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The Physical Anthropology of the Odino People, Western Siberia

The physical features of individuals buried at Odino cemeteries Tartas-1 and Preobrazhenka-6 are compared to those of people belonging to other Neolithic and Early Bronze Age cultures of the Barabinskaya forest-steppe. This study tests the hypothesis about the morphological diversity of the autochthonous substrate, which correlates with various chronological stages and cultures of the region. Measurements of the Odino group were supplemented by published data on the Sopka-2/4A population. We examine individual measurements and average characteristics, processed by principal component analysis. Local populations belonging to the Odino culture were craniometrically diverse. The hypothesis about the ties between Odino and the contemporaneous population of Central Asia is not supported. The analysis of individual data revealed several crania sharply differing from others, and similar to those of the Botai sample of the late fourth and third millennia BC.

Keywords: *Early Bronze Age, Barabinskaya forest-steppe, Odino culture, funerary-ritual complex, craniology.*

Introduction

The Odino archaeological culture was first distinguished by V.I. Molodin on the basis of materials from several cemeteries in the Barabinskaya forest-steppe: Sopka-2/4A, Preobrazhenka-6, and Tartas-1 (2008; 2012: 7–9). Before the separation of this culture, some sites of the forest-steppe zone of the Eastern Trans-Urals and Western Siberia were referred to as the "Odino type of settlement complex" (Molodin, 1985: 33). But the absence of identified cemeteries, and very limited associated goods from the settlements, hampered full-scale reconstruction of characteristics of the culture (Molodin, 2010). The area occupied by this culture ranges from the left-bank Tobol region in the west to the Central Barabinskaya in the east, from the boundary between forest-steppe and steppe in the south to taiga zone in the north (Molodin, 2012: 183).

The cemeteries of the Odino culture from the Barabinskaya forest-steppe occur inside necropolises consisting of burial complexes of varying chronology and different cultures. In Sopka-2, a small group of Odino burials (Sopka-2/4A) displays a spatial continuity with neighboring burials of the Krotovo culture (Sopka-2/4B). At the adjacent Tartas-1 necropolis, a stratigraphic palimpsest of burials of various archaeological cultures of the Bronze Age was discovered, where the Odino burials are placed stratigraphically between graves of the Ust-Tartas and Krotovo cultures. For the Odino complex of Sopka-2/4A, there is a radiocarbon date placing it in the first half of the 3rd millennium BC (29th to 27th centuries BC) (Ibid.: 190–193). The Odino burials from Tartas-1 are dated by the ^{14}C method to the middle and second half of the same millennium, i.e. to the time of the Krotovo culture. Thus, both stratigraphic observations and absolute dates point to the temporary coexistence of

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the Odino and Krotovo cultures (Ibid.: 194). Moreover, the parallel evolution of the two cultures is also reflected in their burial rites (Molodin, Grishin, 2016: 342) and pottery-making traditions (Ibid.: 374).

Human skeletal remains from the Odino culture have been studied previously. A study of a large cranial sample from Sopka-2/4A has demonstrated a similarity to the samples of preceding archaeological stages from Sopka-2, i.e. the Neolithic and Early Iron Age materials. An important feature of the cranial morphology of the sample from Sopka-2/4A is a concentration of traits highly specific for the Neolithic skulls from the same region, which suggests "conservation" of this indigenous Neolithic substrate in the Odino population. The presence of those "morphologically Neolithic" skulls was interpreted as a result of incorporation of individuals related to the Ust-Tartas culture into Odino populations (Chikisheva, 2012: 97). Such an interpretation was based mainly on the concept of the culturogenesis of the population of the Barabinskaya forest-steppe, which assumes a single autochthonous line of evolution from the Neolithic to the Ust-Tartas culture, then to the Odino and Krotovo cultures (not excluding some effect from contemporaneous cultures of the neighboring regions of Eurasia). But the features of the burial rites of the two last-named cultures, as well as their mitochondrial DNA affinities, do not match up to the described scheme.

A supine position of the deceased, with the head to the north-northeast, dominates in both Odino and Krotovo burials (Sopka-2/4A and Sopka-2/4B, respectively) and goes back to the indigenous burial traditions of the Ust-Tartas culture (Molodin, 2012: 176; Molodin, Grishin, 2016: 349). A specific feature of the Odino burials is shallowing of the pit in its northeastern part as compared to the southwestern part, intended to raise the head or the upper part of the body of the deceased. The same aim was pursued by making a ground pillow (Molodin, 2012: 175–176). This trait of the burial rite distinguishes the Odino culture "among cultures of the Early to Middle Bronze Age of Eurasia and general and Western Siberia in particular" (Ibid.: 180). A study of mtDNA has demonstrated the existence of a common genetic background for populations of the Ust-Tartas, Krotovo, and Odino cultures, with the most prominent continuity observed between the first two cultures (Molodin et al., 2013: 177–178).

Integrating the data from archaeological, anthropological, and paleogenetic studies of the ancient population of the Barabinskaya forest-steppe, Molodin arrived at the conclusion that carriers of the two pottery traditions formed by the Final Neolithic time (Linear-Pricked and Comb-Pit) acquired their specifics in terms of both material and spiritual culture, as well as anthropological and genetic features, during the Early Metal Ages. As a result, two groups of populations of different cultural (and, probably, ethnic) traditions (Ust-Tartas and Comb-Pit) had been formed in the region by the 4th millennium BC. Later, these two evolved into the autochthonous Krotovo and Odino cultures, respectively (Molodin, 2016). This conclusion of Molodin's is crucially important for studying anthropological materials belonging to the two cultures, since the autochthonous "substrate" common to both appears to be morphologically polymorphic.

The cranial type of the Neolithic and Early Bronze Age population of the Barabinskaya forest-steppe can be assigned to the Northern Eurasian anthropological formation (Polosmak, Chikisheva, Balueva, 1989: 78–81; Chikisheva, 2012: 68). But assuming such an affinity is not inconsistent with the presence of morphological differences between single populations belonging to different cultural and chronological units. So far, there has been no detailed analysis of the cranial morphology of the Barabinskaya cluster of this, undoubtedly very complex, racial structure. In a monograph from T.A. Chikisheva (2012), it has been demonstrated that the Neolithic to Early Bronze Age population of the Barabinskaya forest-steppe displays a substantial morphological distinctness when compared to all available contemporaneous cranial samples from Northern Eurasia. Since the publication of this monograph, the number of cranial samples representing the population of this cultural/chronological continuity has substantially increased, as a result of excavations in the Barabinskaya forest-steppe, led by Molodin. Importantly, new Neolithic specimens have been studied and described (Chikisheva, Pozdnyakov, Zubova, 2015; Chikisheva, Pozdnyakov, 2016).

In this study, craniometrical data obtained for two samples of the Odino culture are presented and explored. The position of the Odino samples against a background of craniometrical variation of groups representing the archaeological cultures of Barabinskaya forest-steppe of the 6th to 3rd millennia BC is analyzed.

Material and methods

Two cranial samples from the Odino culture were employed in this study. One of the samples represents the Tartas-1 complex located in the Vengerovsky District of the Novosibirsk Region. This site was first detected in 2003 at the floodplain of the right bank of the Tartas River, 2.5 km north of the Stary Tartas village (Molodin et al., 2003), and has been studied since then. The cemetery of the Odino culture was found at the site in 2008 (Molodin et al., 2008), and the skeletal sample was collected during the 2008–2012 field seasons. The second sample was obtained from the Preobrazhenka-6 cemetery in the Chanovsky District of the Novosibirsk

Region, at the margin of the floodplain of the right bank of the Om River, 5 km west of the Staraya Preobrazhenka village (Molodin et al., 2005). The skeletal sample of the Odino culture was collected in the 2005–2010 field seasons. The cranial part of the sample, excavated in 2005, has been studied and described previously (Pozdnyakov, Chikisheva, 2005).

A statistical analysis was carried via cranial measurements (Tables 1–3). Samples of the Neolithic to Early Bronze Age archaeological cultures of the Barabinskaya forest-steppe were used as reference data. These include the following sites: Neolithic (6th to 5th millennia BC) – Sopka-2/1, Protoka, Korchugan (Chikisheva, 2012: 200–208), Vengerovo-2A (Chikisheva, Pozdnyakov, Zubova, 2015); Ust-Tartas culture (4th to first half of the 3rd millennia BC) – Sopka-2/3, Sopka-2/3A (Chikisheva, 2012: 222–237); Odino culture (first half of the 3rd millennium BC) – Sopka-2/4A (Ibid.: 238–263); Krotovo culture (late 3rd to early 2nd millennia BC) – Sopka-2/4B (Ibid.: 268–291)*. For interpopulation comparisons, we employed principal component analysis, which was carried out in Statistica for Windows 10.

Results and discussion

The morphological pattern of the new cranial samples of the Odino culture can be best described through a comparative study, including the published data for the Sopka-2/4A complex. The level of sexual dimorphism of cranial metrics is not increased in any of the three samples, but the degree of cranial robusticity varies substantially between them: both males and females from Sopka-2/4A are the most robust, while the skulls from Preobrazhenka-6 are the least robust (Table 4). The mean of maximum cranial length is the largest in males of Sopka-2/4A, but it is also large in the other two samples. Maximum cranial breadth is medium or small; thus the ratio of these two dimensions varies between meso- and dolichocranial forms. The latter form is found in female skulls from Preobrazhenka-6 and the male sample from Tartas-1. Basion-bregma height is medium in all the Odino samples. The ratio of the occipital and parietal components of the sagittal arc (occipito-parietal index, OPI) is almost equal across the groups: it ranges from 93.2 to 93.9. The only exception is the female sample from Preobrazhenka-6, where it is 97.4. The frontal bone is narrow (in females from Preobrazhenka-6 it is much narrower than in the other samples) and moderately protruding; its squama is strongly inclined.

The dimensions of the facial skeleton are more variable across the Odino samples. The face of both males and females from Sopka-2/4A is wide and moderately tall, while in Tartas-1 and Preobrazhenka-6 it is of medium width and height. The female sample from Preobrazhenka-6 displays a notably narrow and low face; though, according to the conventional account (Alekseev, Debets, 1964: 118), facial dimensions in this group are rather medium, but close to small values. According to the combination of the horizontal profile angles, both males and females from Sopka-2/4A, males from Preobrazhenka-6, and females from Tartas-1 are homomesoprosopic, while males from Tartas-1 and females from Preobrazhenka-6 are heteroprosopic-mesopic and clinognathic. In all the samples, individuals with flattened (platyopic and platygnathic) heteroprosopic faces are present.

In the samples of the Odino culture, decreased values of the angles of the vertical facial profile are observed. The crania from Sopka-2/4A are mesognathic according to the values of general and alveolar facial angles, though prognathic skulls occur in the sample as well. These latter are predominant in the samples from Tartas-1 and Preobrazhenka-6; thus, the mean values of the angles are low in those two groups.

The orbits are absolutely large in all the samples, but relatively low (hameconchia) or medium (mesoconchia) and closer to low variants. The lowest orbit is observed in females from Preobrazhenka-6 and Tartas-1.

The nasal aperture is of medium width in all the samples and relatively mesorrhine. The protrusion of the nasal bridge (simotic and dacryal heights, simotic and dacryal indexes) is medium in all the Odino samples, with the highest values observed in males from Tartas-1. The nasal protrusion angle is low across all the samples, excluding females from Preobrazhenka-6 (where the angle was only measured on two skulls, but was high in both cases). A skull with a strongly protruding nose was also observed in a female from Sopka-2/4A and a male from Preobrazhenka-6. We described the general morphological pattern of the individuals showing strongly protruding noses. This includes a large maximum cranial length, a dolichocranial head-shape, a high OPI, an inclined forehead, a wide, mesoprosopic, and mesognathic face, and a high (protruding) nasal bridge. Females from Preobrazhenka-6 also display an alveolar prognathism.

Summing up, the samples of the Odino culture from three cemeteries (which we assume to belong to three local populations) exhibit a common complex of cranial features: for the cranial vault: large horizontal dimensions, dolicho- or mesocrania, medium height, equal length of the frontal and parietal parts of the sagittal arc, accompanied by a shortening of its occipital part; for the facial skeleton: medium height, mesoprosopia,

*In the monograph cited, the complexes of the Odino and Krotovo cultures are not labeled 4A and 4B, since these labels were introduced after its publication.

Table 1. **Individual data and means of cranial metrics of males of the sample form Tartas-1 (Odino culture)**

Variable*	152	253/2**	247/3	362	364	365	369/2	491	496	497	498	*X* (*n*)	*S*
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Age	30–35	30–35	45–50	50–55	30–35	20–25	30–35	45–50	35–40	45–50	35–40	–	–
1	183.0	178.0	…	…	193.0	189.0	187.0	178.0	178.0	…	180.0	183.3 (8)	5.8
8	144.0	132.0	…	…	141.0	133.0	138.0	134.0	139.0	140.0 ?	127.0	136.0 (8)	5.5
17	131.0	129.0	…	…	133.0	136.0	…	129.0	143.0	…	…	133.5 (6)	5.36
20	111.0	106.0	…	…	110.0	116.0	111.5	106.0	118.0	…	112.0	111.3 (8)	4.23
5	103.0	103.0	…	…	104.0	100.0	…	97.0 ?	107.0	…	…	103.4 (5)	2.51
9	90.5	85.8	99.8	…	95.7	94.3	97.0	96.0	92.5	…	93.0	93.8 (9)	4.06
10	115.0	110.0	123.0	…	117.0	116.0	117.0	112.0	120.0	…	106.0	115.1 (9)	5.16
11	129.0	118.0	…	131.0	127.0	127.0	127.0	120.0	125.0	…	118.0	124.7 (9)	4.82
12	117.0	108.0	…	116.0	107.0	113.0	105.0	109.0	106.0	…	111.0 ?	110.1 (8)	4.61
29	112.2	107.7	115.0	…	111.4	114.5	115.0	108.0 ?	107.5	…	109.5	111.6 (8)	3.13
30	97.2	108.5	…	…	116.0	117.5	115.3	109.5	103.5	…	112.0	109.9 (8)	6.9
31	104.0	90.5	…	93.0	102.0	102.3	93.0	91.2	101.0	…	…	97.1 (8)	5.68
26	128.0	124.0	133.0	…	128.0	132.0	132.0	125.0	121.0	…	121.0	127.1 (9)	4.65
27	107.0	121.0	135.0	…	128.0	129.0	129.0	120.0	127.0	…	128.0	124.9 (9)	8.05
28	128.0	106.0	108.0	115.0	124.0	123.0	115.0	110.0	115.0	…	…	116.0 (9)	7.58
Angle of transverse curvature of the forehead	141.0	141.4	126.7	…	134.6	134.0	134.4	134.8	136.4	…	131.4	135 (9)	4.5
Sub.NB	21.2	22.0	26.5	…	23.5	26.5	23.1	25.5	22.0	…	22.0	23.6 (9)	2.07
Occipital subtense	28.6	24.0	…	28.5	28.0	28.6	21.0	25.0	21.0	…	…	25.6 (8)	3.33
45	138.0	130.0	…	…	…	141.0	…	133.0	139.0	…	131.0	135.3 (6)	4.59
40	96.0	106.0	…	…	107.0	103.0	…	97.0	101.0	…	…	101.7 (6)	4.55
48	71.0	67.0	77.0 ?	…	74.5	78.0	75.0	62.0 ?	67.0	…	68.0	71.5 (7)	4.41
47	117.0	106.0	133.0 ?	…	119.0	126.0	123.0	…	118.0	…	…	118.2 (6)	6.85
43	107.0	105.0	…	…	110.0	115.0	109.0	109.0	109.0	108.0 ?	106.0	108.8 (8)	3.06
46	101.0	95.5	…	…	105.0	100.0	101.0	97.5	99.0	94.0	91.0	98.2 (9)	4.23
60	54.0	56.5	…	…	…	58.0	57.0	…	55.0	…	57.0	56.3 (6)	1.47
61	64.0	62.0	…	…	67.0	62.5	61.0	…	58.0	63.0	58.0	61.9 (8)	3.01
62	42.6	…	50.0	…	…	49.0	47.0	…	47.0	…	50.0	47.6 (6)	2.8
63	33.5	38.5	…	…	40.5	34.0	32.0	…	32.0	38.0	33.0	35.2 (8)	3.31
54	23.5	23.5	…	…	23.5	24.0	26.0	24.0	25.0	25.0 ?	25.0	24.3 (8)	0.92
55	50.0	48.3	53.5	…	53.5	52.0	54.5	44.0 ?	47.5	…	51.0	51.3 (8)	2.55
51	44.0	44.5	…	…	43.0	48.0	42.0	44.0 (dexter)	45.0	…	46.0	44.6 (7)	1.97
51a	41.0	40.3	…	…	40.0	44.5	38.0	…	40.0	…	42.0	40.8 (7)	2.02
52	34.5	32.6	37.3	…	37.5	33.5	33.0	36.5	33.0	…	35.5	34.8 (9)	1.94
Nasomalar angle	140.8	145.6	142.4	…	142.2	136.4	140.0	148.5?	142.4	…	136.4	140.8 (8)	3.15
Zygomaxillary angle	128.9	129.5	…	…	130.4	126.9	124.5	140.4?	129.1	129.5	129.8	128.6 (8)	1.94
SS	2.0	4.0	…	…	5.0	…	…	…	…	…	5.0	4.0 (4)	1.41
SC	5.0	7.0	…	…	9.0	8.0	6.0	…	…	…	7.8	7.1 (6)	1.45

Table 1 (end)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
DS	10.5	14.0	…	…	13.5	…	…	…	…	…	13.0	12.8 (4)	1.55
DC	20.2	21.2	…	…	27.5	…	22.0	…	…	…	20.5	22.3 (5)	3
32	70.0	79.0	…	…	76.0	83.0	75.0	74.0 ?	77.0	…	71.0	75.9 (7)	4.49
GM/FH	59.0	70.0	…	…	62.0	76.0	65.0	66.0 ?	69.0	…	60.0	65.9 (7)	6.15
72	83.0	76.0	…	…	78.0	81.0	85.0	76.0 ?	80.0	…	75.0	79.7 (7)	3.64
73	86.0	79.0	…	…	82.0	87.0	90.0	82.0 ?	85.0	…	79.0	84.0 (7)	4.16
74	78.0	60.0	…	…	70.0	68.0	71.0	63.0 ?	66.0	…	63.0	68.0 (7)	5.86
75	60.0	51.0	…	…	54.0	…	…	…	…	…	49.0	53.5 (4)	4.80
75 (1)	23.0	25.0	…	…	24.0	…	…	…	…	…	26.0	24.5 (4)	1.29

*According to R. Martin (after (Alekseev, Debets,1964)).
**Number of burial/number of skeleton.

Table 2. **Individual data and means of cranial metrics of females of the sample form Tartas-1 (Odino culture)***

Variable	193	253/1	253/3	270/1	286	330/2**	484	487	492	495	*X* (*n*)	*S*
1	2	3	4	5	6	7	8	9	10	11	12	13
Age	30–35	40–45	40–50	35–40	20–25	13–15	60+	19–24	35–40	18–20	–	–
1	186.0	179.0	…	181.0	183.0	178.0	…	…	…	164.0	178.6 (5)	7.66
8	137.0	131.0	…	138.0	…	135.0	…	…	…	134.0	135.0 (4)	3.16
17	127.5	131.0	…	130.0	122.0	125.0	…	…	…	126.0	127.3 (5)	3.56
20	113.0	110.0	…	110.0	…	109.0	…	…	…	105.0	109.5 (4)	3.32
5	102.0	102.0	…	100.0	96.0	93.0	…	…	…	93.0	98.6 (5)	3.97
9	92.2	91.0	…	85.4	87.3	92.0	…	…	98.5 ?	88.5	90.5 (6)	4.63
10	113.0	112.0	…	115.0	107.0	115.0	…	…	…	114.0	112.2 (5)	3.11
11	117.0	118.0	…	123.0	115.0	121.0	…	137.0 ?	…	120.0	121.7 (6)	7.99
12	105.0	102.0	117.0	111.0	…	110.0	…	121.0 ?	…	99.0	109.2 (6)	8.68
29	115.8	112.2	…	109.5	106.8	107.5	107.5	…	116.0 ?	103.6	110.2 (7)	4.69
30	106.0	109.0	118.0	109.5	108.0	108.5	126.0	…	…	103.0	111.4 (7)	7.93
31	104.5	93.4	98.0	103.7	…	89.2	…	94.6	…	88.0	97.0 (6)	6.35
26	130.0	130.0	…	127.0	121.0	127.0	124.0	…	132.0	114.0	125.4 (7)	6.32
27	114.0	122.0	128.0	115.0	120.0	123.0	147.0 ?	…	…	117.0	119.3 (6)	5.20
28	123.0	106.0	118.0	118.0	…	104.0	…	118.0	…	102.0	114.2 (6)	8.21
Angle of transverse curvature of the forehead	133.1	136.4	…	140.8	127.6	128.9	…	…	…	136.8	134.9 (5)	4.93
Sub.NB	25.3	26.7	…	27.0	22.5	28.0	25.2	…	…	21.3	24.7 (6)	2.29
Occipital subtense	26.2	19.6	24.5	24.2	…	21.5	…	22.6	25.0	18.3	22.9 (7)	2.94
45	130.0	128.0	…	…	…	120.0	…	139.0 ?	…	128.0	131.3 (4)	5.25
40	106.0	102.0	…	…	88.0	93.0	…	…	…	93.0	97.3 (4)	8.22
48	66.0	65.0	…	…	65.0	57.0	…	…	87.0	64.0	69.4 (5)	9.86
47	106.0	97.0	…	117.0	116.0	98.0	…	…	…	102.0	107.6 (5)	8.73
43	104.5	102.5	…	104.0	98.0	99.0	…	106.5	117.0	100.0	104.6 (7)	6.15
46	98.0	95.0	…	87.0	…	89.0	…	94.0	101.0	98.0	95.5 (6)	4.85

Table 2 (end)

1	2	3	4	5	6	7	8	9	10	11	12	13
60	53.5	55.0	…	…	51.0	50.0	…	…	54.0	50.0	52.7 (5)	2.11
61	64.5	61.0	…	…	59.0	57.0	…	64.0	69.0	64.0	63.6 (6)	3.41
62	45.0	…	…	…	…	41.4	…	…	…	41.0	42.5 (3)	2.20
63	38.5	37.0	…	37.0	33.0	31.0	…	40.5	40.0	37.0	37.6 (7)	2.49
54	27.0	24.2	…	…	23.0	23.0	…	24.0	24.0	21.5	24.0 (6)	1.80
55	47.3	51.0	…	55.0	49.0	42.3	…	…	63.0	45.0	51.7 (6)	6.49
51	46.5	42.6	…	47.0	…	41.0	…	…	47 (dexter)	…	45.8 (4)	2.13
51a	…	38.8	…	39.0	…	39.0	…	…	…	…	38.9 (2)	…
52	32.3	33.2	…	34	33.0	35.5	…	…	38.5	…	34.2 (5)	2.48
Nasomalar angle	141.0	145.1	…	152.8	135.2	140.0	…	…	144.7	143.1	143.7 (6)	5.76
Zygomaxillary angle	125.6	127.1	…	…	…	132.9	…	131.4	136.4	130.8	130.3 (5)	4.21
SS	4.0	3.0	…	2.5	2.2	2.5	…	…	…	…	2.90 (4)	0.79
SC	9.0	7.0	…	5.5	6.5	6.0	…	…	…	…	7.0 (4)	1.47
DS	…	11.0	…	9.2	…	9.5	…	…	…	…	10.1 (2)	…
DC	…	20.0	…	24.0	…	20.0	…	…	…	…	22.0 (2)	…
32	79.0	86.0	…	85.0	…	85.0	…	…	…	71.0	80.3 (4)	6.90
GM/FH	72.0	76.0	…	75.0	…	82.0	…	…	…	66.0	72.3 (4)	4.50
72	81.0	79.0	…	…	…	78.0	…	…	…	76.0	78.7 (3)	2.52
73	86.0	82.0	…	…	…	83.0	…	…	…	77.0	81.7 (3)	4.51
74	59.0	64.0	…	…	…	63.0	…	…	…	68.0	63.7 (3)	4.51
75	63.0	68.0	…	…	…	65.0	…	…	…	…	65.5 (2)	…
75 (1)	18.0	11.0	…	…	…	13.0	…	…	…	…	14.5 (2)	…

*See note to Table 1.

**Measurements of this individual were not used for calculating the sample mean.

mesognathia, mesorhinia, and absolutely large and mesohameconchal orbits. The width of the face varies from wide to medium.

The female sample from Preobrazhenka-6 is the most specific. Its cranial morphology exhibits features either absent (Tartas-1, males from Sopka-2/4A) or represented by single skulls (a female from burial 191A of Sopka-2/4A, and a male from burial 3 of Preobrazhenka-6) in other samples. The main feature distinguishing this pattern is strong nasal protrusion. The individuals displaying this trait also exhibit large (as compared to the group mean) horizontal dimensions and height of the cranial vault, the highest OPI, a wide, mesoprosopic or mesopno-clinognathic face, and a strongly protruding nasal bridge. The presence of this morphologically specific cranial pattern at Preobrazhenka-6 could probably be interpreted as evidence for close kin relationships between the females buried at this site. Yet another interesting feature of this "type" is the shape of the lower margin of the piriform aperture, which displays the *fossae praenasales* pattern in all females, and in the single male with the strongly protruding nose.

We found an analog to the cranial complex described above in a small sample from the Botai settlement site, dated to the late 4th to 3rd millennia BC (Rykushina, Seibert, 1984), of the Botai archaeological culture (Seibert, 1983). The main subsistence strategy of this culture was horse-breeding, probably accompanied by the hunting of wild horses. The perfectly humidified steppes of Northern Kazakhstan of the 3rd millennium BC provided great conditions for the stable persistence of huge herds of wild horses (Khabdulina, Zdanovich, 1984). At the Odino culture settlements in the Barabinskaya forest-steppe, bones of both wild and domesticated animals, including horses, were found. This makes researchers hypothesize that the Odino population was in transition to a manufacturing economy, i.e. husbandry (Molodin, Nesterova, Mylnikova, 2014). It is likely that this population had some trade contacts with the Botai groups of the Northern Kazakhstan steppe, which led to the introduction of horses into the Odino culture's

Table 3. **Individual data and means of cranial metrics**

Variable	Male												
	1	3	6	9	10	24	37/1	38	41	46	50/1	53	55
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Age	30–35	16–19	15–18	30–35	20–25	30–35	20–25	25–30	45–50	25–30	30–35	25–30	40–45
1	…	187	174	…	…	…	…	193	…	…	…	186	195
8	…	142	153	…	…	…	…	…	…	…	…	…	139
17	…	137	…	…	…	…	…	132	…	…	…	…	137
20	…	121.5	114	…	…	…	…	118	…	…	…	…	111
5	…	104	…	…	…	…	…	98	…	…	…	…	105
9	…	97.2	97.6	…	86	93	…	89.4	97.4	…	…	…	94
10	…	123	116	…	…	123.0 ?	…	111	110.0 ?	…	…	..	117
11	…	128.5?	138	…	…	135.0 ?	…	121	…	…	131	…	128
12	…	112.0?	109	…	…	…	…	110	…	…	113	…	118
29	…	108.3	110.4	…	122.3	112	…	116.6	107.5	…	…	107	120
30	…	112.3	105.8	…	…	…	…	117.3	102.3	…	…	104.5	117.8
31	…	100.5	…	…	…	…	…	95	94.2	…	90	…	102.8
26	…	122	122	…	134	133	…	145	122	…	…	118	139
27	…	123	120	…	…	137	…	137	124	…	…	127	128
28	…	125	…	…	…	…	…	130	116	…	106	…	127
Angle of transverse curvature of the forehead	…	136.4	132.7	…	136.8	134.2	…	133.9	138.8	…	…	…	132.9
Sub.NB	…	21.8	21	…	23.2	25	…	26	24.5	…	…	20.5	27.8
Occipital subtense	…	31.3	…	…	…	…	…	27	25.5	…	20.5	…	29.5
45	…	137	…	…	…	…	…	…	…	…	…	…	137
40	…	102	…	…	…	…	…	99	…	…	…	…	104
48	…	74	70	77.0 ?	…	76	…	70	71	…	…	68	75
47	…	124	117	127.0 ?	…	117	…	…	116.0 ?	…	…	111	124
43	…	109	108	…	98.0 ?	105	…	103	103	111	…	109	108
46	…	101.5	102	…	…	92	…	92	96	106.5	…	97	99
60	…	56	…	…	…	56	…	…	…	60	…	56	62
61	…	62.5	70	61.5	…	60	…	…	59	62	61	57	64
62	…	50	…	46	…	…	…	…	…	49	…	49	52
63	…	33.5	37.5	39	…	39	…	35	32	36.5	40	32	41.5
54	…	24	25.5	22.5	…	…	…	23	26	…	…	25	24
55	…	53	54	55.0 ?	…	53	…	48.5	54	…	…	46	53
51	…	45.5	42.5	47	…	…	…	43	43	…	…	42	42.5
51a	…	42	…	43	…	…	…	38.8	…	…	…	38	39.5
52	…	37	38.7	…	…	…	…	35	33.5 (dexter)	…	…	28	37
Nasomalar angle	…	136.6	137.6	…	150.4 ?	142.6	…	141.4	142	…	…	141.8	148.9

in the sample form Preobrazhenka-6 (Odino culture)*

							Female						
58	61	64/1	66	70	*X* (*n*)	*S*	19/2	47	54/1	62	64/2	*X* (*n*)	*S*
15	16	17	18	19	20	21	22	23	24	25	26	27	28
40–45	40–45	40–45	30–35	20–25	–	–	35–40	45–50	25–30	30–40	20–25	–	–
182	…	…	177	173	183.4 (8)	8.33	…	191.0 ?	178	168	179	179.0 (4)	9.42
137	140	…	140	140	141.6 (7)	5.26	…	131.0 ?	133	131	136	132.8 (4)	2.36
139	127	…	131	126	132.7 (7)	5.12	…	…	127	122	126	125.0 (3)	2.65
111	111	…	123	104	114.2 (8)	6.32	…	…	102.5	99	104	101.8 (3)	2.57
107	…	…	95	96	100.8 (6)	5.11	…	…	92	89	94	91.7 (3)	2.52
95	…	…	93.5	82	92.5 (10)	5.21	93	87.7	83	79.8	95	87.7 (5)	6.44
123	…	…	120	110	117.0 (9)	5.61	118	107	106	106	112	109.8 (5)	5.22
124	121	…	125	120	127.2 (10)	6.13	…	123.0 ?	117	117	121	119.4 (4)	3
100	108	…	111	113	110.4 (9)	4.88	…	107.0 ?	107	100	111	106.3 (4)	4.57
112	…	…	109	102.5	111.6 (11)	5.92	94.8	109.4	104	103	105	103.2 (5)	5.31
116	123	…	108.5	110	111.8 (10)	6.69	…	116	112	107	106.5	110.4 (4)	4.5
93	92	…	93	97	95.3 (9)	4.14	…	…	107	93	96	98.7 (3)	7.37
…	…	…	126	114	127.5 (10)	9.87	123	122	115	120	119	119.8 (5)	3.11
130	137	…	118	125	127.8 (11)	6.79	…	130	124	119	120	123.3 (4)	4.99
110	118	…	115	111	117.6 (9)	8.23	…	…	130	107	117	118.0 (3)	11.53
…	…	…	134.2	142.2	135.8 (9)	3.12	131.4	133.9	137.8	141.2	136.4	136.1 (5)	3.74
…	…	…	25	19	23.4 (10)	2.76	27	20.3	21.5	27	23	23.8 (5)	3.11
24.5	32.5	…	28	22	26.8 (9)	4.05	…	…	30	23	28	27.0 (3)	3.61
139	…	…	132	130	135.0 (5)	3.81	…	…	125	122	130	125.7 (3)	4.04
104	…	…	94	92	99.2 (6)	5.15	…	…	99	97	94	96.7 (3)	2.52
69	…	…	67	64	71.0 (11)	4.07	64.5 ?	70	66	66	66.5	66.6 (5)	2.04
115	…	…	112	111	117.4 (10)	5.76	…	108	110	104	106	107.0 (4)	2.58
110	…	…	105	99	105.7 (12)	4.3	106	101	100	96	104	101.4 (5)	3.85
96	…	…	90	92	96.7 (11)	5.14	…	97	95	92	89	93.3 (4)	3.5
58	…	…	50	54	56.5 (8)	3.66	…	…	56	56	54	55.3 (3)	1.15
65	…	…	59	60	61.8 (12)	3.42	…	62	61	62	61	61.5 (4)	0.58
47	…	…	-	46.4	48.5 (7)	2.16	…	…	46.5	47	47	4.8 (3)	0.29
37	…	…	38.5	34.5	36.6 (13)	3.04	…	34.7	37	34	31.5	34.3 (4)	2.26
24.4	24	…	25	22.2	24.1 (11)	1.21	…	26.5	26	22.5	23	24.5 (4)	2.04
55	…	…	48	46.3	51.4 (11)	3.5	45.5	50.5	46.5	45	46.4	46.8 (5)	2.17
45.7	…	…	41	42.2	43.4 (10)	1.94	41.7	44.5	42	41	44	42.6 (5)	1.52
44.3	…	…	39.3	37	40.2 (8)	2.57	…	42.1 (dexter)	39	37	40.5	39.7 (4)	2.17
35	…	…	33.5	32	34.4 (9)	3.18	33.2	32.5	29.5	30.5	34	31.9 (5)	1.88
135.8	…	…	142.9	142.6	142.1 (11)	4.55	146	136.8	145.8	152.6	143.7	145.0 (5)	5.66

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zygomaxillary angle	…	128.9	132.7	…	…	144.3	…	122.9	128.3	138.2	…	137.2	140.6
SS	…	3.7	3.6	…	…	…	…	2	…	…	…	…	5.2
SC	…	10.4	7.8	…	…	…	…	7	…	…	…	…	11.7
DS	…	12.8	…	…	…	…	…	11	…	…	…	…	11.2
DC	…	25.4	…	…	…	…	…	20	…	…	…	…	19.3
32	…	78	73	…	…	…	…	81	…	…	…	…	75
GM/FH	…	74	63	…	…	…	…	71	…	…	…	…	65
72	…	82	76	…	…	…	…	84	…	…	…	…	81
73	…	89	77	…	…	…	…	89	…	…	…	…	92
74	…	72	72	…	…	…	…	67	…	…	…	…	55
75	…	52	57	…	…	…	…	…	…	…	…	…	67
75 (1)	…	30	19	…	…	…	…	…	…	…	…	…	14

*See note to Table 1.

Table 4. **Mean scores of robustness traits in the cranial samples of the Odino culture**

Variable	Tartas-1		Preobrazhenka-6		Sopka-2/4A	
	Male	Female	Male	Female	Male	Female
Superglabellar region (1–6)	3.7 (9)	1.4 (8)	2.7 (11)	1.4 (5)	4.1 (34)	2.3 (40)
Browridge (1–3)	2.0 (9)	1.4 (8)	1.9 (12)	1.0 (5)	2.1 (35)	1.5 (41)
External occipital prominence (0–5)	2.5 (11)	0.5 (8)	1.2 (10)	0.5 (4)	2.6 (27)	0.6 (35)
Mastoid process (1–3)	1.8 (9)	1.0 (10)	1.3 (13)	1.0 (5)	2.4 (31)	1.5 (40)

Note. In parentheses, number of observations is given.

subsistence economy. But any interpopulation contacts may result in incorporation of people of another culture into a group. Among the burials of the Odino culture, such "incorporates" do not differ from the locals in terms of funerary rite; they are only particular in their physical features. The strongly prognathic facial shape of one of the skulls from Botai was explained by G.V. Rykushina by a possible ancient admixture of equatorial elements into the population of the Botai culture (Rykushina, Seibert, 1984). But in the samples from the Odino culture, the vertical facial profile in general is mesognathic, and there is only a tendency towards an alveolar prognathism. This makes Rykushina's hypothesis less plausible.

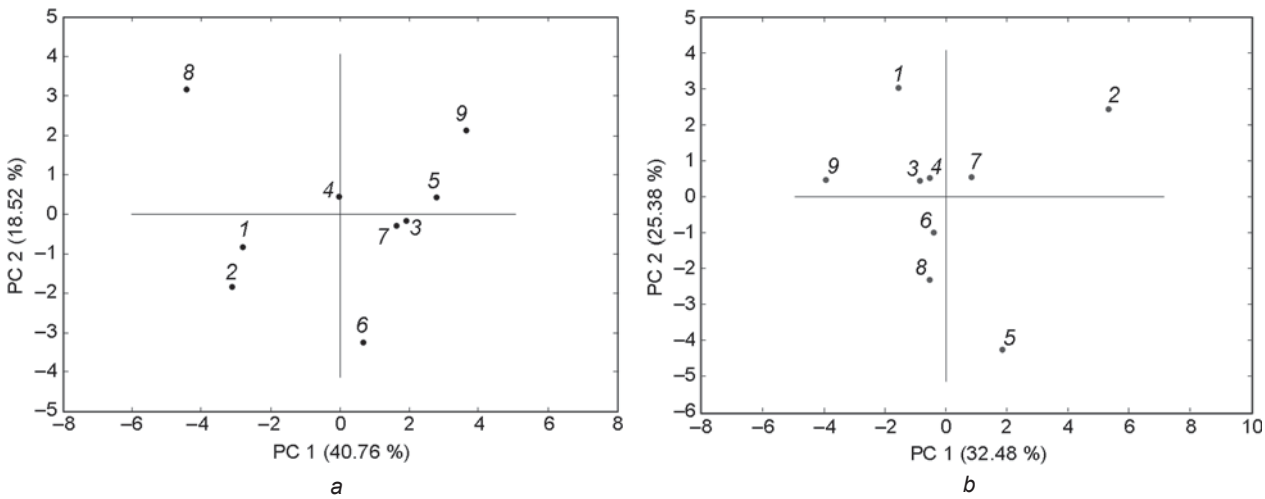
Vast cranial samples from the funerary-ritual complexes of the Barabinskaya forest-steppe appeared not as representative for a comparative statistical analysis of single skulls, owing to the poor preservation of most skulls from those complexes. When variables of both facial and neurocranial compartments were combined in the same analyses in Statistica, this led to a substantial decrease of sample sizes and to the exclusion of unique single Neolithic specimens from the analysis. Thus, a principal component analysis of single individuals was not possible, and only an intergroup analysis based on means was carried out.

Nineteen cranial metric variables were employed. For the neurocranium: maximum length and breadth, *basion-bregma* and *porion-bregma* heights, and minimum frontal breadth. For the mid-facial skeleton: upper facial height, breadth between *frontomalare temporale* and zygomaxillary chord, and nasal and orbital heights and breadths. Indexes of nasal protrusion, simotic and dacryal; and angles: nasomalar, zygomaxillary, forehead inclination, and nasal protrusion.

The first two factors of the principal component analysis account for app. 60 % of the total variance (see *Figure*). Notably, both males and females of the Odino culture from Sopka-2/4A, of the Krotovo culture from Sopka-2/4B, and of the flat burials of the Ust-Tartas culture at Sopka-2/3A cluster compactly close to each other on the plot. A small sample of the Neolithic specimens from Barabinskaya locates in the same sector of the plot. But males and females from the sample of the Late Krotovo culture from Sopka-2/4B display different

Table 3 (end)

15	16	17	18	19	20	21	22	23	24	25	26	27	28
129.3	…	…	137.2	131	133.7 (11)	6.33	…	124.5	133.9	130.4	128	129.2 (4)	3.96
4.2	…	…	3.5	2	3.5 (7)	1.15	…	…	2.5	1	3.5	2.3 (3)	1.26
13.3	…	…	8.5	6	9.2 (7)	2.64	10	…	7.8	6	6.2	7.5 (4)	1.85
10.5	…	…	11	12.7	11.5 (6)	0.97	…	…	9.2	9.2	11	9.8 (3)	1.04
22	…	…	22.5	19.7	21.5 (6)	2.31	…	…	21.8	20.3	20.2	20.8 (3)	0.9
…	…	…	84	72	77.2 (6)	4.71	…	…	82	88	77	82.3 (3)	5.51
…	…	…	75	62	68.3 (6)	5.72	…	…	78	82	67	75.7 (3)	7.77
79	…	…	82	80	80.6 (7)	2.57	…	…	76	75	81	77.3 (3)	3.21
85	…	…	89	86	86.7 (7)	4.86	…	…	80	80	86	82.0 (3)	3.46
62	…	…	61	67	65.1 (7)	6.2	…	…	60	64	65	3.0 (3)	2.65
56	…	…	65	55	58.7 (6)	5.96	…	…	47	…	57	52.0 (2)	…
23	…	…	17	25	21.3 (6)	5.82	…	…	29	…	24	26.5 (2)	…



Scatterplots of the PC1 and PC2 of male (*a*) and female (*b*) samples of the Neolithic and Bronze Age from the Barabinskaya forest-steppe.

1–3 – Odino culture: *1* – Tartas-1, *2* – Preobrazhenka-6, *3* – Sopka-2; *4* – classic period of the Krotovo culture (Sopka-2); *5* – late period of the Krotovo culture (Sopka-2); *6*, *7* – Ust-Tartas culture: *6* – Сопка-2/3, *7* – Sopka-2/3A; *8* – Neolithic (Vengerovo-2); *9* – summary sample of the Neolithic (Sopka-2, Protoka, Korchugan).

affiliations: while the former cluster together with the other samples from Sopka-2, the latter are separated from these. Summing up, the analysis of the Neolithic to Early Bronze Age cranial samples has demonstrated a cultural and chronological continuity in morphology between populations of various periods at Sopka-2.

The male Odino culture samples from Tartas-1 and Preobrazhenka-6 display a morphological similarity, while females from the same samples are quite distinct. The peculiarity of the cranial morphology of the Odino female sample from Preobrazhenka-6 was mentioned above and putatively explained by kin relationships between the females. But the distinct position of the Late Krotovo female sample can be explained by the persistence of a larger proportion of Andronovo-related ancestry in females of this group as compared to its males. Thus, the former retained cranial features more typical of the autochthonous population of the Barabinskaya forest-steppe.

Conclusions

This study was aimed at testing the hypothesis about the degree of morphological polymorphism of the autochthonous substrate, basal for the population of the Barabinskaya forest-steppe. But the expected result was not achieved, as the study failed to demonstrate differentiation of cranial complexes of the samples representing main cultural and chronological formations known from archaeological data. The same unified anthropological variant has persisted without substantial change over several millennia—from the Neolithic to the Middle Bronze Age. However, some variation in features of this general "type" among local populations of the Odino culture was nevertheless detected. It was not described previously, as skeletal material from only one site, Sopka-2, was studied. The addition of new samples from other burial sites of the Odino culture led to the detection of this variation. In our principal component analysis, we have intentionally narrowed the scale of variation of reference data to only one anthropological type represented in the indigenous population of Barabinskaya.

The hypothesis about the ties between the Odino people and the contemporary population of Central Asia was not supported. Such ties were also not confirmed by the mtDNA data (Pilipenko, 2010: 10). On the other hand, in the dental samples from Tartas-1 and Preobrazhenka-6, markers of the "Southern" complex were detected (Zubova, Molodin, Chikisheva, 2016). Not less important, among the grave goods from Sopka-2/4A there are artifacts that have direct analogs from Central Asian sites of the Namazga IV, V period (Molodin, 2012: 190). At the moment, we cannot explain such a discrepancy between the results of different disciplines, and leave this question open until future research.

Our analysis of morphology of individual skulls of the Odino culture detected the presence of single individuals demonstrating a consolidated complex of cranial features dissimilar to the main Barabinskaya "type". Parallels for this complex can be found in some skulls from the late 4th to 3rd millennia BC Botai settlement (Rykushina, Seibert, 1984). Probably, the Odino population of the Barabinskaya forest-steppe had contacts with Botai groups of Northern Kazakhstan.

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