

THE METAL AGES AND MEDIEVAL PERIOD

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USE OF ULAN-KHADA BAY AT LAKE BAIKAL IN THE HOLOCENE (BASED ON FAUNA REMAINS)

The article presents the results of studies of faunal remains from the Ulan-Khada multilayered settlement – one of key habitation sites in the Cis-Baikal region providing information for reconstructing environmental and cultural changes during the Holocene. A complete analysis of the fauna assemblage obtained over the course of long-term excavations is given. For the first time, the site's ichthyofauna is described. The mammalian species composition is revised. Species diversity is evaluated across the time span from the Final Mesolithic to the Late Iron Age. These studies have demonstrated that the main activities at the site during the Neolithic and Bronze Age included seal and ungulate (roe and red deer) hunting. Fishing was also important, especially 4.2–3.8 thousand years ago (Bronze Age).

Keywords: Fauna remains, multilayered habitation site, Mesolithic, Neolithic, Bronze Age, Iron Age, Cis-Baikal region.

Introduction

The settlement in Ulan-Khada Bay on Lake Baikal was the first (and for many years, the only) Holocene multilayered site discovered in Siberia (Petri, 1916). The great amount of data that have been obtained in the course of multidisciplinary studies at this site makes it important for elaborating periodization and chronology of Holocene cultures in the Cis-Baikal region as well as for reconstructing the environmental and climatic changes occurring there (Goriunova, 1984; Goriunova, Savelyev, 1990).

This article presents the results of zooarchaeological research on materials from Ulan-Khada. The analyses have been carried out under the joint Baikal Archaeological Project combining the efforts of researchers from the University of Alberta (Edmonton, Canada) and Irkutsk State University (Russia). For the first time, the entire fauna assemblage (approximately 3000 bones) collected during the whole period of the excavations (1974, 1979, 1982, and 1990) was studied. The species composition was identified by T. Nomokonova and R.J. Losey in 2009. The preliminary data obtained by the analysis of mammal bones

(approximately 150 specimens) previously identified by A.A. Khamzina (1991) were reexamined and supplemented substantially during this new phase of analysis.

The techniques of zooarchaeological identification and qualitative analysis employed in the present study have been described in detail in several publications (Nomokonova, Losey, Goriunova, 2006, 2009c). Quantifying the faunal remains was done by utilizing the number of identified specimens (NISP) and the minimum number of individuals (MNI). These units are broadly used in zooarchaeology (Lyman, 2008; Reitz, Wing, 1999).

Description of the site and the history of studies

The multilayered settlement is located in Ulan-Khada Bay on the southwestern shore of the Mukhor Bay in the Little Sea of Lake Baikal. It is situated 187 km northeast of Irkutsk and 4.5 km north–northwest of the village of Sakhurta of the Olkhon Region, Irkutsk Province (Fig. 1, 2). The site was discovered by the Expedition of the Russian Academy of Sciences headed by B.E. Petri and initially excavated in 1912–1913 and 1916. The Expedition recorded 12 layers attributable to the Neolithic and “Pre-Ceramic Neolithic” (Mesolithic) (Petri, 1916, 1926). In 1959, large-scale excavations were carried out at the site

by the Irkutsk Expedition of the Leningrad Department of the Institute of Archaeology, USSR Academy of Sciences, headed by M.P. Gryaznov and M.N. Komarova. In the course of these studies, Bronze and Iron Age assemblages were recovered from this site (Gryaznov, Komarova, 1992). L.P. Khlobystin (1964) conducted additional stratigraphic research at the site in 1963. Further multidisciplinary studies of the settlement were carried out by the Baikal (Little Sea) team of the Complex Archaeological Expedition of Irkutsk State University in 1974 and 1979 (headed by N.A. Savelyev and O.I. Goriunova) and in 1982, 1990 and 1994 (headed by O.I. Goriunova) (Goriunova, 1984; Goriunova, Savelyev, 1990). Archaeological remains were recovered from layers of dark, humus-rich soil separated by the lenses of grayish-yellow sand. The sediments were accumulated due to slope sliding and eolian processes. Twelve archaeological horizons have been recognized at the site: layer XI has been attributed to the Final Mesolithic; layers X–VIII, to various stages of the Neolithic; layers VII–I, to the Bronze Age; and layer zero was dated to the

Fig. 1. Map showing the location of Ulan-Khada.

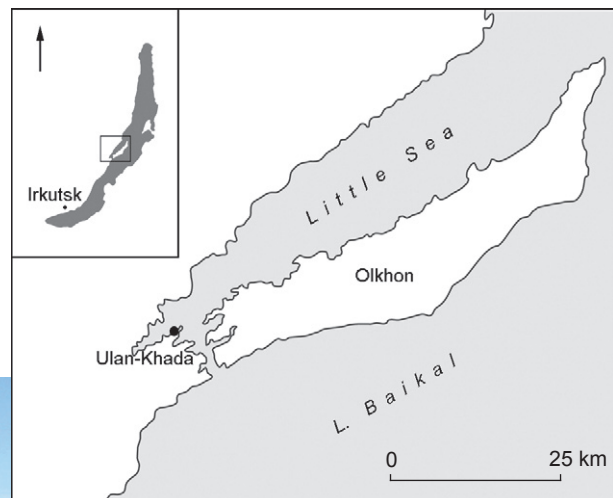


Fig. 2. General (southwestern) view of the Ulan-Khada Bay.

transition to the Iron Age and Late Iron Age. The Bronze Age layers were formed during the accumulation of dune sands and include up to eight buried soils. The soil layers are discontinuous throughout the excavation area, therefore, in some cases, they have been united in II–VII, IV–VII, and V–VII culture-bearing horizons.

Fauna remains

The analyzed sample includes 2746 animal remains from all culture-bearing layers except layer X (Early Neolithic) (see Table). The following mammal taxa have been recognized among identifiable specimens: brown bear (*Ursus actor*), genus *Canis*, seal (*Phoca sibirica*), wolverine (*Gulo gulo*), red deer (*Cervus elaphus*), roe deer (*Capreolus pygargus*), and horse (*Equus* sp.). Certain remains were identified only to the family level (Cervidae and Muridae), and at the order level (Rodentia, Carnivora, and Artiodactyla). Identified bird bones belong to the

genus *Haliaeetus*. Among the fish, bones of perch (*Perca fluviatilis*), pike (*Esox lucius*), sturgeon (*Acispenser baeri baicalensis*), Cyprinidae (including Siberian roach – *Rutilus rutilus lacustris*), and Salmonidae (including *Coregonus*) have been identified.

Cultural layer XI. The fauna remains belong to the Final Mesolithic (7.0–6.6 ka BP). Bones are mostly unidentifiable (95 %); the remainder belong to seal, a large artiodactyl, and sturgeon. MNI does not exceed one. Seal bones likely belong to an adult individual: the distal epiphysis of the 4th metatarsal reveals a fusion line. This epiphysis is formed in members of the genus *Phoca* at the age of 8–12 years (Stora, 2000). Bones with signs of modification are few in number and include a fragment of a tubular bone, two fragments of artifacts (one of which is likely a portion of a composite tool), and a burnt seal bone.

Cultural layer IX. The fauna remains have been recovered in association with the Middle Neolithic layer radiocarbon dated to 4030 ± 115 BP (SOAN-3335), 4560 ± 100 BP (LE-1282), and 5.5 – 4.3 ka BP. The number of

Number of bones in the Ulan-Khada faunal sample by taxon

Taxon	Cultural layers																Subtotal
	0	I	Iu	II	II	III	IV	V	VI	VII	IV–VII	V–VII	II–VII	VIII	IX	XI	
Mammalia	54	75	50	57	89	17	8	3	–	–	11	47	17	180	51	164	823
<i>Equus</i> sp.	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Artiodactyla	2	4	–	2	–	–	–	–	–	–	–	–	–	1	–	1	10
Cervidae	4	–	2	–	6	–	13	–	–	–	–	1	1	20	–	–	47
<i>Cervus elaphus</i>	–	1	5	–	4	–	–	–	–	–	–	–	–	–	–	–	10
<i>Capreolus</i> pyg.	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2
Carnivora	–	1	2	2	–	–	–	–	–	–	–	–	–	–	–	–	5
<i>Ursus actor</i>	–	–	–	–	2	–	1	–	–	–	–	–	–	–	–	–	3
Canidae	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<i>Canis</i> sp.	–	–	17	–	–	–	–	–	–	–	–	–	–	–	2	–	19
<i>Phoca sibirica</i>	5	18	26	36	42	1	29	–	2	10	3	4	10	37	2	3	228
c.f. <i>Gulo gulo</i>	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Rodentia	1	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	4
Muridae	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Aves	1	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	3
<i>Haliaeetus</i> sp.	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Pisces	1	31	–	–	13	208	91	197	4	–	20	–	47	315	–	–	927
Salmonidae	–	–	–	–	–	258	4	17	2	–	1	–	1	50	–	–	333
<i>Coregonus</i> sp.	–	–	–	–	–	16	1	15	–	–	1	–	–	10	–	–	43
Cyprinidae	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2
<i>Rutilus r.lac.</i>	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
<i>Perca fluviatilis</i>	1	10	–	–	3	61	102	9	–	–	1	–	8	54	–	–	249
<i>Esox lucius</i>	1	1	–	1	–	–	–	–	–	1	–	–	–	1	–	–	5
<i>Acispenser b.c.</i>	–	–	–	–	–	–	–	1	–	1	–	–	–	1	–	4	7
Unidentifiable	–	–	–	–	–	–7	–	–	–	–	–	–	–	5	–	–	12
<i>Total</i>	78	145	102	99	162	568	249	245	8	12	40	52	84	675	55	172	2746

bones recovered is very small. The bones of the genus *Canis* have been identified. All are represented by skull fragments with traces of burning. All these bones along with other burnt non-definable bones most likely belong to a single individual. However, since they are heavily fragmented, it is impossible to define the species (a wolf or a dog). Other bones – two seal phalanxes – belong of an old animal individual (the distal epiphyses are fused) (Stora, 2000).

Cultural layer VIII. Animal bones from this layer have been dated to the Late Neolithic (4150 ± 80 BP (LE-128), 4060 ± 80 BP (GIN-4877), and 4.2–4.0 ka BP). The following taxa have been identified: seal, cervid, and artiodactyl. Mammal bones constitute 35 % of the total number of bones. Bones with signs of modification include a tool fragment, a point, and an implement decorated with incisions. Tubular bones show traces of polishing (1 specimen) and burning (57 specimens).

Seal bones dominate the assemblage of mammal remains (MNI=3). Judging by the fusion of epiphysis on various elements (Ibid.), the bones belong to an immature individual, a young individual of 6–7 years and to comparatively old seal (older than 10–12 years). Annual dentin layers in a seal canine, too, show that one seal was at least 8 years old (Weber et al., 1998).

Most bones associated with layer VIII belong to fish (64 %). The following taxa have been identified: perch, pike, sturgeon, and representatives of salmon family including the genus *Coregonus*. Several bones (possibly of a large whitefish) represent three individuals. The collection also includes the ulna diaphysis of a large bird and five bone remains that cannot be classified to any category.

Cultural layers VII–II. Fauna from these layers is attributable to the Early Bronze Age (4.0–3.8 ka BP). Several radiocarbon dates are available: 3660 ± 60 BP (LE-883) for layer VII, 3710 ± 100 BP (LE-1279) for layer VI, 4220 ± 120 BP (LE-1278) for layer V, and 4000 ± 50 BP (GIN-4876) for layer II. The fauna composition is rather diverse and includes artiodactyls (red deer and roe deer), carnivorous mammals (bear and seal), birds (genus *Haliaeetus*), and fish. In addition, bones of a small rodent have been recovered from this layer. Unidentifiable mammal bones have been found in hearth 30 in layer II. A fragment of a tubular bone with traces of working and a tool fragment with incisions have been discovered in association with layer II and united layer VII–II. Traces of burning have been noted on an unidentifiable bone fragment and a seal phalanx.

Seal bones are most numerous within the category of mammal remains (MNI=5). Cut marks representing traces of butchering are visible on a cervical vertebra and metatarsal 1. The phalanx and metatarsal 1 also show signs of pathology. Judging by the noted epiphysis fusion on various elements (Stora, 2000), the bones belong to an immature individual about 4 years of age, to an adult individual of 8–10 years, and to old individuals (10–12 years and older).

Most bones in layers VII–II represent fish (76 % of all specimens by NISP). The following bones have been identified: representatives of the Salmonidae (at least 5 individuals including Coregonidae), perch, representatives of Cyprinidae including Siberian roach, pike, and sturgeon. A half of fish remains (560 bones) were found in layer III (sq. 13–23). The bones belong to perch (61 specimens), at least two individuals; whitefish/omul (*Coregonus*) (16 specimens), at least four individuals; representatives of the Salmonidae (whitefish/omul/grayling) (258 specimens), at least five individuals; and 208 unidentifiable bones.

Cultural layers I, I upper, and I lower. In some areas, sterile lenses divide layer 1 into the lower and upper units. In the places where such division is impossible, the layer is regarded as a single one. The lower sub-layer I has been dated to the Middle Bronze Age (3.8 (3.6) – 3.1 ka BP). There are several dates available for this layer: 3800 ± 100 BP (LE-1277) and 3620 ± 50 BP (GIN-4875). The fauna remains number 346 specimens. These are mostly bones of mammals (86 %), including those of Artiodactyla (bones of large animals probably all belonging to the family Cervidae) and carnivores (seal, dog, and wolverine). Bones of mice and fish also have been identified. The fish bones, including those of perch and pike, are few in number.

In these sediments, as in the layers described above, seal bones form the largest percentage in the category of mammal remains (23 % of all bones in the layer). The upper layer I is the most interesting: it contained 44 seal bones belonging to at least two individuals – judging by the fusion of epiphyses, one young but mature individual and one rather old animal. The elements identified mostly are from the cranium and limbs (Fig. 3).

Five bones including the right scapula, the right radial bone, the left pelvis bone, metatarsal 1 and metacarpal 5 (Fig. 3) show cut marks indicative of butchering. These marks can be associated with separating seal carcasses into smaller parts (Boyle, 2005). Other evidence of butchering (skinning and defleshing marks) has not been recorded. The scapula shows three parallel cut marks suggesting separating the limb from the shoulder. Four deep parallel cut marks on the innominate testify to the separation of the femur head from the pelvis. The same process is reflected on the radius: marks on the interior of the proximal and distal ends were associated with the separation of this part of the limb from the shoulder and flipper, respectively. The cut marks running perpendicular to the long axis of the metatarsal (close to the proximal end) and metacarpal (close to the distal epiphysis) represent the separation of flippers from the rest of the body.

Seal bones recovered from the lower layer I belong to at least two individuals. Judging by the degree of epiphysis fusion on various elements, the bones belong to a young and an adult individual. This supposition is supported by annual

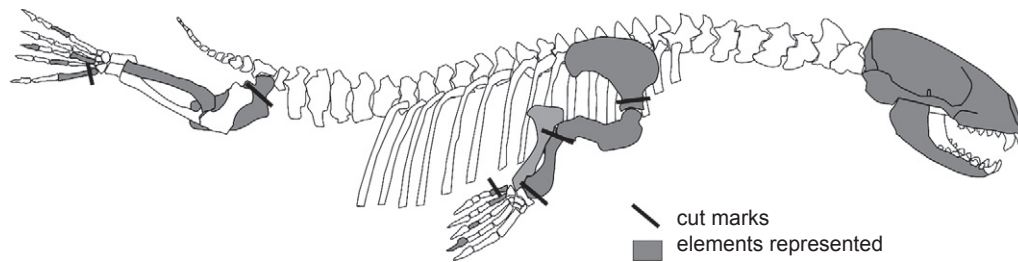


Fig. 3. Skeletal elements of the seal from upper layer I.

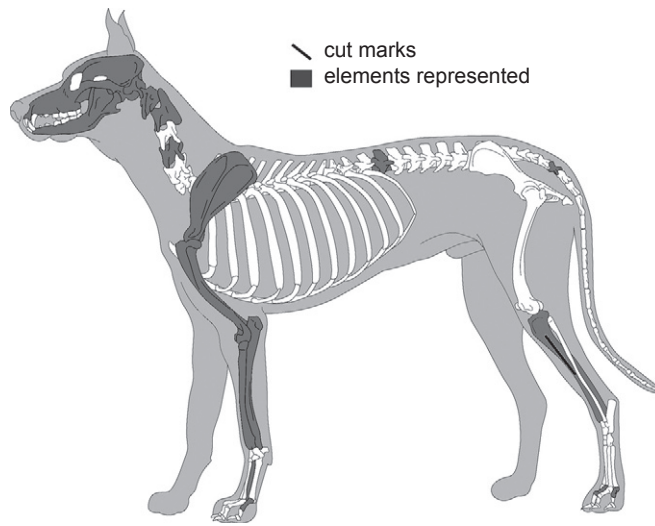


Fig. 4. Skeletal elements of the dog from upper layer I.

dentin layers in three canines found in these sediments: the age of one animal was 6 years and a second was assessed as being over 10 years (Weber et al., 1998).

The bones of a representative of the family Canidae (dog or wolf) from upper layer I are of interest. A total of 19 bones found in the layer includes 17 elements belonging to the genus *Canis* and 2 elements identifiable only as a medium-sized carnivore, likely also of the genus *Canis*; their size suggests they are possibly all from a dog. It is impossible to determine the individual's precise age, but judging by the complete fusion of the distal epiphysis, it was more than 1.5 years old (Silver, 1969). The tibia shows a long linear cut mark running parallel to the bone's long axis (Fig. 4). This is an unusual modification and is difficult to interpret as being associated with any specific activity.

Cultural layer 0. Fauna remains from this layer belong to the Bronze to Iron Age transitional period and the Late Iron Age (2.7–1.0 ka BP). Mammal bones (74 specimens) constitute the largest portion of the assemblage: horse, roe deer, large Cervidae, canids, seal, and small rodent. MNI for each does not exceed 1. The only exception is the seal remains. They represent two individuals, one of which, judging by the synostosis of the distal epiphysis of the humerus (Stora, 2000), was mature, and the other immature.

Other remains are few in number and belong to an unidentified bird and ichthyofauna. Fishes are represented by solitary pike specimen and several perch bones. Generally, the fauna remains in the layer demonstrate a good state of preservation. Horse bones represent the only exception. Only few bones demonstrate traces of modification: a horn with possible traces of working, two burnt bones, and two tubular bones with gnawing marks left by carnivores.

Discussion and conclusions

The faunal remains from the multilayered site of Ulan-Khada belong mostly to mammals (42 %) and ichthyofauna (57 %); several bones represent birds (see *Table*). The mammal bones have been recovered from all analyzed cultural layers (Fig. 5). The Late Neolithic (VIII) and Early Bronze Age (VII–II) layers contained the largest amount of such bones.

Seal bones are the most numerous among the identified mammals. They have been recovered from layers belonging to all chronological periods, from the Final Mesolithic to the Late Iron Age. The Early Bronze layers contained a slightly greater amount of seal bones compared to other layers. The seal bones from the Bronze Age layers show cut marks suggesting that butchering possibly was practiced directly at the site. Most hunted animals were sexually mature individuals, as evidenced by bone dimensions, epiphyseal fusion, and counts of annual layers of dentine in the canines.

The presence of bones of old seals at Ulan-Khada distinguishes this settlement from other sites on the western shore of the Big Sea of Baikal in terms of the choice of individual animals hunted. For instance, bone assemblages from the sites of Tyshkine II, Tyshkine III, and Sagan-Zaba II where Baikal seals were hunted during the spring rookery period include mostly bones of pups under one year of age and young and immature animals (Weber et al., 1998; Goriunova et al., 2007). It seems that seal hunting was not a specialized activity at Ulan-Khada and hunters killed those animals (mostly adult and old individuals) that spent winter in the Little Sea or those came into its bays accidentally.

The Middle Neolithic and Late Bronze Age layers contained canine bones – wolf or dog (see *Table*, Fig. 4). Interestingly, the Middle Neolithic layer comprised burnt canid cranium fragments and the Late Bronze Age layer yielded the part of a canid skeleton with a cut mark on the tibia. Canid bones often are encountered at settlement sites starting from the Mesolithic (Ust-Khaita, Ust-Belaya, and others) and in Baikal Neolithic and Bronze Age burials (Medvedev, 1971; Konopatsky, 1982; Drevniye pogrebeniya..., 2004; Klementyev, Igumnova, Savelyev, 2005). Fragments of a skeleton and a skull of a wolf/dog have been recovered from a habitation site in the Little Sea for the first time.

Another find unusual for the Little Sea sites are bear bones, specifically, penis bones (baculum), of at least two individuals found in the Early Bronze Age layers (II and IV). Such remains have been recorded for the first time at the Little Sea sites. Before, they were recorded only at Kitoi Early Neolithic burial sites in the Cis-Baikal region (Bazaliysky, Weber, 2008).

Artiodactyla remains are represented by several bones of red and roe deer. They have been encountered almost in all chronological units of Ulan-Khada. The bones of birds and rodents are also few in number. Only one bird bone has been examined. It belonged to the sea eagle genus and was recovered from lower layer I attributable to the Middle Bronze Age. Other bird bones are unidentifiable.

Fish bones are more numerous in the Late Neolithic and Early Bronze Age layers than in sediments of other periods (Fig. 5). The Final Mesolithic and Middle/Late Bronze Age layers contained just a few fish bones. The bones of salmonids (possibly whitefish) and of perch (see *Table*) dominate the ichthyofauna remains. The bones of pike, sturgeon, and representatives of the family Cyprinidae, including Siberian roach, also have been identified. The presence of whitefish bones in the Ulan-Khada ichthyofauna assemblage makes it possible to suggest that the site might have been used during the fall (October and December). At this time period, whitefish come for spawning to the Mukhor Bay where the Ulan-Khada Bay is situated (Kozhov, Misharin, 1958; Nomokonova, Losey, Goriunova, 2009a). However, this evidence does not exclude the possibility that people might have visited the Ulan-Khada Bay during other seasons.

Coregonidae are deep-sea fishes. Currently, the Ulan-Khada is the only site with a large collection of whitefish bones, if compared with other sites of the Little Sea (Berloga and Ityrkhei) (Losey, Nomokonova, Goriunova, 2008; Nomokonova, Losey, Goriunova, 2009b). It is hard to say if the whitefish were procured purposefully or incidentally. Other fishes in the assemblage inhabited the Ulan-Khada Bay and other shallow water areas of the Little Sea all the year round; they represent the focus of littoral fishing.

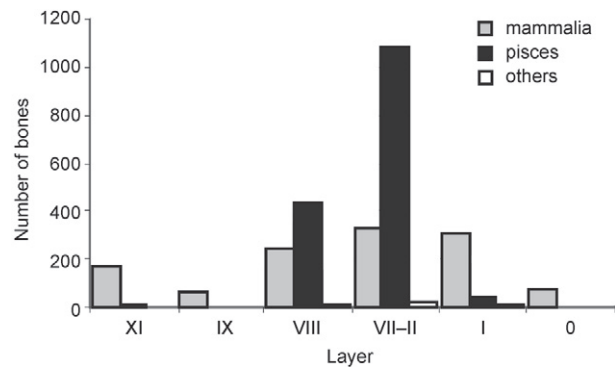


Fig. 5. Distribution of animal categories by layers.

The comparative analysis of animal taxa composition by chronological periods has shown that the faunal remains from the Final Mesolithic (layer XI) and Middle Neolithic (layer IX) are not numerous and these include mostly bones of seal, representatives of the family Cervidae, wolf/dog, sturgeon, and unidentifiable bone fragments. Layers attributable to the Late Neolithic (VIII) and Early Bronze Age (VII–II) have yielded greater quantity of bone remains compared to other culture-bearing sediments. The mammal species composition includes roe and red deer, bear, and the only identified bird is sea eagle. The increase in ichthyofauna was due to the appearance of numerous representatives of Coregonidae and perch, as well as of pike and Cyprinidae (Siberian roach). Fauna remains from the Middle/Late Bronze Age (I) and the Bronze to Iron transitional period (0) layers do not show any particular changes in the mammal species composition, however, they reflect a considerable decrease in the amount of ichthyofauna.

Generally speaking, Ulan-Khada Bay was used by the early populations starting from the Final Mesolithic. The most extensive exploitation of the site occurred during the Neolithic and the Bronze Age. Judging by the fauna remains, the site inhabitants primarily hunted seal and Artiodactyla (roe and red deer). Carnivores (bear and dog) also were hunted, although the reason for this remains unclear. Fishing also was important, especially 4.2–3.8 ka BP (Bronze Age). Representatives of the family Coregonidae, perch, Siberian roach, pike, and sturgeon were mostly caught.

The Ulan-Khada faunal assemblage represents an informative source for the reconstruction of exploitation of the bay by the early populations of the region during the Holocene. Judging by the animals procured here, the site reflects not only the local composition of the fauna in the Olkhon region of Lake Baikal, but also the cultural specifics of predator hunting.

Regrettably, it is difficult to determine whether the same or different animals were hunted at various stages because faunal remains from Ulan-Khada are

too scarce. The present authors intend to undertake a multidisciplinary study of animal bones from the stratified sites in the Olkhon area to assess the cultural and environmental (specifically, climatic) factors which affected the paleoeconomy of Baikal.

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