

## An additional hadrosaurid specimen (Dinosauria: Ornithischia) from the marine Maastrichtian deposits of the Maastricht area

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**Abstract:** An isolated dinosaur vertebra from the marine deposits of the Maastrichtian type area, near the city of Maastricht (The Netherlands), collected during the 19th century and kept in the palaeontological collection of the Museum für Naturkunde in Berlin, is described as a caudal vertebra of a hadrosaurid ornithopod. Although it cannot be identified with greater accuracy, this specimen is an addition to the still scanty, but growing, record of non-avian dinosaurs from the Maastrichtian type area. This record is heavily dominated by hadrosaurs, which probably reflects a real abundance of this group of dinosaurs in the Late Maastrichtian of Europe.

**Key Words:** Vertebra; Dinosauria; Hadrosauridae; Cretaceous; Maastricht.

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**Résumé :** *Un spécimen supplémentaire d'hadrosauridé (Dinosauria : Ornithischia) des dépôts marins maastrichtiens de la région de Maastricht.*— Une vertèbre de dinosaure isolée provenant des dépôts marins de la région type du Maastrichtien, près de la ville de Maastricht (Pays-Bas), récoltée au 19<sup>e</sup> siècle et conservés dans les collections du Museum für Naturkunde (Berlin), est décrite comme une vertèbre caudale d'un ornithopode hadrosauridé. Bien qu'il ne puisse pas être identifié plus précisément, ce spécimen s'ajoute à la liste brève, mais en augmentation, des dinosaures non-aviens de la région type du Maastrichtien. Cette liste est fortement dominée par les hadrosaures, ce qui reflète probablement une réelle abondance de ce groupe de dinosaures dans le Maastrichtien d'Europe.

**Mots-Clefs :** Vertèbre ; Dinosauria ; Hadrosauridae ; Crétacé ; Maastricht.

### Introduction

The occurrence of dinosaur remains in the Maastrichtian marine deposits of the Maastricht area was first mentioned by SEELEY (1880), who then gave a more detailed description of a few bones (SEELEY, 1883), followed soon thereafter by DOLLO (1883), who described additional material. With the exception of the description by UBAGHS (1892) of two purported *Megalosaurus* teeth, which are apparently not dinosaurian (BUFFETAUT *et alii*, 1985) and may be those of mosasaurs (BUFFETAUT & LE LOEUFF, 1991), no additional reports were published until the 1980s, when several new finds were described (MULDER, 1984; BUFFETAUT *et alii*, 1985). Since then, the number of dinosaur specimens known from the Maastrichtian of the Maastricht area (on both Dutch and Belgian territory) has gradually increased, as described in recent reviews (WEISHAMPEL *et alii*, 1999; JAGT

*et alii*, 2003). As noted in a recent record of an additional hadrosaurid specimen (MULDER *et alii*, 2005), terrestrial vertebrate material is extremely rare in the marine Maastrichtian of that area, so the description of a previously unreported dinosaur vertebra from these beds seems to be warranted, although the fossil is incomplete.

### Origin of the specimen

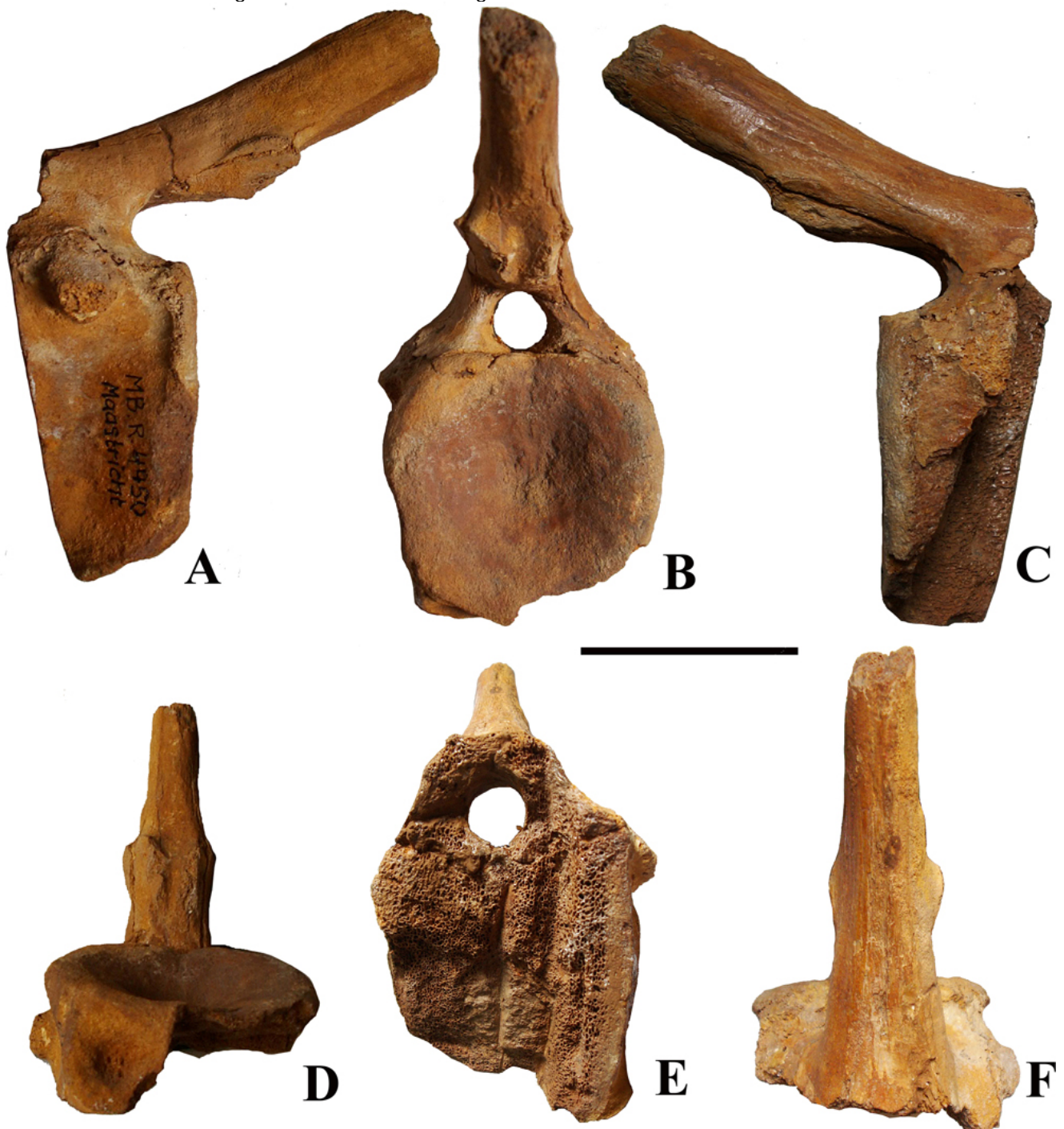
The specimen described here was found in the palaeontological collection of the Museum für Naturkunde of the Humboldt-Universität, Berlin, where it is registered under number MB.R.4450. The label reads: "*Orthomerus dolloi*. Coll. v. BINKHORST, Obersenon Maastricht".

The palaeontological collection of the Dutch geologist Johannes Theodorus BINKHORST van den BINKHORST (1810-1876), who worked exten-

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sively in the Maastricht area during the mid-nineteenth century, was purchased after his death by the Kaiserliches Mineralogisches Museum, Berlin, in 1878 (WINKLER PRINS, 2000; MULDER *et alii*, 2005). A hadrosaurid tibia also from the BINKHORST collection in the Museum für Naturkunde was described by MULDER *et alii* (2005). Like that tibia, the vertebra described below seems to have gone unnoticed for a long

time. BINKHORST van den BINKHORST (1859) mentions vertebrate remains on several occasions in his book on the Late Cretaceous beds of the Maastricht area, but makes no mention of a vertebra which could be MB.R.4450. The specimen seems to have escaped the attention of palaeontologists since it was discovered, sometime in the mid-nineteenth century.



**Figure 1:** Hadrosaurid caudal vertebra from the Maastrichtian of the Maastricht area, Museum für Naturkunde, Berlin, n° MB. R.4450, in left lateral (A), caudal (B), right lateral (C), ventral (D), cranial (E) and dorsal (F) views. Scale bar: 50 mm.

**Figure 1 :** Vertèbre caudale d'hadrosauridé du Maastrichtien de la région de Maastricht, Museum für Naturkunde, Berlin, n° MB. R. 4450, en vues latérale gauche (A), caudale (B), latérale droite (C), ventrale (D), craniale (E) et dorsale (F). Échelle graphique : 50 mm.

The exact geographical origin of the specimen is somewhat uncertain because the label gives few details – there were many quarries in the Late Cretaceous chalk of the Maastricht area in the 19th century, and BINKHORST van den BINKHORST is known to have collected fossils both in the Netherlands and in Belgium (MULDER *et alii*, 2005). However, there is no particular reason to doubt that the bone is from the Maastricht area in the Netherlands, as may be inferred from the label, although an origin in the neighbouring Belgian part of Limburg cannot be completely excluded.

Its exact stratigraphic origin is difficult to ascertain, because the details given on the label are scanty. The fossil has been thoroughly cleaned of all matrix, so that no evidence remains about the type of rock in which it was embedded. The type of preservation and the yellowish-brown colour of the specimen are similar to those of other vertebrate fossils from the Maastrichtian of the Maastricht area, and there is no reason to doubt that it is from there. The vertebra has clearly been cut into by a saw, very probably when the block that contained it was prepared by quarrymen. As noted by JAGT *et alii* (2003, p. 70) about hadrosaurid vertebrae described by DOLLO (1883), "the fact that both specimens display saw marks means that they must have been collected by people working in subterranean galleries. This makes it more than likely that the material comes from the Nekum Member (Maastricht Formation) of the Maastricht area (St Pietersberg)". This conclusion also applies to the similarly cut vertebra MB. R.4450, which probably also comes from the Nekum Member of St Pietersberg. This would place it in the upper part of the Late Maastrichtian (see MULDER *et alii*, 1997, and JAGT *et alii*, 2003, about the stratigraphic distribution of dinosaur remains in the Maastrichtian type area).

## Description and comparisons

Specimen MB. R.4450 (Fig. 1) is the posterior part of a caudal vertebra, including part of the centrum and most of the neural arch. The left and right sides of the centrum are cut obliquely, clearly by a saw. The interior of the centrum shows well preserved cancellous bone. The caudal face has a more or less square outline, with rounded corners. It is deeply concave. Only the left chevron facet is preserved; it is D-shaped and deeply concave, and faces caudoventrally. The lateral faces are preserved mainly on the left side. The left lateral face is more or less vertical and bears a small transverse process in its dorsal part, close to the suture with the neural arch, which curves above the knoll-like process. The neurocentral suture is not fused, which may suggest that the animal was not fully grown, although HORNER *et alii* (2004, p. 453) note that in hadrosaurids "some mature adults retain unfused arches".

The neural arch has broad pedicels, which extend far laterally, covering a large part of the dorsal surface of the centrum. The neural canal is circular in section. The neural spine projects posteriorly well beyond the caudal margin of the centrum, at a low angle. It is rod-like and becomes gradually narrower transversely, while its height remains more or less constant. It is incomplete distally. At its anterior third, it bears well developed postzygapophysial facets, which have an oval outline and face ventrolaterally at an angle of about 45°.

### Measurements:

- Height of caudal articular face: 63.5 mm
- Width of caudal articular face: 64.2 mm
- Length of neural spine: 95 mm

The morphology of the specimen is clearly that of a hadrosaurid caudal vertebra, with a tall, rather squarish centrum and obliquely sloping neural spine. It is reminiscent of the middle caudals of *Hadrosaurus foulkii*, from the Late Cretaceous of New Jersey, figured by LEIDY (1865). In the shape of the centrum, of the chevron facet and of the neural spine, it is remarkably similar to the vertebra described by DOLLO (1883) as a middle caudal of *Orthomerus dolloi* SEELEY, 1883 (also figured by LYDEKKER, 1888). The main difference is that on the vertebra described by DOLLO the transverse process is on the neural arch, whereas it is borne by the centrum on MB. R.4450. This difference probably reflects different positions in the vertebral column. As noted by LULL and WRIGHT (1942, p. 79), in hadrosaurids "transverse processes seem to arise at first from the sides of the neural arch and then gradually descend to the sides of the centra at their upper portion". This suggests that MB. R.4450 was located more posteriorly along the tail than the vertebra described by DOLLO.

It would be unwarranted to attempt an identification beyond Hadrosauridae indet. on the basis of this isolated and incomplete caudal vertebra. *Orthomerus dolloi* SEELEY, 1883, the taxon to which DOLLO (1883) referred a vertebra similar to M.B. R.4450, is now generally considered as a *nomen dubium* (BRINKMANN, 1988; HORNER *et alii*, 2004). Moreover, as noted by WEISHAMPEL *et alii* (1999) and JAGT *et alii* (2003), several hadrosaur taxa are apparently represented in the Maastrichtian beds of the Maastricht area, all by very fragmentary material, which makes a precise identification of an isolated caudal vertebra even more difficult.

## Conclusion

The hitherto overlooked vertebra M.B. R.4450 is an addition to the still relatively short, but steadily growing, list of dinosaur remains from the Maastrichtian type area. It resembles a hadrosaurid caudal vertebra previously described by DOLLO (1883) from the



same area, but cannot be identified with greater taxonomic accuracy. What it does confirm is the relative abundance of hadrosaurids among the non-avian dinosaur assemblages from that time span and area. Apart from a single theropod femur described by SEELEY (1883) as *Betasuchus bredai*, which apparently belongs to a ceratosaur (CARRANO & SAMPSON, 2008), possibly an abelisaurid (LE LOEUFF & BUFFETAUT, 1991), all known non-avian dinosaur remains from the Maastrichtian type area belong to hadrosaurids. There may be palaeobiological or taphonomical reasons for this high percentage, but it probably also reflects a real abundance of hadrosaurs, which appear to have been the dominant herbivorous dinosaurs in the Late Maastrichtian of Europe (LE LOEUFF *et alii*, 1994).

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