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Affinities of the Sargat Population in the Baraba Forest-Steppe

Within-group, between-group, and comparative analysis of craniometric data relating to local and chronological samples of the Sargat population (5th century BC to late 3rd / 4th century AD) was carried out. The study focuses on sample from the Baraba forest-steppe. Comparative analysis, performed with the principal component method, included Early Iron Age samples from adjacent territories. No discontinuity was found in the spatio-temporal cranial variation among the Sargat groups. Despite differences between the three Sargat samples (Baraba, Irtysh, and Trans-Ural), they all represent one and the same Caucasoid physical type, characterized by meso-brachycrany, medium-high braincase, wide low, and somewhat flattened face, moderately inclined frontal bone, and protruding nasal bones. The Baraba group differs from two others by a wider face, larger pyriform aperture, and largest dacryal width. Comparative statistical analysis indicates affinities of the male part of Sargat groups with nomads of the Urals and Kazakhstan—Saka, Sauromatians, and Sarmats. Possibly, military campaigns by the Achaemenid state against the nomadic tribal unions of Central Asia in the second half of the 6th century BC triggered the migration process. Initially, migrants moved to the Irtysh basin, and thence to the western (Trans-Ural) and eastern (Baraba) peripheries of the emerging Sargat culture. The female part of the population was less affected by migratory processes. Female samples of the Sargat reveal an autochthonous cranial complex.

Keywords: *Sargat culture, cranial complexes, West Siberian forest-steppe, Ural and Kazakhstan steppes, nomadic tribes.*

Introduction

The similarities in the ceramics, house-building techniques, and funerary rites observed across the forest-steppes of the Irtysh and Ishim regions led to the formation of the concept and the term "Sargat culture" in the late 1960s (Koryakova, 1982: 115). The accepted boundaries of the Sargat archaeological sites area are as follows: the northern boundary is determined by the Tobol River's mouth, while the eastern boundary is delineated by the western part of the Baraba Lowland, extending to the middle of the Om River. The southern boundary is demarcated by the Kazakh steppes at approximately 55° N, the western boundary by the lower Tobol, Pyshma, Tavda, and the middles of the Iset and Miass rivers. Consequently, this area covers mainly the forest-steppe zone, and at its edge spreads to the northern sections of the steppe and southern forest zones (Koryakova, 1988: 6). The Sargat culture is represented by four local variations: Tobol, Ishim, Irtysh, and Baraba, which are geographically associated with the basins of the major rivers in Western Siberia (Ibid.; Matveeva, 2018).

Radiocarbon dating carried out by N.P. Matveeva on 118 samples from various objects, settlements, and burial mounds provided the results that placed the Sargat culture's primary area of existence (in the Tobol-Irtysh interfluvial region) in the period from the 5th century BC to the first half of the 4th century AD (2017). In accordance with the findings of S.V. Sharapova, the upper chronological boundary does not extend beyond the middle/second half of the 3rd century AD (2020). N.V. Polosmak, who conducted research on the Sargat culture in the Baraba forest-steppe (bordering the eastern edge of the Sargat area), posits that cultural formation began in the late 7th century BC, with its final stage dating from the 1st century BC to the 1st century AD (1987a: 96). Her evidence for this period includes analogs of grave goods, local features of the funerary rite, ceramics, and settlement structures. Nevertheless, dating in accordance with analogy provides a subjective assessment, which might lead to the wider intervals, as evidenced by the Baraba local variant. Therefore, it is imperative to conduct research into the anthropological characteristics of the ancient inhabitants of Baraba belonging to the Sargat culture, with a particular focus on morphology. A comparative analysis of Early Iron Age Sargat groups from different areas has been conducted. In addition, this article presents paleoanthropological studies on ancient people of the Baraba variant of the Sargat culture, which have not been previously published.

Material and methods

The paleoanthropological materials of the Sargat culture from the Baraba forest-steppe, which were obtained by 2000, were published by A.N. Bagashev (2000: 80–88; 338–349). During the last two decades, new data have been collected; thus, the present study has been supplemented by new materials from several cemeteries: Ust-Tartasskiye Kurgany, mound 51 (Mylnikova et al., 2022), Pogorelka-2 (Molodin et al., 2009), Gosudarevo Ozero (Molodin et al., 2017), Yashkino-1 (mounds 1 and 2 were excavated in 1982 by A.N. Neskorov, who discovered the site (Molodin, Novikov, 1998: 64), mound 5, in 2013 (Kobeleva et al., 2013)), and Protoka, barrow of mound 1 (Polosmak, 1987b).

The following comparative craniological material from the Early Iron Age of Western Siberia has been compiled from several publications: Sargat samples from the above-mentioned monograph by Bagashev (2000: 260–355)*, the pooled sample of the Kamen culture from the publication by M.P. Rykun (2013: 88–90), and that of the Bolshaya Rechka culture from the dissertation of M.S. Kishkurno (2023a: App. 2, pp. 22–61).

Multivariate exploratory techniques are designed to characterize a vast array of data. These techniques were applied for a thorough investigation of the craniological characteristics of contemporaneous populations inhabiting the regions of Eurasia neighboring the Sargat area. The data were also utilized in a monographic study where the provenance and archaeological context of the anthropological materials could be observed (Chikisheva, 2012: 13–16). The exceptions are two series stored at Jilin University (Changchun, China), which were analyzed by me but not included in this study. These are from the cemeteries of Nilki (Northeast Xinjiang, northern spurs of the Tien Shan, excavations of 2001) and Yanghai (Central Xinjiang, southern foothills of the Tien Shan, excavations of 1988) (Zhang Tienan, 1995).

To ensure the continued relevance and currency of the anthropological collections and the bibliographic list of sources, it is necessary to replenish them with new individual and average data. The adjustments affected the groups of the Sako-Usun period in Central Asia, and craniological materials of the Uyuk-Sagly culture (6th–4th centuries BC) from the Sagly cemetery in Tyva (Kozintsev, Selezneva, 2011). Furthermore, the pooled series of Usuns from Semirechye (4th century BC to 3rd century AD) (Ismagulov, 1962) was augmented with skulls from burials dating to the 4th–2nd centuries BC (Kitov, Tur, Ivanov, 2019: 195–196, 203–208). I considered it possible to combine these data with the very sparse material from the Zhaosu cemetery (5th–1st centuries BC) (Han Kangxin, Pan Qifeng, 1987), since all the archaeological sites are in one geographical area—the Ili River basin. A series from Korgantas-type burials, dating to the 4th–2nd centuries BC was included in the analysis along with groups of Central Kazakhstan (Beisenov et al., 2015: 181–184). A pooled series from Western Kazakhstan of the 4th century BC to the turn of the eras was formed (Kitov, Mamedov, 2014: 304–349). The quantity of published craniological material from Kyrgyzstan has increased significantly in recent years. In light of the revised dating of the majority of archaeological sites and the attribution of their entire array to the Saka culture (Kitov, Tur, Ivanov, 2019: 68), in the comparative analysis I applied the craniometric data on the newly unified series spanning the 5th–2nd centuries BC from the valleys of Tien Shan (western and central parts) (Ibid.: 69–71, 82–83, 91–92, 209–235) and Pamir-Alai (Ibid.: 82–83, 94–95, 99–100, 106–107, 235–242). The Sauromatian series from the Southern Urals was compiled from the materials of M.S. Akimova (1968) and T.S. Konduktorova (1962), while the Sarmat series combined the data of M.S. Akimova (1968), V.V. Ginsburg and B.V. Firshtein (1958).

*The craniological series of the Ishim variant of the Sargat culture has been excluded from the statistical analysis owing to its paucity and poor preservation. Materials from burials in the Tobol valley and its tributaries have been grouped by Bagashev into the "Trans-Ural" category and will be referred to under this name here.

A total of 34 craniological series were included in the comparative analysis: Sargat culture of the Baraba forest-steppe (1), Trans-Urals (2), and Irtysh basin (3); Bolshaya Rechka culture of the Novosibirsk stretch of the Ob (4); Kamen culture of the Upper Ob (5); Pazyryk culture of the Altai Mountains (6); Tagar culture of the Minusinsk Basin (7); early stage of the Aldy-Bel culture of Tyva, Arzhan-2 (8); final stage of the Aldy-Bel culture of Tyva, Kopto (9); Uyuk-Sagly culture of Tyva, Dogee-Baary-2 (10), Sagly (11); 5th–3rd centuries BC, pooled series from different cemeteries of Tyva (12); Ulangom cemetery in Western Mongolia (13); Saka (14) and Wusun (15) of Eastern Kazakhstan (Irtysh valley); Wusun from the Ili River basin (16); Saka (17), Tasmola culture (18), burials of Korgantas type (19) of Central Kazakhstan; Saka of Northern Kazakhstan (20), Western Kazakhstan (21), Central Tien Shan (22), Alai (23); Saka of Xinjiang—Nilki (24), Yanghai (25), Alagou (26); Dzhetyasar culture (Saka-Tokhar) (27), Chirikrabat culture (Saka-Apasiak) (28), pooled series of 7th–5th centuries BC (Saka-Sakaravak) (29) of the Eastern Aral Sea region; male series of the Kuyusai culture of the Southern Aral Sea region (30); the Sauromatians (31) and Early Sarmats (32) of the Southern Urals; the Sauromatians (33) and Early Sarmats (34) of the Volga-Don interfluve.

A principal component analysis, conducted with Statistica 8 software, was used to facilitate comparative intergroup analysis. The craniometric program comprised 20 features, including the diameters of the cerebral and facial parts of the skull, angular parameters of vertical and horizontal profiles, the orbits and nasal aperture sizes, the width and height of the nose bridge, and the angle of nasal bone protrusion.

Results and discussion

The skeletal remains of the Sargat culture examined by me are poorly preserved. As a result, it is rarely possible to reconstruct the complete morphological type of an individual, characterized by the features of facial and cerebral sections. This does not lend itself to multivariate statistical analyses. At the same time, the craniological materials described by Bagashev, including those from the Baraba forest-steppe, are in a better state of preservation. The pooled series from Baraba provides increasing possibilities to study its craniometric variability. The individual measurement data of the new specimens (Tables 1, 2) don't include calculations of the cranial shape indices. However, these can be calculated, if necessary. The variability of these features will be the subject of discussion in the text.

An analysis of the individual values of craniometric traits in the total Baraba series has shown that nearly all of the craniometric measurements exhibit a normal distribution. This result was obtained through the Shapiro-Wilk test assessment. Among the male subjects, a distribution different from the normal was observed only for the zygomatic diameter ($p = 0.0015$). In this small group, there is an individual (Pogorelka-2, burial 3), whose face was reconstructed after severe deformation; this may have affected the distribution of variation series for this trait, given a very large zygomatic width (159 mm, see Table 1). However, even with this individual excluded, the test demonstrated a significant difference ($p = 0.0356$). In the male series from the Trans-Urals, a similar situation is observed for the length of the skull base ($p = 0.0239$). In the Irtysh series, however, no irregularities in the distribution of traits were observed. Furthermore, in the female Baraba group, the additional trait of upper facial height ($p = 0.0405$) is added to zygomatic diameter ($p = 0.0194$); in the Trans-Urals group, cranial index ($p = 0.0133$) is added; and in the Irtysh group, nose height ($p = 0.0399$).

Thereafter, the morphological differences between the three Sargat variants were examined. The analysis was carried out using Student's criterion for intergroup comparison of trait mean values and Fisher's criterion for sample variance comparison. In the groups under study, almost all traits, with the exception of a few, exhibited normal intragroup distribution. These data also exhibited unimodality, which is typically observed in anthropological data, and the characteristics of both criteria remained intact (Deryabin, 2004: 43, 53).

The results of the tests demonstrate that the differences in the mean values for a greater number of traits in the male Sargat samples were less than the critical level ($p \leq 0.05$) as compared to the female samples. Nevertheless, in the latter, there are considerable differences in dispersion for numerous traits.

The male Baraba group differs from the Irtysh one in cranial index ($p = 0.0357$), height ($p = 0.0234$), and width ($p = 0.0099$) of the pyriform aperture, nasal index ($p = 0.0009$), and dacryal width ($p = 0.0020$). The latter parameter also shows a difference in variance ($p = 0.0387$). The Baraba group differs from the Trans-Ural group in zygomatic width ($p = 0.0504$) and frontal-maxillary index ($p = 0.0276$). The longitudinal diameter of the skull ($p = 0.0458$) and cranial index ($p = 0.0298$) reveal differences between the Trans-Ural and Irtysh series. Consequently, the composition of craniometric features differentiating male Sargat samples is relatively limited. In comparison to other groups, the Baraba one is distinguished by moderate brachycrany (the largest value of cranial index is observed in the Trans-Ural group, while the smallest, belonging to the category of mesocranial, is in the Irtysh group), widest faces and largest dacryal width, and largest pyriform aperture.

The Baraba females differ from the Irtysh and Trans-Ural groups by a smaller naso-malar angle, indicating

Table 1. **Individual dimensions of male skulls from the Sargat cemeteries (Baraba forest-steppe)**

Trait	Ust-Tartasskiye Kurgany, mound 51, burial 23	Yashkino-1, mound 5, burial 1	Gosudarevo Ozero-1		Pogorelka-2			*X*/*N*/*S*
			Mound 1, burial 4	Object 65, burial 10?	Burial 3	Burial 4	Burial 5	
1	2	3	4	5	6	7	8	9
Age	40–45	40–45	20–25	30–35	40–45	40–45	35–40	–
1. Cranial length	188	170	175	176	190	198	…	182.8/6/10.8
8. Cranial breadth	150	158	138	138	146	149	…	146.5/6/7.7
8 : 1. Cranial index	79.8	92.9	78.9	78.4	76.8	75.3	…	80.4/6/6.4
17. Cranial height (from basion)	137	137	129	135	139	146	…	137.2/6/5.5
20. Cranial height (from porion)	116	121	113	118	-	128	…	119.2/5/5.7
5. Cranial base length	108	102	97	102	104	114	…	104.5/6/5.9
9. Minimal frontal breadth	94.2	101.1	90.2	82.3	101	102.4	96	95.3/7/7.2
10. Maximal frontal breadth	117	122	119	109	126	127?	…	120.0/6/6.6
11. Cranial base breadth	132	145	127	127	…	127	…	131.6/5/7.8
12. Occipital breadth	119	118	106	113	…	111	…	113.4/5/5.3
29. Frontal chord	110.8	109	103.6	110.2	131	121.2	…	114.3/6/10.0
30. Parietal chord	106	111	111	107	110	115	…	110/6/3.2
31. Occipital chord	97.5	92.2	94	90.3	87.9	93.7	…	92.6/6/3.3
26. Frontal arc	128	123	118	127	151	141	…	131.3/6/12.3
27. Parietal arc	118	126	127	119	124	126	…	123.3/6/3.9
28. Occipital arc	126	108	118	111	103	119	…	114.2/6/8.4
29 : 26. Frontal curvature index	86.6	88.6	87.8	86.8	86.8	86	…	87.1/6/0.94
Transverse frontal curvature angle (TFCA)	140.4	148.3	143.3	142	133.3	133.5	139.8	140.1/7/5.3
Sub.NB. Longitudinal frontal curvature subtense	24.6	20	18.8	23	33	24.6	…	24.0/6/5.0
Occipital curvature height (OCH)	27	19.7	26.3	24.3	16.1	25.8	…	23.2/6/4.4
45. Bizygomatic breadth	142	150	137	134	159?!	138	…	143.3/6/9.5
40. Facial base length	…	106	98	98	…	112	…	103.5/4/6.8
48. Upper facial height	…	71	65	66	…	70	…	68.0/4/2.9
47. Full facial height	…	120	…	…	…	118	…	119.0/2
43. Upper facial breadth	…	119	104	101	115	113	…	110.4/5/7.6
46. Midfacial breadth	…	108	100	…	…	102	…	103.3/3
60. Alveolar length	…	57	56	46	…	60	53	54.4/5/5.3
61. Alveolar breadth	…	69	66	63	…	67	64	65.8/5/2.4
62. Palate length	…	49.3	46.3	42	…	49	44.6	46.2/5/3.1
63. Palate breadth	…	41	37.8	37.4	…	37.5	39	38.5/5/1.5
55. Nasal height	…	54.1	48.6	47.6	…	54	…	51.1/4/3.5
54. Nasal breadth	…	28.5	27.7	27	…	24.3	…	26.9/4/1.8
51. Orbital breadth from mf.	…	47.3	43.4 (r.)	44.8 (r.)	…	47.2	…	43.4/4/1.9
51a. Orbital breadth from d.	…	43.1	40.7 (r.)	40.2 (r.)	…	45.2	…	42.3/4/2.3
52. Orbital height	…	35	32.5 (r.)	34.6 (r.)	…	34	…	34.0/4/1.1

Table 1 (end)

1	2	3	4	5	6	7	8	9
Bimalar breadth (BB)	…	108.2	98.1	95.5	108.9	105.6	…	103.3/5/6.1
Subtense from nasion to bimalar breadth (SN)	…	15.3	15.7	12.6	23.7	18.2	…	17.1/5/4.2
Zygomaxillary breadth (ZB)	…	111.4	98.6	…	…	100	…	103.3/3
Subtense from subspinale to the zygomaxillary breadth (SS)	…	27.9	22	…	…	22.2	…	24.0/3
77. Nasomalar angle	…	148.5	144.5	150.6	133.1	142	…	143.7/5/6.8
ZM. Zygomaxillary angle	…	126.9	131.9	…	…	132.1	…	130.3/3
SC. Simotic chord	…	9.5	8	7.1	…	6.8	9.5	8.2/5/1.28
SS. Simotic subtense	…	…	5.6	4.2	…	1.7	4.1	3.9/4/1.61
MC. Maxillofrontal chord	…	21.4	17.2	17	…	18.2	…	18.5/4/2.04
MS. Maxillofrontal subtense	…	…	8.2	5.6	…	6.2	…	6.7/3
DC. Dacrial chord	…	25.3	20	23.5	…	20.1	…	22.2/4/2.6
DS. Dacrial subtense	…	…	10.8	11.6	…	10	…	10.8/3
FC. Canine fossa depth (mm)	…	4.1	3.8 (r.)	4.7 (r.)	…	4.6 (r.)	…	4.3/4/0.42
Zygomatic bone curvature height (ZCH)	…	11.6	11.2 (r.)	10.1 (r.)	8.2 (r.)	15.5	…	11.3/5/2.7
Zygomatic bone breadth (ZB)	…	56.5	56.8 (r.)	51.5 (r.)	56.7 (r.)	61.5	…	56.6/5/3.5
32. Frontal profile angle from nasion	…	79	75	76	…	68	…	74.5/4/4.7
GM\FH. Frontal profile angle from glabella	…	70	67	69	…	68	…	68.5/4/1.3
72. General facial angle	…	78	77	85	…	79	…	79.8/4/3.6
73. Mid-facial angle	…	86	80	87	…	83	…	84.0/4/3.2
74. Alveolar angle	…	57	55	73	…	67	…	63.0/4/8.5
75. Nasal bones inclination index	…	…	53	62	…	54	…	56.3/3
75 (1). Nasal protrusion angle	…	…	24	23	…	25	…	24.0/3
68 (1). Mandibular length from condyles	…	121	…	…	101	…	104	108.7/3
79. Mandibular ramus angle	…	124	…	…	106	121	129	120.0/4/9.9
68. Mandibular length from angles	…	86	…	…	84	83	75	82.0/4/4.8
70. Ramus height	…	60	…	…	68	…	56	61.3/3
71a. Minimum ramus breadth	…	37	…	…	36	38	35	36.5/4/1.3
65. Condylar width	…	121	…	…	134	…	128	127.7/3
66. Angular width	…	107	…	…	118	98	118	110.3/4/9.7
67. Anterior width	…	51	…	…	48	47	51	49.3/4/2.1
69. Symphyseal height	…	35	…	…	34	34	35	34.5/4/0.58
69 (1). Corpus height	…	…	…	…	30 (r.)	31	32	31.0/3
69 (3). Corpus breadth	…	14	…	…	12 (r.)	13	15	13.5/4/1.3
C'. Mental protrusion angle	…	65	…	…	…	…	70	67.5/2
Intercilium (IC 1–6)	4	4	3	4	5	5	4	4.1/7/0.69
Browridges (BR 1–3)	2	2	1	2	2	2	2	1.9/7/0.38
External occipital tuber (EOT 0–5)	3	4	2	0	5	0	…	2.3/6/2.2
Mastoid process (MP 1–3)	3	2	2	2	3	3	2	2.4/7/0.53
Inferior margin of the piriform aperture (IMPA)	Anthr.	Anthr.	F. pr.	Anthr.	…	Anthr.	F. pr.	…
Anterior nasal spine (ANS 1–5)	…	3	…	3	…	3	3	3.0/4/0

Table 2. **Individual dimensions of female skulls from the Sargat cemeteries (Baraba forest-steppe)**

Trait*	Ust-Tartasskiye Kurgany				Yashkino-1			Gosudarevo Ozero-1					Pogorelka-2, burial 2	Protoka, mound 1, burial 1 (in the tumulus)	*X*/*N*/*S*
	Mound 51, burial 5 (from the trench wall)	Mound 51, burial 7, sk. 2	Mound 51, burial 13	Mound 51, burial 17	Mound 1, looting pit	Mound 1, burial 1	Mound 2, burial 2	Burial 3	Burial 6	Burial 7	Burial 9	Tumulus			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Age	> 50	25–30	> 50	40–50	40–45	25–30	35–40	20–25	50–60	18–20	35–40	30–35	35–40	25–30	–
1	…	174	…	181	173	…	170	…	…	…	…	172	176	172	174.0/7/3.6
8	…	136	…	131	137	…	135	…	152?	142	149?	132	138	136	138.8/10/6.9
8 : 1	…	78.2	…	72.4	79.1	…	79.4	…	…	…	…	76.7	78.4	79.1	77.6/7/2.5
17	…	132	…	131	133	…	128	…	…	…	…	128	134	130	130.9/7/2.3
20	…	115	…	110	115	…	112	…	…	…	…	113	113	…	113.0/6/1.9
5	…	100	…	102	102	…	95	…	…	…	…	98	102	101	100.0/7/2.6
9	…	88.2	96.6	92.3	98	…	84.5	…	100.8	116	…	86.5	97	90	95.0/10/9.1
10	…	109	…	101	117	…	111	…	125	…	…	111	116	115	113.1/8/7.0
11	…	123	…	124	125	…	121	…	144?	…	132	121	125	126	126.8/9/7.2
12	…	114	…	102	112	…	112	…	…	…	101	101	112	107	107.6/8/5.6
29	…	111.5	114.6	101.5	103.2	…	105.8	…	113.6	…	…	107.3	108.2	108.8	108.3/9/4.4
30	…	96	…	113	107	…	108	…	113	94	…	103	114	106	106.0/9/7.2
31	…	92.8	…	92.6	94.6	…	95.8	…	…	93	96.5	…	88.2	92	93.2/8/2.5
26	…	126	126	136	118	…	119	…	132	…	…	122	121	132	125.8/9/6.4
27	…	110	…	133	118	…	118	…	128	102	120	118	126	126	119.9/10/9.1
28	…	115	…	113	115	…	121	…	…	100	114	…	103	114	111.9/8/6.9
29 : 26	…	91.3	91	74.6	87.5	…	88.9	…	86.1	…	…	88	89.4	82.4	86.6/9/5.2
TFCA	…	135.6	129.1	129.1	141.6	…	140	…	135.8	…	…	138	131.7	…	135.1/8/4.8
Sub. NB	…	20.2	22.7	21	23.1	…	22.5	…	27.7	…	…	23.3	24	22.6	23.0/9/2.1
OCH	…	25.4	…	22	24.8	…	28.2	…	…	21.8	20.7	…	23	22.7	23.6/8/2.4
45	…	133	126?	127	133	…	124	…	152?	…	140?	126	135	133	132.9/10/8.4
40	…	…	…	…	102	…	97	…	…	…	…	92	94	93	95.6/5/4.0
48	…	…	66?	…	73	…	66	…	…	…	…	70	64	65	67.3/6/3.4
47	…	…	116?	…	117	…	106	…	…	…	…	…	…	109	112.0/4/5.4
43	…	101	105	102	108	…	102	…	110	…	…	100	110	100	104.2/9/4.1
46	…	…	90	…	98	…	91	…	…	…	…	…	99	88	93.2/5/5.0
60	…	…	…	…	56	…	51	…	…	…	…	…	52	52	52.8/4/2.2
61	…	…	62.5	…	65	…	58	…	…	…	…	…	67	54	61.3/5/5.3
62	…	…	…	…	43	…	45	…	…	…	…	…	41.7	44.2	43.5/4/1.4
63	…	…	34.3	…	35.6	…	33.6	…	…	…	…	…	39.7	35.6	35.8/5/2.4
55	…	…	51.7	…	52.2	…	51	…	…	…	…	…	51.5	47.5	50.8/5/1.9
54	…	…	28.2	…	26.3	…	24.2	…	…	…	…	…	25.8	23.7	25.6/5/1.8
51	…	…	45	…	46.2	…	40.6	…	…	…	…	43.4 (r.)	47.3	41.4	44.0/6/2.7
51a	…	…	41.5	…	44.8	…	39.8	…	…	…	…	42 (r.)	44.5	40.3	42.1/6/2.3

Table 2 (end)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
52	…	…	34.4	32.7	33.2	…	31.7	…	…	…	…	33.3 (r.)	37.2	35?	33.8/6/1.9
BB	…	93.2	97.1	95.5	98.9	…	94.5	…	101.1	…	…	95.2	105	93.2	97.1/9/3.9
SN	…	18.8	20	20	17	…	17.4	…	16.7	…	…	14.8	22.7	18.2	18.4/9/2.3
ZB	…	…	94.5	…	99.8	…	92.9	…	…	…	…	…	99.4	88	94.9/5/4.9
SS	…	…	23.5	…	23.2	…	21.1	…	…	…	…	…	24.2	19.2	22.2/5/2.1
77	…	136.2	135.2	134.6	142	…	139.6	…	143.5	…	…	145.6	133.3	137.4	138.6/9/4.3
ZM	…	…	127.1	…	130.2	…	131.2	…	…	…	…	…	128.2	132.9	129.9/5/2.3
SC	…	…	10.2	…	4.7	…	8.8	…	8.9	…	…	8	7.4	6.2	7.7/7/1.8
SS	…	…	5.6	…	1.6	…	4	…	3	…	…	3.2	2.3	2.5	3.2/7/1.3
MC	…	…	17.5	…	14.6	…	18	…	…	…	…	18.5	18.6	16.2	17.2/6/1.6
MS	…	…	7	…	6.3	…	7.2	…	…	…	…	6.4	5	7.2	6.5/6/5.0
DC	…	…	21.3	…	17	…	20.2	…	…	…	…	18	24	18.3	19.8/6/2.6
DS	…	…	10.5	…	10	…	10.3	…	…	…	…	7.6	10	9.7	9.7/6/1.1
FC	…	…	4	…	2.5	…	2	…	…	…	…	3.1 (r.)	2.5	5.3?	3.2/6/1.2
ZCH	…	…	11	10.6	9.5	…	10.5	…	…	…	…	11.3	10.5	11.1	10.6/7/0.59
ZB	…	…	53	51.4	53.6	…	52.2	…	…	…	…	51.2	56.2	51	52.7/7/1.8
32	…	…	…	…	83	…	82	…	…	…	…	76	78	80	79.8/5/2.9
GM\FH	…	…	…	…	77	…	74	…	…	…	…	73	75	76	75.0/5/1.6
72	…	…	…	…	82	…	81	…	…	…	…	86	80	88	83.4/5/3.4
73	…	…	…	…	85	…	90	…	…	…	…	93	83	88	87.8/5/4.0
74	…	…	…	…	70	…	65	…	…	…	…	69	75	88	73.4/5/8.9
75	…	…	…	…	59	…	56	…	…	…	…	…	…	67	60.7/3/5.7
75 (1)	…	…	25	…	23	…	25	…	…	…	…	…	…	21	23.5/4/1.9
68 (1)	106	…	…	…	110	100	103	97	104	…	…	…	…	…	103.3/6/4.5
79	113	…	124	…	122	126	118	108	112	…	118	…	…	…	117.6/8/6.3
68	82	…	80	…	81	70	78	81	82	…	82	…	…	…	79.5/8/4.1
70	61	…	61 (r.)	…	55	51 (r.)	58	60	66	…	…	…	…	…	58.9/7/4.8
71a	37	…	37 (r.)	…	35	32 (r.)	36	35	36	…	38 (r.)	…	…	32	35.3/9/2.1
65	123	…	…	…	112	99	112	112	119	…	…	…	…	126	114.7/7/9.0
66	103	…	109	…	99	95	94	93	66	…	113	…	…	85	95.2/9/13.9
67	45	…	49	…	46	47	46	48	67	…	44	…	…	40.6	48.1/9/7.5
69	27	…	32	…	…	30	30	25	69	…	…	…	…	27	34.3/7/15.5
69 (1)	29	…	32	…	29	30	27	25	27	…	30	…	…	28	28.6/9/2.1
69 (3)	14	…	14	…	12	14	12	13	12	…	10	…	…	11	12.4/9/1.4
C'	62	…	70	…	…	61	63	59	-	…	…	…	…	…	63.0/5/4.1
IC	…	3	2	3	2	…	1	…	3	…	…	2	2	2	2.2/9/0.67
BR	…	1	1	2	2	…	1	…	2	1	1	1	1	1	1.3/11/0.47
EOT	…	0	1	1	0	…	0	…	-	…	0	0	0	…	0.25/8/0.46
MP	…	2	2	2	2	3	2	…	2	2	2	1	2	2	2.0/12/0.43
IMPA	…	…	Anthr.	…	Anthr.	…	Anthr.	…	…	…	…	Anthr.	Anthr.	Anthr.	…
ANS	…	…	3?	…	4	…	3	5	…	…	…	…	3	3	3.6/5/0.89

*See traits in Table 1.

a sharper profile at the upper level. Furthermore, there is a significant difference between the Baraba and Trans-Ural group (p = 0.0444). There is no statistical difference in the average of intragroup series features among Baraba women. Nevertheless, it is advisable to highlight these characteristics, since they can serve as a means of differentiation. In comparison to the aforementioned groups, the Baraba group shows a larger longitudinal diameter, a smaller (mesocranial) transverse-longitudinal index, and a larger width of facial region.

The morphological features of the Sargat craniological series exhibit intergroup differences that remain within the boundaries of a Caucasoid anthropological type. The following craniometric characteristics can be identified: meso-brachycrany, medium-high braincase, wide low, and somewhat flattened face, moderately inclined frontal bone, and protruding nasal bones. In other words, the local discreteness of the craniological complexes of the Sargat population has not been identified. Bagashev's craniological study of samples of local variants of the Sargat culture led him to the conclusion that population history was unified and that the groups were closely related (2000: 114, 120). The slight polymorphism observed in the Sargat people's anthropological composition can be attributed to a number of factors. Among these, the introduction of a nomadic population into the West Siberian forest-steppe from the Saka-Sauromatian-Sarmat environment is of particular significance.

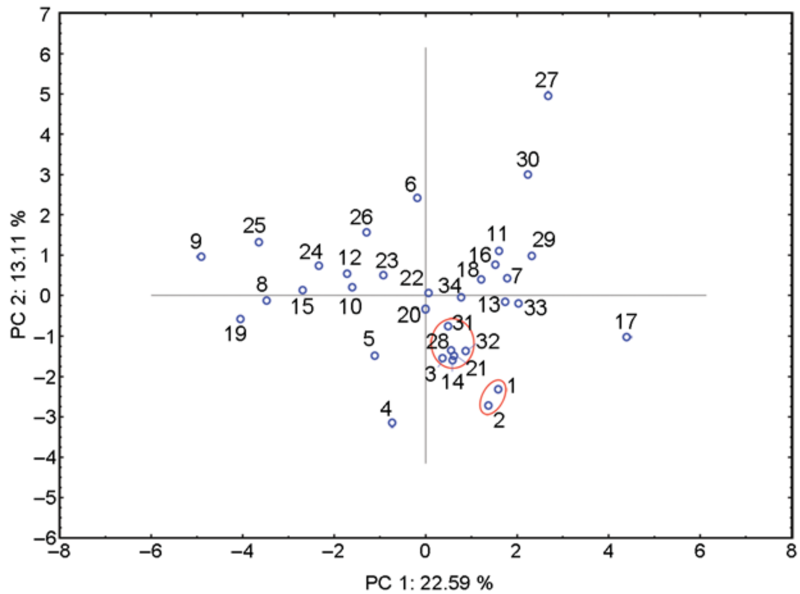

Fig. 1. Graphical result of the statistical analysis of the Early Iron Age craniometry series of West Siberian and Central Asian males (principal component method)
Numbers correspond to serial numbers of series listed in the text. The ellipses indicate the sets of groups with the highest degree of morphological similarity.

There is a substantial range of craniological characteristics and craniometric data from contemporaneous cultures of Eurasian regions adjacent to the Sargat culture, which might have been involved in the process of its formation. This process is believed to have commenced in the late 7th century BC, but indisputably from the 5th century BC, and continued until the first half of the 4th to the second half of the 3rd century AD. The principal component method was utilized in order to identify the relevant groups. The analysis did not include those belonging to previous stages of cultural evolution, dating back to the Late Bronze Age and the transition between the Bronze and Iron Ages. The analysis of morphological space was limited to the chronological framework of the Saka period in order to identify intergroup connections that can be explained by migrations with a specific historical context.

The male Baraba sample of the Sargat culture is located in the coordinates of the first two principal components in the same space as the Trans-Ural and Irtysh samples (Fig. 1). The high factor loadings (approximately above 0.500) in these coordinates fall on several cranial parameters, including the width of the forehead, the symotic and dacryal parameters of the nose, the height of the nose, and the transverse diameter of the skull (Table 3). The Baraba sample exhibits a greater affinity with the Trans-Ural one than with the Irtysh, and the latter forms part of a concentrated population including a series of Saka, Sauromatians, and early Sarmats inhabiting the Ural-Kazakh steppes* and Eastern Aral Sea region (Fig. 1).

A previous study by Bagashev (2000: 122) established a similar pattern of local Sargat groups in craniometric similarity: male samples from geographically more distant regions, including Tobol and Baraba, were

*The concept of "Ural-Kazakh steppes" is derived from A.D. Tairov, who, relying on physical-geographical and archaeological evidence, outlines this region as extending "from the eastern spurs of the Southern Urals and Mugodzhar mountains in the west to the Irtysh valley in the east, from the forest-steppe zone of the Trans-Urals and Western Siberia in the north to Lake Balkhash and the right banks of the Chu and Syrdarya rivers in the south", dividing it into three large regions: Southern Trans-Urals, Northern Kazakhstan, and Central Kazakhstan (2019: 13). In terms of geographical classification, he distinguishes between two subregions within the Southern Urals: the western subregion, which includes Western Kazakhstan, and the eastern subregion, which encompasses the Southern Trans-Urals, both sharing a common border that is delineated by the central ridges of the Urals and Mugodzhar (Ibid.: 14).

Table 3. **Factor loadings on traits**

Trait	Males		Females	
	Factor 1	Factor 2	Factor 1	Factor 2
1. Cranial length	0.287	0.146	0.464	–0.068
8. Cranial breadth from basion	0.333	–0.562	–0.356	–0.267
17. Cranial height	0.122	0.444	0.463	0.232
5. Cranial base length	0.475	–0.139	0.559	0.246
9. Minimal frontal breadth	0.797	–0.245	0.340	0.132
45. Bizygomatic breadth	0.302	–0.241	0.042	–0.270
48. Upper facial height	–0.051	0.688	0.549	–0.545
55. Nasal height	–0.149	0.757	0.586	–0.581
54. Nasal breadth	0.203	0.116	0.637	–0.617
51. Orbital breadth from mf.	0.317	–0.418	0.148	–0.435
52. Orbital height	0.065	0.369	0.071	0.238
77. Nasomalar angle	–0.573	–0.477	–0.206	–0.501
ZM. Zygomaxillary angle	–0.505	–0.412	–0.380	–0.641
SC. Simotic chord	0.617	0.201	0.783	0.066
SS. Simotic subtense	0.829	0.164	0.401	0.526
DC. Dacrial chord	0.531	0.013	0.663	–0.166
DS. Dacrial subtense	0.768	–0.151	0.495	0.572
32. Frontal profile angle from nasion	–0.550	–0.130	–0.551	–0.016
72. General facial angle	–0.069	0.266	–0.169	–0.229
75 (1). Nasal protrusion angle	0.597	–0.047	–0.140	0.649

closer to each other than to a series from the Irtysh region, which was equidistant from both. The researcher attributes this phenomenon to the more pronounced influence of Mongoloid populations in the western and eastern peripheries of the Sargat area. In contrast, the anthropological appearance of the tribes in the Irtysh region was to a lesser extent "deformed by crossbreeding processes, aligning closely with the generalized characteristics of the entire Sargat population" (Ibid.: 124).

The way the Sargat population evolved differs slightly in its interpretation according to the statistical analysis. The discovered characteristics traditionally attributed to the Mongoloid complex, including a higher level of facial skull flattening, do not necessarily indicate the participation of Mongolian groups in the genesis of the population, as this complex is not exclusive to them. The consequence of taxonomically significant individual characteristics spreading to the group as a whole can be attributed to the limited number of the series and the suboptimal state of preservation of the facial skeleton for measurement, in addition to the relatedness of the individuals interred. Notably, among the components that contributed to the anthropological composition of the Sargat people, the autochthonous one of the forest-steppe zone of Western Siberia belongs to the protomorphic anthropological types. These are distinguished by an imbalanced combination of signs that are significant for differentiation between Caucasoids and Mongoloids, namely heteroprosopia of a horizontal profile with a high (Southern Eurasian formation) or low (Northern Eurasian formation) projection of the nose. Bagashev's assumption that the diachronic connections of the Sargat populations can be traced back to the carriers of the Late Bronze Age cultures of the Andronovo (Fedorovka) lineage (Ibid.: 193) is justified and beyond doubt.

Statistical analysis indicates that the connections of the male Sargat population, which are rooted in the nomadic tribes of the Ural-Kazakh steppes and the Eastern Aral Sea region, belong primarily to the Irtysh group. Furthermore, the anthropological type introduced by migrants spread throughout the western and eastern peripheries of the area encompassing the emerging Sargat culture. The migration of certain nomadic and semi-nomadic groups from Central Asia to the West Siberian forest-steppe can be attributed to a multitude of factors, both environmental and historical. The latter include the events of the second half of the 6th century BC associated with the military campaigns of the Achaemenid state against the nomadic associations of Central Asia (Tairov, 2019: 154–155).

The female Baraba sample from the Sargat culture, in coordinates of the first two main components, is situated in the same area as are series from the 5th to

3rd centuries BC from the territory of the Altai Mountains and Tyva. The high factor loadings (approximately above 0.500) associated with these coordinates include the length of the skull base, height of the face, height and width of nasal opening, width of nose, and angles of horizontal profile of face (Table 3). At first glance, this pattern differs from that observed in male populations of these groups. Nevertheless, all samples falling within the general area of the two main components (Fig. 2) are united by the presence of a morphological layer with Southern Eurasian origins. This complex is autochthonous to the Altai-Sayan Highlands and is represented among the earliest nomadic groups in the intermountain basins of this region and the foothills of Dzungaria and the Tien Shan (Kitov, Tur, Ivanov, 2019: 156; Chikisheva, 2008; 2012: 180). This craniological component was also recorded by M.S. Kishkurno among the Early Iron Age population of the forest-steppe Novosibirsk stretch of the Ob (2023b: 12). As shown in the plot (Fig. 2), the Bolshaya Rechka sample (4) is situated in close proximity to the group in question, and may be considered a potential addition. This indicates that the female component of the substratum population demonstrated resilience to the impact of migration, likely due to the influx of male migrants. The peripheral position of the Baraba variant within the Sargat culture area might have served to reduce the intensity of migration infiltration.

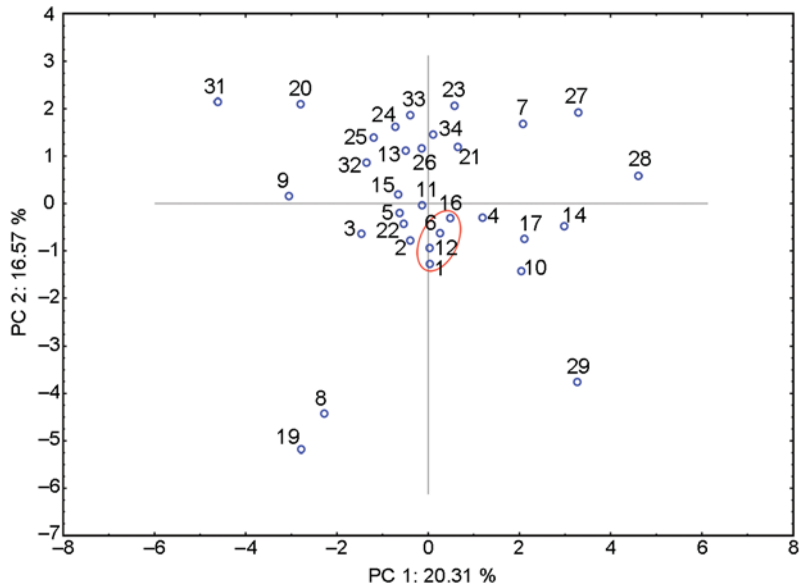

Fig. 2. Graphical result of the statistical analysis of the Early Iron Age craniometry series of West Siberian and Central Asian females (principal component method) Legend same as on Fig. 1.

The Trans-Ural and Irtysh local groups, according to PC1, separated from the Baraba Sargat people and formed a compact population within its negative field. This population consisted of samples from the Saka of Central Tien Shan (22), carriers of the Kamen culture from the forest-steppe Altai (5), and the Uyuk-Saglyn culture from Tyva (11). The distinctive feature (factor loadings greater than 0.500) in this context is the timing of the forehead formation. In terms of ethnoculture, the factor for this group association is Saka origin. However, it is presented in an anthropological form, with the involvement of a morphological complex from the Southern Eurasian formation.

The resulting picture of intra- and intergroup variability of craniometric parameters of samples from three populations of the Sargat culture-bearers and their comparative analysis in the morphological space of the early nomads of Southern Siberia and Central Asia allows us to formulate several conclusions about the factors forming the anthropological composition of this culture. First of all, the quantitative increase of the Baraba craniological series did not change the characteristics given by Bagashev, which emphasizes its insignificant specificity among other Sargat groups (2000: 114)*. The Baraba Sargat people differ from them, according to statistical criteria, in a wider face, a larger pyriform aperture, and largest dacryal width. However, this combination of features doesn't go beyond the overall morphology of the Sargat population. No significant evidence supports the assumption that the Baraba Sargat people included a Mongoloid component "associated in its origin with the inhabitants of the inner taiga regions of Western Siberia" (Ibid.: 126). So far, there are no specific representative craniometric data on the anthropological type of the autochthonous population of the West Siberian forest-steppe, which directly participated in the ethnocultural genesis of the Sargat people. However, the material available in scientific circulation, although not always grouped in adequately dated series, allows the assumption to be made that its peculiarity was a protomorphic combination of the most important diagnostic features, unbalanced in the context of the great Mongoloid and Caucasoid races.

Migration has played an important role in shaping the anthropological composition of the West Siberian population. Tribal associations of nomads from the western part of Central Asia, the Ural-Kazakh steppe—

*Publication of craniometric parameters of new finds, replenishing the known craniological series, is in itself significant, because it allows us to clarify the characteristics of these series, and increases the empirical database for comparative studies.

Saka, Sauromatians, and Sarmats—were the donors. No noticeable changes in the appearance of the people were caused by interbreeding at the level of two phenotypically close anthropological types (the morphological complex of the Southern Eurasian formation is one of the components in some Saka groups). However, using statistical methods based on correlations between craniometric features in series, it was possible to identify their aggregates on the basis of morphological similarity.

Conclusions

The territory of the Sargat culture was constantly infiltrated by nomadic groups during the long period of its genesis. The most intense infiltration came from the southwestern regions of Central Asia. Migration processes had a greater effect on the males, according to anthropological data. Probably, most of them moved to the territory of the West Siberian forest-steppe during the wars. It is likely that the necessary number of generations had not yet elapsed for the effects of interbreeding between the newcomers and the indigenous population to have an equal effect on the female population.

A comparative study of the craniological series of the Sargat culture revealed no significant differences in morphological features. Nevertheless, minor specifics were identified according to local affiliations. To elucidate the anthropological characteristics of the Sargat culture, further studies are required to ascertain the precise nature of the local variants. Specifically, the identification of an indigenous substrate dating to the Late Bronze Age and the transition to the Early Iron Age is essential. This can be achieved through the analysis of craniological material. Therefore, anthropological research should be conducted on paleoanthropological finds at archaeological sites exhibiting complex stratigraphic characteristics of the West Siberian forest-steppe, including burials from a range of historical periods.

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