Beitr. Paläont., **30**:57–87, Wien 2006

Small mammals from the Early Miocene of Sabuncubeli (Manisa, S.W. Anatolia, Turkey)

by

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BRUIJN, H. DE, MAYDA S., HOEK OSTENDE, L. VAN DEN, KAYA, T. & SARAÇ, G., 2006. Small mammals from the Early Miocene of Sabuncubeli (Manisa, S.W. Anatolia, Turkey). — Beitr. Paläont., **30**:57–87, Wien.

Abstract

The assemblage of small mammals from Sabuncubeli is of special interest because: 1) it is the first from the Early Miocene of Anatolia that occurs associated with a set of large mammal remains, 2) it is only the second from Anatolia representing MN3, 3) it has a composition that is essentially different from the one from Keseköy, the other MN3 assemblage from Anatolia.

Some of the genera and species that are common in Keseköy are either very rare or absent in Sabuncubeli: i.e. the insectivores *Galerix uenayae* and *Theratiskos* and the rodents *Debruijnia*, *Vallaris*, *Sayimys* and *Enginia*. Others, such as *Schizogalerix evae*, *Steneofiber eseri*, *Palaeosciurus fissurae* and *Eumyarion orhani* occur in Sabuncubeli, but not in Keseköy. The new species *Schizogalerix evae* and *Eumyarion orhani* are known from Sabuncubeli only.

The differences in fauna composition between the two Anatolian assemblages of approximately the same age are possibly the result of differences in environment. A lacustrine deposit formed on a plateau in the case of Keseköy, a fluviatile deposit in a lowland setting in the case of Sabuncubeli.

Keywords: Early Miocene, *Schizogalerix evae* n. sp., *Eumyarion orhani* n. sp., small mammals, Sabuncubeli, Anatolia, Turkey

Kurzfassung

Die Kleinsäugerfauna von Sabuncubeli ist von besonderem Interesse weil: 1) es die erste Fundstelle aus dem Untermiozän von Anatolien ist, die auch Großsäugerreste führt. 2) Es ist erst die zweite anatolische Fundstelle aus dem MN 3 und 3) ist die Faunenzusammensetzung deutlich unterschieden von der aus Keseköy, der anderen anatolischen MN 3-Faunenvergesellschaftung.

Einige der Gattungen und Arten die in Keseköy sehr häufig sind, sind in Sabuncubeli entweder sehr selten oder fehlen ganz. Wie z.B. die Insectivoren *Galerix uenayae* und *Theratiskos* und die Rodentia *Debruijnia*, *Vallaris*, *Sayimys* und *Enginia*. Andere, wie etwa *Schizogalerix evae*, *Steneofiber eseri*, *Palaeosciurus fissurae* und *Eumyarion orhani* kommen in Sabuncubeli vor aber nicht in Keseköy. Die neue Arten *Schizogalerix evae* und *Eumyarion orhani* sind nur von Sabuncubeli bekannt.

Die Unterschiede in der Faunenzusammensetzung zwischen diesen beiden anatolischen Fundstellen annähernd gleichen Alters sind möglicherweise das Ergebnis unetrschiedlicher Umweltbedingungen. Lakustrine Ablagerungen am Hochland im Falle von Keseköy und fluviatile Sedimente des Tieflandes im Falle von Sabuncubeli.

1. Introduction

The locality of Sabuncubeli is situated along the forest road that leads from the main road between Manisa and Bornova to the village of Sarnic (Fig. 1A). It has been discovered by Dr. O. Kaya and Dr. G. Saraç during a prospecting campaign for small mammals in the autumn of 1998. The fossiliferous lens is situated in the grey coloured sandy mud rocks of the lower part of the Soma Formation (Fig. 1B). Collecting of the remains of large mammals from a fine conglomerate lens (SB) by the second author during the years 2000 – 2004 produced, after wet screening of the matrix on a 0.5 mm mesh, a considerable number of rodent and insectivore teeth. Since not all the fine fraction could be sorted this collection suffers from collecting bias. A second collection (SBb) from the same level, but some twenty five metres to the East of the original site was made

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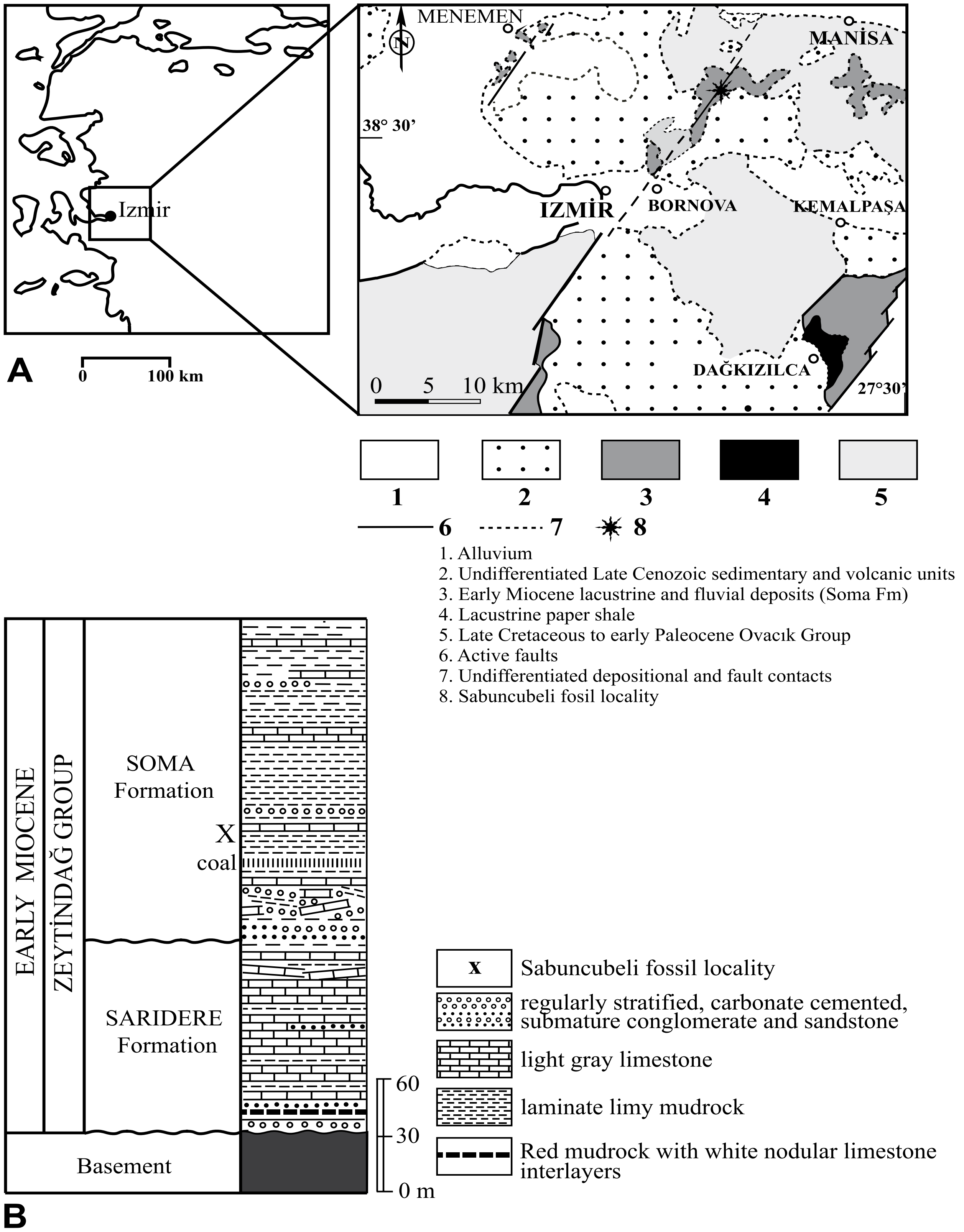


Fig. 1: **A**. Location and geological map (enlarged) of the study area. The locality Sabuncubeli is indicated by an asterisk. **B**. Schematic lithological succession of the continental Early Miocene in the study area. Figs. A and B are modified after Kaya et al. (in press).

in 2005 from the fine grained upper part of the fossiliferous bed with the specific aim to enlarge the small mammal collection. The concentrate of this second collection has been sorted to the 0.8 mm fraction.

The association of fossil mammals from the locality Sabuncubeli (Table 11) is of particular interest because it is the first Early Miocene site in Anatolia that yielded remains of large as well as of small mammals in any quantity. The local biozonation of the continental Neogene is based on rodents (Ünay et al., 2003), but many of these tend to be endemic. Since large mammals generally have much larger geographical ranges the assemblage has a good potential for long-distance biostratigraphical correlation.

The pre-Miocene basement in the study area consists of the Late Cretaceous to Early Paleocene Ovacık Group (Kaya, 1981) The Ovacık Group is unconformably overlain by the Zeytindağ Group (Kaya et al., in press), which can be divided into two units: 1) The Saridere Formation consisting of light grey, medium bedded, micro-crystalline limestone, yellowish grey marly limestone and sandstone, 2) The Soma Formation, a mixed succession of mud rocks, sub-mature conglomerates, lithic and volcanogenic sandstones and white limestones with coal lenses. The contact between the Saridere and Soma Formations is unconformable (Fig. 1B).

The Sabuncubeli fauna has been collected from the lower part of the Soma Formation. The fossiliferous bed consists of a lower part with fine-grained sub-mature conglomerate lenses and a marly upper part that contains mollusc debris. The thickness of these deposits shows considerable variation within the outcrop.

2. Methods

The material described below will be housed in the Natural History Museum of the Ege University (Izmir). The measurements of the cheek teeth have been taken with a Leitz Ortholux microscope with measuring clocks and are given in 0.1 mm units. All teeth are figured as from the left side. If the original is from the right side the relevant number on the plate has been underlined. The magnification used is approximately x 28 for the rodents (castorids excepted), lagomorphs, and insectivores (galericines excepted) and x 10 for the castorid and galericine teeth.

3. Systematic Palaeontology

Ordo Erinaceomorpha Gregory, 1910

Familia Erinaceidae Fischer von Waldheim, 1817

Subfamilia Galericinae Pomel, 1848

Galerix Pomel, 1848

***Galerix uenayae* van den Hoek Ostende, 1992**

(Plate 1, figs. 1-4, 7-9)

Type locality: Keseköy

Type level: Early Miocene (MN 3)

Material and measurements: see Table 1.

Remarks: The small assemblage from Sabuncubeli agrees well in size with the material from the type locality. A protocone-metaconule connection is invariably present in our material, a characteristic that also fits well with G. uenayae. The most characteristic features of the species are its large P4 and a p4 which is sub-equal in length to the m2 (Van den Hoek Ostende, 1992). The last upper premolar is represented by a fragment only, which does appear large. The p4 and m2 in the assemblage both fall within the variation of G. uenayae from Keseköy. The p4 in our material are, nevertheless, clearly smaller than the single m2 found, which may be related to the small sample size.

	Length			Width	
tooth	range	mean	N	range	mean
P4	—	—	—	—	—
M1	—	23.8	1	—	29.7
M2	19.3–19.6	19.5	2	24.4–25.0	24.6
M3	10.7–11.4	1.11	3	14.9–17.5	16.2
d3	—	16.7	1	—	9.4
p1	—	13.4	1	—	5.5
p2	—	19.5	1	—	9.0
p4	18.4–19.1	18.8	2	12.5–12.9	12.7
m1	—	28.8	1	—	18.1
m2	—	24.3	1	—	17.3
m3	—	17.5	1	—	12.4

Table 1: Material and measurements of *Galerix uenayae* van den Hoek Ostende, 1992 from Sabuncubeli (Anatolia, Turkey).

Schizogalerix Engesser, 1980

***Schizogalerix evae* n. sp.**

(Plate 1, figs. 5-6, 10-13)

Derivatio nominis: The species is named after Eva Höck, youngest daughter and trusted assistant of Gudrun Höck-Daxner at the Naturhistorisches Museum Wien.

Holotype: M1 sin., Pl. 1 fig. 6, SB 2401.

Type locality: Sabuncubeli

Type level: Early Miocene (MN 3)

Diagnosis: Large species of *Schizogalerix*. The mesostyle is hardly divided; the posterior cingulum on the lower molars remains low. The m3 is little reduced. The protoconule is well developed on the P4, and M1. The first upper molar has a well-developed labial cingulum.

Differential diagnosis: The very poor division of the mesostyle and a posterior cingulum that does not connect to the entoconid set *Schizogalerix evae* apart from all of the derived species of *Schizogalerix*. It shares these primitive characters with *S. pasalarensis*, *S. pristina* and "*Schizogalerix*" *iliensis*. *Schizogalerix* evae differs from "*Schizogalerix*" *iliensis* in having a bipartitioned cingulum on the M1. It is considerably larger than *S. pristina*, has a better developed metaconid on the p4, and has in contrast to that species a posterocrista on the hypcone of the upper molars. *Schizogalerix evae* shows the closest resemblance to *S. pasalarensis*. It differs from this species in the presence of a protoconule on the P4, better developed protoconules on the M1, a wider labial cingulum on the M1, and a posterocrista on the hypocone of the M1. Unfortunately, the M2 of S. evae is not known. Overall the new species is somewhat larger than *S. pasalarensis*, but the m2 is markedly larger. In addition, the m3 is clearly less reduced than in *S. pasalarensis* (presence of a posterior cingulum!).

Material and measurements: see Table 2

	Length			Width	
tooth	range	mean	N	range	mean
P4	—	21.6	1	—	31.4
M1	25.5–29.1	26.9	3	34.4–37.6	36.1
p4	19.2–19.5	19.4	2	13.6–14.5	14.1
m1	—	30.1	1	—	20.2
m2	—	27.2	1	—	17.7
m3	—	20.2	1	—	14.2

Table 2: Material and measurements of *Schizogalerix evae* n.sp. from Sabuncubeli (Anatolia, Turkey).

Description:

P4. The outline of the occlusal surface is a parallelogram. The premolar is remarkably short. The protocone is a large cusp. It is elongated along the width axis of the P4. Its short anterior arm connects to the protoconule. The latter is a low but distinct cuspule, anterolingually to the paracone. The posterior arm of the protocone connects to the low and conical hypocone. The back of the P4 is bordered by a low posterior ridge, which starts at the base of the hypocone and continues to the posterior-labial corner of the premolar.

The paracone is the largest cusp of the P4, occupying about half of its surface. Its anterior face is remarkable straight, and appears to be even slightly concave near its base. There is a sharp posterocrista, which slopes down steeply, than bends at an angle of about 45°. After this bend, the height of the crista remains the same. In front of the paracone lies a triangular shaped parastylar flange, bearing a very low parastyle.

M1. The molar is clearly wider than long. The outline of the occlusal surface is sub-rectangular. With the exception of the protoconule, all cusps are markedly convex on their lingual sides, whereas their labial sides are relatively flat.

The protocone is the largest cusp. Its anterior arm is short. It connects to the lingual arm of the protoconule. The latter is a well-individualised, drop-shaped cusp. There is a marked, V-shaped notch where the two arms meet. The posterior arm of the protocone connects to the anterior arm of the hypocone, forming one continuous ridge. The hypocone is slightly smaller and clearly lower than the protocone. It has a marked posterocrista, which slopes down and continues as a sharp ridge on the lingual part of the posterior cingulum. In a similar fashion the posterior arm of the metaconule continues as a ridge over the labial part of the posterior cingulum. The metaconule is set closely to the metacone, its short anterior arm ending against the base of that cusp, while the posterior arm of the metaconule is separated from the metacone by a narrow valley.

The labial cusps are elongate, with their tips at the labial side of the cusp. The anterior flank of the paracone is slightly concave; the posterior flank is straight. The cusp has two short, slightly curved arms. The anterior arm slopes down and connects to the parastyle, the posterior arm connects to the mesostyle. The parastyle is a long elongate cusp, which is more or less formed as a labial thickening of a ridge on the wide anterior cingulum, which is present along most of the width of the front of the molar, though not along the base of the protocone. The metacone is somewhat larger and higher than the paracone. Its anterior arm curves backwards, forming a small loop (the so-called Schlaufenbildung in German literature). It meets the posterior arm of the paracone at the mesostyle nearly at a right angle. The posterior arm of the metacone extends to the posterolabial corner of the molar. Near its end it forms a thick bulge on its anterior flank.

Apart from the anterior and posterior cingula, there is a wide labial cingulum. It consists of two parts, one labially of the paracone, the other labially of the metacone. The cingulum is absent near the mesostyle.

p4. The outline of the occlusal surface is subrectangular. It consists mainly of a trigonid, very much resembling the trigonid of the molars. The protoconid is the highest cusp. It has a triangular cross-section. The conical metaconid is somewhat lower than the protoconid. In the unworn specimen it is clearly separated from the latter, with a sharp cristid on its posterolabial face. In this specimen a clear metacristid has developed. In the more worn specimen the protoconid and metaconid have become merged, and there is no sign of a metacristid. The paraconid is blade-like and incorporated in the long paralophid. It is clearly lower than the metaconid. The premolar is bordered by a narrow talonid with a well-defined posterior ridge. In the unworn specimen thickening of the lingual side of the ridges results in a low but fairly large cusp. Such a cusp is not found in the other specimen. There are no cingula.

m1. The only complete m1 is very worn. Apart from it, a trigonid of an unworn specimen has been found. The outline of the occlusal surface is sub-rectangular. The protoconid is the highest cusp. It has a triangular cross-section. The paraconid and metaconid are of similar size; the metaconid is somewhat higher than the paraconid. The trigonid is strongly askew, with the paralophid and the protoconid-metaconid connection set obliquely to the length axis of the jaw. Both the paralophid and the protoconid-metaconid connection are notched near the protoconid. Even from the worn specimen it is clear that the entoconid was a large cusp, partly blocking the talonid basin to its lingual side. There is a short, well-defined metacristid. The anterior cingulum is narrow. There is a weak cingulum on the labial side. The posterior cingulum is thick. Due to the extreme wear, its configuration with respect to the hypolophid and entoconid cannot be discerned.

m2. The outline of the occlusal surface forms a parallelogram, with the anterior and posterior sides set obliquely to the length axis of the jaw. The trigonid is much narrower than the talonid. The protoconid has a triangular cross-section. The paraconid is blade-like and incorporated in the paralophid. The metaconid is elongated. The paralophid and protoconid-metaconid ridge are parallel to one another and set closely together, bordering a very narrow trigonid basin. Both ridges are notched near the protoconid. The entoconid is a large cusp, which extends into the talonid basin. The talonid basin is bordered lingually by the entoconid and a well-defined metacristid. The hypoconid has a slender built, with slightly concave anterior and posterior flanges. The hypolophid is curved. The oblique cristid ends against the base of the protoconid, at about one-fourth of the length of the protoconid-metaconid crest.

There is a well-developed cingulum along the anterior and labial sides running between the anterior flange of the paraconid and the base of the hypoconid. The posterior cingulum is thick, filling in the open space along the basis of the curved hypolophid. It does not connect to the entoconid.

m3. The outline of the occlusal surface is sub-rectangular. The trigonid is much shorter than the talonid, but hardly wider. The trigonid resembles that of the m2, but is smaller and set less obliquely. The talonid is little reduced. The entoconid is a large cusp. In contrast to the m2, its base does not extend into the talonid basin. The blade-like anterior part of the entoconid borders the talonid basin on its lingual side. There is a very small metacristid. The posterior arm of the entoconid is slightly curved inwards, and meets the hypolophid halfway the width of the molar. In our unworn specimen the two ridges can clearly be distinguished at their meeting point, but with wear will merge to a single posterior ridge. The hypoconid is small. The oblique cristid is slightly curved to the labial side and ends against the base of the protoconid. The hypolophid curves slightly backwards. The cingulums seem somewhat less developed than in the m2, but as the anterior cingulum is missing, its development cannot be judged. The posterior cingulum consists of a thick patch at the base of the hypolophid

Remarks: The record of *Schizogalerix evae* in Sabuncubeli represents the geologically oldest occurrence of the genus. Given the large similarity between the two species there can be little doubt that *S. evae* is the ancestor of *S. pasalarensis*. The latter can be readily derived from the Sabuncubeli species by loss of the protoconule on the P4 and reduction of that cusp on the M1, the reduction of the labial cingulum on the upper molars and size reduction of the last two lower molars. Thus the early evolution of *Schizogalerix* seems to have taken place in Anatolia. This is in sharp contrast to recent ideas. Two species outside of Anatolia were coined as possible ancestors to *S. pasalarensis*. "*Schizogalerix*" *iliensis* was described from the lower Miocene of the Aktau mountain (Kazachstan) by Kordikova (2000). Although in the original description the genus name was published between quotation marks, indicating some doubt about the generic assignment, Ziegler (2003) considered the Kazachstan species referable to *Schizogalerix* without question. Indeed, his find of *S. pristina* (Ziegler (2003) incorrectly used the masculine form *pristinus*. Since the genus name *Galerix* is feminine, the name has here been emended accordingly.) from the early Middle Miocene of Austria, in some respects similar to "*S.*" *iliensis*, showed that a stock of galericines with *Schizogalerix*-like features had spread over parts of the Eurasian continent. Although these galericines seemed to make plausible ancestors for *S. pasalarensis*, the discovery of an older, and more advanced *Schizogalerix* in Anatolia itself shows that they are not directly related to the Middle Miocene Anatolian *Schizogalerix*. In fact, the Kazachstan species seems not to be referable to *Schizogalerix* at all because "*Schizogalerix*" *iliensis* does not have the bipartioned posterior cingulum on the first two upper molars, which according to the diagnosis of Van den Hoek Ostende (2001a) is one of the characteristics of the genus. Although the diagnosis of the species provided by Kordikova (2000) mentions a superficially split mesostyle on M1 and M2, the description specifically states that the mesostyle is undivided in all specimens but for one. Doukas & Van den Hoek Ostende (2007) therefore transferred the Kazackstan species to *Galerix*.

Whereas the iliensis species can easily be excluded from *Schizogalerix*, the ascription of *Schizogalerix pristina* to the genus by Ziegler (2003) cannot. The Austrian species closely fits the diagnosis of *Schizogalerix*, although the p4 does not have a well-developed metaconid. But at the time of description this could easily be interpreted as a primitive character. Also the absence of the typical anterolingual-posterolabial elongation of the molars could be seen as a primitive character. However, now that these characters are found to be already present in an MN 3 assemblage, the position of *Schizogalerix pristina* needs to be re-evaluated. The characters mentioned are also found in the genus *Parasorex*, which mainly differs from *Schizogalerix* in the absence of a divided mesostyle. The upper molars are less elongated. According to Van den Hoek Ostende (2001a) this resemblance to *Schizogalerix* is the result of parallel evolution due to a similar life-style. Doukas & Van den Hoek Ostende (2007) suggested that, now that is clear that *Schizogalerix* already obtained many of its advanced characters in MN 3, the Austrian species is no longer a logical ancestor to the *Schizogalerix* lineage. They consider the species better placed in *Parasorex*, representing the oldest occurrence of that species. This would provide a more parsimonious model of evolution, in which *Schizogalerix* develops in the Early Miocene in Anatolia, whereas *Parasorex* evolves in the early Middle Miocene from *Galerix symenodisi* like ancestors in Europe.

The co-occurrence of *Schizogalerix* and *Galerix* in Sabuncubeli is somewhat surprising. In the locality of Keseköy, which is of similar age and yielded a very rich insectivore assemblage, the galericines are represented by *Galerix* only (Van den Hoek Ostende, 1992; 2001b). It was already known that *Schizogalerix* and *Galerix* co-occurred in the small assemblage of Hisarçik (Anatolia, MN 4), but this observation was based on fragments only (Van den Hoek Ostende & Doukas, 2003). The absence of *Schizogalerix* in Keseköy is probably environmentally determined.

Ordo Soricomorpha Gregory, 1910

Familia Talpidae Fischer von Waldheim, 1817

Desmanodon Engesser, 1980

***Desmanodon* cf. *burkarti* Van den Hoek Ostende, 1997**

(Plate 2, figs. 1-4)

Type locality: Keseköy
Type level: Early Miocene (MN 3)
Material and measurements: 1 M1 (24.7 x 14.0), 1 M2 (18.6 x 19.3), 1 M3 (11.7 x 15.2), 1 p4 (11.9 x 7.1).
Remarks: Van den Hoek Ostende (1997) described two species of *Desmanodon* from Lower Miocene deposits in Anatolia. The older one, *D. ziegleri* from the Harami and Kilçak localities (MN 1), is characterized by the invariable presence of a protoconule on both the M1 and M2. In *D. burkarti*, the protoconule is tiny or absent on the M1, but still present as a weak cusp on the M2. In this respect the material from Sabuncubeli agrees well with that from the type locality Keseköy. The degree of division of the mesostyle of the upper molar, another important feature in the taxonomy of the genus, also agrees well with the Keseköy assemblage. A remarkable feature is that all of our elements are narrower than the corresponding elements from Keseköy, even though the length consistently falls within the variation of that assemblage. Because of this, and the somewhat limited material available, we only tentatively assign the *Desmanodon* fossils to *D. burkarti*.

Familia Soricidae Gray, 1821

Soricid gen. et sp. indet.

(Plate 2, fig. 5)

Material: 1 damaged m1 sin.
Remarks: The presence of shrews in Sabuncubeli is only indicated by one single damaged lower molar. Based on such scanty material, it is not possible to identify even the genus.

Ordo Lagomorpha Brandt, 1855
Familia Ochotonidae Thomas, 1897

Introduction: Ochotonids are never abundant in the Early Miocene assemblages from Anatolia and Sabuncubeli is no exception to this rule. Identification of the few specimens from this locality is difficult because the intra-specific variation is not known and the ochotonid material from the localities Keseköy and Harami is not available for comparison because it is under study by Dr. S. Sen in Paris. In order to make the Sabuncubeli material known it will be figured and briefly described below.

Ochotonidae gen. et sp. indet.

(Plate 2, figs. 6-10)

Material and measurements: 1 P2 (8.5 x 16.6), 1 P3 (11.1 x 19.6; presumably belonging to the same individual as the P2), 2 fragmentary molariform upper cheek teeth (13.5-13.9 x --), 1 d3 (16.5 x 12.7), 1 d4 (13.7 x 11.7; presumably belonging to the same individual as the d3).
Remarks: The P2 has a strong root below the protocone and may have had a small vestigial root below the metastyle. The paraflexus is rather long, reaching far postero-labially. Most unusual for a P2 is the well-developed hypoflexus. We have not been able to find a literature reference to a lagomorph P2 with a morphology that is so similar to that of the P3 as in the specimen from Sabuncubeli.
The P3 has no roots. The paraflexus is long. The mesial hyperloph is hardly developed, and does not reach the level of the metacone. This presumably primitive characteristic makes this P3 different from all contemporaneous specimens seen. Therefore we cannot exclude that the teeth described above are not P2 and P3, but D2 and D3. However, their crown height and the development of the hypoflexus make this last interpretation improbable.
The molariform upper cheek teeth show a hypoflexus that reaches far labially.
The d3 and d4 of ochotonids do not show generic characteristics. The anteroconid of the d3 is large, which is considered to be a progressive feature.
Our conclusion is that the ochotonid teeth from Sabuncubeli show similarities to those of the Albertona/Alloptox group. However, the deep hypoflexus of the P2 and the underdeveloped mesial hyperloph of the P3 distinguish them clearly from all representatives of these genera.

Ordo Rodentia Bowdich, 1821
Familia Castoridae Hemprich, 1820

Steneofiber Geoffroy-Saint-Hilaire, 1833

Steneofiber eseri (von Meyer, 1846)

(Pl. 1, fig. 14, Pl. 3, figs. 1-2a)

Type locality: Oerlinger Thal
Type level: Early Miocene (MN 2)
Material and measurements: The measurements given in this table have been taken on isolated teeth as well as on teeth in dentitions. See Table 3.
1 fragment of a right maxilla with P4-M3, length P4-M3 = 14.9
1 fragment of the left maxilla of the same individual, length P4- M3 = 15.0
1 fragment of a left maxilla with P4- M2, length P4-M2 = 10.6

	length			width	
tooth	range	mean	N	mean	range
P4	38.0-49.0	44.7	3	42.3	34.0-47.0
M1-2	35.5-41.0	37.3	13	40.3	34.0-44.5
M3	31.0-33.5	32.2	3	35.2	33.0-37.0
p4	54.5-60.0	57.3	3	48.2	47.0-49.5
m1-2	36.5-41.0	38.0	5	44.8	43.5-46.0
m3	—	37.5	1	36.0	—

Table 3: Material and measurements of *Steneofiber eseri* (von Meyer, 1846) from Sabuncubeli (Anatolia, Turkey).

Remarks: The type specimen of *S. eseri* from Oerlinger Thal has been reported as "probably lost" by Hugueney (1999). However, there is a very good collection of this species from Ulm-Westtangente described by Stefen (1997), who does not comment on the holotype. Hugueney (1999) refers to the abundant, but somewhat smaller, material from the Allier basin (France) for comparison and seems to have been unaware of the work of Stefen. The specimens from Sabuncubeli are semi-hypsodont and lack cement just as in other assemblages of *S. eseri*. The premolars are larger than the molars and the metaloph of the upper cheek teeth is curving backwards and lingually connected to the posteroloph, a feature that is characteristic for post Oligocene *Steneofiber* species. The size of the specimens from Turkey is slightly smaller than that of the *S. eseri* material from Ulm-Westtangente and rather similar to the structurally more primitive *S. dehmi* Freudenberg, 1941 from the Late Oligocene of Gaimersheim (Bavaria). Considering the generally rather large size range in beaver populations due to the relation between ontogenetic stage and tooth size and the well-known size difference between sub-populations of the same beaver species, the observed size difference does not seem to be of taxonomical importance.

The fossil beaver record of Anatolia is rather poor. So far the family is not known from Oligocene deposits and their appearance is in the Early Miocene locality Kilçak 3a (?MN 1) with fifteen isolated teeth. Although this material is metrically and morphologically similar to the specimens from Sabuncubeli it contains some very worn upper molars in which the parafossette and metafosette have been completely obliterated and the hypoflexus and mesoflexus have become enamel lakes. As far as we know a similar simplification of the dental pattern has neither been reported from the abundant material from the Allier basin, nor from Ulm-Westtangente. The only other Anatolian Early Miocene beaver record is *S.* cf. *eseri* in the fauna list of the locality Kınık 2 (Ünay & Göktas, 2000).

Familia Muridae Illiger, 1811

Subfamilia Spalacinae Gray, 1821

Debruijnia Ünay, 1996

***Debruijnia arpati* Ünay, 1996**

(Plate 4, Figs. 1, 1a)

Type locality: Keseköy

Type level: Early Miocene (MN 3)

Material and measurements: 1 M2 (19.1 x 17.2)

Remarks: The single M2 of a primitive spalacid available from Sabuncubeli is very similar to the M2 in the type material of *Debruijnia arpati*. Although the size of this specimen is smaller, and falls outside the range as given by Ünay (1996) this difference seems, judging by comparison with casts of the type material, to be due to the measuring equipment/technique used. The protoloph and metaloph of our specimen are slightly more forwards directed than in the modal specimen from Keseköy, which suggests that Sabuncubeli is slightly older than Keseköy.

Subfamilia: Cricetodontinae Stehlin & Schaub, 1951

Cricetodon Lartet, 1851

***Cricetodon* aff. *kasapligili* de Bruijn et al., 1993**

(Plate 5, figs. 1-4)

Type locality: Keseköy

Type level: Early Miocene (MN 3)

Material and measurements: see Table 4.

	Length			Width	
tooth	Range	mean	N	mean	range
M1	—	24.2	1/2	15.9	15.7-16.0
M2	17.6-18.1	17.9	3/2	16.3	16.2-16.3
M3	14.9-15.0	15.0	2	14.1	14.0-14.2
m1	20.7-22.9	21.8	2/3	14.1	13.7-14.5
m2	—	—	—	—	—
m3	—	—	0/1	14.2	—

Table 4: Material and measurements of *Cricetodon* aff. *kaspligili* de Bruijn et al, 1993 from Sabuncubeli (Anatolia, Turkey).

Remarks: The *Cricetodon* cheek teeth from Sabuncubeli are overall somewhat smaller than the type material of *C. kasapligili*, but the morphology is very similar. The M1 in particular in having a rather narrow labially situated anterocone, three roots and lacking a paracone spur.

The configuration of the metaloph of the M2 (Plate 5, fig. 2) is more primitive than in the type material of *C. kasapligili* because it connects lingually to the hypocone instead of to the posteroloph.

The three m1 from Sabuncubeli all have the metalophulid 1 and 2, whereas the single specimen available from Keseköy has the posterior metalophulid only. It thus seems that the *Cricetodon* from Sabuncubeli is close to, but somewhat more primitive than, the material from Keseköy. Since the variation within these assemblages is not known we refer to our material as *C.* cf. *kasapligili.*

Subfamilia Eumyarioninae Ünay, 1989

Eumyarion Thaler, 1966

***Eumyarion montanus* de Bruijn & Saraç, 1991**

(Plate 7, figs. 1-9)

Type locality: Keseköy

Type level: Early Miocene (MN 3)

Material and measurements: see Table 5.

Remarks: The average size of the *E. montanus* teeth from Sabuncubeli is somewhat smaller than the type material, but the ranges overlap. The morphological similarity of these two associations, which includes the crenulation of the enamel surface of the cheek teeth, is remarkable considering their geographical distance and the difference in sedimentary environment. The only difference observed considers the on average somewhat better development of the posterior paracone spur in the M1 and M2 from Sabuncubeli. Since this characteristic occurs in the Early Miocene representatives of many cricetid

	Length			Width	
tooth	Range	mean	N	mean	range
M1	17.5-21.2	19.69	9/8	13.88	12.8-14.8
M2	14.2-15.5	14.49	10	13.70	13.0-14.4
M3	10.3-12.3	11.1	5	12.0	11.5-12.8
m1	16.8-19.3	18.24	10	11.75	10.0-12.5
m2	12.8-16.2	14.54	15/14	11.86	10.7-13.8
m3	12.7-15.2	13.00	10	11.12	10.1-12.3

$\bar{L}/\bar{W}$ of M1 =1.44, $\bar{L}/\bar{W}$ m1 = 1.55

Table 5: Material and measurements of *Eumyarion montanus* de Bruijn & Saraç, 1991 from Sabuncubeli (Anatolia, Turkey).

	Length			Width	
	range	mean	N	mean	range
M1	15.5-18.6	17.19	24/23	11.80	10.9-12.5
M2	11.7-13.5	12.70	14/13	11.53	10.0-12.1
M3	9.0-11.6	9.90	13	10.62	9.7-12.2
m1	15.0-17.1	16.00	15	9.99	9.4-11.1
m2	11.7-15.5	13.30	18	11.21	10.1-12.9
m3	10.4-12.8	11.86	14	9.98	9.5 -10.8

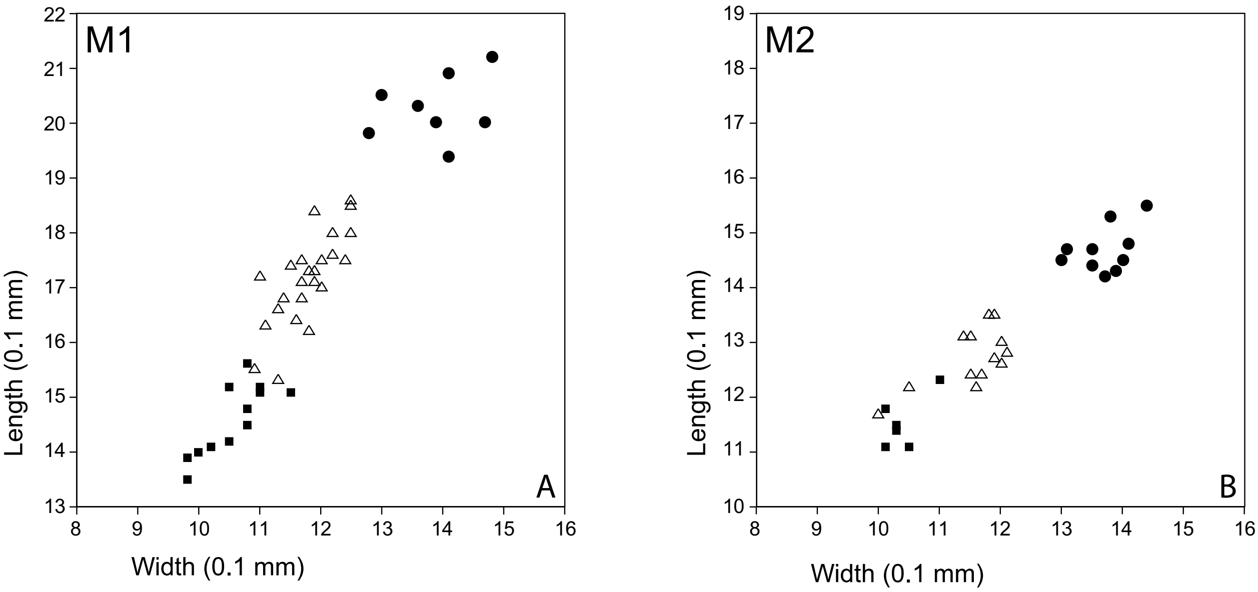
Table 6: Material and measurements of *Eumyarion orhani* n. sp. from Sabuncubeli (Anatolia, Turkey).

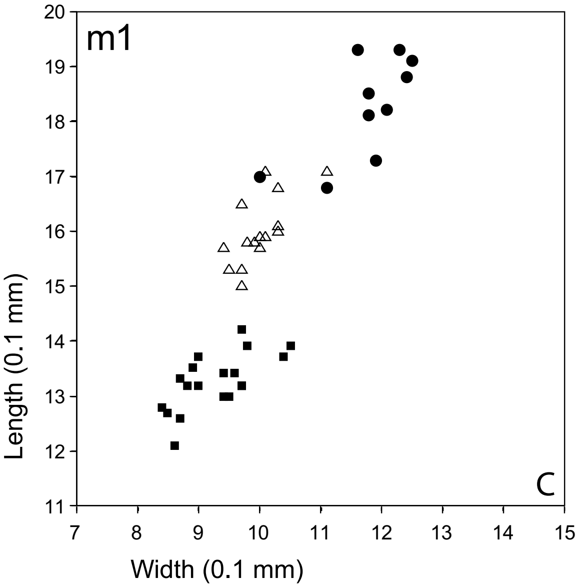
genera and tends to disappear through time it is suggested that Sabuncubeli may be somewhat older than Keseköy.

Eumyarion orhani n. sp.

(Plate 6, figs. 1-6, 9-14)

Derivatio nominis: This species is named after the late Prof. Dr. Orhan Kaya, who discovered the Sabuncubeli fossiliferous deposit and stimulated the integrated study of tectonics and small mammal palaeontology.
Type locality: Sabuncubeli
Type level: Early Miocene (MN 3)
Holotype: M1 sin., Pl. 6 fig. 2, SB 2107
Diagnosis: *Eumyarion orhani* is of medium size. The ectolophs of the M1 and M2 are usually complete and connected to the long mesoloph. The protoloph of the M2 is usually double. The anterocone of the M1 is basically single, rarely indistinctly bifid. The posterior arm of the hypoconid is strong in all m1 and m2, but rarely preserved in the m3. The posterior arm of the protoconid and the mesolophid end free in the central basin in most m1 and m2, but are connected to the entolophid in some.
Differential diagnosis: *Eumyarion orhani* is smaller than all members of the group of medium-sized species (*E. medius* (Lartet, 1851), *E. latior* (Schaub & Zapfe, 1953), *E. weinfurteri* (Schaub & Zapfe, 1953), *E. bifidus* (Fahlbusch, 1964), *E . leemanni* (Hartenberger, 1966), *E. carbonicus* de Bruijn & Saraç, 1991, and *E. montanus* de Bruijn & Saraç, 1991) and larger than the members of the small-sized group (*E. microps* de Bruijn & Saraç, 1991 and *E. intercentralis* de Bruijn & Saraç, 1991.
Eumyarion orhani resembles *E. bifidus* and to a lesser extend *E. microps* in morphology. The resemblance to *E. bifidus* is striking, because, with the exception of the slightly more bifid anterocone in bifidus and the not in all M2 double protoloph in *orhani*, the cheek teeth of the one are just allometrically larger than those of the other.
Material and measurements: see Table 6.
Description:
M1. The anterocone of the M1 is usually simple (rarely indistinctly split) and bears a labial posterior spur as well as a shorter lingual one. The anterior arm of the protocone is in some specimens long, reaching the labial border or the posterior spur of the anterocone, in others it is short and ends freely in the anterior basin. In a few worn specimens the anterior arm of the protocone connects with the paracone forming a protolophule 1. The well-developed posterior spur of the paracone is usually connected to the long anterior arm of the hypocone (mesoloph), which in turn connects to the metacone. This same configuration is characteristic for the M1 of *E. bifidus* (de Bruijn, in press.)
M2. The protolophule of the M2 is double in twelve out of fourteen specimens. It seems that the protolophule 1 is the homologue of the original protoloph and that the protolophule 2 is a neoformation (Pl. 6, fig. 3). The anterior arm of the hypocone is long and connected to the metacone.
M3. The lingual sinus of the M3 is closed along the lingual margin, but in some unworn specimens this new connection is lower than the other ridges. Although the dental pattern of the M3 shows much individual variation the double protolophule is preserved in most specimens.
m1. The morphology of the anterior part of the m1 shows a good deal of individual variation. In some specimens the anteroconid is connected to the metaconid by the metalophid and to the protoconid by the anterolophulid. This configuration is common in *E. carbonicus*, which is the oldest *Eumyarion* known. In others the anterolophulid is detached anteriorly and curves backwards toward the metaconid. The posterior arm of the protoconid is sometimes connected to the metaconid (the primitive situation in *Eumyarion*?), sometimes free-ending or connected to the mesolophid. The posterior arm of the hypoconid is strong in all the m1.
m2. The dental pattern of the m2 is much more stable than that of the m1 because the anterolophid is never interrupted. The posterior arm of the protoconid is, in contrast to the situation in the m1, longer than the mesolophid. The original configuration in which the posterior arm of the protoconid reaches the metaconid is present in one out of the sixteen specimens. In two others this ridge reaches the metaconid after fusion with the mesolophid. The posterior arm of the hypoconid is strong.
m3. The m3 shows the common *Eumyarion* pattern in missing the mesolophid in all but one specimen. A remnant of the posterior arm of the hypoconid is preserved in three out of thirteen specimens.
Remarks: *Eumyarion orhani* is so far the only *Eumyarion* species with cheek teeth that are intermediate in size between those of the small species *microps* and *intercentralis*





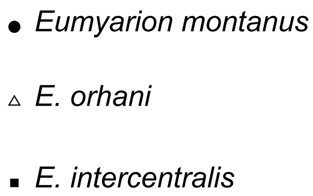


Figure 2: **A** – Length/width scatter diagram of the M1 of *E. montanus*, *E. orhani* and *E. intercentralis* from Sabuncubeli. **B** – Length/width scatter diagram of the M2 of *E. montanus*, *E. orhani* and *E. intercentralis* from Sabuncubeli. **C** – Length/width scatter diagram of the m1 of *E. montanus*, *E. orhani* and *E. intercentralis* from Sabuncubeli.

and the medium-sized species *carbonicus*, *montanus*, *latior*, *weinfurteri*, *medius*, *bifidus* and *leemanni*. Since the oldest species of the group of small species *E. microps* and of the medium-sized species *E. carbonicus* are both structurally potential candidates for the ancestry of *E. orhani*, we cannot reconstruct phylogenetical affiliations. However, the striking similarity in dental pattern of *E. orhani* and *E. bifidus* strongly suggests that they represent the same evolutionary lineage. We therefore consider *bifidus* to be an immigrant into Central Europe that came from the Middle East.

Eumyarion intercentralis DE BRUIJN & SARAÇ, 1991
(Plate 5, figs. 5-16)

Type locality: Keseköy
Type level: Early Miocene (MN 3)
Material and measurements: see Table 7.
Remarks: The specimens from Sabuncubeli assigned to

	Length			Width	
tooth	range	mean	N	mean	range
M1	13.5-15.6	14.60	12	10.56	9.8-11.0
M2	11.1-12.3	11.53	6	10.38	10.0-11.0
M3	8.0- 9.8	8.62	5	9.06	8.4- 9.8
m1	12.1-14.2	13.26	19	9.28	8.4-10.5
m2	11.1-13.6	12.30	14/13	10.38	9.8-11.5
m3	10.2-11.9	10.99	11	9.05	8.2-10.2

$\overline{L}/\overline{W}$ M1 =1.38, $\overline{L}/\overline{W}$ m1 =1.43

Table 7: Material and measurements of *Eumyarion intercentralis* DE BRUIJN & SARAÇ, 1991 from Sabuncubeli (Anatolia, Turkey).

Eumyarion intercentralis resemble the type material of that species in detail, but are on average slightly larger. The crowns of the cheek teeth are also somewhat higher. Measurements (in 0.1 mm) of the crown-height below the protocone of the M1 (N=29) from the type locality give a range between 6.6 and 7.8 and a mean value of 7.3 and a range between 6.8 and 8.6 and a mean value of 7.6 (N=6) for the specimens from Sabuncubeli. It thus appears that their crowns have proportionally approximately the same height. The metaloph of all the unworn M1 is inserting on the (anterior side of) the protocone. The mure of the M1 and M2 from Sabuncubeli is, in contrast to the situation in the specimens from Keseköy, never interrupted. The double protolophule in the M2 and the posterior arm of the m2 are better developed in the material from Sabuncubeli than in the material from Keseköy, but such minor differences may well be due to sampling bias. We conclude that the cheek teeth of *E. intercentralis* from Sabuncubeli are somewhat larger, yet structurally slightly more primitive than those in the type material.

Mirabella de Bruijn et al., 1987

***Mirabella anatolica/crenulata* exemplum intercentrale**

(Plate 4, figs. 2-6)

Type locality *E. anatolica*: Harami 1
Type level: Early Miocene (MN 2)
Type locality *E. crenulata*: Keseköy.
Type level: Early Miocene (MN 3)
Material and measurements: 2 M1: (29.0-29.8) x (17.1-17.4), 2 M2: (19.0-20.4) x (16.1-18.1), 1 m1 (25.4 x 14.5).
Remarks: The *Mirabella* specimens from Sabuncubeli are about the same size as the smaller ones of the type material of *anatolica* and smaller than the few specimens of *crenulata*. The rather short lingual spur of the anterolophule of the M1, the complete metaloph of the M1 and M2 and the presence of a complete hypolophid in the m1 suggest that these teeth are morphologically closer to *anatolica* than to *crenulata*. However, the crowns of the cheek teeth from Sabuncubeli are clearly higher than in the type material of *anatolica* and in this respect similar to *crenulata*. The *Mirabella* specimens from Sabuncubeli therefore occupy an intermediate position between the two species. Judging by the grade of evolution our locality is probably somewhat younger than Harami, but older than Keseköy.

Subfamilia Copemyinae Jacobs & Lindsay, 1984

Democricetodon Fahlbusch, 1964

***Democricetodon doukasi* Theocharopoulos, 2000**

(Plate 7, figs. 10-17)

Type locality: Keseköy
Type level: Early Miocene (MN 3)
Material and measurements: see Table 8.
Remarks: The *Democricetodon* specimens from Sabuncubeli are similar in size and morphology to *D. franconicus* Fahlbusch, 1966 and *D. doukasi*. The difference between these two species is in our opinion negligible because the distinctive characters show a good deal of variation within one association. The only reason to maintain the name *doukasi* here is that a number of M1 and M2 from Sabuncubeli have a rather strong posterior spur of the paracone, a common characteristic of many western Asiatic cricetids that is rare in European ones. The material from Sabuncubeli referred to *D. doukasi* is metrically as well as morphologically identical to the type material from Keseköy.

	Length			Width	
	Range	mean	N	mean	range
M1	13.7-15.2	14.45	10/9	9.11	8.7-9.5
M2	10.1-11.5	10.68	20	9.49	9.1-10.2
M3	—	—	—	—	—
m1	11.6-13.0	12.13	12	8.66	8.2-9.3
m2	10.6-11.5	10.95	8	9.10	8.4-10.1
m3	—	9.3	1	7.2	—

Table 8: Material and measurements of *Democricetodon doukasi* Theocharopoulos, 2000 from Sabuncubeli (Anatolia, Turkey).

Subfamilia Myocricetodontinae Lavocat, 1961

Vallaris Wessels et al., 2001

***Vallaris zappai* Wessels et al., 2001**

(Plate 6, figs. 7, 8)

Type locality: Keseköy
Type level: Early Miocene (MN 3)

	Length			Width	
	range	mean	N	mean	range
M1	11.1-12.3	11.6	5	7.6	6.8-8.0
M2		8.0	1	7.5	
m1	10.2-10.5	10.4	2	6.5	6.3-6.6
m2		9.2	1	7.1	

Table 9: Material and measurements of *Vallaris zappai* Wessels et al., 2001 from Sabuncubeli (Anatolia, Turkey).

Material and measurements: see Table 9.
Remarks: The few Vallaris cheek teeth from Sabuncubeli are on average somewhat smaller than the type material of *V. zappai*, but the ranges show overlap. Since the similarity in dental pattern is striking we do not hesitate to assign our specimens to *V. zappai.*

Familia:Gliridae Thomas, 1897
Subfamilia: Glirinae Thomas, 1897

Glirudinus de Bruijn, 1966

***Glirudinus* aff. *engesseri* Ünay, 1994**

(Pl. 8, figs. 7-18)

Type locality: Kilcak 0”

	Length			Width	
	range	mean	N	mean	range
D4	7.5-8.2	7.9	2	9.1	8.8-9.4
P4	6.4-7.1	6.8	6	8.5	7.5-9.0
M1-2	7.7-9.7	9.0	18/17	11.1	10.0-12.1
M3	6.9-8.3	7.6	3	9.5	8.7-10.0
d4	—	6.6	1	5.3	—
p4	7.0-7.9	7.4	4	7.4	7.0-7.9
m1-2	8.9-10.3	9.7	11	9.5	8.8-10.3
m3	8.0-9.6	8.8	8	8.6	7.3-9.4

Table 10: Material and measurements of *Glirudinus* aff. *engesseri* Ünay, 1994 from Sabuncubeli (Anatolia, Turkey).

Type level: Early Miocene (MN 1)
Material and measurements: see Table 10.
Remarks: The small moderately concave glirid cheek teeth that are assigned with some hesitation to *G. engesseri* show such *Glirudinus* characteristics as the tendency to have the posterior centroloph of the M1-2 detached from the metacone and the centrolophid of the lower molars detached from the metaconid. The dental pattern of the molars shows seven ridges. In addition to these, some M2 and M3 have one more weak short ridge in another position, but these occur less frequently than in the type assemblage of *G. engesseri* (Ünay, 1994:480). The three M3 assigned to *G.* aff. *engesseri* all show a similar, but otherwise very uncommon, pattern (Pl. 8, figs. 13, 14) in having the labial part of the anterior centroloph confluent with the lingual part of the metaloph. Since these three M3 are from the right side this aberrant pattern seems to have been stable in the Sabuncubeli association. The peculiar morphology of the M3 in combination with the difference in frequency of M1-2 with more than seven ridges suggests that this association may represent a new species. However, considering the rather limited material and the perfect similarity of the lower cheek teeth we prefer to assign this association to *G.* aff. *engesseri.*

Glis Brisson, 1762

***Glis galitopouli* van der Meulen & de Bruijn, 1982**
(Plate 8, figs. 1-6)

Type locality: Aliveri (island of Evia, Greece)
Type level: Early Miocene (MN 4)
Material and measurements: see Table 11.
Remarks: The presence of *Glis galitopouli* in Anatolia was already noted for the MN 3 locality of Keseköy. The specimens from Sabuncubeli assigned to this species are metrically and morphologically indistinguishable from the type material from the Greek locality of Aliveri. Considering the present day distance between the two sites and the observation that the assemblage from Aliveri contains an eomyid, a member of a family that did not reach Anatolia until the Middle Miocene (MN 5), the similarity of the *Glis* assemblages is of special interest. Since the Anatolian occurrences are older than the Greek one, it is suggested that *Glis galitopouli* originated there and succeeded to migrate west across a barrier that prevented the eomyids to enter the Anatolian block.

	Length			Width	
	range	mean	N	mean	range
P4	8.8-9.1	9.0	2	10.7	10.4-10.9
M1-2	12.3-12.6	12.5	4	14.1	13.5-14.7
m1	12.8-13.6	12.2	2	11.3	10.3-12.2
m2	—	13.5	1	12.1	—
m3	13.3-14.4	13.0	2	11.6	11.5-11.6

Table 11: Material and measurements of *Glis galitopouli* van der Meulen & de Bruijn, 1982 from Sabuncubeli (Anatolia, Turkey).

Familia Sciuridae Fischer von Waldheim, 1817
Subfamilia: Sciurinae Fischer von Waldheim, 1817

Palaeosciurus Pomel, 1853

***Palaeosciurus fissurae* Dehm, 1950**
(Plate 9, figs. 1-6)

Type locality: Wintershof-West
Type level: Early Miocene (MN 3)
Material and measurements: see Table 12.
Remarks: The Palaeosciurus teeth from Sabuncubeli are on average somewhat smaller than the specimens from Wintershof-West available for comparison, but the overlap is large. The P4 from Turkey is the only tooth that shows a clear morphological difference relative to the material from the type locality because it has a strong parastyle instead of a long anterior cingulum. All other cheek teeth match the type material very well. Even such details as the development of the mesostyl and the constriction of the metaloph of the M1-2, the shallow notch separating the protocone from the posteroloph in the M3, the development of the entoconid and the metalophid in the m1-2 are virtually the same in both assemblages. We therefore do not hesitate to assign our specimens to *P. fissurae*.

	Length			Width	
	range	mean	N	mean	range
D4	—	16.5	1	17.4	—
P4	—	18.3	1	20.0	—
M1-2	18.0-19.8	19.0	5/4	21.9	20.8-23.2
M3	—	19.8	1	20.3	—
m1	18.4-20.6	19.6	4	19.6	19.2-20.3
m2	22.6-22.7	22.7	2	21.6	21.0-22.1

Table 12: Material and measurements of *Palaeosciurus fissurae* Dehm, 1950 from Sabuncubeli (Anatolia, Turkey).

4. Conclusions

The micromammal assamblege from Sabuncebeli consists of four species of insectivore, one ochotonid and twelve rodents. Eight out of the twelve rodent species, representing respectively 86.5 % and 72.5 % of the number of specimens of the original and of the parallel sample collected in 2005, are Muridae (Table 13). This dominance of the Muridae is a feature shared by all Early Miocene rodent assemblages from Anatolia.

Seven of the rodent species and two of the insectivores found in Sabuncubeli are known from Keseköy (MN 3) also, while an eighth rodent (*P. fissurae*) has originally been described from the reference locality of MN 3 Wintershof West. The specimens identified as *G.* cf. *engesseri* are very close to the type material from the Kilçak (MN 1) localities while the *Mirabella* from Sabuncubeli shows a grade of evolution that is clearly intermediate between the species *anatolicus* from Harami (MN 2) and *crenulata* from Keseköy (MN 3). Last but not least, there is *S. eseri*, a beaver that in Central Europe is known from MN 1 through the lower part of MN 3 (Hugueney, 1999). We therefore conclude that the Sabuncubeli association is somewhat older than the one from Keseköy and fits best in the lower part of MN 3.

The absence in Sabuncubeli of the genera *Sayimys*, *Megacricetodon* and *Enginia*, and the near-absence of *Debruijnia*, all common in the Keseköy association, needs explaining. Since *Sayimys* and *Megacricetodon* are thought to be immigrants into Anatolia during MN 3, it is conceivable that the Sabuncubeli level antedates their arrival in the area. The absence of *Enginia* seems to have had ecological reasons because the genus is known from older (Kilçak) as well as from younger (Yapıntı) levels (Ünay et al. 2001). The extreme rareness of *Debruijnia*, a member of the Spalacinae, may well be due to the same paleoecological circumstances because it has been suggested that both *Enginia* and *Debruijnia* were adapted to burrowing. This suggests that the ground water level in the Sabuncubeli area may have been high during the Early Miocene. The presence of the beaver *S. eseri*, a species that is known to have had a similar life-style as the extant Castor (Hugueney & Escuillié, 1995), supports the idea that the area was wet. A remarkable difference in the insectivores is the absence of *Schizogalerix* in Keseköy. As the insectivore assemblage of this locality is quite large, the absence is presumed to be real and probably also related to environmental factors.

Rodent genera and species, beavers excluded	Sabuncebeli	Sabuncebeli B	Sabuncebeli	Sabuncebeli B
	N	**N**	**%**	**%**
Debruijnia arpati	1	0	P	0
Mirabella anatolica / *crenulata* exemplum intercentrale	3	2	2	2.5
Cricetodon kasapligili	4	1	2	1
Eumyarion intercentralis	41	9	24	7.5
Eumyarion orhani	42	27	25	23
Vallaris zappai	9	0	5.5	0
Eumyarion montanus	28	14	17	11.5
Democricetodon doukasi	19	33	11.5	27.5
Glis galitopouli	5	2	3	1.5
Glirudinus cf. *engesseri*	8	29	5	24
Palaeosciurus fissurae	8	2	5	1.5
N = M1+M2+m1+m2	**168**	**119**	**100**	**100**

Table 13: Composition of the rodent assemblages (*Steneofiber* excluded) from Sabuncubeli and Sabuncubeli B as calculated on the basis of the sum of the complete M1, M2, m1 and m2. The third molars have not been considered because those of the small species are as a rule underrepresented. The beaver specimens have not been considered because these are surface finds..

The presence in Sabuncubeli of three species of *Eumyarion* that do not differ much in size (Fig. 2) is very unusual. It is normal in Anatolia to have a small and a medium sized species in MN 1 through MN 3 assemblages and a (small) species of *Anomalomys* and a medium sized *Eumyarion* during MN 4. The third species (*E. orhani*), which is intermediate in size between the two others, is so far known from Sabuncubeli only. Peculiarly, *E. bifidus*, which seems to be its descendant, occupies a similar position in many Central European MN 4- MN 5 assemblages. It is therefore suggested that these two *Eumyarion* species occupied an ecological niche that was different from that of the other members of the genus. Unfortunately the cranial and postcranial skeleton of the species *orhani* and *bifidus* is not known, so what their life-style may have been remains a mystery.

5. Acknowledgements

We are grateful to the governer of Manisa and to the regional Gandarma for permitting us to enter the Sabuncubeli forest during a period of extreme drought. This study has been supported by grants 2004/BIL/020 and 2005/TTM/001 of the Aegean University and by grant YDABAG102Y045 of TUBITAK. The SEM. Pictures and the plates were made by Mr. W. Den Hartog. I (HdB) thank my colleague Kees Hordijk for his patient computer instructions and for making the text figures. We like to thank Gudrun Höck-Daxner and Eva Höck (Naturhistorisches Museum Wien) for the possibility to compare our material of *Schizogalerix* directly with the Austrian finds of that genus. Cor Strang (Naturalis) prepared a *Galerix* mandible.

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PLATE 1

Galerix uenayae

Fig. 1 mandible fragment with p4-m2 (SB 2381)

Fig. 2 mandible fragment with p1-p2. (SB 2405)

Fig. 3 d3 (SBb 2431)

Fig. 4 m3 (SB 2382)

Fig. 7 M1 SB 2384)

Fig. 8 M2 (SBb 2434)

Fig. 9 M3 (SBb 2436)

Schizogalerix evae n. sp.

Fig. 5 P4 (SB 2399)

Fig. 6 M1 (SB 2401, holotype)

Fig.10 p4 (SB 2404)

Fig. 11 m1 (SB 2392)

Fig. 12 m2 (SB 2393)

Fig. 13 m3 (SB 2395)

Steneofiber eseri

Fig. 14 p4 (SB 1991)

PLATE 1

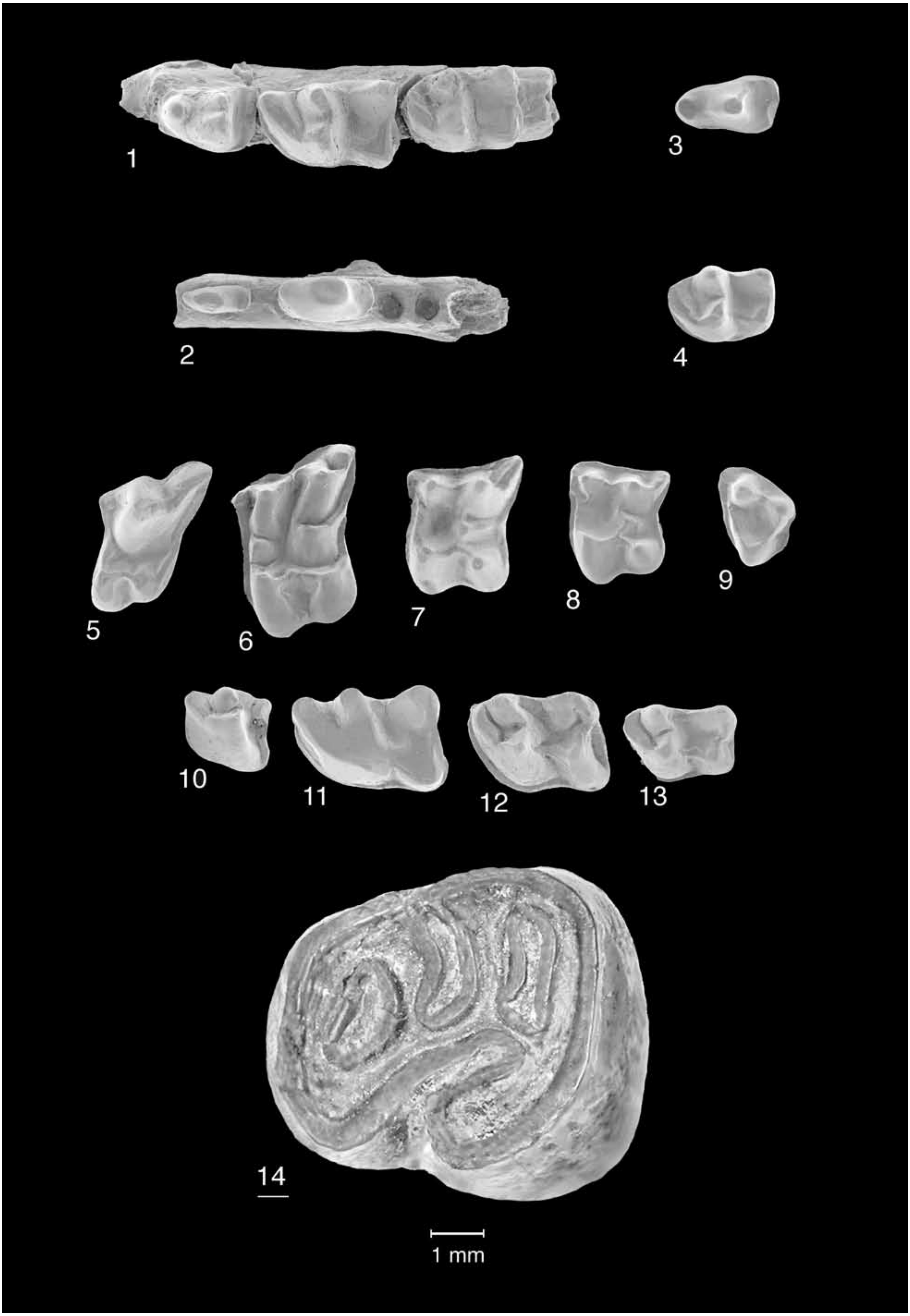

PLATE 2

Desmanodon cf. *burkarti*

Fig. 1	p4 (SB 2411)
Fig. 2	M1 (SB 2412)
Fig. 3	M2 (SBb 2421)
Fig. 4	M3 (SBb 2422)

Soricidae gen. et sp. indet.

Fig. 5	m1 (SB 2410)

Ochotonidae gen. et sp. indet.

Fig. 6	P2 (SBb 1291)
Fig. 7	P3 (SBb 1292)
Fig. 8	molariform upper tooth. (SBb 1293)
Fig. 9	d3 (SBb 1297)
Fig. 10	d4 (SBb 1298)

PLATE 2

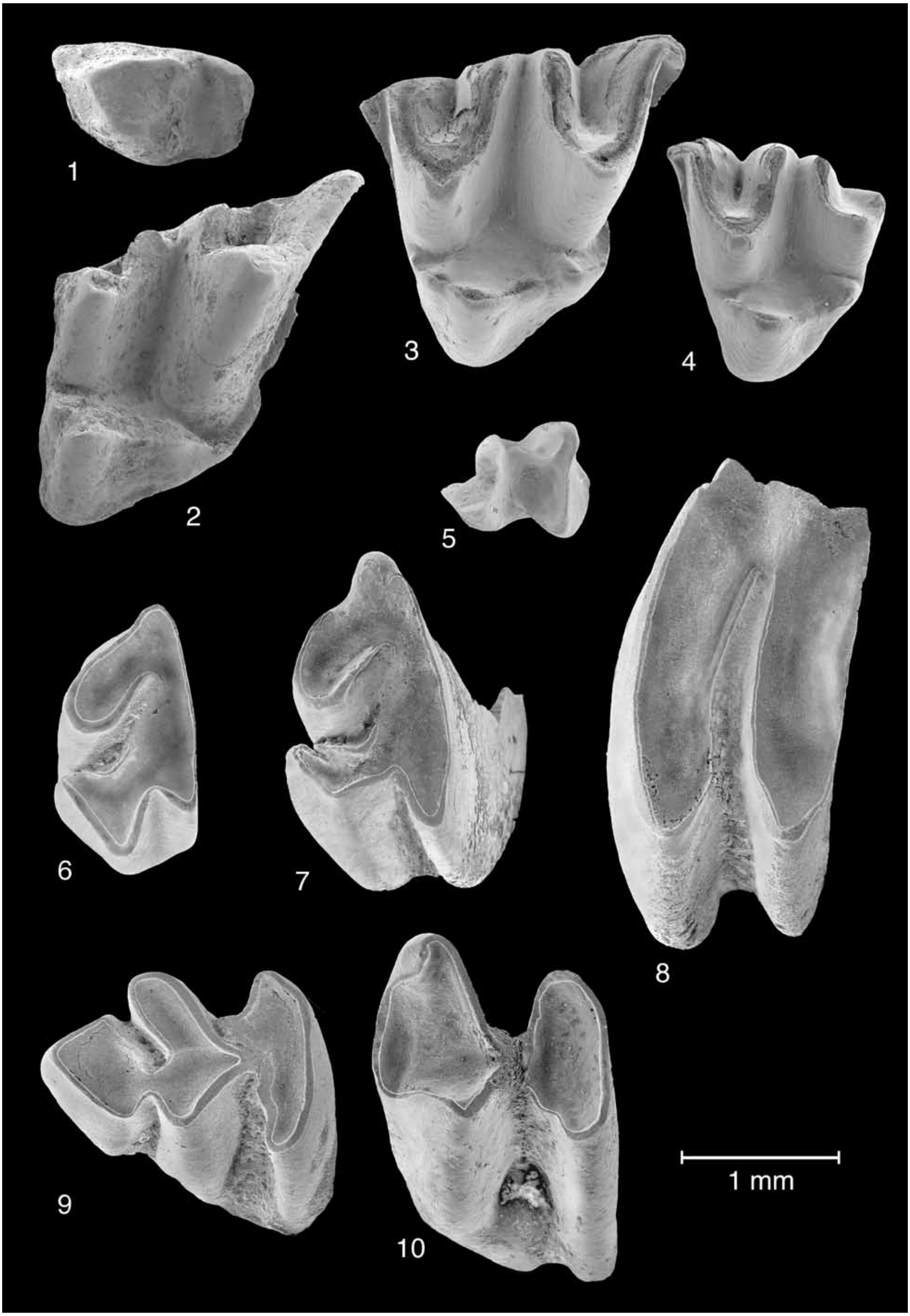

PLATE 3

Steneofiber eseri

Fig. 1 P4 – M3, occlusal view (SB 1981).

Fig. 2 P4 – M2 (SB 1982), occlusal view.

Fig. 2a same specimen as fig. 2, lingual view

PLATE 3

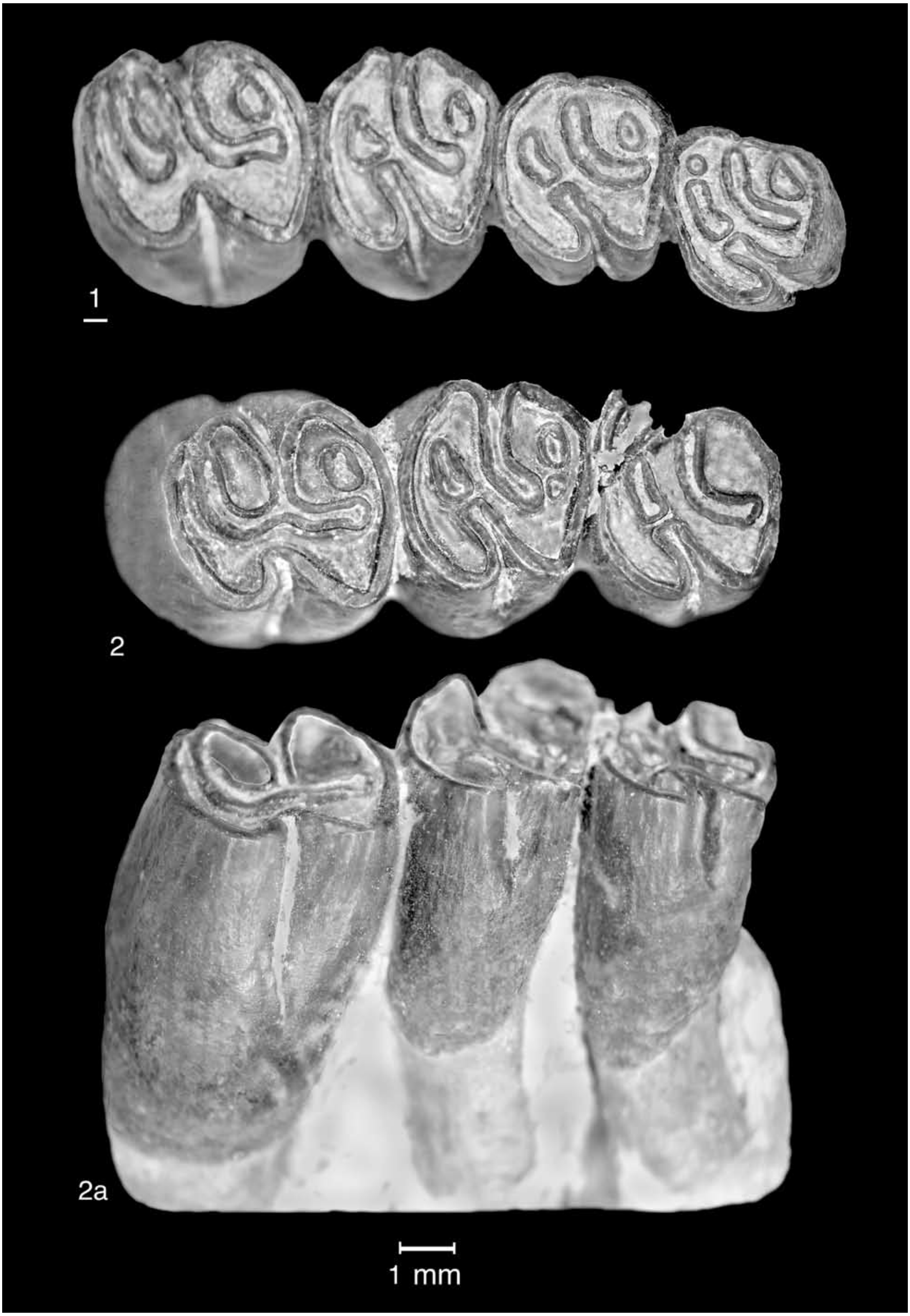

PLATE 4

Debruijnia arpati

Fig. 1 M2 (SB 2001), occlusal view.

Fig. 1a same specimen lingual view.

***Mirabella anatolica/crenulata* exemplum intercentrale**

Fig. 2 M1 (SB 2371)

Fig. 3 M2 (SB 2374), same individual as Fig. 2.

Fig. 4 M1 (SBb 1281)

Fig. 5 M2 (SBb 1283) , same individual as Fig. 4.

Fig. 6 m1 (SB 2376)

PLATE 4

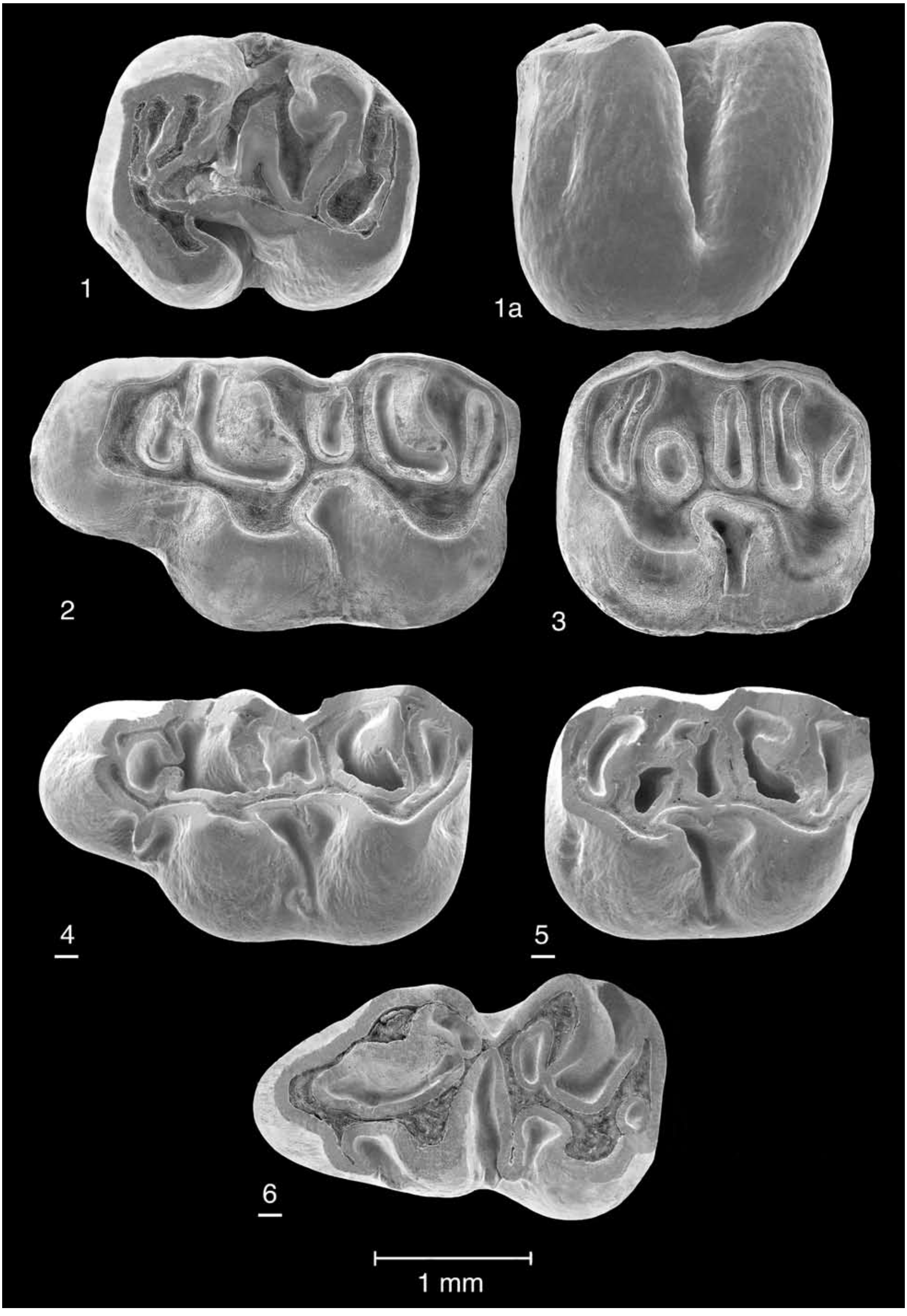

PLATE 5

Cricetodon kasapligili

Fig. 1	M1 (SB 2011)
Fig. 2	M2 (SB 2013)
Fig. 3	M3 (SB 2016)
Fig. 4	m1 (SB 2021)

Eumyarion intercentralis

Fig. 5	M1 (SB 2191)
Fig. 6	M1 (SB 2198)
Fig. 7	M2 (SB 2206)
Fig 8	M2 (SBb 1116)
Fig. 9	M3 (SB 2212)
Fig. 10	M3 (SB 2217)
Fig. 11	m1 (SB 2235)
Fig. 12	m1 (SB 2228)
Fig. 13	m2 (SB 2242)
Fig. 14	m2 (SB 2251)
Fig. 15	m3 (SB 2264)
Fig. 16	m3 (SB 2261)

PLATE 5

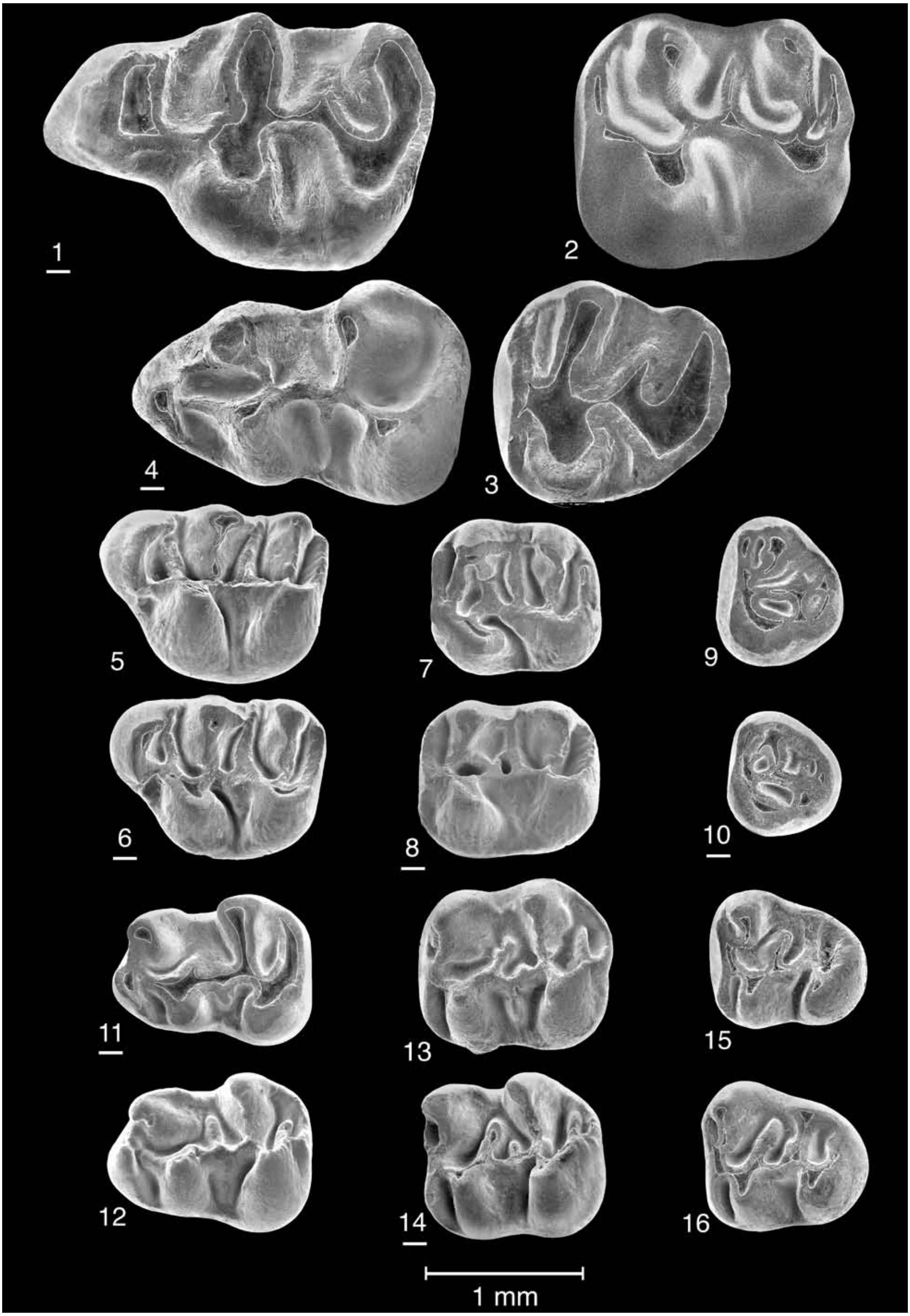

PLATE 6

***Eumyarion orhani* n.sp.**

Fig. 1 M1 (SB 2106)

Fig. 2 M1 (SB 2107, holotype)

Fig. 3 M2 (SB 2121)

Fig. 4 M2 (SB 2123)

Fig. 5 M3 (SB 2131)

Fig. 6 M3 (SBb 1078)

Fig. 9 m1 (SB 2142)

Fig. 10 m1 (SB 2146)

Fig. 11 m2 (SB 2163)

Fig. 12 m2 (SB 2161)

Fig. 13 m3 (SB 2181)

Fig. 14 m3 (SB 2172)

Vallaris zappai

Fig. 7 M1 (SB 2305)

Fig. 8 m1 (SB 2308)

PLATE 6

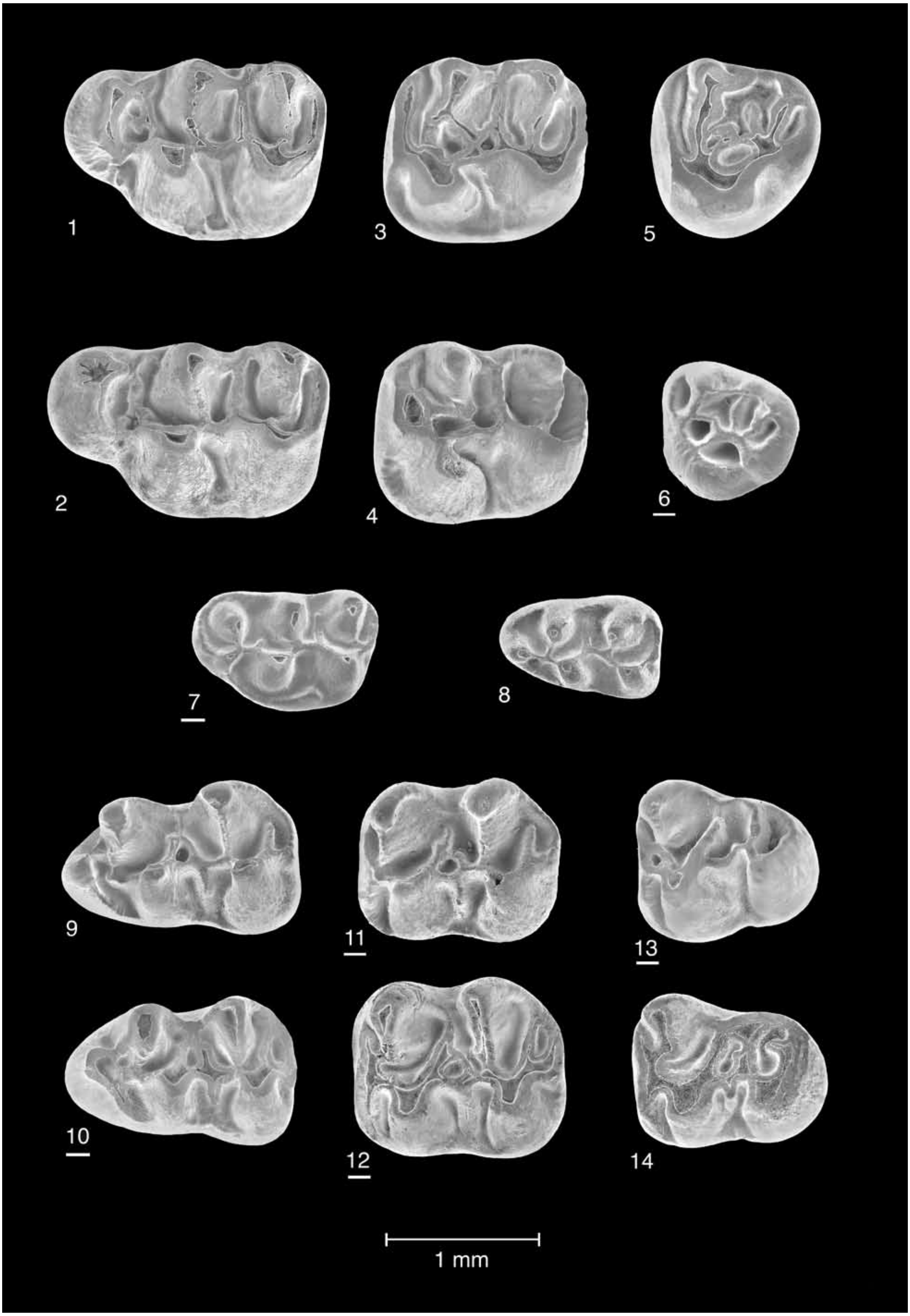

PLATE 7

Eumyarion montanus

Fig. 1 M1 (SB 2302)

Fig. 2 M1 (SBb 1011)

Fig. 3 M2 (SB 2043)

Fig. 4 M2 (SBb 1016)

Fig. 5 M3 (SB 2063)

Fig. 6 M3 (SBb 1020)

Fig. 7 m1 (SB 2071)

Fig. 8 m2 (SB 2082)

Fig. 9 m3 (SB 2092)

Democricetodon doukasi

Fig. 10 M1 (SB 2071)

Fig. 11 M1 (SBb 1171)

Fig. 12 M2 (SBb 1151)

Fig. 13 M2 (SB 2284)

Fig. 14 m1 (SB 2293)

Fig. 15 m1 (SBb 1171)

Fig. 16 m2 (SB 2295)

Fig. 17 m2 (SBb 1185)

PLATE 7

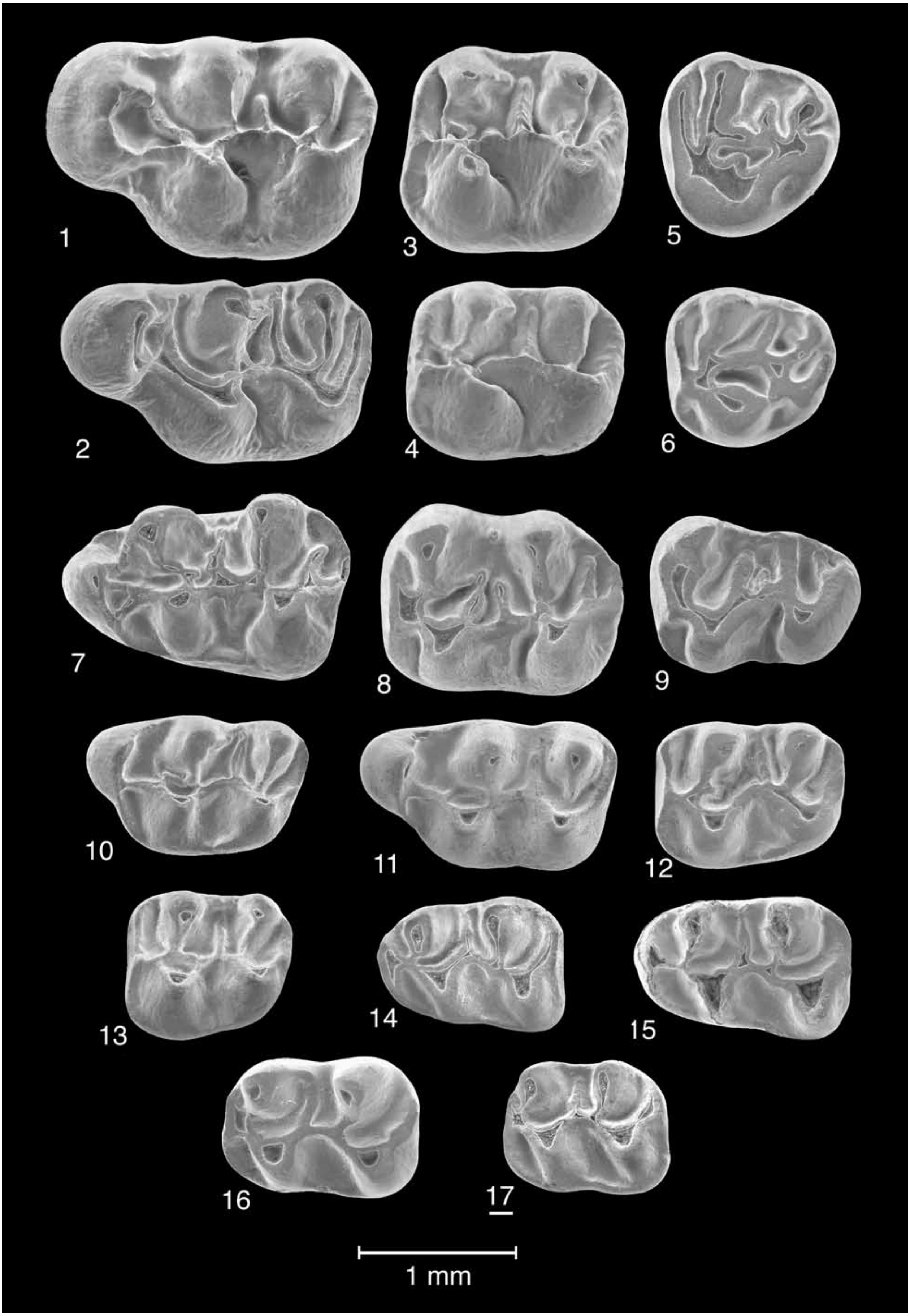

PLATE 8

Glis galitopouli

Fig. 1 P4 (SBb 1271)

Fig. 2 M1 (SB 2363)

Fig. 3 M2 (SB 2365)

Fig. 4 m1 (SB 2368)

Fig. 5 m2 (SB 2369)

Fig. 6 m3 (SB 2370)

Glirudinus cf. *engesseri*

Fig. 7 P4 (SBb 1196)

Fig. 8 P4 (SBb 1193)

Fig. 9 M1 (SB 2343)

Fig. 10 M1 (SBb 1201)

Fig. 11 M2 (SBb 1206)

Fig. 12 M2 (SB 2344)

Fig. 13 M3 (SBb 1221)

Fig. 14 M3 (SBb 1222)

Fig. 15 p4 (SBb 1231)

Fig. 16 m1 (SB 2355)

Fig. 17 m2 (SB 2357)

Fig. 18 m3 (SB 2360)

PLATE 8

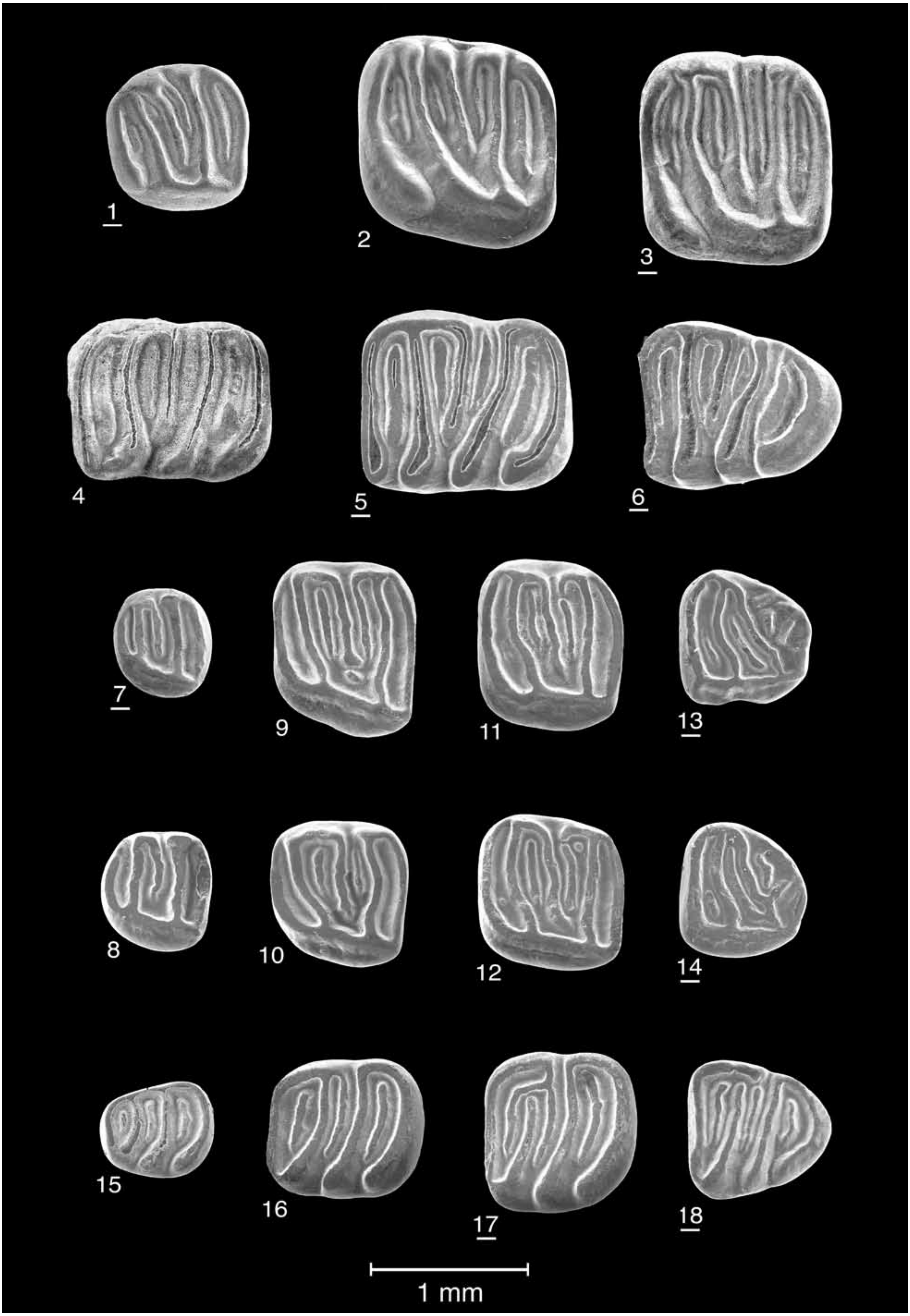

PLATE 9

Palaeosciurus fissurae

Fig. 1	P4 (SB 2322)
Fig. 2	M1-2 (SB 2323)
Fig. 3	M1-2 (SB 2325)
Fig. 4	M3 fragment (SB 2329)
Fig. 5	m1 (SB 2331)
Fig. 6	m2 (SB 2334)

PLATE 9