DOI: 10.17746/1563-0110.2016.44.2.148-154

T.A. Chikisheva
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: chikisheva@ngs.ru

On the Origin of the Neolithic Population of Northeast Asia*

A hypothesis regarding the origin of certain Neolithic groups of Yakutia is put forward. Neolithic crania from that region are Mongoloid and exhibit traits peculiar to present-day Tungus-Manchu speakers as well as to Chukchi and Eskoaleuts. Their distinctive feature is high braincase, seen nowhere else in Eastern Siberia at any time. Samples associated with the Ymyiakhtakh, Belkachi, and Boisman cultures were compared with other Mongoloid groups using multivariate analysis. On the basis of skeletal and environmental evidence it is concluded that Neolithic inhabitants of Northeast Asia were migrants from Beringia—a land that had been submerged following global warming and the melting of glaciers in the Late Pleistocene and Early Holocene. Beringians, who were forced to migrate to adjacent areas, displayed a combination of cranial traits peculiar to Pacific Mongoloids and were likely related to the Boisman people, who lived 7–5 ka BP on the Sea of Japan coast from northern Korea to Peter the Great Bay.

Keywords: *Northeast Asia, Beringia, Ymyiakhtakh culture, Belkachi culture, Boisman culture, Pacific Mongoloids.*

Introduction

One of the peculiar features of Neolithic crania from inland Northeast Siberia, specifically Yakutia, is large cranial height. Although the basion–bregma diameter falls within the medium category on the world scale (small values do not occur in Neolithic crania from Yakutia), auricular height is invariably large. This peculiarity was first noted by I.I. Gokhman and L.F. Tomtosova (1992), who had measured Neolithic crania from Ymyiakhtakh burials (2nd millennium BC) on the Diring-Yuryakh River, the tributary of the Middle Lena, and a female cranium from Rodinka-2 on the Lower Kolyma, associated with the Belkachi culture (3rd millennium BC).

Two decades later, two more crania—that of a male from an Ymyiakhtakh burial at Kyordyugen on the Middle Lena (Chikisheva, Pozdnyakov, 2006) and that of a female from a burial under the habitation layer of the Syalakh culture (4th and 3rd millennia BC) at Vilyuyskoye Shosse (Vilyuy Highway) in Yakutsk (Dyakonov et al., 2003)—were shown to exhibit the same feature. Male crania found in the 1950s in a Belkachi burial at Tuoy-Khaya (Debets, 1956) and on the Bugachan River (Yakimov, 1950) have a moderately high vault.

All the Neolithic crania from Yakutia are Mongoloid, combining features typical of modern Tungus-Manchu, on the one hand, and Eskimos, Aleuts, and Chukchi, on the other. Two hypotheses regarding the origin of this trait combination have been proposed: (1) the amalgam of traits distinguishing modern population groups of Eastern Siberia indicates an early stage of

*Supported by the Russian Science Foundation (Project No. 14-50-00036).

differentiation (Alekseyev, Gokhman, 1984: 34); and (2) this amalgam testifies to early admixture in Yakutia and possibly to an influx of certain groups resembling Eskoaleuts or Chukchi to that territory (Chikisheva, Pozdnyakov, 2006).

In this article, I propose yet another hypothesis regarding the origin of the trait combination that includes high cranial vault in the Neolithic of Yakutia. It concerns crania of the Neolithic Boisman culture of southern Primorye (the coastal area north of Vladivostok, along the Sikhote-Alin range), which are relevant to the affinities between groups of the Pacific coast and those of the inland areas of Northeast Asia. Boisman culture existed 7–5 ka BP on the coast of the Sea of Japan from northern Korea to the northernmost part of Peter the Great Bay.

The cranial sample comes from two cemeteries at Boisman-2, a site on a homonymous inlet of Peter the Great Bay of the Sea of Japan. A.N. Popov, who later introduced the term "Boisman culture" based on his findings (Popov, Chikisheva, Shpakova, 1997), had started excavations in 1991. In a monograph describing this site, measurements of crania from the first cemetery, excavated in 1991–1992, were published (Ibid.), and later, measurements of those from the second cemetery, situated 18 km east of the first and excavated by Popov in 1998–2000 (Chikisheva, 2003).

While our knowledge of the craniology of ancient Eastern Siberians is incomplete, cranial data from several parts of that region are available, so certain generalizations are possible. None of the samples except that from the Middle Lena and its tributaries displays a high cranial vault. On the other hand, series from the Pacific coast, both ancient and recent, do show this peculiarity. In this study, using statistical methods, we test the suggestion that inland and coastal Neolithic populations of Northeast Asia may be related. Apart from lending support to this idea, the results agree with paleogeographic evidence relating to that region.

Materials and methods

Published measurements of crania from Eastern Siberia, the coastal regions of China, Japan, and both Asian and American parts of former Beringia dating to the Neolithic, Early Iron Age, and the recent centuries were compared. Also, beside materials from Yakutia, the following cranial samples were used: Kitoi culture from Trans-Baikal region (Gerasimova, 1992), Upper Lena, and Angara (Mamonova, 1973); Serovo culture from the Upper Lena (Levin, 1956) and Angara (Mamonova, 1980); Glazkovo culture from Trans-Baikal region (Levin, 1953; Gokhman, 1954; Gerasimova, 1992), Upper Lena (Levin, 1956), and Angara (Mamonova, 1973); Ust-Belsk from Chukotka (Alekseyev, Gokhman, 1984), and Xixiahou in coastal China (after (Alekseyev, Trubnikova, 1984)). Among the later (Early Iron Age and medieval) samples, I used those relating to Paleo-Eskimos of Alaska (Ipiutak and Tigara) and Chukotka (Ekven and Welen) (Debets, 1986), people of the Slab Grave culture and Xiongnu of Trans-Baikal region (Alekseyev, Gokhman, 1984), and Mohe (Troitsky cemetery on the Amur River) (Alekseyev, 1980). Recent series are those of Asian Eskimos from Naukan, Chukchi (Reindeer and Coastal), and northern Chinese (Debets, 1951).

I also used my own unpublished data on crania from Japan, measured in 2001, including Neolithic ones relating to Jomon culture, Early Iron Age Okhotsk culture, Hokkaido Ainu, and late 19th–early 20th century Japanese from Tohoku Prefecture, northern Honshu.

The comparison was made using the principal component analysis in the STATISTICA 6.0 software. The distribution of groups in the space of two first principal components was assessed. The trait battery included the following variables: cranial index (M 8 : 1), basion–bregma height (M17), auricular height (M20), minimal frontal breadth (M9), bizygomatic breadth (M45), upper facial height (M48), total facial profile angle (M72), nasomalar angle (M77), zygo-maxillary angle (∠zm'), and frontal profile angle (M32).

Results and discussion

Let us discuss the first and second principal components, jointly accounting for 50 % of the total variance in both males and females. In male samples, cranial height and frontal profile angle show high loadings on the second principal component, whereas cranial index, bizygomatic breadth, and vertical and horizontal facial profile angles display high and similarly directed correlations with the first principal component (see *Table*). Virtually the same factorial structure is observed in female samples, except that the highest loadings on cranial height and frontal profile angle concentrate in the first principal component, whereas facial diameters and profile angles correlate with the second principal component (see *Table*). Also, cranial index in females has no differentiating power.

We will now examine the pattern of group relationships based on the first two principal components. The second principal component

Trait loadings on the first two principal components in male and female samples

Traits	Males		Females	
	PC 1	PC 2	PC 1	PC 2
8 : 1. Cranial index	**–0.638**	–0.140	–0.247	–0.184
17. Basion–bregma height	0.131	**0.843**	**–0.833**	0.013
20. Auricular height	–0.323	**0.819**	**–0.917**	–0.001
9. Minimal frontal breadth	0.010	–0.188	–0.365	0.103
45. Bizygomatic breadth	**–0.783**	–0.092	–0.241	**–0.739**
48. Upper facial height	–0.429	0.233	0.465	**–0.580**
54. Nasal breadth	–0.430	0.145	0.150	0.177
77. Naso-malar angle	**–0.725**	–0.064	0.265	**–0.519**
∠zm. Zygo-maxillary angle	**–0.857**	–0.309	0.032	**–0.865**
SS : SC. Simotic index	**0.620**	–0.444	**0.751**	0.372
32. Frontal profile angle	0.320	**0.730**	**–0.752**	0.319
72. Total facial angle	**–0.589**	0.191	–0.328	**–0.585**

separates the totality of male groups into two parts (Fig. 1). Because cranial height and frontal profile angle loadings are high, positive values on this axis are taken by series which, in terms of Cheboksarov's classification of Mongoloids*, can be attributed to the Pacific branch: Eskimos of Chukotka, both ancient from Ekven (*18*)** and Welen (*19*), and recent (*27*), Tohoku Japanese (*28*), northern Chinese (*29*), Jomon people (*15*), Okhotsk people (*20*), and those of Xixiahou, China (*14*), Boisman-2 (*1*), Kyordyugen (*11*), and Ust-Belaya (*13*).

Paleo-Siberians and ancestors of the Baikalian group of Continental Mongoloids (Tungus-Manchu) as well as certain members of the Arctic group (Paleo-Eskimos of Ipiutak (*16*), Reindeer Chukchi (*25*), and Coastal Chukchi (*26*) concentrate in the area marked by negative values. The Diring-Yuryakh group (*10*), Paleo-Eskimos of Tigara (*17*), and Hokkaido Ainu (*24*) are intermediate but closer to Pacific Mongoloids.

While the second integral dimension links male Neolithic crania from Yakutia with Pacific Mongoloids, the first dimension, differentiating groups with regard to facial traits, joins them with Boisman people (Fig. 1).

In females, cranial height and frontal profile angle show maximal loadings on the first principal component, which separates Pacific and Continental Mongoloids (Fig. 2). Female crania from Diring-Yuryakh are too fragmentary, and their position could not be evaluated even using the relatively small trait battery employed herein. However, the Rodinka-2 cranium (7) joins the Boisman (*1*) and Okhotsk (*14*) series. The second principal component, showing the highest correlations with facial dimensions and horizontal and vertical facial profile angles, separates these clusters from other Pacific Mongoloids such as Tohoku Japanese (*22*), Ainu (*18*), Jomon people (*9*), and the Xixiahou sample (*8*). Unlike the situation with male groups, female Paleo-Eskimos of Alaska from Ipiutak (*10*) and Tigara (*11*) fall within the relatively narrow interval taken by Continental Mongoloids on the first principal component.

Then, results of the multivariate analysis suggest that certain groups from the Pacific coast were among the ancestors of the Neolithic population of inland Northeast Asia. This finding is informative in the context of the paleogeographic situation, which may have affected early population processes in that area.

*In this classification, the Mongoloid race (referred to as Asian metarace) splits into two branches—Pacific, including Southern, Far-Eastern, and Arctic groups, and Continental (referred to as Northern, or Siberian) (Cheboksarov, 1947, 1949, 1951). The former branch differs from the latter by lesser skeletal robustness, smaller cranial breadth but larger cranial height, smaller face, and mesognathism. The majority of Continental Mongoloids are groups of Eastern Central Asia, and Central and Eastern Siberia, the latter region being mostly inhabited by Tungus speakers. Nearly all the remaining people of the Pacific coast of Asia from Chukotka to Taiwan, including Sakhalin, the Aleutian and Commander Islands, the Kuril Islands, and Japan represent the Pacific Mongoloid branch.

**The figures in parentheses hereafter are group codes, which are the same as in the figures.

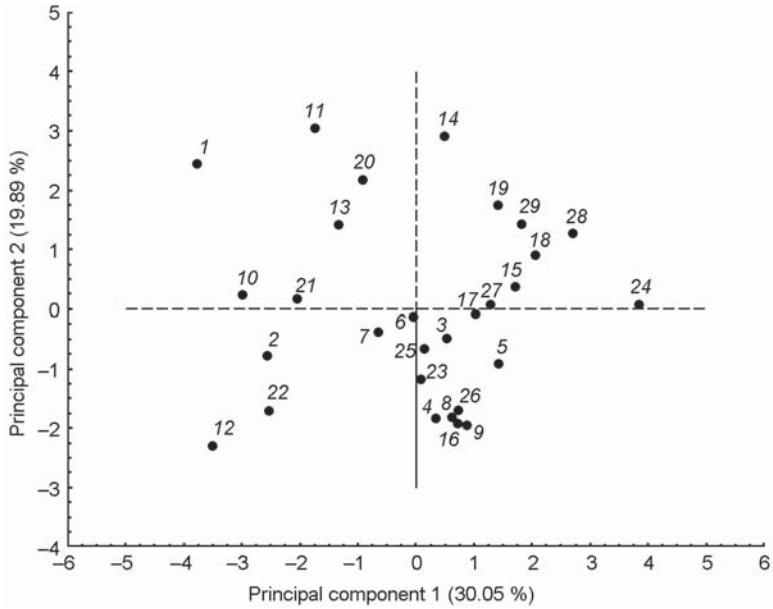

Fig. 1. Position of male groups in the space of the first and second principal components.
1 – Boisman; *2* – Kitoi, Trans-Baikal region; *3* – Kitoi, Upper Lena; *4* – Kitoi, Angara; *5* – Serovo, Upper Lena; *6* – Serovo, Angara; *7* – Glazkovo, Trans-Baikal region; *8* – Glazkovo, Upper Lena; *9* – Glazkovo, Angara; *10* – Diring-Yuryakh; *11* – Kyordyugen; *12* – Tuoy-Khaya; *13* – Ust-Belaya; *14* – Xixiahou; *15* – Jomon; *16* – Paleo-Eskimos, Ipiutak, Alaska; *17* – Paleo-Eskimos, Tigara, Alaska; *18* – Paleo-Eskimos, Ekven, Chukotka; *19* – Paleo-Eskimos, Welen, Chukotka; *20* – Okhotsk; *21* – Mohe, Troitsky; *22* – Slab Graves, Trans-Baikal region; *23* – Xiongnu, Trans-Baikal region; *24* – Ainu, Hokkaido; *25* – Reindeer Chukchi; *26* – Coastal Chukchi; *27* – Asian Eskimos; *28* – Tohoku Japanese; *29* – Northern Chinese.

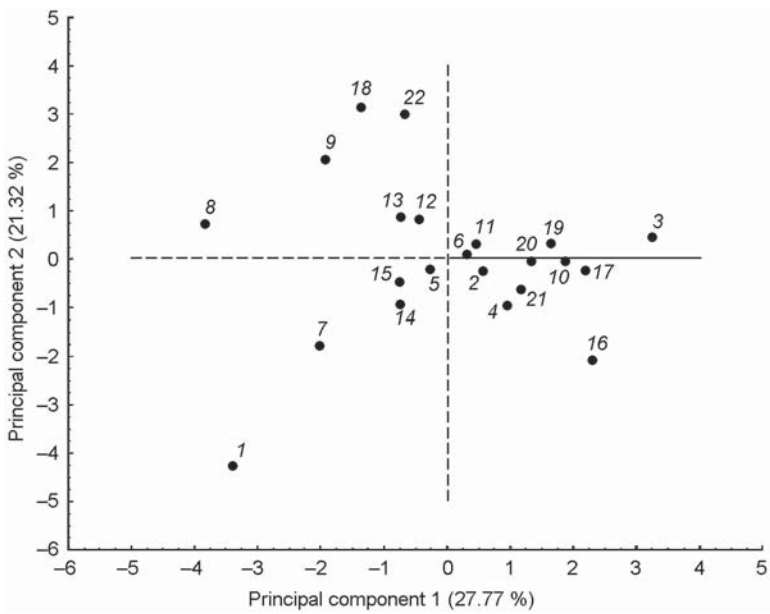

Fig. 2. Position of female groups in the space of the first and second principal components.
1 – Boisman; *2* – Serovo, Upper Lena; *3* – Glazkovo, Upper Lena; *4* – Kitoi, Angara; *5* – Serovo, Angara; *6* – Glazkovo, Angara; *7* – Rodinka-2; *8* – Xixiahou; *9* – Jomon; *10* – Paleo-Eskimos, Ipiutak, Alaska; *11* – Paleo-Eskimos, Tigara, Alaska; *12* – Paleo-Eskimos, Ekven, Chukotka; *13* – Paleo-Eskimos, Welen, Chukotka; *14* – Okhotsk; *15* – Mohe, Troitsky; *16* – Slab Graves, Trans-Baikal region; *17* – Xiongnu, Trans-Baikal region; *18* – Ainu, Hokkaido; *19* – Reindeer Chukchi; *20* – Coastal Chukchi; *21* – Eskimos. Chukotka; *22* – Tohoku Japanese.

Humans are known to have reached Northeast Asia during the last glaciation of the final Pleistocene about 35 thousand years ago, as evidenced by the Dyuktai culture, dating to 35–12.5 ka BP. Dyuktai sites are located on the floodland terraces of the Aldan, Lena, Olekma, Vilyuy, Vitim, and Indigirka. The northernmost site is Berelekh, situated at 71° N. However, the Yana site, unrelated to the Dyuktai culture, is situated even further north (72° N), 120 km away from the Yana River mouth, and its age is 27.0–28.5 ka. The Upper Paleolithic horizons of the stratified Ushki site on the homonymous lake in inland Kamchatka date to 14–10 ka BP.

Most glaciologists believe that Upper Paleolithic humans were able to settle in high-latitude areas of Eurasia because during the final Pleistocene continental glaciers did not cover the entire northern Siberia but formed isolated ice sheets, which emerged during various stages. The peculiar features of this glaciation system were instability and isolation of separate glacial foci even during the coldest periods (Velichko, Faustova, 1989). Shifts in this system forced people to migrate to areas where living conditions were more favorable.

The 25–20 ka BP interval was marked by the last glacial maximum. The reconstructed total volume of ice during that stage was maximal for the entire last glaciation (115–100 to 10 ka BP). Accordingly, the sea level was low, and parts of the continental shelf around the modern Chukchi Sea and Bering Sea were exposed. The resulting land has been subject to numerous multidisciplinary studies since the late 1800s. Initially, it was associated with the land bridge, which connected Northeast Asia with Alaska and across which plants, animals, and humans migrated from one continent to another. P.P. Sushkin (1925) was the first to use the term “Beringia”.

In the second half of the Late Pleistocene, another part of the exposed continental shelf existed south of the Bering Strait, the “Pacific Beringia”. Its climate was relatively mild due to the proximity of the Pacific Ocean, and elements of oceanic and forest biotas dispersed along its coast (Sher, 1971). In terms of paleogeography, this land is regarded as Beringia, the center of which is the Beringian land bridge connecting Asia and America (Yurtsev, 1976). During the last glacial maximum, the boundaries of Beringia, as reconstructed using the shelf areas lying 90–100 m below the sea level, extended meridionally for more than 1000 km. The northern periphery of the Beringian land bridge corresponds to the outer shelf of the Chukchi Sea (about 500 km north of Wrangel Island) and the southern periphery, with the Aleutian Range (Kozhevnikov, Zheleznov-Chukotsky, 1995). The position of the modern coastline in Northeast Asia matches one of the deepest Pleistocene transgressions (Sher, 1976).

The Beringian landscape was a cold tundra-steppe with patches of scrub and birch forest in floodplains, inhabited by large mammals such as mammoths, horses, bison, musk oxen, reindeer, red deer, saiga, and argali (Berman, 2001; Tomirdiaro, 1976). Their abundance was the main factor underlying human dispersal to that area. Global warming and the melting of glaciers in the early Holocene caused the rise of sea level, and eventually Beringia was submerged. About 12.5 ka BP, the Bering Strait emerged, connecting the Pacific and the Arctic oceans and separating Alaska from Chukotka. Approximately 10.5 ka BP, the Bering Sea and the Chukchi Sea assumed their modern outlines. By that time, the cold sharply continental climate had been replaced in the region by a milder maritime climate, causing changes in the Beringian landscapes, which became unsuitable for the mammoth fauna (Tomirdiaro, 1976). Because of these global changes, people abandoned the Beringian coast. The most likely direction of their migration was westerly, to a region with a more habitual climate and landscape, i.e. to Northeast Siberia. To all appearances, it is the descendants of those people, preserving their cranial features, who lived in Yakutia in the 3rd to 2nd millennia BC.

The physical type of Beringians is unknown because their skeletal remains are unavailable. Indirect information, however, can be gained from the remains of people living in territories adjacent to Beringia. West of it, in Eastern and Southern Siberia, for several millennia since the Neolithic (the earliest human remains date to the 6th millennium BC) and until present, the distinctive population characteristic was small and medium cranial height, whereas south of Beringia, the cranial vault was generally high. This distinction was the key feature in Cheboksarov’s classification of Asian Mongoloids with their subdivision into two branches, Pacific and Continental (Cheboksarov, 1947, 1949, 1951).

The fact that Neolithic inhabitants of Yakutia had high cranial vaults may indicate their affinities with Pacific Mongoloids, whereas the earliest known representatives of that branch in Asia are the Boisman people. Possibly, they provide an idea of what ancient Beringians looked like.

Conclusions

The findings of cranial analysis and their comparison with environmental data relating to Northeast Asia lend indirect support to the idea that inhabitants of its continental part may have descended from certain populations of the Beringian land bridge situated in the exposed shelf areas of the modern Chukchi Sea and Bering Sea 25–20 ka BP. Those populations apparently belonged to the Pacific branch of the Mongoloid race and could have been related to the Boisman people.

Physical anthropology alone can hardly answer the question as to whether the people associated with the Boisman culture were indeed related to those who had inhabited the submerged land bridge. The study of ancient DNA may be more helpful in this respect as the genetic diversity of modern northern Eurasians is relatively well known. When bone samples of the Boisman people have been analyzed (such an analysis is forthcoming), the findings may clarify the issue of spatial and temporal continuity between Beringians and the ancient inhabitants of inland Northeast Asia. In any event, the hypothesis about the westerly migration of Beringians is potentially testable, viable, and relevant to the reconstruction of the population history of that region.

References

Alekseyev V.P. 1980
Materialy po kraniologii mokhe. In *Paleoantropologiya Sibiri*. Moscow: Nauka, pp. 106–130.

Alekseyev V.P., Gokhman I.I. 1984
Antropologiya Aziatskoi chasti SSSR. Moscow: Nauka.

Alekseyev V.P., Trubnikova O.B. 1984
Nekotorye problemy taksonomii i genealogii aziatskikh mongoloidov. Novosibirsk: Nauka.

Berman D.I. 2001
Tundrostepi – vymershiye landshafty pleistotsenovoi Beringii. In *Rossiyskaya nauka na zare novogo veka: Sbornik statei laureatov konkursa RFFI*. Moscow: Novyi mir, pp. 242–248.

Cheboksarov N.N. 1947
Osnovnye napravleniya rasovoi differentsiatsii v Vostochnoi Azii. *TIE*, vol. 2: 24–83.

Cheboksarov N.N. 1949
Severnye kitaitsy i ikh sosedi (issledovaniya po antropologii Vostochnoi Azii). *KSIE*, iss. 5: 64–69.

Cheboksarov N.N. 1951
Osnovnye printsipy antropologicheskikh klassifikatsiy. *TIE*, vol. 16: 291–322.

Chikisheva T.A. 2003
Rezultaty issledovaniya novykh paleoantropologicheskikh materialov iz mogilnika na poselenii Boismana-2 (raskopki 1998–2000 gg.). In *Problemy arkheologii i paleoekologii Severnoi, Vostochnoi i Tsentralnoi Azii*. Novosibirsk: Izd. IAE SO RAN, pp. 209–213.

Chikisheva T.A., Pozdnyakov D.V. 2006
Antropologicheskoye issledovaniye ymyiakhtakhskogo voina iz mestnosti Kyordyugen. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*. Novosibirsk: Izd. IAE SO RAN, pp. 234–240.

Debets G.F. 1951
Antropologicheskiye issledovaniya v Kamchatskoi oblasti. Moscow: Izd. AN SSSR. (TIE; vol. 17).

Debets G.F. 1956
Drevniy cherep iz Yakutii. *KSIE*, iss. 25: 60–63.

Debets G.F. 1986
Paleoantropologiya drevnikh eskimosov (Ipiutak, Tigara). In *Etnicheskiye svyazi narodov severa Azii i Ameriki po dannym antropologii*. Moscow: Nauka, pp. 6–148.

Dyakonov V.M., Shpakova E.G., Chikisheva T.A., Pozdnyakov D.V. 2003
Pogrebeniye Vilyuyskoye Shosse v Yakutske: Paleoantropologicheskiye kharakteristiki i predvaritelnaya datirovka. In *Drevniye kultury Severo-Vostochnoi Azii: Astroarkheologiya. Paleoinformatika*. Novosibirsk: Nauka, pp. 65–90.

Gerasimova M.M. 1992
Cherepa iz Fofanovskogo mogilnika (r. Oka, Selenga). In *Drevnosti Baikala*. Irkutsk: Izd. Irkutsk. Gos. Univ., pp. 97–111.

Gokhman I.I. 1954
Materialy po antropologii drevnego naseleniya nizovyev Selengi. *KSIE*, iss. 20: 59–67.

Gokhman I.I., Tomtosova L.F. 1992
Antropologicheskiye issledovaniya neoliticheskikh mogilnikov Diring-Yuryakh i Rodinka. In *Arkheologicheskiye issledovaniya v Yakutii*. Novosibirsk: Nauka, pp. 105–124.

Kozhevnikov Y.P., Zheleznov-Chukotsky N.K. 1995
Beringiya: Istoriya i evolyutsiya. Moscow: Nauka.

Levin M.G. 1953
Drevniy cherep s r. Shilki. *KSIE*, iss. 18: 69–75.

Levin M.G. 1956
Antropologicheskiy material iz Verkholenskogo mogilnika. In *Antropologicheskiy sbornik I*. Moscow: Izd. AN SSSR, pp. 299–339. (TIE; vol. 33).

Mamonova N.N. 1973
K voprosu o drevnem naselenii Priangarya po paleoantropologicheskim dannym. In *Problemy arkheologii Urala i Sibiri*. Moscow: Nauka, pp. 18–28.

Mamonova N.N. 1980
Drevneye naseleniye Angary i Leny v serovskoye vremya po dannym antropologii (k voprosu o mezhgruppovykh razlichiyakh v epokhu neolita). In *Paleoantropologiya Sibiri*. Moscow: Nauka, pp. 64–88.

Popov A.N., Chikisheva T.A., Shpakova E.G. 1997
Boismanskaya arkheologicheskaya kultura Yuzhnogo Primorya (po materialam mnogosloinogo pamyatnika Boismana-2). Novosibirsk: IAE SO RAN.

Sher A.V. 1971
Mlekopitayushchiye i stratigrafiya pleistotsena krainego Severo-Vostoka SSSR i Severnoi Ameriki. Moscow: Nauka.

Sher A.V. 1976

Rol Beringiyskoi sushi v formirovanii fauny mlekopitayushchikh golarktiki v pozdnem kainozoe. In *Beringiya v kainozoye*. Vladivostok: DVNC AN SSSR, pp. 227–241.

Sushkin P.P. 1925

Zoogeograficheskiye oblasti Srednei Sibiri i blizhaishikh chastei nagornoi Azii i opyt istorii sovremennoi fauny Paleoarkticheskoi Azii. *Bull. MOIP. Otd. biolog*., vol. 34: 7–86.

Tomirdiaro S.V. 1976

Arkticheskaya lessovo-lednikovaya ravnina kak amerikansko-aziatskiy most i ee razrusheniye v golotsene. In *Beringiya v kainozoe*. Vladivostok: DVNC AN SSSR, pp. 78–88.

Velichko A.A., Faustova M.A. 1989

Rekonstruktsii poslednego pozdnepleistotsenovogo oledeneniya Severnogo polushariya (18–20 tys. let nazad). *Doklady AN SSSR*, vol. 309 (6): 1465–1468.

Yakimov V.P. 1950

Cherep cheloveka bronzovogo veka iz Yakutii. In *Okladnikov A.P. Lenskiye drevnosti*. Moscow, Leningrad: Izd. AN SSSR, pp. 189–195.

Yurtsev B.A. 1976

Problemy pozdnekainozoiskoi paleogeografii Beringii v svete botaniko-geograficheskikh dannykh. In *Beringiya v kainozoe*. Vladivostok: DVNC AN SSSR, pp. 101–120.

Received November 25, 2015.
Received in revised form December 14, 2015.