Quaternary International 231 (2011) 50–54

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Upper paleolithic mammal fauna of the Baikal region, east Siberia (new data)

Fedora Khenzykhenova [a,*], Takao Sato [b], Ekaterina Lipnina [c], German Medvedev [c], Hirofumi Kato [d], Sergei Kogai [c], Ksenya Maximenko [c], Valentina Novosel'zeva [c]

[a] Laboratory of Cenozoic Geology, Geological Institute, Siberian Branch, Russian Academy of Sciences, 6a sakhjanovoi str., Ulan-Ude, Russia
[b] Department of Archaeology and Ethnology, Keio University, Tokyo, Japan
[c] Department of Archaeology and Ethnology, Irkutsk State University, Irkutsk, Russia
[d] Department of Archaeology, Graduate School of Letters, Hokkaido University, Sapporo, Japan

ARTICLE INFO

Article history:
Available online 13 July 2010

ABSTRACT

A representative mammal fauna attributable to the Karginian Interstadial (MIS 3, 36 000–23 000 BP) has been found for the first time in the Fore-Baikalian region. The faunal remains were recovered from Gerasimov's and Bol'shoi Naryn Paleolithic sites in 2003–2008. Zooarchaeological investigations revealed 51 mammal species in the region, dominated by horse *Equus* sp., steppe lemming *Lagurus lagurus*, narrow-sculled vole *Microtus gregalis* and North-Siberian vole *M.* cf. *hyperboreus*. The early humans appear to have inhabited a forest-steppe, with local patches of tundra-like landscapes. The Karginian climate was warmer and more humid than during the subsequent Sartan glacial epoch (MIS 2).

1. Introduction

The greatest freshwater lake of the planet, Lake Baikal, is located in the center of the Asian continent, between 55°46′ and 51°29′ N. The Baikal region belongs to two natural zones: the periglacial Siberian zone (Fore-Baikalian sub-region, or Fore-Baikalia) and the extraglacial arid zone of Central Asia (Transbaikalia). Similarly, it belongs to two paleozoogeographic sub-regions, the European–Siberian and Central-Asian. Different environments of the Fore-Baikalian region and Transbaikalia have controlled to a considerable degree the species composition of both areas since the Middle Pleistocene (Khenzykhenova, 2008).

Mammal remains recovered from archeological sites provide valuable information on the living environment of early humans. In Transbaikalia, mammal fauna of the Karginian Interstadial have been already studied at several Paleolithic sites (Khenzykhenova, 2005). In the Fore-Baikal region, however, the first representative mammal fauna was discovered in 2003–2005 at the Bol'shoi Naryn site (Sato et al., 2008). Another fauna of that type was discovered in 2007–2008, at the multilayered Gerasimov's site (Kogai et al., 2007) (Fig. 1).

2. New Paleolithic sites of the Fore-Baikal sub-region

2.1. Bol'shoi Naryn

This site (53° 33′ 16.99″ N, 103° 34′ 7.88″ E) is located in the hills facing Osa Bay (Bratsk Reservoir). The hills along the left bank of the Osa R. have been subjected to severe wave erosion due to water level fluctuations in the Bratsk reservoir. In the vicinity of the site, the undercut hill slopes form a cliff 2–10 m high and several kilometers long. Numerous stone implements and fossil remains have been washed out of sediment, transported down the slopes and scattered along the shore of the reservoir. The site has been studied since 2003 by a Japanese–Russian joint research team, and some results have been published (Sato et al., 2008). During the first year more than 4000 artifacts and fossil faunal remains were collected, including *Equus* sp., *Mammuthus* sp., *Coelodonta antiquitatis*, Bovinae gen. indet., and *Bison priscus*. The fossils have been ^{14}C dated at the University of Tokyo between 25 000 and 45 000 BP (Kunikita et al., 2006). Most of the artifacts are stone tools and flakes, mostly of quartz, including blade cores, discoidal cores, points, and hand axes.

Further excavations were performed at two localities considered to be promising: Locality 1 and Locality 2. Cultural remains have been discovered directly in paleosols at both localities, at 406–407 m a.s.l. The stratigraphic setting was much the same in both cases. A paleosol up to 1 m thick, dated to the Karginian Interstadial, lies over a layer of sand and is overlain by a mantle of loess-like sandy loam 1–2 m thick accumulated during the Sartan

* Corresponding author. Tel.: +7 3012433955; fax: +7 3012433024.
E-mail addresses: khenzy@mail.ru, khenzy@gin.bscnet.ru (F. Khenzykhenova), sato@flet.keio.ac.jp (T. Sato), u002343@ic.isu.ru (E. Lipnina), u002343@ic.isu.ru (G. Medvedev), h-kato@sa2.so-net.ne.jp (H. Kato), u002343@ic.isu.ru (S. Kogai), u002343@ic.isu.ru (K. Maximenko), u002343@ic.isu.ru (V. Novosel'zeva).

1040-6182/$ – see front matter
doi:10.1016/j.quaint.2010.06.032

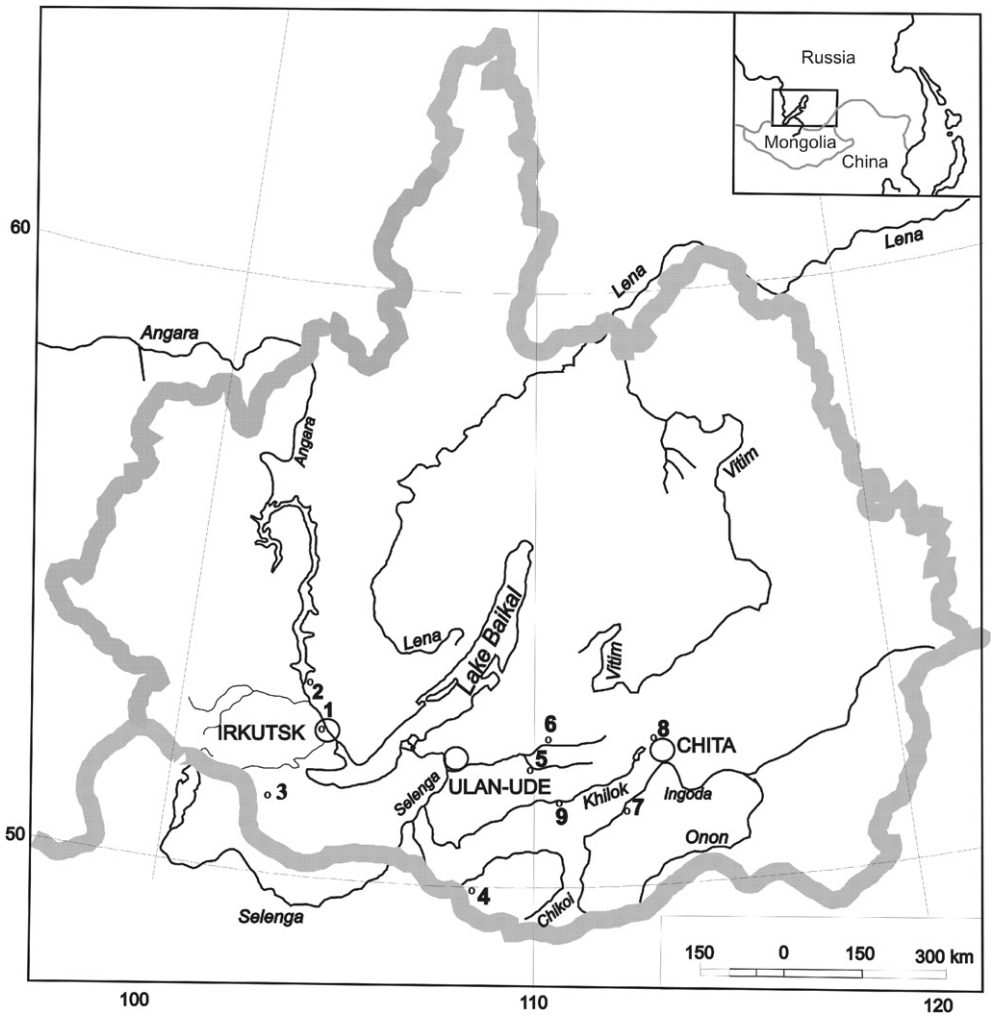

Fig. 1. Upper Palaeolithic sites of Karginian interstadial in the Baikalian region: 1 – Gerasimov's site; 2 – Bol'shoi Naryn site; 3 – Zangisan; 4 – Podzvonkaya; 5 – Kamenka; 6 – Khotyk-3; 7 – Arta-2; 8 – Sukhotino-2; 9 – Tolbaga.

glacial epoch (MIS 2). The modern soil (up to 0.2 m thick) occurs at the top of the sequence. Eleven charcoal samples taken from the paleosol at Locality 1 determined the age of its upper part as 25 000–26 000 BP and that of the lower part between 26 000 and 32 000 BP. Twelve charcoal samples from the paleosol at Locality 2 yielded dates between 25 000 and 29 000 BP (Kunikita et al., 2006). In the course of excavations, 208 artifacts were recovered from the cultural layer at Locality 1, and 129 at Locality 2. Stone tools excavated at the two survey areas were mostly quartz blades, scrapers, and cores. More than 600 identifiable animal remains were found altogether, including some small terrestrial snails.

2.2. Gerasimov's Paleolithic site

This site was found at the right bank of the Irkut R., 2.6 km upstream from its confluence with the Angara R., within the limits of the city of Irkutsk (52° 17′ 29.41″ N, 104° 14′ 55.24″ E). It was discovered in the process of construction work, in a pit cut into the surface of a gentle slope at 455–457 m a.s.l. Salvage excavations at the newly found site were performed over an area of 950 m^2 under the supervision of Professor GI Medvedev and Assistant Professor EA Lipnina (Irkutsk State University). Stratigraphically, the cultural layer corresponds to geological bed 7, varying in thickness from 0.2–0.5 m to 2.0 m. Bed 7 comprises loams, sandy loams, sands and soils differing in colour, and it has been heavily distorted by cryogenesis (Fig. 2). Three parts are distinguishable within the bed. The base of the bed contains lenses of sand, and its lower boundary often forms tongue-like wedges penetrating into the underlying sediments. The middle part shows a complicated multilayered structure, with lens-like stratification, distorted and locally broken. The upper part forms the top of the bed, with sandy lenses.

More than 7000 artifacts and bone remains were excavated. Among the artifacts are side-scrapers, end scrapers, flat-faced cores, columnar cores with closed front for blades (made of large-size monoliths), choppers, and pièces écailles of hard rocks, such as quartzite, quartz, and extrusive lithologies. There are also five unique pieces of Paleolithic art: 1) a blank for a bone bead; 2) a fragment of agalmatolite "bracelet"; 3) a fragment of ornamented reindeer antler; 4) a blank for a flat pendant of agalmatolite; and 5) a large massive flat pendant, pear-shaped, with a hole (Larichev et al., 2009).

A series of radiocarbon dates obtained on large mammal bones in the laboratory of the Institute of Geology and Mineralogy, Siberian Branch of Russian Academy of Sciences, dates the top of bed 7 in the range from 22 345 ± 290 BP (COAH-7536) to 17 950 ± 140 BP (COAH-6871). The middle part of the bed is dated from 29 940 ± 440 BP (COAH-7330) to 26 985 ± 345 BP (COAH-7221), and the lower part from 35 890 ± 420 BP (COAH-7541) to

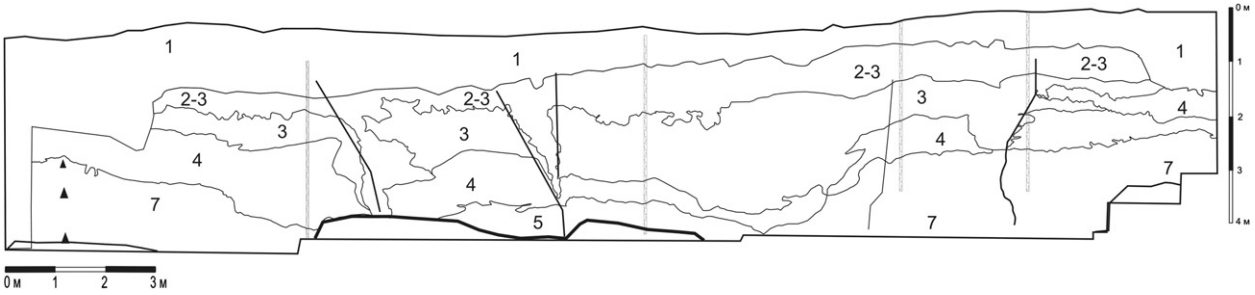

Fig. 2. Gerasimov's site section. 1. Disturbed layer. 2. Fine sand, sandy loam, grey, grey–brown, yellowish-brown, partially carbonized. 3. Sandy loam, light-grey, whitish-grey, loessial, dense, locally carbonized. 4. Loam, light, yellowish-brown dark and light, finely stratified, locally undulatory, interstratified with sandy loams. 5. Sandy loam, yellow-brown, dense, finely stratified, interstratified with thin loam. 6. Strata of layered sandy loam, loam, and sand; Horizontal bedding. 7. Loam, sandy loam, sand and soil differing in colour; heavily distorted by cryogenesis. ▲ - levels of archeological material.

33610 ± 370 BP (COAH-7540) (uncalibrated dates). In addition, two AMS dates have been obtained in South Korea (laboratory of the Institute of Geology and Mineral Resources): R-1 36 750 ± 380 (uncalibrated); 41 780 ± 330 (calibrated) OBn080001, and R-2 32 110 ± 260 (uncalibrated); 36 390 ± 730 (calibrated) OBn080002. The dated objects were recovered from the cluster of artifacts in the lower part of the bed, where some objects of art were also present.

3. Survey method

It is customary to perform multi-disciplinary studies on archeological sites. The excavation strategy consisted in a thorough layer-by-layer removal of geological deposits. Every object and large bone remain was carefully cleansed (while intact), photographed and plotted on the plan with coordinate grid and absolute altitudes (a.s.l.), some fragments of excavation walls being left intact for control. The paleo-microtopography of the cultural layer was reconstructed by thorough cleaning its surface, and recorded using large-scale topographic survey, photo and video cameras. To recover small mammal remains and molluscs invisible to the eye, the enclosing sediment was washed through 1–2 mm sieves. In the laboratory, the mammal remains were carefully cleansed of soil particles and impregnated with adhesive solution. Teeth were fixed on flat plates and determined to species level.

4. Fauna

4.1. Bol'shoi Naryn

Bone remains of megafauna found on the shore included *Mammuthus* sp., *Equus* sp., *C. antiquitatis* Blum., Cervidae gen. indet., and *B. priscus* Boj. (dominant form). Among species found *in situ* were *Alopex lagopus* L., *Mammuthus* sp., *Equus* sp., *Cervus* sp., *Rangifer tarandus* L., and *B. priscus*. Horse, deer, bison and their relatives were predominant forms. Small mammal fauna of Bol'shoi Naryn site dated to the Karginian Interstadial comprised 15 species, including 1 species of insectivore, 1 species of Chiroptera (bats), 3 lagomorphs, and 10 rodent species (see Table 1). Steppe (41%), forest (25%) and tundra (25%) taxa, as well as intrazonal forms found in Loc. 2, North-Siberian vole *Microtus* cf. *hyperboreus* Vinogr. (18.5%), steppe lemming *Lagurus lagurus* Pall. (14.8%), and narrow-sculled vole *Microtus gregalis* Pall. (14.8%), were predominant forms in this fauna.

4.2. Gerasimov's site

Large mammals recovered from the cultural layer of this site included *A. lagopus*, *Martes zibellina* L., *Equus* sp., *Mammuthus* sp., *C. antiquitatis*, *Cervus elaphus* L., *R. tarandus*, *Bos* sp., and *B. priscus*, horse remains being prevalent. Small mammal fauna dated to the Karginian Interstadial comprised 22 species, including 3 lagomorphs and 17 rodent species. Microtheriofauna from the lower part of geological bed 7 were dominated by narrow-sculled vole *M. gregalis* Pall. (23%). Prevalent in this fauna were steppe animals (37%); taiga (27%) and tundra species (15%) were less abundant (Table 1).

Investigations of cultural layers discovered at the Gerasimov's and Bolshoi Naryn sites determined for the first time the species composition of mammals attributed to the Karginian Interstadial (MIS 3) in the Fore-Baikal sub-region. The mammal fauna comprised no less than 27 species of large mammals and 24 species of small mammals. The small mammal fauna has no present-day analogue. It was ecologically mixed and disharmonious, typical of the Late Pleistocene cold epochs.

5. Comparison of MIS 3 fauna of Fore-Baikal Paleolithic sites with contemporaneous Transbaikalian fauna

Large mammal inhabitants of the Baikalian region during the Karginian Interstadial were typical of the Upper Paleolithic faunal assemblage (Gromov, 1948), with *Mammuthus* widely occurring in the Fore-Baikal sub-region and *Coelodonta* in Transbaikalia. The principal distinction between the Transbaikalian and Fore-Baikalian fauna is the presence of Central Asian species in the former, such as *Spirocerus kiakhtensis* M. Pavl. and *Procapra gutturosa* Pall. In Transbaikalia, small mammals mostly belong to steppe and forest species, except for *Microtus fortis* Büchn. that preferred near-water biotopes. Dry steppes of intermountain depressions were inhabited by Brandt's vole *Lasiopodomys brandti* Radde (dominant species) together with Daurian pika *Ochotona daurica* Pall., marmot-tarbagan *Marmota sibirica* Radde, *Meriones*, *Allactaga*, and narrow-sculled vole *M. gregalis* Pall.

Fore-Baikalian faunas of the same age included steppe species (predominant forms), along with those typical of forest, tundra, alpine environments and intrazonal taxa. Steppe lemming *L. lagurus*, narrow-sculled vole *M. gregalis*, steppe pika *Ochotona* cf. *pusilla* Pall., coexisted with tundra animals, such as collared *Dicrostonyx guilielmi* Sanford and Siberian *Lemmus sibiricus* Kerr lemming, North-Siberian vole *Microtus hyperboreus* Vinogr., and Middendorf's vole *M. middendorfi* Poljak. The mammal faunas recovered from the Bolshoi Naryn and Gerasimov's sites were ecologically mixed and exceedingly diversified. Modern ranges of the species found in those sites are located in different natural zones and are separated.

In Transbaikalia, mammals of the Karginian age have been recovered from several Paleolithic sites (Fig. 1): Arta-2 – 37 360 ± 2000 BP

Table 1
Species composition of small mammal fauna of Baikal region during OIS 3.

Species name	Bol'shoi Naryn site		Gerasimov's site		Transbaikalia
	Loc. 1	Loc. 2	MP*	LP**	
Insectivora					
1. *Sorex* sp.		1/1			
Chiroptera					
1. Chiroptera gen. indet.		1/1			
Lagomorpha					
1. *Lepus timidus* L.					+
2. *L. tolai* Pall.					+
3. *Lepus* sp.		1/1			
4. *Ochotona hyperborea* Pall.		12/1		4/2	
5. *Ochotona daurica* Pall.					+
6. *O.* cf. *pusilla* Pall.		1/1		8/3	
7. *Ochotona* sp.	2/1		4/1		
Rodentia					
1. *Eutamias sibiricus* Laxm.				1/1	
2. *Marmota sibirica* Pall.					+
3. *Marmota* sp.				1/1	
4. *Spermophilus undulatus* Pall.		28/3			+
5. *Spermophilus* sp.				1/1	
6. *Cricetulus barabensis* Pall.				1/1	+
7. *Clethrionomys rutilus* Pall.		2/1	1/1	7/4	
8. *Clethrionomys rufocanus* Sundevall.	2/1		2/1	18/4	
9. *Lemmus amurensis* Vinogradov		13/3		11/5	
10. *Myopus schisticolor* Lill.				5/2	
11. Lemmini gen. indet.	2/1		3/2	16/4	
12. *Dicrostonyx* cf. *guilielmi* Sanford		1/1			
13. *Dicrostonyx* sp.			2/1	14/2	
14. *Alticola* sp.				1/1	
15. *Lagurus lagurus* Pall.	9/2	32/4		3/3	
16. *Lasiopodomys brandti* Radde					+
17. *M. gregalis* Pall.	8/3	4/3	4/3	30/17	+
18. *M.* cf. *arvalis* Pall.				1/1	
19. *M.* cf. *middendorffii*				6/2	
20. *M.* ex gr. *middendorffii-hyperboreus*				2/2	
21. *M.* cf. *hyperboreus* Vinogradov	10/4	8/5		11/5	
22. *M. fortis* Buchn.					+
23. *Microtus oeconomus* Pall.		1/1	4/2	16/8	
24. *Microtus* sp.		18/1	1/1	41/5	
25. *Microtinae* gen. indet.				1/1	

MP* – middle part, LP** – lower part of geological bed 7.
1/1 – Number of individuals/number of identified specimens.

(LOIA LE-2967); Arta-4; Podzvonkaya – 38 900 ± 3300 BP (AA-26741), >36800 BP (AA-26742); Kamenka – 35 845 ± 695 BP (SOAN-2903), 31 060 ± 530 BP (SOAN-3133); Sukhotino-4, Sukhotino-2, Zangisan, Tolbaga – 34 860 ± 2100 BP (SOAN-1522), 27210 ± 300 BP (SOAN-1523); Varvarina Gora – 34 900 ± 780 BP (SOAN-1524), 30 600 ± 500 BP (SOAN-850); Khotyk-3 (e.g. Kasparov, 1986; Ovodov, 1987; Kirillov and Kasparov, 1990; Konstantinov, 1994; Germonpre and Lbova, 1996; Tashak, 1999; Kalmykov, 2001;). The distinctive feature is co-habitation of different mammals – typical dwellers of forests, forest-steppes, and of arid mountain steppes. Small mammal fauna of the Kamenka and Podzvonkaya sites consisted mostly of dry steppe elements dominated by Brandt's vole *Lasiopodomys brandti.* Megafauna attributed to MIS 3 was represented by the following mammal species: *Canis lupus* L., *Vulpes vulpes* L., *V. corsac* L., *Ursus arctos* L., *Lynx lynx* L., *Panthera leo* L., *Crocuta crocuta spelea* Gold., *Mammuthus primigenius* Blum., *Equus caballus* L., *E. hemionus* Pall., *C. antiquitatis*, *Camelus* sp., *Megaloceros giganteus* Blum., *Capreolus pygargus* Pall., *C. elaphus* L., *Alces alces* L., *R. tarandus* L., *P. gutturosa* Pall., *S. kiakhtensis* M. Pavl., *Saiga* cf. *tatarica* L., *Capra sibirica* Pall., *Ovis ammon* L., *B. priscus* Boj., and *Poephagus baikalensis* N. Ver. Nine species of small mammals were identified, including 3 lagomorphs and 6 rodents. Species composition of the Transbaikalian fauna suggests a complicated mosaic structure of landscapes, with open landscapes prevalent in intermountain basins and forest-steppes on mountain slopes and in river valleys. Dry steppes were widely distributed over the southern part of the region (Khenzykhenova, 2005).

As follows from the comparative analysis of the mammal fauna dated to MIS 3, the Baikalian region was dominated by species inhabiting open landscapes. In the Fore-Baikal sub-region narrow-sculled vole *M. gregalis* prevailed at the Gerasimov's site, North-Siberian vole *Microtus* cf. *hyperboreus* and steppe lemming *L. lagurus* at the Bolshoi Naryn site, while Brandt's vole *L. brandti* was dominant in intermountain basins of Transbaikalia. Among large mammals, horses predominated in the Baikal region.

6. Conclusion

The species composition of the fauna recovered from the Paleolithic sites in the Fore-Baikalian sub-region is indicative of wide distribution of forest-steppes in MIS 3 time, under conditions of cold-temperate humid climate, with areas of tundra type landscapes occurring locally. The species composition from the Paleolithic sites in Transbaikalia suggests highly diversified (mosaic) landscapes with predominance of open spaces, and essentially arid climate. Dwellers of meadows and forests, forest-steppes and meadow-steppes were widely distributed in the intermountain valleys. Taiga forests covered the mountain slopes.

Acknowledgments

The study of mammal fauna has been supported by the project with support of Ministry of Education, Culture, Sports, Science and

Technology Grants-in-Aid for Scientific Research of Japan (Fundamental research A, Overseas Academic Investigation) “Overall Research on the Adaptive Behavior of Late Paleolithic Man in Northeastern Eurasia”. We would like to thank the friendly support of all archaeologists and students who excavated the Paleolithic sites Bol’shoi Naryn and Gerasimov’s together with us.

References

Germonpre, M., Lbova, L., 1996. Mammalian remains from the Upper Palaeolithic site Kamenka, Buryatia (Siberia). Journal of Archaeological Science 23, 35–37.

Gromov, V.I., 1948. Paleontological and archaeological argument for stratigraphy of Quaternary continental deposits of the territory of USSR (Mammals, Palaeolithic). In: Proceedings of Institute of Geological Sciences 64, Geological Series №17, Moscow. 521 pp. (in Russian).

Kalmykov, N.P., 2001. Mammals and Paleogeography of Lake Baikal basin (Pliocene–Holocene). Buryat Scientific Centre, Siberian Branch, Russian Academy of Sciences Press, Ulan-Ude, 113 pp. (in Russian).

Kasparov, A.K., 1986. The remains of mammals from the Late Paleolithic site Sukhotino 4 in Transbaikalia. In: Mammals of Quaternary Fauna of USSR. Zoological Institute of Academy of Sciences of USSR Press, Leningrad, pp. 98–106 (in Russian).

Khenzykhenova, F.I., 2005. Transbaikalian small mammals during Palaeolithic–Mesolithic. In: Palaeolithic Cultures of Transbaikalia and Mongolia (New Sites, Methods, Hypotheses). Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Novosibirsk, pp. 139–149 (in Russian).

Khenzykhenova, F., 2008. Paleoenvironments of Palaeolithic humans in the Baikal region. Quaternary International 179, 53–57.

Kirillov, I.I., Kasparov, A.K., 1990. Archaeology of Transbaikalia. The problems and perspectives (Epoch of Palaeolithic). In: Chronostratigraphy of Palaeolithic of Northern, Central and Eastern Asia and America: The Reports of International Symposium. Nauka Press, Novosibirsk, pp. 194–198 (in Russian).

Kogai, S., Lipnina, E., Medvedev, G., 2007. Palaeolithic site Gerasimov’s I: new life of Pereselenchesky Punkt I. In: The Problems of Archaeology, Ethnography, Anthropology of Siberia and Adjacent Territories, vol. XIII. The Materials of the Archaeology and Ethnography Institute, Siberian Branch of Russian Academy of Sciences Annual Session, Novosibirsk, pp. 110–113 (in Russian).

Konstantinov, M.V., 1994. Stone Age of the Eastern part of Baikal Asia, Ulan-Ude-Chita, 179 pp. (in Russian).

Kunikita, D., Yoshida, K., Miyazaki, Y., Matsuzaki, H., Kato, H., Sato, T., Medvedev, G.I., Lipnina, E.A., 2006. Chronological evaluation of the upper Palaeolithic cultural complexes in Baikal Siberia, Russia. In: Abstract of the 19th International Radiocarbon Conference. English Heritage, Natural Environmental Research Council, Oxford, pp. 144–145.

Larichev, V.E., Lipnina, E.A., Medvedev, G.I., Kogai, S.A., 2009. Angara’ Paleolithic: Near Sources of Early East Siberian *Homo sapiens* “Artistic Career” and Beginning of their Obtaining of First Knowledge about Nature. High School Scientific Archaeology and Ethnology of Northern Asia. Irkutsk School 1918–1937. All-Russian Seminar Devoted to 125-years of Berngard Eduardovich Petri. – Irkutsk, pp. 249–264. (in Russian).

Ovodov, N.D., 1987. Fauna of Palaeolithic settlements Tolbaga and Varvarina Gora in Western Transbaikalia. In: Palaeoenvironment and Ancient Man during Late Anthropogene. Geological Institute BF Siberian Branch, Academy of Sciences of USSR Press, Ulan-Ude, pp. 122–140 (in Russian).

Sato, T., Khenzykhenova, F., Yoshida, K., Kunikita, D., Suzuki, K., Lipnina, E., Medvedev, G., Kato, H., 2008. Vertebrate fossils excavated from the Bol’shoj Naryn site, East Siberia. Quaternary International 179, 101–107.

Tashak V.I., 1999. Natural conditions of Upper Paleolithic beginning in South of Buryatia. In: Geochemistry of Landscapes, Paleoecology of Man and Ethnogenesis: Abstracts, Ulan-Ude, pp. 496–497 (in Russian).