REMAINS OF AN ORNITHISCHIAN DINOSAUR IN A PLIOSAUR FROM THE KIMMERIDGIAN OF ENGLAND

by MICHAEL A. TAYLOR, DAVID B. NORMAN *and* ARTHUR R. I. CRUICKSHANK

ABSTRACT. A specimen of the Kimmeridgian pliosaur *Pliosaurus brachyspondylus* includes three elements which do not appear to be plesiosaurian. A pair of left and right dermal scutes are ascribed to an unidentified armoured thyreophoran ornithischian dinosaur, and a single fragment is less definitely ascribed to the same animal. It is presumed that the pliosaur had been scavenging a dinosaur corpse shortly before its own death, and that the scutes were transported inside the pliosaur's stomach. This hypothesis cannot be verified because the pliosaur skeleton was severely disarticulated before burial, and partly destroyed before collection.

IN 1980 the skull, mandible and some other bones of a large Kimmeridgian pliosaur *Pliosaurus brachyspondylus* were discovered in the *Aulacostephanus eudoxus* Zone of the Lower Kimmeridge Clay, Lower Kimmeridgian Stage, Upper Jurassic, in the Blue Circle Company's claypit at Westbury, Wiltshire. The animal, known as the 'Westbury Pliosaur', was briefly announced at the time of discovery (Crane 1980) and has now been placed on public display after lengthy preparation and mounting (Swansborough 1989; Taylor 1989). This paper describes, and attempts to identify, three anomalous dermal scutes found with the pliosaur which is itself described by Taylor and Cruikshank (in press).

MATERIAL

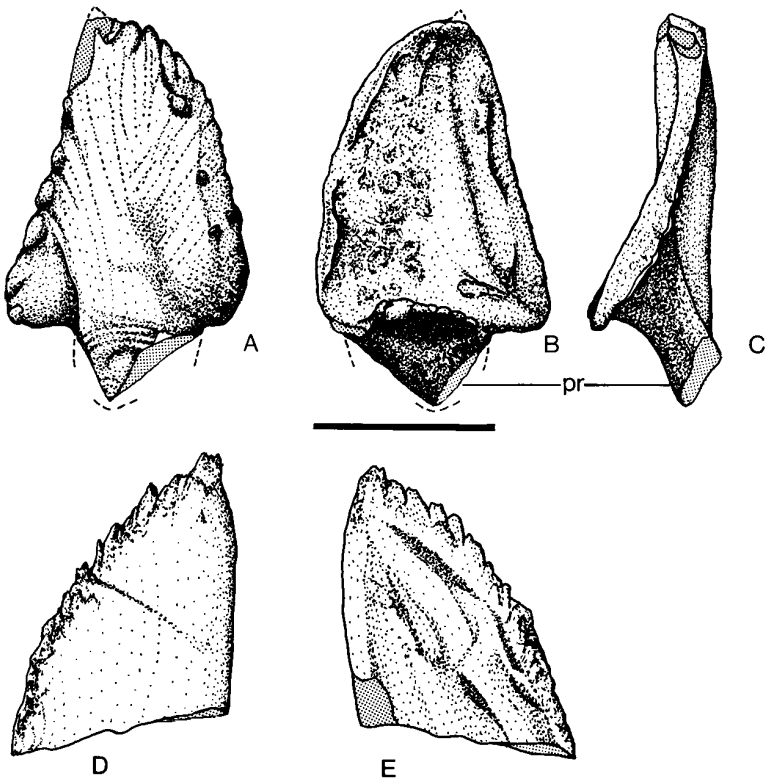
The three bones appear to be dermal scutes, from their texture and the apparent lack of articular or sutural faces, at least in the case of the complete pair. However, dermal scutes have never been reported in plesiosaurs, although many complete skeletons have been found from Jurassic and Cretaceous strata. We consider these bones far more likely to be from another animal, probably a thyreophoran dinosaur. As dinosaurs of any kind are scarce in British Jurassic marine sediments, we think these scutes worthy of report, although we have been unable to identify the original dinosaur.

The material is housed in the Geology Section, Bristol City Museum and Art Gallery (abbreviation BRSMG), Queens Road, Bristol BS8 1RL, UK.

Description. Two of the three bones form a symmetrical pair, identical except for their left- and right-handedness. One (BRSMG Cc332eu) is crushed, but the other (BRSMG Cc332j) is uncrushed and almost intact (Text-figs 1A–C, 2A–C). The latter is a broadly triangular bone, concave internally. The convex exterior surface bears a flat process (pr) merging into the remainder of the bone. This process is damaged in BRSMG Cc332j. Neither bone bears any evidence of a joint with another bone, and appears instead to have been a scute embedded in the dermis, as suggested by the roughening around and within the internal concavity. We identify these scutes as a pair from opposite sides of the original animal.

The third bone is a single isolated fragment (BRSMG Cc332du; Text-figs 1D–E, 2D–E). It appears to be the tip of a flat, narrow bone. Its maximum thickness, as preserved, is about 4 mm. One side

[Palaeontology, Vol. 36, Part 2, 1993, pp. 357–360.] © The Palaeontological Association

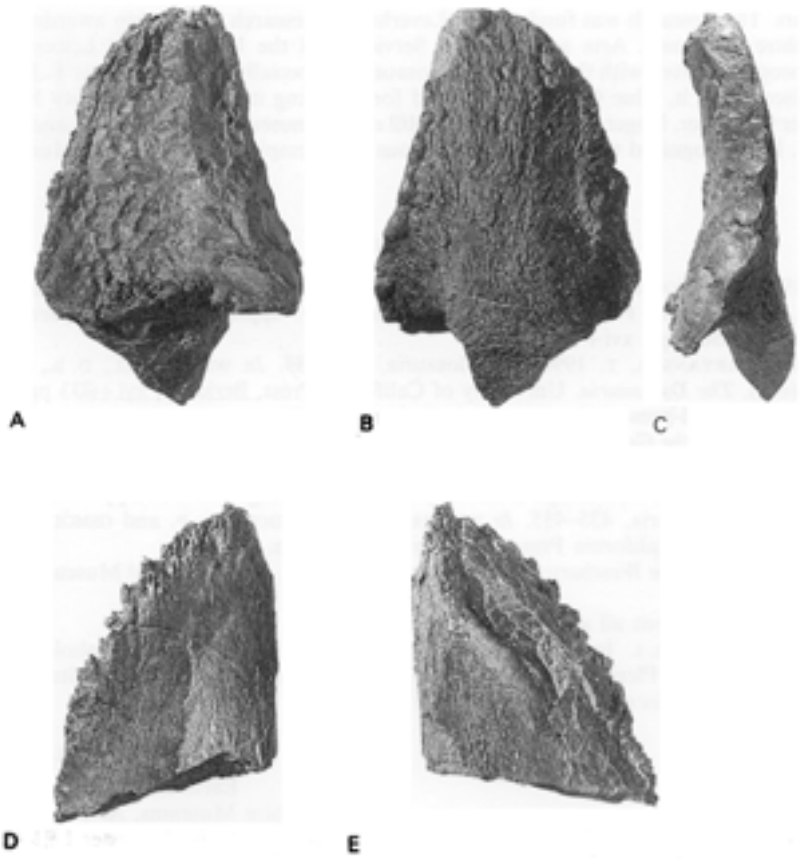


TEXT-FIG. 1. Presumed thyreophoran dinosaur dermal scutes; Kimmeridgian; Westbury, England. A–C, BRSMG Cc332j, one of a handed pair; A, presumed external surface; pr, process; B, presumed internal surface; C, side view. D–E, BRSMG Cc332du, isolated fragment. Scale bar = 50 mm.

is smooth but the other is irregular. It tapers obliquely to a thin, irregular edge which appears to be textured as if to attach to dermis. We are uncertain of its provenance but provisionally identify it as a fragment of dermal scute. We cannot rule out the possibility that it is a fragment of pliosaur bone, possibly one with pathological texture, especially as the snout and parietal crest of the pliosaur show regions of pathological bone growth.

Taphonomy. The taphonomy of the pliosaur is not fully understood, and much of the skeletal association appears to have been destroyed before discovery. Even if the single broken bone is indeterminate, we have to account for the presence of paired left and right scutes. These must have travelled together to the site, probably in the same piece of dinosaur hide. It is conceivable that they fell from a drifting carcass, and landed accidentally on the pliosaur's burial spot. We think this extremely improbable. It seems far more likely that the scutes travelled to the burial spot inside the pliosaur, which had been scavenging a drifting dinosaur carcass.

One of the paired scutes (BRSMG Cc332eu) was found and still remains crushed into the dorsal surface of the palate inside the left orbit of the pliosaur, while the location of the other (BRSMG Cc332j) was not recorded. The single element (BRSMG Cc332du) was found loose between the disarticulated skull and mandible, which lay a few metres apart (BRSMG Geology Section archives). The precise location of the scutes is not, however, significant as they would in any case



TEXT-FIG. 2. Presumed thyreophoran dinosaur dermal scutes; Kimmeridgian; Westbury, England. A–C, BRSMG Cc332j, one of a handed pair; A, presumed internal surface; B, presumed external surface; C, side view. D–E, BRSMG Cc332du, isolated fragment. All ×0·5.

have been displaced during the decomposition and subsequent disturbance of the pliosaur skeleton. The external texture of the scutes reveals no evidence of etching by stomach acids, but the bone could have been protected by its dermal cover.

Identification. Amongst large reptiles known to us from the Kimmeridgian of Europe, only the crocodilians and the thyreophoran dinosaurs had dermal scutes. We do not consider these scutes to be crocodilian, because they lack the typical indented waffle-like pattern. The scutes, on the other hand, resemble in basic form the known dermal armours of thyreophoran dinosaurs such as stegosaurs and ankylosaurs (e.g. reviews by Carpenter 1990; Coombs and Maryańska 1990; Dong 1990; Galton 1990). The paired elements bear some resemblance to cervical scutes of known forms, in having a broad base and separate but ill-defined process. The single fragment could be part of the base of a longer spine, as is known in the tail of stegosaurs. We have been unable to match them precisely with any known forms, so they may come from a novel taxon. However, British Jurassic thyreophoran dinosaurs are relatively poorly known, and we cannot rule out the possibility that the scutes come from a previously undiscovered portion of a described taxon. It is not justifiable to erect a new taxon on these scutes, and we therefore ascribe them to an undetermined thyreophoran ornithischian, presumably an ankylosaur or stegosaur.

Acknowledgements. This research was funded by a Leverhulme Research Fellowship awarded to M.A.T. We thank Leicestershire Museums, Arts and Records Service, and the University of Leicester, for support. Amongst many people involved with the Westbury pliosaur, we especially thank Professor T. Birkelund and his colleagues for discovering it, Blue Circle Cement Ltd for donating it to the Bristol City Museum and Art Gallery, and Peter Crowther, Roger Clark and David Hill of that museum for access, help and producing Text-figure 2. M.A.T. first recognized the scutes as anomalous when employed by the Area Museum Council for the South West.

REFERENCES

CARPENTER, K. 1990. Ankylosaur systematics: example using *Panoplosaurus* and *Edmontonia*. 281–298. *In* CARPENTER, K. and CURRIE, P. J. (eds). *Dinosaur systematics: approaches and perspectives*. Cambridge University Press, Cambridge, xvi + 318 pp.

COOMBS, W. P. and MARYAŃSKA, T. 1990. Ankylosauria. 456–483. *In* WEISHAMPEL, D. B., DODSON, P. and OSMÓLSKA, H. (eds). *The Dinosauria*. University of California Press, Berkeley, xvi + 733 pp.

CRANE, M. D. 1980. A well-preserved pliosaur skull from the Kimmeridge Clay (Jurassic) of Westbury, Wiltshire. *Newsletter of the Geological Curators' Group*, **2**, 619.

DONG, Z.-M. 1990. Stegosaurs of Asia. 255–268. *In* CARPENTER, K. and CURRIE, P. J. (eds). *Dinosaur systematics: approaches and perspectives*. Cambridge University Press, Cambridge, xvi + 318 pp.

GALTON, P. M. 1990. Stegosauria. 435–455. *In* WEISHAMPEL, D. B., DODSON, P. and OSMÓLSKA, H. (eds). *The Dinosauria*. University of California Press, Berkeley, xvi + 733 pp.

SWANSBOROUGH, S. A. 1989. *The Westbury pliosaur. A Jurassic 'Jaws'*. City of Bristol Museum and Art Gallery, Bristol, 9 pp.

TAYLOR, M. A. 1989. Sea-dragons all aswim. *Nature*, **338**, 381.

—— and CRUICKSHANK, A R. I. In press. Cranial anatomy and functional morphology of *Pliosaurus brachyspondylus* (Reptilia: Plesiosauria) from the Upper Jurassic of Westbury, Wiltshire. *Philosophical Transactions of the Royal Society of London, Series B.*

MICHAEL A. TAYLOR
Earth Sciences Section
Leicestershire Museums, Arts and Records Service
96 New Walk, Leicester LE1 6TD, UK

DAVID B. NORMAN
Sedgwick Museum
Cambridge University
Cambridge CB2 3EQ, UK

ARTHUR R. I. CRUICKSHANK
72 Thirlmere Road
Hinkley
Leicestershire LE10 0PF, UK

Typescript received 25 January 1992
Revised typescript received 16 July 1992