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# The insectivorous mammals (Marsupialia: Didelphidae; Insectivora: Nyctitheriidae; Chiroptera) from the early Oligocene of Balm, Switzerland

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*Key words:* Oligocene, mammals, Didelphidae, Nyctitheriidae, Microchiroptera, Soricidae

## ABSTRACT

The dental remains of insectivorous small mammals from the early Oligocene locality of Balm have been studied. Earlier publications mentioned the presence of Erinaceidae and Soricidae in the fauna. The present revision shows that two species of Didelphidae (Marsupialia), and undetermined representatives of the placental taxa Nyctitheriidae and Microchiroptera are found.

## ZUSAMMENFASSUNG

Zahnfragmente von insektenfressenden Kleinsäugetern aus dem früholigozänen Fundort Balm wurden untersucht. Frühere Publikationen erwähnten das Vorkommen von Erinaceidae und Soricidae. Diese Revision ergibt die Anwesenheit von zwei Arten von Didelphidae (Marsupialia), sowie von Vertretern der Nyctitheriidae und Microchiroptera.

## 1. Introduction

In the framework of more extensive studies on the early evolutionary history of the Soricidae (Mammalia, Insectivora: shrews), the Swiss locality of Balm (canton Solothurn/Soleure) appeared of considerable interest. As has been hypothesized by several authors (Brunet, 1977; Butler, 1985, 1988; Reumer, 1987; Wang & Li, 1990) the Soricidae originated from Asia and reached Europe at some stage during the early Oligocene, most probably during or after Stehlin's Grande Coupure. Only very few European localities of middle Oligocene age have so far yielded remains of Soricidae. *Srinitium marteli* HUGUENY, 1976 from Saint-Martin-de-Castillon (Vaucluse, France) is the oldest record, it is dated to biozone MP 23 (Schmidt-Kittler, ed., 1987). An indeterminate shrew from Garouillas (France) is correlated to the biozone d'Antoingt, biozone 10 *sensu* Remy et al. (1987), which corresponds to MP 25. A find of *Srinitium* sp. from biozone 13 of the Pech du Fraysse, also in France, is still slightly younger and dated to either biozone MP 27 or MP 28 (Remy et al., 1987). Engesser & Mayo (1987) mention a "soricid indet." from the Swiss Balm faunule. It is dated to the assemblage zone of Balm, which is MP 22 (Schmidt-Kittler, ed., 1987). If this attribution would be correct, Balm would contain the oldest European Soricidae, and the only early Oligocene one (assuming the MP 22/

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MP 23 boundary to coincide with the boundary between the early Oligocene and the middle Oligocene). To test this, the remains of the insectivorous (marsupial and placental) mammals from Balm were re-examined. They were kindly provided by Dr. B. Engesser, Naturhistorisches Museum, Basel.

## 2. Material and methods

A description of the geological situation of the locality was given by Erni (1941), who also published preliminary identifications of the mammal remains made by Stehlin. In the article itself, based on some 100 kg of washed sediment, the remains were identified as "ein *Peratherium*, ein Erinaceide und ein bis zwei kleinere Insectivoren". In an appendix to the article (Erni, 1941) the result was presented of the washing of some 300 kg of sediment: 6 teeth of *Peratherium*, and 5 teeth of Insectivora. (This adds up to eleven teeth, while only ten teeth are now available)

There are ten dental fragments of functionally insectivorous mammals in the collections of the Naturhistorisches Museum Basel, labelled Blm. 1 through Blm. 10. Apparently based on Stehlin's identifications as published by Erni (1941), the ten fragments were indicated on the collection labels as follows:

- nos. 1, 2, 3, 4, 5 and 6: "*Peratherium*",
- no. 7: "Insectivor";
- no. 8: "Insectivor P" on the label and "Insectivor (Soricide?)" in the museum stock-book;
- nos. 9 and 10: "Soricide".

The specimens were paraffin-mounted on small cardboard stubs, and were remounted for this study in plastilin. The drawings were made with a Wild M5 binocular microscope fitted with a drawing prism; the measurements were taken with a Leitz Ortholux measuring microscope at the Institute for Earth Sciences at Utrecht University. Nomenclature of dental elements is after Crochet (1978) and Reumer (1984).

## 3. Results

Although fragmentary, most dental elements could be identified; they belong to the four following taxa.

Order **Marsupialia** ILLIGER, 1811

Family **Didelphidae** GRAY, 1821

Subfamily **Didelphinae** SIMPSON, 1927

Tribe **Didelphini** CROCHET, 1978

Genus *Amphiperatherium* FILHOL, 1879

*A. cf. minutum* (AYMARD, 1846)

(Figs. 1, 2, 3, 4)

*Attributed material:* Blm. 4, Blm. 6, Blm. 10.

*Description:* In figure 3 I have combined (with the aid of the drawing microscope) the two fragments Blm. 4 and Blm. 10 into a single tooth. This procedure, which seems war-

ranted by the identical structure and size of the overlapping parts, allows us a better impression of the lower molar. It has a shape typical of *Amphiperatherium*, with a sloping anterior face of the metaconid (see Crochet, 1978).

Blm. 4 (Fig. 2, 3b left) is the talonid of a left lower molar. The buccal edge is missing, only the entoconid and the hypoconulid are undamaged. Part of the metaconid is also present. The hypoconulid is well separated from the entoconid; the entoconid is situated at mid-distance between hypoconulid and metaconid. Cingula are not present.

Blm. 10 (Fig. 4, 3 right) is a trigonid of a left lower molar, with well preserved cusps. The protolophid is about half as long as the paralophid. The trigonid basin opens well above the lingual lower edge of the tooth, which edge has no cingulum. A well developed cingulum is however present below the paralophid on the antero-buccal face of the tooth.

Blm. 6 (Fig. 1) is a central fragment of a right lower molar, with the protoconid, metaconid and entoconid preserved. Although somewhat wider, it is attributed to the same species as the former two fragments because it is morphologically identical.

*Sizes:* Blm. 4: talonid width 0.90 mm (estimated from drawing)

Blm. 6: trigonid width 0.97 mm

Blm. 10: trigonid width 0.79 mm

Blm. 4–10: length 1.59 mm (estimated from drawing).

*A. cf. ambiguum* FILHOL, 1877

(Fig. 6)

*Attributed material:* Blm. 1, Blm. 2.

*Description:* Blm. 1 is a severely damaged talonid of a right lower molar. It is considerably larger than Blm. 4 (*A. cf. minutum*). In occlusal view, the entoconid bulges out from the lingual margin of the tooth. The hypoconulid (the only undamaged cuspid) sits at the end of a short and narrow hypolophid (postcristid) which has a curved shape. A pronounced cingulum is present along the posterior margin below the hypoconid and hypolophid. Both buccal and lingual margins lack cingula.

Blm. 2 (Fig. 6) is of about the same size as Blm. 1 and of similar morphology. Hypoconid, hypoconulid and entoconid are preserved. The hypoconid shows a relatively lingual position, its tip is situated at about the mid-line of the tooth. Cingula as in Blm. 1, although a small remnant of a cingulum can be discerned at the bottom of the re-entrant valley (hypoflexid) between hypoconid and the (missing) protoconid.

*Sizes:* Blm. 1: talonid width 1.36 mm;

Blm. 2: talonid width 1.28 mm.

*Remarks:* The shape of the teeth, the position of the cingula and the morphology of the cusps and lophids favour the identification of the fragments as Didelphini. The shape of the metaconid is indicative of *Amphiperatherium* rather than *Peratherium* (Crochet, 1978). Four species of *Amphiperatherium* are recorded from European localities of early Oligocene age: *A. minutum*, *A. lamandini*, *A. exile* and *A. ambiguum* (see Crochet, 1978). These species differ in morphology and size; *A. minutum* being the smallest and *A. ambiguum* the largest one.

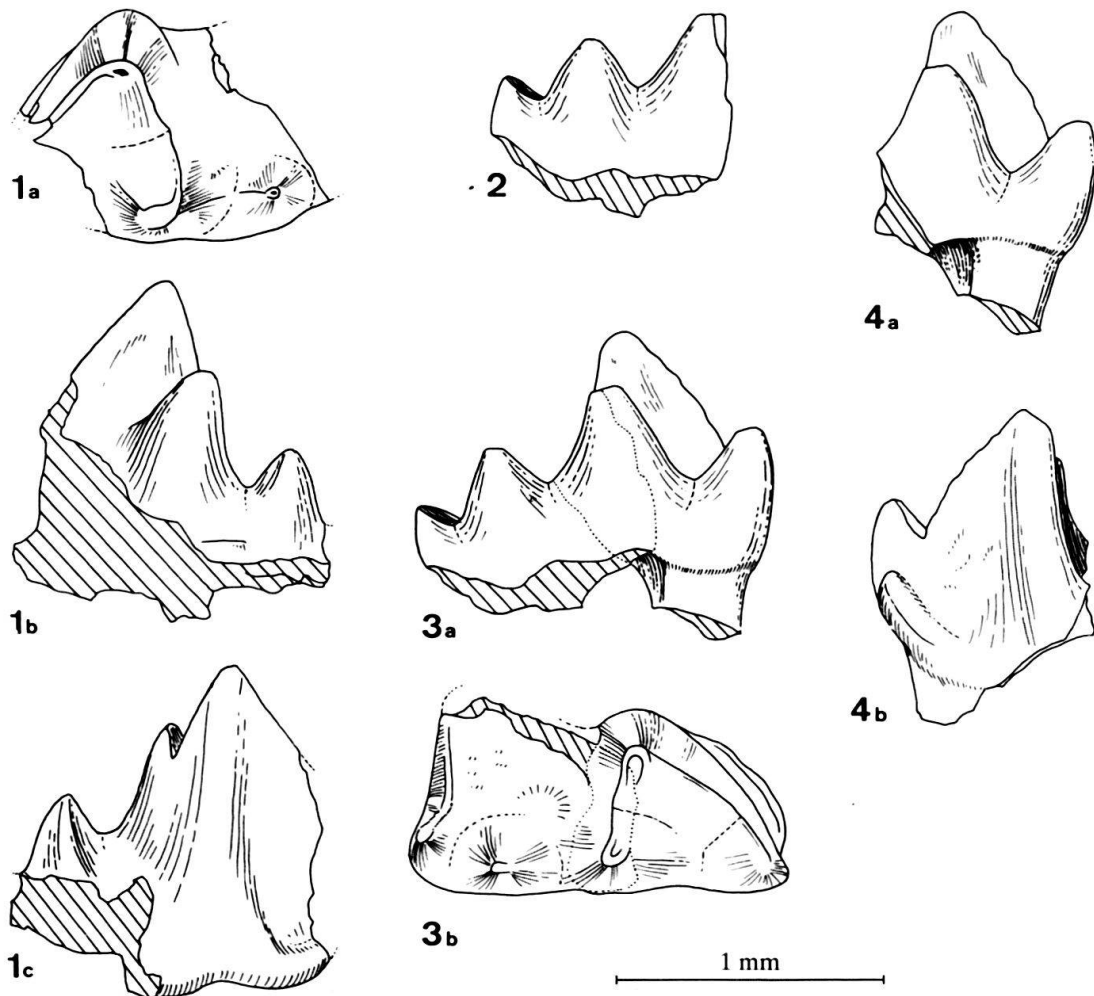


Fig. 1. *Amphiperatherium* cf. *minutum*; right lower molar fragment Blm. 6; a: occlusal view, b: lingual view, c: buccal view.

Fig. 2. *Idem*, left lower molar fragment (taloid) Blm. 4; lingual view.

Fig. 3. *Idem*, combination of Blm. 4 and Blm. 10; a: lingual view, b: occlusal view.

Fig. 4. *Idem*, left lower molar fragment (trigonid) Blm. 10; a: lingual view, b: buccal view.

Blm. 4, Blm. 6 and Blm. 10 agree in size with *A. minutum*, Blm. 1 and Blm. 2 with *A. ambiguum*, but also with *A. exile*. The strong cingula below the hypolophids in Blm. 1 and Blm. 2 support attribution to *A. ambiguum* rather than to *A. exile*. However, in both cases I prefer to use *confer* identifications due to the scantiness of the material.

Order **Insectivora** BOWDICH, 1821

Family **Nyctitheriidae** SIMPSON, 1928

Nyctitheriidae gen. et sp. indet.

(Fig. 5)

*Attributed material*: Blm. 5.

*Description*: A trigonid of a right lower molar (m1 or m2) or possibly premolar (p4), with the paraconid, protoconid and metaconid preserved. It is a stout and somewhat bluntly-

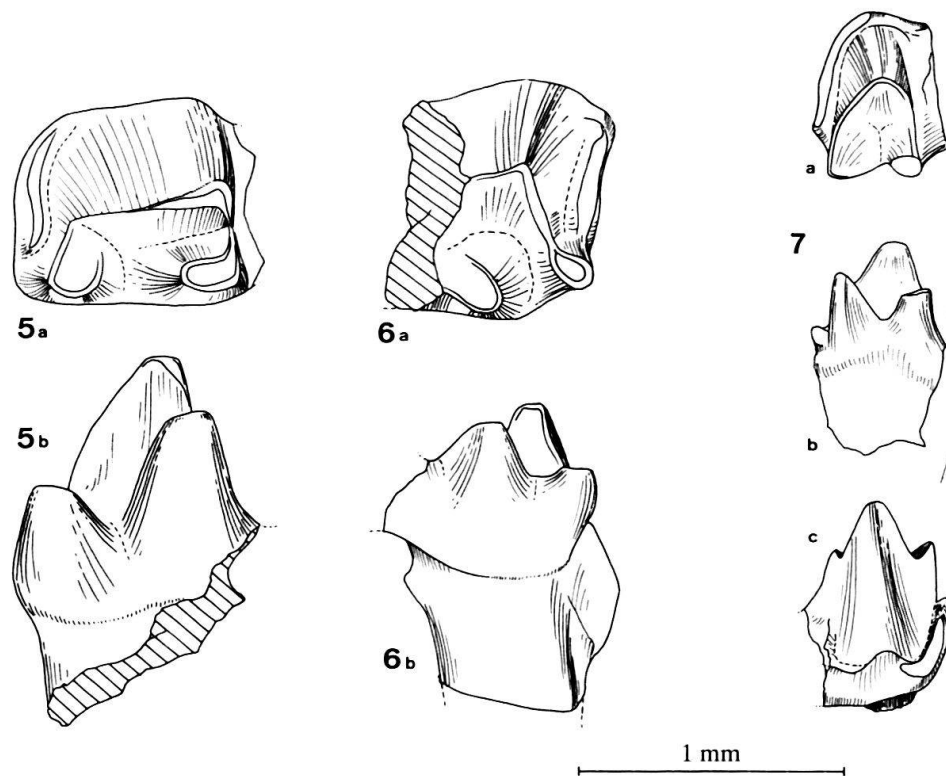


Fig. 5. Nyctitheriidae gen. et sp. indet.; right lower premolar or molar fragment (trigonid) Blm. 5; a: occlusal view, b: lingual view.

Fig. 6. *Amphiperatherium* cf. *ambiguum*; right lower molar fragment (talonid) Blm. 2; a: occlusal view, b: lingual view.

Fig. 7. Microchiroptera gen. et sp. indet.; right lower molar fragment (trigonid) Blm. 9; a: occlusal view, b: lingual view, c: buccal view.

tipped fragment. The lingual side shows no cingulum; a strongly developed cingulum is present below the paralophid. This cingulum runs in a nearly exact lingual-buccal direction, perpendicular to the mid-line of the tooth. The trigonid has, therefore, a rather square outline in occlusal view (see Fig. 5a).

*Size:* trigonid width 0.98 mm.

*Remarks:* The typical "square" shape of the trigonid excludes the Didelphini from the identification. The cingulum, which does not continue below the protoconid, excludes Chiroptera, Soricidae and Heterosoricidae. Its overall morphology applies well to the Nyctitheriidae. These are common insectivores in the early Oligocene, although Balm is at a rather late position within the temporal range. Sigé (1976) demonstrated the persistence of *Saturninia* and other nyctitheriids beyond the Grande Coupure. The size of the trigonid could apply to *Saturninia* or to *Darbonetus* rather than to the usually larger amphidozotheriines, but more specific identification is obviously impossible.

Order **Chiroptera** BLUMENBACH, 1779  
 Suborder **Microchiroptera** DOBSON, 1875  
 Microchiroptera gen. et sp. indet.  
 (Fig. 7).

*Attributed material:* Blm. 8 and Blm. 9.

*Description:* Blm. 8 is the only dental fragment in the sample that belongs to an upper tooth. It is the talon of a left M1 or M2. It has a faintly developed hypocone situated on the ridge surrounding the hypoconal flange. A minute ridge runs from the hypocone to the posterior arm of the protocone, giving the hypocone a triangular Y-shape. This situation is unknown in Nyctitheriidae, which have a rather similar talon, but it is known from certain bats (e. g. *Vespertiliavus*, see Sigé, 1988, Fig. 20)

Blm. 9 (Fig. 7) is a very small trigonid of a right m1 or m2. The tip of the metaconid has broken off; the trigon is rather short in antero-posterior direction. A strong cingulum runs from the antero-lingual corner below the paralophid, the protoconid and the buccal re-entrant valley to below the talonid. It shows a wear-facet below the paralophid. There is no lingual cingulum.

*Size:* Blm. 9: trigonid width 0.80 mm.

*Remarks:* The shape of the hypocone in Blm. 8 and of the cingulum in Blm. 9 warrant identification as Microchiroptera. A more precise identification can not be given. Blm. 9 belonged to an extremely small species; Blm. 8 probably not; the sample could thus include two species.

Unidentified remains

*Remarks:* Two fragments can not be identified. Blm. 3 is part of a two-rooted premolar with one root preserved; Blm. 7 is a rather large paralophid of some right lower molar.

#### 4. Conclusion and discussion

As a result of the present study it can be noted that the insectivorous marsupial and placental mammals from Balm comprise the following taxa:

- *Amphiperatherium* cf. *minutum*
- *Amphiperatherium* cf. *ambiguum*
- Nyctitheriidae gen. et sp. indet.
- Microchiroptera gen. et sp. indet.

This list, even though based on extremely fragmentary material, is an improvement of the list published by Engesser & Mayo (1987), which contained:

- didelphid indet.
- erinaceid indet.
- soricid indet.

Neither Erinaceidae nor Soricidae have now been found to be present in Balm; these taxa should be eliminated from the records.

The present study demonstrates the absence of Soricidae from the faunule of Balm and hence from the latest early Oligocene record of Mammalian biozone MP 22. As long as not demonstrated otherwise, *Srinitium marteli* from Saint-Martin-de-Castillon (MP 23) thus remains the oldest known European shrew.

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