doi:10.17746/1563-0110.2023.51.2.142-152

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A Metric Analysis of a Human Cranium from the Khatystyr Cave, Republic of Sakha (Yakutia)

We present the results of a metric study of a male Early Holocene cranium found in a cave near the Khatystyr village, Yakutia, in 1962. Eight measurements taken on the specimen were subjected to canonical discriminant analysis, using individual data on 14 ancient samples from Siberia and the Far East. Euclidean distances between these samples were calculated, and k-means clustering was performed. Results revealed similarity of the Khatystyr individual with Serovo crania from Cis-Baikal and with the Neolithic series from the Baraba forest-steppe. This suggests that the Khatystyr *male is closely related to the earliest Upper Paleolithic populations of North Asia. A related component, assimilated by members of later migration waves, was also detected in other Northeast Asia territories, including Sakhalin, but is absent in the Neolithic samples from Primorye, in the Old Koryak and Old Bering Sea samples. Comparison with the Late Neolithic Ymyyakhtakh sample from Diring-Yuryakh, Yakutia, reveals no continuity between Early and Middle Holocene groups of that region. The Diring-Yuryakh sample shares no similarity with any other group, and likely represents an isolate.*

Keywords: *Early Holocene, Yakutia, craniometry, peopling of Northern Eurasia, paleogenetics, Khatystyr.*

Introduction

Early Holocene human skeletal remains are rare in North Eurasia; thus, each specimen becomes the focus of close attention of archaeologists and anthropologists. This article outlines the first results of the study of a specimen discovered in 1962 by a foreman of the Aldan timber industry enterprise A. Ivanov in a cave near the Khatystyr village in the Aldansky District of the Republic of Sakha (Yakutia). The cave is located at the right bank of the Aldan River, two kilometers from the village (58°55′07″ N, 125°10′25″ E; Fig. 1). This is a lime cavern, which emerged in a deep crack. The skeleton was found on the cave floor near the entrance, by the wall. Traces of a campfire were detected nearby, while an assemblage of bear, wolf, and fox bones were found in the depth of the cave (Rusanov, 1976: 127). Some bones were later determined by G.G. Boeskorov as belonging to the brown bear *Ursus arctos* L. and domestic dog *Canis familiaris* L.

The original study of the skeleton was carried out by criminal investigation officers and, by their request, by B.S. Rusanov, a geologist. Later, the cave and skeleton were examined by archaeologists Y.A. Mochanov and S.A. Fedoseeva, who recognized the remains as modern. The study of the skeleton was ceased, and it was transferred to the Geological Museum of the Yakutian Branch of the USSR Academy of Sciences (now Geological Museum of the Diamond and Precious Metal Geology Institute (GM DPMGI) of the SB RAS). However, some of the bones were kept by Rusanov for radiocarbon dating, which was carried out in 1970s. The remains were dated to 9800 years BP; thus, it became the most ancient human skeleton not only from Yakutia but from the whole Eastern Siberia at the time. Unfortunately, those results were only presented in a popular science publication (Ibid.: 128) and were not noticed by researchers.

In 2017, a fragment of the Khatystyr skull, together with some other human and animal samples from the GM DPMGI collection, was transferred to the Institute of Accelerator Analysis Ltd. (Japan) for accelerator mass spectrometry radiocarbon dating, which revealed a date of 9010 ± 30 BP (Table 1). The calibrated calendar interval of the date fits into a relatively narrow chronological period from 8291 to 8206 BC (94.4 %), with a range of ±2σ (95.4 %) 8291–8022 BC (OxCal 4.4). Four additional radiocarbon dates were obtained in the same laboratory for the animal bones found in the cave (Table 1): they all fall into the "calendar" interval between 10.2 and 9.5 ka BP, which corresponds to the early period of the Sumnagin Mesolithic culture, dated to 9400–5900 BP (10,700–6800 cal BP) (Istoriya Yakutii, 2020: 478). These results have confirmed the ancient age of the Khatystyr skeleton and the relevance of a further study.

Material and methods

The Khatystyr individual was determined as male based on the depth of the greater sciatic notch and the overall shape of the pelvic bone. The probable age-at-death of the individual was 35–45 years, judging by the features of the pelvic auricular surface, pubic

Fig. 1. Location of the burial near the Khatystyr village.

symphysis, cranial suture obliteration, and attrition of mandibular teeth.

The cranial remains include damaged bones of the cranial vault and mandible (Fig. 2). The poor preservation of the skull (absence of the base and facial skeleton) has limited the number of cranial measurements to only 10 variables (Table 2). The measurements were taken according to the standard protocol by R. Martin, modified by V.P. Alekseev and G.F. Debets (1964). Eight of those dimensions were then employed in intergroup comparisons carried out via several statistical methods. The first stage of the analysis was a canonical discriminant analysis aimed at the reconstruction of the main trends of the population dynamics in Siberia and the Far East, and the position of the Khatystyr individual in respect to these trends. Then, Euclidean distances between the skull from Khatystyr and the reference samples were calculated using the averaged values of several top canonical vectors (CV) of the analysis. The matrix of the Euclidean distances was clustered using the generalized k-means algorithm in the Generalized EM and k-Means Clustering Analysis module (Generalized EM…, (s.a.)). The use of CV coordinates in the cluster analysis instead of the raw variable values was important to achieve two aims. First, the ratio of both intra- and intergroup variability was accounted for when classifying the groups. Second, the influence of random fluctuations of the values of the cranial dimensions on the results was minimized via the exclusion of the minor CVs (mainly dependent on stochastic variation) from the calculations.

Table 1. **Radiocarbon dates for the human skull and animal bones from Khatystyr Cave**

Lab code	Material of the specimen	$\delta^{13}C$, ‰ (mass.)	$\delta^{15}N$, ‰ (mass.)	$\delta^{13}C$, ‰ (AMS)	Data with correction $\delta^{13}C$	
					^{14}C-date, BP	% of modern collagene
IAAA-170069	Human skull	–20.0	11.3	23.00 ± 0.17	9010 ± 30	32.58 ± 0.14
IAAA-183037	Brown bear femur	–18.3	6.12	17.79 ± 0.19	8560 ± 30	34.43 ± 0.15
IAAA-183038	Brown bear humerus	–18.7	5.83	18.30 ± 0.18	8660 ± 30	34.03 ± 0.14
IAAA-183039	Dog skull	–20.4	8.37	20.73 ± 0.18	8980 ± 30	32.68 ± 0.14
IAAA-183040	Dog femur	–19.6	7.73	18.75 ± 0.16	8790 ± 30	33.46 ± 0.14

Fig. 2. Human skull and mandible from Khatystyr.

Table 2. **Craniometric variables of the skull from Khatystyr and reference samples**

Sample	1. Cranial length	9. Minimum frontal breadth	SubNB : 9. Frontal bone subtense (transverse)	10. Maximum frontal breadth	29. Frontal chord	SubNB : 29. Frontal bone subtense (sagittal)	26. Frontal arc	30. Parietal chord	27. Parietal arc	12. Occipital width	Source
Khatystyr	185	88	15.5	113	110	22.5	123	112	125	114	Present study
Glazkovo culture (Fofanovo, Educhanka, Makarovo, Obkhoi)	189.6 (5)	90.04 (5)	14.44 (5)	118.4 (5)	115.12 (5)	24.58 (6)	126.6 (5)	111.2 (5)	122.6 (5)	…	Authors' unpublished data
Serovo culture (Verkholensky, Manzurka, Khunzhir-Olkhon)	186.5 (12)	93.8 (12)	18 (12)	119.67 (12)	110.625 (12)	25.08 (12)	124.83 (12)	113.27 (12)	125.33 (12)	…	"
Boismana culture (Boismana-2)	179.5 (2)	91 (2)	…	110 (1)	114.75 (2)	21.95 (2)	126 (2)	103 (2)	116.5 (2)	109.5 (2)	(Popov, Chikisheva, Shpakova, 1997)
Yankovskaya culture (Cherepakha-13)	177.5 (2)	93 (2)	…	116 (2)	111.85 (2)	24.85 (2)	126 (2)	107.25 (2)	118.5 (2)	108 (2)	(Gromov, Zubova, Moiseyev, 2017)
Old Koryak culture (Cape Bratyev)	177.17 (6)	95.67 (6)	…	119.2 (5)	111.33 (6)	25.55 (6)	130.33 (6)	107.2 (6)	120.83 (6)	111.33 (6)	(Moiseyev et al., 2021)
Ymyyakhtakh culture (Diring-Yuryakh)	187.2 (5)	99.4 (5)	20.3 (4)	122 (5)	121.4 (5)	27.86 (5)	137.2 (5)	99.3 (5)	106.8 (5)	120.2 (5)	(Gokhman, Tomtosova, 1992) and the authors' unpublished data
Susuya culture (Susuya)	185.5 (2)	92 (2)	…	110 (2)	112.4 (2)	23.65 (2)	125 (2)	108.5 (2)	122.25 (2)	…	Authors' unpublished data
Okhotsk culture (Moyoro, Khamanaka, Omisaki, Rebun, Shari-Utoro)	184.175 (39)	93.82 (39)	…	116.24 (39)	114.04 (39)	25.87 (40)	128.93 (39)	109.68(39)	123.23(39)	…	"
Mohe (Shapka, Troitsky)	183.92 (12)	91.46 (11)	16.44 (11)	116.4 (5)	114.22 (11)	23.44 (10)	128.45 (11)	106.62 (12)	120.25 (12)	…	(Chikisheva, Nesterov, 2000) and the authors' unpublished data
Jōmon (composite sample from 15 cemeteries on the Hokkaido Island)	179.38 (25)	96.44 (25)	…	116.7 (22)	106.55 (25)	23.54 (25)	123.77 (25)	116.12 (25)	130.54 (25)	…	Authors' unpublished data
Epi-Jōmon (Usu-Moshi, Rebun, Onkoromanai)	184.4 (5)	99.26 (5)	…	119.4 (5)	105.82 (5)	26 (5)	125.4 (5)	113.8 (5)	126 (5)	…	"
Old Bering Sea culture (Uelen)	187.82 (17)	96.67 (17)	…	113.92 (17)	113.5 (17)	26.08 (15)	129.25 (17)	111.56 (17)	125.125 (17)	…	(Debets, 1975)
Neolithic of the Baraba forest-steppe (Protoka, Vengerovo-2)	182.125 (8)	93.51 (8)	…	116.38 (8)	107.9 (8)	21.5 (8)	121.38 (8)	110.29(8)	124.25 (8)	…	(Chikisheva, 2012; Zubova, Pozdnyakov, Chikisheva, 2013)
Neolithic – Chalcolithic of the Altai (Solontsy-5, Vaskovo-4)	188.75 (4)	94.9 (4)	…	120 (4)	116.28 (4)	23.78 (4)	126.25 (4)	111 (4)	118.25 (4)	…	(Chikisheva, 2012)

All the analyses were carried out in Statistica for Windows v. 8.0. Individual measurements of the skulls from 14 male samples from Siberia, the Russian Far East, and Japanese Archipelago were employed as reference (Table 2). As values of some variables were missing in the original publications, necessary additional measurements were obtained when possible.

Results

Morphological description of the skull. The poor preservation of the specimen precludes a complete craniologic description of the skull. The skull vault is relatively long: maximum length is on the borderline between medium and large values (Alekseev, Debets, 1964: Tab. 6). The frontal bone is convex, very narrow at the narrowest point, and narrow at the coronal suture. The temporal bones are of medium length and moderately curved in the sagittal plane.

Canonical discriminant analysis. The first two CVs account for 66 % of the total variance (Table 3). The first CV differentiates the samples with long frontal arches and chords but short temporal arches and chords (negative values of the vector) from groups displaying an opposite combination (positive values). The sample from Diring-Yuryakh occupies the negative "pole", while the area of positive values is occupied by the ancient groups of the Japanese Archipelago. Notably, Diring-Yuryakh, unlike the Japanese samples, displays an isolated position. The Khatystyr skull is found close to zero of CV I (Fig. 3).

The second CV (18 % of the total variance) is mainly associated with minimum width of the frontal bone. The Diring-Yuryakh sample exhibits the widest (positive extremity), and the Khatystyr individual the narrowest (negative) frontal bone. The latter is similar to the individuals of the Glazkovo and Serovo cultures of Cis-Baikal, as well as to the Neolithic population of the Baraba forest-steppe. Similarly to CV I, the Diring-Yuryakh sample occupy an outlying position: the gap between it and the closest group, Old Koryak, is 27 % of the total range of CV II values.

The Khatystyr specimen, displaying an extremely narrow frontal bone, created one of the poles of CV II; thus, an important question arose of how much the morphological trend described by the vector depended on the unusual features of this single individual. In order to assess this, an additional analysis omitting Khatystyr was performed. The results presented in Table 3 show that the proportion of the total variance described by the first three top vectors, as well as the correlations between the raw measurements and CVs, have changed only slightly, and minimum frontal breadth remains the "leading" variable for CV II. Thus, even if the extremely small width of the frontal bone is an individual feature of the Khatystyr skull, this fact does not substantially affect the intergroup correlations between the cranial metric variables.

The analysis was repeated after the exclusion of the two clearly outlying groups, i.e. Diring-Yuryakh and the series from Japanese Archipelago. The distribution of the groups residing in the morphospace of the first two CVs broadly corresponds to their geographic localization (Fig. 4). The only Arctic sample from Uelen is separated from the others by extremely high positive values of CV I. The gap between the Uelen to the closest group of the Okhotsk culture constitutes

Table 3. **Correlation coefficients between the original craniometric variables and the top three canoninical vectors**

Variable	With Khatystyr			Without Khatystyr		
	CV I	CV II	CV III	CV I	CV II	CV III
1. Cranial length	**–0.394**	–0.177	**0.490**	**–0.393**	–0.186	**–0.499**
9. Minimum frontal breadth	0.227	**0.643**	–0.020	0.222	**0.597**	0.034
10. Maximum frontal breadth	–0.087	0.048	**–0.318**	–0.091	–0.029	0.314
SubNB : 29. Frontal bone subtense (sagittal)	–0.322	**0.421**	**0.434**	–0.330	**0.383**	**–0.429**
29. Frontal chord	**–0.820**	0.158	0.163	**–0.822**	0.139	–0.161
26. Frontal arc	**–0.436**	**0.445**	0.091	–0.441	**0.428**	–0.080
30. Parietal chord	**0.665**	–0.240	0.252	**0.666**	–0.252	–0.260
27. Parietal arc	**0.711**	–0.235	0.281	**0.713**	–0.235	–0.287
Total variance explained, %	48.0	17.9	14.8	49.0	16.6	15.1

Note. The coefficients significant at $p < 0.05$ are given in bold.

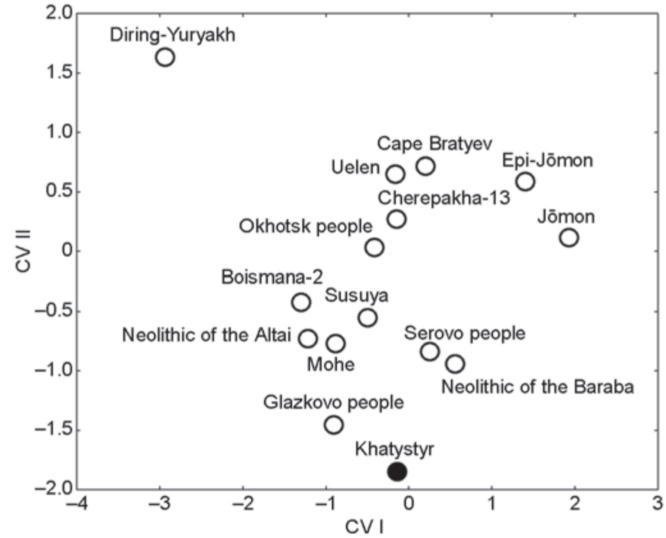

Fig. 3. Canonical discriminant analysis of the skull from Khatystyr and 14 reference samples (CV I and CV II).

39 % of the total variability of CV I. The negative pole of the vector is determined by the Neolithic populations of the Baraba forest-steppe, Altai foothills, and Khatystyr. These specimens display convex frontal bones, small values of the minimum frontal breadth, but large values of maximum frontal breadth (Table 4).

The positive extreme of CV II is occupied by the Boismana-2 sample, alongside with the mainland groups of the Russian Far East: Mohe, Old Koryak, and Yankovskaya cultures. These samples exhibit a combination of a large cranial length and sagittally elongated temporal bones. The opposite combination is observed in Cis-Baikal groups of the Serovo and Glazkovo cultures at the negative pole of the vector.

As compared to the previous analysis, the skull from Khatystyr demonstrates even closer similarity to the populations of the Baraba forest-steppe, Altai, and Cis-Baikal in the morphospace of the first two CVs (Fig. 4).

Euclidean matrix and cluster analysis. A matrix of Euclidean distances between the Khatystyr individual and reference groups was calculated using the sample means of the top three

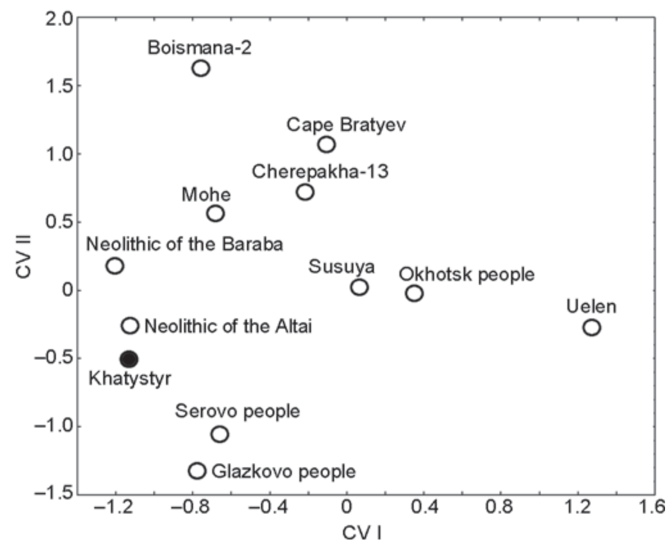

Fig. 4. Canonical discriminant analysis of the skull from Khatystyr and 11 reference samples (CV I and CV II).

Table 4. **Correlation coefficients between the original craniometric variables and the top three canonical vectors: the samples from Diring-Yuryakh and the Japanese Archipelago excluded**

Variable	CVI	CVII	CVIII
1. Cranial length	0.084	**0.748**	–0.355
9. Minimum frontal breadth	**0.421**	0.043	**0.311**
10. Maximum frontal breadth	**–0.320**	**0.305**	0.100
SubNB : 29. Subtense of the frontal bone (sagittal)	0.522	0.261	–0.134
29. Frontal chord	0.170	0.067	**–0.751**
26. Frontal arc	**0.326**	–0.149	–0.210
30. Parietal chord	0.013	**0.571**	**0.338**
27. Parietal arc	0.113	**0.326**	**0.417**
Total variance explained, %	0.370	0.226	0.157

Note. The coefficients significant at $p < 0.05$ are given in bold.

Table 5. **Euclidean distance matrix between Khatystyr and the reference samples**

Sample	Khatystyr	Glazkovo culture	Serovo culture	Mohe	Boismana culture	Okhotsk culture	Old Koryak culture	Old Bering Sea culture	Neolithic of the Baraba forest-steppe	Neolithic of the Altai	Susuya culture
Khatystyr	–										
Glazkovo culture	1.12	–									
Serovo culture	0.88	1.29	–								
Mohe	1.17	1.89	2.02	–							
Boismana culture	2.35	2.99	3.19	1.18	–						
Okhotsk culture	1.27	1.78	1.64	1.28	2.17	–					
Old Koryak culture	1.8	2.84	2.15	1.59	2.11	1.54	–				
Old Bering Sea culture	2.19	2.46	2.21	2.32	3.04	1.06	2.12	–			
Neolithic of the Baraba forest-steppe	1.06	2.14	1.36	1.53	2.46	1.83	1.32	2.66	–		
Neolithic of the Altai	1.2	1.05	1.91	1.24	2.14	1.82	2.66	2.76	2.08	–	
Susuya culture	1.11	1.64	1.65	0.99	1.94	0.32	1.56	1.36	1.73	1.54	–
Yankovskaya culture	1.29	2.22	1.88	0.87	1.62	0.96	0.79	1.84	1.29	1.94	0.86

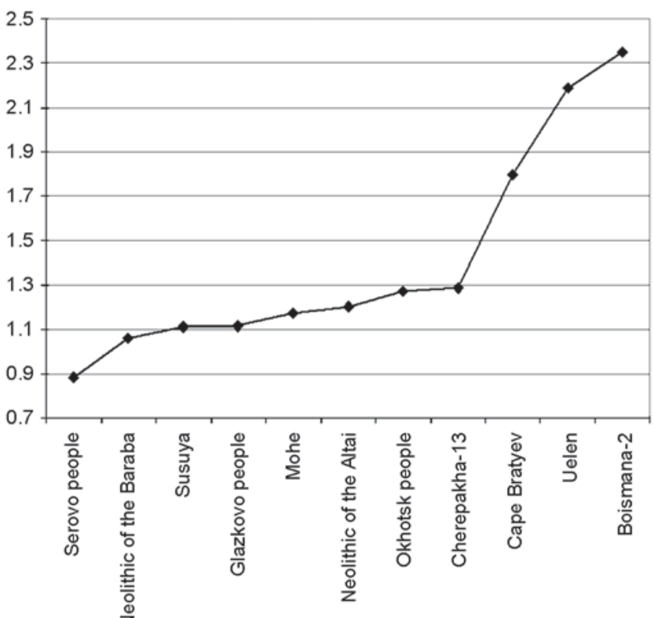

Fig. 5. Euclidean distances between the skull from Khatystyr and reference samples.

CVs (77 % of the total variance) (Table 5). The Cis-Baikal Serovo sample is the closest to Khatystyr, while a number of West and East Siberian, as well as some Far Eastern groups, displays a moderate similarity to the skull under study (Fig. 5). The only samples demonstrating a strong difference from Khatystyr are the Old Koryak, Uelen, and Boismana-2. This possibly suggests that the area inhabited by human groups related to the Khatystyr population might have been quite broad in the past: from the Baraba forest-steppe in the west to Sakhalin in the east. Some morphological features of those ancient groups might have survived to an extent in this area until the medieval times, despite later gene flow. The relevance of the intergroup Euclidean distances is tentatively confirmed by the fact that the samples of the Susuya and Okhotsk cultures from Hokkaido (considered as stages of the same ethnocultural group) display the smallest distance (Deryugin, 2008: 59).

The generalized k-means algorithm was employed for clustering the matrix of Euclidean distances. This algorithm groups the objects under analysis according to the minimal sum of distances between the objects and respective clusters (k). The whole set of raw data is separated into k clusters iteratively until an optimal grouping is achieved. The generalized approach of this algorithm is special in terms of searching of the optimal number of clusters via a v-fold cross validation, while in the conventional k-means technique the optimal number is set by the user voluntary. In our analysis, v=10.

The cluster analysis has shown that three clusters are optimal for the present set of samples. The first

Table 6. **Results of the cluster analysis**

Sample	Number of cluster	CV I	CV II	CV III	Distance to the center of the cluster
Mohe	1	–0.76	–0.58	–0.50	0.35
Boismana culture	1	–0.83	–1.62	–1.06	0.67
Okhotsk culture	1	0.35	–0.05	–0.13	0.23
Old Koryak culture	1	–0.14	–1.12	0.86	0.53
Old Bering Sea culture	1	1.36	0.16	0.07	0.61
Susuya culture	1	0.08	–0.10	–0.29	0.19
Yankovskaya culture	1	–0.23	–0.76	0.17	0.18
Glazkovo culture	2	–0.74	1.31	–0.47	0.21
Neolithic of the Altai	2	–1.16	0.49	–0.99	0.21
Khatystyr	3	–0.81	0.39	0.15	0.23
Serovo culture	3	–0.57	0.99	0.76	0.24
Neolithic of the Baraba forest-steppe	3	–1.12	–0.24	0.95	0.29

of the clusters, the most numerous, included all the groups from the Far East; the second the Glazkovo and Altai foothills Neolithic samples; the third Khatystyr, the Serovo and Neolithic Baraba populations (Table 6). According to the distribution of the sample mean values of the top three CVs (Fig. 6), the first cluster is the most distinct— it displays difference from the others in all the three CVs. The samples belonging to the second and third clusters are separated mainly by the values of CV III.

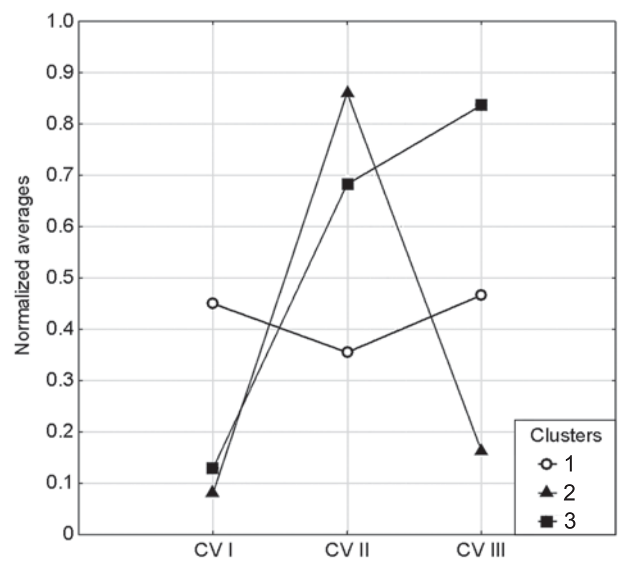

Fig. 6. Comparison of the results of the cluster and canonical discriminant analysis.

Discussion

Reconstructing the population history of the early stages of the peopling of Northeastern Siberia and the Russian Far East by the methods of classic anthropology is a complicated task. A few discoveries of human remains of a Pleistocene or Early Holocene age have been made in Yakutia in the last two decades, but in all the cases only single bones of the postcranial skeleton, cranial fragments, or isolated teeth were found. This makes a direct comparison of those specimens by a unified morphometric protocol impossible.

In Yakutia, the following skeletal individuals were excavated besides Khatystyr: a deciduous tooth from Khaiyrgas Cave (Zubova, Stepanov, Kuzmin, 2016), two teeth from the Yana site, a fragmented female skull from Duvanny Yar, and a sample of bone specimens from the Zhokhova site (Pitulko et al., 2015; Pitulko, Pavlova, 2015; Sikora et al., 2019). The burial from Matta stands apart. It was originally dated to the times of the Ymyyakhtakh culture (Zubova et al., 2017), but the date was later proved incorrect, and more recent studies employing accelerator mass spectrometry (AMS) have shown that the burial is one of the oldest in the region: 6328 ± 81 BP (uncalibrated); 7267 ± ± 91 BP (calibrated). The confidence interval for these dates (1δ) is 7175–7358 BP, calendar age of the burial is 5317 ± 91 BC (NSKA-1663, calibrated in CalPal). These estimates are supported by another study of the Matta burial: 5940 ± 30 BP (Beta-422229) (Kılınç et al., 2021). Overall, these place the burial to the borderline between the Mesolithic (Sumnagin culture) and Early Neolithic (Syalakh culture) of Yakutia.

The dynamics of the main trends of the population history of the region has recently been mainly analyzed by means of paleogenetics, which are not limited by poor preservation of skeletal specimens (Sikora et al., 2019; Yu et al., 2020; Kılınç et al., 2021). The genetic studies have detected three waves of migration in the northern part of Siberia. The first was the emergence of the Ancient North Siberians (ANS). This component is associated with the Upper Paleolithic specimens from Yana (Yana 1 and 2), and the sub-adult from Malta 1 (Sikora et al., 2019: 184). The genetic profile of this ancient lineage is more related to the West Eurasian Upper Paleolithic hunter-gatherers rather than to East Asian populations.

The second large-scale event of the population history of Northern Siberia is dated to the 25–10 ka BP, and, according to genetic data, was associated with a replacement of ANS by populations of a different origin called Ancient Paleo-Siberians (APS). The gene pool of the latter is composed of roughly 75 % of the East Asian component, and 25 % of the Malta 1 genetic cluster. Ancient Paleo-Siberians are represented by the specimens from Kolyma 1 (Duvanny Yar) and Ust-Kyakhta 3 from the Western Trans-Baikal region (Yu et al., 2020: 1235; Pavlenok, Zubova, 2019). These individuals display clear genetic affinities with the modern native groups of the extreme northeast Asia—Koryak, Itelmen, and Chukchi. Finally, the third large migration, which began some 10 ka BP, was associated with the spread of the Neo-Siberians (NS), the ancestors of most modern ethnic groups of Eastern Siberia.

On the basis of the results of our analysis of the cranial metric data, we tried to determine the position of the Khatystyr individual in respect to these three migration waves. The specimens from Zhokhova and Duvanny Yar (Kolyma 1) are chronologically the closest to Khatystyr. But the latter has shown no prominent similarity to either Old Koryak or Uelen sample in any of the statistical analyses. Otherwise, these samples are the least morphologically similar to Khatystyr, and it is thus unlikely that this individual was closely related to the second migration wave.

The Khatystyr individual is highly similar to the Neolithic population of the Baraba forest-steppe, which, in turn, was closely related to the East European hunters-gatherers, according to some previous studies (Chikisheva, Pozdnyakov, 2021). The component of European origin was absent in the third migration wave, while the East Eurasian complexes were predominant. Thus, the genetic components associated with the third wave could not dominate in either the Khatystyr individual or population of Baraba. As such, it can be concluded that Khatystyr belonged to a population where individuals of the first, i.e. the most ancient, wave of peopling of Northern Siberia were prevalent. The main difficulty in determining the status of this individual is the poor preservation and incompleteness of the skull, which precludes measuring some cranial metric characteristics important for the differentiation between European and Asian groups that, according to genetic data, took part in the formation of the ancient population of the region.

Conclusions

Our analysis of the cranial metrics of the skull from Khatystyr suggests that the individual could belong to a population where individuals related to the first wave of peopling of North Asia were prevalent. The skull is most similar morphologically to the samples of the Cis-Baikal Serovo culture and Neolithic Baraba forest-steppe: the groups related to the Upper Paleolithic population of Western Siberia, according to odontological data (Zubova, Chikisheva, 2015).

Some less clear signals point towards the possible persistence of the “Khatystyr-related” anthropological component (assimilated by the later migration waves) in other Siberian regions, including as far east as in Sakhalin. Notably, this component was virtually absent in the Neolithic population of Primorye, as well as in the samples of the Old Koryak и Old Bering Sea cultures.

The pronounced difference between Khatystyr and the skulls of the Late Neolithic Ymyyakhtakh culture from Yakutia suggests a population discontinuity between the Early and Middle Holocene population of the region. The cranial sample from Diring-Yuryakh likely represents an isolated group without close morphological affinities. Based on the cranial characteristics used in our analyses, it is not similar not only to Khatystyr and related populations (these are, in fact, the most distinct from Diring-Yuryakh) but also to any of the reference samples.

Despite the limitations of the present metric analysis, our results are similar to those obtained in the genetic studies. For instance, both cranial metric and genetic data have shown the separation of the populations of the Russian Far East into a single cluster, and a similarity between the samples of the Altai Neolithic and Cis-Baikal Glazkovo culture (Wang et al., 2023).

Acknowledgements

This study was supported by the Russian Science Foundation, Project No. 22-18-00319 (V.G. Moiseyev and A.V. Zubova), state assignment of the DPMGI SB RAS (G.G. Boeskorov and M.D. Tomshin), and state assignment of the IAET SB RAS "North Asia in the Stone Age: Cultural Dynamics and Ecological Context" (FWZG-2022-0003). Radiocarbon dating of the remains was supported by the JSPS KAKENHI (Project No. 15H018990). The authors express their gratitude to V.A Shishkina (Saint-Petersburg State University of Industrial Technologies and Design) for her help with graphical processing of the illustrations.

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Received January 20, 2023.
Received in revised form February 6, 2023.