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Short communication

New mammalian elements of the Ice Age assemblage on the Sakhalin Island

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No bone remains are typically preserved in open air archaeological sites on the Sakhalin Island (Russian Far East). The bulk of sites, which yielded faunal remains, belong to the late period of the Sakhalin history from the medieval to the recent time. Only few cave localities span the age from the end of Late Pleistocene to Early Holocene (Alexeeva et al. 2004). This is why materials from caves are so important for the knowledge of animals and the environment of the ancient people at the transition from Late Pleistocene to Holocene.

Material and methods

This communication is based on bone collections from the Ostantsevaya Cave (Fig. 1). The Ostantsevaya Cave (49°51'N, 143°31'E) is situated in the northern part of the Okada limestone massif (Vaida or Okada-Yama Mountain), on the left bank of the Vitnitsa River, about 70 m above the river level. The cave has two short narrow passages with the height of about 2 m, slightly inclined towards the entrance. They meet at the distance of 2 m and end in a rounded platform with the inclined well that runs down to the depth of 7 m. It was originally filled with loose sediments starting from the depth of 1.2 m from the cave floor (Alexeeva et al. 2004). Other narrow passages occur laterally, also running to the well. This site was discovered by Yu. I. Bersenev in 1981 and excavated in 1994–1997 by the team of the local amateur club for regional studies "Aborigen" headed by S. V. Gorbunov. Bone materials are catalogued by the Tymovskoe Museum of Regional Studies (TMRS). Bone materials were studied in Moscow, namely in the Ice Age Museum (large mammals) and in the Geological institute of the Russian Academy of Sciences (small mammals).

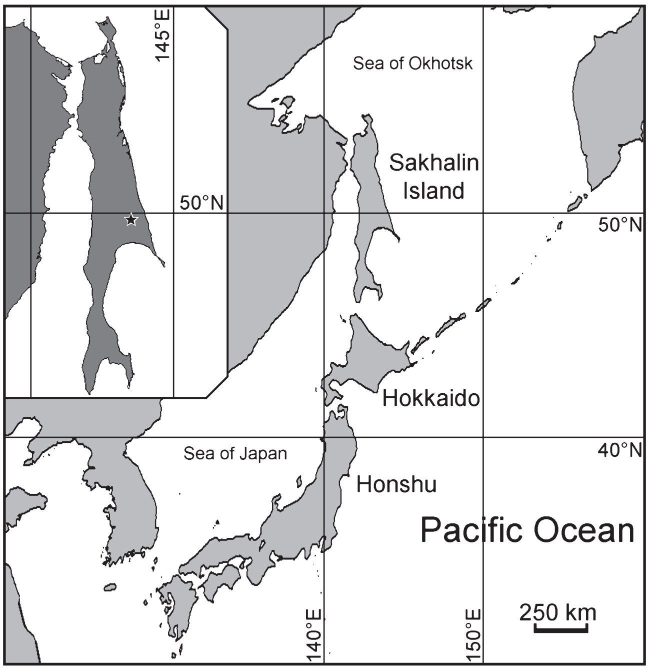

Fig. 1. Schematic map of the location of the Sakhalin Island in the Far East of Eurasia. The inserted map shows the location of the Ostantsevaya Cave, indicated by the star.

Results and discussion

Bones of vertebrates originate from two sites within the Ostantsevaya Cave. Firstly, from a hole dug at the first entrance (199 specimens). This material is dominated by remains of reindeer, Siberian snow sheep, and musk deer. Isolated remains represent hare, bear, red deer, Arctic fox, and horse (Alexeeva 1996; Alexeeva et al. 2004). The dominance of ungulates indicates hunting preferences of ancient people. The snow sheep and red deer were present on Sakhalin quite recently, Arctic fox and horse evidence the glacial epoch. Bones of horse and Arctic fox from the hole yielded dates of 15220 and

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Table 1. Large mammals in the well of the Ostantsevaya Cave (%)

Forms	beds											
	1	2	3	4	5	6	7	8	9	10	11	12
Lepus sp.	17.3	18.5	19.1	13.9	15.7	41.8	26.8	13.9	22.0	29.7	35.61	33.4
Canis sp.	0.4	–	–	0.3	–	–	–	–	–	–	–	–
Canis lupus	–	–	–	–	0.5	–	–	–	–	–	–	–
Alopex lagopus	–	–	–	–	–	–	0.7	–	–	–	–	–
Alopex/*Vulpes*	–	0.7	0.7	0.1	–	1.6	–	–	0.4	0.3	–	–
Vulpes vulpes	1.1	–	–	0.8	5.0	–	–	2.1	3.2	0.6	1.92	2.8
Ursus arctos	55.8	76.6	67.9	67.2	21.7	42.7	39.6	48.5	38.4	53.4	30.02	40.7
Gulo gulo	–	–	–	–	–	–	0.7	0.8	0.4	0.3	0.17	0.5
Martes zibellina	0.7	–	0.5	1.0	1.0	–	–	1.7	2.0	–	0.35	–
Mustela nivalis	–	0.2	–	–	–	–	–	–	–	–	–	–
M. cf. *eversmanni*	–	–	–	–	–	–	–	–	–	0.3	–	–
Lutra lutra	–	–	–	–	–	0.8	–	–	–	–	0.17	–
Mustelidae	–	–	–	0.1	–	0.8	–	–	–	0.9	0.52	–
Panthera cf. *spelaea*	–	–	–	–	–	–	–	0.4	–	–	–	–
Lynx lynx	–	–	–	–	0.5	–	–	–	–	–	0.17	–
Carnivora, large	–	–	–	–	–	2.5	–	–	–	–	1.57	2.8
Moschus moschiferus	–	2.3	0.5	0.4	–	–	–	–	–	0.3	–	–
Cervidae	–	–	–	0.5	–	–	–	–	–	0.3	–	–
Capreolus sp.	–	–	–	–	–	–	–	–	–	–	0.35	
Alces alces	–	–	0.2	–	–	–	–	–	–	–	–	–
Rangifer tarandus	5.9	0.5	3.1	3.5	16.2	7.4	9.4	10.1	9.2	3.4	8.73	6.9
Bovidae, small	–	–	–	–	1.5	–	–	–	–	–	–	0.5
Bovidae, medium	9.6	0.5	4.5	5.0	22.2	1.6	15.4	11.8	16.0	7.1	11.35	6.9
Bovidae	0.4	0.2	–	–	0.5	–	–	–	0.4	–	–	–
Bovidae, large	–	–	–	0.5	0.5	–	–	–	–	0.3	0.17	–
Ovis nivicola	8.8	0.5	3.5	6.7	14.6	0.8	7.4	10.6	8.0	3.1	8.90	5.0
Determinable remains, numbers	271	437	424	735	198	122	149	237	250	350	573	218
Total bone number in the bed	461	710	742	1462	660	302	301	346	878	504	1536	492

Table 2. Small mammals in the well of the Ostantsevaya Cave (number of specimens)

Forms	beds											
	1	2	3	4	5	6	7	8	9	10	11	12
Chiroptera indet.	–	58	–	20	–	–	–	8	–	–	–	8
*Eptesicus nilssoni**	–		–	–	–	–	–	1	–	–	–	–
Ochotona cf. *hyperborean*	–	1	–	–	3	–	–	–	1	–	–	6
Rodentia indet.	–	38	1	4	2	–	10	–	–	2	7	5
Sciuridae indet.	1	–	–	–	1	–	–	–	2	–	2	2
Tamias sibiricus	–	3	–	–	–	–	–	–	–	–	–	–
Spermophilus undulatus	–	–	–	2	1	–	4	1	1	1	–	–
Discrostonyx cf. *torquatus*	–	–	–	–	–	–	–	1	–	2	–	1
Clethrionomys rufocanus	–	2	–	–	–	–	–	–	–	1	–	3
Clethrionomys rutilus	–	–	–	–	–	–	1	–	–	1	–	–
Microtus sp.	–	–	–	–	–	–	–	–	–	1	–	–

* determined by S. V. Kruskop.

16350 radiocarbon years, which indicates the end of the last glaciation. Panteleev (1997) also suggested Late Pleistocene to Holocene age of the avian assemblage from the hole.

The second fossiliferous site of the cave is the well, which is in focus of this communication. The sequence of the well was subdivided in 12 beds. Due to the excavation technique, remains of large sized species dominate in the collected material. Small mammals are represented by isolated specimens. More than 8.5 thousand mammal remains, and 29 bird bones (Zelenkov 2005; Kirillova 2006) have been excavated. Dates on brown bear bones from different beds of the well range from 12685 to 8040 radiocarbon years before present (Kuzmin et al. 2005), i.e. permit the correlation of the assemblage with the end of Late Pleistocene and the beginning of Holocene.

The bone accumulation in the cave resulted from a combination of different taphonomic agents. They probably included the natural processes, as the death of animals within the cave, transport by predators (including avian predators for smaller mammals) and ancient humans (bones and parts of bodies), and a fluvial transport. The heterogeneous distribution of bone material in the section and significant differences in its preservation suggest alternating periods of the cave active use and periods of its actual isolation from bone-accumulating agents.

The mammalian fauna from the well of the Ostantsevaya Cave is summarized in Table 1 (large mammals) and Table 2 (small mammals). The bulk of bones represents two animal pairs (in decreasing order): bear and hare, and reindeer and snow sheep; also notable is the share of fox. Other species are represented by scarce remains. The latter group, along with forms, which disappeared from the Sakhalin fauna quite recently (moose, roe, snow sheep), also includes a number of mammal species found on the island for the first time. They are briefly described below.

Mustela cf. *eversmanni* Lesson, the steppe ferret. It is represented by a right mandibular ramus with the 9.8 mm long carnassial (Fig. 2). The fossil form is distinct from the extant steppe ferret in more robust shape and larger size. It is an impressively eastern record of this mustelid in Eurasia, although in Late Pleistocene steppe ferrets are known to disperse as far to the east as Alaska (Anderson 1977) and the Yukon Territory (Youngman 1994). The eastern limit of the animal's modern range is located in the steppe areas of eastern Amur River region. A fossil

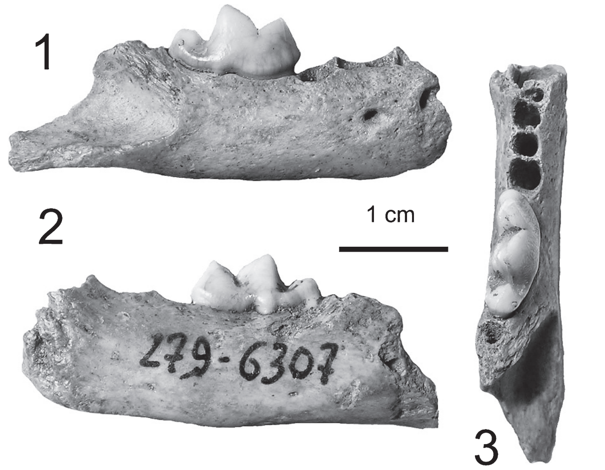

Fig. 2. *Mustela* cf. *eversmanni*, Ostantsevaya Cave, well, bed 10, TMRS no. 279-6307, right dentary: 1. labial view; 2. lingual view; 3. occlusal view.

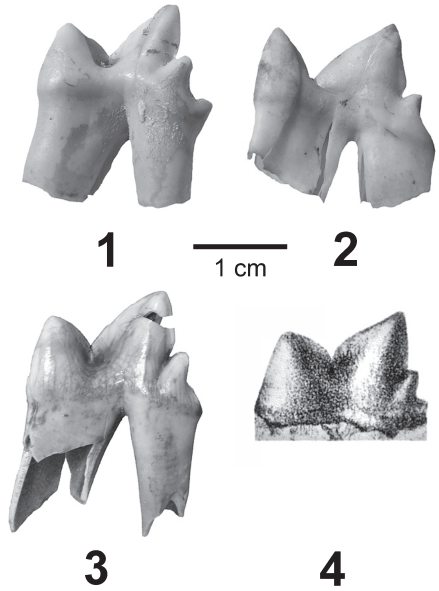

Fig. 3. Last lower deciduous premolar (dp4), right side, lingual view: 1. *Panthera tigris*, recent, Zoological Museum of Moscow State University (ZMMU) S-143594; 2. *Panthera leo*, recent, ZMMU S-3024; 3. *Panthera* cf. *spelaea*, Ostantsevaya Cave, well, bed 8, TMRS no. 279-4843; 4. *Panthera spelaea*, Sanford Hill Cave (after Dawkins and Sanford 1866).

record of the steppe ferret is known from the Bliznets Cave in the southern Sikhote-Alin Mountains (Alexeeva 2003).

Panthera cf. *spelaea* (Goldfuss), the large representative of pantherine cats. This form is represented by a deciduous fourth lower premolar, dp4, from the bed 8 (Fig. 3: *3*). This specimen is 18.6 mm long and 7.5 mm wide. The species-level diagnostics of milk teeth of large cats is not well studied. The comparison of the fossil specimen with deciduous dentitions of juvenile tigers (Fig. 3: *1*) and lions (Fig. 3: *2*) from the Moscow Zoo (Zoological Museum of Moscow State University) showed stronger similarity with the latter. Noteworthy is notably reduced talonid forming a gentle slope of the posterior edge of the dp4 crown in lions and the cat of the Ostantsevaya Cave, as contrasted to its well developed condition in juvenile tigers. Moreover, dp4 of Late Pleistocene cave lion from England (Dawkins and Sanford 1866) also displays the reduction of talonid (Fig. 3: *4*). It is also well known that morphologically fossil cave lions were much closer to extant African lions than to Asian tigers (Sotnikova and Nikolsky 2006). Nevertheless, we are not aware of any unambiguous occurrence of cave lions in the studied region, including Japan and the Russian Far East. In Japan, Late Pleistocene remains of large cats in localities on Honshu are thought to represent tigers or leopards (Hemmer 1981; Kawamura 1994; Kitchener 1999). The reported bones of “cave lion or tiger” in terminal Pleistocene deposits of the Geographic Society Cave (Russian Far East), co-occurring with remains of horses, woolly rhinoceros, mammoth, red deer, wolf, and other mammals (Vereshchagin and Ovodov 1968), most probably belong to tigers. The combination of these observations and the Late Pleistocene geological age of the source level allowed a tentative assignment of the fossil to the cave lion.

Bovinae, large oxen. Several forms of the subfamily can be expected in the fossil fauna of the Sakhalin Island. The most probable are the *Bos* group (yak including) and *Bison*. Species determination of these animals is difficult even in case of complete intact bones because of their strong similarity. Large oxen are represented by diaphyses of radius and femur of young individuals, petrosum, and proximal metatarsal of a medium sized adult from beds 5, 10, and 11 (Fig. 4). This occurrence of bovids in the level known to precede late Holocene, and its preservation similar to other material, exclude the attribution to the large cattle, *Bos taurus*, which appeared on the Sakhalin Island only with Russian settlers in the second half of the 19th century. No sites of this age are known in the vicinity of the Ostantsevaya Cave. This is why the available material, even lacking diagnostic characters, most likely indicates the presence of a wild ox, for example, bison (*Bison* sp.), musk ox (*Ovibos* sp.), or even yak (*Poephagus* sp.).

Spermophilus undulatus (Pallas), the Asian long-tailed ground squirrel. It is represented by postcranial bones

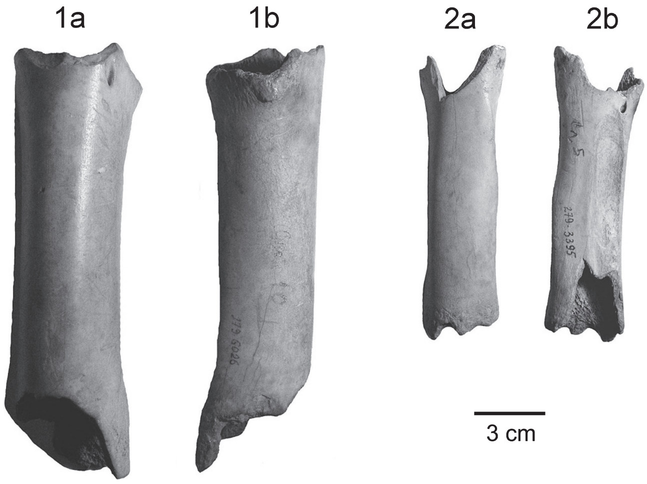

Fig. 4. Bone fragments of large Bovinae from the well of the Ostantsevaya Cave: 1. bed 10, TMRS no. 279-6026, femur; 2. bed 5, TMRS no. 279-3395, radius; a, anterior: b, posterior views.

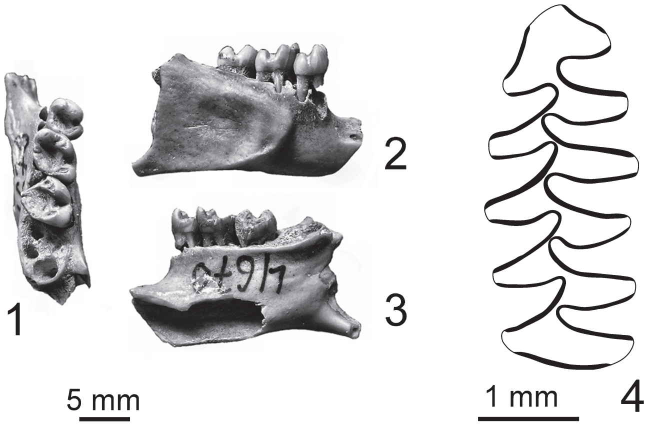

Fig. 5. *Spermophilus undulatus*, Ostantsevaya Cave, well, bed 7, TMRS no. 279-4670, right dentary with p4–m2: 1, occlusal view; 2. labial view; 3. lingual view. 4. *Dicrostonyx torquatus*, Ostantsevaya Cave, well, bed 8, TMRS no. 279-4853: m1, occlusal view.

and mandibles (Fig. 5: *1–3*). Alveolar length of the lower toothrow (115, 120, 128 mm) is above average values of recent *S. undulatus* and close to those of the Beringian ground squirrel *S. parryi*. However, p4 in our material has only one integral posterior root as in *S. undulatus* contrary to the two-rooted condition in *S. parryi* (Gromov et al. 1965). This is the easternmost occurrence of the species and the first record on the Sakhalin Island (Kirillova and Tesakov 2005). Fossil remains of this rodent are common in steppe and forest-steppe Late Pleistocene faunas of eastern Russia recorded in caves of the Altai Mountains (Agadjanian and Serdyuk 2005), middle reaches of the Angara River (together with collared lemming), and Transbakalia (Gromov et al. 1965).

Dicrostonyx torquatus (Pallas), collared lemmings. Isolated teeth (Fig. 5: *4*) and toothless mandibles from the lower levels of the Ostantsevaya Cave is the first known occurrence of this vole in the Far East; it is also the most southeastern record of this rodent in Eurasia. Judging from complex structure of m2–m3 molars inferred from alveolar shape in toothless mandibles and from the geological age, the collared lemming most probably belongs to the recent species *D. torquatus*.

The cave locality of fossil mammals with the radiocarbon dates in the range of Late Pleistocene to early Holocene is for the first time studied on the Sakhalin Island. The age of the locality matches its faunal composition including remains of Arctic fox, horse, and the first records on the island of steppe ferret, cave lion, large bovid, collared lemming, and ground squirrel. The co-occurrence of these mammals permits to consider them as parts of the Ice Age or Mammoth faunal assemblage (Kahlke 1999), which up to now is extremely poorly known on the Sakhalin Island (Kuzmin et al. 2005). During the Late Pleistocene, under conditions of low sea level, the Sakhalin Island was a part of the land bridge connecting the Asian mainland with Hokkaido (Alexandrova 1982). According to Takahashi et al. (2006), remains of woolly mammoth are sporadically known from several chronological levels of Late Pleistocene (ca. 40–16 Ka) on the Hokkaido marking the farthest dispersal of the Mammoth assemblage in this region. The reported fauna form Sakhalin presents the first factual evidence of the presence of many typical mammals of the Late Pleistocene assemblage combining steppe, tundra, and forest elements.

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