Friars Cliff, Mudeford, Dorset

[SZ 195 927]

Highlights

This site provides a link between the Bournemouth and Hengistbury sections to the west and those of the Isle of Wight to the east. The unusual Boscombe Sand sediments here represent mouth bars at the seaward end of tidal channels and also contain some of the most spectacular soft sediment deformation structures in the local Palaeogene succession.

Introduction

The site comprises sea cliffs (Figure 6.12) bounded to the west by a concrete sea wall and promenade (grid reference [SZ 195 927]), with exposures continuing westwards above the latter for a short distance. From the eastern end of the section (around [SZ 199 928]), a well-vegetated cliff separates the site from Highcliffe and the long series of sections described elsewhere in this review under the heading of 'Barton Cliffs'. The strata present comprise the Boscombe Sand, a formation now assigned to the Barton Group of Edwards and Freshney (1987b, p. 65), and the lowest part of the overlying Barton Clay (Bed A_0).

The earliest description of Friars Cliff is probably that of Prestwich (1849a) in which he briefly surveyed the coastal geology from Christchurch to Poole Harbour and introduced such names as the Barton Beds and Boscombe Sand. In a later study, Gardner (1879c) gave the name Highcliff Sands to the sands below the Barton Clay at Friars Cliff, although the term 'High Cliff sands and clays' had already been used by Wright (1851) for what is now unit A_3 of the Barton Clay Formation (see review of 'Barton Cliffs'). Fisher (1862) recognized a threefold division within the strata which he assigned to the 'Bracklesham Series' at this locality.

The few metres of Barton Clay here, together with the much thicker section in 'Barton Cliffs' to the east, has attracted the attention of palaeontologists since the 19th century, e.g. Gardner *et al.* (1888) and Burton (1933). Relatively recent work on the dinoflagellate zonation of the Palaeogene has established that the Barton Clay of Friars Cliff lies within the Zone BAR-1 of this scheme (Bujak *et al.,* 1980). In recent years, a study of the detailed sedimentology of Friars Cliff has been undertaken by Plint (1983a, 1988b) as part of a broader investigation of elastic sedimentation in the Bracklesham Group.

A number of earlier workers have considered the relationship between this section and that of Hengistbury Head to the west of Christchurch Harbour. The controversy which has arisen and its ultimate solution has been considered in some detail by Hooker (1975a) and Curry (1976) and is summarized elsewhere in the review of the Hengistbury Head site.

Description

Although very limited in stratigraphical extent, Friars Cliff provides a useful link in the network of sites between Hengistbury and the Bournemouth sections to the west and those of the Isle of Wight to the east. It is important sedimentologically as far as the Boscombe Sand is concerned, for the facies developed here is different from what is seen elsewhere.

Lithological succession

Apart from a thin development of glauconitic muds above a flint pebble bed at the base of the Barton Clay, the succession comprises some 14 m of the silty sandy muds and clean sands of the Boscombe Sand.

Sedimentology

The Boscombe Sand at Friars Cliff comprises three 5–6 m thick, upward-coarsening sequences (Plint 1983a, 1988b). Plint referred to their upward passage from intensely bioturbated silty sandy clay with abundant fine plant debris, into clean faintly laminated sand, overlain by cross-bedded fine to medium sand. At the western end of the section above the concrete promenade, the middle and uppermost of the three may be examined. The present author noted here that no upward grading was present, with the sediment comprising essentially clean quartz sand throughout. The top of both sequences were disturbed by contemporaneous soft sediment deformation. To the east of the promenade the lowest sequence clearly coarsens upwards from a bioturbated, carbonaceous muddy sand to a clean sand.

The deformational structures are an impressive feature of the section. They vary in their lateral persistence and thickness within each of the three sequences. The boundaries of the latter are difficult to distinguish, whilst 100 m eastwards from the promenade, the general bedded nature and tripartite division of the Boscombe Sand is suddenly lost completely and the whole unit is extensively deformed. Large, elongate pillows up to 2–3 m in length are apparent here. The Barton Clay (about 3 m) here is palaeogeographically and stratigraphically significant. The base is marked by an up to 30 cm thick pebble bed comprising well-rounded flint pebbles in a matrix of muddy glauconitic sand. This is overlain by green glauconitic muds very similar to the lowest part of the 'Hengistbury Beds' but less silty (Hooker, 1975a).

Interpretation and evaluation

Friars Cliff is important from three aspects in particular: the stratigraphical assignment of the Boscombe Sand, the palaeogeographical interpretation of the facies of the Boscombe Sand present here and the well-developed soft sediment deformation structures.

Stratigraphical significance and comparison with other localities

From work on the dinoflagellate microfauna, Costa *et al.* (1976) suggested that the Boscombe Sands corresponded with the highest microplankton zone of the Bracklesham Beds (Zone B-5; see Bujak *et al.* 1980). The Boscombe Sand was included by Curry *et al.* (1978, table 1) in their Bournemouth Formation, whilst Edwards and Freshney (1987b, p. 65) considered it worthy of separate formation status (the Boscombe Sand) and the lowest of the four formations of their Barton Group. They considered that it correlated with Prestwich Bed 28 of Alum Bay and that it ultimately passed eastwards into marine clays included in the Barton Clay. Above the Boscombe Sand, the reworked pebble lag representing the initial Barton Clay transgression may be correlated with the pebble bed at the top of Prestwich Bed 28 in Alum Bay.

Palaeogeography

Plint (1988b) has emphasized the importance of this site to our understanding of the palaeogeography of Boscombe Sand times. He considered that the coarsening-upwards cycles present here may represent prograding mouth-bars at the seaward end of a tidal channel system. The tidal channels themselves are represented in the East Bournemouth Cliffs section (see separate review) further to the west. Plint (1988b, p. 141) believed that the Boscombe Sand of Friars Cliff correlates with lagoonal and coastal marine sediments in the Alum Bay section (Prestwich Beds 27 and 28). The Palaeogene sea at this time appears to have deepened towards the north-east, for the Boscombe Sand is absent in the Southampton Region where the Barton Clay rests directly on the underlying Bracklesham Group.

Soft sediment deformation structures

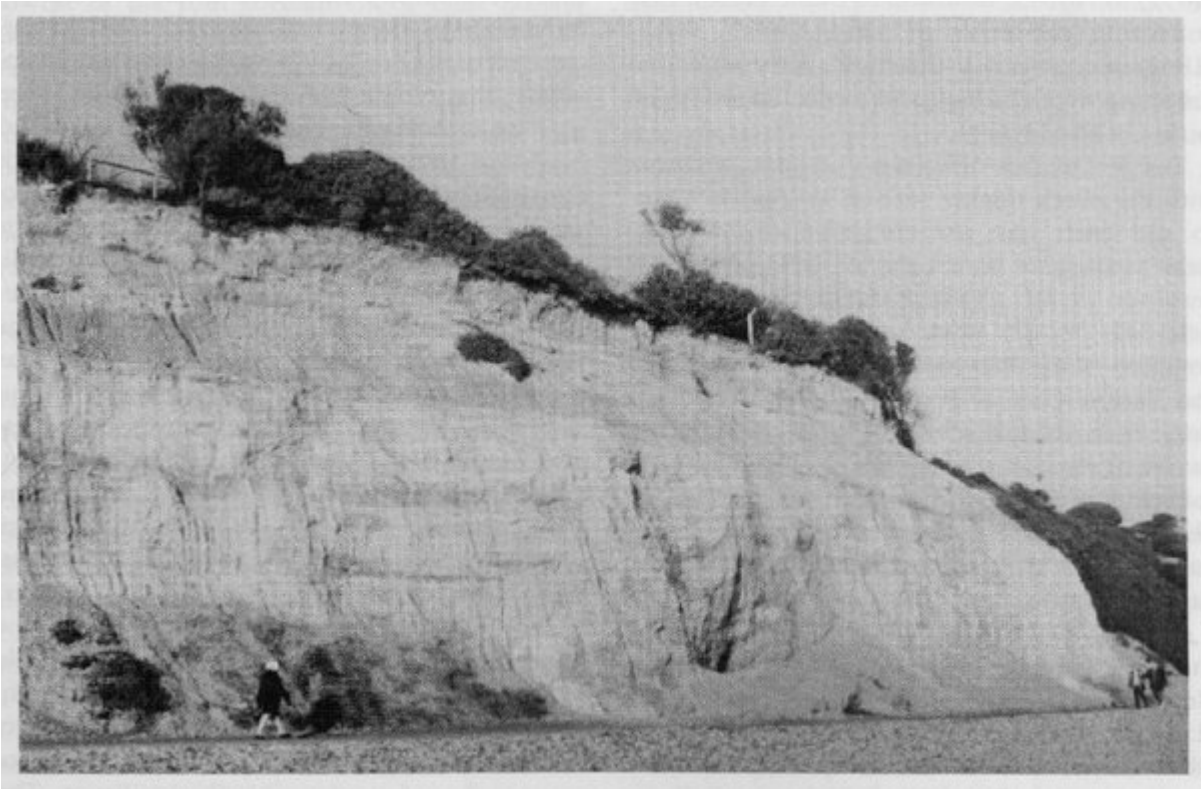
The spectacular structures that Plint (1988b, plate 9) called ball and pillow structures provide one of the few examples of soft sediment deformation in the local Palaeogene succession. They perhaps reflect the dewatering of underconsolidated sands or a response to a density inversion. Plint (1988b, p. 137) has suggested that they resulted from the rapid progradation of sands over unconsolidated water- and possibly gas-saturated muds.

Conclusions

Friars Cliff is nationally important because it provides an opportunity to study the tidal channel mouth bar facies of the Boscombe Sand which is only developed at this locality and hence provides a unique contribution to our overall understanding of contemporary geography. Furthermore, the soft sediment deformation structures present in this facies are amongst the most spectacular in the local Palaeogene succession.

In terms of correlation, the site provides a useful link between Hengistbury and the Bournemouth sections to the west and those of the Isle of Wight to the east.

References



(Figure 6.12) Friars Cliff, Mudeford, Dorset. Boscombe Sand (Barton Group), succeeded by the Barton Clay (greenish), below a cover of Quaternary Gravel at the top of the cliff. Water-escape deformation structures are present in the Boscombe Sand towards the right of the photograph. (Photograph: B. Daley.)