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The Structure of the Late Bronze Age Population of Western Siberia: Cranimetric Evidence

To assess the sources of population differentiation in Late Bronze Age Western Siberia, measurements of 68 cranial samples of this and earlier periods were processed with multivariate statistical methods. Results support the idea of at least two post-Afanasyevo migrations to Siberia from the west—pre-Andronovo and Andronovo. The former was represented by Chaa-Khol, Yelunino, and Samus people. Those associated with Karakol culture partly resemble the above and partly both autochthonous populations—that of Baraba (“Northern Eurasian formation”) and that of Okunev culture (“Southern Eurasian formation”), which appear to be two extremes of a single continuum. Differences between the two Andronovo traditions, Fedorovka and Alakul, are likely due to the local substratum in the former rather than to various origins. The Karasuk group arose through admixture between Okunev and Andronovo. People associated with the classic Karasuk culture are closer to the former, while those of the Kamenny Log stage tend toward the latter. People of the Upper Irtysh and the Mongun-Taiga people from Baidag III resemble those of Karasuk. Two pooled groups, Irmen and Mongun-Taiga, and the Pakhomovskaya sample indicate a possible admixture between both autochthonous formations, Northern and Southern, as well as Andronovo and Karasuk. Among the so-called Andronoid groups, only Yelovka and Pakhomovskaya, as well as a sample from Yelovka I, suggest admixture between Andronovans and Western Siberian natives, while Cherkaskul and Korchazhka, like the Late Krotovo groups from Sopka and Chernozerye and the Begazy-Dandybai group of Baraba, deviate from the Northern Eurasian formation toward Okunev rather than Andronovo. Among the two Eurasian formations, the Southern one (i.e., Okunev) was more affected by admixture between the autochthones and the immigrants.

Keywords: *Western Siberia, Bronze Age, Northern Eurasian formation, Southern Eurasian formation, Okunev culture, Andronovo culture, Karasuk culture.*

Introduction

It is unanimously believed that the principal factor underlying the differentiation of the Late Bronze Age population of Western Siberia was the contact between the aborigines of that territory and the Andronovo immigrants. In the course of this process, a number of

cultures known as Andronoid arose*. Andronoid cultures usually include Cherkaskul in the southern forest zone of the Urals (Kosarev, 1981: 132–141), Yelovka in

*To avoid confusion, I will use this term with reference to cultures rather than physical types of people associated with them.

the Tomsk-Narym stretch of the Ob (Ibid.: 145–162), Korchazhka in the Ob area of the Altai (Kiryushin, Shamshin, 1992), and Pakhomovskaya in the Tobol-Irtysh forest-steppe (Korochkova, 2009).

Despite the facts suggesting a large role of both Andronovo and autochthonous components in the Irmen culture of the Ob-Irtysh forest-steppe, specialists did not term it Andronoid, because it was believed to be relatively late. New radiocarbon dates, however, attest to the appearance of the Irmen people at Chicha as early as 15th–14th centuries BC (Schneeweiss et al., 2018). One of the key problems relating to the Irmen concerns the role of the Karasuk people in its origin (for a review, see (Kovalevsky, 2011)). The same question arises with regard to the Late Bronze Age culture of the Upper Irtysh at the time when the Andronovo tradition was being replaced by the Karasuk tradition (Chernikov, 1960: 74, 98).

Karasuk origins are likewise enigmatic. Certain archaeologists believe that both the Andronovo immigrants and the Okunev natives had taken part in this process (Vadetskaya, 1986: 61–63). Others ascribe the main role in Karasuk origins to Andronovans, while considering Okunev contribution minimal (Poliakov, 2022: 211, 226, 245, 249, 290, 316).

A separate issue is the participation of the Begazy-Dandybai component in the origins of Western Siberian cultures. It is traceable, specifically, in Late Bronze Age cemeteries of Stary Sad and Preobrazhenka-3 in Baraba (Molodin, Neskoro, 1992) and Yelovka I in the Tomsk stretch of the Ob (Kiryushin, 2004: 95). Some think that this component had contributed to the origin of the Yelovka culture at Yelovka II (Ibid.).

Cranimetric evidence is highly relevant to all those issues. Several important summarizing studies in this field have appeared in the recent decades (Alekseyev, Gokhman, 1984; Dremov, 1997; Chikisheva, 2012; Zubova, 2014; Bagashev, 2017). The present article, continuing this direction of studies, aims at testing the hypotheses outlined above using a new material and a new graphic method of representing the data.

Material and methods

Measurements of 68 male cranial samples were used, representing the following cultures, periods, and territories*:

1. Okunev culture, Khakas-Minusinsk Basin, Tas-Khazaa.

*The sources of information are indicated only for the samples that I used for the first time (No. 29–42). Information on other samples can be found in my previous articles (Kozintsev, 2009, 2020, 2021, 2023a, b, 2024).

2. Same, Uybat.
3. Same, Chernovaya.
4. Same, Verkh-Askiz.
5. Karakol culture, Gorny Altai.
6. Chaa-Khol culture, Tuva.
7. Yelunino culture, Upper Ob.
8. Samus culture, Tomsk-Narym stretch of the Ob.
9. Ust-Tartas culture, Baraba forest-steppe, Sopka-2/3.
10. Same, Sopka-2/3A.
11. Odino culture, Sopka-2/4A.
12. Same, Baraba forest-steppe, Tartas-1.
13. Same, Preobrazhenka-6.
14. Krotovo culture, classic stage, Sopka-2/4B, C.
15. Late Krotovo (Cherno-Ozerye) culture, Sopka-2/5.
16. Same, Omsk stretch of the Irtysh, Cherno-Ozerye-1.
17. Andronovo (Fedorovka) culture, Central, Northern, and Eastern Kazakhstan.
18. Same, Baraba forest-steppe.
19. Same, Southwestern Altai.
20. Same, Barnaul stretch of the Ob, Firsovo XIV.
21. Same, Barnaul-Novosibirsk stretch of the Ob.
22. Same, Chumysh River.
23. Same, Tomsk stretch of the Ob, Yelovka II.
24. Same, Kuznetsk Basin.
25. Same, Minusinsk Basin.
- 25a. Andronovo (Fedorovka) culture, pooled (No. 17–25).
26. Andronovo (Alakul-Kozhumberdy) culture, Southern Urals and Western Kazakhstan.
27. Andronovo (Alakul) culture, Central, Northern, and Eastern Kazakhstan.
28. Same, Omsk stretch of the Irtysh, Yermak IV.
- 28a. Andronovo (Alakul) culture, pooled (No. 26–28).
29. Cherkaskul culture, Bashkiria, Krasnogorskoye (Shevchenko, 1980); Chelyabinsk Region, Berezki Vg (Dremov, 1997: 153, 157)*.
30. Pakhomovskaya culture, Tyumen Region, Novo-Shadrino VII (Solodovnikov, Rykun, 2011).
31. Korchazhka culture, Kuznetsk Basin, Tanay-1 and -12 (Zubova, 2014: 183–184).
32. Yelovka culture, Tomsk stretch of the Ob, Yelovka II (Solodovnikov, Rykun, 2011).
33. Late Bronze Age culture, possibly Begazy-Dandybai (Kiryushin, 2004: 95); Tomsk stretch of the Ob, Yelovka I (Solodovnikov, Rykun, 2011).
34. Late Bronze Age culture, affected by Begazy-Dandybai (Molodin, 1985: 140–142; Molodin, Neskoro,

*Materials from Tartysh (Akimova, 1968: 9–11) and Taktalachuk (Rud, 1981) in the Volga-Kama region, sometimes included in the Cherkaskul sample (Dremov, 1997: 153–154; Bagashev, 2017: 118), were not used because of uncertain cultural attribution (Shevchenko, 1980; Solodovnikov, Rykun, 2011).

1992), Baraba forest-steppe, Preobrazhenka-3, Stary Sad (Chikisheva, 2012: 388–390).

35. Late Bronze Age culture of the Upper Irtysh (Solodovnikov, 2009).

36. Irmen culture, Baraba forest-steppe, Preobrazhenka-3 (Chikisheva, 2012: 372–375).

37. Same, Novosibirsk stretch of the Ob (Zubova, 2014: 129).

38. Same, forest-steppe Altai (Ibid.: 134).

39. Same, Tomsk stretch of the Ob (Ibid.: 125).

40. Same, Kuznetsk Basin, Zhuravlevo-1, -3, -4 (Chikisheva, 2012: 372–375).

41. Same, Zarechnoye-1 (Zubova, 2014: 109).

42. Same, Vaganovo-2 (Ibid.: 117).

42a. Irmen culture, pooled*.

43. Karasuk culture proper (“classic stage”).

44. Karasuk culture, Kamenny Log stage.

45. Atypical Karasuk (groups No. 46–49 pooled).

46. Same, Northern group—Kamenny Log burials on the Karasuk River.

47. Same, Malye Kopeny III.

48. Same, Fedorov Uls.

49. Same, Eastern Minusinsk group—Lugavskoye (Beya) burials on the right bank of the Yenisei, south of the Tuba.

50. Karasuk culture, Northern group.

51. Same, Southern group.

52. Same, Yerba group.

53. Same, Left-bank group.

54. Same, Right-bank group.

55. Same, Khara-Khaya.

56. Same, Tagarsky Ostrov IV.

57. Same, Kyurgenner I.

58. Same, Kyurgenner II.

59. Same, Karasuk I.

60. Same, Severny Bereg Varchi I.

61. Same, Sukhoye Ozero II.

62. Same, Arban I.

63. Same, Beloye Ozero.

64. Same, Sabinka II.

65. Same, Tert-Arba.

66. Same, Yesinskaya MTS.

67. Mongun-Taiga culture, Tuva, pooled.

68. Same, Tuva, Baidag III.

The trait battery includes 14 measurements: cranial length, breadth, and height, minimal frontal breadth, bizygomatic breadth, upper facial height, nasal height, nasal breadth, orbital breadth, orbital height, nasomalar angle, zygo-maxillary angle, simotic index, and nasal protrusion angle. Data were processed using

the multiple discriminant (canonical) analysis, and Mahalanobis’ D^2 distances corrected for sample size were calculated. The distance matrix was subjected to nonmetric multidimensional scaling and cluster analysis*. A new graphic device aimed at combining the results of both analyses was employed.

Results

The analysis with small groups resulted in four principal clusters (Fig. 1). The most isolated one is A, which is opposed to three others. It consists of six samples, including three cranially “westernmost” populations—Samus (No. 8) and two Andronovo groups with cranially Mediterranean features: a Fedorovka sample from Firsovo XIV (No. 20) and the Alakul-Kozhumberdy sample (No. 26), as well as three more Andronovo series from Northern, Central, and Eastern Kazakhstan (No. 17), Southwestern Altai (No. 19), and Minusinsk Basin (No. 25).

Among the three remaining clusters, the most isolated one is B. It includes four samples, markedly differing in the expression of western and eastern features: Chaa-Khol (No. 6) and Yelunino (No. 7) being more “western”, and Lugavskoye (Beya) variety of Atypical Karasuk (No. 49) and Karakol (No. 5), more “eastern”. This cluster is opposed to two larger ones, C and D, which include all the remaining samples.

Cluster C, displaying the “easternmost” trait combination, consists of 14 samples: eight from Baraba, representing the Northern Eurasian formation (after (Chikisheva, 2012: 6, 56, 59, 123–124, 179–180)) (No. 9–14) and those close to them (No. 15 and 16), the Andronovo sample from Yelovka II in the Tomsk stretch of the Ob (No. 23), Andronoids of Cherkaskul (No. 29) and Korchazhka (No. 31), Irmen samples from the Novosibirsk stretch of the Ob (No. 37) and from Zarechnoye in the Kuznetsk Basin (No. 41), and a Karasuk group from Arban I (No. 62).

Cluster D is the largest. It takes a central position, being surrounded by three others. It includes 44 samples: all four Okunev (No. 1–4), a half of Andronovo (No. 18, 21, 22, 24, 27, and 28), two Andronoid—Pakhomovskaya (No. 30) and Yelovka (No. 32), Late Bronze Age samples from Yelovka I (No. 33), Baraba (No. 34), and Upper Irtysh (No. 35), most of Irmen (No. 36, 38–40, and 42), all Karasuk except two (No. 43–48, 50–61, 63–66), and both Mongun-Taiga (No. 67 and 68). The Karasuk grouping (III) is distinctly intermediate between Okunev (I) and Andronovo (II).

*Samples No. 36–42 were supplemented by the Irmen sample from Tanay-2 and -7 in the Kuznetsk Basin, which was not used separately because of its small size (Zubova, 2014: 113).

*Boris Kozintsev’s CANON program and Øyvind Hammer’s software package PAST version 4.05 were used.

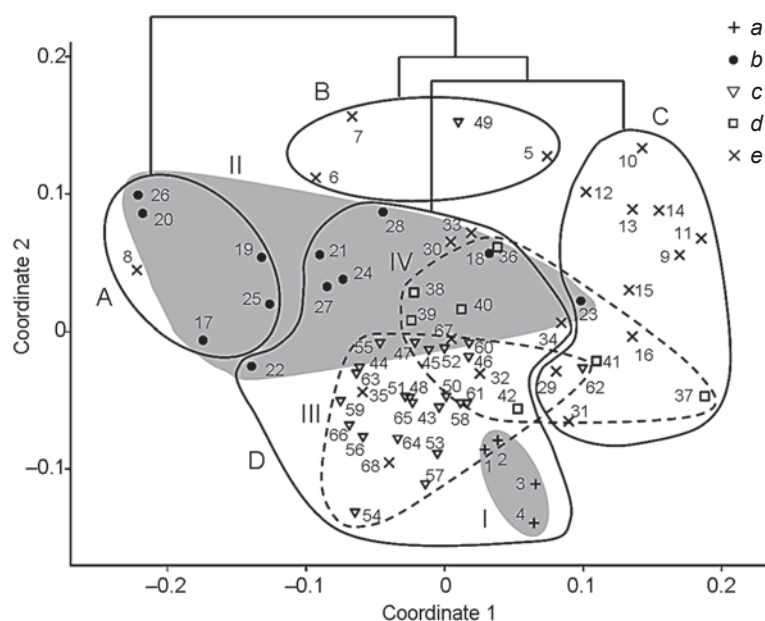


Fig. 1. Position of group centroids on the plane of the nonmetrical multidimensional scaling in the analysis with small groups (the dendrogram shows the hierarchical relationship between four major clusters A–D). a – Okunev; b – Andronovo; c – Karasuk; d – Irmen; e – others. Groups are numbered as in the list (see above). Distribution areas of Okunev and Andronovo groups are shown by spots (I and II), those of Karasuk and Irmen, by dashed contours (III and IV).

As we see, the agreement between clusters and archaeological groupings is far from complete. Only Okunev (entirely) and Karasuk (with two exceptions, see above), fall within a single cluster D. The most notable disagreement concerns Andronovo samples, which are distributed between three clusters: A, C, and D. The Andronovo grouping (II) is markedly stretched along the direction that can be tentatively described as west to east: from morphologically Mediterranean samples of cluster A—Fedorovka from Firsovo XIV (No. 20) and Alakul-Kozhumberdy (No. 26)—to Yelovka II (No. 23), which belongs to the same cluster C as the autochthonous groups of Baraba (Northern Eurasian formation)*.

Likewise stretched along the west to east axis is the Irmen grouping. Most of its members fall within cluster D, together with Andronovo (No. 36, 38–40) and one Karasuk (No. 42) group, but two Irmen samples—from Zarechnoye-1 in the Kuznetsk Basin (No. 41) and the

Novosibirsk stretch of the Ob (No. 37)—are in cluster C, the latter sample displaying the “easternmost” morphology. Two of the remaining samples—Cherkaskul (No. 29) and Korchazhka (No. 31)—are in the opposite, “western” part of that cluster, whereas five—Pakhomovskaya (No. 30), Yelovka (No. 32), and Late Bronze Age samples from Yelovka I (No. 33), Baraba (No. 34), and the Upper Irtysh (No. 35)—are in cluster D.

Because of numerous small samples, the cluster analysis is sometimes inefficient. Large clusters can be rather amorphous, which in this case mostly concerns the “central” and the most culturally heterogeneous cluster D.

Let us try to reduce the statistical noise and make the picture more informative by merging the groups. Thus, only two pooled Andronovo samples, Fedorovka (No. 25a) and Alakul (No. 28a), will be left; two pooled Karasuk samples—“classic” (No. 43) and Kamenny Log (No. 44), as well as a single pooled Irmen group (No. 42a). This does not mean that we consider all

the variation within the pooled samples random (results outlined above disagree with this idea). However, because separating signal from noise is difficult when the samples are small, it makes sense to analyze central tendencies.

Results of analysis with pooled groups (Fig. 2) generally agree with those outlined above, but certain discrepancies are present. Instead of four major clusters, we see three. The former cluster B, which included three pre-Andronovo groups, Karakol (No. 5), Chaa-Khol (No. 6), and Yelunino (No. 7), is no longer present. Now, the latter two samples have joined Samus (No. 8) and Alakul (No. 28a) within the most isolated cluster A, which is morphologically “westernmost”, as in the preceding analysis. The fourth pre-Andronovo group, Karakol (No. 5), which apparently includes a marked “eastern” admixture, has joined the Northern Eurasian formation (subcluster C1), taking, however, the “westernmost” place within it.

Cluster B, which, in terms of composition, largely coincides with the former cluster D, is now structured and consists of two subclusters. The first (B1) includes all Okunev samples (No. 1–4), and that of Yelovka culture (No. 32). The second (B2) consists of two subclusters of a lower rank: B2a—Fedorovka (No. 25a), both Karasuk (No. 43 and 44), Late Bronze Age group from the Upper Irtysh (No. 35), and Mongun-Taiga group from Baidag III (No. 68). Members of subcluster B2b are Pakhomovskaya (No. 30), pooled Irmen

*The “eastern” extreme in this continuum is represented not by Mongoloids in the traditional sense, who are not present among the samples used here, but by evolutionarily conservative groups displaying a plesiomorphic trait combination that is rather neutral on the west to east vector and likely precedes the major split between western and eastern populations of Northern Eurasia (Chikisheva, 2012: 6, 56, 57, 153, 169, 123–124, 179–180; Kozintsev, 2021).

(No. 42a), and pooled Mongun-Taiga (No. 67).

The new cluster C, like the former one with the same designation, is cranially the “easternmost”. It consists of two subclusters, C1 and C2. The first of them includes, apart from Karakol mentioned above (No. 5), six Baraba groups of the Northern Eurasian formation (No. 9–14). The second subcluster includes Late Krotovo (Cherno-Ozerye) samples from Sopka-2/5 (No. 15) and Cherno-Ozerye proper (No. 16), those from burials with Begazy-Dandybai traits in the Tomsk stretch of the Ob (Yelovka I, No. 33) and in the Baraba forest-steppe (No. 34), as well as two Andronoid groups: Cherkaskul (No. 29) and Korchazhka (No. 31). Yelovka I takes an isolated position within this subcluster, tending toward Fedorovka Andronovans (No. 25a). However, both Late Krotovo (Cherno-Ozerye) samples (No. 15 and 16) deviate from the Northern Eurasian formation in a different direction—not toward Andronovans but toward Andronoids of Cherkaskul (No. 29) and Korchazhka (No. 31), as well as toward a sample from burials exhibiting Begazy-Dandybai cultural traits in Baraba (No. 34).

Discussion

In the first analysis, three pre-Andronovo groups—Karakol (No. 5), Chaa-Khol (No. 6), and Yelunino (No. 7)—formed a separate cluster B, opposed to cluster A, which included morphologically “westernmost” Andronovans and the Samus sample (No. 8). This suggests that there were at least two post-Afanasyevo migrations to Siberia from the west, pre-Andronovo and Andronovo. Results of the second analysis do not contradict this despite the disappearance of the former cluster B, because three of the four members of the new cluster A precede Andronovo. Admittedly, the neighbor of Chaa-Khol and Yelunino in the second analysis is Samus rather than Karakol, whereas the Karakol people appear to have originated from a mixture between migrants from the west (Chaa-Khol and Yelunino), on the one hand, and autochthonous members of the Northern Eurasian formation, on the other*.

*This seems to disagree with the fact that the Karakol group—the most isolated of all—is closer to the Okunev-like (i.e., “Southern Eurasian”) sample from Yelovka II than to any “Northern Eurasian” samples from Baraba. I thank

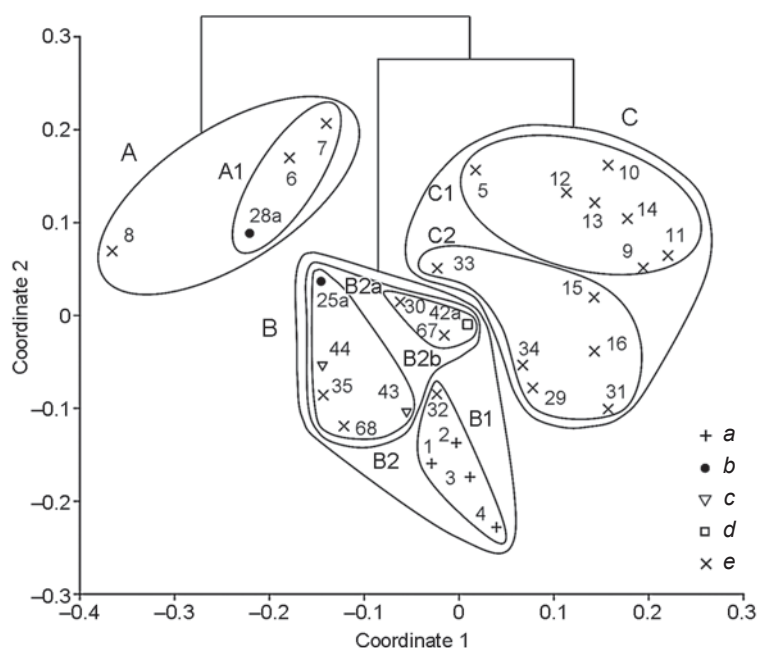


Fig. 2. Position of group centroids on the plane of the nonmetrical multidimensional scaling in the analysis with pooled groups (the dendrogram shows the hierarchical relationship between three major clusters A–C).

a – Okunev; b – Andronovo; c – Karasuk; d – Irmen; e – others. Groups are numbered as in the list (see above). Closed contours show clusters and subclusters.

The two pooled Andronovo samples in the second analysis became members of different clusters: cluster A in the case of Alakul (No. 28a) and subcluster B2a in the case of Fedorovka (No. 25a). However, the distance separating them is small, especially as compared to a large between-group variation within these archaeological groupings (see Fig. 1). Findings of a special study (Kozintsev, 2023b) suggest that Fedorovka and Alakul have had a common origin, and the differences between them are secondary. Specifically, the “eastern” tendency of Fedorovka as compared to Alakul is likely caused by admixture between certain Fedorovka populations and Siberian autochthones.

The neighbors of Fedorovka within subcluster B2a in the second analysis are both pooled Karasuk groups: the earlier “classic” (No. 43) and the later Kamenny Log (No. 44). The apparent reason, apart from the Andronovo component in the Karasuk population, is the fact that the probable ancestors of Andronovans—the Catacomb people of Northern Caucasus, as well as those of Poltavka, Abashevo, and Sintashta—were not used in the present analysis (Ibid.). In both analyses, as in the earlier studies (Kozintsev, 2023a, 2024),

Tatyana Chikisheva, who, in a personal communication, drew my attention to the “Southern Eurasian” tendency displayed by the Karakol people.

Karasuk groups are intermediate between Okunev and Andronovo, “classic” Karasuk being closer to the former, and Kamenny Log deviating toward the latter. This supports both the hypothesis of Karasuk origin through admixture (Vadetskaya, 1986: 61–63; Rykushina, 2007: 15, 20; Kozintsev, 2023a, 2024), and the idea that the transition between Karasuk proper and Kamenny Log was caused by another Andronovo migration, this time from Xinjiang via Mongolia down the Upper Yenisei (Poliakov, 2022: 311).

Apart from Fedorovka and Karasuk samples, subcluster B2a includes a Late Bronze Age group from the Upper Irtysh (No. 35) and a Mongun-Taiga sample from Baidag III in Tuva (No. 68). Both these groups, which are close to one another, take an intermediate position between Andronovo and Okunev. In this respect, they resemble Karasuk. Possibly, they too should be viewed in the context of admixture between Andronovans, on the one hand, and Okunev people or their relatives belonging to the Southern Eurasian formation, on the other (Kozintsev, 2023a, 2024).

The same may concern the Yelovka group (No. 32)—the only non-Okunev member of subcluster B1. It is intermediate between Okunev and Fedorovka, much closer to the former. Although archaeologists speak of an “extremely strong Andronovo component” in the Yelovka culture (Korochkova, 2013: 343), results of the first analysis in the present study indicate only the affinity between Yelovka and the cranially “easternmost” Andronovo groups—one from the same cemetery (No. 23)*, the other from the Baraba forest-steppe (No. 18), i.e., precisely those which, to all appearances, represent Siberian natives subjected to acculturation.

However, the closest affinity to Yelovka is displayed by its neighbors in subcluster B1—the Okunevans, especially the early ones, those from Tas-Khazaa (No. 1) and Uybat (No. 2). The D^2_c values in those cases are negative, which means that the crude D^2 is less than its statistical error. Chronological considerations suggest that what we see here is a similar proportion of two components, native and immigrant (European), rather than direct relationship. The share of the latter was higher in early Okunevans than in the later ones (Poliakov, 2022: 131–132; Gromov, 1997), which, apparently, accounts for the observed result.

Among all the groups used, only that associated with the Yelovka culture can be regarded as a possible direct descendant of the Okunev population or a related one. If so, it likely included a slight Andronovo admixture. The fact that the Yelovka culture is separated from Okunev in both time and space does not contradict the idea of continuity, because the Southern Eurasian formation

included not only Okunevans (Chikisheva, 2012: 57–58; Kozintsev, 2021). Evidently, what we observe here is acculturation, whereby Siberian natives—descendants of Okunevans or their relatives—borrowed the elements of Andronovo culture without mating with the immigrants on a large scale.

Because subcluster B2b takes a central position, it is difficult to assess its status. One of its members is the pooled Irmen group (No. 42a), whose closest parallel is the pooled Mongun-Taiga sample (No. 67). The latter is even closer to Irmen than to the other Mongun-Taiga group—Baidag III (No. 68). Archaeologists wrote about the continuity between Irmen and the Yelovka culture preceding it (see especially (Matyushchenko, 1974: 4–5)). While the cranial resemblance between them does exist, the parallel between Irmen and Mongun-Taiga is even more marked. It is especially prominent in the southernmost Irmen population—that from the forest-steppe Altai (No. 38). Whether or not this is accidental is hard to say. Regarding the relative resemblance of Irmen to Andronovo versus Karasuk, the two-dimensional space occupied by centroids of separate Irmen samples in the analysis with small samples overlaps with both, being shifted in the morphologically “eastern” direction relative to both, especially to Andronovo. In the second analysis, the pooled Irmen group (No. № 42a) is equally distant from pooled Fedorovka (No. 25a), and both pooled Karasuk groups (No. 43 and 44). Its position, like that of the entire subcluster B2b, including Pakhomovskaya and Mongun-Taiga, agrees with the idea of admixture between Fedorovka immigrants and Siberian autochthones similar to those of Late Krotovo (Cherno-Ozerye) stage. Possibly, the agreement would be even better if we assume that Karasuk people, too, were engaged in the admixture. However, Pakhomovskaya (No. 30) is closer to another Andronoid group, Yelovka, than to other members of subcluster B2b. Both groups, despite the impression that the two-dimensional projection conveys (see Fig. 2), are equally removed from Fedorovka, although archaeological facts indicate the predominance of the Andronovo component in Yelovka and the mostly local roots of Pakhomovskaya (Korochkova, 2013).

Representatives of the Late Krotovo (Cherno-Ozerye) stage at Sopka-2 (No. 15) and especially at Cherno-Ozerye proper (No. 16)—members of subcluster C2—deviate from the Baraba groups of the Northern Eurasian formation (subcluster C1) not toward Andronovans but toward the Southern Eurasian formation, specifically the Okunev-Yelovka subcluster B1. This was noted also by T.A. Chikisheva (2012: 123). To an even greater degree, this concerns other members of subcluster C2: possible relatives of the Begazy-Dandybai people in the Baraba forest-steppe (No. 34) and Andronoids associated with the Korchazhka (No. 31) and Cherkaskul (No. 29) cultures.

*This is hardly incidental, given the territorial coincidence of both these groups.

The position of the second presumably Begazy-Dandybai sample, from Yelovka I (No. 33), is rather peculiar; unlike other members of subcluster C2, it really shows a marked Andronovo tendency, compatible with the idea of admixture between aborigines of the Northern Eurasian formation and Andronovans*.

The status of other members of subcluster C2—Late Krotovo (No. 15 and 16), Cherkaskul (No. 29), Korchazhka (No. 31), and cultural relatives of the Begazy-Dandybai people in Baraba (No. 34)—is hardly reconcilable with the above hypothesis. They are far not only from Andronovans but also from an imaginary line connecting them with members of the Northern Eurasian formation (see Fig. 2). Meanwhile, according to a common view, admixed populations are normally intermediate between parental ones in terms of measurements and their combinations. Nor are there any indications that subcluster C2 evidences admixture between Andronovans and Okunev people or their relatives belonging to the Southern Eurasian formation. To all appearances, members of subcluster C2 are Western Siberian autochthones, who, rather than mixing with Andronovans, had undergone acculturation. But which of the two known Eurasian formations did they belong to?

Late Krotovo (No. 15 and 16) is clearly an offshoot of the Northern Eurasian formation, to which people of the classic Krotovo stage belong (No. 14). Cherkaskul people (No. 29) are closest to a Late Krotovo group from Chernozerye (No. 16), but they also resemble people associated with Yelovka culture (No. 32), who belong to the Southern Eurasian formation. The cultural relatives of Begazy-Dandybai people in Baraba (No. 34) are similar to both Late Krotovo (Chernozerye) samples and to Yelovka. The Korchazhka people (No. 31), too, are similar to those of Chernozerye, but also, like the pooled Irmen group (No. 42a), to Mongun-Taiga (No. 67). The latter, in turn, resemble classic Karasuk (No. 43; Chikisheva (2012: 8) attributes both latter groups to the Southern Eurasian formation).

Samples from cemeteries with Begazy-Dandybai features at Yelovka I (No. 33) and in the Baraba forest-steppe (No. 34), according to the results of the first analysis, are situated in the right, i.e., cranially “eastern”, part of the Andronovo grouping. Although in the second analysis they both are members of the same subcluster C2, no particular resemblance between them is seen, and the only group deviating toward Andronovans is Yelovka I, which, like Irmen, is closest to Mongun-Taiga (No. 67). As to supposed cultural relatives of the Begazy-Dandybai people in Baraba (No. 34), this was the group that Chikisheva used to describe the Southern Eurasian

formation for the first time (Ibid.: 57). However, as the statistical analysis demonstrates, this group is closest to Late Krotovo (Chernozerye) samples (No. 15 and 16), which are affiliated with the Northern Eurasian formation, but, like Cherkaskul (No. 29) and Korchazhka (No. 31), displays an even stronger Southern Eurasian tendency. It appears that both Eurasian formations, so far rather vaguely demarcated, are extremes of the same continuum. The group associated with the Yelovka culture (No. 32), which, too, was possibly influenced by the Begazy-Dandybai culture (Kiryushin, 2004: 95), definitely belongs to the Southern Formation, since it is part of the Okunev cluster. Because samples from cemeteries showing elements of Begazy-Dandybai culture are not close cranially, and the Begazy-Dandybai culture proper is not represented by cranial material, these findings can hardly be interpreted in a historically meaningful way. The four Andronoid groups, too, do not display a single physical type. In the second analysis, the two cranially more “western” ones, Pakhomovskaya (No. 30) and Yelovka (No. 32), are members of cluster B, the latter group differing from the former by a distinctly “Okunev” tendency. The more “eastern” samples, Cherkaskul (No. 29) and Korchazhka (No. 31), fall within subcluster C2, together with groups from the Late Krotovo (Chernozerye) cemeteries (No. 15 and 16).

Conclusions

1. Yelunino, Chaa-Khol, and Samus belonged to the second (post-Afanasyevo) migration to Siberia from the west, whereas Andronovans represented the third migration. The Karakol people display contradictory affinities: with pre-Andronovo migrants such as Yelunino and Chaa-Khol, with autochthones of Baraba, and with Andronoids of Yelovka.

2. The small “eastern” tendency of Fedorovka relative to Alakul is likely caused by the native substratum absorbed by the former rather than by various origins.

3. The Karasuk population evidently emerged by admixture between Okunev and Andronovo people. Representatives of the “classic” Karasuk stage are closer to the former, while those of the Kamenny Log stage deviate toward the latter. Late Bronze Age people of the Upper Irtysh and the Mongun-Taiga people of Baidag III resemble those of Karasuk in appearance. They all may have had a common origin.

4. Andronoids of Yelovka II resemble Okunev people, but probably have a small Andronovo admixture.

5. The Late Krotovo (Chernozerye) groups from Sopka and Chernozerye proper deviate from the Baraba natives of the Northern Eurasian formation toward Okunev rather than Andronovo. The same applies to Andronoids of Cherkaskul and Korchazhka and to a group

*It is closest to the Mongun-Taiga group (No. 67), although the latter belongs to another cluster.

from Late Bronze Age cemeteries with Begazy-Dandybai cultural features in Baraba. Yelovka I, which is culturally close to the latter, is intermediate between the Baraba autochthones and Andronovans.

6. Results suggest that both Eurasian formations, Northern and Southern, are extremes of the same continuum.

7. The pooled Irmen group, the pooled Mongun-Taiga group, and the Andronoids of the Pakhomovskaya culture take a central position in the analysis, which agrees with the idea that they originated through admixture of several components—both Eurasian formations, Andronovo, and Karasuk.

8. Only two of the four Andronoid groups, Yelovka and Pakhomovskaya, display traces of admixture between the aborigines and Andronovans. Two other Andronoid groups, Cherkaskul and Korchazhka, show no such traces, and the same is true of Late Krotovo people. The Southern Eurasian formation was more affected by the admixture between the autochthones and the Andronovo immigrants than was the Northern Eurasian formation.

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References

- Akimova M.S. 1968**
Antropologiya drevnego naseleniya Priuraliya. Moscow: Nauka.
- Alekseyev V.P., Gokhman I.I. 1984**
Antropologiya Aziatskoi chasti SSSR. Moscow: Nauka.
- Bagashev A.N. 2017**
Antropologiya Zapadnoi Sibiri. Novosibirsk: Nauka.
- Chernikov S.S. 1960**
Vostochnyi Kazakhstan v epokhu bronzy. Moscow, Leningrad: Izd. AN SSSR. (MIA; No. 88).
- Chikisheva T.A. 2012**
Dinamika antropologicheskoi differentsiatsii naseleniya yuga Zapadnoi Sibiri v epokhi neolita – rannego zheleza. Novosibirsk: Izd. IAET SO RAN.
- Dremov V.A. 1997**
Naseleniye Verkhnego Priobiya v epokhu bronzy (antropologicheskii ocherk). Tomsk: Izd. Tomsk. gos. univ.
- Gromov A.V. 1997**
Proiskhozhdeniye i svyazi naseleniya okunevskoi kultury. In *Okunevskiy sbornik: Kultura. Iskustvo. Antropologiya*. St. Petersburg: Petro-RIF, pp. 301–345.
- Kiryushin Y.F. 2004**
Eneolit i bronzovyi vek yuzhno-taizhnoi zony Zapadnoi Sibiri. Barnaul: Izd. Alt. Gos. Univ.
- Kiryushin Y.F., Shamshin A.B. 1992**
Itogi arkhologicheskogo izucheniya pamyatnikov eneolita i bronzovogo veka lesostepnogo i stepnogo Altaya. In *Altaiskiy sbornik*, iss. 15. Barnaul: Altai. otdel. Vseros. fonda kultury, pp. 194–222.
- Korochkova O.N. 2009**
The Pakhomovskaya culture of the Late Bronze Age. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 37 (3): 75–84.
- Korochkova O.N. 2013**
Andronoidnye kultury Zapadnoi Sibiri i begazy-dandybaevskaya kultura Tsentralnogo Kazakhstana. In *Begazy-dandybaevskaya kultura stepnoi Evrazii: Sbornik nauch. statei, posv. 65-letiyu Z. Kurmankulova*. Almaty: Nauch.-issled. tsentr istorii i arkhologii “Begazy-Tasmola”, pp. 340–347.
- Kosarev M.F. 1981**
Bronzovyi vek Zapadnoi Sibiri. Moscow: Nauka.
- Kovalevsky S.A. 2011**
K voprosu o proiskhozhdenii irmenskoii kulturno-istoricheskoy obschnosti (istoriograficheskii aspekt). *Izvestiya Altaiskogo gosudarstvennogo universiteta*, No. 4-2: 112–119.
- Kozintsev A.G. 2009**
Cranio-metric evidence of the early Caucasoid migrations to Siberia and Eastern Central Asia, with reference to the Indo-European problem. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 37 (4): 125–136.
- Kozintsev A.G. 2020**
The origin of the Okunev population, Southern Siberia: The evidence of physical anthropology and genetics. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (4): 135–145.
- Kozintsev A.G. 2021**
Patterns in the population history of Northern Eurasia from the Mesolithic to the Early Bronze Age, based on craniometry and genetics. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 49 (4): 121–132.
- Kozintsev A.G. 2023a**
Na kogo byli pokhozhi karasuktsy? *Etnograficheskoye obozreniye*, No. 3: 150–164.
- Kozintsev A.G. 2023b**
Origin of the Andronovans: A statistical approach. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 51 (4): 142–151.
- Kozintsev A.G. 2024**
The origin of the Karasuk people: Cranio-metric evidence. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 52 (2): 143–153.
- Matyushchenko V.I. 1974**
Drevnyaya istoriya naseleniya lesnogo i lesostepnogo Priobiya (neolit i bronzovyi vek). Pt. 4: Elovsko-irmenskaya kultura. Tomsk: Izd. Tomsk. Gos. Univ.
- Molodin V.I. 1985**
Baraba v epokhu bronzy. Novosibirsk: Nauka.
- Molodin V.I., Neskorov A.V. 1992**
O svyazyakh naseleniya zapadnosibirskoi lesostepi i Kazakhstana v epokhu pozdnei bronzy. In *Margulanovskiy chteniya 1990 g.*, pt. 1. Moscow: [s.n.], pp. 93–97.
- Poliakov A.V. 2022**
Khronologiya i kulturogenez pamyatnikov epokhi paleometalla Minusinskikh kotlov. St. Petersburg: IIMK RAN.
- Rud N.M. 1981**
Paleoantropologicheskiye materialy epokhi bronzy iz mogilnika Taktalachuk. In *Ob istoricheskikh pamyatnikakh po dolinam Kamy i Beloi*. Kazan: Izd. Kazan. fil. AN SSSR, pp. 71–93.

Rykushina G.V. 2007

Paleoantropologiya karasukskoi kultury. Moscow: Shtyrii sad.

Schneeweiss J., Becker F., Molodin V.I., Parzinger H., Marchenko Z.V., Sviatko S.V. 2018

Radiouglerodnaya khronologiya protsessa zaseleniya pamyatnika Chicha i baiyesovskaya statistika dlya otsenki preryvistogo perekhoda ot epokhi pozdnei bronzy k rannemu zheleznomu veku (Zapadnaya Sibir). *Geologiya i geofizika*, vol. 59 (6): 792–813.

Shevchenko A.V. 1980

Antropologicheskaya kharakteristika naseleniya cherkaskulskoi kultury i voprosy ego etnogeneza. In *Sovremennye problemy i novye metody v antropologii*. Leningrad: Nauka, pp. 163–183.

Solodovnikov K.N. 2009

Svyazi naseleniya kazakhstanskih stepei i Altaiskogo regiona v epokhu bronzy po dannym paleoantropologii. In

Izucheniye istoriko-kulturnogo naslediya Tsentralnoi Evrazii: Materialy Mezhdunar. nauch. konf. "Margulanovskiy chteniya-2008". Karaganda: [s.n.], pp. 158–164.

Solodovnikov K.N., Rykun M.P. 2011

Materialy k antropologii pakhomovskoi kultury epokhi bronzy Zapadnoi Sibiri. *Vestnik antropologii*, No. 19: 112–129.

Vadetskaya E.B. 1986

Arkheologicheskiye pamyatniki v stepyakh Srednego Eniseya. Leningrad: Nauka.

Zubova A.V. 2014

Naseleniye Zapadnoi Sibiri vo II tysyacheletii do nashei ery (po antropologicheskim dannym). Novosibirsk: Izd. IAET SO RAN.

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