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Vertebrate fossils excavated from the Bol'shoj Naryn site, East Siberia

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Abstract

Located at approximately 53°N, 103°E, the Bol'shoj Naryn site lies on the hills facing Osa Bay, in the Bratsk Reservoir. The authors started excavating this site in 2003. By 2005, we had found 337 stone tools and flakes, and more than 600 animal fossils, from the paleosol layers (^{14}C dating: from 25,000 to 32,000 yr BP) deposited in the second half of the Karginian Interstadial.

Large specimens of the fossils collected by visual observation were mostly the bones and teeth of *Equus* sp. and Bovinae, and small specimens obtained through wet sieving included many fossils of *Lagurus lagurus*, *Microtus* sp., and *Spermophilus undulatus*. This suggests that the steppe had spread around this site by the last half of the Karginian Interstadial.

However, some of the animal fossils collected from the Bol'shoj Naryn site were characteristic of tundra or forest, as well as steppe. To understand why, remains characteristic of three different habitats were excavated from the same paleosol of the Karginian Interstadial, detailed discussions centered on the radiocarbon age of each material are needed.

As part of our investigation of the fossils of large vertebrates, we measured various parts of the fossils of *Eanus* sp. in excavated specimens and in specimens collected from the reservoir's shore, in accordance with the procedure described by von den Driesch [1976. A Guide to the Measurement of Animal Bones from Archaeological Sites. Peabody Museum of Archaeology and Ethnology Bulletin 1, Peabody Museum, Harvard University, Cambridge, MA]. We inserted the measured values into the formula of Nishinakagawa et al. [1991. A study on the time and the route of the introduction of cattle and horses into Japan, as examined from skeletal remains of archaeological sites. Report of the Grant-in-Aid from the Ministry of Education, Culture, Sports, Science and Technology, Scientific Research (B) 1990 (Japanese, English abstract)] and found that the collected fossils were mostly of individuals with withers heights between 125 and 135 cm. To clarify the time transition, a future project will use measurements to examine the trait characteristics of the fossils of other large mammals.

In future, we intend to clarify the histories of nature and humankind in the Pleistocene in the Fore-Baikal region and to add animal fossils excavated from other sites to the scope of our research.

1. Introduction

As members of the Japan–Russia joint research team, the authors have lately been conducting research on Pleistocene sites in the Fore-Baikal region along with many researchers. The team started the excavation and research of Bol'shoj Naryn—a human site of the Upper Pleistocene—from 2003, and the research is ongoing. Although it is still impossible to clarify the whole picture, at this site we have found a lot of stone tools and animal fossils compatible with oxygen isotope stage 3. So in this paper, we give a general description of our research and report on the characteristics of the remains—especially those of vertebrate fossils—that we have excavated from the Bol'shoj Naryn site.

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2. Location and current conditions of the site

Located at approximately 53°N, 103°E, the Bol'shoj Naryn site is set in the hills facing Osa Bay, in the Bratsk Reservoir (Fig. 1). The hills that used to face the left bank of the Osa River are being eroded severely by water level fluctuations in the Bratsk Reservoir. Because of this erosion, a cliff as high as 2–10 m stretches around the site for several kilometers. Artifacts and vertebrate fossils presumably flowed down from the hills with soil erosion and were scattered along the shore of the reservoir.

We have collected more than 4000 artifacts or animal fossils from the reservoir's shore since we started our research in 2003. Most of the artifacts are stone tools and flakes, most of which are made of quartz. They include blade cores, discoidal cores, points, and hand axes, all of which, from a technological viewpoint, belong to different development stages. We also collected a point made of deer antler. Yoshida, one of the authors, estimated the radiocarbon age of this antler point to be $27{,}750 \pm 320$ yr BP.

Among the vertebrate fossils found on the reservoir's shore, horses (*Equus* sp.) and bovines (Bovinae) drew attention, and the remains of extinct animals, such as the woolly rhinoceros (*Coelodonta antiquitatis*) and mammoth (*Mammuthus* sp.), are found here and there. Most bovine fossils are supposed to originate in steppe bison (*Bison priscus*). There are also specimens that show clear evidence of artificial dissection and processing, although these are small in number. Unquestionably, the human factor was involved in some of these fossils. Yoshida and his colleagues measured the radiocarbon ages of four animal fossils collected from the reservoir's shore and dated the fossils to roughly 25,000–45,000 yr BP (Kunikita et al., 2006a, b).

3. Survey method

We learned at first glance that the remains were not distributed evenly over the shore of the reservoir. We therefore first drew a terrain map of the site with the help of laser surveying equipment, and then built a distribution map of the remains scattered on the shore. We set up survey districts on the edges of the hills above the shore—the land area where the artifacts were densely distributed—and then we started our excavation work. The survey districts that lay east and west, facing each other, across the stream were named Loc. 1 and Loc. 2 (Fig. 2). We basically collected the remains identifiable by eye at the time of excavation and the tiny fossils of small animals through wet sieving of the soil.

4. Paleosol layers and eras of remains

The sedimentation on the strata was almost the same in both survey districts. At Loc. 1, sandy loess layers of the Sartanian glacial period had accumulated 1–2 m deep immediately beneath the surface soil layer, and a paleosol layer with high viscosity, formed in the Karginian interstadial and 1 m thick, had accumulated beneath the sandy loess layers (Fig. 3). It was in this paleosol layer that we excavated many stone tools and animal fossils from

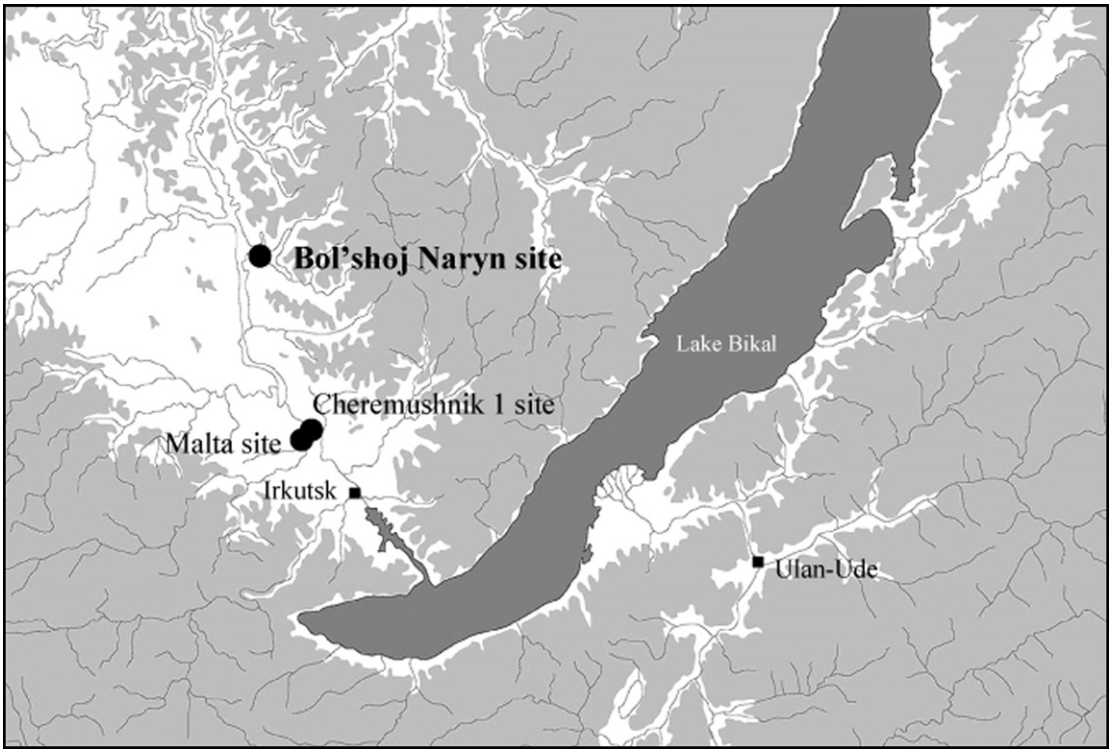

Fig. 1. Location of the Bol'shoj Naryn site.

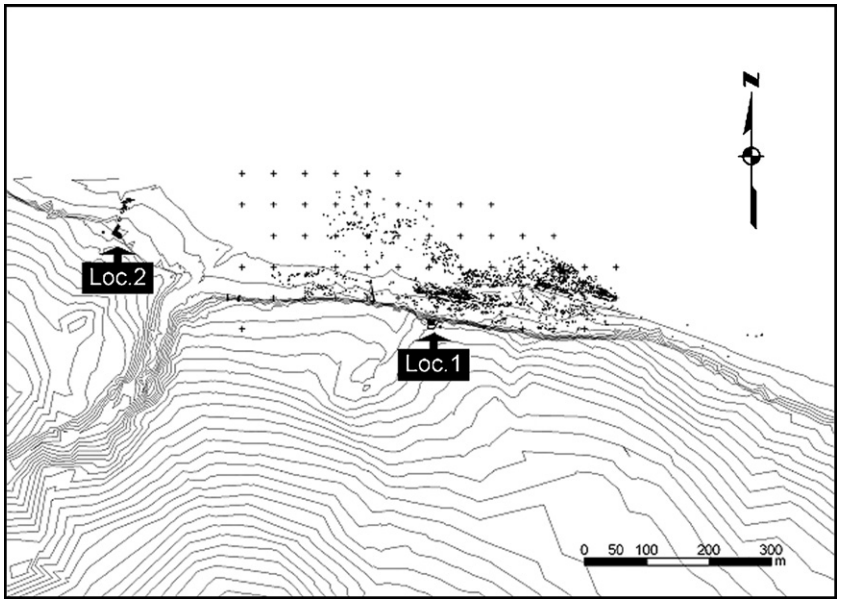

Fig. 2. Location of the excavation areas and the relevant sites distribution of the remains.

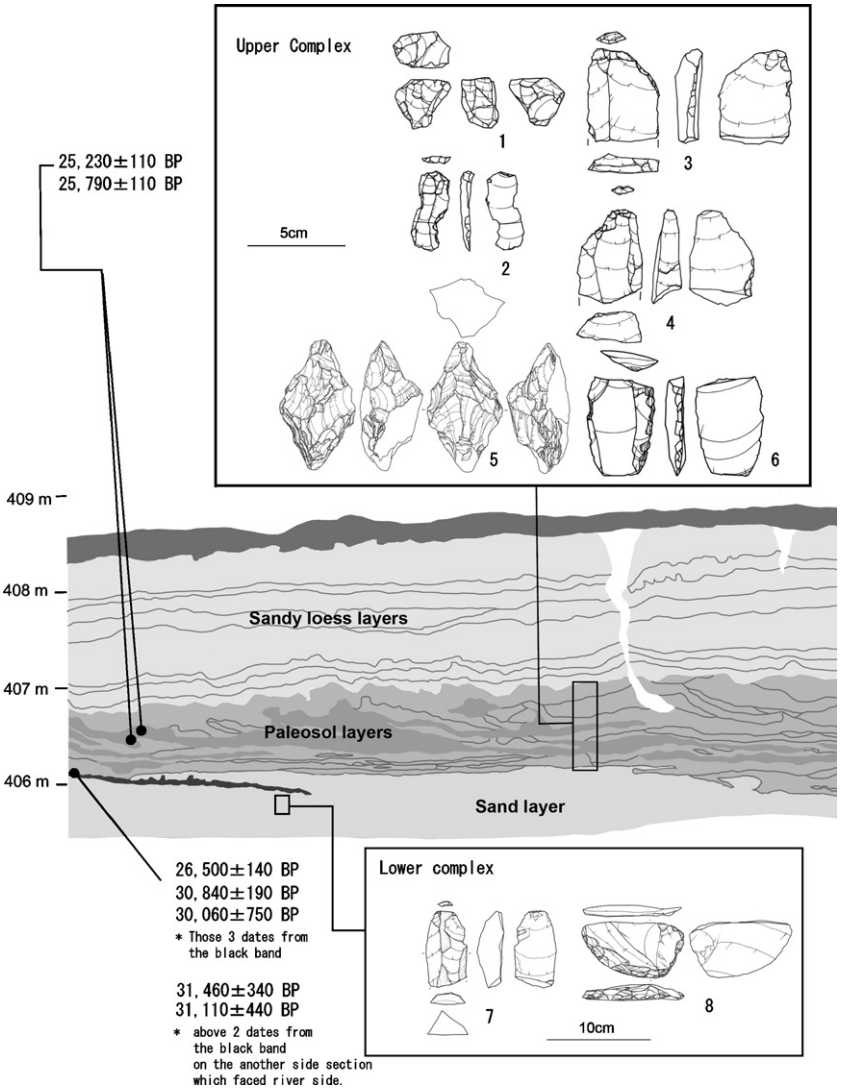

Fig. 3. Positions of dated charcoal samples and typical stone tools on eastern stratigraphic profile of the Loc.1: (1) wedge shaped core, (2) notched scraper, (3) (4) blade, (5) polyhedron core, (6) side scraper, (7) blade, (8) side scraper.

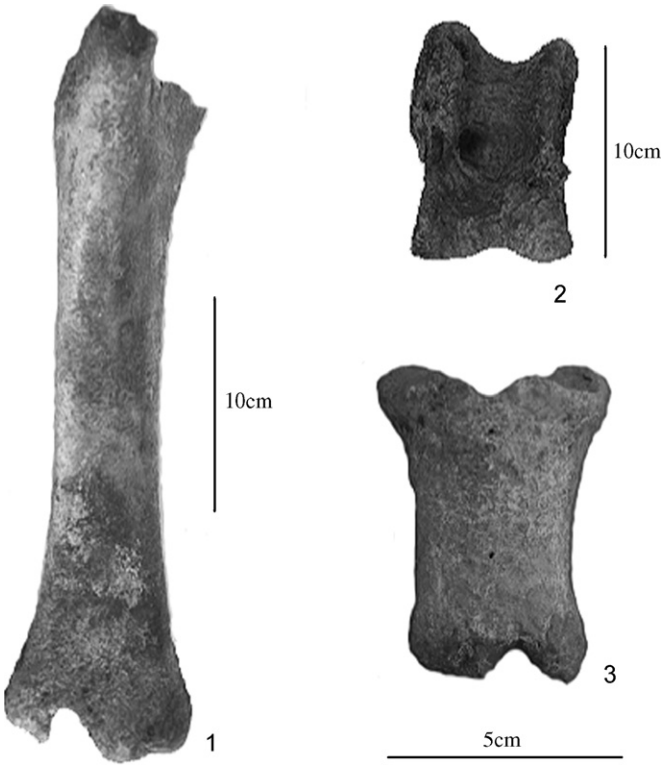

Fig. 4. Part of excavated fossils: (1) left tibia of *Equus*, (2) right talus of *Bison priscus*, (3) first phalanges of *Equus*.

nearly the whole area of each survey district. We were able to divide the paleosol layer on the east section of Loc. 1 into 24 sub-layers. However, it was, of course, impossible to confirm the spread of each sub-layer on the surface because of involutions during the excavation work.

However, in the survey districts, remains were excavated from both the upper and lower parts of the paleosol layer, near the wall surface. Yoshida and his colleagues examined the eras of a total of 11 charcoals contained in the paleosol layer at Loc. 1, and estimated that those in the upper part of the layer were in the age range of 25,000–26000 yr BP, and those in the lower part of the layer were aged in the range of 26,000–32,000 yr BP. He also reported that the 12 charcoals found in the northwest part of Loc. 2 were in the age range of 25,000–29,000 yr BP. Accordingly, it is clear that the remains found in the paleosol layer had an age range of more than several thousand years, at least, in the second half of the Karginian interstadial.

5. Taxa of excavated vertebrate fossils

We excavated 208 items of stone tools and flakes from the paleosol layer at Loc. 1 and 129 at Loc. 2. Kato, the Japanese leader of our research team, indicated that the stone tools excavated from the two survey districts was mostly blades, scrapers, and cores made of quartz (Fig. 3; Suzuki et al., 2006).

On the other hand, a total of more than 600 animal fossils were excavated from the paleosol layers of the two survey districts combined. We excavated 317 vertebrate fossils from Loc. 1 and 243 from Loc. 2, and some micro land snails were also excavated from both survey districts through wet sieving. We would now like to describe these vertebrate fossils.

Sato, the first author, identified 314 remains with the naked eye as vertebrate fossils; more than 80% of these were identified merely as fragments of fossils of large terrestrial mammals. Of all the excavated species, only eight kinds of mammal and one kind of bird were identified to at least the sub-family level. Above all, we excavated many materials from horses and bovines many of which were steppe bison (Fig. 4). Although we did excavate fossils of reindeer and other large deer, there were very few of these. Table 1 shows the minimum number of individuals (MNI), which we computed from the number of identified specimens (NISP), whether the specimen came from the right or left side of the body, the age of the specimen, and the size of each identified animal species. Table 1 indicates that we excavated many materials from horses and bovines.

Khenzykehnova, the second author, analyzed the fossils of small mammals obtained through wet sieving and found that they were mostly materials from steppe lemmings (*Lagurus lagurus*), grass voles (*Microtus* sp.), and long-tailed Siberian sousliks (*Spermophilus undulatus*) (Table 2; Medvedev et al., 2004). The contents of these vertebrate fossils suggest that the steppe had spread around this site in the last half of the Karginian interstadial.

6. Research issues for the future

As is commonly known, among sites from the Upper Pleistocene in Baikal Siberia, the Bol'shoj Naryn site and the Malta site are the only two human sites whose excavated animal fossils have been analyzed quantitatively.

The Malta site is estimated to have been formed in the Sartanian glacial period about 20,000 years ago. The large vertebrate fossils excavated there are mainly mammals living in the tundra, such as reindeer (*Rangifer tarandus*) and arctic foxes (*Alopex lagopus*), indicating that the site had characteristics different from those of the Bol'shoj Naryn site (Table 3; Ermolova, 1978).

From a macroscopic viewpoint, this could be evidenced that the taxa in the Fore Baikal region was steppe in the Karginian interstadial and tundra in the Sartanian glacial period, but no one, of course, can guarantee that climate change and changes in the biome were simply during the Karginian interstadial. In fact, we have found that the fossils of lemmings excavated from the Bol'shoj Naryn site have many characteristics peculiar to the steppe, but they also contain small numbers of characteristics inherent to the tundra and forest. To clarify the background to the fact that three kinds of characteristics with three different kinds of habitat have been excavated from the same paleosol of the Karginian interstadial, deliberate discussions in light of the radiocarbon age shown by each material will be needed.

Table 1
Vertebrate fossils collected with the naked eye

Taxon		The location and the investigative year									
		Loc. 1						Loc. 2		Total	
		2004		2005		Subtotal		2004			
		NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Mammalia											
Pikas	*Ochotona* sp.			1	1	1	1			1	1
Mountain Hare	*Lepus timidus*			9	1	9	1			9	1
Arctic Fox	*Alopex lagopus*							1	1	1	1
Deers	Cervidae			2	1	2	1	4	2	6	3
Bison and relatives	Bovinae	4	1	7	1	11	2	4	1	15	3
Horse	*Equus* sp.	3	1	13	2	16	3	10	1	26	4
Mammoth	Mammuthus sp.							1	1	1	1
Indetermined		43		111		154		100		254	
Aves											
Indetermined				1	1	1	1			1	1
	Total	50	2	144	7	194	9	120	6	314	15

Table 2
Small mammal fossils obtained through wet sieving

Taxon		The location and the investigative year					
		2004		2005		Total	
		Loc.1		Loc.2			
		NISP	MNI	NISP	MNI	NISP	MNI
Insectivora							
Shrews	*Sorex* sp.			1	1	1	1
Chiroptera							
Bats	Chiroptera gen. indet.			1	1	1	1
Lagomorpha							
Hares	*Lepus* sp.			1	1	1	1
Northern pika	*Ochotona hyperborea* Pall.			12	1	12	1
Steppe pika group	*Ochotona*. cf. *pusilla* Pall.			1	1	1	1
Pikas	*Ochotona* sp.	4	2			4	2
Rodentia							
Long-tailed Siberian Souslik	*Spermophilus undulatus* Pall.			28	3	28	3
Northern red-backed vole	Clethrionomys rutilus Pall.	2	1	2	1	4	2
Amur lemming	*Lemmus amurensis* Vinogr.			13	3	13	3
Collared lemmings	*Dicrostonyx* cf. *henseli* Hint.			1	1	1	1
Lemmings	Lemmini gen. Indet	2	1			2	1
Steppe lemming	*Lagurus lagurus* Pall.	137	17	32	4	169	21
Tundra Vole	*Microtus oeconomus* Pall.			1	1	1	1
Narrow-skulled vole	*Microtus gregalis* Pall.	8	3	4	3	12	6
North Siberian vole group	*Microtus* cf. *hyperboreus* Vinogr.	10	4	8	5	18	9
Grass voles	*Microtus* sp.	5	2	18		23	2
	Total	168	30	123	26	291	56

Furthermore, a future project will be to determine the characteristics of the fossils of the large vertebrates on the basis of measurement. As of last summer, more than 100 items had been collected voluntarily from the reservoir's shore over the previous 3 years and stored at the Irkusk State University. The first author started to identify these 108 specimens with reference to the excavation information, and to measure their particulars as specified by von

Table 3
Vertebrate fossils excavated from the Malta site

	Taxon	MNI (MNI)
Mammalia		
Reindeer	*Rangifer tarandus* Linnaeus	589 (83.8)
Arctic fox	*Alopex lagopus* Linnaeus	50 (7.1)
Woolly rhinoceros	*Coelodonta antiquitatis* Blumenbach	25 (3.6)
Woolly mammoth	*Mammuthus primigenius* Blumenbach	16 (2.3)
Steppe bison	*Bison priscus* Bojanus	5 (0.7)
Wolverine	*Gulo gulo* Linnaeus	4 (0.6)
Fox	*Vulpes vulpes* Linnaeus	2 (0.3)
Horse	*Equus ferus* Boddaert	2 (0.3)
Hare	*Lepus* sp.	1 (0.1)
Wolf	*Canis lupus* Linnaeus	1 (0.1)
Cave lion	*Panthera spelaea* Goldfuss	1 (0.1)
Snow sheep	*Ovis nivicola* Eschscholtz	1 (0.1)
Aves		
Grey Lag wild goose	*Anser ferus* Linnaeus	2 (0.3)
Herring gull	*Larus argentatus* Pontoppidan	1 (0.1)
	Total	700

The data in this table owes to Ermolova (1978).

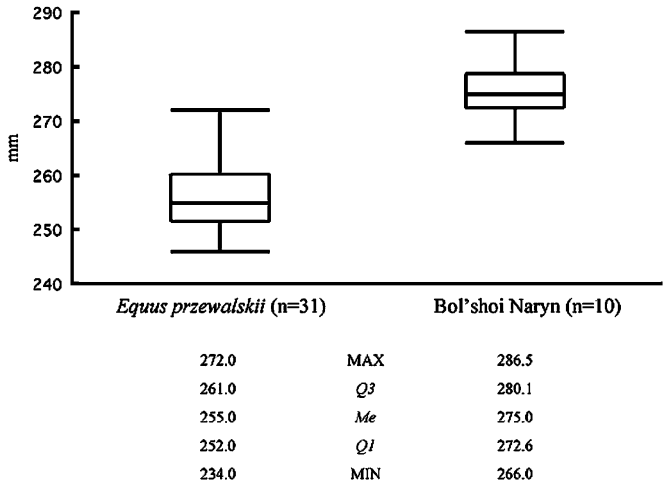

Fig. 5. The distribution of the greatest length of metatarsus bones. Each distribution of measurements in millimeters is represented as the box and whisker plots with their median, first and third quartile. The data of Przewalsk's horses (*Equus przewalskii*) are from Eisenmann and Beckouche (1986).

den Driesch (1976) and Eisenmann (1986). Then compared their measurements with those of the Przewalsk's horse (*Equus przewalskii*) which are reported by Eisenmann and Beckouche (1986). As a result, the fossil of a horse collected from Bol'shoj Naryn site was measured as the same as, or slightly bigger than, the Przewalsk's horse (Fig. 5). This agrees with the estimation formula devised by Nishinakagawa et al. (1991), in which the height of most horses at the withers is either 125 cm or more, or 135 cm or less.

It was recently pointed out that the fossils of horses of the Late Pleistocene excavated from Alaska are becoming smaller (Gurthrie, 2003, p. 170). To clarify why the large terrestrial mammals became extinct in the last period of the Pleistocene, we need to discuss whether this trend can be confirmed in Baikal Siberia and the whole of Siberia.

Fortunately enough, Medvedev, the Russian leader of our research team, has excavated the Cheremushnik 1 site in the neighborhood of the Malta site and has found stone tools and animal fossils from sedimentary layers equivalent to the Holocene, the Pleistocene–Holocene transition, the Karginian interstadial, and the Murukta glacial period. In the future, we want to develop the understanding of the history between nature and mankind from the Pleistocene to the Holocene in the Fore-Baikal region, while adding these animal fossils to the objective of our research.

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