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MIDDLE MIOCENE MOLLUSCS AND MICROVERTEBRATA FROM TĂŞAD (BIHOR COUNTY, ROMANIA)

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Abstract.The results of the paleontologic collection campaign effected in the Valea Brusturilor close to the village Tăşad is given. The fossiliferous clay layer is found under Sarmatian limestone. It produced a rich mollusc fauna and a microvertebrate material. The fossil assemblage makes possible to set up a local correlation point between the marine and nonmarine stratigraphy. The chronological position of the studied fauna is possible to classify as Early Sarmatian, Volhynian substage after the molluscs and MN 7 Zone after the rodents.

Keywords: Stratigraphy, Miocene, Mollusca, Reptilia, Rodentia.

INTRODUCTION

The small village Tăşad is found at the southwestern foothill region of the Munţii Pădurea Craiului (Bihor County, Romania). The studied exposure is situated in the Eastern side of the Valley Brusturilor not far from the well known protected Cave Tăşad. In the lower part of the section (at the level of the stream) 60-cm green clay was found containing the discussed fauna. This fossiliferous level is overlaid by Sarmatian limestone. In the earlier literature a rhinocerotid *Lartetotherium sansaniensis* (Lartet) or *Gaindatherium* (Colbert) was reported from the vicinity of Tăşad (Codrea, 2000). The collection campaign was initiated by Márton Venczel, who collected the first test - samples in 1999. The fieldwork was effected in the summer of 2000 with the help of students. About 800-kg clay was collected. The washing and the sorting was taken place in the Ţării Crişurilor Museum in Oradea by Márton Venczel. The elaboration of the finds was managed by specialists, molluscs: J. Kókay, reptiles: M. Venczel, insectivors: L. Mészáros, rodents: J. Hir. The study was partially Foundation in the framework of the project T - 029148. All the materials studied in this paper belong to the collections of Natural History Department of Ţării Crişurilor Museum in Oradea.

THE MOLLUSC FAUNA

Calliostoma anceps joanneum (Hilb.)
Calliostoma styriacum (Hilb.)
Calliostoma politioanei Jek.
Gibbula biangulata ((Eichw.)
Gibbula cf. picta (Hörn.)
Hydrobia stagnalis (Bast.)
Hydrobia stagnalis suturata Fuchs.
Mohrensternia inflata (Andiz.)
Mohrensternia inflata sarmatica Friedb.
Mohrensternia inflata hydrobioides (Hilb.)
Mohrensternia pseudoinflata Friedb.
Mohrensternia angulata (Eichw.)
Mohrensternia pseudosarmatica Friedb.
Mohrensternia sp.
Rissoina sp.
Pirenella picta bicostata (Eichw.)
Pirenella picta nympha (Eichw.)
Bittium deforme (Eichw.)
Vulgarocerithium rubiginosum (Eishw.)
supported by the Hungarian Scientific
Polimices catena helicina (Bocc.)
Atys miliaris (Brocc.)
Actaeocina lajonkaireana (Bast.)

Extramarin *Gastropoda*

Abida antiqua grossecostata Gott. -Wenz.
Cochlicopa ex. gr. subrimata (Riss.)
Gastrocopta cf. suevica (Sandb.)
Truncatellina lentilii (Miller) var.
Semilimax intermedia crassitesta (Andrea.)
Nesovitrea (Perpolita) ex. gr. subhammonis Gott.
Triptychia cf. suturalis (Sandb.)
Cochlodina cf. oppoliensis Nords.
Limax crassus Clessin
Milax loerentheyi Gaál

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Bivalvia

Musculus sarmaticus Gat.
Cardium vindobonense Partsch.
Cardium praeplicatum Hilb.
Cardium pseudoplicatum Friedb.
Ervilia dissita podolica Eichw.
Ervilia trigonula Sok.
Irus gregarius (Partsc.)

The fauna left in shallow brackish water close to the shore. The majority of the finds are herbivorous taxa (*Mohrensternia, Pirenella, Ervilia*, a.o.). The stratigraphical position is possible to classify on the basis of the molluscs as Older Sarmatian = Volchynian substage = Kozardian substage.

THE HERPETOFAUNA

Systematic description

Class: Reptilia
Order: Sauria McCartney, 1802
Family: Agamidae Gray, 1825
Agamidae indet. (Figures 1-4, Plate I)

Material: 1 maxilla, 3 dentaries, 2 caudal vertebrae

The material is rather fragmentary. The best preserved specimen is an anterior dentary fragment (Plate I: Figure1), bearing heterodont teeth. The single anterior tooth preserved, preceded by a rather large and an extremely small vanmost tooth socket, is of pleurodont type. Posterior to it is a roughly triangle-shaped tooth with acrodont insertion. The remaining specimens bear each a single tooth only (Plate I: 2-4). The teeth are labiolingually compressed with tricuspid tips, having both anterior and posterior lobes reduced. The two rather small and extremely elongated caudal vertebrae are procoelous, unprovided with haemapophyses. One specimen has small transverse processes situated at right angles to the vertebral centrum. All the above characters are consistent with those of agamids, but provide no details for closer assignment. It is worth mentioning that this is the first report of Neogene agamids from the territory of the Carpathian Basin. In the Western part of our continent the only Neogene genus described was *Agama* s.l. (Rage & Auge, 1993; Schleich, 1985), surviving up to the Pliocene (Bailon, 1991).

Family: Lacertidae Bonaparte, 1831
Genus: *Lacerta* Linnaeus, 1758
Lacerta sp. 1 (Figures 5, 6, Plate I)

Material: 1 frontal, 4 dentaries

The material belonged to a small sized species. The dorsal surface of the frontal is sculptured by irregular ridges and pits. The labial surface of the dentary is smooth, with few distinct foramina pro rami nervorum alveolarium inferiorum. The horizontal lamina is slightly convex and relatively thin, somewhat widened in the middle part. The posterior portion of the latter structure in all the specimens is lacking. The Meckel's groove is exposed ventromedially and closed near the anterior margin of the bone. The dentition is of pleurodont type; the teeth have bicuspid or tricuspid tips.

Lacerta sp. 2 (Figure 7, Plate I)

Material: 2 dentaries, 1 maxilla

The specimens belonged to a distinctly larger member of the genus. The horizontal lamina of the dentary is comparatively thinner and more prominent lingually than in the above described form; the ventral crest is distinctly projecting ventromedially. There are eight tooth positions in the best preserved specimen; the dentition is of pleurodont type.

Family Anguidae Gray, 1825
Genus: *Ophisaurus* Daudin, 1803
Ophisaurus sp. (Figures 1-5, Plate II)

Material: 1 frontal, 1 maxilla, 1 dentary, 1 quadrate, 20 osteoderms

The frontal and the quadrate resemble homologous elements of the genus *Ophisaurus* and *Anguis*. The sculpture on the dorsal surface of the frontal is prominent with several pits and grooves. The dentition in the maxillary and dentary fragments is of subpleurodont type. The teeth are conical with their tips without striation and slightly curved posteriorly. The osteoderms are relatively thin having rounded or ovaloid shape with smooth anterior margin and a prominent median ridge. Laterally the outer surface is sculptured by vermicular shaped tubercles. Remains of *Ophisaurus* (sometimes identified as *Anguis*) were described in several Middle Miocene localities of the Carpathian Basin (Hir *et al.* 1998, 2001, Gal *et al.* 1999, 2000).

cf. *Pseudopus* sp.

Material: 1 osteoderm (Figure 6, Plate II)

The specimen is rather thick and of rhomboid shape. The outer surface is uniformly sculptured except its anterior margin. It belonged to a distinctly larger form, resembling the extant genus *Pseudopus*.

Order: Serpentes Linnaeus, 1758
Scolecophidia indet. (Figure 7, Plate II)

Material: 3 vertebrae

In the available specimens the centrum and lower part of the neural arch is preserved only. The centrum is elongated and slightly convex ventrally, devoid of haemal keel; the subcentral foramina are present; the synapophyses are undivided. The cotyle and condyle is depressed dorsoventrally; there is no paracotylar foramina. The prezygapohyseal processes are relatively short, flattened dorsoventrally and with obtuse tips. The combination of the above characters are concordant with those of Scolecophidia, but the material in hand is inappropriate for closer assignment. At the same time it could be mentioned that the only scolecophidian genus known from the territory of Europe is *Typhlops* (Rage & Auge, 1993, Szyndlar, 1991).

Family Colubridae Oppel, 1811
Colubridae indet.

Material: 2 vertebrae

The material is damaged, having prominent haemal keel and distinctly differentiated paradiapophyses. There are no parapophyseal processes. Based on the observed characters the material may be assigned to the family Colubridae.

THE INSECTIVORS

The material is under the study of Dr. Lukács Mészáros (University Eötvös Loránd, Paleontological Department, Budapest). Up to the present he identified only one species: *Schizogalerix cf. pasalarensis*. Similar forms (*S. pasalarensis*) were described from the Middle Miocene of Anatolia (Mészáros, written communication).

THE RODENT FINDS

Systematic description

Order: Rodentia Bowdich, 1821
Family: Sciuridae Gray, 1821
Genus: *Spermophilinus De* Bruijn et Mein, 1968
Spermophilinus bredai (Von Meyer, 1848)

Material and measurements:

	L:	W:	(mm)
1 M3	2,23	1,93	Figure 1, Plate III
1 m2	1,82	1,83	Figure 2, Plate III

In the crown of the M3 molar the anterolophe and the protolophe are connected to the protocone. A shallow transversal trench is found between the two-enamel ridge. The talone -basin is shallow and surrounded by the hypocone and the posterolophe. In the crown of the m2 molar the highest cusp is the metaconid. The protoconid, the anterolophid and the metaconid border the small triangular trigonid -basin. The metaconid, the protoconid, the mesoconid, the hypoconid, the posterolophid and the week entoconid surround the large talonid-basin. An opened gate is found between the mesolophid and the entoconid. The presence of the entoconid contradicts the original description of the genus, but the other morphological elements and the measurements preclude the possible presence of any other sciurid genus. On the basis of the morphology the *Palaeosciurus* come into consideration, but the measurements of this genus are definitely larger (Vianey -Liaud, 1974).

Family: Gliridae Thomas, 1897
Subfamily: Glirinae Thomas, 1897
Genus: *Muscardinus*, Kaup, 1829
Muscardinus aff. *sansaniensis* (Lartet, 1851)

Material and measurements:

	L:	W:	(mm)
2M1	1,22	1,02	Figure 3, Plate III
	1,11	0,98	

The morphology (5 main ridges + 2 shorter ridges in the buccal side) refers to the configuration of *M.* aff. *sansaniensis* from Anwil (Engesser, 1972 Abb. 82/2). The only very special marker in the finds from Tasad is the broken anterolophe in the figured molar.

Genus: *Eliomys*, Wagner, 1840
Eliomys sp.

Material and measurements:

	L:	W:	(mm)
1m1	1,20	1,05	Figure 4, Plate III

The morphology of the occlusal surface is simple on the whole. No anterior extra ridge is present. The lingual end of the metalophid is not connected to the metaconid. The mesolophid-entoconid connection is missing as well. The posterior extra ridge is well developed. The morphology and the measurements refer to the *E. truci*. This was the only *Eliomys* species in Europe from the MN 5 to MN 8 (Daams, 1999). In spite of this fact the "mechanical" assignment would be very dangerous on the basis of the only find.

Family: Cricetidae, Rochebrune, 1883
Genus: *Democricetodon*, Fahlbusch, 1964
Democricetodon brevis (Schaub, 1925)
Material and measurements:

	L:	W:	(mm)
1M1	1,79	1,23	Figure 5, Plate III

1m1	1,68	1,15	Figure 6, Plate III
2m2	1,44	1,20	Figure 7, Plate III
	1,48	1,23	

The M1 molar has an undivided anterocone, a two branched (V-shaped) anterolophule, a long labial spur of the anterolophule and a long mesolophe. The m1 molar characterised by undivided anteroconid, isolated metaconid because the missing of the metalophulid, long mesolophid. This morphological picture refers to D. *freisingensis*, and *D. jazygum* but the measurements are smaller.

Genus: *Megacricetodon*, Fahlbusch, 1964
Megacricetodon cf. minor (Lartet, 1851)

Material and measurements:

	L:	W:	(mm)
2M1	1,50	0,95	Figure 8, Plate III
	1.54	0,97	
2m1	1,48	0,84	Figure 1, Plate IV
	1,41	0,84	Figure 2, Plate IV
1m2	1,15	0,88	

In the crown of the M1 molar the anterocone is divided. The anterolophule has a low developed labial spur. The mesolophe is long. The anteroconid of the m1 molars is undivided and the mesolophid is long. The mesolophid of the m2 molar is middle developed. The measurements refer to the *M. minor* populations, but the long mesolophes in the M1 and long mesolophids in the m1 molars are not typical in this species. *Megacricetodon minor* is the most frequent rodent species among the Middle Miocene vertebrate faunas of the Carpathian Basin. It was found in Neudorf (MN 6) (Fejfar, 1990), Hasznos (MN 6) (Kordos, 1981, 1986), Sámsonháza (MN 6) (Hir et al 1998), Mátraszőlős I -II. (MN 7) (Gál et al, 1999, 2000) (Tab. 1.). A very new unpublished data is the presence of the extremely small sized *M. Ave. minor* in Felsőtárkány (MN 8). In the Bavarian and Swiss Molasse the species was described from the faunas of the MN 5 - MN 8 zones (Bolliger 1994, Sach 1999, Kälin *et al* 2001).
Megacricetodon aff. germanicus ?

Material and measurements:

	L:	W:	(mm)
l M1	1,76	1,20	Figure 3, Plate IV

The anterocone is two parted, but not well divided. The anterolophule bears a small labial spur. The paracone has a very short posterior ectoloph. The mesolophe is middle developed. The building up of the anterocone is between the typical *Democricetodon* and typical *Megacricetodon*. It makes the classification doubtful. Up to the present we have no sure data on the presence of the larger sized *Megacricetodon* species in the Carpathian Basin.
Genus: *Eumyarion* Thaler, 1966
Eumyarion medius (Lartet, 1851)

Material and measurements:

	L:	W:	(mm)
1m1 (damaged)			
	1,82	1,18	Figure 4, Plate IV
1m1 fr.	-	-	

The anterolingual part of the measurable tooth crown is destroyed. In the unmeasurable specimen the anteroconid is undivided. The anterolophulid is Y -shaped and connected to the anteroconid and to the anterobuccal cingulum. There is no connection between the anteroconid and the metaconid. The mesolophid is long. In the figured specimen a short ectomesolophid is found. In the other one the ectomesolophid is missing. The posterolophulid is simple. In the faunas of the OSM a general increase of the dental measurements was experienced during the Middle Miocene (Bolliger, 1994). In the Carpathian Basin the present data are scanty but they make a more complex evolution probable. A gradual enlargement of the dimension of the *Eumyarion* molars is found in the faunas of Hasznos (MN 6) -Sámsonháza (MN 6) -Mátraszőlős (MN 7). But in Tăşad, Felsőtárkány (MN 8) and Rudabánya (MN 9) a smaller species is found again.

Subfamily: Cricetodontinae Stehlin & Schaub, 1951
Genus: *Cricetodon* Lartet, 1851
Cricetodon sp.

Material and measurements:

	L:	W:	(mm)
2 M1	3,27	2,12	Figure 5, Plate IV
	3,57	2,12	
2 M2	2,65	2,10	Figure 6, Plate IV
	2,67	1,97	
1 M3	2,00	1,80	Figure 7, Plate IV
1 m3	2,62	1,72	Figure 8, Plate IV

In the upper molars the transversal ridges (mesolophe, lingual or labial spur of the anterolophe) are completely missing, but the longitudinal ridges (ectolophs) are well developed. In the only m3 molar the mesolophid is completely missing as well. The tooth crown is higher than in the other *Cricetodon* materials of the Carpathian Basin (Hasznos, Sámsonháza, Mátraszőlős) (Table 1.). These characters are typical in the genus *Byzantinia* and *Hispanomys* too, but the M3, m3 molars from Tăşad are not so elongated

than in *Byzantinia*, and the hypoconid of the m3 from Tăşad is less reduced than in *Hispanomys*. For comparison we studied the figures of Weerd (1976) and Ünay (1980), but we could not see the *Hispanomys* material from Comăneşti 1 (Feru *et al*, 1980). The above described molars are the most evolved *Cricetodon* forms in the Carpathian Basin and in the same time it means the last occurrence of the genus referring to our present knowledge.

DISCUSSION

The fauna of Tasad was bedded in a brackish nearshore milieu. The co -occurrence of the rich mollusc fauna and the rodent finds make possible the local correlation of the Paratethys stages and the continental MN - zones: Early Sarmatian - MN 7. During the last 5 years the authors excavated a group of Middle Miocene vertebrate localities in Northern Hungary. The stratigraphical position of Tasad is possible to classify as MN 7 on the basis of the following facts:

- the evolutionary position of the *Cricetodon* material is more evolved than *Cricetodon* cf. *hungaricus* of Mátraszőlős (early MN7), but probable differs from the nonfigured *Hispanomys* species of Comăneşti 1(MN 8) (Table 1.)
- *M. minor* is known from the late MN 5 - to MN 8 zones
- *D. brevis* is known from the MN 7 - 8 zones in the OSM of Switzerland and Southern Germany (Bolliger, 1994).

In southeast Europe the elaboration of a Miocene nonmarin stratigraphy is only in the beginning. In the following years a great deal of new microvertebrate faunas is possible to collect.

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PLATES

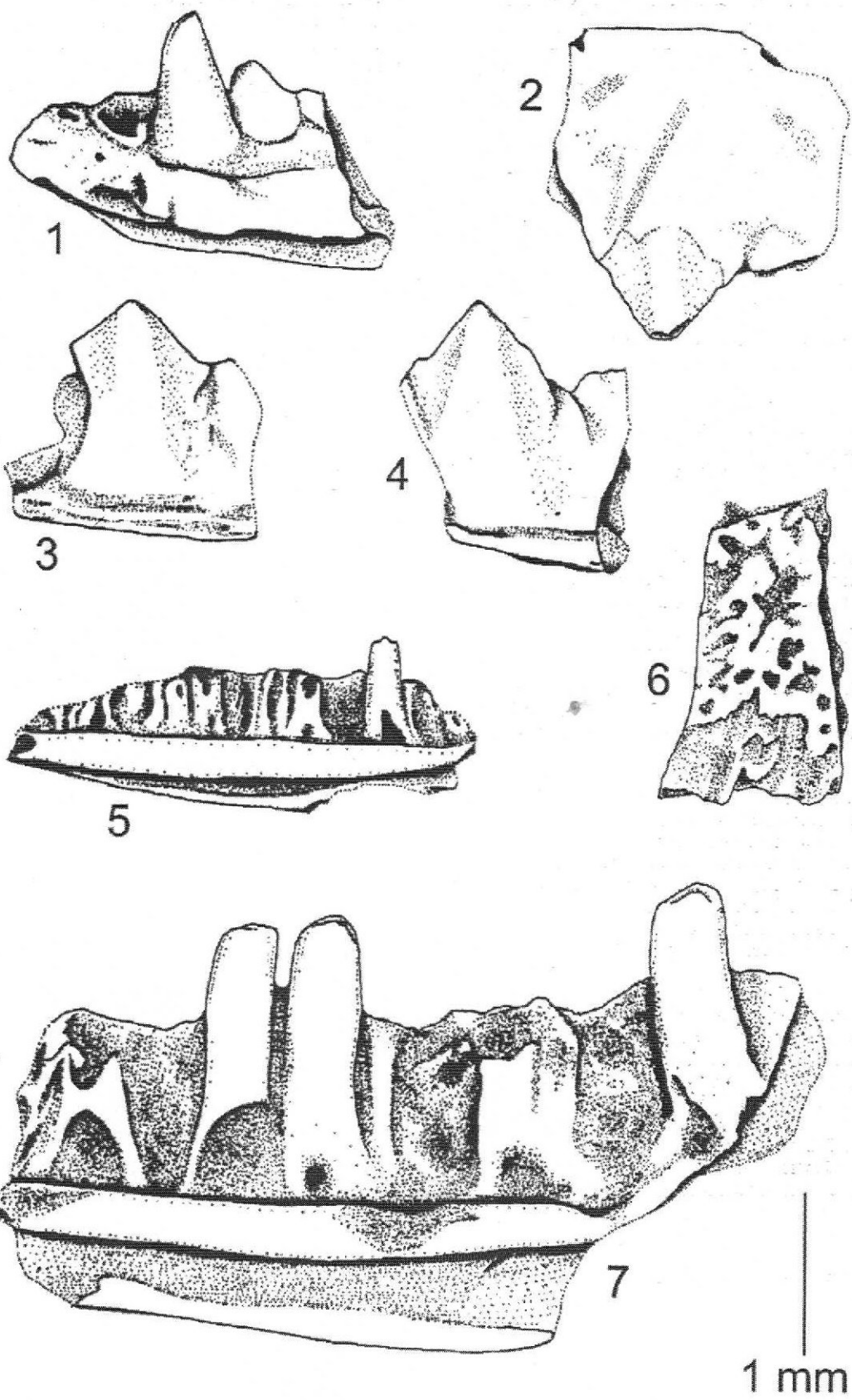
Plate I. Remains of lizards from Tăşad
Figure1: dentary of Agamidae indet.,
Figure2: fragmentary maxilla of Agamidae indet.,
Figures 3, 4: fragmentary dentaries of Agamidae indet.,
Figure5: dentary of *Lacerta* sp. 1,
Figure 6: frontal of *Lacerta* sp. 1,
Figure 7: dentary of *Lacerta* sp. 2.
Figures 1, 3, 4, 5, 7 – lingual views, Figure 2 – labial view, Figure 6 – dorsal view.

Plate II. Remains of Squamata from Tăşad
Figure 1: quadrate of *Ophisaurus* sp.,
Figure 2: osteoderm of *Ophisaurus* sp.,
Figure 3: parietal of *Ophisaurus* sp.,
Figure 4: maxilla of *Ophisaurus* sp.,
Figure 5: dentary of *Ophisaurus* sp.,
Figure 6: osteoderm of cf. *Pseudopus* sp.,
Figure 7: presacral vertebra of Scolecophidia indet.
Figure 1 – lateral view, Figures 2, 3, 6 – dorsal views, Figures 4, 5 – lingual views, Figure 7 – ventral view.

Plate III. Occlusal surfaces of rodent molars from Tăşad
Figure 1: *Spermophilinus bredai* M3,
Figure 2: *Spermophilinus bredai* m2,
Figure 3: *Muscardinus* aff. *sansaniensis* M1,
Figure 4: *Eliomys sp.* m1, Figure 5: *Democricetodon brevis* M1,
Figure 6: *Democricetodon brevis* m1,
Figure 7: *Democricetodon brevis* m2,
Figure 8: *Megacricetodon* cf. *minor* M1.

Plate IV. Occlusal surfaces of rodent molars from Tăşad
Figure 1: *Megacricetodon* cf. *minor* m1,
Figure 2: *Megacricetodon* cf. *minor* m2,
Figure 3: *Megacricetodon* aff. *germanicus* M1,
Figure 4: *Eumyarion medius* m1,
Figure 5: *Cricetodon sp.* M1,
Figure 6: *Cricetodon sp.* M2,
Figure 7: *Cricetodon sp.* M3,
Figure 8: *Cricetodon sp.* m3.

Table 1
Distribution chart of the *Cricetinae* species in the Middle Miocene localities of Hungary and Western Romania.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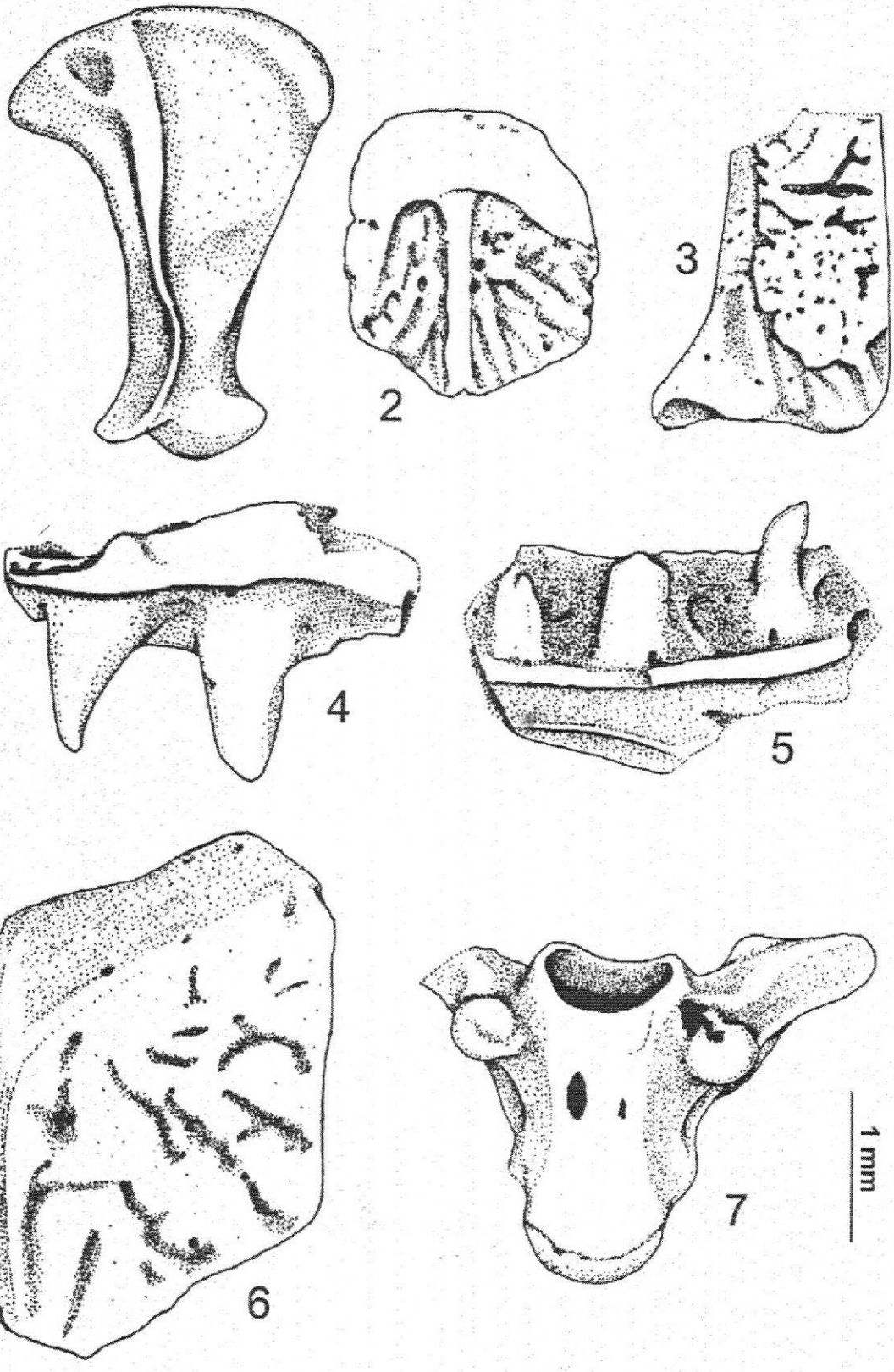
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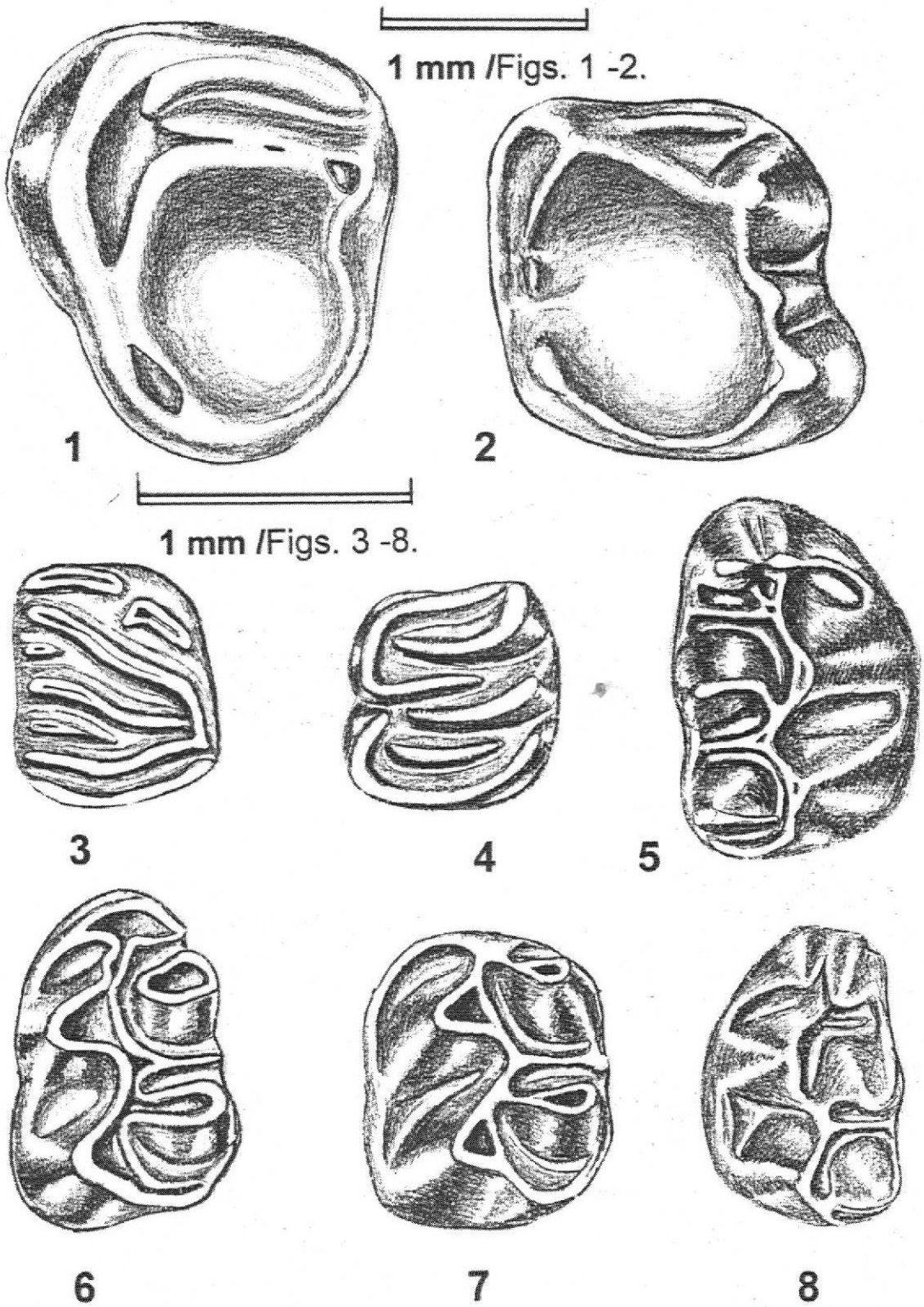
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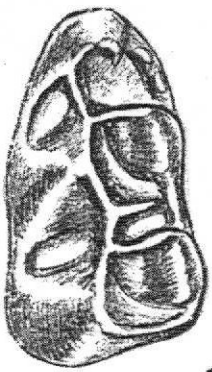

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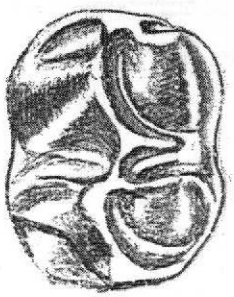

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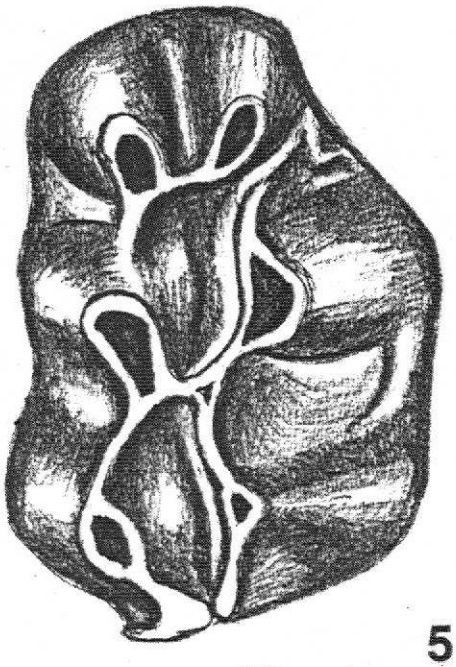

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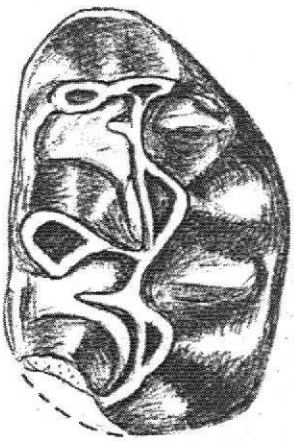

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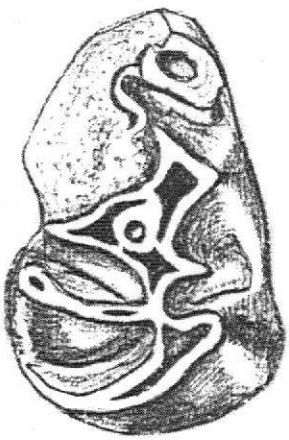

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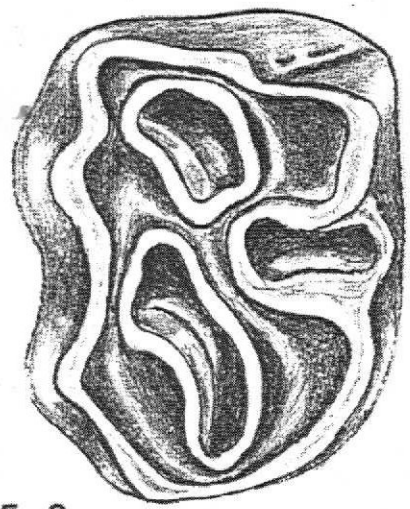
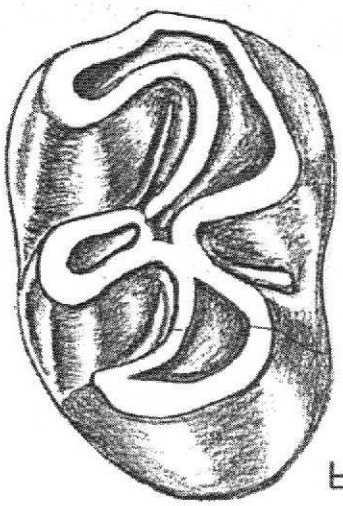


6

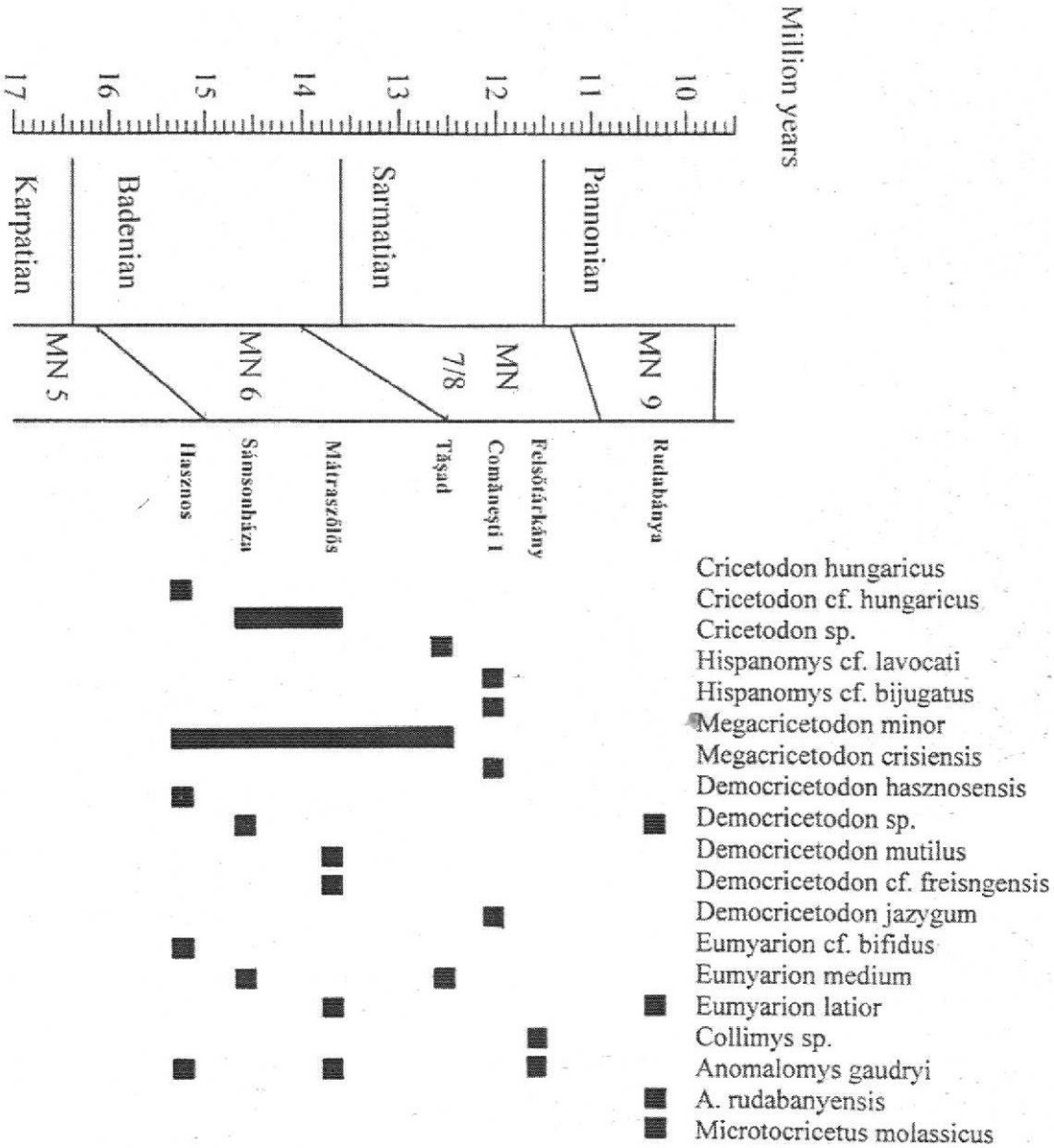
1 mm /Figs. 5 -8.



8

1 mm /Figs. 1 -4.

7


Million years
17
16
15
14
13
12
11
10
Karpatian
Badenian
Sarmatian
Pannonian
MN 5
MN 6
7/8
MN
MN 9
Hasznos
Sámsonháza
Mátraszőlős
Tăşad
Comăneşti I
Felsőtárkány
Rudabánya
Cricetodon hungaricus
Cricetodon cf. hungaricus
Cricetodon sp.
Hispanomys cf. lavocati
Hispanomys cf. bijugatus
Megacricetodon minor
Megacricetodon crisiensis
Democricetodon hasznosensis
Democricetodon sp.
Democricetodon mutilus
Democricetodon cf. freisngensis
Democricetodon jazygum
Eumyarion cf. bifidus
Eumyarion medium
Eumyarion latior
Collimys sp.
Anomalomys gaudryi
A. rudabanyensis
Microtocricetus molassicus