

Small mammal assemblage from lacustrine Late Pleistocene deposits near Ovčiarско (Northern Slovakia)

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Abstract: The Quaternary assemblage of small mammals from Ovčiarско (Northern Slovakia) is documented and described here for the first time and consists of the following faunal elements: *Arvicola amphibius*, *Chionomys nivalis*, *Dicrostonyx cf. torquatus*, *Ochotona pusilla*, *Sicista cf. trizona*, *Cricetulus migratorius*, *Alexandromys oeconomus*, *Microtus agrestis*, *Microtus taticus* and *Lasiopodomys gregalis*. The fossil leftovers of each taxa represent mostly food remains from birds of prey. Based on the faunal characteristics and comparison with other sites from Central Europe, especially from Slovakia, the biostratigraphic age of the fossiliferous horizon represents the Late Vistulian Pleniglacial. Paleoecologically, the fossil small mammal assemblage from Ovčiarско indicates a steppe environment with occasional forested areas and a water body nearby.

Key words: Rodentia, Lagomorpha, Late Vistulian, taphonomy, biostratigraphy, paleoecology

1. INTRODUCTION

The Pleistocene small mammal faunas from Slovakia are scattered and relatively poorly studied. Most of the known small mammal Pleistocene localities are comprised of either cave deposits, fissure fillings or travertine findings (e.g. Fejfar & Heinrich, 1981; Holec et al., 1994; Ábelová & Sabol, 2009; Sabol, 2017; Sabol et al., 2017). Mammal findings from basin sediments are rare and mainly limited to those of occasional large mammal remains (e.g. Holec, 1992, 1993a, b, 1996; Holec & Kernátsová, 1997; Tóth et al., 2005). As such, the small mammals from the locality Ovčiarско reflect the occurrence of the small mammal assemblage from the Late Pleistocene basin deposits in Slovakia (e.g. Horáček & Ložek, 1988; Ložek et al., 1989; Horáček, 2005; Obuch, 2000). The identification of the fossil remains and therefore the taxonomic identification of Pleistocene rodents and lagomorphs allows a relative time estimation between the transition of Late Pleistocene (see Nagel, 1997; Markova, 1998; Kalthoff et al., 2007) to Early Holocene. With few exceptions, rodents and lagomorphs have a short lifespan and are adapted to narrow ecological niches (Wilson et al., 2017). For these reasons, the research on ice age rodents and lagomorphs allows conclusions about formerly prevailing environmental conditions such as temperature and humidity. Due to their rapid generation transitions and the associated evolutionary changes, these groups are used for a first relative dating of the fossiliferous horizon at Ovčiarско and the reconstruction of the corresponding paleoenvironment.

2. LOCATION AND GEOLOGICAL SETTING

The locality was discovered by Marián Golej, a geologist working on the tunnel construction site in 2010. It is situated approximately 1 km southeast from the center of Dolný Hričov and 1.8 km west from village Ovčiarско (49°13'22.98"N, 18°38'9.61"E)

(Fig. 1). The area is a small intramountain basin located next to the valley of middle Váh river. The deposits were accessible only during 2010 when the western portal of the highway tunnel Ovčiarско was built. After construction, they were closed off by a concrete wall and are inaccessible at this time (Fig. 1). This small intramountain basin between Dolný Hričov and Ovčiarско is located in a tectonically complex area in contact with the Pieniny Klippen Belt and Paleogene sequences of Myjava-Hričov Group. The Pieniny Klippen Belt is a structural zone, only a few kilometres wide, but up to 600 km long, shaped mainly by Paleocene to Eocene thrusting and by superimposed Late Eocene - Early Miocene wrench tectonics (Plašienka & Soták, 2015). The Myjava-Hričov Group contains a lithologically diverse "flysch"-type rock sequence; mainly sandstones, claystones, limestones and conglomerates. It is situated along the inner edge of the western part of the Pieniny Klippen Belt (Hók et al., 2019). The quaternary fill of the small local basin, formed at the contact zone of these two units, consists mainly of fluvial and deluvial sediments. During the construction of the portal, lacustrine, organic rich clays, and clayey silts were outcropped. These sediments contain beside numerous coaly plant remains also mollusc fragments (*Planorbis* sp.) and frequent small mammal fossil remains.

3. MATERIAL AND METHODS

The sample was collected from the sediment outcropped during construction of the highway tunnel portal near Ovčiarско. Approximately 300 kg of sediment were screen washed on the set of stable sieves (Daams & Freudenthal, 1988) with 0.5 mm mesh size of the lower sieve. More than 1,800 postcranial and cranial elements were recovered. Additionally, approximately 1,600 teeth were collected (500 isolated incisors, more than 100 mandibles with dentition included and dental fragments with teeth and around 1,000 isolated molars). 88 first molars were identified, measured, and assigned by their characteristic

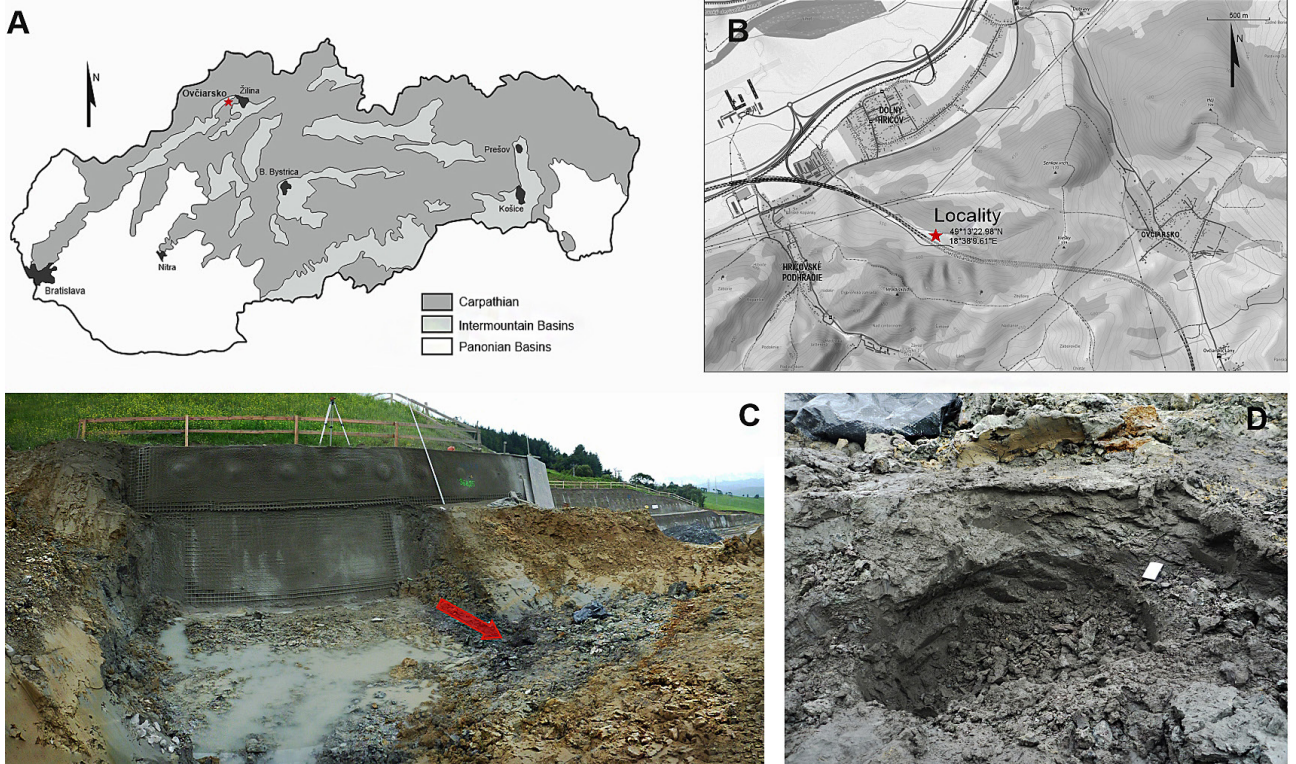


Fig. 1: Locality Otvčarsko. A - position of the locality; B - position of the sampling site; C - view on the outcropped sediments; D - fossiliferous layer

occlusal patterns. The upper cheek teeth are indicated by upper case (P2, P3, P4, M1, M2, M3) and lower cheek teeth by lower case abbreviations (i, p3, p4, m1, m2, m3). Terminology used for teeth morphotypes follows Meulen (1973) for arvicolines (Fig. 2) and Thenius (1989) for Lagomorpha, Cricetidae and Dipodidae. Pictures of the dental elements, as well as measurements, were taken with a confocal microscope (Nikon Eclipse LV150N)

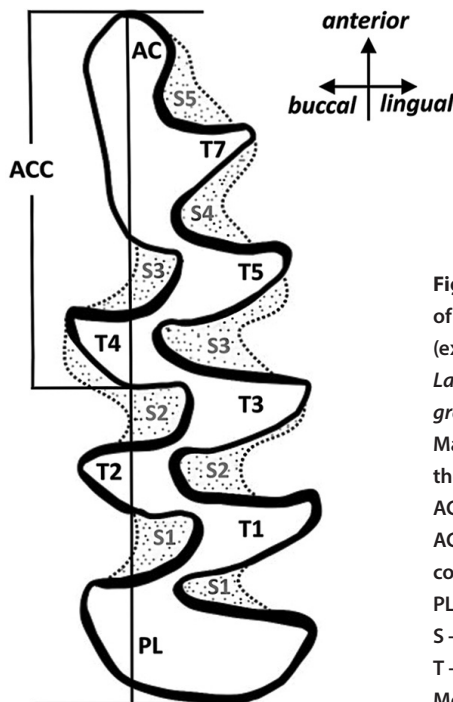


Fig. 2: Terminology of m1 in arvicolines (example *Lasiopodomys gregalis*). Maximum length of the m1 is indicated. AC - anterior cap; ACC - anteroconid complex; PL - posterior lobe; S - syncline; T - triangle, after Meulen (1973).

and a scanning electron microscope (QUANTA FEG 250). The use of a confocal microscope enables a perfect-dimensional representation of a surface of the respective m1, where height and depth of the object are scanned in layers, which allows a non-invasive and precise measurement, while preserving the material. Tooth dimensions are given in millimetres and present minimum, maximum and total mean of the length. Occlusal surface measurements are provided as maximum length (L) and width (W) unless stated otherwise (Appendix 1). The A/L-values, measurements of anteroconid complex (A) divided by measurements of total length without anteroconid complex (L) (Rabeder, 1986), are used for further evaluation of the *Arvicola*, *Chionomys*, *Alexandromys*, *Microtus* and *Lasiopodomys* teeth.

For the taxonomic species level and above species level classification and hierarchy the work from Brands (1898-present), Wilson & Reeder (2005), Kurtén (2007), Wang et al. (2013), and Wilson et al. (2017) were used. Comparative material of recent taxa was used from the collections of the Department of Palaeontology of the University of Vienna (PIUW), and the Natural History Museum of Vienna (NMW). The fossil material described in this paper is stored in the collections of the Department of Geology and Paleontology, Comenius University in Bratislava.

Results: Systematic Paleontology
 Order LAGOMORPHA Brandt, 1855
 Family OCHOTONIDAE Thomas, 1897
 Genus *Ochotona* Link, 1795
Ochotona pusilla (Pallas, 1769), Steppe Pika
 Fig. 3A

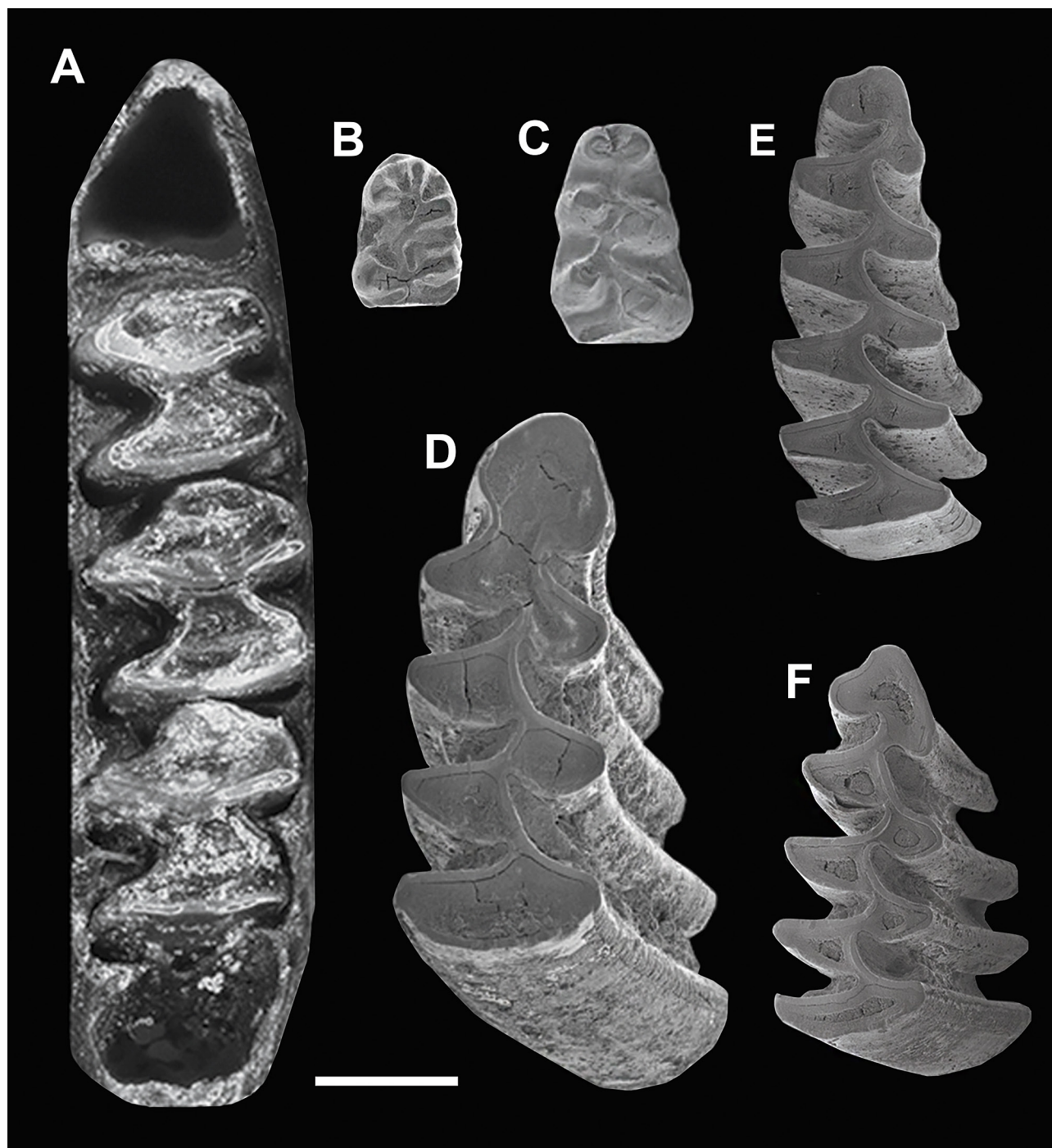


Fig. 3: Rare taxa from Ovčiarsko. A - *Ochetona pusilla* (p4, m1, m2, DH100033), B - *Sicista cf. trizona* (m1, DH100120), C - *Cricetulus migratorius* (m1, DH100032), D - *Arvicola amphibius* (m1, DH100118), E - *Dicrostonyx cf. torquatus* (m1, DH100056), F - *Chionomys nivalis* (m1, DH100045); scale 1 mm.

Material and dimensions: Left mandible with i, p4, m1, m2 (DH100033), (Fig. 3A); right mandible with i, p4 broken, m1 broken (DH100034); molar fragments (DH100035-DH100039). For all measurements see Table 1 and Appendix 1.

Description: The left mandible is almost complete. Part of the incisor alveolar process and ramus are broken. The p3 and m3 are missing, other teeth are well preserved. Right mandible is broken and shows no measurable elements, no mandibular ramus and no condylar process are preserved. p3, m2 and m3 are missing, the

Tab. 1: Measurements of *Ochetona pusilla*

Element	n	Width (mm)	Length (mm)
i	2		
p4	1	1.43	1.53
m1	1	1.57	1.66
m2	1	1.58	1.63

m1 is fragmented. The outer and inner synclinids of five molar fragments are recognizable.

Comments: Extant species of the genus *Ochotona*, distributed in Asia and North America, show hypsodont teeth (Thenius, 1989). Only the P2, P3 and p4 have characteristic patterns, while all other molars have only two enamel prisms, each with a deep syncline which is filled with dental cement. However, an exception is the m3 which is an unarticulated pillar with no characteristics. The p3, which is missing in our sample, is structured in two outer and one inner enamel fold (Thenius, 1989). According to Kurtén (2007) only Late Pleistocene findings from Europe are undoubtedly determined to be *Ochotona pusilla* while in Early Pleistocene four other species are known (*O. lazari*, *O. antiqua*, *O. pseudopusilla*, *O. horaceki*) (Čermák, 2004; Kurtén, 2007). However, Sych (1980) describes another *Ochotona* species from the Early Pleistocene from Poland (*O. polonica*) and shows that measurements of this specimen are shorter in length and width of each tooth in comparison to *O. pusilla*. As p3 are missing in our findings, the shape and width of the p3 alveolus and the measurements from m1 were used for determination. Our findings slightly differ from measurements of *O. pusilla* but much more from those of *O. polonica* and the other three species (Kowalski, 1980). Therefore, our findings were determined to be *O. pusilla* (Fig. 3A). The family Ochotonidae, also known as pikas, have a Eurasian origin and distribution. However, Pleistocene taxa also entered North America. Modern forms are nocturnal, inhabit brushy valleys and steppe areas (Kurtén, 2007). *O. pusilla* (Pallas, 1769), the steppe pika, is often found in the Quaternary fossil record of Europe from the Late Pliocene to the Late Pleistocene and was distributed up to England and westwards of Switzerland (Kurtén, 2007). The modern steppe pikas generally have small forms, less than 15 cm in length, and occur in the eastern parts of Eurasia. Also, *O. pusilla* is strictly a steppe species notably occurring in periglacial environments like tundra steppes. In Pleistocene sites, it is often found together with species like *Lasiopodomys gregalis* and *Dicrostonyx* which indicates a cold continental steppe environment (Stoetzel et al., 2016).

Order RODENTIA Bowdich, 1821

Family DIPODIDAE Fischer de Waldheim, 1817

Genus *Sicista* Gray, 1827

Sicista cf. *trizona* (Frivaldsky, 1865), Hungarian Birch Mouse
Fig. 3B

Material and dimensions: 15 teeth were found not only isolated but also intact in maxillary and mandibular fragments (DH100029, DH100030, DH100119, DH100120, DH100121, DH100122, DH100123, DH100124, DH100125, DH100126, DH100127, DH100128, DH100129, DH100130, DH100131). For detailed measurements of all found elements see Table 2 and Appendix 1.

Description: The occlusal surface of all molars (upper and lower) shows a simplicity comparable to *S. betulina*. The upper molars (M1, M2, M3) have each three roots and show simply shaped paracone, protocone, mesoloph, and metacone. The mesoloph is connected to the adjacent cusps, paracone, and metacone. The lower molars have only two roots, with the first showing clear pentalophodont patterns. The four main cusps are well preserved. A small convexity between the prominent hypoconid and the

Tab. 2: Measurements of *Sicista* cf. *trizona*

Element	n	Width (mm)			Length (mm)		
		min	mean	max	min	mean	max
M1	3	0.92	0.93	0.94	0.96	0.99	1.03
M2	3	1.01	1.01	1.01	0.94	0.97	1.02
M3	2	0.68	0.69	0.71	0.69	0.72	0.76
m1	2	0.8	0.805	0.81	1.10	1.10	1.10
m2	3	0.83	0.85	0.87	1.02	1.06	1.10
m3	2	0.68	0.685	0.69	0.74	0.82	0.90

protoconid is displayed. The mesolophid is well-developed. No spur at the main cusps and in the depression between the entoconid and the posterolophid are observed.

Comments: The length of the lower first molar of our sample is more than 1 mm (1.11mm). This is typical for *Sicista subtilis* (Fig. 3B) as *S. betulina* displays a length of less than 1 mm in the first molars (Pucek, 1982). At present, *S. subtilis* has three subspecies in Europe: *S. subtilis subtilis* (Pallas, 1773), *S. subtilis nordmanni* (Keyserling et Blasius, 1840) and *S. subtilis trizona* (Frivaldský, 1865), with the latter being considered a species in its own right due to geographical isolation, morphological peculiarities, and genetic characteristics (Méhely, 1913; Cserkés et al., 2009, 2015; Wilson et al., 2017). Comparing the width and length of the m1 to recent specimens of *S. subtilis*, *S. betulina* and *S. trizona*, our findings lay between these three species (Fig. 4) (Niethammer & Krapp, 1982; Cserkés et al., 2015). The steppe dwelling Southern birch mouse *S. subtilis* and the forest dwelling Northern birch mouse *S. betulina* can be distinguished based on dimensions and the relative complexity of the lower first molar (Pucek, 1982; Opplinger & Becker, 2010). Kowalski (1979) also states that *S. betulina* from the Pleistocene in Poland has a larger tooth size than the recent specimens. Our m1 shows no spurs at the main cusps and a simple formed mesolophid, which is common in *S. subtilis* specimens. Also, the occlusal outline of our m1 clearly converges anteriorly as well as having a distinct

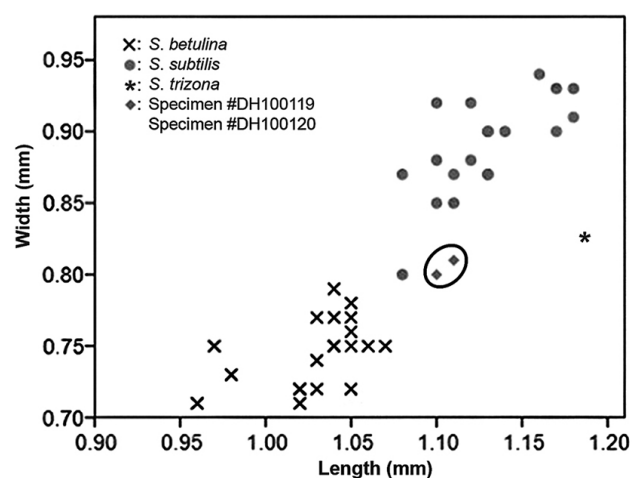


Fig. 4: Length and width (m1) of specimen from Ovčiarsko (*S. cf. trizona* - DH100119, DH100120) compared with *S. subtilis*, *S. betulina* from Romanian site Valul lui Traian (Niethammer & Krapp, 1982) and with *S. trizona transilvanica* (Cserkés et al., 2015).

shallow concavity where the ectoflexid on the m1 reaches the lateral margin of the tooth. This is also a distinct difference from *S. betulina* showing a more oval and rounded outline (Kalthoff et al., 2007). Compared to further measurements from Cserkészt et al. (2009) our specimen resembles mostly *S. trizona* as well as *S. subtilis*. However, earlier research has often not indicated the different subspecies of *S. subtilis* (see Niethammer & Krapp, 1982) with the smallest measurements being attributed to *S. subtilis trizona* after the PhD thesis from Cserkészt (2011). As a result, the specimen is identified as *S. cf. trizona*, correlating with both the findings of the species and the old categorisation as a subspecies. The earliest Pleistocene findings in Europe refer to a third species next to *S. betulina* and *S. subtilis* which is known as *S. praeloriger* (Kormos, 1930) from the early Middle Pleistocene. Rarely, Pleistocene findings from *Sicista* are known to be from the Eemian (Lambrecht Cave; Subalyuk) and Vistulian stage in Germany, Switzerland, Austria, Hungary, Czech Republic and Slovakia (Jánossy, 1986; Ložek & Horáček, 1988; Kowalski, 2001). However, the Northern species occurs in more or less isolated populations in Scandinavia, Finland, Germany, Poland, and Russia, while the Southern form, such as *S. trizona*, is found in steppes of south-eastern Europe and Asia (Kurtén, 2007).

Family MURIDAE Batsch, 1788

Genus *Cricetulus* Milne-Edwards, 1867

Cricetulus migratorius (Pallas, 1773), Gray Dwarf Hamster

Fig. 3C

Material and dimensions: Mandible fragment with incisor and m1 intact (DH100032) (Fig. 3C), one isolated m2 (DH100133). For measurements of all found elements see Table 3 and Appendix 1.

Tab. 3: Measurements of *Cricetulus migratorius*

Element	n	Width (mm)	Length (mm)
m1	1	1.12	1.55
m2	1	0.98	1.24

Description: The anteroconid of the m1 is divided by a depression into a lingual cusp and a labial cusp, which are of similar size. A small pre-anteroconid cingulum on the mesial surface of the molar is recognizable. An anterolophulid could not be determined. The contour of the crown base is irregularly lobed. Also, anteroconid, protoconid, entoconid, hypoconid, and posterior cingulum are well preserved.

Comments: Hír's (1997) m1 description was mainly used for adscription with a range in length of 1.4 mm (min) to 1.88 mm (max) and a simple tooth morphology. The m1 from Ovčiarско (1.55mm) fits in its dimensions while its morphological simplicity resembles more *Cricetulus migratorius* than *Allocrietulus bursae* (Schaub, 1930) and *A. ehiki* (Schaub, 1930). It can therefore be distinguished as *C. migratorius* (see also Bescós, 2003; Nedyalkov, 2016). Fossil hamsters were slightly larger than recent ones which is unexpected compared to other Pleistocene mammals (Kurtén, 2007). However, *Cricetulus migratorius* shows similarities to *A. bursae* and were thought to be one and the same species

by Kurtén (2007). Nonetheless, after investigations from Hír (1997), the recent *C. migratorius* from the Middle East and the fossil *A. bursae* from Hungary are distinguishable based on dental measurements. Only one mandible fragment with the m1 and m2 preserved was found. It is considered to be *C. migratorius* due to the dimensions, simple morphology, shape of the hypoconid and the light indentation between anteroconid and metaconid (Hír, 1997; Bescós, 2003). This clearly distinguishes it from the complex m1 morphology of *A. bursae* and *A. ehiki* (Hír, 1997; Bescós, 2003). Today, this taxon lives in non-boreal open areas such as arid steppes (Niethammer, 1982).

Genus *Dicrostonyx* Gloger, 1841

Dicrostonyx cf. torquatus (Pallas, 1778), Palearctic Collared Lemming

Fig. 3E

Material and dimensions: Three isolated m1, two well preserved (DH100053, DH100054) and one fragmented (DH100056). Two mandible fragments with fragmented first molars, one well preserved (DH100055) and one fragmented (DH100057). For measurements of all found elements see Table 4 and Appendix 1.

Tab. 4: Measurements of *Dicrostonyx cf. torquatus*

Element	n	Width (mm)			Length (mm)		
		min	mean	max	min	mean	max
m1	3	1.04	1.14	1.24	2.91	3.03	3.24

Description: Nadachowski's (1982) morphotype E, with a distinctly developed fifth bucal re-entrant angle, and morphotype C, where the posterior margins of the triangles from the fifth bucal row and triangles from the sixth lingual row occur at different levels, are clearly observable on the isolated and well preserved molar. They lack cement between the triangles, are rootless and show wide synclines; the apexes are enamel free. The m1 from the sample consists of a posterior lobus, seven triangles, and an anterior cap (Fig. 3E).

Comments: To the development of the lower molars through time, especially the m1, is usually given more attention in the determination and identification of the specimen than the upper molars. However, Agadjanian & Königswald (1977) have shown that the maxillary molars of *Dicrostonyx* evolved very quickly, especially in the upper part of the Late Pleistocene. This development enables a good chronological classification of the material. The assignment to the genus *Dicrostonyx* is based on the typical occlusal surface. The artificial adscription to either *D. simplicior*, *D. gulielmi* or *D. torquatus* is possible depending on the majority of certain morphotypes present in the M1 and M2 (Agadjanian & Königswald, 1977). Since there are usually more mandibles found at once, it is a good approximation to record the morphotype frequencies of the m1 (Nagel, 1997). All our few findings show a variation in terms of the morphology and shape and two morphotypes (C and E) were identified (Nadachowski, 1982). However, according to the size of the m1 findings from Ovčiarско (mean

L 3.03 mm, mean W 1.14 mm) they represent *D. cf. torquatus* (Crégut-Bonnoure et al., 2018). The length of the m1 during the time of the Last Glaciation changes shows a reduction in size (Nadachowski, 1982). The occurrence of various species among the extant lemmings in either montane or arctic biotopes are indicators for a specific continental steppe landscape of the Late Pleistocene also known as mammoth steppe. This environment can be linked to the nival zone of today's high mountains but there is no real comparison to a mammoth steppe anymore. Nevertheless, *D. torquatus* is seen as such an indicator of this particular glacial phase (Königswald, 2004). The genus *Dicrostonyx* occurs in Europe in the last glacial period, where it is a common element of the periglacial tundra faunas from Ireland and France in the West to Hungary, Czech Republic, Slovakia, and further to the South and East (Jánossy, 1986; Kurtén, 2007; Lenardić, 2013). It has been assumed that the Pleistocene Arctic lemming of Europe differs from the living form but it is more likely that these are only individual variants of a single population (Kurtén, 2007). The European fossil form is inseparable from the living species. The habitat of the Arctic lemming is the treeless tundra; it feeds for instance on *Salix* and *Polygonum* (Kurtén, 2007).

Genus *Arvicola* Lacépède, 1799

Arvicola amphibius (Linnaeus, 1758), Eurasian Water Vole
Fig. 3D

Material and dimensions: Mandible with m1 (DH100118) and m2 (DH100132). For measurements of all found elements see Table 5 and Appendix 1.

Tab. 5: Measurements of *Arvicola amphibius*

Element	n	Width (mm)	Length (mm)	A/L (mm)
m1	1	1.9	3.7	43.25
m2	1	0.98	1.24	

Description: Teeth are rootless and hypsodont. The m1 shows typical enamel patterns: anterior cap with neck and triangles T4 and T5 broadly confluent which is also characteristic for morphotype A (Nadachowski, 1982). All in all, five dentine triangles are enclosed by enamel. The teeth significantly exceed *Microtus* specimens in length. The enamel of the molars is uniformly thick.

Comments: The stronger thickness of the enamel luv sided (0.085mm) compared to the lee sided thickness (0.055mm) allows an adscription to *A. amphibius* as *A. cantiana* shows the opposite thickness. Also, the length of the m1 and the preserved enamel triangles (1 outside, 2 inside) with a characteristic morphology of the anteroconid complex divided into anteroconid cap and triangle 4 and 5 allows this determination (Fig. 3D). Measurements of fossil arvicolids (voles), especially their teeth, are suitable for morphotype analyses (Rabeder, 1981) as well as for biostratigraphy. The morphology and number of the dentine triangles depends on the functionality of the tooth. The alternating position of the dentine triangles leads to an elongation of the cutting edges without widening the tooth

(Königswald, 1980). The rootless and columnar teeth of the arvicolids identify them as grass eaters. They have possibly differentiated into subspecies, especially in the Pleistocene, whereby their success is undoubtedly related to their teeth formation (Thenius, 1989). *A. amphibius*, the water vole, is one of the largest specimens of voles. Its present-day distribution covers almost all of Europe. It is mainly found near streams and lakes, where it may become perfectly amphibious, but it also occurs in drier biotopes and is then subterranean (Kurtén, 2007). Fossil findings differ in size and length. Late Pleistocene material is mostly referred to the living species or to *A. antiquus* (Pomel, 1853) which may be identical with the living subspecies *A. scherman*. It is found in Late Pleistocene deposits within its modern geographical range (Reichstein, 1982; Kurtén, 2007)

Genus *Chionomys* Miller, 1908

Chionomys nivalis (Martins, 1842), Snow Vole

Fig. 3F

Material and dimensions: Three right fragmented mandibles with m1 (DH100040, DH100041, DH100043); one left fragmented mandible also with m1 intact (DH100042); five isolated m1 (DH100045, DH100046, DH100047, DH100049, DH100050). For measurements of all found elements see Table 6 and Appendix 1.

Tab. 6: Measurements of *Chionomys nivalis*

Element	n	Width (mm)			Length (mm)			A/L (mm)
		min	mean	max	min	mean	max	mean
m1	9	0.9	1.12	1.27	2.29	2.75	2.93	49.73

Description: All 10 molars are well preserved. They show the typical characteristics of *Chionomys nivalis* as the enamel of the posterior part of the teeth is more rounded than in other *Microtus* specimens. Compared to other *Chionomys* species (*C. gud-roberti* stock) the T5 and T6 are separated, the fourth buccal salient angle and fifth lingual salient angle are well developed, and the anterior cap is short. Four of the m1 antero caps are crescent, two are more arrowhead-shaped (Fig. 3F), but none of them show any constrictions.

Comments: The species was formerly part of the genus *Microtus* but has been separated as a distinct genus due to the fossil findings and genetic studies (Krapp, 1982). Late Pleistocene records are widespread from England and France in the West and to the Czech Republic, Slovakia, and Hungary in the East. Its living habitat are the high slopes above the timberline, and it has been observed at an altitude of up to 4,700 m in Europe. It feeds mostly on roots and seeds (Kurtén, 2007). *C. nivalis* is generally an indicator for a higher altitudinal environment and emphasizes the cold character of the landscape at that time (Döppes & Nagel, 1997).

Genus *Microtus* Schrank, 1798

Subgenus: *Alexandromys* Ognev, 1914

Alexandromys oeconomus (Ognev, 1914), Root or Tundra vole
Fig. 5D

Material and dimensions: Two m1 (DH100022 and DH100044), well preserved. For measurements of all found elements see Table 7 and Appendix 1.

Description: The lower m1 show four distinct closed enamel triangles. Also, the anterior cap is elongated and the third buccal synclinal is constricted causing the dentin field between the fifth triangle and the anterior cap to be constricted as well (Fig. 5D).

Comments: *A. oeconomus* differs from other *Microtus* species, among other things, due to the suppression of the buccal anticline which allows the labial border of the anterior lobe to be rounded. Rabeder (1981) describes two morphotypes: longi-ratticeps and pro-ratticeps according to the length of the anterior cap and constriction of the synclinal. Following his description our m1 is assigned to the morphotype longi-ratticeps. For ecological interpretation the occurrence of *A. oeconomus* is

of special importance as it prefers wetland biotopes, although these can be small and widely spread (Königswald, 1985). Kurten (2007) describes that fossil findings of *A. oeconomus* from southern Germany and Hungary are dated to be mainly in cold climate phases without being a direct indicator of glacial climate itself. In England the species was found in interglacial deposits also.

Subgenus: *Microtus* Schrank, 1798

Microtus agrestis (Linnaeus, 1761), Short-tailed Field Vole
Fig. 5C

Material and dimensions: 26 m1 were identified. For collection numbers and measurements of all found elements see Table 7 and Appendix 1.

Tab. 7: Measurements of *Alexandromys*, *Microtus* and *Lasiopodomys* specimens

Species	Element	n	Width (mm)			Length (mm)			A/L (mm)
			min	mean	max	min	mean	max	mean
<i>A. oeconomus</i>	m1	2	1.05	1.17	1.28	2.8	2.48	2.16	51.3
<i>M. agrestis</i>	m1	26	0.83	1.01	1.26	2.2	2.55	2.79	54.72
<i>M. tatricus</i>	m1	2	1.1	1.25	1.4	2.5	2.6	2.7	51.73
<i>L. gregalis</i>	m1	41	0.81	1.02	1.24	2.16	2.62	3.1	54.53

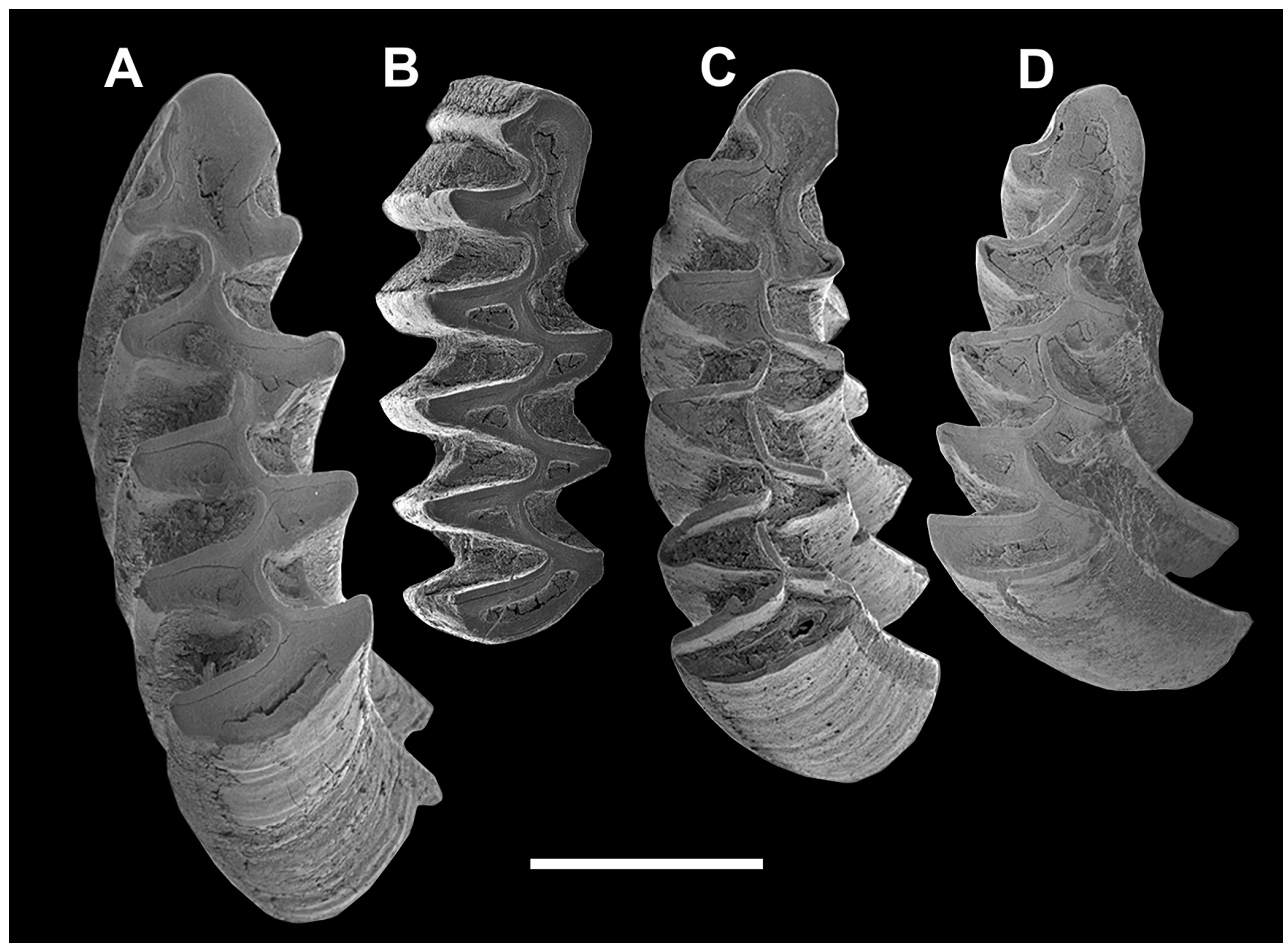


Fig. 5: m1 of A - *Microtus tatricus* (DH1000102), B - *Lasiopodomys gregalis* (DH1000112, mirrored), C - *Microtus agrestis* (DH100100), D - *Alexandromys oeconomus* (DH100044, mirrored); scale 1 mm .

Description: The first lower molar has five closed triangles (T1 to T5), a crescent-shaped posterior lobe and a more complex anterior cap, unlike *M. arvalis*. The latter displays a labial and lingual transversal posterior lobe, a T6 and T7 (Kapischke et al., 2009), which are more asymmetrical compared to *M. arvalis* (Fig. 5C).

Comments: When identifying *Microtus* species with single teeth, it should be noted that several morphotypes can occur. m1, m2 and m3 from *M. agrestis* are similar to *M. arvalis* (Krapp, 1982; Kapischke et al., 2009). However, the symmetry of the fourth and fifth triangle (T4 and T5) next to the anterior cap are important to differentiate between *M. arvalis* and *M. agrestis*. Nadachowski (1984) introduced an index relating the width of T4-T5 for microtids. *M. agrestis* has more asymmetrical lingual and labial triangles (Kalthoff et al., 2007). Also, the anterior cap can show bulges and infoldings. Definite identifications of *M. agrestis* have been made in Eemian and Vistulian stage sites within the same geographical range as *M. arvalis*. Earlier records are mostly described as the arvalis-agrestis group (compare Nagel, 1997). Moist and herbaceous areas such as swamps, bogs, and stream edges are preferred, with increased coverage by grasses and bushes. This seems to be more important for *M. agrestis* than for other *Microtus* species (Niethammer & Krapp, 1982).

Subgenus: *Terricola* Fatio, 1867

Microtus tatricus (Kratochvíl, 1952), Tatra Pine vole
Fig. 5A

Material and dimensions: Two m1 (DH100017 and DH100102), both well preserved. For measurements of all found elements see Table 7 and Appendix 1.

Description: The m1 shows the first three triangles isolated. T4 and T5 are open and connected. The anterior head of the tooth consists of a cap with two spikes (T6 and T7) which are connected to each other and to the anterior lobe (Fig. 5A).

Comments: In general, the m1 of *M. tatricus* resembles the appearance of the morphotypes within *Microtus subterraneus* (de Selys-Longchamps, 1836). However, the anterior lobe may be constricted occasionally and total length of *M. tatricus* is longer. *M. tatricus* is a relict species described from Tatra Mountains, but later on also from other mountain regions. It is endemic to the Carpathian Mountains and can be found in Slovakia, Poland, Ukraine, and Romania (Baláz & Ambros, 2010). Populations occur in the Carpathians 630 - 2,350 m above sea level (Baláz & Ambros, 2010; Wilson et al., 2017) and are found in spruce forests and Tatra meadows (Mošanský, 1993). In Slovakia, *M. tatricus* was identified in the Early Holocene period in Veľká Fatra (Martínková & Dudich, 2003). In the Western Tatra region, it occurs where humid and colder habitats with thicker humus layers and rich undergrowth appear.

Subgenus: *Lasiopodomys* Lataste, 1887

Lasiopodomys gregalis (Pallas, 1779), Narrow-headed Vole
Fig. 5B

Material and dimensions: 41 m1 were identified. For collection numbers and detailed measurements of all found elements see Table 7 and Appendix 1.

Description: All 41 m1 are well preserved. They show equally thick enamel and gregaloid to microtid morphotypes with five triangles and a y-shaped anteroconid complex which allows an identification to *L. gregalis* (Fig. 5B). Only a few of them show fragmentations with a broken enamel structure or roots missing.

Comments: *Lasiopodomys gregalis* is known to be present during cold phases in Europe. Late Pleistocene records date from the Vistulian stage of Germany, England, Switzerland, Hungary, Poland, the Czech Republic, and Slovakia. Recent specimens show an arctic distribution (Kurtén, 2007; Wilson et al., 2017). Around 11 to 15 subspecies of *L. gregalis* are described (Smith & Lunde, 2008). Osteologically, the gregarious vole is often characterized by its narrow skull but may also be identified by the typical morphotype of the lower molar (m1), which only has five triangles and an y-shaped anteroconid complex. However, in our material, we could determine eight different morphotypes of the anteroconid complex which can be summarized to belong to morphotype gregaloid to microtid (compare Smirnov et al., 1986; Markova et al., 2013). The gregaloid morphotype shows a lobe posterior, 5 triangles and an anterior cap with a wide syncline lingual only. Buccally, a sixth triangle can be faintly identified, which indicates a change to the microtid morphotype, with T5 and T4 already separated (Nagel, 1997). The findings from Ovčiarisko show more differences in the anterior cap. Bulges and infoldings on the buccal side appear not only where the T6 can appear. The gap between anterior cap and T7 also varies in width (Fig. 6). Generally, the occlusal shape does not depend on sex or individual age of the animal but demonstrates variability of individuals (Markova et al., 2013). Simple morphotypes do

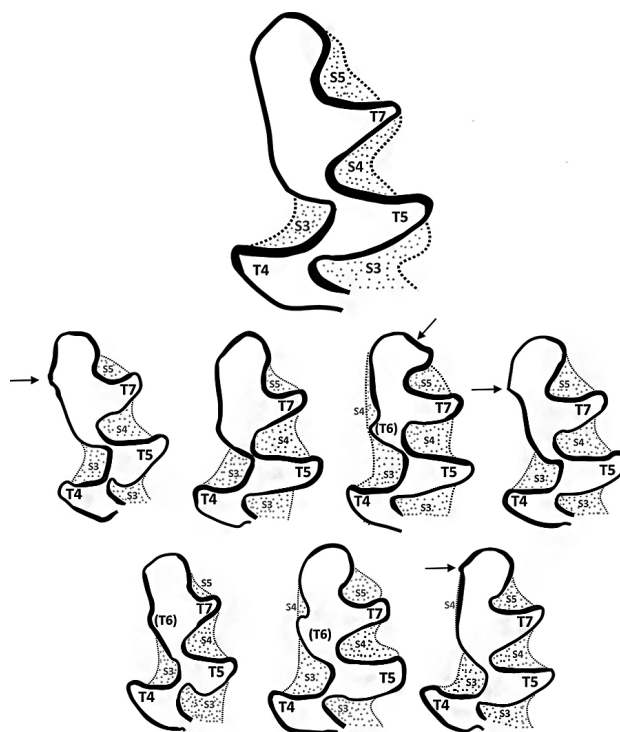


Fig. 6: Morphotype variations of *L. gregalis* from Ovčiarisko. Arrows mark bulges and indentations which do not typically lead to a microtid morphotype with a T6.

not have infolding angles at the buccal side of the paraconid, this side is convex or straight. However, in complex morphotypes, this angle is well developed. A combination of re-entrant angles at both sides of the anterior lobus creates a high variety of morphs, which is shown in Fig. 6 (compare Bolshakov et al., 1980; Smirnov et al., 1986).

4. DISCUSSION

4.1. Composition and Taphonomy

The sample yielded more than 2000 bone and teeth elements. In total 88, first molars could be identified belonging to the families Ochotonidae, Dipodidae and Muridae. Also, bone fragments were identified and ascribed to *Sorex cf. araneus* and Passeriformes. The most abundant species in the material collected from Ovčiarско is *Lasiopodomys gregalis*, while the second most abundant is *M. agrestis* followed by *Chionomys nivalis*, *M. tatricus*, and *A. oeconomus*. Findings of other rodents (*Dicrostonyx*, *Sicista*, *Arvicola*, *Cricetulus*), lagomorphs (*Ochotona*), shrews (*Sorex*), and birds (Passeriformes) are represented by few or singular specimens (Table 8). No large mammals, fish, amphibians, or reptiles were identified.

The composition of the assemblage indicates to stem mostly from an accumulation of food remains produced by birds of prey or terrestrial predators. A distribution of taxa through birds of prey pellets is also likely as the bones are highly fragmented, typical for predatory birds (Filek & Nagel, 2019), and

the composition of taxa indicates different biotopes (Königswald, 1985). The dominance of isolated teeth and the findings of only small to medium sized small mammals argue for a middle-sized raptor (Kalthoff et al., 2007). The different taxa within the pellet remains, however, suggest an origin from different birds of prey, not only diurnal but also nocturnal as *O. pusilla*, the steppe pika, and *M. tatricus*, the Tatra pine Vole, appears similarly at night (Chapman & Flux, 1990; Baláz & Ambros, 2010). The geometry of the small intramountain depression as well as the abundance and preservation of material suggest that it was accumulated by transportation of pellets through heavy rainfalls into a lake deposit in the centre of the basin. The absence of fish -remains and other aquatic animals may indicate a non-permanent water body in the centre of the basin.

4.2. Ecology and Biostratigraphy

The Ovčiarско fauna presents Late Pleistocene small mammals belonging to cold-dry adapted taxa (*Cricetulus migratorius*, *Dicrostonyx cf. torquatus*, *Ochotona pusilla*, *Lasiopodomys gregalis*, *Chionomys nivalis*) indicating an open steppe environment (Kofschoten & Roth, 1993; Obuch, 2000). However, the composition of the assemblage represents various differing biotopes. *A. amphibius* indicates a semiaquatic habitat, which correlates with the preferences of *A. oeconomus* as it prefers a cold humid habitat like wetlands. On the other hand, *C. nivalis* and *M. tatricus* appear in rocky areas with sparse vegetation (Kurtén, 2007; Baláz & Ambros, 2010) and *S. cf. araneus* occurs mainly in woodlands. *S. cf. trizona*, *O. pusilla*, *L. gregalis*, and *C. migratorius* would indicate more open habitats. The associations and the number of findings most likely argue for a rather open steppe-like grassland; a mainly woodless landscape with a temporal waterbody in the basin. Forms that indicate meadow (*M. agrestis*) and higher altitude (*C. nivalis* and *M. tatricus*) are rare. Animals which are usually present in steppe faunas were found but also animals that indicate cold tundra conditions (*Dicrostonyx*, *Alexandromys*). However, no indicators for woodlands such as glirids and murids were present and therefore, we agree with the analysis from Ložek et al. (1989) that Slovakia was not a continuous forested area in the transition between Pleistocene to Holocene. Thus, the findings rather indicate cold-humid to cold-dry conditions with most taxa being generalized in their ecological preferences (Kalthoff et al., 2007). The assemblage can be dated to the Late Pleistocene Vistulian Pleniglacial period through a combination of comparative analyses of other sites from Slovakia and the ecological character of the faunal association (Horáček & Sánchez, 1984; Nagel, 1997; Horáček & Ložek, 1988; Obuch, 2000; Kowalski, 2001). The tooth morphology evolution of various representatives allows a classification of certain time horizons (Nagel, 1997; Rabeder, 1981). The genus *Arvicola* is a reliable marker for the Late Pleistocene Toringium period (Fejfar & Heinrich, 1981). *A. cantiana* indicates an age earlier than Vistulian (probably Eemian) and *A. amphibius* indicates the Vistulian period. The morphotype, the length (3.7 mm)

Tab. 8: Faunal list of all present fossil remains of Ovčiarско

Systematic	MNI
PASSERIFORMES	Σ1
Passeriformes	1
EULIPOTYPHILA	Σ1
Sorcidae	
<i>Sorex cf. araneus</i>	1
LAGOMORPHA	Σ1
Ochotonidae	
<i>Ochotona pusilla</i>	1
RODENTIA	Σ56
Dipodidae	
<i>Sicista cf. trizona</i>	2
Muridae	
<i>Cricetulus migratorius</i>	1
<i>Dicrostonyx cf. torquatus</i>	4
<i>Arvicola amphibius</i>	1
<i>Chionomys nivalis</i>	7
<i>Alexandromys oeconomus</i>	2
<i>Microtus agrestis</i>	16
<i>Microtus tatricus</i>	2
<i>Lasiopodomys gregalis</i>	21

and A/L value of our *A. amphibius* m1 (43.25mm), indicates an age close to the Late Glaciation (Nadachowski, 1982). Also, in the 20th century the Jasovská jaskyňa Cave (west of Košice, Slovakia) was investigated with a limited number of small vertebrates found. Several layers were dated from the Eemian to the Holocene (Ložek et al., 1957). All rodents were identified by Fejfar (in Ložek et al., 1957) and are attributed to the Vistulian age. This includes findings of *A. amphibius*, *D. torquatus*, *A. oeconomus*, *M. agrestis*, *M. arvalis*, and *L. gregalis* (Kowalski, 2001), similar to the faunal assemblage preserved in Ovčiarско. *Sicista* was also found in Bojnice (Early Vistulian) and Maštaľná Cave (Late Vistulian) excavations in Slovakia (Horáček & Sánchez, 1984). However, the faunal association matches the composition of the Early Holocene mammalia zone (VZ A) (Horáček & Ložek, 1988) as well. Combining the occurrences from Late Pleistocene and Early Holocene genera in Slovakia, our findings indicate the Late Vistulian Pleniglacial environment (Horáček & Ložek, 1988; Ložek et al., 1989; Obuch, 2000). *L. gregalis* dominates the assemblage and indicates non-boreal and steppe-like conditions. The latter are supported by the occurrence of *O. pusilla* and *S. cf. trizona* as they occur in steppe-areas with bush growth and *C. migratorius* which also prefers steppes and areas with restricted plant height. Although the arctic lemming (*D. torquatus*) inhabits only the arctic treeless tundras today, the occurrence of *M. tatricus*, *M. agrestis*, which both prefer open ground and open woodland, and *C. nivalis*, which occurs only in habitats of steep slopes above the timber line, suggests a barren steppe-like landscape for the Ovčiarско area with limited precipitation during the Late Pleistocene. With no findings of warm-dry indicators such as *Hystrix vinogradovi* and early Vistulian species like *A. cantiana*, it is unlikely that the material is from the pre-Vistulian period (Horáček & Ložek, 1988; Hír, 1997; Kowalski, 2001). Also combining the interpretation of the morphotypes and measurements from *A. amphibius*, *D. cf. torquatus*, and the *Microtus* specimens compared with sites from Austria, Poland, and Slovakia (Nagel, 1997; Rabeder, 1981; Nadachowski, 1982; Horáček & Sánchez, 1984; Obuch, 2000) the composition of our assemblage allows the attribution to a Late Vistulian Pleniglacial age for the Ovčiarско fauna.

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Appendix 1

Invent.-Nr.	Order	Family	Genus	Species	Element	Width (mm)	Length (mm)	A/L(mm)
DH100033	Lagomorpha	Ochotonidae	<i>Ochotona</i>	<i>O. pussila</i>	p4	1.43	1.53	
DH100033	Lagomorpha	Ochotonidae	<i>Ochotona</i>	<i>O. pussila</i>	m1	1.57	1.66	
DH100033	Lagomorpha	Ochotonidae	<i>Ochotona</i>	<i>O. pussila</i>	m2	1.58	1.63	
DH100130	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M1	0.94	0.96	
DH100129	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M1	0.92	0.99	
DH100030	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M1	0.92	1.03	
DH100029	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M2	1.01	0.94	
DH1000131	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M2	1.01	1.02	
DH100121	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M2	0.90	1	
DH100126	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M3	0.71	0.76	
DH100127	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	M3	0.68	0.69	
DH100120	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m1	0.81	1.11	
DH100119	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m1	0.80	1.1	
DH100122	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m2	0.87	1.1	
DH100123	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m2	0.83	1.02	
DH100124	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m2	0.83	1.1	
DH100125	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m3	0.68	0.9	
DH100128	Rodentia	Dipodidae	<i>Sicista</i>	<i>S. cf. trizona</i>	m3	0.69	0.74	
DH100032	Rodentia	Muridae	<i>Cricetulus</i>	<i>C. migratorius</i>	m1	1.12	1.55	
DH100133	Rodentia	Muridae	<i>Cricetulus</i>	<i>C. migratorius</i>	m2	0.98	1.24	
DH100053	Rodentia	Muridae	<i>Dicrostonyx</i>	<i>D. cf. torquatus</i>	m1	1.24	3.24	
DH100054	Rodentia	Muridae	<i>Dicrostonyx</i>	<i>D. cf. torquatus</i>	m1	1.04	2.94	
DH100056	Rodentia	Muridae	<i>Dicrostonyx</i>	<i>D. cf. torquatus</i>	m1	1.07	2.91	
DH100118	Rodentia	Muridae	<i>Arvicola</i>	<i>A. amphibius</i>	m1	1.90	3.7	43.25
DH100132	Rodentia	Muridae	<i>Arvicola</i>	<i>A. amphibius</i>	m2	1.43	2.36	
DH100040	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.17	2.78	49.53
DH100041	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.21	2.78	51.26
DH100042	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.05	2.89	47.83
DH100043	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.12	2.29	55.9
DH100045	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	0.90	2.65	50.25
DH100046	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.24	2.81	46.8
DH100047	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.07	2.94	50.97
DH100049	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.15	2.84	48.98
DH100050	Rodentia	Muridae	<i>Chionomys</i>	<i>C. nivalis</i>	m1	1.04	2.7	48.02
DH100022	Rodentia	Muridae	<i>Alexandromys</i>	<i>A. oeconomus</i>	m1	1.05	2.16	54.84
DH100044	Rodentia	Muridae	<i>Alexandromys</i>	<i>A. oeconomus</i>	m1	1.28	2.8	47.75
DH100014	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.17	2.31	53.99
DH100016	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.97	2.49	51.02
DH100018	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.91	2.35	54.31
DH100020	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.11	2.56	54.95
DH100023	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.83	2.25	64.16
DH100024	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.05	2.79	59.03
DH100025	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.96	2.6	52.06
DH100079	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.18	2.48	53.27
DH100081	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.26	2.79	55.31
DH100082	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.16	2.6	53.61
DH100083	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.99	2.54	62.73
DH100084	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.18	2.35	54.31
DH100085	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.87	2.54	54.8
DH100086	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.96	2.64	53.5
DH100087	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.91	2.56	55.6
DH100088	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.94	2.33	52.76

Appendix 1 (continued)

Invent.-Nr.	Order	Family	Genus	Species	Element	Width (mm)	Length (mm)	A/L(mm)
DH100090	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.96	2.71	51.93
DH100091	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.11	2.51	52.19
DH100092	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.12	2.75	52.62
DH100093	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.12	2.68	51.75
DH100097	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.94	2.71	54.16
DH100098	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.11	2.74	55.01
DH100100	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.24	2.7	57.29
DH100103	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	0.97	2.2	53.17
DH100106	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	1.13	2.45	54.31
DH100107	Rodentia	Muridae	<i>Microtus</i>	<i>M. agrestis</i>	m1	x	2.7	54.84
DH100017	Rodentia	Muridae	<i>Microtus</i>	<i>M. tatricus</i>	m1	1.4	2.5	50.54
DH100102	Rodentia	Muridae	<i>Microtus</i>	<i>M. tatricus</i>	m1	1.10	2.7	52.91
DH100000	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.07	2.82	53.28
DH100001	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.88	2.52	51.49
DH100002	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.04	2.57	51.83
DH100003	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.18	2.88	51.49
DH100004	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.97	2.16	57.49
DH100005	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.24	3.1	50.42
DH100006	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.01	2.7	54.09
DH100007	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.91	2.43	51.24
DH100008	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.93	2.7	52.8
DH100009	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.92	2.74	55.31
DH100011	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.05	2.67	56.67
DH100012	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.89	2.34	52.86
DH100013	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.07	2.47	57.36
DH100015	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.05	2.65	56.36
DH100019	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.95	2.34	55.19
DH100021	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.01	2.3	55.21
DH100059	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.11	2.91	55.28
DH100060	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.00	2.52	54.74
DH100061	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.04	2.63	54.55
DH100062	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.08	2.82	53.83
DH100063	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.13	2.63	53.27
DH100064	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.06	2.86	54.02
DH100065	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.88	2.6	55.62
DH100066	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.10	2.76	54.48
DH100067	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.07	2.69	64.61
DH100068	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.92	2.61	53.27
DH100069	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.00	2.54	56.16
DH100070	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.20	2.72	57.86
DH100071	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.00	2.48	55.91
DH100072	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.17	2.63	52.4
DH100074	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.00	2.55	55.03
DH100075	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.00	2.68	55.85
DH100077	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.99	2.8	53.96
DH100094	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.07	2.84	55.5
DH100095	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.03	2.43	51.69
DH100096	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.9	2.4	51.02
DH100108	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.09	2.56	57.28
DH100109	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.04	2.63	50.51
DH100110	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	1.06	2.64	57.01
DH100111	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.99	2.57	55.08
DH100112	Rodentia	Muridae	<i>Lasiopodomys</i>	<i>L. gregalis</i>	m1	0.81	2.38	53.59