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### Short communication

## A well-preserved mandible of *Amphiperatherium* from the Middle Miocene fissure filling Petersbuch 39: one of the youngest records of Metatheria (Mammalia) from Germany

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The karst system of the White Jura- $\delta$  of Petersbuch near Eichstätt (Germany, Franconian Alb) is famous for the abundance of fossil-enriched infillings (e.g., Bolliger & Rummel 1994). More than 120 distinct fossil faunas ranging from the Oligocene to the Pleistocene have been recovered from these fissure fillings. One of the poorly studied Middle Miocene faunas is Petersbuch 39. This infilling is noteworthy because it contains remains of several taxa rarely reported from elsewhere in Germany, including representatives of the genus *Cricetodon* and a large cricetid rodent, *Lartetomys* (= *Mixocricetodon*; review of the genus in preparation by the authors and colleagues; Rummel 1997, 2000). Moreover, Mlíkovský (1998) described several fossils of owls (Strigidae), and later also added *Strix edwardsi* and *Coturnix gallica* (Mlíkovský 2002) to the inventory. Szyndlar & Rage (2002) reported on the presence of the Oriental viper (*Vipera* sp.) from Petersbuch 39.

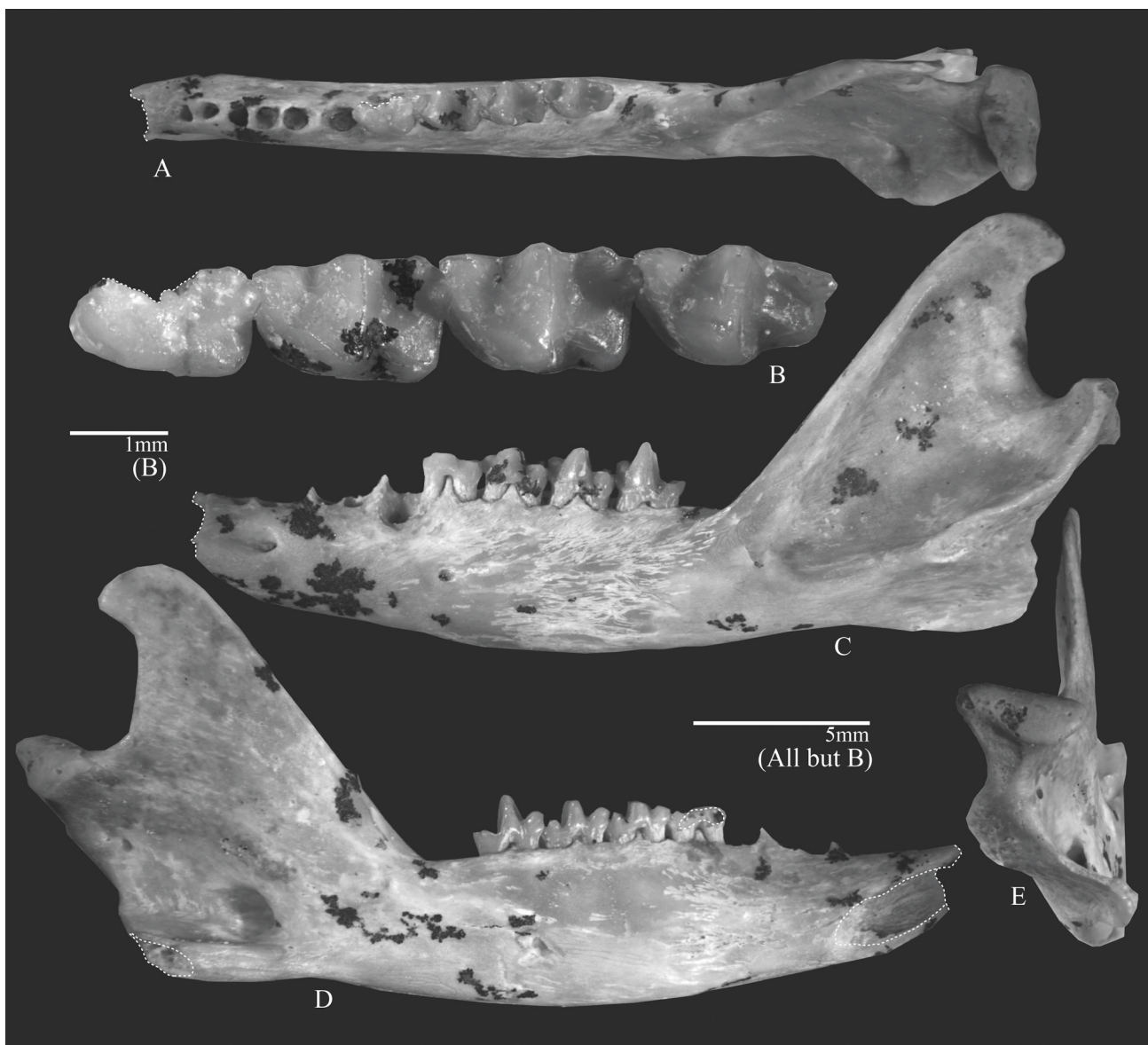
This communication briefly describes and discusses a mandible of *Amphiperatherium*, one of the rarest taxa from Petersbuch 39. The fossil stems from a private collection that was recently acquired by the Bavarian State Collection for Palaeontology and Geology (SNSB-BSPG) in Munich, Germany (see Rössner 2012 for an overview).

The fossil is a well-preserved left mandible (SNSB-BSPG 2011 V 1; Fig. 1) that evidences the presence of a metatherian mammal in the assemblage. It shows the ascending ramus, but the apophysis of the angular process is slightly broken. All molars are in situ but the m1 is lingually damaged. Anteriorly to the m1 occur seven alveoli (a large one for the canine and six smaller ones for the double-rooted p1-p3), and the most anterior part of the bone is missing. The ventral margin of the horizontal ramus is con-

vex, the maximum height of the bone is lower than that of the m2/m3 (see Fig. 2, measurements). Two mental foramina are present, i.e. a larger one located beneath the posterior root of the p1, and a smaller one below the posterior root of the m1. The mandible is morphologically similar to a specimen from Montaigu-le-Blin described and illustrated in detail by von Koenigswald (1970: fig. 9).

The taxonomic status of *Amphiperatherium*, the only marsupial recorded to date from the Middle Miocene of Germany, remains elusive (e.g., von Koenigswald 1970; Lavedèze et al. 2012). It is clearly beyond the scope of this short communication to go into details about this here, but instead we refer to Ziegler (1999) concerning the taxonomy of the species from the North Alpine Foreland Basin and surrounding areas. With regard to size, the molars from Petersbuch 39 correspond well with *Amphiperatherium frequens* from Germany, but the m4 is somewhat longer (Fig. 3). The near-identical size of all four molars and the interconnected talonid cusps of the m4 (cutting blade) are characteristic features of the dentition of this species (von Koenigswald 1970: 40; Kletmann et al. 2014). On the other hand, the postcingulid is lacking in the m1-3 of the Petersbuch 39 specimen (but remnants are present in m4; figs 1B and 2C). This morphological feature is regarded advanced (see Ziegler 2000) and allows the discrimination of *A. f. frequens* from *A. f. erkersthofense* and *A. f. wintershofense*. However, additional specimens will be required to confirm the value of these features in the discrimination between subspecies of *A. frequens*, and we therefore simply identify the specimen from Petersbuch 39 as *A. frequens* ssp.

*Amphiperatherium frequens* fossils have rarely been recorded for the lower-middle Miocene of

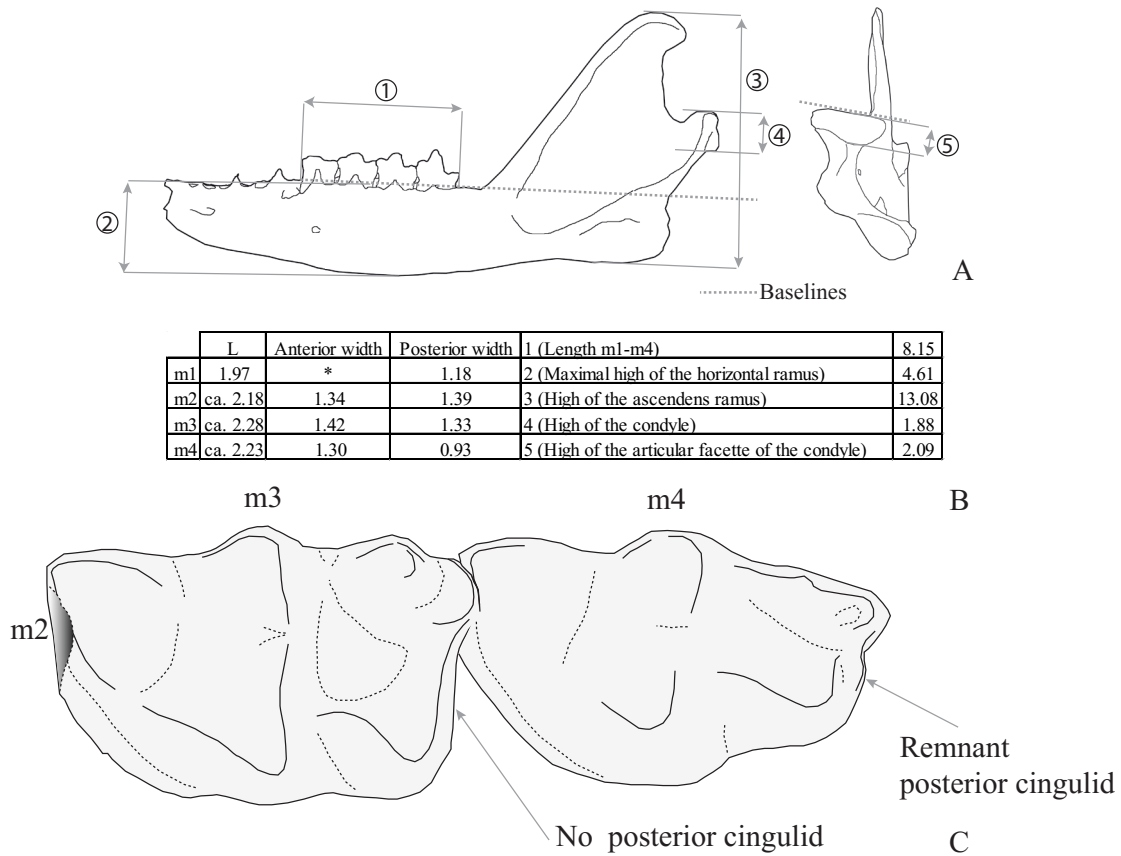


**Figure 1.** *Amphiperatherium frequens* ssp. from Petersbuch 39. Left mandible with m1-m4. **(A)** Occlusal view; **(B)** m1-m4 from occlusal; **(C)** Labial view; **(D)** Lingual view; **(E)** Distal view.

Germany are rare (Ziegler 1999), and also the Swiss part of the molasse basin has not yielded many specimens of this taxon. However, considerable attention has been directed at fossils of this species from somewhat older deposits outside Germany and Switzerland. For example, Furió et al. (2012) document *Amphiperatherium* from the lower Miocene of eastern Spain. These authors also provide a review of the localities containing the taxon. Based on the work by Kälin & Kempf (2009), Furió et al. (2012) list the occurrence of herpetotheriids in two MN7+8 localities from Switzerland. Similar information can also be found in Klietmann (2013). There appears to be a topologic mistake in the paper by Kälin & Kempf (2009). In the annex, the localities Ergeten and Greuterschberg are listed as containing fossils of *Amphiperatherium*, as well as *Democricetodon franconicus*, a lower Miocene cricetid rodent. On the other hand,

Figure 7 in Kälin & Kempf (2009) lists for both Swiss localities several other rodent taxa that fit far better with the assignment of the sites to MN7+8 (see also discussion in Kälin & Kempf 2009, and Prieto 2012: tab. 1). We suspect that the faunal lists in the annexes do not reflect reality. In addition, Bolliger (1992), who studied the small mammals from Ergeten, did not record herpetotheriids. Reasonably, Greuterschberg correlates to the Swiss reference fauna Tägeraustasse (MN 4), and the faunal list from Ergeten simply represents a copy of the list from Eiboden. For these reasons, and following the data provided in Kälin & Kempf (2009), the last occurrence of the marsupial *Amphiperatherium* in the Swiss part of the NAFB is the *Megacricetodon gersii*-*M. similis* interval zone, between ~14 and 14.2 My ago.

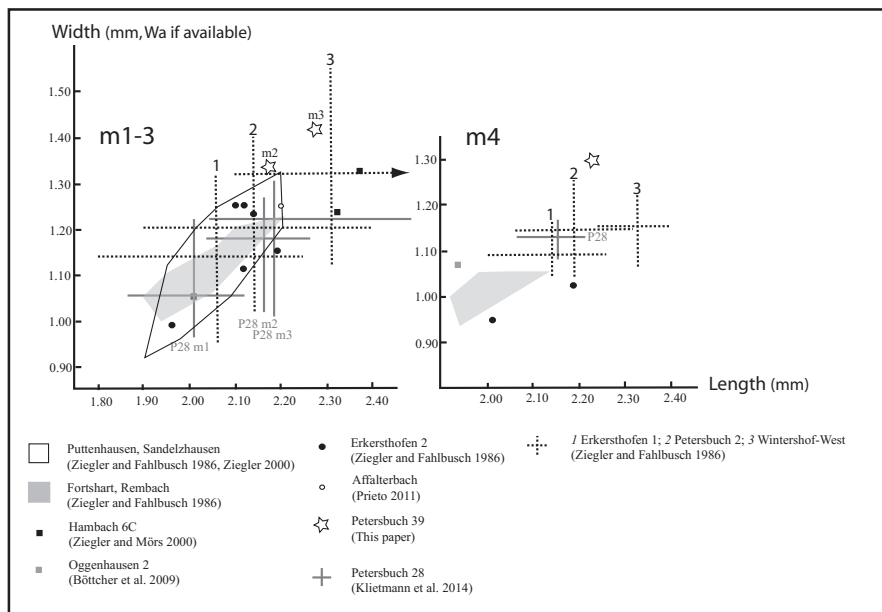
In Germany, this interval is at present not recorded or safely recognized. According to Furió et al. (2012,



**Figure 2.** *Ampheratherium frequens* ssp. from Petersbuch 39. **(A)** Measurement methods; **(B)** measurements of teeth and mandibular elements; **(C)** drawings of m3 and m4, showing the presence/absence of posterior cingulid.

and references therein) the last German marsupials occurred in the *Cricetodon*-containing older localities Gallenbach 2b, Gisseltshausen, Unterzölling, and Laimering 3. The biostratigraphy of this time interval is largely based on size increase in the *Cric-*

*todon* lineage. The evolutionary level of the Petersbuch 39 cricetid rodent is equivalent to Steinberg/Goldberg (Rummel 2000; Rummel & Kälin 2003), and therefore cannot be significantly different from the above-mentioned sites.



**Figure 3.** Molar size comparison (m1-m4) of selected German *Ampheratherium* specimens.

The study of paleofaunas preserved in fissure fillings requires that the possibility of mixed elements is taken into consideration (e.g., Bolliger 1997; Bolliger & Rummel 1994; Rummel 2000). Preliminary studies of part of the rodents from Petersbuch 39 suggest that mixture of elements from different faunas did not occur (Prieto & Rummel 2009a,b). In addition, the *Amphiperatherium* mandible is very well preserved, and the lack of the postcingulid of the m1-m3 is interpreted as representing an advanced character in this lineage of animals in Europe. Besides the fact that the specimen from Petersbuch 39 appears to represent one of the youngest marsupial fossils from Germany, the specimen is remarkable because of its completeness. While important and rich material (including skulls, mandibles and postcranial elements) is known from the European Lower Miocene (von Koenigswald 1970; Crochet 1978; Ziegler 1999; Klietmann et al. 2014), the Middle Miocene record is, as indicated above, much more scanty. Finally, the marsupials are, as stated in previous studies, victims of the end of the mid-Miocene Climate Optimum in Europe.

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