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New data on Late Pleistocene–Holocene small mammal communities from the Ural–Sakmara interfluve, Southern Urals

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ABSTRACT

The paper deals with new fossil material, about 9400 cheek teeth, from 24 elementary samples received from loose deposits of 2 karst cavities – Chernorechka and Chernorechka-2, and 2 rock shelters – Verbluzhka-1 and Verbluzhka-2 located in the Ural–Sakmara interfluve (at about 51°N). One small lagomorph taxon (Lagomorpha) and 30 rodent taxons (Rodentia) were determined from which 4 taxon doesn't inhabit investigated territory nowadays: *Eolagurus luteus*, *Pygeretmus pumilio* and *Pygeretmus* sp., for *Eliomys quercinus* marked the most southern-east point in the area history. Nine stages of the community's development were marked out. The domination of *Lagurus lagurus*, *Eolagurus luteus* and *Microtus gregalis* from the most ancient community concerned it to typical Late Pleistocene steppe type of communities described from the adjacent South Trans-Urals territories. The Holocene time interval is marked by the domination of *Ellobius talpinus* and *Microtus* ex gr. *arvalis* as well as yellow steppe lemming in the community core (four stages). Then in the core composition appeared *Sicista* sp. and *Cricetus cricetus* (four stages) and small mammal communities obtained the mesophilous look. The increasing of xerophilous elements in the last centuries and dozen years reflected regional peculiarities of modern steppe conditions in the south extremity of the Ural mountains.

1. Introduction

Modern steppes as all other known zonal types of ecosystems of Northern Eurasia presented hyperzonal tundra-steppe, hyperboreal, nonanalogue communities of plants and animals of the Late Pleistocene (Agadjanian, 2001; Dinesman, 1977; Markova and Puzachenko, 2007; Smirnov, 2001; Velichko, 2002; and others), or "Mammoth steppe" as was suggested by Guthrie (1990). The development of modern steppe faunistic complexes of small mammals was examined in consideration of geographical peculiarities (Markova et al., 2008) and its evolution was observed investigations (Agadjanian, 2004; Alexeeva et al., 2001; Erbajeva, 1970; Erbajeva et al., 2011; Khenzykhenova, 2008; Markova, 2004; Dmitriev, 2001; Dupal, 2005; Oparin, 2005). The history of mammal communities of the South Urals in Late Pleistocene and Holocene has been examined in a series of discoveries (Danukalova, 2010; Kosintsev and Bachura, 2013; Smirnov et al., 1990; Stephanovskiy et al., 2003; Yakovlev, 2003; Yakovlev et al., 2005; and others). Dynamics of small mammal communities of modern Ural steppe territories was mostly described for the Magnitogorsk key-territory of the South Trans-Urals (Smirnov and Kuzmina, 2005; Kuzmina, 2009) with additional data that specified the details of composition and population structure during Late Pleistocene (Novoselova and Kuzmina, 2012; Kuzmina and Smirnov, 2013; Smirnov et al., 2014).

Data on small mammal community dynamics of the Ural–Sakmara interfluve in this time interval were absent until the present investigations (Kuzmina, 2008, 2014; Kuzmina and Ulitko, 2010). Understanding the dynamics of communities in this region is new and important because previous investigations (made by Eversmann, 1850; Zarudny, 1897 in Rudi, 1996; Kirikov, 1952) were applied with the historical dynamics, community dynamics of the few last centuries or dozen years. The investigations of centuries-old and thousand-year dynamics of small mammal communities of this region defined the aim of the research: to examine species composition and population structure of small mammal communities, to distinguish the main stages of community development and to specify its features in comparison to adjacent steppe territories of the South Trans-Urals to reveal regularities of transformation of the Ural steppe small mammal communities from "Mammoth steppes" to modern zonal steppe complexes. The relative dating is made on the basis of biostratigraphy and types of

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communities from each geologic layer. Designation of the final stages of Late Pleistocene followed Markova et al. (2008). The Holocene subdivisions correspond to Walker et al. (2012).

2. Regional characteristics

2.1. Geographical location

Ural–Sakmara interfluve is a territory in the southernmost (at about 51–52°N) Ural mountains (Fig. 1). It is characterized by an hummock-ridge and ridge-hilly relief and arid climate. Vegetation includes classic and rocky steppes and its anthropogenic variants, mainly herb–stipa–fescue steppes. The soil type is common ordinary black soils (chernozem) (Gerasimov, 1968; Yeremenko, 2006). The Ural–Sakmara interfluve is bordered with forests of the Southern Urals mountain ridge in the north and dry steppes and semideserts of Mugodzhar mountains in the south (Gerasimov, 1968).

2.2. Modern small mammal animal population

According to modern landscape-zoogeographic zonation, the Ural–Sakmara interfluve lies in the Southern-Urals lowland steppe province (Marvin, 1969; Chibilev et al., 1993). This province contains 27 species of small and medium size herbivore mammals in 7 families (given by Gromov and Erbajeva, 1995) and 2 orders (rodents and lagomorphs): Lagomorpha, Fam. Ochotonidae – *Ochotona pusilla* (steppe pika); Rodentia, Fam. Sciuridae – *Spermophilus major* (big souslik), *S. pygmaeus* (small souslik), *Marmota bobak* (steppe marmot); Fam. Castoridae –*Castor fiber* (beaver); Fam. Dipodidae – *Sicista betulina* (forest birch mouse), *S. subtilis* (steppe birch mouse), *Allactaga major* (big jerboa); Fam. Muridae – *Micromys minutus* (harvest mouse), *Apodemus* (*Sylvaemus*) *uralensis* (small forest mouse), *A. (S.) flavicollis* (yellow-necked mouse), *A. agrarius* (field mouse), *Mus musculus* (house mouse), *Rattus norvegicus* (common rat); Fam. Cricetidae – *Allocricetulus eversmanni* (Eversmann' hamster), *Cricetulus migratorius* (grey hamster), *Cricetus cricetus* (common hamster), *Clethrionomys glareolus* (bank vole), *Arvicola terrestris* (water vole), *Microtus oeconomus* (root vole), *M. arvalis* (common vole), *M. agrestis* (field vole), *M. gregalis* (narrow-skulled vole), *Lagurus lagurus* (steppe lemming), and *Ellobius talpinus* (common mole vole).

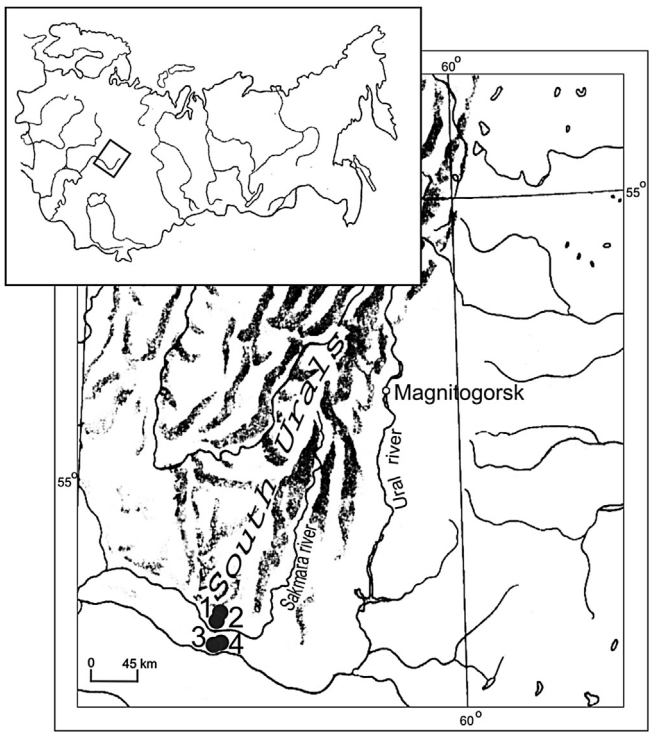

Fig. 1. Investigated area. 1 – Chernorechka cave; 2 – Chernorechka-2 grotto; 3 – Verbluzhka-1 rock shelter; 4 – Verbluzhka-2 rock shelter.

Two species should be marked especially. Northern red-backed vole (*C. rutilus*), Fam. Cricetidae, is not noted in the fauna composition of the region's literature data (Chibilev et al., 1993). Rudi (1996) also noted that this species is absent in the steppe zone and inhabited only forest-steppe zones (forest habitats avoiding damp flood-lands) of the Southern Urals. Another is a very rare species, flying squirrel (*Pteromys volans*), Fam. Pteromydae, that inhabited the flood-land forests of the Sakmara river (Kirikov, 1952; Rudi, 1996).

Mammal faunal complex is characterized by a combination of typical forest and typical steppe species. The steppe species form the dominant ecological group in the modern small mammal population and consists of 11 taxa (Chibilev et al., 1993).

The group of common species includes the following ecological groups: steppe species – steppe pika, big and small sousliks, steppe marmot, steppe birch mouse, big jerboa, steppe lemming, common mole vole; meadow species – common hamster, common vole, field mouse, harvest mouse; forest species – field vole, small forest mouse; riverside species – water vole; and synanthropic species – house mouse and common rat. The group of rare species includes: steppe species – grey and Eversmann' hamsters, narrow-skulled vole; forest species – bank vole, yellow-necked mouse, forest birch mouse, northern red-backed vole, flying squirrel; riverside species – beaver, root vole (Chibilev et al., 1993).

3. Characteristics of the sites

The research was focused on fossil materials from the cave Chernorechka and the grotto Chernorechka-2. Subfossil materials were collected from eagle-owl nests in the rock shelters Verbluzhka-1, Verbluzhka-2 (Orenburg region, Russia).

Chernorechka cave (51°32′N, 56°43′E) is situated in the eastern slope of the Nose-Mountain (Saraktash district of Orenburg region) on the left bank of the river Chernaya rechka (Black River) near its confluence with the Sakmara river. The Nose-Mountain height is about 218 m from flood land of Chernaya rechka, and the incline of the slope is about 45°. The mountain is formed by Sakmara stage Permian limestones. The cave is 8–10 m below the mountain top. Orientation of the entrance is southwest, and the cave length is about 20 m. A borrow pit 0.5 × 1 m^2 was put in the internal part of the cave, 3 m from the entrance, in 2003 and 2009. Loose deposits that were excavated in 2003 in relative horizons of 5–10 cm are presented in this investigation. Nine relative horizons were taken in total.

The stratigraphy of loose deposits from Chernorechka cave contained 3 layers. Layer 1 (0.2 m) is black humus loamy sand with a large quantity of multi-sized angular limestone rubble. Layer 2 (0.4–0.5 m) is taupe-coloured faintly humus loamy sand. Layer 3 (maximum 0.8 m) is hazel-coloured loamy soil lying between a slab and a wall of the cave.

Chernorechka-2 grotto (51°32′N, 56°43′E) is situated on the northern slope of Nose-Mountain at the height of 210 m from the flood land. The width of the grotto is 110 cm, the height is 50 cm, and the length 105 cm. The joint entrance extends for more than 3 m. Most likely, Chernorechka-2 joined the cave Chernorechka through joints and fractures of the Nose-Mountain. This grotto is used by foxes as a den (part of bones on the surface were strongly gnawed) and sometimes by birds of prey as a nest (the intact jaws of rodents indicated the pellets' origin of the part of the material). A borrow pit 0.5 × 0.5 m^2 was excavated in the middle part of the

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