

THE STEVE M. ETCHES COLLECTION OF
KIMMERIDGE CLAY FOSSILS: A SCIENTIFIC
EVALUATION

by

David M. Martill BSc, PhD, FLS

Reader in Palaeobiology: School of Earth and Environmental Sciences, University of Portsmouth



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INTRODUCTION

The Steve M. Etches fossil collection has been sourced from a single geological horizon, the Jurassic Kimmeridge Clay Formation, and from a limited geographical extent, namely the Dorset Coast between St Albans' Head near Swanage and the Fleet at Weymouth. The collection has been assembled over a period of 30 years, beginning in 1980, and is still being added to.

The collection is fully curated with documentation on both hard copy and stored on a computer data base which records locality details, geological horizon, taxonomic and taphonomic notes for each specimen under a unique accession number prefixed K. Digital images of many specimens are also held on a the data base. In this respect, the collection is curated to a high professional standard. Humidity of the collection storage facility is maintained at 40% and is monitored on a daily basis.

All of the specimens in the collection have been prepared by Mr Etches using mechanical techniques, including airbrasive tools, pneumatic scribes and diamond air grinders in a purpose built preparation laboratory. The high standard of curation, skilled preparation work, and scientific worth of the collection has been acknowledged by the Palaeontological Association of London, the professional body for palaeontology in the United Kingdom, who awarded Mr Etches the Amateur Palaeontologist Award in 1993 and 2005. Mr Etches is the only person to have been awarded this honour twice.

Although the collection is privately owned, it has been available for consultation by legitimate researchers, and has been the subject of visits by professional organisations, including the Society of Vertebrate Paleontology (SVP) and the Symposium of Vertebrate Palaeontology and Comparative Anatomy (SVPCA).

THE KIMMERIDGE CLAY FORMATION

The Kimmeridge Clay Formation of England (Figure 1) is the youngest of the four Jurassic marine mudrock formations deposited in epicontinental seas during a high sea-stand in several sedimentary basins of the North West European continent. It most likely was deposited in water depths in excess of 50 m, and quite probably considerably deeper in tectonically active basins such as those of the North Sea Graben.

The formation is dominated by fine grained lithologies, especially clays, and is notable for its high organic carbon content which, at some horizons constitutes oil shales. Consequently, on shore outcrops of the Kimmeridge Clay have been of interest to petroleum geologists, while deeply buried parts of the formation have been source rocks for extractable hydrocarbons in some the North Sea oilfields (Tyson and Pearson, 1991; Wignall and Hallam, 1991; Belin and Brosse, 1992; Tyson, 2004).

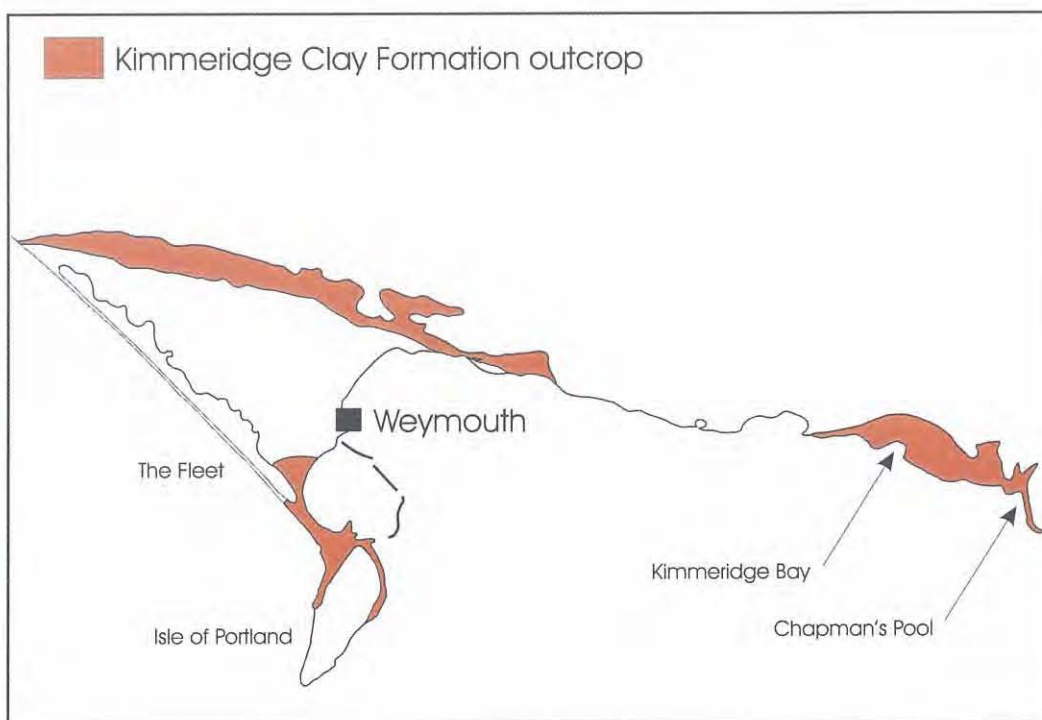


Figure 1. Outcrop of the Kimmeridge Clay in Dorset.

In most places the Kimmeridge Clay is fossiliferous, and preservational quality is often high. This has resulted in numerous studies on the sedimentology and palaeoecology of the formation (e.g. Wignall and Ruffell, 1990; Wignall, and Hallam, 1991; Wignall, 1993b; Wignall, 1994a).

Ammonites frequently display original shell mineralogy, and may retain nacreous lustre. Vertebrates, arthropods and echinoderms are often encountered in an articulated state (Figure 2). Although fossils at many horizons are crushed flat, early diagenetic concretions, such as those occurring in Chapman's Pool, Dorset, frequently yield uncrushed ammonites and bivalves. Historically, the vertebrate palaeontology of the Kimmeridge Clay has been studied by 19th century palaeontologists such as Owen, Philips and others, but few studies have occurred in recent years. Notable exceptions have been studies on the pliosaurs by Tarlo (1960) and plesiosaurs by Brown (1981). Unwin (1988) has described pterosaur remains, while Carpenter (1995) and Taylor and Cruickshank (1993) have described pliosaurs and Grange and Benton (1996) and Wilkinson *et al.* 2008 described crocodylians. Sharks have been documented by Underwood (2002).



Figure 2. A fully articulated decapod crustacean from the Kimmeridge Clay Formation. Such quality of preservation is one of the characteristics that makes the Kimmeridge Clay a Fossil Konservat Lagerstätte. Scale bar in millimetres.

STRATIGRAPHIC SCOPE OF THE COLLECTION

The Etches collection is stratigraphically restricted to the Kimmeridge Clay Formation (Figure 3) from the basal bed in the Baylei Ammonite Biozone to the highest beds of the Kimmeridge Clay in the Fittoni Ammonite Biozone (Figure 4). Thus all of the material within the collection is of Late Jurassic (Kimmeridgian) age (Cope, 1967, 1980; Cox, and Gallois, 1981; Wignall, 1990; Cope, 1995; Gallois and Etches, 2001; Morgans-Bell, *et al.*, 2001). Although the collection contains fossil from the entire range of the Kimmeridge Clay Formation, approximately 60% of specimens come from the Pectinatus Ammonite Biozone of the Upper Kimmeridge Clay.

The majority of specimens have associated documentation recording the stratigraphic horizon. In some cases where material has been collected ex-situ Mr Etches' experience of lithological variation within the Kimmeridge Clay Formation has enabled the horizon to be determined.

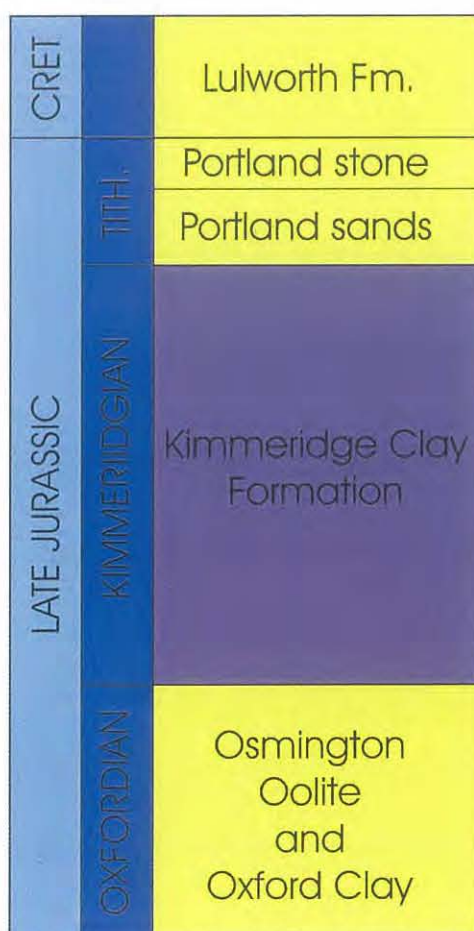


Figure 3. Position of the Kimmeridge Clay Formation within the Late Jurassic.

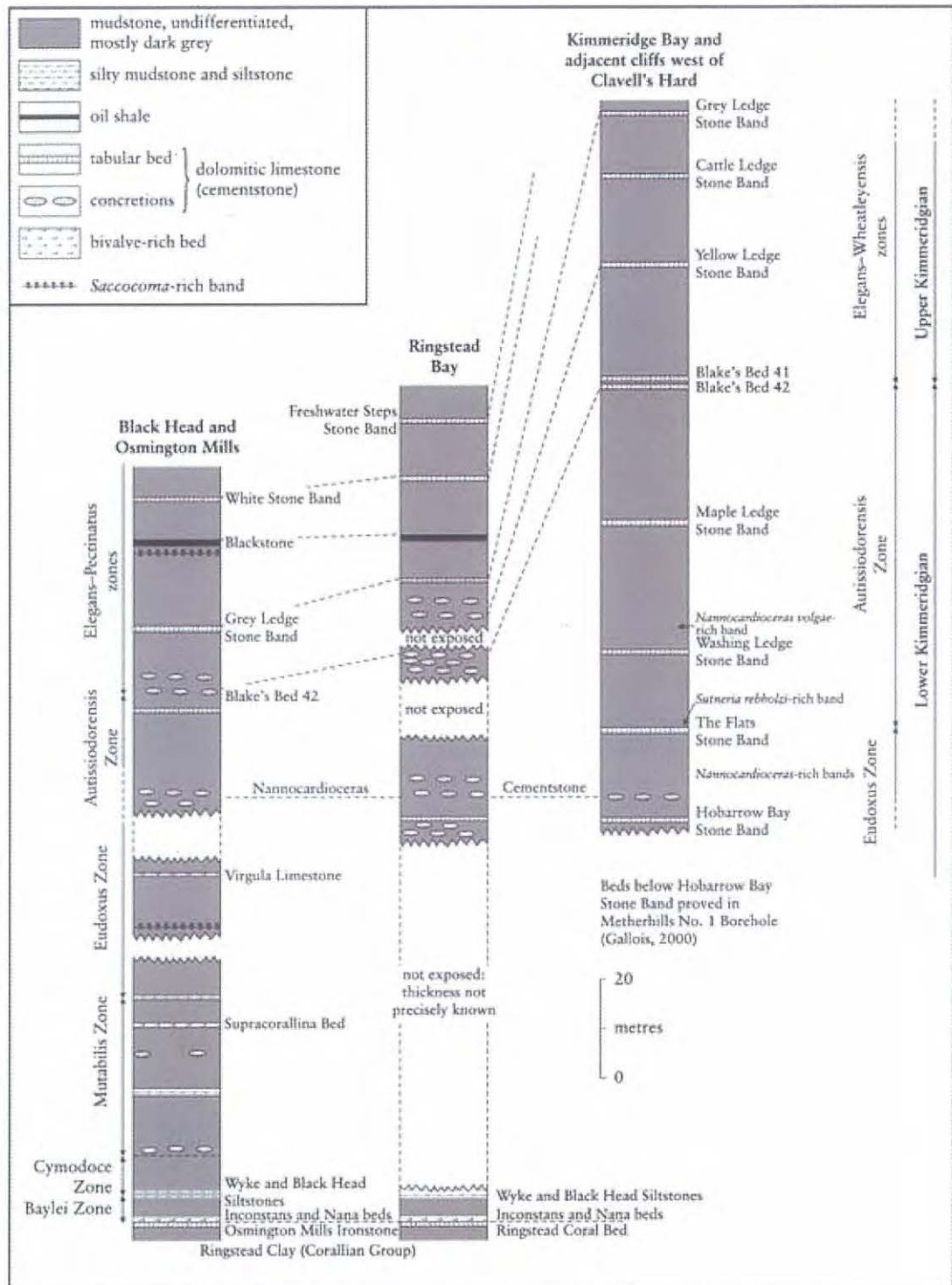


Figure 4. Composite section through the Kimmeridge Clay Formation on the World Heritage coast of Dorset linking ammonite biostratigraphic zonation with lithology (from Morgans-Bell, *et al.*, 2001).

GEOGRAPHICAL SCOPE OF THE COLLECTION

The Etches collection has been obtained largely from the Wessex Basin outcrops of the Kimmeridge Clay Formation of Dorset. By far the majority of the collection has been assembled by personal collecting by Mr Etches along the foreshore and cliffs between St Albans' Head/Chapman's Pool and Gad Cliff, near Kimmeridge Village, Ringstead Bay, Osmington Mills and the shores of the Fleet at Weymouth. A few specimens have been obtained from artificial exposures in land, mainly in Wiltshire including the now abandoned cement works clay pit at Westbury, temporary exposures at Wotton Bassett and the base of gravel pits in the Thames valley at Abingdon. A small quantity of material from the marginal facies of the Kimmeridge Clay Formation of Helmsdale, NE Scotland, is also included in the collection. Due to variable rates of erosion along this stretch of the coast, some specimens missing skeletal elements are awaiting fresh cliff falls to be completed.



Figure 5. Coast between Lulworth Cove and St Albans Head, South Dorset. A majority of specimens in the Steve Etches collection come from exposures of the Kimmeridge Clay along this stretch of the Jurassic Coast World Heritage site. Image from Google Earth.



Figure 6. The coast at the Isle of Portland and shores of the Fleet also have exposures of Kimmeridge Clay Formation. A few specimens in the Etches collection have been sourced from these localities.

Image from Google Earth.

Many previously important exposures of the Kimmeridge Clay Formation in the vicinity of Swindon, Oxford and Ely are now abandoned and inaccessible. Thus, the Dorset exposures are now the only places where Kimmeridgian age fossil can be collected in England

SCIENTIFIC EVALUATION

National Significance

The Etches collection represents the single largest collection of macrofossils from the Kimmeridge Clay Formation outside of the National collection held at the Natural History Museum London. Specifically, it represents a scientifically valuable archive recording the diversity of a Late Jurassic marine ecosystem in the N. W. Europe province at a time of high sea stand. In this regard, the collection highlights ancient biodiversity of the Jurassic of the Dorset coast and is an important educational resource, unique to southern England. The high quality of curation applied to all of the material will allow for the future use of the collection by the scientific community in general palaeontologists and stratigraphers specifically.

International significance

Significantly, the Etches collection contains many specimens new to science and therefore worthy of scientific description. Amongst the vertebrates are several new genera and species, including chelonians, pterosaurs and possibly new ichthyosaur taxon. Many of the fish fossils also represent undescribed species. In addition, many of the specimens representing species that have previously been described reveal new anatomical details that will add significantly to our knowledge of Jurassic vertebrates.

To the best of my knowledge, no other privately assembled collection of Jurassic fossils since the Leeds Brothers of Peterborough (see Leeds 1956) has contained the diversity and quality of material contained in the Etches collection. The Etches collection is, without doubt, the finest assemblage of Jurassic fossils not held by a recognised institution. A significant number of specimens are of scientific importance and every attempt should be made to secure the long term future of the collection for the benefit of all when it passes out of Mr Etches stewardship.