

Anatomy and Systematics of the Rhomaleosauridae (Sauropterygia: Plesiosauria)

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“...The pliosaurs were probably the most terrifying marine predators that ever lived...Were it not for the fossil evidence that unquestionably demonstrates their existence, they would surely be relegated to the realm of nightmares.”

Richard Ellis, 2003



A Victorian restoration of the ferocious pliosaur, *Rhomaleosaurus cramptoni*

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Declaration

The work in this thesis was carried out in accordance with the regulations of the National University of Ireland, University College Dublin. This work is original, except where indicated by special reference.

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Adam Stuart Smith

Thursday 1st November 2007

Abstract

Specimen NMING F8785, a large pliosaur from the Toarcian of Yorkshire, is the holotype of the genus *Rhomaleosaurus* and the family Rhomaleosauridae. The skull of this specimen was prepared, allowing a detailed description to be presented. A strong ectopterygoid boss in *Rhomaleosaurus* would have been covered by a cartilaginous sheath in life, and abutted against the medial wall of the mandible. The first ever, full-body reconstruction of a rhomaleosaurid plesiosaur, *Rhomaleosaurus*, shows that the body of this animal is dorso-ventrally flattened and that there is very little curvature along the vertebral column, except for the pectoral and anterior dorsal regions. Many aspects of the postcranial skeleton are robust and reinforced. There is a notable change in the proportions of the terminal caudal vertebrae in *Rhomaleosaurus*, associated with an irregular vertebra indicating the presence of a vertical caudal fin in this taxon.

The anatomical data collected from this specimen, and a number of additional Lower Jurassic pliosaur specimens from the UK and Germany, is incorporated into the first detailed phylogenetic and morphometric analyses dedicated to pliosaurs. Based on the results of the cladistic analyses, the Pliosauroida forms a monophyletic group in a sister relationship with Plesiosauroida. Three groups are resolved within the Pliosauroida: the Rhomaleosauridae, Leptocleidoidea and Pliosauridae. The genus *Rhomaleosaurus* contains three species, all from the Toarcian of the UK. These include NMING F8785, the holotype of the species *Rhomaleosaurus cramptoni*; BMNH R4853, the holotype of *Rhomaleosaurus thorntoni*; and YORYM G503, the holotype of *Rhomaleosaurus zetlandicus*. Specimen WM 852.S, the holotype of *Rhomaleosaurus propinquus*, is referred to *Rhomaleosaurus cramptoni*. '*R*'. *megacephalus* and '*R*'. *victor* do not belong to *Rhomaleosaurus sensu stricto* and they are removed from this genus.

'*R*'. *megacephalus* is referred to *Eurycleidus* and '*R*'. *victor* represents a novel genus. Specimen LEICS G221.1851 was erected as the neotype of '*R*'. *megacephalus* by Cruickshank (1992b), but this neotype status is rejected because existing casts of the original holotype are valid. This specimen is here referred to *Eurycleidus* sp., A new species of *Eurycleidus* (diagnosed by an elongate mandibular symphysis) is introduced for specimen WARMS G10875 based on the cladistic analysis and morphometric analyses. The genera *Macroplata* and *Archaeonectrus*

are both valid monospecific taxa within the Rhomaleosauridae, diagnosed by a number of autapomorphies. The following pliosauroid taxa are also supported by the morphometric analysis and/or cladistic analysis: *Attenborosaurus*, *Sthenarosaurus*, *Hauffiosaurus*, '*P*' *longirostris*, and an unnamed taxon represented by specimen BMNH 49202. '*Plesiosaurus*' *macrocephalus* represents a juvenile rhomaleosaurid plesiosaur. *Simolestes* resolves as a derived pliosaurid rather than a derived rhomaleosaurid, indicating that a spatulate rostrum is a convergent character amongst pliosauroids. *Maresaurus* resolves as a rhomaleosaurid and therefore represents the youngest member of this clade.

The descriptions and figures presented in this thesis represent the first detailed descriptions of many specimens and provide new information on the anatomy of rhomaleosaurid pliosaurs. Characters shared by many rhomaleosaurid taxa include a dorsal triangular flange of the maxilla, which extends between the orbit and the external naris; a large ectopterygoid that contacts the suborbital vacuity anteriorly; small semi-circular lateral palatine vacuities and large suborbital vacuities; plate-like developments below the basicranium incorporating squared lappets at the base of the quadrate-pterygoid flange; and a medial bump on the retroarticular process. A large dorso-medial foramen situated between the external nares, is restricted to *Rhomaleosaurus*. The identification of gastroliths in *Rhomaleosaurus* confirms that this taxon ingested stones. In conclusion, this thesis provides a greater understanding of the anatomy, diversity and variation in Lower Jurassic pliosauroids and presents the first detailed systematic framework for the Rhomaleosauridae.