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Another record of a hadrosaurid dinosaur from the Maastrichtian type area (The Netherlands, Belgium): SEELEY (1883) revisited

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Abstract

An incomplete left tibia of an indeterminate hadrosaurid from the type area of the Maastrichtian Stage, contained in the collections of the Museum für Naturkunde der Humboldt-Universität Berlin (*ex* Binkhorst van den Binkhorst Colln), is described, illustrated and compared with the type lot of *Orthomerus dolloi* SEELEY, 1883 [*nomen dubium*]. Although the specimen lacks geographic/stratigraphic details, a small matrix sample taken from the medullar foramen has now yielded benthic foraminifera that corroborate its provenance from the Maastrichtian type area, and suggest it to have originated from the upper portion of the Maastricht Formation (Emael or Nekum members).

Key-words: Hadrosauridae, *Orthomerus*, Cretaceous, Maastrichtian, The Netherlands, Belgium.

Résumé

Un tibia gauche incomplet d'hadrosauridé indéterminé de la région stratotypique du Maastrichtien retrouvé dans les collections du Museum für Naturkunde de l'Université von Humboldt à Berlin (ex-collection Binkhorst van den Binkhorst) est décrit, figuré et comparé avec le matériel type d'*Orthomerus dolloi* SEELEY, 1883 [*nomen dubium*]. Aucune donnée stratigraphique ou géographique accompagne ce tibia; dans le foramen médullaire un peu de sédiment a pu être prélevé. Les foraminifères benthiques trouvés dans ce sédiment confirment que son origine est la région stratotypique du Maastrichtien et permet de suggérer que le spécimen provient de la partie supérieure de la Formation de Maastricht (des membres d'Emael ou de Nekum).

Mots-clefs: Hadrosauridae, *Orthomerus*, Crétacé, Maastrichtien, Pays-Bas, Belgique.

Introduction

Extensive collecting over the past forty years from numerous outcrops exposing the fully marine, shallow-water biocalcarenites ('tuffaceous chalk facies') of the Maastricht Formation in its type area (southern Limburg, The Netherlands; Limburg and Liège provinces, NE Belgium), has shown terrestrial vertebrate material to be extremely rare. Two recent accounts (WEISHAMPEL *et al.*, 1999; JAGT *et al.*, 2003) have listed all specimens (cranial fragments, isolated teeth and fragmentary limb bones) then known, documenting more than one non-lambeosaurine hadrosaurid taxon as well as a possible euhadrosaurian.

To these lists can now be added an incomplete left tibia, contained in the collections of the Museum für Naturkunde (Humboldt-Universität, Berlin). As far as we can determine, this specimen has not previously been referred to, described and/or illustrated. Although it forms part of the collection purchased in 1878 by the Kaiserliches Mineralogisches Museum (Berlin) (see VAN REGTEREN ALTENA, 1957; KRUYTZER, 1962, 1963; DE BRUIJN, 1974; LELOUX, 2002) after Binkhorst van den Binkhorst's death (December 1876), it lacks any indication of collector and geographic/stratigraphic provenance. In fact, the only data available are written on the specimen itself, "MB. R. 3286, Senon, Maestricht, coll. Binkhorst 1878." It is unknown to us whether Binkhorst van den Binkhorst collected the specimen himself, or received/bought it from quarrymen in the area – common practice in those days. Although, from 1846 onwards (DE BRUIJN, 1974), Binkhorst van den Binkhorst did most of his collecting in the Maastricht-Geulhem (Valkenburg aan de Geul) area (southern Limburg, the Netherlands), he also visited outcrops at Jauche and Orp-le-Petit (province of Brabant, Belgium) and in the Mons Basin (southern Belgium), on various occasions. This means that the tibia could also have come from one of these outcrops. In order to determine its provenance, a very small matrix sample from the medullar foramen has been extracted and analysed for benthic foraminiferal content (see below).

We cannot say why this specimen has not been described and illustrated before, but the fact that there is no record of it in any of the papers or fossil lists published by Binkhorst himself or by his contempories (BINKHORST VAN DEN BINKHORST, 1858, 1859a, b, 1860, 1861, 1864; ANONYMOUS, 1863; BINCKHORST VAN DEN BINCKHORST [*sic*], 1868; BOSQUET, 1860, 1868; UBAGHS, 1879) may be one of the reasons.

Overall, the present specimen (Pl. 1, Figs. 1-4) shows a striking resemblance to the left tibia in the type lot of *Orthomerus dolloi* SEELEY, 1883 [*nomen dubium*; see WEISHAMPEL & HORNER, 1990, p. 558] (Pl. 1, Figs. 6-11). For reference, other bones (left and right femur, metatarsal) contained in this lot are also illustrated here (Pl. 2).

Description

Abbreviations. – To denote the repositories of specimens referred to in the text, the following abbreviations are used: MB – Museum für Naturkunde der Humboldt-Universität, Berlin; MND – Museum Natura Docet, Denekamp; NHM – The Natural History Museum, London.

As preserved, MB. R. 3286 (Pl. 1, Figs. 1-4) measures 290 mm, the black/darkbrown surface layer of the bone largely missing through abrasion and bioerosion; radular traces assignable to the ichnogenus *Radulichnus* cover large portions of the bone's surface (Pl. 1, Fig. 5; compare JAGT, 2003).

The proximal end including the surface of the femoral condyles, as well as a major portion of the outer malleolus (*sensu* NORMAN, 1987, fig. 59, appendix 3) are missing; this may in part be the result of sawing. Despite this, most of the characters listed by WEISHAMPEL & HORNER (1990, pp. 552, 553) as typical of hadrosaurid tibia may still be seen. Essentially, the bone is a thin, straight shaft which expands greatly both proximally and distally. Although the proximal end is lost, it may be deduced from its overall aspect that the medial femoral condyle was larger than the lateral. The posterior part of the medial femoral condyle projects backwards.

The cnemial crest is sharp and notably well developed craniolaterally in the proximal half of the bone. It has the tendency to fold laterally around the lateral femoral condyle. Caudolaterally, at the base of proximal third of the bone, the medullary foramen with a delicate rim is seen; it is directed obliquely downwards. Below the medullary foramen, the tibial shaft is cranially flattened and caudally convex in cross section. At *c.* 45° to the medial plane of the tibia, the shaft expands distally to form the inner and outer malleolus, developing into the astragalar and calcaneal condyle, respectively. In accordance with the general description of the hadrosaurian tibia by WEISHAMPEL & HORNER (1990), the distal craniolateral face is flattened. Caudomedially, between the inner and outer malleolus a ridge appears to have been present, being far less developed than in iguanodontids (compare NORMAN, 1987, fig. 59D). As far as the state of preservation of MB. R. 3286 allows this to be observed, craniolaterally the inner and outer malleolus are divided by a depression. Seen distally, there is an obtuse angle between the inner and outer malleolus.

As is usually the case in hadrosaurian tibiae, MB. R. 3286 does not reveal any muscle scar. No fibular facets are preserved.

Discussion

In size and state of preservation, MB. R. 3286 is closely comparable to NHM 42954 (*ex* Van Breda Colln), another hadrosaurid left tibia from the Maastrichtian type area, first described and illustrated by SEELEY (1883) and reillustrated by BRINKMANN (1988), and in the NHM collections since 1871 (MULDER, 2003). As preserved, NHM 42954 measures 360 mm, contrary to SEELEY (1883, p. 251), who erroneously stated that its length was 270 mm. Features seen in MB. R. 3286 (see above) and in NHM 42954 are strikingly similar (see Pl. 1), leading to the conclusion that they are conspecific, and should be referred to as Hadrosauridae *incertae sedis*.

MND K 21.04.004, described by MULDER (1984), is only a small fragment of a hadrosaurid left tibia from the Meerssen Member (Maastricht Formation) at Geulhem (Valkenburg aan de Geul), yet it does preserve the medullar foramen and reveals the craniolateral section of the cnemial crest (see JAGT *et al.*, 2003, fig. 2B). The surface layer is yellowish light brown in colour and shows no sign of erosion. Only 180 mm remain of this bone; originally, this tibia must have measured *c.* 600 mm in length, much larger than MB. R. 3286 and NHM 42954. At the height of the medullar foramen, the tibial shaft of MB. R. 3286 measures only 98 mm across, whereas in MND K 21.04.004 it measures 209 mm.

The small matrix sample extracted from the medullar foramen in MB. R. 3286 was analysed for benthic foraminiferal content by J.P.M.T. Meessen (pers. comm., June 2004), who identified *Pseudoparrella limburgensis* VISSER, 1950, *Mississippina binkhorsti* (REUSS, 1862), *Pararotalia tuberculifera* (REUSS, 1862), *Gavelinella* sp. and *Gavelinopsis* sp., and, based on matrix habitus, was able to confirm provenance from the Maastrichtian type area. The presence of *Ps. limburgensis*, *M. binkhorsti* and *P. tuberculifera*, and the absence of typical 'warmwater' indicators, would suggest that the tibia was collected either from HOFKER's (1966) benthic foram zone I (= Emael Member, Maastricht Formation) or from the lower portion of benthic foram zone K (= lower Nekum Member, Maastricht Formation).

Thus, this 'new' specimen compares well with previous records of hadrosaurids from the Maastrichtian type area, both in morphology and stratigraphic provenance.

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Explanation of the Plates

PLATE 1

Indeterminate hadrosaurid left tibiae from the Maastrichtian type area (Maastricht Formation,?Emael and/or Nekum members; Late Maastrichtian, *Belemnitella junior* Zone of authors). Scale bars equal 50 mm, except in Fig. 5, where it represents 10 mm.

Figs. 1-5 — MB. R. 3286, in cranial, lateral, caudal, and medial views, respectively, and a close-up showing radular traces (ichnogenus *Radulichnus*).

Figs. 6-11 — NHM 42954 (part of the type lot of *Orthomerus dolloi* SEELEY, 1883 [*nomen dubium*]), in cranial, lateral (compare SEELEY, 1883, fig. 3A), caudal (compare SEELEY, 1883, fig. 3C), medial, proximal, and distal (compare SEELEY, 1883, fig. 3D) views, respectively.

PLATE 2

Indeterminate hadrosaurid limb bones, representing the remainder of the type lot of *Orthomerus dolloi* SEELEY, 1883 [*nomen dubium*] from the Maastrichtian type area, Maastricht Formation (?Emael or Nekum members). Scale bars equal 50 mm.

Figs. 1-4 — NHM 42955, right femur, in cranial, lateral, caudal (compare SEELEY, 1883, fig. 2A), and medial (compare SEELEY, 1883, fig. 2B) views, respectively.

Figs. 5-9 — NHM 42956, left femur, in cranial, lateral, caudal, medial, and distal (compare SEELEY, 1883, fig. 2D) views, respectively.

Figs. 10-13 — NHM 42957, metatarsal, in medial (or lateral), cranial (or caudal), distal, and proximal views, respectively (not illustrated by SEELEY, 1883, p. 253).

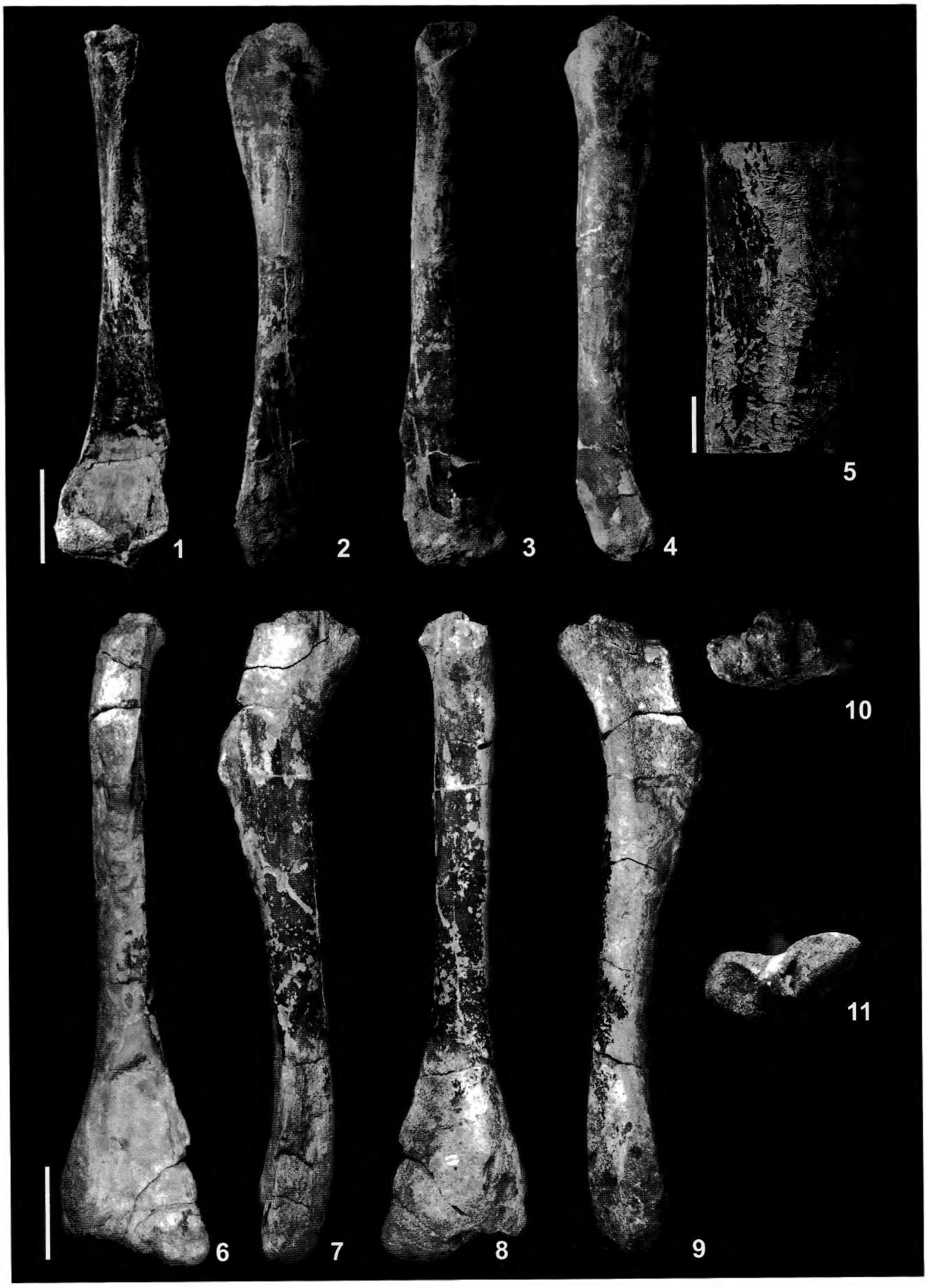

PLATE 1

PLATE 2