A systematic study of the middle-late Miocene rodents and lagomorphs (Mammalia) of Felsőtárkány 3/8 and 3/10 (Northern Hungary) with stratigraphical relations

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ABSTRACT
The present paper gives a systematic study of rodent and lagomorph remains together with the list of terrestrial molluscs recovered in the localities FT 3/8 and FT 3/10. Miocene nonmarine deposits and fossils had been known from the beginning of the 20th century in the surroundings of the village Felsőtárkány, close to the town of Eger. An intensive sampling campaign was initiated by the first author in 2000. The collection was taken by screen-washing. Up to the present seven localities were studied. Among them, Felsőtárkány 3/8 and 3/10 occur in the highest lithostratigraphic position. The faunas of FT 3/8 and 3/10 are unusual due to the association of Vallesian rodents (e.g., *Myoxus vallesiensis*, *Microtocricetus molassicus*, *Megacricetodon minutus*) and Sarmatian molluscs (e.g., *Perforatella punctigera*, *Pirenella picta nympha*). The coexistence of *Collimys* and *Microtocricetus* is rare among the European Early Vallesian faunas. Another special character of the fauna FT 3/10 is the high frequency (53%) of *Collimys*. The biostratigraphic comparisons suggest that the age of the studied faunas cannot be younger than the A-B mollusc zones of the Vienna Basin (Fig. 11; Papp 1951) and fits with the lower part of MN 9 or perhaps the uppermost MN 7/8. This late Sarmatian-Early Pannonian period is imperfectly documented in the Central European Neogene.

KEY WORDS
Mammalia,
Rodentia,
Lagomorpha,
terrestrial molluscs,
Miocene,
biostratigraphy,
Hungary.

RÉSUMÉ
Étude systématique des rongeurs et des lagomorphes (Mammalia) du Miocène moyen-tardif des sites 3/8 et 3/10 de la localité de Felsőtárkány (nord de la Hongrie) et relations stratigraphiques.
Cet article présente l'étude systématique des rongeurs et des lagomorphes ainsi qu'une liste des fossiles de mollusques terrestres des sites FT 3/8 et 3/10. Les sédiments non marins et les fossiles du Miocène de la localité de Felsőtárkány, située à proximité de la ville d'Eger, sont connus depuis le début du xx^{e} siècle. Une campagne de collecte intensive a été lancée par le premier auteur en 2000. La collecte se réalise par le lavage de la vase. Jusqu'à ce jour, nous avons étudié sept sites ; parmi eux, les sites de Felsőtárkány 3/8 et 3/10 étaient les points lithostratigraphiques les plus élevés. La faune de FT 3/8 et FT 3/10 est particulière du fait qu'elle présente une coexistence de rongeurs vallésiens (par exemple *Myoxus vallesiensis*, *Microtocricetus molassicus*, *Megacricetodon minutus*) et de molusques du Sarmatien (*Perforatella punctigera*, *Pirenella picta nympha*). La coexistence des *Collimys* et des *Microtocricetus* est rare dans la faune du Vallésien précoce d'Europe. L'autre particularité de la faune FT 3/10 est la haute fréquence (53 %) des *Collimys*. Les comparaisons biostratigraphiques montrent que l'âge des faunes étudiées n'est pas plus jeune que la zone à mollusques du bassin de Vienne (Fig. 11 ; Papp 1951) et la partie inférieure de la zone MN 9 ou de la partie supérieure de la zone MN 7/8. Cette période du Sarmatien tardif-Pannonien précoce est mal documentée dans le Néogène d'Europe centrale.

MOTS CLÉS
Mammalia,
Rodentia,
Lagomorpha,
mollusques terrestres,
Miocène,
biostratigraphie,
Hongrie.

INTRODUCTION

Between 2000 and 2007, fossil microvertebrates were collected from late Sarmatian terrestrial deposits in the Felsőtárkány Basin, Northern Hungary, close to the town of Eger (Figs 1-4). The first report on the nonmarine molluscs found north of the village of Felsőtárkány was published by Schréter (1913). Subsequent studies on the macroflora, terrestrial molluscs and vertebrate fossils were done by Andreánszky & Kovács (1955), Kretzoi (1982), Hír (2003, 2005, 2006), Erdei & Hír (2002). The aim of the present study is to describe one lagomorph and 13 rodent species from two new localities of the Felsőtárkány Basin, in addition to the lists of their terrestrial molluscs. These localities are lithostratigraphically at the highest fossiliferous strata of the Felsőtárkány-Basin.

ABBREVIATIONS

Aver	average;
D	upper deciduous molar;
d	lower deciduous molar;
L	length (in mm) of the occlusal surface of the molar;
M	upper adult molar;
m	lower adult molar;
MMP	Municipal Museum of Pásztó;
No. inv.	inventory number;
P	upper adult premolar;
p	lower adult premolar;
W	maximal width (in mm) of the occlusal surface of the molar (in the lower molars of *Eurolagus* Lopez-Martinez, 1977 the width of the anterior lobe Wa and the width of the posterior lobe Wp were measured separately).

LOCALITIES

As a result of the new scientific activities since 2000, seven vertebrate localities have been discovered along two sections in the Felsőtárkány Basin (Figs 1-3). The section between the villages Felsőtárkány and Felnémet includes:

TABLE 1. — List of lagomorph and rodent species from three localities of the Felsőtárkány Basin, Hungary.

	FT 3/2	**FT 3/8**	**FT 3/10**
Eurolagus fontannesi (Depéret, 1887)	+	+	+
Trogontherium minutum (von Meyer, 1838)	+		+
Spermophilinus bredai (von Meyer, 1848)	+		
Miopetaurista sp.	+		
Albanensia cf. *grimmi* (Black, 1966)	+		
Neopetes sp.	+		+
Blackia miocaenica (Mein, 1970)	+		
Muscardinus aff. *sansaniensis* (Lartet, 1851)	+		
Muscardinus sp.	+		+
Glirulus cf. *lissiensis* (Hugueney & Mein, 1965)		+	
Paraglirulus werenfelsi Engesser, 1972	+	+	+
Myoglis meini Baudelot, 1965	+		+
Myoxus vallesiensis (Agustí, 1981)			+
Eomyops oppligeri Engesser, 1972		+	+
Keramidomys mohleri Engesser, 1972	+		+
Megacricetodon minutus Daxner, 1967	+		+
Eumyarion medius (Lartet, 1851)	+	+	+
Collimys dobosi Hír, 2005	+		+
Microtocricetus molassicus Fahlbusch & Mayr, 1975		+	+
Anomalomys gaudryi Gaillard, 1900		+	+

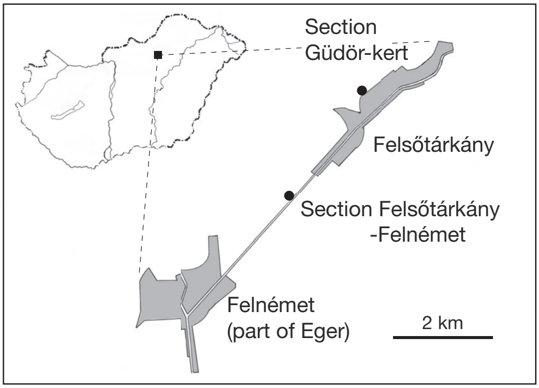

FIG. 1. — The topographical position of the two studied sections in the Felsőtárkány Basin, Hungary.

- Felsőtárkány-Felnémet 2/3 (FF 2/3), Hír 2006, 2007;
- Felsőtárkány-Felnémet 2/7 (FF 2/7), Hír 2006, 2007.

The section of Felsőtárkány Güdör-kert includes:

- Felsőtárkány 1 (FT 1), Hír 2001, Hír *et al.* 2001 and Hír & Kókay (2009);
- Felsőtárkány 2 (FT 2), Hír & Kókay (2009);
- Felsőtárkány 3/2 (FT 3/2), Hír 2003, 2005 and Hír *et al.* 2001;
- Felsőtárkány 3/8 (FT 3/8), present paper;
- Felsőtárkány 3/10 (FT 3/10), present paper.

The section of Güdör-kert (Fig. 3) was studied by a Canadian research team from the University of Toronto between 2003 and 2005 under the guidance of Prof. David Begun. Their results were published by Kordos & Begun (2003) and Hutchinson & Begun (2006, 2008). A brief description of the geological context of the Felsőtárkány Basin is given by Hír (2007). The most abundant microvertebrate fauna at the Felsőtárkány Güdör-kert section is from FT 3/2 (Table 1).

The Felsőtárkány 3/8 locality (47°58.5’19”N, 20°24.7’1”E) consists of a 70 cm green clay layer (“Upper Green Clay” in Hutchinson & Begun 2006, 2008) located 140 cm above the lignitic seam of the Güdör-kert section (Fig. 3). In the field, shells of terrestrial molluscs (mainly helicids) are visible in the layer. The vertebrate fauna of Felsőtárkány 3/8 is relatively scarce, consisting of only 21 intact lagomorph and rodent molars (Table 1). This material is moderately suitable for deductions, the presence of *Microtocricetus* Mayr & Fahlbusch, 1975 molars is remarkable. The low frequency of the fossil material in this layer is difficult to explain because

TABLE 2. — List of the mollusc fauna from the Felsőtárkány 3/10 locality, Hungary.

Taxa	**Stratigraphical range in the Paratethys**
Pirenella picta nympha (Eichwald, 1853)	Badenian-Sarmatian
Palaina martensi (Andreae, 1902)	Late Badenian-Sarmatian
Pyramidula sp.	Neogene
Valvata moguntina (Boettger, 1884)	Early Miocene-Sarmatian
Bithynia glabra (Zieten, 1830)	Early Miocene-Sarmatian
Carychium sandbergeri Handmann, 1887	Badenian-Pontian
Carychium pachychilus Sandberger, 1875	Sarmatian-Pontian
Galba dupuyana (Noulet, 1854)	Badenian-Sarmatian
Stagnicola praebouilleti Schlickum, 1970	Badenian-Sarmatian
Stagnicola sp.	Neogene
Radix dilatata (Noulet, 1854)	Karpatian-Sarmatian
Radix socialis cf. *praelongata* (Gottschick-Wenz, 1916)	Badenian-Sarmatian
Lymnaea turrita Klein, 1855	Badenian-Sarmatian
Aplexa subhypnorum physaeformis Gottschick, 1920	Late Badenian-Sarmatian
Gyrorbis hilgendorfi (Fraas, 1868)	Badenian-Sarmatian
Gyrorbis hilgendorfi subcarinata (Gottschick, 1920)	Badenian-Sarmatian
Anisus dupuyanus omalus (Bourguignat, 1881)	Badenian
Gyraulus nedici (Brusina, 1902)	Sarmatian
Hippeutis fasciatus Gottschick, 1920	Late Badenian-Sarmatian
Segmentina larteti (Noulet, 1854)	Badenian-Pontian
Planorbarius cornu mantelli (Dunker, 1848)	Badenian-Sarmatian
Planorbarius sansaniensis (Noulet, 1854)	Early Miocene-Sarmatian
Vertigo callosa (Reuss, 1860)	Late Oligocene-Pontian
Gastrocopta acuminata (Klein, 1846)	Badenian-Pontian
Gastrocopta suevica (Boettger, 1889)	Badenian-Pontian
Pupilla submuscorum (Gottschick-Wenz,1919)	Late Badenian-Sarmatian
Vallonia lepida (Reuss, 1852)	Oligocene-Pontian
Strobilops uniplicata plana (Clessin, 1885)	Karpatian-Badenian
Succinea minima Klein, 1853	Karpatian-Sarmatian
Limax sp.	Neogene
Triptychia sp.	Neogene
Serrulastra brandti Schütt, 1967	Sarmatian
Serrulastra ptycholarinx (Boettger, 1877)	Badenian-Sarmatian
Serrulella michelottii (Michaud, 1862)	Pliocene
Serrulella clessini (Boettger, 1877)	Badenian
Cochlodina oppoliensis Nordsieck, 1981	Badenian-Sarmatian
Nordsieckia pontica Lueger, 1981	Sarmatian-Pontian
Nordsieckia fischeri (Michaud, 1862)	Pliocene
Laminifera sp.	Neogene
Psdeudoleacina kleiniana (Pilsbry, 1909)	Badenian
Perforatella punctigera (Thomae, 1845)	Early Miocene-Sarmatian
Tropidomphalus (*Pseudochloritis*) *zelli* (Kurr, 1856)	Karpatian-Badenian
Klikia coarctata (Klein, 1853)	Karpatian-Sarmatian
Cepaea sp.	Neogene

the sedimentological study (Hutchinson & Begun 2006, 2008) verified the return to the low energy conditions prevalent during the formation of the FT 3/2 layer containing rich fauna.

The Felsőtárkány 3/10 locality (47°58.51'40"N, 26°24.7'01"E) has been found in 2004, when the Güdör-kert section was completed by an artificial trench dug by an excavator. 29 m NW from the Güdör-kert profile (Fig. 2), a brown clay lens was found (Figs 2; 4). This locality is clearly bedded above the locality FT 3/8. In the field, small fragments of terrestrial molluscs were visible in the clay and in the sand close to the clay lens. This locality called Felsőtárkány 3/10 yielded lagomorph and rodent species listed in Table 1.

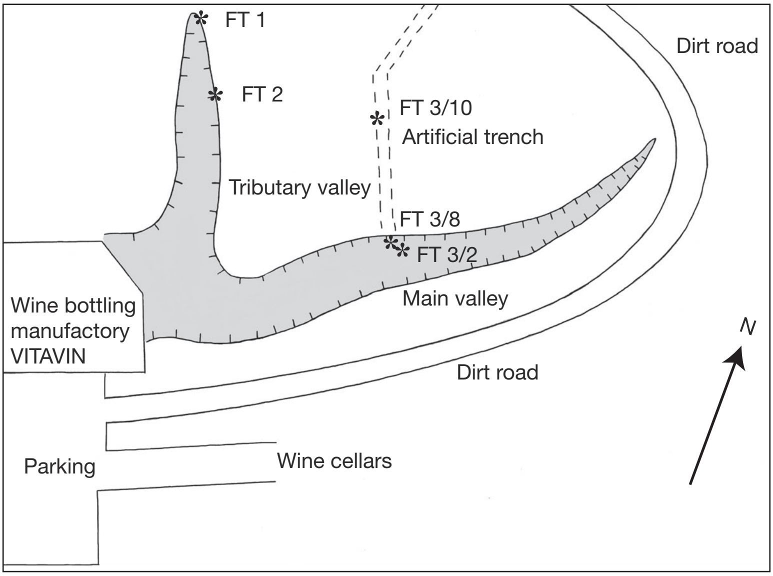

Fig. 2. — Non-scaled sketch map of the topographic position of the localities at the Felsőtárkány Güdör-kert, Hungary.

The facies association of the Felsőtárkány Güdörkert section is indicative of deposition in a low energy, subaqueous environment with lacustrine or lagoonal margin sedimentary successions (Hutchinson & Begun 2006, 2008).

MATERIAL AND METHODS

In total, about two tons of sediment were collected and screen-washed from FT 3/8 in 2004 and 2006. From FT 3/10 the first positive test samples were taken by the first author in May 2005. Intensive sampling has been done during the summers of 2005 and 2006 with the help of volunteer student workers who participated in the paleontological research camps organized by the Municipal Museum of Pásztó.

In total, four tons of sediment were collected from FT 3/10. The fossiliferous lens of this locality was completely excavated, while FT 3/8 remains suitable for more sampling. In the field, the samples were air dried. After drying, the material was soaked in water with some H_2O_2. The soaked samples were screen-washed using a sieve set, the mesh of the lowest sieve being 0.5 or 0.6 mm. The sorting was done by the first author. The finds are stored at the Municipal Museum of Pásztó. The nomenclatures of the dental morphology applied in the systematic descriptions of the rodent material are after the following authors: Castoridae, Hugueney (1999); Sciuridae, Cuenca Bescos (1988); Myoxidae, Daams (1981); Eomyidae, Engesser (1999); Cricetidae, Mein & Freudenthal (1971) as a rule, Freudenthal & Daams (1988) in the special nomenclature of M3 and Rummel (1998) in the special nomenclature of *Eumyarion* Thaler, 1966; Anomalomyidae, Kordos (2005).

THE MOLLUSC FAUNA

The study of the mollusc material and the edition of the mollusc faunal lists is given by the second author. The Felsőtárkány 3/8 locality yielded the following mollusc species:
– *Limax* sp.;
– *Milax* sp.;
– *Tropidomphalus* sp.;
– *Perforatella* (*Monachoides*) *punctigera* (Thomae, 1845);
– *Klikia* sp.;
– *Cepaea* sp.

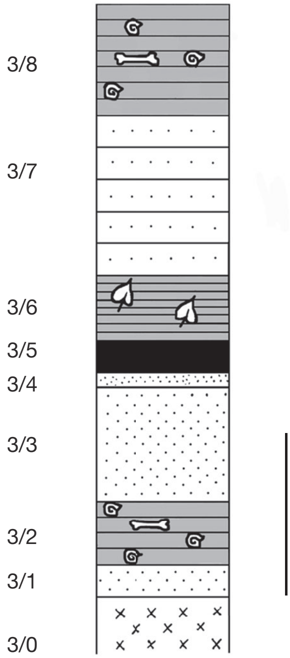

FIG. 3. — Section at the main valley of Güdör-kert with the vertebrate localities of Felsőtárkány 3/2 and 3/8 and the level with the macroflora of Felsőtárkány 3/6 (Andreánszky & Kovács 1955): **3/8**, 70 cm green clay containing mollusc shells and vertebrate finds; **3/7**, 100 cm tuffitic sand; **3/6**, 40 cm laminated mud containing leaf imprints; **3/5**, 20 cm lignite; **3/4**, 10 cm brown sand; **3/3**, 70 cm tuffitic sand; **3/2**, 40 cm green clay containing mollusc shells and vertebrate fauna; **3/1**, 20 cm hard tuffitic sand; **3/0**, rhyolitic tuffite. Scale bar: 1 m.

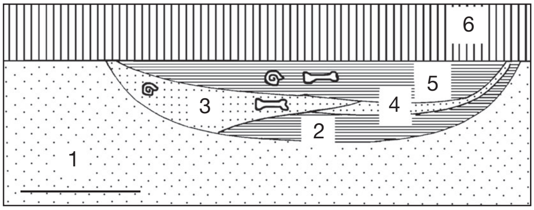

FIG. 4. — Profile of the vertebrate locality Felsőtárkány 3/10 in the artificial trench excavated in 2004: **1**, gray sand; **2**, brown clay; **3**, yellow sand containing mollusc shells and vertebrate finds; **4**, red sand; **5**, brown clay containing mollusc shells and vertebrate finds; **6**, recent soil. Scale bar: 1 m.

The fauna consists of only terrestrial elements. The *Perforatella* Schlüter, 1838 species ranges from the Early Miocene to the middle Miocene (Sarmatian).

The mollusc species of the Felsőtárkány 3/10 locality are listed in Table 2.

This rich mollusc fauna is attributable to the Sarmatian. This age is supported in particular by the presence of *Pirenella picta nympha* (Eichwald, 1853). The *Pirenella* Gray, 1847 species are frequent elements of the Sarmatian restricted marine mollusc faunas in the Central Paratethys. The shoreline of the great brackish lake of the Carpathian Basin was situated probably not far from the locality. The importation of the *Pirenella* specimen into the freshwater facies was possible by occasional storms.

SYSTEMATICS OF THE LAGOMORPHS AND RODENTS

The study of the mammal finds was done by the first author. The systematics of rodents and lagomorphe follows McKenna & Bell (1997) and Erbajeva (1988), respectively. The measurements are given in mm.

Order LAGOMORPHA Brandt, 1855
Family PALAEOLAGIDAE Dice, 1929
Genus *Eurolagus* Lopez-Martinez, 1977

Eurolagus fontannesi (Depéret, 1887)

MATERIAL EXAMINED. — See Table 3 for data and measurements.

DESCRIPTION

The lower deciduous premolar is larger and more robust than the corresponding tooth of *Prolagus* Pomel, 1853. The p4-m1 is a juvenile specimen with the beginning of root formation. The m2 is an adult one with developed roots. The root formation is a substantial character of the genus *Eurolagus* among the middle Miocene lagomorphs.

COMMENTS

In the Felsőtárkány Basin, *Eurolagus* was found in the localities FT 3/2, FT 3/8, FT 3/10. *Prolagus* was collected from FF 2/3 and FF 2/7. These two genera never occur together in the Felsőtárkány localities.

Order RODENTIA Bowdich, 1821
Family CASTORIDAE Hemprich, 1820
Genus *Trogontherium* Fischer von Waldheim, 1809

Trogontherium minutum (von Meyer, 1838)

MATERIAL EXAMINED. — See Table 4 for data and measurements.

DESCRIPTION
The juvenile molar is hypsodont and shows an early phase of root formation. No cement is apparent in the sinuses. The occlusal surface is divided into an anterior and a posterior lobe by the two transverse sinuses: hypoflexus on the lingual and mesoflexus on the labial side. There is a large enamel islet in the anterior lobe, the parafosette and two islets in the posterior lobe, the metafosette and submetafosette.

COMMENTS
Trogontherium minutum is a frequent but not abundant element of late Astaracian-Early Vallesian faunas in the Carpathian Basin. The published occurences are Felsőtárkány-Felnémet 2/3 and 2/7 (MN 7-8; Hír 2006), Felsőtárkány 3/2 (MN 7-8; Hír 2003), Rudabánya (MN 9; Kordos 2003), Borsky Sväty Jur (MN 9; Sabol *et al*. 2004) and Götzendorf (MN 9; Bachmayer & Wilson 1984).

Family SCIURIDAE Fischer von Waldheim, 1817
Subfamily PTEROMYINAE Brandt, 1855
Genus *Neopetes* Daxner-Höck, 2004

Neopetes sp.

MATERIAL EXAMINED. — See Table 5 for data and measurements.

DESCRIPTION
The occlusal surface is triangular. The root stumps are preserved. The anteroloph is protuberant. The protoloph and the metaloph are parallel. There is a mesoloph-like structure in the lingual end of the central valley, but it is not connected to the protocone. The valley between the metaloph and the posteroloph is very narrow. In the D4 of *Spermophilinus bredai* (von Meyer, 1848), this valley is wider (Hír 2003).

TABLE 3. — Individual data of *Eurolagus fontannesi* (Depéret, 1887) finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	Wa	Wp	Fig.
FT 3/10	2007.196	d3	3.0		1.87	5C
FT 3/10	2007.196	p4-m1	2.4	2.3	1.80	
FT 3/8	2007.227	m2	2.65	1.73	1.75	5D, E

TABLE 4. — Data of the *Trogontherium minutum* (von Meyer, 1838) find from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.197	M2	3.55	2.95	5A, B

TABLE 5. — Data of the *Neopetes* sp. find from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.173	D4	1.47	1.62	6A

COMMENTS
In a previous paper of the first author, the *Neopetes* remains from FT 3/2 have been described as *Hylopetes* Thomas, 1908 (Hír 2003). However, it would be better to follow Daxner-Höck (2004a) in attributing them to the genus *Neopetes*. The isolated molar from FT 3/10 is inadequate for species determination.

Family MYOXIDAE Gray, 1821
Subfamily MYOXINAE Gray, 1821
Genus *Glirulus* Thomas, 1906

Glirulus lissiensis (Hugueney & Mein, 1965)

MATERIAL EXAMINED. — See Table 6 for data and measurements.

DESCRIPTION
The occlusal surface is rectangular and concave. It bears five main ridges (including the centrolophid) and two extra ridges. The endolophid is

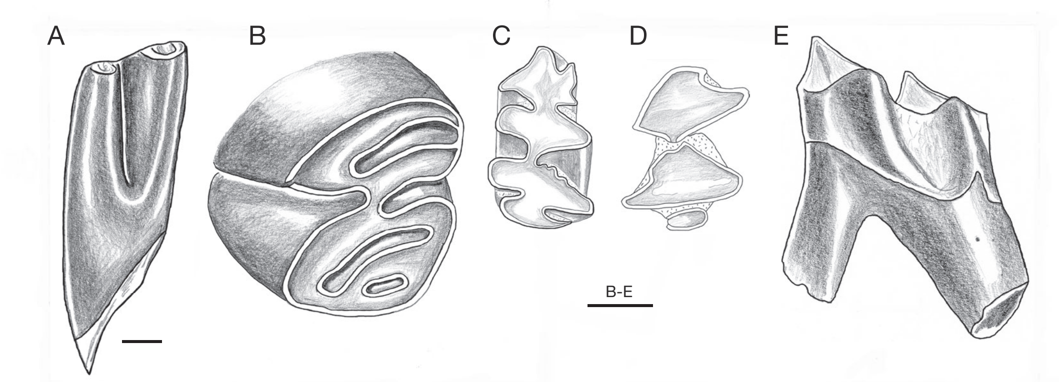

FIG. 5. — Lagomorphs and Castorids from Felsőtárkány 3/8 and 3/10, Hungary: **A**, **B**, *Trogontherium minutum* (von Meyer, 1838); **A**, M2, lingual view FT 3/10, MMP.2007.197; **B**, M2, occlusal view, FT 3/10, MMP.2007.197; **C**-**E**, *Eurolagus fontannesi* (Depéret, 1887); **C**, d3, occlusal view, FT 3/10, MMP.2007.196; **D**, m2, occlusal view, FT 3/8, MMP.2007.227; **E**, m2, labial view, FT 3/8, MMP.2007.227. Scale bars: 1 mm.

TABLE 6. — Data of the *Glirulus lissiensis* (Hugueney & Mein, 1965) find from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/8	2007.2520	m2	0.87	0.85	6I

TABLE 7. — Individual data of the *Muscardinus* sp. finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.88	p4	0.59	0.62	6G
FT 3/10	2007.178	m1	1.20	1.05	6H

TABLE 8. — Individual data of *Myoglis meini* Baudelot, 1965 finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.175	D4	1.39	1.57	
FT 3/10	2007.78	M2	1.68	2.03	
FT 3/10	2007.122	M3	1.58	1.82	6N
FT 3/10	2007.77	m1	1.68	1.41	

interrupted between the centrolophid and the mesolophid. The centrolophid is long but does not reach the labial margin. The extra ridges are not developed in both sides of the centrolophid. This morphotype is found in an m1 among the paratypes of the species (Hugueney & Mein 1965: pl. III, fig. 58).

COMMENTS

In eastern Central Europe, *G. lissiensis* is found in the following late Astaracian-Early Vallesian localities: Rudabánya, Richardhof-Golfplatz, Richardhof-Wald (MN 9; Daxner-Höck 2005), Schernham (*Glirulus* sp.; MN 10; Daxner-Höck 2004b), Borsky Sväty Jur (MN 9; Sabol *et al.* 2004), Belchatow A (MN 9; Kowalski 1997; Garapich 2002) and Subpiatra 2/2 (MN 7/8; Venczel *et al.* 2005).

Genus *Muscardinus* Kaup, 1829

Muscardinus sp.

MATERIAL EXAMINED. — See Table 7 for data and measurements.

DESCRIPTION

The small p4 has a rounded occlusal surface and four transverse ridges. The first anterior ridge is strongly worn. The 1st-2nd and 3rd-4th ridges are labially connected. The m1 is trapezoidal in outline. The anterior margin is narrower than the posterior one. It has flat occlusal surface and six transverse ridges. The lingual and labial

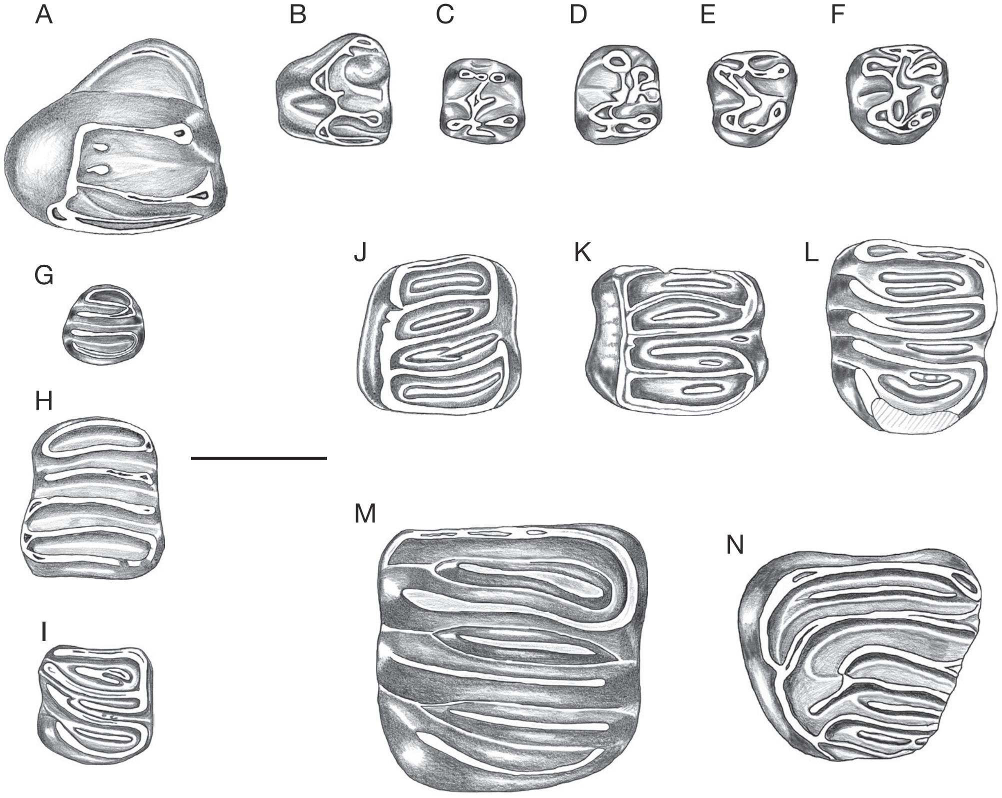

Fig. 6. — Occlusal views of Sciurids, Eomyids and Glirids from Felsőtárkány 3/8 and 3/10, Hungary: **A**, *Neopetes* sp., D4, FT 3/10, MMP.2007.173; **B**-**F**, *Eomyops oppligeri* Engesser, 1990; **B**, D4, FT 3/10, MMP.2007.79; **C**, p4, FT 3/8, MMP.2007.221 (reversed); **D**, p4, FT 3/8, MMP.2007.222; **E**, m3, FT 3/8, MMP.2007.213 (reversed); **F**, m3, FT 3/8, MMP.2007.214; **G**, **H**, *Muscardinus* sp.; **G**, p4, FT 3/10, MMP.2007.88; **H**, m1, FT 3/10, MMP.2007.178; **I**, *Glirulus lissiensis* (Hugueney & Mein, 1965), m2, FT 3/8, MMP.2007.220; **J**-**L**, *Paraglirulus werenfelsi* Engesser, 1972; **J**, M1, FT 3/10, MMP.2007.176 (reversed); **K**, M2, FT 3/8, MMP.2007.225 (reversed); **L**, m2, occlusal view, FT 3/10, MMP.2007.177; **M**, *Myoxus vallesiensis* (Agustí, 1981), m2, occlusal view, FT 3/10, MMP.2007.122 (reversed); **N**, *Myoglis meini* Baudelot, 1965, M3, occlusal view (reversed) FT 3/10 MMP.2007.122. Scale bar: 1 mm.

connections exist between the 1st-2nd and the 5th-6th ridges.

COMMENTS

Without M1 the determination is uncertain**.** In the Early Vallesian of eastern Central Europe, three *Muscardinus* species have been found in the following sites: Rudabánya (MN 9; *M. hispanicus* de Bruijn, 1966; *M.* cf. *vallesiensis* Hartenberger, 1966; Daxner-Höck 2005), Belchatow (MN 9; *M. topachevskii* Nesin & Kowalski, 1997; Nesin & Kowalski 1997), Borsky Sväty Jur (MN 9; *M. hispanicus*; Sabol *et al.* 2004), Richardhof Golfplatz (MN 9; *M. vallesiensis*; Daxner-Höck 2005) and Götzendorf (MN 9; *M.* cf. *hispanicus*; *M.* cf. *vallesiensis*; Daxner-Höck 2005).

Genus *Myoglis* Baudelot, 1965

Myoglis meini Baudelot, 1965

MATERIAL EXAMINED. — See Table 8 for data and measurements.

DESCRIPTION

In the upper molars, the extra ridges between the anteroloph and protoloph are long. The anterior

TABLE 9. — Data of the *Myoxus vallesiensis* (Agustí, 1981) find from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.121	m2	1.97	2.0	6M

TABLE 10. — Individual data of the *Paraglirulus werenfelsi* Engesser, 1972 finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.176	M1	1.18	1.19	6J
FT 3/8	2007.225	M2	1.18	1.27	6K
FT 3/10	2007.89	d4	0.83	0.63	
FT 3/10	2007.177	m2	1.36	1.20	6L

extra ridges are connected to the middle part of the anterior centroloph. The main ridges are merged in the protocone. In this, the FT 3/10 form differs from *Myoglis ucrainicus* Nesin & Kowalski, 1997 (Nesin & Kowalski 1997) in which the main ridges of M1-2 are frequently not merged in the protocone region.

COMMENTS

The morphology of these teeth is similar to that of the material described by Baudelot (1965), Engesser (1972) and Nemetshek & Mörs (2003) as *Myoglis meini*. This species is already known in three other Felsőtárkány localities, i.e. FT 3/2, FF 2/3 and FF 2/7, as described by Hír (2003, 2006). The material from the borehole Lövölde Square, Budapest, described by Kretzoi (1943) as "*Pentaglis földvárii*" should be included in this species.

Genus *Myoxus* Zimmermann, 1780

Myoxus vallesiensis (Agustí, 1981)

MATERIAL EXAMINED. — See Table 9 for data and measurements.

DESCRIPTION

The flat and rectangular occlusal surface of the molar 2007.121 displays four main ridges (anterolophid, metalophid, mesolophid, posterolophid). Anterolophid and metalophid are lingually connected. There are three – slightly less developed – secondary ridges (anterior extra ridge, centrolophid, posterior extra ridge). The anterior extra ridge and centrolophid are centrally positioned and not connected with the lateral margins. The posterior extra ridge is situated at the lingual margin of the occlusal surface.

COMMENTS

Beyond the original description (Agustí 1981), the characters noted here above recall those of the middle and late Miocene *Myoxus* remains described by Kowalski (1997) and Daxner-Höck (2005).

The large dimensions of this molar are noticeable. They are greater than those of the type material from Seu d'Urgell. *Myoxus vallesiensis* is regarded as a typical early Vallesian faunal element. The Vallesian faunas of eastern Central Europe includes two *Myoxus* species: the smaller *M. minor* Kowalski, 1963 and the larger *M. vallesiensis*. *Myoxus minor* occurs at Rudabánya (MN 9), Richardhof Golfplatz (MN 9), Richardhof Wald (MN 10) and Götzendorf (MN 9) (Daxner-Höck 2005). *Myoxus vallesiensis* occurs at Belchatow A (MN 9; Kowalski 1997) and Grytsev (MN 9; Nesin & Kowalski 1997).

Genus *Paraglirulus* Engesser, 1972

Paraglirulus werenfelsi Engesser, 1972

MATERIAL EXAMINED. — See Table 10 for data and measurements.

DESCRIPTION

The occlusal surface of the upper molars is concave and rectangular. The endoloph is continuous. The M1 has five main ridges, all connected to the endoloph. The four extra ridges have no connections. On the M2 the anterior centroloph reaches the endoloph. The five extra ridges have no connection. The m2 has five main ridges, which are connected to the endolophid. This endolophid is not continuous but interrupted between the centrolophid and mesolophid. The anterior and the posterior extra ridges are doubled.

COMMENTS

Paraglirulus werenfelsi remains from Felsőtárkány 3/2 were erroneously interpreted as *Glirulus* sp. and *Paraglirulus* aff. *werenfelsi* by the first author (Hír 2003). This error was based on the overestimation of the lingual connection of the anterior centroloph in the M1-2 and a misconsideration of the slightly larger size of the FT 3/2 form compare to *P. werenfelsi*. *Paraglirulus werenfelsi* is a frequent element of the European Miocene faunas. Its occurence in eastern Central Europe is reported from Obergänsernorf (MN 5; Daxner-Höck 1998), Belchatow A (MN 9; Kowalski 1997), Grytsev (MN 9; *P.* cf. *werenfelsi* in Nesin & Kowalski 1997), Richardhof-Golfplatz (MN 9; Daxner-Höck 2005), Rudabánya (MN 9; Daxner-Höck 2005), Richardhof-Wald (MN 10; Daxner-Höck 2005), Schernham (MN 10; Daxner-Höck 2004b) and Subpiatra (MN 7/8; Venczel *et al.* 2005).

Family EOMYIDAE Winge, 1807
Genus *Eomyops* Engesser, 1979

Eomyops oppligeri Engesser, 1990

MATERIAL EXAMINED. — See Table 11 for data and measurements.

DESCRIPTION

The P4 has a trapezoidal occlusal outline. The paracone is not involved into the anteroloph. The mesoloph is short. The metacone has no posterior connection with the posteroloph. The p4 has a trapezoidal occlusal surface. The anterior part is narrower than the posterior part. The anterolophulid is not developed, the protoconid and the metaconid are situated at the anterior margin. The mesolophid reaches the lingual margin (2007.222) or exhibits intermediate development (2007.221). The occlusal surface of m3 is nearly rectangular, but the posterior margin is rounded. The labial arm of the anterolophulid is less developed than the lingual one. The metalophid is connected to the anterolophulid. The mesolophid displays intermediate development. The hypolophid is lacking (2007.223) or weakly developed and connected to the posterolophid (2007.214).

TABLE 11. — Individual data of *Eomyops oppligeri* Engesser, 1990 finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.79	D4	0.84	0.87	6B
FT 3/8	2007.221	p4	0.66	0.64	6C
FT 3/8	2007.222	p4	0.77	0.66	6D
FT 3/8	2007.213	m3	0.69	0.67	6E
FT 3/8	2007.214	m3	0.78	0.70	6F

TABLE 12. — Individual data of *Megacricetodon minutus* Daxner, 1967 finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Figs
FT 3/10	2007.123	M1	1.36	0.85	
FT 3/10	2007.170	M1	1.34	0.91	8G
FT 3/10	2007.171	M1	1.41	0.81	
FT 3/10	2007.172	M1	1.40	0.84	
FT 3/10	2007.180	m1	1.36	0.81	6H
FT 3/10	2007. 87	m3	0.85	0.70	6I

COMMENTS

The material is limited and shows a mixture of morphological markers of *E. oppligeri* and *E. catalaunicus* (Hartenberger, 1966), but the dimensions are definitely smaller than that of *E. catalaunicus* and clearly refer to *E. oppligeri*. The late Astaracian-Early Vallesian occurences of the two *Eomyops* species in eastern Central Europe are at Rudabánya (MN 9; Daxner-Höck 2005) and Götzendorf (MN 9; Rögl *et al.* 1993) for *Eomyops catalaunicus*, and at Belchatow A (MN 9; Garapich 2002), Felsőtárkány 1 (MN 7/8; Hír 2001) and Felsőtárkány 3/2 (MN 7/8; Hír 2003) for *Eomyops oppligeri*.

Family CRICETIDAE Rochebrune, 1883
Genus *Megacricetodon* Fahlbusch, 1964

Megacricetodon minutus Daxner, 1967

MATERIAL EXAMINED. — See Table 12 for data and measurements.

DESCRIPTION

The anterocone of M1 is divided, the anterolophule is short, the protolophule I is developed in one specimen

TABLE 13. — Measurements of *Collimys dobosi* Hír, 2005 finds from Felsőtárkány, Hungary.

	L				W		
Position	**Min**	**Aver**	**Max**	**No.**	**Min**	**Aver**	**Max**
M1	1.74	1.99	2.14	17	1.16	1.26	1.34
M2	1.37	1.51	1.61	14	1.19	1.28	1.40
M3	1.19	1.32	1.36	7	1.12	1.20	1.26
m1	1.62	1.87	2.04	10	1.05	1.19	1.26
m2	1.47	1.57	1.65	14	1.16	1.26	1.32
m3	1.33	1.47	1.60	6/5	1.06	1.16	1.20

(2007.123), the mesoloph reaches the labial margin (2007.170, 171), or shows an intermediate level of development (2007.123). The anteroconid of m1 is divided, the anterolophulid has a short labial spur in the specimen 2007.172, the mesolophid exhibits an intermediate development, an ectomesolophid-like conelet is found in the molar 2007.172.

Comments

In the original diagnosis (Daxner 1967) the following markers of M1 are noted: small size, undivided anterocone, labial sinus curved forward and occasionally connected with the lingual sinus, lingual cusps wide, labial cusps mesio-distally reduced, mesoloph moderately developed and occasionally connected with the paracone spur. But the original material consists of only two M1 (holotype from Inzerdorf and paratype from Vösendorf, Austria) and one M2. In the Carpathian Basin, a *M. minutus* population was found at Borsky Sväty Jur in Slovakia (Joniak 2005), which is abundant and represents the morphological variability of *M. minutus*. In this population, three morphotypes of M1 anterocone are equally found: well splitted, slightly splitted and undivided are equally. In the same way, the mesoloph of M1 may be long, moderately developed or short (or absent). On the basis of morphological characters, we cannot distinguish the species *M. minor* and *M. minutus*. The useful markers are the slightly smaller mean dimensions of *M. minutus*. Furthermore a very similar taxon: *Megacricetodon* aff. *minor* was described from MN 7-8 faunas of the Northern Alpine Voreland Basin (Fahlbusch 1964; Engesser 1972; Bolliger 1992, 1994; Prieto 2007). The mean dimensions of *M. minutus* from FT 3/2 and 3/10 are among the smallest for *M. minor-M. minutus* group in Central Europe. Joniak (2005) demonstrated that *Megacricetodon debruijni* Freudenthal, 1968 is a junior synonym of *Megacricetodon minutus*. Beyond the above mentioned localities *M. minutus* was reported from the early Pannonian of Austria: Mataschen, Richardhof-Golfplatz, Bullendorf (Daxner-Höck 2004c).

Genus *Collimys* Daxner-Höck, 1972

Collimys dobosi Hír, 2005

MATERIAL EXAMINED. — See Table 13 for measurements.

Morphotype analysis

The result of the morphotype analysis of the *Collimys* molars is given in Table 14.

The explanation of the codes of the morphotypes is primarily given in Hír (2005). A brief summary of this explanation is as below:

M1

A	anteromesoloph is long, uninterrupted and reaches the labial margin;
B	anteromesoloph is interrupted;
a	protocone and paracone are connected by the protolophule I;
b	protocone and paracone are connected by the protolophule II;
x	protolophule I and II are equally developed;
1	mesoloph reaches the buccal margin;
0	mesoloph is long but does not reach the labial margin;
v	metalophule is simple;
W	metalophule occasionally bears an extra enamel ridge.

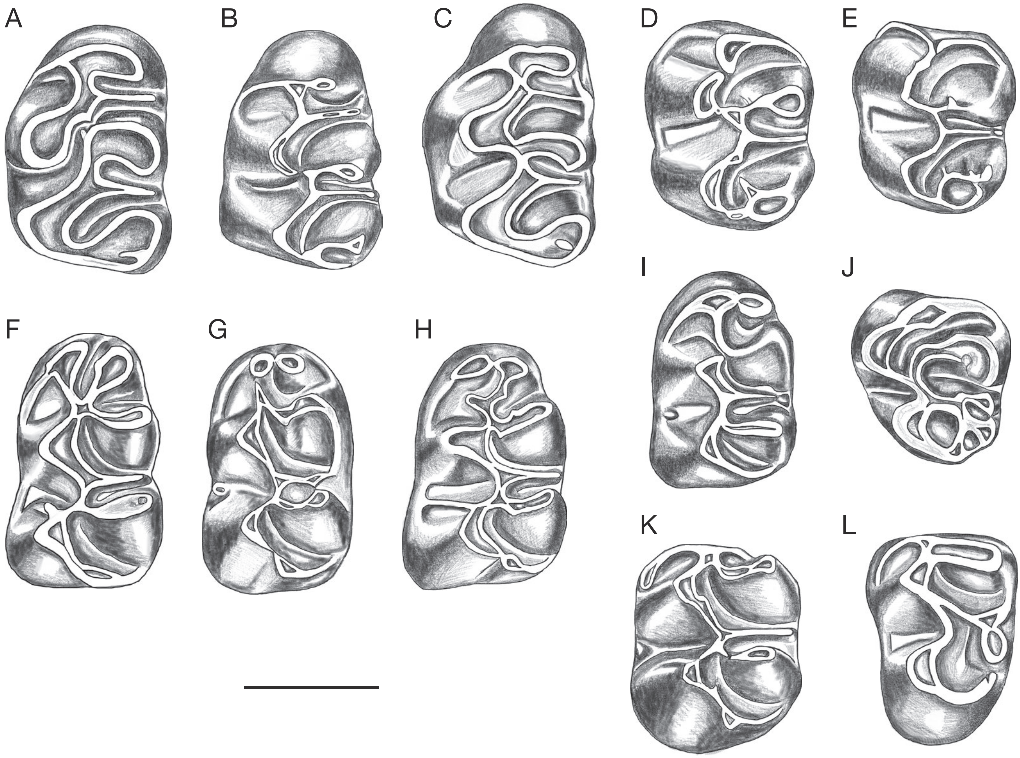

FIG. 7. — Occlusal surfaces of *Collimys dobosi* Hír, 2005 molars from Felsőtárkány 3/8 and 3/10, Hungary: **A**, M1, FT 3/10, MMP.2007.65 (reversed); **B**, M1, FT 3/10, MMP.2007.93 (reversed); **C**, M1, FT 3/10, MMP.2007.91; **D**, M2, FT 3/10, MMP.2007.139; **E**, M2, FT 3/10, MMP.2007.150; **F**, m1, FT 3/10, MMP.2007.132; **G**, m1, FT 3/10, MMP.2007.135 (reversed); **H**, m1, FT 3/10, MMP.2007.134; **I**, m1, FT 3/10, MMP.2007.69; **J**, M3, FT 3/10, MMP.2007.150; **K**, m2, FT 3/10, MMP.2007.135 (reversed); **L**, m3, FT 3/10, MMP.2007.158 (reversed). Scale bar: 1 mm.

M2

A	lingual anterolophule is completely missing;
B	lingual anterolophule is weak;
C	lingual anterolophule is well developed;
0	no connection between protocone and paracone;
a	protolophule II is well developed, protolophule I is completely missing;
b	protolophule II is well developed, protolophule I is incompletely developed;
c	protolophule II and I are equally developed;
1	mesoloph reaches the buccal margin;
o	mesoloph does not reach the labial margin;
x	metalophule is simple;
y	metalophule bears an extra enamel ridge.

M3

A	protolophule I and II are equally developed;
B	only protolophule II is developed;
C	only protolophule I is developed;
D	protolophule I and II are equally weak or absent;
a	anterior and posterior metalophule are equally developed;
b	only the posterior metalophule is developed.

m1

A group	anterolophulid has 1 branch ore 1 main branch, anteroconid is 1, 2 or 3 parted;
B group	anterolophulid is always 2 branched, anteroconid is constantly 2 parted. The branches of the anterolophulid are connected to the cusps of the anteroconid;
C group	anterolophulid is 2 branched, anteroconid is 2 or 3 parted. The labial branch of the anterolophulid is mainly connected to the anterolabial cingulum;

TABLE 14. — Morphotype occurences in molars of *Collimys dobosi* Hír, 2005 from Felsőtárkány 3/10, Hungary. See text for morphotype codes.

Position	**Morphotypes / No. of specimen**							
M1	Aa1v / 1	Ap1v / 6	Ap0v / 7	Ap1w / 1	Bp0v / 1	Ax1v / 0		
M2	Ca1x / 5	B01x / 1	Ca1y / 2	Ba1x / 1	Ba1y / 1	Bb1y / 1	Bb1x / 1	Ba1y / 1
M3	Aa / 2	Ba / 2						
m1	A0 / 3	B1 / 6	C1 / 1					
m2	Alo / 4	Alx / 5	0lo / 2	0lx / 1				
m3	0o / 3	Ao / 2						

D group	anterolophulid is always 3 branched, anteroconid is 2 or 3 parted;
0	ectomesolophid is not found;
1	ectomesolophid is developed.

m2

0	antero-lingual cingulum is not developed;
A	antero-lingual cingulum is developed;
S	mesolophid does not reach the lingual margin;
L	mesolophid reaches the lingual margin;
o	ectomesolophid is not developed;
x	ectomesolophid is developed.

m3

0	antero-lingual is not developed;
A	antero-lingual cingulum is developed;
o	ectomesolophid is not developed;
X	ectomesolophid is developed.

DESCRIPTION

The anterocone of the juvenile M1 consists of two conelets, which are not divided by a notch (Fig. 7A-C). The cingulum is developed in the antero-lingual side between the anterocone and the basis of the protocone. In the adult M1 the anterocone is broad and undivided (Fig. 7A, D). The anterolophule of the M1 is short and broad. In M2 and M3 the buccal anteroloph is always well developed. In M2 the lingual anteroloph is less developed but exists in all M2. In M3 the lingual anteroloph is absent or incipient (Fig. 7J).

The anteromesoloph of M1 is highly developed (highly elevated from the level of the sinus) and reaches the buccal margin (Fig. 7A, C). In one specimen it is interrupted (type "B"). The protocone-paracone connection is developed mainly by the protolophule II (Fig. 7B-E). There is a notch between the protocone and the lingual end of the protolophule II in one M1 (Fig. 7A) and in one M2 (2007.99). Only two M1 (type "x") and two M3 (type "A") have both protolophules. M1 with protolophule I alone is never found. The mesoloph is highly developed and reaches the buccal margin (type "1"; Fig. 7B). In some M1, this ridge ends immediately before the buccal margin (type "0"; Fig. 7C). The metalophule of the M1 and M2 is short and connected to the posteroloph. It bears a short extra enamel ridge (type "W" in M1 and type "y" in M2; Fig. 7D, E). Anterior and posterior metalophules are both developed in the M3.

In the lower dentition, the anteroconid of the m1 is divided. The anterolophulid is simple (type "A") or two branched (types "B" and "C") (Fig. 7F-I). It is situated between the labial cuspula of the anteroconid and the protoconid. In one specimen the anterolophulid is connected to the metaconid (2007.135; Fig. 7I). It is the only morphotype which is not observed in the type sample of *C. dobosi* from FT 3/2. The mesolophid is highly developed (highly elevated from the level of the sinus) and always reaches the lingual margin. The ectomesolophid is found in seven m1 (type "1") (Fig. 7H) and six m2 (type "x"). The antero-lingual cingulum is found in nine m2 (Fig. 7K) and two m3 (type "A").

COMMENTS

The type sample of *Collimys dobosi* is from the locality Felsőtárkány 3/2, which is in the same section as Felsőtárkány 3/10 (Fig. 3; Table 1). The detailed description and morphological analysis of this species was done by Hír (2005). No significant difference is observed, neither in morphology and size between the samples from Felsőtárkány 3/2 and Felsőtárkány 3/10. *Collimys dobosi* is the dominant species in both faunas. Its frequency is 54.5% in FT 3/2 and 53.5% in FT 3/10 of the rodent remains. Such a high dominance of *Collimys* is not known beyond the Felsőtárkány Basin.

Recently the *Collimys* material from Southern Germany was studied by Prieto (2008) and Prieto & Rummel (2009). They proved the presence of *Collimys dobosi* in the fauna of Hillenloh. They revised and presented the *Collimys* material of Hammerschmiede, in which *Collimys hiri* Prieto & Rummel, 2009 is the ancestor of *C. dobosi*.

Genus *Eumyarion* Thaler, 1966

Eumyarion medius (Lartet, 1851)

MATERIAL EXAMINED. — See Table 15 for data and measurements.

DESCRIPTION

On the M2, the lingual anterolophule is absent. The five main ridges are transverse and nearly parallel (anterolophule, protolophule, mesoloph, metalophule, posterolophule). The mesoloph exhibits intermediate development and the protolophule is inflated to form a cusp-like structure. The M3 has hypocone and metacone reduced and also reduced mesoloph, metalophule and posteroloph ridges. A strong axioloph is developed in the center of the crown. In lower molars, the metaconid and entoconid are higher than the protoconid and hypoconid. On the m1 the anteroconid is unicuspid with a bean-shaped occlusal surface. On the m1 the labial anterolophid is developed between the anteroconid and the base of the protoconid. The lingual anterolophid connects the anteroconid and the metaconid. The anterolophulid occurs between the lingual part of the anteroconid and the protoconid.

The metalophulid intersects the anterolophulid between the metaconid and the labial anterolophulid. Enamel ridges occur in the central region of the lower molars. The posterior arm of the protoconid is incipient in m1, and well developed in m2 and m3. The mesolophid is long and connected to the posterior base of the metaconid in m1, and extends to the ingual margin in m2 and m3. The posterior arm of the protoconid and mesolophid are merged in m2, but independent and parallel in m3. The ectomesolophid is short in m1, but absent in m2 and m3. The structure of the m1 from FT 3/8 is slightly different: in the anterior region only the anterolophulid and the posterior arm of the metaconid are well developed, no posterior connection of the anterolophulid towards the protoconid occurs because there is a notch in the anterior margin of the protoconid. The mesolophid and the posterior arm of the protoconid are merged.

TABLE 15. — Individual data of *Eumyarion medius* (Lartet, 1851) finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.111	M2	1.68	1.50	8E
FT 3/10	2007.169	M3	1.39	1.34	8F
FT 3/8	2007.217	M3	1.22	1.26	
FT 3/10	2007.07	m1	1.69	1.32	
FT 3/10	2007.167	m1	2.07	1.40	8A
FT 3/10	2007.66	m1	2.00	1.29	
FT 3/8	2007.215	m1	2.00	1.29	8B
FT 3/10	2007.109	m2	1.62	1.37	8C
FT 3/8	2007.216	m3	1.54	1.26	
FT 3/10	2007.110	m3	1.72	1.33	8D
FT 3/10	2007.168	m3	1.69	1.32	

COMMENTS

Detailed morphological analysis of the *Eumyarion* teeth from FF 2/3, FF 2/7 and FT 3/2 is given by Hír (2003, 2006). No significant differences have been found between the morphology and the dimensions of *Eumyarion* molars of Felsőtárkány 3/10 and the earlier published materials from the Felsőtárkány Basin. The occurrence of *Eumyarion* species in the Vallesian faunas of eastern Central Europe has been reported from Rudabánya (MN 9; *E. latior* (Schaub & Zapfe, 1953) in Kretzoi & Fejfar 2005), Götzendorf (MN 9; *Eumyarion* sp. in Rögl *et al.* 1993), Borsky Sväty Jur (MN 9; *E. leemani* (Hartenberger, 1965) in Sabol *et al.* 2004) and Belchatow A (MN 9; *E. latior* in Garapich 2002).

The dentition of *Eumyarion* species displays a high morphological variation, as previously mentioned by Engesser (1972), De Bruijn & Saraç (1991) and Bolliger (1994); this feature is also observed in the populations from the Felsőtárkány Basin.

TABLE 16. — Individual data of *Microtocricetus molassicus* Mayr and Fahlbusch, 1975 finds from Felsőtárkány, Hungary.

Locality	No. inv. MMP	Position	L	W	Fig.
FT 3/10	2007.112	M1	2.23	1.18	9A, E
FT 3/8	2007.226	M3	1.64	1.27	9D, H
FT 3/8	2007.218	m1	2.17	1.25	9B, F
FT 3/8	2007.219	m2	1.90	1.37	9C, G

Genus *Microtocricetus*
Mayr & Fahlbusch, 1975

Microtocricetus molassicus
Mayr & Fahlbusch, 1975

MATERIAL EXAMINED. — See Table 16 for data and measurements.

DESCRIPTION

The molars are semihypsodont. The unique M1 represents a subadult specimen. The flat occlusal surface consists of three lingual and four labial anticlines. It has a weak anteromesoloph. The molars from FT 3/8 (2007.218, 2007.219, 2007.226) probably belong to one individual, because the occlusal surfaces are not yet flattened due to the early ontogenetic stage of the specimen. The M3 has three lingual and four labial anticlines. There are two islets in the anteroloph. The paracone is independent. The mesoloph and the metacone are labially connected. The posterior lobe is narrow and rounded. The occlusal surface of m1 is formed by five lingual and four labial anticlines. The anteroconid encloses a large islet. The occlusal complex formed by the anteroconid, protoconid and metaconid is very similar to an anteroconid complex of an arvicolid m1. The m2 is made up by four lingual and four labial anticlines forming four transversal lobes. There is a small islet in the anterolophid. The longitudinal connection between the lobes is incipient. The posterior lobe is narrower than the three others.

COMMENTS

The morphology of the molars concurs in all with the detailed descriptions of Mayr & Fahlbusch (1975), Kowalski (1993), Fejfar (1999), Kretzoi & Fejfar (2005). In these publications *Microtocricetus* is regarded as a typical but relatively rare element of MN 9 faunas. The European occurences are listed by Kretzoi & Fejfar (2005). This list is not reinterpreted here, only three new localities are added: Borsky Sväty Jur and Pezinok in Slovakia (Sabol *et al.* 2004), Nebelbergweg-Transitgasleitung II in Switzerland (Engesser & Kälin 2005).

The coexistence of *Collimys* and *Microtocricetus* association was only known in two localities in Europe: Hammerschmiede with *Megacricetodon minutus*-*Collimys* sp.-*Microtocricetus molassicus* association. Originally the *Collimys* remains from this locality have been partially described as "*Democricetodon gaillardi* (Schaub, 1925)-*D. freisingensis* Fahlbusch, 1964" by Mayr & Fahlbusch (1975) and later corrected to *Collimys* by Kälin (1999) (recently this material was described as *Collimys hiri* [Prieto 2008; Prieto & Rummel 2009]). The other locality is Belchatow A with *Eumyarion*-*Democricetodon* sp. (1-2)-*Megacricetodon* aff. *minor* (Lartet, 1851)-*Collimys transversus* Heissig, 1995-*Microtocricetus molassicus* hamster association. However, *Collimys* is a rare element in Belchatow A, its frequency is 0.2% (Garapich 2002).

In the Vienna Basin, the occurence of *Microtocricetus* is reported from the locality Richardhof-Golfplatz. This locality is dated as Early Pannonian, and referred to the mollusc zone E (*Congeria subglobosa* Partsch, 1835) = C5n2n paleomagnetic zone =10.1-10.2 Myr by Daxner-Höck (2004a, b). The slightly older age of the *Microtocricetus* findings from Felsőtárkány 3/8 and 3/10 is possible because the mollusc material of the Felsőtárkány localities is undoubtedly Sarmatian and *Collimys* is absent in the MN 9 faunas of the Vienna Basin. *Microtocricetus molassicus* is the best potential rodent candidate for the "index fossil" status of the MN 9 zone in Central Europe (De Bruijn *et al.* 1992) but the exact datation of the FAD of this species is not known.

Family ANOMALOMYIDAE De Bruijn, 1984
Genus *Anomalomys* Gaillard, 1900

Anomalomys gaudryi Gaillard, 1900

MATERIAL EXAMINED. — See Table 17 for measurements.

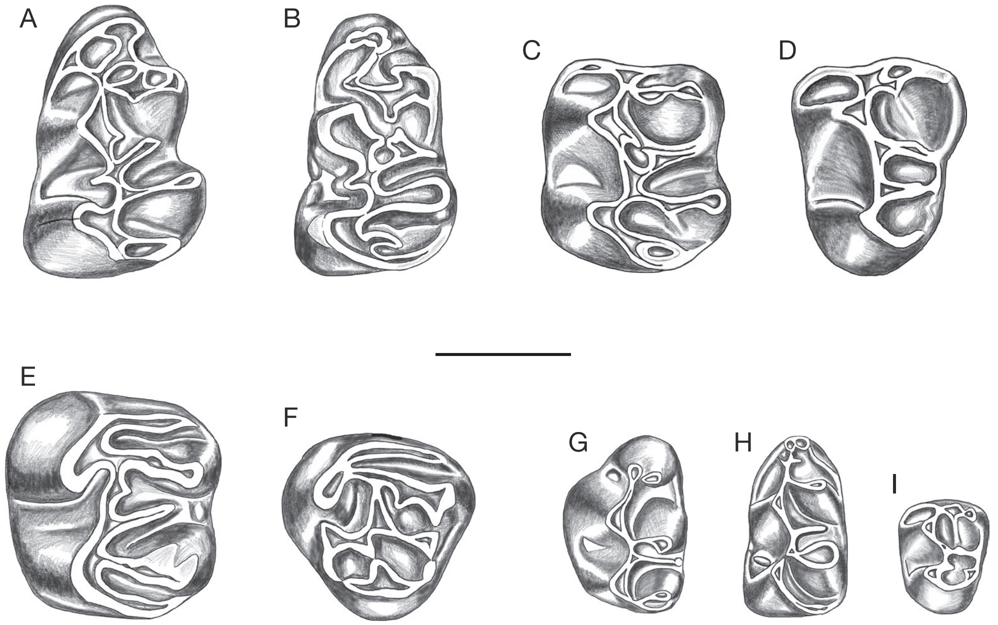

FIG. 8. — Occlusal views of *Eumyarion medius* (Lartet, 1851) and *Megacricetodon minutus* Daxner, 1967 molars from Felsőtárkány 3/8 and 3/10, Hungary: **A**-**F**, *Eumyarion medius*; **A**, m1, FT 3/10, MMP.2007.167; **B**, m1, FT 3/8, MMP.2007.215 (reversed); **C**, m2, FT 3/10, MMP.2007.109; **D**, m3, FT 3/10, MMP.2007.110; **E**, M2, FT 3/10, MMP.2007.111; **F**, M3, FT 3/10, MMP.2007.169 (reversed); **G**-**I**, *Megacricetodon minutus*; **G**, M1, FT 3/10, MMP.2007.170; **H**, m1, FT 3/10, MMP.2007.172; **I**, m3, FT 3/10, MMP.2007.87. Scale bar: 1 mm.

TABLE 17. — Measurements of *Anomalomys gaudryi* Gaillard, 1900 finds from Felsőtárkány, Hungary.

		L				W		
Position	**Locality**	**Min**	**Aver**	**Max**	**No.**	**Min**	**Aver**	**Max**
M1	FT 3/10	1.83	1.93	2.09	4	0.91	1.12	1.36
M1	FT 3/8	1.68	1.80	1.92	2	1.11	1.18	1.26
M2	FT 3/10	1.51	1.66	1.81	7	0.91	1.12	1.32
M2	FT 3/8		1.54		1		1.25	
M3	FT 3/10	1.13	1.15	1.18	3	0.84	0.92	1.05
m1	FT 3/10	1.81	1.90	1.96	5	0.94	1.08	1.29
m1	FT 3/8	1.72	1.85	1.99	2	1.20	1.22	1.25
m2	FT 3/10	1.64	1.83	2.00	4	1.05	1.24	1.44
m2	FT 3/8	1.72	1.87	2.03	2	1.20	1.22	1.25
m3	FT 3/10		1.47		1		1.02	
m3	FT 3/8		1.47		1		1.09	

DESCRIPTION

The teeth are semi-hypsodont with flat occlusal surface and thick enamel (Fig. 10E-H). In M1 and M2 the occlusal surface consists of three enamel folds (anteroloph, medioloph and posteroloph) (Fig. 10A, B). The folds are divided by one lingual and two labial sinuses. In M2, the first labial sinus becomes an enamel-ring during the early stage of wear process. A distinct mesoloph is not developed, since it is involved in the medioloph. The occlusal surface of lower molars consists of three enamel folds (anteroconid, mediolophid, posterolophid). In the juvenile m1, the mediolophid is sometimes segmented in two parts (Fig. 10D, H). The folds are

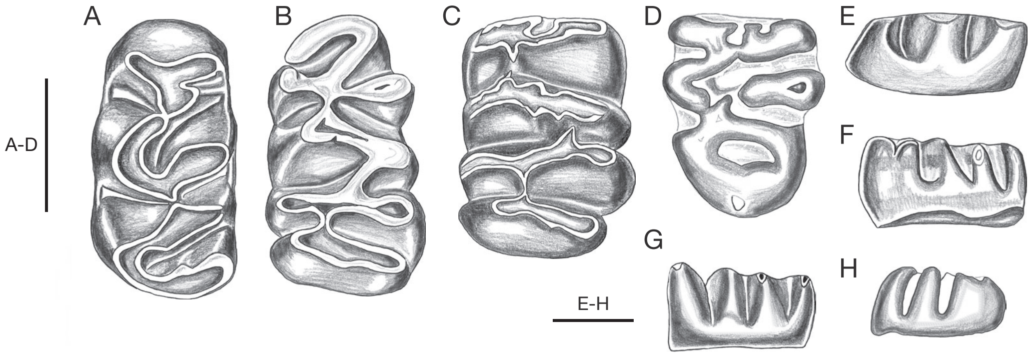

FIG. 9. — *Microtocricetus* Mayr & Fahlbusch, 1975 molars from Felsőtárkány 3/8 and 3/10, Hungary: **A**-**H**, *Microtocricetus molassicus* Mayr & Fahlbusch, 1975; **A**, M1, occlusal view, FT 3/10, MMP.2007.112 (reversed); **B**, m1, occlusal view, FT 3/8, MMP.2007.218; **C**, m2, occlusal view, FT 3/8, MMP.2007.219 (reversed); **D**, M3, occlusal view, FT 3/8, MMP.2007.226 (reversed); **E**, M1, lingual view, FT 3/10, MMP.2007.112 (reversed); **F**, m1, labial view, FT 3/8, MMP.2007.218; **G**, m2, labial view, FT 3/8, MMP.2007.219 (reversed); **H**, M3, lingual view, FT 3/8, MMP.2007.226 (reversed). Scale bars: 1 mm.

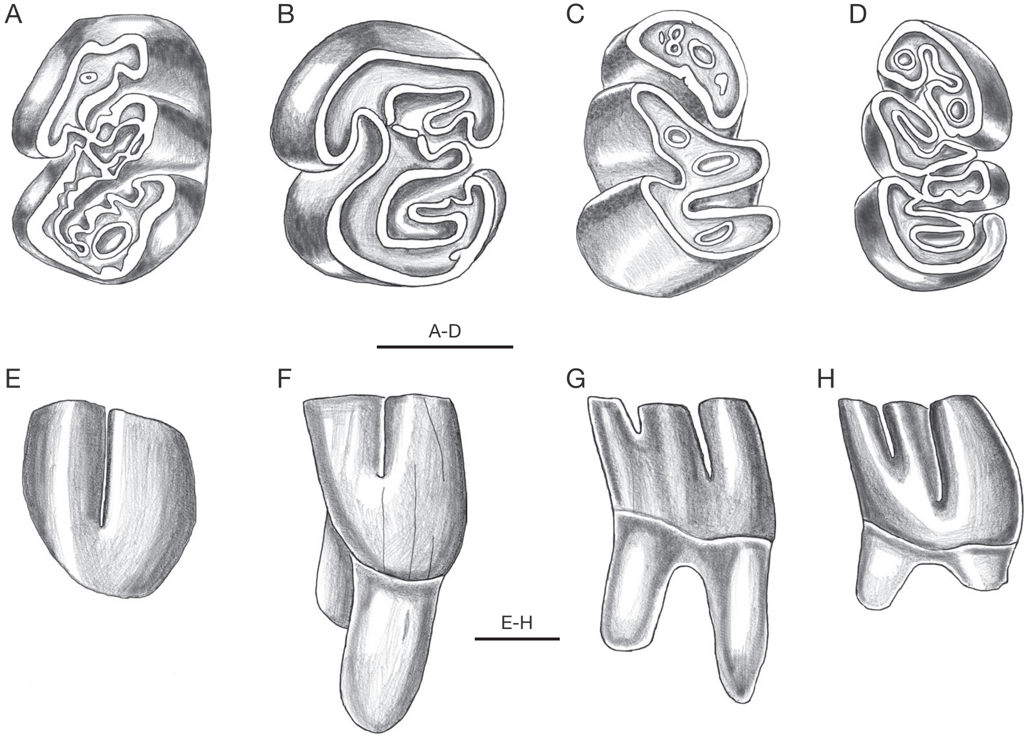

FIG. 10. — *Anomalomys gaudryi* Gaillard, 1900 molars from Felsőtárkány 3/8 and 3/10: **A**, M1, occlusal view, FT 3/10, MMP.2007.186 (reversed); **B**, M2, occlusal view, FT 3/10, MMP.2007.185; **C**, m1, occlusal view, FT 3/10, MMP.2007.183; **D**, m1, occlusal view, FT 3/10, MMP.2007.181 (reversed); **E**, M1, lingual view, FT 3/10, MMP.2007.186 (reversed); **F**, M2, lingual view, FT 3/10, MMP.2007.185; **G**, m1, labial view, FT 3/10, MMP.2007.183; **H**, m1, labial view, FT 3/10, MMP.2007.181 (reversed). Scale bars: 1 mm.

divided by one labial and two lingual sinuses. The anteroconid contains 1-5 enamel rings in the juvenile stage of wear. There is a large enamel ring in the lingual part of the mediolophid, which never forms a sinus during the wear process (Fig. 10C, D).

COMMENTS

The occlusal pattern of the m1s from the Felsőtárkány Basin does not show any tendency towards the typical morphotype (having a large sinus in the medioloph of m1) of *A. rudabanyensis* Kordos, 1989. In the late Astaracian-Early Vallesian faunas of eastern Central Europe three *Anomalomys* species were described:

Anomalomys rudabanyensis from Rudabánya (MN 9; Kordos 1989, 2005), *Anomalomys gaudryi* from Belchatow A (MN 9; Kowalski 1994; Garapich 2002), Felsőtárkány 1, Felsőtárkány 3/2 (MN 7/8; Hír 2001, 2003) and Felsőtárkány-Felnémet 2/3 and 2/7 (MN 7/8; Hír 2006), and finally *Anomalomys* cf. *gaillardi* Viret & Schaub, 1946 from Götzendorf (MN 9, Rögl *et al.* 1993).

DISCUSSION

Felsőtárkány 3/8 and 3/10 are the lithostratigraphically highest fossiliferous localities of the Felsőtárkány-Güdörkert section, overlying the levels bearing the rich vertebrate fauna of Felsőtárkány 3/2 (Hír 2003) and the macroflora of Felsőtárkány (Andreánszky & Kovács 1955; Erdei & Hír 2002).

The majority of the lagomorph and rodent taxa are common in the faunas of FT 3/2 and FT 3/10, including *Eurolagus fontannesi*, *Trogontherium minutum, Neopetes* sp., *Paraglirulus werenfelsi*, *Eomyops oppligeri*, *Eumyarion medius*, *Megacricetodon minutus*, *Collimys dobosi* and *Anomalomys gaudryi.*

Collimys dobosi and *A. gaudryi* are the dominant species in both faunas. However, they display some differences:

– the diversity of Sciuroidea is lower in FT 3/10, in which *Spermophilinus bredai*, *Blackia miocaenica* Mein, 1970, *Albanensia grimmi* (Black, 1966), *Miopetaurista* sp. are absent;

– in FT 3/8 and FT 3/10 several Vallesian elements appear, including *Myoxus vallesiensis* and *Microtocricetus molassicus*. It means that the studied faunas are possibly to classify as MN 9. As a consequence of the results of Prieto & Rummel (in press) on the study of the Early Vallesian *Collimys* populations from Germany and Hungary, we can classify the faunas FT 1, FT 2, FT 3/2 as MN 9 too, because *Collimys dobosi* is a constant element of these materials.

All the five localities of the Felsőtárkány, Güdörkert section produced rich mollusc faunas which are undoubtedly Sarmatian. These assemblages consist of mainly freshwater and land elements but there are some sporadic brackish species too, which are certainly not reworked (e.g., *Pirenela picta nympha* from FT 3/10 or *Dorsanum duplicatum* (Sowerby, 1839) from FT 1.

The latest occurence of Sarmatian elements in the mollusc fauna was found in the lowermost Pannonian A-B zones in the Vienna Basin (Harzhauser *et al.* 2004). These zones can be the possible minimal age of the faunas from the Felsőtárkány Basin (Fig. 11).

From a chronostratigraphical point of view the consistent coexistence of Sarmatian molluscs and Vallesian rodents in the Felsőtárkány localities is a contradiction following the generally accepted 11.1 Myr *Hipparion* datum (Agustí & Moya-Sola 1991) and the data for the Sarmatian/Pannonian boundary: 11.5 Myr (Daxner-Höck 1996), 11.6 Myr (Harzhauser & Piller 2007), 12.0 Myr (Magyar *et al.* 1999). Not having found *Hipparion* and without paleomagnetic and radiometric data we can give only speculative attempts at the solution of this contradiction.

VERSION 1

We accept the 11.1 Myr *Hipparion* datum but we presume the appearence of the rodent faunas characterized by *Microtocricetus molassicus* and/or *Collimys hiri/dobosi* before the *Hipparion* datum. This idea was already published by Hír (2003, 2005) when he classified the Felsőtárkány 3/2 fauna as late MN 7-8. In this case the German and Swiss faunas Nebelbergweg, Nebelbergweg TGL II and TGL III, Hammerschmiede, Marktl, Hillenloh and Belchatow A in Poland can be moved into the late MN 7-8 zone.

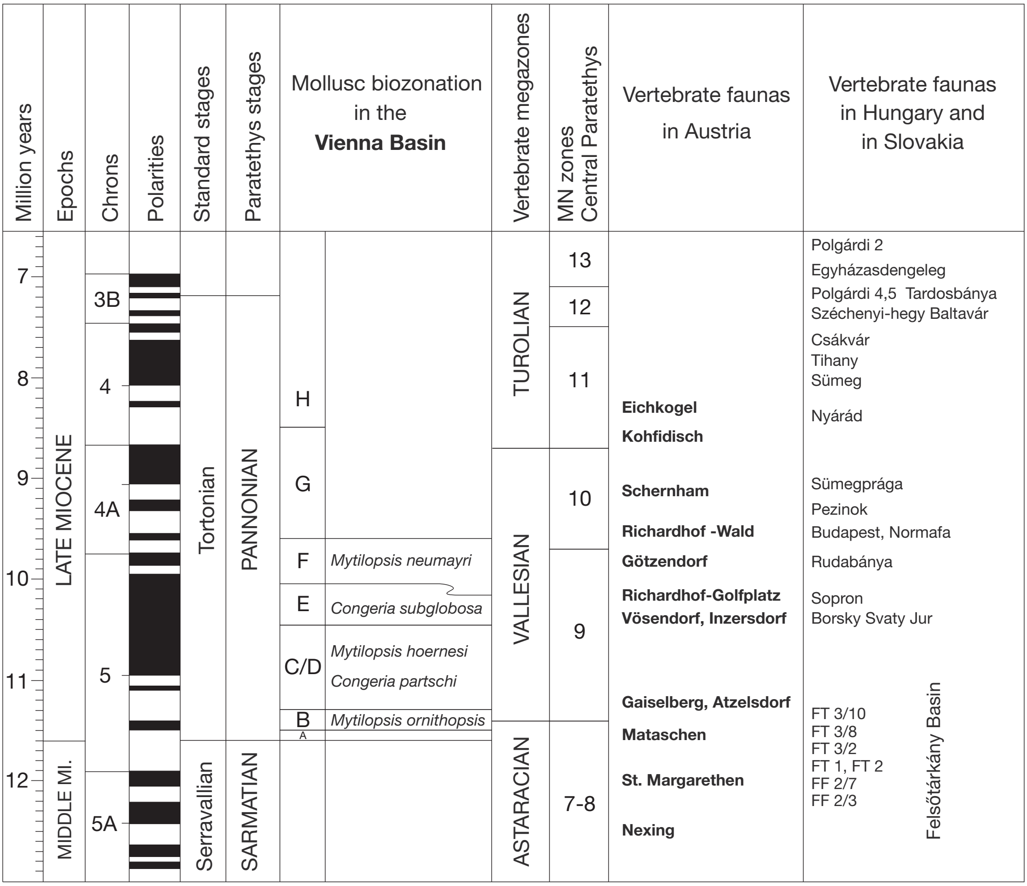

FIG. 11. — Possible chronological position of the Felsőtárkány Basin (Hungary) vertebrate faunas in comparison to the late Miocene vertebrate faunas from Austria, Hungary and Slovakia (after Daxner-Höck 2004a, b; Sabol *et al*. 2004; Kordos 2008).

VERSION 2

We question the 11.1 Myr *Hipparion* datum and follow Aguilar *et al.* (2004) and Vangengeim *et al.* (2006) who reinterpreted the paleomagnetic data of some important vertebrate-bearing sections from the Mediterranean and from the Eastern Paratethys and suggested an older dating of 11.5-11.8 Myr for the *Hipparion* datum.

More research in the continental series at Felsőtárkány is needed to clarify aspects of the imperfectly documented late Sarmatian-Early Pannonian period of the eastern Central European Neogene, which approximates the MN7/8-MN9 transition (Daxner-Höck 2001). This time interval represented the end of deposition of the Obere Süßwassermolasse (Kälin & Engesser 2001; Kuhlemann & Kempf 2002; Engesser & Kälin 2005). In the Carpathian Basin, a nearly simultaneous regression took place and the fluvial facies penetrated far into the basin, resulting in the erosion and reworking of the Sarmatian strata (Magyar *et al.* 1999; Harzhauser & Piller 2004 ; Harzhauser *et al.* 2004). The scarcity of species-rich late Astaracian vertebrate localities in the Carpathian Basin can be the result of this erosion (Fig. 11).

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