

## On the alleged presence of *Halisaurus* (Squamata, Mosasauridae) in the latest Cretaceous of the Maastrichtian type area

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### Abstract

The presence of *Halisaurus* (Squamata, Mosasauridae) in the uppermost Cretaceous of the Maastrichtian type area, suggested by Lingham-Soliar (1996) on the strength of two partial vertebrae, is questioned. The anatomy of these elements suggests that they pertain not to *Halisaurus*, but more probably to *Plioplatecarpus marshi* Dollo, 1882.

**Keywords:** mosasaurs, Maastrichtian type area, New Jersey, vertebrae

### Introduction

It has been noted by several authors (e.g., Bless, 1991; Gallagher, 1993; Jagt & Kennedy, 1994; Bardet et al., 1998; Kennedy & Jagt, 1998; Mulder, 1998) that marine deposits of latest Cretaceous age in the Maastrichtian type area and New Jersey share common taxa, both vertebrate and invertebrate. The vertebrate species include mosasaurid squamates, notably *Mosasaurus hoffmanni* Mantell, 1829 and *Plioplatecarpus marshi* Dollo, 1882, which are held to be conspecific with *M. maximus* Cope, 1869 and *P. depressus* (Cope, 1869), respectively (Kuypers et al., 1998; Mulder, 1999).

One of 'the rarest and least well-known of the mosasaurs' (Baird, 1986a; Holmes & Sues, 2000) is the basal taxon *Halisaurus platyspondylus* Marsh, 1869, to which until recently only isolated bones from strata of Maastrichtian age in the eastern United States could be referred. *Halisaurus platyspondylus* is characterised by dorsoventrally compressed vertebral centra. Furthermore, the synapophyses of the cervical

and anterior dorsal vertebrae are large in comparison to the breadth of the vertebral centra (Baird, 1986a, b; Holmes & Sues, 2000) (Fig. 1:1). The synapophyses of the cervicals extend notably below the centra (Holmes & Sues, 2000). At present, the only other undisputed species of the genus *Halisaurus* is *H. sternbergi* (Wiman) from the Santonian (Niobrara Chalk) of Kansas (Holmes & Sues, 2000).

From the St Pietersberg (Maastricht), Lingham-Soliar (1996) reported two 'probable *Halisaurus* vertebrae', which are housed in the Department of Palaeontology collections at the Natural History Museum (formerly British Museum [Natural History]), London, where they bear registration numbers NHM 42900 and NHM 44822 (see App. 1). Unfortunately, Lingham-Soliar (1996) did not discuss why he referred these specimens to *Halisaurus*. Therefore, confirmation of the supposed identity and provenance of *Halisaurus* in the Maastrichtian strata of the type area, as already hinted at by Kuypers et al. (1998), was desirable. Recently, Holmes & Sues (2000) described from the Severn Formation (Maastrichtian)

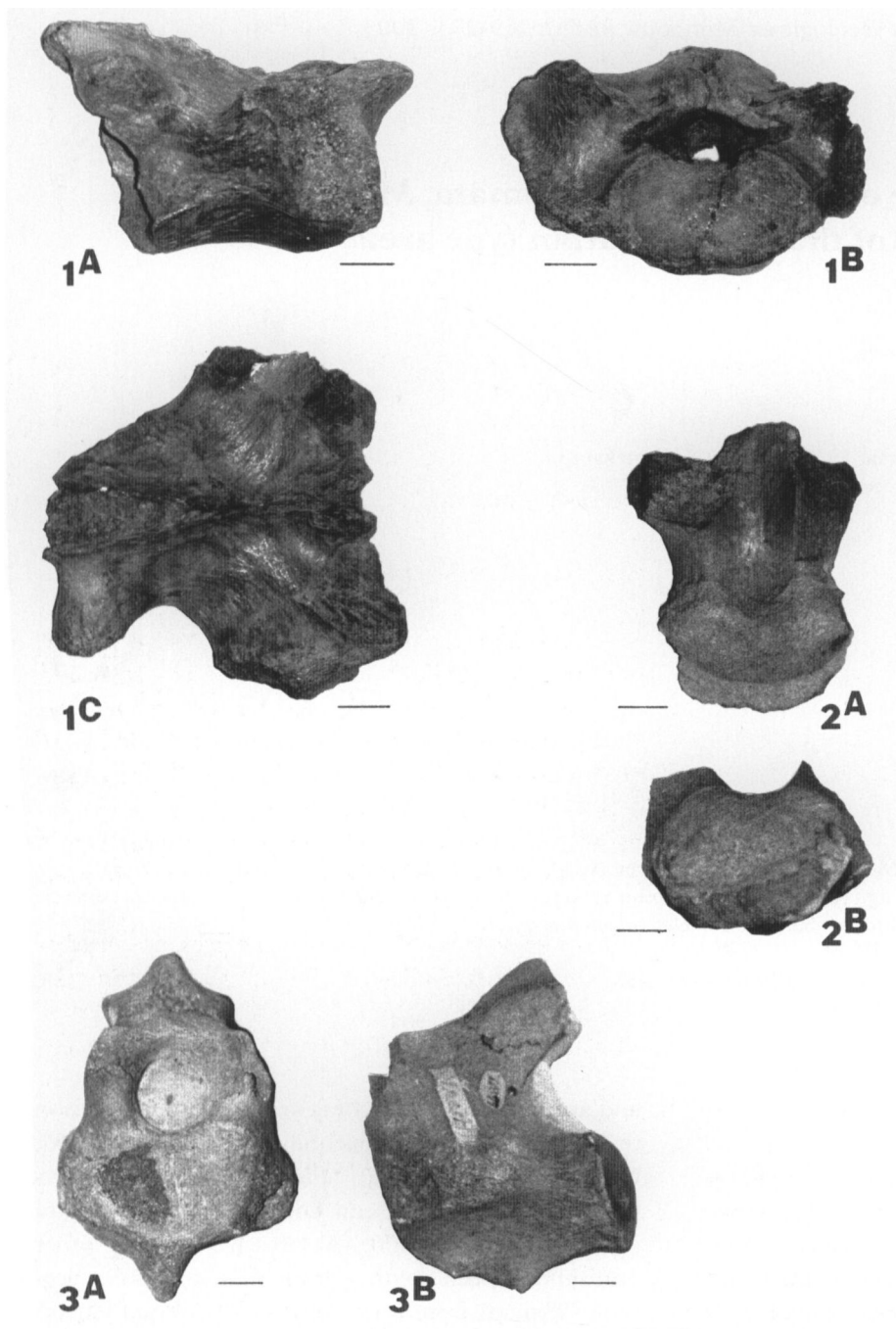


Fig. 1. Mosasaur vertebrae: 1 - *Halisaurus platyspondylus*, dorsal vertebra (ANSP 15316), in right lateral, cotylar, and dorsal views, respectively (compare Baird, 1986b, figs 1B1, 1B2, 1B4); 2 - plioplatecarpine mosasaur (*Plioplatecarpus*(?) sp.), cervical or anterior dorsal vertebra (NHM 42900), in dorsal and condylar views, respectively; 3 - *Plioplatecarpus* sp., cervical vertebra (NHM 44822), in cotylar and left lateral views, respectively. Scale bar equals 10 mm.

of Maryland the first specimen of *H. platyspondylus* to comprise associated cranial and postcranial material of a single individual. Also, Bardet & Pereda Suberbiola (2002) reported from the Maastrichtian Phosphates of Ruseifa, Jordan, an isolated tooth, referable to the genus as according to these authors.

In the present paper cervical and dorsal vertebrae of the Maryland specimen and a single *Halisaurus* dorsal vertebra (Academy of Natural Sciences Philadelphia collections, ANSP 15316 (see App. 1; Fig. 1.1)), are compared with NHM 42900, NHM 44822, as well as with vertebrae of *Plioplatecarpus marshi*, housed in the collections of Teylers Museum (Haarlem, the Netherlands) (see App. 1).

### Description of material

In their overall appearance and brownish colour the specimens considered do not differ from mosasaurid vertebrae from the Maastrichtian type area. Although Lingham-Soliar (1996, p. 133) stated that NHM 42900 and NHM 44822 were collected at the St Pietersberg (Maastricht), this is not confirmed by the accompanying labels, which merely mention 'Maastricht' as locality.

NHM 42900 is a fragmentary cervical or anterior dorsal vertebra, of which only the centrum is preserved. In the bottom of the neural canal, thus in dorsal position on the centrum, a rectangular foramen is

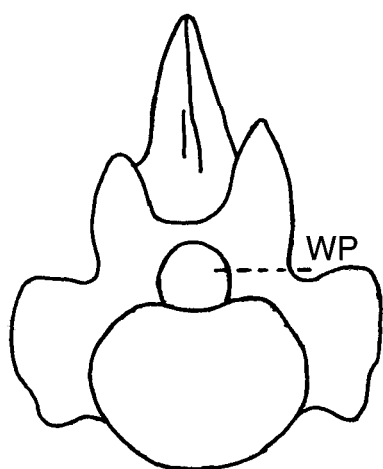


Fig. 2. Schematic cotylar view of a cervical vertebra of *Plioplatecarpus*; WP - width of pedicel.

visible. The condyle has a reniform outline and is slightly upturned (Fig. 1.2; compare Lingham-Soliar, 1996). The centrum length (as preserved) is 51 mm; the condylar width is 39 mm.

NHM 44822 is a cervical vertebra, of which the neural spine, prezygapophyses and synapophyses are almost completely broken off, or worn away (Fig. 1.3). The cotyle looks eroded. The bottom of the neural canal is not visible, because the canal itself is filled with indurated matrix. Centrum length: 44 mm; vertebral height: 62 mm; width of neural canal 12.5 mm; width of pedicels: 10.5 mm (see also Fig. 2).

## Discussion

In cervicals and anterior dorsals of *Halisaurus platyspondylus*, the pedicels are wider than the neural canal (Fig. 1.1) (Holmes & Sues, 2000). This phenomenon is quantified in Table 1 (Fig. 2).

In NHM 44822 the ratio between the width of the neural canal and the width of the pedicels differs from the same ratios in the cervicals of *Halisaurus* (see Table 1). The ratio in NHM 44822 is similar to that in *Plioplatecarpus marshi*. Here, the width of the pedicels of the cervicals and anterior dorsals comes close to the width of the neural canal (see Table 2).

Table 1. Ratio between width of the neural canal (WNCA) and width of the pedicels (WP; see also Fig. 2) of cervical vertebrae of *Halisaurus platyspondylus*, USNM 442450 (based on Holmes & Sues, 2000, fig. 7), as compared to WNCA/WP of NHM 44822.

| Vertebra           | WNCA/WP     |
|--------------------|-------------|
| <b>USNM 442450</b> |             |
| C3                 | 0.73        |
| C4                 | 0.64        |
| C5                 | 0.65        |
| C6                 | 0.52        |
| C7                 | 0.60        |
| <b>NHM 44822</b>   | <b>1.19</b> |

NHM 44822 shows a strong resemblance to cervicals of the last-mentioned species (Fig. 1.3). Halisaurine characters as mentioned earlier cannot be observed in the fragmentary synapophyses of NHM 44822.

Preservation of the other specimen, NHM 42900, is so fragmentary that no 'halisaurine' character can be observed. However, the rectangular foramen on the centrum suggests plioplatecarpine affinities. Furthermore, the condyle in this vertebra is not nearly dorsoventrally compressed enough for it to be assigned to *Halisaurus*, but is similar in proportions to a cervical vertebra of *Plioplatecarpus* (compare Holmes, 1996; Holmes & Sues, 2000).

It is therefore concluded, that the presence of *Halisaurus* in the latest Cretaceous of the Maastrichtian type area is not supported by either NHM 42900 or NHM 44822. The common occurrence of *Plioplatecarpus marshi* in the uppermost Cretaceous of the Maastrichtian type area has been observed ever since Dollo's brief description of the species (Dollo, 1882).

## Acknowledgements

I wish to thank Professor G.J. Boekschoten (Vrije Universiteit Amsterdam) and Dr J.W.M. Jagt (Natuurhistorisch Museum Maastricht), who critically read the typescript and made useful suggestions. I acknowledge the valuable comments made by Dr R.B. Holmes (Canadian Museum of Nature, Ottawa) and an anonymous reviewer. Furthermore, I extend my

Table 2. Measurements (in mm) of studied vertebrae of *Plioplatecarpus marshi* from the Maastrichtian type area; CL - centrum length; CW - centrum width; WNCA - width of neural canal (measured at condyle); WP - width of pedicel.

| Vertebra | CL   | CW   | WNCA | WP   | WNCA/WP |
|----------|------|------|------|------|---------|
| TM 11226 | 50.5 | 38.5 | 14.2 | 11.8 | 1.20    |
| TM 11318 | 53.5 | 40.8 | 14.2 | 13.2 | 1.07    |
| TM 11331 | 52.3 | 42.4 | 15   | 11.5 | 1.30    |
| TM 17246 | 48   | 37.8 | 15   | 12.3 | 1.21    |

best thanks to the following people for allowing access to museum collections and for assistance in various ways: S. Chapman (The Natural History Museum, London), Dr E. Benamy and E. Gilmore (both Academy of Natural Sciences Philadelphia) and J. van Veen (Teylers Museum, Haarlem).

## Appendix 1. Material studied

### Academy of Natural Sciences Philadelphia (ANSP)

ANSP 15316 - *Halisaurus platyspondylus*, dorsal vertebra; Phoebus Landing, North Carolina; Maastrichtian. From the same locality there is another, much smaller specimen bearing the same registration number.

### The Natural History Museum, London (NHM)

NHM 42900 - plioplatecarpine mosasaur, *Plioplatecarpus*(?) sp., fragmentary cervical or anterior dorsal vertebra; Maastrichtian type area (*ex* Van Breda Colln according to label). Specimen not listed in Lydekker (1888).

NHM 44822 - *Plioplatecarpus* sp., cervical vertebra; Maastrichtian type area. According to Lydekker (1888, p. 273), 'presented by B. Bright Esq., 1873', and listed as *Clidastes* sp.

### Teylers Museum, Haarlem (TM)

TM 11226 - *Plioplatecarpus marshi*, anterior dorsal vertebra; St Pietersberg, Maastricht; Late Maastrichtian (Maastricht Formation), *ex* P. Camper Colln.

TM 11318 - *Plioplatecarpus marshi*, anterior dorsal vertebra; St Pietersberg, Maastricht; Late Maastrichtian ('Craie à silex gris' [= Emael Member], Maastricht Formation).

TM 11331 - *Plioplatecarpus marshi*, fragmentary posterior cervical vertebra; St Pietersberg, Maastricht; Late Maastrichtian ('Craie à silex gris' [= Emael Member], Maastricht Formation), *ex* Henckelius Colln.

TM 17246 - *Plioplatecarpus marshi*, anterior dorsal vertebra; St Pietersberg, Maastricht; Late Maastrichtian (Maastricht Formation).

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