

# The first known femur of *Hylaeosaurus armatus* and re-identification of ornithopod material in The Natural History Museum, London

PAUL M. BARRETT

Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ

**SYNOPSIS.** The first known femur of the British Lower Cretaceous ornithopod dinosaur *Hylaeosaurus armatus* Mantell, 1833 is described. The status of *Camptosaurus valdensis* (Lydekker, 1889) is reviewed, and it is suggested that it might be senior synonym of *Valdosaurus canaliculatus* (Galton 1975).

## INTRODUCTION

The purpose of this brief paper is to report and describe the first recognised femur of the nodosaurid ankylosaur *Hylaeosaurus armatus* Mantell 1833, and to clarify the taxonomic position of several ornithopod specimens. The status of *Camptosaurus valdensis* (Lydekker 1889) is also reviewed and it is provisionally placed in synonymy with *Valdosaurus canaliculatus* (Galton 1975). Unless otherwise stated, all of the specimens described are of Wealden (Lower Cretaceous) age and are from the Isle of Wight, England. They belong to the Fox Collection housed in the Department of Palaeontology, The Natural History Museum, London (NHM; register numbers prefixed BMNH in this paper).

## SYSTEMATIC PALAEONTOLOGY

DINOSAURIA Owen 1841

ORNITHISCHIA Seeley 1887

THYREOPHORA Nopsca 1915, *sensu* Sereno 1986

ANKYLOSAURIA Osborn 1923

Family NODOSAURIDAE Marsh 1890

Genus *HYLAEOSAURUS* Mantell 1833a

**TYPE AND ONLY SPECIES.** *Hylaeosaurus armatus* Mantell 1833b; Lower Cretaceous (Upper Valanginian), East and West Sussex, southern England.

*Hylaeosaurus armatus* Mantell 1833

Fig. 1

1833b *Hylaeosaurus armatus* Mantell: 328.

**HOLOTYPE.** BMNH R3775, the anterior part of a skeleton embedded in a block of matrix.

**HORIZON AND LOCALITY.** Hastings Beds (Lower Wealden), Upper Valanginian, Lower Cretaceous (Rawson *et al* 1978). Tilgate Forest, Cuckfield, West Sussex, England.

**REFERRED MATERIAL.** As listed by Pereda-Suberbiola (1993) and BMNH R604k (now registered as BMNH R12555), the distal portion of a right femur.

**DESCRIPTION AND COMPARISON.** The distal portion of a large right femur (Fig. 1a), BMNH R604k (Dawson Collection), from the Wealden, near Hastings, East Sussex, may represent the first recognised femur of *Hylaeosaurus armatus*.

This specimen was originally identified as *Iguanodon* sp.<sup>1</sup> but was later referred to as a large individual of *Hypsilophodon foxii* (Huxley) by Molnar & Galton (1986). However, the femur is much more massive than that of *H. foxii*, and the absence of a marked anterior intercondylar groove suggests that it is not referable to *Iguanodon*. The absence of ridges running up the femoral shaft from the condyles supports the view that R604k is not referable to either of these genera. There is a marked posterior intercondylar groove and the lateral and medial condyles extend equal distances posteriorly from the femoral shaft. The lateral condyle is much more massive than the medial one, and there is a distinct 'step' between the medial condyle and the medial extremity of the femur (Fig. 1b). The femur bears a strong resemblance to that of the Oxfordian nodosaur *Cryptodraco eumerus* (Galton 1983) which also displays a 'step' between the medial condyle and the medial border of the femur. BMNH R604k can be distinguished from the femora of the other known Wealden nodosaur *Polacanthus foxii* (BMNH R175) by a number of features. For example, *Polacanthus* shows no 'step' medial to the medial condyle, and the medial condyle is more massive in *Polacanthus* than in BMNH R604k. It seems unlikely, therefore, that BMNH R604k is referable to *Polacanthus*. It is suggested that BMNH R604k is not ornithopod as previously supposed but thyreophoran, and the locality and the horizon from which the specimen was recovered suggests that it is referable to *Hylaeosaurus*. The relatively small size of the femur (only 83mm across the distal end) suggests that it belonged to a juvenile (W. Blows, pers. comm.). Unfortunately, due to the fragmentary nature of the specimen, this assignment can only be tentative. Nonetheless, the femur provides valuable information on the alleged synonymy of *Hylaeosaurus* and *Polacanthus* (Coombs 1971, Blows 1987, Coombs & Maryanska 1990, Pereda-Suberbiola 1991, 1993).

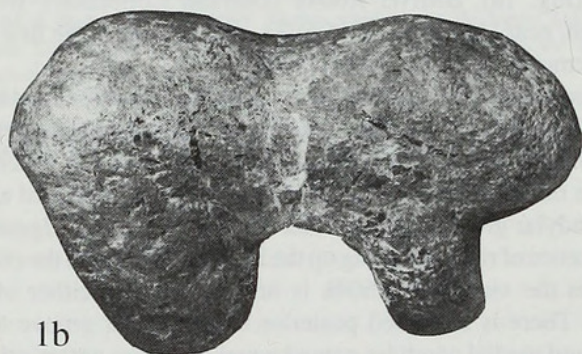
Coombs (1971) and Coombs & Maryanska (1990) suggested that

<sup>1</sup>Lydekker (1888) listed a number of specimens as BMNH R604a–e. These registered numbers include a number of theropod, ornithopod and ankylosaur remains, all of which come from the Wadhurst Clay near Hastings and are part of the Dawson Collection. The femur in question is labelled BMNH R604k. There is no record of this number in either Lydekker (1888) or in the accessions catalogues of the Natural History Museum (S. Chapman pers. comm.). The specimen label identified the femur as *Iguanodon* sp. from the Wadhurst Clay near Hastings.





1a



1b

**Fig. 1** *Hylaeosaurus armatus* Mantell. Right femur, distal end; BMNH R12555; **1a**, posterior view,  $\times 0.7$ ; **1b**, distal view (note the 'step' medial to the medial condyle),  $\times 0.8$ .

*Polacanthus* is a junior synonym of *Hylaeosaurus*. However, these authors claimed that no homologous elements are present in the holotype material of *Hylaeosaurus* and *Polacanthus* so the proposed synonymy was based largely on the similar geographical and stratigraphical distributions of these genera. In contrast, Blows (1987) suggested that the two genera are stratigraphically distinct, with *Hylaeosaurus* originating from the Hastings Beds (Valanginian) of East Sussex, whilst *Polacanthus* remains have been recovered from the Wessex Formation (Barremian) in the Isle of Wight. He also suggested that the arrangement of the dermal armour differs between the two genera.

Recently it has been proposed that the North American nodosaur *Hoplitosaurus* is a junior synonym of *Polacanthus* (Pereda-Suberbiola 1991, 1993). A specific separation, based on femoral characters, is retained to distinguish the British form (*P. foxii*) from the North American form (*P. marshi* Lucas, 1901). If these two genera are genuinely synonymous then a number of elements referred to *P.* (= *Hoplitosaurus*) *marshi* that were previously unknown in the holotype of *P. foxii* (e.g. humerus and scapula) can be used for comparison with *Hylaeosaurus*. Comparisons of the pectoral girdle, forelimb, hindlimb and dermal armour led Pereda-Suberbiola (1991, 1993) to the conclusion that *Hylaeosaurus* and *Polacanthus* were distinct genera.

If BMNH R604k does belong to *Hylaeosaurus*, this would provide another point of comparison between these two genera. The

characters listed above suggest that *Polacanthus* and *Hylaeosaurus* can be distinguished on femoral characters, adding weight to the arguments of Blows (1987) and Pereda-Suberbiola (1993). This specimen has been re-registered as BMNH R12555 in order to avoid confusion with other specimens allotted to BMNH R604, which contains a variety of other specimens from the same locality including *Iguanodon* remains (Lydekker 1888).

#### ORNITHOPODA Marsh 1881

Family **DRYOSAURIDAE** Milner & Norman 1984

Genus **VALDOSAURUS** Galton 1977

TYPE SPECIES. *Dryosaurus canaliculatus* Galton 1975; Lower Cretaceous (Valanginian–Barremian), West Sussex and Isle of Wight, southern England.

#### *Valdosaurus canaliculatus* (Galton 1975)

Fig. 2

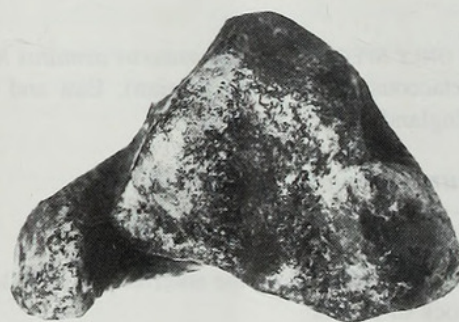
1975 *Dryosaurus?* *canaliculatus* Galton: 747.

1977 *Valdosaurus canaliculatus* (Galton); Galton: 231.

1982 *Valdosaurus canaliculatus* (Galton); Galton & Taquet: 147.



2a



2b

**Fig. 2** *Valdosaurus canaliculatus* (Galton). Left femur, proximal end, BMNH R12440; note the deep cleft and wide separation between the lesser and greater trochanters. **2a**, posteromedial view; **2b**, proximal view;  $\times 1$ .



**HOLOTYPE.** BMNH R184 and BMNH R185, associated left and right femora.

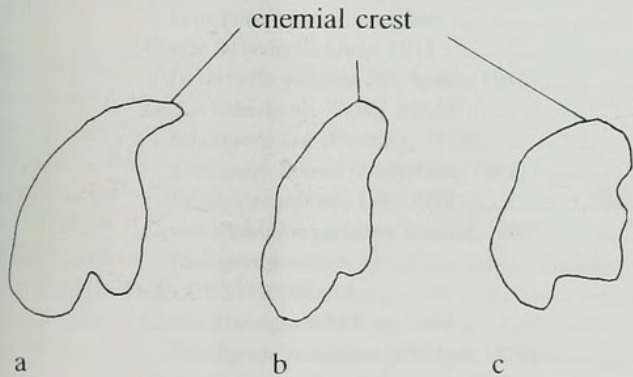
**HORIZON AND LOCALITY.** Hastings Beds, Upper Valanginian, Lower Cretaceous (Rawson *et al.* 1978). Tilgate Forest, Cuckfield, West Sussex, England. Wealden Shales, Barremian, Lower Cretaceous (Rawson *et al.* 1978), Isle of Wight, England.

**REFERRED MATERIAL.** Specimens listed by Galton (1975), Galton & Taquet (1982), BMNH R167 an incomplete left femur (see below) and BMNH R170 (now registered as BMNH R12440) the proximal portion of a right femur (see below).

DESCRIPTION AND COMPARISON

Lydekker (1888) referred a number of unassociated limb bone fragments (BMNH R170) to *Hypsilophodon foxii* (Huxley). Galton (1975) noted that two of the femoral fragments within BMNH R170 differed significantly from the majority of femora attributed to this genus. In *H. foxii* the distal end of the femur has a moderate posterior intercondylar groove and lacks an appreciable anterior intercondylar groove. Proximally, the lesser trochanter is separated from the greater trochanter by a narrow cleft (Galton 1974). Galton (1975) showed that the two specimens in question possess a distinct anterior intercondylar groove and he referred these specimens (now registered as BMNH R8420 and BMNH R8421) to *Valdosaurus* (= *Dryosaurus*) *canaliculatus*, a dryosaur from the Wealden of the Isle of Wight (Galton 1977, Galton & Taquet 1982). Examination of the specimens remaining within BMNH R170 has yielded a proximal femoral fragment (Fig. 2a) in which the lesser trochanter is separated from the greater trochanter by a deep cleft (Fig. 2b). This feature is characteristic of the Dryosauridae (*sensu* Sues & Norman 1990) and the locality and horizon from which the specimen comes suggests that it is referable to *Valdosaurus canaliculatus*, BMNH R12440. Several limb bone fragments attributable to *H. foxii* remain as BMNH R170.

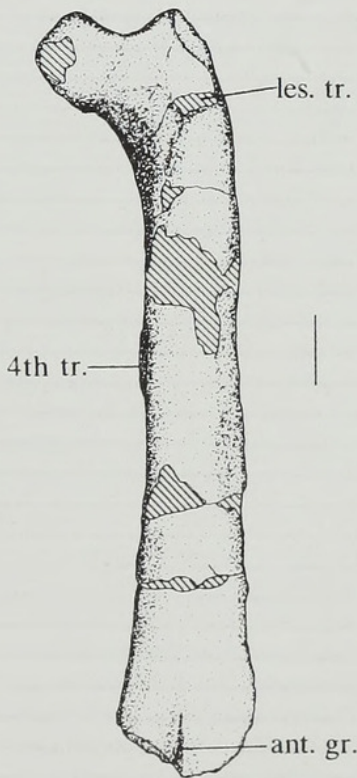
Galton (1975) suggested that a small right tibia (BMNH R124), previously listed as *Iguanodon* sp. (Lydekker 1888) was also referable to *H. foxii*. However, the form of the proximal end of BMNH R124 appears to be more similar to that of *Iguanodon* than to that of *H. foxii*. In *Iguanodon* the cnemial crest is longer than in *H. foxii*. In addition, the cnemial crest of *Iguanodon* swings laterally near its anterior margin (see Fig. 3). On the basis of these characters BMNH R124 is referred to *I. cf. atherfieldensis* Hooley. The small size of the specimen suggests that it belonged to a juvenile.



**Fig. 3** Proximal right tibiae; **3a, b**, *Iguanodon atherfieldensis* Hooley, 1924; **3a**, after Norman 1986, **3b**, BMNH R124; **3c**, *Hypsilophodon foxii* (Huxley), after Galton 1974; anterior is towards the top; drawings not to scale.

ON THE STATUS OF *CAMPTOSAURUS VALDENSIS* (Lydekker, 1889)

The femur BMNH R167 (Fig. 4) has proved something of an enigma. Lydekker (1888) listed it as *H. foxii*, but suggested that it may represent a distinct species of *Hypsilophodon* due to its greater size. Later, Lydekker (1889) suggested that BMNH R167 shared a number of similarities with the femur of his new species *Camptosaurus leedsi*, and he designated BMNH R167 the holotype of another new species, *Camptosaurus valdensis*. However, Gilmore (1909) noted several differences between *C. valdensis* and the North American *Camptosaurus dispar* Marsh, 1879 (the type species of the genus). For example, the fourth trochanter of *C. dispar* is situated on the distal half of the femoral shaft, whilst in *C. valdensis* the fourth trochanter is more proximally placed. Galton (1974) suggested that this and several other features indicated that BMNH R167 was not referable to *Camptosaurus*, but was in fact a large specimen of *H. foxii*. The use of *C. leedsi* as a representative specimen for *Camptosaurus* was also in error. Galton (1980) showed that the holotype of *C. leedsi* (a femur, BMNH R1993) differs from North American *Camptosaurus* in lacking a deep anterior intercondylar groove and by having a proximally placed fourth trochanter. Due to these and other features, Galton (1980) made *Camptosaurus leedsi* the type species of a new genus *Callovosaurus*, which is now regarded as *Camptosauridae nomen dubium* (Norman & Weishampel 1990). Placing *Camptosaurus valdensis* is difficult as the areas that provide most of the features used in distinguishing between ornithopod femora, the form of the distal end and the shape and position of the lesser trochanter, are either missing or badly damaged. Sues & Norman (1990), in their recent review of the Hypsilophodontidae, regard BMNH R167 as *Hypsilophodontidae nomen dubium*. It is suggested here that *Camptosaurus valdensis*



**Fig. 4** *Camptosaurus valdensis* (Lydekker, 1889). BMNH R167, anterior view, showing the anterior intercondylar groove; abbreviations: ant.gr. = anterior intercondylar groove, les.tr. = position of lesser trochanter, 4th tr. = fourth trochanter; scale bar = 20 mm.



(Lydekker, 1889) may be a senior synonym of the dryosaur *Valdosaurus canaliculatus* (Galton, 1975), as the beginnings of a marked intercondylar groove can be seen on the anterior face of the distal end of the femoral shaft (*contra* Galton 1974). This assignment is tentative as many diagnostic features are lacking on the specimen.

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## REFERENCES

- Blows, W.T.** 1987. The armoured dinosaur *Polacanthus foxii* from the Lower Cretaceous of the Isle of Wight. *Palaeontology*, **30** (3): 557–580.
- Coombs, W.P.** 1971. The Ankylosauria. Ph.D. thesis (unpublished), University of Columbia, 487pp.
- & **Maryanska, T.** 1990. Ankylosauria. In Weishampel, D.B., Dodson, P. & Osmolska, H. (Eds.) *The Dinosauria*. University of California Press, Berkeley: 456–483.
- Galton, P.M.** 1974. The ornithischian dinosaur *Hypsilophodon* from the Wealden of the Isle of Wight. *Bulletin of the British Museum (Natural History), Geology*, **25**: 1–152.
- 1975. English hypsilophodontid dinosaurs (Reptilia; Ornithischia). *Palaeontology*, **18**: 741–752.
- 1977. The ornithopod dinosaur *Dryosaurus* and a Laurasia – Gondwanaland connection in the Upper Jurassic. *Nature*, **268**: 230–232.
- 1980. European Jurassic ornithopod dinosaurs of the families Hypsilophodontidae and Camptosauridae. *Neues Jahrbuch für Geologie und Paläontologie. Stuttgart. Abhandlungen*, **160**: 73–95.
- 1983. Armoured dinosaurs (Ornithischia; Ankylosauria) from the Middle and Upper Jurassic of Europe. *Palaeontographica A*, **182**: 1–25.
- & **Taquet, P.** 1982. *Valdosaurus*, a hypsilophodontid dinosaur from the Lower Cretaceous of Europe and Africa. *Geobios*, **15**: 147–159.
- Gilmore, C.W.** 1909. Osteology of the Jurassic reptile *Camptosaurus*, with a revision of the species of the genus, and a description of two new species. *Proceedings of the United States National Museum*, **36**: 197–332.
- Lydekker, R.** 1888. *Catalogue of the Fossil Reptilia and Amphibia in the British Museum; Part I*. British Museum (Natural History), London. 309pp.
- 1889. On the remains and affinities of five genera of Mesozoic reptiles. *Quarterly Journal of the Geological Society of London*, **45**: 41–59.
- Mantell, G.A.** 1833a. Observations on the remains of the *Iguanodon*, and other fossil reptiles, of the strata of Tilgate Forest in Sussex. *Proceedings of the Geological Society of London*, **1**: 410–411.
- 1833b. *The Geology of the South-East of England*. Longman, London. xix + 376pp.
- Molnar, R.E. & Galton, P.M.** 1986. Hypsilophodontid dinosaurs from Lightning Ridge, New South Wales, Australia. *Geobios*, **19**: 231–239.
- Norman, D.B.** 1986. On the anatomy of *Iguanodon atherfieldensis* (Ornithischia; Ornithopoda). *Bulletin de l'Institut Royal des Sciences naturelles de Belgique: Sciences de la Terre*, **56**: 281–372.
- & **Weishampel, D.B.** 1990. Iguanodontidae and related ornithopods. In Weishampel, D.B., Dodson, P. & Osmolska, H. (Eds.) *The Dinosauria*. University of California Press, Berkeley: 510–533.
- Pereda-Suberbiola, J.** 1991. Nouvelle evidence d'une connexion terrestre entre Europe et Amerique du Nord au Cretace inferieur: *Hoplitosaurus*, synonyme de *Polacanthus* (Ornithischia; Ankylosauria). *Comptes Rendus de l'Academie de Sciences de Paris (Series 2)*, **313**: 971–976.
- 1993. *Hylaeosaurus*, *Polacanthus*, and the systematics and stratigraphy of Wealden armoured dinosaurs. *Geological Magazine*, **130**: 767–781.
- Rawson, P.F., Curry, D., Dilley, F.C., Hancock, J.M., Kennedy, W.J., Neale, J.W., Wood, C.J. & Worssam, B.C.** 1978. A correlation of Cretaceous rocks in the British Isles. *Geological Society of London, Special Report*, **9**: 1–70.
- Sues, H.-D. & Norman, D.B.** 1990. Hypsilophodontidae, *Tenontosaurus*, Dryosauridae. In Weishampel, D.B., Dodson, P. & Osmolska, H. (Eds.) *The Dinosauria*. University of California Press, Berkeley: 498–509.



Barrett, Paul M. 1996. "The first known femus of *Hylaeosaurus armayus* and re-identification of orthithopod material in the natural History Museum, Lomndon." *Bulletin of the Natural History Museum. Geology series* 52, 115–118.

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