

# First evidence of a chalicothere (Mammalia, Perissodactyla) in The Netherlands

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Amongst many fossils from 'de Kuilen' in Mill-Langenboom (The Netherlands, Noord-Brabant province) an upper molar fragment of a peculiar land mammal, hitherto unknown in the Netherlands, has generated special interest. Comparison of the molar with several fossil large mammals, in particular extinct Miocene chalicotheres, in the Natural History Museum, Basel, made clear that the specimen is a second or third upper molar of a representative of the subfamily Chalicotheriinae. Due to the incompleteness of the specimen, a more accurate judgement of the position of the molar ( $M^2$  or  $M^3$ ) is not possible. A conclusion as to which species it could belong to is also difficult to draw, because morphology as well as dimensions of the teeth in two species, *Chalicotherium grande* (de Blainville, 1849) and *C. goldfussi* (Kaup, 1833) show a very strong resemblance. The fossil therefore is described as *Chalicotherium* sp.

KEY WORDS: extinct mammals, Chalicotheriidae, Miocene, Mill-Langenboom

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## Introduction

Locality 'de Kuilen' at Mill-Langenboom (Noord-Brabant, The Netherlands) is a site well-known to many, predominantly non-professional collectors in the Netherlands for its wealth of fossil material. In the last decades a great diversity of invertebrate as well as vertebrate remains have been extracted from Neogene sands that are sucker-dredged here from below groundwater level for commercial purposes.

The geological situation in the area and the stratigraphy of the locality were described by Wijnker *et al.* (2008). From the stratigraphical framework in their study no unambiguous conclusions can be drawn, however, as to the origin and geological age of the many finds of land mammal fossils. Almost all fossils in this category were found *ex situ* and seem to indicate more than one period of deposition. An exceptional *in situ* find (a cervid molar) was described by de Vos & Wijnker (2006) and interpreted as early Pliocene. Many other terrestrial mammal remains seem to be of younger age and possibly represent an early Pleistocene (Villafranchian) fauna. Some of these fossils have been dealt with in previous contributions by Mol *et al.* (2011) and Peters & de Vos (2012), other remains will have to be looked at more closely and need further investigation.

Uncertainty about the stratigraphical context is further strengthened by the occurrence of fossils at Mill-Langenboom that point to a possibly older (late Miocene)

fauna as well (*Hipparion* and *Chalicotherium*).

Herein we focus on a single fossil that we recently detected in a private collection from Mill-Langenboom: a molar of an extinct chalicothere. Remains of these perissodactyl mammals were hitherto unknown in the Netherlands. We therefore consider the find worthwhile to describe in a separate contribution.

Chalicotheres were herbivorous, odd-toed ungulate mammals, characterized by an unusual gorilla-like body plan with very long forelimbs with clawed digits, short hind limbs and a partial knuckle-walking position (Zapfe, 1979), although Geraads *et al.* (2006) argue that the chalicothere hand was clearly not designed for walking. Their claws were most likely used in a hook-like manner to pull down branches, suggesting they lived as bipedal browsers, but analysis of dental microwear and mesowear shows that at least in some chalicotheres fruits and seeds or bark supplemented leaf browsing (Schultz *et al.*, 2007; Semprebon *et al.*, 2011).

## Material

An incomplete upper molar (Fig. 1), collection Frans and Robbie Reijs (Beers, The Netherlands). A cast with number MAB 4616 is housed in Museum de Groene Poort in Boxtel (The Netherlands).



**Fig. 1.** Molar fragment of *Chalicotherium* sp. (F. & R. Reijs collection, Beers, The Netherlands; cast available in Museum de Groene Poort, Boxtel, nr MAB 4616) from Mill-Langenboom. A: occlusal view; B: lingual view; C: mesial view. Scale bar 10 mm. Photograph Barry van Bakel.

### Systematic palaeontology

Order Perissodactyla Owen, 1848  
Family Chalicotheriidae Gill, 1872  
Subfamily Chalicotheriinae Gill, 1872  
Genus *Chalicotherium* Kaup, 1833

*Description* – The molar fragment is the mesio-lingual part of an upper  $M^2$  or  $M^3$ . Due to its incompleteness the circumference of the brachyodont molar can only be estimated, but length and width of the (complete) crown seem to be roughly equal. The enamel of the crown has a shining pale-grey appearance with a soft blue-greenish tone. The roots are largely missing.

The crowns of the bunoselenodont molars of *Chalicotherium* have four main cusps, of which the complete protocone and part of the paracone are preserved in the Mill-Langenboom fragment. Also part of the longitudinal fossa between the outer and inner cusps can be observed. On the mesial side of the crown a strongly swollen cingulum is present and between protocone and paracone a protoconule can be seen on the protoloph.

*Measurements* – The crown fragment measures 33,5 mm in mesio-distal direction and 28 mm in bucco-lingual direction. The height of the crown measured at the tip of the slightly worn paracone is 16 mm.

### Discussion and conclusions

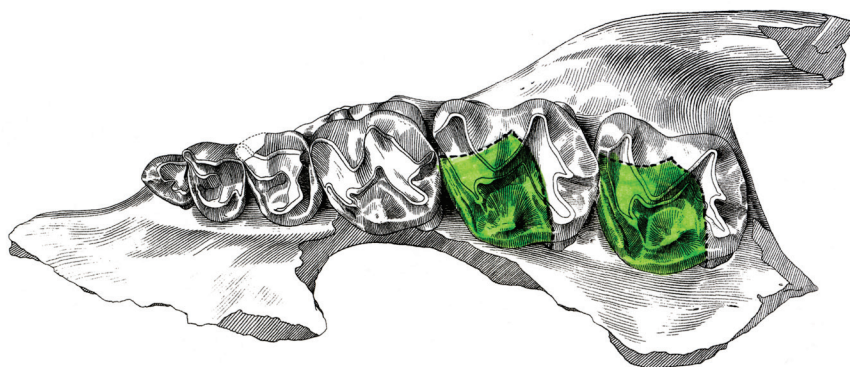
Several molars of two different *Chalicotherium* species in the Natural History Museum of Basel, some of them isolated, some *in situ* in the maxilla, have been used for a morphological and biometrical comparison with the Mill-Langenboom specimen.

In particular the very strong resemblance between the present molar and two molars in a left maxilla of *Chalicotherium grande* (de Blainville, 1849) with 3 premolars and 3 molars, described and illustrated by Zapfe (1979), made clear that the Mill-Langenboom fragment is an upper  $M^2$  or  $M^3$  of a Chalicotheriinae species. Figure 2 is a reproduction of Zapfe's drawing of this maxilla (O.E. 73) of *Chalicotherium grande* from Dĕvinská Nová Ves (Slovakia). The relative position of the Mill-Langenboom fragment ( $M^2$  or  $M^3$ ) is superimposed in colour in this drawing.

The measurements of the two O.E.73 molar crowns in the Basel collection are (in mm):

$M^2$ : Length (L) 41,4 Width (W) 38,3 Height (H) 17,3  
 $M^3$ : Length (L) 40,0 Width (W) 41,7 Height (H) 21.

The dimensions of the Mill-Langenboom fragment are difficult to compare because of its incompleteness, but seem to match quite well the corresponding part of the  $M^2$  or  $M^3$  in the Dĕvinská Nová Ves specimen.



**Fig. 2.** Left maxilla with P<sup>2</sup>- M<sup>3</sup> of *Chalicotherium grande* (de Blainville, 1849) from Dĕvinsk Nov Ves (Slovakia) in the Natural History Museum in Basel (O.E. 73; after Zapfe 1979, fig. 6, p. 23). Insertion in color: the relative position of the Mill-Langenboom molar fragment (M<sup>2</sup> or M<sup>3</sup>).

Some isolated and incomplete molars of *Chalicotherium goldfussi* (Kaup, 1833) in the Basel museum collection were compared with the Mill-Langenboom molar as well, but could not give a decisive answer to whether or not our molar could belong to that species.

Whether the partial crown is a M<sup>2</sup> or M<sup>3</sup> is difficult to decide, morphology of the two being very similar. Length(L) x 100/width(W) index of the molar could give a clue, the

M<sup>2</sup> having an index >100, the index for M<sup>3</sup> being always <100 (Zapfe, 1979). But for an incomplete molar such as the fragment from Mill-Langenboom calculating this index is impossible. Zapfe (1979) also illustrated (strongly worn) upper cheek teeth of *Chalicotherium goldfussi* from the Dinotheriensande of Eppelsheim, which by their morphology and measurements are not easily distinguished from the Dĕvinsk Nov Ves molars.



**Fig. 3.** Reconstruction of a chalicothere, on exhibition at Museum ‘De Groene Poort’, Boxtel, The Netherlands. The model of this extinct animal was produced by Aart Walen. His reconstruction is based in particular on the many fossil chalicothere skeletal elements he studied in the collections of the Naturhistorisches Museum, Basel (Switzerland). Especially proportions of the limbs, an estimated height of c. 190 cm and body-length of 220 cm, as well as the presumed upright position were derived from the fossil material itself, as well as from its description and interpretation by Zapfe (1979). Hair length and colour, of course, are more speculative. (Photo A. Walen).

The brachyodont character of the molar as well as the (supposed) roughly square crown circumference are indicative for a chalicothere belonging to the subfamily of the Chalicotheriinae. Generally speaking, the Chalicotheriinae have lower crowned and less elongated molar teeth than the Schizotheriinae (Semperebon *et al.*, 2011). *Chalicotherium grande* and *C. goldfussi* are two representatives of the subfamily, well-known from the Miocene in Europe. Since a revision of European Chalicotheriinae by Geraads (2001) most students prefer the name *Anisodon grande* for the middle Miocene species instead of *Chalicotherium grande* used by Zapfe. In our study the Dĕvinská Nová Ves molars described by Zapfe played a major role and therefore, for the sake of convenience, we herein adopt the genus name he used in his monograph.

Attributing the Mill-Langenboom molar fragment to one of the two *Chalicotherium* species is very difficult. While postcranial elements possibly could differentiate between the two species, isolated molars cannot (Zapfe, 1979). So we consider the present molar to be *Chalicotherium* sp.

Fossil remains of Chalicotheriinae are recorded from many sites in central and western Europe, the best known being Dĕvinská Nová Ves (Neudorf) in Slovakia, Sansan in France and Eppelsheim in Germany. Fossil finds of *Chalicotherium* are reported from more localities, among others La Grive, St. Gaudens (France), Esselborn, Wissberg, Wolfsheim (Southern Germany), Buñol, Paracuellos, Can Llobateres, Terrassa (Spain), Rudabanya (Hungary). Mill-Langenboom is certainly the northernmost locality in Europe in this biogeographical distribution pattern of Chalicotheriinae so far.

All sites mentioned here are middle or late Miocene in age, ranging from MN zone 4 up to MN 10. In the stratigraphical context of the Mill-Langenboom locality and in view of other finds there a late Miocene age of the fossil molar is most likely, but reworking from middle Miocene sediments cannot be ruled out.

No chalicotheres survived beyond the late Miocene in Europe. In his monograph of 1979 Zapfe presumed the middle Miocene *Chalicotherium grande* to be the ancestor of the late Miocene *Chalicotherium goldfussi*. Recent studies (Anquetin *et al.*, 2007), however, have considerably strengthened the hypothesis that *Anisodon* and *Chalicotherium* represent divergent chalicotheriine clades. This assumption led Semperebon *et al.* (2011) to a scheme of likely relations among the European Miocene chalicothere species, which excludes a direct descentance of *Chalicotherium goldfussi* from *Anisodon grande*.

An impression of how the Mill-Langenboom chalicothere might have looked is given in Figure 3.

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