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Remains of small mammals from fossil burrows in the archaeological Pleistocene site Ihrovytsya (western Ukraine)

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Abstract. This paper presents the results of study on fossil materials collected from the archaeological site Ihrovytsya I (western Ukraine). The small mammals remains were accumulated inside fossil animal burrows. Six taxa of rodents (*Spermophilus* sp., *Microtus gregalis*, *Microtus arvalis/gregalis*, *Microtus* (*Terricola*) sp., *Dicrostonyx gulielmi* and *Lemmus lemmus*) and one taxon of lagomorphs (*Ochotona pusilla*) were identified among the collected bone remains. Species representation indicates a typical steppe-tundra community related with a cool climatic period. The age of the assemblage is confirmed by their position in a stratified and previously geologically investigated profile and should be connected with early part of the Last Glaciation (MIS 5a-5b or early part of MIS 4).

Key words: fossil rodents, late Pleistocene, taphonomy, Eastern Europe.

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I. INTRODUCTION

The archaeological site Ihrovytsya I (Ukr. Игровиця) is located in the Seret river basin, about 20 km to the north of the city Ternopil', GPS coordinates: 49°40´26´´N , 25°32´37´´ E (Fig. 1). During the geological-archaeological field survey in 2010 the presence of some

post-sedimentary structures in a lower part of the profile was noticed. The found structures can be interpreted as several generations of animal burrows. As the archaeological trench had been opened for several years, it was not clear if the burrows are fossil or modern structures. However, detailed observations noted the presence of sparse bone remains of small mammals in the fillings of some of the burrows. Systematic studies of these remains allowed an estimation of the age of these structures. To verify the quantity of the bones deposited in burrows and to recognize if they represent a fossil faunal complex, the remains were separated from the sediment and taken for palaeontological analysis.

II. MATERIAL AND METHODS

The profile of Ihrovytsya site consists mainly of Pleistocene loess overlying the Neogene marine sands of Paratethys (SYTNYK 2000; SYTNYK et al. 2001). The upper part of the sands formed parent material for a forest paleosol of luvisol type that surely had developed before the sedimentation of the loess series. The topsoil had been almost totally eroded and the remaining part of the soil was disturbed by cryogenic deluvial processes. Only the illuvial horizon B is quite well preserved. The soil type and its relation to the overlying loess series indicates the similarity to the lower soil of the Horokhov paleosol complex, well known from many sites of Western Ukraine and South-Eastern Poland (MARUSZCZAK 1994; MADEYSKA 2002) as well as from the neighboring sites (BOGUCKYJ et al. 2009). Fossil soils of that type are related to Eemian Interglacial and early part of the Last Glaciation (MIS 5a-5e, see BOGUCKYJ & ŁANCZONT 2002). The pa-

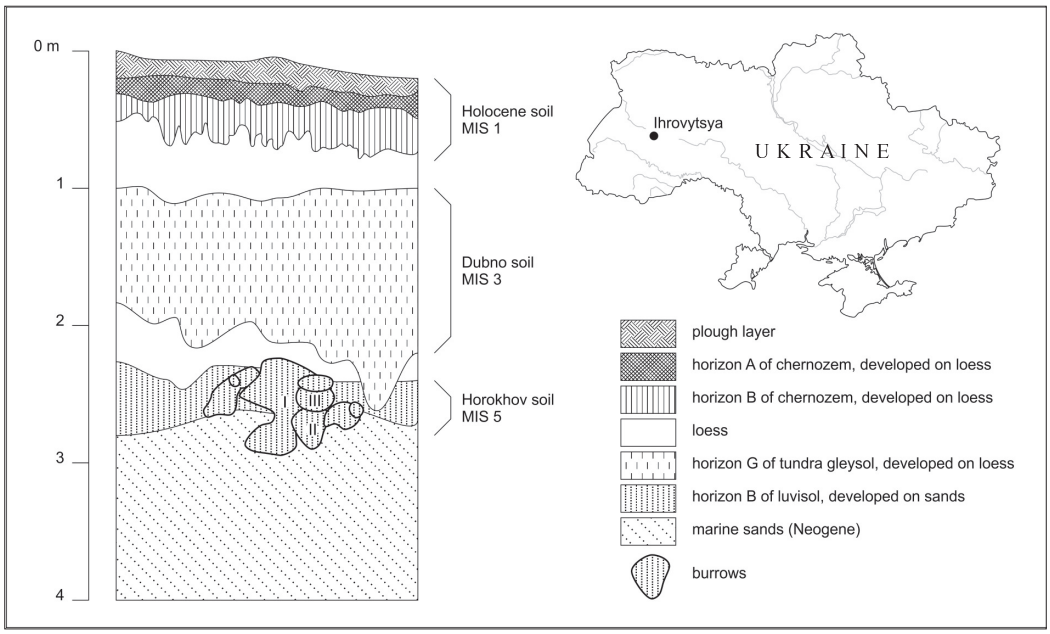

Fig. 1. The profile and localization of Ihrovytsya I site in Ukraine. I, II, III – examined animal burrows. Stratigraphy according to SYTNYK (2000) and SYTNYK et al. (2001).

leosol is covered by loess series. Both in the paleosol itself and in the lower part of loess there occurs a dispersed cultural horizon with Middle Palaeolithic artifacts (SYTNYK 2000). All mentioned sediments are cryoturbated. In the upper part of the loess a tundra soil of Dubno type is developed (MIS 3). Above occurs a thin layer of loess related to the Last Glacial Maximum (MIS 2) with Upper Palaeolithic artifacts and the Holocene chernozem in the uppermost part of the profile.

The fossil animal burrows are located within the horizon B of Horokhov soil and partially in the top of Neogene sands (Fig. 1). Their average diameter is between 20 and 30 cm (Fig. 2). Several generations of the burrows and the sequence of their origins could be indicated on the basis of their mutual cross-cutting. All of them are filled with sands of the horizon B of Horokhov soil, mixed with clear Neogene sand and rarely with humic sand, however no traces of loess could be found inside the fillings. They show a sinusoidal lamination. The occurrence of faunal remains was noticed during field works in only one burrow numbered I (Fig. 1). That burrow and additionally two other neighboring burrows (number II and III) were sampled. From each chosen burrow a 10 kg sample was carefully taken. The sediment was next dried and sieved. Bone or tooth remains were picked and identified under stereoscopic microscope with magnitude 10-12 x.

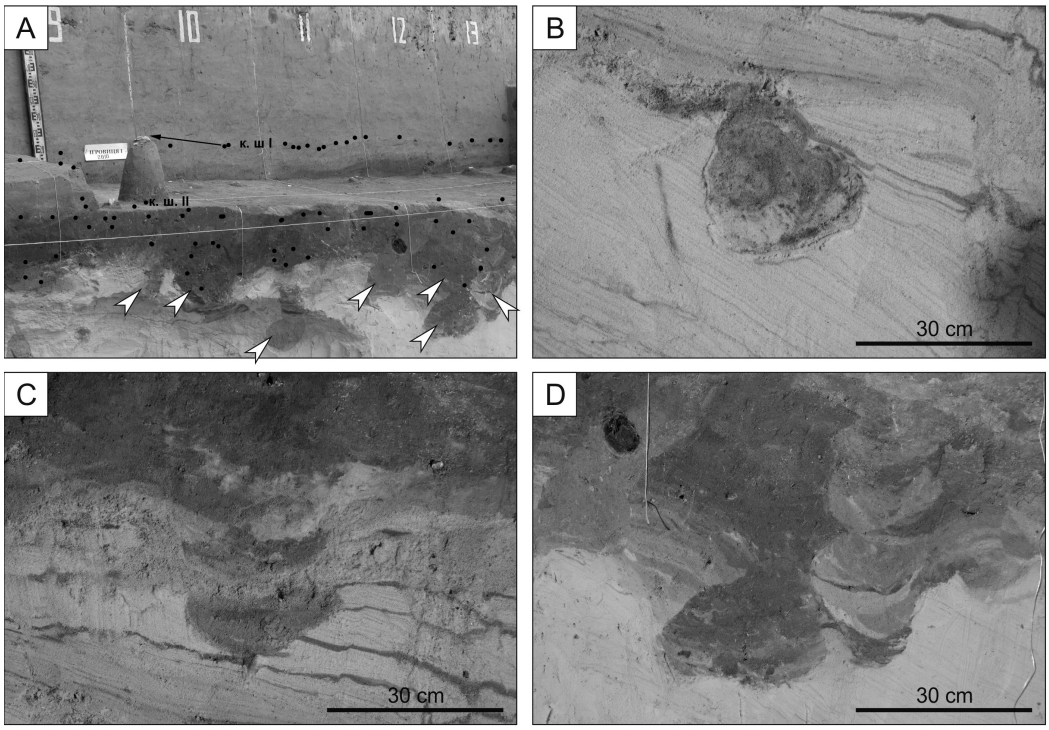

Fig. 2. Photographs of burrows from Ihrovytsya I. A – a view of the site; black dots mark the positions of artifacts; к.ш.I and к.ш.II are cultural horizons (according to SYTNYK 2000; SYTNYK et al. 2001); arrows indicate some of the burrows. B, C, D – exemplary burrows.

III. RESULTS

Numerous bone remains of small mammals were discovered in the sediment samples from each of analyzed burrows. Most of them are postcranial bones (53% of the collected material) but also fragments of mandibles, crania and single teeth were found. Some of the collected remains could be identified to species or genus level (Table I, Fig. 3).

The sample of studied bone material from Ihrovytsya is unlikely to be fully representative as there are only 18 identified specimens. However, the species composition is quite rich. Among the identified taxa the most abundant group of identified remains are teeth of rodents from the subfamily Microtinae.

Table I
Species representation of small mammals remains in particular burrows

Taxon \ Anatomy	M1	M2	M3	P3-M3 *	m1	m2	m3	m1-m2 *	m1-m3 *	incisor	cranial bones **	postcranial bones
Burrow I												
Spermophilus sp.				1								
Microtus gregalis					1			2	1			
Microtus cf. *gregalis*	1											
Microtus arvalis/gregalis	2							1				
Dicrostonyx gulielmi					1	1		1				
Microtus (*Terricola*) sp.					1							
Microtinae indet.	3	1			2	1	2					
Rodentia indet.										25	5	41
Lagomorpha indet.												1
Mammalia indet.												16
Burrow II												
Microtus gregalis								1				
Dicrostonyx gulielmi	1											
Lemmus lemmus			1									
Ochotona pusilla		1										
Microtinae indet.							1					
Rodentia indet.										5	4	3
Mammalia indet.												2
Burrow III												
Dicrostonyx gulielmi						1						
Microtinae indet.						2						
Rodentia indet.										6	6	26
Mammalia indet.												1

* with fragments of skull or mandible
** fragments without teeth

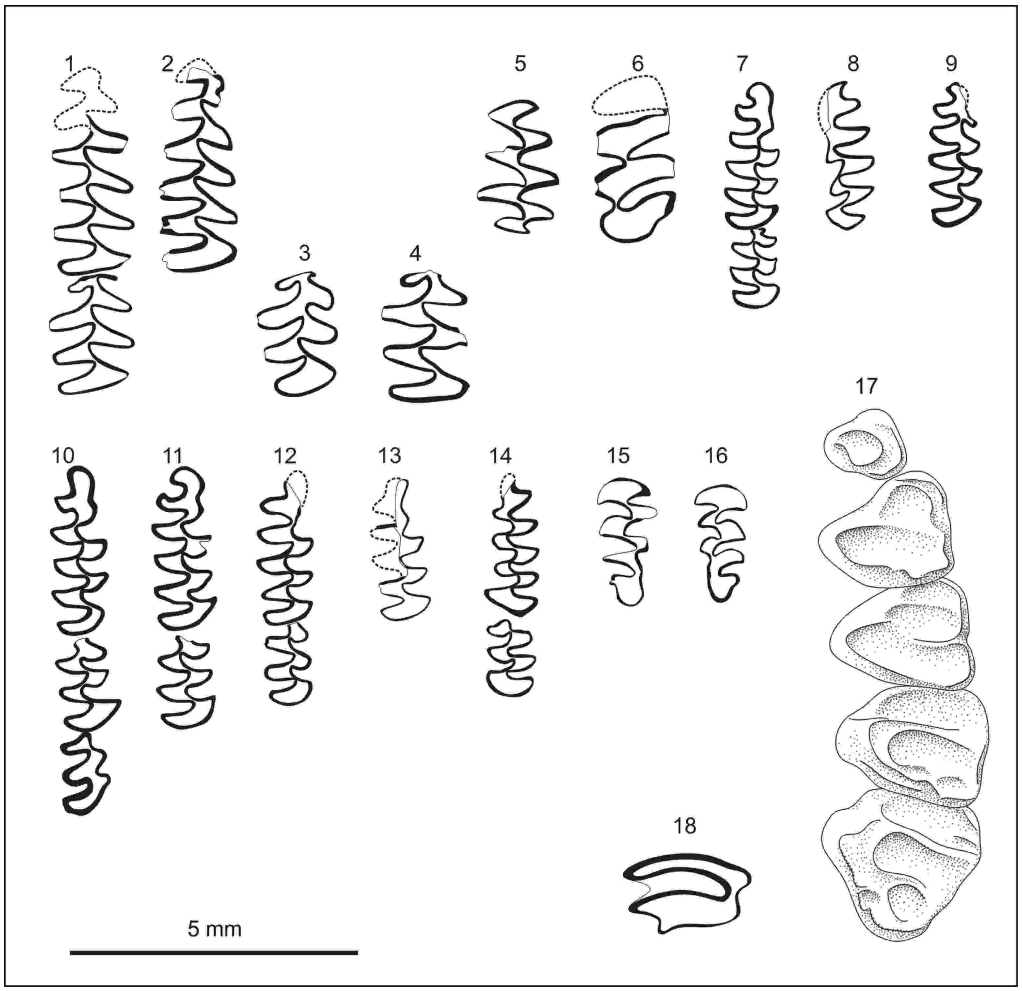

Fig. 3. Identified teeth of small mammals from Ihrovytsya. 1-5 – *Dicrostonyx gulielmi*: 1 – right m1-m2, burrow I; 2 – right m1, burrow I; 3 – right m2, burrow I; 4 – right m2, burrow III; 5 – left M1, burrow II. 6 – *Lemmus lemmus*, right M3, burrow II. 7 – *Microtus gregalis,* right m1 and m2, gregaloid-arvaloid morphotype, burrow I. 8 – *Microtus gregalis*, left m1, gregaloid morphotype, burrow II. 9 – *Microtus* (*Terricola*) sp., right m1, burrow I. 10-12 – *Microtus gregalis*, 10 – right m1-m3, gregaloid-arvaloid morphotype, burrow I; 11 – right m1-m2, gregaloid-arvaloid morphotype, burrow I; 12 – right m1-m2, gregaloid morphotype, burrow I. 13 – *Microtus* cf. *gregalis*, right m1, burrow I. 14-16 – *Microtus arvalis/gregalis*: 14 – left m1-m2, burrow I; 15 – left M3, burrow I; 16 – right M3, burrow I. 17 – *Spermophilus* sp., left P3-M3, burrow I. 18 – *Ochotona pusilla*, right M2, burrow II.

Characteristics of species

Microtus gregalis (PALLAS, 1779) – teeth of this species are the most abundant group of identifiable remains. Five specimens of certain affinity and one fragmentary specimen were identified (Fig. 3, number 13). They represent at least five individuals. The specimens of certain affinity represent two morphotypes: gregaloid-arvaloid (Fig. 3, numbers 7, 10 and 11) and gregaloid (Fig. 3, numbers 8, 12 and 13) (compare with BOCHEŃSKI et al. 1985).

Microtus arvalis/gregalis – the state of preservation of three specimens makes their unambiguous assignment to either *M. arvalis* or *M gregalis* impossible. The m1 (Fig. 3, number 14) might represent either *M. arvalis* or the arvaloid morphotype of *M. gregalis*.

Microtus (*Terricola*) (FATIO, 1867) sp. – only one specimen of m1 shows a broad connection between the loops T4 and T5, which is a characteristic feature of the subgenus *Terricola*, although it also occurs with low frequency in *M. gregalis* (NADACHOWSKI 1982; BOCHEŃSKI et al. 1985). The certain determination of species is impossible because the anteroconid complex is damaged.

Dicrostonyx gulielmi (SANFORD, 1870) – teeth of this species are the second most abundant group of identified remains, after *M. gregalis*. Teeth belong to at least three individuals. Because the anteroconid complexes of each m1 are destroyed, it is impossible to recognize their morphotypes. The only well preserved M1 corresponds to the morphology of *D. gulielmi/torquatus* and clearly differs from the older form *D. simplicior* FEJFAR 1966 from the Middle Pleistocene (GROMOV & POLIAKOV 1977).

Lemmus lemmus (LINNAEUS, 1758) – only one partially preserved M3 was identified (Fig. 3, number 6).

Spermophilus sp. CUVIER, 1825 – a fragment of maxilla with complete left row of cheek teeth is preserved (Fig. 3, number 17). Its age could be determined on the basis of the tooth wear to being a 3-5 month subadult (according to method presented by RU IĆ 1978).

Ochotona pusilla (PALLAS, 1769) – only one tooth of this species was recovered (Fig. 3, number 18). Also a third phalanx – corroborating in size and morphology to a small lagomorph – may belong to the steppe pika.

IV. DISCUSSION

The age of the faunal complex and burrows

The species structure of the small mammals community found at Ihrovytsya shows a typical composition of biocenosis of the Late Pleistocene steppe-tundra in Central and Eastern Europe (see NADACHOWSKI 1989; REKOVETS & NADACHOWSKI 2007; KROKHMAL' & REKOVETS 2010). The highly arctic species (i.e. *D. gulielmi*, *L. lemmus* and *M. gregalis*) clearly outnumber the steppe (*Ochotona pusilla*, *Spermophilus* sp.) and eurythopic (*M.* (*Terricola*) sp., *M. arvalis/gregalis*) taxa in this assemblage. Such species representation indicates the connection of the faunal assemblage with a rather cool and dry climatic period.

The infilling of the burrows with sediments from horizon B of interglacial soil dated to MIS 5e indicates that the burrows have originated after the soil development, so after the Eemian Interglacial, in cooler conditions. Such age is also confirmed by the high representation of *D. gulielmi* and *M. gregalis*, which is typical in sediments from stadials of the Last Glaciation in Central and Eastern Europe (NADACHOWSKI 1989; KROKHMAL' & REKOVETS 2010). The age interpretation is also supported by the presence of *D. gulielmi* instead of *D. simplicior*. The presence of the latter species in the assemblage is characteristic for

the penultimate glaciation in Central Europe (NADACHOWSKI et al. 2009). The lack of solifluction or other cryogenic disturbances across the burrows, which are common in the surrounding sediments, indicates that the burrows are younger than the solifluction phase of the Early part of the Last Glaciation. The lack of loess or Dubno soil traces inside the burrows suggests that they had originated before the tundra soil development (MIS 3, see: ŁANCZONT & BOGUCKYJ 2002; MARUSZCZAK 1994) and even before the loess sedimentation period (late MIS 4, see: as above), meaning the early part of the Last Glaciation (MIS 5a-5b or early MIS 4, between the stratigraphic phases 4a and 4b *sensu* BOGUCKIJ et al. 1998). The small mammal fauna of the early part of the Last Glaciation has been only sporadically described so far from the Ukraine (KROKHMAL' & REKOVETS 2010), and in the Western Ukraine the faunas of MIS 5a-5b or early MIS 4 age have not been known at all. Relatively abundant assemblages of rodents and insectivores of this age were described from some archaeological sites in the Crimea, e.g. in Kabazi II (MARKOVA 2011). However, due to the lack of lemmings in these faunas, direct comparison is not possible.

Origin of the burrows

The connection of the burrows with the small mammal assemblage is a difficult issue to explain. Certainly the burrows were not created by any of the rodent or lagomorph species because they are too large. However, some fragments of systematically unidentified bones of larger mammals were found together with the small mammals remains. Also some remains of larger animals were excavated during earlier archaeological works (among others *Marmota bobak* and *Anas querquedula*, see: SYTNYK 2000; SYTNYK et al. 2001). The presence of larger bones suggests that the examined bone assemblage might belong to prey of a medium size carnivore inhabiting the underground burrows, like red fox *Vulpes vulpes* LINNAEUS, 1758, corsac fox *Vulpes corsac* LINNAEUS, 1768, arctic fox *Vulpes lagopus* LINNAEUS, 1758 or steppe polecat *Mustela eversmanii* LESSON, 1827. Some remains of such species (corsac fox, arctic fox) were previously found in Ihrovytsya I (SYTNYK et al. 2001). It could not be excluded that some of small mammals have secondary inhabited the burrows.

V. CONCLUSIONS

The post-sedimentary structures from Ihrovytsya I found in horizon B of Horokhov soil are fossil burrows originating in the early part of the Last Glaciation (late MIS 5 / early MIS 4). Inside the burrows a faunal assemblage with relatively rich species representation occurs. The predomination of *Dicrostonyx gulielmi* and *Microtus gregalis* is the most characteristic feature. The burrows are an interesting example of the natural fossil degradation of archaeological cultural layer. They indicate that the process of mixing the sediments from the Last Interglacial or early part of the Last Glaciation, bearing the Middle Palaeolithic archaeological artifacts, might have occurred at some sites.

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