

Paleoreconstruction of Pleistocene Environments of Human Habitats in the Late Pleistocene and Holocene near the Charyshskii Naves Cave, Central Altai, Russia

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Abstract—The results of the study of the small mammal fauna from the Charyshskii Naves cave (Central Altai, Russia) in the 2003 field season are provided. The dynamics of fossil small mammals was studied and the natural habitats of the ancient man were reconstructed on this basis. Two stages of sedimentation, corresponding to the domination of different biotopes, were recognized.

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INTRODUCTION

Charyshskii Naves is a relatively small, dry cave, 25 m² in area, the greatest height is 4 m. The Charyshskii Naves cave is an archeological site located 10 km from Ust'-Kan, the center of the Ust'-Kanskii District, Central Altai (Fig. 1). This cave is situated at the mid-height of the northeastern slope of a valley that was

formed by small left tributaries of the Charysh River. Charyshskii Naves has a southwestern exposure situated 30 m above a dry stream. The beds are dry and dusty, and the layer integrity is fine. Local people are familiar with Charyshskii Naves and visit it occasionally. The need to clarifying the nature of Upper Paleolithic industry in the Kan Depression led to excava-

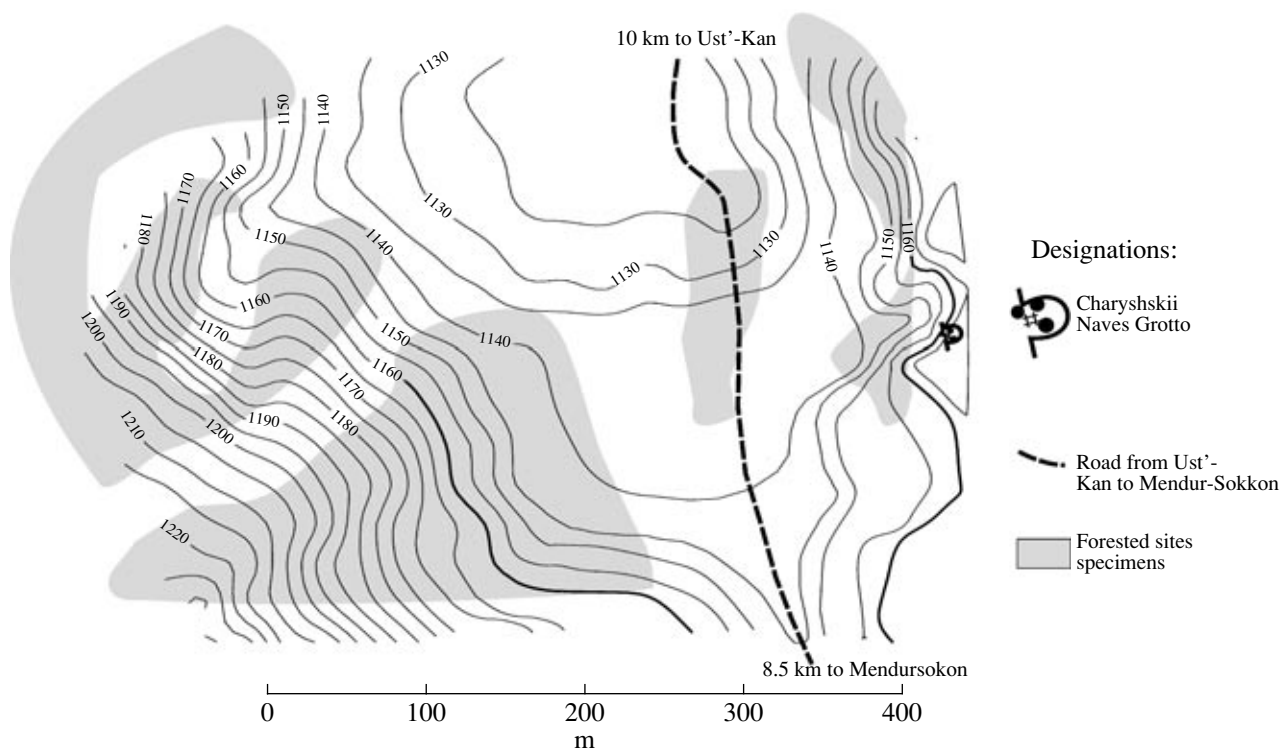


Fig. 1. The Charyshskii Naves site, the map of the working region (after Postnov, 2003).

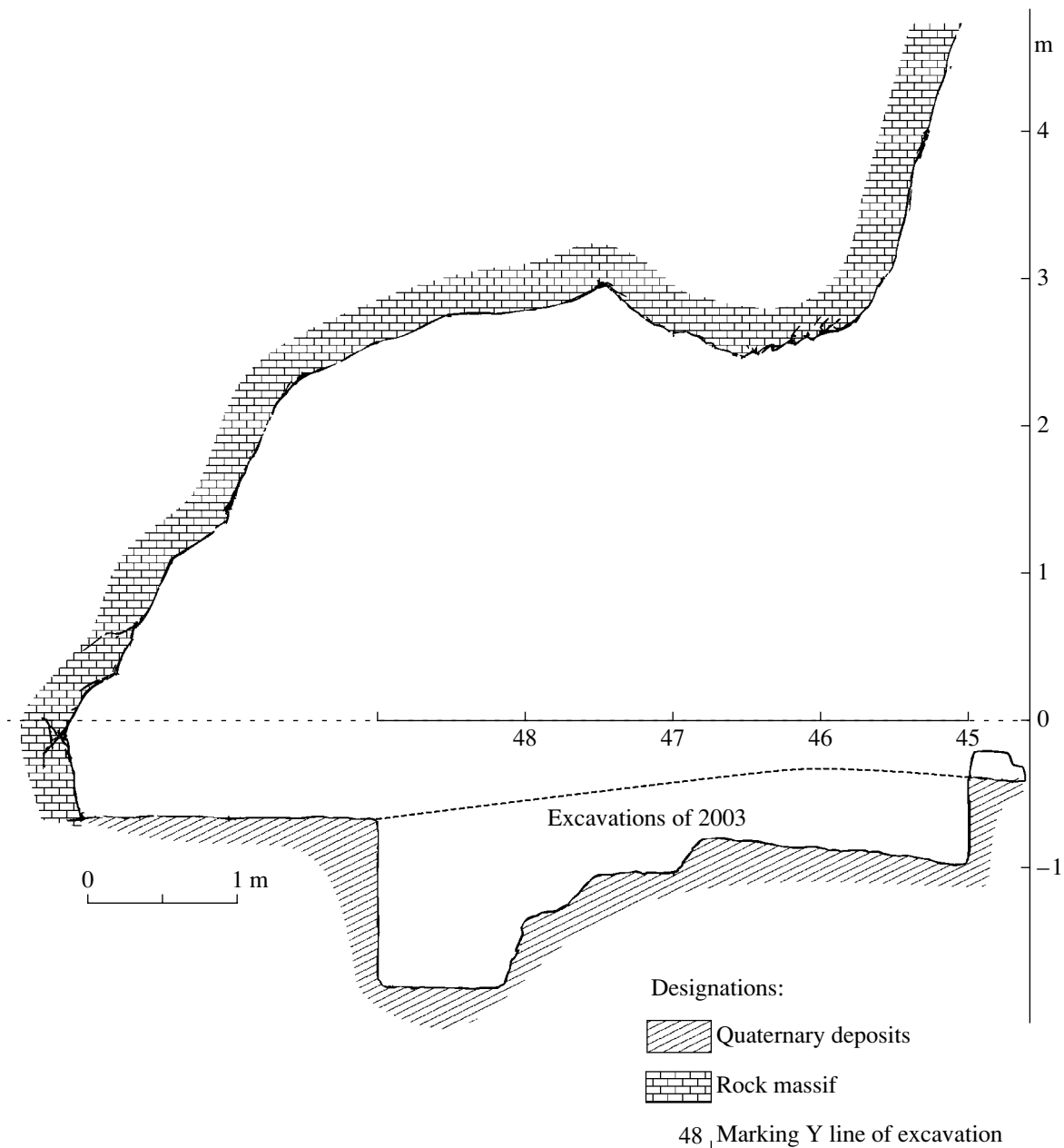


Fig. 2. The Charyshskii Naves site, the northeastern slope of the excavation (after Postnov, 2003), side view.

tions at Charyshskii Naves. In the nearby Ust'-Kanskaya cave and other caves (Strashnaya cave, Okladnikova cave), which are located 30–40 m above the river level, the Upper Paleolithic layers show the influence of the Mousterian tradition. However, in the Upper Paleolithic sites (Ust'-Karakol-1, Anui-2) situated below this mark, Paleolithic industries do not have Levalloisian elements. Sites with similar hypsometric and stone industrial features have not been recorded in the Ust'-Kanskii District. The nearest site found in this area is Charyshskii Naves.

In 2003, the deposits of Charyshskii Naves were excavated within the area of 12 m². Archeological and

faunal specimens were recorded in each layer. Complex studies of archeological sites, engaging various experts (geologists, palynologists, paleontologists), increase research possibilities and allow a more complete reconstruction of ancient human habitats (*Archeology...*, 1998; Derevyanko et al., 1992, 2003). Data on small mammals are successfully used in modern paleontology for paleoreconstructions. Small mammal bones are found in continental sediments dozen of times more frequently than large mammal remains. In addition, small mammals show a high rate of evolution. Most of them are specialized herbivores and, therefore, are strongly attached to their habitats. Any changes in floral

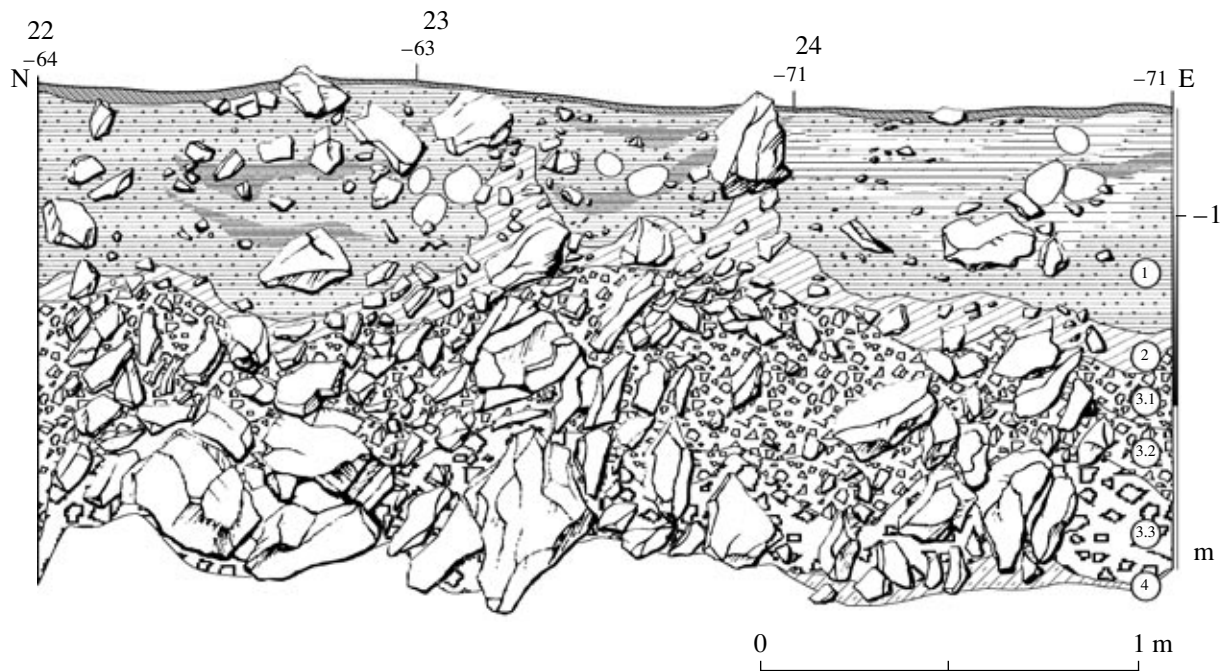


Fig. 3. Northeastern slope of the excavation, stratigraphy.

composition influence the population structure of small mammals. This group has become a favorite indicator group due to its rapid and sensitive response to environmental changes (Kahlke, 1986; Smirnov et al., 1986; Kolfshoten, 1990; Dupal, 1998; Serdyuk, 2000).

STRATIGRAPHY

Our work provided stratigraphic descriptions of four walls, i.e., the northeastern, southeastern, southwestern, and northwestern walls. The sequence is particularly clear in the northeastern wall of the Charyshskii Naves site. The profile is composed of the following layers downwards in the section (Fig. 2).

Layer 1. This layer consists of loamy sand. The layer boundaries are distinct. The thickness is 80 cm. This layer is pierced by mole burrows.

Layer 2. The layer consists of loam with fillers. The layer boundaries are distinct. The thickness is 20 cm.

Layer 3. The layer is composed of limestone blocks and debris, divided into three sublayers. Sublayer 3.1 consists of small and medium-sized limestone blocks. Sublayer 3.2 contains small and medium-sized flat sharp-cornered blocks. Sublayer 3.3 contains large blocks, with a small number of fillers. Visible thickness is 70–80 cm.

All lithological subdivisions contain paleontological and archeological material.

MATERIALS AND METHODS

The position of the cave far from the river prevents the traditional washing excavation. Therefore, prelimi-

nary sifting was used for division of fractions. After that the residual soil was eluted (Derevyanko et al., 2004). Water flushing of rock samples was performed in sieves with 1 mm mesh. Residual concentrate was dried and sieved in soil sieves with 1 to 5 mm mesh. Each bone specimen was labeled, indicating the square, layer, and level numbers, and was preserved. In field conditions, this material was partly examined by N.D. Ovodov. His collection contains about 2500 bone specimens. The rest of the fossil material of small mammals is housed in the Paleontological Institute of the Russian Academy of Sciences (PIN), in the laboratory of Mammals under collection no. 5124. For our work we used an MBS-12 binocular microscope. The bone material is rather fragmentary, but of good preservation, and comprises teeth and isolated bones.

Fossil material from Charyshskii Naves probably mostly results from pellets produced by birds of prey, as is characteristic of small mammal specimens from caves. This is supported by the presence of traces of digestive juice on the bones and teeth. A total of 10174 bone fragments were identified. The results were summarized for each layer; the species composition, absolute numbers, and proportions of small mammals were determined, and the population dynamics estimated.

POPULATION DYNAMICS OF SMALL MAMMALS

Figure 3 displays the changes in the fossil small mammals. Apart from the collection stored in PIN, I analyzed the results of N.D. Ovodov's research. Ovodov's collection contains certain species that sup-

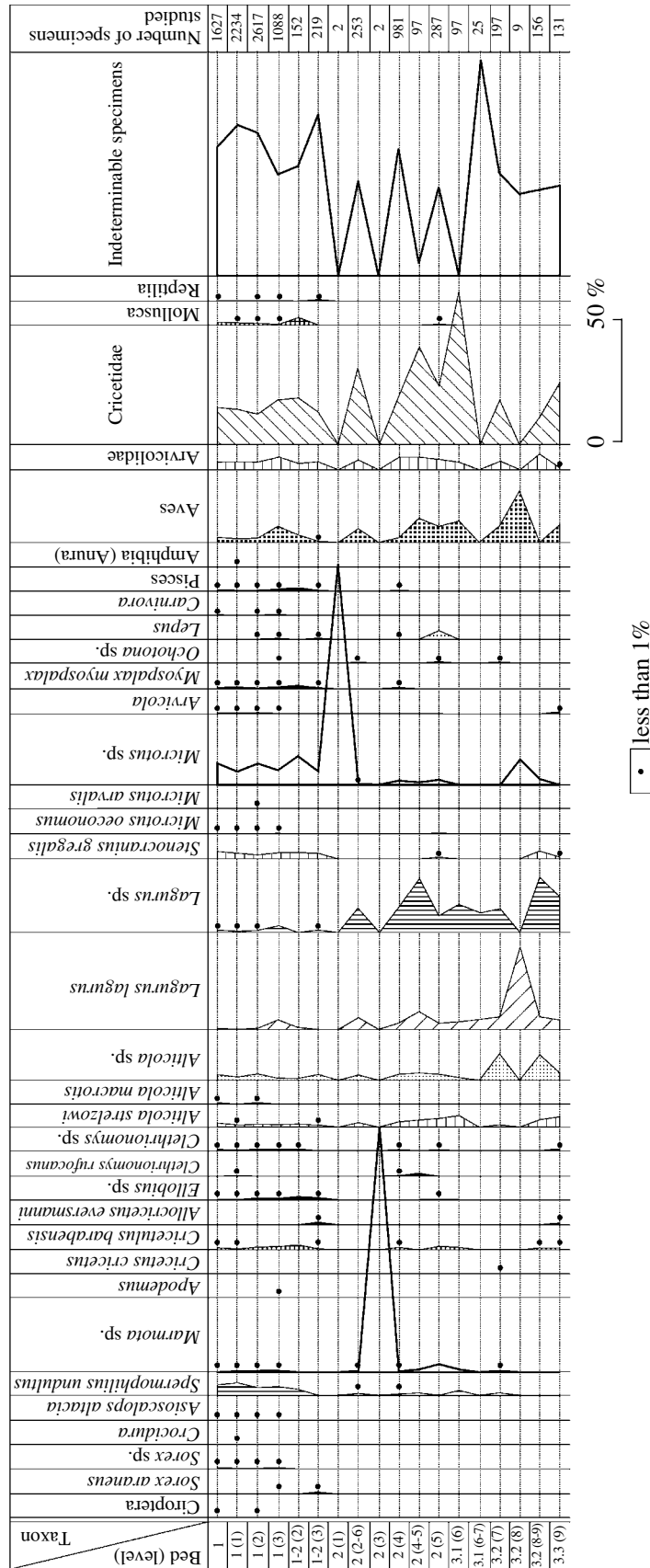


Fig. 4. Dynamics of the numbers of small vertebrates in the Charyshskii Naves locality.

Table 1. Number of large mammal specimens in the layers of Charyshskii Naves

Taxon \ Layer	1	2	3	Total
Fox <i>Vulpes vulpes</i>	3	0	3	6
Fox <i>Vulpes</i> sp.	1	0	0	1
Horse <i>Equus</i> sp.	2	3	1	6
Deer <i>Cervus elaphus</i>	47	0	0	47
<i>Ovis-Capra</i>	48	47	2	97
Small ungulates	94	147	147	388
Large ungulates	6	7	0	13

Table 2. Number of stone artifacts and large mamal bones in the layers of Charyshskii Naves

Layer	Stone artifacts	Large mamal specimens
1	333	1220
2	339	404
3.1	161	85
3.2	233	86
3.3	91	86

plement our species list. In particular, *Asioscalops* sp., *Eutamias* sp., *Allactaga* sp., and *Apodemus* sp. were added to the species list of layer 1, and *Castor* sp. was added to the list of layer 2.

The overall composition of small mammal fossil remains from Charyshskii Naves and morphological characters of the teeth of common species suggest an Upper Pleistocene age for this fauna. No significant changes occurred in the small mammals population. According to the species distribution in the deposits of Charyshskii Naves, the time of layer accumulation can tentatively be divided into two periods, the period from layer 3.3. to layer 2 and the period of accumulation of layer 1.

At the first stage, typical open-space species are present: steppe lemmings of the genus *Lagurus*, rock voles of the genus *Alticola* (flat-skulled and large-eared ones), the pikas *Ochotona*, and the tolai hare *Lepus tolai* were recorded. The second stage is characterized by the presence of the following mammals: the ground squirrel *Spermophilus undulatus*, the striped hamster *Cricetulus barabensis*, the narrow-skulled vole *Stenocranius gregalis*, and the northern mole vole *Ellobius* sp. However, the water vole *Arvicola* and the tundra vole *Microtus oeconomus*, species that prefer moist biotopes, were also found. Solitary representatives of Chiroptera occurred, while they were absent from the lower layers. Previous research (Agadjanian, 1998) showed that the presence of ancient man disrupted bat lifecycle and forced bats to leave habitats.

The facts suggesting the presence of man are discussed below.

POPULATION DYNAMICS OF STONE ARTIFACTS AND LARGE MAMMALS

The presence of ancient man is manifested by domestic articles, artifacts, and stone tools found in the cave. Large mammal bones with treatment marks are also evidence of the presence of humans. Figure 4 shows that the number of stone artifacts decreases from layer 3.2 to the present, while the large mammals increase in number. The largest proportion of artifacts (73%) is in layer 3.2. The reduction of artifact number is probably a consequence of decreasing frequency of human visits to the Charyshskii Naves site. At the same time, the increase in the number of large mammal

remains is a consequence of growing activity of the predators that inhabited the cave in the absence of ancient man. Bones of large mammals with cuts, traces of fire and gastric juice were found in insignificant quantities.

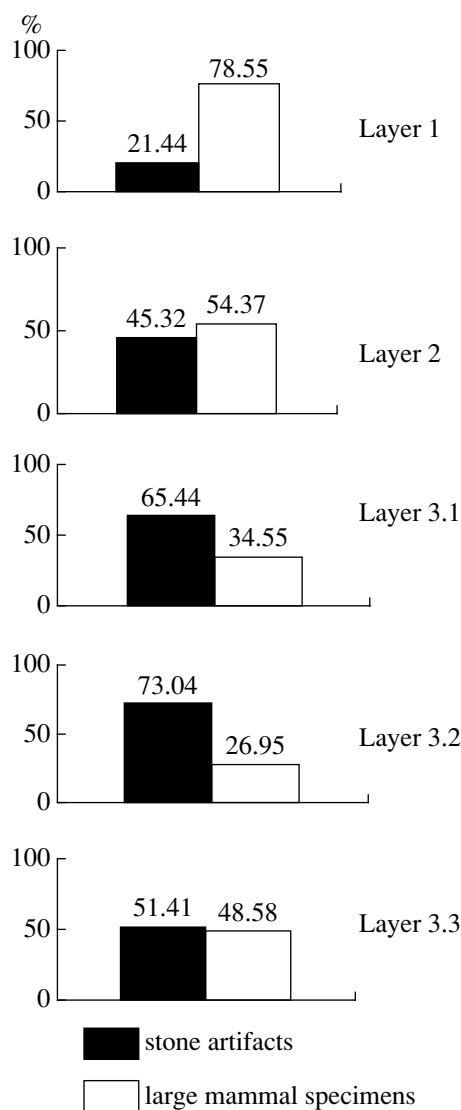


Fig. 5. Distribution of artifacts and large mammals over the layers of the Charyshskii Naves site, %.

Table 3. Landscape climatic conditions near the Charyshskii Naves in the Late Pleistocene and Holocene

General scale of Quaternary System (1998)					Regional unit		Age, ka	Climatic phases and dominant landscapes	Layer	Species indicating conditions	
System	Superdivision	Division	Unit	Step	Superhorizon	Horizon					
Quaternary	Holocene		Recent			Recent	10 (11)	warm, humid forb steppes mixed forest	1(1)–1	<i>Myospalax myospalax</i> , <i>Ellobius</i> sp., <i>Cricetulus barabensis</i> , <i>Asioscalops</i> sp., <i>Clethrionomys</i> sp., <i>Arvicola</i> sp.	
								cool, dry forb–grassy steppe	1(2)	<i>Myospalax myospalax</i> , <i>Spermophilus undulatus</i> , <i>Lepus</i> sp.	
								warm, moderately humid forest–steppe, nival biotopes, dark coniferous or mixed forest	1(3)	<i>Cricetulus barabensis</i> , <i>Ellobius</i> sp., <i>Lagurus</i> sp., <i>Ochotona</i> sp., <i>Lepus</i> sp., <i>Arvicola</i> sp., <i>Microtus oeconomus</i> , <i>Apodemus</i> sp., <i>Clethrionomys</i> sp.	
	Pleistocene	Neopleistocene	Upper III	Forth	Zyryanian	Sartanian		22 (23)	transitional forest–steppe	1-2(2)–2(1)	<i>Cricetulus barabensis</i> , <i>Arvicola</i> sp., <i>Allocricetus eversmanni</i>
									cool, dry grassy steppe	2(2-6)–2(3)	<i>Lagurus lagurus</i> , <i>Marmota</i> , <i>Alticola</i> , <i>Ochotona</i>
									moderately cool mixed or coniferous forest, nival biotopes	2(4)–2(4-5)	<i>Myospalax myospalax</i> , <i>Cricetulus barabensis</i> , <i>Alticola</i> , <i>Lagurus</i> sp., <i>Ellobius</i> sp., <i>Clethrionomys</i> sp.
									transitional forb steppe	2(5)	<i>Ellobius</i> sp., <i>Clethrionomys</i> sp., <i>Marmota</i> , <i>Lagurus</i> sp., <i>Stenocranius gregalis</i>
									cold, dry grassy steppe	3.1(6)–3.1(7)	<i>Lagurus lagurus</i> , <i>Cricetus cricetus</i> , <i>Marmota</i> , <i>Allocricetus eversmanni</i>
		warm moderately humid coniferous forest	3.2(8-9)–3.3(9)	<i>Stenocranius gregalis</i> , <i>Clethrionomys</i> sp., <i>Arvicola</i> sp.							

RECONSTRUCTION OF ANCIENT HUMAN HABITATS

Palynological examination provides very significant data for paleoreconstruction. Palynological samples were taken from three layers. The samples from layers 2 and 3 are similar in both composition and palynological profile. Pollen of Compositae, Chenopodiaceae, and Ranunculaceae dominates. *Ephedra* pollen is also present. The pollen of trees found in the samples belongs to birches (*Betula* sp.) and pines (*Pinus* sp.). Spores of ferns (Polypodiaceae, cf. *Pteridium* sp.), green mosses, and fungi also occur (Postnov et al., 2005).

Samples from layer 1 have a substantial amount of pollen of shrubs: alders (*Alnus* sp.) and willows (*Salix* sp.). The content of pollen belonging to trees (pine-trees and birches) reaches the highest percentage for all spore and pollen specters studied in this site; pollen of sedge and pondweed and other Cyperaceae and Poaceae as well as solitary diatom algae are also recorded, while pollen of *Ephedra* is absent (Postnov et al., 2005).

When producing a paleoreconstruction based on small mammal data, a researcher faces some difficulties

which were repeatedly discussed in the literature (Andrews, 1990; Kowalski, 1990; Agadjanian and Serdyuk, 2005; etc.). Various biotic and abiotic factors influence the accumulation pattern of the bone specimens in cave deposits. The factors may be nonbiological or biological. In particular, if animals and humans effect the accumulation of fossil remains, their feeding selectivity is involved. It is clear that pellets predominantly contain species from open landscapes, which are consumed by particular predators. Therefore, the species list from pellets will differ from the list of species inhabiting the area under study. Consequently, even scarce finds of forest species are evidence of a taiga component in the respective period.

The present study shows that there were no sharp environmental changes during the deposit formation in Charyshskii Naves. This fact is well supported by the data on palynological spectra and small mammal composition. The lists of fossil small mammals and plants are stable.

Based on small mammals, two climatic periods are tentatively recognized in Charyshskii Naves. The first stage is characterized by the domination of open

unwooded spaces, mixed grass steppes. Rock voles, which prefer stony steppes, are evidence of the presence of nival elements in the Charyshskii Naves environs. The presence of mixed coniferous–small-leaved forests on the northern slopes cannot be excluded. Possibly, the climate was more severe than nowadays. Steppe lemmings recorded at this stage are an indicator of cool, dry conditions. The hydrological regime of the nearby stream was not stable, since records of beaver and water vole are infrequent.

The second stage of sedimentation was distinguished by the expansion of forests. The number of steppe species decreased, while the number of forest species increased. The typical inhabitants of broad-leaved forests, such as chipmunk and wood mice, appeared. At that time, the stream was deep. Probably it became dry recently. The flood plain was inhabited by water voles, tundra voles, and narrow-skulled voles. The northern mole vole and striped hamster testify to a mild climate, resembling the contemporary climate.

At the time of sedimentation of layers 3 and 2, Charyshskii Naves cave was visited by people regularly; starting from the beginning of the formation of layer 1, humans visited it less often.

The first stage of sedimentation is compared to the Sartanian Cold Period, which is dated about 22 ka. The second stage of sedimentation is compared to the Holocene stage of paleogeographical history. The results of small mammal study agree with the conclusions of palynological analysis and radiocarbon data on layer 1, i.e., 1950 ± 35 years (SO RAN-5296) and 1200 ± 40 years (SO RAN-5297).

CONCLUSIONS

(1) The lower layers of the Charyshskii Naves site are dated Upper Pleistocene.

(2) Two stages were recognized in the course of sedimentation in Charyshskii Naves. At the first stage, open landscapes (steppe areas) prevailed. During the subsequent period (second stage), forest and damp biotopes occupied a significant area.

(3) The presence of humans at the first stage was more expressed than at the second stage.

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