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Insectivorous mammals (Lipotyphla, Soricidae) of the Perm Pre-Ural in the Late Pleistocene and Holocene time

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ABSTRACT

Remains of 8 species (Soricidae: *Sorex minutissimus*, *S. minutus*, *S. caecutiens*, *S. tundrensis*, *S. isodon*, *S. araneus*, *Neomys* sp., *Crociodura* cf. *leucodon*) have been found in Late Pleistocene and Holocene layers from 9 localities of the Perm Pre-Ural. Their description, systematic position, and temporal distribution are given. *S. tundrensis* dominated in the explored territory until the early Holocene. Currently, this species is very rare. Fossil white-toothed shrew (*Crociodura* cf. *leucodon*) has been discovered for the first time in the study area.

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1. Introduction

Excavations (1999–2012) of karst cavities and rock deposits, situated in the Perm Pre-Ural (Yayva – Kizel – Gubakha, 59°31′–58°55′ N; 57°41′–57°30′ E), have provided rich collections of bones of Pleistocene and Holocene vertebrates. The total amount of small remains obtained by these excavations exceeded 180 000 molars, maxillas, and mandibles. Until recently, characterization of faunal complexes of the Late Pleistocene and Holocene was based on data obtained as a result of a study of rodents (Order Rodentia). However, our current knowledge about fossil representatives of the insectivores were limited. There are two reasons for this: 1) bones of insectivorous mammals were found in relatively smaller quantities in comparison with the bones of rodents in the investigated sediments of caves and on rocky sites; 2) there are no clear criteria of species identification of bone insectivorous mammals, particularly their mandibles. Most fossils of this group were identified only to family or genus levels (Fadeeva and Smirnov, 2008). As a result, all new information concerning the fossil insectivorous mammals of the Perm Pre-Ural, is very valuable and important.

Two genera and seven species of red-toothed shrews (*Neomys fodiens*, *Sorex minutissimus*, *S. minutus*, *S. caecutiens*, *S. tundrensis*, *S. araneus*, *S. isodon*) are known in the recent insectivore fauna of Perm Pre-Ural (Demidov and Demidova, 1990; Samokhvalov et al.,

2010). Among recent insectivores, the Eurasian shrew (*Sorex araneus*) is the most numerous species, living in several geobotanical districts (Table 1).

The fossil material was obtained from 9 localities (Fig. 1): caves – Makhnevskaya ledyanaya, Makhnevskaya-2, Bolshaya Makhnevskaya, Dolgogo Kamnya-1, Dolgogo Kamnya-3, Verkhnegubakhinskaya, grot Rasik, rocks Koziy, Lazarevskiy. Numerous partial and complete maxillae and mandibles of fossil insectivorous mammals are part of these collections. The fossil material included all genera of insectivorous mammals (hedgehog, mole, red-toothed shrews) living at present in the study area. Fossil bones of hedgehog and mole are rare and fragmentary. White-toothed shrews are found only in fossil form in the study area. The fossil samples and part of the modern bones are housed and catalogued in the Mining Institute of the Ural Branch, Russian Academy of Sciences. The list of radiocarbon dates is given in Table 2. The subdivision of the Holocene is represented by the new official scheme of the Commission of Stratigraphy (an Early-Middle Holocene boundary at 8200 BP and Middle-Late Holocene boundary at 4200 BP) (Walker et al., 2012).

Twenty-seven variables of the mandible of red-toothed shrews (Fig. 2) were measured to the nearest 0.01 mm using an ocular micrometer (with increasing 2×–4×) in binocular microscope. Some measurements (i-m3, h m1 prot., h m1 hyp., h m1 pigm, h i, l i) were made only for mandibles of young animals (subadultus) with teeth without traces of the erasure. Morphometric characteristics of fossil bones of white-toothed shrews are described in the text. Angles of internal temporal fossa were measured with an ocular protractor (Kochev, 1984).

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Table 1
Proportion of recent species of shrew (%) in the Perm regions (LCT – light coniferous taiga forests; DCT – dark coniferous taiga forests; WST – western section of the southern taiga; EST – eastern section of the southern taiga; CBF – coniferous-broadleaved forests; MT – mountain taiga; KFS – Kungur forest-steppe).

Species/geobotanical or administrative district	LCT ^a	DCT ^a	WST ^a	EST ^a	CBF ^a	MT ^a	KFS ^a	Chusovskoi district ^b
<i>Sorex araneus</i>	100	87.9	86.5	86	90.4	98	100	86.9
<i>Sorex caecutiens</i>	–	9.1	6.4	3.5	6.6	–	–	6.7
<i>Sorex minutus</i>	–	–	2.6	1.4	2.9	–	–	1.7
<i>Sorex isodon</i>	–	–	3.8	6.3	–	2	–	3.5
<i>Sorex tundrensis</i>	–	–	–	–	–	+	–	0.4
<i>Sorex minutissimus</i>	–	–	–	–	–	+	–	–
<i>Neomys fodiens</i>	–	3	0.7	2.8	0.1	–	–	0.8

^a 1983–1988 years (by Demidov and Demidova, 1990).

^b 2005–2008 years (by Samokhvalov et al., 2010).

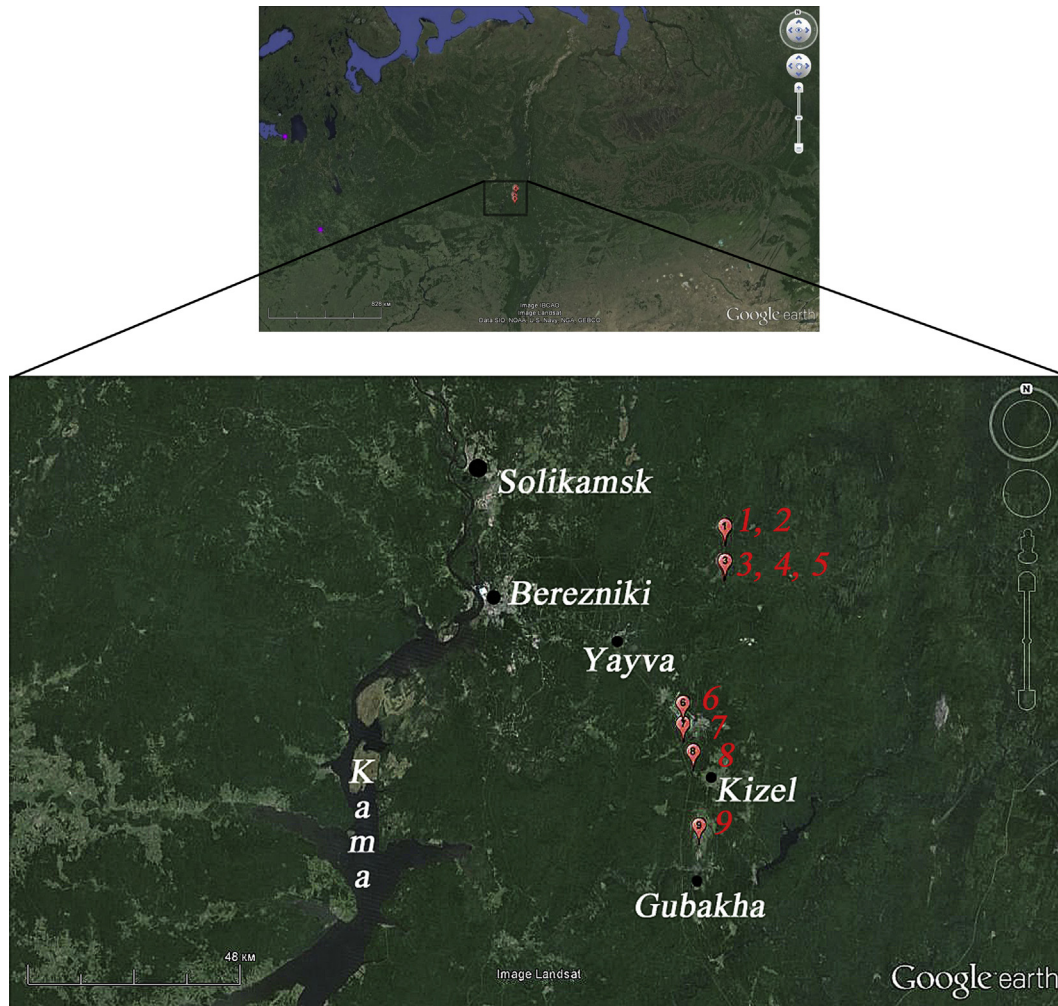


Fig. 1. Map of fossiliferous localities in the Perm Pre-Urals. Caves – Dolgogo Kamnya-3 (1), Dolgogo Kamnya-1 (2), Bolshaya Makhnevskaya (3), Makhnevskaya ledyanaya (4), Makhnevskaya-2 (5), Verkhnegubakhinskaya (9), grot Rasik (8), rocks – Koziy (6), Lazarevskiy (7).

2. Systematic paleontology

Class MAMMALIA Linnaeus, 1758
Order LIPOTYPHILA Haeckel, 1866
Subfamily Soricinae Fisher von Waldheim, 1817
Family Soricidae Fisher von Waldheim, 1817
Genus *Sorex*, 1758
Sorex minutissimus Zimmermann, 1780
(Fig. 3 (A, A', A*); Table 3)

Material. Fossils mandibles: **Late Pleistocene:** Late Valdai (Lateglacial transition) (Makhnevskaya-2 cave: layer 4 – 1; grot Rasik: layer B28 – 1); **Middle Holocene - Late Holocene** (Atlantic-Subboreal) (Bolshaya Makhnevskaya cave: layers 1.40–1.47 m – 4; 1.50–1.55 m – 1). **Recent** mandibles: Perm region, Dobrynskiy district, Nigee Zadolgoye – 1.

Description. Small size shrew. The descending branch of the mandible is thin. It has almost equal heights from the level of p4 and m3. Height of m1 is more than height of the descending branch. The mental foramen is located under the rear part of the protoconid

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