Special issue of the Natural History Museum in Belgrade

Life on the shore

Geological and paleontological research in the Neogene of Sibnica and vicinity (Levač basin, Central Serbia)

Part I

Edited by:
Zoran Marković & Miloš Milivojević

LIFE ON THE SHORE

GEOLOGICAL AND PALEONTOLOGICAL RESEARCH
IN THE NEOGENE OF SIBNICA AND VICINITY
(LEVAČ BASIN, CENTRAL SERBIA)

Part 1

Natural History Museum in Belgrade

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Life on the shore - geological and paleontological research in the Neogene of Sibnica and vicinity (Levač basin, Central Serbia) Part 1

Editor-in-Chief
Slavko Spasić

Editors
Zoran Marković
Miloš Milivojević

Computer Layaut
Nataša Pavlov

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An early record of the moschid genus *Micromeryx* (Mammalia, Ruminantia)

Sanja Alaburić[1], Predrag Radović[2]

Alaburić, S. & Radović, P. (2016): An early record of the moschid genus *Micromeryx* (Mammalia, Ruminantia). *In*: Marković, Z. & Milivojević, M. (eds.): Life on the shore – geological and paleontological research in the Neogene of Sibnica and vicinity (Levač basin, Central Serbia). Part 1. *Special Issue of the Natural History Museum in Belgrade*: 141–148.

Abstract

The paper presents the description of six isolated fossil teeth discovered in 2011 at Sibnica 4 locality (Central Serbia). Based on the morphological characteristics, the material is identified as belonging to a small fossil moschid *Micromeryx* sp., which makes the first occurrence of this genus in Serbia. Moreover, the associated small mammalian fauna suggests MN4 age for the fossils from Sibnica, constituting the earliest record of this genus discovered so far.

Key words: Early Miocene, Moschidae, *Micromeryx*, Serbia

Introduction

Moschids are small-sized hornless pecoran ruminants represented in the extant fauna only by the musk deer (*Moschus* spp.), inhabiting forested and mountainous scrub habitats of eastern Asia. The phylogenetic position of Moschidae has long been debated. Systematic clustering based on morphological, molecular and behavioral characters and supertree methods have been used to decipher the phylogenetic relationships of the Moschidae. They have been considered to be the sister group of the Cervidae, Cervidae+Antilocapridae, Cervidae+Bovidae, Bovidae, or all other pecorans (Janis & Scott 1987, Hernández-Fernández & Vrba 2005, Vislobokova & Lavrov, 2009). Recent morphological, as well as molecular studies, have shown that moschids represent a sister group of the Bovidae (Hassanin & Douzery 2003, Sánchez *et al.* 2009, 2010). The European moschid genera, *Hispanomeryx* Morales, Moyà-Solà & Soria, 1981 and *Micromeryx* Laret, 1851, from the Middle to Late Miocene share a number of diagnostic features with the extant *Moschus* (Aiglstorfer & Costeur 2013). Three species of the genus *Hispanomeryx* are currently recognized: *Hispanomeryx duriensis* Morales *et al*. 1981 (type species, MN9-10), *H. aragonensis* Azanza, 1986 (MN7/8) and *H. daamsi* Sánchez, Domingo & Morales, 2010 (MN6/7). Other than in Spain *Hispanomeryx* has been identified in the Caucasus and in Turkey (Sánchez *et al*. 2010). Five European species of the genus *Micromeryx* are considered valid (Aiglstorfer *et al*. 2014). The type species *Micromeryx flourensianus* was described by Lartet (1851) on the basis of material from Sansan (France, MN6). Additional material of this species ranging in age between MN5 and MN9 has been discovered in Central Europe and Asia (Aiglstorfer *et al*. 2014). Thenius (1950) described *Micromeryx styriacus* on basis of a rather poor dental sample from the locality Göriach (Austria, MN5/6) but no other finds of this species have been discovered since. Three additional species of this

[1] Natural History Museum, Njegoševa 51, 11000 Belgrade, Serbia. E-mail: sanja.pavic@nhmbeo.rs

[2] National Museum in Kraljevo, Trg Svetog Save 2, 36000 Kraljevo, Serbia. E-mail: pedja_radovic@yahoo.com

genus have been described in recent years. Vislobokova (2007) described *Micromeryx mirus* from Kohfidisch (Austria, MN11). The abundant vertebrate fauna from Torril-3 in Spain (MN7/8) yielded *Micromeryx azanzae* Sánchez & Morales, 2008. The species *Micromeryx soriae* Sánchez, Domingo & Morales, 2009 was described on the basis of the material from three Spanish sites (La Roma-2, Batallones-1, and Batallones-10, MN 10).

Only one putative fossil moschid specimen has been reported from Serbia so far. Laskarev (1939) described a right mandibular ramus from Rusce village near Vranje (Southern Serbia), which he identified as *M. flourensianus*. Unfortunately, this specimen has been lost, so we were not able to check its taxonomic status. Based on the flora (Mihajlović 1985), molluscs (Veselinović *et al.* 1958) and small mammals (Marković *et al*. 2013) the strata at Rusce were deposited during the Late Eocene, so this specimen has most probably been misidentified by Laskarev. This means that moschids were unknown from Serbia until recent sampling at Sibnica.

Abbreviations

NHMBEO NVLM – Natural History Museum Belgrade Neogene Vertebrate Large Mammals Collection.

Material and methods

The Natural History Museum of Belgrade team collected the material that will be described below from the locality Sibnica 4 in 2011. The geological setting of this locality is described in detail in Knežević *et al*. (2016, this volume). Sieving of the sediment from Sibnica 4 resulted in the discovery of six isolated teeth of a small moschid: NHMBEO NVLM 019471 (d3 sin), NHMBEO NVLM 019472 (p3 sin), NHMBEO NVLM 019473 (m2 dext), NHMBEO NVLM 019474 (m2 sin), NHMBEO NVLM 019475 (m3 dext), NHMBEO NVLM 019476 (m3 sin). Dental terminology used follows Bärmann & Rössner (2011). Measurements were taken using digital calipers (with a precision of 0,1 mm). Crown height was measured on the lingual sides of the teeth. Comparative metrical data were taken from the literature (Vislobokova 2007, Thenius 1950, Hillenbrand *et al*. 2009, Sánchez *et al*. 2009, Sánchez *et al*. 2010, Rössner 2010, Aiglstorfer *et al*. 2014). All specimens are figured as left ones. If the original is from the right side its number is underlined on the plates.

Systematic paleontology

Order Cetartiodactyla Montgelard, Catzeflis & Douzery, 1997
Suborder Ruminantia Scopoli, 1777
Family Moschidae Gray, 1821
Genus *Micromeryx* Lartet, 1851
Micromeryx sp.

(Pl. 1. 1– 3b; Pl. 2. 1-3b)

Permanent dentition: The p3 (NHMBEO NVLM 019472) displays a dominant centrally placed mesolingual conid. The mesolabial conid is small and positioned distally; there is no anterolingual cristid. The transverse cristid is strongly skewed backwards, forming a deep and obliquely oriented posterior valley, which is open on the lingual side. The anterior conid and the anterior stylid are well developed. Seen in the labial view, mesolabial conid is deeply

separated from the anterior conid/stylid – the anterolabial cristid is not a continuous ridge, but a v-shaped structure. The posterolabial and posterolingual conids are prominent. The anterior valley is deep. The posterior valley is deep and almost fully closed by a strong posterior stylid and posterior cristid.The labial wall of the tooth is flat and there are no cingula. The lower molars have relatively high crowns, with long wings of the protoconid and metaconid. The anterior cingulid is well marked on all molars, but other cingula are absent. All molars show a split postprotocristid, with a conspicuous *Paleomeryx* fold (*sensu* Janis (1987)). Second molars (NHMBEO NVLM 019473–019474) are characterized by a large ectostylid, which although much smaller in size is also present in third molars (NHMBEO NVLM 019475–019476). The metastylid is poorly developed in the second molars, although it is slightly more pronounced in NHMBEO NVLM 019473. As for the third molars, metastylid is large in NHMBEO NVLM 019476, and relatively small in NHMBEO NVLM 019475. The third lobe in both third molars is fully closed and much reduced in size. The entoconulid is much smaller than hypoconulid and fused with the posthypocristid. The lingual walls are not smooth as in p3, but show the presence of lingual ribs; however, the lingual relief of the third lobe is much smoother. The prehypoconulidcristid and hipoconulid are well developed.

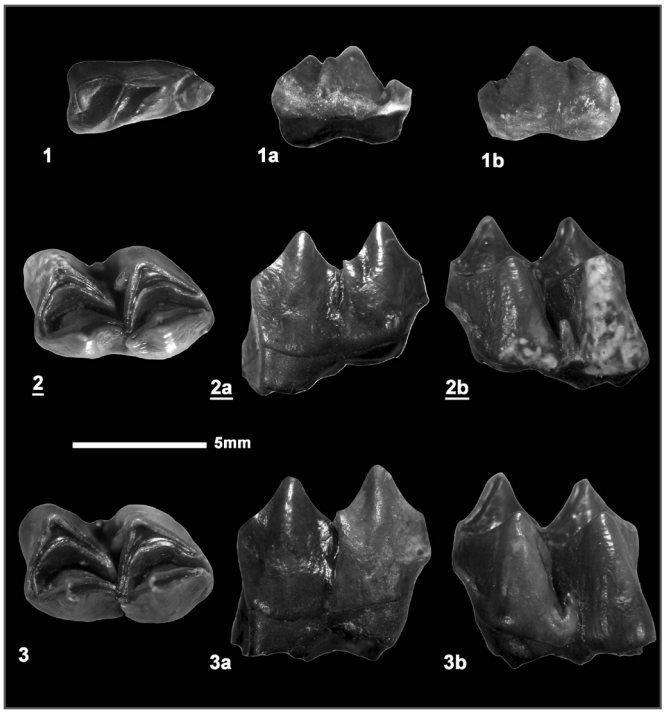

Plate 1: *Micromeryx* sp. from Sibnica 4: p3 sin (NHMBEO NVLM 019472) - occlusal (1), lingual (1a), labial (1b) views; m2 dex (NHMBEO NVLM 019473) – occlusal (reversed) (2), lingual (reversed) (2a), labial (reversed) (2b) views; m2 sin (NHMBEO NVLM 019474) - occlusal (3), lingual (3a) and labial (3b) views.

Deciduous dentition: The crown of the d3 (NHMBEO NVLM 019471) is much lower and longer than that of the p3. The anterior valley is not fully closed, since it opens on the labial side. The protoconid is well developed and placed centrally. The narrow, deep mesofossa is closed. The hypoconid is placed mesially (in line with the protoconid) and its wings enclose the posterior valley. There are no cingula.

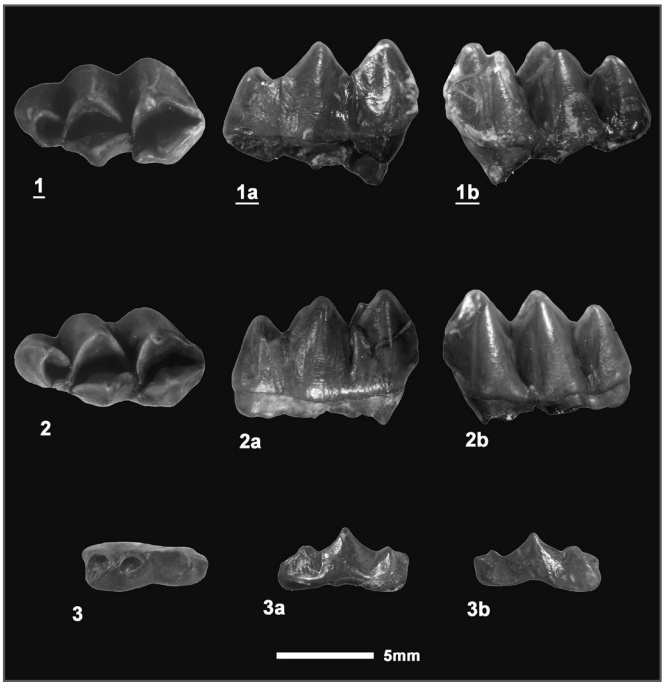

Plate 2: *Micromeryx* sp. from Sibnica 4: m3 dex (NHMBEO NVLM 019475) - occlusal (reversed) (1), lingual (reversed) (1a), labial (reversed) (1b) views; m3 sin (NHMBEO NVLM 019476) – occlusal (2), lingual (2a), labial (2b) views; d3 sin (NHMBEO NVLM 019471) - occlusal (3), lingual (3a) and labial (3b) views.

Discussion

The morphology of the teeth presented show clear affinities with the moschid genus *Micromeryx*. This is especially evident in the lower molars, which have a clear external postprotocristid (*Paleomeryx* fold), which characterizes all species of the genus except *Micromeryx azanzae*. In contrast, the external postprotocristid is always absent in *Hispanomeryx* (Sánchez *et al.* 2008). In *Micromeryx*, all cingula in the lower molars are reduced except the anterior one, which is the condition in the specimens from Sibnica. Both third molars from Sibnica show bicuspidate third lobe, a character consistently present in *Micromeryx* (Sánchez *et al.* 2008); however, the third lobe is relatively small and shows a reduced (small) entoconulid, which differentiates it from *M. florensianus* and *M. styriacus*. In terms of size, the teeth from Sibnica are similar to those of other species of the genus *Micromeryx*. A detailed comparison with various *Micromeryx* species (Tabs 1-4)

shows that there are only minute differences in dental measurements. While the size of the molars from Sibnica 4 fall into ranges for *M. florensianus*, the p3 is somewhat smaller and the d3 differs by its greater length and slightly smaller width. The molars also fall into size ranges for *M. azanzae*, but the p3 from Sibnica is narrower. Compared to *M. soriae* the p3 and m2 from Sibnica are smaller. The metric difference with *M. mirus* is basically restricted to the relatively short m3 of that species. Comparison to *M. styriacus* is necessarily restricted to the lower third molars. The m3 from Sibnica is slightly smaller. We should keep in mind that the metric differences between the various *Micromeryx* species are only slight (often less then millimeter) and inufficient for identification. The sizes of Sibnica teeth are also similar to those of the small cervid *Lagomeryx parvulus* (MN 4-6 and possibly MN3) (Tabs 1-4). However, *Lagomeryx* differs from moschids of comparable size by having relatively low crowns and by lacking third lingual cuspid in m3 Rössner (2010). The only consistent size distinction that we see concerns *Hispanomeryx daamsi*, which shows larger dental measurements (Tabs 1-3). Although the Sibnica material clearly belongs to the genus *Micromeryx*, we were not able to determine it to the species level. We could only exclude *M. azanzae* because the lower molars of this species do not show an external postprotocritid.

Specimen/Species	**Locality**	**References**	**p3 L min/max**	**p3 aw min/max**	**p3 W min/max**
NHMBEO NVLM 019472	Sibnica	Our data	5.36	2.2	2.56
Micromeryx florensianus	Atzelsdorf, Gratkorn, Sansan	Hillenbrand *et al*. (2009), Aiglstorfer *et al*. (2014), Rössner (2010)	5.5/6.1	2.7/3.5	-
Micromeryx azanzae	Toril-3	Sánchez & Morales (2008)	4.37/5.98	3.2/3.7	-
Micromeryx soriae	La Roma-2	Sánchez *et al*. (2009)	5.4	-	3.2
Micromeryx mirus	Kohfidisch	Vislobokova (2007)	5/5.5	-	2.8/3.4
Hispanomeryx daamsi	Toril-3	Sánchez *et al*. (2010)	5.62/6.24	-	3.06/3.38
Lagomeryx parvulus	Sandelzhausen, Reischenau	Rössner (2010)	5.9/6.4	2.6/3.4	-
Lagomeryx pumilio	Sandelzhausen, Reischenau	Rössner (2010)	3.8/4.9	1.8/3.4	-
Lagomeryx ruetimeyeri	Landstrost, Oberdorf	Rössner (2010)	6.7/8.3	2.7/4.4	-

Table 1: Measurements (in mm) for Sibnica p3 specimen and comparative taxa; L – crown length; aw – anterior (mesial lobe) width; W – width.

Previously, the earliest known records of the genus *Micromeryx* (species *M. florensianus* and *M. styriacus*) were dated to MN5 (Aiglstorfer *et al.* 2014). However, the associated small mammals suggest an MN4 (= Late Ottnangian/Early Karpatian) age for the Sibnica fauna (Marković *et al*. 2016, this volume), which makes this record of *Micromeryx* the earliest so far.

Specimens/Species	Locality	References	m2 L min/max	m2 aw min/max	m2 W min/max
NHMBEO NVLM 019473	Sibnica	Our data	7.35	4.76	4.82
NHMBEO NVLM 019474	Sibnica	Our data	7.32	4.72	4.83
Micromeryx florensianus	Atzelsdorf, Gratkorn, Sansan	Hillenbrand *et al*. (2009), Aiglstorfer *et al*. (2014), Rössner (2010)	6.2/7.5	4/6.9	-
Micromeryx azanzae	Toril-3	Sánchez & Morales (2008)	6.92/8.27	-	4.63/5.42
Micromeryx soriae	La Roma-2	Sánchez *et al*. (2009)	7.8	-	5
Micromeryx mirus	Kohfidisch	Vislobokova (2007)	6.7/7.4	-	4/4.6
Hispanomeryx daamsi	Toril-3	Sánchez *et al*. (2010)	8.47/10.11	-	5.01/5.76
Lagomeryx parvulus	Sandelzhausen, Reischenau	Rössner (2010)	7/7.8	4.5/5.1	-
Lagomeryx pumilio	Sandelzhausen, Reischenau	Rössner (2010)	5.4/6.4	3.2/4.2	-
Lagomeryx ruetimeyeri	Landstrost, Oberdorf	Rössner (2010)	9.5/9.6	6.5/6.8	-

Table 2: Measurements (in mm) for Sibnica m2 specimens and comparative taxa; L – crown length; aw – anterior (mesial lobe) width; W – width.

Specimens/Species	Locality	References	m3 L min/max	m3 aw min/max	m3 W min/max
NHMBEO NVLM 019475	Sibnica	Our data	9.42	4.77	4.45
NHMBEO NVLM 019476	Sibnica	Our data	9.43	4.72	4.39
Micromeryx florensianus	Atzelsdorf, Gratkorn, Sansan	Hillenbrand *et al*. (2009), Aiglstorfer *et al*. (2014), Rössner (2010)	8.5/10.4	3.9/4.8	-
Micromeryx azanzae	Toril-3	Sánchez & Morales (2008)	8.48/10.07	4.22/4.87	-
Micromeryx mirus	Kohfidisch	Vislobokova (2007)	7	-	-
Micromeryx styriacus	Göriach	Thenius (1950)	9.8	-	4.8
Hispanomeryx daamsi	Toril-3	Sánchez *et al*. (2010)	11.2/13.5	-	4.9/5.7
Lagomeryx parvulus	Sandelzhausen, Reischenau	Rössner (2010)	9.4/10.7	3.7/5.4	-
Lagomeryx pumilio	Sandelzhausen, Reischenau	Rössner (2010)	5.9/8.8	3.1/4.9	-
Lagomeryx ruetimeyeri	Landstrost, Oberdorf	Rössner (2010)	13.3/14.8	6.8/8	-

Table 3: Measurements (in mm) for Sibnica m3 specimens and comparative taxa; L – crown length; aw – anterior (mesial lobe) width; W – width.

Specimen/Species	Locality	References	d3 L min/ max	d3 aw min/ max	d3 W min/ max
NHMBEO/NVLM 019471	Sibnica	Our data	6,14	1,81	2,31
Micromeryx florensianus	Atzelsdorf, Gratkorn, Sansan	Aiglstorfer *et al*. (2014), Rössner (2010)	5.1/5.5	-	2.4/2.5
Lagomeryx parvulus	Sandelzhausen, Reischenau	Rössner (2010)	5.8/6.1	2.4/2.7	-

Table 4: Measurements (in mm) for Sibnica d3 specimen and comparative taxa; L – crown length; aw – anterior (mesial lobe) width; W – width.

Conclusion

The six isolated fossil teeth described represent the first occurrence of the genus *Micromeryx* in Serbia. Moreover, the age of Sibnica (as inferred from the associated small mammalian fauna) extends the stratigraphic range of the genus *Micromeryx* to MN4. This early dating together with the morphological peculiarities of the material, emphasis the importance of Sibnica for the understanding the moschid diversity and evolution in Europe.

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