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A NEW MIDDLE MIOCENE VERTEBRATE FAUNA FROM SUBPIATRĂ (BIHOR COUNTY, ROMANIA)

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Abstract. A new Middle Miocene locality complex was discovered near Subpiatră (Bihor County, W-Romania) in summer of 2004. The Subpiatră 2/1 locality yielded numerous fish bones and otoliths, lissamphibians (*Triturus* sp., *Latonia gigantea*, *Rana (Pelophylax)* sp.), reptiles (cf. *Diplocynodon*, *Ophisaurus* sp., *Lacerta* sp., Varanidae indet., Colubrinae indet., *Vipera* sp.), still undetermined birds and insectivores, large mammals (Suidae indet., Cervidae indet.), leporids (*Eurolagus fontannesi*) and rodents (*Muscardinus* aff. *sansaniensis*, *Myoglis meini*, *Megacricetodon* sp., *Democricetodon freisingensis*, *D.brevis)*. The Subpiatră 2/2 locality yielded a number of lissamphibians (Salamandridae indet., *Latonia gigantea*, *Palaeobatrachus* sp., *Hyla* sp.), squamates (*Ophisaurus* sp., Colubrinae indet.), still undetermined insectivores, and rodents (Pteromyinae indet., *Blackia miocaenica*, *Spermophilinus bredai*, *Muscardinus* aff. *sansaniensis*, *Glirulus lissiensis*, *Paraglirulus werenfelsi*, *Myoglis meini*, *Megacricetodon germanicus*, *Democricetodon freisingensis*, and *Eumyarion medius*). Based on micromammals, one may presume substantial difference in the biochronological positions of the two localities: Subpiatră 2/1 R can be assigned to MN 6 unit, while Subpiatră 2/2 is probable younger (MN 7/8).

Introduction

Subpiatră (Bihor County, Romania) is a small village situated near Aleşd town, about 40 km east to Oradea. The presence of continental deposits ("deltaic facies") in the area have been mentioned among others by Vadász

(1957: p. 602) and Istocescu & Istocescu (1974). In the summer of 2004 during a geological survey downward the Rece Creek (a tributary brook of Crişul Repede river) near Subpiatră several fossil-bearing layers have been identified. The main outcrop has a depth of about 11 m, named as Subpiatră 2/1 R and it is situated in the right slope of the Rece Valley in a small ravine (47º00' N and 22º18' E) at an elevation of 296 m above sea level. A rather similar facies was found in the left side of the ravine, named as Subpiatră 2/1L. In the Subpiatră 2/1R and 2/1L localities microvertebrate remains and terrestrial molluscs were found in 15-20 cm thick sandy clay and silt deposits, interbedded into a series of clay and calcareous clay layers (Figure 1).
About 25 m west from the Subpiatră 2/1R locality there is another outcrop of circa 3 m depth, named Subpiatră 2/2. In the latter, the vertebrate fossils were enclosed in a dark-brownish clay layer of about 15-20 cm thickness overlaid by 60-70 cm thick yellow clay layer, both extremely rich in planorbids. Another locality complex has been identified on the right slope of Rece Valley (Subpiatră 2/3) during 2005.

From the Subpiatră 2/1R locality about 600 kg sediments have been excavated, while from Subpiatră 2/2 about 1 ton of sediments have been processed. The fossils resulted from repetitive intensive washing and sieving of the samples using screens with mashes of 0.8 and 0.6 mm. All the fossils belong to the Natural History Department of the Ţării Crişurilor Museum in Oradea, Romania. In the present paper we provide a brief description of the lissamphibians, reptiles and rodents coming from the above localities.

Abbreviations used in the text: **CL** – centrum length, **CW** – centrum width, **FOD** – first occurring date, **LOD** – last occurring date, **MAT** – mean annual temperature, **MNI** – minimum number of individuals, **SU** – Subpiatră.

Description

A preliminary list of vertebrates identified from the localities Subpiatră 2/1 and 2/2 is given below (see Table 1).

Amphibians

Triturus sp. - The four available trunk vertebrae belonged to small sized individuals. The centrum is relatively short and opisthocoelous with a moderately vaulted the neural arch. The neural spine is relatively high which has some lateral enlargement of its dorsal surface. The condyle is rounded,

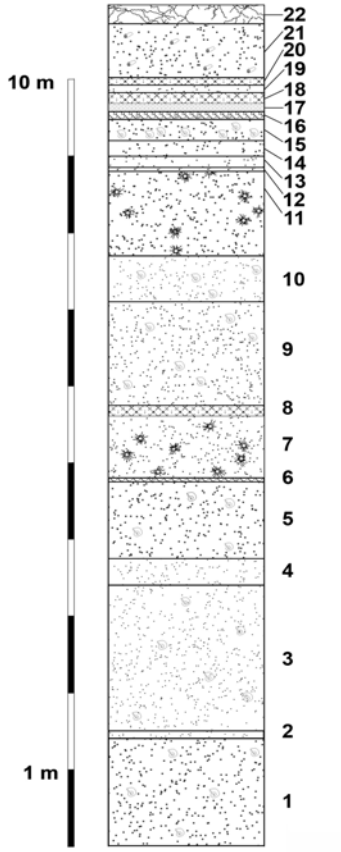

Figure 1. *Lithologic log of the locality SU 2/1R : 1, 14 - green sandy clay; 2, 4, 19 – grey sandy clay; 3 – grey clay with rare Helicidae; 5, 15 – green sandy clay with Helicidae; 6, 16 – yellowish clay sand with Helicidae; 7, 11 – grey sandy clay with calcretes; 8, 18 – clay sand; 9 – compact grey sandy clay with Helicidae; 10 – grey sandy clay with rare Helicidae; 12 – sand and silt with silicified wood; 13 – compact grey sandy clay; 17 – calcareous clay; 20 – fine yellowish clay sand; 21 – green clay with silicified wood; 22 – soil.*

Table 1 - List of vertebrates from the Middle Miocene of Subpiatră

Taxon / Locality	**SU 2/1R (MNI)**	**SU 2/2 (MNI)**	**SU 2/1 R (No. of molars)**	**SU 2/2 (No. of molars)**
Triturus sp.	1	-	-	-
Latonia gigantea	7	4	-	-
Palaeobatrachus sp.	-	1	-	-
Hyla sp.	-	1	-	-
Rana (Pelophylax) sp.	45	-	-	-
cf. *Diplocynodon* sp.	2	-	-	-
Ophisaurus sp.	2	1	-	-
Lacerta sp.	3	-	-	-
Varanidae indet.	1	-	-	-
Colubrinae indet.	2	1	-	-
Vipera sp.	1	-	-	-
Eurolagus fontannesi	-	-	1	-
Petauristidae indet.	-	-	-	2
Blackia miocaenica	-	-	-	2
Spermophilinus bredai	-	-	-	8
Muscardinus sansaniensis	-	-	3	-
Muscardinus aff. *sansaniensis*	-	-	-	2
Glirulus lissiensis	-	-	-	2
Paraglirulus werenfelsi	-	-	-	2
Myoglis meini	-	-	2	24
Megacricetodon sp.	-	-	89	-
Megacricetodon germanicus	-	-	-	12
Democricetodon freisingensis	-	-	-	7
Democricetodon brevis	-	-	3	-
Eumyarion medius	-	-	-	3

separated from the vertebral centrum by a constriction. The transverse processes are inserted distantly from each other with a relatively small rib articulating surface. In ventral view, there is a prominent subcentral keel delimited laterally by relatively large subcentral foramina. The above features are reminiscent of some members of the subgenus *Palaeotriton* of the genus *Triturus* (Bolkay 1928) (e.g. *T. roehrsi* among the fossil members of the latter genus).

Latonia gigantea (Plate 1: 1). - The outer surface of several fragmentary frontoparietals and maxillae is covered by a secondary sculpture formed by bony ridges and tubercles. The coronoid process of the prearticular projects medially and there is a posterior situated paracoronoid process, which is nearly vertical. The scapula is short and cleft with a relatively wide suprascapular part. The available ilia belonged to specimens of various sizes. The supraacetabular region in all the specimens is broken off, but there is a well-defined supraacetabular fossa; the preacetabular region is reduced. The dorsal protuberance is well defined, but sometimes is delimited indistinctly from the relatively high iliac crest. The junctura ilioischiadica is distinctly widened ventrally and it is provided with a prominent interiliac tubercle.

The secondary sculpture on some cranial bones and the presence of paracoronoid process differentiate the genus *Latonia* from the related *Discoglossus*, recorded among others from the Middle Miocene locality of Mátraszőlős, Hungary. The genus *Latonia* was rather common in the Middle Miocene deposits of Central Europe (Roček 1994, Rage & Roček 2003). This large bodied form with good swimming and jumping abilities probably inhabited various types of azonal ecosystems (Böhme 2002).

Palaeobatrachus sp. (Plate 1: 3). – The posterior section of frontoparietal table is wide and flat; the parasagittal ridges in the middle section are prominent and situated close to each other producing a narrow and concave surface.

The morphology of the frontoparietal strongly differs from that of *P. hiri*, known from the Middle Miocene localities of Mátraszőlős and Sámsonháza of Hungary (Venczel 2004) as well from that of *P. robustus*, known from the Earliest Miocene of France (Hossini & Rage 2000).

Hyla sp. - From the single fragmentary ilium the larger part of the preacetabular region was broken off. The remnant of the latter structure is extremely thin edged. The dorsal prominence was presumably high and of oval shaped, but its dorsolateral surface is partly eroded and in consequence closer assignment of the above specimen is not possible.

Rana (Pelophylax) sp. (Plate 1: 2). - The coronoid process of the prearticular is well-developed displaying a wrinkled lingual margin. A large number of ilia belonging to various sized individuals of have been found in Subpiatră 2/1R. The acetabulum is nearly circular; the supraacetabular and the preacetabular region (if preserved) are roughly of equal height. The dorsal protuberance is of same height or sometimes higher than the iliac crest. In larger specimens the ventral margin of the dorsal protuberance is thickened bearing a projection similar to specimens known from the Middle Miocene localities of Mátraszőlős 1 and 2 (Venczel 2004).

Reptiles

cf. *Diplocynodon* sp. (Plate 1: 6). - Fifteen isolated fragmentary teeth and three fragmentary osteoderms were available for study. The largest tooth approaches 9 mm in length. The tooth crown is finely striated with faint antero-posterior crests. The osteoderms display pitted dorsal surface and finely ornamented sutural margins. The above remains, based on the size of specimens and paleobiogeographical data, may be assigned with some doubts to genus *Diplocynodon*. The latter represents the most recent European crocodile which during the Badenian reached north of 37ºN paleolatitude (Böhme 2002, 2003).

Ophisaurus sp. (Plate 1: 7). - The osteoderms are variable in size and morphology. Their dorsal surface displays a smaller smooth margin and a larger sculptured surface. The latter consists of a prominent keel, bordered by a series of isolated or sometimes confluent tubercles. The trunk vertebrae are of relatively small-size; the centrum is with flattened subcentral margin; the lateral margins of the posterior part of the centrum are slightly divergent anteriorly.

Lacerta sp. (Plate 1: 4). - Two fragmentary frontals, four fragmentary maxillae, four fragmentary dentaries have been assigned to this taxon. Judging on the size and morphology of maxillae and dentaries at least two, relatively small sized forms were present in the deposit.

Varanidae indet. (Plate 1: 5). – Only isolated fragmentary teeth were available for study. The teeth are slightly curved and labiolingually compressed; the tooth base is striated and the posterior tooth margin bears a finely striated crest.

Colubrinae indet. (Plate 1: 8, 9). - The centrum of the largest vertebra reaches 5 mm in length, while its width is 3.34 mm (CL/CW = 1.49). The neural arch

is moderately vaulted and the anterior margin of the zygosphene is crenate. The haemal keel is flattened and spatulate shaped. The paradiapophyses are diminutive with the diapophyseal and parapophyseal portion of roughly the same length.
Vipera sp. - Two fragmentary trunk vertebrae and one venom fang were found in the Subpiatră 2/1R locality. The centrum length of the largest vertebra is 4.24 mm, while its centrum width is 2.92 mm (CL/CW = 1.45). The tip of the hypapophysis is broken off, but its base is directed posteroventrally. The size and morphology of the above vertebrae is reminiscent of the *Vipera aspis* complex of the genus *Vipera* (Szyndlar & Rage 2002).

The rodents

In the Subpiatră 2/1R locality the hamsters are nearly exclusive, while the glirids are the dominant family in the sample from the Subpiatră 2/2, and there is a diverse sciurid material also.

Sciuridae

Sciurinae
Spermophilinus bredai (Von Meyer 1848) (Plate 2: 1). - The most important features of the available molars are the smooth enamel and the rounded lingual contour of the occlusal surface of the lower molars devoid of entoconid.

Pteromyinae
Blackia miocaenica Mein, 1970. - The small sized flying squirrel is represented by two molars.
Pteromyinae indet. - Two fragmentary m3 were found in SU 2/2. The larger specimen has hummocky sculptured enamel in the talonid basin while the middle sized one has wrinkled enamel comparable to the ornamentation of *Blackia*.

Gliridae

Muscardinus aff. *sansaniensis* (Plate 2: 3). - The morphology of the available three M1 is characterized by five main ridges. The development of the

secondary ridges is variable. The shape of the flat occlusal surfaces of the M1 is not elongated and the anterior width is not narrower than the posterior one.

According these characters, the species *Muscardinus vallesiensis* Hartenberger 1966, *M. hispanicus* de Bruijn 1966, and *M. topachevskii* Nesin & Kowalski 1997 may be excluded.

Myoglis meini (de Bruijn 1965) (Plate 2: 2). – There are four main ridges (anteroloph, protoloph, metaloph, posteroloph) on the flat occlusal surface of the M1 and M2 and a well developed anterior centroloph. In the lower m1 and m2 the four main ridges (anterolophid, metalophid, mesolophid, posterolophid) and the well developed anterior extra ridge are always present. The development of the secondary ridges is variable but they are less developed than the corresponding ones of *M. meini* population from Felsőtárkány 3/2 (MN 7/8; Hír 2004).

The measurements of the Subpiatră finds (M1 no. 25: 1.81 x 1.82 mm, M1 no. 27: 1.83 x 1.89, M1 no. 31: 1.81 x 1.89) are distinctly of larger values than those of the early Miocene species *Myoglis antecedens* Mayr 1979. *Myoglis ucrainicus* Nesin & Kowalski (1997) may be excluded also because the protoloph, metaloph and posteroloph ridges are strictly merged in the protocone in all M1-M2 of Subpiatră.

Paraglirulus werenfelsi Engesser, 1972 (Plate 2: 4). - The occlusal surface of the molars is concave with five main ridges (anterolophid, metalophid, centrolophid, mesolophid and posterolophid). The centrolophid and the mesolophid are connected in the buccal side; there are four extra ridges.

Glirulus lissiensis (Hugueney & Mein 1965). - The species is represented by only one M2 in SU 2/2 (0.87 x 1.01 mm). The occlusal surface is concave, the lingual surface is ornamented. The outline is rectangular with the anterior margin wider than the posterior one. There are five main transversal ridges of the occlusal surface (anteroloph, protoloph, posterior centroloph, metaloph, posteroloph), all connected to the endoloph. The last is complete. The anterior centroloph has a connection to the paracone as well. The posterior centroloph is interrupted without any connection to the endoloph, or to the metacone. There are three extra ridges.

Cricetidae

Democricetodon freisingensis Fahlbusch, 1964 (Plate 2: 5). - The anterocone of the M1 is divided by a short and very shallow notch on the anterior surface. The lingual cingulum of the anterocone reaches the antero-lingual base of the protocone. The anterolophule has a well developed labial spur (= anteromesoloph) which reaches a strong parastyle at the labial margin of the occlusal surface. The protolophule I is not developed. The mesoloph is long and reaches the labial margin. The short protolophule and metalophule are directed postero-lingually. The posterosinus is labially closed. The anteroconid of the m1 is simple, subtriangular. A labial cingulum of the anteroconid reaches the antero-labial base of the protoconid. The anterolophulid is connected to the metaconid. There is a narrow notch between the anterolophulid and the protoconid. The mesolophid is long and reaches the lingual margin of the occlusal surface. The ectomesolophid is developed but in the figured specimen the lingual end of this ridge does not reach the mesoconid.

Democricetodon zarandicus Rădulesu & Samson, 1988 has a slightly similar morphology, but its anterocone of M1 is divided, the anteroconid is clearly connected to the protoconid and there is no ectomesolophid in the m1.

Democricetodon brevis (Schaub, 1925). - The anterocone of the molars is simple. The anterior surface is without any notch. The anterocone has a lingual and a labial cingulum as well. The latter structures reach the anterior base of the protocone and the metacone. The labial spur of the anterolophule is variable in length. The mesoloph is long but does not reach the labial margin. The posterosinus is labially closed.

Megacricetodon germanicus Aguilar, 1980. - The anterocone of the M1 is divided. The lingual cuspula of the anterocone is connected to the protocone. The anterocone has a lingual cingulum reaching the antero-lingual basis of the protocone. The protolophule I is connected to the antero-lingual basis of the paracone. The posterior spur of the paracone is very short, while the mesoloph is moderately developed. The anteroconid of the m1 is unicuspidate. There are cingulums on the lingual and the labial sides of the anteroconid. The anterolophulid has a buccal spur which is connected to the antero-labial cingulum; the mesolophid is short.

The species is rather frequent in the Swiss – Bavarian molasse (Bolliger 1994) but it is uncommon in the Carpathian Basin. Up to the present *M. germanicu*s is known from Tăşad (Hír et al. 2002) and from Felsőtárkány–Felnémet only (Hír pers. obs.).

the protocone and the metacone. The labial spur of the anterolophule is variable in length. The mesoloph is long but does not reach the labial margin. The posterosinus is labially closed.

Megacricetodon germanicus Aguilar, 1980. - The anterocone of the M1 is divided. The lingual cuspula of the anterocone is connected to the protocone. The anterocone has a lingual cingulum reaching the antero-lingual basis of the protocone. The protolophule I is connected to the antero-lingual basis of the paracone. The posterior spur of the paracone is very short, while the mesoloph is moderately developed. The anteroconid of the m1 is unicuspidate. There are cingulums on the lingual and the labial sides of the anteroconid. The anterolophulid has a buccal spur which is connected to the antero-labial cingulum; the mesolophid is short.

The species is rather frequent in the Swiss – Bavarian molasse (Bolliger 1994) but it is uncommon in the Carpathian Basin. Up to the present *M. germanicu*s is known from Tăşad (Hír et al. 2002) and from Felsőtárkány–Felnémet only (Hír, pers. obs.).

Megacricetodon sp. (Plate 2: 6, 7, 8). - Twenty M1 and 18 m1 were collected in Su 2/1. The anterocone of the M1 is divided. The protolophule I is present in 14 molars but it is missing in 6 specimens. The posterior spur of the paracone is short. A well developed entomesoloph was found in five M1 and in six M1. The latter structure is weak but visible (only the lingual part is developed). Among the 23 M2 available for study well developed entomesoloph was found in four specimens, while the weekly developed variant was found in seven ones only. The occurrence of this enamel ridge is not mentioned in the descriptions of other *Megacricetodon* populations (e.g. Fahlbusch 1964, Daams & Freudenthal 1988, Aguilar 1995). The morphological feature of the m1 is the long lingual and labial spurs of the anterolophulid (in eight molars). However, only labial spur was found in eight specimens. *Megacricetodon minor*, the generally most frequent species of the Middle Miocene faunas of the Carpathian Basin is missing in Subpiatră.

Eumyarion medius (Lartet, 1851). - The most important markers are the weakly developed antero-lingual cingulum, the lingually merged posterior spur of the protoconid with the mesolophid. A central enamel ring is surrounded by these ridges.

Concluding remarks

The biochronologic position of SU 2/1 and SU 2/2 faunas was estimated according the stratigraphic ranges of some marker rodents (see Table 2), based on recently published data of Bolliger 1994, Daxner-Höck 2005, Kälin et al. 2001, and Nemetschek &Mörs 2003.

Table 2 – Stratigraphic range of selected marker rodents from the Middle Miocene of Subpiatră

Taxa	**FOD**	**LOD**
Muscardinus aff. *sansaniensis*	MN 6	MN 7/8
Myoglis meini	MN 5	MN 10
Paraglirulus werenfelsi	MN 5	MN 10
Glirulus lissiensis	MN 4	MN 13
Democricetodon freisingensis	MN 6	MN 7/8
Democricetodon brevis	MN 6	MN 7/8
Megacricetodon germanicus	MN 6	MN 7/8
Eumyarion medius	MN 6	MN 7/8

SU 2/1 R can be assigned to MN 6, while SU 2/2 is probable younger: MN 7/8. The fauna from Subpiatră 2/1 indicates a relatively mild paleoclimate with a MAT higher than 14.5 ºC, as suggested by the presence of monitor lizards and crocodiles. Since the latter groups lack in Subpiatra 2/2 one may presume that the MAT in this locality never reached 14.5 ºC. However, according the faunal composition of Subpiatră 2/2 a forested paleoenvironment can be concluded because the higher participation of Sciuridae and Gliridae.

In order to explain the paleoecological background of the strongly different SU 2/1 and SU 2/2 assemblages we intend to include all the relevant groups

in the further investigations (e.g. ostracods, molluscs, fish, birds and large mammals).

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Explanations of plates

Plate 1.

Amphibians and reptiles from the Middle Miocene of Subpiatră. Fig. 1 – right Ilium of *Latonia gigantea* from SU 2/2 in lateral view; Fig. 2 – left ilium of *Rana (Pelophylax)* sp. from SU 2/1R in lateral view; Fig. 3 – frontoparietal of *Palaeobatrachus* sp. from SU 2/2 in dorsal view; Fig. 4 – left dentary fragment of *Lacerta* sp. from SU 2/1R in lingual view; Fig. 5 – isolated tooth of Varanidae indet., from SU 2/1R; Fig. 6 – isolated tooth of cf. *Diplocynodon* sp. from SU 2/1R; Fig. 7 – osteoderm of *Ophisaurus* sp. from SU 2/1R; Fig. 8, 9 – trunk vertebra of Colubrinae indet., in dorsal (7) and ventral (8) views. Scale bar 1 mm.

Plate 2.

Rodent molars from the Middle Miocene of Subpiatră. Fig. 1 – *Spermophilinus bredai* m2 from Subpiatră 2/2; Fig. 2 - *Myoglis meini* m1 from SU 2/2; Fig. 3 - *Muscardinus* aff. *sansaniensis* M1 from SU 2/1; Fig. 4 - *Paraglirulus werenfelsi* m1 from SU 2/2; Fig. 5 - *Democricetodon freisingensis* M1 from SU 2/2; Fig. 6 - *Megacricetodon* sp. M1 from SU 2/1; Fig. 7 - *Megacricetodon* sp. m1 from SU 2/1; Fig. 8 - *Megacricetodon* sp. M2 from SU 2/1. Scale bar 1 mm.

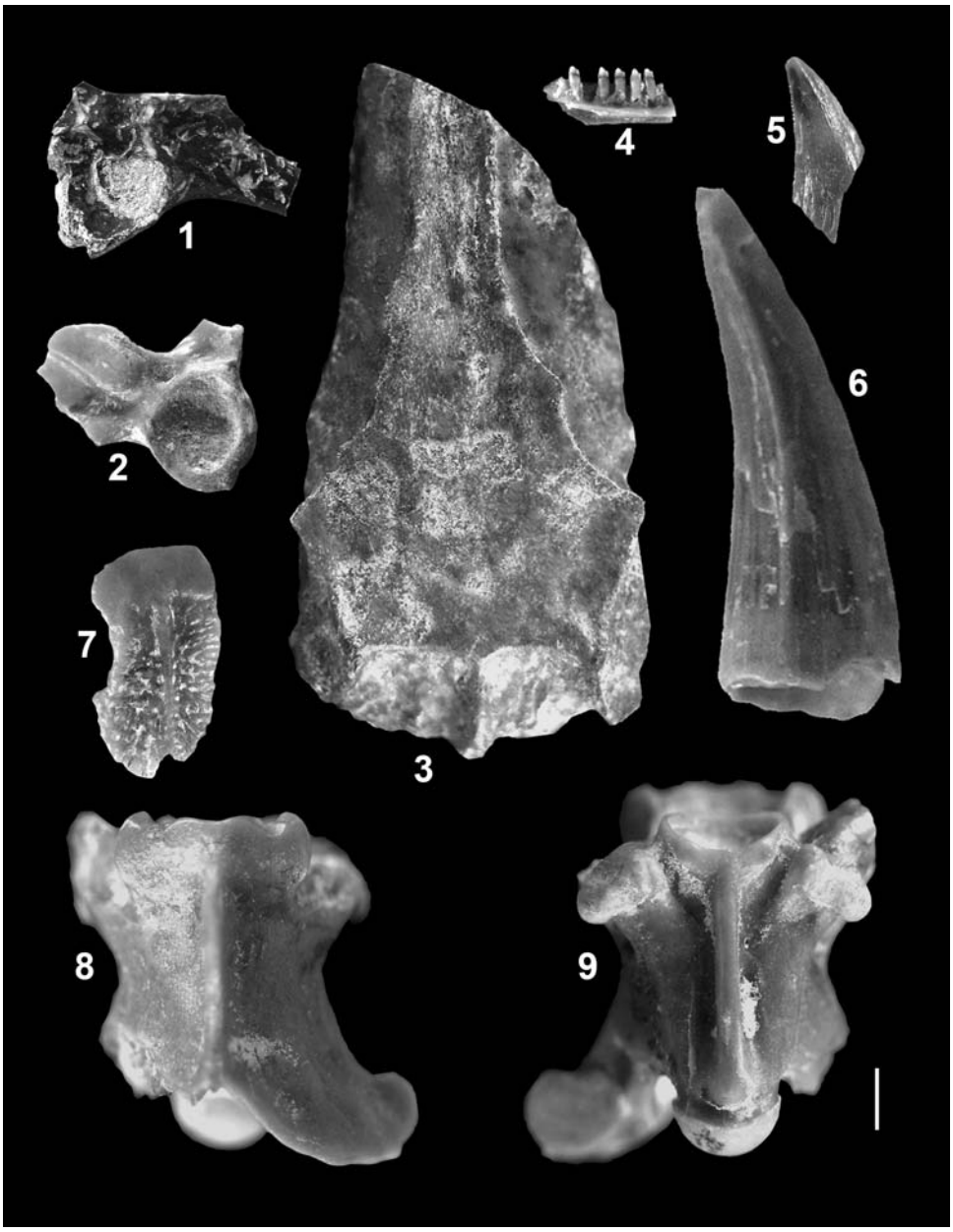

Plate 1.

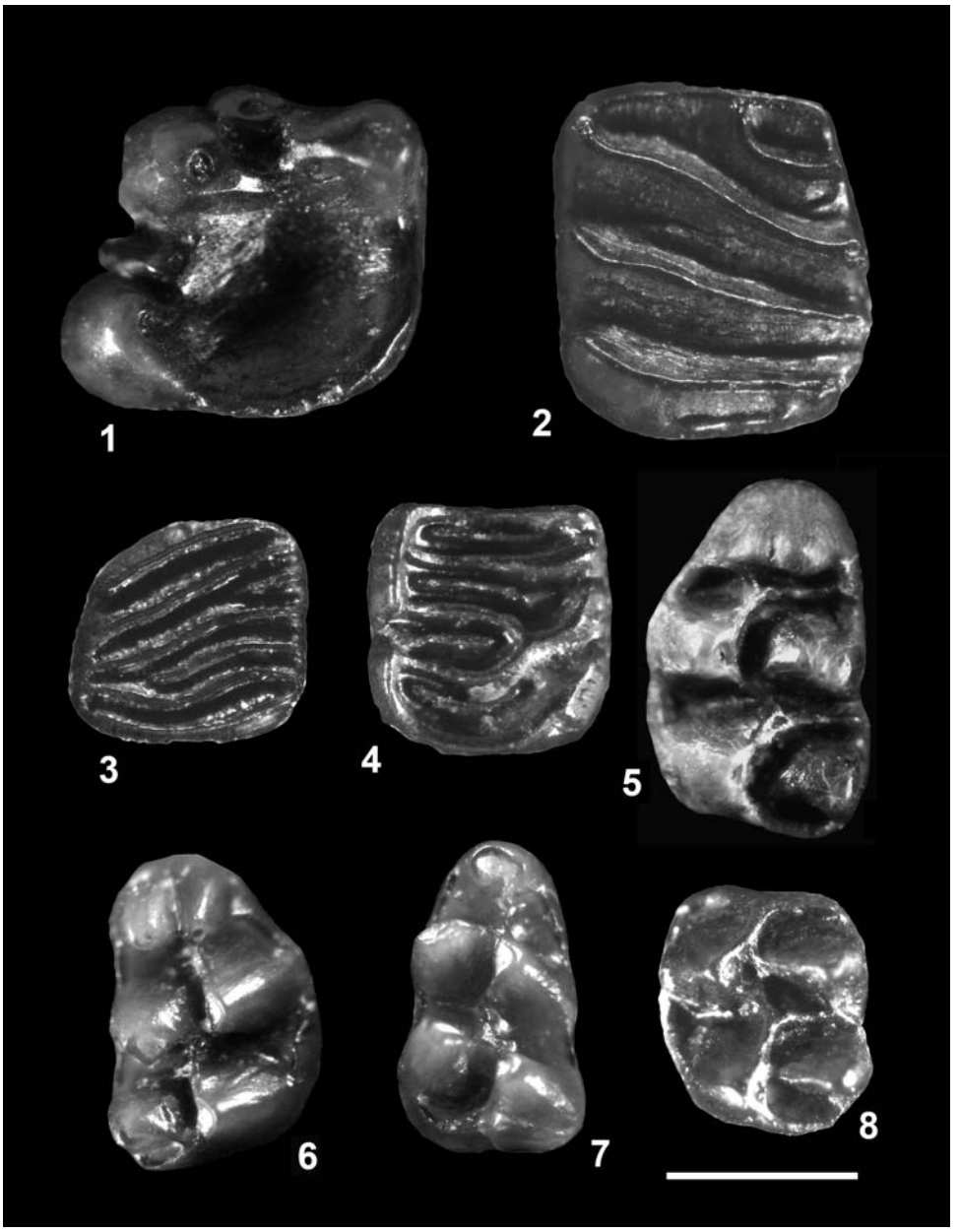

Plate 2.