BARTON CLIFF

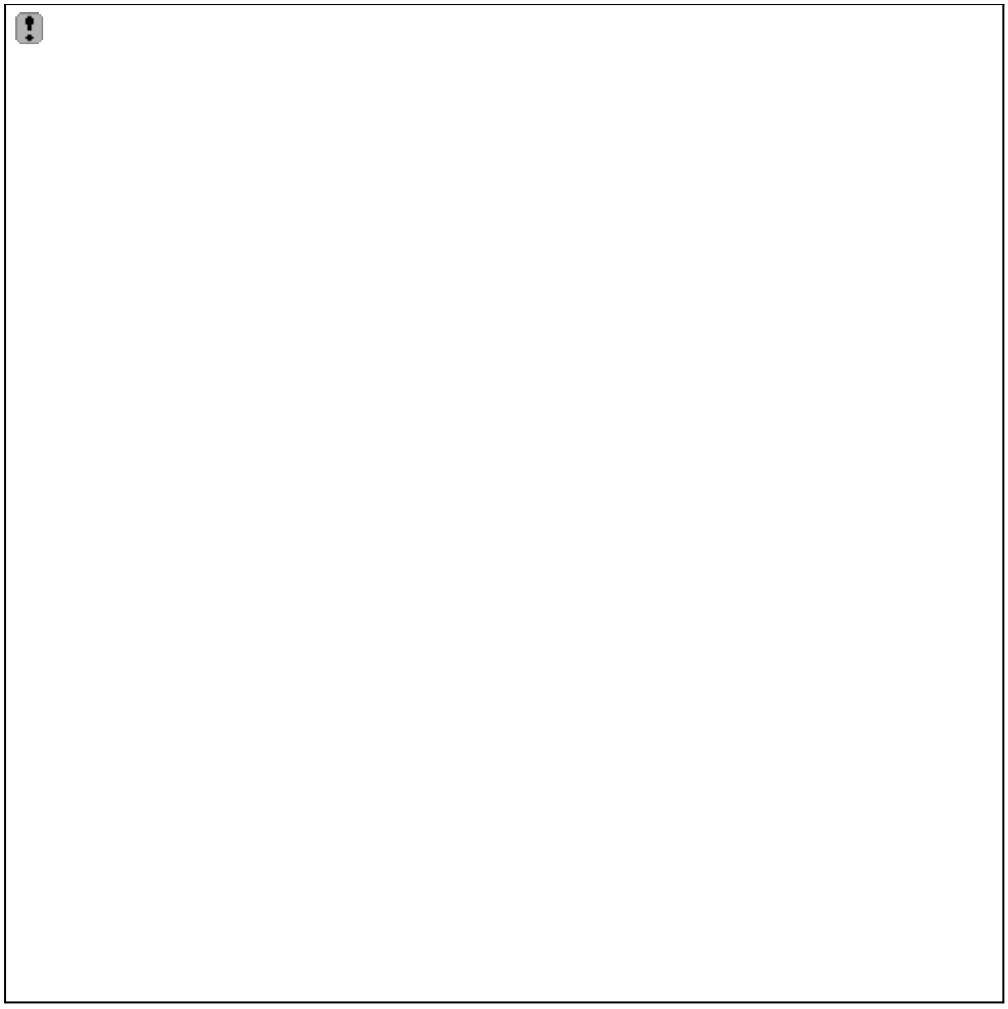
OS Grid Reference: SZ218930–SZ252925

Highlights

From the Barton Group at Barton Cliff in Hampshire, a large number of vertebrates, including sharks and teleosts, come from several horizons. At least 30 chondrichthyan taxa are present and one anuran is also recorded.

Introduction

The stretch of sea cliffs in Christchurch Bay between Chewton Bunny (on the Hampshire –Dorset border) eastwards to Becton Bunny, known as Barton Cliff (Figure14.14A, 14.14B), has produced an excellent vertebrate fauna of Mid–Late Eocene age. Fossils from the Barton Beds have been collected for more than two centuries and the site has excellent potential for further finds.



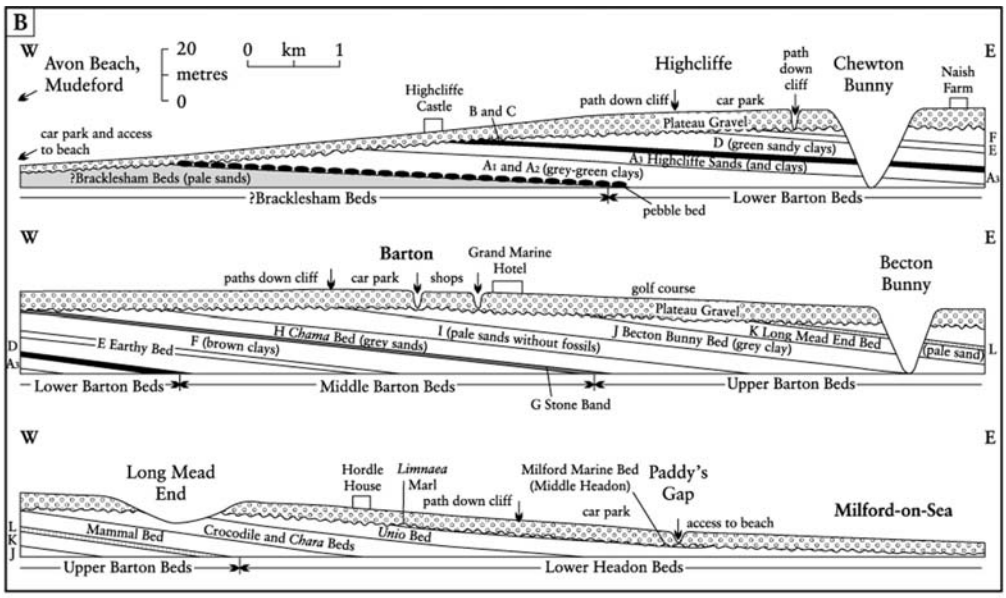


Figure 14.14: (A) Exposure of the Barton Clay, looking east from below Highcliffe, in the vicinity of Barton-on-Sea, Hampshire (photo: S.J. Metcalf). (B) Section from Mudeford to Milford-on-Sea.

The stratigraphy of the marine Barton Beds at Barton Cliff has been discussed in detail by Gardiner *et al*. (1888), Burton (1929, 1933), Hooker (1986) and Edwards and Freshney (1987). The succession was divided by Gardiner *et al*. (1888) into the Lower, Middle and Upper Barton Beds on the basis of faunal changes through the sequence. Burton (1929) gave faunal lists and lettered the Barton Beds A1–AL based on different lithologies and faunal content.

Hooker (1986) formally designated the Barton Clay Formation and erected the new unit, the Becton Sand Formation, for the Barton Sand of earlier stratigraphical schemes. The site has been described by Benton and Spencer (1995) as one providing a notable reptile fauna; much of the following is based on their account.

Description

The Barton Clay Formation (*sensu* Hooker, 1986, pp. 203–5) is exposed in the cliff section between Friar's Cliff, Mudeford in the west to just east of Barton-on-Sea in the east (SZ 194927–SZ 242927). The beds (*c*. 40–60 m thick) consist of grey to brown silty, usually shelly, sandy clay. There are several layers of calcareous phosphatic and sideritic nodules. The faunal list is large and diverse, including malacostracan crustaceans, ostracods, foraminiferans, brachiopods, molluscs (bivalves and gastropods), asteroids and ophiuroids, sharks, teleosts, marine mammals and turtles, and land-derived mammals, birds, and reptiles (Burton, 1929; Hooker, 1986). An associated flora of fruits, seeds, cones and wood indicates the close proximity of land, and the marine aspect of the fossils and the sediments suggests a predominantly low-energy nearshore environment for the formation.

The Becton Sand Formation (*c*. 25 m; Hooker, 1986, p. 205) occurs in the cliff section to the west of Sea Road Gap, and may be traced eastwards to Long Mead End (Taddiford Gap) at the eastern end of Beacon Cliff (SZ 229931–SZ 262922). The lithology is fine sand, which is clayey and silty at the base of the formation. The biota is sparse, but essentially the same as that of the Barton Clay below. Terrestrial fossil material is similarly reduced and no mammals have been found. Towards the top of the sequence, the molluscs indicate shallowing waters with a change to brackish conditions, leading to the non-marine Lower Headon Beds of Hordle (Hordwell) Cliff that succeed conformably to the east.

The fishes come from a number of levels, but have most commonly been obtained from horizons in the Lower and Middle Barton Beds, where they are commonly associated with shell-rich clays and silts. Burton (1929, p. 229) noted that ‘Vertebrae of fishes and remains of Chelonia in a fragmentary condition' were obtained from Horizon E (‘Earthy' Bed, Lower Barton Beds), from a ‘thin but persistent seam of *Ostrea* (*Ostrea* cf. *flabellula* Lamark) ...' that occurs at the base of the unit. The only amphibian recorded is an anterior vertebra referrable to the ‘discoglossid 1' frog genus of Milner *et al*. (1982) and this was found in Barton A1–A3 beds at Highcliffe (Milner, 1986).

Fauna

Many of the fish remains from Barton Cliff are in the NHM.

Barton Clay, Beds A1–A3 Chondrichthyes: Elasmobranchii: Neoselachii: Squalomorphii

Notorhynchus kempi Ward, 1979

Squalus minor (Leriche, 1902)

Chondrichthyes: Elasmobranchii: Neoselachii: Squatinomorphii

Squatina prima (Winkler, 1874)

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii **Carcharias hopei** (Agassiz, 1843)

Carcharocles (*Procarcharodon*) *auriculatus* (de Blainville, 1818)

Eostegostoma angusta (Nolf and Taverne) in Herman, 1977

Galeocerdo latidens Agassiz, 1843

Galeorhinus minor (Agassiz, 1843)

G. recticonus (Winkler, 1873)

Isurus praecursor (Leriche, 1904)

Jaekelotodus trigonalis (Jaekel, 1895)

'*Lamna*'*lerichei* Casier, 1946

*Odontaspis winkleri*Leriche, 1905

Physogaleus secundus (Winkler, 1874)

P. tertius (Winkler, 1874)

Scyliorhinus woodwardi Cappetta, 1976

S. pattersoni Cappetta, 1977

'*Scyliorhinus*'*minutissimus* (Winkler, 1873)

'*S.*'*biauriculatus* Casier, 1950

'*Scyliorhinus*' sp.

Synodontaspis macrotus (Agassiz, 1843)

S. striatus (Winkler, 1874)

S. acutissima (Agassiz, 1843)

Chondrichthyes: Elasmobranchii: Neoselachii: Batomorphii

Dasyatis jaekeli (Leriche, 1905)

Dasyatis. sp.

Gymnura sp.

*Myliobatis striatus*Buckland, 1837

M. toliapicus Agassiz, 1843

Myliobatis sp.

Pristis lathami Galeotti, 1837

Pristis sp.

Rhinobatos bruxelliensis Jaekel, 1894

Rhynchobatus vincenti (Jaekel, 1894)

TETRAPODA

Anura: Discoglossidae

'discoglossid 1' of Milner *et al*. (1982)

Barton Clay, Beds B–H Chondrichthyes: Elasmobranchii: Neoselachii: Squalomorphii

*Notorhynchus kempi*Ward, 1979

Chondrichthyes: Elasmobranchii: Neoselachii: Squatinomorphii

Squatina prima (Winkler, 1874)

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii**Galeorhinus minor** (Agassiz, 1843)

Isurus praecursor (Leriche, 1904)

Jaekelotodus trigonalis (Jaekel, 1895)

'*Lamna*'*lerichei* Casier, 1946

*Odontaspis winkleri*Leriche, 1905

Physogaleus secundus (Winkler, 1874)

P. tertius (Winkler, 1874)

Scyliorhinus sp.

'*Scyliorhinus*'*minutissimus* (Winkler, 1873)

'*S.*'*biauriculatus* Casier, 1950

'*Scyliorhinus*' sp.

Synodontaspis macrotus (Agassiz, 1843)

S. striatus (Winkler, 1874)

S. acutissima (Agassiz, 1843)

Chondrichthyes: Elasmobranchii: Neoselachii: Batomorphii

Aetobatus irregularis Agassiz, 1843

Burnhamia sp.

Dasyatis jaekeli (Leriche, 1905)

Gymnura sp.

Myliobatis toliapicus Agassiz, 1843

Pristis sp.

Rhinobatos bruxelliensis (Jaekel, 1894)

Chondrichthyes: Holocephali: Chimaeriformes

Amylodon sp.

Edaphodon leptognathus Agassiz, 1843

Otoliths

Interpretation

The depositional environments of the Bartonian of the Hampshire Basin are divided into marine and non-marine provinces by Hooker (1986). The Barton Clay and Becton Sands formations in Christchurch Bay were deposited in three large cycles. The erosive base of each cycle may be the result of a rapid marine transgression of a shelf sea, which then withdrew over a longer period, hence forming the rest of each cycle (Hooker 1986). Marine indicators include glauconite, the trace fossil *Ophiomorpha*, foraminifera, bivalves and gastropods. The invertebrate faunas suggest that the cooling seen in lower formations continued, and water salinities may have been slightly reduced. These sediments seem to have been deposited in

marine waters up to 100 m deep, some at perhaps less than half that depth. Some terrestrial vertebrate fossils occur, as well as archaeocete whales, which were presumably preserved *in situ* (Hooker, 1986). The non-marine units occur in the Creechbarrow Limestone Formation, a lateral equivalent of the Barton Clay Formation, and are seen outside the GCR site.

Many of the elasmobranchs were durophagous and would have passed much of their time in the vicinity of shell banks. Other invertebrates, especially arthropods, may have formed the food base for elasmobranchs and osteichthyans alike. About 20 species of teleosts are known from the Elmore Member of the Barton Clay (Kemp *et al.*, 1990), and they are sturdy, active, largely predatory forms.

Comparison with other localities

On the basis of the perissodactyl mammal *Plagiolophus cartailhaci* from the Middle Barton Beds, the Barton succession, at least in part, is tentatively considered to be coeval with the Castrais fauna of the Aquitaine Basin of southern France (Hooker, 1972, p. 182). The mammal fauna of the Totland Bay Member of the Headon Hill Formation, which succeeds the Barton Beds, correlates with the upper part of the Calcaire de Fons at Fons; thus the Becton Sand Formation ('Upper Barton Beds') may correlate with the Robiac unit below. The Lower Barton Beds may be Marinesian, perhaps partly equivalent to the Calcaire de St Ouen, since these lie above the Bracklesham Group that are well correlated with the Auversian Stage.

Conclusions

The Barton Cliff sites are situated within marine and non-marine facies distributed within three cycles. Their conservation value lies in the marine sandy clay facies which yields an abundance of elasmobranchs, many of which were durophagous.

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