are copper, magnesium, lead, manganese, zinc, and silver. Elements such as aluminum, chromium, silicon, and tin are determined in the high-temperature flame of acetylene, and there are interferences that must be taken into account. Representative weights of samples are required for accurate determination of these elements, which is not always possible in practice.

The multi-element method of inductively coupled plasma mass spectrometry (ISP-MS) has been rapidly developing over the last twenty years. It has also been successfully used for analyzing archaeological finds, when it is needed to determine the full composition of elements in one sample in a wide range of concentrations up to the level of less than 10^{-6} % (Vertman, Dubova, 2013; Ryndina, Ravych, 2012). The high sensitivity of the method makes it possible to establish the elemental composition of the inclusions of uranium, rare-earth elements, arsenic, mercury, and difficult-to-detect elements without destroying the artifact. The main disadvantage of the AAS and ISP-MS methods is the need to transfer the sample to a solution form, since the analyses entail spraying the solutions in a flame of air-acetylene, acetylene-nitrous oxide, or in argon plasma. Therefore, sample preparation is crucial for the analysis using these methods (Drugov, Rodin, 2002; Karpov, Savostin, 2003).

Each of the described methods of analysis has its limitations as to the number of elements to be determined or the limits of detection. The most reliable information can be obtained from the results of study by all three methods.

Measuring instruments, auxiliary equipment, reagents, and materials

The elements were determined using a TM1000 scanning electron microscope (Hitachi) with an X-ray fluorescence EDS unit (SwiftED), AA280FS atomic absorption spectrometer (Varian), and Agilent 7500a spectrometer with ionization in the inductively coupled plasma. For calibration of instruments, samples (GOST 8.315 (GSO)) containing aqueous solutions of ions of detectable elements, with the error of the certified value not exceeding 2 %, as well as multi-element standards Tuning Solution No. 5183-3566 and Multi-Element Calibration Standard-2 by Agilent, with the accuracy of the certified value not exceeding 2 %, were used.

For analysis, the samples were decomposed with hydrochloric and nitric acids of extra high purity grade, chemically pure hydrofluoric acid, and wine acid of pure grade. For the preparation of solutions, deionized water from the Millipore Q3 unit was used with the specific resistance (18.2 MΩcm^2) MOhm × cm^2.

For establishing trace elements, batches of samples weighing 0.01–0.07 g were decomposed into 5 ml of aqua regia (hydrochloric and nitric acids in a ratio of 3:1) in a Berghoff 4 microwave oven, at a temperature of 240 °C and pressure of 40 atm, and were brought to a volume of 100 ml with deionized or bidistilled water. The resulting solutions were analyzed by the ISP-MS method.

Description of study objects

Seventeen metal items from Xiongnu kurgans 20, 22, and 31 from the Noin-Ula burial site were subjected to physicochemical analysis. All artifacts were discovered during restoration of the Noin-Ula textiles in the restoration laboratory of the Institute of Archaeology and Ethnography SB RAS.

According to their functional purpose, the artifacts belong to two groups. The first group includes ornaments on the walls of coffins; the other group comprises decorations on clothes. The ornaments from the coffin walls include carved wooden trefoils covered with gold foil. These were elements of ornamental composition, and were located in the center of diamond-shaped thin planks covered with gold foil (Fig. 1). There are holes for nails made of foil in the crossbars of these golden strips. The thickness of the nail stem is 0.84 × 0.65 mm; the thickness of the nail cap is 125 μm; the thickness of the foil on the rim of the cap is 1.17 × 0.65 mm (Fig. 2).

Fig. 1. Ornaments of a coffin wall. Reconstruction based on the evidence from kurgan 22.

Eleven items were ornaments of clothes. These include narrow (600 μm wide) strips of foil, which wrapped around kingfisher feathers; openwork onlay on a belt buckle (Fig. 3); a spherical sewn-on plaque with a round step-like relief, which may have been formed as a result of external pressure on a wooden matrix; and a sewn-on plaque in the form of a dragon representation (Fig. 4). These things were made of foil 150–200 μm thick. In addition, there is a clasp for clothing in the form of a thin hollow cylinder 48 mm long and 4 mm in diameter (Fig. 5). Its ends are decorated with an edging of miniature balls 600 μm in diameter, which were soldered in a circle and covered with a miniature insert of turquoise framed in gold (Fig. 6). The ornaments include sewn-on plaques of rectangular, square, and round shape, with a relief pattern of twisted strips of foil on the front side (Fig. 7). The items show roughly made holes for fastening to fabric. The category of finds under consideration includes a belt buckle, which was made of round wire 2–3 mm in diameter. The ends of the wire were flattened; they have square holes, into which nails for fastening the textiles or leather were inserted (Fig. 8). Another adornment with stone inserts is a semi-oval plate framed with gold wire of rectangular cross-section. The front part of this artifact is divided by the same wire into scale-like cells with the inserts of a gray mineral (Fig. 9).

Results of physicochemical analysis

The elemental composition of gold items was established using the XRF*, AAS, and ISP-MS methods (Table 1). According to the XRF data, along with gold and silver, mercury was present in significant concentrations (0.5; 4.1; 1.4; 3.1; 0.24; 6.0 %) on the surface of six artifacts: strips of the foil of the coffin decoration from kurgans 22 and 31, the spherical sewn-on plaque, the edging of the turquoise inserts from kurgan 22, the plaque with the dragon representation, and the decoration with the stone inserts from kurgan 20, which may indicate the use of amalgam for treating the surface of these items. The gold foil of the coffin decoration, onlay on the belt buckle, spherical sewn-on plaque, and edging of the turquoise inserts from kurgan 22 included platinum (0.008–0.004 %) and palladium (up to 0.002 %). The content of the remaining metals of the platinum group was less than 10^{-6}–10^{-5} %; the uranium content was at the level of 10^{-6}–10^{-5} %.

According to the quantitative elemental analysis of 17 artifacts, the gold content ranged from 71.3 ± 2.5 to 98.00 ± 2.0 %, the silver content from 0.499 to 26.8 %, and the copper content from 0.01 to 4.4 %.

*SEM-XRF analyses were conducted at the Chemical Research Center for Collective Use of the SB RAS.

Fig. 2. Decorative nail, kurgan 22.

Fig. 3. Openwork onlay on belt buckle, kurgan 22.

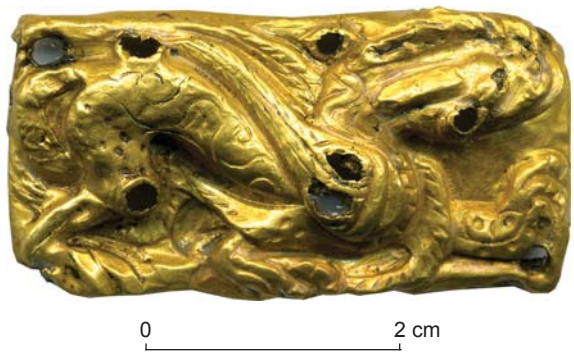

Fig. 4. Plaque with dragon representation, kurgan 20.

Fig. 5. Clasp, kurgan 22

Fig. 6. Insert of turquoise in a gold frame, kurgan 22.

Fig. 7. Rectangular (*1*), square (*2*), and round (*3*) sewn-on plaques, kurgan 22.

Fig. 8. Belt buckle, kurgan 22.

Fig. 9. Gold adornment with stone inserts, kurgan 20.

A gold content from 79 ± 3 to 90.3 ± 3.0 %, silver content from 3.7 to 16.9 %, and copper content from 0.1 to 4.4 % were established for ten artifacts: the nails of the coffin decoration from kurgans 22 and 31, the onlay on the belt buckle, spherical plaque, clasp, edging of the turquoise inserts, the rectangular, square, and round plaques, belt buckle from kurgan 22, and decoration with stone inserts from kurgan 20. The share of gold in three items (strips of foil on the decoration of the coffins from kurgans 20 and 31, and the edging of the turquoise inserts from kurgan 22) ranged from 71.3 ± 2.55 to 77.5 ± 2.0 %, while the percentage of silver increased to 26.29; 26.8, and 19.3 %. Four artifacts (strips on the coffin decoration, coverings of trefoils, foil on the decoration with feathers from kurgan 22, and the sewn-on plaque with the dragon representation from kurgan 20) were made of high-grade gold. Their composition included high shares of gold (97 ± 3; 97 ± 3; 98 ± 2; 96.5 ± 3 %), and small admixtures of silver (0.6; 0.6; 0.6; 0.499 %) and copper (0.08; 0.09; 0.05 %)*.

Sources of gold from the Xiongnu burials in Mongolia

The method of comparing archaeological gold with gold of ore deposits and placers has been described in detail in the studies of V.V. Zaikov and his colleagues (Zaikov et al., 2012; Tairov, Beisenov, Blinov, 2014; Gusev, Zaikov, 2015). The experience of such studies was also described in the monograph "Ancient Silver of Siberia" (Drevneye serebro Sibiri…, 2005).

The composition of archaeological gold was compared to that of native gold of Mongolia, the chemical contents of which are provided in the electronic database (Zadorozhnyy et al., 2017). All analytical procedures were carried out at the Analytical Center for Multi-Elemental and Isotope Research SB RAS. The database was compiled based on the information collected during the long-term field works aimed at the identification of perspective gold deposits in Mongolia by the researchers from the Sobolev Institute of Geology and Mineralogy of the SB RAS.

The map of the northeastern part of Mongolia, on which the presently known placers and ore deposits are indicated (Geographic Information Systems (GIS)…, 2006; Goldfarb et al., 2014), shows that the burial site in Sudzukte Pass is located in close proximity to ore deposits and placers of native gold (Fig. 10).

For comparing native and archaeological gold, a statistical method of the Student's t-test was used for calculation. The hypothesis that two samples belong to one general totality was tested. Ten samples were created for comparison with archaeological gold. The first sample contained all values of gold fineness available in the catalog; the second sample contained all values of fineness for placer gold; the third group contained all values of fineness for ore gold from the catalog. The subsequent seven samples contained definitions of gold fineness for four ore-placer sites nearest to the burial: Zunharaa, Sharyngol, Tolgoit, and Zaamar (Table 2). The eleventh sample combined the values of fineness for archaeological gold. The distribution of random variables in all the samples was close to normal, which means that the gold was not doped with silver, and retained a natural ratio of elements.

*By itself, fineness is not an informative feature for determining the source of gold. The difference in the composition of gold in the artifacts found in the Xiongnu graves in this case indicates that it was native gold. Its fineness may vary within even one ore field. A deposit is usually a multi-stage site, and its gold may correspond to each stage. Usually gold is high-grade in the early stages and low-grade in the late stages. The difference in values may reach 40–50 %. In addition, gold available for extraction by primitive methods (not counting placer gold) was usually concentrated on the surface in the oxidation zones where its purification and increase in fineness occurred.

Table 1. **Elemental composition of gold items according to XRF, AAS, and ISP-MS analyses, mass %**

Sample No.	Research objects	Research method	Au	Ag	Cu	Zn	Pb	Fe	Pd	Pt	As	Sn	Hg	Bi
1	Foil strips of coffin decoration, kurgan 31	XRF	83.50	15	–	–	–	1.0	–	–	–	–	0.5	–
		AAS	71.0 ± 2.0	26.8	0.02	0.006	< 0.002	0.03	–	–	–	–	–	–
2	Foil strips of coffin decoration, kurgan 20	XRF	78.80	19.30	–	–	–	–	–	–	–	–	–	–
		AAS	77.50 ± 2.0	18.7	0.17	0.003	0.01	0.06	–	–	–	–	–	–
		ISP-MS	77.40	19.20	0.12	0.003	0.005	–	–	–	0.004	0.040	0.002	0.001
3	Foil strips of coffin decoration, kurgan 22	XRF	93.1	0.9	–	–	–	–	–	–	–	–	4.1	–
		AAS	97.0 ± 3.0	0.6	0.08	0.004	–	0.09	0.002	0.008	–	0.001	0.02	–
4	Foil covering of trefoils, kurgan 22	XRF	96.80	3.2	–	–	–	–	–	–	–	–	–	–
		AAS	97.0 ± 3.0	0.6	0.09	0.005	–	0.1	–	–	–	–	–	–
5	Nails: edge, cap, and stem, kurgan 31	AAS	79.0 ± 3.0	16.91	0.10	–	–	–	–	–	–	–	–	–
			79.0 ± 3.0	19.83	0.16	–	–	–	–	–	–	–	–	–
			81.0 ± 3.0	15.91	0.10	–	–	–	–	–	–	–	–	–
6	Nails: edge, cap, and stem, kurgan 22	AAS	82.0 ± 2.5	14.92	0.63	–	–	–	–	–	–	–	–	–
			82.0 ± 2.5	15.06	0.90	–	–	–	–	–	–	–	–	–
			82.0 ± 2.5	16.0	0.50	–	–	–	–	–	–	–	–	–
7	Foil strip of decoration with feathers, kurgan 22	XRF	81.6	0.5	–	–	–	2.1	–	–	–	–	–	–
		AAS	98.60 ± 2.0	0.6	0.05	0.006	–	0.10	–	–	–	–	–	–
8	Onlay on belt buckle, kurgan 22	XRF	89.8	8.6	–	–	–	1.5	–	–	–	–	–	–
		AAS	87.0 ± 2.0	11.61	0.09	0.009	–	0.05	–	–	–	–	–	–
		ISP-MS	91.2	12.0	0.04	0.003	< $2.6E^{-5}$	0.21	$5.4E^{-4}$	0.006	–	0.032	0.005	–
9	Spherical sewn-on plaque, kurgan 22	XRF	90.4	5.4	2.6	–	–	–	–	–	–	–	1.4	–
		AAS	90.3 ± 3.0	8.82	0.46	0.04	–	0.07	–	–	–	–	–	–
		ISP-MS	85.0 ± 3.0	12.0	0.43	≤ 0.0001	< $2.6E^{-5}$	< 0.007	$7.7E^{-5}$	0.005	–	–	0.06	–
10	Plaque with dragon representation, kurgan 20	XRF (on the inside)	95.8 (96.5)	0.4 (1.4)	–	–	–	0.7 (2.2)	–	–	–	–	3.1 (–)	–
		AAS	96.5 ± 3.0	0.499	0.01	0.008	< 0.002	0.01	–	–	–	–	–	–
11	Clasp for clothing, kurgan 22	XRF	89.4	8.9	0.5	–	–	–	–	–	–	–	–	–
12	Edging of turquoise, kurgan 22	AAS	71.3 ± 2.5	26.29	0.49	–	–	0.06	0.001	0.003	0.019	–	–	–
		ISP-MS	82.0 ± 2.5	≥ 18.0	>0.1	0.006	0.005	0.03	0.001	0.004	0.024	0.029	0.24	–
13	Sewn-on plaque, rectangular, kurgan 22	XRF	88.0	9.0	2.8	–	–	–	–	–	–	–	–	–
14	Sewn-on plaque, square, kurgan 22	XRF	91.9	3.7	4.4	–	–	–	–	–	–	–	–	–
15	Sewn-on plaque, round, kurgan 22	XRF	91.9	3.7	4.4	–	–	–	–	–	–	–	–	–
16	Belt buckle, kurgan 22	XRF	87.6	12.4	–	–	–	–	–	–	–	–	–	–
17	Adornment with stone inserts, kurgan 20	XRF	84–87	10–12	0.7	–	–	–	–	–	–	–	3–6	–
		AAS	87.3 ± 3.0	12.5	0.6	0.002	< 0.002	0.01	–	–	–	–	–	–

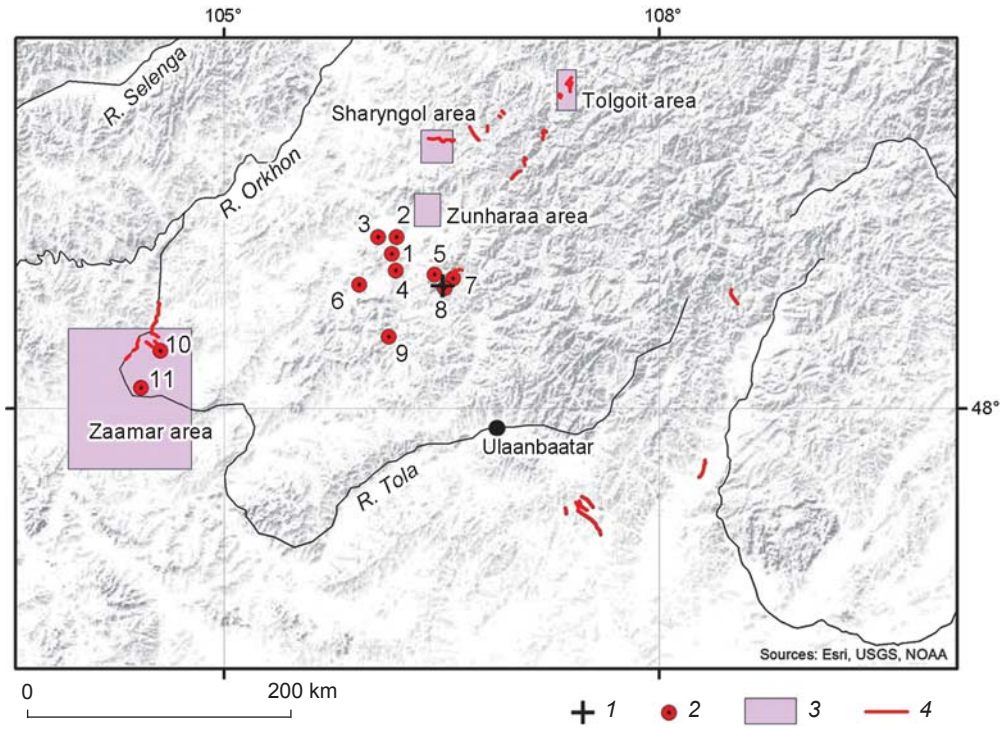

Fig. 10. Overview map of gold occurrences in Northeastern Mongolia.
1 – the Noin-Ula burial site; *2* – gold deposits; *3* – territory of the site; *4* – gold placers. Gold deposits: 1 – Boroo; 2 – Boroo 4; 3 – Boroo 7; 4 – Narantolgoi; 5 – Urt; 6 – Baavgait; 7 – Eriin; 8 – Sudzukte; 9 – Bayantsagaan 2; 10 – Bumbat; 11 – Narijn Gol.

Table 2. **Descriptive characteristics of fineness samplings for native and archaeological gold**

No.	Sampling	Number of samples	Fineness, average	Standard deviation	Standard error	Median	Dispersion
1	All fineness values	3338	83.81956	12.65071	0.21896	85.66	160.4051
2	Placer gold	2117	85.1517	11.44195	0.24868	86.59	130.91829
3	Ore gold	997	79.22644	14.12168	0.44724	79.85	199.42197
4	Placer gold from Zunharaa area	14	91.81857	4.65702	1.24464	92.405	21.68781
5	Ore gold from Sharyngol area	22	85.66909	8.78563	1.8731	88.925	77.18728
6	Placer gold from Sharyngol area	20	86.0625	5.98843	1.33905	87.465	35.86133
7	Ore gold from Tolgoit area	35	93.28314	8.68508	1.46805	96.71	75.43068
8	Placer gold from Tolgoit area	25	91.4976	7.45549	1.4911	93.15	55.58435
9	Ore gold from the Zaamar area	30	80.95067	12.35851	2.25635	81.79	152.73279
10	Placer gold from Zaamar area	197	88.98772	8.33941	0.59416	90.05	69.54583
11	Archaeological gold	35	86.70571	7.45512	1.26015	87.3	55.57879

The Student's t-test was calculated using the Microcal Origin 6.0 Professional software and the standard method for independent samples, at a confidence level of 95 % (p = 0.05) (Miller, 1965; Isakova, Tarasevich, Yuzyuk, 2009). In five cases out of ten, these comparisons did not contradict the hypothesis that the compared samples might have belonged to the same general totality (Table 3). For getting a more accurate answer to the question concerning the sources of gold, the archaeological gold was compared with the gold that was mined in the areas adjacent to Mongolia, such as Altai, Khakassia, Tuva, and China. According to the results, the gold was most likely procured from placer sources. It is also possible that it was mined within the Sharyngol and Zaamar areas.

Special attention should be given to the Zaamar gold-bearing ore-placer area. At present, the Zaamar ore cluster is one of the largest ore-placer regions of Eurasia, as far as the explored reserves are concerned. A significant part of its gold reserves is associated with Quaternary sediments of the Tuul River. The development of these placers has become possible only due to modern technologies. However, gold-bearing placers of Cretaceous and Neogene ages, located on the slopes of the valley, which essentially represent ancient placers and appear as positive forms in modern relief, could have been a source of easily accessible placer gold (including large nuggets) for ancient prospectors.

Further, the content of trace elements (Hg and Cu) was compared. For clarity, the compositions are indicated on ternary diagrams of the systems Au-Ag-Cu and Au-Ag-Hg (Fig. 11). The studies of Zaikov and his co-authors indicate that copper contents exceeding 2 %

Table 3. **Values of Student's t-test**

No.	Sample	t	p	Result
1	Placer gold from Sharyngol area	–0.32946	0.7431	Average values differ insignificantly
2	Ore gold from Sharyngol area	–0.47689	0.63533	″
3	Total data for placer gold	–0.8006	0.42345	″
4	All values of fineness from e-catalog	–1.34712	0.17803	″
5	Placer gold from Zaamar area	1.51433	0.13129	″
6	Ore gold from the Zaamar area	–2.30959	0.0242	Average values differ significantly
7	Placer gold from Zunharaa area	–2.3786	0.02149	″
8	Placer gold from Tolgoit area	2.45455	0.01713	″
9	Total data for ore gold	–3.11708	0.00188	″
10	Ore gold from Tolgoit area	3.39969	0.00113	″

Note. t – Student's t-test, p – probability.
The lines are arranged in the descending order of the calculated probability value.

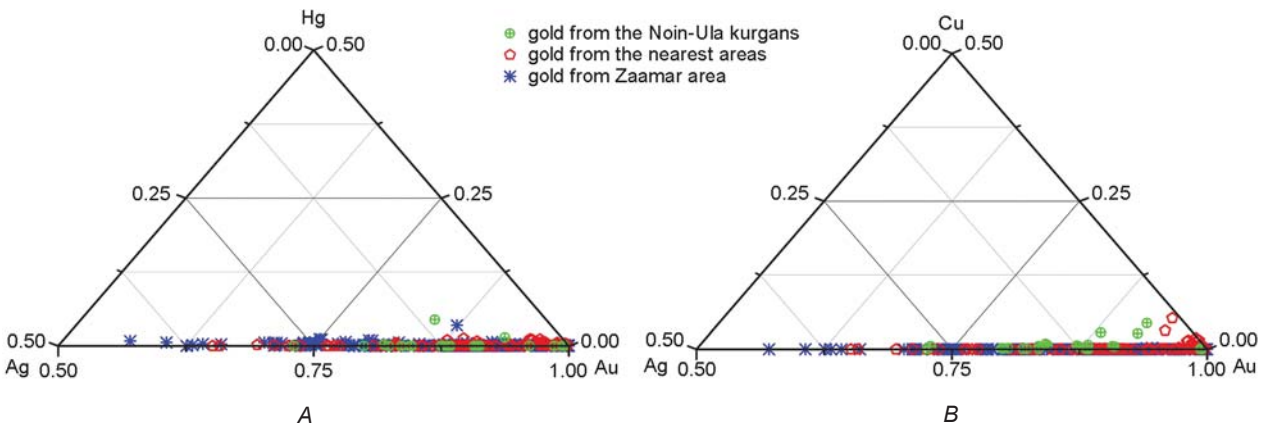

Fig. 11. Gold composition in triple diagrams.
A – Au-Ag-Hg; *B* – Au-Ag-Cu.

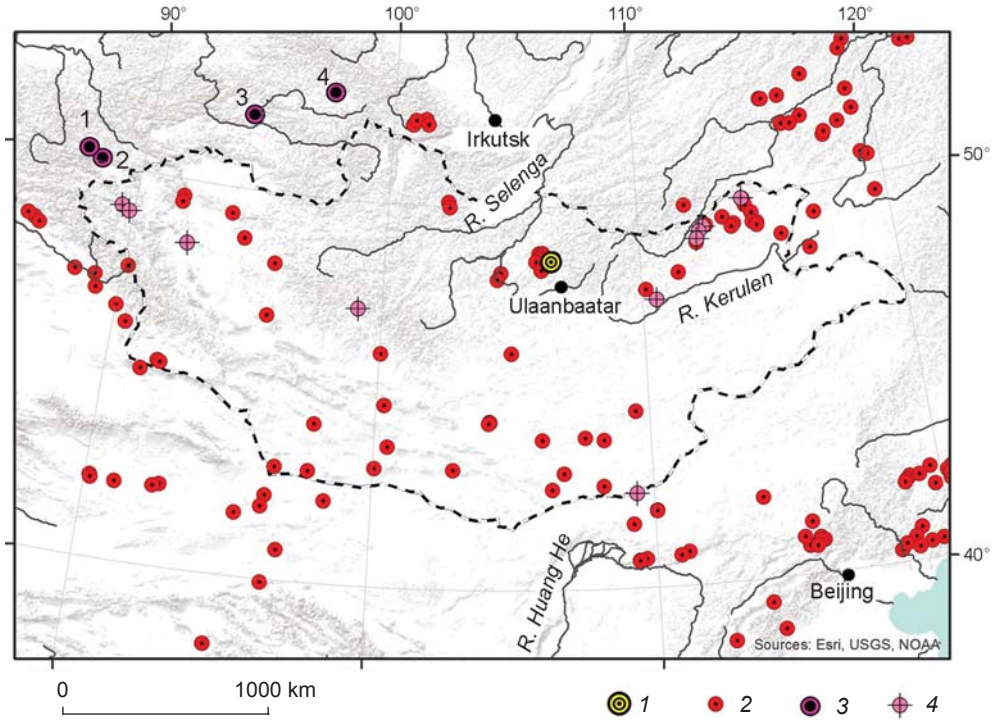

Fig. 12. Gold ore and mercury sites in Central Asia (after (Dejidmaa et al., 2002; Geographic Information Systems (GIS)…, 2006; Goldfarb et al., 2014)).
1 – the Noin-Ula burial site; *2* – gold deposits; *3* – mercury deposits; *4* – mercury ore occurrences. Mercury deposits: 1 – Aktash; 2 – Chagan-Uzun; 3 – Terligkhay; 4 – Chazadyr.

is indicative of a gold alloy doped with copper (Zaikov et al., 2012). Indeed, copper impurities in gold rarely exceed 1 %; however, native gold (in particular, in Mongolia) sometimes contains 3–6 % Cu (Zadorozhnyy et al., 2017). The increased copper contents in native gold correlate with the presence of basic and ultrabasic intrusions near deposits and ore manifestations.

The presence of mercury impurities, as well as thin amalgam coatings, were detected in the composition of gold artifacts. Ancient metallurgists obviously used mercury, but it is unclear in what capacity—to enrich gold concentrates or only as a "solvent" for applying thin layers of gilding. Amalgamation is one of the earliest methods of gold purification; it is quite possible that it was used by prospectors in the Mongolian steppes in the early first millennium AD. There is some indirect evidence in favor of this assumption. Numerous strands of hair and braids discovered in burial mounds of the nobility at the Noin-Ula burial site have been analyzed using X-ray fluorescent analysis using synchronous radiation of elements at the Siberian Synchrotron and Terahertz Radiation Center of the Institute of Nuclear Physics of the SB RAS. According to the researchers, "the mercury content was extremely high in the hair from the burial, while its levels did not exceed the regular values in the clay from the burial. These data indirectly indicate an internal source of mercury in the hair"* (Trunova et al., 2017: 324). The largest mercury deposits closest to Noin-Ula are located on the territory of the Altai Mountains and Tuva. There are no gold and mercury deposits on the territory of China adjacent to the location of the burial site under study (Fig. 12).

Steppe gold (instead of conclusions)

For the first time, the analysis of gold artifacts (foil strips and quatrefoils on ornaments of coffins from four Xiongnu burials at the Gol-Mod burial ground, Mongolia) was conducted by French researchers (Guerra, Calligaro, 2003: 177–179), who concluded that native and alluvial gold was used for making the finds under consideration. However, owing to the lack of sufficient amount of comparative evidence they were unable to establish whether these things had been produced locally or resulted from interaction with neighbors. Our study has made it possible to answer this question in a substantiated way.

*It is known that in ancient China people attributed special properties to mercury: it was procured by heating cinnabar and was used to create medicines which were believed to ensure immortality (see, e.g., (Eliade, 1998: 50–51)).

All gold artifacts from the Xiongnu kurgans analyzed in this article were made of foil or wire. The apparent simplicity of manufacturing may be misleading. Foil production, just like wire production, required knowledge, skills, and certain conditions to complete the task. Wooden coffins of a special design, known from the finds in the burials of Xiongnu nobility, were made and decorated, imitating Han coffins with silk fabrics and a rhombic net of wooden strips and quatrefoils covered with thick gold foil (Polosmak, Bogdanov, Tseveendorj, 2011: 73). Probably, the coffins and their decorations were made by Chinese artisans, who also created clothing, fragments of which are found in the graves of the noble Xiongnu. Decorations on such clothing, numerous gold sewn-on plaques, which constituted one of the most common categories of gold items in the Han period (Kravtsova, 2004: 758), could have been made in China. Together with sets of clothes mostly made of silk, they were a part of the gifts from the imperial court sent to the Chanyu, who would hand out all gifts of the Emperor to his courtiers (Barfild, 2009: 96–97). Therefore, many valuable items of Han production have been found in the graves of the Xiongnu nobility. In addition to the Chinese and Han items, the graves of the Xiongnu contain many things originating from Western countries; such finds can be present among gold artifacts (Polosmak, Bogdanov, Tseveendorj, 2011: 67, fig. 2, 39). Like our French colleagues, we have analyzed only a specific category of gold items associated with decorations of coffins and clothes. These items, related to the Han culture and traditions (clothing and fabrics), were a part of the gifts which the Chanyu received from the Emperor. Massive coffins may have been made to order by Chinese artisans. These things could have been made on the Mongolian steppe, but their production remained the prerogative of Chinese artisans.

In ancient times, China did not possess gold reserves, and therefore gold items were not produced in such great numbers as was the case with Rome, Parthia, Bactria, or Egypt. Gold was valued throughout the entire ancient world, but jade, jasper, and jadeite were especially highly valued in China. China has always lacked gold, and its domestic production has never satisfied the country's needs (Khokhlova, 2016). In ancient China, "gold was at first used in decorative and applied art as an auxiliary material for decoration", and only in the Warring States period did goldsmithery become a relatively independent activity—belt buckles and clothing plaques started to be made of gold (Kravtsova, 2004: 756). The Noin-Ula kurgans, like almost all large kurgans of the Xiongnu, date back to the reign of Wang Mang (9–23 AD). According to the written sources, in order to replenish the treasury, Wang Mang ordered his aristocrats to turn in gold in exchange for gilded bronze knives, which replaced money. The treasury was significantly replenished not from procuring the valuable metal, but from withdrawing it from circulation. Where did gold appear in ancient China from? Judging by the chronicles of the Tang period, the court would receive rich gold offerings from Tibet, Korea, and Central Asian possessions, such as Chach, Kesh, and other lands (Shefer, 1981: 335), but very little gold was mined in China's own gold deposits. In the Han period, the famous gold-bearing provinces of China (Guangdong, Guangxi, and Yunnan) were not yet a part of the Empire (Kravtsova, 2004: 754).

The interdisciplinary studies conducted allow the conclusion to be made that the gold artifacts from the Xiongnu graves, which were most likely manufactured by Chinese artisans, were made of the native gold of Mongolia. Along with gold from other known and unknown sources, it came to Han China from the Xiongnu.

There was always exchange of goods between the Xiongnu and the Han people. The Han people gave much more than they received. Silk, grain, chariots, weapons, jewelry, lacquer and bronze dishware, even princesses were sent to the steppe on a regular basis; while the Xiongnu could only give in return horses and livestock products. The exchange was clearly not equivalent, so it was always perceived as a disguised homage to the Xiongnu from China in exchange not for goods, but for peace along the border. Yet, if gold appears in this whole chain of goods, the picture changes. The Xiongnu lands, so useless for China, as the Eastern Han historian Ban Gu (32–92 AD) wrote that "one cannot feed from their land through farming" (cited after (Krol, 2005: 195)), hid other riches in themselves—easily accessible placer gold, which could be mined during the time of interest for our study in the area from the Gobi Desert to the Trans-Baikal region. Complex and controversial relations, which evolved between the neighboring states, may have been to some extent advantageous to the Han Empire. It received gold, which the Xiongnu had, who wandered over one of the richest gold-bearing territories of Central Asia. Everything that the imperial court regularly gave as a gift to the Xiongnu was to some degree compensated by the gold, which was partially returned to the steppe in the form of gold items. The absence of direct references to this exchange in the written sources can be easily explained by the fact that the sources (chronicles) belong to the Chinese side. These manifest undisguised disrespect, misunderstanding, and contempt for the wild barbarians "with the face of a man, but with the heart of a beast" (Ibid.: 194). Not surprisingly, there is no direct information about such mutually beneficial relationships. Archaeology opens our eyes to many things when written sources are biased.

In conclusion, it should be mentioned that at the beginning of the 21st century, Mongolia became one of the leaders in world gold production. The country

annually produces over 20 tons of gold, almost half of which is mined by placer miners (now there are about 100,000 of them). In several aimags, gold mining has become the main occupation, pushing aside traditional nomadic cattle breeding (Mikhalev, 2012: 196). Modern placer miners work using the same methods, which were probably known two thousand years ago to the Xiongnu, and on the same sources of native gold, which could have been developed by ancient miners. Gold is being smuggled in large amounts from Mongolia to China, which still lacks this metal. In some ways, the situation of two thousand years ago is repeating itself.

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M.A. Stoyakin[1] and Park Kyujin[2]
[1]National Research Institute of Cultural Heritage,
132, Munji-ro, Yuseoung-gu, Daejeon, 34122, South Korea
E-mail: stake-14@yandex.ru
[2]Novosibirsk State University,
Pirogova 1, Novosibirsk, 630090, Russia
E-mail:gogoraccoon@gmail.com

Geophysical Studies at the Horogoru Fortified Settlement in South Korea

The results of prospection studies at the medieval site Horogoru, in the Gyeonggi-do Province of South Korea, are described. Using ground-penetrating radar, the defense wall, built of tamped earth and masonry, was reconstructed. The analyses of GPR images and 3D-models of the wall were confirmed and supplemented by archaeological excavations. Prospection studies in the central part of the site have enabled us to assess tentatively the thickness of the habitation layer and its preservation. Structures associated with various archaeological cultures were analyzed. The results of excavations demonstrated a relative reliability of GPR, which had revealed anomalies at various depths. However, an accurate and complete assessment of the outlines of most structures proved impossible, owing to repeated medieval rebuilding, peculiar accumulation processes, and modern disruption. The GPR analysis of the anomalies indicated several stages of habitation. Early features, dating to the Koguryo period (400–700 AD), include a reservoir and a well, and next to these, heaps of roof tiles. Late features, dating to the Koryo stage (1000–1200 AD), include seven buildings, a stone pavement, and pits with roof tiles. Overall, the results demonstrate the efficiency of geophysical methods for the assessment of the site's structure and of the preservation of its cultural layers.

Keywords: *South Korea, Koguryo, Koryo, Middle Ages, fortified settlement, GPR.*

Introduction

The Horogoru fortified settlement (Fig. 1) is located in the Gyeonggi-do Province of South Korea, on a high steep bank of the Imjin River. It is protected by the natural terrain from all sides except the eastern one, where a high defense wall (rampart) is constructed. The fortified settlement has a sub-triangular shape in plan view; the area of its internal space is approximately 5300 m^2. The site is stratified: its upper layers belong to the advanced Middle Ages (the Koryo stage), while lower ones were accumulated during the Early Middle Ages (the Koguryo period).

The Horogoru fortified settlement was first examined during the Japanese annexation of Korea (Ryu Imanishi, 1916) and was studied only in recent times during several seasons. This is one of rare lowland fortified settlements in the Koguryo Kingdom, where upland settlements predominated. The site's location, close to the boundary with the DPRK, restricts the possibility of a complete survey of it. Economic activities in the settlement area have resulted in considerable destruction of the upper cultural layer. Improving efficiency of subsequent archaeological excavations at the site requires preliminary study of it by non-destructive methods.

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Fig. 1. Layout of the Horogoru fortified settlement (after (Sim Gwangju et al., 2014: 39)).

In recent years, geophysical techniques have been put into practice when studying early medieval fortified settlements of the Bohai period. However, the lack of illustrations, entangled methodology, and unclear reconstruction (Bessonova, Koptev, 2015) are barely adequate to the tasks of archaeology. Representative data have been obtained as a result of studying a Bohai grave near the Kraskino fortified settlement (Gelman et al., 2016).

In 2007, prospection studies were conducted at the Horogoru fortified settlement. To perform the ground-penetrating radar (GPR) survey, the Loza-M georadar, having an antenna-operating frequency of 200 MHz, was used. Operation at comparably low frequencies was aimed at identifying the structure and character of subsurface soil layer, and analysis of anomalies arising as a result of anthropogenic activities in the past. Subsequently, the results were compared to archaeological materials, which confirmed or supplemented the obtained data.

Rampart of the fortified settlement

Geophysical studies. A sounding trace, for tracing the longitudinal profile of the site, was routed almost along the entire length of the eastern rampart, to reveal its character and structure (Fig. 2). A reflected high-intensity signal manifested itself in its upper portion: this signal corresponds to the vegetable layer, containing modern disruptions and structureless stone heaps, which are hardly visible. Undulating lines of a positive and negative intense reflected signal are observed below. Red areas, distinguishable in the surrounding soil, may pertain to the rampart's stone structures. In addition, a GPR profile was routed in the southern part of the rampart to reveal the structure of the cross-section of the internal side of the rampart and the adjacent area of the fortified settlement. A high-intensity reflected signal, which could be interpreted as masonry or a heap of stones on the rampart,

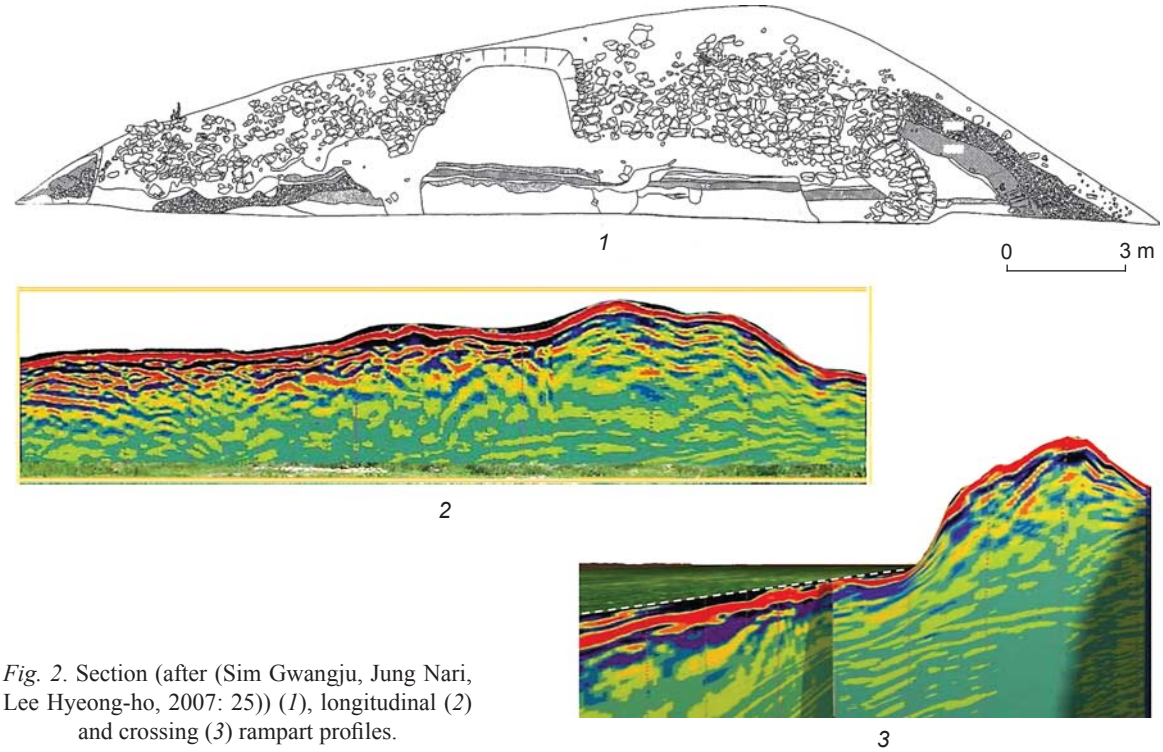

Fig. 2. Section (after (Sim Gwangju, Jung Nari, Lee Hyeong-ho, 2007: 25)) (*1*), longitudinal (*2*) and crossing (*3*) rampart profiles.

was observed in the upper layers and disappeared at a greater depth. Probably, this was due to the special features of the rampart structure.

Archaeological studies. In 2001, an entrance to the settlement was broken through by a tractor in the southern portion of the eastern rampart (where, probably, the entrance was initially located), following which cleaning of the rampart section was performed, and the rampart construction preliminarily determined (Yeoncheon…, 2009). The rampart is 10 m high, 90 m long, and the width of the base reaches 40 m. The foundation is built of tamped earth layers 1.2 m high and 21 m wide. Loam with crushed stones is spread and tamped thereon (the layer 4 m wide). On the outer side, the rampart is strengthened with two masonry rows 7 m wide. These, in turn, are supported against collapse by a stone prop and tamped clay to a height of 2 m. Later, during the Unified Silla period, the rampart was strengthened from the outside with a sangar, from the central part of which a tower projected (Sim Gwangju, Jung Nari, Lee Hyoungho, 2007: 297–298) (Fig. 3).

Subsequent excavations demonstrated more complex construction in the eastern rampart. Two lines of post holes, each consisting of two parallel rows, were revealed. One of these was located near the fill base on the inner side, while the other one was 2 meters from it, under the rampart. This indicates that at the initial stage the settlement was protected with a wooden palisade, and subsequently fortified with a strong rampart (Sim Gwangju et al., 2014: 48–52; Yeoncheon…, 2011). A palisade was usually erected as a temporary fortification around a fortress during the building stage, until stone walls were constructed. As a rule, it was supplemented by earthwork fortified structures. Such construction was also discovered at other Koguryo ancient settlements and forts in South Korea (Stoyakin, 2015: 272; Yang Si-eun, 2010: 107–108; 2013: 178–182).

Apertures for four vertical posts, located at a distance of approximately 2 m from one another, were found in the stone wall. In front of these, several skewbacks for the posts that strengthened the masonry frame are preserved. Nearby, pottery and roof tile fragments belonging to the Koguryo period were found. A different construction time for the rampart's external extension, where roof tiles belonging to the Unified Silla period were found (Sim Gwangju et al., 2014: 45–48), was confirmed. On the internal slope of the wall, stones that do not form regular masonry were found, as was, for example, traced at the Bohai Kraskino fortified site in Primorye. The GPR data from the Horogoru rampart were confirmed by archaeological materials.

Internal space of the fortified settlement

The total inner area of the fortified settlement surveyed by the ground-penetrating radar is ca 1500 m^2. The survey was performed in an area of 40 × 50 m in size, the distance between profiles laid along a square marking (10 × 10 m) was 1 m. Unfortunately, the limited scope of the GPR studies provided no way of revealing the

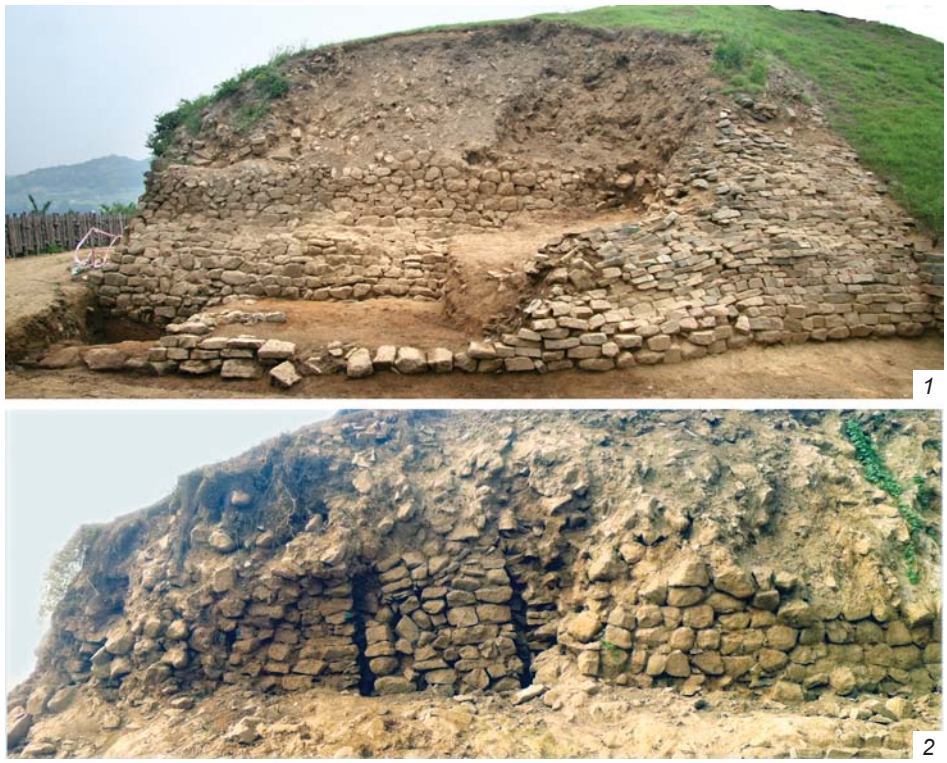

Fig. 3. General view of the rampart (*1*), and apertures for the vertical posts (*2*).

whole pattern of the cultural layer within the fortified settlement. When sounding, we tried to embrace maximally the central ground, which might contain important features, but which was not expressed in roughness of terrain. Beyond the settlement, trenches were laid, which revealed the remains of several structures and drainage (Ibid.: 94).

As a result of the GPR study, certain areas showing increased amplitude of reflected signals were identified. Earlier, during exploration works, finds belonging to various subsequent medieval cultures (Koguryo, Unified Silla, and Koryo) were encountered. It can be assumed that this will have an effect on the stratigraphic column. Taking into account the cultural layer's accumulation rate, the features associated with each culture should be located at different depths. Therefore, analysis of GPR images was focused on identification of anthropogenic strata, such as stone constructions at depths of 33 and 85 cm and, whenever possible, in deeper areas.

For example, a comparatively intense anomaly, in the form of a spread of stones, manifested itself at a depth of 33 cm throughout the entire thickness. Unfortunately, an accurate and complete assessment of the outlines of the structures proved impossible, with some exceptions. Other anomalies, obviously also related to structures, were observed in places at a depth of 85 cm. In deeper areas, anomalies were recorded sporadically, and yielded little information. Nevertheless, we may speak of the probable presence of some ancient buildings and structures.

At the geophysical survey site, archaeological excavations were conducted, leading to the finding of medieval features belonging to various times.

Geophysical and archaeological studies of Koguryo's objects

Water collection system. The georadar recorded an unusual location for the anomaly in the square N3/W3, not far from the rampart (Fig. 4, *1*). A high-intensity reflected signal manifested itself in the layer's upper portion, while a weak signal, correlated with internal filling of the water reservoir, appeared below. Even lower, a high-amplitude anomaly corresponding to the masonry was observed again. Its boundaries had a regular shape in plan view. Below, the signal attenuated again. In the adjacent square N4/W3, an anomaly caused by the drain well was represented in the upper layers, below which a considerable decay of the signal was observed.

The excavations discovered a water collection system (Fig. 4, *3*; 5, *1*), consisting of a reservoir (storage basin), which could have been used to accumulate and store water, and an adjacent well, located at a higher level,

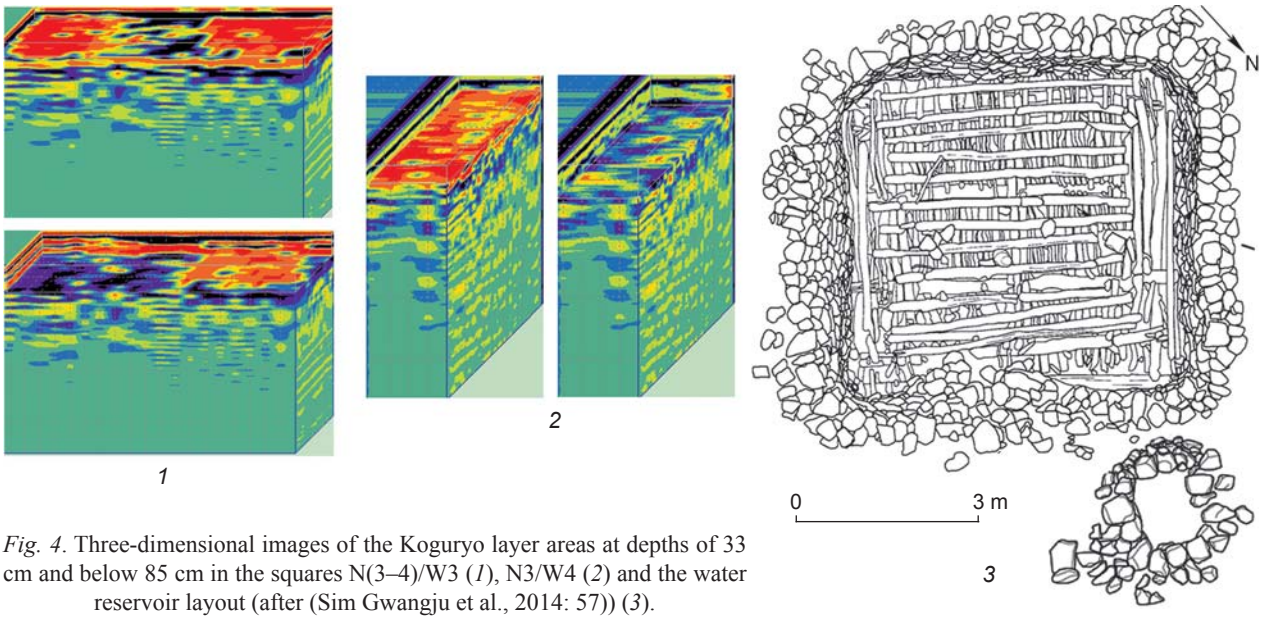

Fig. 4. Three-dimensional images of the Koguryo layer areas at depths of 33 cm and below 85 cm in the squares N(3–4)/W3 (*1*), N3/W4 (*2*) and the water reservoir layout (after (Sim Gwangju et al., 2014: 57)) (*3*).

where water was collected before entering the water reservoir. The storage basin has a subsquare shape (7.86 × 7.20 m, 2.68 m deep) in plan view. The walls were lined with gauged stones, and a wooden construction in the form of a cribwork made of different-thickness planks can be traced on the floor.

The filling stratigraphy, wherein seven levels are distinguished, is rather complex. After the water reservoir had been out of service for some time, a dwelling was built at this place, with an L-shaped stone construction (kan, ondol) typical of the Koguryo culture. Large, flat stones for the column pillar were discovered right above the water reservoir; but below the kan, in layer 5. Later, a hearth belonging to the Unified Silla period was located here (Ibid.: 64).

Roof tile heaps. In the square N3–4/W4, at a depth of 33 cm, a comparatively intense anomaly manifested itself throughout the entire thickness (see Fig. 4, *2*). It was correlated with heaps No. 1 and 2 of Koguryo roof tiles. No anomalies are traced at a depth of 85 cm, which generally coincides with the archaeological data.

The excavations have demonstrated that heap No. 1 has an irregular round shape in plan view, the dimensions are 8.0 × 7.5 × 0.5 m. The pit was filled with a brown loam containing large number of roof tiles (see Fig. 5, *2*). A "cord" ornament prevails, "lattice" and saw-tooth ornaments are also present. Also, roof end tiles, with lotus ornaments, and finials

Fig. 5. Koguryo features.
1 – water reservoir; *2* – roof tile heap No. 1 (after (Sim Gwangju et al., 2014: 75)).

have been discovered. A fragment of a ceramic drum is an interesting find. Heap No. 2, 6.2 × 0.2 m in size, oriented from north to south, was located in the square N3/W4 and partially overlapped heap No. 1 in the southwest. The layer consists of only one row of roof tiles, with a predominately "lattice" ornament.

Geophysical and archaeological studies of Koryo objects

Structures. A large number of stones, which formed masonwork in places, were found below the sub-vegetable layer. To determine the character and cultural affiliation of these features, an excavation unit was established. Remains of seven buildings and a spread of flat stones were identified in the squares N1/W7–N4/W7, S1/W4–N3/W5 (Fig. 6).

This area is characterized by the following stratigraphy: under the first layer, ca 50 cm thick, partially mixed with the sub-vegetable layer, the second layer was located, of light-brown loam with small pieces of calx and abundant roof tiles; the third layer is represented by brown clay (subsoil). Apparently, layer 2, containing roof tiles of the Koguryo and Unified Silla periods, was piled up; later, during the Koryo period, the buildings were erected thereon.

Determination of the spatial planigraphy of features is difficult, owing to the later considerable destruction of the layer, and ancient rebuilding. Nevertheless, building No. 1 is preserved well enough. It was installed on a platform (ca 20 m long and 3.6 m wide) consisting of three masonry levels. Column-bases were discovered inside, which allowed the building's construction to be revealed. Obviously, it consisted of five spans in length and one span in width. Judging by the size of the building and the surrounding extensions, this structure was the main and central one. A spread of stones (35.0 × 1.8 m) was located in front of it in axial alignment.

The finds are mainly Koryo-type roof tiles. Various types of ornament are also noteworthy: a "herring-bone" design was found on the tiles near buildings No. 1, 3, 7, and a spread of stones, incised lines near building No. 2, and thin linear pattern near buildings No. 5 and 6. Important finds include a bronze mirror with a lotus ornament, and gold-coated silver and bronze belt-plaques.

Both the stratigraphic situation showing many strata and the spatial arrangement of features with various tiles

Fig. 6. Locations of Koryo features (after (Sim Gwangju et al., 2014: 83)).

point to different construction times of Koryo buildings. Buildings No. 1, 3, 7, and probably 4, and a spread with roof tiles ornamented in a similar manner, located along the same NE-SW line, parallel to the river bank, may be assigned to the initial structures.

Ornaments, and a rich belt-set popular in the 11th–12th centuries (Joo Kyeongmi, 2014), suggest a very high status for their owner in the bureaucratic hierarchy. The Horogoru site is situated in a strategically important location, where the transport route had run between modern Pyongyang and Seoul since the period of the Three States. Near the settlement, there was a river harbor, where local products were collected from the entire basin of the Imjin River until the beginning of the 20th century. Judging by the strategic location of the settlement and the type of finds, it may be assumed that it was a county administrative center during the Koryo period, and that building No. 1 was the residence of an official with a high bureaucratic position.

Roof tile heaps. Heaps No. 3–7 were discovered below the Koryo buildings. Pits No. 3 and 4 are small and round. The first contained tiles belonging to the Unified Silla period. Pit No. 5 is irregular, 5.5 × 4.6 × 0.8 m in size. Four spreads of stones intended for columns, unrelated to this pit, were found in the filling. The majority of roof tiles have "cord" ornaments. Pit No.6, rectangular in plan view and 3.9 × 1.8 × 0.2 m in size, was discovered in the lower part of building No. 7. Roof tiles with saw-tooth ornaments prevail; also, there are many fragments of Koguryo finials. Pit No. 7 is recorded between structure No. 1 and a spread of stones. Here, in the square N1/W5–6, the most intense anomaly manifested itself at a depth of 85 cm; meanwhile, it was slightly weaker at a depth of 33 cm.

Conclusions

Judging by the data from radiocarbon analysis and dendrochronology, the settlement existed from the middle of the 5th century. The construction time of the rampart is dated to the mid-6th century (Lee Hyeong-ho, 2015: 47–50). Horogoru, located in a strategically valuable location, had an important defensive function during the Koguryo period. Apart from the rampart, the water collection system and roof tile heaps belong to the epoch. A large number of roof tiles, especially roof end tiles and finials, suggests a high status for the settlement, since roof tiled buildings were high-status in the Middle Ages and served as palaces, government offices, temples, etc. This was probably a district capital during the Koguryo period (Sim Gwangju, Kim Joohong, Jung Nari, 1999: 207–210; Sim Gwangju, Jung Nari, Lee Hyeong-ho, 2007: 302–304).

After the fall of the Koguryo Kingdom in the middle of the 7th century, the settlement was used in Unified Silla for a certain time. At this time, the rampart was completed. However, judging by vigorous building activities, a new start was given to Horogoru during the Koryo period. The county administrative center could have been located here (Jung Yegeun, 2005: 210). Belt ornaments suggest that the central building could have existed in the 11th–12th centuries.

Unfortunately, the GPR survey results did not allow an accurate and complete assessment of the outlines of the structures, owing to peculiarities of the cultural layer accumulation, and modern disturbances. Nevertheless, a special administrative Koryo building was reconstructed. The data on Koguryo features, except for the water reservoir and roof tile heap, are rather fragmentary and do not give the whole picture.

During excavations, the earliest fortification line of the settlement, unexpressed in the terrain's relief, was revealed. Subsequently, a strong fortified structure appeared in its place. The structure of the earth rampart, covered with stones, generally represented in the GPR image, is confirmed by archaeological data.

Application of various geophysical methods undoubtedly provides more accurate information about an ancient site, its planigraphy, and structure, which considerably improves the efficiency of archaeological excavations and reduces their costs. For example, the use of a package of geophysical methods (electric profiling, magnetic prospecting, ground-penetrating radar, electrical tomography) at the *Uchkakar* fortified settlement ensured the possibility of comparative analysis of data, while focused excavations have proved the correctness of their preliminary interpretation (Zhurbin, Ivanova, 2018).

Though prospection studies of medieval fortified settlements in South Korea are still at an early stage, certain results have been achieved. Generally, archaeological excavations at the Horogoru fortified settlement confirmed the data of prospection studies, which points to the necessity of mainstreaming new technologies and methodologies to collect more complete information about the past.

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S.F. Tataurov and S.S. Tikhonov
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. K. Marksa 15/1, Omsk, 644024, Russia
E-mail: tatsf2008@rambler.ru; semchi957@gmail.com

Medieval Sites of Tara Region, the Irtysh Basin: Origin, Chronology, Cultural and Ethnic Attribution

We describe 17 medieval kurgans at Murlinka, dating to the late 1st millennium AD and associated with archaeological sites at Aitkulovo, in the Tarsky District of the Omsk Region, on the right bank of the Irtysh, in the borderland between the forest-steppe and the taiga. The deceased were buried in a supine extended position. Some burials were made on the virgin soil, and some on the buried soil. Most kurgans accommodated one grave, but in some cases the number of graves was two and more. Inside the kurgans, at the buried soil level and above, limb bones of animals and small potsherds were found. In certain graves, traces of fire, such as partly burned bones, charcoal, ash, or charred earth, were detected. We also found ditches and various structures inside the mounds. In eleven mounds, there were funerary offerings, such as vessels, arrowheads, celts, bits, and ornaments, similar to those found in the graves. We give a detailed description of bronze ornaments and pommels, tools, and belt sets made of white metal, as well as glass and ceramic beads, iron artifacts, details of horse harness, iron and bone weapons, and pottery. Parallels are found in the taiga regions of the Middle Ob, Ural, and the steppe zone of northern Altai. We discuss the chronology and cultural attribution of the finds in the context of the ethnic processes that occurred in the region.

Keywords: *Middle Irtysh, Middle Ages, chronology, ethnic attribution, bronze casting, burial rite.*

Introduction

In the 8th to 12th centuries, Turkic-speaking inhabitants of the steppe regions of eastern Altai and the upper Irtysh migrated to the forest-steppe and the southern taiga subzone of the Middle Irtysh. Inter-ethnic contacts resulted in the formation of Turkic-Ugric population groups in the said zones. Specialists attribute the archaeological sites left by them to the Ust-Ishim culture*. A part of the Ugric population that inhabited this territory was, probably, forced to the lower Irtysh basin. This article analyzes bronze artworks from the undescribed

*The Ust-Ishim culture was distinguished by B.A. Konikov in 1983 on the basis of materials from kurgans found near Ust-Ishim village, the Ust-Ishimsky District, the northern Omsk Region (1983: 14–17). It is dated to the 9th to 13th centuries. The vast majority of sites belonging to this culture are located on the banks of the Irtysh River, from the Tara River's mouth in the south to the Tobol River's mouth in the north; and in the lower reaches of the right Irtysh tributaries (Tara, Shish). Some sites are located beyond the limits of the cultural area, namely: in the Vasyugan upper reaches in the east, near the Tavda River, a Tobol tributary, in the north-west, and between the mouths of the Tobol and Demyanka in the north. In the south, Ust-Ishim materials are encountered in the forest-steppe zone to the south of Tara.

collections* discovered by A.S. Chagaeva in the middle Irtysh basin during the 1960–1970 excavations.

Archaeological complex at Aitkulovo

The sites in the neighborhood of Aitkulovo village (the Tarsky District of the Omsk Region) are located on the rock terrace of the Irtysh's right bank (Fig. 1, 2). In 1961–1962, V.I. Matyushchenko discovered a medieval fortified settlement of Murlinka (Fig. 2, *B*), a kurgan cemetery near Lake Buren—the Murlinka kurgans (Fig. 2, *A*), and a cemetery on the bank of the Irtysh—the Murlinka kurgans near the Irtysh River (Fig. 2, *B*). Chagaeva conducted excavations at the last-mentioned burial ground in 1965, 1967, and 1976, and at the fortified settlement in 1965. In 1983, Matyushchenko continued studying the Aitkulovo fortified settlement (1983). We assume that all sites were left by a single group of population. This presumption is based upon the similarity of finds (artifacts made of ceramics, iron, bronze, bones, etc.) from the fortified settlement and from the cemeteries, in terms of shape and ornamentation of ceramic ware, and types of metal and bone weapons and tools.

This article focuses on the artifacts found in the Murlinka kurgans near the Irtysh River. Twenty-two features were located on an elongated, low dune in the river. In the northern part of the cemetery, mounds of kurgans 4 and 7–10 were located outside the main line (Fig. 2, *B*). All kurgans 7 to 14 m in diameter with a height up to 1 m had a hemispherical shape. Robber pits were recorded in all burial mounds.

Over four years of work, Chagaeva excavated 17 kurgans (1962 – 4, 1965 – 1–3; 1967 – 7, 8, 10, 11, 21; 1976 – 13–20). The materials were partially described (Chagaeva, 1973).

Burial rite

The above sizes of kurgans should be deemed conditional: artifacts found in the burial mounds are concentrated only in their central parts; consequently, the mound diameters were, probably, smaller in ancient times. The majority of kurgans accommodated a single burial under the mound (kurgans 1–4, 7, 10, 11). Three kurgans accommodated 2 buried persons each. Judging by the burial goods, a man and a woman were buried in two of them (kurgans 8 and 13), and a woman and a child in one burial mound (kurgan 6). In kurgan 21, three burials were discovered (Fig. 3). Kurgan 9 contained, probably, three burials, as

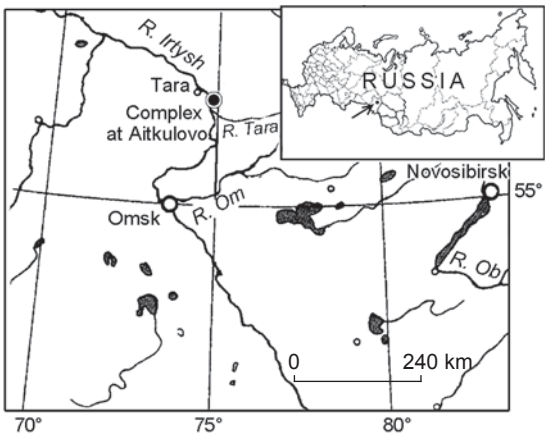

Fig. 1. Arrangement of the archaeological complex at Aitkulovo.

the field inventory of this kurgan shows a relevant record; though the field journal mentions only one grave. Kurgan 12 could, possibly, have contained a cenotaph: there is a record indicating that no skeleton was discovered.

Burial pits are absent. Burials were predominantly made 20–25 cm above the level of the virgin soil (kurgans 2, 3, 10, 11), and one burial (kurgan 1) was performed on the virgin soil. We suppose that the deceased were buried on the ancient daylight surface, which has been transformed into buried soil over the past centuries.

In the mounds of kurgans 1–3, 7, 10, 11, 20, traces of fire (charred earth), or charcoal, ash, and burned bones were discovered. The mounds of kurgans 2–4, 6, 7, 9–11, 13, 14, and 20 contained funerary offerings to the diseased: ceramic vessels, iron arrowheads, celts, bits, bronze ornaments, and beads.

The deceased were buried in supine extended positions according to the inhumation rite. Some of them are oriented to the NW (kurgans 1, 2, 11), and one of them to the W (kurgan 9). The majority of burials contain grave goods, such as cult artifacts cast in bronze, weapons, tools, stirrups, bits, etc. Above a burial, a kurgan was erected, without a ditch or structures inside the mound. In kurgan 2 only, an oval birch-bark sheet 3.5 × 1.8 cm was recorded. Horse teeth and bones, ceramic vessels, bits, weapons, and ornaments were placed in or on the burial mound. In kurgan 2, a birch-bark box was put in the grave or in the mound. Though the use of fire during funeral ceremonies has been established, it is impossible to determine the details of the rite (secondary cremation, partial burning, filling up with charcoal or ash).

Analysis of materials

Knife-pommels and pendants—bronze casting. A pommel cast in the volume-openwork manner, with

*The collection is stored in the Omsk State Museum of History and Regional Studies (collections No. OMK 15581/1-230 and No. BMK 2095/1-63).

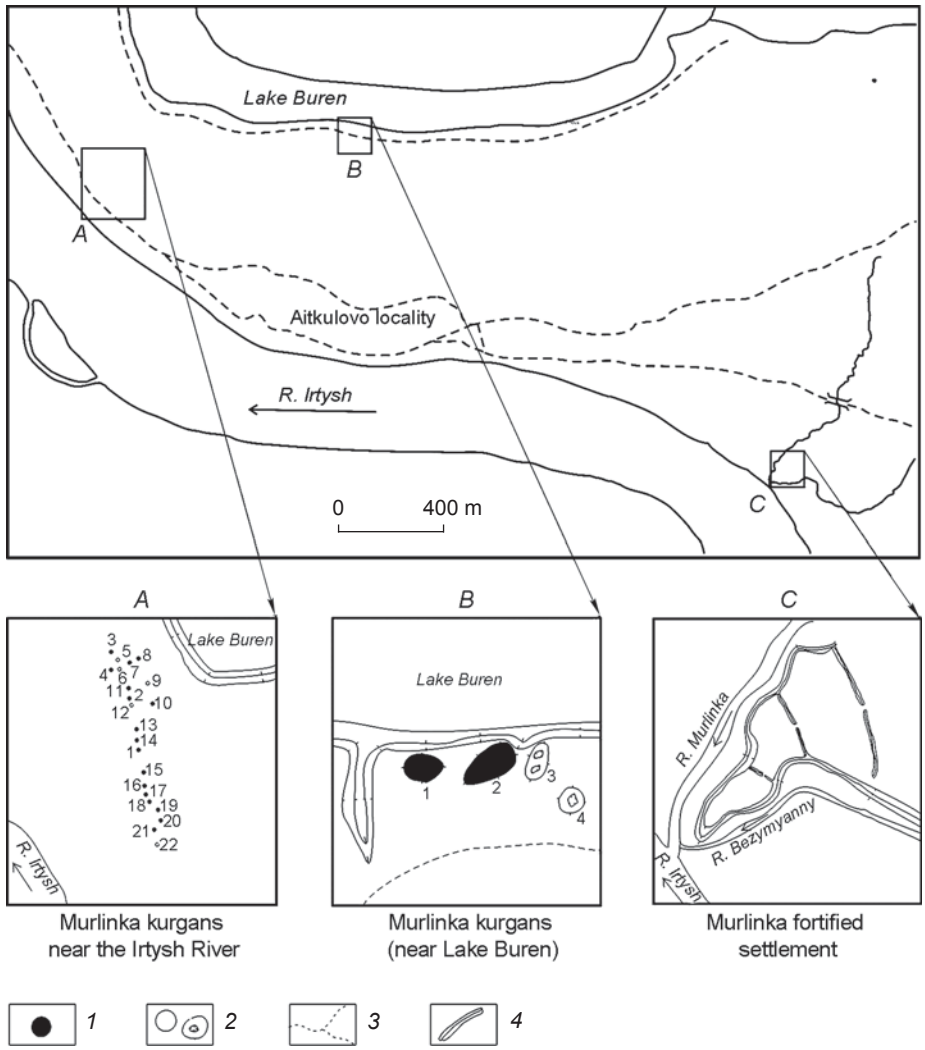

Fig. 2. Features of the complex.
1 – an excavated kurgan; *2* – an unexcavated kurgan; *3* – forest roads; *4* – a trench and earthworks.

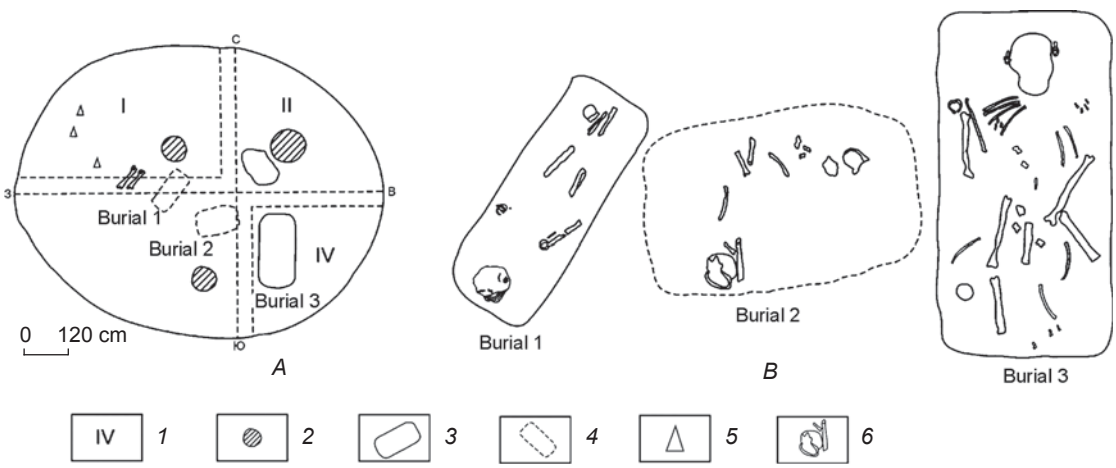

Fig. 3. General plan (*A*) and layouts of burials (*B*) of kurgan 21.
1 – a sector number; *2* – a pit in the virgin soil; *3* – boundary of a grave in the virgin soil; *4* – a conventional boundary of the grave; *5* – ceramics in the burial mound; *6* – human bones.

small ornamentation (Fig. 4, *3*). A very similar artifact was discovered at the cemetery of Ust-Balyk (the Nefteyugansky District, the Khanty-Mansi Autonomous Okrug of the Tyumen Region) (Semenova, 2001: 98).

A pendant in the form of a bird with outspread wings and tail, and with its head turned to the right (see Fig. 4, *1*). The entire figurine was covered with ornamentation symbolizing the bird's feathering. V.A. Mogilnikov associates it with the Potchevash culture (Finno-ugry…, 1987: 190).

A heart-shaped pendant with pearl ornamentation along the edge, and with an image of a flower with three petals at the center (Fig. 4, *5*). D.G. Savinov attributes pendants with similar shape and decoration to the Srostki culture (9th to 10th centuries) (1984: 122). Mogilnikov considers the pendant to be a Potchevash one (Finno-ugry…, 1987: 190). According to Konikov, such ornaments are typical of the entire period of existence of the Ust-Ishim culture (2007: Fig. 226). In our opinion, artifacts of this type existed in this territory for a more prolonged period. Pendants of identical shape have been found at the Nadezhdinka IV cemetery (14th to 16th centuries) and in the town of Tunus (late 16th century), which are located on the flood plain of the right tributary of the Tara, 2 km above its mouth (the Muromtsevsky District of the Omsk Region) (Tataurov, 2002).

Pendants representing a pangolin or a predatory animal (four intact items and several fragmented ones) are bell-shaped; the animal is rendered symbolically (Fig. 5). Two items that are three-dimensional representations have each only a row of "pearls" on the animal's side, while the head, paws, and tail are worked out in detail (Fig. 5, *1*, *3*). In our view, these pipe-shaped pendants depict a pangolin. Almost identical representations are stored in the Surgut Local Lore Museum (Surgutskiy kraevedcheskii muzey…, 2011: Fig. 188, p. 82). V.I. Semenova reasons that similar items were worn by inhabitants of taiga regions of Western Siberia from the first half of the 9th century to the 12th century (2001: 75). One more pendant depicting a pangolin was found at the Argaiz I cemetery, in the northern Omsk Region (Konikov, 2007: Fig. 262). Two pendants show an animal looking like a wolverine and depicted in the same posture as the pangolin, though in a different manner. Each figurine is entirely covered with "skeleton" lines; U-shaped signs are seen on the sides (Fig. 5, *2*, *4*).

Pipe-shaped beads depicting pangolins or predatory animals are widely represented in the taiga and forest-steppe zones of the Trans-Urals, Western and Southern Siberia. Recently, the number of sites containing such items has considerably increased. The closest parallels to these artifacts are pendants from cemeteries of the Surgut region of the Ob (Semenova, 2001: 89).

A decorative element (a pendant?) in the form of a bird's tail, tied in a large symbolically-rendered knot (see Fig. 4, *4*). A large U-shaped fastening clip is on the back side of the item.

Pommel of a knife or a staff in the form of the head of a carnivorous bird (a sea eagle?) (see Fig. 4, *2*). A nearly

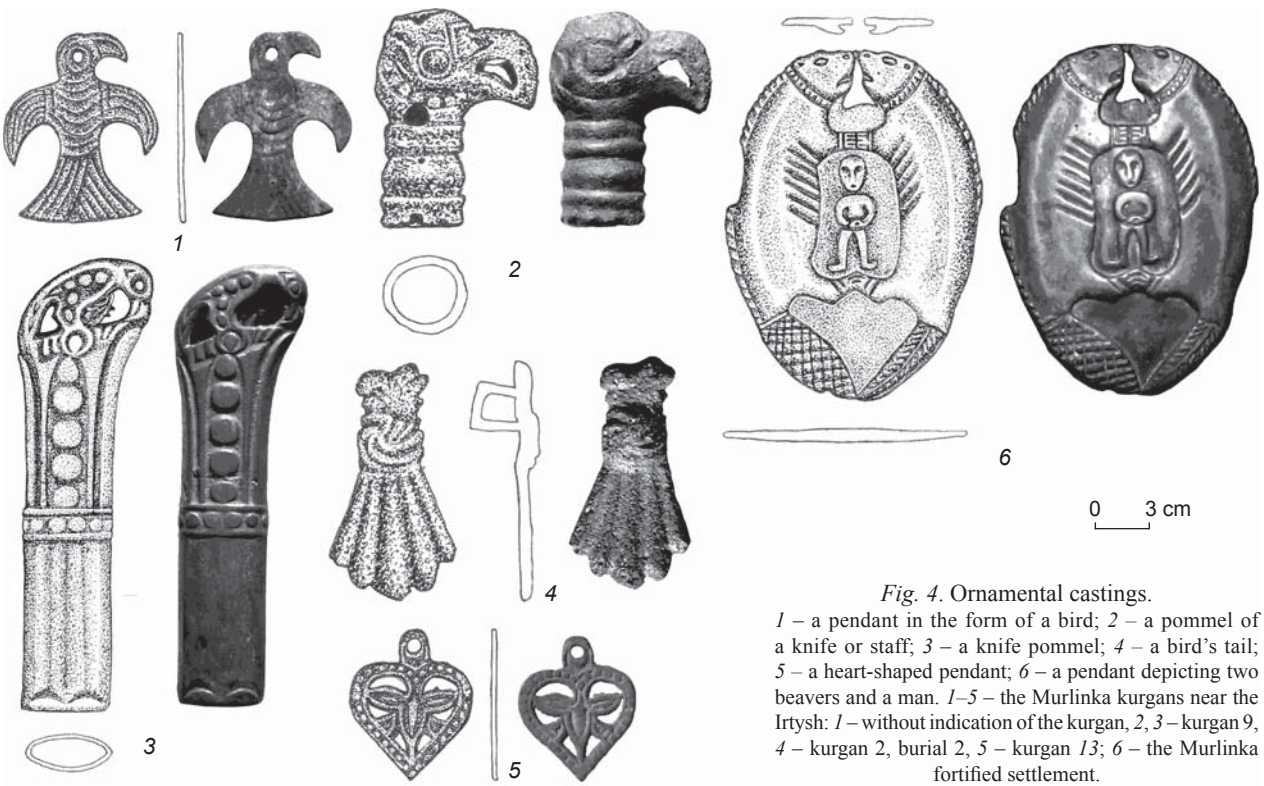

Fig. 4. Ornamental castings.
1 – a pendant in the form of a bird; *2* – a pommel of a knife or staff; *3* – a knife pommel; *4* – a bird's tail; *5* – a heart-shaped pendant; *6* – a pendant depicting two beavers and a man. *1–5* – the Murlinka kurgans near the Irtysh: *1* – without indication of the kurgan, *2*, *3* – kurgan 9, *4* – kurgan 2, burial 2, *5* – kurgan *13*; *6* – the Murlinka fortified settlement.

Fig. 5. Representations of a pangolin (*1*, *3*) and a wolverine (*2*, *4*).

identical pommel was found by Konikov when excavating the Kipy III kurgan cemetery, in kurgan 2, burial 2 (the Tevrizsky District of the Omsk Region) (2007: 206, fig. 257).

Pendant depicting two beavers and a man (see Fig. 4, *6*) (Shemyakina, 1980: 28–33). Its closest compositional analog is a plaque from the Vasyugan hoard that depicts a man with a mask on his chest at its center, and a bird and a sable on its sides (Chindina, 1991: 69, 162, 170). Mogilnikov has described a pendant representing a similar subject and showing figures of beavers and a human mask between them; the pendant was accidentally found in the Ust-Ishimsky District of the Omsk Region (Finno-ugry…, 1987: 199, fig. LXXXII, *12*; p. 330).

The two above artifacts are solid-cast copper items. The casting was performed in coarse-grained sandstone molds, which determined the surface roughness of the artifacts. After casting, the surface was not treated.

Pendants. Parts of dangle pipe-shaped pendants are represented by two types: tubular solid-cast two- and four-piece parts, and spherical ellipsoid parts, different in their proportions and manufacturing technology (from casting in a single mold to joining two parts by riveting (Fig. 6, *15–17*). The collection consists of pear-shaped pendant-buttons, a pear-shaped small bell with a linear slot and a horizontal belt (Fig. 6, *19*), and a flat ring with an ornament of longitudinal and transverse lines (Fig. 6, *18*). According to Konikov, such small bells gained widespread use in the early 2nd millennium AD (2007: 435, fig. 262).

Nine pendant-earrings have been discovered. These are similar to the earrings in their shape, but small in size, which prevents from assigning them to the bracelets made of wire with a round cross-section. The items are made of bronze pins, some of which are forged together (3 spec.). These vary from 3 to 8 cm in diameter. Some of them were most probably used as earrings, and others for decoration on clothes.

Pendants, each with a ring, a pin, and a lug. Three items have been discovered (Fig. 6, *1*, *2*). A similar pendant was discovered by Konikov at the Aleksandrovka I kurgan cemetery, and assigned by him to the last development stage of the Potchevash culture. In his opinion, such ornaments are Finno-Ugric, they were widespread from the Ob basin to the eastern boundary of Old Rus (2007: 223).

Finger-ring. The ornaments of this type were widespread till the 19th century. Judging by the symbolically-rendered "pearls", the finger-ring is for a female (Fig. 6, *20*). Such finger-rings were found in female burials of the 17th–18th century cemetery of Bergamak II, near the Tara River (Tataurov, Tikhonov, 1996: 82–83). The presented assemblage of ornaments is common for the forest-steppe belt of Western Siberia (Chindina, 1991; Konikov, 2007).

Belt sets. A belt set, comprising an elongated tip with an ornament in the form of long longitudinal stripes and clips, which were fastened tightly together, was made of white metal (Fig. 7, *1*). The clips are decorated with representations of two wide radiating leaves. An identical set from the Baltargan cemetery is exhibited in the Anokhin Museum in Gorno-Altaisk (Hudiakov, Kocheev, Monosov, 1996: Fig. 1). Similar belts are abundant at the Altai funerary sites (Alekhin, 1996: Fig. 12; Neverov, Gorbunov, 1996: Fig. 6, 7; Tishkin, Gorbunov, 2000: Fig. 2).

A belt set with figured onlays of various shapes (strict geometric plates, as well as symbolically-rendered heart-shaped and segment-like ones) (Fig. 7, *2*). Belts with such sets of plaques were widespread in the Upper Irtysh basin (Arslanova, 1972: 56). Such diversity of onlays on waist belts with plates is typical of the belts pertaining to the Ust-Ishim culture (Konikov, 2007: 422).

A belt set with round silver plaques fastened by two small nails (Fig. 7, *3*). A similar belt was found at the Sabinka I cemetery in Khakassia (Dobzhansky, 1990: 40, 138; Savinov, Pavlov, Pauls, 1988: 83–103). Such a belt is present in the materials from burial 1 in kurgan 13 of the Ust-Ishim I cemetery in the Irtysh basin (Konikov, 2007: Fig. 200).

Fig. 6. Ornaments.
1, *2* – pendants; *3* – a pendant-earring; *4–11* – tubular pipe-shaped pendants; *12–17* – volumetric pendants; *18* – a flat ring with cut-marks; *19* – a small bell; *20* – a finger-ring; *21–30* – paste beads.
1–18, *20–30* – the Murlinka kurgans near the Irtysh: *1*, *2*, *10–15*, *21*, *23*, *24*, *26–30* – kurgan 20, *4–9*, *20* – kurgan 4, *16* – kurgan 9, *17* – kurgan 4, *18* – kurgan 7, *25* – kurgan 6, *19* – the Murlinka kurgans.

The sets of belt onlays described above are different in their style and manufacturing technique. Buckles serve to unify them (Fig. 7, *4–7*). All the buckles found in the Murlinka burials are bimetallic (bronze with an iron tang) and miniature (Finno-ugry…, 1987: 198). Such buckles have been found in burials of many cemeteries dated to the first third of the 2nd millennium AD in the Tara region of the Irtysh: in particular, at the cemeteries of Alekseevka XX and XXVI in the Tara lower reaches (Tataurov, 2001: 199; 2003: 69). Konikov assigns the items of this type to the period of the Ust-Ishim culture (2007: 422).

Beads. The collection contains eight glass (paste) beads and two ceramic ones (see Fig. 6, *21–30*). All paste beads, apart from the cylindrical one (carved from a pipe),

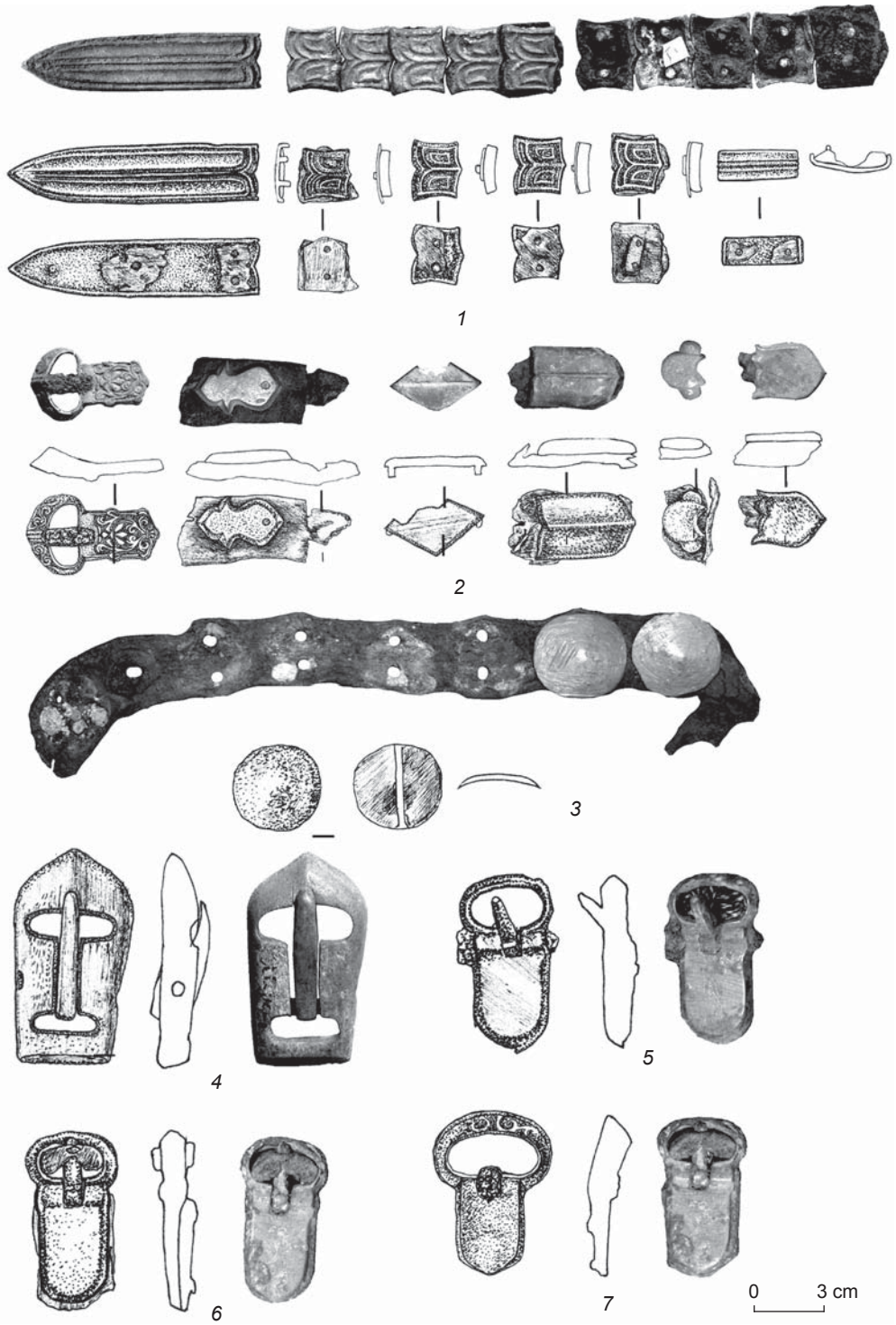

Fig. 7. Belt sets (*1–3*) and buckles (*4–7*).
1–3, *5–7* – the Murlinka kurgans near the Irtysh: *1–3* – kurgan 23, *5* – kurgan 20, *6* – kurgan 7, *7* – kurgan 2; *4* – the Murlinka kurgans.

are made with the curling technique. Such set of beads is common for the sites located in the forest-steppe and taiga Irtysh basin (Ibid.: 225–226) and in the Surgut region of the Ob (Semenova, 2001: 90–92). Mogilnikov points out that the beads were manufactured mainly in Old Rus and were of considerable value (Finno-ugry…, 1987: 199).

Horse harness. Ring bits are made of iron pins; the junctions between the rings or mouthpiece shanks

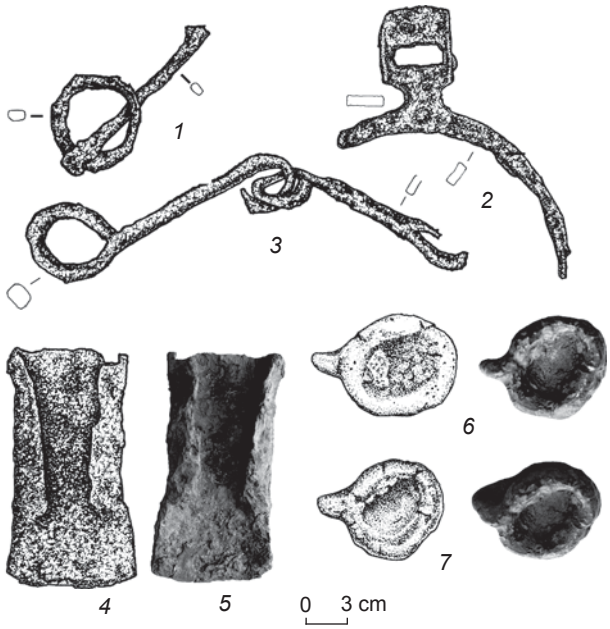

Fig. 8. Details of horse harness (*1–3*) and tools (*4–7*).
1, *3* – bits; *2* – stirrup; *4*, *5* – celt; *6*, *7* – clay ladles. *1–5* – the Murlinka kurgans near the Irtysh: *1*, *2* – kurgan 1; *3* – kurgan 6; *4*, *5* – kurgan 4; *6*, *7* – the Murlinka fortified settlement.

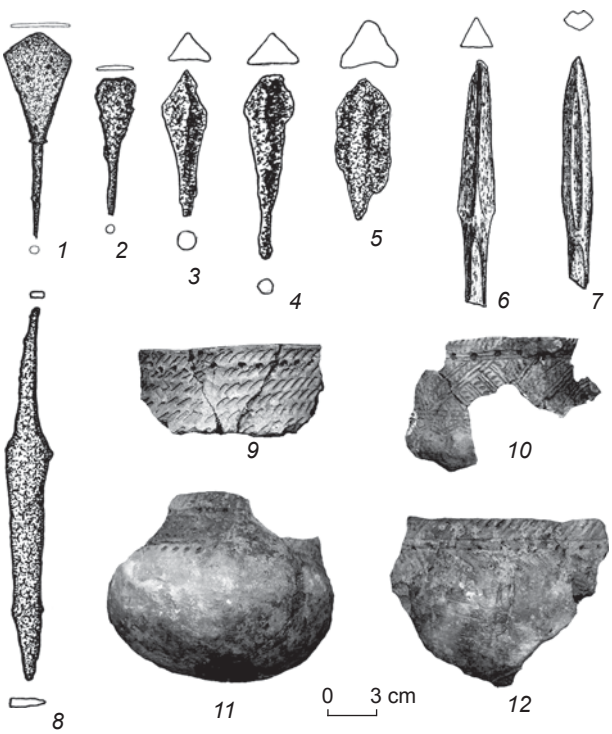

Fig. 9. Arrowheads (*1–7*), a knife (*8*), and ceramic vessels (*9–12*).
1–5 – iron arrowheads; *6*, *7* – bone arrowheads; *8* – an iron knife; *9–12* – vessels. *1–12* – the Murlinka kurgans near the Irtysh: *1* – kurgan 12; *2*, *5–7*, *9* – kurgan 4; *3*, *4* – kurgan 23; *8* – kurgan 7; *10* – kurgan 6; *11* – kurgan 11; *12* – kurgan 8.

are poorly worked out. These were widespread in the Irtysh basin throughout the entire 2nd millennium AD (Fig. 8, *1*, *3*). Horse bits with free rotating ring cheek-pieces appeared in the Irtysh basin in the 10th century (Ibid.: 198).

A stirrup with a strap attachment in the form of a clip in a specially designated upper portion, with a flat cross-section in the upper part of the shanks, and roundish towards the pad. The pad itself is absent (Fig. 8, *2*). The same fragment is provided, unfortunately without indicating the location of the find, by Konikov in his monograph devoted to the Omsk region of the Irtysh in the Middle Ages (2007: Fig. 210). Stirrups with nearly arch-shaped shanks, with a wide foot-plate and a neck-plate, and a rectangular opening for the stirrup-strap, are typical of the second half of the 8th century to the first half of the 9th century (Finno-ugry…, 1987: 189, pl. LXXVIII, *1*). Identical artifacts were discovered at the southern Siberian sites (Kubarev, 2005: 120, 209, 309).

Celts. There are eight items, similar in their type and manufacturing technology, but different in size (see Fig. 8, *4*, *5*). According to Konikov, elongated items could have been used as small hoes (2007: Fig. 167). However, celts-hoes found at the Bergamak II site, in the Irtysh basin, had a more elaborated working portions, which were wider and thinner (Tataurov, 1999: 118). Such tools are known from the sites of the Ust-Ishim culture (Konikov, 2007: Fig. 164, 165).

Clay ladles for molten metal and a crucible. These artifacts were found during excavations at the Murlinka fortified settlement in 1965. Both ladles had tails in the form of handles (Fig. 8, *6*, *7*). The use of the items is evidenced by bronze scale on their inner walls and by traces of ceramic blistering on the outer walls. Such clay ladles for molten metal, and crucibles, are typical of the Ust-Ishim settlements (Ibid.: Fig. 176, 177).

Weapons. Five iron (Fig. 9, *1–5*) and two bone stemmed (Fig. 9, *6*, *7*) arrowheads, as well as one iron knife (Fig. 9, *8*), were found. Two iron arrowheads are flat (one of these is diamond-shaped, the other is chisel-shaped); three arrowheads are trihedral, with the center of gravity displaced to the killing portion. One bone arrowhead is trihedral, the other is tetrahedral. The stemmed knife has a straight, evenly tapered blade. Arrows of such type appeared in the Irtysh basin in the late 9th century AD, during migrations of population from the area of distribution of the Srostki culture (Savinov, 1984: 104–106).

Ceramic items. All vessels are round-bottomed, and jar-shaped, with slightly bulging bodies. These are carelessly made of poorly kneaded paste, and slightly under-dried. Ornaments composed of oblique comb-stamp imprints, forming parallel rows, "herringbones", or more complex geometric compositions, are arranged along the rims and in the upper portions of the bodies.

Cannelures or rows of pits serve as separators. Certain decoration elements in the form of arcs or rows of parallel depressions are below the ornamentation zones (Fig. 9, *9*, *11*). The ware is similar to the Ust-Ishim pottery (Bolshanik, Zhuk, Matyushchenko, 2001: 166–169; Konikov, 2007: Fig. 137).

Dating, and cultural and ethnic attribution

In general, finds from the cemeteries under consideration, along with the Ust-Ishim materials from the Murlinka fortified settlement, allow a conclusion to be drawn about the formation of the complex in the 10th century, within one or two centuries after the arrival of the Turks in the Middle Irtysh basin. From our point of view, this is evidenced by a change in the burial rite, i.e. transition from cremation to inhumation. However, the turkization process in this territory had not been completed by that time.

Migration by the Turks caused replacement of population in the Middle Irtysh basin. Konikov reasons that the northern (the Middle Irtysh) version of the Kimek-Kipchak culture was established in the forest-steppe and southern-taiga Irtysh region with the participation of Turks (2007: 253–258). Upon the arrival of the Turks, a smaller part of local population was forced out, while the predominant part underwent assimilation. The latter was reflected in all segments of the material and intellectual culture of the Irtysh basin inhabitants in the late 8th to the 10th century. The items manufactured by Irtysh craftsmen suggest deep interpenetration between the cultures of migrants and that of the local population, and profound influence from the southern Siberian component on formation of the Middle Irtysh population's culture.

Analysis of bronze castings allows the conclusion to be drawn that development of bronze casting technologies and design subjects in the Tara region of the Irtysh proceeded under the influence of traditions that formed in the Perm Territory and in the Kama and Lower Ob regions (in the middle of the 1st to the early 2nd millennium AD). In these territories, artifacts similar to the Irtysh ones were found, in terms of the volume-openwork casting technology and anthropo- and zoomorphic images design. This was also true for the Middle Ob basin, where artifacts, although being reminiscent of the Irtysh ones, are characterized by a variety of animal images in decoration, a greater realism of representations (especially anthropomorphic ones), and by the volume-casting technique. According to Chindina, figurines from the Irtysh basin are considerably less different from those found in the Ob basin than from the Perm castings (1991: 65). The close similarity between the artifacts can be explained by sustainable relations between the inhabitants of the Ob and Irtysh regions, which were maintained directly through the Vasyugan Swamp. Contacts between the local residents and newcomers became more intense after the resettlement of Ugrian people to the southern-taiga and taiga Ob-Irtysh interfluve from the forest-steppe zone of Western Siberia under the influence of southern migrants in the late 9th century AD. Obviously, the complex of Murlinka kurgans in the Irtysh basin was situated at the intersection of trade routes, and, possibly, also migration flows.

Conclusions

In the late 1st millennium AD, a new population was formed in the Middle Irtysh region under the influence of the turkization processes. This population may be associated with the Kimeks and Kipchaks, whose archaeological sites belonged to the Srostki culture. The new population, which included groups of local Ugrians, maintained ties with inhabitants of the Ob region, the northern taiga of the Kama region, and the lower reaches of the Ob (Konikov, 2007: 248–249, 256).

According to a number of researchers, in the early Middle Ages the following archaeological cultures existed sequentially in the Omsk region of the Irtysh: Potchevash, Ust-Ishim; and during the advanced Middle Ages, groups of Siberian Tatars were formed. In our opinion, at the end of the Potchevash period, a new, basically Turkic-speaking, population was formed in the forest-steppe and southern-taiga Irtysh region as a result of Srostki people's arrival. This new population left sites belonging to the Middle Irtysh Kimek-Kipchak culture. This culture, from our point of view, is in no way associated with the Ust-Ishim culture. It may be concluded that the Ust-Ishim archaeological culture disappeared, because from the beginning of the 1st millennium AD, the Middle Irtysh area became a part of the Kimek-Kipchak world, which is genetically related to the Srostki culture.

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L.A. Bobrov and D.M. Ismailov
Novosibirsk State University,
Pirogova 1, Novosibirsk, 630090, Russia
E-mail: spsml@mail.ru; ismailov_dm@mail.ru

A Central Asian Helmet from the Northern Kazakhstan Regional Museum

We describe a richly decorated iron helmet owned by the Northern Kazakhstan Regional Museum in Petropavlovsk. It consists of a low solid hemispherical crown, a slightly convex plate, made of copper alloy, with an opening for a (missing) tube in which the plume was inserted, a wide iron hoop, and a bipartite visor of the box type. The two last-named elements are covered with Arabic inscriptions inlaid in gold. Those on the hoop are verses from the Quran 2, 255–257, Al-Baqarah—The Cow. That on the "shield" of the visor is a prayer for protection, known as the "message of peace" read before a long journey or a difficult and dangerous enterprise, such as a battle. Such helmets were common in Central Asia between the late 16th and the mid-18th centuries. This specimen was likely manufactured in Mawarannahr, Xinjiang, or some town on the Syr Darya, for a high-ranking Uzbek, Uyghur, or Kazakh warrior. This accounts for the combination of a solid crown and a hoop with Arabic inscriptions with a box-type visor typical of helmets worn by Mongolian and Turkic nomads during the Late Middle Ages and the Early Modern Age. The closest parallels are found in the museums of Kazakhstan. Judging by the traces of repair and reconstruction, this helmet was used for a long time.

Keywords: *Central Asia, Kazakhstan, Mawarannahr, armor, helmet.*

Introduction

The Northern Kazakhstan Regional Museum (NKRM, Petropavlovsk) owns an iron helmet decorated with gold inlay (Inv. No. NKRM No. 455). Its construction and decoration pattern are quite original. The helmet is of interest to Russian and foreign archaeologists, ethnologists, and weaponologists.

The helmet was described for the first time in 2015 by S.O. Baitenova (2015), the Head of the Ethnology Department of the Northern Kazakhstan Regional Museum, who provided information on the date and circumstances of the helmet's acquisition by the Museum, as well as a brief description. It was established that the helmet was among the first exhibits acquired by the Museum in the 1930s. Baitenova supposed that the helmet was submitted to the ethnological collection of NKRM together with a set of items "relating to the Kazakh material culture" (Ibid.: 79). Unfortunately, the formalities for the museum pieces acquired in the 1920–1940s were not properly completed; thus, the first record concerning the helmet is dated to the 25th of July 1950. Kazakh scholars dated the helmet to the 15th century, and correlated it with the Eastern Desht-i Qipchaq nomad armor-set of the relevant period. The Arabic inscription was decoded by Zeinulla Kamallitdinov, an imam of the Din-Muhammad Mosque in Petropavlovsk.

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According to him, verses of four ayats from the two Quran surahs and the name of the warrior Akhmed Yakub-uly were inscribed on the hoop. The inscription on the helmet visor is "The Prophet Muhammad is with you" (Ibid). Baitenova also cited the attribution of the helmet by T. Rustemov, a resident of Chimkent, who "came to the conclusion that the name of Akhmed Yakub-uly was inscribed later, and the inscription was related to the son of Zhakyp Abulais, the Khan of the Western Fergana Khaganate… T. Rustemov believed that father of Yakub (Zhakyp) was born and grew up in Samarkand, and wrote several books explaining surahs of the Quran" (Ibid.: 80).

This article gives a description of the helmet's construction and decoration, as well as a more accurate estimate of its age and attribution.

Description of the helmet's construction and decoration

The helmet is made of iron, with a solid crown, and its dome is hemispherical (Fig. 1). It is 23.5 cm high (without the missing plume-tube) and 21.0 cm in diameter. Its characteristic feature is a low, solid hemispherical crown. The signs of damage are insignificant; these are mainly scratches and shallow depressions. A wide (4.5 cm) iron hoop with even edges is riveted to the lower part of the crown. Rivets with copper or gold-coated heads were pinned along the hoop's upper edge. The central part of the hoop is decorated with ornamentation inlaid in gold. The pattern consists of a row of subrectangular horizontal "cartouches", framing Arabic inscriptions and images of miniature two-petaled stems. The cartouches' lateral sides are decorated with semicircular scallops with double gold edging; their backgrounds bear a dotted gold design; and the space between them is filled with motifs of flourishing five-petaled flowers, surrounded by twisting vegetative shoots. The main pattern on the hoop is bordered above with a chain of open rings, surrounded by gold "sparkles", and below with a string of S-shaped curls. The inscriptions on the hoop are quite well preserved as compared to the upper and lower decorative bands, which are badly worn, and the gilding is mostly missing (Fig. 1).

Fig. 1. Helmet from NKRM (Inv. No. NKRM No. 455).

Fig. 2. Visor and fragment of hoop of the helmet from NKRM.

A thick box-type visor, consisting of a horizontal "ledge" 1.7 cm wide and a vertical "shield" 2.3 cm wide, is riveted to the forehead part of the helmet. The pentagonal "ledge" is decorated with vegetative motifs, surrounding the "cartouche" with Arabic inscriptions in the center. The "shield" has a vertical stiffener and a weakly defined rim along its lower edge. The lateral blades of the visor show two pairs of rivets connecting the visor to the crown (Fig. 1, 2). Almost the entire "shield" surface is covered with gold inscriptions in Arabic; the lower border is decorated with a row of "pearls" inlaid in gold (Fig. 2). The manufacturing technique and style of the motifs on the hoop and the visor are identical, suggesting that the ornamentation was executed by a single artisan.

The helmet is topped with a slightly convex plate made of copper alloy, serving as a base for the decorative top. The plate's border is slightly thickened. The plate is fixed to the crown with rivets with copper heads. In the center of the plate, there is an opening for a (missing) tube in which the plume was inserted. The material and working-technique of the plate differ considerably from those of the helmet's other elements, suggesting that the plate was added to the helmet later. Probably, the copper plate replaced the original iron plate, damaged in a battle, which would have been consistent with the ornamentation on the hoop and visor.

The lower edge of the hoop shows 14 openings, into which loops of copper alloy were inserted. These loops served for attaching an aventail (only a few loops have survived). Most likely, the aventail was made of mail. It was attached to the iron rod passing through the loops at the lower edge of the hoop.

Of great interest are the inscriptions, which were read and attributed by V.N. Nastich, Head of the Oriental Manuscripts Department of the Institute of Oriental Studies RAS*. It has been established that the forehead part of the helmet hoop contains verses from the Quran 2, 255–257, Al-Baqarah—The Cow. The inscription on the "shield" is a popular prayer for protection, known as the "message of peace", which was read before a long journey or a difficult and dangerous enterprise, such as a battle.

Dating and attribution

The helmet can be dated and attributed on the basis of analysis of its construction, and the decoration of the crown, visor, and hoop. Solid helmets with hemispherical crowns were already used by the warriors of Western Asia during the early and

*The authors highly appreciate V.N. Nastich's contribution in the reading and interpretation of the inscriptions.

a *b*

Fig. 3. Fragments of helmets from NKRM (*a*) and NMRK (*b*).

middle medieval period (The Arts…, 2008: 314, 316; Gorelik, 1983: 262, pl. VIII, fig. 11, 12; p. 264, pl. IX, fig. 2; 2002: 75, fig. 24, 26). During the late medieval period, such helmets were worn by the Siberian Tatars, Uzbeks, Kazakhs, Oirats, Tibetans, Bhutanese, and other nations (LaRocca, 2006: 7, 99, 134, 135; Bobrov, Hudiakov, 2008: 458, fig. 189; Bobrov, 2009). However, the main dating characteristic of the helmet is the box-type visor consisting of a "ledge" and a "shield". It is the typical element of helmets of the 15th to mid-19th centuries from Central Asia and continental East Asia (Akhmetzhan, 2007: 153; Bobrov, Hudiakov, 2008: 418, 426, 432, 440–444, 446, 447, 450–452; Anisimova, 2013: 276, 277; LaRocca, 2006: 7, 73–75, 77–79, 82, 85, 86, 91, 99; Bobrov, Anisimova, 2013). Pentagonal bipartite visors with wide "shields" and distinctive stiffeners are typical of this period. For instance, the Oirat helmets of the late 16th to early 18th centuries were provided with such visors (Bobrov, Hudiakov, 2008: 440, 441, 443, 444).

The combination of the solid hemispherical crown and the box-type visor is most often found on battle and festive headgears from the Bhutan and Tibet of the 18th and 19th centuries (LaRocca, 2006: 7, 99, 134, 135). However, the presence of Arabic inscriptions on the hoop excludes the possibility that this helmet was manufactured by the Tibetan or Bhutanese artisans, who professed Buddhism.

Ottoman, Mamluk, and Iranian headgears with solid hemispherical crowns decorated with gold inlay are also known (Robinson, 2006: Pl. VIIa, IXc; The Arts…, 2008: 316). Some Ottoman and Iranian helmets of the 16th–19th centuries are decorated with horizontal subrectangular "cartouches" with scalloped edges (Gosudareva Oruzheinaya palata, 2002: 60–62, 64; Khorasani, 2006: 716). Their interiors are covered with Arabic inscriptions or vegetative ornamentation. Some helmets have "cartouches" alternating with four-petaled flower images (Gosudareva Oruzheinaya palata, 2002: 60–62; Khorasani, 2006: 716). Such decoration of the helmet from NKRM is similar to that of the pieces of armor from Western Asia. But riveted hoops and, especially, bipartite box-type visors are not typical of Ottoman or Iranian helmets. This observation hampers attribution of the specimen under study to the Western Asian products.

The noted combination of the solid crown with Arabic inscriptions and the Mongolian-Turkic box-type visor suggests that the helmet was produced by the Muslim artisans of Central Asia or Kazakhstan. Its closest parallels can be found in the collections of the Central State Museum of Kazakhstan (CSMK) and the National Museum of the Republic of Kazakhstan (NMRK). Unlike the hemispherical helmet under study, the solid crown of the helmet from CSMK (KP 2070/7) has a sphero-conical shape*, but on the forehead part of the helmet, the same typical box-type visor is attached, though with slightly different decoration. The lower part of this helmet is decorated with a "pseudo-hoop" of the Arabic inscriptions inlaid in gold. The "ledge" and

*It cannot be excluded that prior to installation of the copper plate, the helmet from NKRM also had a sphero-conical shape, formed by the conical or hemispherical plate and the plume-tube.

"shield" of the visor are covered with vegetative ornamentation (Akhmetzhan, 2007: 153, fig. 17). The helmet from CSMK was manufactured by Central Asian or Kazakh artisans. This suggests that the combination of the box-type visor and solid crown, bearing Muslim symbols, was not something exceptional for the products of local armorers.

The peculiar motif in the form of a chain of open rings on the hoop is important for attribution of the helmet from NKRM. In our opinion, this design, inlaid in gold, imitates the technique of decoration of weapons with rows of small round "chases" for precious and semiprecious stones or pieces of colored glass, traditional in Central Asia during the late medieval period (Khudozhestvennoye oruzhiye…, 2010: 96–99, fig. 161, 163, 165, 167, 168, 172, 173; Anisimova, 2013: 261, 267, 270, 271, 273, 276–277). The pattern of gold "pearls" on the visor of the helmet from NKRM also occurs on the battle and festive headgears produced in Central Asia and Iran: "Kuchum's cap" from the Kremlin Armory (OP-164), the "Kula-khud" helmet from the Russian Museum of Ethnography (No. 3806-1), a lobster-tailed pot helmet from the Military Historical Museum of Artillery, Engineers and Signal Corps (No. 0138/95), and others (Gosudareva Oruzheinaya palata, 2002: 50–52; Bobrov, Anisimova, 2013; Bobrov, 2014).

Our hypothesis on the Central Asian origin of the headgear from NKRM is also supported by the famous gilded helmet (ПМО УК 8228) from the collection of NMRK. Certain elements in the decoration of this helmet are nearly identical to the relevant features on the headgear under study. For instance, the dome of this helmet is decorated with gold "cartouches" with scalloped edges framing the Arabic inscriptions; the "cartouche" background is covered with the same dotted design, and the edging is decorated with a row of typical S-shaped curls (Fig. 3).

Conclusions

The typological analysis makes it possible to specify the time of manufacture, and also the attribution, of the helmet (Inv. No. NKRM No. 455) from the collection of the Northern Kazakhstan Regional Museum. Most likely the helmet was forged by armorers from Central Asia or Southern Kazakhstan from the second half of the 16th century to the middle of 18th century. The helmet could also have been manufactured by artisans from Mawarannahr, Xinjiang, or the cities in the Syr-Darya region, for a high-ranking Uzbek or Kazakh warrior, which would have influenced the construction and decoration of the headgear. It is noteworthy that the three helmets mentioned above, and demonstrating similar decoration, were found in Kazakhstan. Judging by the traces of repair and reconstruction, the helmet under study might have been used as a battle or festive headgear for a long time, until the mid-19th century.

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E.E. Nechvaloda
Institute for Ethnological Studies,
Ufa Federal Research Center, Russian Academy of Sciences,
Karla Marksa 6, Ufa, 450077, Russia
E-mail: pishi-nikonor@yandex.ru

The 18th-Century Udmurt Women's Outfits Depicted in J.P. Falk's Book: Interpretation and Attribution

This study describes three engravings in the book by Academician Johan Peter Falk, showing Udmurt women in traditional outfits. Falk headed one of the most important expeditions of the 18th century, sponsored by the Russian Academy of Sciences. According to the figure captions, the women are Votyak, Bashkir, and Mishar, respectively; but ethnographic data suggest that two of these attributions are wrong. On the basis of comparison of the women's outfits to those drawn by members of other 18th-century expeditions and of late 19th to early 20th-century ethnographic sources, relating to the composition of outfits, their construction, decoration, and ornaments, all the three women are Udmurt. The "Votyak" outfit matches that of the southern Udmurt, the allegedly Mishar woman is central Udmurt, and the one said to be Bashkir is northern Udmurt. The accuracy of detail allows us to specify not only the ethnicity of the women, but their social status as well. The so-called "Votyak" and "Bashkir" outfits are those worn by married women, and that of the alleged "Mishar" is a girl's dress. Generally, accurate representations, such as those illustrating the proceedings of the 18th-century expeditions from the Academy of Sciences, are a valuable and underexplored source of information.

Keywords: *18th century academic expeditions, Johan Peter Falk, traditional outfit, early representations, Udmurt, graphic images attribution.*

Introduction

Images of people of various ethnicities, wearing traditional outfits, from the book by J.P. Falk, represent a valuable source of historical and ethnological information. The engravings were based on drawings from life; they accurately show every detail, and do not repeat any illustrations from the works by other scholars and travelers of the 18th century (Zhabreva, 2007; Vishlenkova, 2011: 49). The ethnic types from Falk's book were rarely reproduced. Until recently, these images have not been analyzed by ethnologists, and have not been used by folk outfit specialists in their publications. This article provides an ethnological analysis of the three images from the book.

Analysis of the graphic sources

One of the images of a woman in a traditional outfit from the illustrations in Falk's book (1786: Bd. 3, Tab. XXXII) is provided with the caption "Eine Wotjakin"—'Votyak woman' (hereinafter, "Votyak"). The Udmurt woman is shown in front and back views. The characteristic features of the traditional Udmurt outfit are rendered: a high headdress *aishon*, a fringed shawl *syulyk*, caftan *shortderem* of white cloth (obviously hand-made cloth), with false sleeves with slits in the upper parts, and Udmurt bast shoes with pointed toes (Fig. 1). The Udmurt women used to wrap their feet with black cloth, which footwear was designated as *kuttor* in the

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Fig. 1. "Votyak" (Falk, 1786: Bd. 3, Tab. XXXII).

Sharkansky and other central districts. The decorative details of the outfit are shown accurately. The Udmurt people of the Kosa River used to double the inner side of the shirt cuff with red fabric; such shirts were worn with the cuffs turned up in order to show this red edging (Lebedeva, 2008: 24–25). The turned up red ends of sleeves shown on the engraving evidently illustrate this tradition. The sleeves decorated with longitudinal red fabric strips represent a typical feature of the Kosa Udmurt woman's shirt *gorden* with the red ribbons sewn lengthwise. The Kosa Udmurts used to edge the slits of caftan sleeves with red fabric strips: the same edging is shown on the image under discussion.

The ornamentation of the shawl in the engraving is not clearly seen, yet the specific features of the Udmurt *syulyks* are visible: 1) in the corners, rhomboids are rendered (four Trees of Life *pispu puzhi* were rested on the similar rhomboid vertices); 2) small black elements of pattern on the white background of the *syulyk* are similar to small rhomboids and triangles that constituted the image of the Tree of Life; 3) the rhomboid with triangles at its vertices, placed at the center of the shawl, corresponds to small rhomboids surrounded by triangles, which were often put in the center of the composition. The manner of wearing the shawl shown in the picture meets the tradition of one from the southern Udmurt group: the *syulyk* is not spread over the shoulders, but draped in two pleats hanging down from the top of the headdress. This way of wearing *syulyk* was recorded in Zavyalovo of the former Sarapulsky Uyezd, Vyatka Governorate (Ibid.: 91, photo 82). In other Udmurt groups, it was acceptable to wear shawls spread over the shoulders (Manninen, 1957: S. 72, Abb. 24).

On the "Votyak's" breast, there is no embroidered or appliqué breast garment (*nagrudnik**). Instead, appliquéd ornament is shown in the form of a rhomboid made of red strips; from its top, a strip is running, which rests on a delta-shaped figure. To the left of it (i.e. on the right side of the breast), another vertical red strip is shown. It can be assumed that the red strip near the right shoulder frames the chest slit, which in the old Udmurt shirts was made from the right side. The Udmurt woman is shown wearing an *aishon*— a dress for married women, who had to wear a textile breast garment (*kabachi, muresaz*) over the shirt, according to the northern Udmurt tradition. In the southern Udmurt outfit, the textile breast garment *kykrak* was worn under the shirt. The "Votyak's" outfit's features (the way of wearing the *syulyk* shawl, the absence of a breast garment over the shirt) suggest that the engraving shows the southern Udmurt women's clothing set. The features in common with those of northern Udmurt outfit are explainable by both's having originated from the ancient stratum, on the basis of which the traditional Udmurt outfit was developed. These features survived longer in the northern regions, in particular in the Kosa Udmurt outfit, than in the southern regions: by the end of the 19th century, such features were lost.

The representation of the Udmurt women's outfit from Falk's book matches well to the representations and descriptions from the materials of his contemporaries. In publication by D.G. Messerschmidt, an Udmurt woman is depicted wearing a high headdress named "ashkon" (Napolskikh, 2001: 86, 140). The engraving from G.F. Miller's book shows an Udmurt woman wearing a caftan with false sleeves, and a headdress *aishon* with a high frame, with an attached shawl, one corner of which hangs down at the front (1791: 20, ill. 5). J.G. Georgi (2005) provides the image of an Udmurt woman wearing a similar high headdress, covered with a white shawl with red fringes, a caftan similar to that

**Nagrudnik* is a typical folk name for the short tunic-like garment that was put over the undershirt.

of Falk's "Votyak" woman, which has false sleeves with slits, and a shirt with the sleeves similarly decorated with longitudinal red strips. Over the caftan, both in "Votyak" by J.G. Georgi and "Votyak" by J.P. Falk, there is a waist apron.

The published materials of Falk's expedition also contain other illustrations that, as we believe, represent the sets of the Udmurt traditional outfit. However, the caption to one of the figures states "Eine Baschkirin im Sommer Anzuge" ('Bashkir woman in summer outfit'; hereinafter, "Bashkir") (1785: Tab. XXXV), and the caption to the other figure is "Eine Metscherjakin in Sommerskleidung" ('Mishar woman in summer clothing'; hereinafter, "Mishar") (Ibid.: Tab. XXXVI). The outfit and adornments of the "Bashkir" (Fig. 2) do not match any sets of the Bashkir traditional women's outfit. This image differs considerably from the images known from the publications by P.S. Pallas and J.G. Georgi, and does not agree either with the contemporaneous descriptions of the traditional Bashkir clothing, or with more recent ethnological materials. The "Bashkir" is shown wearing a cross on her breast (Bashkirs are Muslims), bast shoes and black puttees, an apron, and necklaces of alternating red and black beads instead of the traditional Bashkir women's adornment in the form of a breast garment decorated with coins and coral beads. Such necklaces, aprons, black puttees, and bast shoes didn't form part of the traditional Bashkir women's outfit of the 18th century. I.I. Lepekhin wrote that neither Bashkir women nor men ever wore bast shoes (1772: 151).

The "Mishar" woman looks equally strange (Fig. 3). Her outfit cannot be regarded as a Tatar folk outfit because of its elements and their composition. The adornments shown on the "Mishar" woman image do not correspond to the Tatar tradition. One of them is a long string of multicolored beads, with a cross in the middle; another is a pair of earrings in the form of question marks, connected to one another through a long string of large and elongated white "grains" (probably representing cowrie-shells). Mishars never wore necklaces with crosses, because they are Muslims. The earrings of this form, connected by a string of beads, were not known to either Mishars, or other Tatar groups. The manner of wearing an apron rendered on the picture in Falk's book does not match the Tatar tradition either. The "Mishar" picture shows a waist apron, tied over the caftan. The apron was not an essential element of a

Fig. 2. "Bashkir" (Falk, 1786: Bd. 3, Tab. XXXV).

Fig. 3. "Mishar" (Falk, 1786: Bd. 3, Tab. XXXVI).

traditional Tatar women's outfit; it was never tied over outerwear. Engravings from the 18th century never show a Tatar woman wearing an apron. The alleged "Mishar" is represented in bast shoes with pointed toes, while the typical Tatar bast shoes had straight toecaps. At the head of the "Mishar", a hemispherical cap sewn with small coins is depicted. Headdresses decorated with coins were part of the traditional Mishar outfit (Mukhamedova, 1997: 55, 56; Georgi, 2005: 131, 219), but they were not their distinctive feature. The hemispherical caps covered with coins, similar to that shown on the "Mishar's" head, were recorded as parts of the outfit of a young woman/bride in many folks of this region: the Tatars (Mishars) (*taika*), Chuvashs (*tukhya, tokhya*), Mari people (*takiya, takia*), and Udmurts (*takya*).

The question is: who is shown on the engravings under the names of "Bashkir" and "Mishar" women? The outfits in the engravings were typical of the peoples from the Volga-Ural region: clothing made of white linen, decorated with embroidered motifs and sewn-on red strips; a long linen shirt is worn together with outerwear of white linen. As mentioned above, the depicted women could have been neither Tatar, nor Bashkir. They could not have been Mordovians (neither Moksha, nor Erzya), because their outfits differed greatly from that shown in the engraving (parts of clothing, their decoration, way of wearing).

Parallels of the depicted outfit elements are known in the traditional clothing of the Mari, Chuvash, and Udmurt peoples. However, the Chuvash and Mari garments demonstrate not only features in common with the discussed outfits, but also significant distinctions. The Chuvash women's outfit included towel-like headdresses (like that on the "Bashkir" image), caps with coins (like that on the "Mishar"), necklaces with crosses (Belitser, 1971: 328), black puttees (Ibid., 329), and aprons of a similar construction (Nikolaev, Ivanov-Orkov, Ivanov, 2002: 63, ill. 49). However, in the Chuvash traditional outfit, the apron was not tied over the caftan; the pattern of sleeve decoration was other than that depicted on the "Mishar"; there were no question-mark earrings, connected with a string of beads; and the shape of the Chuvash bast shoes was different. An apron tied over a caftan was part of a set of white linen garments worn by the Meadow Mari; they also used to wear earrings connected with a ribbon or a chain, resembling the adornments under discussion (Shikaeva, 1987: 140–141, fig. 5; Mariyskiye ukrasheniya…, 1985: 14, 32), black puttees, hemispherical caps decorated with coins, and thick chains with crosses. However, wearing a caftan together with a shirt was not obligatory in either the Mari or Chuvash tradition (Molotova, 1992: 56). Meadow Mari women wore such an outfit only for festivals. The engravings in the books by P.S. Pallas and J.G. Georgi show the Chuvash women wearing only shirts without caftans, like the Mari woman on one image from J.G. Georgi's book. According to materials from the 16th–17th centuries, the Mari didn't wear hemispherical girl's caps together with the question-mark temple rings (as in the "Mishar's" outfit), because such rings were part of a married woman's outfit (Shikaeva, 1987: 139). Mari bast shoes differed in their shape from the shoes with pointed toes depicted in the engravings. The manner of wearing the head towel by the "Bashkir" is not typical of the Chuvash or Mari. Decoration of the "Mishar's" sleeves and the "Bashkir's" caftan's front flaps also don't show any parallels to the Mari and Chuvash folk outfit. Hence, the available ethnological materials indicate that the alleged "Bashkir" and "Mishar" images could have portrayed neither a Chuvash nor a Mari woman. This is not surprising, because Falk's expedition did not manage to reach the main areas of the Mari and Chuvash compact settlement, located westwards of the expedition's route. Therefore, it is very doubtful that the expedition members were able to make visual records of the Chuvash and Mari traditional outfits.

Notably, certain elements of the depicted outfits can be observed in the clothing of various folks populating the Volga-Ural region. The "Bashkir's" set as a whole, including outfit elements, their cut, decoration, and way of wearing, among the various clothing sets of the region, demonstrates the closest similarity to that of the northern Udmurt people of the Lower Cheptsa. This garment set differs considerably from the traditional clothing of other peoples of the Volga-Ural region. The route of Falk's expedition passed through the areas populated by Udmurts in the Vyatka Governorate. This is a probable reason why many features of the clothing in the depicted "Bashkir" and "Mishar" women find their parallels in the Udmurt women's folk outfit.

The "Bashkir's" clothing matches well the traditional women's garment set of the Kosa Udmurts (clothing of white linen, decorated with sewn-on strips of red fabric): *derem* shirt, *shortderem* caftan, *ashshet* waist apron (tied over the caftan), *vesyakkyshet* head towel (it covered the head tightly, with its ends tied in the back), bast shoes with the pointed toes typical of the Udmurt, and black puttees on the feet. The caftan and the apron were essential elements of both festive and everyday outfits of the Udmurt women. All available engravings of the 18th century show the Udmurt women wearing caftans. Strings of *gad ves* multicolored beads were essential elements of the Udmurt women's clothing set (Kosareva, 2000: 55). The *ugykal* adornment, consisting of the earrings connected with a chain, was an element of the festive outfits of the Udmurt women and girls from the Kosa River's basin (Ibid.: 56; Lebedeva, 2008: 27). The quotation-mark earrings were also used by the Udmurts earlier; such adornments have been found in archaeological sites dated to the 16th–17th centuries

(Shikaeva, 1987: 150). The necklace with a copper cross (*kiros*, *kiroskal*) was widely used by the Udmurts (Belitser, 1951: 75; Kosareva, 2000: 85).

The Kosa traditions are obvious in the specific shape of the collar and the decoration of front flaps of caftan shown in the "Bashkir" image. The caftan depicted in the engraving from Falk's book shows a turned-down collar, which is seemingly spaced away from the flap's edge, forming a peculiar step. Such a shape of the turned-down collar was typical of the festive caftans of the Kosa Udmurts, and followed the traditions of its decoration: "In the festive caftans, the front flaps were incised at breast level, perpendicular to the edge of the flap… and over the incision, they were turned outwards to form rectangular lapels… These lapels were edged and built up with silk ribbons on the right side, and with white linen on the inner side" (Kosareva, 2000: 32). The discussed engraving shows the caftan collar edged in the same manner with a red strip and fabric of another color. Below the collar, the caftan's flaps are decorated with transverse strips at the edges. This tradition of decorating the flaps of the white linen caftans with horizontal strips of fabric of contrasting colors sewn along the edges was also typical of the festive caftans of the Kosa Udmurts outfit. Transverse strips on the caftan's front flaps at breast level can also be seen in the image of "Votyak" from the Miller's book (1791: Ill. 5).

In the women's caftans of the Kosa Udmurts, there were slits edged with red fabric in the upper parts of sleeves for threading the arms. The "Bashkir" image in the engraving shows a red transverse strip in the upper part of the sleeve; in one place it runs slightly beyond the sleeve's outline, and in another it seems to flatten the sleeve. Obviously, this demonstrates the edging with red fabric of the slits in the caftan sleeves; hence, the patterned sleeves below these red strips are the shirt sleeves. Their ornamentation consists of longitudinal strips and chains of rhomboids. The Kosa Udmurts decorated the sleeves of their *gorden* festive shirts in similar way: with longitudinal strips of *kechaten* embroidery (each representing a chain of rhomboids), and with strips of red fabric sewn on along the embroidery (Kosareva, 2000: 29–31).

The opening between the caftan's front flaps in this representation does not show the breast slit of the undershirt (as in the "Votyak" image described above). The "Bashkir's" breast between the caftan's front flaps is decorated with vertical zigzags, which join one another, forming a chain of rhomboids in the center. This is probably the decoration of the women's embroidered breast garment *kabachi*, which was worn under the caftan, upon the shirt. It was an essential element of the old women's outfit of the northern Udmurts. The embroidered motif on breast garments often had a net structure, with rhomboid cells (which were sometimes left open).

The outfit set depicted in the engraving includes a white waist apron (probably of linen). The *ashshet* waist apron (which was worn over the caftan till the end of the 20th century) was an essential element of the Kosa (Lower Cheptsa) Udmurt traditional outfit set (Ibid.: 50). This set also included adornments similar to those depicted on the "Bashkir". In the engraving, the woman's breast is decorated with a necklace of alternating light and dark medium-sized beads, with a large cross in the middle, and a string of large beads, hanging from her ears. The cross was a typical adornment of the Lower Cheptsa (Sloboda) Udmurts (Ibid.: 85). The *ugy kal* earrings with a chain hanging from the ears to the breast were in use among the Lower Cheptsa Udmurts, in particular Kosa Udmurts, and earlier also Sloboda Udmurts (Lebedeva, 2008: 27; Kosareva, 2000: 85).

The analysis of clothing of the woman designated as "Bashkir" in the engraving suggests a correlation of this outfit, in terms of its composition, cut, way of wearing, and decoration features, with the Lower Cheptsa set of the Udmurt traditional women's outfit (primarily, with its Kosa version). The engraving shows a festive dress of a married Udmurt woman.

The set of clothes depicted in the "Mishar" (headdress, outerwear, clothing decoration, shoes, and adornments) demonstrates the closest parallel to the Udmurt folk outfit. The "Mishar" woman is represented in outerwear of white linen with an apron. The apron, as in "Votyak" and "Bashkir" (i.e. representations of Udmurt women), is sewn without a bib, and is tied over the caftan; in its construction and decoration it is similar to the "Bashkir" (Udmurt) woman's apron. The cut and manner of wearing of the "Mishar's" apron are close to those of the traditional Udmurt outfit of the 18th century. The decoration of sleeves in the "Mishar's" caftan is the most interesting with respect to the ethnic attribution. They are decorated with a complex composition of longitudinal strips (in the lower part) and a large rhomboid rosette, surrounded by angles and triangles (in the upper part); the sleeves' edges are decorated with transverse strips in the form of cuffs. The typical sleeve decoration of the Volga-Ural region peoples consists of either a longitudinal strip/strips or a rosette on the shoulder (the embroidered rosettes on the sleeves of women's shirts occur in the Chuvash, Udmurt, and Mari traditional outfits). The sleeve decoration consisting of the sewn-on longitudinal red cotton strips (in the lower part) and a large embroidered rosette (in the upper part) was recorded only on the old caftans of the central (Sharkansky) Udmurts. The embroidered rosette of subsquare or rectangular form includes small angles and triangles, which join the edges of the figure from two or four sides (Vyshitaya odezhda udmurtov…, 1987: Cat. No 338; Lebedeva, 2008: 164, ph. 186, 187; Lebedeva, 2009: 75–76, ill. 137–140). The "Mishar's"

sleeves also show rosettes surrounded by open angles. The noted similarity in the decoration patterns of caftan sleeves of the Sharkansky Udmurts to those depicted on the "Mishar" is supported by peculiar sleeve edging with horizontal fabric strips, forming a broad cuff.

The front flaps of the "Mishar" caftan do not meet together (we consider the red strips depicted on her breast as the edges of flaps, because the edges were often decorated with red fabric strips). Between the caftan's front flaps, the bib of the shirt is visible. The right side of the shirt's bib shows red and yellow vertical strips. The breast slit was usually edged with red fabric. The depicted shirt in reality probably had a slit on the right side, typical of the old Udmurt women's and girls' shirts (Kosareva, 2000: 26, 66–67). Furthermore, at the "Mishar's" breast, the placket-edging of the slit on the right side is joined by three vertically arranged triangles, with their apexes facing down. The shirts decorated with chains of three appliqué triangles have not been recorded in the traditional clothing of the Volga-Ural peoples. The Udmurt girl's shirts were typically decorated on the breast with the appliqué (made of strips of red fabric) in the form of a triangle-amulet *gadkotyrtem*, with its apex down, which joined with one of its corners to the slit (Gagen-Torn, 1960: 28; Belitser, 1951: 37; Kosareva, 2000: 29, 66). This feature may be regarded as a parallel to the "Mishar's" shirt. Notably, the tradition of decorating the clothing with sewn-on, mostly red strips of fabric is quite old, and was widespread over the Volga-Ural region in the past. This was a method of decorating and strengthening (both in the practical and magical sense) the seams, edges, and slits. This tradition included several specific ethnic versions. The Udmurt version implied the use of appliqué triangular pieces of fabric, and forming triangles and separate angles of fabric strips. Such angles were sewn on the sleeves of the Udmurt women's shirts (at shoulder-level); triangles and rhomboids were sewn on the caftan's sleeves above the slits (Manninen, 1957: S. 136, Abb. 135). "Votyak" and "Mishar" images in Falk's book show red triangles (probably appliqué), decorating the upper parts of caftans' sleeves. The Udmurt appliqués in the form of a chain of three triangles (like on the discussed engraving) are unknown to the current author; but paired triangles connected in the same way occur in the Udmurt embroidery (on *syulyk* shawls) and in the appliqués (on the old shirts of the Krasnoufimsk Udmurts, red paired triangles framed the breast embroidery) (Nikonorova, 2008; Sadikov, Nikonorova, 2009). Importantly, decoration of clothing not only with isolated triangles, but also with triangles in which an apex of one adjoins the base of another (as in the "Mishar's" outfit), agrees with the Udmurt tradition. Thus, though decoration of the bib of the "Mishar's" shirt doesn't show exact parallels to the available materials on the Udmurt clothing of the late 19th–early 20th centuries, in general it corresponds to the tradition of sewing a triangle-amulet on the breast of a girl's shirt, and of combining the triangles in the appliqué decoration motifs. Interestingly, both the "Mishar's" and "Votyak's" shirts show rhomboids fashioned with red ribbon on the lower part of the bib. It may be considered an additional proof of the compliance of the "Mishar's" outfit's appliqué decoration with the "Votyak" tradition.

In the engraving, the "Mishar" is depicted in a cap decorated with a scaly pattern of small coins, and covered with a kerchief with a red fringe. The kerchief's ends are fastened together under the woman's chin, and the fringe is spread over her shoulders. The headdress unambiguously indicates that the girl is represented in a bridal outfit. The scaly decoration of girl's caps is a version of decoration that is typical, in particular, of the Sharkansky Udmurt people. In some places, the Udmurt girls wore *takya* caps without kerchiefs, but "in the Glazovsky and Sarapulsky districts, the *takya* cap was covered with a kerchief, with its ends tied under the chin and leaving open the front part of the *takya*, decorated with silver coins" (Belitser, 1951: 57). The engraving apparently shows a girl-bride's headdress *takya* and a kerchief *takya kyshet*, typical of the central Udmurt population.

The "Mishar's" outfit shows adornments: earrings connected with a chain with a cross, hanging down to the breast. For the Lower Cheptsa Udmurts, similar earrings with chains often served as supplements to clothing; the cross was worn on a string *kiros* (Kosareva, 2000: 85). The bast shoes represented on the "Mishar's" feet have a shape typical of Udmurts—with straight weaving and pointed toes. The Tatar and Russian bast shoes look different. The set of clothes and adornments depicted on the "Mishar" generally has more parallels in the central Udmurt and Sharkan-Yakshur Bodya traditional outfits.

Conclusions

We have no doubt that the "Bashkir" and "Mishar" women images in Falk's book show clothes illustrating the Udmurt traditional outfit, and the figure captions in the book are incorrect. Taking into account the circumstances of the preparation of the Falk's manuscript for publishing, mistakes in figure captions were quite possible (Nechvaloda, 2014a, b). Three of six images of representatives of the Russian folks from Falk's book show Udmurt women wearing Udmurt women's traditional outfits ("Votyak" and "Bashkir") and a girl's outfit ("Mishar"). The three Udmurt sets of clothes are associated with various traditional outfits: the "Votyak's" outfit matches that of the southern Udmurt, the "Mishar's" that of the central Udmurt, and

the "Bashkir's" the northern Udmurt. The last-named definition raises doubts because J.P. Falk did not visit the northern Udmurts. He visited the southern part of the Vyatka Governorate, "the right bank of the Kama and the lower Vyatka" (Zapiski…, 1824: 191). Hence, the traveler could have met only the central and southern Udmurts, and could have seen outfits of Sharkan-Yakshur Bodya (central Udmurt), southern Udmurt, and Trans-Vyatka. Presumably, Falk's expedition recorded an outfit of the Udmurts living in the Perm Governorate, where its route ran; but the clothes of this Udmurt group differed considerably from the set shown on the "Bashkir" (Nikonorova, 2008; Sadikov, Nikonorova, 2009), for which reason this suggestion should not be taken into consideration. The clothing shown on the "Bashkir" was probably noted by Falk in the region to the south of the Perm Governorate, in the area of the central Udmurts' settlement; because even in the early 20th century their clothing had many features in common with the northern Udmurt outfit (Lebedeva, 2008: 156–157). These two traditions might have been even closer in the 18th century, and the similarity even larger.

It is necessary to turn to the issues of the reliability of pictorial materials of the 18th century, and the possibility of their use as a source of historical-ethnological information. Following T.A. Kryukova, an authority on ethnology, who was of the opinion that the illustrations in the P.S. Pallas and J.G. Georgi's works were "loose reproductions of the real things by an artist" (1949: 140), scholars became cautious with such materials. The current author's experience of working with early illustrations (Nechvaloda, 2016), in particular with the engravings from J.P. Falk's book (Nechvaloda, 2014a, b) makes it possible to regard the representations from the travelers' works as a valuable and underestimated source of information. For studies of traditional outfits of the 18th century it is the most valuable, because artifacts deposited in museums are scarce, and descriptions are too general. Only pictorial representations (despite their conventionality) can provide the integral image of an outfit: its composition, in part the cut, decoration, and manner of wearing, as well as local and age-related distinctions.

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M.A. Kucherskaya
National Research University Higher School of Economics,
Staraya Basmannaya 21/4, Moscow, 105066, Russia
E-mail: mayakuch@gmail.com

Wearing Folk Costumes as a Mimetic Practice in Russian Ethnographic Field Studies

Wearing folk costumes was a mimicry practiced by certain mid-19th-century Russian ethnographers and folklorists. The most consistent of these was Pavel Yakushkin, who posed as a peddler when doing field work in villages. In this he followed the instructions written by the famous writer, historian, and antiquary Mikhail Pogodin. The sources of Pogodin's ideas on how a folklorist and ethnographer should look were the Slavophiles' perception of the Russian costume, Alexander Pushkin's habit of wearing a red shirt, as well as court jokes and folk legends about top-ranking persons wearing folk costumes. While the changing of clothes first used by Yakushkin was later adopted by other ethnographers, such as Sergey Maksimov and Pavel Rybnikov, political reasons prevented it from spreading. Nevertheless, in the 1870s, at the peak of the movement of the Narodniki (Populists), using folk costumes re-emerged as a way of bringing the intelligentsia closer to the peasants and workers. The erosion and eventual disappearance of class boundaries in Soviet Russia made such ways of winning confidence pragmatically irrelevant; however, wearing traditional folk costumes as a political gesture is meaningful even today.

Keywords: *History, ethnography, Pavel Yakushkin, disguise, Russian costume, mimicry, Russian Populists.*

Introduction

A clear shift in the scholarly research of folk poetry and peasant life occurred in the mid 1830s–early 1840s, in the period of the revived public debate about the specific nature of the Russian national identity (Pypin, 1891: 1–2). However, despite the fact that ethnographic research entered a new stage of development, collectors faced serious difficulties, primarily, distrust on the part of peasants. To overcome the suspiciousness of the informants, ethnographers began to dress in folk costumes. This practice was most consistently applied by one of the first professional collectors of folklore in Russia Pavel Yakushkin, who walked around the villages wearing a red shirt and plush trousers under the guise of a peddler. According to the recollections of his contemporaries, Yakushkin, "bought goods on ten rubles, brought a carrying basket, and headed for the villages to collect traditional songs" (Leikin, 1884: LXIX).

This article attempts to reconstruct the sources behind the practice among folklore collectors in the mid 19th century of changing clothes to traditional outfits, which has not yet been described in detail by the historians of Russian ethnography. The influence of this practice on the further development of ethnography and later behavioral strategies of intellectual-populists who wanted to get close to the peasants and workers, are also analyzed.

Social mimicry by Pavel Yakushkin

Pavel Yakushkin "walked around as a peasant", "but wore glasses, because of which real peasants did not want to recognize him as one of their own, but thought that he

Archaeology, Ethnology & Anthropology of Eurasia 47/1 (2019) 127–136 E-mail: Eurasia@archaeology.nsc.ru

Fig. 1. Pavel Yakushkin. Photograph of the late 1860s. Nizhny Novgorod (from the collection of the State Museum of the History of Russian Literature).

was 'someone who put on a disguise'" (Leskov, 1958: 73). Yakushkin was the son of a nobleman, the retired Lieutenant I.A. Yakushkin, and a peasant serf woman. He graduated from the Orel Gymnasium and Department of Physics and Mathematics of the College of Philosophy at Moscow University (Balandin, 1969: 16–18), became interested in collecting, and eventually became an educated writer and professional researcher of folk culture and everyday life. Thus, the definition of "disguised" is fully applicable to Yakushkin: he indeed put on a disguise and played a role.

Importantly, after returning from his expeditions, Pavel Yakushkin continued to wear the same peasant clothes. N.S. Leikin gave its detailed description, "He wore the same outfit in St. Petersburg: people recognized him from his traditional Russian outfit and glasses. It was not the dashing Russian ballet costume worn by some of the Slavophiles of that time, who would flaunt lacquered boots, sarcenet shirts, and hats with peacock feathers. Yakushkin's caftan was made of the coarsest woolen cloth, always soiled; his boots in most cases were worn out and dirty; a low hat of lambskin was on his head in the winter and summer; his red kumach ['calico' – *translator's note*] shirt was girded with a simple belt containing a written prayer or sometimes just with a rope. I rarely saw him wearing a peaked cap" (1884: LXIX) (Fig. 1). The soiled caftan and shirt girded with a rope, which Pavel Yakushkin wore not only on expeditions, but also in the capital city, indicates that he obviously felt more comfortable wearing such an outfit. This is confirmed by the recollections of N.S. Leskov who studied with Yakushkin in the same Gymnasium, although a bit later, who claimed that negligence in clothing and hairstyle was typical of Pavel Yakushkin even in his young years (Leskov, 1958: 72).

For Yakushkin, traditional clothes, just as the "peasant words" he used, were obviously a marker of his closeness to Russian peasants. However, in popular aesthetic notions, untidy clothes were perceived as indecent (Zlydneva, 2011: 548). Only working clothes directly during work might look dirty on a working person, but not everyday clothes and particularly not festive clothes. Thus, the impression of "disguise" was probably reinforced by the untidiness of Yakushkin's outfit.

It is quite possible that Pavel Yakushkin would have started to wear peasant clothing even without starting to collect folklore: his engagement with the traditional culture only seemed to legitimize his natural inclination and self-perception. All this, however, does not explain why Yakushkin consciously played the role of a peddler, selling dry goods to peasants. Yet, the idea of dressing as a peddler did not belong to him, but was suggested by his teachers of the collection of ethnographic materials.

Sources of the social mimicry of Pavel Yakushkin

In his years of study at Moscow University, Pavel Yakushkin met with Petr Kireevsky and Mikhail Pogodin, under whose influence his interest in traditional lore and everyday life took shape. Since 1843, the student Yakushkin started to gather folklore for Kireevsky's complete collection of folk songs (Azadovsky, 1958: 328–338). In 1844, his first publication entitled "Folk Tales about Hoards, Robbers, Sorcerers, and Their Actions, Recorded in Maloarkhangelsky Uyezd" appeared in *Moskvityanin* Journal (No. 12) which was published by Pogodin. It included some of the materials collected on his first two expeditions. It was Pogodin who gave special instructions to Yakushkin on how to collect folk songs. These instructions have been preserved in the work of N.P. Barsukov (1896: 23–25).

Pogodin gave Yakushkin many recommendations. He pointed that songs should be recorded "the way they were sung", "without any corrections", and that preference should be given to historical and ritual songs, as well as spiritual poems. In fact, the same instructions essentially contained a detailed scenario of the forthcoming expedition: to walk around villages

Fig. 2. Popular print of a peasant man and woman, 1850 (from the collection of the Department of Rare books and Manuscripts at the Scientific Library of the Lomonosov Moscow State University).

in peasant dress disguised as a peddler and use small-scale trade as a reason to get acquainted with peasants. "Do not say anywhere that you came with a certain purpose—to collect songs, or anything else. Gradually, inadvertently, in passing, you should accomplish it, not showing yourself to be smart, and not feeling uncomfortable by any stupidity or vulgarity. It seems that it would be best", Pogodin wrote, "if you were to grow a beard, put on a kumach shirt with the collar off center, gird your caftan with a sash, and stock up with various small goods: earrings, rings, beads, hair and patterned ribbons, ringshaped dry rolls, and gingerbread, and start trading in the villages. Then you would have the best excuse to begin your acquaintance with village singers" (cited after (Balandin, 1969: 25–26)). Pavel Yakushkin followed this advice to the letter: he grew a beard, bought goods, and started to go around the villages with a carrying basket, selling beads and rings to peasant women, and giving gingerbread to children (Fig. 2). In addition, it is true, he treated the men with "wine" (vodka), so they would sing more willingly. It was this practice that obviously led the collector, who did not shy away from the common merriment, to quite predictable and sad consequences.

It is curious that long before that, in 1838, P.V. Kireevsky, N.M. Yazykov, and A.S. Khomyakov also compiled a brief guide for folklore collectors, "On Collecting Folk Songs and Poems", which was published in *Simbirskiye Vedomosti**. They encouraged their enlightened contemporaries to collect folk songs and poems, "these precious remnants of antiquity", and formulated the basic principles for recording the texts, "Songs that are sung among the people should be recorded word for word, all without exception, indiscriminately, disregarding their contents, brevity, clumsiness, and even the apparent lack of sense" (Parilova, Soimonov, 1968: 49; Soimonov, 1960: 148). The intersection with the rules set out in the instruction by Pogodin is obvious, but the earlier "song proclamation" by Kireevsky, Yazykov, and Khomyakov did not have a single mention about dressing as a peddler.

Such a manner of recording folklore was unique for Russia in the 1840s–1850s. This is indicated by one of the first biographers of Yakushkin, the famous ethnographer and writer S.V. Maksimov, "It must be remembered that Yakushkin's departure was new—no one had laid such a path before him. There was nowhere to study the methods; no one had yet dared to take such bold, systematically calculated steps and such daring actions—meeting face-to-face with the people. According to the spirit of that time, the plan of Yakushkin can be considered positive madness which, at least, could be justified only by the passions of youth. <…> Deciding to collect authentic

*Addition to No. 15 (April 14) of *Simbirskiye Vedomosti* for 1838.

folk songs far from being a child, but almost thirty years of age*, Yakushkin made a major literary step, without knowing it, and in any case he treaded the path on which it would be already a little easier for others to walk" (1884: XXIII).

Calling Yakushkin's departure "new", Maksimov obviously had in mind that none of Yakushkin's predecessor-collectors (albeit not too numerous) (Azadovsky, 1958: 42–112) changed their clothes to look like a peddler. Nevertheless, the instructions of Pogodin looked surprisingly well-polished, filled with confidence that this was the exact way that songs should be collected, although despite all his enthusiasm for folklore Pogodin did not put on traditional Russian clothing, much less did he sell ribbons and ringshaped dry rolls in the villages. Thus, the confidence of Pogodin must have been based not on personal experience, but on completely different sources.

The influence of the Slavophiles and P.V. Kireevsky

According to Barsukov, the instructions cited above were compiled "in the forties" (1896: 22–23); their dating is not difficult to clarify. Pogodin regretted that Yakushkin did not even want to complete his university course, preferring to go on a journey immediately. This means that this happened in the last year of his studies, that is, in the 1844/45 academic year. Yakushkin's debut story, "Folk Tales about Treasures, Robbers, Sorcerers and Their Actions…" was published in the 12th issue of the *Moskvityanin* Journal in 1844. At the end of the publication, Pogodin reported, "The author, Yakushkin, a student of Moscow University, intends to go on a trip across all of Russia to collect the remnants of our national spirit". Apparently, shortly thereafter, he wrote his instructions to his student, most likely in 1845. Precisely in the mid 1840s, the Slavophiles introduced the fashion of wearing a traditional Russian outfit and beard.

K.S. Aksakov was the first who grew a beard and dressed in the Russian traditional clothes; A.S. Khomyakov grew his beard in the fall of 1845 (Mazur, 1993: 128). Aksakov sewed himself a "svyatoslavka" (an Old Russian *zipun* 'homespun coat' with long flaps) for himself, wore an old-fashioned "murmolka" hat, boots, and a red shirt. His example was followed by Khomyakov and I.S. Aksakov. As is well known, the attempts of the Slavophiles to testify to their respect for the Russian national idea in such a way mostly caused ridicule. The famous joke of P.Y. Chaadaev, mentioned by A.I. Herzen in "My Past and Thoughts", that people on the streets took K.S. Aksakov for a Persian, is one of the numerous testimonies of public skepticism to the Slavophile venture (Herzen, 1956: Vol. 9, 148) (see also (Chicherin, 1929: 239–240)). The caustic review by the censor A.V. Nikitenko concerning the public appearance of Khomyakov in a traditional outfit (1893: 29) is also known (see also (Kirsanova, 1995: 138–139)). However, his record of the meeting dates back to January 1856—long since the time when the fashion was introduced. Thus, the idea of dressing in peasant clothes was probably taken by Pogodin from the Slavophiles, with whom he was close.

Kireevsky, who was the second mentor of Pavel Yakushkin in folklore collecting and had no less influence on him than Pogodin, also dressed simply and talked with peasants. "A nobleman who does not serve, is always keeping company with simple people, neglects all rules of haut ton, dresses in a svyatoslavka, with a bob haircut"—this is how the portrait artist E.A. Dmitriev-Mamonov, who was close to the Slavophiles, described Kireevsky (1873: 2492–2493).

The reasons why folklore collectors and Slavophiles dressed in traditional outfits were different. The Slavophiles in such a manner sought to emphasize the value of the Russian national idea, to visibly mark the connection with the pre-Petrine time, as well as to emphasize personal freedom and the right to dress according to one's desire and taste. Conversely, Pogodin offered Yakushkin this kind of mimicry for pragmatic reasons in order to inspire confidence, have the opportunity to engage in conversation with peasants, and therefore, become closer to the informants, and record folk songs more productively. Local dwellers could be suspicious about a collector who did not bother to disguise himself. Pogodin understood this well. Misadventures, which Kireevsky experienced during his trips gathering songs, were most likely known to him as well. Here is a description of one such failure of the famous collector in Ostashkov.

"I imagined", wrote P.V. Kireevsky to N.M. Yazykov on September 1, 1834, "that I would find back country, but instead I found almost the most educated uyezd town in Russia, in which every blacksmith and every gingerbread maker reads 'A Thousand and One Nights' and was already ashamed of bearded songs, but sang: 'Who could love so passionately' and even 'The dashing troika is riding full tilt'… I had hope in the outskirts and lived there for over two months, driving around to village fairs. And in fact a lot of curious things could have been gathered in that uyezd, but not in the circumstances in which I was there. To succeed, I needed: 1) to have some outside excuse for living in Ostashkov and 2) acquaintance with the landowners, but I had neither of the two and therefore not only among the common people, but even in the local beau-monde I was feared like the plague, first imagining

*Inaccuracy: P.I. Yakushkin conducted his first expeditions at the age of 21–22.

Fig. 3. Popular print of peasants, 1850 (from the collection of the Rare Books and Manuscripts Department at the Scientific Library of the Lomonosov Moscow State University).

me to be a spy and then a Carbonarist. Therefore, I had a lot of hilarious, most quixotic adventures happening to me (more on them later), but gathering songs was a complete failure" (Kireevsky I.V., Kireevsky P.V., 2006: 123)*.

Interestingly, M.P. Pogodin himself, although he traveled extensively around Russia and was seriously interested in traditional culture, rarely visited peasant houses, starting with a visit to the Governor and continuing with a visit to the Bishop (Balandin, 1969: 144). It was risky for a landowner to go around wearing peasant clothes; this led to conflicts with the police. Yakushkin survived many of them, and the famous Pskov story was only the most sensational in the long series of his misadventures (Yakushkin, 1986: 141–153). Meanwhile, Professor I.M. Snegirev collected folklore wearing his official uniform, and the head of the 3rd Department V.A. Dolgorukov in one of the internal documents referred to his experience as successful (Balandin, 1969: 126). Once, while collecting songs from the people, Kireevsky was "dragged by the collar" by a district officer (Pogodin, 1859).

Another similarity in the strategies of collecting folklore by Kireevsky and Yakushkin was payment for songs. Yakushkin sold his goods for almost free; he basically gave peasants scarves and earrings as gifts, and would often buy vodka for everyone; this livened up people's merriment and therefore increased the number of recorded texts (see, for example, a description of one of his early travels (Yakushkin, 1986: 448–449)). He could have adopted the practice of paying for the songs which he heard from Kireevsky, who, according to his mother A.P. Elagina, "gathered beggars and old men in Ostashkov and paid them money for listening to their non-paradisal songs" (cited after (Rozanov, 2006: 216)) (Fig. 3).

The red shirt of Alexander Pushkin

The Slavophile dressing in the Russian traditional outfit was the actual context that most likely influenced Pogodin's ideas concerning folklore collection in the popular environment in the 1840s. However, while compiling his instructions for Yakushkin, he could have relied on an earlier source—the experience of his good friend Alexander Pushkin, who also recorded songs and fairy tales. Pushkin was one of the main initiators of compiling a collection, which eventually Kireevsky became occupied with, and the former gave Kireevsky all the recordings of songs he had (Soimonov, 1968).

Pushkin would also dress in peasants' clothes. This was recalled by his coachman in Mikhailovskoye, the peasant Peter, "He wore a red shirt tied with a sash, wide pants,

*Cf. the story, transmitted by V. Dal, about A.S. Pushkin, who collected songs and recollections about Pugachev; the peasants took him for the Antichrist (1985: 262).

a white hat on his head: he did not cut his hair or nails, and he did not shave his beard; he cut the hair on the crown of his head a little, and walked around like this" (Parfenov, 1985: 463). There are other testimonies that Pushkin wore a red silk shirt of the traditional Russian cut (Raspopov, 1985: 399). Wearing a peasant outfit, he went to the Svyatogorsky Monastery fair, where he listened to folk songs and fairy tales that beggars sang (Vulf, 1985: 447).

Since Pushkin wore a red shirt and beard not only at fairs, but also in villages and on the road, it can be assumed that it was an artistic, partly non-conformist gesture. In addition, his love for a red traditional shirt could manifest, first of all, an imitation of George Byron, who dressed with the refined carelessness of an aristocrat and dandy, but who also loved to dress in various outfits (from traditional Albanian to monastic), second of all, the tendency toward theatricalization of life, natural for his time (Lotman, 1992), and third of all, the desire to mark an internal kinship with the people, to act with the same logic as Denis Davydov, who in 1812 put on a "peasant's caftan" and began "to grow a beard" (Ibid.: 276). Pogodin, who was in friendly and business relations with Pushkin, most likely knew about the whims of the poet and could have taken them into consideration.

Thus, by the mid 1840s, when Pavel Yakushkin was about to go on an expedition, a complex of ideas concerning the appearance of the villager had been finally formed among the Russian intellectuals. First of all, the red shirt was selected from out of the entire diversity of traditional Russian clothes, which in the traditional peasant culture was considered festive and in no way everyday clothing. Another attribute of the "peasant's" appearance was the beard. The reasons for this choice are clear: such marked elements of ethnic identity were extremely vivid, almost theatrical; we can say that the researchers themselves were originators of a cheap popular image of the Russian peasant, offering to consider the folk costume in isolation from real traditions.

The traditional outfit of Achim von Arnim

It is known that the Slavophiles and Pogodin, who was close to them, were formed under the influence of German philosophy, adopting the ideas of Hegel, Schelling, and Schlegel. I.V. Kireevsky personally spoke with Schlegel several times while studying in Germany. Interestingly, the form of collecting songs by the famous German folklorists Achim von Arnim and Clemens Brentano, the founders of the Heidelberg circle of German romantics, somewhat resembled the form that Pogodin offered to Yakushkin. In their journey along the Rhine bank, which later became legendary (a collection of adaptations of folk songs, "The Boy's Magic Horn: Old German Songs", published in 1806–1808, was prepared using the materials collected during this journey), Arnim walked around wearing a simple outfit obviously trying to imitate a villager. Based on her personal recollections of the two friends, Bettina, the sister of Clemens Brentano, wrote, "Arnim looked so clumsy in his too wide outfit. With a sleeve ripped along the seam, a heavy stick and hat from which the torn lining protruded; you were so slim and graceful with a red cap pulled down on thick black curls, a thin cane and interesting snuffbox sticking out of your pocket" (Zhirmunsky, 1981: 67). Thus, Arnim, a nobleman who knew how to dress elegantly, on a journey dressed in simple clothes, as subsequently did Yakushkin, obviously trying to get close to simple dwellers of villages and following his dream of becoming "a poet of the people".

"The Boy's Magic Horn" seems to have been known to Pogodin, although there is no direct proof of this. The book "Spring Wreath", by Bettina von Arnim (the sister of Brentano who then married her brother's friend Arnim), consisting of correspondence with Clemens during his journey on the Rhine, was published in 1844, when Pogodin was writing his instructions for Yakushkin. However, in a paradoxical way, the famous collection of Arnim and Brentano was not discussed in Russia—at least in Russian journals there is no response either to that collection or to the "Spring Wreath" (Azadovsky, 1958: 316). Listing for N.M. Yazykov the collections of songs known to him in a letter, P.V. Kireevsky did not mention "The Boy's Magic Horn" (Kireevsky I.V., Kireevsky P.V., 2006: 376–377). Probably, the parallel in behavior between the German and Russian collectors lies in typology. Obviously, the motives of Arnim and Yakushkin were different. The former wore simple clothes trying to get closer to his ideal of a national poet, while the latter did the same from a natural inclination and for the sake of simplifying the recording of songs.

The motif of changing clothes in Russian folklore

The cultural, historical, and literary circumstances described above, that is the attention of the Slavophiles and folk song collectors close to them to peasant clothing, might certainly have served as a breeding ground for the instructions of M.P. Pogodin. Yet, none of them can be considered to be its main source. Moreover, the proposal to go to villages under the guise of a peddler does not find any direct parallels in the history of the previous folklore studies at all. Most likely, this was Pogodin's own idea. However, in this case he must have relied not so much on literary, but on folklore sources.

The "disguising", of which the peasants accused Pavel Yakushkin, was well-known to them primarily from the

calendar rituals of Christmastide and Cheese-fare Week. The dressing of a person belonging to a noble or even royal family in simple clothes was also a widespread subject of folklore*. In popular legends about kings and other dignitaries, this subject was used most frequently; as a rule, the changing of clothes was performed in such cases for getting closer to the people (Chistov, 1967: 207, 212).

M.P. Pogodin, a researcher and connoisseur of folk culture, collector and publisher of handwritten antiquities, author of novels in the popular style, insightfully suggested making the move captured in the saying, "Greet him according to his clothes, take leave according to what he knows" for communicating with peasants. And it seems that he turned out to be accurate in his calculations: Pavel Yakushkin followed his advice and became one of the most successful collectors and ethnographers. Certainly, the recipe for success was not limited to the outfit alone, but the clothes and carrying basket on his back indeed made a good impression on the villagers.

Although wearing a traditional outfit for Yakushkin was not an ideologically colored gesture—despite his inclination for provocative behavior, he nevertheless did not like play-acting, masquerading, or "buffoonery". M.I. Pisarev, who described the last days of Yakushkin, cited his following words, "Eccentric characters are born, not made… I do not like buffoonery. Nothing can be more disgusting…" (Russian State Archive of Literature and Art. F. 236, Inv. 1, D. 367, fol. 2v).

Based upon the fact that in his instructions Pogodin offered the student Yakushkin to change into a traditional outfit and grow a beard, in his early years Yakushkin did not wear either of the two. Gradually, however, wearing plush pants and red shirt became an integral part of his existence; it had nothing to do with "disguise". Judging by Yakushkin's "Travel Letters", informants from among the common people (peasants, their wives, retired soldiers, fishermen, or trade people) did not have a problem with his glasses, and saw not a "disguised landowner" in him, but a "traveling man", calling him "dear", "honorable", "darling", or "brother" (1986: 44, 122, 131, 252, 259).

*Cf., for example, "All of Moscow heard anecdotes and rumors about Grand Duke Konstantin Pavlovich. People said that he kept doing eccentric things: he went everywhere dressed in a simple outfit; everywhere he asked about and investigated everything, and he reported about all unrest to the Empress; and they said that many poor people used this; and that the simple people loved him greatly; and the rumor began to spread that Peter had not died in him and that he would be just like him in everything" (Bolotov, 1988: 446). Cf. also the story about L.N. Naryshkin, who covered his "rich caftan which had all his medals" with a "worn out jacket of one of his stokers" in order to assess the degree of impartiality on the part of the town authorities (Russkiy literaturniy anekdot…, 1990: 61–62).

Followers of Yakushkin

Very few of the ethnographers of the 1850s–1860s dared to use the "disguising" practiced by Yakushkin, primarily because it was risky—not everyone was ready to confront the authorities. The ethnographer and traveler S.V. Maksimov, a close acquaintance of Yakushkin and the author of his first biography, was one of his few and brief followers. He made his first expeditions (1855–1858) walking around villages either wearing peasant clothes or the outfit of an ordinary merchant (Tokarev, 2015: 428; Lebedev, 1994: 486). P.N. Rybnikov also wore a traditional Russian outfit during his trip to the Chernigov Governorate, where he collected information on the history of local industry as well as folklore and ethnographic materials. Soon he was arrested "on suspicion of having relations with the schismatics and for inappropriate discussions about political matters" (Saprykina, 2007: 401), although there were rumors that one of the reasons was his traditional Russian outfit (Herzen, 1958: Vol. 14, 144). Rybnikov himself thus explained, "…I decided to leave the post road and drive along the governorate using village roads and by water. This gave me the means to look closer into the everyday life of peasants and it partly spared from officiality. It is known how difficult it is for a 'landowner' and especially for an official to get some accurate information from simple people. His title, his travelling document, the whole situation of his driving places somehow does not inspire people's confidence in him; a peasant is always inclined to suspect that an official has, perhaps, some 'pertinent' business concerning him, and even if there is no pertinent business, the very person of the official, his concepts, his habits, make him a stranger to the peasant. Can it be true, some would say, in order to collect ethnographic data, one has to be dressed up in a traditional outfit and imitate the appearance of a commoner? Disguise and imitation, of course, are no good. But one can wear a traditional outfit, and then it is not without use for studying the life of the people in the regions of Great Russia. At least, this helped me personally in relations with the Chernigov Sloboda dwellers, although it entailed great inconveniences" (Rybnikov, 1864: X) (Fig. 4).

Obviously, over time there was no longer a need for ethnographers to change clothes: many of them began to travel to the far corners of Russian governorates as representatives of official expeditions organized by the Russian Geographical Society, the Academy of Sciences, and the Military and Maritime Ministries, and could use the advantages of administrative offices in their communication with peasants, also feeling protected from the local authorities. Pavel Yakushkin, who also became a corresponding member of the Russian Geographical Society, might probably have

Fig. 4. "Kaliki perekhozhiye" ("wandering minstrels")—members of ethnographic expeditions of the late 1850s to early 1860s. Caricature from the *Iskra* Journal (1864, No. 9). P.I. Yakushkin, P.N. Rybnikov, V.A. Sleptsov, I.I. Yuzhakov, and S.V. Maksimov are in the foreground; I.L. Otto and A.I. Levitov are in the background.

given up wearing a traditional outfit on expeditions, but the peasant short fur coat, boots, and red shirt had long become a part of his personality.

Conclusions

As it has been shown, Pavel Yakushkin's dressing in a peasant outfit united two motives: a desire to designate his closeness to the popular environment through such external gestures, and the need to inspire trust in the common people. Subsequently, these two motives began to serve as the basis for two models of behavior actively used both by those who wanted to look like peasants out of sympathy for them and partly from ideological considerations, and those who wanted to make a good impression on them. When the Slavophiles would dress in traditional Russian clothes or A. Grigoriev with a guitar walked across all of Moscow to visit A. Fet, dressed in a "coachman's outfit which did not exist among the simple people" (Fet, 1980: 331), we may say that they followed the first model. It turned out to be unusually viable, and in the early 20th century, M. Gorky (Skulptor…, 1964: 108) and "peasant poets" N. Klyuev, S. Gorodetsky, and in the early period S. Yesenin also emphasized their closeness to ordinary people by publicly wearing a traditional shirt with an off-center collar and high boots.

The second, "pragmatic" model, designed to win over people, was not widely used by ethnographers. However, it was actively used for other purposes far from gathering folklore. It was adopted by the Populists—young intellectuals who went to the working and peasant environment to propagate revolutionary ideas in the 1870s (in the framework of "going to the people"). In order to win over informants from among the simple people, they would also dress in peasant clothes and go to villages under the guise of trade middlemen and craftsmen. This is how the well-known anarchist P.V. Kropotkin described his "going to the people": "Of course, all those who carried out propaganda among the workers, were dressed as peasants. The gap that separates the 'landowner' from the peasant in Russia is so deep, and they so rarely come into contact, that the appearance of a man dressed in a 'lordly' manner in a village would arouse everyone's attention. But even in a city, the police would immediately be alerted if they noticed among the workers a person who differed from them in dress and speech. 'Why would he hang around with ordinary people if he had no malicious intent?' Very often after having lunch in an aristocratic house or even

in the Winter Palace where I sometimes went to visit a friend, I would take a cab and hurry to my poor student's apartment in the remote suburbs, where I took off my elegant clothes, put on a calico shirt, peasant's boots, and fur coat, and went to my weaver friends, joking along the road with simple men" (Kropotkin, 1988: 307)*. As is known, despite the fact that peasants were quite eager to enter into conversation with propagandists, agitation of the Populists did not give any tangible results. Greeting them "according to his clothes", the peasants still bid farewell to them "according to what he knows".

In the 20th century, after the October 1917 Revolution, the distance separating "landowners" from peasants, common people from the intelligentsia, was reduced for obvious historical and political reasons. In a situation when the class borders turned out to be practically erased, there was no longer any need to change into peasant clothes for confidential conversation with the people. Thus, the second model which appeared thanks to M.P. Pogodin and was strengthened thanks to P.I. Yakushkin, died out after existing for over half a century. At the same time, the use of traditional outfits as a political and ideological gesture has survived until nowadays: recent political events in the Ukraine have sharply increased the demand for ethnic "embroidered shirts", and Russians often wear traditional folk clothes during religious festivities, in particular church processions. Finally, in some regions, for example in Yakutia, the traditional folk costume can perform the function of the official representative clothing of the titular nation.

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*See also the description of the process of preparing a propagandist girl for visiting a rag factory, "Subbotina dressed Betya Kaminskaya in a simple Russian cotton sarafan with puffy sleeves and tied simple glass beads around her neck, the way peasant girls wear; she attended to her like a friend dressing a bride" (Dzhabadari, 1986: 200).

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E.F. Fursova
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: mf11@mail.ru

Types of Winter Clothing Worn by Descendants of the Russian Pioneers in Siberia (Late 19th to Early 20th Centuries)

Warm clothing was an important cultural adaptation, enabling the Russian pioneers to survive in the harsh climate of Siberia. The sources for the study are archival documents, including V.K. Multinov's manuscript "Clothing of the Angara People" (1926), results of field studies in the 1970s and 1980s by the present author, museum artifacts, and collection inventories compiled by A.N. Beloslyudov, S.P. Shvetsov, I.I. Baranova, and I.I. Shangina, as well as data collected by climatologists, technologists, and designers. Types of winter clothing, including outfits for hunting and fishing, worn by the Russians living on the Angara, in the Altai, and Trans-Baikal, are described. These include cloth-covered and non-covered fur coats, short fur coats, those with the fur on the inside, robes, as well as warm pants, fur hats, boots, and mittens. Protection from the cold was ensured by the use of high-volume insulating materials, several layers, and by habits such as tucking one piece of clothing into another (the so-called "Siberian one-piece garment"). Specific features in Siberia are observed, including the use in winter hunting outfits of certain elements of native Siberian clothing (specifically that of the Tungus clothing on the Angara), and the women's habit of wearing men's garments with belts.

Keywords: *Thermal insulation, winter clothing, hunting outfits, Siberian Russians, interdisciplinary approach, Siberian one-piece garment.*

Introduction

Until now, ethnographers have not given due attention to winter clothing, which had a special role in the life support system and traditional culture of the Siberians, mostly focusing on the description of types and varieties of clothing, and on identifying their names. A historiographic overview shows that scholars have not posed the question concerning climatic features of the winter clothing worn by the old residents of Siberia. In the process of research, the current author followed a multidisciplinary method, which made it possible to take a fresh look at this cultural phenomenon and its structural links (Tishkov, 2016: 5). This study analyzes only traditional homemade clothing, which was intended for protecting people from the snow and cold during everyday household work, as well as fishing and hunting activities. The author took into account the data on climate periods and temperature anomalies, which were noticeably manifested in Siberia (Kislov, 2001: 248, 255, 259). According to the studies of climate, prior to the 20th century the climate was much colder than today. Cold winters in Central Russia occurred in the 17th–19th centuries—the time of the Russian settlement in Siberia (Ibid.: 248).

A Siberian dweller wearing a winter outfit looked large and clumsy, as is testified by sketches made by travelers and collectors of the 19th century (Fig. 1), now kept in archives, as well as recollections of contemporaries. The

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Fig. 1. A Siberian wearing a winter outfit (Puteshestviya po Sibiri…, 1865: 254).

image of a Siberian ("Siberian bear") was formed under the influence of the set of spacious fur clothing for the winter. According to numerous archival descriptions, the winter outfit of the inhabitants of Siberia was similar to the clothing set worn by the peasants of the Perm Governorate, which constituted the core of Siberian settlers (Na putyakh…, 1989: 10–16, 309; Sibir…, 2014: 99).

This study employed the manuscript by V.K. Multinov, "Clothing of the Angara People", from the Department of Manuscripts of the Russian Museum of Ethnography (DM RME), which was virtually unknown to ethnographers. This manuscript describes the clothes of the local Chaldons* as "clothing of hunters and plowmen" (1926). The peasants in the south of that region lived in the taiga zone; accordingly, their non-agricultural activities were associated with forest-based gathering and woodworking, as well as hunting, and fishing. For identifying the common and particular features in the culture of the Siberians against a broad ethnographic background, the study used Western Siberian evidence obtained in field studies in the 1970s and 1980s, and related to the Russian old residents in various regions of Western Siberia, including the Uymon Old Believers of the Altai (Shitova, 2013: 74–75). The data from the studies of exhibits from museums in Moscow and regional capital cities, descriptions made by collectors (RME, Museum of History and Culture of the Peoples of Siberia and the Far East of the Institute of Archaeology and Ethnography of the SB RAS (MHCPSFE IAET SB RAS)), as well as archival materials (Russian Geographical Society (RGO), DM RME) have also been used.

*Chaldons are the self-name of the Siberian old residents who associated their origins with the Don River and Yermak, the "conqueror of Siberia" (Fursova, 2015: 12–13).

Winter and hunting clothing of the Siberian peasants according to archival, museum, and field evidence

Multinov indicated the following varieties of men's "lopot" (as winter clothing was called in the Angara region): *azyam*, *zipun, or adneryadka**, *shabur* (*shoidennik*), fur coat, *tulup*, khalat, and coat (local name *kozlovka*). "The ozyam or zipun", as Multinov wrote, "is a type of armyak coat made of homespun woolen cloth, white or black, without a collar, rather wide; when put on, it is thoroughly wrapped (without fasteners) and tightly girdled with a belt or homespun long 'sash'. When it is not particularly cold, the zipun is worn in villages in order to pass from one house to the other, and both men and women like to wear it with one sleeve (over one shoulder – **E.F.**). A town coat is worn only by non-locals. <…> Of course, at work, especially while working in the forest, the zipun soon wears out and then it is covered with canvas. Such a zipun sewn over with canvas is called a 'shabur' or 'shoidennik'. Rarely, a simple armyak made of canvas, which is worn instead of a zipun, is called a 'shabur'" (1926: Fol. 17). Multinov pointed out that in some villages of the Angara region, "a shabur worn by women is called a 'ponitok'** from the name of the fabric" (Ibid.: Fol. 21).

According to field materials, clothes such as the *shabur* and *ponitok*, which were worn by all sex and age groups (men, women, children), also belonged to everyday, working clothing in southwestern Siberia. Laughing at the stereotypical opinion of them as people who could endure cold especially well, the Chaldons would say, "What, can the parya***, really be cold—he took two shaburs from off the stove and both are hot!" The old residents explained this custom of dressing

**Adneryadka* (from the word *odnoryadka*—'of a single row') was the outer clothing of the 17th century, in which the flaps converged in front, without overlapping (Gromov, 1979: 207).

***This is the name of the inter-seasonal khalat-like clothing made of homespun *ponitchina* cloth, woven onto 4 threads, where the base was linen yarn and weft was wool, became common in the villages of Western Siberia.

****A Chaldon word for a young man.

"carelessly" in the winter by their careful attitude toward fur clothing and thriftiness, "What will happen to the parya; he put on two shaburs from the stove—both are hot! …It would be a pity to wear a fur coat".

The description of the Altai *zipuns* collected for the funds of RME by the "statistician" S.P. Shvetsov in 1905 in the village of Uymon in Biysky Uyezd of the Tomsk Governorate, as stated in the inventory (RME, inventories of exhibits No. 1343-1, 1343-2, and 1343-3), was performed uniformly. It was only indicated that "the fit is like that of the Caucasian sleeveless burka cloak, but with sleeves. The sides are with gores, as are the sleeves". According to the author's inventory, *zipuns* were worn by both men and women.

In 1978, the Altai ethnographic team of the Institute of History, Philology, and Philosophy of the Siberian Branch of the USSR Academy of Sciences (today—IAET SB RAS) recorded a *zipun* of homemade woolen brown fabric, belonging to A.F. Kharlamova in the village of Bystrukha, in the East Kazakhstan Region of the Kazakh SSR. The *zipun* of a tunic-like cut was sewn from two sheets 2.16 m long, folded over the shoulders. The sides were widened by gores, two on each side. The sleeves were slanted with one gore each; the armholes were straight. The edges of the sleeves were trimmed with black satin. The shawl collar was trimmed with homespun black linen. The *zipun* was hand-sewn in the 1920s using black and white coarse threads (FMA, 1978).

It was unthinkable to live without a fur coat in Western or Eastern Siberia. As described by Multinov, the fur coat was an ordinary sheepskin coat, yellow or dyed black, with a sheepskin collar. "There are no cloth-covered fur coats. Fur coats are sewn by village fur-coat specialists" (Multinov, 1926: Fol. 16). Such fur coats, as Multinov indicated, were worn daily not only by men, but also by women.

The Western Siberian version of this clothing was a festive fur coat made of sheepskin of light brown color, found in the village of Maloubinka of the East Kazakhstan Region of Kazakhstan—the territory where Russian Old-Believers, known as *Polyaki* settled. This fur coat was made in the early twentieth century. Local fur clothes of the *Polyaki*, according to the materials of the above-mentioned expedition, did not differ from that of other groups of the old resident population. "This sheepskin fur coat is sewn with the fur on the inside; the shawl collar is trimmed with black karakul. Fur strips also trim the edges of the sleeves and bottom hem. The coat is of a straight silhouette, overlapping from right to left. The sleeves are made with a single seam; the armholes are straight" (FMA, 1978). Everyday fur coats were sewn from cheaper materials. Thus, the inhabitants of the village of Bystrukha in the East Kazakhstan Region preserved an old, home-sewn, short fur coat of black calfskin. "The wide collar is made of red calfskin. There are a straight silhouette and straight fastenings buttoned right to left. The sleeves are straight and wide. The fur coat was sewn with a lining of cotton fabric" (FMA, 1978).

Multinov noted that women's festive clothing differed from men's festive clothing in the Angara region, "This is a long coat padded with flax tow or even cotton, and on the outside covered with satin or another shiny fabric, sometimes with woolen cloth, with a fur collar and fur cuffs. Such a coat is a source of pride for its owner, and it is worn only on extremely solemn occasions: people wear it while going to a wedding, on a big feast day, or going to the parish church (for taking Communion). Such a coat is often made of costly fur (squirrel, sable)" (Multinov, 1926: Fol. 20). Types of outer clothes similar in appearance and design were worn by the female "Semeyskie" Old Believers of the Trans-Baikal region. The collection of the MHCPSFE IAET SB RAS contains a fur coat sewn from goat skins with the fur on the inside (No. 350, Buryatia, 1973, collected by T.N. Apsit). On the outside, it was covered with burgundy semi-silk fabric, probably *kanfa* dense satin (made in China) (Fig. 2). The sleeves were narrow, exceeding the length of one's arms (80 cm). At the bottom, they were trimmed with black goat fur and two strips of braid. The collar and the edges of the flaps were also trimmed with fur.

In its design, the fabric covering was similar to Russian gored sarafans with two rectangular gores on the sides. In

Fig. 2. Fur coat sewn from goat skins with the fur on the inside. MHCPSFE IAET SB RAS, No. 350.

an expanded form, the fur coat almost formed a circle. The silk fabric was sewn manually through the fur to the center of the back with small seams made with a fore-stitch. Stitching was made parallel to the connecting seam on the back on both sides of it. The stitches connecting the top and fur of the coat were also made in front parallel to the slit-fastener. Stitching with coarse linen thread was also made along the bottom of the hem. Apparently, later, with the spread of sewing machines, machine stitching was made over the hand-made stitches.

In appearance, such a fur coat resembled old-Russian unbuttoned fur coats of the 17th century with long sleeves, which were sewn from expensive patterned fabrics and were decorated with gold and silver embroidery (Gromov, 1979: 208). In contrast to medieval fur coats, the Semeyskie fur coats were khalat-like, without fasteners (overlapping to the left). In the middle of the 19th century, similar fur coats must have become known in Western Siberia, where non-covered fur clothes were valued less, while clothing covered with industrial fabric was considered expensive and prestigious. M. Serebrennikov thus wrote about the clothes of peasants from the village of Kamyshevo*, "In wintertime, men wear a sheepskin coat and zipun of homemade woolen cloth; on feast days, rich people wear fur coats made of the same sheepskin *covered with blue or black industrial woolen cloth* (my italics – **E.F.**), while poor people use the same clothes as on ordinary days" (1848: Fol. 1). Women, as the author noted, "in the winter wear sheepskin coats and zipuns for work, and on feast days sheepskin coats *covered with nankin or woolen cloth or drap-de-dames* (my italics – **E.F.**) with squirrel fur collars…" (Ibid.: Fol. 2).

Another fur coat of the Semeyskie from the Trans-Baikal region, kept in the same museum (No. 357, collected by T.N. Apsit), was sewn of sheepskin, and was covered with Chinese *kanfa* dense satin. The burgundy semi-silk *kanfa* of large-knit weave was decorated with knotted ornamental decoration, swastika images, etc. The fur coat was sewn with the fur on the inside, trimmed with strips of black hare fur on the bottom of the sleeves, around the collar, and along the flaps in front. Its length is shorter than the above-described fur coat No. 350. Examination of this fur coat, like the previous one, suggests that the craftsmen tried to remove all structural seams (including shoulder and side seams) of the upper fabric (*kanfa*) to the back. The elbow seams of the sleeves, when the fur coat is worn, are visible only from the back. Location of seams in the front could have been considered impractical or did not meet the aesthetic requirements of traditional clothing. The design drawing of fur coat No. 357, just as fur coat No. 350, corresponds to the design of gored sarafans supplemented with long sleeves (below the hands). The seams between the skins on the sides coincide with side seams of the upper fabric and are interconnected. The seams of the upper and lower parts of the fur are also connected along the center of the back; the rest of the seams do not match. The stitching (made by hand) runs in three vertical lines on both sides of the center of the back and in two vertical lines on the flaps. In this fur coat, just as in the fur coat described above, pieces of fur were sewn together and sewn to the fabric with slanting stitches using coarse linen thread.

The Trans-Baikal women wore festive fur coats over the shoulders, without a belt, as opposed to working khalat-like clothing. It is surprising that even in this clothing they managed to hold their children in their arms under the flaps. *Prikhvatkas* (ties woven of ropes to hold the flaps) were sewn under the flaps of fur coats at the waist level on both sides (No. 357). Such fur coats were considered an expensive gift, and were passed down from generation to generation. They were given to daughters as a dowry, which Multinov confirmed in his manuscript (1926: Fol. 20). We found similar fur coats during the work of the Trans-Baikal ethnographic team (Fig. 3).

It was customary among the old residents of Siberia to prepare for their daughters as a dowry not only bright, stitched fur coats in the form of silk khalats, but also sheepskin fur coats. "When I was given in marriage, a fur coat for me was blackened, edged with sheep fur. It went straight down. We tanned the sheepskin ourselves", recalled T.A. Polomoshnova (born in 1914), a resident of the village of Bolshoi Bashchelak, Charyshsky District, the Altai Territory.

In the Angara region, heat-preserving clothing worn under the fur coat or zipun was a sleeveless jacket-*nadevashka*. Multinov observed, "There are also women's warm sleeveless jackets worn under a fur coat or zipun ('nadevashki'). They were fastened in the front just like cardigans which were specially made for household use and work" (Ibid.: Fol. 23). In Western Siberia, this type of clothing has not been observed.

Going on a long journey, the Siberians, just as the dwellers of all of Russia, put on the *tulup*. Multinov thus wrote about the Angara *tulup*, "…this is actually a dokha (a name not particularly popular on the Angara, and used by non-locals) mainly from dog's fur, with the fur on the outer side. There are also goatskin (wild goat fur), bearskin, calfskin, and composite tulups. <…> During winter trips, the tulup is an irreplaceable thing and warms much better than our Russian fur coats covered with woolen cloth. People sew tulups at homes, and a certain number of long-haired laika dogs are bred especially for them in every household" (Ibid.: Fol. 16).

Multinov noted that bearskin *tulups* were rare, because they were very heavy. "Deerskin dokhas are almost completely not seen on the Angara, and they are

*One of the settlements on the Om River, now the Ust-Tarksky District of the Novosibirsk Region.

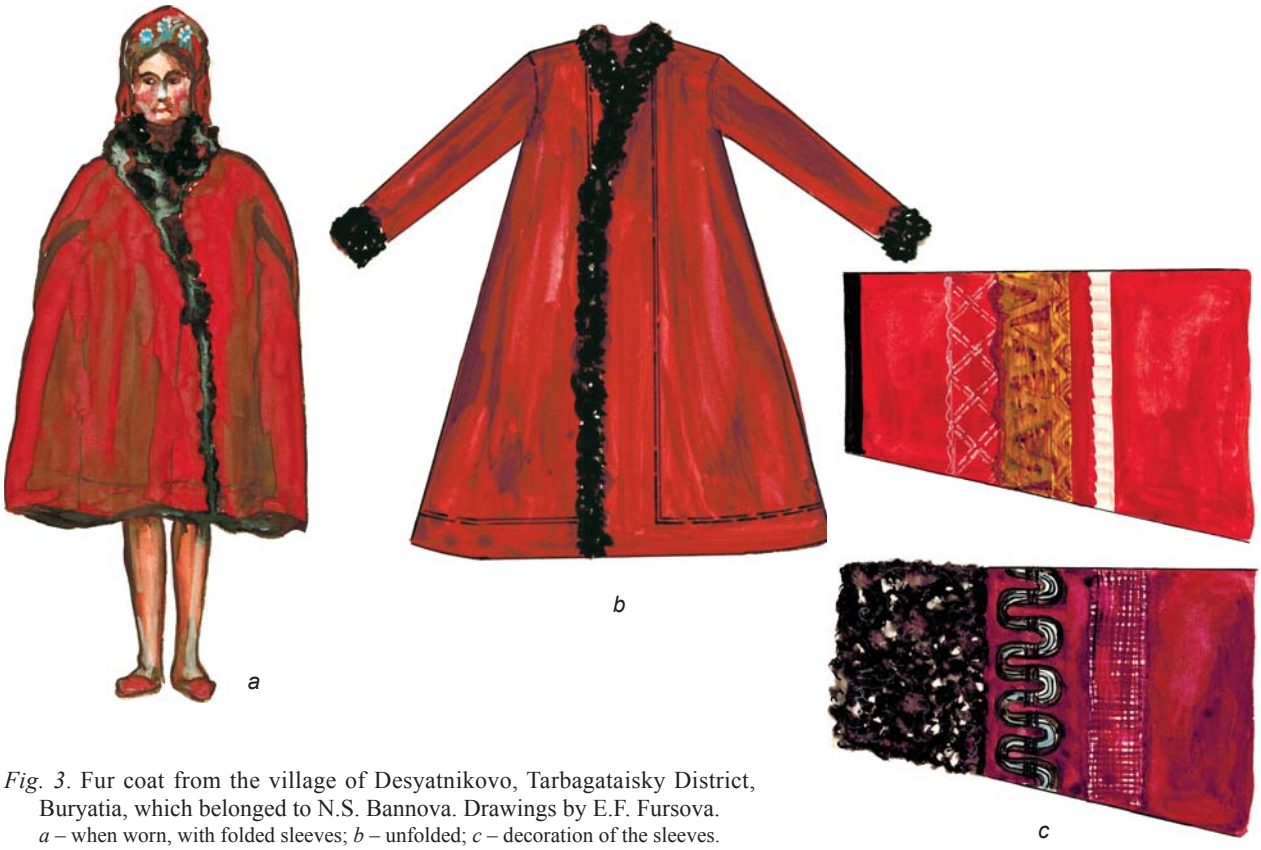

Fig. 3. Fur coat from the village of Desyatnikovo, Tarbagataisky District, Buryatia, which belonged to N.S. Bannova. Drawings by E.F. Fursova.
a – when worn, with folded sleeves; *b* – unfolded; *c* – decoration of the sleeves.

of Tungus origin. An Angara dweller puts on the tulup not only during long journeys 'in wagons', but also during short 'household' trips (transporting firewood, hay, and wheat, since there are almost no roads in the summer), and therefore it is rarely sewn below the knees" (Ibid.: Fol. 16).

As opposed to the *dokha*, *tulups* in Western Siberia were sewn of sheepskin with the fur on the inside. *Tulups* were worn during snowstorms and blizzards over short fur coats and *zipuns*; they were not girdled or fastened, only overlapped from right to left. This type of clothing had a specific element in the form of a high sheepskin fur collar. Old residents sewed fur coats by themselves at home, but they ordered *tulups* from local craftsmen. According to the expedition field materials, *tulups* were very long and wide: as old men recalled, "they would hide girls in tulups" (apparently, during the youth festivities of Christmastide).

In the severe cold, a *dokha* was put over a sheepskin coat or regular coat. In Western Siberia, *dokhas*, as was mentioned above, were sewn with the fur on the outside. Clothes of this type were worn during long journeys, not only in winter, but also on cold days in the fall and spring. The collection of the RME contains a *dokha* sewn from 12 dog skins of red light yellow and black color in the village of Novoaleiskoye, Tretyakovsky District, the Altai Territory (collected by I.I. Shangina and I.I. Baranova, 1975). The *dokha* had a straight design, set-in straight sleeves, and a wide semicircular collar which was tied by strings. The left side overlapped the right; it was fastened with two black buttons. The lining was made of pieces of black and gray satin. According to the collectors, the design of the fur coat, made in 1962, was traditional for this territory (RME, No. 8525-79).

The word khalat for winter clothing was much less common in Siberia than the words fur coat and *tulup*. According to Multinov, in the Angara region, people used the word khalat for a canvas cover put over a fur coat. "It is somewhat longer than a fur coat and has rather wide sleeves; however, people sew it already when the fur coat is worn out in several places and has no need for being protected. The khalat is always made of homespun canvas, rarely dyed" (Multinov, 1926: Fol. 15). The Trans-Baikal Semeyskie used the word "khalat" for wool-padded clothing covered with semi-silk Chinese fabric. The design of the fabric covering was the same as in fur coats, with gores; the sleeves were made significantly longer than the hands (for example, the length of the sleeves in khalat No. 1327 from MHCPSFE IAET SB RAS is 75 cm, collected by F.F. Bolonev). We were able to examine khalats in the village of Desyatnikovo, Tarbagataisky District, Buryatia (Fig. 4).

Clothing called a khalat, but festive, purchased, which was worn by a dweller of Western Siberia, can

Fig. 4. Female cotton-padded khalat covered with dense satin, from the village of Desyatnikovo, Tarbagataisky District, Buryatia. Drawing by E.F. Fursova.

be seen on a photograph taken by A.N. Beloslyudov in 1914. The description of the photograph says, "The owner is standing at the door wearing a fancy Kokand khalat, purchased in China during the sale of elk antlers; the village of Fykalka" (Fursova, 1997: 167). Judging by the ethnographic evidence, khalats with or without ornamental decoration occurred in the region only sporadically.

Multinov made a description of men's legwear, which according to his information always included two layers: long underwear (*podshtaniki*) and outer pants (*sharovary*). "Podshtaniki are made of coarse homemade canvas, not dyed, using calico only as an exception. They are sewn fairly short (for reasons of economy) have a so-called *opushka* around the upper edge, through which a drawstring is pulled; there are no buttons. *Sharovary* are made of woolen cloth or plush, dyed linen ('to resemble those bought at the market'), of *cheviot* (woolen fleecy fabric – **E.F.**), or *adreatin*" (Multinov, 1926: Fol. 19). Multinov provided detailed information about *sharovary*, "Canvas sharovary are dyed mainly the favorite *kubovy* (blue) color. In addition, they, just like shirts, are dyed brown with oak. The cut of sharovary is straight, not particularly wide. Buttons are sewn onto them, and even pockets are made. Sometimes there are suspenders, but usually, sharovary are girded by a belt with the shirt tucked in or tied with a drawstring. Sharovary are worn tucked into 'brodni' waders or boots, but sometimes they are worn over brodni or felt boots. This original method is practiced while walking in deep snow and in order to make it difficult for black flies to get inside the footwear" (Ibid.: Fol. 20).

Pants among the inhabitants of the Yenisei region were also a part of the women's fishing outfit, which was not typical of everyday clothing among the peasants from other regions (Fursova, 2015: 116). Multinov wrote, "Women's pants are clothing for fishing with a seine, offering protection from black flies. They are worn under the skirt and often women use men's *sharovary*. Of course, in the forest, women also cannot do without pants, which in a funny way come out from under the skirt and are tucked into leather 'chirki' shoes and tied with a rope at the bottom, sometimes tucked into stockings*. While fishing with a seine, especially when one has to stand in the water, women flaunt pants tucked into waders or untucked, without a skirt. But in the winter, no matter how cold it was, even on a long journey, the Angara women never put on anything warm under their skirts" (1926: Fol. 23).

In Western Siberia, men going on trips or for long-term work in the open air or in the deep snow, tuck their short fur coats or *zipuns* into wide *chambary* pants. We can find a description of *chambary* from among the Altai Old Believer-"Stoneworkers" in A.N. Beloslyudov, who collected ethnographic materials on the territory of Kazakhstan in 1925. These were working *chambary* made of white canvas with triangular inserts between the pant legs in the front and back from the village of Bykovo, in the former Semipalatinsk Governorate (RME, No. 5158-23). In 1925, in the Uba River region, Beloslyudov purchased *chambary* of homemade fabric with yellow, red, and blue strips (RME, No. 5091-10).

In the village of Sekisovka, in the East Kazakhstan Region, the local resident T.A. Babina showed us men's *chembary* pants (another variant of *chambary*) made of white coarse linen with a low crotch, which were sewn by her mother-in-law in the early 20th century according to the old style. *Chembary* were used as outer pants; they were worn over long underwear made of striped linen or thinner white linen (FMA, 1978). The *Polyaki* Old-Believers of the Altai tucked a *ponitok* robe into *chembary* made of white canvas, and put a fur coat or short fur coat on top. "A shirt, ponitok, and dokha—people put these on going into the woods", recalled Ivan Novikov from the village of Soloneshnoye, the Altai Territory (born in 1906, *Polyaki* Old-Believer).

Multinov described in detail the headwear of the Angara peasants, "The headwear of a peasant in the winter and summer is a warm hat of woolen cloth trimmed on the outside and sometimes on the inside with fur. But often flax tow is simply placed under the lining of the hat… The Angara dweller prefers to wear all year round a hat with loose earflaps dangling while walking. The fur on the hats is predominantly that of dogs, hares ("ushkan",

*These were knee-length stockings, usually knitted of linen or wool.

according to the local dialect), rarely squirrels. In the years of the Civil War, when it was not possible to sell furs at all, squirrel (the entire hat, without even woolen cloth) hats appeared" (1926: Fol. 7). Hats in the shape of papakhas were made of the skins of bears, otters, dogs, squirrels, rarely wolves or calves. "Nansen hats were also made of calfskin. Almost all hats are homemade; very few are market-bought. Women sew them. The distinctive hats made of 'cherpa', green fur, apparently that of the seal, should be mentioned. Nansen hats of Tungus origin made of fur from autumn unborn animal fetuses are rare and highly valued" (Ibid.: Fol. 7).

The author noted that the Chaldons "also wear ordinary Tungus deer hats—pointed caps. Very rarely, one might also find among the Chaldons on the Angara Tungus headwear connected to a fur 'shirt', as the whole combination is called, and mittens. Combined with 'luntay'*, such an outfit completely "envelops" its carrier, and leaves only the face open, which suffers little from frost due to habit, and is only lubricated with some lard in the extreme cold. All things of Tungus origin are sewn not with threads, but with deer tendons" (Ibid.).

Multinov provided some information about the headwear, "There are very few fur hats with long ears, the so-called 'malakhais', on the Angara. Creative imagination of a hat's owner is sometimes manifested in the cut of the hats: for example, people may sew a very uncomfortable and heavy bear hat of colossal size… Sometimes there is also a very strange selection of fur in one hat: one 'earflap' is of squirrel fur, another of dog fur; the front flap visor is of 'ushkan' hare fur. Nansen hats are often supplied with a hard visor of woolen cloth sticking forward, as on a cap. Winter hats on the Angara are worn only by men and children. Women wear them very rarely, unless sometimes while traveling" (Ibid.: Fol. 8). Multinov also mentioned the *treukh* as the headwear of old men, which was worn by fishers and hunters in the autumn as they went to the woods, and was called a "hunting hat". "This hat is supplied with a wide 'tail' of canvas falling down over the shoulders at the back. This 'tail' is called a *luzan* and has the purpose of protecting from snow off the trees from falling down the shirt… A hunting hat is put on only in the forest and is not worn in the village. There is also a simplified version of that hat as a round, low pointed cap of woolen cloth… also with such a 'tail'" (Ibid.).

A spherical fox hat, stitched from small pieces of fur, which was purchased from the Trans-Baikal Semeyskie (No. 353, collected by F.F. Bolonev, 1969) is stored in the MHCPSFE IAET SB RAS. This fox hat has earflaps connected using black cotton fabric (Fig. 5). The strings were stitched in such a way that three loops in the shape of a trefoil are formed on the top of the head when the hat is worn with the earflaps in the raised position. It was probably possible to loosen or tighten the hat with their help, depending on the size of the head. At the bottom, the hat is padded with lamb fur; pieces of soft brown felt were laid between the two layers of fur—fox and sheepskin.

A complement to the outfit of the Angara dwellers was the woolen scarf, which was almost never used in Western Siberia. "People knit scarves of wool—it is a necessary attribute of the Angara outfit. Ushkan scarves are white with a black strip at the ends, or the wool is not purely ushkan (hare – **E.F.**), but with the addition of sheep wool. There are multi-colored and striped scarves. The length is significant—5–7 arshins. They are worn in a special way: they are wrapped twice around the neck and then they cross over the bulk (body – **E.F.**). The width is not significant. The scarves end with tassels. It is interesting that scarves are very often knit by men who do not consider it shameful to be engaged in this handiwork" (Ibid.: Fol. 25).

The harsh climate and black flies did not allow the Angara dwellers to go outside with bare hands even in the summer. Multinov wrote, "Home knit, woolen handgear with one sheath for the thumb are 'mittens'. There is a hole on the palm for sticking out the index finger when shooting. While working in the open air, a second pair of elk leather 'verkhonki' handgear was worn on top of the woolen mittens. Sometimes mittens for durability are sheathed with canvas. There are also 'kokoldy' mittens of Tungus origin, made of elkskin with fur… Mittens knit of hare wool have the reputation of being very warm.

Fig. 5. Fox fur hat with earflaps. MHCPSFE IAET SB RAS, No. 353.

**Luntay*, *lunty* and probably *unty* are words of the Northern Russian origin, denoting footwear sewn with fur on the outside.

By the way, mittens in general, often with a hole for sticking out the hand for 'hunting' convenience are often called 'kokoldy'. The sheath for the thumb is called the 'napalok'" (Ibid.).

According to the informants, fur mittens were called *mokhnashki* in southwestern Siberia. The collection of the RME contains three almost identical pairs of such *mokhnashki*, from the Altai Territory, discovered by the ethnographers I.I. Shangina and I.I. Baranova (RME, No. 8525-31/1, 2). They are rectangular, sewn from dog fur of white, red, and black color, and are equipped with leather loops (RME, No. 8525-84/1, 2; No. 8525-87/1, 2).

For agricultural work on cold days, on top of the mittens, people put on handgear made of cowhide ("cattle") leather. Such leather handgear was sewn according to special patterns. "Cattle" mittens were intended for working, so for greater convenience, the thumb was made out of canvas, and the edges of the mittens were made with a leather cuff. In the inventory of Shvetsov's collection, they are listed as *verkhonki*—"non-covered handgear with black woolen 'mittens'" (RME, No. 1343-10).

The wide range of footwear among the Russian dwellers of the Angara region indicates not only the development of home craftsmanship for processing leather and fur, but also the great ingenuity of Siberians, their ability to create comfortable and functional footwear for living in Siberia. Multinov indicated the existence of leather (*brodny*, *boukuli*, *bakari*) and fur (*luntai*, *lunty*, *lakomei*, *dyshiki*, etc.) types of footwear. Unlike Western Siberia, where the main type of winter footwear, along with *obutki* and *brodni*, were homemade felted *pimy* or *katanki*, felted footwear on the Angara was exclusively purchased and was called "market-bought", which means that people did not felt these on their own (Multinov, 1926: Fol. 6).

According to M.P. Berezikova*, in Western Siberian villages, in the winter, in addition to *pimy* felt boots, people wore self-made leather *chirki* footwear (another variant *charki*) with boot tops and *potnik* long felt socks. Fishing and hunting footwear of the inhabitants of the Uymon Village in Biysky Uyezd of the Tomsk Governorate in the early 20th century (collected by S.P. Shvetsov) were functionally adapted to winter conditions.

Lunty were boots made of skins taken from goat legs with the fur inside, worn by old men in the winter (RME, No. 1343-6). *Kisy* were winter footwear made from skins taken from goat legs (RME, No. 1343-7). The presence of a pair of woolen stockings in the collection of Shvetsov indicates that the above footwear was worn with this heat insulating item (RME, No. 1343-5). Woolen stockings could also be worn in the fall and spring with leather *koty*. In the inventory, the collector thus wrote about them, "Ankle boots with fringes fastened with twine" (RME, No. 1343-9).

Principles of conserving heat in Siberian clothing

According to scientific research, humans have 250,000 skin receptors that perceive cold. This is over six times higher than the amount of heat-perceiving receptors (Osobennosti zashchity cheloveka…, 2008: 133). Conserving heat during the cold season, that is, for almost six months, was an important concern of the descendants of the Russian pioneers in Siberia. In their efforts to protect themselves from the cold, they were guided by the following principles. First, *materials* with heat-preserving properties, such as wool (woven and non-woven), fur, and leather were used for manufacturing clothes. Mathematical descriptions of heat transferring processes carried out by scientists have shown that high-volume heat-insulating materials having a porosity of 90–99 %, that is furs, have the lowest heat conductivity (Bessonova, Zhikharev, 2007: 106). Second, people created *multilayered* outfits thereby forming air layers, which preserved heat between woolen and fur materials. On long trips and travels, old residents put on additional fur clothes, and the location of the fur side was regulated by the principle of oppositeness: inward toward the body (lower layers) and outward as is the case with the outfits of the peoples of the Far North (for example, the Samoyeds, and others) (Prytkova, 1970: 8, 12; Khomich, 1970: 107–109). In this case, clothes such as the fur coat and short fur coat with an interior fur surface acted as the intermediate layer. Third, people sought to ensure, as far as possible, maximum *insulation* from the outdoor weather conditions. Khalat-like types of clothing were loose, but air circulation was hampered by belts which girdled garments such as the short fur coat, *zipun*, *azyam*, etc. in certain situations. Thus, with a high level of snow, they were tucked into the upper pants. Pant legs stretched over felt boots created insulation from the adverse effects of the environment, forming something like a cocoon, which we may call a "Siberian one-piece garment" (Fig. 6). Notably, similar principles of insulating outfits of three layers, like clothes with the fur inside and outside, are actively used today in creating heat protection outfits in the garment industry (Vygodin, 1997: 41).

Analytical dependences of thermal resistance of fibrous materials on temperature, humidity, and the value of mechanical pressure, have been scientifically established. The package should include clothes of sufficiently spacious structures so that the body could

*Berezikova Maria Perfilievna, born in 1908, Old Believer. She was born and lived in the village of Bolshoi Bashchelak, Charyshsky District, the Altai Territory.

"breathe" and there was no heat loss (Osobennosti zashchity cheloveka…, 2008: 147). It is logical to assume that the "Siberian one-piece garment" for hunting or long trips (together with fur outer clothing: a *tulup* or *dokha*) minimized heat loss, while providing for heat flow from points of the body with higher temperatures to points with lower temperatures.

In the case of a long stay in the snow in the cold, old residents supplemented *outfits for fishing and hunting*, known in Siberia from the 17th century, with such elements as the *luzan*, or knee pieces (Bakhrushin, 1951: 88). A specific Siberian feature was the use of some clothing elements of the local Siberian peoples (for example, of the Evenks in the Angara region) in the outfits for fishing and hunting, and women wearing men's legwear.

It should be noted that aesthetic qualities and compliance with their own traditions were important for Russian old residents of Siberia in addition to heat-preserving properties of the outfit. For this reason, *everyday* and *festive* complexes of winter clothing did not include the types of clothes of the indigenous peoples: for example, fabric made with one-piece shoulders (like that of the peoples of the Far North), hoods, or fur footwear.

Fig. 6. Woman wearing a khalat covered with plush (velvet), and man wearing a "Siberian one-piece garment". Altai, 1912. Fragment of a photograph by A.E. Novoselov.

Conclusions

The variety of categories and types of winter clothing made from various materials and using various methods reflects the experience of previous generations of people coming to Siberia from northern, northeastern and southern regions of European Russia. Numerous testimonies have shown that migrants to Siberia, including those coming from Southern Russia, arrived in outfits appropriate for the local climatic conditions. Such types of clothes as the *tulup*, short fur coat, *zipun*, and other clothing with high heat-preserving properties were well known not only to Northern Russian settlers, which was natural, but also to peasants from Southern Russia. Thus, the inventory of the outer clothing of peasants from the Trubchevsky, Bryansky, and Karachevsky Uyezds of the Orel Governorate mentions such clothes as *korset*, *zipun*, *chekmen*, *polushubok*, *svita*, and *tulup* (RGO Archive. Division 27, Inv. 1, No. 18, fols. 112–117). The principle of layering to enhance thermal protection has long been known among the Russians: in the winter, the *svita* as warm and beautiful clothing was worn over the short fur coat or *tulup* (RGO Archive. Division 27, Inv. 1, No. 18, fols. 117–118).

Such manifestations of "Siberian courage" as working in the cold without hats and mittens, refusing to wear scarves, putting on the outer garment over one shoulder, in one sleeve and so on reveals the good health and hardiness of the Siberian dwellers in the late 19th to early 20th centuries. Light clothing for winter work (half-woolen *shabur*, *ponitok*, etc.) were heat treated: for making them warm they were preheated on the stove. Temperature changes in the cold season and winter thaws determined the appearance of manifold variants for winter clothing and various words for it, falling within a limited amount of types, which nevertheless ensured comfortable living conditions throughout the entire cold season. This excluded cooling of the body and consequently the occurrence of cold-related and other diseases.

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V.V. Kufterin
Anuchin Research Institute and Museum of Anthropology,
Lomonosov Moscow State University,
Mokhovaya 11, Moscow, 125009, Russia
E-mail: vladimirkufterin@mail.ru

Long-Bone Growth in the Bronze Age Skeletal Population of Gonur-Depe, Turkmenistan

This article presents some results of the analysis of long-bone growth rate in the sub-adult skeletal population from Gonur-Depe—a Bronze Age proto-urban center in Turkmenistan, the Bactria-Margiana Archaeological Complex. The sample includes 130 skeletons of sub-adults (735 skeletal elements) from burials in the "ruins" of the palace-temple ensemble, excavated in 2010–2015. The results indicate a significant retardation of long-bone growth relative to modern standards. The individual variation is considerable. The retardation is maximal in the leg bones (especially femur and fibula), and minimal in the forearm bones. The latter fact is confirmed by the sub-adult to adult bone length ratio. The smallest lag in growth rates is observed in children aged from birth to 2–3 years. This was apparently due not only to optimal nutrition (breast-feeding), but also to a more stable genetic determination of growth during this period. The lag is greater in age cohorts showing stress markers, such as porotic hyperostosis and enamel hypoplasia. Retardation of skeletal maturity in this group is interpreted not as a symptom of maladaptation, but as a result of a complex process of adapting to the totality of environmental factors. The comparison of the paleodemographic, paleopathological, and "paleoauxological" data confirms that the ancient population of the Murghab oasis was well adapted to the environment.

Keywords: *Paleoauxology, skeletal growth, sub-adults, Bronze Age, Gonur-Depe, Turkmenistan.*

Introduction

Since the study by F. Johnston (1962) on long bones' longitudinal growth rate in the sample from Indian Knoll (Kentucky, USA) was published, the number of works focusing on the analysis of skeletal growth and development in various past populations has grown to several dozen (Armelagos et al., 1972; Y'Edynak, 1976; Merchant, Ubelaker, 1977; Mensforth, 1978; Stloukal, Hanakova, 1978; Sundick, 1978; Hummert, Van Gerven, 1983; Molleson, 1989; Lovejoy, Russel, Harrison, 1990; Wall, 1991; Hoppa, 1992; Robles et al., 1992; Saunders, Hoppa, Southern, 1993; Ribot, Roberts, 1996; Piontek, Jerszynska, Segeda, 2001; Schillaci et al., 2011; Pinhasi et al., 2014; and others). Similar publications in the Russian language are still not as numerous (Fedosova, 1997, 2003 (see for a review of foreign publications up until 1994); Tur, Rykun, 2006; Kufterin, 2012, 2015, 2016b; Kufterin, Nechvaloda, 2016). This field of research was named "paleoauxology" by Hoppa (2000) and Tillier (2000), but this (quite appropriate) term has not been widely used so far.

Most of the works on longitudinal growth in skeletal samples are based on the comparison between empirical results for an ancient sample and modern growth standards. The most popular modern reference is the growth charts for a sample of roentgenograms of Caucasoid children and adolescents published by M. Maresh (1955, 1970;

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Fedosova, 2003). Using such an approach, it is possible to unify the growth rates of various bones and thus enlarge sample size (Fedosova, 2003: 526; Goode, Waldron, Rogers, 1993; Sciulli, 1994). Some authors assess the rate of postcranial growth by comparing sub-adults' values with those in adults of the same population (see (Mensforth, 1978; Lovejoy, Russel, Harrison, 1990)). The femur is used in most ontogenetic studies (Israelsohn, 1960), since this skeletal element is thought to be the most "adequate" in reflecting environmental effects (Bogin et al., 2002). It is also typically the most numerous and well-preserved bone in skeletal samples (Agnew, Justus, 2014: 190). However, other long bones are employed in many studies as well.

A delay in growth and development rates as compared to modern standards is typical for skeletal populations (Fedosova, 2003: 529), and is most often explained by a complex influence of negative environmental factors, including nutritional stress. Such an explanation is based on the positive relationship between economic status of a population and sub-adult growth rate (Larsen, 1997: 43). In order to assess the economic status, the analysis of skeletal growth curves is often accompanied by an analysis of paleodemographic and paleopathological data (see (Molleson, 1989; Ribot, Roberts, 1996; Agnew, Justus, 2014; Pinhasi et al., 2014)).

The main methodological difficulties in the analysis of postcranial growth in paleopopulations include the lack of standardized techniques for describing and comparing growth curves, poor compatibility of various authors' data (due to the difference in measurement protocols and/or the number of age cohorts), and underestimation of differences in the growth rates of various limb segments (Fedosova, 2003).

This study outlines the pattern of longitudinal growth of long bones in the Gonur-Depe population, and builds upon my previous works (Kufterin, 2012, 2015, 2016b). The results of the previous research are tested on a much larger sample and compared to paleopathological data on the sub-adult remains from Gonur-Depe (Kufterin, 2016a).

Materials and methods

The sample includes the remains of 130 children and adolescents (0–14 years) from Gonur-Depe, the administrative and cultural center of ancient Margiana (Mary Region of Turkmenistan, Bactria-Margiana Archaeological Complex, late 3rd to middle 2nd millennia BC) (Sarianidi, 2002, 2005, 2007, 2008) studied by the author in 2010–2015 (Fig. 1; Table 1). The sample comprises 735 skeletal elements, including 144 humeri, 139 radii, 131 ulnae, 127 femora, 108 tibiae, and 86 fibulae.

The dental age of the sub-adults was assessed using conventional methods (Altukhov, 1913: 84; Ubelaker, 1978: Fig. 71; AlQahtani, Hector, Liversidge, 2010). The rate of longitudinal growth of all long bones was estimated using standardized measurements (Sciulli, 1994). As the standard for children and adolescents from 0 to 18 years of age, the data published by Maresh and quoted from Fedosova (2003) were used. The percentage of adult size attained was also calculated for the measurements of the limb-bones of the sub-adults, where the adult sample from the "ruins" of the Gonur-Depe palace-temple ensemble (Excavation 5, male skeletons) was taken as a reference (Dubova, Rykushina, 2004: 331). The long-bone diaphyses were measured by trammel or sliding caliper (precision 0.1–0.5 mm) according to the Fazekas and Kosa protocol (1978: 43–51), adopted for older individuals. As previous research on documented skeletal samples have not found significant sexual differences in the diaphyseal lengths (Facchini, Veschi, 2004), the sexes of the individuals in our samples were not determined. Similarly to annual intervals typically used in growth curve analyses (see (Agnew, Justus, 2014: 198)), nominal age cohorts were constructed by adding six months before and after the previously determined exact dental age. Descriptive statistics were calculated in AtteStat (www.attestatsoft.narod.ru), while the growth curves were built in MS Excel. The results were further compared to our previously published data on the paleodemography and paleopathology of the Gonur-Depe sub-adults (Kufterin, 2016a).

Results and discussion

The descriptive statistics of the longitudinal dimensions of long bones in the Gonur-Depe sub-adult skeletal sample can be found in Table 2 and Fig. 2 and 3. These data clearly show that growth of the bones was substantially retarded as compared to modern standards (Table 3). The δl_m parameter, which indicates the mean deviation from standard values, is 0.83 in the total sample. But this parameter displays a strong individual variation as well, ranging from 0.73 to 1.19 for the humerus, 0.74–1.17 for the radius, 0.76–1.21 for the ulna, 0.72–1.15 for the femur, 0.72–1.21 for the tibia, and 0.70–1.23 for the fibula. The retardation is maximal in the leg bones (especially femur and fibula), and minimal in the forearm bones. This is confirmed by the sub-adult to adult bone length ratio (Table 4). Previous research has detected an even stronger retardation of the growth of the lower-limb bones in the samples of the Afanasievo culture of the Altai Mountains (Tur, Rykun, 2006: 74, 109) and the Alakul timber-grave cultural type of the Southern Trans-Urals (Kufterin, Nechvaloda, 2016). My previous results, based on a substantially smaller sample, have demonstrated a

Fig. 1. Location of Gonur-Depe.

tendency to a stronger retardation of the proximal limb segments than to distal (Kufterin, 2012; 2015; 2016b). This tendency is not clearly confirmed by the result of the present study. The pattern of body proportions typical of the adult Gonur-Depe population (general meso- or dolichomorphy with the forearm and lower leg elongated as compared to the shoulder and hip, respectively) (Babakov et al., 2001; Dubova, Rykushina, 2004, 2007a) was probably forming at later stages of ontogeny (i.e. adolescent period and following years).

Children aged from birth to 2–3 years are the least retarded, which corresponds well with my own results (Kufterin, 2012; 2015; 2016b), as well as with the results of other authors. This is explained by relatively good nutrition at that age due to breast-feeding, but also by a strong genetic determination of growth typical of this cohort (Fedosova, 2003: 529).

Retarded growth rates in paleopopulations as compared to modern standards are traditionally explained by the immediate reaction of the growing body to any fluctuation of environmental factors during the periods of the highest sensitivity, i.e. weaning and the adolescent growth spurt (Fedosova, 2003). Thus, the retardation is considered a consequence of poor nutrition and physiological stress (Larsen, 1997: 43–44); but the real situation may be more complicated. As I. Ribot and C. Roberts noted, "… the interpretation of the results remains difficult, as growth is so variable and the aetiology of stress indicators so hypothetical…" (1996: 67). This is followed by an even less "trivial" conclusion: "…there is no relationship between the frequency of stress indicators and the growth of long bone lengths" (Ibid.: 75). While not fully accepting such radical views, I would like to note that, according to some authors, soft tissues, but not the skeleton, are mostly affected by stress

Table 1. **Size of the sample of sub-adults with known dental age**

Age cohort	*N*	%
0	37	28.5
1	24	18.5
2	17	13.1
3	5	3.8
4	4	3.1
5	14	10.7
6	2	1.5
7	7	5.4
8	7	5.4
9	5	3.8
10	2	1.5
11	1	0.8
12	3	2.3
13	1	0.8
14	1	0.8

Note. Skeletal remains of all individuals represented by at least one bone of any side were included in the total sample. Nominal age cohorts include the six months intervals before and after the age indicated in the table. Individuals younger than 6 months (inclusive) were assigned to the "0" cohort.

(Little, Malina, Buschang, 1988). For instance, there were no differences in stature found between adults with and without linear enamel hypoplasia (LEH) (Temple, 2008). On the other hand, a relation between LEH frequency and growth rate below the mean level was observed (Schillaci et al., 2011). The frequency of porotic hyperostosis, one more nonspecific stress marker, displays a correlation with growth retardation, but only until 6 years of age, i.e. during the period of growth deceleration (Armelagos, Huss-Ashmore, Martin, 1982).

What conclusions can be drawn from a comparison of the paleopathological, paloedemographic, and "paleoauxological" results of this study? In one of my previous publications, I noted that "…the high quality of life and good demographic situation in the Gonur-Depe population (Dubova, Rykushina, 2007b: 318) is in good agreement with the observation that ontogeny is generally decelerated in "centenarian" groups, owing to a retardation of skeletal maturation in children (Pavlovsky, 1987; Buzhilova, 2005: 20)" (Kufterin, 2016b: 280). It seems that the new data do not dismiss this notion. According to some authors, the bones that grow faster are more vulnerable to adverse environmental conditions (Sciulli, 1994: 257–258). A previous paleopathological study of the sub-adult sample from Gonur-Depe generally confirmed the view on this ancient population as well

Table 2. **Variation of longitudinal measurements of the long bone diaphyses**

Age cohort	Right side					Left side				
	N	*M*	*S*	Min	Max	*N*	*M*	*S*	Min	Max
1	2	3	4	5	6	7	8	9	10	11
					Humerus					
0	20	74.5	9.42	60.4	90.6	21	78.7	12.26	64.3	102.0
1	13	101.4	9.08	87.1	112.0	19	98.9	7.86	87.4	112.0
2	15	122.4	6.04	110.7	133.0	13	123.9	5.85	115.0	133.5
3	2	113.0	–	107.0	119.0	1	116.5	–	–	–
4	2	131.5	–	131.0	132.0	2	131.3	–	130.0	132.5
5	4	136.9	4.77	132.0	142.5	6	147.7	10.09	134.0	163.0
6	2	147.5	–	141.0	154.0	2	149.5	–	142.0	157.0
7	5	170.4	10.31	157.0	186.0	5	165.1	11.71	151.5	182.0
8	4	187.3	15.09	173.5	205.0	4	180.9	9.99	173.0	195.5
9	1	173.0	–	–	–	3	182.7	–	172.0	199.0
10	1	190.0	–	–	–	1	194.0	–	–	–
11	–	–	–	–	–	–	–	–	–	–
12	2	217.5	–	214.0	221.0	2	218.8	–	217.5	220.0
13	–	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	–	–	–	–	–
					Radius					
0	21	60.2	8.41	49.7	80.0	16	64.0	8.56	52.7	81.0
1	14	79.7	6.85	68.0	89.0	14	78.0	6.21	68.0	88.5
2	9	93.4	4.97	86.0	100.0	15	94.8	6.15	85.4	106.0
3	2	89.0	–	84.0	94.0	–	–	–	–	–
4	2	98.8	–	96.0	101.5	2	100.5	–	98.0	103.0
5	9	111.2	9.71	101.0	130.0	8	109.8	9.09	100.5	130.0
6	2	112.3	–	110.5	114.0	2	113.0	–	109.0	117.0
7	3	130.5	–	116.5	140.0	4	130.5	10.25	116.0	140.0
8	2	133.3	–	132.5	134.0	5	138.9	5.25	134.0	145.0
9	4	151.5	12.70	135.0	165.0	2	143.0	–	135.0	151.0
10	1	147.0	–	–	–	1	147.0	–	–	–
11	–	–	–	–	–	–	–	–	–	–
12	1	173.0	–	–	–	2	169.5	–	167.0	172.0
13	–	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	1	194.0	–	–	–
					Ulna					
0	20	68.6	9.22	57.1	91.5	18	71.8	10.02	56.6	92.5
1	16	89.1	6.71	77.0	99.0	11	88.0	6.74	77.0	100.5
2	9	104.8	4.14	99.0	110.5	14	105.0	5.63	96.0	115.5
3	1	93.8	–	–	–	2	97.3	–	93.6	101.0
4	2	112.3	–	110.0	114.5	2	112.8	–	109.5	116.0

Table 2 (continued)

1	2	3	4	5	6	7	8	9	10	11
5	5	118.4	3.76	113.0	122.5	9	122.8	7.89	113.5	140.0
6	1	122.0	–	–	–	2	126.0	–	122.0	130.0
7	2	142.0	–	131.0	153.0	4	144.5	10.08	130.0	153.0
8	3	153.7	–	149.0	162.0	5	155.5	6.40	149.0	164.0
9	2	162.0	–	154.0	170.0	3	159.7	–	154.0	168.0
10	–	–	–	–	–	1	164.0	–	–	–
11	–	–	–	–	–	–	–	–	–	–
12	1	195.0	–	–	–	1	193.0	–	–	–
13	–	–	–	–	–	1	203.0	–	–	–
14	–	–	–	–	–	–	–	–	–	–
					Femur					
0	20	92.4	17.29	68.2	127.0	21	86.3	15.69	67.7	127.5
1	10	128.4	13.05	107.1	145.0	10	131.4	12.62	107.2	145.0
2	8	161.5	7.68	149.0	174.5	11	159.0	7.74	147.9	174.0
3	4	156.5	11.14	141.0	167.5	5	156.3	9.63	141.0	167.0
4	1	173.0	–	–	–	1	173.5	–	–	–
5	6	203.5	19.92	188.0	241.0	7	193.8	6.94	185.0	203.0
6	2	207.0	–	197.0	217.0	2	209.0	–	197.0	221.0
7	3	238.7	–	228.0	259.0	3	237.3	–	226.0	259.0
8	3	257.7	–	247.0	277.0	3	265.0	–	251.0	279.0
9	3	268.0	–	262.0	277.0	4	272.3	12.89	259.0	288.0
10	–	–	–	–	–	–	–	–	–	–
11	–	–	–	–	–	–	–	–	–	–
12	1	320.0	–	–	–	1	314.0	–	–	–
13	–	–	–	–	–	–	–	–	–	–
14	1	345.0	–	–	–	–	–	–	–	–
					Tibia					
0	20	79.9	14.48	60.0	107.0	18	77.8	12.02	60.1	96.1
1	6	102.5	12.48	89.9	119.0	7	108.3	11.28	89.3	118.5
2	8	132.6	6.65	122.5	142.0	8	133.0	6.78	123.0	144.0
3	3	127.7	–	116.5	139.5	2	129.3	–	118.5	140.0
4	2	143.0	–	140.0	146.0	–	–	–	–	–
5	7	160.7	15.14	151.0	194.0	5	161.0	18.59	150.0	194.0
6	2	167.0	–	162.0	172.0	2	166.8	–	160.0	173.5
7	3	194.3	–	180.0	209.0	2	194.5	–	179.0	210.0
8	4	208.5	6.95	202.0	218.0	4	215.6	13.40	201.5	233.0
9	3	220.0	–	210.0	226.0	1	211.0	–	–	–
10	–	–	–	–	–	–	–	–	–	–
11	–	–	–	–	–	1	255.0	–	–	–
12	1	263.0	–	–	–	–	–	–	–	–

Table 2 (end)

1	2	3	4	5	6	7	8	9	10	11
13	–	–	–	–	–	–	–	–	–	–
14	1	306.0	–	–	–	–	–	–	–	–
Fibula										
0	15	76.5	13.29	59.1	104.0	14	71.3	10.69	58.4	86.8
1	4	95.1	12.63	88.0	114.0	2	105.4	–	98.7	112.0
2	7	127.6	7.54	118.5	138.5	6	127.0	5.93	119.5	137.0
3	3	124.0	–	112.5	134.0	1	114.5	–	–	–
4	1	143.5	–	–	–	1	144.0	–	–	–
5	9	155.6	12.31	146.0	186.0	5	156.5	16.13	146.0	185.0
6	2	163.5	–	159.0	168.0	2	164.0	–	159.0	169.0
7	3	188.8	–	173.5	201.0	22	187.0	–	173.0	201.0
8	2	204.5	–	200.0	209.0	1	200.0	–	–	–
9	2	215.5	–	209.0	222.0	3	213.7	–	207.0	223.0
10	2	222.0	–	218.0	226.0	–	–	–	–	–
11	1	236.0	–	–	–	–	–	–	–	–
12	1	254.0	–	–	–	1	254.0	–	–	–
13	–	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	–	–	–	–	–

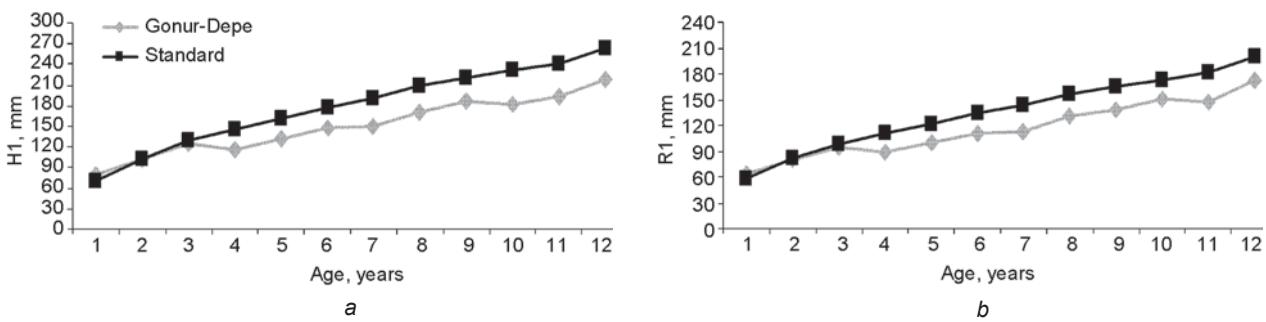

Fig. 2. Age variation of the humeral (*a*) and radial (*b*) diaphyseal lengths as compared to standard values.

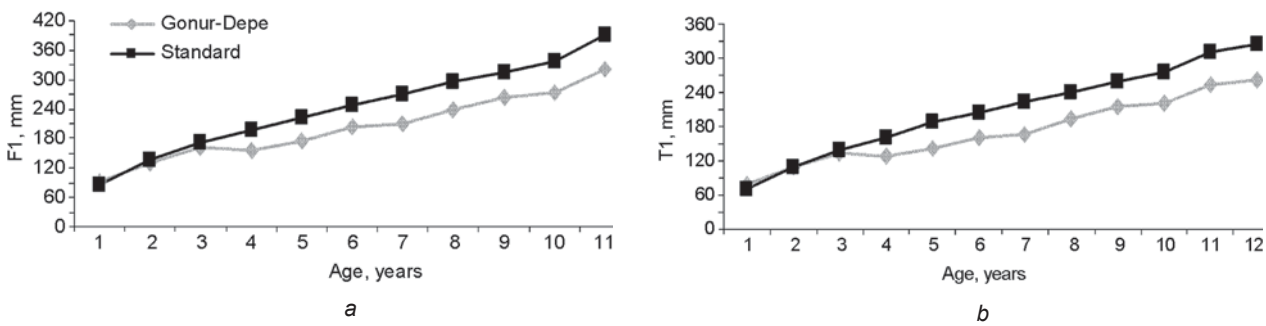

Fig. 3. Age variation of the humeral (*a*) and tibial (*b*) diaphyseal lengths as compared to standard values.

Table 3. **Limb bone diaphyseal lengths in respect to age standards**

Age cohort	Humerus		Radius		Ulna		Femur		Tibia		Fibula		Total	
	N	δl_m*	*N*	δl_m	*N*	δl_m	*N*	δl_m	*N*	δl_m	*N*	δl_m	*N*	δl_m
0	40	0.98	37	0.96	38	0.99	41	0.93	38	1.00	29	0.99	223	0.98
1	27	0.90	29	0.90	27	0.91	19	0.87	13	0.90	6	0.89	121	0.90
2	28	0.93	24	0.95	23	0.95	19	0.92	16	0.93	12	0.91	122	0.93
3	3	0.78	3	0.78	3	0.81	9	0.80	5	0.79	3	0.77	26	0.79
4	4	0.81	4	0.82	4	0.84	3	0.77	3	0.77	1	0.79	19	0.80
5	10	0.81	17	0.83	14	0.82	13	0.80	12	0.79	14	0.77	80	0.80
6	4	0.78	4	0.78	3	0.79	4	0.77	4	0.75	4	0.74	23	0.77
7	10	0.81	4	0.82	4	0.83	4	0.83	5	0.81	5	0.79	32	0.82
8	8	0.84	5	0.82	6	0.85	5	0.82	5	0.81	2	0.78	31	0.82
9	4	0.78	6	0.86	5	0.85	7	0.80	4	0.80	5	0.79	31	0.81
10	2	0.80	2	0.81	1	0.82	–	–	–	–	2	0.78	7	0.80
11	–	–	–	–	–	–	–	–	–	–	1	0.78	1	0.78
12	4	0.83	3	0.85	2	0.88	2	0.81	2	0.80	2	0.81	15	0.83
13	–	–	–	–	1	0.84	–	–	–	–	–	–	1	0.84
14	–	–	1	0.83	–	–	1	0.74	1	0.77	–	–	3	0.78
Total	144	0.84	139	0.85	131	0.86	127	0.82	108	0.83	86	0.81	735	0.83

*Parameter indicating the mean deviation of limb bone measurements from standard values.

Table 4. **Limb bone diaphyseal lengths, percentage of the adult value attained by a particular age**

Age cohort	Humerus	Radius	Ulna	Femur	Tibia	Fibula
0	25.6	26.3	27.3	20.7	21.3	21.4
1	33.0	32.8	33.9	29.4	28.8	29.4
2	40.3	39.0	39.9	36.1	35.4	35.6
3	37.9	36.6	37.0	35.0	34.4	34.6
4	42.7	41.4	42.9	38.8	38.1	40.2
5	48.0	45.8	46.7	45.5	42.9	43.7
6	48.6	46.5	47.9	46.7	44.5	45.8
7	55.4	53.7	54.9	53.4	51.8	52.7
8	61.0	57.2	59.1	59.3	57.4	57.1
9	59.4	62.3	61.6	60.9	58.6	60.2
10	63.0	60.5	62.3	–	–	62.0
11	–	–	–	–	67.9	65.9
12	71.1	71.2	74.1	71.6	70.0	70.9
13	–	–	77.1	–	–	–
14	–	79.8	–	77.2	81.4	–

Note. The largest mean value of either right or left side was used for calculation.

adapted to environment (Kufterin, 2016a). This is evident, for instance, in the low frequency of infection markers on the skeletons, and the absence of cases of scurvy, rickets, or traumatic lesions (Ibid.: 97).

Notably, the frequency in the studied sample of *cribra orbitalia*, the skeletal marker of anemia, is the highest in the cohort of 5-to-9-year-old children. This cohort also displays the highest level of retardation of longitudinal growth (statistically significant) as compared to the younger age group (Ibid.: 94–95). The probable age of emergence of most hypoplastic enamel defects (1–1.5 years) correlates to some extent with growth rates as well. As was noted above, the cohort of 2–3 year old children deviates the least from the modern standards. The observed younger age of formation of the hypoplastic defects could be related to the beginning of weaning, while some "delay" of longitudinal growth (in respect to the stress marker) might be associated with differences in genetically determined growth rates between the dentition and skeleton.

Finally, the results of the study of longitudinal growth in "agriculturalist" and "pastoralist" ancient populations of the Bronze and Iron Ages from Ukraine (Piontek, Jerszynska, Segeda, 2001) are of interest for interpretation of the results of the present work. The "pastoralist" sub-adults were found to be taller than their "agriculturalist" counterparts, which is explained by the Ukrainian and Polish researchers (among other factors) by different reproductive strategies in the two groups, similar to the classical r- and K-strategies (Ibid.). The "agriculturalists" displayed a higher fertility, a larger reproductive potential, a shortened duration of breast-feeding, and an early maturation (Ibid.: 69). Indeed, it is tempting to interpret the relatively high level of sub-adult (including infant) mortality in the late population of Gonur-Depe (burials in the "ruins" of the palace-temple ensemble), accompanied by a growth retardation in children and adolescents, as manifestations of the r-strategy. But direct parallels are barely relevant here, since no species (moreover, no population, "agriculturalist" or "pastoralist") is subjected to purely r- or K-selection (Pianka, 1970; MacArthur, Wilson, 2001: 148–149).

Conclusions

The study of the rate of longitudinal growth in children and adolescents from Gonur-Depe has confirmed the views on this ancient population as well-adapted to its environment. The observed retardation of skeletal maturation, which is expressed in the "lagging" of longitudinal growth, can by no means be considered a manifestation of maladaptation of the population. Rather, it reflects a complex and multifaceted interaction with the environment. The comparison of paleodemographic, paleopathological, and growth rate data shows that the sub-adult sample from Gonur-Depe can be viewed as a "litmus test", which integrally reflects the most complex process of biosocial adaptation of the Murghab oasis population to its environment. Any mechanistic interpretation of the "paleoauxological", as well as paleopathological, data seems unpromising, and the "osteological paradox" is not to be forgotten (Wood et al., 1992; Jackes, 1993).

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AN RB – Academy of Sciences of the Republic of Bashkortostan

AN RT – Academy of Sciences of the Republic of Tatarstan

BAR – British Archaeological Reports

FMA – Field materials of the author

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

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

IEA RAN – Institute of Ethnography and Anthropology, Russian Academy of Sciences (Moscow)

IG RAN – Geological Institute, Russian Academy of Sciences (Moscow)

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

INP SB RAS – Budker Institute of Nuclear Physics, Siberian Branch, Russian Academy of Sciences (Novosibirsk)

IPOS SO RAN – Institute of Northern Development, Siberian Branch, Russian Academy of Sciences (Tyumen)

KarNC RAN – Karelian Research Center, Russian Academy of Sciences (Petrozavodsk)

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

MIA – Materials and Investigations on Archaeology in the USSR

NSU – Novosibirsk State University (Novosibirsk)

SPbGU – Saint Petersburg State University (St. Petersburg)

UrO RAN – Ural Branch of the Russian Academy of Sciences

VNIIK – All-Russian Research Institute for Horse Breeding (Ryazan)

Ayremlou Y., Senior Lecturer, University of Mohaghegh Ardabili, Daneshgah Street, 56199-11367, Ardabil, Iran. E-mail: yahya_ayramlou@uma.ac.ir; https://orcid.org/0000-0002-0396-5575

Bobrov L.A., Leading Researcher, Associate Professor, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: spsml@mail.ru; https://orcid.org/0000-0001-5071-1116

Bulatova E.K., Associate Professor, Nosov Magnitogorsk State Technical University, pr. Lenina 38, Magnitogorsk, 455000, Russia. E-mail: bulatova_ek@bk.ru; https://orcid.org/0000-0003-4010-021X

Eisvand S.F., Graduate Student, University of Mohaghegh Ardabili, Daneshgah Street, 56199-11367, Ardabil, Iran. E-mail: Samanehfarokhii@gmail.com; https://orcid.org/0000-0003-3191-4553

Epimakhov A.V., Leading Researcher, South Ural Department of the Institute of History and Archaeology, Ural Branch, Russian Academy of Sciences; Professor, South Ural State University, pr. Lenina 76, Chelyabinsk, 454080, Russia. E-mail: eav74@rambler.ru; https://orcid.org/0000-0002-0141-1026

Fursova E.F., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: mf11@mail.ru; https://orcid.org/0000-0002-9459-7033

Hariri N., Doctoral Student, University of Mohaghegh Ardabili, Daneshgah Street, 56199-11367, Ardabil, Iran. E-mail: hariri.nemat@gmail.com; https://orcid.org/0000-0001-6190-7544

Herva V.-P., Professor, University of Oulu, Oulun yliopisto, Pentti Kaiteran Katu, 1, Oulu, 90014, Finland. E-mail: vesa-pekka.herva@oulu.fi; https://orcid.org/0000-0002-5925-4406

Ismailov D.M., Doctoral Student, Research Assistant, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: ismailov_dm@mail.ru; https://orcid.org/0000-0002-0211-4103

Kalinkin P.N., Researcher, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: p.kalinkin@g.nsu.ru; https://orcid.org/0000-0003-1030-9100

Karpova E.V., Senior Researcher, Vorozhtsov Novosibirsk Institute of Organic Chemistry, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 9, Novosibirsk, 630090, Russia. E-mail: karpovae@nioch.nsc.ru; https://orcid.org/0000-0001-8803-4237

Kazaneva E.K., Associate Professor, Nosov Magnitogorsk State Technical University, pr. Lenina 38, Magnitogorsk, 455000, Russia. E-mail: mgnket@mail.ru

Kovalevskaya V.B., Leading Researcher, Institute of Archaeology, Russian Academy of Sciences, Dm. Ulyanova 19, Moscow, 117036, Russia. E-mail: ver.kov@mail.ru; https://orcid.org/0000-0002-1658-1669

Krause R., Professor, Goethe-Universität, Campus Westend, Norbert-Wollheim-Platz 1, Frankfurt am Main, 60323, Germany. E-mail: R.Krause@em.uni-frankfurt.de

Kucherskaya M.A., Professor, National Research University Higher School of Economics, Staraya Basmannaya 21/4, Moscow, 105066, Russia. E-mail: mayakuch@gmail.com; https://orcid.org/0000-0002-1007-6426

Kufterin V.V., Researcher, Anuchin Research Institute and Museum of Anthropology, Lomonosov Moscow State University, Mokhovaya 11, Moscow, 125009, Russia. E-mail: vladimirkufterin@mail.ru; http://orcid.org/0000-0002-7171-8998

Kundo L.P., Leading Chemical Technologist, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: kundoludmila@ngs.ru

Kupriyanova E.V., Director of the Educational and Research Center for the Study of Nature and Human Problems, Chelyabinsk State University, Bratyev Kashyrinykh 129, Chelyabinsk, 454001, Russia. E-mail: dzdan@mail.ru; https://orcid.org/0000-0001-8842-9976

Matveeva N.P., Professor, Tyumen State University, Volodarskogo 6, Tyumen, 625003, Russia. E-mail: nataliamatveeva1703@yandex.ru; https://orcid.org/0000-0003-0240-0561

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

Mylnikova L.N., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: l.mylnikova@yandex.ru; https://orcid.org/0000-0003-0196-5165

Nechvaloda E.E., Senior Researcher, Institute for Ethnological Studies, Ufa Federal Research Center, Russian Academy of Sciences, Karla Marksa 6, Ufa, 450077, Russia. E-mail: pishi-nikonor@yandex.ru; https://orcid.org/0000-0001-5267-4830

Nenakhov D.A., Leading Engineer, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: nenaxoffsurgut@mail.ru; https://orcid.org/0000-0002-0820-9410

Nordqvist K., Researcher, University of Helsinki, Helsingin yliopisto, Fabianinkatu, 24, Helsinki, 00014, Finland. E-mail: kerkko.nordqvist@helsinki.fi; https://orcid.org/0000-0001-8696-1707

Novikov I.K., Senior Lecturer, Kurgan State University, Sovetskaya 63, bldg. 4, Kurgan, 640020, Russia. E-mail: sherlock2479@yandex.ru; https://orcid.org/0000-0001-8912-0081

Ovchinnikov I.Y., Researcher, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia. E-mail: ivovchinnikov@igm.nsc.ru; https://orcid.org/0000-0003-4947-9043

Park Kyujin, Doctoral Student, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: gogoraccoon@gmail.com; https://orcid.org/0000-0003-1333-7959

Parkhomchuk E.V., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Associate Professor, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: ekaterina@catalysis.ru; https://orcid.org/0000-0003-2200-884X

Parkhomchuk V.V., Chief Researcher, Budker Institute of Nuclear Physics, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 11, Novosibirsk, 630090, Russia; Professor, Laboratory Head, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: parkhomchuk@inbox.ru; https://orcid.org/0000-0001-5833-0051

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

Rastigeev S.A., Senior Researcher, Budker Institute of Nuclear Physics, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 11, Novosibirsk, 630090, Russia. E-mail: S.A.Rastigeev@inp.nsk.su; https://orcid.org/0000-0003-0555-7935

Reinhold S., PhD, German Archaeological Institute, Im Dol 2-6, Berlin, D 14195, Germany. E-mail: sabine.reinhold@dainst.de; https://orcid.org/0000-0002-8107-6300

Rezalou R., Associate Professor, University of Mohaghegh Ardabili, Daneshgah Street, 56199-11367, Ardabil, Iran. E-mail: r_rezaloo@uma.ac.ir; https://orcid.org/0000-0001-7067-1916

Sandell S., Independent Researcher, Helsinginkatu, 14, Helsinki, 00500, Finland. E-mail: sarita.sandell@gmail.com; https://orcid.org/0000-0002-6111-3362

Shatskaya S.S., Senior Researcher, Institute of Solid State Chemistry and Mechanochemistry, Siberian Branch, Russian Academy of Sciences, Kutateladze 18, Novosibirsk, 630128, Russia. E-mail: Shatskaya@solid.nsc.ru; https://orcid.org/0000-0001-6527-29

Smolyaninova L.G., Researcher, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia. E-mail: smol@igm.nsc.ru; https://orcid.org/0000-0002-4662-8130

Stolarczyk E., Researcher, Goethe-Universität, Campus Westend, IG-Farbenhaus, Office: V5, 6.51, Frankfurt am Main, 60323, Germany. E-mail: Stolarczyk@em.uni-frankfurt.de; https://orcid.org/0000-0001-7476-4810

Stoyakin M.A., Researcher, National Research Institute of Cultural Heritage, 132, Munji-ro, Yuseoung-gu, Daejeon, 34122, South Korea. E-mail: stake-14@yandex.ru; https://orcid.org/0000-0001-9558-3533

Tataurov S.F., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. K. Marksa 15/1, Omsk, 644024, Russia. E-mail: tatsf2008@rambler.ru; https://orcid.org/0000-0001-6824-7294

Tikhonov S.S., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. K. Marksa 15/1, Omsk, 644024, Russia. E-mail: semchi957@gmail.com; https://orcid.org/0000-0001-6909-0727

Ulchitsky O.A., Department Chair, Nosov Magnitogorsk State Technical University, pr. Lenina 38, Magnitogorsk, 455000, Russia. E-mail: archi-mgtu@mail.ru; https://orcid.org/0000-0003-1065-3251

Veremey O.M., Associate Professor, Nosov Magnitogorsk State Technical University, pr. Lenina 38, Magnitogorsk, 455000, Russia. E-mail: o.veremey@mail.ru; https://orcid.org/0000-0001-9738-9830

Volvakh A.O., Researcher, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia. E-mail: sizikova@igm.nsc.ru; https://orcid.org/0000-0002-7292-9076

Zadorozhnyy M.V., Junior Researcher, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia. E-mail: zador@igm.nsc.ru; https://orcid.org/0000-0001-8271-8259

Zykin V.S., Laboratory Head, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia; Professor, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: zykin@igm.nsc.ru; https://orcid.org/0000-0002-8664-7547

Zykina V.S., Leading Researcher, Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia. E-mail: zykina@igm.nsc.ru; https://orcid.org/0000-0002-9269-4200