

Reptiles from the Upper Kimmeridge Clay (Kimmeridgian, Upper Jurassic) of the vicinity of Egmont Bight, Dorset

MICHAEL ALAN TAYLOR

Area Museum Council for the South West, City of Bristol Museum and Art Gallery,
Queen's Road, Bristol BS8 1RL

and

MICHAEL J. BENTON

Department of Geology, The Queen's University of Belfast, Belfast BT7 1NN, Northern Ireland.

published 1986

ABSTRACT

The Upper Kimmeridge Clay of the coast between Swyre Head and Chapman's Pool, centred on Egmont Bight, Isle of Purbeck, Dorset, has yielded specimens of plesiosaurs, ichthyosaurs, crocodylians, a pterosaur, and a chelonian. The area is currently the most important reptile locality in the Upper Kimmeridgian of Britain.

The Upper Kimmeridge Clay of southern England has yielded relatively few fossil reptiles when compared with the Lower Kimmeridge Clay. In recent years, however, some important specimens of marine reptiles have been collected from the Upper Kimmeridge Clay of the western coast of the Isle of Purbeck, Dorset, between Swyre Head and Chapman's Pool. This locality, which is centred on Egmont Bight (Fig. 1), has produced specimens of plesiosaurs, ichthyosaurs, crocodylians, a chelonian, and a pterosaur. It is probably the most productive of the rather few localities in the Upper Kimmeridge Clay of Britain which currently yield fossil reptiles. It has accordingly been designated as a Site of Special Scientific Interest (SSSI) by the Nature Conservancy Council during its Geological Conservation Review of British fossil reptile localities (Benton and Wimbledon 1985).

The locality is also one of the only two sources of the plesiosauroid *Kimmerosaurus* (Brown *et al.* in press). In 1967 R. A. and P. A. Langham recovered the partial skull of a plesiosaur from the Upper Kimmeridge Clay of the locality, Brown (1981a) described this as the new *Kimmerosaurus langhami*, ~~also~~ noted its highly modified dentition, and later (1981b) suggested that the slender and recurved teeth were used to strain small prey such as crustaceans and fish from the water. *Kimmerosaurus*, then, is of great interest, as only two other plesiosaurs are thought to have been filter feeders (Brown 1981b, 1981a).

This paper aims to outline the geology and reptilian fauna of the Egmont Bight locality, with details of the exact provenances, as far as possible. It stems from work by M.A.T. on Jurassic plesiosaurs, and by M.J.B. on British fossil reptile localities.

Repository abbreviations are: BMNH, British Museum (Natural History), London; DORCM, Dorset County Museum, Dorchester, Dorset; GSM, British Geological Survey, Keyworth; OUM, Geological Collections, University Museum, Oxford.

Note on locality names

This paper relies primarily on those topographic names established by use in the six inch to one mile Ordnance Survey map (Fig. 1). In particular, 'Freshwater Steps' refers to the point where a stream comes down from Encombe House and emerges as a waterfall over the rocks of the foreshore. 'Encombe' is the valley (not marked in Fig. 1) running north-south from Encombe House to Freshwater Steps. It will, however, be necessary to define two other topographic names mentioned in the literature, collectors' reports, or museum records. 'Freshwater Point' refers to the spot where a flight of steps comes down to the beach immediately west of Freshwater Steps. 'Encombe Bay' has been used to refer to Encombe Bight, or to the bay further west, between Rope Lake Head and Freshwater Steps. However, 'Encombe Bay' is not

recognised by the Dorset Environmental Records Centre, Dorset County Museum (pers. comm. via Mr P. C. Ensom 1983), and it is not shown on any current Ordnance Survey map. The term 'Encombe Bay' will therefore not be used in this paper except when mentioned in an earlier report. 'Clavell's Tower' is spelt 'Clavel Tower' on the current Ordnance Survey maps.

Nineteenth century collectors and workers often extended the names of famous localities beyond their accurate geographical limits, so as to cover several less well-known but separate localities nearby, as in the Upper Lias of the Whitby district, where material from several miles away was nevertheless labelled as 'Whitby' (Benton and Taylor 1984). It is thus possible that some of the earlier collections (and perhaps some more recent material) labelled as coming from 'Kimmeridge' or 'Kimmeridge Bay' actually came from the vicinity of Egmont Bight, and this is perhaps suggested by the lack of older material specifically labelled as coming from Egmont Bight or the vicinity; there is only one specimen labelled 'Egmont Bight' (see below).

GEOLOGY AND OCCURRENCE OF THE REPTILES

Stratigraphy

The Kimmeridgian is divided up into 13 ammonite zones (Table 1; Cope 1967, 1978, Cox and Gallois 1981). The Swyre Head-Chapman's Pool SSSI (SY 937773 to SY 955771), including Egmont Bight, exposes the upper portion of the Upper Kimmeridge Clay (Fig. 1). This section comprises a sequence of grey calcareous mudstones, bituminous shales and clays with 'stone bands' (coccolith-rich limestones) towards the base of the section, and cementstone concretions ('nodule beds') nearer the top of the section. The sequence, according to Cope (1967, 1978), Cope *et al.* (1980), and Cox and Gallois (1981) is:

Portland Sand Massive Bed
Upper Kimmeridgian:

<i>fittoni</i> Zone	m
Hounstout Marl	21.00
Hounstout Clay	8.35
<i>Rhynchonella</i> and <i>Lingula</i> Beds (upper part)	8.00
	<hr/>
	37.35
<i>rotunda</i> Zone	
<i>Rhynchonella</i> and <i>Lingula</i> Beds (lower part)	15.00
<i>rotunda</i> Shales	13.50
<i>rotunda</i> Nodule Bed (cementstone concretions in two layers)	3.30
shales and clays	3.00
hard bituminous shales	1.25
	<hr/>
	36.05
<i>pallasioides</i> Zone	
grey mudstones and bituminous shales (nine individual subunits, Cope 1978)	37.00
	<hr/>
	37.00

Occurrence of reptiles in the Upper Kimmeridge Clay to the west of the SSSI

Several finds have been reported from the lower portions of the Upper Kimmeridge Clay exposed to the west of Swyre Head, outside the SSSI (Fig. 1). A partial plesiosauroid postcranial skeleton, the type of *Plesiosaurus manselii* Hulke 1870 (BMNH 40106), came some years before 1868 from 'the cliffs east of Clavell's Tower, in Kimmeridge Bay' (Hulke 1870, p. 612). In fact, Clavell's Tower (SY 909786) lies at the east end of Kimmeridge Bay in the strict sense. This assignment suggests that the specimen came from Hen Cliff or the cliffs further east, towards Clavell's Hard, and less probably even further east towards Swyre Head. The specimen could then have come from the *autissiodorensis* Zone of the Lower Kimmeridge Clay, or the lower zones of the Upper Kimmeridge Clay. Brown (1981a) referred the specimen to *Colymbosaurus trochanterius* and suggested that it came from the *pectinatus* Zone (*sensu* Arkell 1933). This assignment is rather unlikely as that zone only appears in the cliffs between Rope Lake Head and Egmont Bight, at least 2 km southeast of Clavell's Tower.

Cope (1967, p. 10) mentions further remains from the Upper Kimmeridge Clay of the coast to the west of Swyre Head, without giving any locality data: the anterior portion of a skeleton of the ichthyosaur *Ophthalmosaurus* 4 m above the Cattle Ledge Stone Band (thus basal *wheatleyensis* or topmost *scitulus* Zones) (specimen now in Dept. of Geology, Keele University); an ichthyosaur skull 4 m below the White Stone Band (thus *hudlestoni* Zone); and a plesiosaurid tooth about 1.5 m above the Yellow Ledge Stone Band (thus *scitulus* Zone). The last two specimens remain in Dr J. C. W. Cope's possession (pers. comm., 1983).

The limb bone of a plesiosaurid (DORCM G187) was found loose on the foreshore below Clavell's Tower, below a stone band, 9 m from the cliff, by Mr R. Hooper (DORCM records), thus possibly the *autissiodorensis* Zone of the Lower Kimmeridge Clay. However, another plesiosaurian limb bone (DORCM G185, partial specimen collected by Mr G. A. Rabbitts) came from 'Clavell's Hard', thus probably the lower portion of the Upper Kimmeridge Clay.

Other Upper Kimmeridge Clay reptile sites in Britain

There are rather few reptile localities in the Upper Kimmeridge Clay of Britain apart from the vicinity of Egmont Bight, and none is currently so productive.

Some ichthyosaurs, plesiosaurs and crocodylians (DORCM specimens) have come from Ringstead Bay, Dorset, at equivalent horizons to those described here. Woodward (1895, p. 161) noted that 'saurian and fish remains occur in shales of Holworth Cliff (SY 761814), above Ringstead Bay. Delair (1959, pp. 72, 73; 1960, pp. 67, 75) has noted some finds from Ringstead. Some specimens of the crocodylian *Stenosaurs*, collected by Miss C. Oules, are labelled 'east of Ringstead Cottages' (DORCM G96 and G116, same individual) and 'west of Ringstead Cottages' (DORCM G114 and G115), thus about SY 751813 and SY 747813, but these localities lie in beds of the Lower Kimmeridge Clay.

A partial postcranial skeleton of the plesiosauroid *Colymbosaurus trochanterius* (BMNH R.10062) was collected in 1966-1968 and 1982-83 from the *rotunda* Zone of the Upper Kimmeridge Clay exposed below the coastguard station on the Isle of Portland (SY 706722) (Brown 1984). This specimen possesses the entire pelvic girdle, but lacks most of the anterior portion of the neck.

The pits on Shotover Hill, Oxfordshire (SP 558065, SP 560066, SP 562066, SP 564066, etc.) have yielded reptiles from marine deposits of the Kimmeridge Clay. Most specimens from 'Shotover' have no exact provenance information, and it is not yet clear which horizons were the most productive. The large quarries seem to have exposed mainly the sandy Shotover Grit Sands and Shotover Fine Sands of the *pectinatus* Zone, and the blue-grey clays of the *wheatleyensis* Zone, when they were in operation (Woodward 1895, p. 168; Arkell 1947b, pp. 107-108; Cox and Gallois 1981). A few of the 'Shotover' specimens in the OUM are labelled '*pectinatus* Zone' (e.g. crocodylians OUM J.1432, J.1438), while others show a sandy matrix characteristic of this zone. Other OUM material bears a matrix of dark blue-grey clay and can perhaps be ascribed to the *wheatleyensis* Zone. It may tentatively be concluded that the large number of marine reptile specimens from Shotover, generally isolated bones, came mostly from the Upper Kimmeridge Clay. The quarries are now derelict and no new material is being collected.

Finally, some isolated plesiosaurid bones (BMNH specimens) have been found in the Hartwell Clay (*pallasioides* Zone) of localities in Buckinghamshire: Hartwell (SP 7916), and Hardwick, near Aylesbury (SP 8019).

Acknowledgements

We especially thank Messrs. R. A. and P. A. Langham for information. We thank the following people for showing us the specimens in their care and for correspondence: Dr D. S. Brown (University of Newcastle), Mr P. C. Ensom (DORCM), Dr A. C. Milner (BMNH) and Mr H. P. Powell (OUM). We thank Professor T. R. E. Southwood, FRS, for permission for M.A.T. to do this work in the Zoological Collections of the Oxford University Museum, during his tenure of a Christopher Welch Scholarship and a Graduate Award, Wolfson College, Oxford, and we also thank both grant-awarding bodies.

The Dorset Natural History and Archaeological Society is grateful to The Royal Society for a grant enabling the publication of this article.

REFERENCES

- Acland, J. E., 1931, 'Report of the Curator (Capt. J. E. Acland, FSA), of the Dorset County Museum, for the year 1930. List of acquisitions to the Dorset County Museum, for the year 1930', *Dorset Proceedings*, Vol. 52, pp. 4-9.
- Arkell, W. J., 1933, *The Jurassic System in Great Britain*, Oxford.
- Arkell, W. J., 1947a, 'The geology of the country around Weymouth, Swanage, Corfe and Lulworth', *Mem. geol. Surv. UK*.
- Arkell, W. J., 1947b, *The Geology of Oxford*, Oxford.
- Benton, M. J. and Taylor, M. A., 1984, 'Marine reptiles from the Upper Lias (Lower Toarcian) of the Yorkshire coast', *Proc. Yorks. geol. Soc.*, Vol. 44, pp. 399-429.
- Benton, M. J. and Wimbledon, W. A., 1985, 'The conservation and use of fossil vertebrate sites: British fossil reptile sites', *Proc. geol. Ass.*, Vol. 96, pp. 1-6.
- Brown, D. S., 1981a, 'The English Upper Jurassic Plesiosauroida (Reptilia) and a review of the phylogeny and classification of the Plesiosauria', *Bull. Br. Mus. nat. Hist. (Geol.)*, Vol. 35, pp. 253-347.
- Brown, D. S., 1981b, 'Dental morphology and function of plesiosaurs', *J. Dent. Res.*, Vol. 60 (B), p. 1114.
- Brown, D. S., 1984, 'Discovery of a specimen of the plesiosaur *Colymbosaurus trochanterius* (Owen) on the Island of Portland', *Dorset Proceedings*, Vol. 105, p. 170.
- Brown, D. S., Milner, A. C. and Taylor, M. A., in press, 'New material of the plesiosaur *Kimmerosaurus langhami* Brown from the Kimmeridge Clay of Dorset', *Bull. Br. Mus. nat. Hist. (Geol.)*.
- Cope, J. C. W., 1967, 'The palaeontology and stratigraphy of the lower part of the Upper Kimmeridge Clay of Dorset', *Bull. Br. Mus. nat. Hist. (Geol.)*, Vol. 15, pp. 1-79, pls. 1-33.
- Cope, J. C. W., 1978, 'The ammonite faunas and stratigraphy of the upper part of the Upper Kimmeridge Clay of Dorset', *Palaeontology*, Vol. 21, pp. 469-533, pls. 45-56.
- Cope, J. C. W., Duff, K. L., Parsons, C. F., Torrens, H. S., Wimbledon, W. A. and Wright, J. K., 1980, 'A correlation of Jurassic rocks in the British Isles. Part Two: Middle and Upper Jurassic', *Geol. Soc. Lond.*, Special Report No. 15.
- Cox, B. M. and Gallois, R. W., 1981, 'Stratigraphy of the Kimmeridge Clay of the Dorset type area and its correlation with some other Kimmeridgian sequences', *Rep. Inst. Geol. Sci.*, No. 80/4, pp. 1-44.
- Delair, J. B., 1959, 'The Mesozoic reptiles of Dorset. Part two', *Dorset Proceedings*, Vol. 80, pp. 52-90.
- Delair, J. B., 1960, 'The Mesozoic reptiles of Dorset (part three: conclusion)', *Dorset Proceedings*, Vol. 81, pp. 59-85.
- Delair, J. B., 1966, 'New records of dinosaurs and other fossil reptiles from Dorset', *Dorset Proceedings*, Vol. 87, pp. 57-66.
- Drury, D., 1929, 'Photographs of ichthyosaurian remains from the Purbeck coast', *Dorset Proceedings*, Vol. 50, p. 48, 1 pl.
- Hulke, J. W., 1870, 'Note on some plesiosaurian remains obtained by J. C. Mansel, Esq., FGS, in Kimmeridge Bay, Dorset', *Q. Jl. geol. Soc. Lond.*, Vol. 26, pp. 611-622, pl. 41.
- Lang, W. D., 1958, 'Geology', *Dorset Proceedings*, vol. 79, pp. 23-25.
- Lang, W. D., 1959, 'Geology', *Dorset Proceedings*, Vol. 80, p. 22.

- McGowan, C., 1976, 'The description and phenetic relationships of a new ichthyosaur genus from the Upper Jurassic of England', *Can. J. earth. Sci.*, Vol. 13, pp. 668-683.
- Seeley, H. G., 1875, 'Note on *Pelobatochelys blakii* and other vertebrate fossils exhibited by the Rev. J. G. Blake in illustration of his paper on the Kimmeridge Clay', *Q. Jl. geol. Soc. Lond.*, Vol. 31, pp. 234-237, pl. 13.
- Steel, R., 1973, 'Crocodylia', in Kuhn, O. (ed.) *Handbuch der Paläoherpetologie*, Part 16, Gustav Fischer Verlag, Stuttgart.
- Taylor, M. A., 1981, 'Plesiosaurs - rigging and ballasting', *Nature, Lond.*, Vol. 290, pp. 628-629.
- Woodward, H. B., 1895, 'The Jurassic Rocks of Britain. 5. The Middle and Upper Oolitic rocks of England (Yorkshire excepted)', *Mem. geol. Surv. GB*.

CHECKLIST OF REPTILE TAXA FROM THE VICINITY OF EGMONT BIGHT

PLESIOSAURIA

- Colymbosaurus trochanterius*: lower zones of Upper Kimmeridge Clay or *autissiodorensis* Zone of Lower Kimmeridge Clay.
- Colymbosaurus* sp.: probably *pectinatus* Zone.
- Kimmerosaurus langhami*: *eastlecottensis* Subzone, *pectinatus* Zone.
- Pliosaurus brachyspondylus*: unspecified Upper Kimmeridge Clay.
- pliosauroid indet.: probably *pectinatus* Zone; *scitulus* Zone; possibly *autissiodorensis* Zone of Lower Kimmeridge Clay.
- plesiosaurians indet.: *eastlecottensis* and *paravirgatus* Subzones, *pectinatus* Zone; *hudlestoni* Zone; lower portion of Upper Kimmeridge Clay; unspecified Upper Kimmeridge Clay.

ICHTHYOSAURIA

- Ichthyosaur indet.: *eastlecottensis* Subzone, *pectinatus* Zone; probably *pectinatus* or *pallasioides* Zones; *hudlestoni* Zone; basal *wheatleyensis* or topmost *scitulus* Zones; *scitulus* Zone.

CROCODYLIA

- Crocodylian indet.: basal *eastlecottensis* Subzone, *pectinatus* Zone; probably *eastlecottensis* Subzone, *pectinatus* Zone.

PTEROSAURIA

- Pterosaur indet.: *paravirgatus* Subzone, *pectinatus* Zone.

CHELONIA

- Pelobatochelys* sp.: *paravirgatus* Subzone, *pectinatus* Zone.