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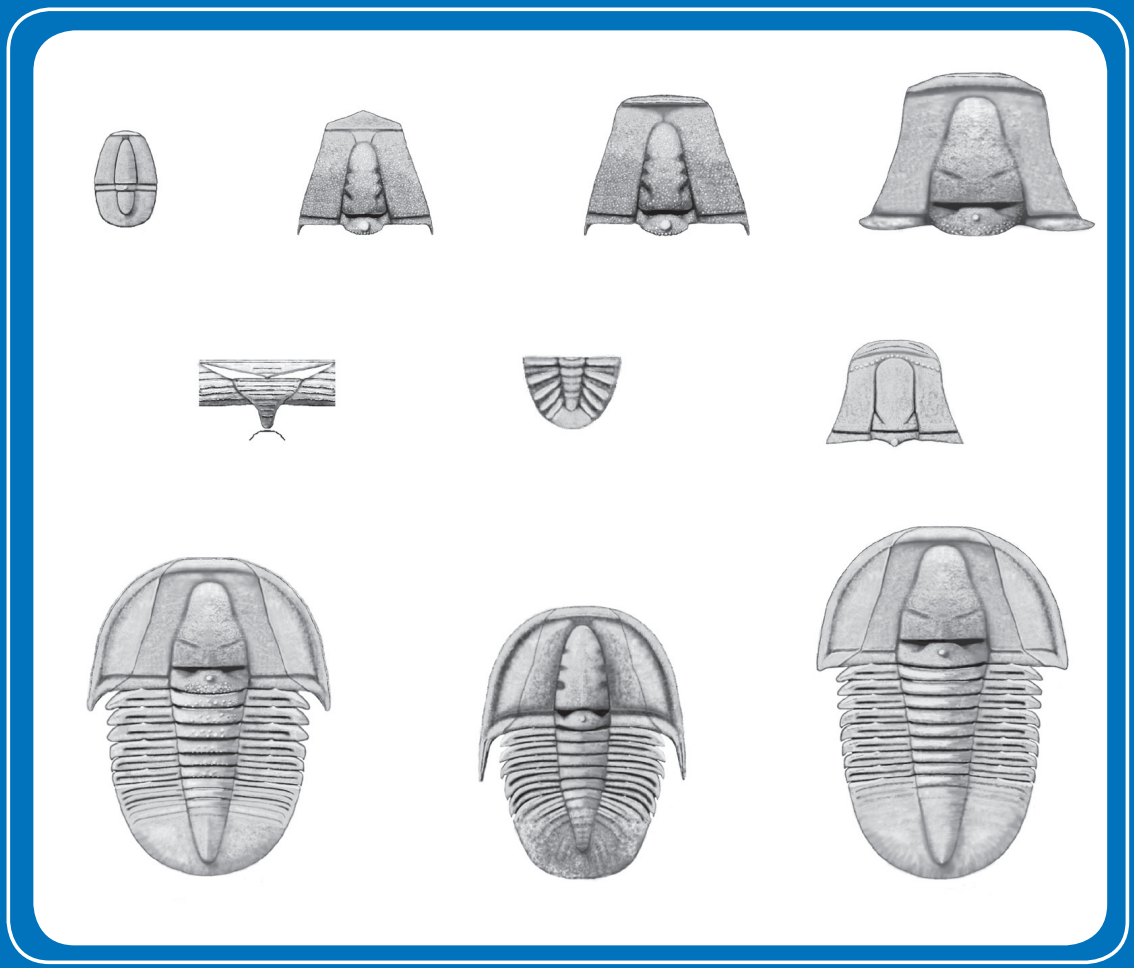

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Cover illustration: Tentative reconstructions of different taxa and ontogenetic stages in the trilobite genus *Drevermannia*, as well as of *Silesiops*? sp. For details, see Basse, M.: Revision und Ontogenie des Trilobiten *Drevermannia schmidti* Richter 1913 aus dem Oberdevon des Bergischen Landes, pp. 9–58 in this issue.
Back cover: Atrium of the Munich Palaeontological Museum, view from the main entrance.

Umschlagbild: Rekonstruktionsversuche für verschiedene Taxa und ontogenetische Stadien der Trilobitengattung *Drevermannia* sowie für *Silesiops*? sp. Für weitere Informationen siehe Basse, M.: Revision und Ontogenie des Trilobiten *Drevermannia schmidti* Richter 1913 aus dem Oberdevon des Bergischen Landes, S. 9–58 in diesem Heft.
Rückseite: Lichthof des Paläontologischen Museums München, Blick vom Haupteingang.

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Comments on the morphologic and metric variability in the cricetid rodent *Deperetomys hagni* (Fahlbusch, 1964) from the Middle Miocene of South Germany

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Abstract

Fossils of the late Middle Miocene *Deperetomys* Mein & Freudenthal, 1971 have predominantly been reported from the North Alpine Foreland Basin and the surrounding calcareous plateau. They represent a single species, *D. hagni* (Fahlbusch, 1964), that has a relatively short stratigraphic range in the area. The taxon therefore is of great significance in biostratigraphy. In this paper molars of *Deperetomys* from the fissure filling Petersbuch 48 near Eichstätt (Frankonian Alb, South Germany) are compared to molars assigned to *D. hagni* from the molasse, especially to the large sample from Kleineisenbach. Although minor metric and morphologic differences exist, an evolutionary trend within the species cannot be demonstrated.

Keywords: Bavaria, biostratigraphy, Cricetidae, Mammalia, Rodentia

Kurzfassung

Die späten Mittelmiozänen *Deperetomys* Mein & Freudenthal, 1971 Funde kommen in erster Linie aus den Nordalpinen Vorderlandbecken und dem umliegenden Kalkplateau. Die Fossilien stellen eine einzige Art, *D. hagni* (Fahlbusch, 1964), dar, welche in der Region eine relative kurze stratigraphische Reichweite hat. Das Taxon ist daher sehr wichtig für biostratigraphische Untersuchungen. In dieser Arbeit werden Molaren von *Deperetomys* aus der Spaltenfüllung Petersbuch 48 in der Nähe von Eichstätt (Fränkischen Alb, Süddeutschland) mit *D. hagni* Funden aus der Molasse, insbesonder mit der umfangreichen Kollektion aus Kleineisenbach, verglichen. Obwohl kleine metrische und morphologische Unterschiede beobachtet werden, kann bei der Art eine Entwicklungsrichtung nicht klar festgestellt werden.

Schlüsselwörter: Bayern, Biostratigraphie, Cricetidae, Mammalia, Rodentia

1. Introduction

Fossils of the Cricetodontini, large-sized cricetid rodents, represent important indicators in Neogene biostratigraphy. For example, in the North Alpine Foreland Basin, *Cricetodon*-lineages have successfully been used in the dating of part of the localities of the Middle Miocene (from late OSM E; see Abdul-Aziz et al. 2010). With regard to younger deposits, however, only a few small mammal lineages are available for dating, thus rendering the resolution of the biostratigraphic subdivisions limited. Prieto (2007) recognizes a *Megacricetodon* aff. *similis-M. similis* lineage that ranges from MN 6 to MN 8, but this lineage is poorly documented in South Germany. Similarly, based on the observations of Kälin et al. (2001), Prieto & Rummel (2009a) comment on the *Megacricetodon* aff. *germanicus* (probably as *M. gersii* in Kälin & Kempf 2009)-*M. germanicus* (MN 6 to MN 8) lineage. Two additional lineages have been documented for the genus *Collimys* (MN 7–?MN 9; Prieto & Rummel 2009b, c). However, these lineages clearly remain insufficient for the long period (more than 2 My) that they only partially convert, and new efforts have to be taken in order to more accurately characterize mammal lineages.

The genus *Deperetomys* Mein & Freudenthal, 1971 has been recorded for a relatively short period of time in Switzerland and South Germany (MN 7 and MN 8, according to Kälin & Kempf 2009), but often represents a large segment of the fauna (Prieto 2007). In this paper, *Deperetomys* teeth are described from the fissure filling Petersbuch 48, and comments are offered on the metric and morphologic variability of this genus in South Germany.

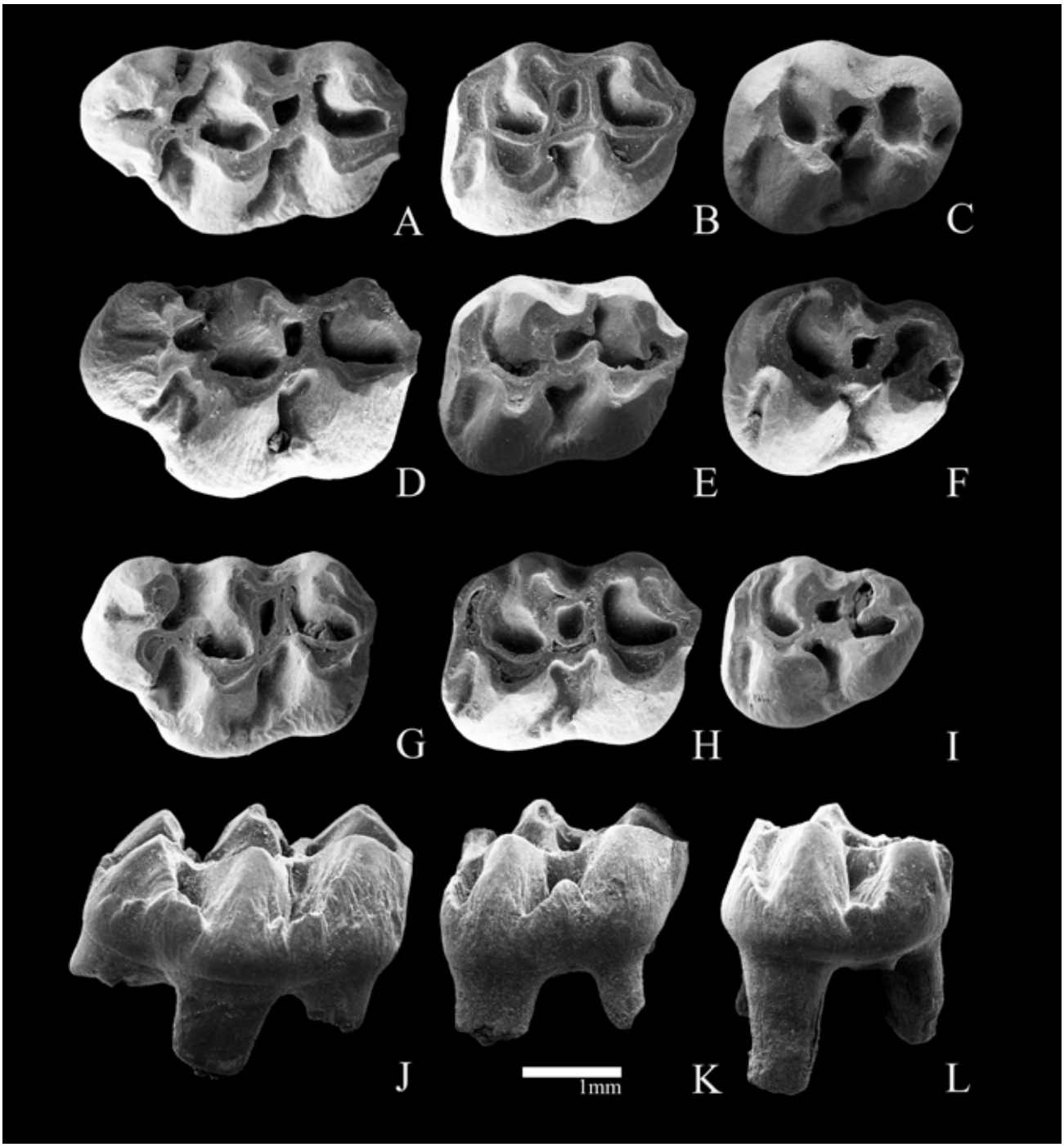


Figure 1: Upper Molars of *Deperetomys hagni* (Fahlbusch, 1964) from Petersbuch 48. **(A–I)** Occlusal view. **(J–L)** Lingual view. Reversed teeth: A, B, F, H, I and L. M1: A (BSPG 1998 VI 1031), D (BSPG 1998 VI 1032), G (BSPG 1998 VI 1038), and J (BSPG 1998 VI 1036). M2: B (BSPG 1998 VI 1066), E (BSPG 1998 VI 1048), H (BSPG 1998 VI 1057) and K (BSPG 1998 VI 1050). M3: C (BSPG 1998 VI 1088), F (BSPG 1998 VI 1093), I (BSPG 1998 VI 1084) and L (BSPG 1998 VI 1085).

2. Locality

The fauna was collected from the fissure filling n°48 in the Weissjura-δ quarry of the Juma company at Petersbuch near Eichstätt (Frankonian Alb, South Germany); GPS coordinates and elevation can be found in Ziegler (2003b: p. 618). Ziegler (2003 a,b,c, 2005) described the shrews, erinaceids, dimylids and bats from the fissure filling, while Prieto (2007) gave a description of the small mammal fossils (exclusive bats) based on fossils housed in the Bayerische Staatssammlung für Paläontologie und Geologie at Munich, Germany. Ziegler (2003a,b,c) correlates the Petersbuch 48 fissure filling with MN7/8; this correlation is corroborated by the presence of the gymnure *Parasorex socialis* (Ziegler 2005). However, this species might also be present somewhat earlier (MN 6) in the area (Prieto & Rummel 2009d). Anyway, the mammal assemblage belongs to the *Deperetomys hagni* taxon range zone of Kälin & Kempf (2009), dated at around 13.8–13.2 My.

3. Material and methods

The specimens are housed in the collections of the Bayerische Staatssammlung für Paläontologie und Geologie (BSPG) at Munich, Germany, under accession 1998 VI. Measurements were taken with an ocular micrometer and are indicated in mm. SEM and digital images were captured at the Biogeology and Applied Palaeontology laboratory of the Eberhard Karls University at Tübingen, Germany. As the species *Deperetomys hagni* has been described extensively in the literature, a detailed description of the specimens is not provided in this paper, but only notable new features are documented. The comparison with *Deperetomys hagni* from the richest molasse locality (i.e. Kleineisenbach) is based on both published (Fahlbusch 1964; De Bruijn et al. 1993) and supplementary data (listed in Prieto 2007).

The terminology used in the description of the molars mainly follows Freudenthal et al. (1994). However, this terminology was established based on Pseudocricetodoninae, and thus is sometimes difficult to apply to other cricetid rodents. Furthermore, some discrepancies in the interpretation of the dental structures in the literature have been noticed, especially concerning the Cricetodontini (see nomenclature in Rummel 1998). It is beyond of the scope of this paper to propose a generalized nomenclature for the teeth. I use certain termini with the following meaning:

–The term paraconus spur is used, but its direction is indicated as in Lopez-Antoñanzas et al. (2010). Anterior ectoloph is reserved for a crest connecting the anterocone to the paracone. The forward paracone spur is thus also recognized.

–Similarly, the backward paraconus spur is recognized, and posterior ectoloph reserved for a crest connecting paracone to metacone.

–The crest connecting the anterolophule to the base of the paracone is named protolophule I (anterior). Similarly, the posterior protolophule is named protolophule II.

–The anterior arm of the hypocone of Rummel (1998) is maintained, as posterior prolongation of the entoloph.

–In the M3, the posteroloph is recognized as such only in the case of both posteroloph and metalophule being present. Otherwise the crest closing the posterior part of the molar is the metalophule (as in López-Antoñanzas et al. 2010).

4. Systematic paleontology

Order : Rodentia Bowdich, 1821
Family: Cricetidae Fischer von Waldheim, 1817
Genus: *Deperetomys* Mein & Freudenthal, 1971

Diagnosis: Mein & Freudenthal (1971)
Emended diagnosis: De Bruijn et al. (1993)

Type species: *Cricetodon sansaniensis hagni* Fahlbusch, 1964.

Other species included in *Deperetomys*: *Deperetomys rhodanicus* (Depéret, 1887), *D. intermedius* (De Bruijn et al., 1987), *D. anatolicus* De Bruijn et al., 1993. Moreover, De Leeuw et al. (2011) report an unnamed *Deperetomys* from the Oligocene of Bosnia and Herzegovina.

Species: *Deperetomys hagni* (Fahlbusch, 1964)
Figs 1 & 2

2007 *Deperetomys* aff. *hagni* (Fahlbusch, 1964) – Prieto, unpublished, p. 88–90, figs 40, 41A–F.

Type locality: Giggenhausen.

Age: Middle Miocene.

Material and measurements: 20 M1, 38 M2, 27 M3, 28 m1, 30 m2, 22 m3 (BSPG 1998 XVI 1031–1196); see Fig. 3.

The teeth from Petersbuch 48 differ from the specimens from Kleineisenbach in the following characters:

M1: The teeth are somewhat broader. Lingual anteroloph and paraconus spur are much more often discontinuous: in Kleineisenbach, the lingual anteroloph reaches the base of the protocone posteriorly; seldom (16%) is the crest incomplete or missing (e.g. De Bruijn et al. 1993: pl. 1, fig. 7). On the other hand, the crest is often (37.5%) broken near the anterocone in Petersbuch 48 (Fig. 1A, D, G). The crest is then often strong and style-shaped (protostyl?). Most of the molars from the molasse (81.4%) have a long and labially bent anterocone spur that reaches the border of the anterosinus (e.g. De Bruijn et al. 1993: pl. 1, fig. 4); in Petersbuch this crest is often missing or shorter (Fig. 1G), and complete in 68.7% of the specimens.

The protolophule I is better developed in the sample from the fissure filling: in most of the molars, it reaches the base of the paracone, while in Kleineisenbach this crest is extremely reduced (e.g. De Bruijn et al. 1993: pl. 1, fig. 4), and can be interpreted as a short labial spur of the anterolophule. It may not reach the base of the paracone; in only half of the teeth it is complete.

M2: The teeth metrically belong to the variation of *D. hagni* from Kleineisenbach, but are on average larger (see De Bruijn et al. 1993: 158). The backward paraconus spur connects to the mesoloph generally much more labially.

M3: Considering the mean length, the M3 is somewhat longer. In the Petersbuch molars, the protolophule II most often connects to the antero-lingual wall of the paracone, while this crest has a somewhat posterior position in Kleineisenbach, in the middle of

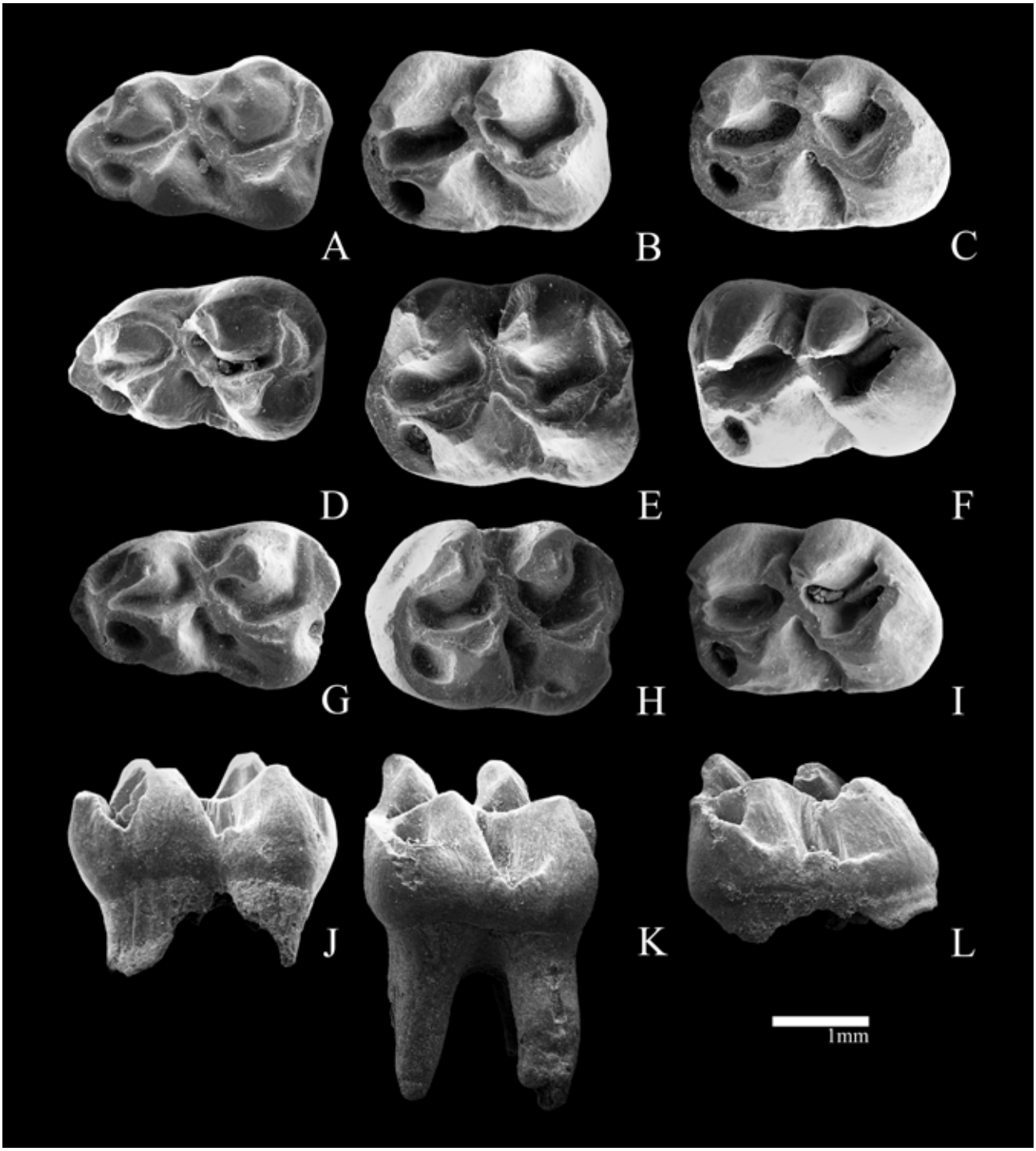
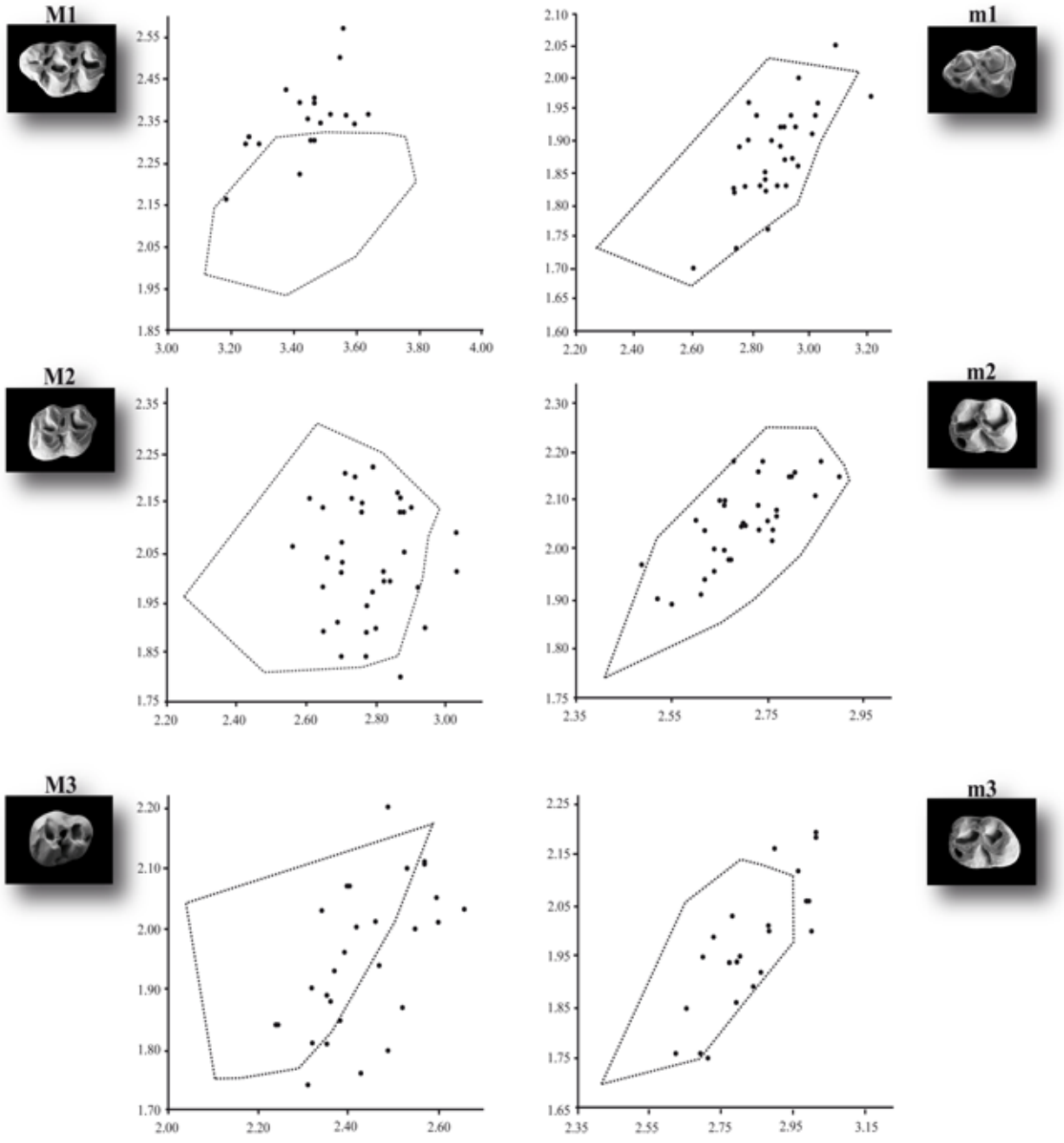


Figure 2: Lower Molars of *Deperetomys hagni* (Fahlbusch, 1964) from Petersbuch 48. **(A–I)** Occlusal view. **(J–L)** Lingual view. Reversed teeth: B, E, H, I, J and L. m1: A (BSPG 1998 VI 1113), D (BSPG 1998 VI 1114), G (BSPG 1998 VI 1105), and J (BSPG 1998 VI 116). m2: B (BSPG 1998 VI 1134), E (BSPG 1998 VI 1131), H (BSPG 1998 VI 1132) and K (BSPG 1998 VI 1141). m3: C (BSPG 1998 VI 1162), F (BSPG 1998 VI 1163), I (BSPG 1998 VI 1171) and L (BSPG 1998 VI 1161).

the lingual wall of the cusp, or on its postero-lingual part. The anterior arm of the hypocone tends towards the paracone in Petersbuch, while this crest is more longitudinally directed in Kleineisenbach, somewhat between paracone and protocone. Although the posterior part of the M3 is highly variable, the posteroloph may be better developed in Petersbuch than in Kleineisenbach: while the crest is present in half of the specimens from Petersbuch (Fig. 1C, F), it is most often absent in Kleineisenbach (De Bruijn et al. 1993: pl. 1, fig. 9), or not clearly developed (De Bruijn et al. 1993: pl. 1, fig. 3) as the metalophule closing the posterior part of the tooth. In the latter case, a very small concavity is sometimes present at the posterior part of the molar. Although hard to quantify, it is noted that a small crest is more often present on the anterior wall of the metacone in Petersbuch than in Kleineisenbach.



		Length			Width		
	n	min.	mean	max	min.	mean	max
M1	19	3.19	3.45	3.64	2.16	2.35	2.57
M2	36	2.56	2.78	3.03	1.80	2.04	2.22
M3	25	2.24	2.44	2.66	1.74	1.94	2.20
m1	28	2.60	2.89	3.21	1.70	1.88	2.05
m2	30	2.49	2.70	2.90	1.89	2.06	2.18
m3	21	2.62	2.82	3.01	1.75	1.96	2.19

Figure 3: Measurements of *Deperetomys hagni* (Fahlbusch, 1964) from Petersbuch 48, in comparison with the same species from Kleineisenbach.

m3: The morphotype from Petersbuch 48, characterized by a crest in the posterosinusid (Fig. 2F, I), was found in 14% of the molars, but was observed in only one corroded m3 from the large sample from Kleineisenbach.

Discussion: The molars from Petersbuch 48 do not differ fundamentally from those from Kleineisenbach, and thus correspond to a species close to *Deperetomys hagni*. Fahlbusch (in De Bruijn et al. 1993: 158) recognizes the similarity of his species from Giggenhausen with *D. rhodanicus*, but maintains *D. hagni* for the following reasons: *D. rhodanicus* is only known by its holotype, i.e. a single M1 (Mein & Freudenthal 1971: pl. 1, fig. 3) from La Grive PB fissure A, collected by Chantre and Depéret at the end of the 19th century, and the species has not been found again since (Mein & Ginsburg 2002). The M1 morphotype *D. rhodanicus* is unknown in Giggenhausen and Kleineisenbach. Regarding the sample from Petersbuch 48, it is evident that the intraspecific variability of *D. hagni* is great, and that the species probably represents a synonym of *D. rhodanicus.* However, I refrain from formally synonymizing the two taxa in this paper because of the extremely limited material from La Grive. Because the complete dentition of the French species remains unknown to date, some doubts still exist.

5. Biostratigraphic implications

The late Middle Miocene *Deperetomys* fossils have predominantly been reported from the North Alpine Foreland basin and the surrounding calcareous plateau (Tab. 1). A notable exception is *D. rhodanicus* from the French fissure fillings at La Grive. Nevertheles, except from the localities Kleineisenbach and Giggenhausen, figured and described specimens are relatively rare:

–Engesser (1972) provides excellent illustrations of *D. hagni* from Anwil. The width of the M1 (Engesser 1972: diagram 39) overlaps the variation range of both Kleineisenbach and Petersbuch 48, although most of the Swiss specimens correspond to the molasse fossils, rather than to the wide specimens from the Frankonian Alb.

–the few specimens from Ottenberg 3 (Bolliger 1996: fig. 7) are insufficiently representative, and thus it is impossible to comment on their relationship with Petersbuch 48.

–According to Seehuber (2009), the M2 from Tiefenried cannot be assigned to *Deperetomys hagni* because of the development of an entomesoloph. In the illustrated specimen (Seehuber 2009: pl. 9, fig. 8), the entomesoloph is very low and can easily be interpreted as a labial extension of the entostyl. Although very rare, this type of crest is present in Kleineisenbach (e.g. BSPG 1972 XVI 105), and there is thus no reason to not assign the M2 from Tiefenried to *D. hagni*.

All the localities from which *Deperetomys hagni* has been reported to date are relatively close in age to one another, but with weakly defined absolute dating (e.g. Kälin & Kempf 2009). The occurrence of the species could be restricted to a short time interval (around 600 Ky for Kälin & Kempf 2009: fig. 8), in theory a sufficient time to recognize evolutionary trends as, for instance, in the genus *Megacricetodon* (Abdul-Aziz et al. 2010). Although certain metric and morphlogic differences are observed in Petersbuch 48, it is presently not possible to recognize a clear

Table 1: Occurrence of *Deperetomys hagni* (Fahlbusch, 1964) in the fossil record.

Locality	Country	Species	References
Kleineisenbach	Germany	*D. hagni*	Fahlbusch 1964; De Bruijn et al. 1993; Prieto 2007
Giggenhausen	Germany	*D. hagni*	Fahlbusch 1964; Prieto 2007
Tiefenried	Germany	*D.* cf. *hagni*	Seehuber 2009
Ottenberg 3	Switzerland	*D. hagni*	Bolliger 1996; Kälin 2003; Kälin & Kempf 2009
Greuterschberg	Switzerland	*D. hagni*	Kälin & Kempf 2009 (in text and fig.7, not in appendix)
Anwil	Switzerland	*D. hagni*	Engesser 1972; Kälin & Kempf 2009
Burstel-Haselberg	Switzerland	*D. hagni*	Bolliger 1998 Kälin & Kempf 2009 (in text and fig. 7, not in appendix)
Petersbuch 6	Germany	*D.* cf. *hagni*	Prieto 2007
Petersbuch 18	Germany	*D.* cf. *hagni*	Prieto 2007
Petersbuch 35	Germany	*D. hagni*	Rummel 2000
Petersbuch 48	Germany	*D. hagni*	Prieto 2007, this paper

trend in *D. hagni*, as ecologic parameters could be also involved.

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