

## The age and identity of an ichthyosaur reputedly from the Purbeck Limestone Group, Lower Cretaceous, Dorset, southern England

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### ABSTRACT

Ichthyosaurs are widespread in Mesozoic marine sequences. The marginal marine to terrestrial strata of the Cretaceous Purbeck Limestone Group of Dorset are an unlikely source for the remains of such animals. A specimen in the collections of the Oxford University Museum of Natural History, acquired in the nineteenth century, is recorded as collected from these strata. Despite the suggestion that this specimen might represent a relict taxon of a much earlier lineage in the evolution of ichthyosaurs [Delair, J.B., 1969. The first record of the occurrence of ichthyosaurs in the Purbeck. *Proceedings of the Dorset Natural History & Archaeological Society* 90, 128–132], its age and source have not been questioned. A comprehensive investigation of the matrix, including a palynological study, confirms a Purbeck Limestone Group origin for the specimen. Reassessment of the preserved postcranial skeleton provides evidence that the specimen, though strictly indeterminate, is consistent with attribution to a juvenile of an ophthalmosaurid such as *Brachypterygius*. The ‘notched’ phalanx previously considered to be ‘primitive’ is an artefact of damage to the specimen, either as the slab broke away from the cliff or shore, or during collection and subsequent preparation.

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### 1. Introduction

Ichthyosaurs, though abundant in Upper Jurassic Kimmeridgian strata, are rare in Portland Group (Tithonian) sediments and are very rare in the strata between these beds and those of the Middle Cretaceous, most records being from Germany, Russia and South America (Delair, 1969; McGowan and Motani, 2003, fig. 10). However a partial skeleton of an ichthyosaur (Fig. 1) identified as having come from ‘Purbeck Swanage’ in the collections of the Oxford University Museum (OUM J.13795) was fully described by Delair (1969). Delair regarded the specimen as indeterminate, but reported two features that were unexpected in a Late Jurassic ichthyosaur, namely that some of the phalangeal elements were rectangular, and that one appeared to exhibit a deep anterior notch. Delair noted that the rectangular and notched phalanges were unlike those of the late Callovian–Kimmeridgian ophthalmosaurs *Ophthalmosaurus* and *Macropterygius* (now regarded as a *nomen dubium* by Maisch and Matzke, 2000, p. 87, and McGowan and Motani, 2003, p.129) and resembled those of more primitive

ichthyosaurs such as the Liassic *Eurypterygius*. The rectangular phalanges bore a resemblance to those of the Kimmeridgian *Brachypterygius*, which lacked the anterior notches. Delair concluded that the specimen might represent a separate lineage from the other, better-known Late Jurassic ichthyosaurs.

Since Delair’s description, no mention of OUM J.13795 has been made in any published work. Neither the specimen nor Delair’s original paper are discussed by Maisch and Matzke (2000) or by McGowan and Motani (2003), the most recent comprehensive reviews of the Ichthyopterygia. However it is clear from the cladistic analysis and stratigraphic distributions given by McGowan and Motani (2003) that Delair’s observations remain valid. Only one indeterminate ichthyosaur with notched phalanges is known from post-Toarcian rocks namely *Chacaicosaurus cayi* from the Bajocian of Argentina. Only a few post-Toarcian ichthyosaur genera, including *Brachypterygius* and *Platypterygius*, have significant numbers of rectangular phalanges.

Unfortunately, the information content of the inscription, ‘Purb. Swanage’, on the specimen is limited and ambiguous. The term ‘Purb.[eck]’, while more likely to refer to the strata from which it came, might refer to the broader locality, ‘The Isle of Purbeck’ in which Swanage is situated. If this were the case, the Isle of Purbeck has, in addition to the Purbeck Limestone Group, exposures of both

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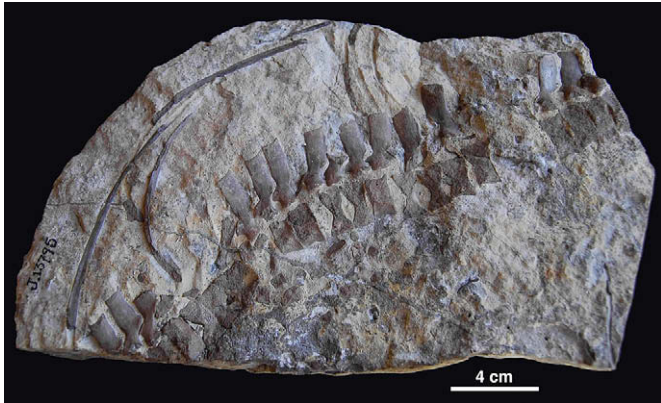


Fig. 1. Ophthalmosauridae *incertae sedis* OUM J.13795, Purbeck Limestone Group, Lower Cretaceous; 'Swanage', Dorset, England.

the Kimmeridge Clay Formation and the Portland Group. Even if the Purbeck assignment is correct, there are some 115 m of Purbeck Limestone Group strata, from which the specimen might have come, exposed on the coast and in the quarries around Swanage. Because of these ambiguities, it was felt that the specimen merited re-evaluation along with the sediments in which it is embedded.

The specimen and samples referred to in this paper are housed in the collections of the Oxford University Museum of Natural History, prefixed OUM.

## 2. Background to the study and history of the specimen

In recent years, most of the tetrapod fauna of the Purbeck Limestone Group has been reviewed and revised. The volume edited by Milner and Batten (2002) included comprehensive descriptions or revisions of the amphibian (Evans and McGowan, 2002), lepidosaur (Evans and Searle, 2002), crocodile (Salisbury, 2002), dinosaur (Milner, 2002; Norman and Barrett, 2002), and mammal (Sigogneau-Russell and Kielan-Jaworowska, 2002) taxa from the Isle of Purbeck. An earlier review of the pterosaurs (Howse and Milner, 1995) and later reviews of the turtles (Milner, 2004) and their isolated osteoderms (Barrett et al., 2002) has meant that the only remaining unrevised tetrapod groups are the ichthyosaurs and plesiosaurs. The aim of this work is a reassessment of the only ichthyosaur specimen reported from the Purbeck Limestone Group (Delair, 1969). An integral part of this reassessment has been an analysis of the matrix of the specimen, in order to provide an accurate date for the specimen, improving the quality of the data held by the OUM, and enhancing the research value of this specimen. This study required the sampling of the matrix of the specimen for destructive analysis for microflora and fauna.

Research by one of us (P.A.J.) at the OUM has revealed that the specimen was inscribed in Indian ink directly onto the back of the slab (Fig. 2), in the hand of either William Buckland, or Mary his wife. This suggests that the specimen had arrived in the OUM during the first half of the nineteenth century. The specimen is not referred to in any of Buckland's accounts. There is no evidence that the specimen has been faked, and in any case, at the time when it was recovered, the presence or absence of a fossil ichthyosaur in the Purbeck strata would have seemed unremarkable to those studying such remains. The available data points to acquisition during the first half of the nineteenth century from Swanage in Dorset.

## 3. Stratigraphy of the Purbeck Limestone Group

Central to the discussion within this paper, is the stratigraphic framework provided by the Purbeck Limestone Group of south



Fig. 2. Handwritten inscription, 'Purb. Swanage', on the reverse of OUM J.13795. A, Image taken in natural light; B, Image taken in ultraviolet light.

Dorset, UK – principally as seen at the type section of the Group at Durlston Bay. Ensom (2002) has shown that there is lack of total agreement as to the stratigraphic classification for this Group of rocks. This short section and accompanying table (Table 1) shows the framework we have adopted here.

For Durlston Bay, we have used Clements' (1993) description and bed numbers (DB numbers in the text). In the table, column 7, the DB numbers are for the bases of the lithostratigraphic units given – as far as is appropriate.

The old, and now redundant, tripartite "Lower", "Middle" and "Upper" divisions are shown in column 8 of the table. These traditional divisions are still widely quoted in the literature (and herein), principally because of the need to quote early authors. There is a particular problem about the definition of the base of the "Middle Purbeck Beds" – particularly at Durlston Bay. This is fully discussed in Clements (1993) – and is indicated by the query symbol in column 7 of the table. We would recommend using the lower limit.

There remain problems (and therefore uncertainties) about the correlation of the Jurassic/Cretaceous boundary across the Tethyan (the standard) and Boreal realms, and between marine (standard) and non-marine successions (see discussion by Rawson, 2006). Within the Purbeck Limestone Group, the Boreal Volgian/Ryazanian boundary seems to remain reasonably drawn where Casey (1963) put it – at the base of the Cinder Bed Member. The Tethyan-related Tithonian/Berriasian boundary is placed with reasonable confidence near the base of the Group, but following Hunt (2004) we have indicated a range of uncertainty in columns 1 and 2 of the table. No great weight should be attached to the position shown for the Berriasian/Valanginian (and Ryazanian/Valanginian) boundary – merely that it is thought to lie above the Purbeck Limestone Group (see Rawson, 2006). The current consensus is that the Purbeck Limestone Group is largely Berriasian (Lower Cretaceous) in age.

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