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New Data on the Chronology of the Initial Neolithic Gromatukha Culture, Western Amur Region

Since its discovery in the early 1960s, the chronology of the Neolithic Gromatukha culture in the Western Amur region has undergone radical changes. After the appearance of a series of carbon dates based on charcoal and organic remains in clay texture, its initial attribution to the Early and Middle Neolithic (second half of the 5th to 4th millennia BC) was replaced by a much earlier estimate (from 16–15 to 8 cal ka BP). As a result, Gromatukha became not only one of the most ancient Early Neolithic cultures in the Amur Region, but also one with the earliest pottery among forest and riverine hunter-gatherer cultures. To date, its absolute chronology is based on 34 dates, comprising 9 derived from charcoal, 8 from organic remains in clay texture, and 17 from samples of charred remains on pottery. The latter are analyzed in this article. Comparison of the chronological limits of Gromatukha culture demonstrates that the widest of them concern dates based on organic remains in clay texture (16,260–8010 cal BP); narrower limits relate to estimates based on charred remains on pottery (15,010–9550 cal BP); and the narrowest limits to those based on charcoal (14,820–11,200 cal BP). A new series of dates based on charred remains on pottery indicates a span of 5460 years, which is 2790 years less than that based on organic remains in clay texture, and 1840 years more than what the charcoal-derived estimates suggest.

Keywords: *Gromatukha culture, Initial Neolithic, AMS carbon dating.*

Introduction

The Gromatukha culture was distinguished by A.P. Okladnikov in 1961 by the finds from a multilayered site in the mouth of the Gromatukha River, in the Zeya River basin. For the first time, these materials were presented to the scientific community at the Third Far Eastern Conference in Komsomolsk-on-Amur in 1962 (Okladnikov, 1962). In 1963, stone artifacts and ceramics close to Gromatukha were discovered near the village of Sergeyevka, in the upper Amur basin (Okladnikov, 1966). In various years at the turn of the 20th–21st centuries, in the Zeya and Amur basins, archaeologists found artifacts that could have been assigned to the Gromatukha culture. The Gromatukha culture sites studied via excavations in the Western Amur region are rare. In 1963–1965, studies were conducted at the Sergeyevka settlement; in 1965–1966 and 2004 at the eponymous site of Gromatukha; in 2006 and 2010 at the Chernigovka-on-Zeya settlement; and since 2004 they have been continued at the Kalinovka rock art site in the upper Amur area (Fig. 1) (Okladnikov, Derevianko, 1977: 8–9; Derevianko, Kang Chan Hwa, Ban Mun Be et al., 2004; Nesterov, Zaitsev, Volkov, 2006; Nesterov, 2008; Zabiyako, Kobyzov, 2011). On the basis of materials from excavations at the Gromatukha site, in 1960s, a detailed typology of stone tools and ceramics belonging to the Gromatukha culture has been developed. A.P. Okladnikov and A.P. Derevianko noted that the artifacts from "three cultural layers of the settlement compose a single well-matured complex", while the percentage ratio of tools and differently ornamented ceramics represents development of the Gromatukha culture in time (1977: 79–98). Owing to the absence of radiocarbon dates, the Gromatukha culture was preliminarily dated by the analogs and typology of artifacts to the 5th to the early 4th millennia BC, or to the second half of the 5th to the 4th millennia BC (Ibid.: 161, 173). However, as early as the outset of the study of this culture, assumptions were made regarding its older age, which were taken skeptically by many scientists. For instance, in 1965, one of the authors of this article had occasion to discuss the degree dissertation of a historical sciences candidate in the Paleolithic Department of the Leningrad Branch of the Institute of Archeology of the USSR Academy of Sciences. The disputants rejected the dates of the Early Neolithic cultures of the Middle Amur region, proposed by the defender of thesis: the late 7th to early 6th millennia BC for the Novopetrovka culture, and the late 6th to early 5th millennia BC for Gromatukha. The opponents pointed out that no Neolithic cultures with ceramics of such an ancient age are known either in the Near East or in Europe. Because of the absence of absolute dates and because of this criticism, the author of study was forced to reduce the age of these cultures by two thousand years (Derevianko, 1965).

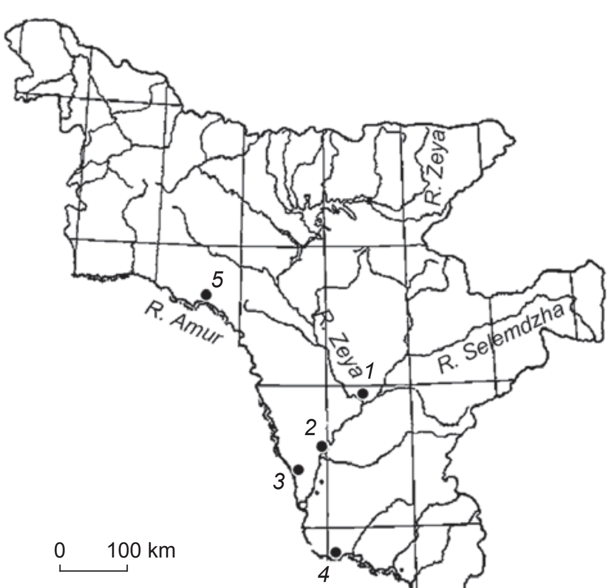

Fig. 1. Neolithic sites of the Initial Neolithic in the Amur Region. *1* – Gromatukha; *2* – Chernigovka-on-Zeya; *3* – Sergeyevka; *4* – Novopetrovka II; *5* – Kalinovka.

Radiocarbon dates obtained from charcoal and organic admixture in ceramics

The first data on radiocarbon dating based on charcoal and organic plant admixture in the Gromatukha ceramics were obtained in 1996–2002 (Derevianko, Kuzmin, Burr et al., 2004). The studies at the Gromatukha site in 2004 resulted in the discovery of numerous stone and pottery artifacts, along with 22 samples of charcoal, 11 of which were subjected to radiocarbon dating in laboratories in Russia, Japan, and the USA (Nesterov et al., 2006). Five radiocarbon determinations obtained from these samples correspond to the initial stage of the Gromatukha culture (Table 1, No. 1, 2, 4, 6, 23) (Nesterov et al., 2005: 170). One date belonging to the Initial Neolithic is available for the Chernigovka-on-Zeya settlement (Table 1, No. 32) (Kuzmin, Nesterov, 2010).

A series of 17 radiocarbon dates for the Gromatukha and Chernigovka-on-Zeya sites obtained in 2010* supplemented the relative chronology of sites, which was based on stratigraphic observations and typological analysis of material, with absolute indicators.

*For reference: by 2010, five radiocarbon dates were available for the Early Neolithic Novopetrovka culture of the Western Amur region, and six dates for the Late Neolithic Osinovoye Ozero culture. The archaeological culture of the Middle Neolithic has not been distinguished in this area so far.

Table 1. **Radiocarbon dates of the Gromatukha culture, obtained in 1996–2002**

No.	Site, layer	Material	Laboratory code	^{14}C-date, BP	Calendar date, BP, ±2σ	Source
1	Gromatukha, layer 3	Charcoal	MTS-05937	12,380 ± 70	14,820–14,090	(Nesterov et al., 2006)
2	" "	"	MTS-05936	12,340 ± 70	14,740–14,030	(Ibid.)
3	" "	"	AA-36079	12,340 ± 60	14,700–14,040	(Ibid.)
4	" "	"	MTS-05936	12,300 ± 70	14,560–13,980	(Ibid.)
5	" "	"	AA-60765	12,120 ± 40	14,090–13,840	(Ibid.)
6	" "	"	SOAN-5762	11,580 ± 190	13,810–13,100	(Ibid.)
7	" "	"	AA-36447	9895 ± 50	11,600–11,200	(Jull et al., 2001)
8	" "	Organic admixture (grass)	AA-20940	13,310 ± 110	16,260–15,350	(Derevianko et al., 2004)
9	" "	Ditto	AA-20939	13,240 ± 85	16,120–15,300	(Ibid.)
10	" "	"	SNU02-002	11,320 ± 150	13,360–13,050	(Ibid.)
11	" "	"	AA-38108	10,450 ± 60	12,650–12,120	(Ibid.)
12	" "	"	AA-38102	8660 ± 90	10,200–9630	(Ibid.)
13	" "	"	AA-38107	7310 ± 45	8200–8010	(Ibid.)
14	" "	Charred remains	MTS-17798	12,400 ± 100	15,010–14,050	This study
15	" "	"	Tka-15189	12,170 ± 50	14,190–13,840	Ditto
16	" "	"	MTS-17808	11,440 ± 80	13,450–13,140	"
17	" "	"	MTS-17799	9680 ± 80	11,230–10,770	"
18	" "	"	MTS-17800	9620 ± 80	11,200–10,730	"
19	" "	"	MTS-17797	9360 ± 80	10,780–10,280	"
20	" "	"	MTS-17802	9460 ± 80	11,090–10,510	"
21	" "	"	MTS-17796	9150 ± 80	10,520–10,190	"
22	" "	"	MTS-17801	9280 ± 90	10,680–10,250	"
23	" layer 2.2	Charcoal	Beta-205394	10,660 ± 40	12,820–12,650	(Nesterov et al., 2006)
24	" layer 2	Charred remains	MTS-17805	12,530 ± 90	15,120–14,190	This study
25	" "	"	MTS-17794	10,060 ± 90	11,970–11,270	Ditto
26	" "	"	MTS-17793	9960 ± 80	11,750–11,730	"
27	" layer 2.2	"	MTS-17806	9910 ± 70	11,680–11,200	"
28	" layer 2	"	MTS-17795	9900 ± 80	11,700–11,190	"
29	" "	"	MTS-17807	9360 ± 70	10,760–10,300	"
30	" layer 1	"	MTS-17803	9670 ± 80	11,220–10,770	"
31	Novopetrovka II	Organic admixture (grass)	AA-38103	12,720 ± 130	15,430–14,320	(Derevianko et al., 2004)
32	Chernigovka-on-Zeya, layer 2	Charcoal	AA-78935	9885 ± 55	11,600–11,200	(Kuzmin, 2006)
33		Charred remains	MTS-17811	9080 ± 230	11,060–9550	This study
34	Sergeyevka	Organic admixture (grass)	AA-38104	7940 ± 45	8980–8640	(Derevianko et al., 2004)

Stratigraphic analysis of strata on the area where the Gromatukha site is situated has shown that three Neolithic cultural layers (Fig. 2, *1*) lie under the layer associated with the Russian settlement that emerged during intense development of the territory in the 20th century.

Layer 1 is composed of tawny light loam. Its thickness varies from 10 to 40 cm. In the eastern part of the area unearthed by excavation in 2004, traces of a ground dwelling belonging to the Osinovoye Ozero culture were recorded (Volkov, Nesterov, 2008). Charcoal from layer 1 produced one date: 3600 ± 45 BP (SOAN-5759), the calendar value of which corresponds to (±2σ) 3730–4080 BP. This is in good agreement with three determinations based on samples from the dwelling, which could have existed in the interval from 3410 to 3690 BP (3290 ± 40 BP (MTS-05940), 3340 ± 40 BP (MTS-05939), and 3350 ± 40 BP (MTS-05941)) (Kuzmin, Nesterov, 2010: 105). Only one charcoal sample from this dwelling has shown the date of 2600 ± ± 95 BP (SOAN-5760), which corresponds to the time of the Uril culture of the Early Iron Age ((±2σ), 920–410 BP)), whose separate pottery fragments are found in redeposited form at this site.

Layer 2 is composed of dark humic sandy loam. In the majority of sections made in 2004, it was possible to identify a division of this layer into two horizons. In certain sections, a thin (5–7 mm) sandy interlayer was established between the horizons. The thickness of layer 2 is from 20 to 70 cm, or 40–50 cm on average. The calibrated dates based on two charcoal samples from this layer (6175 ± 125 BP (SOAN-5761), 10660 ± ± 40 BP (Beta-205394)) and on one collagen sample from a roe-deer bone (5140 ± 140 BP (AA-36085)) indicate a calendar calibrated age of the layer in the interval (±2σ) from 5600 to 12,820 BP (Ibid.: 104–105).

Layer 3 is composed of gray sandy loam represented discretely by lenses in all sections. In the places where layer 3 is absent, layer 2 lies directly on crushed-stony/clay layer 4, containing no archaeological artifacts. For layer 3, 13 radiocarbon dates have been obtained from charcoal and organic remains (grass) in clay texture (Table 1, No. 1–13), according to which the calendar calibrated age of the layer (±2σ) is approximately 8010–16,260 BP (Derevianko, Kuzmin, Burr et al., 2004; Kuzmin, Nesterov, 2010: 104–105).

Stratigraphic studies at the Chernigovka-on-Zeya site have determined that the top layer of the terrace is a weakly sodded arable field exposed to severe water and wind erosion (Fig. 2, *2*). In fact, this is the upper horizon of archaeological layer 1. As a result of its destruction, some artifacts proved to be redeposited. Apart from the Gromatukha finds, rare potsherds belonging to the Uril culture of the Early Iron Age and the Early Middle Ages (Mohe) were encountered here. The part of layer 1 (red sandy loam) undisturbed by tillage wedges out towards the south in the meridional sections, while its underlying layer 2 (black sandy loam) and, occasionally, sterile layer 3 near the southern wall of the excavation area, lie immediately under the arable field. The thickness of the layers increases towards the north by 30–40 cm for

Fig. 2. Stratigraphy of Gromatukha (*1*) and Chernigovka-on-Zeya (*2*) sites.

layer 1, and by 40–50 cm for layer 2. At the same time, it reduces eastwards. A blade-based arrowhead, discovered in the arable land layer, is similar to the arrowheads from Novopetrovka III (Western Amur region), where for layer 1 a radiocarbon calibrated date of (±2σ) 8610–9240 BP (8040 ± 90 BP (MTS-05943)) is available (Nesterov et al., 2005: 170). The radiocarbon date obtained from the charcoal sample found in layer 2 (9885 ± 55 BP (AA-78935)) has shown an interval of 11,200–11,600 BP (Kuzmin, Nesterov, 2010: 104).

Radiocarbon dates from charred remains on pottery

In 2015, for the first time for the Gromatukha culture, our Japanese colleagues conducted radiocarbon (AMS) dating of charred remains (deposited during cooking) on ceramicware fragments from the Gromatukha (20 samples) and Chernigovka-on-Zeya sites (1)*. Potsherds for analysis were taken from collections of the Gromatukha (excavations by A.P. Okladnikov, A.P. Derevianko, E.I. Derevianko in 1966 (14 samples), and S.P. Nesterov in 2004 (6)) and Chernigovka-on-Zeya sites (excavations by Nesterov in 2006 (1 sample)) (Table 2; Fig. 3, 4). Samples of charred remains on pottery were dated in the University of Tokyo, Japan (laboratory codes MTS and Tka).

Radiocarbon dating of charred remains on Neolithic pottery from the Western Amur region resulted in 21 dates, 17 of which were attributed to the Gromatukha culture. For the Gromatukha site, nine dates were established based on samples from layer 3, six dates from layer 2, and one date from layer 1. One date (9070 ± 240 BP) (MTS-17811)) was derived from charred remains on pottery from layer 2 of the Chernigovka-on-Zeya site**.

*Also, two charcoal samples from the medieval sites were dated: Ozero Dolgoye, pit No. 17 – 1760 ± 40 BP (MTS-17572), (±2σ) 139–385 AD, and Osinovoye Ozero, dwelling 3 – 1535 ± ± 40 BP, (±2σ) 427–604 AD.

**Charred remains on pottery (which has no cultural attribution so far) from layers 2 and 1 of the Gromatukha site produced two new radiocarbon dates: 5680 ± 60 BP (MTS-17792) (±2σ), 6634–6318 BP, and 5430 ± 50 BP (MTS-17810) (±2σ) 6313–6020 BP, respectively. Two samples, one of which pertains to layer 1 (3380 ± 45 BP (MTS-17809) (±2σ), 3811–3479 BP), and another one represents the dwelling (3460 ± 50 BP (MTS-17804) (±2σ) 3852–3587 BP), were assigned to the period of the Late Neolithic Osinovoye Ozero culture. In the latter case, the date relates, most probably, to the soot that appeared on one of the conjoining vessel fragments as a result of a fire, in which the dwelling was burnt down (Volkov, Nesterov, 2008: 109). On the mating sherd, there are neither charred remains nor traces of fire (Fig. 4, *6*; see Tab. 2).

Discussion of results

The dates of the Gromatukha sites were derived from charcoal, organic remains (grass) in clay texture, and charred remains on vessels.

Dating of charred remains on pottery is performed using the standard procedure; however, its interpretation should take into account some special features. The matter is that the cooking of food is often accompanied by absorption of carbon dissolved in water, which can have a greater (up to several hundreds of years) radiocarbon age than plant or animal food cooked in a ceramic vessel. In such a case, the date determined from the charred remains will be more ancient than that established from contemporaneous charcoal from a hearth or a layer (Fischer, Heinemeier, 2003; Kuzmin, Nesterov, 2010: 103, 106).

As for radiocarbon dating of an organic admixture (usually, chopped grass) in clay texture of ceramics, it is based on carbon (approx. 1.0–0.1 %) released as a result of heating the milled ceramics (preliminarily cleared from carbonates and humic acids) under oxygen atmosphere at a temperature of 400 ºC. However, even at 400 ºC, there remains a probability of the organic admixture's being polluted with more ancient carbon from clay. Radiocarbon dates from organic material in pottery, as compared with ^{14}C-dates from charcoal and charred remains at the same sites, give a greater chronological range, but show the similarity of age for all other types of carbon-containing materials. This makes the dates obtained from organic remains in clay texture sufficiently reliable as well (Kuzmin, Nesterov, 2010: 106).

The largest number of charcoal and pottery samples for radiocarbon analysis was obtained from layer 3 at the Gromatukha site. Comparison of dates from charcoal and organic admixture has revealed a somewhat older age (approximately by 1 thousand years) of pottery samples with grass in clay texture (see Table 1). In general, the dates of artifacts from Gromatukha layer 3 are in the range of (hereinafter ± 2σ) 14,820–11,200 calendar years ago for charcoal, and 16,260–8010 BP for organic admixture. A charcoal sample from interlayer 2.2 of layer 2, taken at the boundary with layer 3, has also demonstrated a considerably ancient age of 12,820–12,650 BP. The dates of finds from layer 2 of the Chernigovka-on-Zeya are comparable with the dates of samples from layer 3 of the Gromatukha site. Dates corresponding to the period of the Gromatukha culture have also been derived from ceramics containing grass in clay texture at the Novopetrovka II and Sergeyevka sites. Pottery from Novopetrovka II represents the period up to 15,430 BP, while the Sergeyevka sample (8980–8640 BP), obviously represents the final stage of Gromatukha development in the Western Amur region, contemporaneous with the Novopetrovka culture.

Table 2. **New radiocarbon dates for the Gromatukha and Chernigovka-on-Zeya sites**

Sample No.	Year of excavations, No. of pottery fragment according to the list, archaeological culture	Location of charred remains on a vessel	No. of figure in this article	Laboratory code	^{14}C-date, BP	Calendar date, BP, ±2σ	Carbon content, C%	Nitrogen content, N%	Carbon-to-nitrogen ratio, C/N
1	2	3	4	5	6	7	8	9	10
Gromatukha									
Gro-1	1966, layer 3, Gromatukha culture	On the inside of the body	3, *1*	Tka-15189	12,170 ± 50	13,843–14,185 (100 %)	39.3	4.9	9.3
2015Gro-1	1966, layer 2, No. 12598, culture not identified	On the inside of the rim	3, *2*	MTS-17792	5680 ± 60	6318–6375 (10 %) 6387–6574 (80 %) 6577–6634 (10 %)	48.0	3.7	15.3
2015Gro-2	1966, layer 2, No. 8256, Gromatukha culture	Ditto	3, *3*	MTS-17793	9960 ± 80	11,228–11,728 (99 %) 11,731–11,751 (1 %)	44.3	4.5	11.5
2015Gro-3	1966, layer 2, Gromatukha culture	"	3, *4*	MTS-17794	10,060 ± 90	11,272–11,844 (89 %) 11,858–11,973 (11 %)	54.7	5.8	10.9
2015Gro-4	1966, layer 2, No. 3457, Gromatukha culture	On the inside of the body	3, *7*	MTS-17795	9900 ± 80	11,187–11,629 (98 %) 11,672–11,699 (2 %)	30.1	4.0	8.8
2015Gro-5	Layer 3, Gromatukha culture	On the inside of the rim	3, *6*	MTS-17796	9150 ± 80	10,189–10,519 (100 %)	8.7	0.9	10.7
2015Gro-6	Layer 3, No. 2494, Gromatukha culture	On the inside of the body	3, *5*	MTS-17797	9360 ± 80	10,275–10,775 (100 %)	4.3	0.4	12.1
2015Gro-7	1966, layer 3, No. 9285, the Gromatukha culture	Ditto	3, *9*	MTS-17798	12,400 ± 100	14,048–15,009 (100 %)	42.2	6.4	7.7
2015Gro-8	1966, layer 3, Gromatukha culture	"	3, *10*	MTS-17799	9680 ± 80	10,773–11,229 (100 %)	52.5	5.4	11.4
2015Gro-9	1966, layer 3, No. 895, Gromatukha culture	"	3, *8*	MTS-17800	9620 ± 80	10,733–11,197 (100 %)	54.8	5.7	11.3
2015Gro-10	1966, layer 3, No. 2657, Gromatukha culture	On the inside of the rim	3, *11*	MTS-17801	9280 ± 90	10,247–10,679 (100 %)	–	–	–
2015Gro-11	1966, layer 3, No. 8921, Gromatukha culture	On the inside of the body	3, *12*	MTS-17802	9460 ± 80	10,508–10,898 (77 %) 10,917–11,088 (23 %)	8.6	1.1	9.0
2015Gro-12	2004, layer 1, No. 347, Gromatukha culture	On the inside of the rim	4, *3*	MTS-17803	9670 ± 80	10,766–11,223 (100 %)	27.0	3.1	10.2
2015Gro-13	2004, Osinovoye Ozero culture dwelling, No. 1001	Ditto	4, *6*	MTS-17804	3460 ± 50	3587–3602 (2 %) 3610–3852 (98 %)	37.9	4.5	9.8
2015Gro-14	1966, layer 2, Gromatukha culture	On the inside of the body	4, *1*	MTS-17805	12,530 ± 90	14,191–15,117 (100 %)	16.5	2.5	7.6

Table 2 (end)

1	2	3	4	5	6	7	8	9	10
2015Gro-15	2004, layer 2.2, No. 7935, Gromatukha culture	On the outside of the rim	4, *2*	MTS-17806	9910 ± 70	11,202–11,619 (99.9 %) 11,680–11,681 (0.1 %)	38.9	1.8	25.6
2015Gro-16	2004, layer 2.2, No. 8030, Gromatukha culture	Ditto	4, *7*	MTS-17807	9360 ± 70	10,299–10,325 (1 %) 10,341–10,353 (1 %) 10,373–10,756 (98 %)	14.6	1.5	11.4
2015Gro-17	1966, layer 3, No. 9397, Gromatukha culture	"	4, *4*	MTS-17808	11,440 ± 80	13,136–13,450 (100 %)	–	–	–
2015Gro-18	2004, layer 1, No. 1003, Osinovoye Ozero culture	On the inside of the rim	4, *8*	MTS-17809	3380 ± 45	3479–3721 (99 %) 3800–3811 (1 %)	–	–	–
2015Gro-19	2004, layer 1, No. 301–302, culture not identified	On the inside of the body	4, *9*	MTS-17810	5430 ± 50	6020–6052 (3 %) 6061–6079 (1 %) 6111–6154 (7 %) 6174–6313 (89 %)	23.4	3.4	8.0
Chernigovka-on-Zeya									
Cher-P1	2006, layer 2, No. 1714, Gromatukha culture	Ditto	4, *5*	MTS-17811	9080 ± 230	9545–10,785 (99.5 %) 10,979–10,988 (0.1 %) 11,036–11,059 (0.4 %)	–	–	–

Note. Gro-1 and 2015Gro-1…-19 are indices of pottery samples from the Gromatukha site for ^{14}C-analysis, Cher-P1 is from the Chernigovka-on-Zeya site.

Radiocarbon dates were calibrated using the Calib radiocarbon calibration program (Calib 611) (Stuiver, Reimer, 1993).

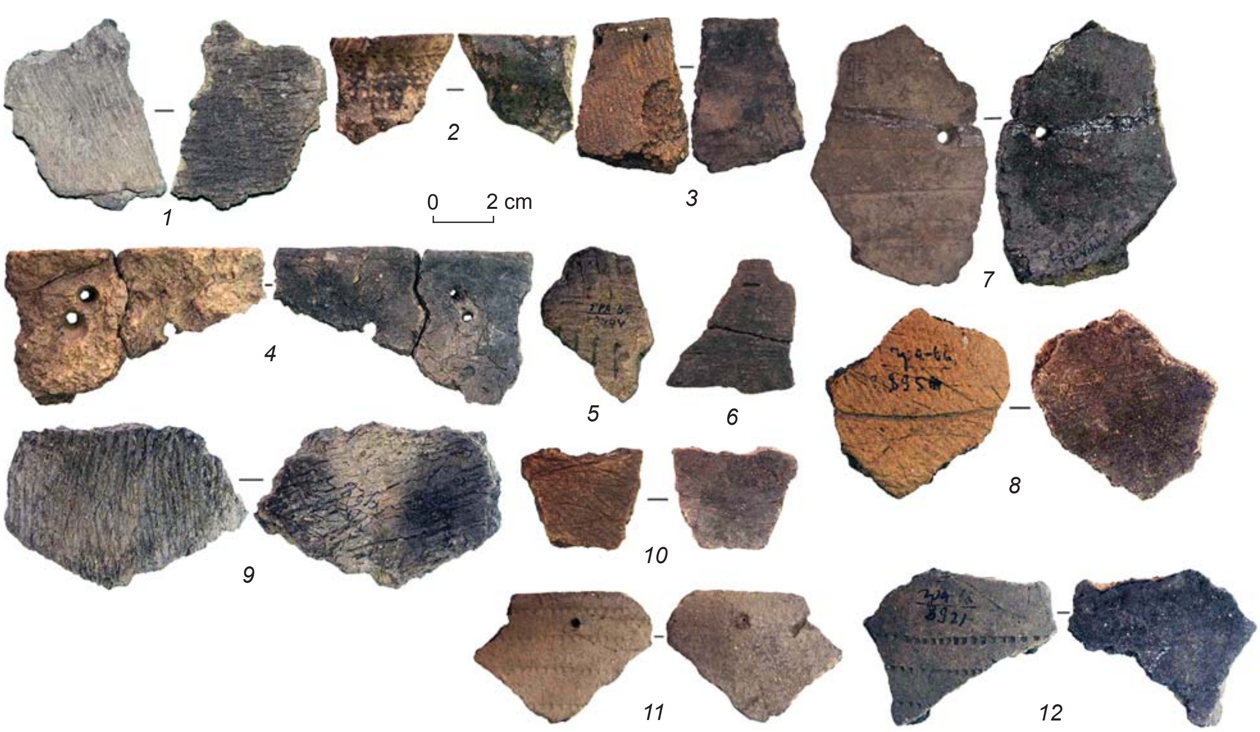

Fig. 3. Pottery-fragments with charred remains on the surface, from the Gromatukha site.

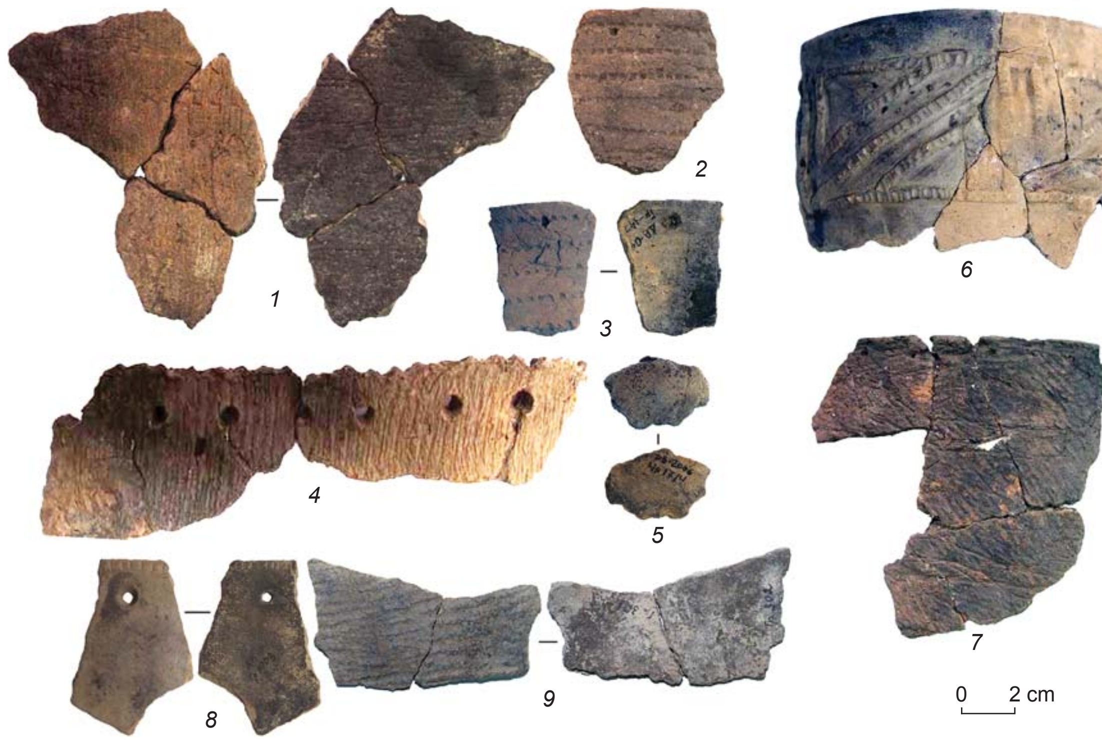

Fig. 4. Pottery-fragments with charred remains on the surface, from the Gromatukha site (*1–4*, *6–9*) and Chernigovka-on-Zeya site (*5*).

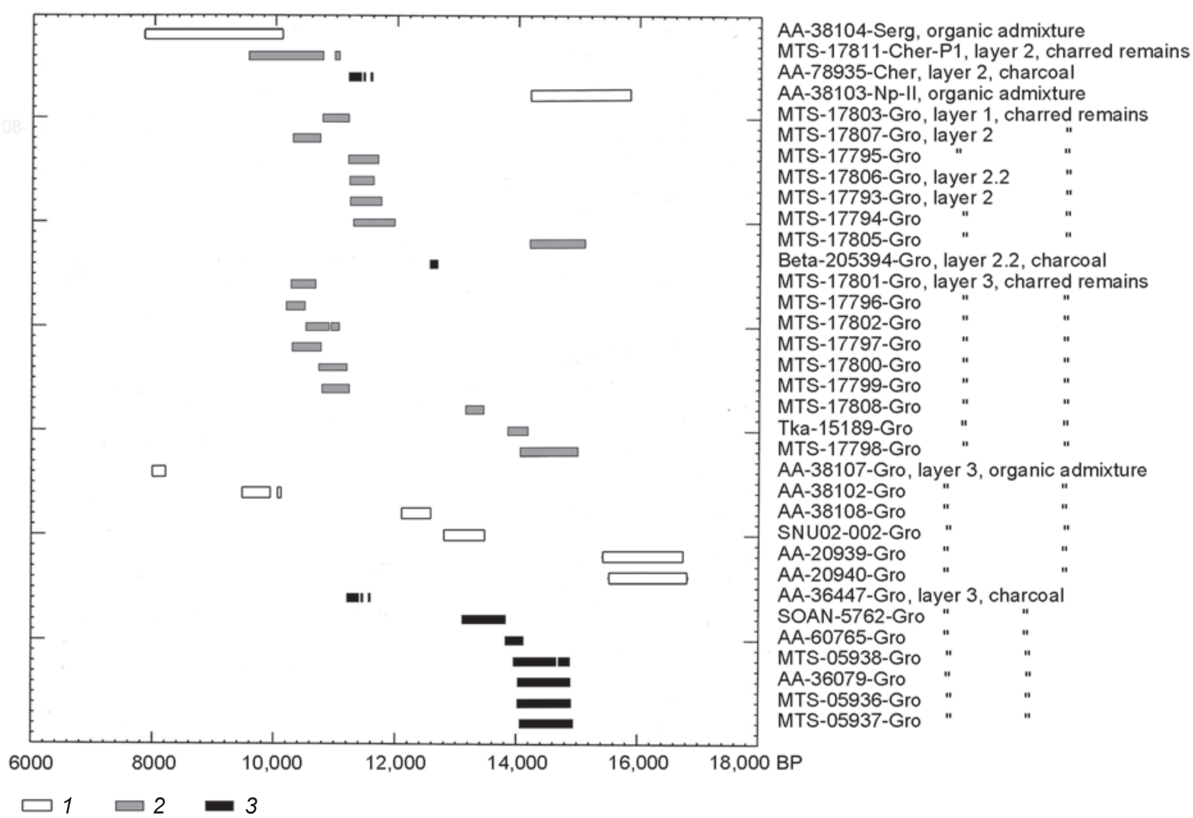

Fig. 5. Ranges of radiocarbon dates for the Gromatukha culture of Western Amur region. Gro – Gromatukha, Cher-P1, Cher – Chernigovka-on-Zeya, NP-II – Novopetrovka-II, Serg – Sergeyevka.
1 – by organic admixture; *2* – by charred remains; *3* – by charcoal.

The Gromatukha culture dates derived from charred remains on pottery from layer 3 of the Gromatukha site pertain to its initial period, which falls between the calendar calibrated dates (±2σ) from 15,010 (MTS-17798) to 10,250 BP (MTS-17801). Determinations from charred remains on pottery from layer 2 of the same site also correspond to the Initial Neolithic, from 15,120 (MTS-17805) to 10,300 BP (MTS-17807). Another early date (11,220–10,770 BP (MTS-17803)) was determined from charred remains on the Gromatukha pottery (Fig. 4, *3*) that were discovered in layer 1. The date for Chernigovka-on-Zeya obtained from charred remains on pottery from layer 2 (Fig. 4, *5*) (11,060–9550 BP) (MTS-17811) is close to this. The latter dates have a greater standard deviation (or a standard error) of ±230 as compared to that for other radiocarbon dates (from ±70 to 90 years (see Table 1)).

Several explanations for a resemblance between the dates for layers 3 and 2 of the Gromatukha site can be proposed. The first is a discrete distribution of layer 3 over a terrace, whereby layer 2 (interlayer 2.2) in some places is located directly on crushed-stony/clay layer 4. The second is the presence of Gromatukha lithic industry and ceramics in layer 2, similar to artifacts from layer 3; i.e. continuous deposition of material. And the third is the displacement of early material from layer 3 during digging by the Gromatukha people themselves, and by later inhabitants that left deposits in layers 2 and 1. Trampling and subsidence of subjects into the underlying layers cannot be ruled out. For instance, during excavations in 2004, a fragment of Osinovoye Ozero pottery-rim with appliquéd segmented fillets was found lying 7 cm below layer 1. A piece of ocher and an adjacent cluster of Osinovoye Ozero pottery can be assigned to the boundary between layers 1 and 2. Chalcedonic flakes were found near the cluster. All these objects could have been trampled in by inhabitants of the Osinovoye Ozero dwelling.

The presence of a more ancient pottery sample (Fig. 4, *3*) in layer 1 of the Gromatukha site is explained by its redeposition as a result of the activities of inhabitants of the site at the mouth of the Gromatukha River, which could have taken place at any stage after the Gromatukha culture, from the Late Neolithic to the period of the site's occupation in the first half of the 20th century.

Conclusions

According to the data from radiocarbon analysis of charcoal and organics from pottery, the chronological framework of the Gromatukha culture is 16,260–8010 BP, i.e. this culture existed for about 8250 years. Actually, this time-range corresponds to the dates derived from organic admixture in ceramics; the charcoal-based dates fall within the said chronological limits. However, if we rely on the dates established from charcoal only (14,820–11,200 BP), this period is reduced to 3620 years (see Table 1) (Kuzmin, Nesterov, 2010).

New radiocarbon dates determined from charred remains on the Gromatukha pottery give a chronological range of 15,010–9550 BP (for Gromatukha layers 3 and 2, and Chernigovka-on-Zeya layer 2); in other words, the duration of existence of ceramics within the Gromatukha culture of the Initial Neolithic in the Western Amur region was 5460 years. This is 2790 years less than the period of existence of the tradition of manufacture of the said ceramicware, established by organic remains in clay texture, and 1840 years more than the Gromatukha culture period determined from charcoal found in the cultural layers of the sites (Fig. 5). Comparative studies of the lithic industry and ceramics of the Gromatukha sites will demonstrate to what extent such existence periods of the Gromatukha culture, determined from charcoal, organic remains in pottery, and charred remains on pottery, are realistic, and which of them represents actual events.

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Holocene Fishing in the Big Sea Region of Lake Baikal (Based on Materials from Multilayered Habitation Sites)

This article offers new data on ancient fishing in the Big Sea region of Lake Baikal. Materials for this research were recovered during fieldwork conducted at multilayered habitation sites Sagan-Zaba II and Buguldeika II by the joint Russian-Canadian expeditions (a project between Irkutsk State University (Russia) and University of Alberta (Canada)). The research presented here is based on the analysis of ichthyofaunal remains and artifacts associated with fishing activities (hooks, harpoons, net sinkers, and fish imagery). For the first time, we are able to reconstruct not only taxa and fishing techniques used but also to trace which species were consumed during different chronological periods. Chronological assessment of analyzed cultural layers at Sagan-Zaba II and Buguldeika II was done through over 90 AMS radiocarbon dates made on ungulate bones in Oxford Radiocarbon Accelerator Unit. Archaeological periodization of analyzed sites spans from the Mesolithic to the ethnographically contemporary period. Fish species composition at the two sites was compared with that from sites of the Little Sea area of Lake Baikal. These new data added a better understanding of the relative importance and subsistence uses of fish on Lake Baikal during the Holocene period. It has been demonstrated that fishing traditions of Early and Middle Holocene hunter-gatherers were continued by pastoralists, especially in regard to the consumption of deep-water species. It is concluded that ancient populations living on the shores of Lake Baikal exploited a wide range of natural resources, and fishing played a very important part in this.

Keywords: *Lake Baikal, Siberia, Holocene, fishing, multilayered habitation sites, radiocarbon dating.*

Introduction

Fishing is a main subsistence activity among many past and present hunter-gatherer groups. Lake Baikal is one of the most important fishing locations in southeastern Siberia (Fig. 1), and this lake has a wide range of fish species present, including 14 food species and subspecies that are historically considered to be important dietary sources for Baikal's human populations (Kozhov, Misharin, 1958: 33–590; Sideleva, 2003: 1–23). Sturgeon (*Acipenser baeri baicalensis*) is one of these species, and inhabits specific parts of the lake and its main tributaries.

The majority of the human-consumed fishes in Lake Baikal can be subdivided as littoral and deep-water species (Kozhov, Misharin, 1958: 101–590: Kozhova, Izmest'eva, 1998: 153–159). For example, the small, shallow, and warm coves of Kurkut and Mukhor gulfs of the Little Sea area (Fig. 1) have year-round inhabitants such as perch (*Perca fluviatilis*), roach (*Rutilis rutilis lacustris*), dace (*Leuciscus leuciscus baicalensis*), and pike (*Esox lucius*). Other species prefer deep and cooler sections of Lake Baikal (such as the Big Sea). Representatives of this group are whitefish (*Coregonus lavaretus baicalensis*), white and black grayling (*Thymallus arcticus baicalensis brevipinnis* and *Th. arcticus baicalensis*), lenok (*Brachymystax lenok*), and taimen (*Hucho taimen*). The last two species are mainly present in the lake during summer and spend the rest of the year in lake's tributaries. Whitefish and burbot *(Lota lota*) are found in rivers and the lake's shallow sections mainly during spawning seasons (Kozhov, 1972: 109–114). White grayling prefers the eastern side of Lake Baikal, but black grayling is widespread throughout the lake and enters its small tributaries for spawning, especially those along the western shore of the Big Sea (Kozhova, Izmest'eva, 1998: 158). Nevertheless, the most well-known species of Lake Baikal is omul (*Coregonus migratorius*), which plays an important role in the contemporary industrial fishery on Lake Baikal.

Fig. 1. Map indicating location of the multilayered habitation sites Sagan-Zaba II and Buguldeika II.

Omul is represented by a few populations in the lake, and enters less deep sections of lake and rivers only during the spring-summer spawning migrations (Kozhov, Misharin, 1958: 131–214; Sideleva, 2003: 13–14).

Many researchers had previously addressed questions in regards to the ancient fishing practices carried out on Lake Baikal. Their works were based on typological analysis of tools associated with fishing from habitation sites along the Little Sea shoreline (Svinin, 1976; Novikov, Goriunova, 2005), as well as on the ichthyofaunal remains from these same sites (Tsepkin, 1976; Nomokonova, Losey, Goriunova, 2009a, b, c: 53–75; Nomokonova et al., 2011; Nomokonova, Goriunova, 2012). Multiple publications demonstrated the importance of fishing in lives of Early and Middle Holocene hunter-gatherers inhabiting shores of the Little Sea area. These publications produced lists of identified fish species, possible seasonality indicators, fishing techniques, reconstructed sizes of perch and roach, as well as discussions of changes in uses of fish species and their quantities through different chronological periods (Novikov, Goriunova, 2005; Nomokonova, Losey, Goriunova, 2009a, b, c: 75–91; Losey, Nomokonova, Goriunova, 2008, 2014).

Despite these publications of multiple reconstructions of ancient fishing in the Little Sea area, many problems regarding the use of fish resources in the Big Sea region remain unsolved. This is partially explained by the small amount of multilayered and well-stratified habitation sites containing remains of fishing tools and ichthyofauna along the shores of the Big Sea. This situation changed in 2006–2008 as a result of new excavations conducted by teams of Russian-Canadian expeditions (a joint project between Irkutsk State University and the University of Alberta) at the multilayered habitation sites Sagan-Zaba II and Buguldeika II located on the western shore of Lake Baikal (Fig. 1–3). During these collaborative investigations, a new set of data on ancient fishing in the Big Sea region of the lake was produced. These materials, further discussed in this article, have brought new understanding to the importance of fishing in the subsistence of people living on the shores of Lake Baikal during the Holocene.

Materials and methods

This article is based on the analysis of 1553 ichthyofaunal remains and 39 artifacts associated with fish procurement (hooks, harpoons, net-sinkers, and fish imagery) recovered from excavations of multilayered habitation sites Sagan-Zaba II and Buguldeika II. These sites are located in the central section of the western shoreline of Lake Baikal, about 35 km from each other, and 154 km and 130 km to the northeast from the modern city of Irkutsk. Sagan-Zaba II was discovered for the first time by North-Asian Expedition of IIFF SO AN USSR led by A.P. Okladnikov (Okladnikov, 1974: 17). This expedition also conducted excavations at this location in 1974 and 1975 (Aseev, 2003: 51–61). Buguldeika II was found in 1987 by a team from Irkutsk State University, led by N.A. Saveliev and V.M. Vetrov. This site was further investigated by a joint expedition between the Tourism and Regional Historical Child and Youth Center and the Irkutsk State University, under supervision of V.V. Altukhov and N.A. Saveliev in 1999–2004. Interdisciplinary studies were carried out at both sites by the Russian-Canadian Expeditions in 2006–2008 (Goriunova et al., 2006, 2008; Bocharova, Korshunov, 2010; Losey, Nomokonova, Saveliev, 2014).

Fig. 2. View of Sagan-Zaba bay. Photo by A.W. Weber.

This article analyzes fish remains and fishing items from trenches 4B and 4C at Sagan-Zaba II and trenches 4 and 5 at Buguldeika II. Field methods included stratigraphic excavations and three-dimensional recording of the positions of all cultural remains and sieving of all sediments through screens of 3 mm diameter mesh. This method was very successful, as 99 % of all ichthyofaunal remains were received during the process of sieving. In a few cases, concentrations of fish bones were found. One of them was recorded under the rock of a hearth in layer IV (excavation level 7) at Buguldeika II. In addition, a few Salmonidae vertebrae and bones, partially in anatomical order, were found in the lower layer III, under the remains of a pot, at habitation site Sagan-Zaba II.

Fig. 3. View of archaeological site Buguldeika II. Photo by A.W. Weber.

Chronological dating of cultural remains at Sagan-Zaba II and Buguldeika II is based on over 90 AMS radiocarbon dates made by Oxford Radiocarbon Accelerator Unit. Detailed analyses of these dates have been discussed in a few publications already (Nomokonova et al., 2013; Losey, Nomokonova, Saveliev, 2014). A summary of the chronological spans of cultural layers for both habitation sites is presented in Table 1. In terms of archaeological periodization, materials are dated from the Mesolithic to the ethnographically contemporary period.

Ichthyofaunal remains were described and identified to the element, portion, side, and to the most specific taxonomic category possible using standard zooarchaeological methods (number of identified specimens and minimum number of individuals), and animal behavioral characteristics were also employed in our interpretations (Nomokonova, Losey, Goriunova, 2006; Lyman, 2008: 21–82; Reitz, Wing, 2008: 142–170). Methods of working with fishing artifacts were based on typological analysis of items developed for the Cis-Baikal region and on ethnographic analogies (Okladnikov, 1936, 1941, 1950: 246–258; Studzitskaya, 1972, 1976; Novikov, Goriunova, 2005).

Ichthyofaunal remains from Big Sea habitation sites

Fish remains from Sagan-Zaba II and Buguldeika II are represented by 1553 specimens. The majority of them were found at Sagan-Zaba II, but ichthyofauna comprise only 2.1 % of the total faunal remains found at this

Table 1. **Chronology of habitation sites**

Geologic Timescale		Archaeological Timescale	Sagan-Zaba II		Buguldeika II	
			Cultural layers	Chronological span, cal BP	Cultural layers (sublayers)	Chronological span, cal BP
Holocene	Early	Mesolithic			V, IV (9, 8)	10,410–9030
			VII	9020–8650		
	Middle	Neolithic	VI	8160–7880	IV (5–1)	8610–5590
			V lower	Not dated		
			V upper	6750–6310		
			IV	5590–4870	III	5660–4650
	Late	Bronze Age	III lower	4440–2000	II (3)	3210–2780
					II (2)	2680–1950
		Early Iron Age	III upper	1970–1540	II (1)	2130–1530
		Late Iron Age – ethnographically contemporary period	II, I	1230–940	I	2040 – contemporary period

Table 2. **Fish species composition and quantities of their remains at Sagan-Zaba II**

Taxa	Common name	Cultural layer							Total
		VII	VI	V	IV	IIIl	IIIu	II, I	
Pisces unidentified	Fish	107	1	14	52	141	107	92	514
Salmonidae	Family of salmonids	–	–	29	–	363	428	31	851
Coregonus sp.	Genus of whitefishes	–	–	–	3	8	6	–	17
Thymallus articus	Grayling	3	–	–	–	1	2	1	7
Cyprinidae	Family of cyprinids	–	–	–	1	1	–	–	2
Leuciscus baicalensis	Dace	–	–	–	–	1	1	–	2
Rutilus rutilus lacustris	Roach	–	–	–	–	–	3	–	3
Acipenser baerii baical.	Sturgeon	–	1	10	1	28	5	3	48
Esox lucius	Pike	–	–	3	11	–	–	1	15
Lota lota	Burbot	–	–	–	2	–	–	–	2
Perca fluviatilis	Perch	–	–	31	17	5	2	–	55
Total		110	2	87	87	548	554	128	1516

habitation site (total is 74,040 spec.). There were only 37 fish remains found at Buguldeika II, which is only 0.2 % of the total number of animal bones from this location (total is 20,263 spec.).

About 34 % of the ichthyofaunal remains at habitation site Sagan-Zaba II (Table 2) were unsuitable for further identification. Grayling, roach, dace, perch, burbot, pike, sturgeon, as well as members of the genus of coregonids (omul/whitefish), and families of cyprinids and salmonids (grayling/whitefish), were identified at this site. Fish remains were found in each cultural layer of this habitation site, which date to different periods of the Holocene, starting at over 9000 cal BP. They are the most abundant in layer III lower (4440–2000 cal BP) and III upper (1970–1540 cal BP), and less numerous in layer VI (8160–7880 cal BP) (Fig. 4).

The majority of the identified specimens belong to salmonids. They compose 88 % (875 specimens including the grayling and whitefish/omul categories) of the total number of fish remains found in all cultural layers of Sagan-Zaba II, with exception of layer VI. They are most numerous in lower and upper III layers (Fig. 4). The remaining identified bones and scales are from perch (55 spec.), sturgeon (48 spec.), pike (15 spec.), cyprinids (7 spec., including roach and dace), and burbot (2 spec.). Sturgeon remains were found in almost every layer at this site with exception of layer VII. Perch bones and scales were found in layers spanning from 6750 to 1540 cal BP.

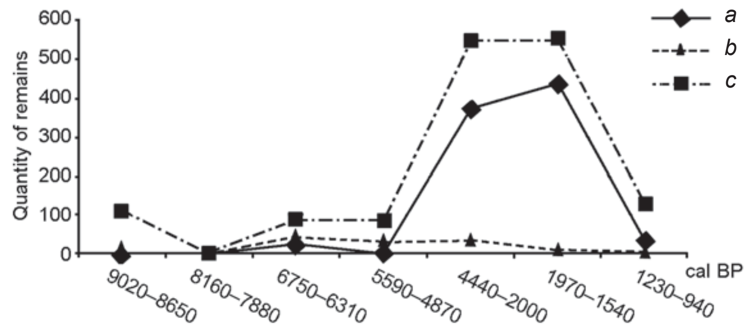

Fig. 4. Relative abundance of salmonid remains and of other species at habitation site Sagan-Zaba II summed by chronological period.
a – Salmonidae; *b* – other; *c* – total.

Pike remains were mostly identified in deposits associated with the middle portion of the Holocene (layers V and VI), and were found in very small numbers in layers II and I (1230 – 940 cal BP). Cyprinids and burbot bones are rare in comparison to those of other fish species. Cyprinids were found in layers IV, III lower, and III upper. Remains of burbot were identified only in layer IV (5590–4870 cal BP).

The majority of the ichthyofaunal remains from Buguldeika II (37 spec.) are remains of sturgeon (*Acipenser* sp.) with a total of 25 specimens. One pike bone (*Esox lucius*) and two from family of cyprinids (Cyprinidae) were also found. The remaining nine fragments were not suitable for further identification. Many of ichthyofaunal remains, including those from pike and sturgeon, were found in layer IV (22 specimens; sublevels 2, 3, 6–8, all with a chronological span from 10,410 to 6570 cal BP). Layer II contained mainly remains from sturgeon but also two bones from cyprinids. Only one unidentified fish bone was found in layer I. These layers have chronological spans starting from 3210 cal BP through to the ethnographically contemporary period.

Fishing artifacts from habitation sites

Excavations at habitation sites Sagan-Zaba II and Buguldeika II produced 39 artifacts associated with fishing (21 and 18 items, respectively). These include stone net sinkers, fragments of antler and bone harpoon heads, slate shanks of composite fishhooks and their preforms, bone hook or barbs for fishhooks, a small nephrite sinker, and stone fish images (Table 3, Fig. 5).

Fishing artifacts are found at Sagan-Zaba II starting with the layers dating to the Early Holocene. A bilateral and symmetrically barbed antler harpoon head fragment, with splayed base and a hole for attachment for a line, along with a pebble net sinker with notches on opposite sides, were recovered from layer VII.

Sagan-Zaba II Middle Holocene deposits contained 18 artifacts associated with fish procurement. They were found in cultural layers associated with different periods of the Neolithic and chronologically span from 8160 to 4870 cal BP. All layers contained shanks of composite fishhooks, bone harpoon head fragments, and fish images. In terms of numbers, fishhook technology is predominant and includes eight (whole and fragmented) shanks of composite fishhooks and a tip of a single bone hook. Almost all shanks are made from slate, with exception of one bone item from layer IV. These shanks of composite fishhooks have different typological forms associated with different periods of the Neolithic. Layer VI had a curved shank that was 3.2 cm in length and with notches on its upper end and a lateral form of attachment for a hook (the so called Baikal type). A complete shank of similar

Table 3. **Fishing tools from habitation sites Sagan-Zaba II and Buguldeika II**

Artifacts	Sagan-Zaba II			Buguldeika II		
	Early Holocene	Middle Holocene	Late Holocene	Middle Holocene	Late Holocene	Total
Harpoon heads	1	4	1	–	–	6
Shanks of composite fishhooks	–	8	–	10	–	18
Hooks for composite fishhooks	–	1	–	–	–	1
Net sinkers	1	–	–	7	1	9
Small net-sinkers	–	1	–	–	–	1
Fish images	–	4	–	–	–	4
Total	2	18	1	17	1	39

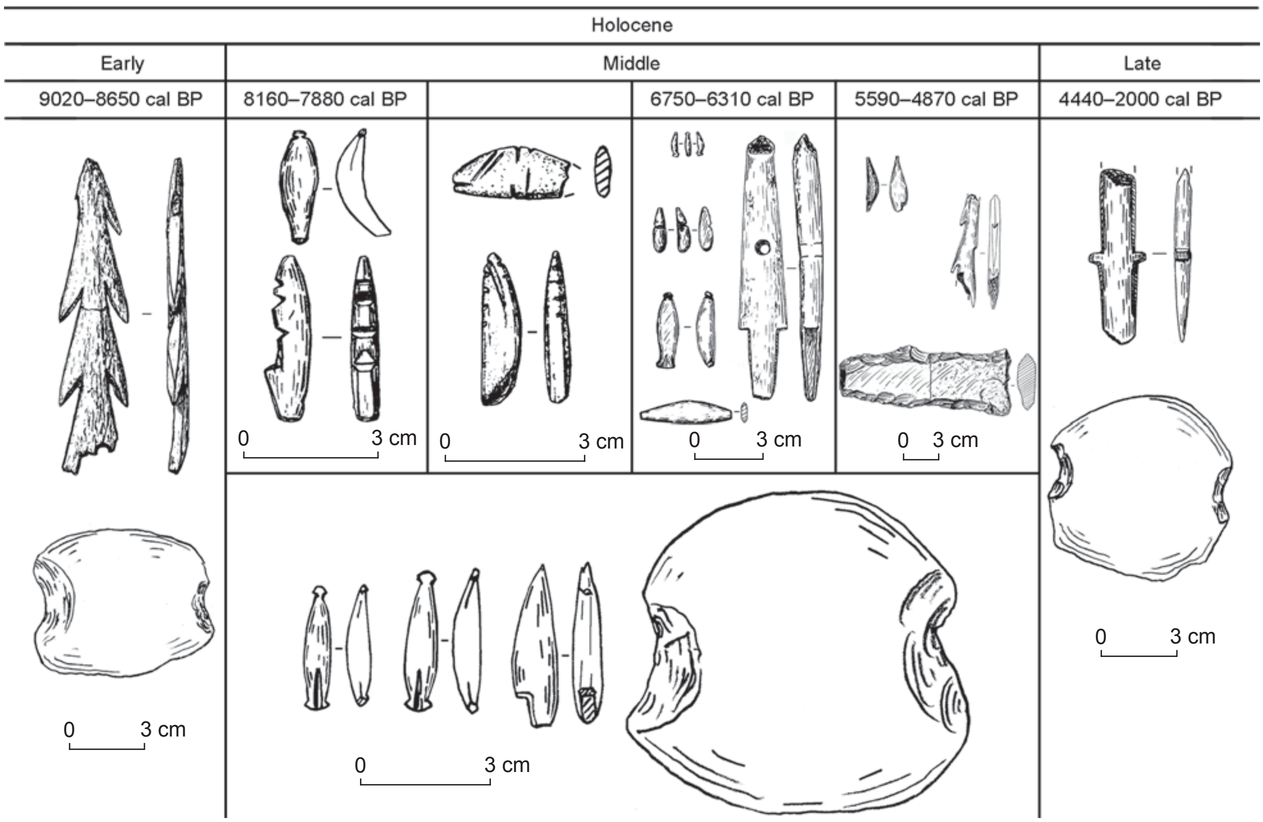

Fig. 5. Distribution of fishing artifacts from habitation sites Sagan-Zaba II and Buguldeika II summed by chronological period.

size (3.3 cm) from layer V lower is straight with convex back, lateral attachment for a hook, and notches on the upper ends for attachment of a line. Its surface is covered with several incisions. Fragments from two shanks were also found in this layer. They have sharpened upper ends, and two incisions are present on one of them. A classic Kitoy shank of a composite fishhook was found in the V upper layer. It is straight with convex back, has half-moon shaped ends, and frontal attachment for a hook. Its length is 3.5 cm. Another two shanks, one of which is a fragment, are straight with convex backs. The complete shank has a half-moon shaped upper head and a pointed lower end. The complete shank is 1.1 cm long; a fragment is 1.8 cm long. A bone shank of a composite fishhook from layer IV has a convex back and lateral attachment for a hook. Its upper end is sharpened but lower end is widened. The length of this shank is 4.5 cm.

A small nephrite sinker (shank?) was found among the materials of the V upper layer. It has a straight shape with convex back. One end is sharpened; the other end is of oval shape (widened). The middle portion of its back has a half-circle shaped incision. The length of this item is 2 cm.

Bone harpoon heads are all fragmented in the Neolithic layers. One has unilateral barbs (layer VI). Two others are bilaterally barbed (layer IV). Another harpoon fragment was found in the V upper layer and has a tapering base and a hole in its body for a line attachment.

Fish images are also associated here with the process of fishing (4 items). One of them was found in the V lower layer. This item is made from marble and is a stylistic depiction of a fish with a convex back. Its tale is broken off. It has bilateral modelling. An incised line is used to show its mouth. Double incised lines are drawn to show its gills. Incised lines are also visible in the area of its dorsal and pelvic fins. The length of this fish image is around 3 cm. A second fish image, also from marble, has a convex back and a length of 4 cm. It was found in the V upper layer. The image can be described as schematic. Layer IV contained a complete stone fish image of whitefish shape with a length 14.5 cm, as well as a fragment of a tail from another fish image.

Late Holocene deposits at Sagan-Zaba II produced only one artifact associated with fishing. It is a bone harpoon head fragment with straight base with bilateral line guard projections, and was from the layer III lower.

All fishing artifacts at habitation site Buguldeika II (17 out of total 18 items) were found in layers dating to the Middle Holocene. Many of them are shanks

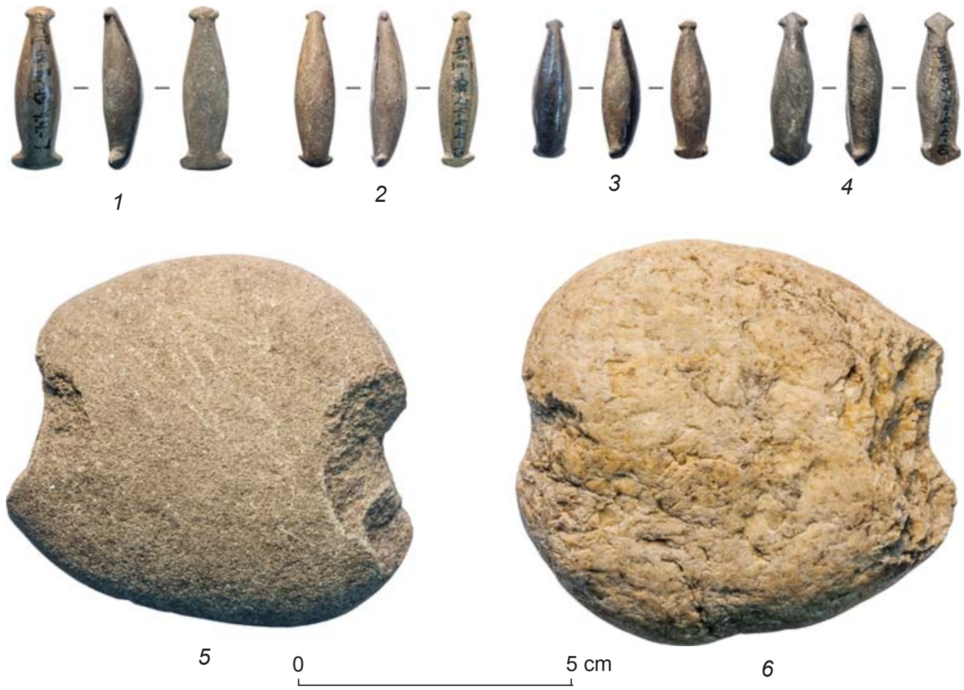

Fig. 6. Shanks of composite fishhooks (*1–4*) and stone net sinkers (*5*, *6*) from layer IV of habitation site Buguldeika II. Photo by S. Kogai.

of composite fishhooks (6 items) and their pre-forms (4 items). All complete shanks are of the classic Kitoy type. They are straight with convex backs and half-moon projections on both ends (Fig. 6, *1–4*). The attachment for the hook is frontal. The size range of the length of these items is 2.7–3.2 cm. The shank pre-forms from layer IV (sublevel 7) has a lateral attachment for a hook. One end of it has a few incisions. Seven net sinkers made from flat stones and pebbles were found in layer IV (sublevel 4) (Fig. 6, *5*, *6*). They are shaped by bilateral notches located on their opposite sides.

One net-sinker was found in the Late Holocene layer II (sublevel 2). It is a flat stone with notches on opposite ends.

Discussion

New data generated from the multilayered habitation sites Sagan-Zaba II and Buguldeika II, located on the western shore of the Big Sea area of Lake Baikal, allowed us for the first time to not only identify species composition and reconstruct fishing techniques, but also to trace changes in use of different fish species through time. Faunal collections contain both littoral and deep-water species such as perch, cyprinids (roach and dace), pike, burbot, sturgeon, and salmonids (grayling and coregonids). The latter group prefers the lake's deep and cold sections, and these fish are predominant in terms of quantitative estimates among the fish remains at Sagan-Zaba II. Salmonids were not identified at Buguldeika II.

Comparison of ichthyofaunal remains from habitation sites of the Big Sea and Little Sea regions demonstrated substantial differences in their quantitative compositions (Fig. 7). Many of these differences could be explained by location of the habitation sites either near shallow or deep-water sections of the lake's. For example, ichthyofaunal composition in the Little Sea area includes mostly littoral fish species such as perch, cyprinids, and pike. Coregonid remains are rare, and perhaps, these species were entering

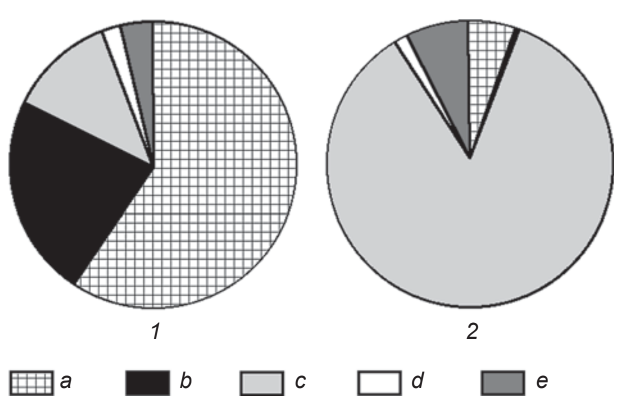

Fig. 7. Quantitative composition of ichthyofaunal remains from the habitation sites of the Little Sea region (*1*) and habitation sites of the Big Sea region (*2*).
a – perch; *b* – cyprinids; *c* – salmonids; *d* – pike; *e* – sturgeon.

to coves of this region only during their spawning migrations (Nomokonova, Losey, Goriunova, 2009a, b: 75–85; Nomokonova et al., 2011). Remains of salmonids are predominant at habitation site Sagan-Zaba II, including grayling bones, remains of which were found for the first time in the Olkhon region.

At the same time, there are notable differences between the two habitation sites analyzed in this article. For example, Sagan-Zaba II materials contained variable fish species, including littoral and deep-water ones. Remains of burbot were found here as well, whose bones, just as those from grayling, were found for the first time at habitation sites in the Olkhon region. Ichthyofaunal remains from Buguldeika II were present in substantially lower quantities, and its species composition was also more limited, with just bones and scales from sturgeon, cyprinids, and pike being present.

Analysis of species composition and richness of ichthyofauna by chronological periods shows both similarities and substantial differences between habitation sites located in the Big Sea and Little Sea regions. For example, fishing activities are traced at both locations throughout the whole period of Holocene starting at over 9000 BP. The differences between both regions are in terms of more or less intensive periods of fishing. Fish remains are predominant at the Little Sea habitation sites mostly in deposits of Middle Holocene and earlier, starting approximately at 8000 BP. However, this situation occurs in the Big Sea area mainly in the Late Holocene layers (especially from 4440 to 1540 cal BP).

Ethnohistoric records often indicate that Cis-Baikal pastoralists and those from neighboring regions despised fish and conducted fishing only when they had to (the exception to this was the industrial fishing by Buryat populations inhabiting Baikal shores since the 17th century AD) (Levin, 1897; Mikhailov, 2006: 109–121). However, large numbers of fish remains in the Late Holocene deposits at habitation site Sagan-Zaba II (especially in layers from the Iron Age and ethnohistorically contemporary layers such as III upper, II, and I) clearly demonstrate that fishing traditions of Early and Middle Holocene hunter-gatherers on Lake Baikal had continued among its pastoralists.

Fishing artifacts from the archaeological sites of the western shore of the Big Sea region of Lake Baikal appear in the Early Holocene deposits. Items from layer VII at Sagan-Zaba II allowed for the reconstruction of fishing techniques that existed during the Mesolithic, starting at 9020 cal BP. It is possible that ancient populations speared fish with harpoons and caught them with the use of nets. The last technique is supported by the presence of specially made stone net sinkers found at the habitation site. The use of nets assisted in more effective and productive fishing. Habitation sites of Little Sea also have evidence towards the use of nets in the materials of Late Mesolithic (Novikov, Goriunova, 2005; Nomokonova, Goriunova, 2012).

Neolithic (Middle Holocene) deposits at the analyzed habitation sites of the Big Sea region are distinguished by the numbers of recovered artifacts associated with fishing, with Sagan-Zaba II showing the most variety of such items. Hook and line fishing (angling) items are widespread and demonstrate a presence of individual fishing tools (fishing rods). This is supported by findings of shanks from composite fishhooks and their bone hooks. Shanks with lateral attachment for a hook (the so called Baikal type) are found in deposits throughout the Middle Holocene. Shanks of the Kitoy type with a frontal attachment for a hook (V upper layer of Sagan-Zaba II, and IV layer of Buguldeika II) co-exist with the Baikal type in the chronological span from 8610 to 6310 cal BP. The role of fishing in ancient subsistence along the shores of Lake Baikal is also demonstrated by findings of stone fish images (layers V and IV at Sagan-Zaba II). These stone images, based on ethnographic analogies, were used as fish lures during fishing with harpoons (Okladnikov, 1941, 1950: 246–258; Studzitskaya, 1976). Variability of technical gear found at habitation sites is evidence of different fishing techniques: the use of the harpoon in shallow sections, and the fishing rod and net in deep-water areas. It is also noticeable that transportation technology (watercraft) is required to fish for deep-water species on Lake Baikal during the summer period.

Comparison of fishing gear found in the Middle Holocene deposits between the habitation sites of the Big Sea region and those from the Little Sea shores showed their similarities (presence of hook and line technologies, composite fishhooks, findings of stone fish images, the large number of harpoon head fragments, and net sinkers). Also repetitive are main typological characteristics of some of these artifacts (shanks of the Baikal type, stylized schematic fish images, whitefish – like fish, etc.) (Novikov, Goriunova, 2005). The presence of Kitoy type shanks of composite fishhooks is new for the western shores of Big Sea, as these types are not found at habitation sites of the Little Sea region.

Fishing also did not lose its importance among the local populations of the Late Holocene. For example, Bronze Age deposits (sublayer 2 of layer II at Buguldeika II, and III lower layer at Sagan-Zaba II) contained a stone net sinker and a harpoon fragment with straight base and line guard projections. It is also interesting that layer III lower at Sagan-Zaba II contained a large number of ichthyofaunal remains, but only a few artifacts associated with fishing. The layer just above it (III upper, Early Iron Age) contained no fishing items at all. It is possible that fishing was done by different types of gear that was not preserved (seine and other nets).

Based on analysis of fishing items and faunal remains from the habitation sites located in the Big Sea region of Lake Baikal, their habitants carried out fishing throughout the Holocene. It is also interesting that despite the importance of fishing in the subsistence of the ancient Baikal populations, this activity is not commonly shown in local rock art images. Fishing is only shown at the rock art panel in Aya bay, located on the western shore of Lake Baikal, about 16 km and 51 km to the northeast from habitation sites Sagan-Zaba II and Buguldeika II, respectively (Fig. 1). The rock art panel has depictions of two realistic style fish images consisting of a smoothed depiction (Fig. 8). Based on its outline (a narrow pointing head, specific body shape), these drawings appear to represent sturgeon or sterlet (Okladnikov, 1974: 36–37). Fish images (along with other animals—snakes and birds) are depicted near the horned anthropomorphic image, perhaps representing a shaman. Rock art images at Aya bay are dated to the Bronze to Early Iron Ages. Perhaps, they are associated with beliefs of ancient populations about Lower (fish and snake) and Upper (birds) Worlds, suggesting a mythological meaning for the image.

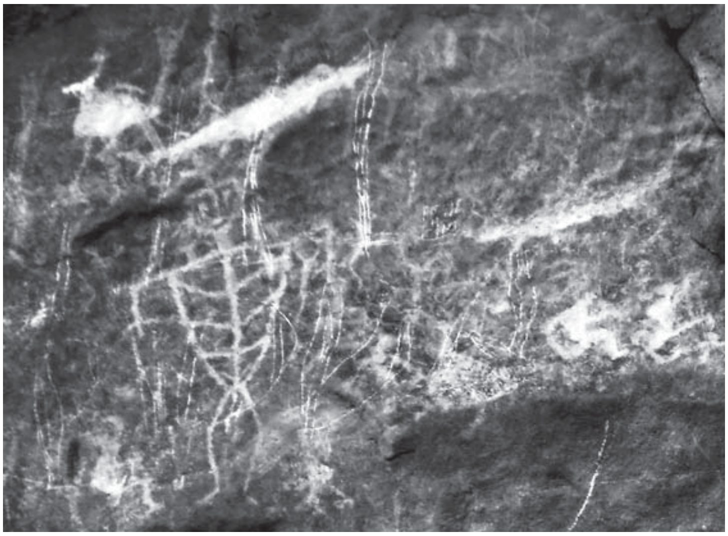

Fig. 8. Rock art images from Aya bay. Photo by A.G. Novikov.

Conclusions

The first data on ichthyofaunal remains from the western shore of the Big Sea region of Lake Baikal were generated as a result of excavations at the multilayered habitation sites Sagan-Zaba II and Buguldeika II. This was made possible due to the field excavation methods, which were based on sieving of all archaeological sediments through screens of 3 mm diameter. This method showed that 99 % of all ichthyofaunal remains came from the screens. Application of this technique illustrates a need to use sieving in all further archaeological excavations at other archaeological sites in this region (Nomokonova, Losey, Goriunova, 2006, 2009: 51–53; Nomokonova et al. 2010).

Analysis of ichthyofaunal and fishing artifacts from the multilayered habitation sites Sagan-Zaba II and Buguldeika II produced new interesting data on fish procurement in the Big Sea region of Lake Baikal throughout the Holocene. Fishing as a distinct subsistence strategy starts in this region during the Early Holocene (Mesolithic). Improvements to fishing technologies are noticeable during the Middle Holocene (Neolithic) by the appearance of new types of fishing artifacts and evidence for variable fishing techniques. Different typological characteristics of shanks of composite fishhooks, harpoons, and fish imagery are identified based on their presence during different chronological periods within the Neolithic. For the first time, reliable information on Baikal fishing, not only during the Bronze Age but also during the Iron Age, was produced as a result of excavations at habitation sites Sagan-Zaba II and Buguldeika II.

New materials from the western shores of the Big Sea region allowed us to compare existing data on fishing from the Little Sea habitation sites and to identify major differences in fish species composition, periods of intensive use of habitation sites, and main subsistence patterns. It has been demonstrated that deep-water fish species, such as salmonids and sturgeon, were procured mostly in the Big Sea region, but littoral and shallow-water species, such as perch, cyprinids, and pike, were fished mainly in the Little Sea region.

Further, differences were identified between these two regions and between chronological periods of more or less intensive fishing. Fish remains in the cultural layers of Middle Holocene and earlier periods are predominant at the Little Sea habitation sites; however, at the Big Sea habitation sites, this situation is more common in the Late Holocene layers. It is also noticeable that ichthyofaunal remains from the Big Sea region are found in small quantities (2.1 % at Sagan-Zaba II and 0.2 % at Buguldeika II) relative to the total number of faunal materials found at these sites. It looks like Baikal seals were the focus of subsistence activities at these locations, which have been previously discussed several times in our other publications (Losey, Nomokonova, Saveliev, 2014; Nomokonova et al., 2015). Fishing was of lesser importance at habitation sites Sagan-Zaba II and Buguldeika II. However, at the Little Sea habitation sites, fishing played a key role in the subsistence

(Nomokonova, Losey, Goriunova, 2009a, b, c: 75–91; Nomokonova, Goriunova, 2012). Overall, Baikal populations living on shores of Lake Baikal during the Holocene had subsistence patterns composed of complex use of natural resources with fishing playing a significant role.

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Comparative Characteristics of Stone Tools from the Neolithic Sites on the Upper and Middle Kama

This article presents the results of a comprehensive analysis of stone tools from six Neolithic sites in the Upper and Middle Kama region, three of which belong to the Kama culture, and three to the Volga-Kama culture. Technological, typological, traceological, and spatial analyses were carried out. Differences between the two lithic industries are minor in all aspects. Technologically, both are characterized by regular knapping aimed at the production of blades and blade-like flakes. Tools on flakes are more numerous than those on blades. Marginal retouch was widely used; several tools are bifacial; the most common types are end-scrapers, knives, points, blades, and retouched flakes. In tools from the Kama sites, ventral retouch is more frequent. The traceological analysis revealed that the principal tools were end-scrapers for processing various materials, butchering knives, planing-knives, drills, and perforators. In the Volga-Kama industry, bone-processing tools are more frequent. The spatial analysis demonstrated that zones of various subsistence activities often overlap, or are vaguely delimited. Apparently, adaptation to one and the same environment leveled off any cultural differences.

Keywords: *Neolithic, Kama basin, stone tools, Kama Neolithic culture, Volga-Kama Neolithic culture.*

Introduction

The Upper and Middle Kama region is situated in the Middle Cis-Urals, in the Perm Territory (Fig. 1). In this region, the Neolithic sites of the Kama and Volga-Kama cultures have been established (Lychagina, 2014: 288). The Kama culture was identified by O.N. Bader (1970: 166; 1973: 103), who subdivided it into two stages: Khutor (Middle Neolithic) and Levshino (Late Neolithic) (1978: 72). With the discovery of the Early Neolithic Kama sites in the 1970s–1980s, one more stage was established, an Early Neolithic one (Vasiliev, Vybornov, 1993). At present, three developmental stages have been generally accepted: Early Neolithic, Khutor, and Levshino (Lychagina, 2013a: 55–67).

The concept of the Volga-Kama culture was introduced by A.K. Khalikov (1969: 40–92), who subdivided it into five subsequent developmental stages. He proposed stage 1 corresponding to the pre-ceramic Neolithic, stage 2 comprising the sites with pricked pottery, stage 3 with comb pottery, which, as he thought, had arisen on the basis of the preceding pottery-type. Stages 4 and 5 were identified as parallel to the stages of the Bader's classification of the Kama culture (Khutor and Levshino stages, respectively) and were associated exclusively with sites containing comb ceramics. Later on, the idea of the development of pricked ceramics into comb ones was rejected (Tretyakov, 1972; Kalinina, 1979; Vybornov, 1992: 45–65). In one of his latest papers, Bader suggested restricting the term of Volga-Kama culture exclusively to the culture associated with pricked-incised ceramic ware (1981: 47). This concept has been accepted by modern researchers (Vasilieva, Vybornov, 2012). This culture is subdivided into two main periods: Early Neolithic and Middle Neolithic (Lychagina, 2009).

Identification of the cultures was based mainly on distinctions noted within ceramic complexes: the Kama ceramics are characterized by decoration with comb imprints, while the Volga-Kama have pricked decoration. The lithic industries were considered less significant because it was barely possible to distinguish between technocomplexes at stratified sites. This paper aims at the most comprehensive analysis of stone tools from the sites whose cultural attribution is not in doubt. We have used the method of comprehensive analysis proposed and tested by G.N. Poplevko at the sites in various regions (2007, 2011, 2013, 2014a, b). This method includes typological, technological, traceological, and spatial analyses.

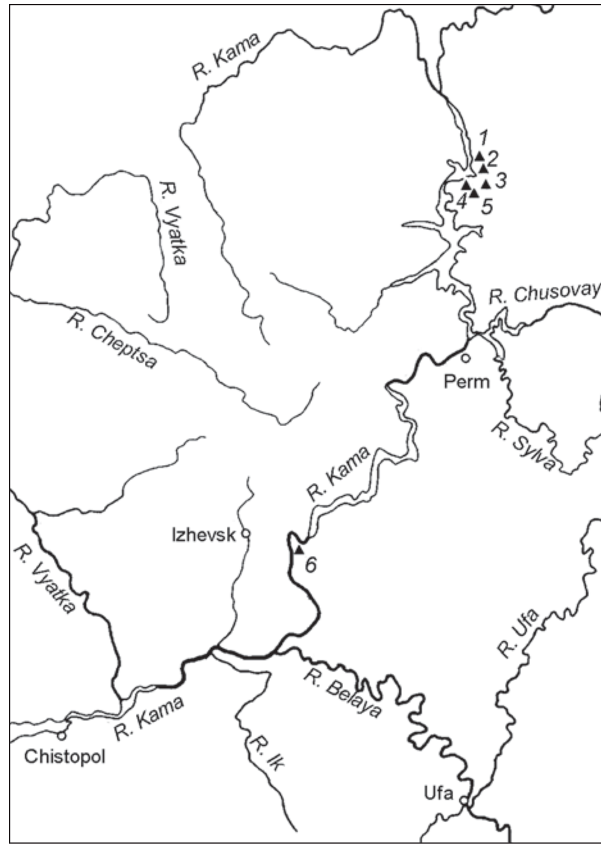

Fig. 1. Map showing locations of the sites under study.
1 – Chashkinskoye Ozero VI; *2* – Chashkinskoye Ozero VIII; *3* – Chashkinskoye Ozero IV; *4* – Chashkinskoye Ozero IIIa; *5* – Khutor; *6* – Chernushka.

Discussion

The analysis was based on the whole lithic collections from individual sites (Chashkinskoye Ozero IV and VIII), or, more often, on the stone tools from particular excavation areas, having no considerable admixture of artifacts from other cultures. However, a certain intermixture of artifacts cannot be excluded. For that reason, the description of the lithic industry from a particular site was based on the major trend rather than solitary facts, which means that general (not individual) patterns of raw-material selection, features of primary and secondary reduction, blank shapes and dimensions were taken into consideration. Description of tools was focused on most typical forms.

The comprehensive analysis of lithic industries associated with the most important Neolithic sites in the Upper and Middle Kama was based on collections from the following sites: Khutor (trench VI), Chernushka (trench II), and Chashkinskoye Ozero IIIa (trench II) attributed to the Kama culture, and Chashkinskoye Ozero IV, VI (trench I, 2005), and VIII belonging to the Volga-Kama culture (Lychagina, 2008; Lychagina, Poplevko, 2011, 2012; Lychagina, Poplevko, Tsygvintseva, 2014). All Kama sites pertain to the Middle (Khutor) stage. The Volgo-Kama site of Chashkinskoye Ozero VIII belongs to the Early Neolithic, while the two other sites represent the Middle Neolithic period.

Technological analysis. This analysis was carried out using microscope MBS-9 (50–98x magnification) in the Laboratory for Archaeological and Ethnographic Research of the Perm State Humanitarian Pedagogical University. The analysis has shown that during the Neolithic, various techniques of primary reduction were used by the populations of the Upper and Middle Kama. Flaking was performed with a stone or bone hammer; pre-cores were prepared using pressure technique or percussion through intermediate technique. Tool-blanks were also obtained using pressure technique and percussion through intermediate technique. The Volga-Kama evidence suggests that tools were made on flakes removed with a hard (stone) hammer (Lychagina, Tsygvintseva, 2013: 24–27).

The core-trimming elements display the preparation of flaking surface with reduction of overhang and subsequent platform flattening. However, the majority of flakes were detached without any rejuvenation of the flaking surface. The striking platforms on tools show mostly scars of overhang reduction in combination with abrasive trimming. The abovementioned features provide sufficient grounds to infer the broad distribution, in the Neolithic of the Upper and Middle Kama, of intentional and regular stone-knapping aimed at production of blades and blade-like flakes for the manufacture of tools. At the same time, it has been noted that tools were also made on occasional spalls and primary flakes, without any signs of preparation. This situation is equally typical for the sites of both Kama and Volga-Kama cultures (Lychagina, Poplevko, Tsygvintseva, 2014: 16–17; Lychagina, 2014).

At the Volga-Kama sites, the predominant raw material was local gray, beige, or dark brown pebble flint of varying quality. Judging by the split pebbles in the assemblages, pebbles 3 to 5 cm long were used as pre-cores. Large tools were produced of silica limestone, silica clay, dolomite, or quartzitic sandstone. Bifacially worked tools (points and knives) were made of gray or brown semitransparent chalky flint, or high-quality colored flint. No chalky flint outcrops have been discovered close to the sites, which suggests long-distance transportation of the raw material. No tools made of tabular flint were found. Some artifacts show signs of firing, but these signs were not related to stone-heating before knapping. Most likely, signs of firing represent post-depositional effects.

At the Kama sites, the main raw material also included local low-quality pebble flint of the same colors as above. However, at Chernushka, approximately 40 % of tools were made of the high-quality, semitransparent chalky flint. The degree of the raw material's utilization was maximal. Judging by the insignificant amount of chalky flint chips and scales, this raw material was brought to the site in the form of cores and ready tools. At the Khutor site, the tool collection contains ca 30 % of items made of grayish-dark-red, fine-grained quartzitic sandstone. As the quality of this raw material is not particularly high, we can explain this by its easy accessibility for the inhabitants of the site. The tools of quartzitic sandstone are generally bigger that those made of flint. Wide use of the former material was possibly related to the absence of comparatively large (> 5 cm) flint pebbles. At all Kama sites, bifacial tools made of gray or light brown tabular flint have been discovered. The proportion of these tools does not exceed 20 % of all typologically distinct tools at any site. However, the use of tabular flint is a characteristic feature of the Kama Neolithic culture, which makes it distinct from both the Volga-Kama Neolithic and the Kama Mesolithic cultures. As with the Volga-Kama sites, some artifacts demonstrate signs of firing that suggest post-depositional effects.

The majority of sites under study are characterized by the use of small flakes (< 3 cm) for manufacturing tools. This was likely because of the dimensions of the raw material (small flint pebbles) rather than intended microlitization of the tools. The only exception were the sites of Khutor and Chashkinskoye Ozero IV, where medium-sized flakes (3–5 cm) were typical. At the Khutor site, this was likely related to the use of quartzitic sandstone, as mentioned above. In the case of the Chashkinskoye Ozero IV site of the Volga-Kama culture, we can hypothesize the intentional selection of larger flakes for tool manufacture.

The analysis of blades has also shown that at the Kama sites, smaller blanks were used than at the Volga-Kama sites. Thus, at the Kama sites, the proportion of small blades (up to 1 cm wide) is not lower than 50 % of all the traceologically defined tools on blades; while at the Volga-Kama site of Chashkinskoye Ozero VI (which is the largest among those under study), this proportion is 45 %. Further multidisciplinary studies of the Neolithic industries in the Kama basin will show if this trend was stable.

Typological analysis. One of the basic indexes of any lithic industry is the ratio between the stone tools made on flakes and those on blades. Various researchers have mentioned that the proportion of tools on blades in the Kama collections did not exceed 15 % (Bader, 1978: 72; Denisov, 1960: 52–53), while in the Volga-Kama collections, tools on blades predominate (Gabyashev, 1976: 37–41; 2003: 37). However, during this study, it has been established that tools on flakes prevail over those on blades at almost all sites under study, irrespective of their cultural affiliation. The only exception is Chernushka, where tools on blades prevailed (Fig. 2).

Thus, our results did not support the orthodox idea that the Kama culture was characterized by the flake-based lithic industry, and the Volga-Kama industry was dominated by blades. Moreover, the percentage of tools on blades was higher in the Kama collections than in those of Volga-Kama culture. At Chernushka, the high proportion of tools on blades is explained by the features of the area (riverside, where butchering was performed with side-bladed tools) (Lychagina, Poplevko, Tsygvintseva, 2014), while at other Kama sites, the excavated areas represented multi-purpose zones (as identified by the traceological and spatial analysis), and the established toolkit was rather typical (Lychagina, Poplevko, 2011). In general, the two-fold predominance of the tools on flakes over the tools on blades should be regarded as a characteristic feature of the Middle Neolithic Kama culture (Fig. 2).

The low proportion of tools on blades in the Volga-Kama collections requires additional study. The Chashkinskoye Ozero VIII provided an apparent explanation: the site was determined to have been a workshop where heavy-duty tools for woodworking were produced (Lychagina, 2008); but other sites did not reveal any specific features. It is possible that the high percentage of blade-based tools, noted by various researchers, was typical of the early period of the Volga-Kama culture development; while at the sites of the more recent period, this proportion might have significantly

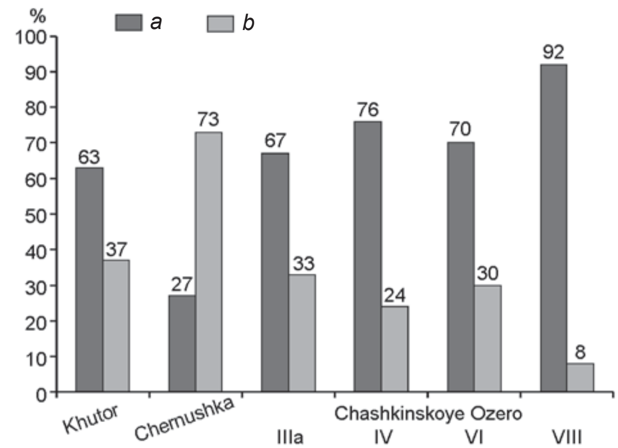

Fig. 2. The ratio of the typologically defined tools on flakes (*a*) and on blades (*b*).

decreased. Discovery and investigation of new sites of the Volga-Kama culture in this region would produce new information on the topic.

Analysis of the pattern of secondary working has shown the following features (Table 1). In all cases, the majority of artifacts (over 60 %) displayed marginal unifacial retouch. Dorsal retouch predominated. At Kama sites, up to 15 % of the total number of tools showed ventral retouch, while at Volga-Kama sites this was used very rarely. One of the Chernushka-specific features is the significant (29 %) proportion of artifacts with bifacial retouch, which is probably due to the maximal utilization of blanks of the high-quality, semi-transparent chalky flint. This is supported by the results of traceological analysis: all artifacts with such retouch were made of this type of raw material, and each of them had two working surfaces on the opposite faces.

The idea that bifacial working was not typical of the Volga-Kama culture has not been confirmed by this study. Bifacial retouch was used for manufacturing arrowheads, knives, and chisel-like tools in both the Kama and Volga-Kama industries. For instance, the Chashkinskoye Ozero VI collection contains such tools in association with a small number of Kama pottery (Lychagina, 2007a), while in the collections from Chashkinskoye Ozero IV and VIII no such pottery has been found (Lychagina, 2007b).

Major tool categories at the sites of these two cultures were end-scrapers, knives, points, and retouched blades and flakes (Table 2). No significant distinctions in the toolkits have been noted.

Thus, the typological analysis has not shown any significant distinctions between the lithic industries of the Kama and Volga-Kama sites. Both industries are characterized by the prevalence of tools on flakes over those on blades, the wide use of marginal unifacial retouch, and bifacial retouch on some tools, as well as by the predominance of end-scrapers, knives, points, and retouched blades and flakes. The only distinction is a broader use of ventral retouch in the Kama collections. However, this assumption requires further study of a larger sample in order to exclude the element of randomness.

Traceological analysis. This analysis was carried out using microscopes MBS-9 (50–98x magnification), Micromed MC-2-ZOOM, and POLAR-2 (80–400x magnification) in the Laboratory for Archaeological and Ethnographic Research of the Perm State Humanitarian Pedagogical University and the Experimental-Traceological Laboratory of the Institute of History of Material Culture of the Russian Academy of Sciences. All collections of stone tools have been examined microscopically, irrespective of the presence or absence of signs of secondary working. As a result, use-wear traces were found on blades, flakes, and spalls from cores that did not have any clear signs of secondary working. Some artifacts had more than one working-surface. Therefore,

Table 1. **Features of secondary working**

Sites	Marginal retouch			Bifacial working	Burin spall	Abrasion
	Dorsal	Ventral	Bifacial			
Khutor	61 (72)	13 (15)	1 (1)	6 (7)	4 (5)	–
Chernushka	8 (47)	2 (12)	5 (29)	2 (12)	–	–
Chashkinskoye Ozero IIIa	18 (62)	–	–	7 (24)	–	4 (14)
Chashkinskoye Ozero IV	39 (78)	2 (4)	4 (8)	5 (10)	–	–
Chashkinskoye Ozero VI	126 (91.5)	4 (3)	3 (2)	2 (1.5)	3 (2)	–
Chashkinskoye Ozero VIII	11 (52.5)	2 (9.5)	–	4 (19)	–	4 (19)

Note: The first numeral represents the number of tools with such type of working, the second numeral (in brackets) shows the percentage of the given category to the total number of tools at the site.

Table 2. **Type list of the typologically defined tools**

Category	Khutor	Chernushka	CO IIIa	CO IV	CO VI	CO VIII
End-scrapers	31 (36.5)	3 (16.7)	7 (17)	14 (26.5)	39 (27.9)	1 (4.75)
Scraper-knives	4 (4.5)	1 (5.5)	1 (2.5)	5 (9.5)	19 (13.6)	–
Scraper-like tools	2 (2.5)	–	1 (2.5)	–	–	–
Knives	12 (14)	–	5 (12)	7 (7.5)	21 (15)	7 (33.5)
Arrowheads	1 (1.5)	1 (5.5)	4 (9.5)	5 (9.5)	2 (1.4)	2 (9.5)
Burins	4 (4.5)	–	–	–	3 (2.1)	–
Cutters	1 (1.5)	–	–	–	–	–
Hammerstones	2 (2.5)	–	–	1 (2)	–	1 (4.75)
Chisel-like tools	–	2 (11.25)	1 (2.5)	4 (7)	5 (3.6)	1 (4.75)
Adzes	–	–	1 (2.5)	–	–	1 (4.75)
Drills	3 (3.5)	–	1 (2.5)	2 (3.5)	6 (4.3)	–
Borers	4 (4.5)	1 (5.5)	–	1 (2)	3 (2.1)	–
Combination tools	–	–	1 (2.5)	–	–	–
Retouched blades	15 (17.5)	6 (33.3)	3 (7)	5 (9.5)	19 (13.6)	1 (4.75)
Retouched flakes	6 (7)	2 (11.25)	2 (5)	6 (11.5)	16 (11.5)	1 (4.75)
Sinkers	–	1 (5.5)	1 (2.5)	–	2 (1.4)	–
Blanks, tool fragments	–	1 (5.5)	2 (5)	–	4	5 (23.75)
Abraders	–	–	9 (22)	2 (3.5)	–	–
Anvil	–	–	2 (5)	1 (2)	1 (0.7)	–
Axes	–	–	–	–	–	1 (4.75)
Total	85 (100)	18 (100)	41 (100)	53 (100)	140 (100)	21 (100)

Note: CO – Chashkinskoye Ozero; numerals in brackets represent the percentage from the total numer of tools at the site.

the number of tools (working-faces) established by use-wear analysis has turned to be greater than that established by the typological analysis (Table 3).

As a result of the traceological analysis, the proportion of tools on blades has increased as compared to that on flakes (Fig. 3). This proportion remained unchanged only for Chernushka site, where these dominated anyway. The most noticeable changes were mentioned in the collection from Chashkinskoye Ozero VI, where the number of traceologically identified tools on blades became predominant.

Analysis of the technical blanks, which were used as tools or for tool-manufacture, attests to the selection of small and medium-sized flakes, as well as blades of various widths (Table 4). This was described in more detail above.

The toolkit is dominated by end-scrapers, butchering knives, and planing-knives. Arrowheads, perforators, and drills form small but stable sets (see Table 3). Neither typological nor traceological analysis has shown any significant distinctions in the toolkits from the Kama and Volga-Kama sites.

Analysis of the subsistence activities of populations of the Upper and Middle Kama in the Neolithic has shown the following. All Kama sites contained the main set of tools relating to processing of game and fish, totaling from 45.0 % to 59.5 % (Fig. 4). The next numerous category was represented by wood-working tools, the proportion varying from 29.5 % to 41.0 %. Two other established sets were comparatively small. The small number of stone-working tools can be explained by the fact that the excavated sites mostly represented open utility zones where butchering and finishing of wooden tools took place. The only exception is Chashkinskoye Ozero IIIa, which yielded a considerable set of hammer-stones, abraders, and anvils (Fig. 4). A small number, or absence (Chernushka), of tools for bone/horn working is characteristic of the

Table 3. **Type list of the traceologically defined tools***

Category	Khutorskaya	Chernushka	CO IIIa	CO IV	CO VI	CO VIII
Scrapers	36 (38.5)	1 (2.4)	10 (11)	16 (26)	83 (30.3)	4 (18.3)
Scraper-knives	–	3 (7)	6 (7)	10 (16)	30 (10.9)	–
Chisels	–	3 (7)	5 (5.5)	–	3 (1.1)	2 (9)
Adze	–	1 (2.4)	–	–	–	–
Knives	31 (33.5)	20 (47.6)	27 (30.5)	15 (24.5)	78 (28.4)	4 (18.3)
Arrowheads	1 (1)	1 (2.4)	4 (4.5)	4 (6.5)	1 (0.4)	–
Drills	6 (6.5)	2 (4.8)	5 (5.5)	3 (5)	20 (7.3)	1 (4.5)
Borers	1 (1)	1 (2.4)	5 (5.5)	4 (6.5)	4 (1.5)	1 (4.5)
Planing-knives	8 (8.5)	4 (9.6)	6 (7)	3 (5)	19 (7)	4 (18.4)
Burins	5 (5.5)	–	–	2 (3)	–	2 (9)
Cutters	3 (3.5)	1 (2.4)	2 (2.5)	–	22 (8)	–
Retoucher	–	–	–	1 (1.5)	–	–
Saws	–	–	–	–	–	2 (9)
Harpoon inserts	–	1 (2.4)	4 (4.5)	–	4 (1.5)	–
Cutter-scraper-knife	–	2 (4.8)	–	–	5 (1.8)	–
Gouge	–	1 (2.4)	1 (1)	–	2 (0.7)	–
Sinkers	–	1 (2.4)	1 (1)	–	2 (0.7)	–
Whetstones	–	–	9 (10.5)	2 (3)	–	–
Hammerstones	2 (2)	–	–	1 (1.5)	–	1 (4.5)
Anvils	–	–	2 (2.5)	1 (1.5)	1 (0.4)	–
Tool fragments	–	–	1 (1)	–	–	–
Ice picks	–	–	–	–	–	1 (4.5)
Total	93 (100)	42 (100)	88 (100)	62 (100)	274 (100)	22 (100)

*See note to Table 2.

Kama sites. Only the Khutor site yielded a relatively significant set of such tools (11 %).

The Volga-Kama collections also revealed two most numerous assemblages: tools for processing game and fish, and those for woodworking (Fig. 4). The collections from the sites of Chashkinskoye Ozero IV and VI contain a considerable number of tools for bone/horn-working (ca 20 %). Stoneworking tools at all sites of Volga-Kama culture are represented by isolated specimens.

Thus, the particular distinctive feature between the utility tools at the Kama and Volga-Kama sites concerns the amount of bone/horn-working tools. In the Kama collections, such tools were quite few; while at the Volga-Kama sites, the proportions of these tools were comparable with those of woodworking tools (Chashkinskoye Ozero IV). Further traceological studies

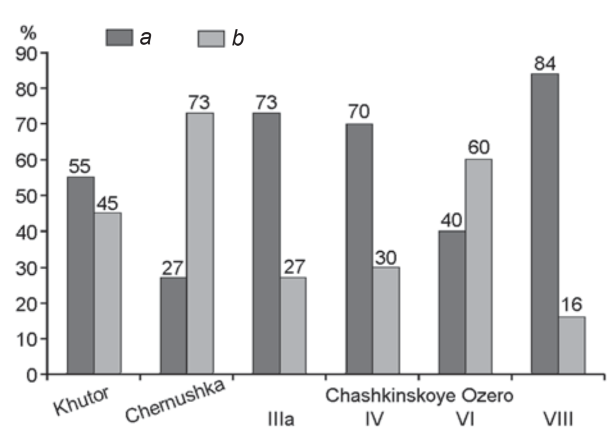

Fig. 3. The ratio of the traceologically defined tools on flakes (*a*) and on blades (*b*).

Table 4. **Classification of the traceologically defined tools by the blank types**

Blanks	Khutor	Chernushka	CO IIIa	CO IV	CO VI
Flakes	32	3	24	28	77
large (above 5 cm)	3	–	1	2	–
medium (3–5 cm)	22	–	6	20	16
small (below 3 cm)	2	2	17	5	61
fragments	5	1	–	1	–
Blade-like flakes	10	6	17	8	16
large (above 5 cm)	3	–	–	–	–
medium (3–5 cm)	4	1	5	8	4
small (below 3 cm)	3	5	12	–	12
Blades	35	24	15	16	143
large (above 1.5 cm)	2	2	3	1	33
medium (1.0–1.5 cm)	4	10	2	4	44
small (below 0.5–1.0 cm)	25	12	10	10	53
microblades (below 0.5 cm)	5	–	–	1	12
Core-like fragments	7	2	8	6	18
Tablets	5	4	9	3	9
Pebbles and fragments	4	3	15	1	11
Total	93	42	88	62	274

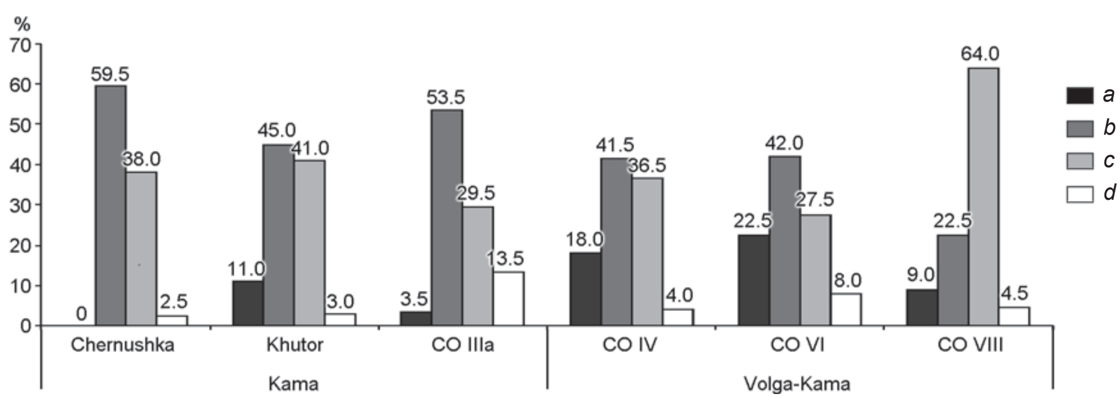

Fig. 4. Classification of tools by their utility types.
a – bone/horn-processing; *b* – game/fish-processing (meat, skin); *c* – woodworking; *d* – stoneworking. CO – Chashkinskoye Ozero.

of stone tools from the sites of both cultures will show if this trend is accurate.

Spatial analysis. This analysis has allowed us to identify at some sites (Khutor, Chernushka, Chashkinskoye Ozero IV and VI) the areas for processing meat and fish, manufacturing and repair of the side-bladed tools made of horn and bone, and wood-processing (Lychagina, Poplevko, 2011; 2012; Lychagina, Poplevko, Tsygvintseva, 2014). In particular, at Khutor site, areas for butchering (sq. К/213 and Л/211) and manufacture and repair of side-bladed bone/horn tools (sq. К–Л/212–213) have been discovered (Fig. 5, *1*). At Chashkinskoye Ozero IV, utility zones for meat-processing and woodworking were located in the (presumably) central area of the settlement (sq. З–И/43–44), overlapping each other (Fig. 5, *3*). At Chernushka, tools for meat-processing were concentrated in sq. Щ–Э/89–90, while woodworking tools were accumulated in sq. Ф–Ш/85–86 and Ф–Ш/87–88 (Fig. 5, *2*). At Chashkinskoye Ozero VI, the butchering zone could have been located in sq. К/40 and К–М/41, while the largest accumulation of various wood-working tools has been noted in sq. М–О/38–39. Bone/horn-working tools (scrapers, a cutter, and a chisel) were concentrated in sq. Н/37–39 (Fig. 5, *4*).

In general, the spatial analysis demonstrated that zones of various subsistence activities often overlapped each other, or were vaguely delimited. This was likely because of the specifics of the excavated portions of the

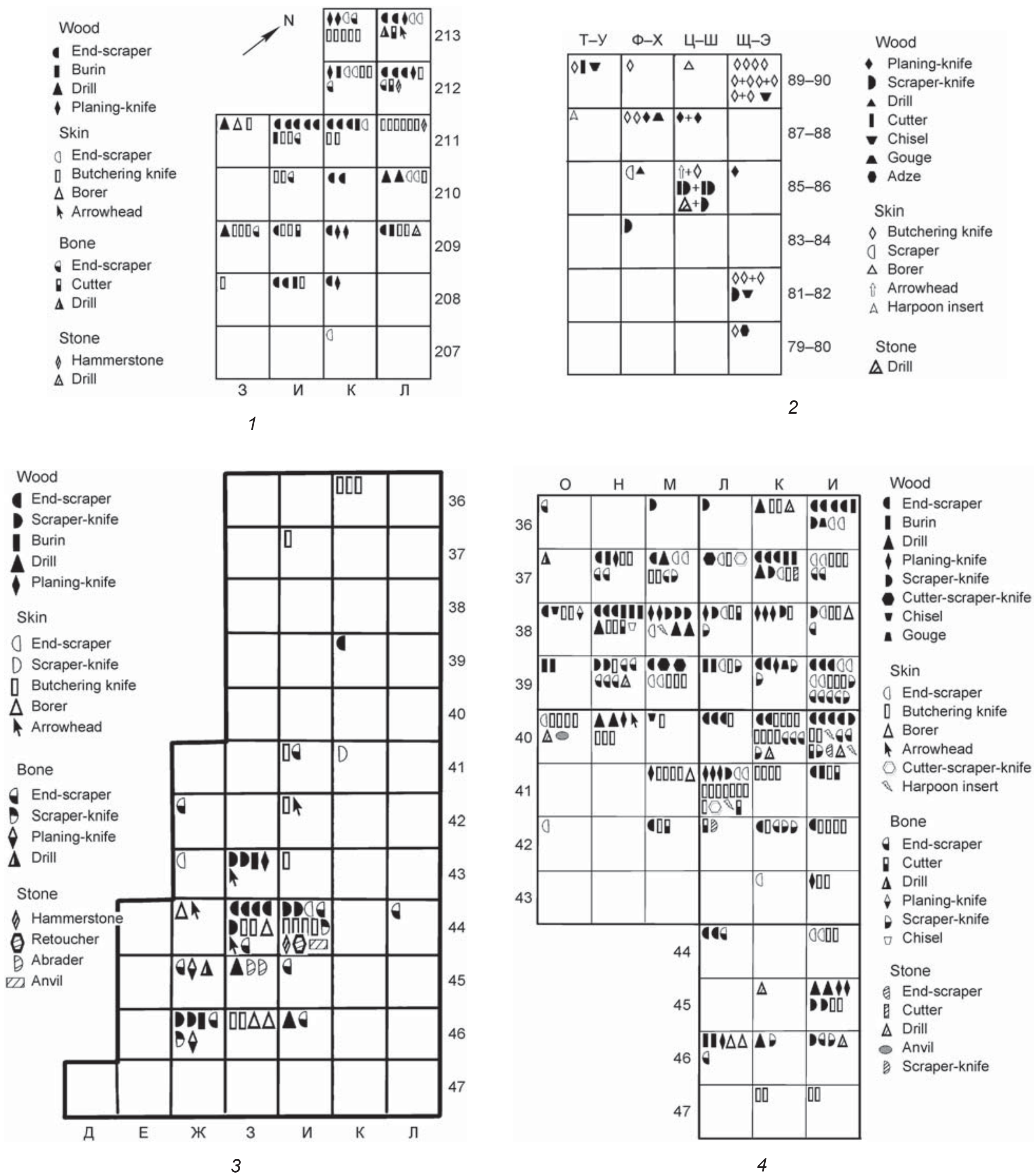

Fig. 5. Spatial analysis.
1 – Khutor; *2* – Chernushka; *3* – Chashkinskoye Ozero IV; *4* – Chashkinskoye Ozero VI.

sites: riverside where various utility areas could have been located in different periods of time. However, it cannot be excluded that some of them could have co-existed in one utility area.

Conclusions

Thus, the comprehensive analysis of stone tools from the Upper and Middle Kama Neolithic sites has shown a high degree of similarity in the following features: shape of blank, method of primary and secondary working, and the type-list of the recovered tools. Minor distinctions have been noted only in the dimensions of blanks (smaller blades and possibly flakes used in the Kama sites), in the occurrence of ventral retouch (more frequently used at the Kama sites), and in the role of bone/horn-processing tools in the utility assemblages (significant number of such tools at the Volga-Kama sites). Apparently, the need for adaptation to similar environmental conditions led to the leveling off of cultural differences in the lithic industries. This concerns mostly the Middle Neolithic. Possibly, comprehensive analysis of stone tools from the Early Neolithic sites might show greater distinctions. However, the currently available source base doesn't provide a sufficient sample for such analysis (Lychagina, 2013b).

Notably, the obtained analytical data do not always support the generally accepted conceptions of the Kama and Volga-Kama cultures. In particular, the thesis as to scarcity of tools on blades at the Kama sites and to their prevalence at the Volga-Kama sites has not been confirmed.

Further studies of the subsistence activities of the Kama populations during the Neolithic require comprehensive analysis of lithic industries from other sites in this region, a search for new sites (primarily those belonging to the Early Neolithic), and research in the paleoenvironment of the region.

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On the History of Asian Bosporus in the Early Byzantine Times: Excavations at Verkhnegostagaevskoye

This study focuses on Verkhnegostagaevskoye—a fortress in the Krasnodar Territory, dating to the Late Antiquity and Early Byzantine era. It has a multilevel fortification system constructed with the use of Classical Greek building materials according to the tradition of adobe-and-stone architecture. The fortress, situated far away from major seashores and inland transportation arteries and studied by nondestructive topographic methods such as magnetic survey, was a strategically important refuge. The scale of construction activities indicates significant administrative resources of the rulers. The master-builders were qualified specialists with a good knowledge of local materials, the relief, and the geological structure of the area. The construction materials differed with regard to their position: shell limestone was used for the outer facades, whereas the peripheral defensive structures were made of local sandstone and limestone. Judging by parts of columns including Doric capitals with very flat echini, dating to the Late Hellenistic or Roman period, dismantled remains of public buildings were used for fortification. The production of building materials and the construction works may have been a long-term job for the Bosporans. The fortress was probably part of a political structure involved in the minting of the famous replicas of Roman denarii. These replicas marked one of the oldest routes connecting the Black Sea coast with Central Ciscaucasia via the Kuban basin.

Keywords: *Northwestern Caucasus, Antiquity period, Byzantine period, fortification, nondestructive methods, survey.*

Introduction

Archaeological records of the Northern Black Sea region and the ancient Bosporus state (Blavatsky, 1985; Frolova, 1998: 249), which was located there at the turn of the Late Antiquity and Early Byzantine period (3rd–6th centuries), are of particular importance for research into the history of the region mentioned by ancient authors in insufficient detail. Processes that led to the desolation and decline of the economic and political system (Gaidukevich, 1949: 439–484; Blavatsky, 1985; Kruglikova, 1966: 9–24) occurred at that time over large areas of the

Northern Black Sea region, including the Asian part of the Bosporus. Written sources scarcely report about the movement of the Barbarian tribes, for example, the Goths, over the territory of the Asian Bosporus. The "Anonymous Periplus", which is traditionally dated to the 5th century, albeit including the fragments of earlier works (Agbunov, 1987: 13–15), mentions the center of the Eudusians (the Goths-Tetraxites), associated with the former ancient Gorgippia-Eudusia (Ibid.: 15). The Byzantine historian of the 6th century Procopius of Caesarea mentioned that the Goths-Tetraxites were in close proximity to the place of Eulysia or on its territory (Prokopiy Kesariyskiy, 1950: IV. 4, 7), which is identified with Eudusia of the "Anonymous Periplus" (Medvedev, 2011).

This information has no archaeological support: sites associated with everyday life of the Late Antiquity–Early Middle Ages in this region are almost unknown (Kovalevskaya, 1981: Fig. 57; Gavritukhin, Pyankov, 2003: Fig. 12). Therefore, dating the ancient fortress with powerful fortifications, which was discovered there in 2013, to the Migration Period (4th–7th centuries) became a notable event.

A topographic survey carried out at the fortress has clarified the available cartographic materials (1 : 10,000 scale) (Fig. 1). The series of GPS-points was correlated with the aerial photographs of 1943 from the collection of the National Archives of the U.S., and satellite images (Fig. 2, *1*, *2*). A comparative analysis of these materials has allowed us to obtain the dimensional characteristics of the fortress and to evaluate its fortification and communication capacities, as well as the economic feasibility of its creation. Judging by the traces of roads and open spaces, in the mid-20th century the site was used for economic needs more intensely than in ancient times, although the landscape did not undergo any significant changes.

In 2013 and 2015, works for identifying and studying the building remains of the ancient fortress using nondestructive methods (magnetic survey) were carried out on the upper fortified ground, or citadel, and in the adjacent defensive structures (Fig. 2, *3*, *4*). This research method is a proven effective way of studying settlement structures, in particular, fortifications (Smekalova et al., 2016). During the excavations of the fortress, which lasted for four years, the cultural layer and the elements of the most important objects of the fortification system and everyday life of the monument were studied. Laboratory studies of the obtained materials (establishing the content of the phosphorus compounds in the deposits of the fortress and analyzing paleobotanical samples)* made it possible to establish specific features of the cultural layer at various parts of the site, to clarify the range of building materials used, and to obtain new data on the chronology of the monumental citadel structure.

The study of the fortress was carried out using nondestructive and destructive methods; thus, these studies can be described as comprehensive. The article summarizes the results of the above works, which have made it possible to clarify the topography, stratigraphy, and chronology of this cultural heritage site discovered in 2013.

Fortification of the Verkhnegostagaevskoye settlement

The fortress is located on the northern slope of the watershed ridge between the Kotlama and Gostagaika rivers, which belong to the Black Sea basin. The structures of the fortress occupy almost the entire area (2.7 ha) of the promontory, which has an irregular shape close to quadrangular. The terrain of the promontory is very sophisticated: its territory comprises absolute marks ranging from 280 to 294 m; the inclination angle of the slopes reaches 40° in the eastern and northeastern directions and 25–30° in the western and northwest directions (see Fig. 1, *2*, *3*). On the southeast, west, and northwest, the promontory is bounded by deep ravines connected with the basin of the Gostagaika River. An elongated, large (about 0.8 km) isthmus adjoins the base of the promontory on the northern side. An important feature for the system of fortification and communication is the crest of the ridge, which cuts through the territory of the fortress and isthmus in the meridional direction (hereafter referred to as "the meridional ridge") (see Fig. 1, *1*, *a*).

The strength and inclined bedding of rocks ensure the stability of the northeastern and eastern slopes of the promontory, which fosters the erection of monumental structures in the area even despite the great inclination of the slope. The fortress had two lines of stone defensive structures: a wall around the perimeter of the entire settlement and an additional wall that fenced the citadel from the main part of the fortress.

Citadel

The upper ground of the promontory covering an area of 0.5 hectares, where the citadel of the fortress is located, is of subrectangular shape and is stretched along the NE-SW axis. The boundary of the citadel is a rampart-like embankment, which can be well seen on both topographic plans and aerial images (see Fig. 2). Magnetic survey has revealed an interesting feature of the citadel fortification:

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*Studies on the phosphorus content in the layer were carried out by I.V. Turova at the Chemical Laboratory of the Institute of Geography of the Russian Academy of Sciences. The species of the trees were identified by Dr. A.A. Golyeva.

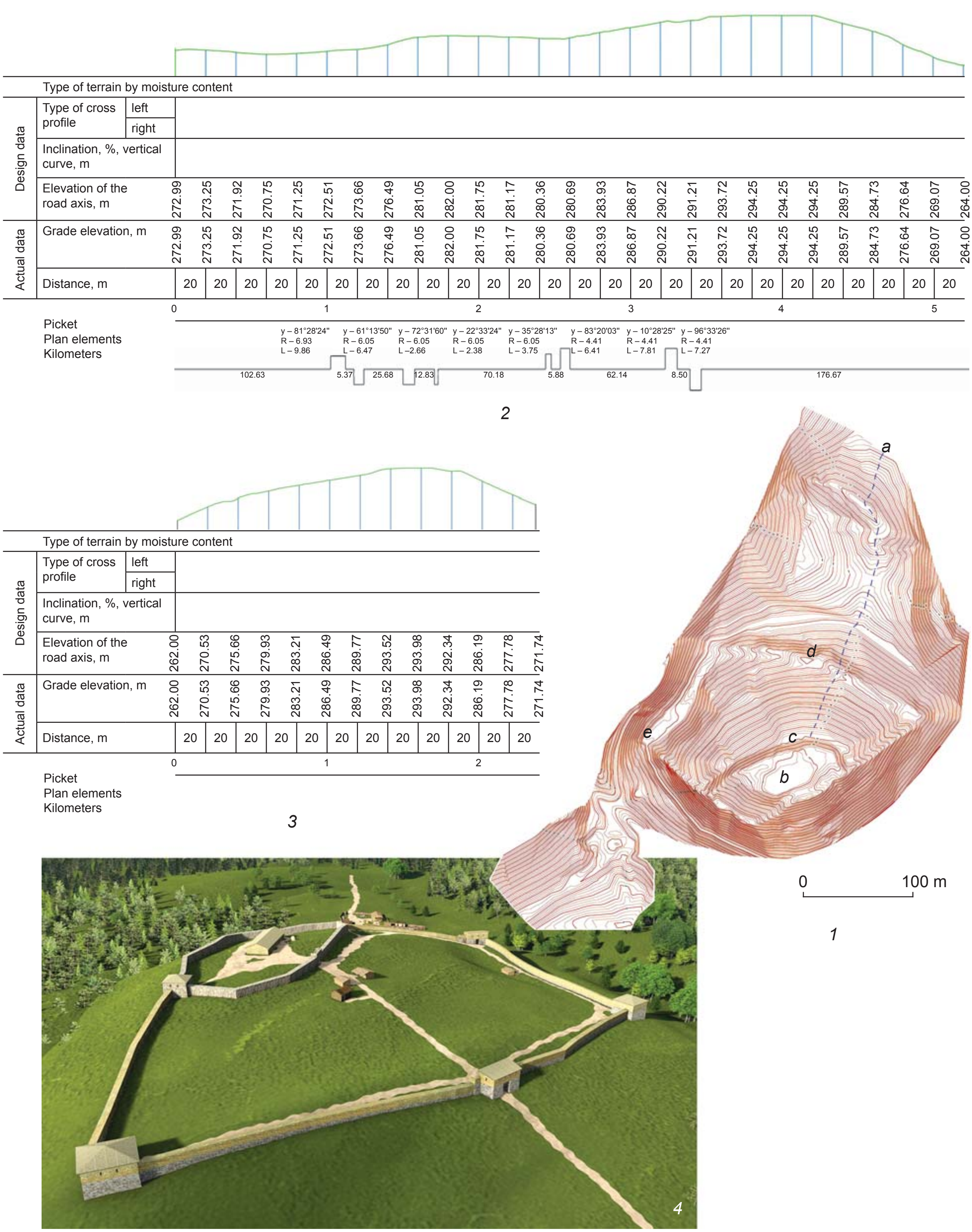
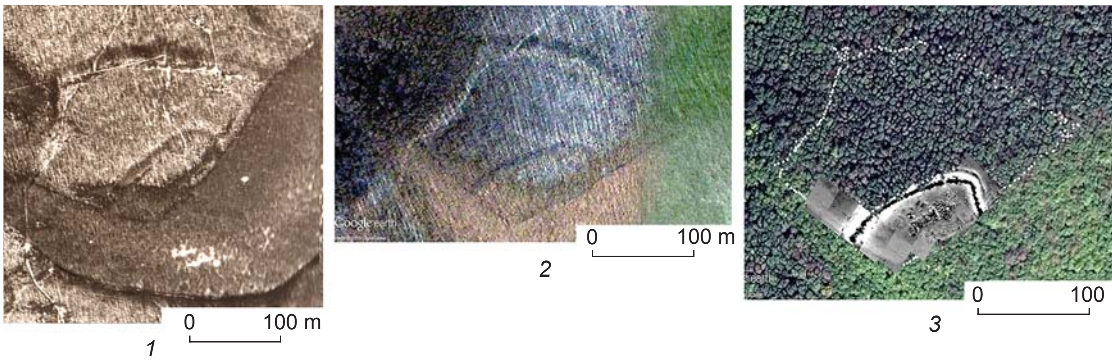


Fig. 1. Verkhnegostagaevskoye fortress and its environs.
1 – topographic map: *a* – "the meridional ridge", *b* – location of the monumental structure on the citadel, *c* – hypothetical location of the entrance structure of the citadel, *d* – entrance structure at the fortress, *e* – excavation at the outer defensive wall; *2* – cross-section of the fortress along the W-E axis; *3* – cross-section of the fortress along the N-S axis; *4* – 3D reconstruction of buildings at Verkhnegostagaevskoye fortress (by V.V. Moor).



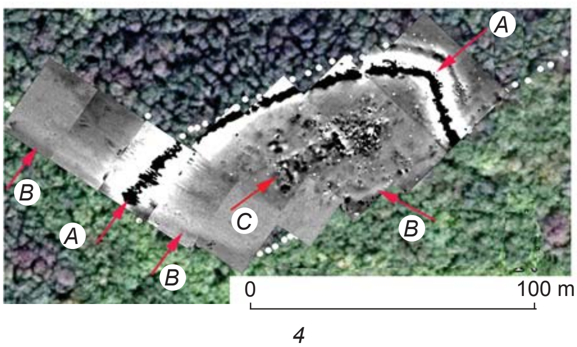


Fig. 2. Materials of aerial photography of the fortress in 1943 (*1*); a satellite image taken on February 24, 2011 (*2*); magnetic field map superimposed on the satellite image (made by T.N. Smekalova and A.V. Chudin) (*3*, *4*): *A* – intense positive magnetic anomaly from the inner wall of the citadel; *B* – weak negative anomaly from the outer wall of the fortress; *C* – anomalies from the rectangular monumental structure inside the citadel.

the inner wall fencing the "acropolis" was built of stone and heavily burned clay-wattled or adobe structures. They appeared in the magnetic field in the form of a rectilinear negative anomaly (the wall material was non-magnetic stone) (see Fig. 2, *4*). This observation was made as a result of the strong positive magnetic anomaly above the wall, the same anomaly as the one over the walls of the Rayevskaya and Krasnaya Batareya fortified settlements. During a fire, the clay underwent high-temperature impact, which caused its burning, slagging, and magnetization.

For building the rampart-like embankment, the slope of the watershed ridge was made into an escarp by the creators of the citadel to the northwest and northeast. Since these ramparts were joined at the crest of "the meridional ridge", taking into account the irregularities of the terrain, their contour does not have a regular geometric shape.

The outlines of a road on the inside of the embankment and a noticeable "dip" in the terrain suggest that the entrance to the citadel was located at the northern part of the embankment. The height of the embankment on the western side is over 3 m, and on the northern and northeastern side it is over 2 m. The southwestern, southern, and eastern corners of the citadel are distinctly outlined. Judging by the terrain, the walls on the southeastern side were built on a small earth embankment, and to the southwest simply on the layer of rock.

The issue remains as to whether tower structures were located in the southwestern, southern, and northern parts of the fortification at the turning points of the rampart-like embankment. A rectangular area of about 6 × 6 m can be found only at the junction of the northeastern and southeastern sections of the rampart-like embankment. The strategic need for a tower in this area for controlling access to the citadel gates is obvious.

The interior of the citadel is characterized by a complex relief with height difference reaching 9 m. In the southwestern part, there is a steep slope approximately 26 m wide, which ends at the edge of an even steeper cliff. It cannot be excluded that it was possible to enter the citadel from the side, from the junction of the rampart-like embankment and the southern precipitous promontory slope of the fortress.

Most of the citadel area is a natural plateau of oval shape measuring 26 × 47 m (and about 294 m high) on the top of the promontory, oriented just like the entire citadel along the NE-SW axis. If we do not take into account the significant difference in height on the southwestern slope, the height difference does not generally exceed 1.0–1.5 m. The terrain of the adjacent territory, judging by the folds which are also visible behind the rampart-like embankment, corresponds to the natural relief of the plateau.

Monumental structure

The magnetic survey conducted in 2013–2015 on the plateau mentioned above, revealed a rectangular structure (with the approximate dimensions of 10 × 30 m), oriented along the axis of the plateau. Judging by the negative magnetic anomalies, the foundations of the walls of the structure were made of stone. The eastern and western walls of the structure are additionally marked by strong positive anomalies. It is possible that adobe bricks, which became magnetized in a large fire, were used for erecting these walls. An extensive alternating anomaly of a mosaic structure corresponding to the collapsed burned adobe walls and possibly the tiled roof can be observed to the east of the rectangular structure.

In 2014–2016, the main part of the monumental structure was explored by excavations (Fig. 3, 4); the masonry of three walls was cleared for a width of about 1.2 m; the longitudinal walls were traced for approximately 17 m, and the transverse wall was traced for approximately 10 m.

The facades of the walls have been preserved up to the height of 0.6–0.7 m (three to four rows of stonework). Despite the impact of slope deformation, especially noticeable on the longitudinal northeastern wall, the masonry retained its distinct row structure (Fig. 4, *3*, *4*, *6*). The external facades of the walls that form the northern corner of the building facing the entry gates of the citadel, were built of large, 0.15–0.20 m high, quadrels of polished shell limestone (Fig. 4, *6*). The internal facades were made of stones usually of smaller size; local limestone occurs more frequently.

Doorways approximately 1.6 m wide were made for entering the building. In the longitudinal walls they are arranged in pairs. The bases of the thresholds are composed of three rows of objects of short cylindrical shape (probably, column shaft drums) made of shell limestone, and are paved on top with thin limestone slabs (see Fig. 3). The pavement on the outside of entrances 1 and 4 marks the ancient day surface and indicates a slight deepening of the building walls using one foundation row of masonry at approximately 0.2 m. Drums of column shafts made of shell limestone with a diameter of about 0.4 m have also been found in the lower foundation row of stonework.

Piles of collapsed stonework were found everywhere in the filling of the room. Cleared piles of building stone make it possible to reconstruct the height of the outer wall which might have reached 1 m. The remains of longitudinally burned oak slabs interspersed with the fragments of roofing tiles and accompanied by layers of ash and adobe mortar were found within the building. This layer, in our opinion, was formed by the remains of the roofing which collapsed during the fire. According to the building tradition of Antiquity, the roof was tiled (see Fig. 4, *6*).

Most of the fragments belong to flat roof tiles (keramides) with upstands along two longitudinal sides. The overall dimensions (different widths) and, most importantly, the design features of the lateral upstands which are associated with a placement technique not typical of the Hellenistic period, make it possible to date the finds to the Roman period (Zeest, 1966: 59–60). Approximately half of the fragments belonged to roof tiles which were made of a red-brown clay mixture typical of the production of ancient Gorgippia in the Roman period. The material of the roof tiles is characterized by a porous structure, coarse-grained impurities of grog, sand, and white grains (lime) (Kruglikova, 1966: 148).

External defensive line

The space between the citadel embankments and the outer line of defensive structures is extensive; its area exceeds 2 hectares. The significant inclination of the surface was important for fortification purposes, but created many problems for economic activities. Traces of economic use of this area (terracing, presence of a cultural layer) on the slope are absent, and traces of re-planning (escarps or upfilling) have been found only along the outer perimeter of the fortress.

Intensive economic activity was also hampered by the shortage of water: it was practically impossible to obtain water from the wells on the territory of the fortress. The availability of a system for collecting and storing rainwater has not yet been confirmed by archaeological research.

The building of the external defensive contour with a total length of about 675 m required significant efforts during the construction of the fortress. The shortest west-northwestern section approximately 140 m long was inscribed into the slope, which had an internal bend in the form of an amphitheater (see Fig. 1). The natural fracture of the slope was made into an escarp, and the break of the isolines on the topographic plan makes it possible to establish the width of the resulting terrace, reaching about 20 m. The soil was most likely used for constructing a rampart-like embankment on the field (northern) side of the fortress.

A barely noticeable elevation can be presently observed along the outer edge of the terrace around the entire external perimeter of the fortress. As excavations have shown, a layer of dark gray dense loam, which are probably disintegrated adobe bricks, covered the foundations within 1 m of the two-faced defensive wall 1.0–1.1 m wide (see Fig. 1, *1*, *e*), composed mainly of large slabs of local rocks—limestone and sandstone. Judging by a sharp break in the isolines, a patrol trail or road up to 3 m wide used to pass along the external defensive wall. Almost half of the south-southwestern and east-southeastern sections of the outer perimeter are associated with the fortification of the citadel.

The entrance to the fortress, flanked by rampart-like embankments, was located in the southeastern corner. The embankment of the road leading to the entrance was made

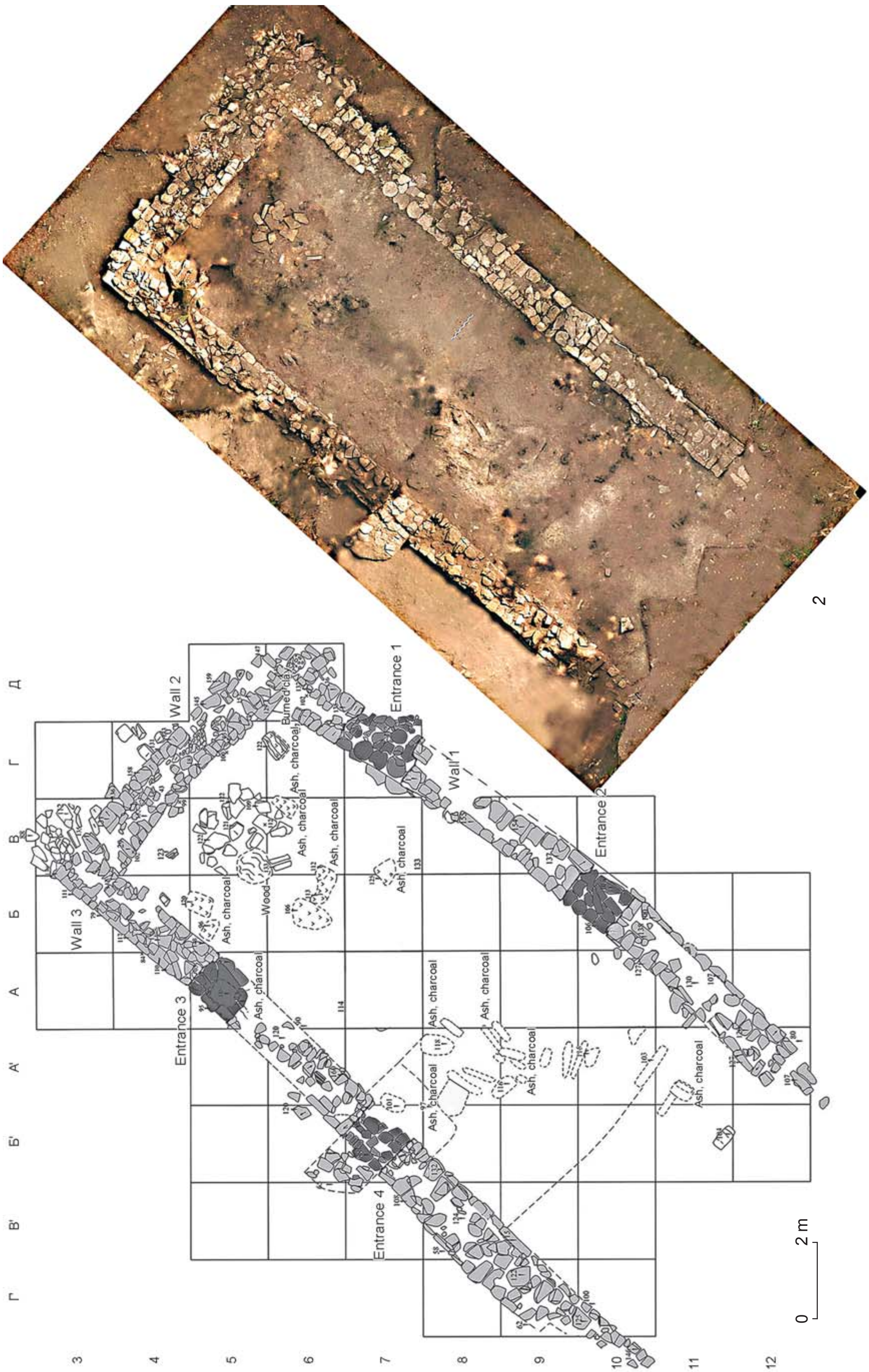


Fig. 3. Consolidated plan (*1*) and aerial photograph (*2*) of the monumental structure on the territory of the citadel.

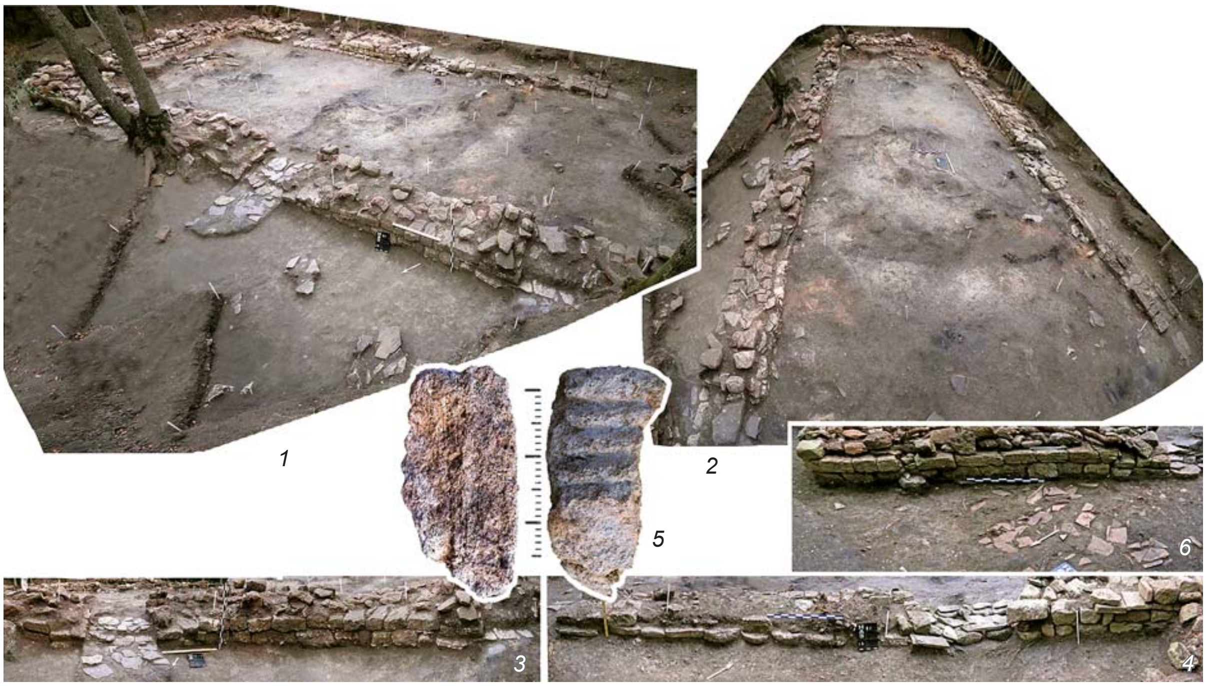


Fig. 4. Monumental structure on the territory of the citadel.
1 – view from the southwest; *2* – view from the south; *3* – opening of entrance 4 with a ramp, external facade of wall 3; *4* – opening of entrance 1, the base of the external facade of wall 1 built of sections of column shafts; *5* – fragment of an object of shell limestone; *6* – external "frontal" facade of wall 3, with piles of roofing tiles in the foreground.

through a deep ravine. A small cape-like protuberance measuring 5 × 10 m on the slope of the fortress suggests that originally it was possible to enter the fortress by a bridge. Judging by the route of the access road on the aerial photograph taken in 1943 (see Fig. 2, *1*), the situation in that area has practically not changed since the time of the photograph.

The most important and labor-consuming task was to build the fortification system in the field (northern) side. This complexity was conditioned by the considerable length of about 230 m, as well as height differences up to 10 m in the latitudinal direction. Currently, the access to the settlement is covered by a rampart-like embankment whose height from east to west doubles, to 4 m. The absence of traces of the outer ditch confirms the assumption that soil obtained from terracing the slopes during the construction of structures of the external defensive line and communications inside the fortress was used for making the embankment. Extensive areas of tower structures have been found in the places where the embankment joined other sections of the external defensive contour.

The above mentioned "meridional ridge" played a crucial role in the topographic situation in the northern part of the settlement. The northern rampart-like embankment "leans" on it in its middle part and thus acquires a convex outline in plan. In addition, this ridge determined the location of the access road from the valley of the Gostagaika River and the entrance to the fortress.

The entrance structure was discovered due to a saddle-shaped depression in the northern rampart-like embankment; the excavations revealed stonework of a monumental structure over 2 m high built in the light-gray loam of the native soil (see Fig. 1, *1*, *d*). A filling in the form of burned light beige or pinkish clay with coarse-grained structure has been observed above the stonework. This filling resulted from disintegrated adobe bricks, which confirms the assumption of the use of the combined adobe-and-stone building tradition of Antiquity in the fortification.

Wall 3, oriented along the axis of the rampart-like embankment, constitutes the basis of the entrance structure. Clearing the southern (interior) facade made it possible to establish the heterogeneous nature of masonry over its entire height (over 2.6 m) (Fig. 5, *1*). The lowest row, constituting the foundation, is built of stones which vary in height in order to reduce the unevenness of the ancient day surface. The next four rows consist of standard blocks of shell limestone of regular shape measuring 0.15–0.2 × 0.2 × 0.5 m. The quadrels bear the traces of saws and tools of primary processing (Fig. 5, *4*) (cf. (Wright, 2005: Ill. 90)). The majority of the blocks, which are of dark gray color, are permeated with humus. This, along with the indices of the content of specific

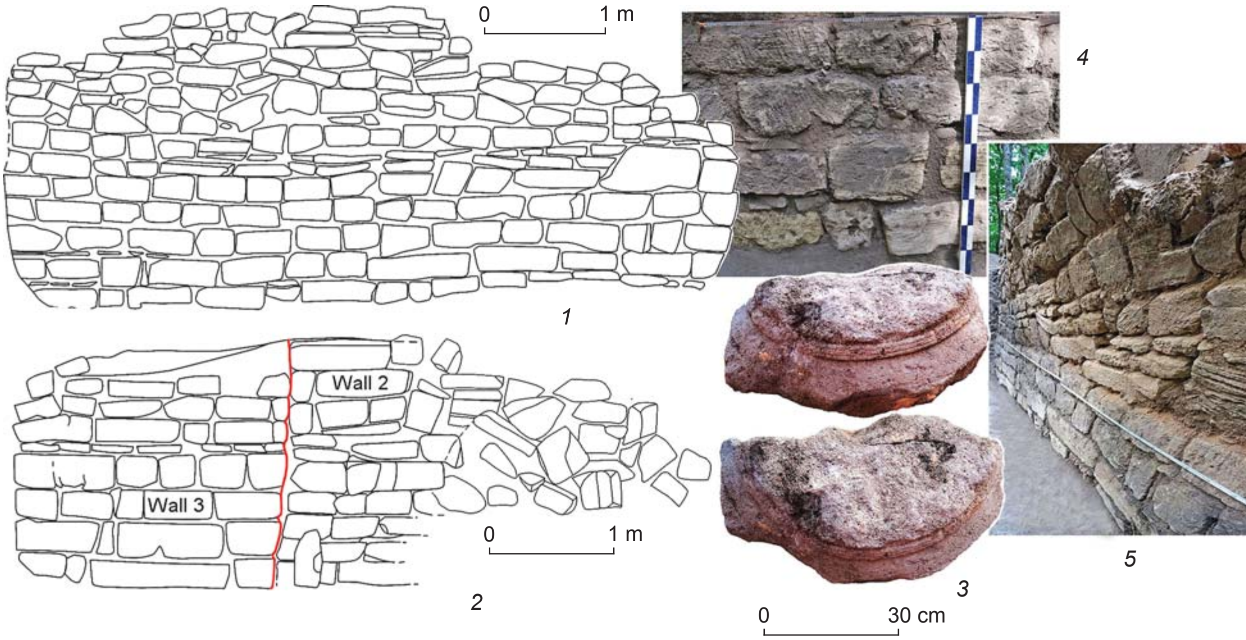


Fig. 5. Entrance structure, wall 3.
1 – internal surface; *2* – surface of the internal space of the entrance structure; *3* – fragment of a capital of a column of Doric order from the masonry of wall 3; *4*, *5* – traces of processing on masonry blocks.

phosphorus in the soil, indicates that the masonry was covered by the cultural layer up to a height of 0.8 m.

The upper rows underwent a strong longitudinal deformation, which caused the tilt of the upper rows of the masonry and even their noticeable horizontal shift (Fig. 5, *5*). The variation in the sizes of stone blocks increases noticeably in the upper levels, and unprocessed plates made of local rocks (limestone and sandstone) start to appear. Careless masonry in the upper rows might have resulted from hasty or unprofessional repairs after the collapse of the structure due to slope deformation or enemy attack.

The eastern end of wall 3 (2 m wide) forms the surface of the inner part of the entrance structure (Fig. 5, *2*; 6). A buttress consisting of three walls (No. 2, 4, 5) was added to the outside of wall 3 for compensating for the impact of slope deformation. The joining of walls 2 and 3 end-to-end indicates that the external structure appeared at a later time. The elements of a similar structure were also traced on the opposite side of the entrance structure.

The stonework on the surfaces of the walls forming the internal space of the gates is strongly burned and shows a significant tilt inwards. We may assume that during a siege, the oak gates were burned; the design of the part of the building above the gates collapsed and blocked the passage with building stones mixed with charcoal and adobe debris. During the excavation, the internal space of the entrance structure was cleared about 6.5 m in length; the laying of a stone threshold was found in the entrance at a width of 3 m (Fig. 6).

Dating

Materials obtained through archaeological excavations have allowed us to establish the period when the fortress existed in the systems of relative and absolute dating. The lower border (the early 4th century BC) is given by a single coin, a bronze Bosporus stater of Radamsad (318/319 BC (309/310–322/323))* (Frolova, 1997: Pl. LXXXIV, *27–29*, pp. 319–321) (Fig. 7, *2*). More numerous pottery finds include the fragments of red-glazed tableware and amphorae, typical of the cultural layers of the Black Sea sites of the late 4th–5th century**. Red-glazed pottery, which is represented both by the imported forms of LRC (Late Roman Ceramics) 3C (Fig. 7, *4–6*) (Hayes, 2008: Fig. 39, 1269, 1270, 1272, 1273), LRC 3B (Fig. 7, *7*) (Ibid.: Fig. 38, 1262), PRSW (Pontic Red Slip Ware) 1 (Fig. 7, *12*) (Sazanov, 2012b: Fig. 1, *6*, pp. 135–138), and local imitations PRSW 7 (imitation of Hayes LRC 2) (Fig. 7, *9–11*) (Sazanov, 2012a: Fig. VII.3, *1*, p. 213), goes back to the period from the late 4th to the third quarter of the 5th century.

The objects from the not very numerous amphora collection do not contradict that chronological framework and show the chronological indicators typical of the Northern Black Sea coast of Late Antiquity: profile parts of narrow-necked amphorae of light-colored clay of types E and F (Fig. 7, *1*, *3*) (Sazanov, 2012b: 125–133),

*Identification by Dr. M.A. Abramzon.
**Identification by Dr. A.V. Sazanov.

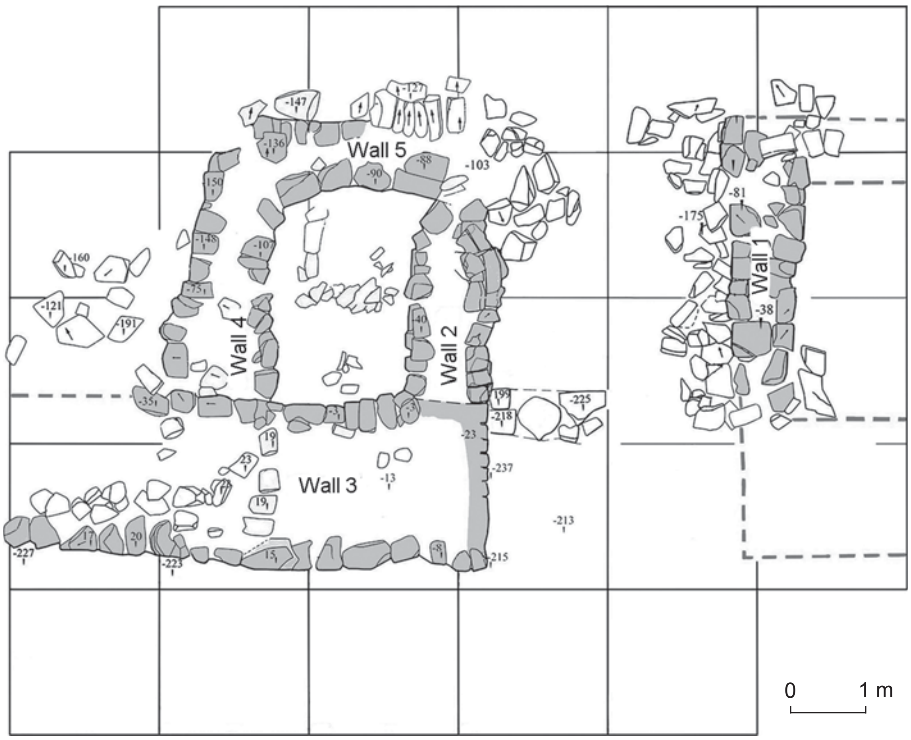


Fig. 6. Consolidated plan for the excavation of the entrance structure.

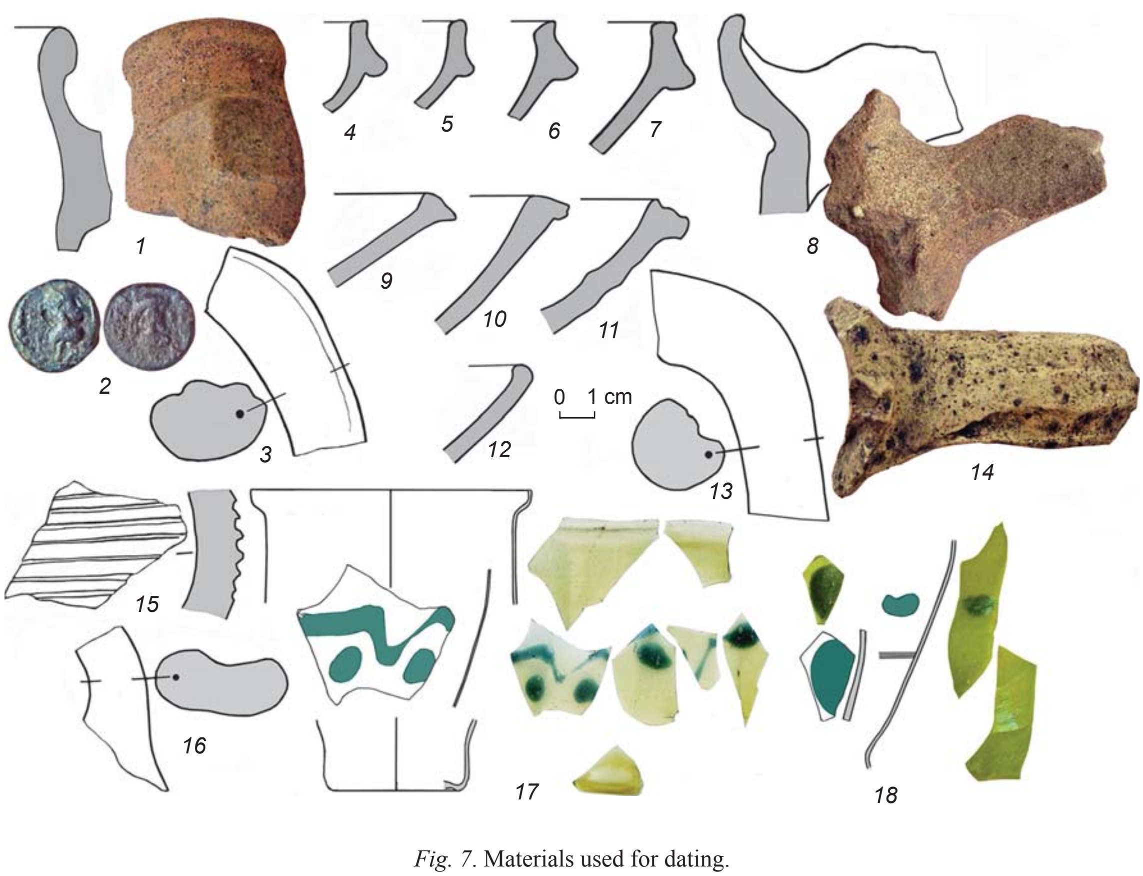


Fig. 7. Materials used for dating.
1, *3*, *8*, *13–16* – fragments of amphorae; *2* – Bosporus stater of King Radamsad; *4–7*, *9–12* – fragments of tableware pottery, red glaze; *17*, *18* – fragments of glass vessels.

as well as the handles and walls of the LRA (Late Roman Amphora) forms 1A (Fig. 7, *8*, *13*, *14*) (Sazanov, 2007: 803–804), LRA 2 (Fig, 7, *15*) (Ibid.: 804), and LRA 3 (Fig. 7, *16*) (Ibid.: 804–806, fig. 4, 8, 9, 20, 32, 33).

The fragments of two glass vessels of transparent olive color with drops of blue glass on the body, which were found on the territory of the citadel, are also typical of the Late Antiquity of the Northern Black Sea coast of the late 4th–second half of the 5th century. One of the fragments is decorated with an ornamented belt of festoons, drops of blue glass, and bands; the other fragment has drops and polished bands (Fig. 7, *17*, *18*). The contours of the vessels make it possible to reconstruct a conical body; one fragment retained a part of a narrow flattened base (Isings, 1957: Form 109; Sorokina, 1971: 90, type II; Sazanov, 2012b: 140–142).

The materials of the absolute dating and the results of the ^{14}C analysis of two charcoal samples from the filling of the monumental structure reveal dates corresponding to the final stage of the existence of this complex in the Late Antiquity–Early Byzantine period: from the second half of the 5th (472 (430 ± 60)) to the 6th centuries (598 (590 ± 60))*.

Discussion

The remoteness from the main transportation arteries on the sea and on land (20 km from the lower reaches of the Anapka River (Gorgippia, the Black Sea) and the Gostagaika River (fortress near the villages of Kapustin and Vityazevsky Liman)) allows us to view this monument as a refuge fortress of very high rank. The minimum content of specific phosphorus and the scarcity of mass materials in the cultural layer of the fortress (Golyeva, Malyshev, 2003) indicate a low intensity of economic activity and a low population density.

There is no doubt that the fortress occupied an advantageous geographical and strategic position. It was erected in the area of the axis of the last significant spur on the northwestern tip of the Main Caucasus Range. In ancient times, just as now, this ridge divided the territory into various natural zones and at the same time served as a bridge that from olden times connected two regions: the northern with steppe dominating, and the southern, covered with the forests of the foothills.

The territory with terrain more favorable for communications is located to the north of the fortress. The fairly wide and low-sloped crest of the above "meridional ridge" extends in the latitudinal direction and leads to the upper reaches of the Gostagaika River. The active use of this zone is evidenced by the abundance of building material of shell limestone. It is known that the area of buildings made of this type of stone gravitates towards the lower reaches of the Kuban River. Judging by the elements of columns discovered here, which include a capital of a Doric column dated by the very flat echinus to the Late Hellenistic–Roman period*, the remains of a destroyed public building were reused as construction materials (see Fig. 5, *3*). The presence of roof tiles made of clay similar to the Gorgippian clay mixture, as well as entranceways facing the Anapa Valley, confirms the assumption that the construction material could have been delivered from the west.

The scale of building activities testifies to considerable administrative resources possessed by the rulers of this center. Highly professional specialists who knew the specific features of the microrelief and local construction materials were engaged in the construction work. It is possible to draw a conclusion about a differentiated approach to the building materials: shell limestone, which was brought from afar, was used for creating the main structures, while local sandstone and limestone were used for building peripheral defensive structures. The delivery of construction materials and building of the fortress might have been a long-term servile obligation of the population of the Asian Bosporus.

Conclusions

Recently, it has been suggested that the beginning of the systemic crisis was triggered by the population of the region that is known in the scholarly literature as the Abrau Peninsula (Sazanov, 2011). It is no accident that many scholars locate there the political entity associated with the minting of the famous imitations of the Roman denarii (Kruglikova, 1966: 203; Shelov, 1973). These imitations mark the movement along one of the oldest routes connecting the Black Sea coast through the Kuban region with the Central Ciscaucasia (Shelov, 1973: 193).

Comprehensive studies of the Verkhnegostagaevskoye fortress, which was fortified in the traditions of Antiquity, provide new information about one of the least studied periods in the history of the Asian Bosporus.

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The Jōmon Megalithic Tradition in Japan: Origins, Features, and Distribution

The Jōmon monumental structures on the islands of Kyushu, Honshu, and Hokkaido represent the earliest of three traditions, the two others being associated with the cultures of Yayoi and Kofun. The beginnings of this tradition date back to the Early Jōmon (ca 8000 BP), while its peak coincides with the Late Jōmon (4000–3000 BP). Unlike the people associated with the two later traditions (agriculturalists and animal breeders), the Jōmon people were hunters, gatherers, and fishers. This is the first Russian study that addresses various types of Jōmon monumental structures (stone alignments, stone circles, earthen mounds, and "geometric" shell middens), their distribution and chronology. The most interesting sites (Yubunezawa II, Ōyu, Komakino, Sannai Maruyama, Kasori, etc.) are documented with drawings and photos. It is hypothesized that the tradition originated as early as the Final Paleolithic and the transition to the Jōmon Mikoshiba culture. We present parallels with sites in the adjacent territories of the Russian Far East (Primorye) such as Ustinovka-4, Suvorovo-4, and Bogopol-4. Given the complexity of the monumental structures (elaborate layout, traces of wooden structures, burials, numerous works of art, visual effects, astronomical orientation, "sundials"), these sites can be viewed as multifunctional ritual centers. In terms of the amount of material and labor required for construction, they are comparable with the Neolithic funerary structures of Western Europe.

Keywords: Japan, Jōmon, funerary structures, mounds, burials.

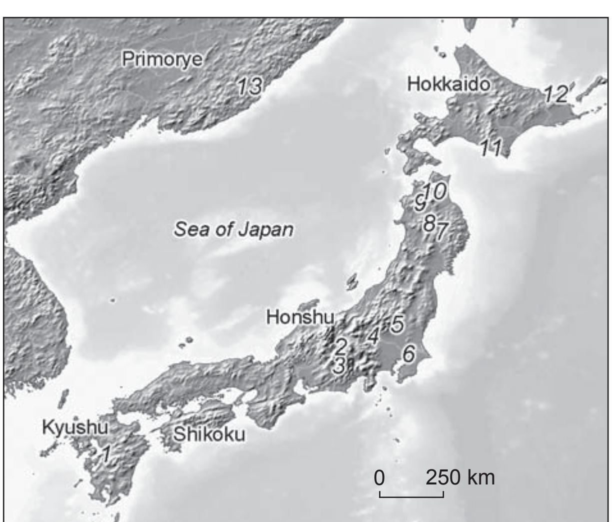
Introduction

Archaeological evidence suggests that there were at least three traditions of monumental structures in ancient times on the territory of the Japanese Archipelago. Two of them are later; one of these is associated with the dolmens of the Korean Peninsula and the distribution of the Yayoi culture on the greater part of the archipelago (3rd century BC to 3rd century AD), and the second is associated with the "period of burial mounds" ("Kofun-jidai", 3rd–6th centuries AD). The third, more ancient and mysterious tradition, is represented by sites of the Jōmon period (13,800–2300 BP). According to the variety of forms, monumentality, amount of materials used, and number of builders, as well as time and energy spent on the construction works, this tradition is by no means inferior to the later traditions on the Japanese archipelago. Moreover, from a global perspective, the Jōmon tradition is yet another confirmation of the complexity and sophistication of ritual practices in the societies of hunters, gatherers, and fishermen who were not associated with a producing economy. The followers of those ritual practices actively experimented with materials (stone, soil, wood, or shells) for creating monumental structures, enhanced the visual effect by incorporating their complexes into the landscape, and carried out regular "maintenance" of ritual objects intended for long-term use. The megaliths (stone structures) are only one type of monumental structure, but they are the best preserved and most informative in archaeological terms.

The very first European archaeologists who studied monuments of different periods, showed interest in monumental structures on the Japanese islands (Morse, 1880); there are articles and sections of books on individual complexes with "stone circles" and "sundials", but comprehensive studies of this phenomenon have not yet been made in the European languages. In Russian archaeology, detailed research of the megalithic traditions in the ancient cultures of the Japanese archipelago is just beginning (Gnezdilova, 2015; Ivanova, 2015a; Ivanova, Tabarev, 2015). This article makes an overview of the main types of complexes, their distribution, and chronology. The historiography of the problem and discussion of the purposes of sites with monumental structures would require a separate study. Nevertheless, interesting parallels with the Final Paleolithic cultures of the Russian Far East (Primorye) will be identified already in this article, and a hypothesis on the origins of the early tradition will be proposed.

The Jōmon megalithic tradition: distribution and main types of complexes

There is no single classification of the monumental structures of the Jōmon period. An overview can be carried out according to various principles: time (from the earliest to the latest), territories (Kyushu, Honshu, Hokkaido), type (circles, alignments, clusters, pilings, etc.), size, presence or absence of accompanying burials, location outside settlements or on their territory, main building material (stone, wood, earth, or shells), etc.



The earliest versions of monumental structures are those in the form of stones placed in a row. For example, such clusters of stones have been found at the sites of the Early Jōmon period (about 8000 BP) of Setaura (Kumamoto Prefecture, southern Kyushu) and Yamanokami (Nagano Prefecture, Chūbu region) (Fig. 1). The former case is a cluster of rectangular shape measuring 21 m along the W–E line and 7 m along the N–S line. The latter case is a U-shaped alignment with the sizes of 11 and 9 m respectively, and with its open side facing west in the direction of Mount Gaki (the Hida Mountains, the Northern Japanese Alps). Numerous stone tools, represented mainly by polished points with concave bases, have been found at both sites. In addition to stone clusters, the complexes include semi-dugouts, hearth structures, and earth pits (Daikuhara Yutaka, 2013).

The Early Jōmon sites (6500 BP) include the Akyū site (Hara village, Suwa District, Nagano Prefecture) covering an area of 55,000 m^2. According to Japanese archaeologists, the earliest parts of the site are "stone circles" (see below) of large and small stones (over 100,000) arranged in two rows. The diameter of the outer circle is 120 m; the diameter of the inner circle is 90 m. A "central area" measuring 30 × 30 m is located inside the circles. Traces of a structure of 24 large (the largest height was about 1.2 m) and small stones, which were vertically set, and eight flat slabs of andesite were found there. Over 700 pits (presumably burials) of oval shape measuring 1 × 2 m in size and up to 0.3 m in depth were discovered under the clusters. Stone pillars were directed to the east towards Mount Tateshina (the Yatsugatake Mountains). In addition to the clusters of stones, holes from vertically erected posts have been found. These holes are the traces of 11 rectangular structures with sizes varying from 4.7 × 4.3 to 7.3 × 6.8 m. The number of holes ranges from 4 to 27; their depth reaches 1.5 m. These objects have been dated to the first half of the Early Jōmon period. Traces of dwellings including over 50 semi-dugouts and eight groups of holes from posts (probably traces of pile foundations) were found within a radius of 50–100 m from the burial ground. The remains of the settlement go back to the beginning–middle of the Early Jōmon period (Akyū iseki…, 1978: 26–30).

The earliest structures belonging to the variant with "vertically erected wooden posts" appear at the Akyūjiri site (the city of Chino, Nagano Prefecture), which is dated to the first half of the Early Jōmon period (6500 BP). The total area of the complex is over 11,000 m^2. The remains

Fig. 1. Main sites mentioned in this article.
1 – Setaura; *2* – Akyūjiri; *3* – Yamanokami; *4* – Nomura; *5* – Terano Higashi; *6* – Kasori; *7* – Goshono; *8* – Ōyu; *9* – Sannai Maruyama; *10* – Komakino; *11* – Goten'yama; *12* – Shuen; *13* – Ustinovka-4, Suvorovo-4, Bogopol-4.

of 39 dwelling pits of various shapes (round, oval, square, and rectangular with rounded corners) with an average size of 5.5 × 4.5 m have been discovered at the site. Traces (holes from posts) of 20 structures of square and rectangular shape (with rounded corners) of various size and various amounts of posts, ranging from small (2.2 × 2.1 m, eight holes from posts) to large (5.9 × 6 m, 18 holes), have been found. The depth of the holes varied from 0.5 to 1.5 m; the average diameter was 0.9–1.2 m in the upper part and 0.5–0.7 m at the bottom. Fifty seven small earth pits of oval shape, several pits with stone lining, and individual clusters of stones have also been found at the site. The remains of the dwellings and the earth pits belong to the range from the second half of the Early Jōmon to the beginning of the Middle Jōmon period (Akyūjiri iseki…, 1993: 55–103).

The construction of "stone circles" (one of the most spectacular types of monumental structures) began at least from the end of the Middle Jōmon period (4100–4000 BP), reached the largest scale in the first half of the Late Jōmon period (4000–3700 BP), and ended in the Final Jōmon period (3000–2300 BP). Currently, over 100 complexes are known. They have been discovered on the island of Hokkaido and in the northeast of the island of Honshu, mainly in the Aomori, Iwate, and Akita Prefectures. There is also some evidence of finding "stone circles" in Central Japan (Kanto and Chūbu regions). On the southern islands of the archipelago (Kyushu and Ryukyu), during the Late–Final Jōmon period (4500–2800 BP), such structures are absent; burials with various types of stonework (stone piles, various types of dolmens) are typical of this area (Nakamura Kenji, 2007).

Small (not more than 3–5 m) scattered groups of stones piled together have been observed at many sites of the island of Hokkaido and in the Tohoku region from the late Middle to the first half of the Late Jōmon period (about 4100–3700 BP). Stone clusters of rounded shape in the form of an arc, which resemble mountains, or in the form of a "strained bow" have been found. Oval earth pits up to 1 m deep were located under individual groups of stones; human remains have not been found in the pits. In Japanese literature, such objects are defined as immediate predecessors of the monumental "stone circles" of the Late Jōmon period. These monuments include the sites of Yubunezawa II, Kabayama, Hatten, Simizuyashiki II, Tateishino I, and the Monzen shell midden site, located in the Iwate Prefecture (Jōmon no sutōn sākuru…, 2012: 7–21) (Fig. 2).

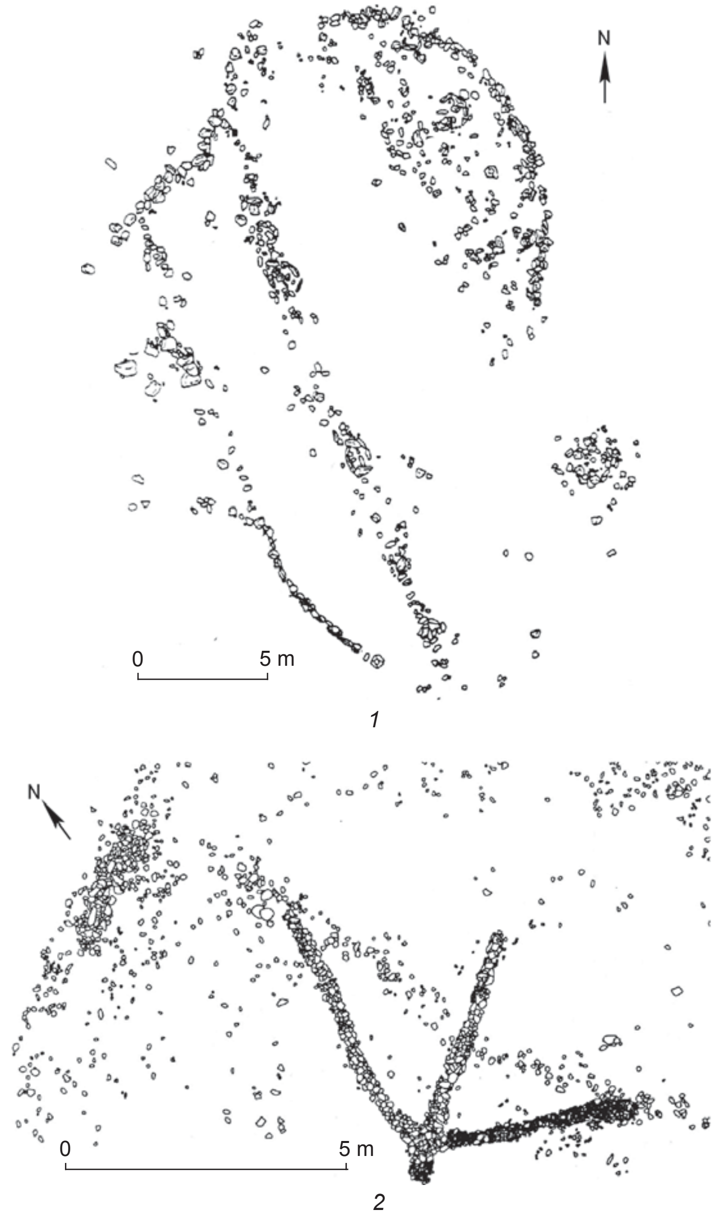


Fig. 2. Monuments with stone alignments at Yubunezawa II (*1*) and Monzen (*2*).

A large number of complexes with early "stone circles" are known on the territory of the Gunma Prefecture: Nomura site (the city of Annaka), Hisamori site (the town of Nakanojō), Tazuno Nakahara site (the city of Tomioka), Higashihara Teranishi site (the city of Fujioka), as well as Achiya Daira site (the town of Asahi) and Dojitte site (the town of Tsunan) in the Niigata Prefecture. The Nomura site, located in the northern part of the city of Annaka (southwestern district of the Gunma Prefecture), consists of a settlement of a concentric type (first half of the Early Jōmon period) and a large "stone circle" (second half of the Middle Jōmon period). The circle is of rectangular shape with rounded corners; its size is 36 m along the W–E line and 30 m along the N–S line. The northern half of the "stone circle" has a finished appearance, while the southern half looks incomplete or partially damaged. Flat graves were found nearby, and a group of dwellings with stone-paved floors was located on the northern side. Apparently, when choosing a place for constructing "stone circles", attention was paid to the connection of the landscape (mountains) and astronomical events (summer and winter solstice, spring and autumn equinox). For example, at the Nomura site, one may observe the sunset over Mount Myōgi during the winter solstice, and at the Tazuno Nakahara site (the city of Tomioka, southern part of the Gunma Prefecture) over Mount Asama during the summer solstice. Many scholars have also noted that specific features of the stone arrangement might have had a certain visual effect. Thus, if you look at the rectangular structure at the Nomura site from a hill, its shape looks absolutely round (Daikuhara Yutaka, 2005, 2013: 42; Hatsuyama Takayuki, 2005).

Noteworthy are also the monumental complexes located inside large settlements, for example, the Goshono site in the Iwate Prefecture on the island of Honshu. This site is dated to 4500–4000 BP and belongs to the middle and the second half of the Middle Jōmon period. Seven clusters of stones of various shapes and sizes were located in its central part. They are arranged in a circle with a diameter of 30–40 m. The clusters are of oval shape; they range in size from 1.0 to 2.5 m. Oval earth pits measuring 0.5 × 1.0 and 2 × 3 m, which might have been graves, have been found around them. About 650 holes from posts have been discovered around the perimeter of the complex. They form several groups located along the perimeter of a rectangular area. Currently, this part of the monument is reconstructed in the form of open supporting structures with a canopy on six pillars (Takada Kazunori, 2005: 32–46; Ivanova, 2015b).

"Stone circles" of the Late Jōmon period differ from the structures of the early stage by their scale and a clearly articulated oval or rectangular shape measuring 30 to 50 m. Beginning in the first half of the Late Jōmon period, arc-shaped clusters started to appear in the Kanto and Chūbu regions. Thus, in the Gunma Prefecture, such objects have been found at the Tazuno Nakahara site (the city of Tomioka), Yokokabe Nakamura site (the town of Naganohara), and Karasawa site (the city of Shibukawa). In some cases, under the arc-shaped clusters, flat graves were located.

The Ōyu complex of the Late Jōmon period, located in the Akita Prefecture on the island of Honshu, stands out from all sites with "stone circles" and alignments. The complex consists of two separate structures, the Manza (lit. 'ten thousand places') and Nonakado ('temple in the middle of the field'), each consisting of two stone circles. The former structure is made of over 105 stones; the diameter of the outer circle is 52 m; the diameter of the inner circle is 16 m. The Nonakado structure amounts to over 55 stones; the diameter of the outer circle is 44 m; the diameter of the inner circle is 14 m. In the northwestern parts of both structures, small complexes are located, called "the sundials" (Fig. 3, *1*): elongated large stones are radially placed around a vertical stone pillar, and the whole structure is enclosed in a ring of stones. According to S. Kawaguchi (1956), the Ōyu complex was based on the beliefs of the Jōmon population concerning the motion of the celestial bodies. If we draw a straight line between the "sundials" of Manza and Nonakado, it will coincide with the line of the sunset during the summer solstice. Eight pile-supported structures were reconstructed around the Manza "stone circle" (Fig. 3, *2*); several burials were excavated, and a sophisticated object consisting of over 50 wooden posts arranged in a circle was found in the western part of the Ōyu complex (Jōmon no sutōn sākuru, 2012: 22–31; Kobayashi, 2004: 180–181).

An even more sophisticated complex covering about 9700 m^2 and going back to the Late Jōmon period, was investigated at the Komakino site (Aomori Prefecture) (Endo Masao, Kodama Daisei, 2005). It consists of three "stone circles": central (2.5 m), inner (29 m), and outer (35 m) (Fig. 4, *1*). The central circle is composed of large blocks with a total weight reaching 500 kg, and several dozens of small blocks. The inner and outer circles are laid out in two layers in a special order according to the pattern, "one large stone set vertically and from three to six set horizontally", which has received the name of the "Komakino style". It is notable that a similar pattern in the simplified form "1 + 2" was also used for creating small circles (Fig. 4, *2*). The placement of stones was preceded by a large-scale digging of soil (over 300 m^3) and its layered redistribution. All stone material (over 2500 boulders) was delivered from the banks of the Arakawa River, which is located ca 500 m from the site. Small ring-shaped, arc-shaped, and sub-rectangular complexes were found around the outer ring and inside the circles. These complexes are the markers of burials (in pits, jars), elements of household pits, "paths", and dwelling structures. It may be assumed that burials in the inner ring (in ceramic vessels) might have belonged to the representatives of the tribal elite (chiefs, shamans) (Kodama, 2003: 258; Ivanova, Popov, Tabarev, 2013). In the Aomori Prefecture, several small stone structures dating to the Late Jōmon period have been found, including the Ōishidai site and complexes in the city of Hachinohe and the town of Sannohe (Jōmon no sutōn sākuru, 2012: 53–65).

In the Final Jōmon period, a noticeable decline in construction of monumental structures is observed. The most impressive complexes of that time include the Ōmori-Katsuyama site (Aomori Prefecture) and Tateishi site (Iwate Prefecture). The former represents

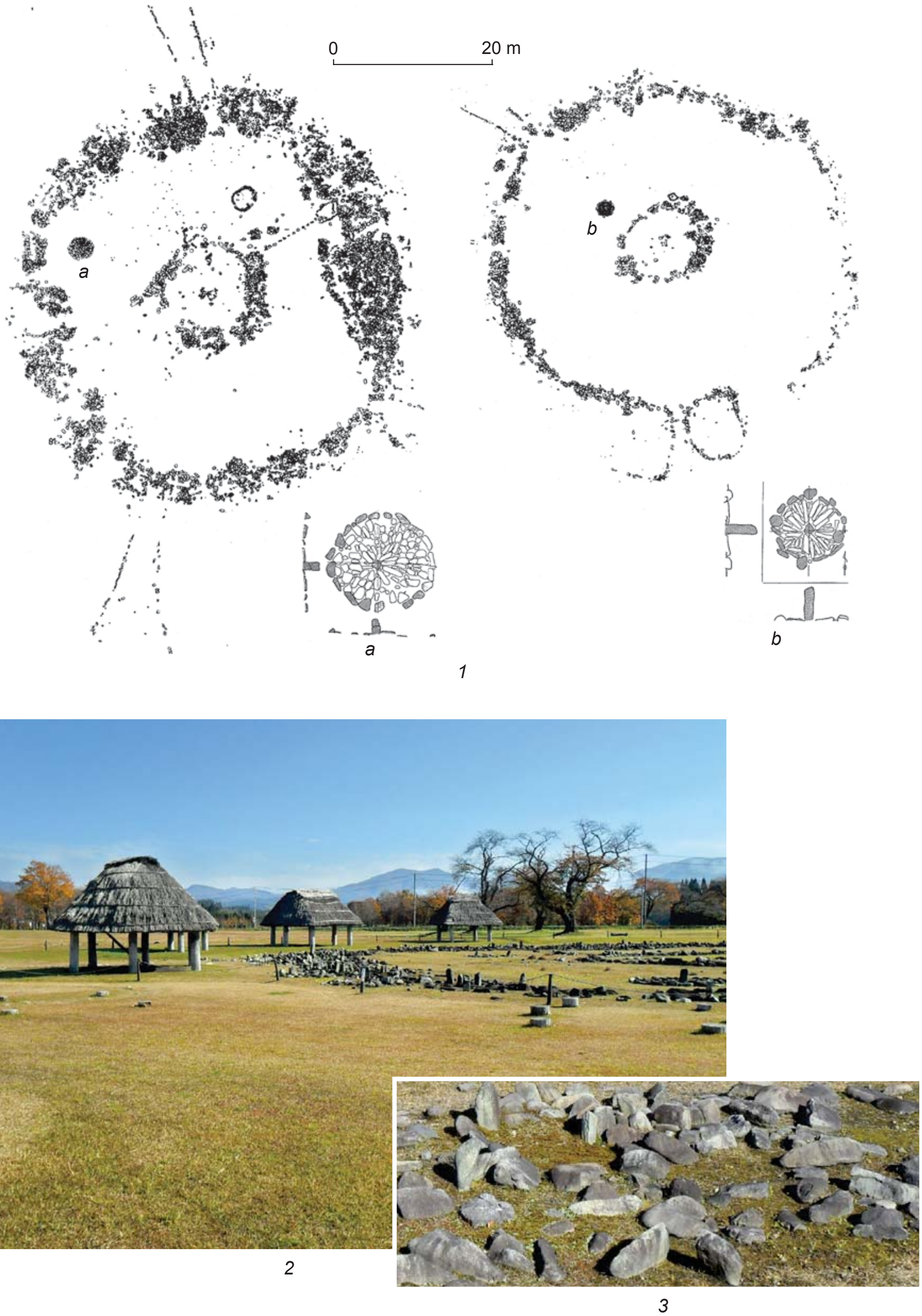


Fig. 3. The Ōyu complex.
1 – general plan: *a*, *b* – the "sundial"; *2* – reconstruction of pile-supported structures; *3* – fragment of stone circle (photograph by D.A. Ivanova).

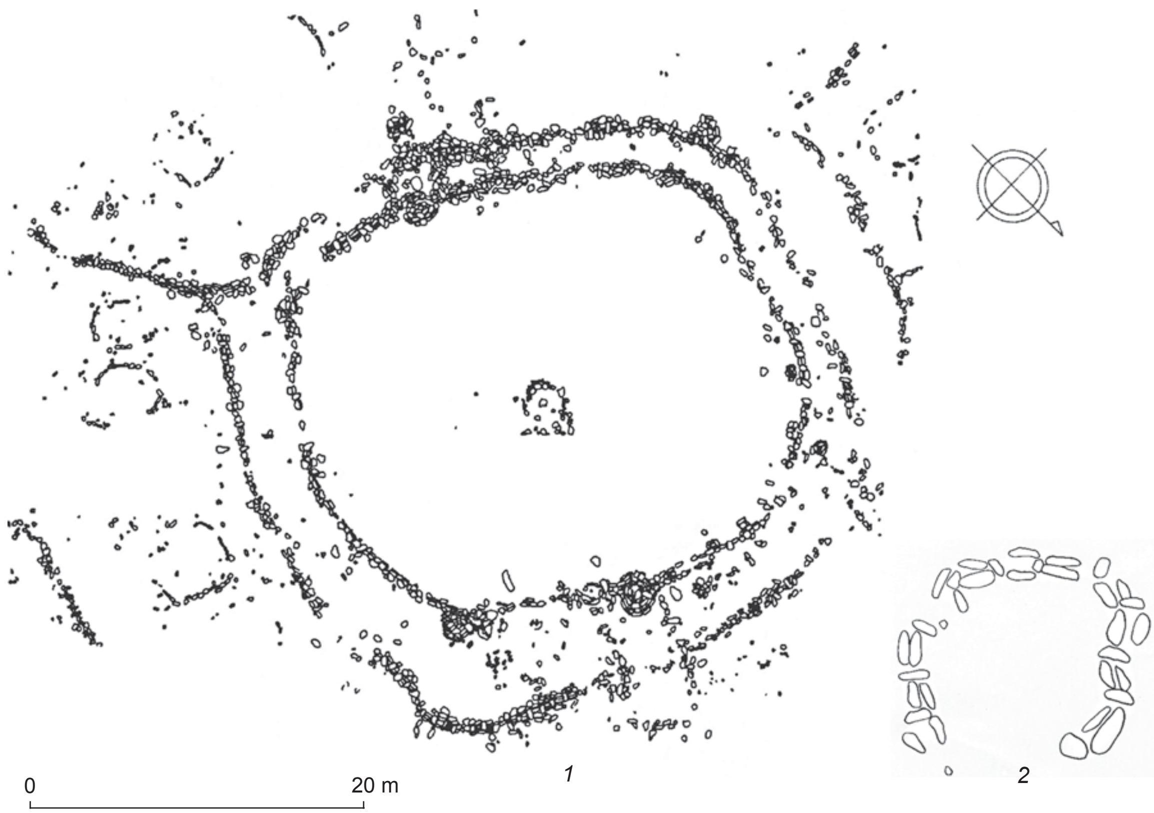


Fig. 4. General plan (*1*) of the Komakino complex and fragment of ring stonework in the "Komakino style" (*2*).

a "stone circle" with a diameter of 48.5 m accompanied by 77 small clusters of stones. The latter complex consists of scattered stone alignments. In general, burial complexes with various identification signs (vertically set stones), stone boxes, and small piles of stones became common at this stage (Yamada Yasuhiro, 2007; Ivanova, 2012).

About 60 sites with "stone circles" and large clusters of stones going back to the Late–Final Jōmon period are known from the territory of the island of Hokkaido. Complexes of the Late Jōmon period are represented by circles and round and square stone clusters, which range in size from 5 to 40 m. These include the sites of Washinoki, Nishizakiyama, Yunosato V, and Kamui Kotan. Burial grounds with "stone circles" appear at two large sites of Goten'yama and Shuen. Both complexes consist of several "stone circles" with a diameter of 32 m and about 20 "stone rings" of oval or subrectangular shape ranging in size from 2.5 to 7.0 m inside the larger circles. A small barrow (from 0.6 × 0.8 to 1.3 × 3.3 m), lined with stones, was located inside each "stone ring"; a grave pit of oval or round shape, 1.5–2.0 m deep, was underneath the mound. There were 21 burials at the Shuen burial ground, and about a hundred burials at the Goten'yama burial ground (Fujimoto Hideo, 1971: 37–55; Vasilievsky, 1981: 96–104).

Sites with monumental earthen mounds, shell middens, and wooden structures

Stone was not the only building material for monumental structures. An example of a complex with a thick earthen mound is the Terano Higashi site, located in the southeastern part of the city of Oyama (the southern part of the Tochigi Prefecture), on the border with the city of Yūki (Ibaraki Prefecture). Archaeological objects from the Paleolithic to the Heian period were found on an area of 26 hectares on the right bank of the Togawa River, on the edge of a terrace rising 43 m above the sea level. The remains of a large settlement, represented by dwellings (127 dwelling pits), earth pits (over 900), and burial urns (95 jars) belong to the Middle Jōmon period (4600–4000 BP). A large earthen mound was erected in the center of the site in the range from the first half of the Late Jōmon period (3800 BP) to the first half of the Final Jōmon period (2800 BP). The mound has the shape of a semicircle; its outer diameter is 165 m and the inner diameter is 100–110 m; the width of the mound varies from 15 to 30 m; the height ranges from 2.5 to 4.4 m. In its center, the remains of a platform of 18 × 14 m paved with stone have been found. The mound is constituted not by a single massif, but consists of four individual parts (northern, northwestern, western, and

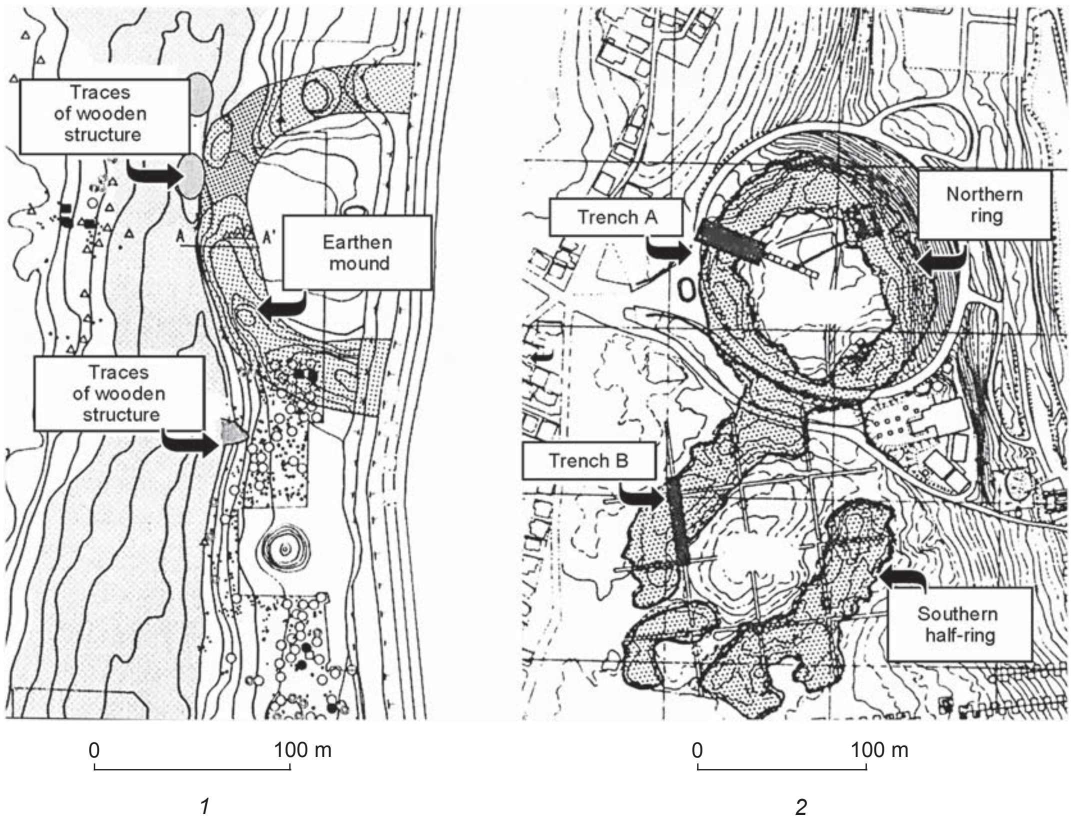


Fig. 5. The Terano Higashi earthen mound (*1*) and Kasori shell midden (after: (Kawashima, 2010)) (*2*).

southern). An artificial ditch 10–15 m wide with depth reaching 17 m in some places, adjoins the mound on the western side. Traces of 14 wooden "platforms" or containers for temporary storage of seafood have been found on the bottom of the ditch (Hatsuyama Takayuki, 2005) (Fig. 5, *1*).

The Kasori site in the Chiba Prefecture is the most vivid example of a Jōmon site where shell middens act as monumental structures (Fig. 5, *2*). The largest shell midden in the world is located there, covering an area of over 13.4 hectares and reaching a height from 4 to 18 m. The midden consists of two parts: the northern ring (up to 130 m in diameter) dating to the Middle Jōmon period, and the southern half-ring (over 170 m in diameter), which was made in the Late Jōmon period.

Several large shell middens of ring or horseshoe shape, belonging to the Middle–Late Jōmon period, such as Arayashiki (diameter 150 m, height up to 19 m), Horinouchi (about 200 m in diameter), and Takanekido (diameter of over 100 m, height up to 15 m), etc., have been discovered in the same area (the Tokyo Bay). According to some archaeologists, the increase in the amount of consumed seafood in the Late and Final Jōmon period was caused not by the demographic situation, but by an intensification of ritual activities and regular performance of ceremonies accompanied by feasts (Kawashima, 2010: 189–190). This is confirmed by numerous ritual objects (clay *dogu* figurines, amulets, elegantly decorated dishware) among the materials from the sites.

In the large dwelling complex of Sannai Maruyama (5050–3900 BP), which includes over 700 dwellings, a necropolis, earthen mounds, and several shell piles, a unique wooden structure (supposedly, an astronomical complex) has been found. This is a pile-supported structure on six supporting posts up to 1 m in diameter, with a height of approximately 20 m, and with three layers of platforms (Fig. 6) (Habu, 2004: 110–118; Ivanova, 2014). The situation with the Sannai Maruyama site is not unique. Rather, it confirms the general Eurasian trend: megaliths in many cases was preceded by wooden structures. The most famous example is the traces of massive wooden structures at the site where later Stonehenge was built in England (Darvill et al., 2012; Lawson, 1997).

Conclusion: in search of the origins of the Jōmon megalithic tradition

As it has been already mentioned above, the earliest monumental structures ("stone rings", alignments) on

Fig. 6. Reconstruction of a layered structure, Sannai Maruyama (photograph by D.A. Ivanova).

the Japanese Archipelago appeared already in the Initial and Early Jōmon period (8000–6500 BP). The origins of this tradition are rooted in even greater antiquity, the Late Paleolithic. The most important element in the majority of megalithic complexes are vertically placed stones or columns. Owing to the poor preservation of organic materials in acidic soils, it is difficult to trace wooden structures, but sufficiently large numbers of stone finds have been discovered. The earliest of them are the fragments of symbolic figurines sculpted from elongated pebbles from the sites of Iwate, Masugata, and Musashi dating from 20,000 to 16,000 BP. Some Japanese scholars believe that they can be even earlier, going back to 24,000–20,000 BP (Harunari, 1996).

Large natural outcrops of columnar dacites are known on the island of Honshu (Gunma, Saitama, Nagano, and Niigata Prefectures), as well as on the island of Hokkaido (Fig. 7, *1*). It is as if nature offered humans ready-made elements for ritual complexes and structures. For the first time, the use of fragments of dacite columnar joints with a hexagonal cross-section as vertical symbols was observed at the sites of the Mikoshiba culture (13,500–11,500 BP), transitional from the Paleolithic to the Jōmon period, seen in the Mikoshiba A and Karasawa B sites (Mikoshiba Site…, 2008: 22–25; Tabarev, 2011) (Fig. 7, *2*, *3*). The tradition of their use continued into the Jōmon period; dacite hexahedrons of various lengths (from 5–10 to 100 cm and more) have been found in dwelling complexes, graves, and in small clusters of stones, which constituted circles and alignments (Jōmonjin no ishigami…, 2010: 5–10; Sasaki Akira, 1989) (Fig. 7, *4*, *5*).

The early tradition of vertical stone symbols appeared not only on the islands of the Japanese Archipelago; its manifestations in the Final Paleolithic have been observed in the coastal part of the Russian Far East (15,000–12,000 BP). This is evidenced by complexes with hexahedrons and bifaces at the sites of the Ustinovka culture in Primorye. The first description of such a complex was published in 1997 (Dyakov, 1997). The complex was discovered at the Ustinovka-4 site. It consisted of seven bifacial objects placed on a small (0.3 × 0.3 m) area; one more biface (the largest) was vertically set on a small elevation in the center. In 1999, during the excavation of the Suvorovo-4 site, a 24.5 cm long fragment of a columnar joint of dacite-porphyry with hexagonal cross-section was found at its highest point (Fig. 8, *1*). A date of 15,900 ± 120 BP (AA-36626) was obtained from the charcoal accompanying this complex. In 2002, at the Bogopol-4 site, a complex with a stone hexahedron (39.8 cm long) accompanied by three rounded pebbles and two elongated fragments of stone was found (Fig. 8, *2*). A bifacial knife was discovered underneath the hexahedron at a depth of 11 cm (Krupyanko, Tabarev, 2001: 8–9; 2013; Tabarev, 2011). Natural outcrops of columnar dacites with hexagonal cross-section are known in Primorye and on the Korean peninsula, so there is no reason to speak about any borrowings between the regions.

Thus, the Jōmon megalithic tradition is an outstanding landmark of an entire era in the ancient history of the Japanese Archipelago. These spectacular monuments reflect sophisticated ritual practices of hunters, gatherers, and fishers, evolving over 10,000 years. At the same time, this phenomenon is one of the elements in a sophisticated mosaic of megalithic traditions which existed in the ancient cultures of the continental, coastal, and island parts of East and Southeast Asia. The search for the parallels and possible links between these traditions, and their analysis seem to offer interesting perspectives for research, which may lead to unexpected discoveries.

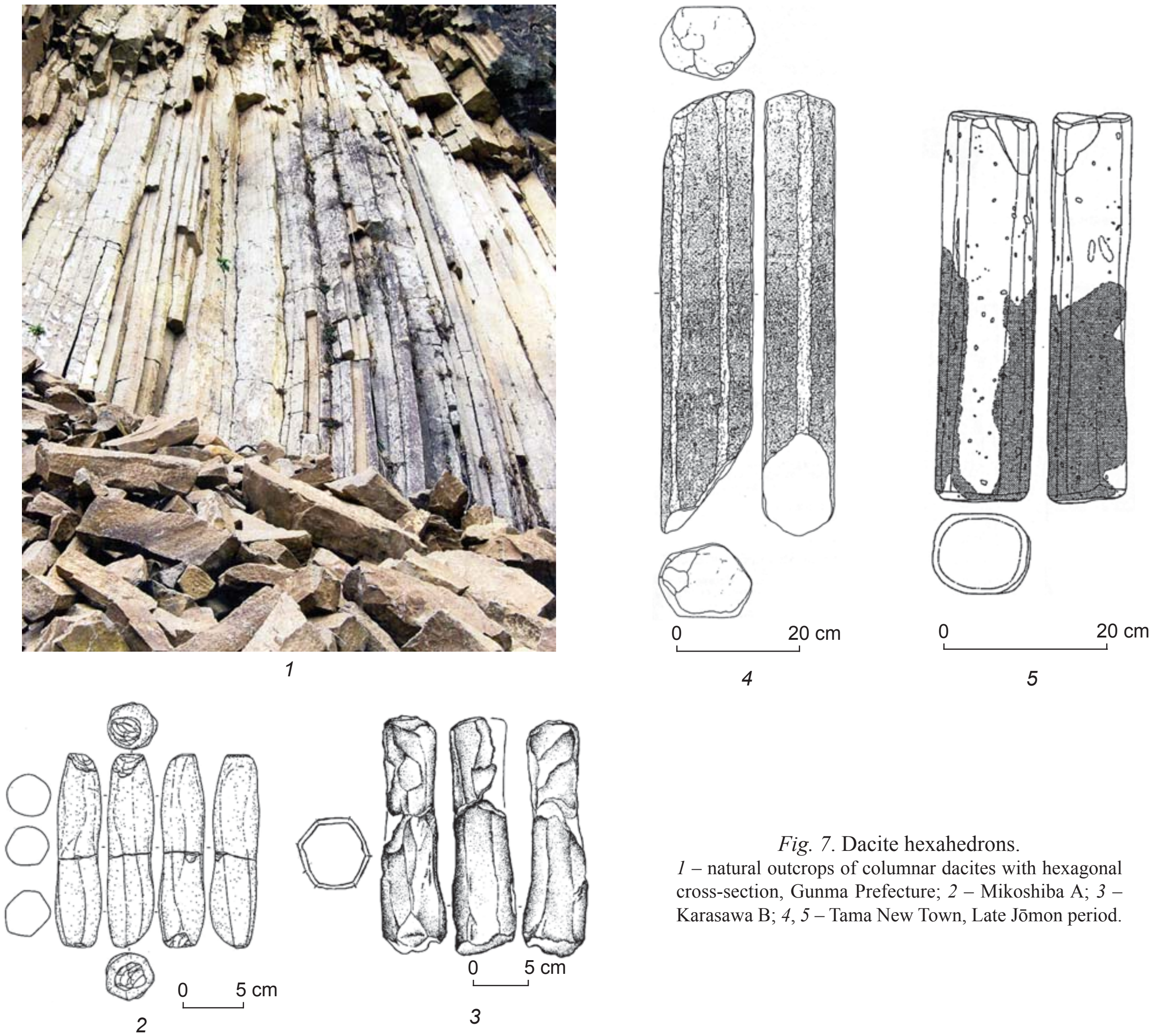


Fig. 7. Dacite hexahedrons.
1 – natural outcrops of columnar dacites with hexagonal cross-section, Gunma Prefecture; *2* – Mikoshiba A; *3* – Karasawa B; *4*, *5* – Tama New Town, Late Jōmon period.

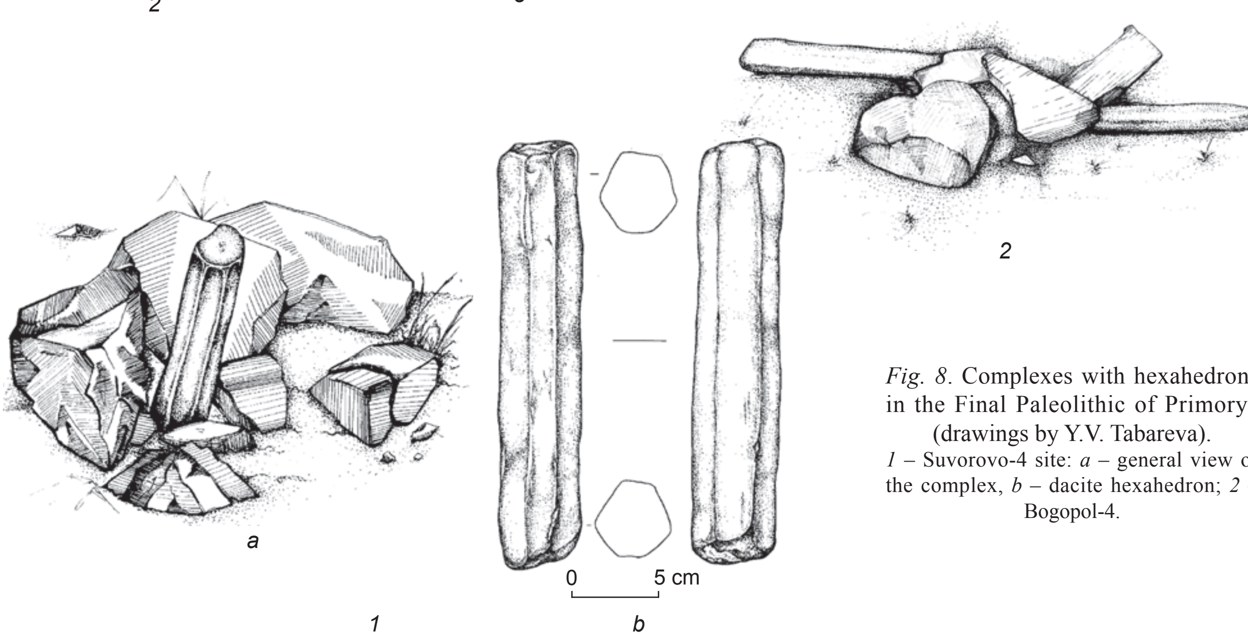


Fig. 8. Complexes with hexahedrons in the Final Paleolithic of Primorye (drawings by Y.V. Tabareva).
1 – Suvorovo-4 site: *a* – general view of the complex, *b* – dacite hexahedron; *2* – Bogopol-4.

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A Morphological Analysis of Malyshevo Middle Neolithic Pottery from the Lower Amur

We analyze the forms of clay vessels from the Malyshevo Middle Neolithic sites on the Lower Amur, and compare them with those relating to the contemporaneous Late Kondon culture of the same region and to the Boisman and Vetka cultures in Primorye, using V.F. Genning's methodology. On the basis of the results, a reconstruction of cultural contacts in the Russian Far East during the Middle Neolithic is attempted. On another level, H.A. Nordström's approach helps to reveal the "standard" forms of vessels. The closest parallels are those with the Boisman ceramics, whereas the Vetka vessels are the least similar.

Keywords: *Neolithic, Lower Amur, Malyshevo culture, ceramics, morphological analysis.*

Introduction

The Middle Neolithic period in the southern part of the Russian Far East is represented by the Malyshevo, Kondon, and Boisman cultures, and also by the Belkachi and Vetka cultural-chronological complexes (Medvedev, 2005; Popov, 2006; Shevkomud, Kuzmin, 2009) (Fig. 1). Despite the long history of the study of possible contacts between these cultures, the topic is still debated (Moreva, Batarshev, 2009). In research in the ancient intercultural contacts, great importance has always been given to ceramics (Shepard, 1965: 336-341; Arnold, 1989: 107-110; Kozhin, 1989; Zhushchikhovskaya, 1997, 2003; Tsetlin, 2012: 2, 40-251). According to some Russian and foreign scholars, classification and typology of ceramics is based on morphological features (Gifford, 1960; Grebenshchikov, Derevianko, 2001: 38; Mylnikova, 2014: 31–33). For instance, the outlines and shapes of vessels' parts may be regarded as indicators of the cultural affinity of ceramicware (Shepard, 1965: 224–248).

In Russian archaeology, there are three main approaches to the analysis of forms of clay vessels: 1) visual- and emotional-descriptive (M.G. Rabinovich, R.L. Rosenfeld, and others); 2) formal-classificatory (V.A. Gorodtsov, V.F. Gening, and others); 3) historical-cultural (A.A. Bobrinsky, Y.B. Tsetlin, and others) or experimental-technological (S.V. Saiko, I.G. Glushkov, and others). In addition, attempts have been made to elaborate new analytical methods, including those based on computer programs (V.G. Loman and others) (Gening, 1973; Bobrinsky, 1978, 1986; Glushkov, 1996: 110/1–110/3; Loman, 2006; Tsetlin, 2012: 142–169). Foreign scholars have mostly relied in their research on the so-called complex approach (Shepard, 1965: 225-255; Nordström, 1972: 72-73; Ericson, Stickel, l973; Hole, 1984; Orton, Hughes, 2013: 81-85), the initial stage of which is based on the "universal method" proposed by

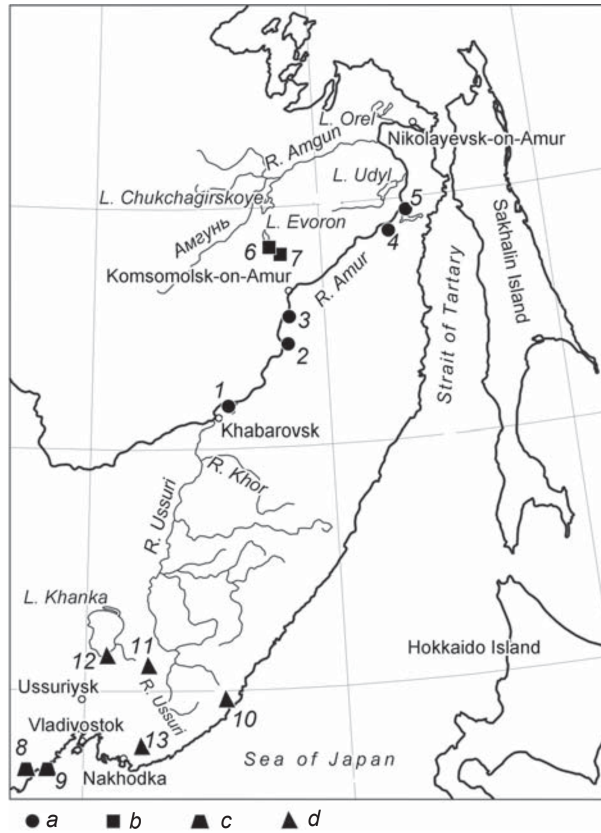

Fig. 1. Map showing location of the main Middle Neolithic sites in the southern regions of the Russian Far East.
a – Middle Malyshevo sites: *1* – Gasya; *2* – Innokentyevka; *3* – Voznesenskoye; *4* – Kalinovka; *5* – Suchu; *b* – Late Kondon sites: *6* – Kondon-Pochta; *7* – Kharpichan-4; *c* – Boisman sites: *8* – Boisman-1, *9* – Boisman-2; *d* – Vetka sites: *10* – Vetka-2, *11* – Sheklyaevo-7, *12* – Luzanova Sopka-2, *13* – Pereval.

G.D. Birkhoff (1933: 83–91). Archaeologists from Siberia and the Far East use various analytical techniques in their research, both Russian and foreign. For instance, L.N. Mylnikova has analyzed the vessels' morphology using the techniques proposed by I.P. Rusanova, V.F. Gening, A.A. Bobrinsky, Y.B. Tsetlin, A.O. Shepard, and H.A. Nordström (Mylnikova, 1999: 48–55; 2014: 36–42; Molodin, Mylnikova, Ivanova, 2014; Mylnikova, Selin, 2015: 114–116).

Despite the lack of general methodology, morphological analysis of the Malyshevo ceramics and their comparison with the Lower Amur and Primorye vessels will provide additional information for Neolithic studies in the southern part of the Russian Far East.

Material and methods

The present study focuses on the ceramic collections from various Malyshevo sites, gathered during excavations in various years (Derevianko et al., 2000: 4–5; 2002: 8–10). Currently, these materials are stored in the Institute of Archaeology and Ethnography of SB RAS (Novosibirsk). The author also analyzed the published data on the Lower Amur (Mylnikova, 1999: 48–56; Shevkomud, 2003; Shevkomud, Kuzmin, 2009) and Primorye (Zhushchikhovskaya, 1998; Popov, Chikisheva, Shpakova, 1997: 30–32; Moreva, 2003; Moreva, Popov, 2003; Moreva, Batarshev, Popov, 2008; Batarshev, Dorofeeva, Moreva, 2010) ceramics. We have measured 152 specimens: 78 intact and reconstructed vessels, 16 upper and lower parts, and 58 upper parts*.

The ceramics' morphology was analyzed using Gening's statistical approach, based on the main parameters of the vessels: rim diameter, neck-base diameter, maximal body diameter, base diameter, total height, neck height, shoulder height, and base height (1973). Subtypes have been identified by the shape of the vessel's upper part and the whole vessel's outline. The procedure proposed by Nordström was also applied. His method is based on calculation of the proportion of half-maximal diameter to height from the vessel's base, at which height this diameter is located; and also on the drawing and superposition of semi-profiles of vessels and their graphic models, generated by connection of extreme points, onto one another, with all semi-profiles brought to a standard height (1972: 72–73).

*The upper and lower parts of one vessel have been counted as one specimen.

Results

The forms of the Middle Malyshevo vessels have all been subdivided into two main groups: without necks (111 spec.) and with necks (41 spec.). Each group contains open (20 spec.) and closed (132 spec.) forms. The indices of forms, calculated using Gening's statistical methodology*, are given in Tables 1 and 2.

Within the subgroup of open vessels without necks (3 spec., which corresponds to 8.5 % of the whole sample: eight intact vessels, upper and lower parts belonging to two vessels, and three upper parts), seven types of vessels have been identified (Fig. 2). The vessels have not been further classified by the shape of service parts, yet types 6 and 7 have been subdivided into two subtypes by their outlines. In general, this subgroup is homogenous, owing to a special rim-design. Superposition of the semi-profiles of vessels and their graphic models onto one another has

*Neck height index (NHI) and neck profile index (NPI) have been determined only for vessels with necks.

Table 1. **Indices of forms of the vessels without necks of the Middle Malyshevo culture**

Index	Vessels of open types							Vessels of closed types					
	Type 1 (n=1)	Type 2 (n=1)	Type 3 (n=5)	Type 4 (n=1)	Type 5 (n=1)	Type 6 (n=2)	Type 7 (n=2)	Type 3 (n=8)	Type 4 (n=12)	Type 5 (n=1)	Type 6 (n=25)	Type 7 (n=28)	Type 8 (n=24)
Height (HI)	0.10	0.43	0.33–0.57	0.56	0.77	0.81–0.87	0.91–0.92	0.40–0.55	0.51–0.82	0.68	0.59–1.14	0.18–1.10	0.43–1.00
Neck breadth (NBI)	1.10	1.00	0.99–1.04	0.99	1.01	1.00–1.02	1.00–1.02	0.91–1.01	0.84–1.00	0.95	0.85–1.00	0.72–1.01	0.35–0.99
Body height (BHI)	0.10	0.43	0.33–0.68	0.56	0.77	0.81–1.00	0.91–0.92	0.40–0.55	0.51–0.82	0.61	0.59–1.14	0.18–1.10	0.43–1.00
Shoulder height (SHI)	1.25	0.50	0.45–0.67	0.51	0.38	0.36–0.78	0.33–0.35	0.17–0.67	0.20–0.71	0.81	0.15–0.91	0.10–0.86	0.34–0.90
Shoulder convexity (SCI)	0.00	0.00	0.00–0.10	0.00	0.00	0.00–0.07	0.00	0.00–0.25	0.00–0.11	0.01	0.00–0.07	0.00–0.28	0.04–0.93
Base width (BWI)	0.00	0.35	0.90–1.49	–	–	0.39–0.57	0.16–0.44	0.50–0.86	0.50–0.98	–	0.24–0.90	0.14–0.53	0.22–1.00

Note: Numbering of the vessel types identified in the first subgroup is maintained.

Table 2. **Indices of forms of the vessels with necks of the Middle Malyshevo culture***

Index	Vessels of open types				Vessels of closed types	
	Type 2 (n=1)	Type 3 (n=2)	Type 4 (n=2)	Type 5 (n=3)	Type 2 (n=14)	Type 3 (n=20)
Height (HI)	0.81	1.03–1.19	0.88–1.03	0.97–1.12	0.69–0.91	0.90–1.50
Neck height (NHI)	1.55	1.77–3.24	5.69–7.00	1.19–1.77	0.87–3.33	1.03–7.21
Neck breadth (NBI)	1.04	1.08–1.15	1.02–1.08	0.99–1.08	0.76–1.02	0.64–0.97
Neck profile (NPI)	0.06	0.21–0.25	0.01–0.03	0.06–0.25	–0.67–0.08	–0.17–0.13
Body height (BHI)	0.79	0.99–1.09	0.88–1.03	0.97–1.12	0.69–0.91	0.52–2.10
Shoulder convexity (SCI)	0.75	0.45–0.84	2.33–2.37	0.23–0.45	0.27–1.14	0.25–1.51
Shoulder curvature (FG)	–0.02	0.02–0.07	–0.04–0.02	0.02–0.05	–0.11–0.32	0.03–0.61
Base width (BWI)	–	0.46	0.27–0.63	0.56–0.73	0.16–0.71	0.35–0.78

*See note for Table 1.

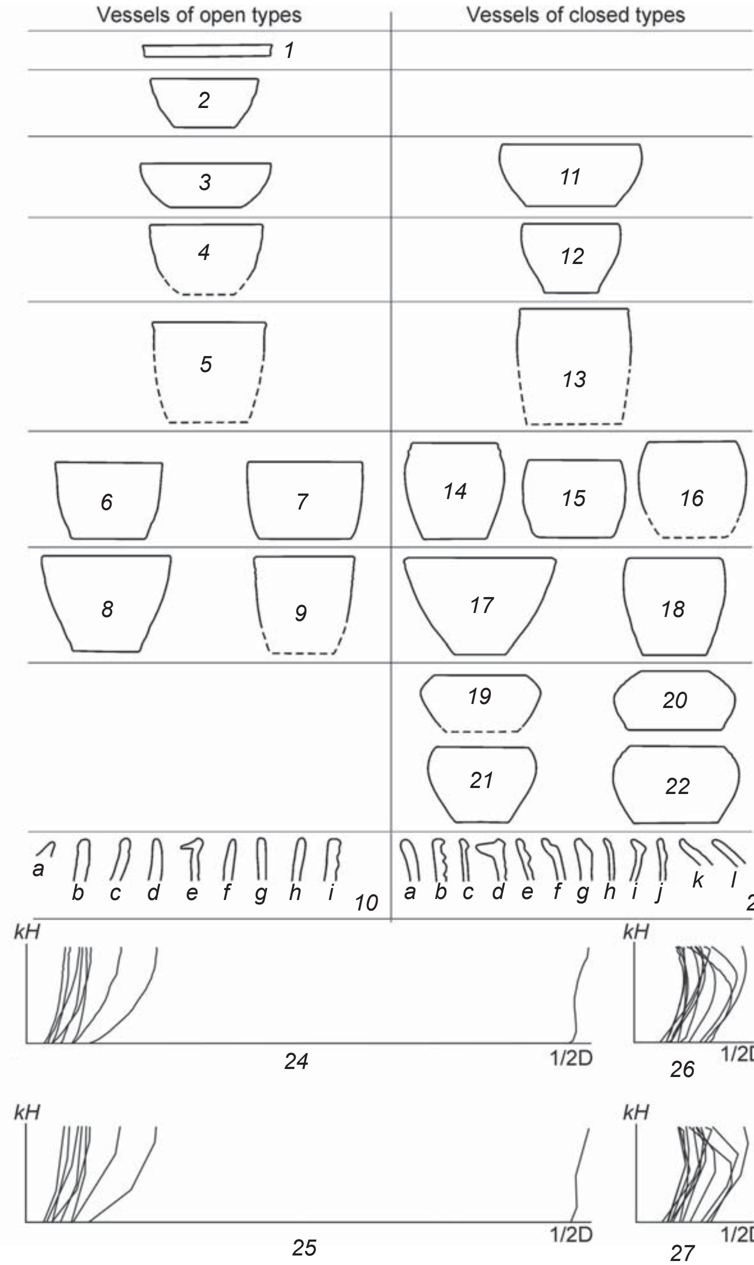

Fig. 2. Shapes of vessels without necks of the Middle Malyshevo culture.
1–9, *11–22* – outlines; *10*, *23* – rim profiles; *24*, *26* – semi-profiles of vessels; *25*, *27* – vessel models.
1–7, *9*, *10a–c, g–i*, *11*, *13*, *15*, *17*, *18*, *20–22*, *23a, c, d, f–l* – Suchu; *8* – Innokentyevka; *12*, *23b* – Kondon-Pochta; *10d*, *19* – Voznesenskoye; *10e, f*, *14*, *16*, *23e* – Gasya.

shown the absence of "standard" forms; yet the trend towards such a standard has been detected, because deviations in the shapes of some vessels were associated, not with their general proportions, but with their width.

Within the subgroup of closed vessels without necks (98 spec., or 64.5 %: 49 intact vessels, upper and lower parts belonging to nine vessels, and 40 upper parts), six types of vessel have been identified (Fig. 2). Types 6 and 7 have been further subdivided into subtypes by the shape of their service parts; types 6, 7, and 8 include subtypes by their outline features. Ceramics of this subgroup are also rather similar, again mostly because of the rim-design. The superposition of the semi-profiles of vessels and their graphic models has shown the absence of "standard" forms, as in the first subgroup, while the trend towards such standard forms has been noted.

In general, the open and closed vessels without necks (73 %) are medium, low, or very low vessels with narrow, medium, wide, or very wide mouths. Their bodies are round, squat, or very squat, with medium, high, or very high shoulders showing moderate, gentle, or very gentle convexity. Their bases are flat, medium, wide, or very wide. "Standard" vessels are absent.

The subgroup of open vessels with necks (7 spec.; 4.6 %; five intact vessels and two upper parts) has been subdivided into four types (Fig. 3). Type 2 was classified into two subtypes by the shape of service parts, and into two subtypes by the vessel's outline. The subgroup includes flat-based and round-based vessels. The superposition of the semi-profiles of vessels and their graphic models onto one another has revealed certain features of the semi-profile of the "standard" vessel. Within the subgroup of closed vessels with necks (34 spec., or 22.4 %: 16 intact vessels, upper and lower parts belonging to five vessels, and 13 upper parts), two types of vessels have been identified (Fig. 3). Both types have been further subdivided into three subtypes by the shape of service parts. Classification by the outline is as follows: the first type was subdivided into five subtypes, the second type into six. Superposition of semi-profiles of vessels and their graphic models onto one another has shown that despite of deviations to the left and to the right, the predominant "ideal" shape, shown in the center, is clearly evident.

In general, vessels with necks of open and closed forms (27 % of the total) are low, medium, high, or very high vessels. These have low, medium, high, or very high, wide or very wide necks; with the necks inclined inward or gently profiled; their bodies are squat, round, or very elongated; their shoulders are very low, low, medium,

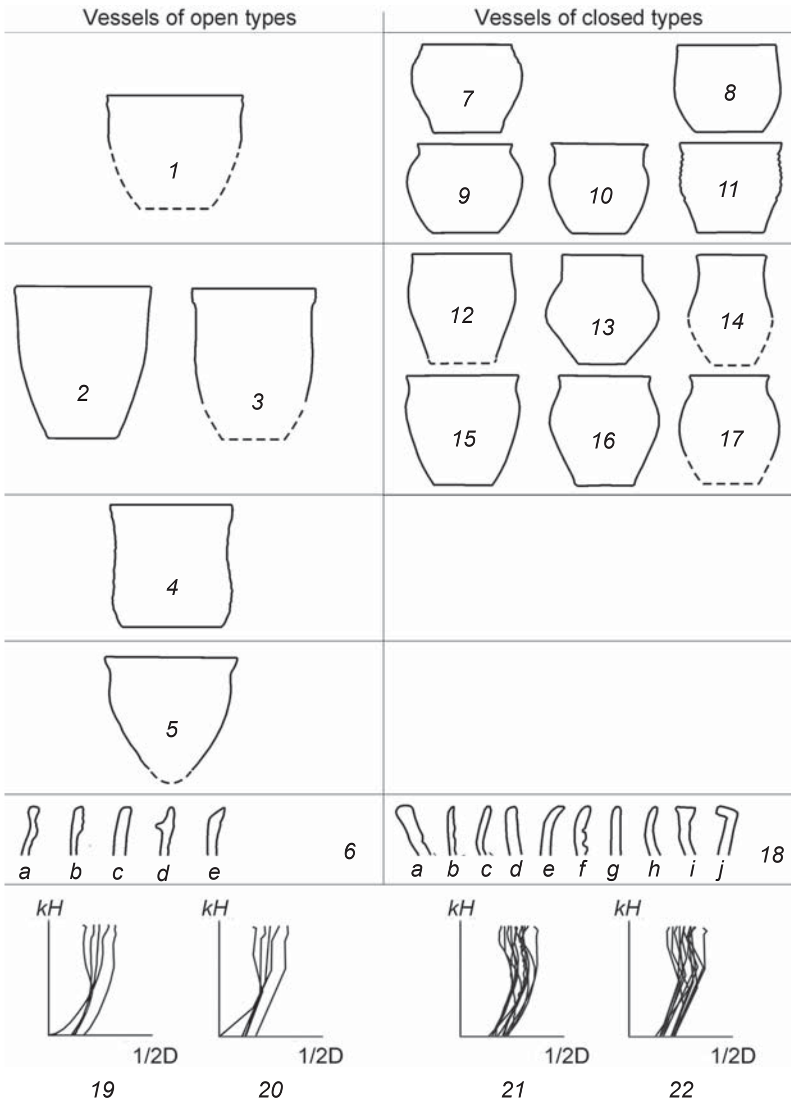

Fig. 3. Shapes of vessels with necks of the Middle Malyshevo culture.
1–5, *7–17* – outlines; *6*, *18* – rim profiles; *19*, *21* – semi-profiles of vessels; *20*, *22* – vessel models.
1, *3*, *5*, *6a, b, e*, *7–17*, *18a–j* – Suchu; *2*, *6c* – Voznesenskoye; *4*, *6d* – Gasya.

or high, medium-convex, gently convex, or very gently convex. Bases are flat or round, medium, wide, or very wide. The "standard" vessel is recognized within the subgroup of the closed vessels.

Correlation of all indices enabled identification of the main features of the forms of Middle Malyshevo pottery:

1) in terms of height index (HI): low and medium;

2) in terms of neck height index (NHI): low, medium, high, and very high;

3) in terms of neck breadth index (NBI): medium, broad, and very broad;

4) in terms of neck profile index (NPI): inclined inward and gently profiled;

5) in terms of body height index (BHI): squat and round;

6) in terms of shoulder height index (SHI): medium, high, and very high;

7) in terms of shoulder convexity index (SCI: medium-convex, gently convex, and very gently convex; and

8) in terms of base width index (BWI): medium, wide, and very wide.

Superposition of semi-profiles of vessels and their graphic models onto one another has shown that while the vessels without necks only tended towards "standard" form, those with necks (of closed type) partially already demonstrated such a form.

Comparison of the data obtained from morphological analysis of the ceramicware of the Early (Filatova, 2015) and Middle Malyshevo culture has shown both similarities and differences. However, the differences are not consistent, because they have not been identified in all subgroups. Comparison of the indices (Table 3) has shown coincidences in the majority of indicators. Differences have been noted only in vessels with high necks (NHI) and with very low shoulders (SHI). The complete coincidence has been noted for the neck breadth index (NBI) and neck profile index (NPI). Notably, the mentioned parts of the vessels indicate the cultural affinity of the objects. In our opinion, this points to the continuity and the intrinsic development of the pottery tradition. Superposition of semi-profiles of vessels and their graphic models onto one another also indicates the definite proximity of the Early and Middle complexes of Malyshevo culture. The greatest similarity has been recorded in the group of the closed vessels with necks. Certain similar features have also been noted in the rim shaping.

Comparison of the Malyshevo ceramics with those of the Kondon, Boisman, and Vetka materials has shown certain similarity in their morphology (Fig. 4). The Late Kondon and Vetka ceramics reveal the closest similarity to the Malyshevo vessels without necks. Malyshevo vessels with necks have parallels with the Kondon and Boisman ceramics. In sum, in terms of morphology, the most similar to the Malyshevo ceramics is the Boisman pottery, then the Kondon, while the least similar is the Vetka pottery. Superposition of semi-profiles of vessels and their graphic models onto one another has also shown

Table 3. **Indices of shape characteristics of the vessels of the Early and Middle Malyshevo culture**

Index		Early Malyshevo	Middle Malyshevo
HI	0.41–0.80	Low (0.62–0.74)	Low (0.43–0.77)
	0.81–1.20	Medium (0.81–1.16)	Medium (0.81–1.19)
	1.21–1.60	High (1.32–1.50)	High (1.50)
NHI	0.51–1.50	Low neck (0.94–1.40)	Low neck (0.87–1.19)
	1.51–3.00	Medium neck (1.67–2.06)	Medium neck (1.55–1.77)
	3.01–5.00	High neck (3.57)	High neck (3.23–3.24)
NBI	0.66–1.00	Broad (0.93–1.00)	Broad (0.66–1.00)
	>1.00	Very broad (1.01–1.08)	Very broad (1.01–1.15)
NPI	<0.00	Inclined inward (0.00)	Inclined inward (–0.67–0.00)
	0.01–0.26	Gently profiled (0.03–0.25)	Gently profiled (0.01–0.25)
BHI	0.50–0.85	Squat (0.62–0.82)	Squat (0.50–0.85)
	0.86–1.15	Round (0.88–1.07)	Round (0.86–1.15)
SHI	>2.00	Very low (2.25)	Very low (2.33–2.37)
	0.50–1.00	Medium (0.53–1.00)	Medium (0.50–1.00)
	0.26–0.50	High (0.26–0.40)	High (0.26–0.50)
SCI	<0.25	Very gently convex (0.00–0.24)	Very gently convex (–0.11–0.25)
	0.26–0.57	Gently convex (0.28)	Gently convex (0.27–0.54)
	0.58–1.00	Medium convex (0.91)	Medium convex (0.61–0.93)
BWI	0.57–1.00	Medium (0.60)	Medium wide (0.57–1.00)
	0.25–0.56	Wide (0.25–0.55)	Wide (0.26–0.56)
	<0.25	Very wide (0.09–0.17)	Very wide (0.00–0.24)

the closeness of the Lower Amur and Primorye ceramics. Certain parallels have been noted in the rim-designs, too. Thus, comparative analysis of the Amur and Primorye ceramic materials suggests various degrees of similarity in the morphology of the Middle Neolithic vessels from the southern regions of the Russian Far East.

Conclusions

Study of the Middle Malyshevo ceramics using Gening's methodology has revealed both common and specific features in the morphology of the clay vessels, and has suggested the main features of their modeling tradition. In general, two main forms have been identified. These are the closed flat-based vessels with or without necks. The presence of open vessels (with or without necks) likely suggests the attempts to produce certain "intermediate" variants between the two main forms. This assumption is supported by the observed scarcity of the open vessels. This situation apparently implies not only the internal development of the pottery tradition, but also the external influence. Nordström's methodology allowed us to identify the trends towards formation of the "standard" forms in the pottery tradition of the Late Malyshevo people, which also indicates their attempts to develop some "intermediate" forms.

Correlation of the Malyshevo ceramics with the Kondon, Boisman, and Vetka suggests cultural contacts

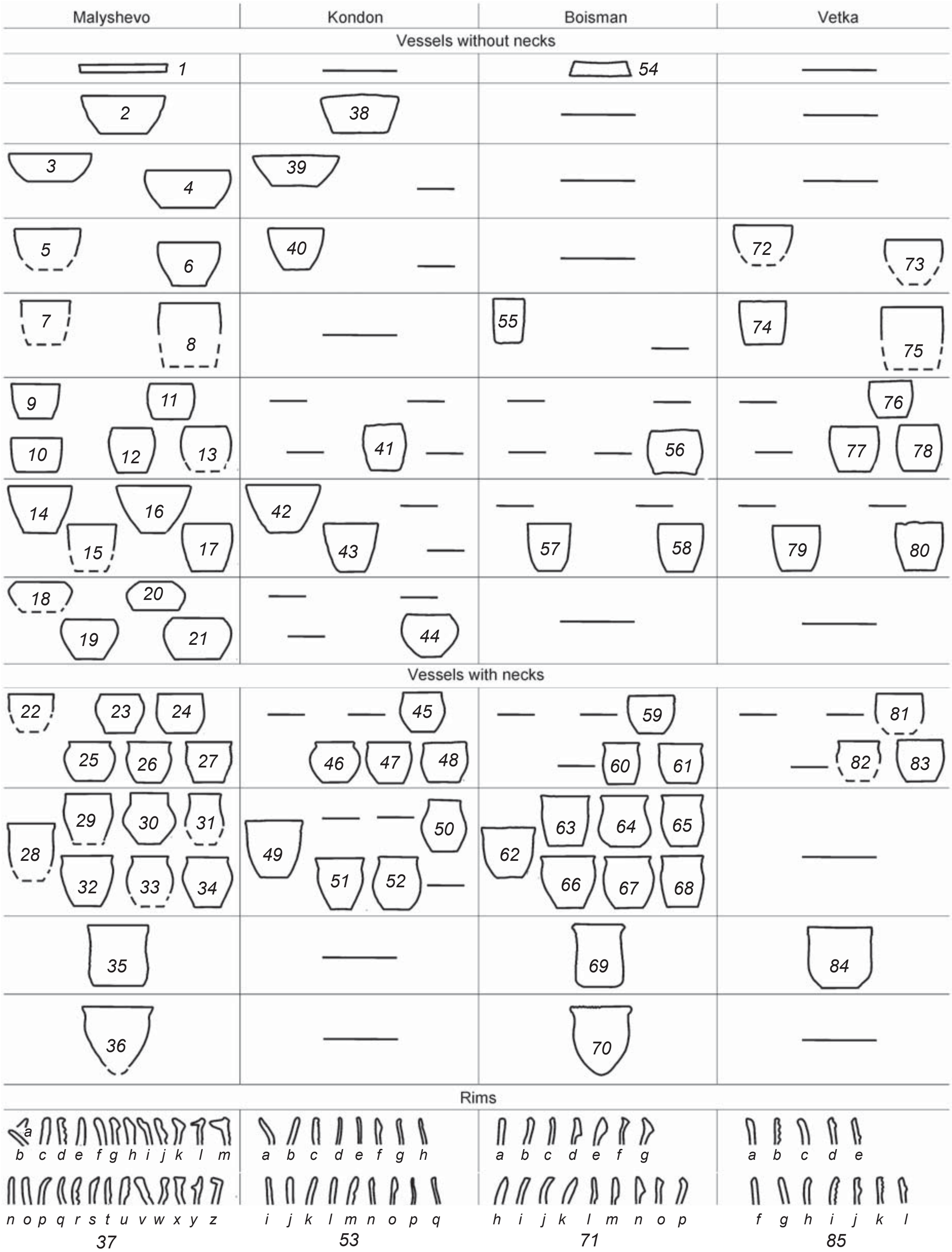

Fig. 4. Middle Neolithic vessels from the Lower Amur and Primorye.

1–36, *38–52*, *54–70*, *72–84* – outlines; *37*, *53*, *71*, *85* – rim profiles.

Malyshevo culture: *1–5*, *7–11*, *15-17*, *19-34*, *36*, *37a–c, f–i, k, m–x, z* – Suchu, *6*, *37d* – Kondon-Pochta, *12*, *13*, *35*, *37j, l, y* – Gasya; *14* – Innokentyevka; *18*, *37e* – Voznesenskoye; Kondon culture: *38–52, 53a–q* – Kondon-Pochta; Boisman culture (after: Zhishchikhovskaya, 1998; Moreva, 2003; Moreva, Popov, 2003; Popov, Chikisheva, Shpakova, 1997)): *54*, *57–70, 71a–p* – Boisman-2, *55*, *56* – Boisman-1; Vetka culture (after (Batarshev, Dorofeeva, Moreva, 2010)): *72*, *74*, *76*, *80*, *81*, *83*, *85a, c–l* – Vetka-2, *73*, *84*, *85b* – Boisman-2, *75* – Luzanova Sopka-2, *77*, *79*, *82* – Sheklyaevo-7; *78* – Pereval.

of various degrees. In the case of the Malyshevo and Boisman people, the most probable explanation is the constant interaction between them. Their long-term contacts are suggested by occurrences of the Boisman ceramics in the Malyshevo sites (Moreva, Batarshev, 2009). A comparatively smaller mutual influence existed between the Malyshevo, Kondon, and Vetka tribes.

Thus, comparative analysis of the Lower Amur and Primorye materials has shown similarities and differences at various levels: developmental, regional, and cultural. The established parallels are: 1) predominance of closed forms (developmental); 2) trend towards prevalence of vessels with necks (regional); and 3) intratypic variation of closed vessels with necks (cultural). The distinction is represented by the dominance of vessels with closed mouths and without necks in the Middle Malyshevo complex.

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New Absolute Dates for the Trans-Uralian and Western Siberian Neolithic

This article deals with the absolute chronology of the Neolithic cultures of the eastern Ural, Middle Irtysh-Baraba, and Upper Ob regions. Twenty-two new radiocarbon dates for the ceramic assemblages of the Trans-Uralian Neolithic and thirteen for those of the western Siberian forest-steppe suggest that the Kozlov Mys, Poludenka, and Boborykino sites in the forest-steppe coexisted with those of the Makhandzhar type in eastern Ural and Kazakhstan during the early Neolithic and in the beginning of the Late Neolithic. Late Neolithic Artyn settlements on the Middle Irtysh and in Baraba are contemporaneous with the Protoka and Vengerovo-2A burial grounds (middle and second half of the 5th millennium BC). Boborykino sites in the Trans-Urals are contemporaneous with Avtodrom-2/2, representing the same culture (first half and mid-5th millennium BC). The Izylinka/Zavyalovo stage of the Middle Neolithic on the Upper Ob dates to the late 6th to early 5th millennia BC. Late Neolithic Kiprino/Novo-Kuskovo sites on the Upper Ob date to the mid-5th to early 4th millennia BC. The Bolshoy Mys sites date to the 4th millennium BC.

Keywords: *Radiocarbon dating, AMS-dating, absolute chronology, Neolithic, Trans-Urals, southwestern Siberia.*

Introduction

An essential task of archaeology is to reconstruct historical and cultural processes. Reliance upon a verified regional chronological scale will allow objective reconstruction of the genesis, spread, and possible mutual influence of the various traditions that existed in the territory under study in the Neolithic epoch. At present, the radiocarbon dates obtained for Neolithic sites in the forest-steppe region from the Ural Mountains to the Ob River are distributed very non-uniformly. For example, there are more than 100 dates available for the Trans-Urals, while only a few for the vast territory of western Siberia. It is imperative to increase the analytical database. Over two years after generalization of all available radiocarbon dates on the Neolithic in the Urals (Vybornov, Mosin, Epimakhov, 2014), for the forest-steppe zone of the Trans-Urals and western Siberia, more than 30 new dates have been obtained, among which both conventional radiocarbon dates and those determined by the AMS-method are present. This article presents mostly the results of radiocarbon dating of ceramics. This is a rather new area of Russian archaeology. At the same time, such practice is on the rise throughout the world, especially in the case of deficiency of organic material samples (see review in (Kulkova, 2014)). The obtained data, on the one hand, have confirmed the chronological positions of individual cultural assemblages and, on the other hand, have indicated the problem of comparing the results obtained from ceramics dating and the AMS-dates determined from the soot on ceramics.

Results of radiocarbon dating of Trans-Uralian Neolithic assemblages

One of the main problems in periodization of the Neolithic in the Trans-Urals is the chronological relationship between the Koshkino and Boborykino cultural traditions (Kovaleva, 1989: 62; Zakh, 2009: 250–253). For the first of these, which is considered by the majority of Ural archaeologists to be the earliest one in the Neolithic of the region (Vybornov, Mosin, Epimakhov, 2014), a series of 27 radiocarbon dates was earlier obtained, in the interval from 7150 ± 100 (LE-8901) to 5840 ± 90 (Ki-16169) BP. Four dates for the Koksharovsky Kholm, in the range from 7440 ± 200 (LE-7882) to 7610 ± 80 (Ki-16386) BP, were recognized to be strongly overestimated, and were not included in the statistics. New dates for the Koshkino tradition, obtained from the soot-deposits on ceramics from the peat-bog site of Beregovaya II and from a bone found at the Mergen-6 site (Zhilin, Savchenko, Zaretskaya, 2015; Zakh, Enshin, 2015), are 7325 ± 40 (KIA-42074) and 7147 ± 38 (OxA-27706) BP, respectively. They close the gap between the main series of dates and four of these that were considered too ancient. However, such a serious "oldering" of the neolithization process for the forest and forest-steppe zones of the Trans-Urals can be barely viewed as realistic so far, as the dates of 7700 BP are considered debatable even for the steppe-zone of the Volga-Urals and the Caspian Sea region.

According to the concept introduced by V.T. Kovaleva (1989: 48–59), which was subsequently confirmed by 23 radiocarbon dates ranging from 6210 ± 90 (Ki-16862; Vtoroy Poselok) to 5180 ± 90 (Ki-15118; Tashkovo III) BP (Vybornov, Mosin, Epimakhov, 2014) for Basyanovsky-Boborykino assemblages, this tradition pertains to the Late Neolithic. V.A. Zakh (2009: 252), on the basis of two dates for the site of Yurtobor-3—7701 ± ± 120 BP (UPI-559; dwelling 1), and 9025 ± 70 BP (SOAN-531; dwelling 2))—regards it as an Early Neolithic one. To solve the existing problematic situation, new data were required.

In 2014, on the basis of a Boborykino pottery fragment from the Yurtobor-3 settlement, a date of 6064 ± 100 BP (Table 1, No. 14) was obtained, which corresponds to the chronological interval earlier established for this tradition, as well as the new dates for Boborykino assemblages from the Pikushka I and Ust-Suerka-4 settlements (Table 1, No. 16–18). In 2015, an AMS-date, 1000 years older (7110 ± 70 BP), was obtained in Germany from the soot-deposits found on the same vessel (Table 1, No. 15). This could suggest attribution of the Yurtobor-3 assemblage to the Early Neolithic. However, the value of ^{13}C amounted to –29.67 ± 0.19, which presumes a high probability of the reservoir effect, owing to which the dates can be made older by 500–2000 years (oral report by M.A. Kulkova).

Currently, the presence of the reservoir effect during dating poses a substantial problem. For example, the dates for the Kozlov Mys assemblage of the Kochegarovo-1 settlement have shown a chronological interval from 6073 ± 100 (SPb-1272) to 5740 ± 90 (Ki-16856) BP (Mosin, Strakhov, 2012). Their accuracy is confirmed by the data obtained at the Mergen-7 site, where the assemblage, being close in terms of its material culture but somewhat younger typologically, is dated by charcoal and ceramics to the range from 5520 ± 120 (Ki-17081) to 5790 ± 115 (SOAN-8897) BP (Enshin, 2015). However, as with Yurtobor-3, the AMS-dates obtained in Arizona for the Kozlov Mys assemblage of Kochegarovo-1 proved to be much more ancient: 6539 ± 41 and 6619 ± 38 BP (Table 1, No. 6, 7). Again, ^{13}C values amounted to –34.6 and –31.9, respectively, which also presumes making the artifacts considerably older owing to the reservoir effect.

Two dates obtained for the Makhandzhar tradition in the Northern Kazakhstan, at the Solenoye Ozero I and Ekindin 24 sites (5966 ± 120 and 5662 ± 120 BP, respectively (Table 1, No. 11, 12)) have become important for understanding the cultural situation in the Late Neolithic in this region; and also the date of the vessel belonging to this tradition from the Kochegarovo-1 settlement (6049 ± 130 BP) (Table 1, No. 13), which is very close to the date obtained from a fragment of such ceramics found at the Boborykino site Uk VI (6040 ± 80 BP (Ki-15960)). A vessel of Makhandzhar appearance has also been found at the Mergen-7 settlement (Ibid.). All these data allow us to state with confidence that Kozlov Mys, Poludenka, and Boborykino forest-steppe and Makhandzhar steppe assemblages of the Trans-Urals and Kazakhstan co-existed from the end of the Early Neolithic to the beginning of the Late Neolithic.

Another example of the reservoir effect is introduced by two dates obtained for the Iska III settlement of the Tashkovo culture (Table 1, No. 21, 22). The more ancient of these two dates is accompanied by the indicator $\delta^{13}C(VPDB) = -32.45 \pm 0.05$ ‰, which implies a considerable overestimation due to the reservoir effect.

Table 1. **New radiocarbon dates of the Trans-Uralian Neolithic sites**

No.	Site	Laboratory index	^{14}C-date, BP	Calendar date, years BC
1	Kochegarovo-1	SPb-1271_1	5815 ± 150	4841–4494 (1σ) 5034–4354 (2σ)
2	"	SPb-1273_1	5817 ± 130	4806–4521 (1σ) 5307–4685 (2σ)
3	"	SPb-1274_1	5878 ± 120	4865–4591 (1σ) 5044–4461 (2σ)
4	"	SPb-1269	5952 ± 100	4964–4723 (1σ) 5080–4591 (2σ)
5	"	SPb-1272	6073 ± 100	5077–4843 (1σ) 5228–4729 (2σ)
6	"	AA104958	6539 ± 41	5530 – 5475 (1σ) 5612 – 5384 (2σ)
7	"	AA104959	6619 ± 38	5615 – 5525 (1σ) 5621 – 5491 (2σ)
8	"	SPb-1669	5630 ± 120	4593–4348 (1σ) 4744–4251 (2σ)
9	"	SPb-1270	4115 ± 100	2780–2576 (1σ) 2917–2458 (2σ)
10	"	SPb-1668	5130 ± 120	4054–3762 (1σ) 4241–3657 (2σ)
11	Ekindin-24	SPb-1670	5662 ± 120	4615–4363 (1σ) 4790–4322 (2σ)
12	Solenoye Ozero I	SPb-1671	5966 ± 120	5007–4709 (1σ) 5209–4581 (2σ)
13	Kochegarovo-1	SPb-1667	6049 ± 130	5079–4793 (1σ) 5307–4685 (2σ)
14	Yurtobor-3	SPb-1275	6064 ± 100	5076–4836 (1σ) 5226–4724 (2σ)
15	"	KIA-51100	7110 ± 70	6090–5840
16	Pikushka I	SPb-1674	6120 ± 120	5322–4769 (2σ)
17	Ust-Suerka-4	SPb-1675	6226 ± 120	5469–4906 (2σ)
18	"	SPb-1676	5505 ± 120	4606–4045 (2σ)
19	Nizhneye Ozero III	SPb-1672	5953 ± 110	4984–4715 (1σ) 5080–4550 (2σ)
20	"	SPb-1673	5481 ± 110	4458–4231 (1σ) 4541–4046 (2σ)
21	Iska III	SPb-1639	3965 ± 120	2632–2286 (1σ) 2872–2194 (2σ)
22	"	SPb-1640	5130 ± 150	4058–3713 (1σ) 4263–3649 (2σ)

Note: Dates No. 6, 7, 15 were obtained from the soot, the rest from ceramics.

Also, an inconsistency between the dates obtained from charcoal and from organic remains in ceramics is often encountered. In the Trans-Urals, this has been clearly recorded for the first time when dating the Koksharovsky Kholm materials (Shorin, Shorina, 2011). For the Nizhneye Ozero III settlement (Chairkina, Dubovtseva, 2014), two dates (5953 ± 110 and 5481 ± 110 BP) have been determined from the organic remains in ceramics (Table 1, No. 19, 20). They proved to be much younger than those obtained earlier in Kiev: 6510 ± 90 (Ki-15394) and 6250 ± 90 (Ki-15395) BP. Even more ancient dates were obtained for charcoal from the floors of dwellings of this settlement: 7735 ± 90 (SOAN-6203) and 6645 ± 140 (SOAN-6944) BP.

Absolute chronology of the Baraba forest-steppe Neolithic settlements in terms of correlation with radiocarbon dates of burials

Correct comparison of cultural and chronological diagrams based on studying settlement and burial assemblages remains pertinent for research into the Neolithic of the Baraba forest-steppe. The concept proposed by V.I. Molodin is based predominantly on the materials from burials studied in the 1970s to 1990s. He suggests that in the Late Neolithic, Baraba and the forest-steppe Irtysh basin became the places of interaction between the indigenous communities with retreating-pricked pottery and the bearers of the comb-pit ceramic tradition of western and northwestern origin (Molodin, 1977: 33; 1985: 5–7; 2001: 26–27).

The ^{14}C dates obtained for Sopka-2/1, 3, Protoka, and Korchugan burial grounds in laboratories of Novosibirsk (Russia) and Edmonton (Canada) form the main database for the absolute chronology of the Neolithic and Early Metal Age in the Baraba forest-steppe (Molodin, 2001: 117; Molodin et al., 2004). According to the calibrated values at ± 2σ, Z.V. Marchenko (2009) has proposed the following chronological column: Sopka-2/1 (the second half of the 7th to the beginning of the 6th millennium BC) – Korchugan (the second quarter to the mid-6th millennium BC) – Protoka/the 1st stage (the second third of the 6th to the first quarter of the 5th millennium BC) – Protoka/the 2nd stage (the mid-5th millennium BC), and Sopka-2/3 (the second half of the 5th millennium BC) – Tartas-1 (the second quarter to the mid-3rd millennium BC). In this diagram, the second stage of existence of the Neolithic burial ground of Protoka is synchronous with the Early Metal Age burials of the Ust-Tartas culture at the Sopka-2/3 burial ground, while relatively late Ust-Tartas burials of Tartas-1 have indicated the problem of periodization of this culture (Ibid.: 143). Quite recently, on the basis of the radiocarbon dating results, calendar dates of the Neolithic burials from the Vengerovo-2A cemetery were determined: 5363–5001 (SOAN-8738) and 5358–4864 (SOAN-8739) BC (Molodin et al., 2012: 121). The revealed range corresponds to the chronology of the Protoka burial ground (Ibid.).

Over the past decade, Kemerovo specialists under the supervision of V.V. Bobrov have conducted large-scale excavations of the Avtodrom-1 and -2 Neolithic settlements in northwestern Baraba. The materials from the latter settlement are of especial importance here. Typical of this site is a compact arrangement of large mixed-culture villages belonging to the Artyn (Avtodrom-2/1) and Boborykino (Avtodrom-2/2) traditions, represented by remains of dwellings, ceramics, and stone tools, which is unique for southwestern Siberia (Bobrov, Marochkin, Yurakova, 2012). On the basis of these materials, it was proposed to refine the Baraba Neolithic diagram by distinguishing two lines of development: the autochthonous line represented by the original Artyn culture at the Late Neolithic stage, and the allochthonous one relating to local migrations of the Boborykino population from the Trans-Urals (Bobrov, Marochkin, 2011a; 2013). Chronostratigrapy of the Boborykino and Artyn assemblages suggests that the latter is more recent (Bobrov, Marochkin, 2011b), but dating the ceramic materials of these assemblages by the TL-method has demonstrated their contemporaneity at the second half of the 5th to the beginning of the 4th millennium BC (Bobrov, Komarova, 2008). In 2014–2015, ^{14}C-dates were obtained for the Boborykino and Artyn ceramics. This makes it possible to correlate the assemblages with other sites.

On the basis of organic inclusions in the Artyn ceramics from Avtodrom-2/1, four dates were obtained: 5795 ± 100, 5914 ± 150, 5350 ± 100, and 5342 ± 100 BP (Table 2, No. 4–7). At ± 1σ, the calibrated values are divided into two chronological groups: 1) the first half of the 5th millennium BC (Table 2, No. 4, 5); 2) the last quarter of the 5th millennium BC (Table 2, No. 6, 7). At ± 2σ, the grouping continues to persist with widening of probable intervals: 1) the last quarter of the 6th to the first half of the 5th millennium BC; 2) the second third of the 5th to the beginning of the 4th millennium BC. Such a considerable deviation is recorded for typologically uniform ceramics that, however, originate from different dwellings. The earlier group includes samples from the layer and dwelling 4, the later one from spatially close dwellings 15 and 18. In theory, the relation between the designated chronological groups and various objects of the site allows their interpretation within the internal periodization. However, such an approach requires a larger number of dates and chronostratigraphic observations. The results of dating the Artyn ceramics from Stary Tartas-5 do not solve the problem, since they demonstrate the same discrepancy for spatially close

Table 2. **New radiocarbon dates of the Western Siberian Neolithic sites, obtained from ceramics**

No.	Site	Laboratory index	^{14}C-date, BP	Calendar date, years BC
1	Avtodrom-2/2	SPb-1276_1	5748 ± 130	4780–4451 (1σ)
				4980–4331 (2σ)
2	"	SPb-1277	5967 ± 100	4964–4726 (1σ)
				5081–4605 (2σ)
3	"	SPb-1278	5884 ± 100	4851–4651 (1σ)
				5000–4505 (2σ)
4	Avtodrom-2/1	SPb-1279	5795 ± 100	4770–4536 (1σ)
				4857–4447 (2σ)
5	"	SPb-1280_1	5914 ± 150	4987–4611 (1σ)
				5208–4485 (2σ)
6	"	SPb-1281	5350 ± 100	4266–4145 (1σ)
				4358–3971 (2σ)
7	"	SPb-1282	5342 ± 100	4263–4052 (1σ)
				4353–3970 (2σ)
8	Tanai-4A	SPb-1680	2938 ± 120	1429–891 (2σ)
9	"	SPb-1681	4694 ± 120	3707–3095 (2σ)
10	Stary Tartas-5/12	SPb-1683	5799 ± 120	4940–4441 (2σ)
11	"	SPb-1684	5040 ± 120	4073–3633 (2σ)
12	Dolgaya-1	SPb-1677	6165 ± 110	5229–4978 (1σ)
				5358–4835 (2σ)
13	"	SPb-1679	5804 ± 110	4787–4536 (1σ)
				4939–4446 (2σ)

and typologically identical vessels: 5799 ± 120 and 5040 ± 120 BP, which at ± 2σ corresponds to the first half of the 5th millennium BC and the end of the 5th to the first third of the 4th millennium BC, respectively (Table 2, No. 10, 11). Thus far it is apparently expedient to use averaged indicators and date the Artyn assemblage of Avtodrom-2 and the Artyn culture in general to the period from middle to the second half of the 5th millennium BC*. Even at this stage, the contemporaneity of the Artyn settlements and the Late Neolithic cemeteries of Protoka and Vengerovo-2A is shown, which raises the question of their integration within a single culture. Probable chronological ranges of the Artyn settlements and Ust-Tartas burials of the Early Metal Age at the Sopka-2/3 burial ground are close to each other in their extreme values. This serves as more evidence of interaction between the Ust-Tartas groups of the Early Metal Age and the indigenous Late Neolithic population, which is reflected in the construction of burial grounds of Sopka -2/3, -3A (Molodin, 2001: 106) and confirmed by their radiocarbon chronology (Marchenko, 2009: 143).

Three dates have been obtained for the Boborykino ceramics: 5748 ± 130, 5967 ± 100, and 5884 ± 100 BP (Table 2, No. 1–3). Having taken the calibrated values at ± 2σ, the Boborykino assemblage of the Avtodrom-2 settlement should be dated to the first half to the middle of the 5th millennium BC, which narrows the distance between its chronological position and the main series of dates for Boborykino antiquities of the Trans-Urals (see the previous section) and suggests its synchronization with the earliest Artyn assemblages. This makes it impossible to adopt the viewpoint of V.A. Zakh and D.N. Enshin regarding the relationship between the Avtodrom-2/2 settlement and migration processes during the early stage of the neolithization of western Siberia (2015: 42). In contrast, the obtained results confirm the idea of the existence, in the Late Neolithic, of the Middle

*For more detailed information about the chronology of the Artyn antiquities and their place in the Neolithic of western Siberia see (Bobrov, Marochkin, Yurakova, 2017).

Irtysh-Baraba Boborykino cultural exclave surrounded by indigenous communities with simplified retreating-incised-pricked ornamentation of pointed-base pottery (Bobrov, Marochkin, 2013).

New results of radiocarbon dating of the Upper Ob Neolithic and Chalcolithic settlement assemblages

Current knowledge of the Neolithic and Chalcolithic in the Upper Ob region is based on the results of multi-year studies of settlement and funerary assemblages in the Kuznetsk-Salair mountain area, Tomsk, Barnaul, and Novosibirsk Ob regions, northern foothills of Altai (for review of historiography see (Marochkin, 2013)). These studies have led to the formation of a concept of an original Upper Ob Neolithic culture, the development of which is divided into two stages: the earlier (Zavyalovo stage according to Molodin, or Izylinka stage according to Zakh) and the later (Kiprino) (Matyushchenko, 1973: 60–61; Molodin, 1977: 11–25; Zakh, 2003: 146). In the southeastern areas of the Upper Ob region, the Kuznetsk-Altai Neolithic culture of East-Siberian origin has been distinguished (Anikovich, 1969; Molodin, 1977: 25–30; Okladnikov, Molodin, 1978; Bobrov, 1988). The Chalcolithic period is characterized by the Novo-Kuskovo culture of the Chalcolithic to Early Bronze Age in the Tomsk Ob region (Kosarev, 1974: 43; Kiryushin Y.F., 2004: 12–13) and the Bolshoy Mys Chalcolithic culture in forest-steppe Altai and the Northeastern Salair region (Kiryushin Y.F., 2002: 36–38; Bobrov, 2010). A large number of sites have a debatable epochal and chronological attribution. The Neolithic age of the Kiprino stage is contested, and its identity with the Novo-Kuskovo stage is proposed (Kosarev, 1974: 43; Kiryushin Y.F., 2004: 12–13); the Neolithic appearance of the Bolshoy Mys material assemblage in the northeastern part of its area is substantiated (Bobrov, 2010). The controversy about the chronology of the Novo-Kuskovo and Igrekovo sites in the Tomsk Ob region still persists: both Neolithic attribution (Komarova, 1952; Matyushchenko, 1973: 60–61, Marochkin, 2014: 25; Bobrov, 2015) and belonging to the Early Metal Ages (Drevnyaya istoriya, 1953: 43–44; Kosarev, 1974: 43–47; Molodin, 1977: 36–44; Kiryushin Y.F., 2004: 25–28) are well-founded. The situation is aggravated by the small number of the available radiocarbon dates and the absence of their correlation with ceramic assemblages.

At present, a series of dates is available for a number of ceramicless Neolithic flat-grave burials in the Altai Mountains and their northern foothills, and also on the southern periphery of the Kuznetsk Basin (Kuznetsky, Bolshoy Mys, Ust-Isha, Solontsy-5, Kaminnaya, NTP-1) (Kungurova, 2005: 57, tab. 4). In the calibration value, at $\pm$ 2σ, the dates for most of these assemblages are distributed in the interval from the second half of the 5th to the beginning of the 4th millennium BC, while for a number of burials of the Bolshoy Mys burial ground oldering to the last quarter of the 6th millennium BC is possible (Marochkin, 2014: 24). Along with the calibrated values of radiocarbon dates obtained with birch-bark from burials of the Old Muslim cemetery (forest areas of the Tomsk Ob region) within the limits of the 5th millennium BC (Kiryushin Y.F., 1988), this series determines the chronology of the Late Neolithic in the Upper Ob region.

Chalcolithic attribution of the Bolshoy Mys settlement assemblages dated within the 3rd millennium BC has been substantiated by Y.F. Kiryushin on the basis of the Tytkesken-2 settlement's stratigraphy (2002: 33). Relying on the absolute date of the most-ancient copper-ore minings of the Altai Mountains, he tolerates the possibility of oldering these settlements to the second half of the 4th millennium BC (Ibid.: 32–35). Quite recently, data on the Bolshoy Mys assemblage of the Novoilyinka VI settlement in the Kulunda forest-steppe have been introduced (Kiryushin Y.F., Kiryushin K.Y., 2015). Judging by the results of radiocarbon dating of the bones, researchers assign this site to the first half of the 3rd millennium BC but; at the same time, they do not rule out the oldering of the lower limit of calibrated values to the middle of the 4th millennium BC (Ibid.: 164). For the Tanai-4a settlement, which marks the northeastern periphery of the Bolshoy Mys area, there are three dates obtained from bones in the Institute of Geology of the SB RAS, and one date obtained from fish-scale in the German Archaeological Institute. They correspond to the middle of the 3rd millennium BC according to their uncalibrated values, and to the beginning of the second half of the 4th millennium BC after calibration (Bobrov, 2010). That is, it can be stated that the settlements with Bolshoy Mys ceramics were relatively contemporaneous in various areas where this culture spread. At the same time, the obtained results once again point to the incorrectness of cultural identification of these settlements with the Bolshoy Mys burial ground (northern foothills of Altai), which, as previously noted, demonstrates the most ancient dates in the series for Neolithic settlements of the Upper Ob region. The Novoaltaysk-Razvilka flat-grave burial ground (which, according to the radiocarbon dating of bones, pertains to the turn of the 4th to 3rd millennium BC) is the closest to the Bolshoy Mys culture settlements in terms of chronology (Kiryushin K.Y., Volkov, 2006). The calibrated value of this date corresponds to the first half of the 4th millennium BC.

In 2015, several radiocarbon dates were obtained for Izylinka, Kiprino-Novo-Kuskovo, and Bolshoy Mys settlement ceramics from the Kuznetsk Basin in the Isotope Center of the Department of Geology and Geo-Ecology of the Herzen State Pedagogical University of Russia. These results play a pivotal role in refining the chronology of the early assemblages of the Upper Ob region.

A date of 6165 ± 110 BP has been obtained for the Izylinka vessel from the Dolgaya-1 site. The calibrated values determine the following ranges: the last quarter of the 6th to the early 5th millennium BC at ± 1σ, the last third of the 6th to the first quarter of the 5th millennium BC at ± 2σ (Table 2, No. 12). When substantiating the Izylinka stage, Zakh assigned it to the first half of the 5th millennium BC (2003: 146), which was supported by us when analyzing the Izylinka ceramics from the Lower Tom region (Marochkin, Yurakova, 2014). Later on, Zakh and Enshin (2015), judging by the palynological analysis of the layers of Inya settlements, dated this stage within wide limits from 6600 to 5410 BP (i.e. the second third of the 5th to the middle of the 4th millennium BC), having related it to the middle of the Atlantic Period. The date of the vessel found at the Dolgaya-1 site makes the Izylinka settlements older, which generally corresponds to the existing understanding of their lower chronological position relative to the Kiprino-Novo-Kuskovo assemblages. Zakh and Enshin (Ibid.), who insist on the introduced neolitization of western Siberia, line up the Boborykino sites of the Trans-Urals, the Boborykino assemblage of the Avtodrom-2 settlement in the Baraba forest-steppe, and settlements with Izylinka ceramics in the Upper Ob region in a chronological sequence that allegedly reflects the stages of spread of ceramic tradition to the east. This seems contrary to numerous radiocarbon dates obtained for the Boborykino sites of the Trans-Urals, and is not confirmed by the above group of dates for the Boborykino assemblage of Baraba.

In 2010 and 2015, two dates for the Kiprino-Novo-Kuskovo ceramics from the Dolgaya-1 site were first obtained. The date for one of them (a pointed-base jar ornamented with horizontal rows made by smooth rocking-stamp) is 5804 ± 110 BP. The calibrated values determine the following intervals: the first quarter to the middle of the 5th millennium BC at ± 1σ, the beginning to the second quarter of the 5th millennium BC at ± 2σ (Table 2, No. 13). For another vessel (a jar ornamented with bands of pit-pricks), a date of 5200 ± 100 BP (SPb-570) was obtained from the soot (Marochkin, Yurakova, 2014). Giving consideration to the calibrated value at ± 2σ, it should be dated to the last third of the 5th to the first quarter of the 4th millennium BC. This has supported the contemporaneity of the Kiprino-Novo-Kuskovo sites with some Late Neolithic burial grounds of the region (Ibid.). The obtained dates, even though single ones, raise the question of periodization of the assemblages belonging to this cultural area. The date of the first vessel closes the gap between the Izylinka/Zavyalovo settlements and the Kiprino-Novo-Kuskovo assemblages, thus, probably, marking the earliest formation-stages of the latter.

The experience of radiocarbon dating of the Bolshoy Mys culture ceramics should be recognized as less successful (Table 2, No. 8, 9). For one sample, a maximally underestimated date of 2938 ± 120 BP was obtained, which gives upon calibration (± 2σ) the middle of the 2nd to the beginning of the 1st millennium BC. Undoubtedly this result is obviously discordant with the above dates, and it should be excluded from consideration. The radiocarbon date of the second sample is 4694 ± 120 BP; but the calibrated values at ± 2σ cover a quite considerable range from the second quarter to the end of the 4th millennium BC. This basically confirms the earlier obtained information, but is actually useless for elucidating the chronological relationship between the Bolshoy Mys settlements and other early sites of the region.

Conclusions

The main task of this article is to solve such most debated issues of western Siberian archaeology as the chronology of assemblages of the Neolithic and the Early Metal Ages. Accordingly, the task-specific selection of samples for dating was carried out by natural science methods. Geographically, these samples are related to the assemblages of the Trans-Urals, Baraba forest-steppe, and Upper Ob region. Despite the small number of absolute dates obtained for such a vast area, these have allowed certain conclusions to be drawn.

In the perception of many specialists in the archaeology of the Trans-Urals, the chronology of Neolithic assemblages is contradictory. This applies especially to the Boborykino culture. New absolute dates obtained from materials of this culture, both from the central regions of its area and from the assemblages beyond its limits (western Baraba), coincide with the majority of those determined earlier by natural science methods. They support the dating of this culture to the first half of the 5th millennium BC, and allow the conclusion to be drawn of the co-existence of the Boborykino assemblages with the Kozlov Mys and Poludenka ones in the Trans-Urals for some period of time. At the same time, the conducted study has indicated the problem of AMS-dating, relating to the so called reservoir effect. This is not an archaeological problem, but it should be taken into account when questioning the reliability of the data.

The new absolute dates obtained for the assemblages of eastern areas of the western Siberian forest-steppe also comply with the main task. The date of the Izylinka/Zavyalovo stage not only confirms its established relative chronology, but also suggests its contemporaneity with the Boborykino assemblages. As for the Kiprino-type/

Novo-Kuskovo stage, many specialists attribute these to the transitional period. In terms of traditional dating methods, it is later than the Izylinka/Zavyalovo stage. This is confirmed by the absolute dates; however, they indicate that this stage pertains to the Neolithic chronological range. Naturally, solving this problem will require a representative series of absolute dates and analysis of new archaeological sources.

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Anthropomorphic Bronze Masks from the Timiryazevo-1 Burial Ground

This paper addresses rare funerary artifacts: anthropomorphic bronze masks unearthed in 1973 and 2014 from 5th–8th century AD mounds at Timiryazevo-1, on the Lower Tom River, southwestern Siberia, by an expedition from Tomsk State University. A detailed description of these is provided, and the archaeological context is described. Stylistically and technically, the masks represent a distinct group, termed Timiryazevo and distributed in the Tomsk-Narym region of the Ob basin. In broader terms, they belong to medieval repoussé ritual masks from western Siberia. As we demonstrate, the Timiryazevo specimens were details of funerary dolls made of organic materials and resembling those manufactured by Siberian natives in the recent past. They were meant to provide a temporary abode for one of the deceased person's souls. The archaeological context suggests that at Timiryazevo-1 cemetery, dolls were buried separately, with their miniature belongings. We also suggest that other types of dolls were buried there, too. Those were made of purely organic materials that did not survive, as evidenced by numerous isolated clusters of miniature objects buried in shallow pits inside burial mounds or between them.

Keywords: *Timiryazevo-1, western Siberia, Early Middle Ages, burial mounds, anthropomorphic masks, ritual dolls, miniature models.*

Introduction

The Timiryazevo-1 group of burial mounds, dated to the 5th–8th centuries AD, is recognized as a unique medieval site in the archaeology of western Siberia. It is located on the Lower Tom River, on its left bank, opposite the city of Tomsk. Exploratory studies of the burial site were conducted by V.I. Matyushchenko (1957), who excavated two mounds in 1956. The site became well-known to the scientific community after large-scale excavations carried out by L.M. Pletneva, who studied 68 mounds in 1971 and 1973 (Pletneva, 1974, 1984; Belikova, Pletneva, 1983).

The uniqueness of the Timiryazevo-1 cemetery is determined, in particular, by its size. Omitting the part that is already destroyed, its current area is about 19 ha. There are some discrepancies in the data on the quantity of visually recorded burial mounds. 272 mounds were marked on the approximate plan of the site made by Pletneva in 1971 (Belikova, Pletneva, 1983: 7). Furthermore, in common with A.D. Gaman, we suppose that the Timiryazevo-1 and Timiryazevo-2 burial grounds are not two independent sites, but rather parts of a single large Early Medieval cemetery, a considerable portion of which was destroyed some time ago during the construction of Timiryazevo village (Ocherki…, 1994: 236). The Timiryazevo-2 burial ground, according to its researcher R.A. Uraev, contained 110 mounds in 1959 (Ibid.: 23). In 2009, the Tomsk Regional Center for Preservation and Use of Historical and Cultural Heritage recorded more than 800 objects (including excavated mounds) of the Timiryazevo-1 cemetery when determining the border of the Timiryazevo archaeological complex (Berezovskaya, Markov, 2012: 170). We can state that the Timiryazevo burial ground is the largest

Early Medieval burial complex in western Siberia (Zaitceva et al., 2016: 282).

In 2014, Tomsk State University (TSU) conducted rescue excavations (under the supervision of O.B. Belikova) on the northern periphery of the burial ground, which was damaged during construction of the Snegiri housing complex. For the first time in the history of the study of this site, the excavations were conducted at continuous areas, including the space between mounds, in addition to burial mounds, poorly recordable in relief. The results of the excavations have dramatically changed the earlier ideas about the cemetery, since outside of the burial mounds, flat burials and a number of very interesting funerary objects were also identified. Among the latter, two clusters of miniature metal items were studied, including two anthropomorphic bronze masks (see *Figure*, *5*, *6*; collection 7951 of the V.M. Florinsky Museum of Archaeology and Ethnography of Siberia of TSU (MAES)). Four such masks had been discovered by Pletneva in 1973 in mounds 39, 55, 59, 60 (see *Figure*, *1–4*; collection 9004 MAES). Thus, six anthropomorphic bronze masks from the Timiryazevo-1 burial ground are known at the present time. Our publication is devoted to comprehensive analysis of this category of finds. Special attention has been given to the context of discovery of the masks, and to logical interpretation of their function in the funerary rite of the population that had left the Timiryazevo-1 burial ground.

Description of materials

It seems appropriate to provide detailed descriptions of all six bronze masks and the context of their discovery.

Mask 1 (see *Figure*, *1*; mound 39). Its height is 5.9 cm, its weight 18 g. Single-sided flat casting. There is a defect: run-out of metal on the right side of the item. The general outline of the face image is oval. The eyes are rendered by a fuzzy round outline, the mouth by an oval fillet, and the nose by a narrow straight fillet. On each cheek, two oblique cut-marks, symmetrical relative to the vertical facial axis, are observed. A neck, 2.2 cm long, is distinguished, on which an amorphous oval-shaped figure is designated by a low relief (a representation of "the line of life"?). On the head is, as we suppose, a combat helmet, with a low, round dome; cheek-guards and eye-protection elements are also represented. The lower edge of the dome is shaped by two wavy recesses above the eyes. The above elements of the helmet are rendered by a higher relief relative to the face level. One more detail, a narrow nosepiece passing into the eye-protecting elements is shown, apparently using a similar technique. At the top edge of the item, hardly noticeable cut-marks, likely made to attach the helmet to some base, can be seen.

The mask was found in the northeastern sector of the burial mound, at a depth of 8–9 cm, near its foot. It lay along with a miniature iron knife, under an small intact ceramic vessel (Belikova, Pletneva, 1983: 28). This vessel, into which the mask and the knife were probably placed intentionally, shows no traces of household usage. A human burial has been found considerably lower, away from the above finds: at a depth of 0.6 m, in the southwestern sector of the mound, near its floors. The skull of a 25–30-year-old woman, an intact miniature ceramic vessel, a bronze buckle, and two indeterminate iron items were discovered in the grave.

Mask 2 (see *Figure*, *2*; mound 55). Its height is 4.0 cm, its weight 7 g. Single-sided flat casting. The general outline of the face image is rounded. The brows (or eyebrow ridges?), eyes, mouth, and symmetrical lines on the cheeks are rendered by deepened relief lines, while the nose is shown by a narrow relief fillet. The neck, 1.3 cm long, is clearly shown.

The archaeological context of the mask's occurrence is extremely interesting (Ibid.: 10). In the southwestern part of the mound, near its floors, at a depth of 0.5 m, two ceramic vessels were recorded. A ceramic vessel, in which the mask under consideration was found along with a set of 16 iron and bronze artifacts, was inserted into another, larger vessel. 12 similar things were discovered in the adjacent ceramic vessel. All three vessels show no traces of household usage and, like the items placed therein, are characterized by their miniature size. No burial was found in mound 55.

Mask 3 (see *Figure*, *3*; mound 59). Its height is 3.8 cm, its weight 6 g. Single-sided flat casting. The general outline of the face image is rounded; the image is characterized by roughly rendered details. The eyes are shown by rough cut-marks, which form two rhomboids. A cut-mark can be seen on each cheek. The mouth is marked by a deepened suboval contour, and the nose is shown by a protruding narrow relief fillet. On each of the opposite side edges of the mask, at the level of the eyes and a little lower, a recess 1–2 mm deep has been made, probably after casting; and on the nose-bridge, a deep cut-mark. According to Pletneva, these details were used to tie the mask to some base (Ibid.: 87). Two short transverse cut-marks depicting, as suggested by Pletneva, "the line of life" (Ibid.), are observed at the narrow neck, which is 1.2 cm long; though these could have been intended for attachment of the item to the base.

The mask was discovered during removal of the southwestern part of the burial mound, near its floors at a depth of 10–12 cm, along with two fragments of ceramics (Pletneva, 1974: 91, fig. 283). The latter are probably the remains of a vessel that was broken during archaeologization. A burial of a 30–40-year-old man was located at the central part of the mound at a depth of 0.6 m. It contained two ceramic vessels, one of which

Anthropomorphic bronze masks from the Timiryazevo-1 burial ground.
1–4 – excavations by L.M. Pletneva in 1973; *5*, *6* – excavations by O.B. Belikova in 2014, excavation area 2.
1 – mound 39; *2* – mound 55; *3* – mound 59; *4* – mound 60.

was of miniature size, and also iron items: a socketed chisel (?) and a small knife.

Mask 4 (see *Figure*, *4*; mound 60). Its height is 4.7 cm, its weight 10 g. Single-sided flat casting. The general outline of the face image is oval. The eyes and mouth are rendered using the same technique in the form of oval contours. There are three symmetrical oblique cutmarks on each cheek. Above the forehead, a headdress is depicted, as suggested by Pletneva, by three longitudinal flutes (Belikova, Pletneva, 1983: 17). In the authors' opinion, these horizontal details in the upper part of the head are intended to show the three-rowed structure of the headdress's crown, which is, quite possibly, a low combat helmet with a round dome. The neck's length is 0.9 cm. The edges are not treated.

The mask was discovered during removal of the central part of the burial mound, at a depth of 12–15 cm. It was found in a small vessel that contained another three iron artifacts: a knife, a buckle and a miniature model of an adze. According to the report, the burial was located at a depth of 0.60–0.75 m (Pletneva, 1974: 91–92, fig. 287, 288), in a pit arranged in the bedrock layer. The vessel with the mask was located above the northern edge of this flat burial. It contained the remains of a 30–40-year-old man and a 16–20-year-old woman, and abundant grave goods.

Mask 5 (see *Figure*, *5*; excavation area 2, 2014). An item with an ornithomorphic top. Its total height is 5.6 cm, its weight 6.8 g. The casting is single-sided, and the shape of the artifact on the back side deeply concave. There are signs of a high relief, which renders the image of a bird. The general outline of the human face is oval. The eyes are shown by arc-shaped deepened lines forming ovals. Two pairs of slightly curved horizontal lines extending across the nose, which is designated by a narrow relief fillet, are marked symmetrically on the cheeks. A similar line is used to render the mouth. The chin is clearly modeled. Below is a subsquare relief projection, possibly depicting some face detail (a beard?). The length of the subrectangular neck is 1.8 cm. A subtriangular figure, probably symbolizing "the line of life", is drawn on it.

A sitting bird with drooping wings is represented full-face on the head of an anthropomorphic character. It adjoins the human head tightly, and seems to be set on it at the middle of the forehead. This ornithomorphic figure is interpreted as a peculiar headdress or headgear. In the opinion of S.S. Moskvitin, a zoologist of the TSU, the bird-outline corresponds, most probably, to a representative of Falconiformes, or diurnal birds of prey.

Mask 6 (see *Figure*, *6*; excavation area 2, 2014). An item with a zoomorphic top. Its total height is 4.7 cm, its weight 11.3 g. Single-sided flat casting. The general outline of the human face is subrectangular. The eyes are shown by a circular contour, the eyebrows and three pairs of symmetrical cut-marks on the cheeks are rendered by straight deepened lines, and the nose by a fillet, on which a cut-mark is made at the location of the mouth. The neck's length is 0.5 cm; a convex subtriangular figure ("the line of life") is seen on it. The image of an animal facing left is separated from the human face by a horizontal line. The animal's eye is rendered using the same technique as the human eyes, i.e. by a deepened contour, which, however, has an oval shape. The top is interpreted as a representation of a headdress in the form of an animal. A zoomorphic creature is rendered symbolically; therefore its species cannot be determined unambiguously.

Masks 5 and 6 were found during excavations in 2014, and are related to the same flat burial that contained remains of two children. The burial pit, 1.11 × 0.46 m in size and 0.32 deep, is oriented along the NE–SW line. The first individual is represented by the crown of a deciduous molar, the age of his/her death is 6 ± 3 months; the second one has permanent teeth, the age of his/her death is 5 years ± 16 months*.

Mask 5 was found at the very bottom of the burial pit, near its northeastern wall, in a cluster of objects including a small iron buckle, a bronze buckle of normal size, a bronze image of a bear's head, and small iron items, barely identifiable. Also, two iron three-bladed arrowheads and fragments of a ceramic vessel were found in the grave.

Mask 6 was discovered at a distance of about 1 m from mask 5, near the southwestern upper edge of the burial pit, i.e. at the ancient daylight surface level, also in a cluster of iron objects: a small knife with the remains of sheath, a small buckle, and a fragment of plate.

Analysis of materials

The stylistic unity of all six anthropomorphic masks from the Timiryazevo-1 burial ground is undoubted: the finds are unified by several common features.

The masks were made by single-sided flat casting. They have no loops or holes for fastening. The masks are similar in size (their length varies from 3.8 to 5.9 cm) and weight (from 6 to 18 g).

There are deepened stripes and lines in the middle sections of the faces of all the anthropomorphic creatures. In general, 1–3 oblique strokes are applied on the cheeks; these are symmetrical relative to the vertical facial axis. On one image, two slightly curved horizontal lines are drawn through the nose across the face (see *Figure*, *5*). All these flutes, taking into account their direction and specific locations, are interpreted as peculiar paintings or tattoos rather than nasolabial or other natural wrinkles.

In all masks, the nose is designated by a straight fillet, and eyes by deepened contours. In general, the anthropomorphic images show realistic parts of the face. Each mask has a "neck", shown by a straight process 0.8–2.2 cm long. The necks of some characters contains various details such as those called "the line of life".

The main differences between the Timiryazevo-1 masks are related to depiction of the upper part. In this zone, two masks show figures of animals (see *Figure*, *5*, *6*), interpreted as zoomorphic headdresses in the form of birds. Two other masks have representations of other types of headdress: a combat helmet with a low round dome (see *Figure*, *1*), and some headdress with a crown composed of three horizontal rows (see *Figure*, *4*). In the parietal region of the two other masks, no additional elements are designated.

Common regularities can also be identified in the context of discovery of all six masks. The first was earlier noted by Pletneva with respect to the materials of the 1970s: the masks were found in clusters of objects including miniature models (2010: 181). The second: these clusters almost always contained a ceramic vessel and/or an iron knife. In half of the cases, masks and other miniature objects were placed inside a vessel. The third is that said clusters of objects with masks were located outside of burials, usually at a very small depth from the surface. An exception is the cluster with mask 5, which was recorded immediately in the grave.

Dating and analogs

The presented anthropomorphic images from the Timiryazevo-1 cemetery have been found in complexes dated to the 5th–8th centuries (Belikova, Pletneva, 1983: 16–19). Arguably, bronze masks were used in the ritual of this site throughout the entire period. Two objects from mounds 55 and 60 (see *Figure*, *2*, *4*) are dated to the 5th–6th centuries, judging from the associated clusters of miniature models and other things typical of the Tashtyk culture. Two other masks from mounds 39 and 59 (see *Figure*, *1*, *3*) are assigned to the 6th–8th centuries (Ibid.: 16–19, 95). When determining the upper date of occurrence of anthropomorphic images, we should consider the opinion of Pletneva that these were not encountered in the Tomsk region of the Ob after the 9th century (2010: 182). Judging from stylistic analogs of

*Anthropological definitions have been made by the junior researcher of the Laboratory of Anthropology and Ethnology of the Institute of the Problems of Northern Development of SB RAS, E.O. Svyatova (2015: 16–17).

the Timiryazevo-1 masks, the distribution of such images was limited to the Tomsk-Narym region of the Ob.

The artifacts closest to those considered in this article are available in the collection of the Novosibirsk State Museum of Local History and Nature, which is composed of objects discovered, according to A.V. Shapovalov, in the Tomsk region of the Ob. This collection includes five bronze masks made in the same artistic style as the finds from the Timiryazevo-1 burial ground. Unfortunately, the archaeological context of the artifacts stored in the Novosibirsk Museum is unknown. They are assigned to the 6th–8th centuries with reference to similar materials from the dated cemeteries of Timiryazevo-1 and Relka (Shapovalov, 1995: 40, fig. 1, *1–5*).

Among the masks found in the Narym region of the Ob, located north of the Tomsk region of the Ob, the only complete analog of Timiryazevo items is the bronze find from the Relka burial ground of the 6th–9th centuries (Chindina, 1971: Fig. 2, *2*; 1977: Fig. 34, *17*; 1991: 67). Other anthropomorphic images discovered in the burials and clusters of objects in the Relka mounds (Chindina, 1977: 34) are considerably different stylistically from the Timiryazevo masks.

In other Siberian regions, no analogs of the discussed artifacts from Timiryazevo-1 have been recorded; in particular, in the Novosibirsk region of the Ob, the Kuznetsk Depression, Baraba, and the Omsk region of the Irtysh (see (Baraba…, 1988; Troitskaya, Novikov, 1998; Konikov, 2007; Bobrov, Vasyutin, Onishchenko, 2010; Ilyushin, 2012; and others)).

Bronze and wooden masks (15 spec.) that were studied in detail and defined as “images of doll faces” by K.G. Karacharov (2002) may be mentioned as indirect analogs of the Timiryazevo finds. These are from funeral and settlement assemblages of the Surgut region of the Ob, and are assigned to the second half of the first millennium AD, primarily the 8th–9th centuries. Like the masks from the Timiryazevo-1 cemetery, they are small in size, flattened, with marked “necks”, and made in a realistic and laconic manner of rendering the facial details (their noses are rendered by straight fillets). Another common feature is the depiction of a headdress. The main distinction of the Surgut anthropomorphic characters is the absence of lines designating, probably, tattoos.

The results of analysis of the collection of anthropomorphic images from the Timiryazevo-1 cemetery (6 spec.) and a search for their analogs are indicative of a specific Timiryazevo group of masks distributed in the Tomsk region of the Ob in the 5th–8th centuries. Taking into account the abovementioned artifacts from the Novosibirsk State Museum of Local History and Nature (5 spec.) and from the Relka burial ground (1 spec.), this group currently comprises 12 specimens. These artifacts belong to the same iconographic type known from the materials of medieval repoussé ritual masks from western Siberia.

The Timiryazevo masks differ from the anthropomorphic images of the previous Kulai time, though they maintain a certain continuity in very notion of, and the general features of, image-rendering. L.A. Chindina rightly points out that Early Medieval metal figurines represent a typologically new casting, differing from the Kulai technique by a total absence of open-work details; and by realism in the creation of images, the polishing of the front surface of masks, and some other features (1991: 62).

Anthropomorphic masks in the funerary rite of Timiryazevo-1

Earlier, analyzing the ritual of the Timiryazevo-1 burial ground, Pletneva proposed to consider the objects from the mound as elements intended to “supply” the deceased person “not only during the funeral, but also later, during the funeral feast”. She also suggested that the mask from mound 59 was applied “to some base, probably to a wooden or rag doll”. On the basis of ethnographic materials related to Siberian peoples, she interpreted this doll as “an abode for one of the deceased person’s souls” (Belikova, Pletneva, 1983: 107, 111–112). A hypothesis that bronze masks from the Timiryazevo-1 burial ground were details of dolls, other parts of which were made from non-persistent organic materials, is now supplemented by new arguments.

1. All six Timiryazevo masks shown elongated necks. In our opinion, such a neck is a structural member that was used to fasten an artifact to an organic base.

2. Unique dolls of the 8th–9th centuries have been discovered in the neighboring Surgut region of the Ob. In ten cases, it was reliably recorded that masks “were details of dolls having soft bases with flat frames of twigs” (Karacharov, 2002: 27). The masks were bronze or wooden.

The use of small dolls with metal masks, which served as their “faces”, is well known in the ritual practice of Siberian peoples. Such dolls probably represented both familiar spirits and deceased relatives (Alekseenko, 1971; Sokolova, 1995; Baulo, 2004; and others). The masks could be very similar in appearance, so it was not possible to determine whom exactly they represented without the help of tradition-bearers as informants. Karacharov studied the dolls found at settlements and burial grounds in the Surgut region of the Ob, and pointed out that it was impossible to determine their function unambiguously (2002: 49). The archaeological context of the masks, and their comparison with the ethnographic data, allow the Timiryazevo dolls to be interpreted as ritual doubles of the deceased persons.

There are many publications about various peoples of Siberia that describe the rite of manufacturing a temporary funerary substitute by the deceased person's kindred; so it is impossible to provide even a quick overview. Dozens of different variants of this rite are recorded among the Ugric, Samoyedic and Turkic peoples, and also among the Kets (Alekseenko, 1971; Pelikh, 1972: 73–78; Shishlo, 1975; Gemuev, 1990: 206–208; Sokolova, 1995; and others). Therefore, ethnic interpretations of the archaeological materials that confirm the existence of the rite under consideration seem inappropriate. This tradition is best described and studied for the Ob Ugrians (Chernetsov, 1959; Sokolova, 1995, 2001, 2007, 2009; Fedorova, 2007, 2010; Zolotareva, 2011; and others), since in their culture the practice of making dolls as temporary abodes for one of the deceased's souls was recorded in a number of places even at the turn of the 20th–21st centuries (Sokolova, 2009: 638; Fedorova, 2010: 316).

In general, this tradition provided for manufacturing a small doll as an abode to be temporarily taken up by one of the deceased person's souls. The doll was treated as a living person: it was "fed", "put to sleep", and provided with specially sewn clothes—miniature copies of clothes for living people. After a certain time, this "soul" of the deceased "settled" in a newborn child of the same clan. Interpretation of the archaeological context of Timiryazevo masks requires ethnographic descriptions of subsequent actions with the dolls. For example, the following variants have been recorded among territorial groups of the Khanty and Mansi (see (Gemuev, 1990: 179; Sokolova, 2009: 624–625, 630; Fedorova, 2007: 209–210)): dolls were taken to a sanctuary or simply to a forest, where they were left or buried; carried over from the house to the attic where they were to be stored; burnt; brought to a cemetery, and placed into a grave structure, or put ("sub-buried") into the grave of the person for whom this doll was made; buried in the earth near the cemetery or at the cemetery itself; representations of the oldest or most honored people of the clan were stored at home and passed down through the generations.

It is clear that not all the above methods of handling the images of the deceased can be traced via archaeological materials. Noteworthy also is the following practice recorded only archaeologically: according to Karacharov, concealment of dolls also took place at abandoned, already "archaeologized" settlements (2002: 28).

In the Timiryazevo-1 ritual, an intentional burial of dolls in the site area is reliably reconstructed. Most commonly, they were sub-buried at a small depth in the burial mound. In a double burial of children (excavation area 2, 2014), one doll (see *Figure*, *5*) was placed directly in the grave, while another (see *Figure*, *6*) was left at its edge. The dolls were buried along with "their belongings": miniature copies of real tools of trade, weapons, adornments, and ware. Interestingly, the set of these models generally coincides with the composition of grave goods from burials with real human remains. Moreover, the reduced iron models repeat the shape of regular items such as adzes, knives, and arrows. Metal buckles often found in the clusters of things astonish by their diminutiveness, and their manufacture must have required real pinpoint precision.

From ethnographic materials, it is known that dolls representing the deceased had their "belongings": as adornments, ware, and knives. They were accompanied by various "additions" such as tobacco, gunpowder, coins, and even banknotes (Sokolova, 2007: 66–68; 2009: 618–619). Only miniature clothes were specially sewn for the dolls, while other items designated for them were common everyday objects. No tradition of intended manufacture of other small items for dolls has been recorded by ethnographic studies. Notably, in the Timiryazevo-1 burial ground, along with miniature models, full-size objects have also been found, i.e. real objects could have been placed together with a doll.

From our point of view, the context of discovery of the Timiryazevo masks is a key to understanding another specific feature of the ritual: the presence of dozens of clusters of miniature metal objects without obvious traces of practical use, often placed in small ceramic vessels, outside of burials. This raises the question, why were only six masks (structural parts of dolls representing deceased people) found during the excavations of the tremendous Timiryazevo-1 cemetery? Most probably, they reflect only one type of the similar dolls that were used in the postfuneral practice of the medieval population in the Tomsk region of the Ob. This assumption is based on the fact that the use of dolls made of organic materials only is known from archaeological and ethnographic materials of Siberia. In such cases, only grave goods that accompany dolls can be recorded archaeologically. In Timiryazevo-1, these goods include primarily miniature models (metal objects, ceramic vessels), and also full-size items. About 30 such accumulations of objects have been reliably recorded from the site study materials.

The dolls could have been made on the basis of anthropomorphic bronze figurines that were cast "at full height". Only one such artifact was found in Timiryazevo-1, mound 15 (Belikova, Pletneva, 1983: Fig. 26: 161). Regrettably, the archaeological context of this find is unclear, since the mound was looted, and the figurine was found in the discharge (Ibid.: 23).

Conclusions

The comprehensive study of these six anthropomorphic bronze masks from the Timiryazevo-1 burial ground has resulted in a conclusion about distribution of Timiryazevo masks, belonging to the same iconographic type of western Siberian medieval masks, in the Tomsk region of the Ob in the 5th–8th centuries. Analysis of the context of their discovery has revealed the ritual of manufacture, from organic materials, of deceased persons' images in the form of dolls, whose faces were represented by these masks. The dolls were used in the postfuneral rites, following which they were sub-buried in mounds, placed in graves, or left nearby.

It is conceivable that dolls of other types, made from purely organic materials that did not survive to the time of excavations, were also buried at Timiryazevo-1. This is evidenced by numerous isolated clusters of miniature objects buried in shallow pits inside burial mounds or between them.

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A Multidisciplinary Study of Burial Mounds and a Reconstruction of the Climate of the Turan-Uyuk Depression, Tuva, During the Scythian Period

This article presents the results of a multidisciplinary study of Beloye Ozero-3—an early nomadic cemetery in the Turan-Uyuk intermountain trough in Tuva, southern Siberia. The radiocarbon analysis of wood from four of its mounds suggests that they were constructed 2565–2390 (calibrated, 1σ), or 2465–2380 (uncalibrated) years ago. In four complex mounds with burials in cribworks, spoil-heaps and peripheral rings were overlaid by stones. In the mound No. 3, there were stone slabs, and the mound No. 4 was encircled by a ditch. The construction of the fourth mound proceeded in two stages. A total of 12,744 m^2 of space between the mounds was excavated, and 38 pavements for funerary repasts were found. Fragments of gold figurines of various animals, ceramics, and arrowheads can be attributed to the Uyuk culture. The results of the palynological analysis suggest that during the construction of the first two mounds, the climate was more humid than at present. By the time the third mound was constructed, 95 years later, the climate had become slightly drier. But before the final stage in the construction of the necropolis, the new humidization of climate began. Environmental changes are evidenced by fluctuations in the amount and composition of pollen of plants adapted to various ecological conditions: xerophytes, mesophytes, hydrophytes, and ruderals. In general, dry-steppe communities prevailed over mesophytic ones. Hydrophytic vegetation and larch grew near the water-bodies. The anthropogenic pressure on landscape increased during the early and final stages of the necropolis, corresponding to the Uyuk culture. Background and ancient soils are largely similar, indicating relative stability of the climate during the construction of mounds, and its proximity to modern environmental conditions.

Keywords: *Paleosols, palynological analysis, radiocarbon dating, Early Iron Age, burial mounds.*

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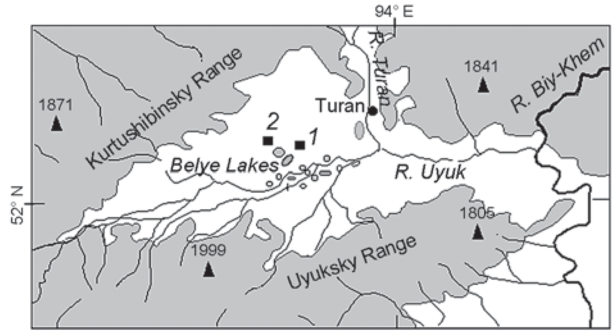
Introduction

Archaeological research provides various information on subsistence activities and funerary rites of past ethnic communities, and also on changes in paleosols and vegetation as compared to their modern background analogs, making it possible to reconstruct the past environment. Currently, insufficient information on the Holocene environmental settings and their chronology for the Tuva is available. For instance, the Holocene climate of the Turan-Uyuk depression in Tuva has been described on the basis of palynological analysis of the stratigraphic column at Beloye Ozero (Dirksen, Chugunov, 2007). The palynological data are also available for the higher altitudes in the Altai-Sayan highlands (Yamskikh, 1983, 1995; Chistyakov et al., 1997; Blyakharchuk et al., 2007; Blyakharchuk, Chernova, 2013). Present data have been collected during the rescue archaeology works forming part of the project of the Elegest-Kyzyl railroad construction in Tuva. This work is aimed at multidisciplinary study of the burial mounds of the Scythian period in this region, in order to identify the features of the funerary rite and to reconstruct the past climatic and environmental conditions on the basis of paleopedological and palynological analyses.

Materials and methods

The cemetery of Beloye Ozero-3, studied in 2013, is located in the Valley of the Kings in the Turan-Uyuk depression, five kilometers from the village of Arzhan and 83 km from Kyzyl, in the Piy-Khemsky District of the Tuva Republic (52º04.458′ N; 93º44.092′ E; 840 m asl) (see *Figure*). The valley, 80 km long and 30–40 km wide, is delimited by the Kurtushibinsky and Uyuksky mountain-ranges of the Western Sayan. The area consists of a swampy depression containing several saline lakes, each named Beloye Ozero. The Uyuk and Turan are the main local rivers, belonging to the Yenisei River basin. The climate in the depression is sharp continental; the average yearly air temperature is –3.0 ºC; the average January temperature is –34.9 ºC; that of July 16.9 ºC. The annual precipitation is 330 mm, of which 70 % fall in summer (data from the Turan meteorology station).

The major part of the soils in the depression belongs to the steppe cryoarid type, dominated by the southern black earth (chernozem) soils and dark chestnut (brown) soils (Nosin, 1963; Volkovintser, 1978). Prior to the early 1990s, the area between the mounds was plowed; currently it is used as a pasture. The most typical vegetation types include couch grass (*Elytrigia repens*), *Cleistogenes squarrosa*, sedge (*Carex duriuscula*), bindweed (*Convolvulus arvensis*), cinquefoil (*Potentilla bifurca*), wormwood (*Artemisia scoparia*, *A. frigida*), palm-grass (*Setaria viridis*), goosefoot (*Chenopodium album*), pea shrub (*Caragana pygmaea*), and others. Currently, after overburdening of pastures, the vegetative communities have not been recovered yet, owing to the proximity to the stock-keeper station and because of the insufficient restoration period. The river valleys are vegetated by stepped forests of birch, poplar, and willow. The lower parts of the forest-belt of the surrounding mountain ranges are covered by larch, birch, spruce, and pine forests (Kuminova, 1983; Dubrovsky et al., 2014).



Map showing location of Beloye Ozero-3 cemetery (*1*) and Arzhan-2 mound (*2*).

The soil-archaeological approach implies the comparison of the paleosols buried under archaeological sites with the modern background soils. Soil samples are also subjected to spore-pollen analysis. Such complementary studies provide more comprehensive information enabling the reconstruction of paleoecological changes occurring through time and space (Chistyakov et al., 1997; Prikhodko et al., 2014; Chendev et al., 2016; Gerasimenko, 1997).

We have studied the morphological features of two background soils and four paleosols: alkalinity, salinity, carbonate neoformations, gypsum and readily soluble salts, and also their forms, composition, and depth of deposition. Soil samples were taken layer by layer, at an interval of 10 cm up to 1 m in depth, and an interval of 20 cm from a depth of 1–2 m. For the palynological analysis, paleosol samples were collected from the surface layer of 0–2 cm from four mounds; for the pedological analysis, paleosol samples were taken at an interval of 0–10 cm to a depth of 30 cm from the same mounds. Five samples of background soil were taken from a depth of 0–10 cm in the area between the mounds.

The analyses were executed in the Center of Common Facilities of the Institute of Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences, using standard techniques: $C_{org.}$ was determined by Tyurin's method, pH by potentiometry (soil : water = 1.0 : 2.5), CO_2 in carbonates by titrimetry, grain-size distribution by pyrophosphate method, cation exchange capacity by Schollenberger's method, and labile phosphorus and potassium by Machigin's method (Vorobieva, 1998). The radiocarbon analysis of ancient wood from burials was carried out in the Radiocarbon Laboratory of the Institute of Material Culture of the Russian Academy of Sciences (headed by G.I. Zaitseva). Calibration was carried out using the program (Stuiver, Reimer P.J., Reimer R., 2005). Identification of pollen and spores from the layer 0–2 cm of paleosols was performed under the supervision of Doctor of Geographical Sciences and Professor N.P. Gerasimenko, according to the established procedure (1997). Soil samples (100 g) were successively treated with hydrochloric acid (HCl, 10 %), sodium pyrophosphate (15 %), again with hydrochloric acid (HCl, 10 %), potassium hydroxide (10 %), and hydrofluoric acid (40 %). Residual palynomorphs were separated by heavy liquid ($CdI_2 + KI$) with specific weight of 2.2 g/cm^3.

Palynological analysis was performed by T.A. Blyakharchuk, using a light microscope with 400x magnification. Pollen and spores were assessed by ecological groups: xerophytes, mesophytes, hydrophytes, xerohydrophytes, and ruderals (Kuminova, 1983). In the Tuva environment, Poaceae were attributed to the mesophytic group rather than to the steppe community, because their pollen content is higher in the more humid ecotopes of highlands and in northern meadow-steppes of the region than in dryer southern steppe areas (Blyakharchuk, Chernova, 2013). A multiplicity of ecological niches of club-moss (*Lycopodiella inundata*) makes it possible to attribute this plant to mesophytic, hydrophytic, and ruderal groups. In Tuva, club-moss has been included into the ruderal group because it expands quickly on disturbed and water-logged soils on lake and river banks. Spirea (*Spiraea alpina*) and dwarf birch, forming thickets in Tuva highlands, have been attributed to the mesophytic group.

Results of the archaeological studies

The mounds under study demonstrate certain different features in their construction and funerary rite. Each mound consists of tumulus 50–90 cm high, composed of stones and humus sandy loam, and a spoil-heap of reddish sandy loam from the main grave. Along the edge of the ground structure of each of three mounds, there is a curb circle made of large stones. Mound No. 3, encircled with a shallow ditch, is reinforced with large slabs instead of stones. Larger stones are placed at the edge of the tumulus, but in the center of the mound they are absent. In mound No. 4, firstly a layer of soil was added, then a grave-pit was dug out, over which an earthen tumulus overlaid by stones was formed.

The spoil-heaps, 50–80 cm high, are covered with stones placed in one or two layers. In the heaps, accompanying burials were found, mostly of infants. Mound No. 1 revealed a child burial in a stone cist. The spoil-heap of mound No. 3 shows one burial in a wooden cribwork, and four burials in stone cists. Mound No. 4 contained a cenotaph paved with stones, possibly imitating an infant or placenta burial. In addition, small stone triangles have been discovered under the spoil-heap and close to the peripheral ring. These triangles represent ritual burials that are interpreted as placenta burials of Tuvan and Khakas people, according to the ethnographic data. The mounds are encircled by the ritual peripheral rings of stones.

Mound No. 4 shows a dromos running through the spoil-heap in a SW direction; mound No. 3 has a dromos running in a NW direction. These were possibly either looting-passages, or passages for secondary burials. In mound No. 4, the dromos reached the ceiling of the cribwork and was filled with stones.

The burial pits had rectangular shape, were about 4 m deep, and were oriented with their corners according to the cardinal points. The pits above the cribwork were filled with dark gray earth, and closer to the walls with red sandy loam. In the central pit at mound No. 4 (possibly at mound No. 1), at a depth of 2 m, a step was made, on which an additional wooden frame with a ceiling was placed, which is typical of the Early Uyuk–Aldy-Bel tradition. Inside the pits, the cribworks were located, covered with several layers of half-logs or beams. The ceiling and floor were made of wooden boards and were directed NW–SE. The layer of birch-bark was placed between the upper and lower layers of the ceiling in burial mounds No. 2 and 3; birch-bark was also found on top layer of cribwork in burial mound No. 3. The lower logs of the ceiling had special cuts made for attaching them to the logs of the cribwork. In total, 15 logs ~ 3 m long and ~ 0.2 m wide have been found.

The cribworks, about 1 m high, were made of 3 or 4 rows of logs joined with saddle notch, and were oriented with their corners according to the cardinal points. The external dimensions of the cribworks are 3 x 3 m; the internal dimensions are 2.5 x 2.5 m. The cuts for inserting floor boards were made in the lowest layer of logs. Earthen bedding to even the floor was used in some places under the boards.

The number of buried individuals and their poses have not been identified, because all the graves were looted. All the ceilings were broken in their central parts, possibly by the looters aiming to get access to the burials. Only in mound No. 1, in the northwestern and southeastern edges of the central grave, were skeletal remains found, which had been likely retrieved from the bottom of the central grave-pit and put on wooden platforms. In mound No. 2, inside the central grave, a man and a child were buried, apparently after looting. These burials may have been sacrificial.

Grave goods are mostly represented by fragments of golden plates, sewn on the clothing, that showed images of griffins, ibex, and lion, typical of the Uyuk culture. A belt with plates on the leather base, with bronze clips, is a feature of the Aldy-Bel culture. The bone and bronze arrowheads with short strikers and long stems correspond to the Early Scythian period in Tuva.

In the ritual peripheral rings of stones, Scythian pottery was found. This is represented by jars of two types: made of red clay and of gray clay, with the marked rims and appliquéd fillets with notches thereunder. Such vessels are typical mostly of the Aldy-Bel culture. A medieval hoard—an intact suit of body-armor of brigandine type—was discovered in the tumulus of mound No. 4.

All excavated burial sites demonstrate the features corresponding to the Uyuk culture of the Scythian period.

Results of palynological analysis

Characterization of the current vegetation was based on the published data of the spore-pollen analysis of two soil samples taken 2 km from the study-area (Dirksen, Chugunov, 2007). The amount of spores was determined as the difference between 100 % and the sum of pollen of woody and herbaceous groups (Table 1). The share of grass and shrubs in the overall pollen composition of modern soil is 78 %; that of wood is 22 %, including pollen grains of pine (*Pinus sibirica* and *P. Sylvestris* together) 9 %, fir (*Abies sibirica*) and larch (*Larix*) 2 %, and spruce (*Picea obovata*) less than 1 %. Among herbaceous pollen, dominates pollen of wormwood (*Artemisia*)—36 % and 41 %; Poaceae and sedge shares are 7 % and 16 % each, chenopods (Chenopodiaceae) 3 % and 5 %, Ephedra and Asteraceae 1 % and 3 % each.

In each paleosol sample, 454–555 pollen and spore grains were identified. Their species diversity varies from 21 to 48 pollen types. Spores of ferns and mosses in paleosol samples composed from 8 to 30 %, those in the background samples 24 to 27 %. The composition of fossilized pollen spectra is dominated by the herbaceous pollen grains; their share in paleosols is greater than in modern soil samples; in contrast, the share of arboreal palynomorphs is lower: 7–12 %. The latter are dominated by the pollen of Siberian pine (*Pinus sibirica*)—from 1 % to 11 %; palynomorphs of Scot's pine (*P. sylvestris*) and larch (*Larix*) total to 1–5 %; pollen grains of spruce (*Picea obovata*), fir (*Abies sibirica*), and birch (*Betula*) are few.

The share of pollen of xerophyte-steppe subgroup in paleosols varies from 41 % to 50 %, where the wormwood pollen predominates. The proportion of pollen of the mesophytic plants is also great: from 8 % to 32 %. The main representatives of this subgroup are palynomorphs of spirea (*Spiraea*) 2–12 %, St. John's wort (*Hypericum type*), Poaceae, and Rosaceae. Cichorioideae, attributed by the present authors to ruderals, also belong to the mesophytic group. The amount of pollen and spores of hydrophytic plants is quite small: from 4 % to 8 %. These are dominated by hypnum mosses spores (*Bryales*) and various types of club-mosses (*Lycopodium*). The smallest share is represented by sedges and horsetail. In addition, a considerable number of micro-pieces of charcoal and mushroom spores are recorded. The proportions of Poaceae and sedges pollen in the modern spectra are 7–16 % each, those in the fossilized samples are 4–8 % and 0.4–3.0 %, respectively. It is known that pollen of Poaceae is poorly preserved in paleosols.

In this region, dry areas are occupied by steppe plants, and humid areas are dominated by mosses, club-mosses, horsetails, and sedges.

The soil under study also contains clumps of pollen (1–2 %)—a few pollen grains of the same species that failed to ripe and to disintegrate into separate grains. This might be the result of the extreme climatic conditions or anthropogenic impact, for instance trampling and damage of plants by cattle (Schlütz, Lehmkuhl, 2007).

Features of soil morphology

The thickness of the former arable layer is 25 cm. The layer of humus containing horizons A1 and AB is up to 40–45 cm thick. Carbonate neoformations have been noted at a depth of 35–42 cm and up to 200 cm (the bottom of the section). The layer of most dense accumulation of carbonates lies at a depth of 40–80 cm; their neoformations are abundantly represented by powdery form.

The study of space between the mounds has shown that horizon A1 was removed from the area up to 50 m from the mounds during the mounds' construction and was moved to the mounds' embankments during the Scythian period. New soil horizons have been formed around the mounds over a period of 2500 years; at a distance of 20 m from the mound, the soil horizon A1 is 10–15 cm thick; the thickness of horizon AB does not exceed several centimeters. At a distance of 20–50 m from the mound, the thickness of A1 gradually grows to 20–25 cm, that of AB up to 10 cm, getting close to the thickness of modern soil layers.

The buried soils from horizons A1 and AB remain unaffected by hydrochloric acid. In general, the morphology of paleosols is largely similar to that of background soils. The soils under study are represented by dark chestnut, moderately thick sandy loam.

Chemical composition of soils

In the background sandy loam soils, the shares of fine-grained fractions (fine-dust and silt, accumulating

Table 1. **Pollen compositions of modern and fossil soils from the studied mounds**

Palynomorphs	Background soils*		Mounds			
			No. 3	No. 2	No. 1	No. 4
	1	2	2565 BP	2520 BP	2425 BP	2390 BP
1	2	3	4	5	6	7
Trees						
Pinus sibirica + *P. sylvestris*	19	18	3	15	3	9
P. sylvestris c	–	–	1	4	1	2
P. sibirica	–	–	1	11	1	7
Abies sibirica	2	1.3	0.4	0.3	–	–
Picea obovata	0.4	0.4	–	0.3	–	0.3
Larix	1	1	4	5	4	3
Betula pendula	–	–	–	0.3	–	2
Betula alba	–	–	–	0.3	–	0.3
Salix	–	–	0.2	–	–	2
Total	22	21	7	21	7	16
Xerophytes						
Artemisia	41	36	40	41	49	47
Ephedra	3	2	1	5	0.6	0.3
Limonium vulgare	–	–	–	–	–	0.8
Total	44	38	41	46	50	48
Mesophytes						
Androsace	–	–	3	5	1	0.5
Aster (type)	0.7	2	0.8	1.1	0.2	2
Betula nana	3	10	–	1	0.2	3
Bupleurum	–	–	0.4	–	–	0.5
Dryas	–	–	0.7	–	–	–
Fabaceae	–	–	0.2	–	1	1.1
Galium	–	–	–	–	0.2	0.3
Geranium	–	–	0.4	0.3	–	0.5
Hypericum (type)	–	–	1	–	8	2
Lamiaceae	–	–	0.8	–	–	0.3
Phlomis	–	–	–	–	0.2	0.3
Pedicularis	–	–	0.6	–	–	0.5
Poaceae	14	16	4	6	4	8
Polygonum alpinum	–	–	–	–	–	0.8
Ranunculaceae	–	–	0.2	0.3	–	–
Rosaceae	–	–	2	0.3	5	1.1

Table 1 (end)

1	2	3	4	5	6	7
Rumex	–	–	0.2	–	–	0.3
Saxifraga	–	–	3	1	–	2
Scrophulariaceae	–	–	–	1	–	–
Spiraea (type)	–	–	12	11	12	2
Total without spore plants	18	28	29	27	33	28
Trilete ferns	–	–	–	0.7	–	0.4
Monolete ferns	–	–	0.9	3.3	–	–
Total spore plants	–	–	0.9	4	–	0.4
Xerohydrophytes						
Carex	14	7	1	2	0.4	2.7
Equisetum horsetail (spore)	–	–	–	1	–	2.3
Hydrophytes						
Bryales	–	–	1.3	2.0	1.1	2.1
*Lycopodium clavatu*m	–	–	1.1	–	1.1	–
Lycopodium lagopus	–	–	–	3.1	1.1	2.6
Lycopodum dubium	–	–	0.9	0.7	0.2	3.2
Sphagnum	–	–	0.2	0.7	0.2	1.3
Total	–	–	4	7	4	8
Ruderals						
Cannabis	–	–	–	1	–	–
Cichoirioideae	–	–	19	1	9	1
Chenopodiaceae	3	5	0.4	1	0.2	1
Plantago	–	–	0.2	0.3	0.4	0.3
Urtica	–	–	1	0.3	0.6	2
Total without spore plants	3	5	21	4	10	4
Lycopodiella inundata	–	–	3	11	9	18
Spores of ferns and mosses, %	27	24	8	23	14	30
Pollen clumps, %	–	–	1.3	1.1	1.8	1.5
Fungi spores, %	–	–	42	24	7	19
Total of palynomorphs, spec.	–	–	555	454	549	531

*Data after: (Dirksen, Chugunov, 2007). The palynomorphs content < 0,5 %, found in one paleosol, is not provided in the Table, but is included into total scores of various ecological groups.

organic carbon and nutrients) reach 8–11 % in total (Table 2). Their distribution throughout the profile is rather even. The pH value of the background soil water extract varies across the profile from the mildly alkaline (8.1) in the upper horizons to strongly alkaline (9.0–9.4) in the lower layers. Cation-exchange capacity is comparatively low: 11–15 cmol (eq.)/kg of soil. The composition of exchange cations is dominated by calcium—80–90 %; the share of magnesium is 9–12 %, that of sodium 0.4–2.5 %.

Table 2. **Main characteristics of the studied soils, %**

Depth, cm	Organic substance, $C_{org.}$				Carbonate CO_2				Clay particles, < 0.01 mm	
	Background soil	Tumulus	Paleosol		Background soil		Paleosol		Background soil	Paleosol
			prior to reconstruction	reconstructed content	profile 1	profile 2	mean			
							profiles 2, 4	profiles 1, 3		
0–10	0.96	1.01	0.74	1.47	1.0	1.1	0.9	1.0	15	14
10–20	0.78	0.98	0.44	0.88	0.8	0.8	1.0	1.1	18	15
20–30	0.71	0.45	0.39	0.78	1.0	0.8	1.1	0.7	12	13
30–40	0.56	0.41	0.27	0.54	1.1	0.8	1.0	1.4	13	15
40–50	0.51	–	0.22	0.44	3.9	11.5	7.8	2.5	12	14
50–60	0.36	–	0.14	–	3.9	7.6	8.5	4.6	–	–
60–70	0.28	–	0.17	–	2.9	8.4	6.9	3.1	–	11
70–80	0.24	–	0.12	–	4.3	4.6	5.1	4.1	12	16
80–90	0.19	–	0.10	–	4.4	2.4	4.2	4.1	–	–
90–100	0.17	–	0.12	–	5.5	2.7	5.8	2.3	13	13

The proportion of organic carbon in the background soils from the former arable horizon is 0.8–1.0 %; its amount in horizon AB decreases to 0.6 %. Concentration of mobile forms of phosphorus and potassium in the root-layer 0–40 cm varies from 11 to 14 and from 6 to 17 mg/100 g of soil respectively. Concentration of mobile potassium in soils is high, that of the mobile phosphorus is medium.

The soils under study can be classified into two groups by concentration of carbonate CO_2, within the layer of 40–100 cm: 4.1 and 6.2–8.0 %. The background soils are not saline; the proportion of readily soluble salts is less than 0.1 %. Sporadically, readily soluble salts occur in the proportion of 0.5 % in one background profile and in two profiles of paleosol at the depth of 40–70 cm.

In many chemical properties, paleosols from under the mounds are similar to the background soils. The proportion of $C_{org.}$ in paleosols is lower than in the background soils, which is explained by the termination of tree-waste supply and by the long-term mineralization of $C_{org.}$. In terms of carbonate content, two paleosol samples are close to the first group of background soils, in which the content of carbonate CO_2 in the layer at the depth of 40–100 cm is 4.1 %; two other paleosol samples are close to the second group (8 %). The absence of exchangeable sodium, gypsum, and readily soluble salts is due to their absence in the parent rock. These are the characteristic features of soils in Tuva (Nosin, 1963).

Discussion of results

On the basis of archaeological data, the cemetery of Beloye Ozero-3 has been attributed to the Uyuk culture of the Scythian period. The diagnostic materials are the fragments of golden plates on clothing in the form of figurines of various animals, fragments of ceramics, and arrowheads.

The palynological analysis has shown that the share of arboreal pollen in paleosols from three of the four mounds is on the average smaller by 5–15 % than that in the modern soil samples (the paleosol from mound No. 2 is equal to that). In the modern soils, the proportion of palynomorphs of Siberian pine and Scot's pine is considerably higher than in the three paleosols. Pine-pollen is produced by pine trees in abundance; it is well preserved and dispersed over great distances; it might have been windblown from the mountains surrounding the depression. This is the reason why the pollen spectra from the modern woodless highlands in southwestern Tuva contain up to 20 % of the Siberian pine pollen from the Altai (Blyakharchuk et al., 2007).

The larch pollen is very large and heavy, and is not windblown over the large distances. Therefore, presence of larch pollen, even in a small amount, suggests that larch trees grew in the immediate vicinity to the site. The proportions of larch pollen are higher in all paleosols (3–5 %) than in the modern soils (1 %). In the soil samples from the latest mound, the content of larch pollen is slightly lower than in other buried soils. It cannot be excluded that this was the result of deforestation caused by human. The cleared space was maintained by the continuous use of this area as a pasture for large numbers of livestock. The small number of local larch trees in the region is most likely the result of complete deforestation nowadays, rather than climatic impact.

The noted fluctuation in the amounts of arboreal pollen might have been caused by the changes in the size of the forested areas and predominant winds. Domination of the northern winds during trees' blossoming periods facilitated transportation of tree pollen from the Western Sayan range; the predominant southern winds brought more palynomorphs of steppe grasses. The prevailing directions of winds could also have been influenced climatic conditions by bringing moisture from the north and northwest and drought from the south.

According to the two or three radiocarbon dates obtained on wood from each mounds under study, the mounds were constructed 2565–2390 BP (calibrated, 1σ) or 2465–2380 BP (uncalibrated) (Table 3). The mounds were constructed in the following chronological sequence: No. 3–2–1–4. Ranging of the obtained spore-pollen spectra of the soil from under the mounds suggests the following possible scenario.

For the initial stage of the cemetery's construction, features have been identified suggesting a much more humid climate than the modern one: a considerably larger amount of pollen of mesophytes in the pollen spectrum from the paleosol at mound No. 3 as compared to the background, and the maximum amount of fungi spores among paleosols. On the other hand, certain features point to a more arid climate: in the palynospectrum of mound No. 3, the aggregate amount of tree pollen is smaller than that in the modern spectra, and the amount of hydrophites pollen is the smallest among the paleosols under study. These discrepancies can be explained by the following: at the beginning of the necropolis' construction, the climate was more humid than today, which is evidenced by the mesophytes pollen. The features of humidity of this stage are possibly concealed by the large number of Cichorioideae palynomorphs (19 %, in contrast to 1–9 % in other paleosols), which plants are ruderals and attest to anthropogenic disturbance of the landscapes. The arboreal taxonomic composition of the fossil spectrum shows the

Table 3. **Radiocarbon dates for wood from burial mounds***

Mound No.	Lab code	^{14}C-date, BP	Calibrated, BP			
			1σ		2σ	
			Range; reliability	mean	Range; reliability	mean
1	LE-10344	2430 ± 25	2363–2489; 0.975	2425 ± 65	2355–2505; 0.749	2430 ± 75
					2634–2696; 0.192	
	LE-10367	2410 ± 18	2359–2438; 0.979		2354–2489; 0.993	
2	LE-10356	2380 ± 50	2345–2472; 0.948	2520 ± 177	2325–2540; 0.821	2520 ± 192
	LE-10375	2460 ± 25	2459–2520; 0.320		2379–2549; 0.453	
			2587–2617; 0.182		2552–2620; 0.214	
			2632–2699; 0.440		2628–2705; 0.333	
2/2	LE-373	2465 ± 25	2482–2539; 0.310		2426–2712; 0.973	
			2632–2699; 0.434			
3	LE-10366	2470 ± 40	2484–2544; 0.294	2565 ± 138	2379–2717; 1	2540 ± 177
			2557–2619; 0.302			
			2629–2703; 0.370			
	LE-10368	2440 ± 18	2427–2492; 0.564		2360–2501; 0.672	
			2640–2679; 0.301		2635–2694; 0.257	
4	LE-10346	2380 ± 30	2349–2432; 1	2390 ± 40	2342–2490; 0.984	2415 ± 75
	LE-10347	2380 ± 30	2349–2432; 1		2342–2490; 0.984	

*The dates with reliability less than 0.1 are not provided.

predominance of the local larch over the long-distance transported pine pollen, vice versa in the background.

The trend towards further humidization continued when mound No. 2 was erected, i.e. 45 years after the beginning of this necropolis' construction. This is confirmed by the increase in the amount of pollen from trees and hydrophytes, including club-moss, as compared to the modern palynospectra. In 95 years (mound No. 1), some features of aridization appeared: small amount of pollen of arboreal species, hydrophytes, moss and fern spores; increase of the xerophytes pollen content by 3–7 % as compared to the background; and negligible spread of fungi spores. The spectrum of mound No. 1 contains a considerable proportion of mesophytes, while the share of hydrophytes is minor. This suggests that the areas formerly vegetated by hydrophytic plants became dryer and were transformed into meadow steppes with mesophytic vegetation.

The final stage in the necropolis' construction is characterized by features indicating new humidization of the climate: the amount of palynomorphs of various trees, hydrophytes, and spores increased, and the composition of mesophytic plants was expanded. At this stage, the number of ruderals increased considerably because of the wide spread of club-moss, while the Cichorioideae pollen nearly disappeared. This attests to the increasing anthropogenic pressure on the landscape in the form of pasture degradation along the banks of water-bodies.

The ancient and modern background soils have many features in common. The paleosols differ from the background analogs in their smaller amount of organic carbon. It was shown elsewhere that the upper horizons of steppe soils retain about 50 % of the initial amount of $C_{org.}$ after 2 thousand year-long burial under the mounds (Ivanov, 1992). The reconstructed amount of $C_{org.}$ in the layer of 0–30 cm of ancient soils is greater than that in the modern analogs, given that 50 % of humus have been mineralized over the past 2500 years. The content of $C_{org.}$ in the paleosol layer of 0–10 cm is 0.74 ± 0.08 %; the reconstructed content is 1.46 ± 0.15 %; this value for the background soils is 0.96 ± 0.10 %. However, comparisons with virgin soils are more reliable, because in the arable land the amount of $C_{org.}$ goes down. Upon conversion of the arable land into pasture, fertility of soil has not been restored owing to the very short transitional period (13 years), pasture degradation, and climate warming. Comparisons between the periods of 1977–2006 and 1961–1990 (period of normal climate as suggested by the World Meteorological Organization) have shown that in the Turan-Uyuk depression, the average yearly soil temperature has increased by 1.8 °C, that of the air by 2.4 °C; at the same time, the amount of annual precipitation decreased, causing a certain loss in land-productivity over the last 30 years (Andreichik, 2011).

The content of $C_{org.}$ in the 0–10 cm layer of the virgin sandy loam dark chestnut soils has been established in the range of 1.2–1.7 % according to mass-analysis (Nosin, 1963: 242). Thus, the comparison of the reconstructed amount of $C_{org.}$ in the Uyuk paleosols with that in the virgin analogs has shown that these have only minor differences in the layer of 0–10 cm. Comparison of virgin and background soils revealed a decrease of $C_{org.}$ in 0–10 cm layer by 34 relative percent, owing to anthropogenic impact. Consequently, approximately the same decrease of $C_{org.}$ took place in the layer of 10–30 cm of background soils (the former arable land layer). On the basis of these data, we have calculated the amount of $C_{org.}$ that could have been present in the background soils of 10–30 cm layer prior to anthropogenic impact. This amount turned out to be greater than the reconstructed $C_{org.}$ content in the paleosol layer of 10–30 cm. In general, the concentration of organic carbon in the four paleosols is nearly the same. This suggests that the paleoclimate in the time of mounds' construction was close to the modern one. Possibly it was more arid earlier, leading to the decrease in $C_{org.}$. Subsequent improvement of environmental conditions was short, and resulted in humus-accumulation only in the topmost soil layer.

Environmental conditions in Tuva and adjacent regions during the Scythian period

Scythian tribes arrived in Tuva after the 9th century BC, which is earlier than in the Eurasian steppes. This is evidenced by the study of the burial mound of Arzhan-1, constructed in the Turan-Uyuk depression at the turn of the 8th–9th century BC (Gryaznov, 1980). The unique unlooted burial mound of Arzhan-2 was erected in the mid-7th century BC (Chugunov, Nagler, Parzinger, 2002). These dates have been obtained using dendrochronological and radiocarbon methods. In the deposits of Beloye Ozero, the layer corresponding to the Scythian period shows a sharp increase in the amount of arboreal pollen, and higher humidity than at the present time. These conditions stimulated migrations of the Scythian cultures to Asian regions (Dirksen, Chugunov, 2007).

The spore-pollen diagram of the bottom deposits from Lake Tere-Khol in southeastern Tuva shows that during the chronological interval from 3.2 to 1.0 ka BP, there was an alternation of five humid and four arid periods. In the early and late 1st millennium BC the climate was dry, and in the middle it was humid (Bolikhovskaya, Panin, 2008; Bronnikova et al., 2014). Similar periods have been identified on the basis of the pollen diagram of Lugovoye bog in the Western Sayan (Blyakharchuk, Chernova, 2013). From the study of radiocarbon-dated paleosols in the adjacent Central Tuva and Khemchik depressions it was established that 2.7 ka BP the climate was similar to the modern one, while 2.5 ka BP it was moderately warm and humid (Dergacheva, Ochur, 2012). The dendroindicational research provides additional information (Myglan, Oidupaa, Vaganov, 2012). Analysis of the wood from Pazyryk burial mounds in the Altai has shown that in the Scythian period mean summer temperatures tended to decrease by 2.2–2.5 °C, with minimums in the 6th and 3rd centuries BC, as compared to the modern conditions (Bykov, Bykova, 2006). Study of the Kholash cemetery (4th–3rd centuries BC, this date being based on archaeological finds) in western Tuva suggests that during the cemetery's construction, the number of pollen of xerophytes was larger than today, and the biological activity of paleosols was lower than today owing to the arid climatic conditions (Chistyakov et al., 1997).

Analysis of the above paleoecological data revealed considerable paleoclimatic changes: in the early and late 1st millennium BC, the climate was mostly arid, and in the middle of this millennium, during the flourishing of the Scythian culture, the climate was humid. Hence, during this time, the steppe cenoses of the Turan-Uyuk depression were characterized by high productivity. These conditions favored habitation of the region by the Scythian tribes.

Conclusions

This article presents the results of a multidisciplinary study of Beloye Ozero-3—a Scythian cemetery in the Turan-Uyuk depression in Tuva, southern Siberia. Palynological research suggests that during the construction of the first two burial mounds, the climate was much more humid than the modern one; 95 years later, it had become drier. During the final stage of construction of the necropolis, humidization began again. During the Uyuk period, the major part of the region was occupied by the dry-steppe communities, with hydrophytic vegetation areas near water-bodies and on the north-facing slopes. The area of thin larch forests was greater than today because of their subsequent human-induced deforestation.

The oldest mound was constructed on the area that was possibly cultivated earlier. This is suggested by the great amount of pollen of weeds belonging to Cichorioideae group. The anthropogenic pressure on landscape increased during the final stage of the necropolis' construction, which resulted in the reduction of larch stands. Dynamic increase in pasture degradation of vegetation cover during the construction period is assumed. This is suggested by four-fold growth of the content of club-moss (*Lycopodium inundata*) spores during the erection of mound No. 2 as compared to the initial stage of the necropolis' construction, and 6-fold growth during the final stage. Club-moss is known to spread out on disturbed and waterlogged soil. Its increase at the final stage of the mounds' construction might indicate a considerable number of livestock during that time. The watering animals trampled down the natural vegetative communities near the water-bodies. This, in turn, disturbed the natural vegetation cover of the soil, and facilitated the spread of club-moss.

Properties of background and ancient soils are largely similar; the reconstructed content of $C_{org.}$ in the 0–10 cm layer of paleosols is close to that in the virgin analogs, and in the 10–30 cm layer lower than that in the modern soils. These data indicate the relative stability of the paleoclimate during the construction of mounds, and its proximity to modern environmental conditions.

Study of the unique burial mounds of Arzhan-1 and -2 in the Valley of the Kings in Tuva is important for our understanding of the origins of the Early Scythian culture; and study of the mounds constructed in the subsequent 250–450 years provides a new insight into the development of this culture, and the reasons for migration of the Scythian tribes to the west.

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Classification of 9th–13th Century Arrowheads Found in Azerbaijan

Ninety-five arrowheads dating to 800–1300 AD and found in the cities of Qabala, Shamakhi, Baku, Shabran, Shamkir, Beylagan, and Sharur, in the castles of Gulistan and Gasymkhan-qala, and in the villages of Shamdan, Burovdal, and Shakashekhr are described. The study is based on the classification of Siberian, Far Eastern, eastern and western Central Asian, and Eastern European arrowheads suggested by Y.S. Hudiakov and A.I. Soloviev. All specimens are made of iron; some are stemmed and some socketed. Stemmed ones fall into eight groups in terms of cross-section. Those with sockets form a single group. In terms of function, three groups of arrowheads are described: (1) used against light armor; (2) used against chain mail; (3) used against plate armor. On the basis of casting molds, metal sheets with notches, and leather templates, manufacturing techniques are reconstructed. Arrowheads were forged from irregular metal blanks or rods, and cut from metal sheets using templates; additional forging was optional. The most representative group includes specimens with narrow faceted blades and acute-angled tips ensuring deep penetration. Flat arrowheads are the most common. A few specimens from Mongolian burials at Mingachevir, dating to the late 13th century, are described.

Keywords: *Azerbaijan, Middle Ages, weapons, arrowheads, Mongolian burials.*

Introduction

During the Middle Ages, weaponry in the territory of Azerbaijan was represented by elements differing in their character. This is largely explained by the geographic position of local states that were influenced by many Eurasian regions.

So far, archaeological studies conducted in the Republic of Azerbaijan have made it possible to accumulate materials that allow us to classify the arrowheads and to determine their role and their place in the general development of warfare.

This study covers the period of the 9th to 13th centuries, which is traditionally not considered very rich in such finds as weapons. The wide distribution of Islam in the territory of Azerbaijan put an end to the funerary rite that involved burying warriors with weapons: while in the 7th–9th centuries weapon burials emerged because of penetration of Khazars here; after the 9th century, they became untypical of the region. Therefore, such archaeological materials pertaining to the High Middle Ages in Azerbaijan are rarer than in the epoch of antiquity.

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A classification system for the arrowheads found in Azerbaijan had not been created until recently, allowing no way of tracing the specific historical path of weapons development in time and space or revealing the regularities in evolution of their shapes. The results of the work that we started in order to classify medieval weapons—in particular, arrowheads—from the territory of the Republic of Azerbaijan have been reflected in the study *Medieval Weapons of Azerbaijan (on the Basis of Archaeological Materials)* (Əhmədov S.Ə., Cəfərova, 2005: 43–54). This is devoted to studying the arrowheads that were described in the archaeological literature of Azerbaijan before 2004. In 2013, T. Dostiyev (2013), the head of the Shamkir Archaeological Expedition, suggested a classification of arrowheads found in the medieval fortified settlement of Shamkir in 2006–2011. This article analyzes materials presented in the above publications, and also some museum specimens (accidental finds) and arrowheads found during 2008–2010 archaeological excavations in medieval layers of the town of Qabala.

Arrowheads from archaeological excavations

This study is based on the classification of arrowheads manufactured by the Turkic peoples of Siberia, Far East, eastern and western Central Asia, and Eastern European steppes, as presented in the papers published by Russian archaeologists Y.S. Hudiakov (1986, 1991) and A.I. Soloviev (1987). It allows us to subdivide the said finds into classes (in terms of material (bone, iron, etc.)), divisions (in terms of the stem shape (stemmed, socketed)), groups (in terms of the cross-section of blade (flat, trihedral, etc.), and types (depending on the blade-contour (rhombic, elongated-rhombic, etc.)).

The arrowheads from medieval sites of Azerbaijan (in total, 95 specimens studied) belong to a single class—iron. Among them, items of two divisions (stemmed and socketed) are identified. It has been established that stemmed arrowheads fall into eight groups in terms of cross-section.

Group I. Round arrowheads. Two types are distinguished.

Type 1. Elongated-triangular (Fig. 1, *30*). One specimen from Beylagan is included (Əhmədov Q.M., 1979: 53, şək. 32). The arrowhead has an acute-angled tip and straight shoulders.

Type 2. Elongated-rhombic. Two specimens from Shamkir are included (Fig. 2, *1*, *4*) (Dostiyev, 2013: 77, tab. I, 1, 4). The arrowhead has an acute-angled tip and sloping shoulders.

Group II. Square arrowheads. Eight types are identified.

Type 1. Elongated-triangular (Fig. 2, *5*, *11*, *14*; 3, *17*; 4, *3*). Twelve specimens from Shamkir are included (Ibid.: Tab. I, 5, 11, 14; II, 17; V, 3).

Type 2. Elongated-triangular with a rest (see Fig. 2, *2*, *17*, *18*). Three specimens from Shamkir are included (Ibid.: Tab. I, 2, 17, 18).

Type 3. Warhead triangular (see Fig. 2, *6*, *7*). Five specimens from Shamkir are included (Ibid.: Tab. I, 6, 7).

Type 4. Elongated-rhombic. Three specimens from Shamkir are included (see Fig. 3, *11*; 5, *10*) (Ibid.: Tab. II, 11; IV, 10).

Type 5. Narrow elongated (see Fig. 2, *8*, *9*; 4, *4*; 6, *5*, *13*). Six specimens from Shamkir are included (Ibid.: Tab. I, 8, 9; III, 13; V, 4).

Type 6. Pyramidal with sloping shoulders (see Fig. 4, *5*). One specimen from Shamkir is included (Ibid.: Tab. V, 5).

Type 7. Elongated-pentagonal with a rest (see Fig. 3, *4*; 4, *6*). Two specimens from Shamkir are included. The items are rather large in size (11 cm long) and weight (Ibid.: 77, tab. II, 4; V, 6).

Type 8. Chisel-like with a rest (see Fig. 6, *1*, *3*). Two specimens from Shamkir are included (Ibid.: 77, tab. III, 1, 3).

Group III. Tetrahedral arrowheads. Six types are identified.

Type 1. Elongated-rhombic (see Fig. 1, *33*, *35*). One specimen from Qabala and one specimen from Beylagan are included (Babayev, Əhmədov Q.M., 1981: 46, şək. 29; Əhmədov Q.M., 1979: 53, şək. 32). The arrowhead has an acute-angled elongated tip and acute-angled shoulders.

Type 2. Rhombic (see Fig. 1, *36*, *37*, *44*). One specimen from the castle of Gulistan, one specimen from Beylagan, and one specimen from Shakashekhr (the Astarinsky District, Republic of Azerbaijan) are included (Ciddi, 1967: 88, tab. 14; Əhmədov Q.M., 1979: 53, şək. 32).

Type 3. Pyramidal with sloping shoulders (see Fig. 4, *3*; 6, *7*). Two specimens from Shamkir are included (Dostiyev, 2013: 77, tab. A, III, 7; V, 3).

Type 4. Elongated-triangular (see Fig. 2, *10*; 3, *10*, *12*). Three specimens from Shamkir are included (Ibid.: 77–78, tab. I, 10; II, 10). The arrowhead has an acute-angled tip and straight shoulders.

Type 5. Pentagonal (see Fig. 4, *7*; 6, *10*). Two specimens from Shamkir are included (Ibid.: Tab. 78, tab. A, III, 10; V, 7).

Type 6. Elongated-triangular with a rest (see Fig. 3, *16*). One specimen from Shamkir is included (Ibid.: Tab. II, 16).

Group IV. Flattened tetrahedral arrowheads. Six types are identified.

Type 1. Pentagonal (see Fig. 1, *34*). One specimen from the territory of Azerbaijan is included (the exact location of the find is unknown) (Novruzlu, 2000: 123, tab. 24). The arrowhead has an acute-angled tip, nearly parallel sides, and sloping shoulders.

Type 2. Rhombic with a rest (see Fig. 4, *8*). One specimen from Shamkir is included (Dostiyev, 2013: 78, tab. V, 8). The arrowhead has an acute-angled tip and similar shoulders converging at the rest.

Type 3. Rhombic (see Fig. 1, *42*, *51*). One specimen from Shabran and one specimen from Dzhanakhyr are included (Dostiyev, 2001: 133, şək. 32). The arrowhead

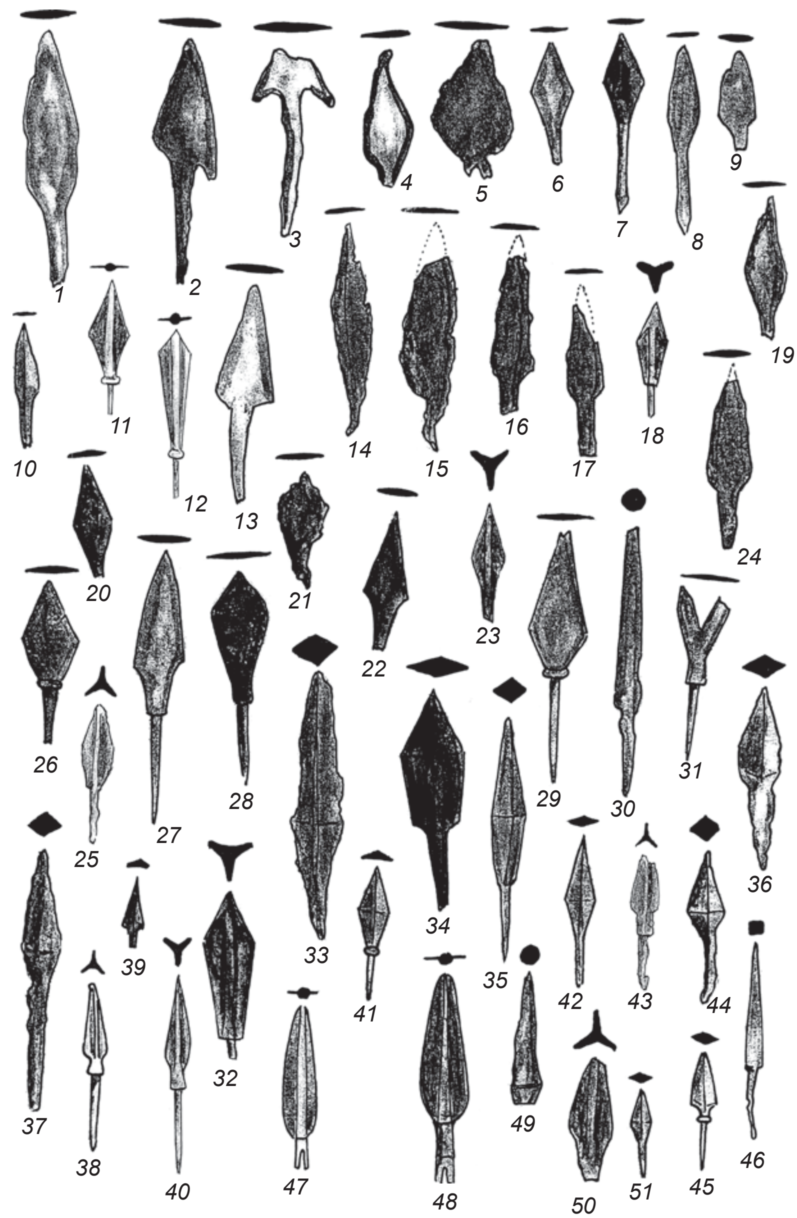

Fig. 1. 9th–13th-century arrowheads found in Azerbaijan.
1, 2, 9, 13, 27, 35 – Qabala; *3, 25, 30, 33, 37, 43, 50* – Beylagan (Örənqala); *4, 38* – Shamakhi; *5, 14–17, 19, 24* – Baku; *6, 7, 20, 22, 26, 41, 42, 45, 51* – Shabran and its vicinities; *8* – village of Shamdan; *10* – castle of Gasymkhan-qala; *11, 12, 47, 48* – Sharur; *18, 23, 28, 31, 32, 34, 39, 40, 46, 49* – the exact location of the find is unknown; *21, 36* – castle of Gulistan; *29* – village of Burovdal; *44* – village of Shakashekhr.

has an acute-angled tip and similar shoulders.

Type 4. Warhead triangular with a rest (see Fig. 1, *45*). One specimen from Shabran and one specimen from Dzhanakhyr are included (Ibid.). The arrowhead has an acute-angled tip, a marked warhead, and sloping shoulders converging at the rest.

Type 5. Asymmetrically-rhombic with a rest. One specimen from Shamkir is included (Ibid.: 78, tab. V, 12).

Type 6. Chisel-like with a rest (see Fig. 5, *3*, *8*). Two specimens from Shamkir are included (Ibid.: 78, tab. III, 5, 6).

Group V. Trihedral arrowheads. Three types are identified.

Type 1. Triangular (see Fig. 1, *39*). One specimen from the territory of Azerbaijan is included (the exact location of the find is unknown) (Novruzlu, 2000: 123, tab. 24). The arrowhead has an acute-angled tip and straight shoulders.

Type 2. Rhombic with a rest (see Fig. 1, *41*). One specimen from Shabran and one specimen from Shamkir are included (Dostiyev, 2001: 133, şək. 32; 2013: 78, tab. III, 8). The arrowhead has an acute-angled tip and similar shoulders converging at the rest.

Type 3. Triangular with a rest (see Fig. 5, *4*). One specimen from Shamkir is included (Dostiyev, 2013: 78, tab. IV, şək. 4).

Group VI. Three-barbed arrowheads. Three types are identified.

Type 1. Warhead asymmetrically rhombic with a rest (see Fig. 1, *18*, *32*). Two specimens from the territory of Azerbaijan are included (the exact location of the find is unknown) (İbrahimov, 1988: 48, tab. 9). The arrowhead has an acute-angled tip, a marked warhead, and elongated acute-angled shoulders converging at the rest.

Type 2. Rhombic (see Fig. 1, *23*, *25*, *50*). Two specimens from Beylagan and one specimen from the territory of Azerbaijan (the exact location of the find is unknown) are included (Əhmədov Q.M., 1979: 53, şək. 32; Novruzlu, 2000: 123, tab. 24). The arrowhead has an acute-angled tip and acute-angled shoulders.

Type 3. Elongated-rhombic with a rest (see Fig. 1, *38*, *40*, *43*). One specimen from Shamakhi, one specimen from Beylagan, and one specimen from the territory of Azerbaijan (the exact location of the find is unknown) are included (Ciddi, 1967: 53, tab. 1; Əhmədov Q.M., 1979: 53, şək. 32; Novruzlu, 2000: 123, tab. 24). The arrowhead has an acute-angled tip and wide-angled shoulders converging at the neck with a rest.

Group VII. Two-bladed arrowheads. Two types are identified.

Type 1. Rhombic with a rest (see Fig. 1, *11*). One specimen from the village of Yurdchu (Sharur) is included (Novruzlu, Baxşəliev, 1993: 45–46, tab. 48). The

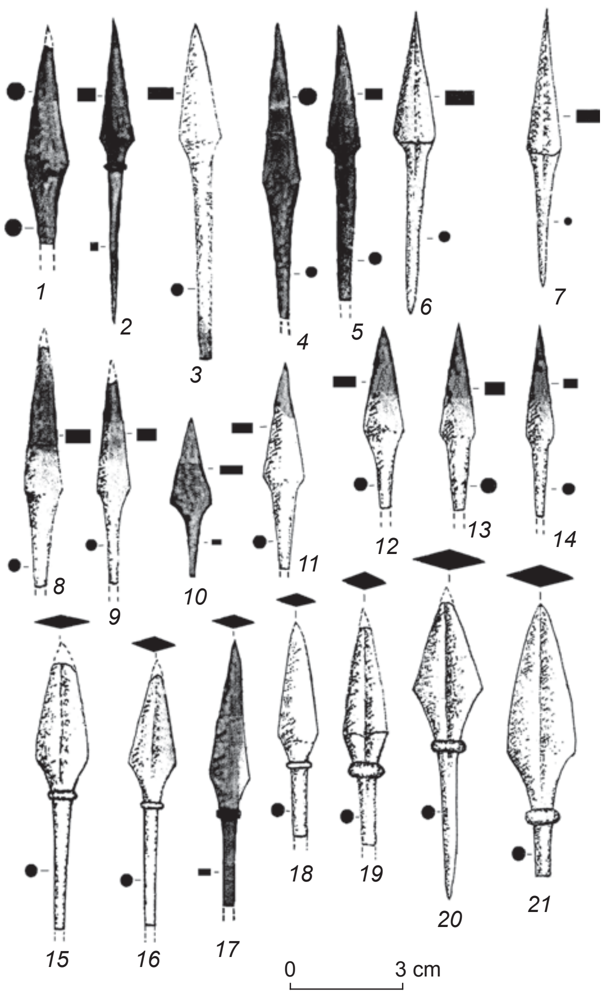

Fig. 2. 9th–13th-century arrowheads found at the medieval fortified settlement of Shamkir.

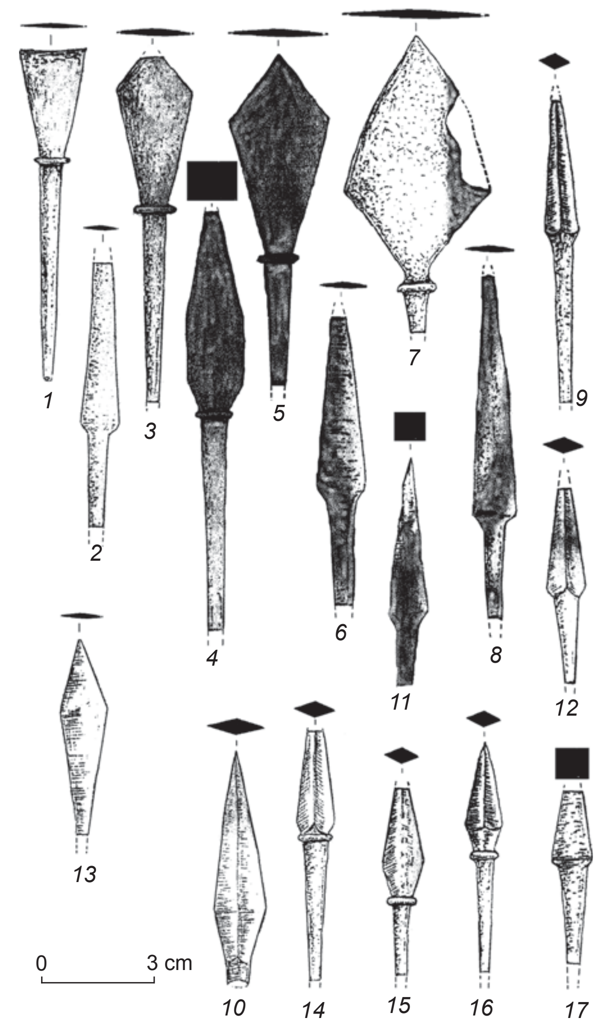

Fig. 3. 9th–13th-century arrowheads found at the medieval fortified settlement of Shamkir.

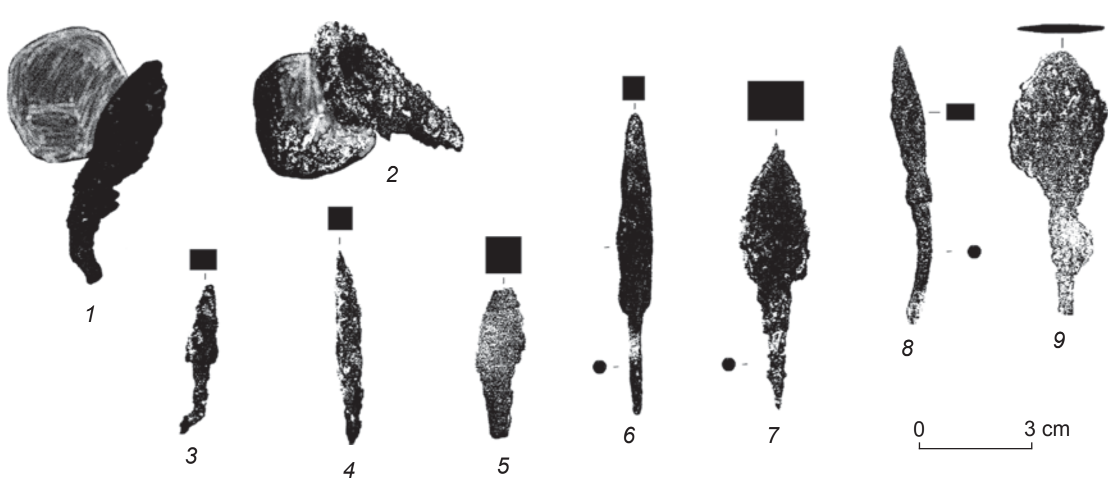

Fig. 4. 9th–13th-century arrowheads found at the medieval fortified settlement of Shamkir.

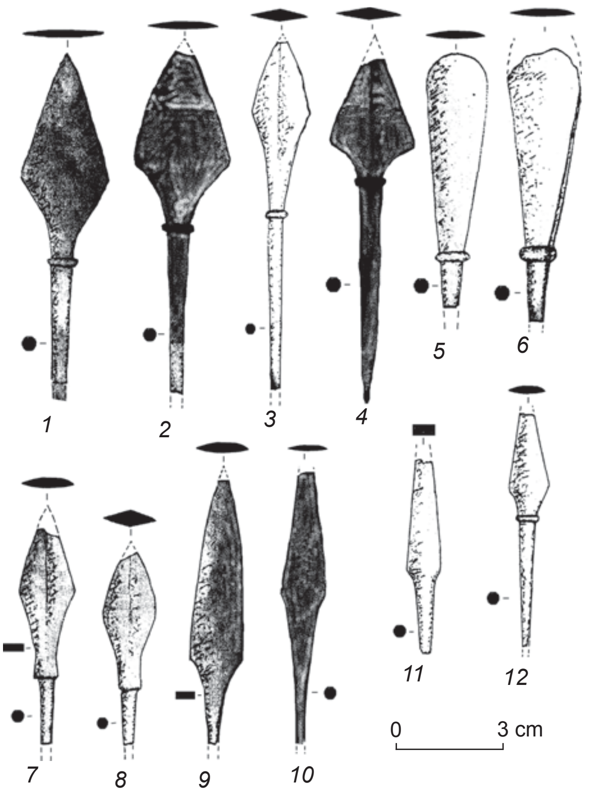

Fig. 5. 9th–13th-century arrowheads found at the medieval fortified settlement of Shamkir.

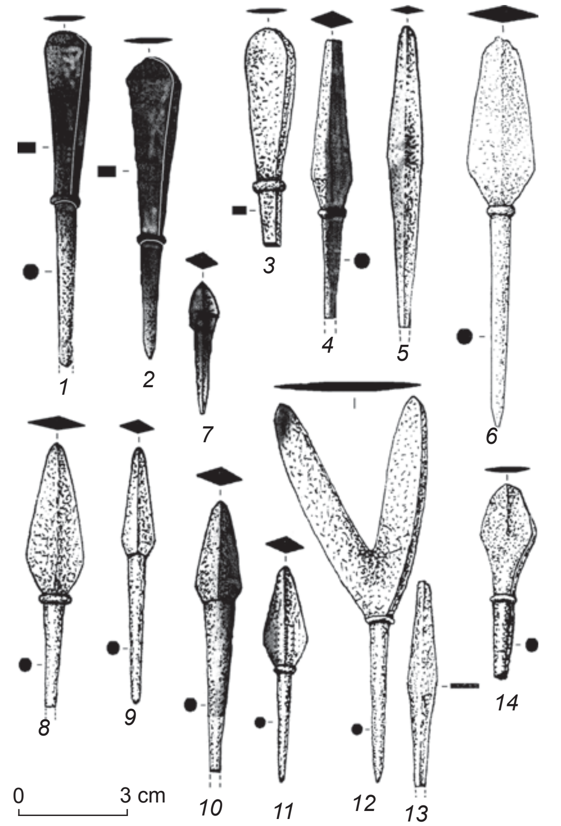

Fig. 6. 9th–13th-century arrowheads found at the medieval fortified settlement of Shamkir.

arrowhead has a marked central rod, an acute-angled tip, and shoulders converging at the rest.

Type 2. Asymmetrically-rhombic with a rest (see Fig. 1, *12*). One specimen from the village of Yurdchu (Sharur) is included (Ibid.: tab. 48). The arrowhead has a marked central rod, a wide-angled tip, and shoulders converging at the rest.

Group VIII. Flat arrowheads. 15 types are identified.

Type 1. Warhead elongated-triangular spurred (see Fig. 1, *2*). One specimen from Beylagan is included (Əhmədov Q.M., 1981: 46, şək. 29). The arrowhead has an acute-angled tip with a marked warhead, spurs, and sloping shoulders.

Type 2. Triangular spurred (see Fig. 1, *3*). One specimen from Beylagan is included (Əhmədov, 1962: 38). The arrowhead has an acute-angled tip, spurs, and sloping shoulders.

Type 3. Leaf-shaped (see Fig. 1, *5*; 5, *9*, *11*). One specimen from Beylagan, one specimen from Qabala (the Selbir quarter), and two specimens from Shamkir are included (Əhmədov Q.M., 1979: 53, tab. 32; Qəbələ…, 2011: 142; Dostiyev, 2013: 78, tab. IV, 9, 11). The arrowhead has an acute-angled tip and sloping shoulders.

Type 4. Split-tail with a rest (see Fig. 1, *31*; 6, *12*). One specimen from the territory of Azerbaijan (the exact location of the find is unknown) and one specimen from Shamkir are included (İbrahimov, 1988: 48; Dostiyev, 2013: 77, tab. II, 13). The arrowhead has two acute-angled tips and wide-angled shoulders converging at the neck with a rest.

Type 5. Asymmetrically-rhombic (see Fig. 1, *14*; 3, *13*). Four specimens from Baku and one specimen from Shamkir are included (İbrahimov, 1995: 20, tab. 4; Dostiyev, 2013: 78, tab. II, 13). The arrowhead has an acute-angled tip and acute-angled elongated shoulders.

Type 6. Elongated-triangular (see Fig. 1, *13*). One specimen from Qabala is included (Babayev, Əhmədov Q.M., 1981: 46, şək. 29). The arrowhead has an acute-angled elongated tip and short sloping shoulders.

Type 7. Elongated-rhombic (see Fig. 1, *22*). One specimen from Shabran, one specimen from Qala, and one specimen from the Selbir part of the Qabala fortified site are included (Dostiyev, 2001: 133–134, fig. 32; Qəbələ…, 2011: 225). The arrowhead has an acute-angled elongated tip and gently curved shoulders.

Type 8. Elongated-triangular (see Fig. 3, *8*). One specimen from Shamkir is included (Dostiyev, 2013: 78, tab. II, 8). The arrowhead has an acute-angled tip and sloping shoulders.

Type 9. Rhombic with a rest (see Fig. 1, *26*; 4, *9*; 5, *7*; 6, *14*). One specimen from Shabran, one specimen from Salman-bulagy, and three specimens from Shamkir are included (Dostiyev, 2001: 133–134, şək. 32; 2013: 78, tab. III, 14; IV, 7; V, 9). The arrowhead has an acute-angled tip and similar shoulders converging at the rest.

Type 10. Warhead elongated-rhombic with a rest (see Fig. 1, *27*). One specimen from Qabala is included (Babayev, Əhmədov Q.M., 1981: 46, şək. 29). The arrowhead has an acute-angled tip, a marked warhead, and sloping shoulders converging at the neck with a rest.

Type 11. Asymmetrically-rhombic with a rest (see Fig. 1, *28*; 3, *3*, *5*). Two specimens from Shamkir and one specimen from the territory of Azerbaijan (the exact location of the find is unknown) are included (Dostiyev, 2013: 78, tab. II, 3, 5; Novruzlu, 2000: 123, tab. 24). The arrowhead has an acute-angled short tip and wide-angled shoulders converging at the neck with a rest.

Type 12. Rhombic (see Fig. 1, *1*, *4*, *6–10*, *15–17*, *19–21*, *24*). Two specimens from Qabala, two specimens from Shabran, one specimen from the village of Sandygtepe, one specimen from the castle of Gasymkhan-qala (Ismailli District), six specimens from Baku, and one specimen from the village of Shamdan (Ismailli District) are included (Babayev, Əhmədov Q.M., 1981: 46, şək. 29; Qədirov, 1984: 95, tab. 16; Dostiyev, 2001: 133–134, şək. 32; İbrahimov, 1995: 20, tab. 4; İbrahimov, Osmonov, 1993: 63; Kudryavtsev, 1984: 96, tab. 1). The arrowhead has an acute-angled tip and similar shoulders.

Type 13. Elongated-rhombic with a rest (see Fig. 1, *29*). One specimen from the village of Burovdal (Ismailli District) and one specimen from Shamkir are included (İbrahimov, Osmanov, 1993: 64, tab. 4, 12; Dostiyev, 2013: 78, tab. II, 15). The arrowhead has an acute-angled tip and similar shoulders converging at the rest.

Type 14. Chisel-like with a rest (see Fig. 5, *7*). Four specimens from Shamkir are included (Dostiyev, 2013: 78, tab. II, 1; III, 2; IV, 5–7).

Type 15. Leaf-shaped with a rest. One specimen from Shamkir is included (Ibid.: 78).

Socketed arrowheads comprise a single group.

Group I. Two-barbed arrowheads. One type is presented.

Type 1. Elongated-ellipsoid (see Fig. 1, *47*, *48*). Two specimens from the village of Yurdchu (Sharur) are included (Novruzlu, Baxşəliev, 1993: 45–46, tab. 48). The arrowhead has a marked central rod, a rounded tip, and oval shoulders.

Analysis of illustrative materials has demonstrated that images in book-miniatures and various objects generally represented triangular or rhombic arrows (this was possibly related to a certain artistic tradition). This is with the exception of two images: a bowl from Beylagan shows an image of a dismounted archer with an arrow provided with a split-tail arrowhead, while a plate from Gabala shows a horse archer shooting an arrow with a split-tail arrowhead (Yakobson, 1959: Tab. 9; Dostiyev, 1999: Tab. 9).

Arrowheads were manufactured using several techniques: 1) forging from irregular metal blanks (mainly, arrowheads with a complex cross-section) (İbrahimov, 1988: 48); 2) forging from iron rods (mainly, arrowheads used against chain mail) (Kudryavtsev, 1984: 96, 102); and 3) cutting from metal sheets using templates, with subsequent additional forging (judging by leather templates found in Baku, this technique was employed for rhombic and elongated-rhombic arrowheads with a rest) (Əhmədov Q.M., 1979: 53; İbrahimov, 1995: 21).

We thought fit to specify (without entering into the general statistics of 9th–13th-century arrowheads found in Azerbaijan) several arrowheads discovered in Mongolian burials dating to the late 13th century (Fig. 7). During archaeological works on the banks of the Kura River, in mound II (on the right bank) and in settlement No. 3 (on the left bank), burials of Mongolian warriors were found (for more detailed information about their locations and about artifacts from the burials see (Akhmedov, 2009)).

Mound II, 24–26 m in diameter and 3 m high, was located in the center of a burial ground, where it was excavated in 1946. The mound's top had a depression resulting from the collapse of the walls of the burial chamber of joint burial No. 8 (Aslanov, Vaidov, Ione, 1959: 93). The burial pit accommodated a human skeleton, and a horse's skeleton was found above the pit.

The human skeleton belonged to a young man, who was lying extended on his back, with his head towards the north and legs towards the south (Fig. 7). A birch-bark quiver in the form of elongated trapezoid lay to the right of the thigh bone of the buried (Ibid.: 102)*. The presence of the birch-bark quiver explains the function of the iron part found near the right knee of the warrior (archaeologists attributed this to the category of iron items that had lost their shape). Apparently, this find is a fragment of a quiver-hook: the hook was attached to the quiver's bottom by its flat end, and the hook itself was slipped over a strap suspended from the belt. Similar hooks are known from Siberian and Central Asian finds (Nesterov, Maksimov, 1990: 122–124; Soloviev, 1987: 37; Hudiakov, 1986: 173; 1991: 93, 128).

The quiver contained arrowheads of various sizes including**: iron stemmed three-bladed and trihedral

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*The quiver's remains are stored in the National Museum of History of Azerbaijan (the archaeological fund (hereinafter—NMHA AF), No. 2543).

**The classification data specify sequentially: material, the shape of connection with the shaft, the shape of top warhead in a cross-section, the shape of blade.

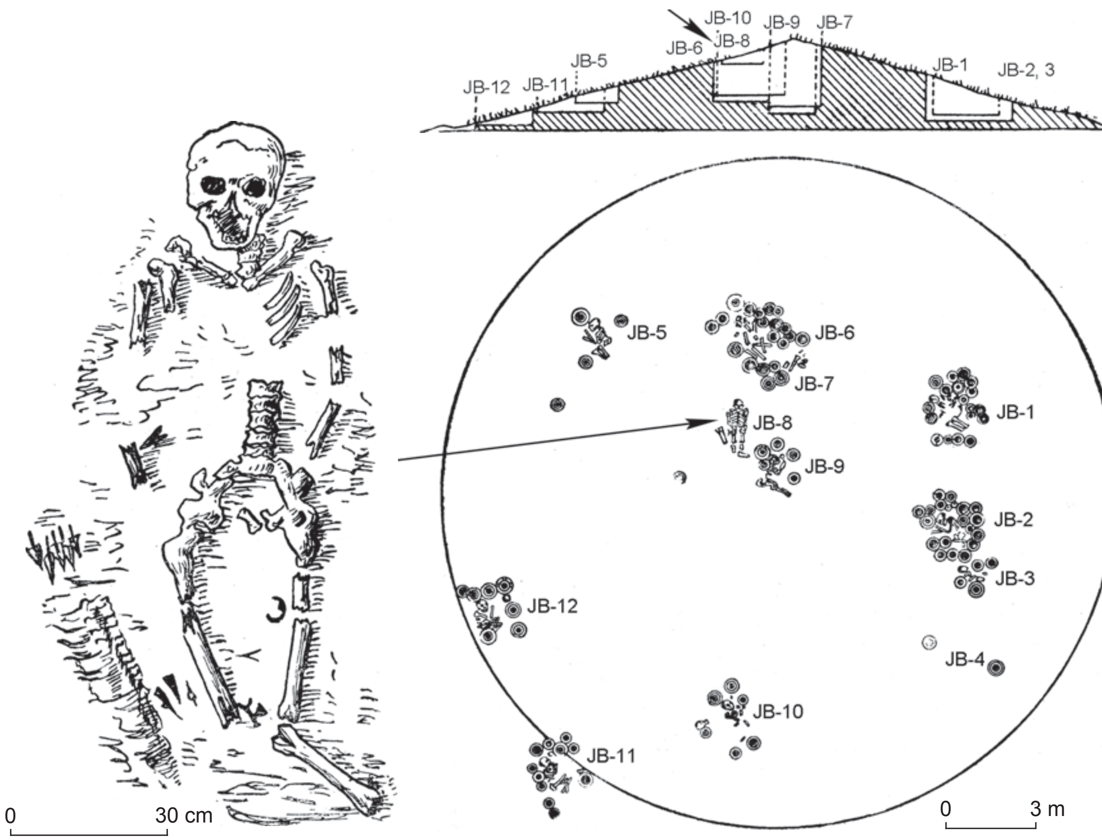

Fig. 7. Burial of a Mongolian warrior of the 13th century at Mingachevir.

triangular; iron stemmed flat chisel-like; iron stemmed round elongated-triangular (styloid); and iron stemmed flat triangular ones. Arrowheads of these types are typical of the Mongolian burials of Mongolia, Trans-Baikal, Cis-Baikal, Tuva, Northern Caucasus, and Crimea (Hudiakov, 1991: 105, fig. 54, *1*, *3*, *5*). The set of arrows from the above grave coincides with the set of arrows from mounds No. 7 and 9 of the Olen-Kolodez cemetery on the Don River, dating to late 13th to early 14th centuries (Efimov, 2000: 172–174).

Two iron stemmed flat chisel-like heads stand out from the others (NMHA AF, No. 1977-1, 1977-2). G.M. Aslanov, R.M. Vaidov, and G.I. Ione consider them to be projectile points: the quiver contained "iron heads of arrows and projectiles of several kinds" (1959: 102). However, it is known that arrows and projectiles were never carried in the same quiver, primarily because of a great difference in the lengths of the shafts of arrows (no more than 0.6–0.7 m) and projectiles (more than 1 m). Trapezoid birch-bark quivers were only used to carry arrows. Quivers for projectiles were long (1.0–1.5 m) and made of leather. In our opinion, a false conclusion by the above researchers is based on the concept that the largest arrowheads (0.11–0.12 m) had a chisel-like shape.

This type of quiver is typical of nomadic cultures: it was comfortable for horsemen, and was encountered as early as the Scythian epoch. Trapezoid birch-bark quivers were widely distributed over a vast territory from the Pacific Ocean to the Black Sea steppes (Hudiakov, 1986: 75, 91, 99–100, and others).

Archaeologists date burial No. 8 of mound II to the late 13th to early 14th centuries. This date coincides with the dates of Mongolian graves found in Mongolia, Trans-Baikal, Cis-Baikal, Tuva, Northern Caucasus, Crimea, and also in the mountain Ingushetia and Don areas. Analysis of materials found in this burial (Fig. 8) suggests that the buried young man was a light cavalryman. The warrior wore a quiver, suspended from the belt by means of a quiver hook, on his right side. A set of arrows in the quiver allowed him to hit enemies who wore plate armor (arrows with three-bladed and trihedral triangular arrowheads), chain mail (arrows with styloid arrowheads) or light leather clothes (arrows with flat triangular arrowheads). Chisel-like arrowheads were used to shoot at enemies' horses. On the basis of materials from Mongolia, Trans-Baikal, Cis-Baikal, Tuva, Northern Caucasus, and Crimea, Y.S. Hudiakov has made a reconstruction of a lightly-armed Mongolian horseman (1991: 153, fig. 83). In our view, this can be

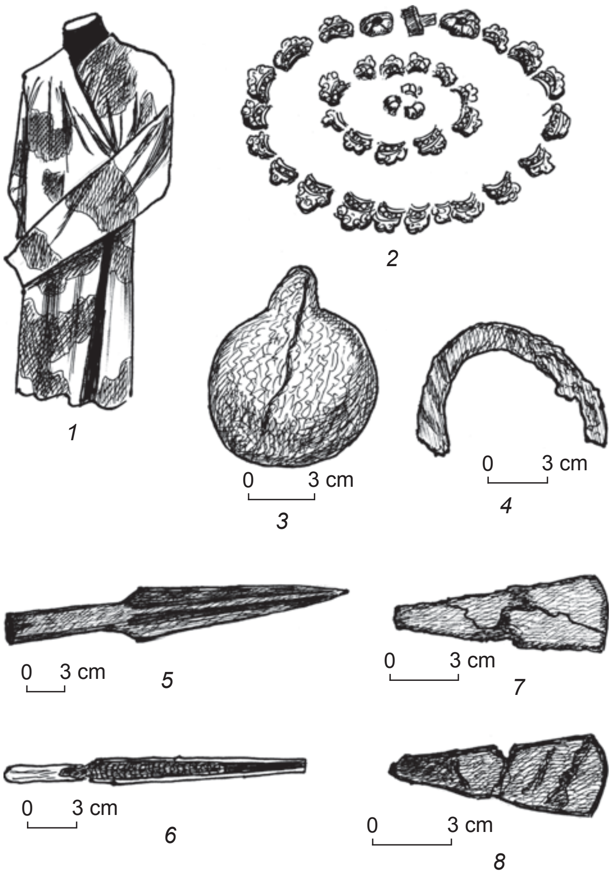

Fig. 8. Finds from the burial of a Mongolian warrior of the 13th century at Mingachevir (NMHA AF).
1 – a silk Mongolian men's robe of brownish-sandy color; *2* – decorative overlays of a thin men's belt; *3* – a round iron paiza 8.7 cm in diameter; *4* – a fragment of an iron horseshoe; *5* – an iron stemmed elongated-rhombic spearhead 37.6 cm long; *6* – a piece of a dagger with a bone handle and a preserved fragment of wooden sheath; 7 – an iron stemmed flat chisel-like arrowhead 11 cm long; *8* – an iron stemmed flat chisel-like arrowhead 12 cm long.

used to restore the appearance of the Mongolian warrior, whose skeleton has been discovered in joint burial No. 8.

Discussion of results

The range of arrowheads under consideration is apparently far from being complete; however, the available forms give an idea of its variety. Noteworthy is a large proportion of flat arrowheads. This is explained by the fact that these were cheap and easy to manufacture, while their shape allowed more arrows to be carried in one quiver and, consequently, to increase the rate of fire.

In terms of function, the arrowheads under study can be divided into the following types.

1) Used against the light-armed enemies. They include stemmed flat, two-bladed, three-barbed, and also socketed two-barbed shapes that were incapable of penetrating metal or thick leather armor (especially at great distances) and therefore, probably, were applied to shoot at enemies without respective armature. 33 arrowheads have been found. This type is most abundant, which means that shooting at warriors without armor was most common in Azerbaijan during the period under consideration.

2) Used against enemies wearing chain mail armor. They include stemmed shapes of round or square cross-section. A narrow armor-piercing arrowhead successfully penetrated chain mail rings. Even if soldered joints or rivets of a ring could have withstood an impact, a warrior still was wounded owing to penetration of the arrowhead to some depth through the ring hole. 37 arrowheads have been found. The arrowheads of this type could have also been used against warriors who wore leather and cotton felt armor.

3) Used against enemies wearing plate armor. They include stemmed trihedral, tetrahedral, and flattened tetrahedral shapes, sufficiently powerful and heavy to penetrate a plate of leather armor or to split apart a plate of metal armor. The arrowheads of this type could have also been used against warriors who wore leather and cotton felt armor. 25 arrowheads have been found.

Conclusions

Study of arrowheads can supplement not only our understanding of the general development level of warfare and metallurgy, but also the knowledge of certain elements of warfare among the population of Azerbaijan in the 9th–13th centuries.

All studied arrowheads pertain to the same class (made of iron) and two divisions (stemmed and socketed). In terms of cross-section, stemmed shapes fall into eight groups, while those with sockets form a single group. The majority of finds have narrow faceted blades and acute-angled tips ensuring deep penetration. This is a special feature of arrowheads found in Azerbaijan.

In terms of function, the arrowheads under study can be divided into three categories: used against light armor (34.7 %); used against chain mail (38.5 %); and used against plate armor (26.3 %). On the basis of this information, it may be concluded that armor was widely used in warfare by medieval population of Azerbaijan.

Unfortunately, the set of arrowheads found so far is insufficiently representative to elucidate their evolution within the period of time under consideration. It is also difficult to distribute the material by territorial groups to determine the local features of various regions.

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Chinese Lacquerware from the Pazyryk Burial Ground Chineta II, Altai

This article describes fragments of lacquer from the early nomadic burials in mounds 21 and 31 at Chineta II, northwestern Altai. Their location in the graves, material, and distribution pattern suggest that these fragments belonged to wooden cups. The analysis, which included methods of analytical chemistry, infrared and Fourier spectrometry, revealed that the remains of paint resembled those of Chinese lacquerware coatings based on qi-lacquer 生漆. The analysis of the paint layers showed that the lacquer coatings were manufactured following the traditional technology used in ancient China. The red upper layers, similar to those known as zhu-qi 朱漆, were applied over dark brown layers of qi-lacquer (漆). Parallels are found among the Chinese lacquers from Pazyryk, Bugry II, etc., owned by the State Hermitage Museum. The comparison of samples from Chineta II with those from high-ranking Scythian Age burials in the Altai suggests that lacquer items were imported by the nomads from a single manufacturing center in China in the Scythian period. It has been suggested that persons buried at Chilikta II mounds 21 and 31 must have belonged to the elite, although these burials were inferior to the "royal " mounds at Tuekta, Pazyryk, Bashadar, Berel, Katanda, etc., in terms of status.

Keywords: *Altai, early nomads, Pazyryk culture, funerary rite, Chinese lacquerware, qi-lacquer (漆), FTIR spectroscopy, science-based methods.*

Introduction

The burial ground of Chineta II is located on the second terrace above the floodplain of the Inya River, 1.0–1.4 km to the south-southeast of the village of Chineta in the Krasnoshchekovsky District of the Altai Territory (northwestern Altai) and belongs to the Chineta archaeological microregion. This burial ground includes objects of the Scythian-Saka period, as well as the Turkic, Kyrgyz, and Srostki cultures (Dashkovskiy, Usova, 2011; Dashkovskiy, 2014, 2015; and others). During the study of mounds No. 21 and 31 at the Chineta II burial ground, a complex of specific artifacts including fragments of Chinese lacquerware was discovered, which show parallels to the Pazyryk culture.

Since ancient times, Chinese artisans covered their products with a mixture based on the sap of the Chinese lacquer tree (*Rhus verniciflua*) of the *Anacardiaceae* family (Chinese 'qi-zhu' (漆樹)), and used lacquer coatings based on *qi*-lacquer (漆)* not only as decorative,

*Lacquer trees grow in China as a wild species and have been cultivated there since ancient times. The lacquer tradition spread from China throughout East Asia and penetrated into Japan. *Qi*-lacquer is made of the sap of the Chinese lacquer tree, or *Rhus verniciflua Stokes* (*Toxicodendron vernicifluum* but also as moisture-protective and waterproof films (Novikova, 2000). Notably, not all modern organic coating materials possess a set of physical, mechanical, and adhesive properties that ensure superpreservation (superdurability). The number of natural substances that since ancient times have been used as coating materials with similar qualities is extremely small, and their coatings are quite specific. One such "long-living" filming agent is the unique Chinese *qi*-lacquer (since ancient times, it was called "the king of paints"). By modifying it, adding pigments to it, and developing the technology of applying mixtures made of it, the Chinese initiated the development of East Asian coating materials*.

The resistance of coating materials of *qi*-lacquer not only to moisture, but also to acids and alkalis results from the high degree of polymerization of the phenolic components, formation of chemical bonds with the metals of the substrate, and the affinity with the lignins of the wood. In terms of their durability, lacquer-based composites are comparable to artifacts made of inorganic materials** (Kumanotani et al., 1979). According to their physical and mechanical properties (hardness, heat resistance, etc.), casting biopolymers from *qi*-lacquer are the precursors of synthetic materials of the phenolic type invented in the 20th century—thermosets, such as resite or bakelite (Elikhina, Novikova, 2013).

In the context of the discussion of *qi*-lacquer, we should mention old film-forming agents used in painting. Vegetable drying oils (tung oil, linseed oil, etc.)—full esters of glycerol and unsaturated fatty acids—also dry in the air. The process of solidification of *qi*-lacquer and oils has some differences caused by their chemical structure and molecular weight. Lacquer coatings from natural oils do not achieve a high degree of polymerization, and according to a whole range of properties they are not comparable to those based on *qi*-lacquer. Films of drying oils are chemically unstable, which is confirmed by the methods of analytical chemistry.

Non-polar substances, such as vegetable oils, are well-combined with Chinese lacquer, since *qi*-lacquer is an emulsion of a polar liquid in a non-polar urushiol continuous phase ("water-in-oil" type). *Qi*-lacquer has always been expensive*, and people often tried to reduce its cost (often with a loss of quality) using modifiers/diluents, such as natural film-forming agents, for example, drying natural oils (due to high elasticity of their films). Complex coating materials with a large number of modifiers represent a specific feature of lacquers made during the Han period**. Currently, drying vegetable oils are used mainly in paints for art. Lacquer coatings based on *qi*-lacquer are still used today in various industries of China (for example, military production) due to their unique properties (strength, electrical and thermal protection, anticorrosive properties, etc.). Nowadays, *qi*-lacquer is modified using materials based on synthetic resins, such as epoxy, acrylic, etc.

Date and cultural attribution of burial mounds containing the remains of wooden lacquerware

The burial ground of Chineta II, along with the previously explored necropolis of Khankarinsky Dol (Dashkovskiy, 2016; and others) marks the northwestern border of the Pazyryk culture area in the Altai. The diameter of mound No. 21 is 18 m, and its height is 0.6 m (Fig. 1, 2). This is one of the largest of the researched objects at the necropolis of Chineta II. A gold earring with pendants (Fig. 3, *1*) deserves special attention among the grave goods. An earring of similar type was found in mound No. 27 at Balyk Sook I cemetery, dated to the second half of the 6th century BC (Kubarev, Shulga, 2007: 69–70, fig. 14, *3*). Parallels also include earrings with pendants from mound No. 6 of the Lebedevka II cemetery in the Southern Transurals (Treister, 2012: 142–144, fig. 73),

(Stokes) F.A. Barkley, according to the new nomenclature); its main component is urushiol—a mixture of polyphenols with a radical of 15 or 17 atoms of carbon and double bonds (Symes, Dawson, 1953, 1954).

*Other East Asian lacquers (Burmese, Vietnamese, or Thai) are also made of the sap of trees belonging to the *Anacardiaceae* family, such as the Japanese wax tree (*Rhus succedanea*) and the Burmese lacquer tree (*Melanorrhoea usitata*) (Honda et al., 2008). In addition to urushiol, these also contain other urushiods (tshitshiol and lacquecol) with a larger molecular mass and different structure of the hydrocarbon radical. The specificity of Chinese lacquers is determined by the ratio of the phenolic components in urushiods. The markers of Oriental lacquers are available (Wana et al., 2007; Li et al., 2016).

**An example of such an object is a fragment of a rounded glass on a dark brown stem (Inv. No. 2551), which is a part of the exhibition of Noin-Ula finds in the State Hermitage Museum. This object was found in the burial mound No. 49 and is made of a mixture of Chinese lacquer and sawdust (Elikhina, Novikova, 2013).

*One of the greatest difficulties of the lacquer technology is the low recovery rate of sap. From 75 to 125 grams of sap can be collected from one tree per day; and 10 kg of lacquer can be collected from one tree during its entire life. To this day, there is a saying in China, "A hundred thousand knives give one pound <(0.4536 kg)> of paint.

**One of the ancient modifiers of *qi*-lacquer (tung oil) changes the rheological and decorative properties of lacquer (the compounds become more liquid and the coatings more shiny and plastic). In addition, tung oil, or *tong-ou* (桐油), is needed for grinding cinnabar in *qi*-lacquer, since this lacquer destroys the pigment. Oil protects the pigment from the impact of lacquer by encapsulating the pigment particles. In modern chemistry, this process is called transformation of the pigment surface.

Fig. 1. Mound No. 21 of the Chineta II burial ground after clearing the embankment.

Fig. 2. Grave in mound No. 21.

dated mainly within the 6th–5th centuries BC (Kiryushin, Frolov, 1998: 124–125, fig. 11, *1*; and others). It is notable that earrings of this type correlate with objects representing the jewelry tradition of Asia Minor, in particular, with the objects of the Achaemenid Circle (Treister, 2012: 142–144; and others).

Other objects of the grave goods from mound No. 21, including a ceramic jar-shaped vessel, iron two-link ringed bit, two bone tubular beads (Fig. 3, *10*, *11*), and a girth buckle (Fig. 3, *12*), show parallels to the materials of the Pazyryk culture (Kubarev, 1987, 1991, 1992; Kubarev, Shulga, 2007; and others). Thus, close parallels to the girth buckle and tubular beads were found in mound No. 99 at the Borotal I burial ground, in mound No. 11 of the Ala-Gail-3 cemetery (Kubarev, Shulga, 2007: 118, fig. 30, *12–16*; 39, *8*, *12–16*), and in mound No. 7 at the Kaindu burial

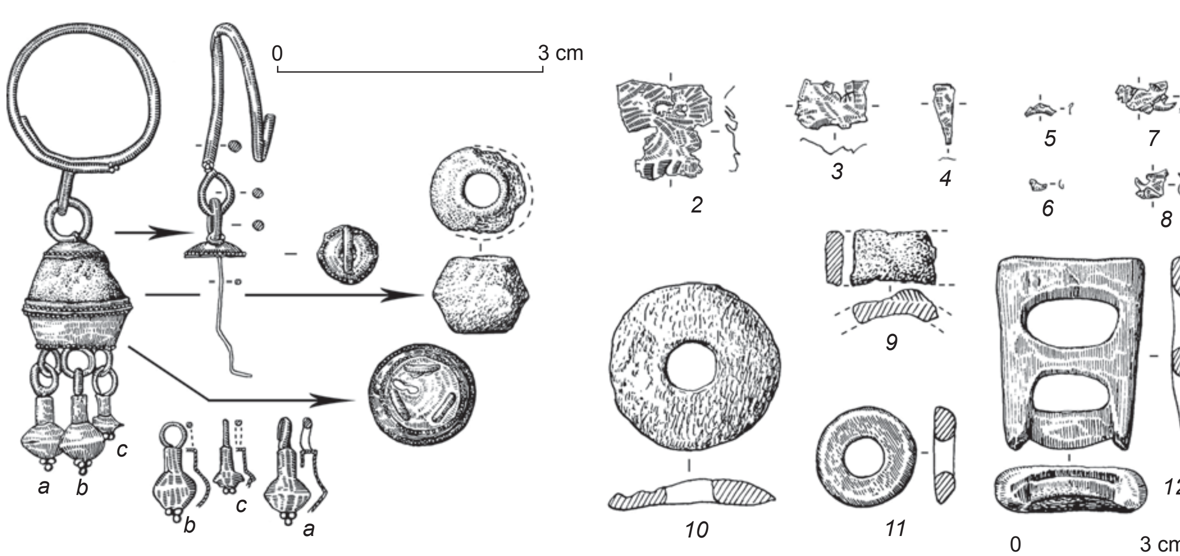


Fig. 3. Grave goods from mound No. 21.

ground (Kiryushin, Stepanova, 2004: 236–237, fig. 55, *8*; 56, *7*), investigated in the Altai Mountains. All these objects belong to the early Pazyryk period and date to the mid 6th–5th centuries BC.

The eastern orientation of the buried female in the burial mound under consideration and the presence of an accompanying horse burial are also typical of the Pazyryk culture, although the animal was buried at the western, and not at the northern wall of the grave, and was oriented with its head to the north. Non-canonical position of accompanying burials of horses in Pazyryk cemeteries has also been recorded in some other sites of this time in the Altai: mound No. 27 of the Tytkesken VI cemetery, mound No. 7 of the Kastakhta cemetery, mound No. 23 of the Maltalu IV cemetery, and mounds No. 11 and 21 of the Kok-Su cemetery (Kiryushin, Stepanova, Tishkin, 2003: 68; Kiryushin, Stepanova, 2004: 234; Kubarev, 1992: 114; Sorokin, 1974: 79). Notably, the above mounds at the Tytkesken VI and Kastakhta burial grounds belong to the early Pazyryk period of the mid 6th–5th centuries BC, and the mounds of the Maltalu IV and Kok-Su cemeteries are not earlier than the 3rd century BC. We should keep in mind that the fragments of lacquerware objects in a certain way "make the dates younger", since Chinese products occur in the Pazyryk mounds mainly of the 4th–3rd centuries BC (Shulga, 2015: 30).

Mound No. 31, studied at the Chineta II burial ground (Fig. 4, 5), was up to 15 m in diameter, and up to 0.85 m in height. During its excavation, traces of the burial rite were found, which show similarity to those at previously studied Pazyryk sites both in the northwestern Altai (the cemeteries of Khankarinsky Dol and Inskoi Dol (Dashkovskiy, 2016)) and in other parts of the Altai, including the central and southeastern areas (Kubarev, 1987, 1991; Kubarev, Shulga, 2007; Kiryushin, Stepanova, Tishkin, 2003; and others). Scarce grave goods were found in mound No. 31. It included an iron ringed bit (Fig. 6, *1*), iron knife (Fig. 6, *2*), fragments of gold foil (Fig. 6, *3–18*, *20*, *21*), ceramic vessel (Fig. 6, *22*), horn girth buckle (Fig. 6, *23*), and forehead plate made of

Fig. 4. Mound No. 31 of the Chineta II burial ground after clearing the embankment.

Fig. 5. Grave in mound No. 31.

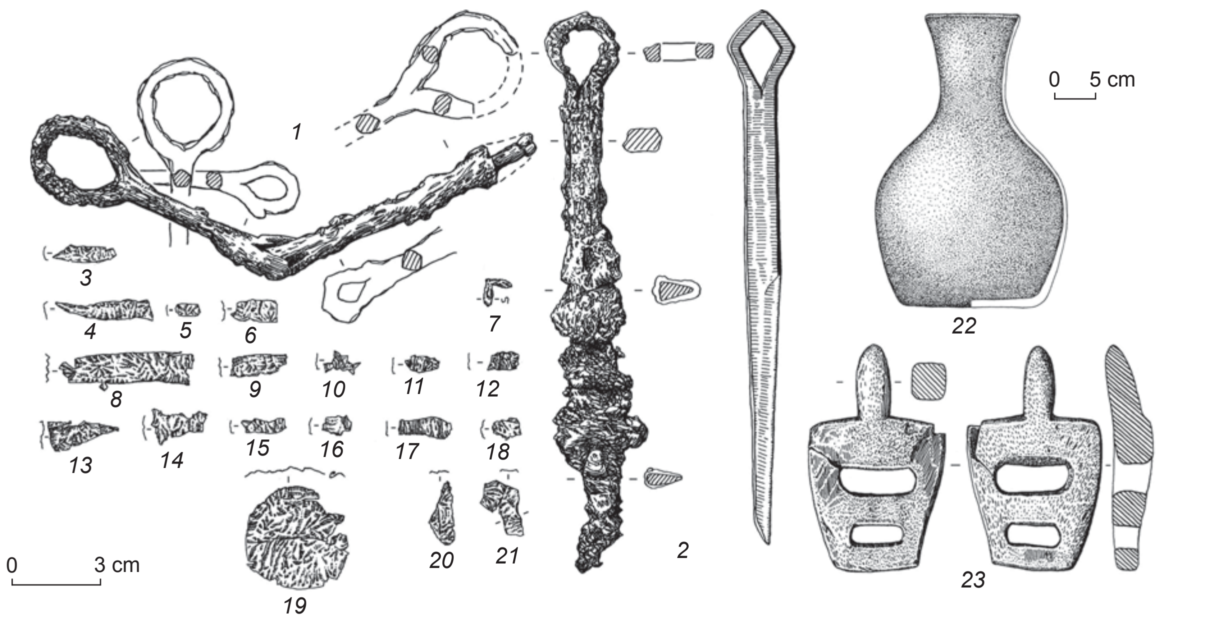


Fig. 6. Grave goods from mound No. 31.

gold foil (Fig. 6, *19*). These things have stable parallels in the materials of the Pazyryk culture of the Altai (Kubarev, 1987, 1991, 1992; Kubarev, Shulga, 2007). An interesting element of the horse harness is the girth buckle, which according to the classification of V.D. Kubarev (1987: 29–30, fig. 14, *4*; 1991: 49–52, fig. 10, *3*; and others) can be attributed to the block-shaped type with two oval slots and an immovable outwardly protruding prong. Girth buckles of this type have been found in the burial mounds of the Pazyryk culture of the second half of the 5th to 3rd centuries BC (Kubarev, Shulga, 2007: 119–123, fig. 81, *4*). The inventory of other categories from mound No. 31 is also dated to a rather wide chronological range from the second half of the 5th to the 3rd centuries BC.

Taking into account specific features of the funerary rite and grave goods, mounds No. 21 and 31 can be preliminarily dated to the 4th to mid-3rd century BC. Further studies of materials from the burial mounds, including radiocarbon analysis, will make it possible to establish a more precise date.

Natural science analysis of lacquerware finds

Lacquerware artifacts in burial mounds No. 21 and 31 occur only in compact clusters of red lacquer residues, which must have been caused by significant pressure from stone filling of the graves, clay soil, and groundwater at the monument. The lacquerware fragments in both mounds were found in the same area. In mound No. 31, there were two closely located clusters. According to their shapes, the object to which the remnants of the lacquer coatings belonged is tentatively identified as a wooden cup. This assumption is also based on the fact that in the process of clearing, under the lacquer flakes, the remains of a very poorly preserved wooden object were found. On some fragments of the lacquer coating, primer residues have survived. Lacquer fragments (varying in size from 0.5 to 30.0 mm) were located to the northeast of the human skull, in the place where pottery and wooden vessels were usually placed in the Pazyryk burials. Materials from the Ulandryk I, Tashanta II (Kubarev, 1987: 49–50), Yustyd XII (Kubarev, 1991: 65–68), Barburgazy I (Kubarev, 1992: 49–51), and Ak-Alakha III (Polosmak, 2001: 194–202) burial grounds and other sites in the southeastern Altai testify to the wide use of vessels made of wood by the nomads.

Methods of analytical chemistry including microscopy, infrared (IR) spectroscopy, and X-ray diffraction*, and other methods of analysis were used to study the remains of lacquer coatings from the Chineta II burial ground. The Chinese *qi*-lacquer can be confidently determined by methods of analytical chemistry. In order

*The IR-spectra were taken using a Shimadzu FTIR-8400S scanning infrared spectrometer with a highly sensitive heat-stabilized DLATGS detector in KBr tablets in the range of 7800–350 cm^{-1}. The analysis of the elemental composition was carried out using an ARTAX X-ray fluorescence spectrometer manufactured by Bruker (voltage 50 kV, current intensity 700 mA, spectrum accumulation time 40 s). The sensitivity of the method was 0.05–0.5 %. The authors would like to thank S.V. Khavrin, the Deputy Head of the Department of Scientific and Technical Expertise of the State Hermitage Museum, for conducting the X-ray fluorescence analysis.

to identify the components of Oriental lacquer materials, FTIR-spectroscopy is often used, and the spectrum of an unknown coating is compared with the spectra of identified materials (Urushi…, 1985). In the course of our study, the infrared spectra of the lacquer coating were determined, and X-ray fluorescence analysis and microphotography were performed. The results have been compared with the lacquer objects from the collection of the State Hermitage Museum, originating from mounds No. 1–7 of the Pazyryk burial ground (40 samples), mounds of the Noin-Ula necropolis (over 200 samples), mounds of Bugry burial ground, and other archaeological sites.

The IR-spectra of the samples were in accordance with the IR-spectra of the traditional Chinese lacquers. Three bands typical of aromatic compounds of urushiol were observed in the spectra in the area of 1450–1650 cm^{-1}. The bands in the areas of 1630, 1543, and 1420 (1406) cm^{-1} and characteristic out-of-plane deformation vibrations of the –CH groups and –CH bond groups of the aromatic ring in the area of 670–900 cm^{-1} (in our case, 651, 797, 875, and 919 cm^{-1}) were identified for this site. The absorption bands of the –CH, –OH, –C=O groups specific for urushiol polymerization products, and the –CO group specific for plant and wood polysaccharides were also present. The red paint layer of the coating contained almost no tung oil (the band of 712 cm^{-1} was absent).

The multilayer lacquer coatings were created using a specific technique based on a natural film-former of lacquer tree sap—a biopolymer from pyrocatechins of urushiol. Kaolin, quartz, and albite (traditional materials/fillers of primers of the Chinese coating materials based on *qi*-lacquer) were found in the layers of the primer. Microimpurities consisting of the salts of manganese, calcium, and potassium were detected. Titanium ions were found in one of the samples from mound No. 31, which is significant.

In most cases, the pigment of cinnabar (HgS), the classical pigment of Chinese lacquers, gave the color to the upper layers of the lacquer coating. The admixtures of antimonite (Sb_2S_3) and galenite (PbS), typical of native cinnabar, were not found. For the final layer of paint, a thin protective layer of natural protein glue was used; it has been partly preserved. The specific feature of the samples of coating materials from the Chineta II burial ground was that the upper layers of paint on the object from mound No. 21 were made with paint in which iron oxide was used (possibly as a pigment/filler).

Remains of lacquer coating from mound No. 21 are represented by several large and firm fragments of red-brown color and fragile small accumulations of lacquer coating of red color (Fig. 7). The two largest conglomerates (1.5 × 2.8 and 1.2 × 2.3 mm) consisted of layers of brown lacquer and high-solid paint on the lacquer (yet the upper layers of paint have not chalked*). All layers of lacquer coating retained high adhesion strength between themselves and the layers of primer, which was not destructible in acids and alkalis and resulted in high durability of the fragments of lacquer coating.

The pigment of the paint was ferriferous ocher of light reddish-brown color; its particles were coarse (Fig. 8). Small amounts of filler based on aluminosilicates were added to the paint. Both samples have double-sided coatings, and a relief of fibers (probably vegetable) saturated with lacquer in the inner layers. The gray primer was made of silica (it contains the ions of copper, zinc, titanium, and manganese) with the addition of large particles of coal. The preservation of the lacquer coatings is generally good; no cracks have been observed.

The paint conglomerate has been preserved in a satisfactory state in the transverse direction, but has undergone some alterations which resulted in interlayer delamination in the longitudinal direction.

A flake of lacquer coating of bright red color was found in one of the samples. It lay on the surface of a layer of ocher with which it lost contact. This lacquer coating was also two-layered (15 μm thick) and consisted of a layer of red paint lying on a layer of dark lacquer. The color of this layer resulted from cinnabar—the classical pigment of Chinese lacquerware technology. The degree of filling the paint with cinnabar was high. The pigment was coarse, and although the paint was considerably well-filled with pigment, the process of chalking (flaking) of the upper layer of the lacquer coating was almost undetectable (Fig. 9). This testifies to the skill of the ancient technologists, who added the optimal amount of pigment to the lacquer and achieved a high degree of the components' consolidation and longevity of the lacquer coating. Only a slight excess of the critical volume concentration of pigment with a minimum amount of *qi*-lacquer was observed.

In the analyzed samples from mound No. 21, the lower layer of lacquer was brown with a minimum amount of iron ions; *qi*-lacquer without the addition of metal salts (similar lacquer coatings were found in the samples from the barrows at the Pazyryk cemetery) was used for its preparation. In later lacquer coatings on the objects from the Noin-Ula burial mounds, which we investigated, there were layers of black-colored *qi*-lacquer with a significant amount of iron ions underneath the red paint layers.

The analysis showed that the lacquerware finds from mound No. 21 constituted the remains of a wooden lacquerware object with the wall thickness reaching about 5 mm, painted on both sides. For its manufacturing, *qi*-

*"Chalking" is the destruction of pigmented lacquer coatings accompanied by the formation of free particles of pigments and/or fillers on the surface due to the loss of their bond with the binder.

Fig. 7. General view of lacquerware fragments from mound No. 21.

Fig. 8. Microphotograph of the top layer of paint from mound No. 21. Red ocher pigment. ×720.

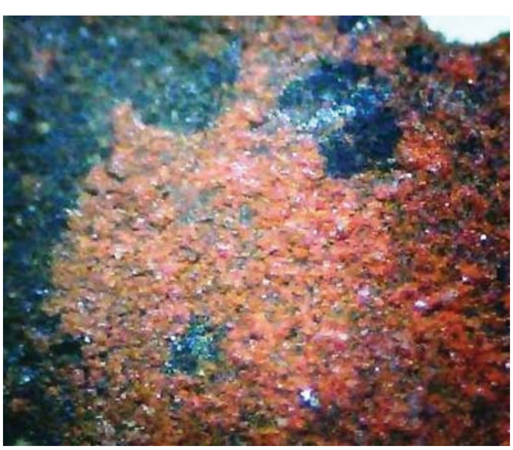


Fig. 9. Microphotograph of the top layer of paint from mound No. 21. Cinnabar pigment. ×500.

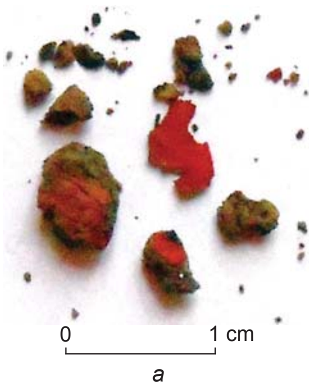
lacquer and the compounds based on *qi*-lacquer were used following the technology of alternating layers of lacquer coating, similar to the Chinese lacquer technology. Ocher and cinnabar, typical of Chinese lacquers, were discovered in the upper layers of coating. It can be assumed that there were two red shades in the painting/coloring of the lacquerware object. Such multicolor painting appears in the decoration on a fragment of the wall of a Chinese "eared" *erbei* lacquer cup (Chinese 耳 杯) (Sutyagina, Novikova, 2016) and on other Chinese products (Chu Qin Han…, 1996; Qin Han qiqi…, 2007).

Remains of lacquer coating from mound No. 31. Most of the fragments from mound No. 31 (samples from clusters No. 1 and 2) are the remains of red-black lacquerware of varying degrees of preservation. The object was painted on both sides but has not survived (Fig. 10). The lacquer coating samples are extremely brittle, and the adhesion strength of the layers is minimal. The thickness of the lacquer flakes depends on the number of layers that have preserved adhesion: from 13 μm; two layers of lacquer coating (with the primer) up to 36.5 μm. The length of the samples is 20 mm.

Some fragments of lacquer coating have been preserved completely. They are double-sided; their obverse and reverse have a bright red color. A glue of animal origin was applied over the red coating. A black layer of *qi*-lacquer colored with iron salts is visible through small losses in the red layer (Fig. 11, 12). In general, the preservation of the lacquer coating (small number of cracks, scratches, chips, etc.) makes it possible to suggest that the object was in use only for a short time before being buried.

Other fragments are coating flakes which remained after the delamination of the lacquer coating along the layer of a weak base reaching complete loss of bonding with it. The samples of such loose films have simple stratigraphy and consist of two traditional layers: red and black (Fig. 13, *a*). The remains of a regular woven structure of vegetable threads of open weave, probably of Chinese ramie nettle, have been observed (Fig. 13, *b*). As it was customary for the Chinese lacquerware technology, the fibers were soaked in a natural filming agent. Although black *qi*-lacquer was most frequently used for sizing, in our case, different glue, probably of animal origin, was applied. This may be why the "woven" layer turned out to be the weakest in this fragment of the lacquer coating.

It may be assumed with high probability that two distinct lacquerware objects were located in mound No. 31. They were differently colored: the lacquer coating of two clusters in this barrow is different. The layer of red paint from cluster No. 1 is thinner than the layer from cluster No. 2 (see Fig. 12). Apparently, one object was painted with a more liquid paint, which gave a thinner paint layer after drying. Artifact No. 2 was made in the technique of a "hollow model", without using a base. Fabric was glued upon a wooden or ceramic blank, and then the layers of lacquer coating were applied. The object was dried in a special room with necessary temperature and humidity conditions.



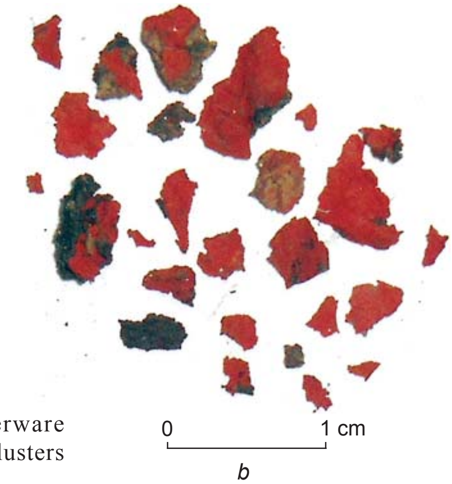


Fig. 10. General view of lacquerware fragments from mound No. 31. Clusters No. 1 (*a*) and 2 (*b*).

Fig. 11. Microphotograph of the top layer of paint from mound No. 31. Cinnabar pigment. ×720.

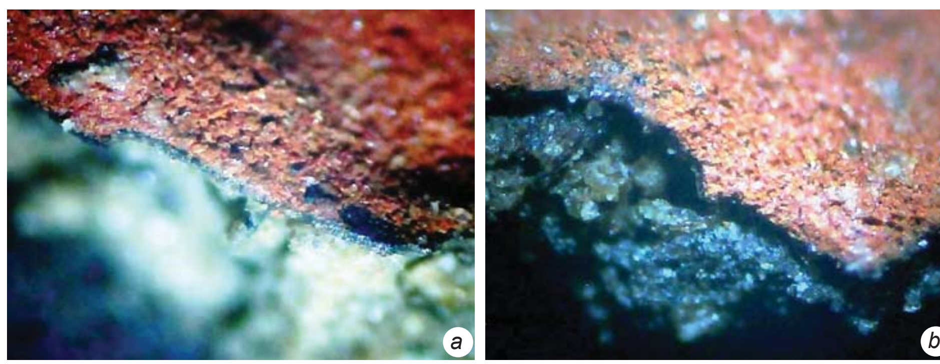


Fig. 12. Microphotograph of a section of lacquer coating from mound No. 31. Clusters No. 1 (*a*) and 2 (*b*).

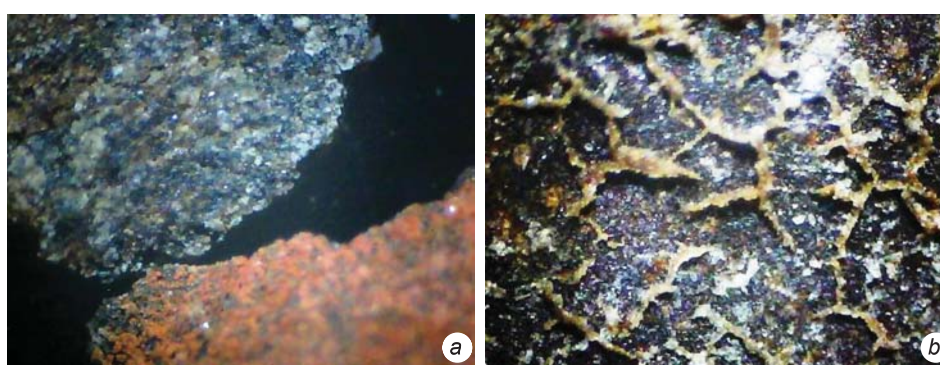


Fig. 13. Microphotograph of the top layer (obverse) and back (reverse) of lacquer coating from mound No. 31. Clusters No. 1 (*a*; ×20) and 2 (*b*; ×300).

After reaching hardness and durability, the base was removed, and the layers of coating material were applied to the inner surface of the solid lacquer coating. The object was dried again and at the last stage it was painted on both sides with thick opaque paint. The durable and light vessel has not stood the test of time. The ancient product has not reached our days in its original form, because the layers of *qi*-lacquer with the finest woven base have not survived the load of the soil. The object was broken into pieces, and the lacquer coating (due to the replacement of the *qi*-lacquer in the primer with glue) was delaminated along the weak layer.

Discussion

In their color, the artifacts from the Chineta II burial ground, which have not survived to the present day, are similar to the examples of Chinese lacquer coatings, and find parallels among the lacquer materials from the elite monuments of the Scythian period in the Altai. A study of the stratigraphy of paint layers in the samples from the site under investigation has shown that the lacquer coatings were manufactured using the traditional lacquerware technology of ancient China. The upper lacquer layers of red color (the layer of pigmented red flakes) are similar to the layers of red paint *zhu-qi* (Chinese 'zhū-qī' 朱漆, a mixture of *qi*-lacquer with cinnabar). They were applied to thin layers of dark brown *qi*-lacquer (the remains of lacquer coating from mound No. 21), and in some cases of black lacquer (fragments of lacquer coating from mound No. 31). This is consistent with the principles of the *Huainanzi* Treatise (2nd century BC) that "the craftsman may paint <the product> *only with red color upon the black* <layer>, but not in reverse order" (our italics – **the Authors**) (Lubo-Lesnichenko, 1969: 267). Similar to traditional Chinese lacquerware, the layers of the lacquer under investigation were on top of a layer of fabric made of plant fibers. In some samples of lacquer coatings, the primer of kaolin, quartz, and albite has been preserved. Thus, the stratigraphy of the layers of lacquer coating from the Chineta II burial ground and all components of their paint layers are traditional for ancient Chinese lacquerware techniques.

Among the fragments of archaeological lacquer coatings from the collection of the State Hermitage Museum, which have been found in burials in Siberia and Central Asia (Novikova, Stepanova, Khavrin, 2013; Tishkin, Khavrin, Novikova, 2008), finds from the Chineta II burial ground correspond to the fragments from the sites of the Pazyryk circle according to the cumulative data (stratigraphy, microanalysis, physical and chemical analysis). Lacquer coatings from the Chineta II cemetery differ from the lacquer coatings with complex stratigraphy found in the Xiongnu burial mounds at Noin-Ula (Elikhin, Novikova, 2013; Polosmak et al., 2011; Polosmak, Bogdanov, Tseveendorj, 2011; Polosmak, Bogdanov, 2015) in the simple application technique (a minimum of basic layers typical of Chinese lacquer coatings) and in the lack of modifiers based on vegetable oils (thus, the cinnabar was poorly ground). A finely porous ("spongy") structure of the top layer of paint is visible in microphotographs.

Among 40 lacquer artifacts from mounds No. 1–7 of the Pazyryk cemetery, 28 samples showed relative similarity in terms of coincidence of characteristic bands with the spectra of lacquer coatings from the Chineta II necropolis, and 6 samples showed definite similarity. A specific feature of many lacquer coatings from Pazyryk burial mounds is the presence of water-soluble copper salts. Notably, copper ions were present only in sample No. 1 from mound No. 21 of the Chineta II burial ground*.

Similarities between the lacquer coatings from the Chineta II site and mounds No. 3–5 of the Pazyryk burial ground, which are dated to the period between the middle and the end of the 5th century BC (Rudenko, 1953; Marsadolov, 2000) or the late 4th–mid-3rd century BC (Evraziya…, 2005: 165–166), have been found. It is also possible to draw parallels between the lacquer coatings from the burial ground under consideration and from Pazyryk mound No. 3, more precisely, with the sample No. 1685/400 with a carved bow-shaped bone onlay from a horse harness and the sample No. 1685/261. There is a similarity between the lacquer coatings from the Chineta II and the Pazyryk burials: lacquer coatings from the shield and from the components of the horse bridle in mound No. 4 (No. 1686/135 and 1686/146) and from the components of the horse bridle and saddle in mound No. 5 (No. 1687/138, 1687/144, 1687/153, 1687/156–157, and 1687/272). A distinctive imprint of fabric structure on the reverse of the lacquer coatings was a common feature in the Chineta finds and some of the artifacts from the Pazyryk mounds No. 1–5.

The remains of the lacquer coatings under consideration show a relative similarity to the fragments of lacquer coatings found during the excavations of the Bugry mound cemetery in the Altai steppe zone (Rubtsovsky District of the Altai Territory). For comparison, 12 lacquer samples from Bugry II were used: from mound No. 1 (graves 1–3) and No. 4 (grave 6 and the dromos) (Chugunov, 2014; Tishkin, 2012: 507; Sutyagina, Novikova, 2016).

A specific feature of paint from Bugry was the absence (or just traces) of tung oil. Cinnabar in the lacquer coating was coarse; the paint was highly filled. The lacquer is close in its composition to the lacquer coating from the Chineta II burial ground (containing a significant amount of iron and calcium ions, and an admixture of titanium ions). The coatings are strong and solid, since they were made using high-quality *qi*-lacquer that did not contain significant quantities of modifiers (such as tung oil), as did the later Han lacquers from the Noin-Ula burial grounds (Elikhina, Novikova, Khavrin, 2013, 2015). The greatest similarity was observed between our fragments of lacquer coating and three red and black lacquer fragments from the necropolis of Bugry II: the fragment of the wall of a Chinese "eared" *erbei* lacquer cup with painting, manufactured not earlier than late 3rd century BC, from grave 3 of mound No. 1, and presumably the fragments of cups from grave 1 of mound No. 1 and grave 6 of mound No. 4 (Sutyagina, Novikova, 2016).

Fragments of lacquer coatings from Chineta II can be correlated with the remains of lacquer coatings from the tear-shaped plate that was a part of the breast collar of a horse harness found in the Second Tuekta burial mound. The circle of parallels from the burial mounds of the Pazyryk culture could be expanded, but this is not yet possible due to the small number of comparable samples of that time in the collection of the State Hermitage Museum that retain the set of all completely preserved lacquer layers.

*Water-soluble copper salts in a burial (on things, in the soil) can be an indirect sign of the presence of inserts of bronze in the artifacts or next to them. For example, the Chinese *erbei* cups found by P. Kozlov in Mongolia, had gilded bronze onlays on their handles (Elikhina, Novikova, 2013).

Conclusions

Research of lacquer coatings from mounds No. 21 and 31 of the Chineta II burial ground in the northwestern Altai has shown that they were made using traditional Chinese materials (*qi*-lacquer, cinnabar, kaolin, and albite) and observing traditional *qi*-lacquer technology with alternating paint and lacquer layers. Thus, the remains of the artifacts with lacquer coating found in the nomadic burials represent a special category of Chinese imported goods, and a specific social marker.

Comparison of the results of analysis of ancient remains of lacquers and paints from the burial mounds of the Pazyryk culture located at the Chineta II necropolis with the lacquer coatings from mounds No. 2–5 of the Pazyryk cemetery has revealed many similarities. The high price of imported lacquerware indicates a significant social status of those buried in mounds No. 21 and 31 at Chineta II. In terms of size, these mounds are smaller than the "royal" barrows at the necropolises of Pazyryk, Tuekta, Bashadar, and Berel, but greatly exceed other structures of the Chineta II burial ground. Chinese lacquerware discovered in mounds No. 21 and 31, along with other elements of funerary rite and grave goods, make it possible to consider the buried persons to be a part of the regional elite of nomads inhabiting the northwestern Altai. In addition, it can be suggested that lacquerware objects, the remains of which were found in the burials of the Altai Mountains (the Second Tuekta mound and mounds No. 3–5 at the Pazyryk cemetery) and the Altai foothills (mounds No. 21 and 31 at Chineta II, and mounds No. 1 and 4 at Bugry), reached the nomads in the Scythian period from the single center of lacquerware manufacture of ancient China.

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A Late 16th to Early 17th Century Mongolian Ceremonial Helmet from the Moscow Kremlin Armoury

This article describes a richly decorated iron helmet from the collection of the Moscow Kremlin Armoury. The specimen has never been analyzed in detail before. It has been ascertained that it was one of the gifts sent by the Khotogoid Lama Erdeni Dai Mergen Nangso to the Russian Tsar Mikhail Fyodorovich Romanov on January 14, 1635. The helmet was handed over to the State Treasury no later than November 29, 1636, and later transferred to the Armoury. Apart from the helmet proper, the headgear in its initial condition includes a tripartite aventail made of narrow iron plates and decorated with colored velvet and silk, a cloth arming cap, and yellow satin straps, which were tied under the warrior's chin. All the organic parts have been missing since the early 1700s. The base of the apex and the peak are covered with inscriptions in Sanskrit, containing the Simhamukha Mantra. This mantra was meant to protect the warrior from adverse charms and weapons. The technological analysis suggests that letters on the base of the apex were gilded, and those on the peak, silvered. Initially, the Armoury experts identified the helmet as a "Manchu hat". The typological analysis suggests that the headgear was made by Central Asian (Mongolian or Oirat) artisans in the late 16th or early 17th century. The specimen may be used as a standard for dating and attributing randomly found and unattributed combat and ceremonial headgear worn by Late Medieval and Early Modern Central Asian nomads.

Keywords: *Moscow Kremlin, Armoury, Mongols, Khotogoids, Oirats, protective weapons, helmets.*

Introduction

Over recent decades, the Russian and international scholarly community has seen a steady growth of interest in the military history, weaponry, and military arts of Central Asian nomads of the Late Medieval and Early Modern Period. Special studies have shown that the warfare of the nomads during this historical period did not degrade, but on the contrary actively developed and adapted to the new military and political conditions of the "Gunpowder Revolution". The Mongolian and Turkic nomads of the 16th–19th centuries not only adopted new types of weaponry (guns and cannons), but also persistently improved the traditional weaponry of ranged and close combat, as well as the protective armor set (Bobrov, Borisenko, Hudiakov, 2010: 30–287; Bobrov, Hudiakov, 2008: 75–681).

A specific feature of sources concerning the armor of the Late Medieval nomads is that most of the objects of protective weaponry originated not from closed archaeological sites, but from random finds, old arsenals, private collections, etc.* This circumstance hampers dating and attribution of armor, helmets, vambraces, and shields of the Mongolian and Turkic nomads of the 16th–19th centuries. In this context, the objects of protective armor, whose place and time of production can be reliably established using written sources and typological analysis, are of special value. These objects may serve as a kind of reference materials for dating and attributing armor elements from random finds and old weaponry collections. Publishing such specialized material sources, which were previously unknown to a wide circle of specialists and lovers of military history, makes it possible to clarify many problems related to the evolution of warfare among the nomads of the 16th–19th centuries. The unpublished artifacts of the Central Asian peoples inhabiting the Great Steppe, which are kept in museum and private collections of the Russian Federation, are of particular interest from that point of view.

Collections of the Moscow Kremlin Museums include a richly decorated iron helmet (Inv. No. OR-2058), which for various reasons for a long time did not attract the due attention of Russian and Soviet scholars. Its only colored image (in three projections) was made in the first half of the 19th century by the Academician of historical painting F.G. Solntsev for the edition, *Antiquities of the Russian State*. In addition, a black-and-white photograph of the helmet full-face was published in the third part of the book, *Inventory of the Moscow Armoury* in 1884 (Opis…, 1884: Tab. 342, fig. 1). This article aims to present the helmet to a wider scholarly audience and to provide a description of its structure and decoration, as well as its dating and attribution, since this object is of considerable interest for Russian and international archeologists, weaponry experts, and military historians.

Circumstances and time of acquisition of the helmet in the Moscow Kremlin Armoury

We can establish how and when the helmet entered the Tsar's Treasury on the basis of Russian official documentation in the first half of the 17th century. For the first time, the helmet is mentioned in the report on the Embassy of the Tomsk son of a boyar Y.E. Tukhachevsky to the Khotogoid Ombo Erdeni Khong Tayiji (June 3, 1634 to May 12, 1635) (Materialy…, 1959: 203–214).

The Khotogoid State was founded at the end of the 16th century by the famous Mongolian military leader Sholoi Ubashi (1567–1627), who took the title of "Khong Tayiji" ("Grand Prince"). During the flourishing of their state, the Khotogoid rulers controlled northwestern Mongolia and a significant part of southern Siberia, and waged long (often successful) wars with their Oirat and Khalkha neighbors. Sholoi Ubashi became the first Mongolian ruler with whom the Russian State established direct diplomatic contacts (1616). Noting his military and political power, Russian diplomats (following the Oirats and the Yenisei Kyrgyz people) began to refer to the Khotogoid Khong Tayiji as Altyn Khan ("The Golden Khan"). This honorary title spread to the descendants of Sholoi Ubashi (Shastina, 1949: 385).

In the early 17th century, Russian envoys regularly visited the state of the Altyn Khans. Vasily Tyumenets went to the headquarters of the Khong Tayiji in 1616; Kazyi Karyakin in 1631; Yakov Tukhachevsky, Druzhina Agarkov, and Luka Vasiliev in 1634–1635; Stepan Grechenin and Bazhen Kartashev in 1636–1637, and Vasily Starkov and Stepan Neverov in 1638. During negotiations, the envoys discussed political, economic, and military cooperation between the Russian State and the State of the Khotogoids. At the same time, the goals of the negotiating parties differed significantly. The Moscow Government expected that the Altyn Khans would become Russian subjects and would give a corresponding *shert* (oath of allegiance), while the Khotogoid Khong Tayijis perceived the Russians only as military allies who could be used to fight their political opponents in Central Asia. Misunderstanding and mutual claims made the negotiations come to a deadlock in 1638 and resulted in the interruption of talks for 19 years (Ibid.: 384–387).

The exchange of gifts, which often included weaponry, was an important element of diplomatic etiquette in the 17th century. A portion of such gifts (the Moscow diplomats traditionally defined them as "tribute") was given to the Russian envoys on January 14, 1635*. This time, the Khotogoid Ombo Erdeni Khong Tayiji (the son of Sholoi Ubashi) and his

*The abandonment of the traditional funerary rite when the weaponry belonging to the deceased was placed in the grave together with his body was caused by the spread of beliefs among the nomads that directly or indirectly prohibited placement of objects of material culture that were not directly related to the relevant religious cult (Bobrov, Hudiakov, 2008: 44, 45).

*All dates are given according to the Julian Calendar.

spiritual adviser, the Lama Erdeni Dai Mergen Nangso, brought as a gift to the Tsar Mikhail Fyodorovich Romanov items of defensive weaponry including the helmet under consideration, "On the 14th day of January, Altyn Tsar let Yakov and Druzhina, and the Boyar's son, and the servants go home. And the Altyn Tsar made tribute from himself to the Tsar and Grand Prince Mikhail Fyodorovich of All Russia: a set of copper silvered armor with a silver breastplate, a jasper stone, snow leopard skin, two hundred sable skins, and 10 beaver skins… And the spiritual father of the Tsar, Altyn Dai Mergen Nangso, sent tribute from himself to the Tsar and Grand Prince Mikhail Fyodorovich of All Russia: a set of armor and an *iron cap lined with colored green velvet* [our italics – *the Authors*], and armor vambraces, and a snow leopard skin, and 100 sable skins" (Materialy…, 1959: 212–214). In an entry from the inventory of the Arsenal of Tsar Mikhail Fyodorovich (1642–1643), it is specified, "Helmet of damask steel with written Arab words. Sent from the Tungus lands with the armor provided with colored velvet. The price is 5 rubles. And upon inspection, on the upper part of the helmet on the base of the apex, there are silvered and gilded Arab words. The *gorodok* and the area above the *verie** are also silvered upon iron. And Arab white silvered words are on the peak. Iron upon colored velvet is attached to the ears and the back of the head". Along with the vambraces, the set with the helmet included a set of plate-sewn armor: "armor with sleeves; it has five shield plates with buttons on hinges. The armor and shield plates are covered with bad colored velvet with floral patterns of various colors. The Laba [Lama] sent it as a tribute to the Tsar in 144 (1636). The price of the armor is thirty rubles" (Opis…, 2014: 104, 105).

The further destiny of the helmet can be traced using the receipt and spending book of the State Treasury. The entry of November 2, 149 (1640) states that on this day, among other items from the Treasury, the Armoury received for storage a "helmet of damask steel; silvered Muslim words are on the helmet above the forehead. This helmet was sent to the Tsar as a tribute from Loba [Lama] Erdeni Dai Men Gerlanzu of the Tunguz lands in the year 144 (1636) on the 29th day of November, with a price of five rubles" (Opis…, 1884: 35). Thus, the analysis of the diplomatic documentation on the history of Russian-Mongolian relations in the first half of the 17th century shows that the helmet was sent as a gift to the Tsar Mikhail Fyodorovich by the influential Khotogoid Lama Erdeni Dai Mergen Nangso on January 14, 1635, and almost two years later (on November 29, 1636) it entered the Treasury, from where on November 2, 1640 it was transferred to the Moscow Kremlin Armoury.

The first detailed description of the helmet was made by the authors compiling the inventory of the treasury of the Tsar Mikhail Fyodorovich and Tsarevich Aleksei Mikhailovich, "Words are engraved on the upper frontal part of the helmet; the back and the sides of the plank [that is, the plates on the neck guard and ear guards of the aventail – *the Authors*] are covered with colored velvet, floral patterns of dark-red, and green, and yellow silk, with a price of five rubles. The Laba sent it as a tribute to the Tsar in 144 (1636)" (Opis…, 1884: 35; Opis…, 2014: 105). In the Armoury inventory of 1643, the helmet is listed as No. 5. In the inventory of 1687, it was referred to as a part of "the German and Kalmyk hats", where it was indicated under No. 3: "Iron Kalmyk hat, smooth on the lower part with an upright tube above; was sent to the Armoury from the Treasury, having a price of twenty-five *altyns*; the straps are of yellow satin… And according to the current inventory of the year 195 and upon inspection, that hat corresponded to the old inventory books; the armored ear and back pieces are covered with colored velvet; Kalmyk words are on the upper part of the hat under the upright tube and on the peak. According to the current estimate, one and a half ruble" (Opis…, 1884: 35).

The inventories of 1701 and 1711 indicate that the helmet still had the aventail during this period, but already in the documents of 1727 it was stated that "…there is no lining in the hat, and according to the present examination, there are no earpieces" (Ibid.). The helmet suffered the greatest damage during the fire of 1737. In the inventory of 1746, where it was listed in the category of "Yerikhonka hats" under No. 15, there is a note "burned" (Ibid.). Apparently, as the result of fire, the headpiece ultimately lost its plated and sewn aventail and other organic elements. In 1812, the helmet, together with other items, was taken by the President of the Imperial Academy of Arts, Privy Councilor in Deed and the well-known scholar A.N. Olenin "for research", and was returned to the museum collection only on June 18, 1843 (Ibid.: 36).

The compilers of the "Inventory of the Moscow Armoury Chamber" of 1884 systematized the documents of the past years and proposed their attribution of the helmet. They defined the head of the headpiece as a "Manchu hat" and gave a brief description, "Plated, of damask steel, raised silver words are over the forehead; the peak is box-shaped; a finely molded iron

*Embossed bands and angles on the upper part of the helmet.

upright tube is on top" (Ibid.: 35). At present, it seems possible to clarify the attribution of this helmet.

Helmet structure and decoration

According to its material, the helmet belongs to the class of iron headpieces; according to the design of the crown, to the order of riveted headpieces; and according to the shape of the skull, to the type of cylindrical-conical headpieces (Fig. 1). Its total height is 22.3 cm; the frontal-occipital diameter is 20.5 cm; the temporal diameter is 20.8 cm. The weight of the helmet is 1.2 kg.

The headpiece was riveted with four plate-sectors. Their joints are covered with wide (1.8 cm at the top, 7.5 cm at the bottom) iron bands with a cut-out edge and a front surface in relief. Each of them has two pairs of symmetrical indentations where the rivets, which connect the bands with the plates of the crown, were hammered. A clearly pronounced horizontal reinforcement rib crosses the skull of the helmet and gives the headpiece a characteristic cylindrical-conic silhouette. The upper parts of the plates of the crown and the overlays are covered with a weakly expressed pattern in relief made in the technique of metal embossing. The pattern (about 8.0 cm wide) is composed of a series of repeating Y-shaped symbols (Fig. 1). The employees of the Armoury in the 19th century called such ornamental decoration "paths connected with each other by small towns" (Opis…, 1884: 37). In the modern weaponry literature, it is called a "two-fingered palmated" pattern (Bobrov, Hudiakov, 2008: 437).

An additional fastening element of the crown's plates is the band, which is an iron strip with an even edge (3.5 cm wide); its ends are connected at the back of the headpiece (Fig. 1, *d*). Eight rivets with hemispherical heads (0.35 cm in diameter) were driven along the upper edge of the band for connecting it with the plates of the crown and the overlays. Twelve through holes for attaching the aventail were punched along the bottom edge of the band.

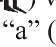
A "box-shaped" peak, consisting of a horizontal pentagonal "shelf" (14.5 cm long) and vertical "shield" (1.0–1.7 cm wide), was riveted to the frontal part of the helmet. The peak was attached to the crown with three rivets hammered into the mounting plate on the inside of the helmet skull. The edges of the "shelf" and "shield" are equipped with a convex rim (Fig. 1, *a–c*). The surface of the peak is covered with relief inscriptions in Sanskrit (see below), made in the technique of chased engraving (the convexity of the elements is achieved by removing the background metal with a graver). Initially, the markings were silvered, but later (possibly in the fire of 1737) the silvering was mostly lost.

The helmet is topped by an apex consisting of a base (*podvershie*) and upright tube-socket for the plume. The base has the form of a short cylindrical thimble with a convex rim along the lower edge (2.2 cm high; 4.3 cm in diameter at the top, and 5.1 cm in diameter at the bottom). The sides are covered with gilded inscriptions in relief in Sanskrit (see below). The upper part of the base is decorated with images of eight convex three-petalled buds covered with gilding. Rivets for attaching the apex to the plates of the skull are hammered between the buds. The plume socket is a hollow upright tube (7.3 cm high, 1.2 cm in diameter) with three washer-like fittings in the lower, central, and upper parts (1.7 cm in diameter, 2.0, 1.7, and 1.8 cm high, respectively). The fittings are pentahedral and taper towards their middle parts.

The use of gilding and silvering in the decoration of the helmet was confirmed by an expert on precious metals and jewels of the Moscow Kremlin Museums, N.V. Parmenova. The analysis was carried out using a Prisma-M (Au) energy dispersive X-ray fluorescent unit. Notably, low assay gold with a high content of silver was used. Thus, the concentration of gold on the base was 53.46 %; the concentration of silver was 27.99 %. The silver content on the peak was 78.90 %.

The inscriptions in Sanskrit, placed on the peak and the base (Fig. 2) are of considerable interest. They were translated and analyzed by V.P. Zaitsev, Researcher at the Department of the Far East of the Institute of Oriental Manuscripts of the Russian Academy of Sciences. It was established that all three inscriptions (one on the base and two on the peak) were written using the "Lantsa" ("Ranjana") alphabet. Each inscription consists of 17 characters and is read from left to right. The inscription on the vertical "shield" of the peak is divided into four parts of three, six, five, and three characters, respectively. The writing style on the base is slightly different from the style of characters on the peak. All three inscriptions are almost identical and transmit the same text. The inscription on the peak contains an error. Transliteration of the text on the base is as follows:

"// a ka sa ma ra ca śa ta ra sa ma ra ya pha ḍa :".

On the peak, the syllable "o" () was mistakenly written instead of the first syllable "a" ():

"// o ka sa ma ra ca śa ta ra sa ma ra ya pha ḍa :".

Fig. 1. Helmet from the Moscow Kremlin Armoury (Inv. No. OR-2058).
a – front view; *b* – left view; *c* – right view; *d* – back view.

Fig. 2. Drawing of the inscription on the base of the helmet's apex (by V.P. Zaitsev).

The orthography of the inscriptions on the helmet suggests that this text was “translated” (copied using the “Lantsa” alphabet) from the Tibetan version:

“a ka sa ma ra tsa sha da ra sa ma ra ya phaT :”.

The text is a mantra of the Lion-headed or Lion-faced Dakini (Simhamukha). The mantra performed a protective function, was used for “repelling murder” and “repelling the enemies”, helped to deflect the enemy’s magical impact, and protected against enemy weapons. According to the tradition, even simple wearing of a mantra on the body had a protective effect. Despite such characteristics, this mantra occurs extremely rarely on the combat headgear of the peoples of Central and East Asia. At present, the helmet from the collection of the Moscow Kremlin Armoury is the only headpiece of the series decorated with such inscriptions.

The organic elements of the helmet were lost in the first half of the 18th century (see above), but thanks to the inventories of 1640, 1687, 1727, it is possible to clarify some features of their cut and design. Thus, it is known that originally the headpiece was equipped with an aventail consisting of three elements: a pair of earpieces (“side pieces”, “ears”) and the back piece (“back”, “back of the head”). The aventail had a plate-sewn (“armored”) structure of armoring. The iron plates (“planks”) were riveted to the inner side of the organic base in such a way that only the rivet heads were visible on the outside. The aventail was covered with a special sheath of silk and brocade of green, yellow, and red colors, decorated with an embroidered floral ornamental pattern (in the inventory of the treasury of Tsar Mikhail Fyodorovich and Tsarevich Aleksei Mikhailovich, they were called “herbs”). A cloth arming cap (“lining”) was attached to the inner side of the skull. The helmet was additionally fastened on the head with special straps of yellow satin, which in the fighting position were tightened under the chin of the warrior (Opis…, 1884: 35).

Discussion

Iron riveted helmets made of four plate-sectors and four wide onlays with two pairs of indentations are a typical kind of combat headgear of the warriors from Central Asia and southern Siberia of the Late Medieval and Early Modern Period (Bobrov, Hudiakov, 2008: 425, fig. 153; p. 434, fig. 165, *1*; 167, *1–3*; p. 439, fig. 171; Bobrov, Myasnikov, 2009: 236, fig. 1; p. 237, fig. 2; p. 238, fig. 3; p. 240, fig. 4; LaRocca, 2006: 69, 87). However, it should be noted that the vast majority of the Mongolian, Oirat, Tibetan, Bhutanese, and Buryat helmets of this series have spherical-conical or hemispherical shapes. Riveted cylindric-conical headpieces are not generally typical of the defensive armor of nomads inhabiting the region, yet they were typical of the Manchu (and more broadly the Later Jin, Qing) panoply of the 17th–19th centuries. Probably, precisely this fact allowed the employees of the Armoury in the 19th century to define the helmet in question as a “Manchu hat” (Opis…, 1884: 35).

Such an attribution seems erroneous. With the exception of the silhouette of the skull, the helmet has little in common with uniform Manchu cylindrical-conic “zhou” skulls. The crown of these helmets was traditionally riveted not of four–eight iron sectors, but only of two large curved plates supplied with a horizontal reinforcement rib (Bobrov, Hudiakov, 2003: 197, tab. 16, fig. 11–13, 15, 16, 18). The Qing onlays (“lian”) covering the joints of the plates, were convex and narrowed, with an even, not jagged edge (Ibid.). In the rare cases when they were supplied with indentations, the indentation had the shape of a three-petalled bud (Ibid.: Tab. 16, fig. 11). An almost mandatory element of the Manchu “zhou” hats was a massive forehead “hue” plate with cutouts above the eyebrows, which is absent in the helmet under consideration.

The wide iron band riveted on the back of the head is typical of the Mongolian, Oirat, and southern Siberian headgear of the 16th and 18th centuries, while it is extremely rare for the Qing helmets (Bobrov, Hudiakov, 2008: 425, fig. 153, p. 427, fig. 155, p. 428, fig. 156, 157, p. 429, fig. 158, 159, p. 430, fig. 160, p. 431, fig. 162, p. 435, fig. 168, p. 436, fig. 169, p. 438, fig. 170, p. 440, fig. 173, p. 441, fig. 174, p. 443, fig. 175, p. 444, fig. 176, p. 445, fig. 177). The plate-sewn aventails were attached to the Manchu helmets using massive rivets with hemispherical heads (which survive in most cases even after the loss of the aventail). However, the holes on the headpiece under consideration are empty, which suggests that the aventail was attached to a leather strap stretched through those holes. Such a system of hanging the aventail often appears on the Mongolian, Oirat, southern Siberian, Tibetan, and Bhutan headpieces of the 16th–19th centuries (Bobrov, Hudiakov, 2008: 420, 440, fig. 173, p. 441, 449, 460, fig. 190, *2*, *3*, p. 467).

“Box-shaped” peaks consisting of a horizontal pentagonal “shelf” and vertical “shield” are a classic element of face protection on the Central and East Asian helmets of the 15th–19th centuries (Ibid.: 418, 421, 426, 432, fig. 167, p. 440, fig. 173; p. 441, 443, 444, 446, 447, 450–452). The peculiarity of the object in question results from its decoration pattern. At present, we know of 59 Oirat, Mongolian, and Qing helmets decorated with Buddhist symbols. Inscriptions with religious content have been found on 45 of them. However, in all known cases they were made on the crown or in rare cases on the band. The helmet from the collection of the Moscow Kremlin Museums is the only example of a series where the inscriptions cover the "shelf" and "shield" of the peak. The technique of their application also shows marked specificity.

The base of the apex (*podvershie*), made in the form of a short cylindrical thimble with a convex rim along the bottom edge, does not have exact parallels among the known headpieces of Central and continental East Asia. In its construction and silhouette, it occupies an intermediate position between the almost flat bases of Oirat spherical-cylindrical helmets, and the bases in the form of a high cylinder tapered in the center of Ming, Qing, and Korean helmets (Bobrov, Hudiakov, 2003: 197, tab. 16, fig. 12, 13, 15, 16, 18, 19; Bobrov, Hudiakov, 2008: 440, fig. 173, p. 441, fig. 174, p. 444, fig. 176; LaRocca, 2006: 65, 86). The closest to our helmet are the thimble-like bases of the Central Asian (Oirat?) helmets from the territory of the Volga region, Kazakhstan, and Mongolia (spherical-cylindrical helmet No. 1233 from the collection of the State Hermitage) (Bobrov, Hudiakov, 2008: 432, fig. 163), but their silhouette and decoration are significantly different. The upright tube-socket of our headpiece, equipped with three facetedhead-pieces, belongs to rare varieties of Central Asian plume sockets of the 15th–18th centuries, and occurs on some Mongolian and Oirat helmets of that period (LaRocca, 2006: 73; Bobrov, Hudiakov, 2008: 418, 444).

The pattern in relief similar to the tracks of two-toed bird paws is absolutely atypical of Manchu headgear, but can be found on Oirat helmets of the 17th century (Bobrov, Hudiakov, 2008: 429, 438; LaRocca, 2006: 87). Notably, the decoration of the Far Eastern "zhou" helmets of the 17th–19th centuries shows essential differences from the helmet under consideration (Bobrov, Hudiakov, 2003: 197, tab. 16, fig. 11–13, 15, 16, 18).

In the first half of the 17th century, both Central and East Asian helmets were provided with plate-sewn aventails. The coloring of the Manchu aventails was strictly unified and regulated. Thus, yellow aventails were added to the helmets of the elite corps of the "Yellow Banner" and the "Bordered Yellow Banner". However, according to the imperial regulations, yellow fabric was combined not with green (as on the helmet in question), but with red (edging) and blue (lining) colors. As far as the Oirat plate-sewn armor is concerned, yellow-green colors, on the contrary, occur quite often in their decoration. Thus, for example, a tripartite aventail, covered with green cloth, is kept in the collection of the Tobolsk State Historical and Architectural Museum-Reserve, and a Dzungarian laminar armor "robe" with yellow cloth covering, green edging, etc. is kept in the Museum of Archaeology and Ethnography of Siberia at Tomsk State University (Bobrov, Hudiakov, 2008: 448, 449, 466–468; Bobrov, Ozheredov, 2010: 25). Thus, the color choice of the aventail on the helmet from the collection of the Moscow Kremlin Museums also shows that it is closer to the headpieces of the Mongolian-speaking nomads inhabiting Eurasia in the period under consideration.

The combination of Central Asian technologies and structural and decorative solutions with a cylindric-conical skull allows the conclusion to be drawn that the artisan-creator of the helmet followed the Central Asian military and cultural tradition, but was familiar with the products of Manchu gunsmiths. If he lived on the territory of Mongolia, the helmet could have been manufactured not earlier than the late 16th century. If the headpiece was made by Oirat artisans, it must have occured most likely from the 1610s to the first half of the 1630s. In both cases, the lower border of the period when the helmet decorated with Buddhist symbols could have been made can be reliably established from the time of the spread of Lamaism among the Mongols and Oirats (Zlatkin, 1983: 98–103). In this context, the person of the helmet donor becomes of considerable interest.

Erdeni Dai Mergen Nangso-lama* was a part of the highest elite of the Northern Mongolian state of the Altyn Khans. He was the most famous and respected representative of the Lamaist church in the state of the Khotogoids and served as the spiritual mentor of the Ombo Erdeni Khong Tayiji and his closest relatives. The Russian envoys publicly called the Lama "the teacher of the Mughal land, the spiritual father of Altyn Tsar and his mother Chechen-Tsarina, and his brothers", "the spiritual father of all Mughal Noyans and herdsmen of the Tangut land", etc. (Materialy…, 1959: 207–214; Opis…, 2014: 104, 105). The high-ranking Lama lived in the Altyn Khan's domain "for

*In the Russian sources of the first half of the 17th century, the spiritual instructor of the Khotogoid Khong Tayiji is called the Tangut (that is, the Tibetan) laba Irdenei Dain Mergen-lanzu, Dain Mergen-lanzu, Tai Mergen-lanzu, Irdenei Dain-men Gerlanzu, etc.

hire; in a year he receives a hundred sheep, serves him according to their faith, and in Russian terms is instead of a priest" (Shastina, 1949: 387).

Erdeni Dai Mergen Nangso actively participated in the political life of the state of the Altyn Khans, received ambassadors, conducted diplomatic negotiations, etc. In addition, he often traveled around the region. In his own words, the Lama "visited… the Chinese and Tangut lands [i.e., Tibet – *the Authors*], and the Black Kalmaks [i.e., Oiratia – *the Authors*], and many other lands" (Russko-kitaiskiye otnosheniya…, 1969: 109–111; Opis…, 2014: 104, 105). Erdeni Dai Mergen Nangso also travelled a lot around Mongolia. Apparently, the Lama was given our helmet as a gift during one such trip. Such a practice of offering weaponry to the Lamaist priests was widespread among the Central Asian nobility in the historical period under consideration (Bobrov, Hudiakov, 2008: 48).

In the mid 1630s, Erdeni Dai Mergen Nangso, among other wealth, owned a military arsenal including elite weaponry objects of foreign and local production. Thus, for example, the Lama had a richly decorated Late Jurchen (Manchu) helmet, which he gave as a gift to Tsar Mikhail Fyodorovich in 1637 (Opis…, 1884: 19, 39; Opis…, 2014: 105). As follows from the description of the armor, the core of the weaponry collection of the Altyn Khans' spiritual advisor consisted of the products of Central Asian and primarily Mongolian artisans (Opis…, 1884: 39; Opis…, 2014: 104, 105).

Domestic production of armor was rapidly developing in 17th century Mongolia. According to the reports of the Ambassadors of Daisha-zaysan, "They have plenty of iron ore, and they make armor, and brigandines, and spears on their own" (Bobrov, Hudiakov, 2008: 353). In addition, a number of suits of body-armor reached the Khotogoids as tribute from the peoples of southern Siberia (Ibid.: 348). Thanks to a purposeful policy aimed at the development of weaponry production, the Altyn Khans, as well as their Khalkha and Oirat neighbors, managed to form large contingents of armored (*kuyashnaya*) cavalry. In the Russian documents of the 17th century, detachments of Central Asian nomads of 400, 2000, 4000 *kuyashniks* are mentioned (Ibid.: 360, 361). Such cavalry armored units, trained in close combat using long pole and bladed weapons, were the main striking force of the army of the Khotogoid Altyn Khans in the mid 1630s, "The Mughal Altyn people go to combat with bows, spears, and sabers; there are no firearms. And they go to battle against their enemies wearing armor, brigandines, helmets, vambraces, and poleyns, while some more wealthy people on the battlefield have horses wearing iron armor and other implements" (Ibid.: 558).

It seems quite logical that for demonstrating his wealth and influence, Erdeni Dai Mergen Nangso might have given the Tsar a gift of armor of both foreign and local production. If our helmet of the Central Asian type was sent to Moscow in 1636, the headpiece forged by Manchu armorers (Inv. No. OR-2057) was sent in 1637.

Conclusions

A comprehensive analysis of the sources has made it possible to specify the time of manufacturing and the attribution of the helmet from the collection of the Moscow Kremlin Museums (Inv. No. OR-2058). Thus, the suggestion by the employees of the Armoury in the 19th century as to the Manchu origin of the headpiece was not confirmed. Most likely, the helmet was made by Mongolian or Oirat artisans in the late 16th to the first third of the 17th century. Theoretically, some changes in the construction of the headpiece and its elements could have been introduced until the middle of January, 1635. The helmet was commissioned by a noble Central Asian feudal who confessed Lamaism (and hence the Buddhist mantras on the base of the apex and peak). In the mid 1630s, the owner of this headpiece was Lama Erdeni Dai Mergen Nangso, the spiritual advisor of the Khotogoid Khong Tayiji. At the reception on January 14, 1635, the helmet was handed over to the Russian envoy Y.E. Tukhachevsky as a gift to the Tsar Mikhail Fyodorovich Romanov. In 1636, this headpiece entered the State Treasury from where it was transferred to the Moscow Kremlin Armoury in 1640. Availability of written evidence that reliably localizes the time of this helmet's functioning makes it possible to use it as a reference example for dating and attributing combat headpieces of Central Asian nomads of the Late Medieval and Early Modern period.

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Dendrochronological Methods in the Architectural and Ethnographic Study of Russian Towns in Siberia: The Case of Tara, Omsk Region

This study focuses on the use of dendrochronological methods in architectural and ethnographic surveys, particularly with reference to early Russian towns in Siberia. These methods are used for the tentative dating of eight architectural constructions in the town of Tara. The standard dendrochronological technique includes the use of the calibrated tree-ring chronology relating to the study area, and the relative chronology built using samples from a specific site. The method has numerous advantages, but also certain limitations, such as difficulties with dating partially reconstructed buildings. These difficulties can be overcome when using a multidisciplinary approach. As a result, the time of construction and reconstruction of several buildings in Tara has been evaluated, and a 419-year-long tree-ring chronological scale has been constructed, spanning the period from 1596 to 2015. This will facilitate the dating of 17th–18th-century wooden architectural constructions in western Siberia.

Keywords: *Western Siberia, Russian towns, wooden architecture, dendrochronological analysis.*

Introduction

Architectural and ethnographic survey is one of the first stages in the identification and preservation of immovable objects of cultural heritage (buildings and other structures). It involves several types of research (historical and bibliographic studies, field surveys, architectural measurements, etc.) and is performed using its own set of methods (analysis of academic literature and sources, participant observation, questionnaire surveys, recording of measurements, creation of large-scale orthogonal drawings of plans, facades, cross-sections, individual elements, etc.). Use of a multidisciplinary approach to the study of immovable objects of cultural heritage is due to the fact that architecture is a complex and multidimensional cultural phenomenon. A significant problem is establishing the time when the buildings were constructed. The humanities use various dating methods, yet, dendrochronology as a field of the natural sciences makes it possible to obtain objective data on the functioning of the material component of buildings and structures (Goryachev, Myglan, Omurova, 2013; Zharnikov, Vizgalov, Knyazeva et al., 2014; Zharnikov, Rudkovskaya, Vizgalov, Myglan, 2014; Myglan, Vedmid, Mainicheva, 2010; Myglan et al., 2010; Myglan, Slyusarenko, Mainicheva, 2009, 2010; Shiyatov et al., 2000; Shiyatov, Khantemirov, 2000). All these studies focus on individual immovable objects of cultural heritage and not on comprehensive architectural and ethnographic research of populated areas. The novelty of this article is that it deals with some aspects of dating architectural monuments in the town of Tara using the dendrochronological method within the framework of the architectural and ethnographic survey of settlements.

The town of Tara was founded on the left bank of the Irtysh River in the autumn of 1594 for uniting new territories to the south of Tobolsk with the Moscow State and creating conditions for the ultimate defeat of the Siberian Khanate (Miller, 1999: 280–281). Since that time and until the early 19th century, the town was a key outpost protecting the Russian lands from threats coming from the Kazakh steppes (Tataurov, 2012). Currently, Tara is the administrative center of the Tarsky District of the Omsk Region. Many monuments of wooden architecture have survived in the historical part of the town. The lack of documents on the time of their construction has fostered the need to use the dendrochronological method for determining the age of architectural monuments and confirming their historical and cultural status.

Methods and materials

In the context of a multidisciplinary approach, the study used architectural-ethnographic and dendrochronological methods.

Architectural and ethnographic survey. As a result of observation, analysis of the available sources and academic literature, as well as photographic recording, it was possible to describe the architectural features of eight historical buildings investigated in 2014–2015, and establish their preliminary dating. These buildings constitute a part of the cultural heritage of the town of Tara.

The house at the address of Sovetskaya 7 is a building with a transverse inner, structural wall (*pyatistenok*), paneled on the outside with wide boards. Corners with projecting ends of the outer logs and of partition walls are covered with pilasters. The roof is two-sloped; currently it is covered with asbestos slates and has a profiled cornice extending far beyond the walls and a frieze with an overlaid triangular carving. There are six windows on the street facade (with rectangular endings of window frames and paneled shutters), three windows on each of the side facades, and one window on the yard facade. The entrance to the building is in a wooden addition located in the yard. At present, the house is abandoned.

The house at the address of Sovetskaya 9 is the former house of the merchant V.I. Serebrennikov (Fig. 1) (Tsaregorodtseva et al., 2012: 62). The uyezd treasury used to operate in this long, two-story house (Gumenyuk, Lyalikov, 2014: 252), which is rectangular in plan view with an added entryway and a corridor-enfilade internal layout. The upper story is paneled with planks; the ends of the outer logs and of the partition walls are covered with pilasters. The first floor is built of brick and is decorated with a multi-row cornice. The windows are decorated with a continuous narrow cornice with medallions. The entrance to the building is from the main facade; at present, the entrance is boarded up. The style of architecture is eclecticism, combining elements of Classicism and folk motifs. The house has the status of a monument of history and culture of regional importance.

The house at the address of Sovetskaya 16 is the former house of the lawyer Korikov-Mikhailov. The administration of public organizations and a library operated in the building in the 1920s, then the district department of culture, and later the registry office. This two-story, wooden building made of logwork on a stone pedestal is covered with planks. The rectangular plan has an addition with an intricate figurate roof on the south side, and an entryway on the east side. The enfilade system is dominant in the arrangement of the interior space. The style of architecture can be defined as eclecticism with elements of the Siberian Baroque. The building is interesting due to its rows of windows: six large windows appear on the second floor of the street facade, including one in a two-story addition, and five subsquare windows are located on the first floor. All the windows are decorated with beautiful carved frames. High wooden gates with a door, which have not survived, are visible in the photograph taken in 1927; the gateposts were decorated with pilasters. The building has the status of a monument of history and culture of regional importance. Insignificant reconstruction (replacement of the entrance door) has been made in the building.

The house at the address of Dzerzhinskogo 11 is the former house of the Smorodennikovs. It is a two-story, extended building, rectangular in plan view, "with two parts connected". The walls are made of 20 rows of logs using saddle notches, with projecting butts of the logs. There is a high stone foundation. At present, the roof has not been preserved. Five arched windows are located on the street facade of the second floor; the upper elements of their carved frames are richly decorated. Five small semicircular windows closed with shutters are symmetrically arranged on the first floor. The style of the

Fig. 1. House at the address of Sovetskaya 9.

house is eclecticism with the elements of folk architecture. The house shows some features of an object of cultural heritage, but has not been registered.

The house at the address of Dzerzhinskogo 13 is the former house of the town dweller M.I. Shklyaeva and a typical example of an urban, two-story, wooden building, rectangular in plan view, "with two parts connected". It was made using saddle notches, with projecting butts of the logs; the walls consist of 27 rows. The facades have numerous windows with richly decorated frames and shutters. Traditionally, they are larger in size on the second floor than on the first floor. The building stands on a stone foundation with air drains, which slightly rises above the ground surface. A hipped roof with four sloping surfaces has a carved cornice and undercornice boards.

The abandoned house near Yubileynaya Square is the former house of a Tara merchant of the second guild, Y.V. Orlov. It is in a ruined state. A brick semi-basement and the first floor have survived; the second floor, which was made of logs, is now destroyed. Numerous windows are simple in shape and currently do not have frames. The house stands on a hill slope and its unusual volumetric solution was caused by significant difference in elevation. One facade has three stories including the semi-basement, while the opposite facade has only two stories. The rectangular plan of the building is complicated by the addition of a two-story entryway. The house is significant in size and stands out in its monumentality.

The house at the address of Nerpinskaya 48, the former house of the merchant I.F. Nerpin, was built as an orphanage (Fig. 2). Currently, a youth outdoor club and an evening school are located in the building. This three-story L-shaped house is an archetypal stone building of merchants from the early 19th century in the style of Classicism (Tsaregorodtseva et al., 2012: 63). A hipped roof with four sloping surfaces is covered with iron sheets and is decorated with a cornice projecting a considerable distance from the walls. The stories of the building are separated from each other by a cornice with multi-row corbelling. The windows of the second floor are decorated with head mouldings and medallions. As a result of repair and restoration work, many of the windows have lost their decoration. The entrance to the building is from the side facade.

The barn at the address of Aleksandrovskaya 89 is an extended building made of four interconnected, square log constructions (Fig. 3). The walls were made of 11 rows of logs using saddle notches, with projecting butts of the logs. The roof is two-sloped and covered with iron sheets; a dormer window with bow-shaped upper part was cut under the roof on the front facade. Two-winged gates are located at the side of the building. A window with a bow-shaped upper part can be seen on the side facade of the first square log construction.

According to the data available in the literature and specific features of architecture, all buildings can

Fig. 2. House at the address of Nerpinskaya 48. Photograph of the Soviet period, provided by S.A. Alferov.

Fig. 3. Barn at the address of Aleksandrovskaya 89.

be approximately dated from the mid-19th to the early 20th century (Ibid.; Spisok…, 2015).

Dendrochronological dating. A standard method of monument dating was used. This method involves the availability of two components: the generalized indexed tree-ring chronology bound to the calendar scale for the research area, and a relative tree-ring chronology compiled using the samples from a particular historical monument. For reliable dating, these tree-ring chronologies must intersect with each other at a section of at least 60–100 years.

Laboratory processing of the samples and measuring the width of annual rings were conducted using a LINTAB semiautomatic unit (with an accuracy of 0.01 mm). The measured series of growth were dated by a combination of graphical cross-dating (Douglass, 1919) and cross-correlation analysis in the specialized DPL (Holmes, 1984) and TSAP system V3.5 (Rinn, 1996) software package for dendrochronological research. The age trend from the tree-ring series was removed using a spline of two-thirds of the length of the individual chronology using the ARSTAN software (Cook, Krusic, 2008).

For compiling the generalized indexed chronology for the research area in 2014–2015, six timber sites were chosen within a radius of 20 km from the town of Tara. Because of massive wood harvesting in the past, considerable time was spent on searching for sites with trees whose age would be over one and a half centuries. Chronologies were built for two main forest-forming species: Scots pine (*Pinus sylvestris* L.) and Siberian larch (*Larix sibirica* Ledeb.). The cores were extracted with the help of an increment bore using a standard technique at a height of 1.3 m from the ground surface (Shiyatov et al., 2000). A total of 81 core samples was taken from six sites. For clarifying the architectural and planning dates, 94 cores were extracted using a special drill for dry wood from eight buildings (from roof beams, house walls, and boards of window and door openings).

Results and discussion

The measured growth series of living trees (Scots pine and Siberian larch) were cross-dated. Samples that showed abnormal growth (hard streaks, traces of exposure to ground fires, etc.) were excluded from the sampling. As a result, six tree-ring chronologies were built for the selected sites: Nec_pin, Ced_pin, Berg_pin, Ants_pin, Anls_pin, and Ced_larx. The analysis of five chronologies of Scots pine has shown that the annual variability in the width of annual rings was insignificant, and individual growth series were characterized by the presence of significant age trend. Given the small distance of the sampling sites of pine trees from each other and good consistency of growth, the chronologies were averaged, which resulted in compiling a 214-year-old generalized Pin_std tree-ring chronology for Scots pine. Correlation analysis of the standardized chronologies for Scots pine and Siberian larch (Ced_larx, 314 years) has shown the absence of a common signal between them (the correlation coefficient was insignificant). Thus, determining the tree species of the samples was of fundamental importance for dating historical monuments. The analysis of the collection of samples from the surveyed buildings has shown that pine wood was the main building material. Therefore, the Pin_std tree-ring chronology was used for dendrochronological dating of wood from the monuments.

For creating relative ("floating") tree-ring chronologies, individual growth series for each building were cross-dated and standardized. The subsequent cross-dating of the "floating" chronologies has shown that four of them (sov7, dz11, nch48, and amb) have a total overlap period of 70 years (the average value of the correlation coefficient was 0.61; Fig. 4). For establishing the calendar time for the construction of the buildings, all chronologies were compared with the Pin_std tree-ring chronology for living trees. As a result, five of the "floating" chronologies were linked to the calendar scale, including sov7 (Sovetskaya 7) – 1882, sov9 (Sovetskaya 9) – 1954, dz11 (Dzerzhinskogo 11) – 1858, nch48 (Nerpinskaya 48) – 1842, and amb (Aleksandrovskaya 89) – 1907 (Fig. 4). The information on the number of dated samples from the surveyed objects is provided in the *Table*. Buildings that could not be dated (Sovetskaya 16; Dzerzhinskogo 13, and the abandoned house near Yubileynaya Square) were most likely transported from afar or were built from wood harvested at remote sites upstream, where another set of external factors influenced the growth of trees.

An important result of the work was the extension of the Pin_std tree-ring chronology into the past using an averaged chronology of architectural monuments (the Pearson correlation coefficient was 0.34 for the period from 1850 to 1950; Fig. 5). Thus, a 419-year long "Tara" tree-ring chronology was obtained, covering the period from 1596 to the present. On the basis of the dendrochronological analysis, the calendar time for the construction of five buildings has been determined.

The house at the address of Sovetskaya 7. Samples (11 spec.) were taken from all main wooden elements of the building. Only three of the samples were dated. The average value of the interserial correlation coefficient was 0.39 (see *Table*). The dates when the peripheral rings were formed in three samples varied over a very wide interval (1795–1882). Since the subcrustal ring was not preserved in any of them, it can only be assumed that timber for the construction was harvested not earlier than 1882, and the house was built not earlier than the 1880s. For refining the dendrochronological dating, it is necessary to supplement the collection of samples from the object of research.

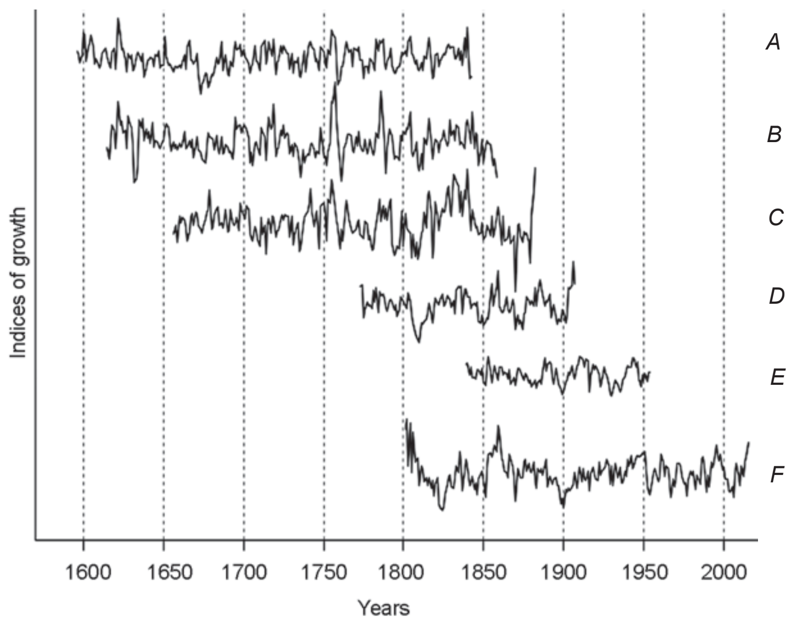

Fig. 4. Cross-dating of tree-ring chronologies compiled from surveyed objects in the town of Tara.
A – Nerpinskaya 48; *B* – Dzerzhinskogo 11; *C* – Sovetskaya 7; *D* – Aleksandrovskaya 89; *E* – Sovetskaya 9; *F* – Pin_std tree-ring chronology.

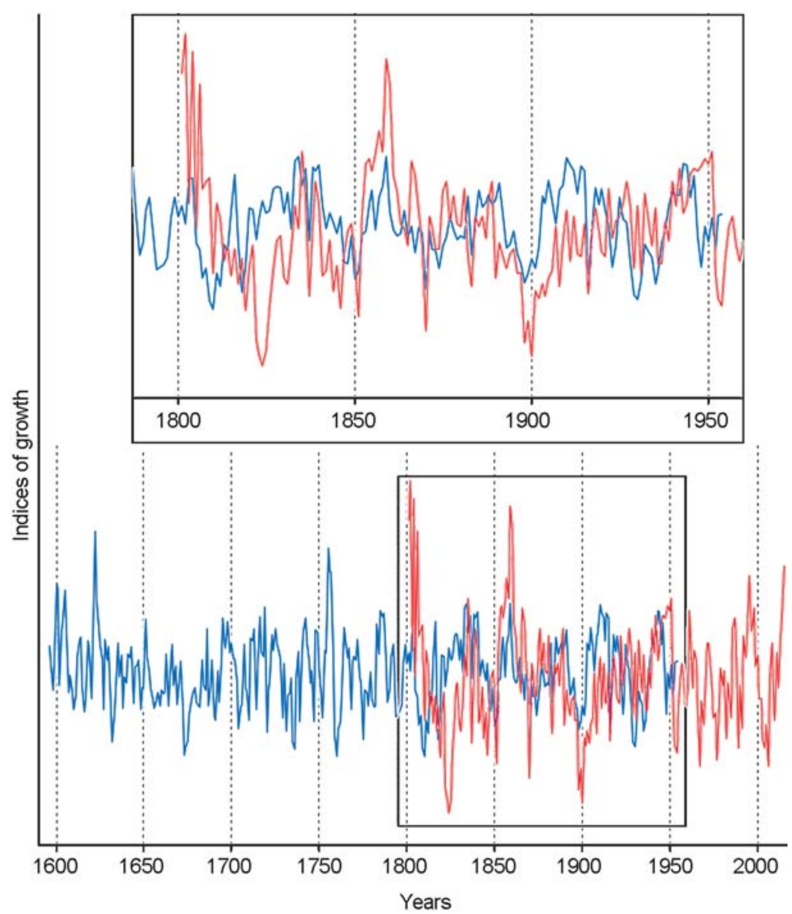

Fig. 5. Cross-dating of the "Tara" generalized tree-ring chronology (blue line) and "Pin_std" tree-ring chronology (red line).

Description of the samples of historical timber from the buildings of Tara

No.	Laboratory code	FR	PR	R	SD	Sampling location
1	2	3	4	5	6	7
			Sovetskaya 7			
1	sov7_6	1672	1882	0.353	0.356	Top beam
2	sov7_2	1687	1852	0.34	0.291	"
3	sov7_11	1656	1795	0.473	0.25	Northwestern wall, 4th layer of logs
4	sov7_4	Not datable				Top beam
5	sov7_1	"				"
6	sov7_9	"				"
7	sov7_10	"				"
8	sov7_8	"				Northwestern wall, 3rd layer of logs
9	sov7_7	"				Ditto, 7th layer of logs
10	sov7_5	"				Southeastern wall, 5th layer of logs
11	sov7_3	"				Ditto, 3rd layer of logs
			Sovetskaya 9			
12	sov9_01	1840	1954*	0.317	0.198	Top beam
13	sov9_02	1847	1954	0.596	0.19	"
14	sov9_03	1839	1954	0.431	0.385	"
15	sov9_04	1853	1954*	0.605	0.189	"
16	sov9_05	1841	1954*	0.603	0.195	"
17	sov9_06	1842	1954	0.528	0.244	"
18	sov9_07	1867	1952	0.42	0.247	"
19	sov9_08	1839	1954*	0.417	0.194	"
20	sov9_09	1859	1948	0.69	0.241	"
21	sov9_10	1861	1954	0.513	0.212	"
			Dzerzhinskogo 11			
22	dz11_10	1617	1844	0.43	0.304	Eastern wall, 6th layer of logs
23	dz11_2	1633	1858	0.292	0.27	Ditto, 7th layer of logs
24	dz11_3	1647	1828	0.386	0.415	
25	dz11_12	1615	1849	0.515	0.321	Ditto, 8th layer of logs
26	dz11_6	Not datable				Southern wall, 1st layer of logs
27	dz11_7	"				Ditto, 2nd layer of logs
28	dz11_8	"				
29	dz11_4	"				Ditto, 5th layer of logs
30	dz11_1	"				Eastern wall, 7th layer of logs
31	dz11_13	"				Partition wall, 3rd layer of logs
32	dz11_5	"				Ditto, 4th layer of logs

Table (end)

1	2	3	4	5	6	7
33	dz11_11	Not datable				Top beam, 2nd floor
34	dz11_9	"				Top beam
			Nerpinskaya 48			
35	nch48_02	1695	1829*	0.404	0.223	Top beam
36	nch48_03	1612	1829	0.526	0.308	"
37	nch48_04	1715	1829	0.526	0.235	"
38	nch48_05	1691	1829	0.423	0.287	"
39	nch48_06	1618	1830*	0.663	0.281	"
40	nch48_07	1707	1828*	0.578	0.249	"
41	nch48_08	1676	1842*	0.544	0.264	"
42	nch48_09	1653	1829	0.612	0.331	"
43	nch48_10	1596	1829*	0.329	0.303	"
44	nch48_11	1666	1841	0.544	0.322	"
45	nch48_12	1696	1829	0.514	0.356	"
46	nch48_14	1596	1829*	0.397	0.348	"
47	nch48_15	1607	1829*	0.374	0.248	"
48	nch48_13	Not datable				"
49	nch48_01	"				"
			Aleksandrovskaya 89			
50	amb_09	1790	1872	0.301	0.199	Northwestern wall, 2nd layer of logs, 1st cribwork
51	amb_03	1797	1905*	0.612	0.261	Ditto, 5th layer of logs, 1st cribwork
52	amb_02	1777	1893	0.415	0.247	Ditto, 6th layer of logs, 1st cribwork
53	amb_01	1788	1907*	0.433	0.222	Ditto, 8th layer of logs, 1st cribwork
54	amb_08	1803	1905	0.627	0.244	Ditto, 9th layer of logs, 1st cribwork
55	amb_06	1785	1876	0.623	0.326	Southeastern wall, 6th layer of logs, 1st cribwork
56	amb_15	1789	1905	0.514	0.286	Ditto, 6th layer of logs, 4th cribwork
57	amb_05	1786	1907	0.465	0.325	Ditto, 7th layer of logs, 1st cribwork
58	amb_04	1784	1903*	0.552	0.296	Ditto
59	amb_11	1773	1904	0.541	0.349	Southeastern wall, 9th layer of logs, 2nd cribwork
60	amb_12	1781	1901	0.43	0.328	Ditto, 9th layer of logs, 3rd cribwork
61	amb_14	1793	1897	0.439	0.322	Ditto, 10th layer of logs, 3rd cribwork

Notes: FR – year when the first ring was formed in the sample; PR – year when the peripheral ring was formed; R – interserial correlation coefficient; SD – standard deviation; asterisk marks the samples with the subcrustal ring.

The house at the address of Sovetskaya 9. Samples (10 spec.) were taken from roof beams. All were dated; the average value of the interserial correlation coefficient was 0.52 (see *Table*). The date when the peripheral rings were formed in eight samples was 1954. Four of the samples (sov9_01, sov9_04, sov9_05, sov9_08) preserved subcrustal rings indicating the year of tree harvesting (1954). Almost all samples show traces of fire impact on the external surface. According to the information obtained, the timber for the construction was harvested not earlier than 1954, while according to official sources, the house was built in the 19th century (Spisok…, 2015). The only logical explanation for this discrepancy is that in the mid-1950s, the roof of the building was repaired with complete replacement of all its elements.

The house at the address of Dzerzhinskogo 11. Samples (13 spec.) were taken from all the main wooden elements of the building. Only four were dated; the average value of the interserial correlation coefficient was 0.41 (see *Table*). The latest dates when the peripheral rings were formed were 1849 and 1858. According to the data received, the timber for the construction was harvested not earlier than 1858, and the house was probably built in the late 1850s. Notably, for a more correct dating of the monument, it is necessary to supplement the collection of samples.

The house at the address of Nerpinskaya 48. The building was constructed of brick; samples from the roof structure were taken for analysis. Thirteen samples out of 15 were dated; the average value of the interserial correlation coefficient was 0.50 (see *Table*). Seven samples preserved the subcrustal rings, which were mostly formed in 1828–1830, and only one sample (nch48_08) was formed in 1842. Judging from the data obtained, it can be assumed that the timber for the construction work was harvested in two periods: in the late 1820s and in the early 1840s. The time of the roof construction (the end of the second quarter of the 19th century), which we established, was at least a quarter of a century later than the time indicated in the official source (the early 19th century) (Ibid.). The cause of the occurrence of these two groups of dates remains unclear. This may indicate either the use of timber harvested in different years for the construction of the roof, or possible local reconstruction of the roof in the 1840s. For refining the dendrochronological dating, it is necessary to supplement the collection of samples.

The barn at the address of Aleksandrovskaya 89. Samples were taken from the northwestern and southeastern walls. All 12 samples were dated; the average value of the interserial correlation coefficient was 0.50 (see *Table*). The formation time of the peripheral rings in eight samples was 1901–1907. The subcrustal layer in three of them (amb_01, amb_03, amb_04) indicates a long period of wood harvesting (1903–1907). In this case, we should date the construction to the latest date. Consequently, the timber for the construction was harvested not earlier than 1907, and the barn was built at the end of the first decade of the 20th century.

Conclusions

Architectural and ethnographic survey using the method of dendrochronology resulted in a field study of important and previously unresearched buildings in the town of Tara. Comprehensive analysis made it possible to establish the calendar time of building (rebuilding) of five structures, three of which are monuments of architecture. The house at the address of Sovetskaya 9 was repaired in the mid-1950s; the barn at the address of Aleksandrovskaya 89 was built at the end of the first decade of the 20th century; the house at the address of Sovetskaya 7 was built not earlier than the 1880s (most likely, later); the house at the address of Dzerzhinskogo 11 was built in the late 1850s; and the roof of the brick building at the address of Nerpinskaya 48 was erected at the end of the second quarter of the 19th century (which contradicts the date of the building construction, the early 19th century, by a quarter of a century).

Thus, this study is a clear example of how the dendrochronological method can be used for confirming and refining historical dating of architectural monuments. This practice should become an integral part of any architectural and ethnographic survey *in situ*. Having a number of undeniable advantages, this method also has natural limitations. For example, in our case, there were difficulties with dating buildings having traces of numerous rebuilding events. The study has shown that for more correct dating of monuments in the region under consideration, it is sometimes necessary to gather a more extensive collection of samples than the number indicated in the standard methodology. At the same time, a multidisciplinary approach makes it possible to overcome such problems through multifactor analysis involving the data from several fields. As a result of the study, it was possible to clarify the time of construction (rebuilding) of several immovable objects of cultural heritage of Tara, and to build up a tree-ring chronology covering the period from 1596 to 2015, which will subsequently help scholars to date timber from the wooden architecture of western Siberia of the 17th–18th centuries.

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Kinship Analysis of Human Remains from the Sargat Mounds, Baraba Forest-Steppe, Western Siberia

We present the results of a paleogenetic analysis of nine individuals from two Early Iron Age mounds in the Baraba forest-steppe, associated with the Sargat culture (five from Pogorelka-2, mound 8, and four from Vengerovo-6, mound 1). Four systems of genetic markers were analyzed: mitochondrial DNA, the polymorphic part of the amelogenin gene, the autosomal STR-loci, and the STR-loci of the Y-chromosome. Complete or partial data, obtained for eight of the nine individuals, were subjected to kinship analysis. No direct relatives of the "parent-child" type were detected. However, the data indicate close paternal and maternal kinship among certain individuals. This was evidently one of the reasons why certain individuals were buried in a single mound. Paternal kinship appears to have been of greater importance. The diversity of mtDNA and Y-chromosome lineages among individuals from one and the same mound suggests that kinship was not the only motive behind burying the deceased people jointly. The presence of very similar, though not identical, variants of the Y-chromosome in different burial grounds may indicate the existence of groups such as clans, consisting of paternally related males. Our conclusions need further confirmation and detailed elaboration.

Keywords: *Paleogenetics, ancient DNA, kinship analysis, mitochondrial DNA, uniparental genetic markers, STR-loci, Y-chromosome, Baraba forest-steppe, Sargat culture, Early Iron Age.*

Introduction

The Sargat culture of the Early Iron Age has existed for about 1000 years (from the middle of the I millennium BC to the middle of the I millennium AD) and occupied the vast areas of the forest-steppe zone of Eurasia—from the Trans-Urals in the West to the Baraba forest-steppe (interfluve of Ob and Irtysh rivers, western Siberia) in the East. The people of this culture lived in between the Savromatian-Sarmatian nomads and the eastern nomads of southern Siberia and Central Asia.

A typical feature of the Sargat burial tradition was the construction of several burials beneath the same kurgan mound. Such burial complexes are found throughout the area of this culture, they comprise more than one third of all complexes in the Baraba forest-steppe (Polosmak, 1987: 16). There are two types of burial arrangement in such mounds: 1) one central burial and several others around, surrounding it and lying at the periphery of the mound; 2) several burials in a row. Another feature of the Sargat burial complexes is construction of burials at different depths—both in the subsoil and in the mound. It has been hypothesized that individuals buried under the same mound were usually inhumed at different times, and the burials might have been divided by substantial time spans (Berseneva, 2011: 129–133).

Such "multiburial" mounds are most often interpreted as family (or kin) cemeteries (Koryakova, 1988: 156; Matveeva, 1993: 149; Berseneva, 2011: 129–133). This implies a biological kinship of some degree between at least some of the deceased. But typically, neither archaeological nor physical anthropological data can be used for a reliable determination of kinship. For the Sargat culture, there are only a few cases when the kinship between skeletal individuals was convincingly confirmed by osteological methods (Kurto, Razhev, 1997). The studies analyzing the Sargat burial traditions have concluded the difficulty of the assessment of kinship structure, and the lack of possibilities for resolving this question without applying some new approaches. Paleogenetics appears to be the most powerful solution for evaluation of the degree of genetic relatedness between skeletal individuals.

In this study, the remains of individuals of the Sargat culture from two "multiburial" mounds from the Baraba forest-steppe (mound 8 of Pogorelka-2 burial site, and mound 1 of Vengerovo-6 burial site) have been analyzed by the methods of molecular genetics. The results of the study are discussed in terms of the possible relatedness of the individuals and, more broadly, in the light of the burial traditions of the Sargat population.

Material and methods

Skeletal remains and their archaeological context. The remains of individuals of the Sargat culture from two burial grounds from the Baraba forest-steppe, Pogorelka-2 (mound 8) and Vengerovo-6 (mound 1), were studied. The two sites are different in terms of their arrangement of burials under the mound.

Pogorelka-2 is situated in the Chanovsky District of the Novosibirsk Region, 2.5 km south of the village of Pogorelka, along the country road leading to the village of Osintsevo. At this burial site, more than 40 mounds were detected visually. Mound 8 was excavated in 2009 by an expedition led by V.I. Molodin. Six burials were found: five adult and one subadult (burial 1). The burials are placed such that they form a chain in plan (Fig. 1). Judging from the items found in the burials, the latter can be unequivocally assigned to the Sargat culture (Fig. 2) (Molodin et al., 2009). Burial 1 contained fragments of the skull vault of an infant. Owing to the very poor preservation of its bones, this burial could not be sampled for the genetic study. Burials 2 to 6 yielded the remains of five adult individuals, in various states of preservation. Samples from all 5 individuals (long bone fragments) were taken (Table 1, Pg1–Pg5).

Vengerovo-6 is situated in the second fluvial terrace of the right bank of Tartas River, 2.5 km south from the village of Vengerovo, in the Vengerovsky District, Novosibirsk Region. The site comprises two mounds. Mound 1 was studied in 2011 by Molodin (Molodin et al., 2011). Five burials of adult individuals were excavated (Fig. 3, 4). Burial 1 was situated in the center of the mound, while other burials were at its periphery, in the western, southwestern, and southern parts of the burial ground. This is one of the two most typical patterns of burials: one central burial is surrounded by several peripheral ones (see above). All burials had been looted. Only the skeleton of the individual from burial 3 was found in the correct anatomical order, while in all other burials bones were commingled. Burial 5 contained only poorly preserved fragments of bones, not suitable for sampling. The individuals from burials 1–4 were sampled for the genetic study (Table 1, Sg1– Sg4). The bones from burials 1–3 were well preserved, while the remains from burial 4 were poorly preserved. According to the grave-goods found in the burials, they can be assigned to the Sargat culture (Fig. 5, 6).

Preliminary treatment of the skeletal samples and DNA extraction. The protocol of this study is described in our previous publications (Pilipenko et al., 2015, 2017). In order to eliminate modern DNA contamination, the external surface of the samples was treated by 5 % sodium hypochlorite and then irradiated with UV. The external bone layer (~1–2 mm thick) was mechanically removed. Fine bone powder was then drilled out from the cortical layer. Then, the powder was incubated in a 5M guanidine thiocyanate buffer at 65 ºC, while being constantly mixed during incubation. DNA extraction was performed using a phenol/chloroform protocol with subsequent sedimentation with isopropanol.

Analysis of genetic markers. This study employed four systems of genetic markers: mtDNA (HVR I region was employed in this study as a matrilineal kinship marker); polymorphic fragment of the amelogenin gene (sex marker); nine autosomal STR-loci (universal markers of kinship); 17 STR-loci of the Y-chromosome (employed in this study as patrilineal kinship markers) (see (Pilipenko, Trapezov, Polosmak, 2015)). The genotyping protocols for all marker systems are described below.

Amplification of the mtDNA HVR I region was carried out using two different protocols: four short overlapping fragments in one round of PCR (Haak et al., 2005), and one long fragment by nested PCR (consisted

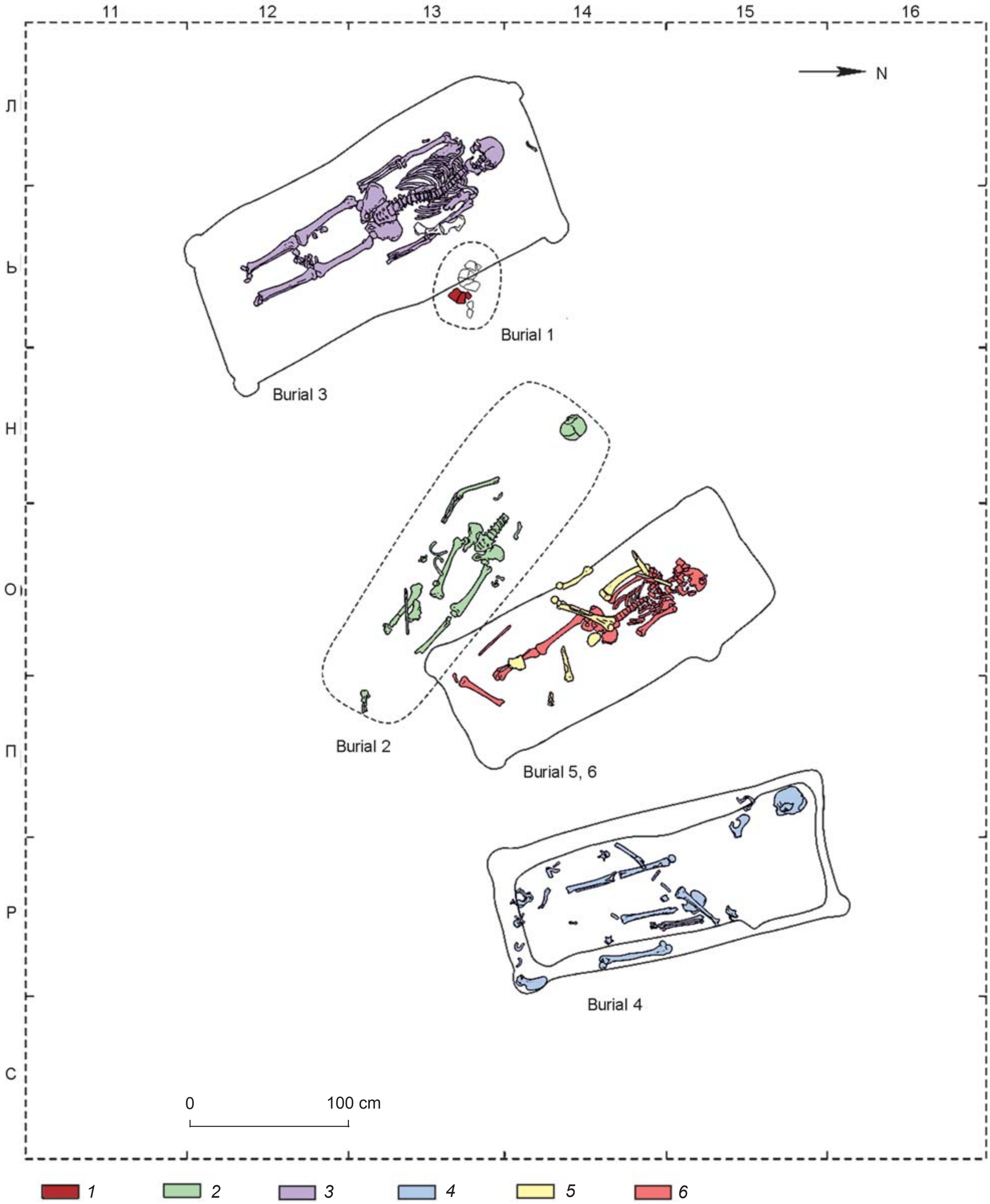

Fig. 1. Layout of burials in the central part of mound 8 of the site of Pogorelka-2.
1 – human remains from burial 1; *2* – human remains from burial 2; *3* – human remains from burial 3; *4* – human remains from burial 4; *5* – human remains from burial 5; *6* – human remains from burial 6.

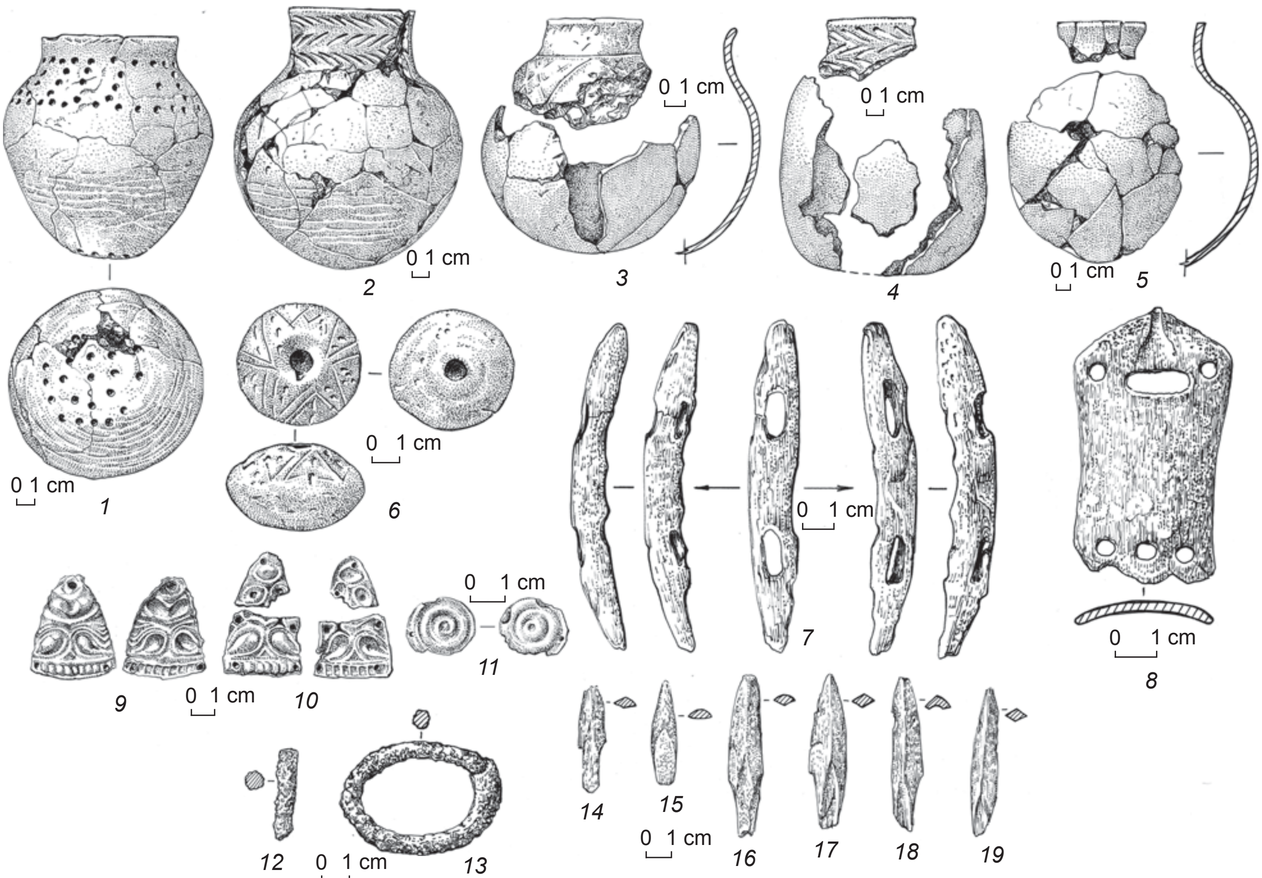

Fig. 2. Grave-goods from mound 8 of Pogorelka-2.
1–5 – ceramic vessels; *6* – ceramic spindle whorl; *7* – horn cheek-piece; *8* – horn buckle; *9–11* – plaques-stripes of yellow metal; *12*, *13* – iron items; *14–19* – bone arrowheads.

Table 1. **Skeletal individuals studied and the results of the mtDNA structure analysis**

Code of individual	Burial complex	Haplotype of the mtDNA HVR I	Haplogroup of mtDNA
Pg1	Pogorelka-2, mound 8, burial 2	16147A-16172C-16189C-16223T-16248T-16320T	N1a1a1a
Pg2	Ditto, burial 3	16192T-16256T-17270T-16399G	U5a1
Pg3	Ditto, burial 5	16366T	H
Pg4	Ditto, burial 4	16256T-16270T-16399G	U5a1
Pg5	Ditto, burial 6	16223T-16239T-16298C-16327T-16357C	C4a2c1
Sg1	Vengerovo-6, mound 1, burial 1	16256T-16270T-16399G	U5a1
Sg2	Ditto, burial 2	16288C-16362C	H8
Sg3	Ditto, burial 3	16288C-16362C	H8
Sg4	Ditto, burial 4	No data	No data

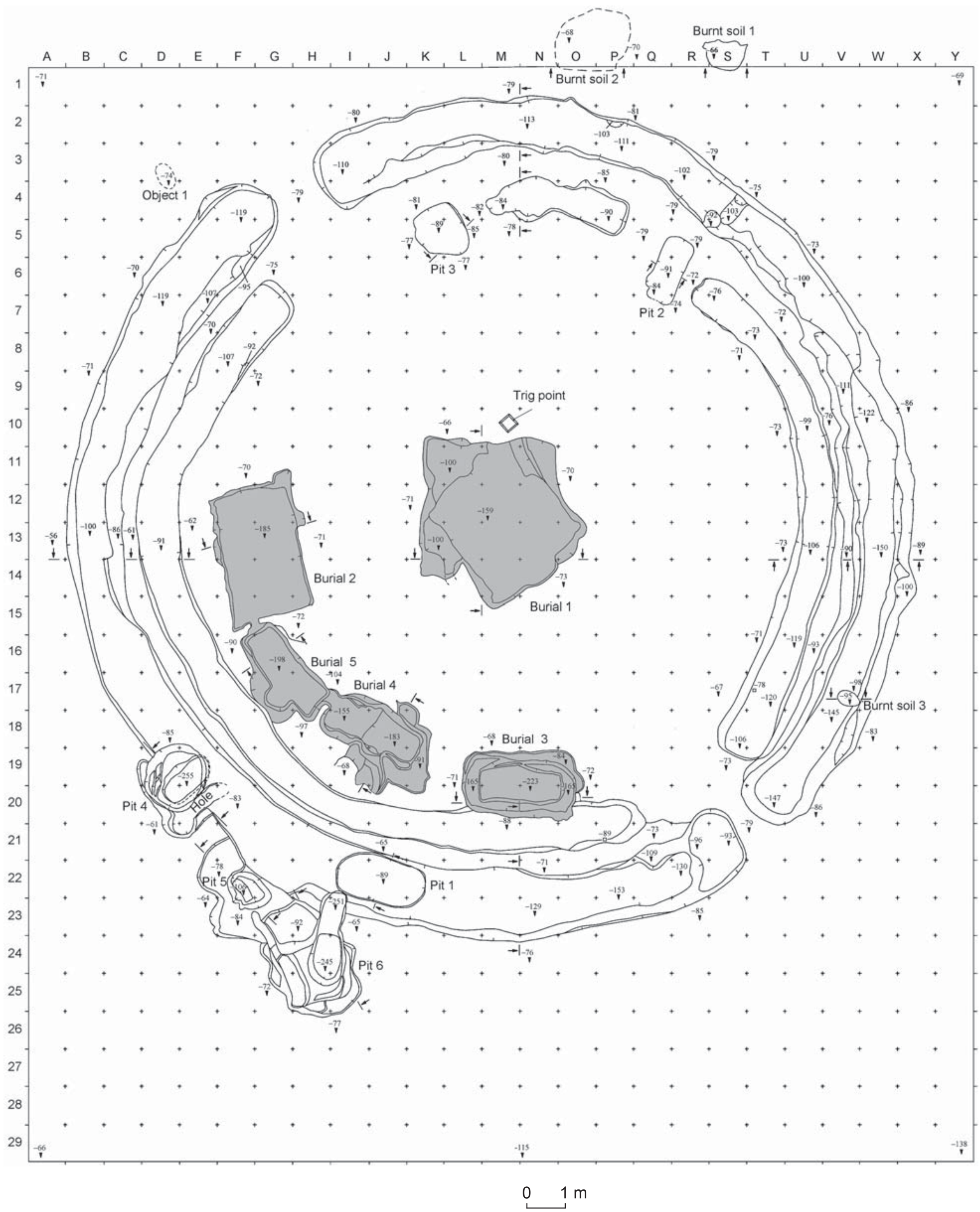

Fig. 3. Layout of mound 1 of the site of Vengerovo-6.

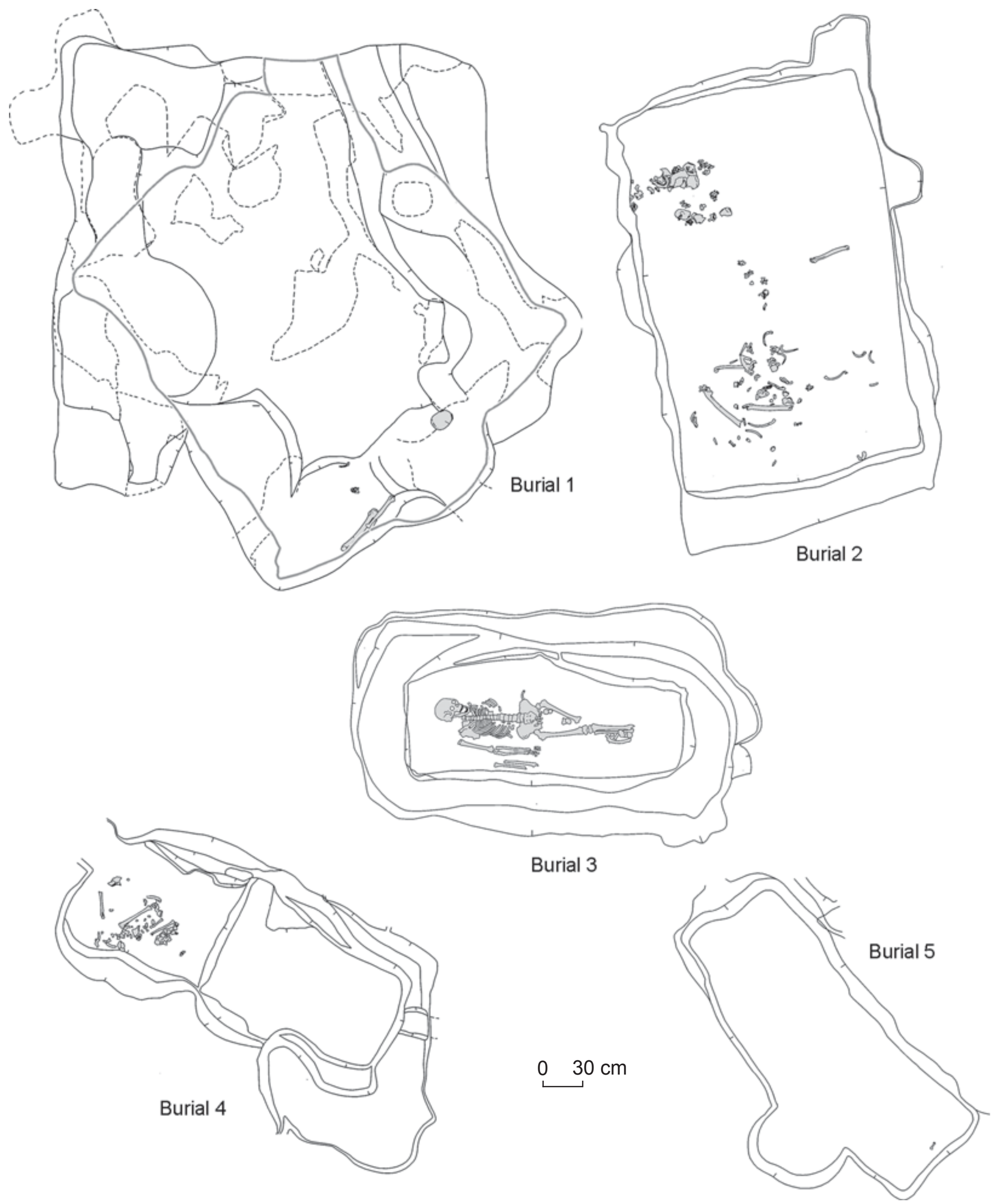

Fig. 4. Layout of burials of mound 1 of Vengerovo-6.

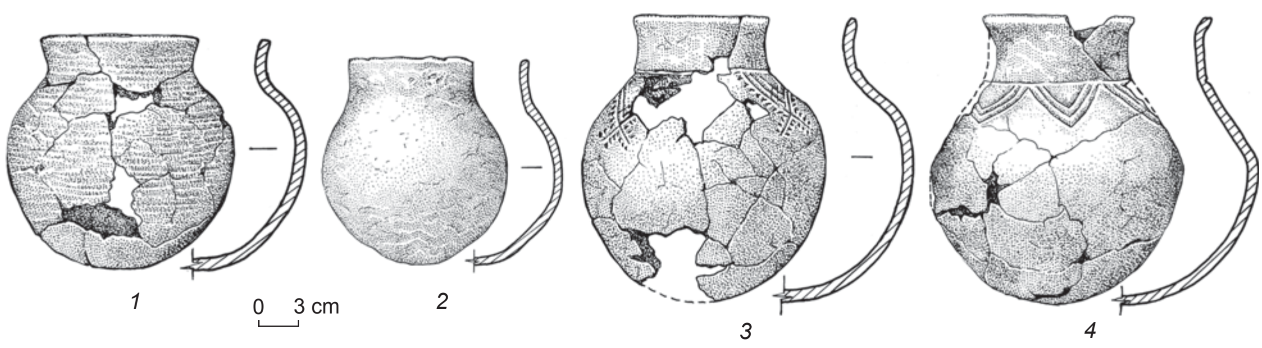

Fig. 5. Ceramic vessels from the burials of mound 1 of the cemetery of Vengerovo-6.

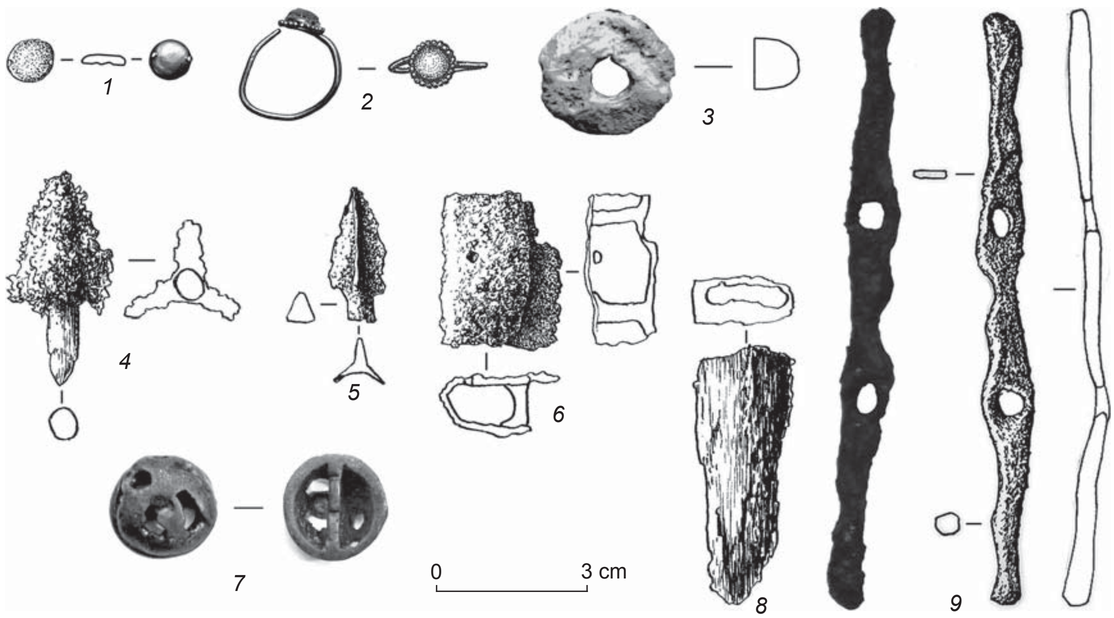

Fig. 6. Finds from the burials (*1–8*) and filling of the ditch (*9*) of mound 1 of Vengerovo-6.

of two reaction rounds) (Pilipenko et al., 2008). DNA sequencing was carried out with an ABI Prism BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems, USA). Sequencing extracts were analyzed with an ABI Prism 3100XL Genetic Analyzer automatic capillary sequencer (Applied Biosystems, USA) at the SB RAS Genomics Core Facility (http://sequest.niboch.nsc.ru).

Profiling of nine autosomal STR-loci and analysis of the amelogenin gene region polymorphism was performed using commercial AmpFlSTR® Profiler® Plus PCR Amplification Kit (Applied Biosystems, USA), following the manufacturer's protocol. Profiles of 17 STR-markers of the Y-chromosome were determined using commercial AmpFlSTR® Y-filer® PCR Amplification Kit (Applied Biosystems, USA), following the manufacturer's protocol. Haplogroups of the STR haplotypes of the Y-chromosome were determined using two programs: Whit Athey's Haplogroup predictor (http://www.hprg.com/hapest5/) and Vadim Yurasin's YPredictor 1.5.0 (http://predictor.ydna.ru).

Measures against contamination and verification of the results. All procedures with the skeletal specimens were carried out in a specially-equipped Laboratory for Molecular Paleogenetics (Institute of Cytology and Genetics of the SB RAS and Institute of Archaeology and Ethnography of the SB RAS, Novosibirsk, Russia). A description of the anti-contamination measures and verification of the results can be found in our previous publication (Pilipenko, Trapezov, Polosmak, 2015). Employment of those measures and consistency of the obtained results ensure reliability of our experimental data.

Results and discussion

DNA preservation. The effectiveness of molecular genetics methods in the determination of kinship of individuals in collective burials strongly depends on the degree of preservation of the DNA in the remains. For assessment of kinship between individuals, it is necessary to have data on several systems of genetic markers, including mtDNA, autosomal, and Y-chromosome STR-loci and sex-markers. Full, or at least partial, data on the markers mentioned above can be only obtained by PCR-based techniques if the preservation of the DNA in the remains is good enough to extract long (100–300 base pairs) fragments of mitochondrial, as well as nuclear, DNA.

Our previous research on heterochronous Bronze Age burial sites has shown that skeletal remains from the Baraba forest-steppe are suitable, in general, for a molecular genetic analysis, at least at the level of mtDNA. But despite climatic conditions in this region being favorable for DNA preservation, the latter varies substantially not only among different sites but also among burials at the same site, and even between individuals from the same communal burial (Molodin et al., 2012; Molodin et al., 2013). Apparently the degree of DNA preservation in skeletal remains from the Baraba forest-steppe depends on a number of factors, including the depth of a burial, local variations in soil composition and humidity, and, finally, burial traditions (the degree of the body's decomposition before inhumation, the effect of high temperatures, etc.).

The nine samples analyzed in this study also demonstrated different degrees of DNA preservation.

Table 2. **Results of the analysis of autosomal STR-loci and the sex-specific region of the amelogenin gene**

Code of individual	D3S1358	vWA	FGA	D8S1179	D21S11	D18S51	D5S818	D13S317	D7S820	Amelogenin (sex)
Pg1	16/18	16/16	21/22	13/15	31/33.2	15/18	11/12	10/12	10/12	XX (female)
Pg2	17/17	15/18	23/25	14/14	30/31.2	14/18	7/11	10/12	9/9*	XY (male)
Pg3	16/16	17/18	22/23	14/16	30/32.2	No data	11/12	10/13	12/12*	XY (male)
Pg4	16/17	14/18	20/21	13/13	30/32.2	17/18	12/12	8/11	8/11	XY (male)
Pg5	15/15	14/19	22/24	13/13	28/31.2	17/17*	9/11	10/10*	13/13*	XY (male)
Sg1	14/17	18/18	23/24	14/16	30/31.2	14/14*	10/11	8/8*	10/11	XY (male)
Sg2	17/18	16/16	20/23	12/13	31/33.2	12/17	11/11	11/13	8/9	XY (male)
Sg3	14/19	16/18	21/23	10/13	30/31	13/13*	11/12	8/11	No data	XY (male)

* There is a possibility of the absence of a signal from the second allele, which was not amplified owing to poor DNA preservation.

In burial 4 of mound 1 in Vengerovo-6 (Table 1, Sg4) it was not possible to obtain reliable results for any of the genetic markers because of poor DNA preservation. This is concordant with the visually observed poor preservation of bone-tissue in this individual. But other skeletons yielded either full or partial molecular genetic data. In all of these individuals, the mtDNA HVR I region was determined, which made possible the evaluation of their phylogenetic status (Table 1). We also obtained full or almost full profiles of autosomal STR-loci (eight out of nine), and assessed the status of the sex-specific region of amelogenin gene (Table 2). A full profile of the 17 STR-loci of the Y-chromosome was determined for 3 out of 7 males employed in this study, an almost full profile (16 out of 17 loci) was determined for one of the individuals, while for the rest of the sample from 11 to 13 loci were determined (Table 3). In all cases, the Y-chromosome variants were unequivocally assigned to haplogroups, using the predictor software. Thus, we were able to obtain the bulk of the possible molecular data for eight out of the nine individuals who were initially sampled: five individuals from Pogorelka-2, mound 8, and three from Vengerovo-6, mound 1.

Notably, the samples from the latter (excluding the poorly preserved Sg4 specimen) exhibit a better DNA preservation than the specimens Pogorelka-2, mound 8. This is particularly evident from the results for the Y-chromosome STR-loci (Table 3). Importantly, there is a correlation between the success of analysis of a locus and the length of DNA fragment that is necessary for performing the analysis. As it could be expected for degraded ancient DNA, amplification of short segments of nuclear DNA has always been more effective than amplification of longer segments. This is an additional argument in favor of the authenticity of the studied DNA. Our results unambiguously support the high value of skeletal samples from the Baraba forest-steppe for a wide range of molecular genetics research on both mtDNA and nuclear DNA.

Sex determination. In seven out of the eight successfully sampled individuals, two variants of the amelogenin gene (typical of the X- and Y-chromosomes) were determined; thus the individuals were males. In one of the individuals, just one of the variants, typical of the X-chromosome, was found (female; see Tables 1, 2, Pg1). These molecular-genetics results are fully consistent with the preliminary sex determinations made by physical anthropologists. Interestingly, the prevalence of males is typical of the Sargat burial mounds, including multiple burials (Razhev, 2009: 74–75; Berseneva, 2011: 83).

Autosomal STR-makers and an assessment of possible direct "parent-child" kinship. It was hypothesized that individuals buried under the same mound might have been inhumed at different times, and the burials might have been divided by different time spans. One of the hypotheses suggests that the descendants could have been buried in the same mound as their ancestor (or ancestors). In the light of such views, it is important to address specifically the issue of possible direct kinship between the individuals from both mounds: five skeletons from Pogorelka-2, mound 8, and three from Vengerovo-6, mound 1. For all eight individuals, full (nine loci) or almost full (eight loci) allelic profiles of the autosomal STR-loci were obtained (see Table 2)*.

The direct kinship of "parent-child" type is imprinted in the structure of the allelic profile: direct relatives possess one common allele for each of the studied loci. Following this criterion, there are no "parent-child" pairs among the individuals employed in this study. Thus, the

*Note that for some loci with the longest amplicons, an incomplete amplification of the longer allele might be observed when applying the variant of multiplex PCR used in this study (see note to Table 2).

Table 3. **Results of genotyping of the Y-chromosome STR-loci**

Code of individual	DYS456	DYS389 I	DYS390	DYS389 II	DYS458	DYS19	DYS385 a/b	DYS393	DYS391	DYS439	DYS635	DYS392	Y GATA H4	DYS437	DYS438	DYS448	Predicted haplogroup
Pg2	15	14	26	31	15	16	11/14	13	11	11	24	No data	13	No data	No data	No data	R1a
Pg3	16	14	25	32	No data	16	No data	13	10	No data	23	Ditto	12	14	Ditto	Ditto	R1a
Pg4	14	15	24	31	17	14	11/13	14	11	11	23	14	12	14	10	19	N
Pg5	14	15	24	31	No data	14	No data	14	11	11	23	No data	No data	14	No data	No data	N
Sg1	14	14	24	30	18	14	11/13	14	11	11	23	14	12	14	Ditto	19	N
Sg2	14	13	24	29	17	14	11/13	14	11	11	23	14	12	14	10	19	N
Sg3	14	13	24	29	17	14	11/13	14	11	11	23	14	12	14	10	19	N

results of this study cannot provide empirical support for the hypothesis as to the existence of a tradition in the Sargat culture of burying descendants in the mounds of their direct ancestors.

Structure of mtDNA and the allelic profiles of STR of the Y-chromosome, matrilineal and patrilineal kinship. The uniparental markers—mtDNA (matrilineal) and the Y-chromosome (patrilineal)—are phylogenetically and phylogeographically informative for reconstruction of the genetic history of human populations. In this study we do not address these aspects, as the structure of both male and female gene-pools of the Sargat population of Baraba will be assessed by molecular data for a more representative sample in a special publication (now in preparation). Here, we only present the results of an analysis of diversity of the Y-chromosome and mtDNA lineages in the sample from the point of view of kinship between the individuals.

The sample used in this study exhibits a great diversity of mtDNA lineages. The same, according to author's data, applies to the Sargat population in general. All five individuals from Pogorelka-2, mound 8 display different structures of mtDNA and, consequently, belong to different maternal lineages. For instance, we were not able to detect a genetic relationship of the single woman in this mound with any of the four male individuals buried there. Among three individuals from mound 1 of Vengerovo-6, two variants of mtDNA were detected. The two adult males from peripheral burials 2 and 3 possess the same variant (at least at the level of the mtDNA HVR I) that belongs to Western Eurasian haplogroup H8 (see Table 1, Sg2 and Sg3). Thus, they might be matrilineal relatives.

The analysis of allelic profiles of the Y-chromosome STR-loci (full, including 17 loci, or partial—11–16 loci) using the predictor software has assigned the seven Y-chromosome specimens (from all male individuals) to two haplogroups—N and R1a (see Table 3). In two out of four individuals from mound 8 of Pogorelka-2, variants of the haplogroups were detected as well. Allelic profiles of the individuals possessing variants of haplogroup R1a were substantially different: the difference was detected in six out of nine Y-chromosome STR-loci successfully genotyped in both individuals (see Table 3, Pg2 and Pg3). Thus, these people could not have been patrilineal relatives. In contrast, the two carriers of haplogroup N display identical allelic profiles of all 10 loci (see Table 3, Pg4 and Pg5). Therefore, a patrilineal kinship between these two individuals is plausible.

The Y-chromosomes of all three skeletons from mound 1 of Vengerovo-6 belong to haplogroup N. Also, the two individuals for whom full allelic profiles of the 17 STR-loci were determined possessed identical variants of the Y-chromosome (see Table 3, Sg2 and Sg3). Taking into account the fact that their mtDNA variants were also identical, we might reasonably suggest that these two individuals were close relatives on both maternal and paternal sides. Such a pattern of genetic similarity can be observed in siblings. Another possibility might be that they had one common parent of either sex, while the second parents were siblings. More distant kinship cannot be excluded, but is less probable.

The structure of the Y-chromosome variant of the third individual from the same mound (16 STR-loci) is quite close to the two others, but differs by 3 loci out of 16. Thus, this individual from the central burial cannot be a close patrilineal relative of the individuals from the peripheral burials. The similarity of the structure of the allelic haplotype could point to a more distant relatedness, i.e. at the level of kin or several paternally related kin. The similarity of allelic variants of haplogroup N, observed in some specimens from both sites, is a solid argument for the presence in the Sargat population of Baraba individuals who were not direct patrilineal relatives but shared a common patrilineal origin (e.g. kin or clans) in the relatively recent past. So, the individuals for whom full data on the Y-chromosome STR-loci allelic profile were obtained (one from mound 8 of Pogorelka-2 and two from mound 1 of Vengerovo-6; see Table 3, Pg4, Sg2, and Sg3), shared a common allelic motif, which unites 15 out of 17 STR-loci. Such similarity suggests a remote paternal kinship between these individuals.

Summing up, our molecular genetic data enable us to make some preliminary inferences regarding the kin relationships of individuals buried in the same mound. To the moment, we have not found any empirical evidence for burying adult close relatives ("parent-child") under the same mound. Some cases of close patri- and matrilineal kinship were detected, which suggests that such kinship might be a reason for burying people in the same mound. At the moment, patrilineal kinship appears to be a more important factor: the only case of possible matrilineal kinship was observed in the pair of individuals who possessed identical variants of the Y-chromosome as well (see Tables 1–3, Sg2 and Sg3). Meanwhile, not all people buried in the same mound were close relatives. For instance, the presence of individuals not connected even by a remote kinship in the same mound was detected: the best example is the carriers of haplogroups R1a and N from mound 8 of Pogorelka-2. The diversity of mtDNA variants is even higher. Thus, other reasons for burying in the same mound, besides kinship, existed in the Sargat society. One of the reasons might have been membership of a particular social group, i.e. a military elite (Razhev, 2009: 74–75). Then, the burial of individuals not connected by close blood kinship in the same mound can be inferred. Such inference corresponds well with the high prevalence of males, as compared to females and children, in burial mounds. Meanwhile, only one female skeleton from a mound with several burials was studied, which prevents conclusions regarding kin relationships between females and males from such mounds. It can only be pointed out that the absence of direct blood kinship of "mother-son" type between the female and the males buried in this mound might point towards another type of relationship of the female with one of the males, e.g. marital.

The presence of individuals possessing not identical but very similar variants of the Y-chromosome in mounds from different sites separated by dozens of kilometers could provide evidence for a particular role of some groups of males of shared patrilineal ancestry in the Sargat society, maybe "male" kin or clans. We realize that this inference, like other conclusions of this study, is preliminary and requires additional confirmation. There is also a demand for a much more detailed molecular genetic analysis of numerous additional samples from skeletons of the Sargat culture from different regions of the Baraba forest-steppe, and also from other areas occupied by this culture in the Trans-Urals forest-steppe and western Siberia.

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Intragroup Variation of the Facial Skeleton in 16th–19th Century Rural Russian Populations in the Worldwide Context: A Principal Component Analysis

This article outlines a technique for comparing cranial samples by studying their patterns of individual variation against the background of worldwide variation, using principal component analysis (PCA). The training set consisted of 357 male crania from 27 populations of Europe, Asia, and North America. Our measurement protocol included 14 linear dimensions of the facial skeleton. As a test set, we used four recent rural Russian samples, while several series representing Finno-Ugric and Baltic populations and those of central and northern Europe were employed as reference data. The variation in the training set, assessed by PCA without any discriminant statistical methods, shows a clear pattern of between-group differences. The individual variation within the samples is very informative, revealing marked differences between the four Russian samples. While those from Nikolskoye and Staraya Ladoga are morphologically homogeneous, that from Kozino is extremely heterogeneous: its variation encompasses virtually the entire Caucasoid range. As compared to European samples, including Karelians and Finns, Russian samples, excluding Kozino, are more similar to the Mordvinian series than are other European groups, including the western Finns. This, however, refers only to intragroup variation, because at the group level the Russian samples display no Mordvinian tendency. On the other hand, we found no particular similarity between the Russians and the Saami. In general, Russians are no more "Mongoloid" than most other Europeans, but the presence of several crania evidencing a Mongoloid trait combination should be noted.

Keywords: *Craniology, principal component analysis, intragroup variation, Russians.*

Introduction

Statistical analysis. The question of which multivariate statistical method is optimal for intergroup comparisons of cranial samples has been hotly debated in the last two decades (Deryabin, 2008: 115, 212–229). However, none of the techniques designed for ordination of sample means describes the pattern of intragroup variation in the samples properly. The positions of two sample means in a plot with respect to each other (be they similar or very different) do not tell much about the distribution of individuals of both samples in morphospace, nor about to what extent these distributions overlap. For instance, there may be several individuals in a sample that, morphologically, differ substantially from the bulk of the sample (so called "mechanical admixture"). But the presence of such individuals can barely be identified through a comparison of sample means.

Visual empirical search for "components" inside a cranial sample (typological approach) has been convincingly criticized (see (Debets, 1948; Alexeev, 2008a)), and is largely abandoned at present. But typological thinking, surprisingly, survives, and can still be found, in different forms, in craniological literature. This could arguably be explained by the unusual relationships between inter- and intragroup variation in *Homo sapiens*. It is well established that, at the global level, intergroup differences account only for some 20 % of total variance of most genetic markers and morphological variables in humans (Kozintsev, 2016; Lewontin, 1972; Relethford, 1994). As a result, values of intergroup genetic distances (e.g. Fst) in humans, even between the most distinct populations, are quite low compared with those in chimp subspecies and other primates (see (Weaver, 2014) and citations therein). Such a phenomenon can be explained by the uniquely rapid pace of migration and dispersal of modern *H. sapiens*, as well as by a decreased pressure of stabilizing selection in our species due to the development of social adaptation (Alekseeva, 1986; Miklashevskaya, Solovieva, Godina, 1988). Taken together, these factors might have led to the increased intragroup variability and long-standing persistence of diverse phenotypes in human populations. The issue of exploring intragroup variation becomes even more vivid when studying archaeological cranial samples, in which intragroup variation is not only a matter of migration and admixture. On the one hand, archaeological documentation relating to the sample might be absent, scarce or misinterpreted; on the other hand, theoretical views on classification of archaeological cultures and their dates often change. These factors directly affect the composition of the archaeological sample, which in some cases represent a mix of individuals from different groups and time periods (Alekseev, 2008a: 123–125).

Principal component analysis (PCA) is considered the method of choice for exploring intragroup variation (Deryabin, 2008: 76). In canonical discriminant analysis (CDA), the distribution of individual points around the sample mean can be also assessed, but "…the main purpose of this method is to solve the task of discrimination, and many features of the method are aimed to achieving the best possible separation of the multidimensional correlation ellipsoids that include individual observations…" (Ibid.: 212). This feature of the method is not that desirable, since the extent of the similarity between samples is not any less important than usually subtle, but exaggerated by CDA, differences between them. However, employing PCA for comparison of intragroup structure of multiple samples requires the solution of two important problems:

1. What is a "group" and what is the boundary between intra- and intergroup analyses (see (Alekseev, 2008a: 128–135))?

2. How to make the results of intragroup analyses of different samples fully comparable?

Clearly, the morphological meaning and variance of principal components are strongly dependant on the sample's composition (Deryabin, 2008: 22). This means that the pattern of overlap between distribution plots of two given samples will depend upon how many, and which, reference samples are used in a PCA.

An answer to the first question might be found in the practice of morphometric research in zoology, wherein PCA is used in quite a flexible way in order to explore inter-individual variation in a number of populations of the same species simultaneously, or in several species simultaneously (O'Higgins, Jones, 1998; Cardini, Elton, 2008; Nanova, 2014). Such an approach has also been employed successfully for studying human and hominin cranial variation (Harvati, 2003; Roseman, Weaver, 2004; Freidline, Gunz, Hublin, 2015). The second question can be dealt with using the method developed by V.E. Deryabin for constructing typological schemes of body constitution (2008: 101).

According to this approach, a training sample, which is as large and diverse as possible, should be employed to construct a PCA morphospace for a number of metric variables. Coefficients of the PCs equations for the training sample are then used to calculate PC scores for new individuals added to the analysis. In doing so, any individual, either new or from the training sample, has unchangeable PC scores and a permanent position in the morphospace. Thus, a universal "background" for comparison of intragroup variation in any number of sample is created, which provides for objective assessment of the degree and pattern of intragroup variance in each of the samples. Using this "background" makes the results of studies based on different samples fully comparable. In this study, we employ a world-wide craniological sample, in which most continental groups of humans are represented, to calculate "world" PCs for a number of mid-facial linear measurements.

Only mid-facial measurements were used in this study since the mid-face, according to existing views, is less susceptible to the influence of social and environmental factors and secular trends as compared to the neurocranium (Alekseeva, 1973, 1986; Beals, Smith, Dodd, 1984). While rapid changes of the shape of the latter can occur during a few generations and obstruct the comparison of diachronic samples (Debets, 1948; Godina et al., 2005), the mid-facial skeleton seems to be more stable.

Craniofacial morphology of the rural ethnic Russian population: state of research.* There have been numerous studies on the modern (17th to early 20th centuries)

*In the context of this study, the term "Russian(s)" refers to the name of an ethnic group (previously called "Velikoross"), not citizenship or nationality.

population of various Russian cities published in the last two decades (see (Shirobokov, Uchaneva, 2015) and citations therein). Nevertheless, there are still only a few samples from synchronous rural cemeteries: Nikolskoye (Trofimova, 1941) and Kozino (Evteev, 2011) in the Moscow region, and from Sebezh and Staraya Ladoga from northwestern Russia (Alekseev, 2008b: 46–49). The two latter samples are, in fact, "conditionally rural" since they belong to small settlements that were considered cities at some periods of their history. The vast samples of ethnic Russians from anatomical collections in St. Petersburg, Moscow, Kazan, and Odessa described by V.P. Alekseev (Ibid.) can only very cautiously be considered representative of the rural population of Central Russia. A sample of peasants who have migrated to a large city does not necessarily represent their various rural social groups and layers equally (see (Shirobokov, Uchaneva, 2015)). Also, owing to the specifics of the class system of the Russian Empire, a substantial part of those nominal "peasants" could well have been born and raised in the city (Rubakin, 1912). Finally, it should be borne in mind that the crania published by Alekseev were aggregated into samples according to the province (gubernia) that the individuals came from (2008b: 46–49); and so the samples cannot be used for describing morphological variation in local rural populations. Thus, the craniofacial morphology of those populations is still poorly understood.

Main theoretical views on the cranial morphology of modern ethnic Russians and the factors that have shaped it were formulated in classic works by T.A. Trofimova (1941), T.I Alekseeva (1973), and V.P. Alekseev (2008b). The results of these studies are generally in good agreement with each other, and have not been seriously questioned in recent decades. According to those views, the modern Russians display a strongly pronounced Caucasoid craniofacial morphology, and in this respect are more similar to medieval Western, rather than Eastern, Slavs (Alekseev, 2008b: 216–218). The latter, in turn, were more similar to Baltic than to the Finno-Ugrian medieval tribes of Eastern Europe (Alekseeva, 1973: 267–273). Both modern and medieval Eastern Slavs exhibit a characteristic craniofacial pattern that clearly distinguishes them from German-speaking populations (Ibid.). The anthropological type of modern Russians is quite uniform throughout their population distribution, and local variants of this type do not differ substantially from each other. These variants have been formed because of the differences in mating networks rather than because of different population origins. The Caucasoid pattern of craniofacial morphology became even more pronounced (e.g. nasal and facial protrusion increased) in Central Russia in late medieval times as compared to the earlier centuries. Meanwhile, in the northern and northwestern Russian regions, there was an opposite temporal trend. Those changes are thought to be due to migrations, and the turnover of population.

But the results of those classic anthropological works and recent genetic studies are not in full agreement. So, the degree of genetic intergroup differentiation of ethnic Russian populations is much higher than that of European local populations (thus, they are not as "uniform"), and their gene pool contains a substantial admixture from the neighboring Finno-Ugrian populations (Balanovskaya, Balanovsky, 2007). The latest genome-wide SNP research also points to a close genetic relatedness between Russians, Finns, and Mordovians (Lazaridis et al., 2014). Contrary to the results based on uniparental markers (Balanovskaya, Balanovsky, 2007), the share of East Asian alleles in the gene pool of these peoples is substantial, as compared to other European populations (Lazaridis et al., 2014, Suppl.). In our opinion, the contradictions mentioned above could not be solved by studying sample means only, but can be addressed better through an analysis of intragroup variation. The main research questions of this study are:

1. How high is the level of intra- and intergroup variation in ethnic Russian rural populations as compared to other ethnic groups?
2. How high is the degree of admixture from Eastern European Finno-Ugrian populations in the gene pool of ethnic Russians?
3. Can Mongoloid (East Asian) admixture be convincingly traced in a cranial sample as the presence of a few individuals of Mongoloid craniofacial morphology, the number of which is too small to change the sample mean?

Our study was by no means intended to resolve these important and long-standing questions completely. Rather, its main purpose was to introduce the "world PCA" technique as a new method for intergroup craniological analysis and to test its effectiveness in respect to other existing techniques.

Material and methods

The "world" PCs were calculated using 14 linear measurements of the mid-face. The set includes 9 commonly used variables: simotic chord (Martin 57, Biometric school SC), simotic subtense (Biom. SS), interorbital breadth at *maxillofrontale* (Mart. 50), zygomaxillary chord at *zygomaxillare anterior* (Mart. 46, Biom. GB) and the subtense from *subspinale* to the zygomaxillary chord, nasal breadth (Mart. 54), orbital height (Mart. 52), zygoorbitale chord (Mart. 45(3)), the subtense from *nasomaxillare* to the zygoorbitale chord. Also, 5 author's measurements were taken (see (Evteev, 2010) for a detailed description): height of the frontal process of the maxilla (number 2.5 according to

(Evteev, 2010)), cheek height (3.4 + 3.5), palate breadth (4.5), nasal aperture height (4.6), and the lateral length of the body of the maxilla (5.1). The reader can also find details of the protocol at https://sites.google.com/site/worldpcaeng. The measurements employed here were previously chosen from a much more numerous set of variables on the base of the results of a correlation analysis (Evteev, 2010, 2014).

The training sample included 357 male skulls representing 27 samples from Eurasia, Africa, and America (for details see (Evteev, 2014: Tab. 1) and https://sites.google.com/site/worldpcaeng). As compared to this earlier publication, the number of individuals in some samples was slightly reduced, and two new samples were added: Saami (13 individuals) and Druze (18 individuals). The PC coefficients from the training-sample analysis were further used to calculate PC scores for the individuals of the test sample that included rural Russian samples and reference data (see *Table*). Note that some population samples are common, at least partially, between the training and test samples. Missing variables (not more than one or two per individual) were replaced by the mean of the respective population sample.

Notably, the sample of Napoleon's Great Army soldiers who died in Königsberg (now Kaliningrad) during the Russian retreat is in fact a composite sample, which might include people from various European countries, mostly French, Germans, Dutch, and Italians (Khokhlov, 2014). The individual points of the skulls belonging solely to the training sample are not plotted in the graphs.

The ellipses in the graphs outline the 90 % range of empirical distributions; larger markers stand for sample means. All raw data used in this study, as well as a lot of additional illustrations and texts, can be found at https://sites.google.com/site/worldpcaeng.

Results

Training-sample analysis. The results of this analysis are only briefly outlined here, while a more comprehensive description can be found at https://sites.google.com/site/

Sample

Population	Provenance	Date	Number of skulls	Depository
Ethnic Russians				
Nikolskoye	Moscow Region	16th–18th cc	17/0/2	RIMA
Staraya Ladoga	Leningrad Region	17th–18th cc	17/0/1	MAE
Sebezh	Pskov Region	17th–18th cc	34/0/3	MAE
Kozino	Moscow Region	18th to early 19th cc	63/15/12	RIMA
Eastern Finns (Volga-Ural region)				
Mordovians (Erzya), Novaya Pyrma	Republic of Mordovia	17th–18th cc	28/0/8	RIMA
Komi (Zyryane), Podielsk, Griva	Komi Republic	19th–20th cc	28/0/7	MAE
Western Finns				
Karels	Republic of Karelia	19th–20th cc	49/0/11	MAE
Finns (Suomi)	Finland, mainly Helsinki	19th–20th cc	20/12/4	RIMA, MAE
Saami	Kola Peninsula	19th–20th cc	25/18/10	MAE
Baltic-speaking peoples				
Latvians (Latgal), Ludza	Latvia	18th c	22/14/3	RIMA
Western and Northern Europe				
Königsberg (Great Army soldiers)	Kaliningrad	19th c	65/13/5	RIMA
Norse (Oslo and Bergen)	Norway	19th c	18/16/2	NHM

Notes: Number of skulls – total / of which in the training sample / individuals with missing measurements (one or two) replaced by the mean of respective sample; RIMA – Anuchin Research Institute and Museum of Anthropology, Lomonosov Moscow State University (Moscow, Russia); MAE – Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences (St. Petersburg, Russia); NHM – Natural History Museum (London, Great Britain).

worldpcaeng. The PC1 of the analysis can definitely be considered a "Caucasoid-Mongoloid vector": the distributions of the skulls from European and East Asian populations have almost no overlap along this PC. PC2 describes a narrowing and a decrease in protrusion of the nasal bones and nose in general, a narrowing of the nasal bridge and, to a lesser extent, of the face and piriform aperture. This PC is highly variable in both Caucasoid and Mongoloid groups. PC3 and PC4 are related to the peculiarity of Sub-Saharan Africans and the difference between Northern and Southern Caucasoid populations.

As the rural Russian samples, as well as the reference samples, are weakly differentiated along PC3 and PC4, we will only discuss the first two PCs further.

Intra- vs. intergroup variation in the rural Russian samples. The position of the mean of Kozino is apparently intermediate with respect to other sample means (Fig. 1), but in fact this sample displays the widest range of intragroup variation. The plot of individuals from Kozino fully covers the distributions of the three other Russian samples. A number of skulls in Kozino and, to a lesser extent, from Staraya Ladoga, are distinguished by having very low scores on PC2 (see above). According to the standard deviations (SD) of PC1 and PC2 (see Fig. 2; a unit was extracted from original SD values), Kozino is one of the most diverse of all samples studied: it shows a higher level of intragroup variation than even does the "international" sample from Königsberg. In contrast, the three other Russian samples are among the most homogenous. As the difference between the means of these samples is fairly strong, intergroup variation among these samples is high with respect to their intragroup variance.

To the question regarding Mongoloid, Uralic, and Lappanoid admixture in ethnic Russians. The plot in Fig. 4 confirms the well-established opinion about the absence of any substantial East Asian admixture in the ethnic Russian population. The same applies to a possible admixture from typical representatives of Uralic anthropological variants (e.g. Khanty or Mansi). But there are single skulls in the Russian samples that are plotted quite close to the margins of the distributions of some Mongoloid or admixed populations (note arrows in the graph). Importantly, the skulls are not only close to those distributions but also notably remote from the centroids of their own samples. A similar picture is observed in some European samples, namely in Königsberg, Latvians, and Karels: some two or three skulls in each of these samples display Mongoloid features of craniofacial morphology to the same extent as the Russian individuals mentioned above.

The Saami sample shows the lowest level of intragroup variability of all populations studied, and plots very densely in morphospace of PC 1and PC2. A substantial part of this sample plots outside the range of Caucasoid groups.

Eastern Finn admixture in the Russian samples. The distribution of individuals of the Mordovian sample is notably compact: this is one of the most homogenous

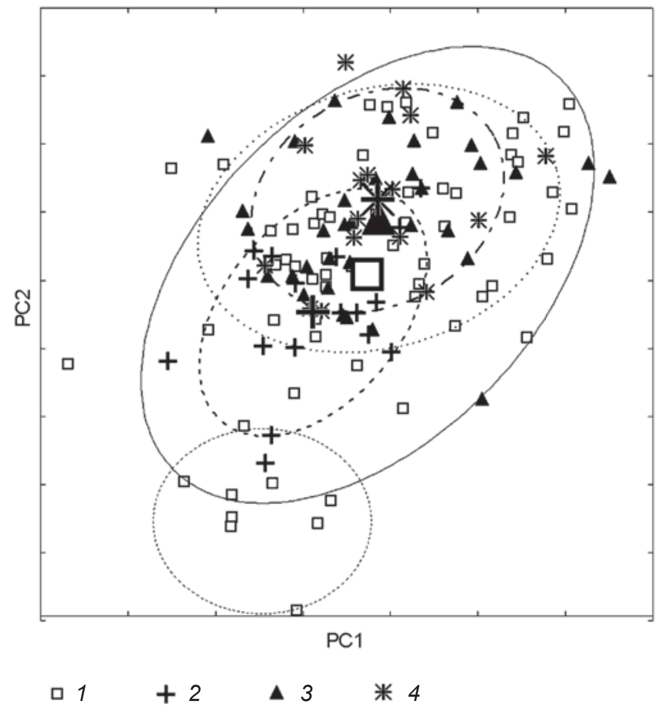

Fig. 1. Relationship between intra- and intergroup variation in the samples of ethnic Russians.
1 – Kozino; *2* – Staraya Ladoga; *3* – Sebezh; *4* – Nikolskoye.

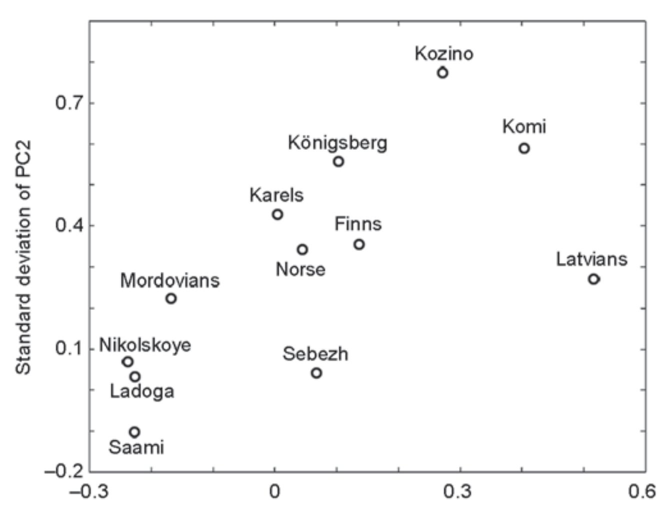

Fig. 2. Standard deviations of PC1 and PC2 in the samples used in this study.

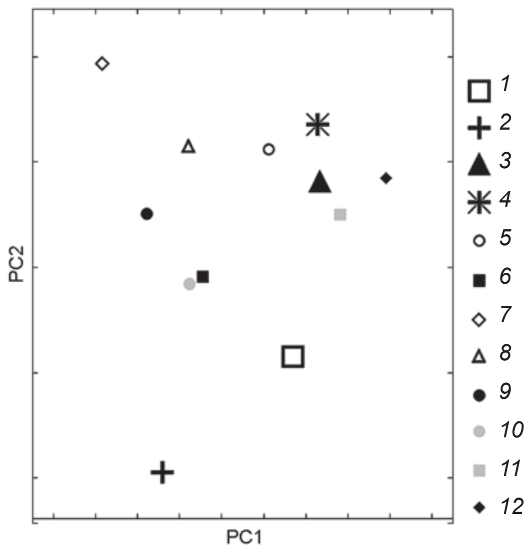

Fig. 3. Means of PC1 and PC2 in the samples used in this study.
1 – Kozino; *2* – Staraya Ladoga; *3* – Sebezh; *4* – Nikolskoye; *5* – Karels; *6* – Finns; *7* – Saami; *8* – Mordovians; *9* – Komi; *10* – Latvians; *11* – Königsberg; *12* – Norse.

populations (Fig. 5). Unlike Saami, this distribution lies completely in the range of variation of the Russian samples. 76 % of individuals from Nikolskoye, 68 % from Sebezh, and 71 % from Staraya Ladoga plot inside the ellipse outlining 90 % of the distribution of the Mordovian sample. But despite the fact that centroid of Kozino is closer to the centroid of Mordovians than is the centroid of Staraya Ladoga, only 46 % of individuals from Kozino plot inside the ellipse (see Fig. 3). The same percentage for the European samples ranges from 42 (Königsberg) to 50 (Latvians and Norse), and to 60 (Finns and Karels). Thus, three out of four Russian samples studied are substantially more morphologically similar to the Mordvinian sample than to any of the European populations.

Russian samples and Baltic populations: Karels, Finns, and Latvians.* As both the means and the distributions of the Finns and Karels are very similar, only the latter are discussed further. All individuals from Nikolskoye and Staraya Ladoga are plotted inside the range of the Karelian sample, but occupy just a relatively small part of this range. Of the skulls from Nikolskoye, 57 % are found inside the 90 % range ellipse of Karels, while the same figure for Staraya Ladoga is only 31 %. Note that centroids of Nikolskoye and Karels lie quite close in the plot, while the mean of Staraya Ladoga is quite remote from them (Fig. 3). The similarity between Karels and Sebezh is more "genuine", as the distributions of the two samples are almost identical.

A notable feature of the Latvian sample is the presence of several skulls displaying fairly well-defined Mongoloid morphology (low scores on PC1). In this sense, Latvians are similar to Komi, both in terms of means and distributions (see Fig. 3).

Ethnic Russian population against the background of Central and Western European craniofacial variation: preliminary results. The distribution of Königsberg completely covers those of three Russian samples but Kozino. The latter is in fact more diverse than Königsberg according to the scores of the first two PCs. The main difference between Königsberg and Kozino is the presence of several skulls with very low scores on PC2 in the latter. The distribution of the Norse lies fully inside the range of the Russian samples. Among these, Staraya Ladoga exhibits the least similarity to the Norse: distributions of the two samples overlap weakly.

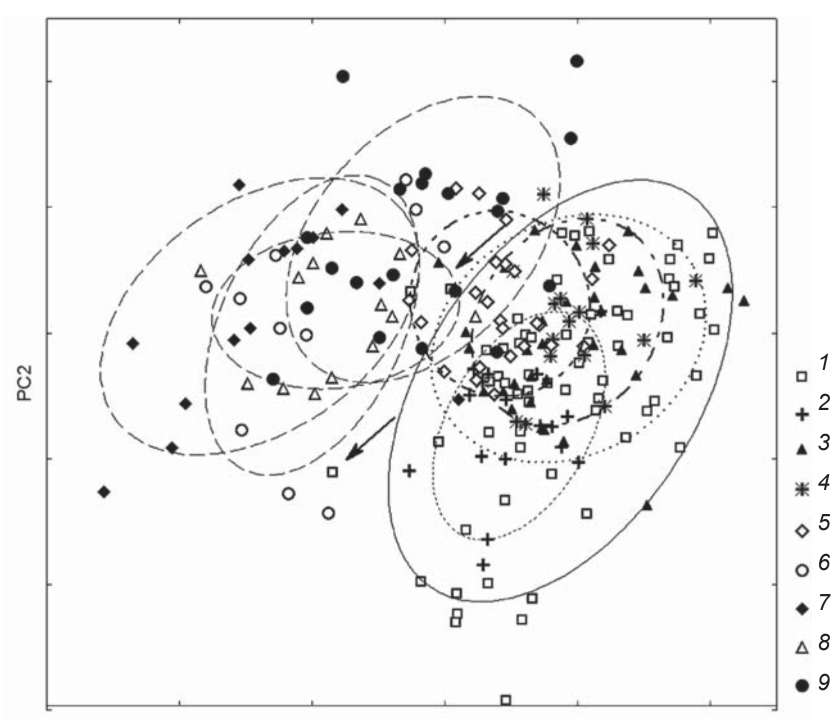

Fig. 4. Evaluation of the proportion of Mongoloid, Uralic, and Lappanoid admixture in the ethnic Russians.
1 – Kozino; *2* – Staraya Ladoga; *3* – Sebezh; *4* – Nikolskoye; *5* – Saami; *6* – Kalmyks; *7* – Mongols; *8* – Khanty; *9* – Chinese, Koreans.

*Illustrations for this and following sections can be found at https://sites.google.com/site/worldpcaeng/.

Conclusions

The distribution of the individuals from the training sample in morphospace of the "world" PCs of craniofacial measurements is perfectly consistent with the established views on the worldwide variation of cranial shape in man. Using this morphospace provides a more solid base for the assessment of the degree of intragroup variation (Fig. 2), as well as for detecting skulls of atypical morphology in cranial samples (see Fig. 1, 4, 5). For example, a quite impressive finding is that the sample from Kozino, an 18th century village near Moscow, demonstrates a higher level of intragroup variation (according to PC scores) than the sample from Königsberg, which includes people from multiple regions of several European countries. Moreover, it is more variable than the sample of Native Americans from all parts of North American continent.

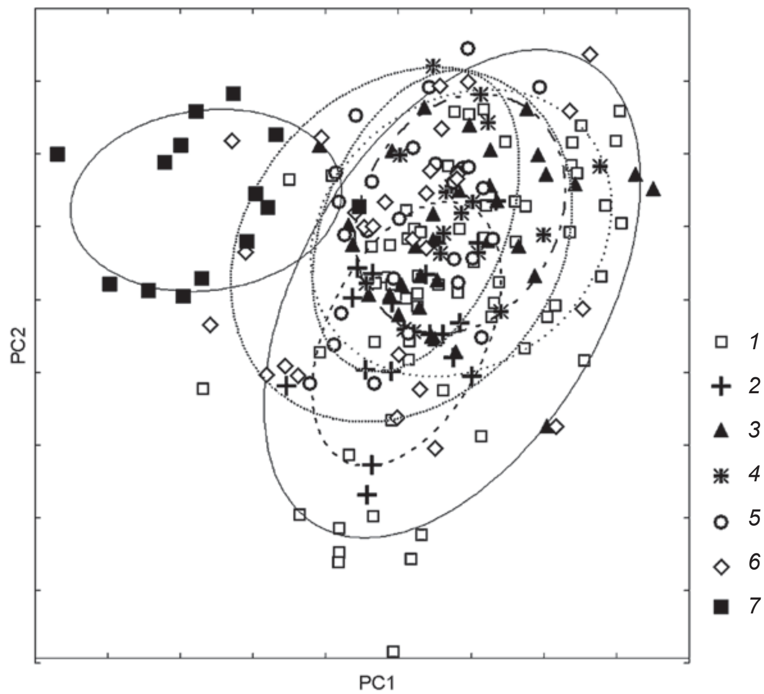

Fig. 5. Evaluation of admixture from Eastern (Volga-Ural) Finns in the ethnic Russians.
1 – Kozino; *2* – Staraya Ladoga; *3* – Sebezh; *4* – Nikolskoye; *5* – Mordovians; *6* – Komi; *7* – Khanty.

Intergroup variation between the Russian samples, in respect to their intragroup variation, is prominent as well (see Fig. 1, 3). The difference between Nikolskoye and Staraya Ladoga is almost "typological": distributions of both samples are very compact, while the distance between their means is exceptionally great (see Fig. 1). As a result, the distributions overlap minimally. According to the position of the mean in the plot, the sample from Kozino seems to display an intermediate morphology between the two samples mentioned above. But in fact it is extremely morphologically heterogeneous (see above). Its distribution covers not only the distributions of Nikolskoye and Staraya Ladoga, but almost the whole range of variation in all Caucasoid populations. This observation might be explained by the turbulent history of this region of Central Russia in the 17th–19th centuries: village of Kozino lies very close to the road connecting Moscow with Poland through Belarus. In relation to this, it is worth recalling the peculiarity of the Russian populations assigned to the "Upper Oka" local anthropological variant, to which the region belongs (Proiskhozhdeniye…, 1965: 155). Taken together, the results of this study are in better agreement with the genetic data pointing to a high level of intergroup differentiation among local populations of ethnic Russians (Balanovskaya, Balanovsky, 2007) than with the widely accepted views on modern ethnic Russians as an anthropologically homogenous people (Alekseev, 2008b: 216–218; Alekseeva, 1973: 267–273; Proiskhozhdeniye…, 1965: 130, 163, 191).

About 3 % of the individuals from the Russian samples display unusually low scores on PC1 and thus, as compared to the bulk of the skulls from their samples, lie farther from their respective centroids and closer to the distributions of some Mongoloid populations (Fig. 4). But importantly, the outliers are plotted only at the margins of those distributions. This finding is in good agreement with population genetic studies that show that the frequency of Eastern Eurasian haplogroups in modern Russians is 2 % (Balanovskaya, Balanovsky, 2007); while according to genome-wide SNP data, the proportion of East Asian admixture in this group is estimated as 6 % (Lazaridis et al., 2014). A similar proportion of "Mongoloid" skulls is observed in the samples from Königsberg, Latvia, and Karelia (note that respective modern populations—Germans, Latvians, and Karels—were not studied by Lazaridis et al.). Such skulls are absent in the Norse and Finns, as well as in two out of four Russian samples. The presence of individuals displaying some Mongoloid craniofacial features is interesting, and should not be ignored; but in general, the Russians do not seem more "Mongoloid" than most European populations employed in this study.

The population means of the Russian samples are plotted closer to the means of the European groups than to centroid of the Mordovian sample (Fig. 3). But the analysis of their individual distributions has shown that in fact all Russian populations but that of Kozino are definitely more similar to the Mordovians (Fig. 5). The sample from Sebezh also exhibits a similarity to Karels, both in terms of means and distribution. The results of genetic studies showing a specific similarity of ethnic Russians to Eastern and, to some extent, Baltic Finns (Balanovskaya, Balanovsky, 2007; Lazaridis et al., 2014) are better supported by our data than the views on the Russians as "mean Europeans" (Alekseev, 2008b; Alekseeva, 1973). At the same time, the hypothesis about a "Lappanoid" component in the Russian population (see, e.g., (Trofimova, 1941)) is not supported by our results.

Notably, one of the Russian samples, the 18th century one from Kozino, shows no more similarity with the Mordovians than do the Königsberg or the Norse samples. This fits well into the conception of "caucasoidisation"* of the population of central (but not northwestern) regions of the European part of Russia in the late medieval times (Trofimova, 1941; Alekseev, 2008b: 216–218; Alekseeva, 1973: 267–273). This temporal change in craniofacial morphology, due to a hypothetical gene flow from more (south)western regions, is particularly evident when Nikolskoye (16th–18th centuries) and Kozino (18th to early 19th centuries) are compared, as the two sites are situated just few dozen kilometers from each other.

The Latvian sample employed in this study shows a morphological similarity to the Russians neither in terms of mean nor in terms of distribution of individual skulls. Rather, the pattern plotted in the graph provides yet another piece of evidence for an "attenuation of Caucasoid features" in this population (Alekseev, 2008b: 114).

The individuals of three out of four Russian samples are plotted inside the distribution of the sample from Königsberg, which suggests that the craniofacial morphology of those Russian samples varies inside the range of the European population. But the sample from Kozino is special. First, according to PC1 and PC2 scores it is more variable than Königsberg; and second, it includes a substantial number of skulls of a particular craniofacial morphology that is very rarely observed in any other sample (Fig. 1, 5: the area of high scores on PC1 and low scores on PC2). The typical features of these skulls are very large nasal bones, a very wide nasal bridge, and a wide face.

*I.e. an increase in the prominence of Caucasoid craniofacial features, mostly a stronger nasal and mid-facial protrusion.

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Sergei Pavlovich Nesterov

On April 10, 2007, Sergei Pavlovich Nesterov, Doctor of Historical Sciences and one of the greatest scholars of ancient cultures of the Amur region, turned sixty.

Sergei Nesterov was born in the Moshkovsky District of the Novosibirsk Region. In 1974, he finished secondary school in Novosibirsk, and in 1975, entered the Department of Humanities of Novosibirsk State University. The school teacher of history fostered Sergei's interest in archaeology, and he chose it as his major subject.

The first expedition of Sergei Nesterov at the famous sites under the Mount Tepsei in Krasnoyarsk Territory was led by Y.S. Hudiakov. The topic of Nesterov's further research was determined during that expedition. Subsequently, it became the subject of his Ph.D. dissertation entitled, "Horse in the Cults of the Turkic-Speaking Tribes of Central Asia in the Early Middle Ages" (supervised by the Academician A.P. Derevianko), which Sergei Nesterov successfully defended in 1987. After graduating from the university in 1980, Sergei Nesterov started his work in the Institute of History, Philology and Philosophy of the Siberian Branch of the Soviet Academy of Sciences. Academician A.P. Okladnikov included him into the group of E.I. Derevianko, who conducted her research in the Amur region in the Far East. Since that time, the scholarly interests of Sergei Nesterov have been associated with the Far Eastern archaeology, although in 1982–1983 he took part in the studies of Denisova Cave and Okladnikov Cave in the Altai.

In 1987, when the Bureya Dam was started to be built in the eastern part of Russia, S.P. Nesterov was sent there to investigate the archaeological sites in the area of the future reservoirs, and became the leader of the Bureya archaeological expedition.

In 2001, Sergei Nesterov defended his doctoral dissertation entitled, "Ethnic and Cultural History of the Amur Region Peoples in the Early Middle Ages". He leads the Amur team of archaeologists who excavate the following sites of the Neolithic, Early Iron Age, and Middle Ages: Gromatukha, Novopetrovka III, Chernigovka-on-Zeya, Troitskoye cemetery, Osinovoye Ozero, Ozero Dolgoye, Gora Shapka, etc. Sergei Nesterov heads the joint international Russian-Korean expeditions which have been working in the Amur Region for five years. By the invitation of his foreign colleagues, he has been participating in field archaeological works in Japan and Korea. Using the materials from the sites of the Amur Region, in particular the Bureya valley, he clarifies and supplements the cultural and chronological scale of the history of the population that inhabited the Western Amur region from the Neolithic to the Middle Ages. S.P. Nesterov has identified two previously unknown archaeological cultures: the Talakan culture, belonging to the second stage of the Early Iron Age, and the Mikhailovskoye culture of the Early Middle Ages. According to him, the vector of the ethnic history of the peoples inhabiting the Western Amur region was determined by the change of the Mongolian-speaking populations by the Tungus-speaking migrant Mohe people.

Sergei Nesterov is the author and coauthor of 13 monographs and over 170 research articles. His studies always provoke great interest of Russian national and international scholarly community; dozens of his works have been published internationally in Korea, Japan, China, Vietnam, Italy, and the USA. Sergei Nesterov is an active participant of many Russian and international scientific conferences, symposia, and congresses.

In the Institute of Archaeology and Ethnography of the SB RAS, S.P. Nesterov was involved in the training of doctoral students in archaeology. For many years, he was a member of the examination committee for the admission into the doctoral program. Three of his doctoral students have successfully defended their Ph.D. dissertations.

Currently, Sergei Nesterov is the Head of the Department of the Archaeology of the Bronze and Iron Age in the Institute of Archaeology and Ethnography of the SB RAS, the Head of the Amur Laboratory of Archaeology and Ethnography, the member of the Academic Council of the Institute of Archaeology and Ethnography of the SB RAS, the Executive Secretary of the Journal *Archaeology, Ethnology and Anthropology of Eurasia* (since 2003), the curator of the archaeological section in the Journal *Gumanitarnye Nauki v Sibiri* ('Humanities in Siberia'), and a member of editorial boards in a number of periodicals, including international journals.

We wish our celebrant new expeditions and creative achievements!

A.P. Derevianko, V.I. Molodin, E.I. Derevianko, V.P. Mylnikov, L.N. Mylnikova, N.V. Polosmak, T.A. Chikisheva, A.I. Soloviev, A.P. Borodovsky, A.V. Tabarev, Y.S. Hudiakov

AN SSSR – USSR Academy of Sciences

ASGE – Archaeological Collection of the State Hermitage Museum

BAR – British Archaeological Reports

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

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

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

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

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

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

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

IYALI – G. Ibragimov Institute of Language, Literature and Art, Tatarstan Academy of Sciences (Kazan)

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

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

MAES TGU – Museum of Archaeology and Ethnography of Siberia, Tomsk State University (Tomsk)

MarNIIYALI – V.M. Vasilyev Mari Research Institute of Language, Literature and History (Yoshkar-Ola)

MIA – Materials and Investigations on Archaeology in the USSR

NGU – Novosibirsk State University (Novosibirsk)

SAI – Collection of Archaeological Sources

TIE – Transactions of the Institute of Ethnography

UrO RAN – Ural Branch of the Russian Academy of Sciences

VSOGO SSSR – East Siberian Department of the Geographical Society of the USSR

VSORGO – East Siberian Department of the Russian Geographical Society

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