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FIELD EXCURSION TO THE CRETACEOUS AND CENOZOIC OF REDCLIFF (SANDOWN) AND WHITECLIFF BAY, ISLE OF WIGHT, 5TH JANUARY 1992

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The north - south traverse from Redcliff [SZ 612 849] to Whitecliff Bay [SZ 643 863] crosses the Isle of Wight Monocline, the site of Cretaceous - Cenozoic basin inversion and later folding. On the Redcliff section facies developed in Lower to Upper Cretaceous sediments reflect a marine transgression from fluvial and lagoonal environments, through shallow seas and into open marine conditions. This succession has an overprint of transgressive and regressive phases, some of which conform to global models of the times of sea-level change: these too are times of tectonic changes in the Channel Basin, of which the Isle of Wight succession is a part.

The history of sedimentation across the Isle of Wight Monocline can be related to phases of rifting, thermal relaxation, basin inversion and deformation. The aim of the trip was to examine the structural effects of these tectonic processes. The party gathered at the ferry terminus in Southampton, and travelled from there to Redcliff via minibus from Cowes. Despite some light rain and two abortive stops at local hostelries, a full and enjoyable day was had by the eleven members of the excursion.

The east-west trending monoclinal fold forms the backbone of the island. The vertical-dipping beds of the Chalk on the west coast give rise to the sea-stacks known as the 'Needles'. Bedding is near-horizontal in the centre of the island, where two limbs of the monocline are offset. The oldest strata (Wealden Group) are exposed in the Brightstone and Sandown Anticlines, developed on the hanging-wall of a Cretaceous normal fault, reactivated as a monocline in Cenozoic times. These anticlines are asymmetrical with gently dipping southern limbs and steeper northern flanks.

An excursion map, with location stops is given in Figure 1; the stratigraphy and structure of the Cretaceous succession at Redcliff is shown in Figure 2.

Wealden sediments are exposed here on the eastern limb of the Sandown anticline: they are visible at Stop 1 between the car park at Yaverland and high bluffs of Red Cliff, dipping north beneath the Lower Greensand Group, and toward the monocline.

A sharp, scoured contact between the Wessex Formation and the Cowleaze Chine Member of the Vectis Formation is present. This junction represents the initial transgression of a lagoonal environment across the braidplain of the Wessex Formation. There is a pronounced but gradual transition from the Cowleaze Chine Member into the Barnes High Sandstone Member. This arenaceous influx is a basinward shift in facies from the lagoonal muds below into delta/ baymouth bar environments. The Barnes High Sandstone Member displays a range of sedimentary structures including erosional surfaces, flaser bedding, wavy lenticular bedding, trough cross-bedding, mud-drapes and megaripples.

The Barnes High Sandstone Member can be traced along the cliff for approximately 80 metres (Stop 2). A small, iron-indurated ledge with rippled surfaces marks the top of the member where there is a distinct but gradational change into silts and muds of the Shepherd's Chine Member (37 metres in thickness). The basal 5 metres of the member contains three current rippled, coarse-grained sandstones, averaging 10 cm thick and cemented by iron oxide and non-ferroan calcite. They have a similar lithology to the Barnes High Sandstone Member, suggesting that they may represent episodes of reworking of the delta-top sediments elsewhere in the basin. The precise depositional environment of the Barnes High Sandstone Member remains an enigma: of the models discussed by the party, a delta prograding into a lagoon found most support.

At Stop 3 the Shepherd's Chine Member is a succession of finely laminated muds and silts with gutter-casts, non- and quasi-marine shell-beds. The shell-beds form four distinctive coquina limestones that range in thickness from 10 to 20 cm. The Shepherd's Chine Member is exposed intermittently along the vegetated slopes above the beach northeast towards Redcliff. The upper 30 metres of the section is present in a large intact slump block on the intertidal zone beneath the large landslip of the Atherfield Clay (Figure 2). The Atherfield Bone Bed of the Perna Beds can be seen in this section, resting erosively on the Shepherd's Chine Member below. 1.5 metres of sandy glauconitic mud separates the bone bed from the marine shell bed above. Many of the bivalves are *Mulletia mulleti,* previously known as *Perna.* The *Perna* Beds represent the transition to fully marine conditions and the passage of a shoreface across the lagoon. Only minor erosion is evident, and from biostratigraphic and magnetostratigraphic constraints it is not thought that a significant time-gap is present. However, this major facies change from the lagoonal sediments (with marine influences increasing upwards) of the Vectis Formation into shelf sediments of the Lower Greensand Formation is marked by ravinement, in which the relict shoreface is incorporated. This interpretation suggests that a 112 ma sequence boundary depicted on the Exxon "Cycle Chart" may correspond to the base of the Perna Beds observed on the Isle of Wight.

Stop 4 comprises the bulk of the Lower Greensand Group at this location. The shallow (10 degrees) dip at the western end of the section increases to around 30 degrees in the east. The sharp contact between the Atherfield Clay Formation (Upper Lobster Beds Member) and Ferruginous Sands Formation is clearly visible. At Stop 5 the top of the Ferruginous Sands Formation contains several grit and pebble beds including fragments of derived Oxfordian and Kimmeridgian ammonites (the latter including *Pavlovia).* The contact with the Sandrock Formation is marked by a dark grey and black silt with light yellow sand-filled burrows. The Sandrock is around 30 metres thick: large normal faults disrupt the continuity of the beds, although the characteristic clean white sands and cross-bedding of the upper beds of the Lower Greensand are visible.

Above the Sandrock is the Carstone Formation, a 15 metre-thick medium to coarse-grained sand with iron cement and a distinctive pebble-bed 6 metres below the Gault. The Carstone is thicker at Redcliff than anywhere else on the island. This is unusual given the fact that all the Cretaceous formations below thicken southwards into the Channel Basin. In boreholes sunk to the north of the monocline, the Lower Cretaceous is absent, and Carstone sediments are found resting unconformably on the faulted and folded Jurassic strata of the footwall. This change in subsidence in the early Albian can be related to tectonic movements in Dorset associated with minor uplift, erosion and renewed subsidence.

A path was followed up the landslip along the Sandrock - Gault contact, where fallen blocks of the basal Chalk were examined. At Whitecliff Bay sediments of Cretaceous (Chalk) to Oligocene (Cenozoic) age are exposed. The Chalk is exposed at the far east of the bay, where it is vertical, being astride the axis of the monocline. The Palaeogene sediments are also vertical, dips shallow close to the zig-zag path, until in the youngest beds

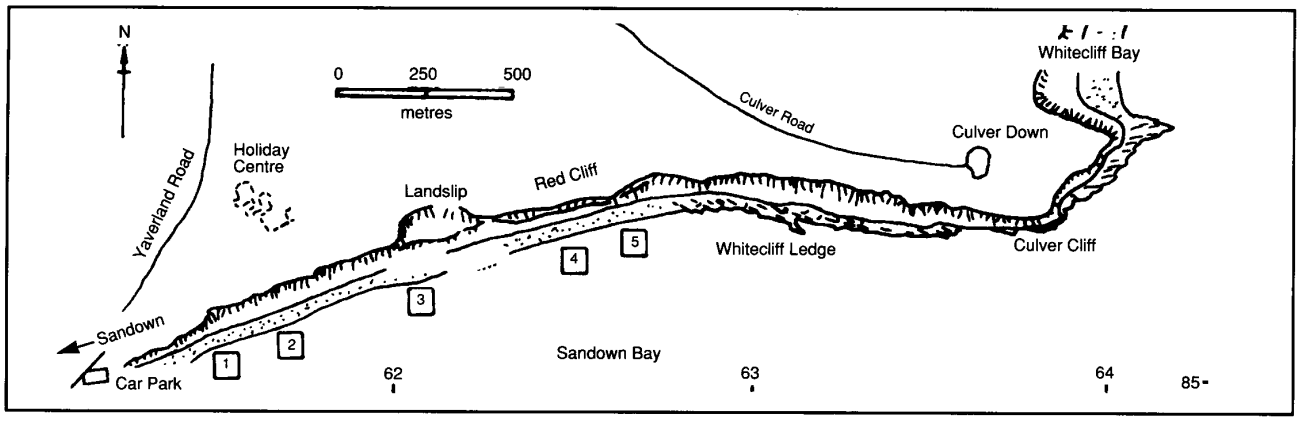

Figure 1. Location map of the Redcliff - Whitecliff Bay transect. Boxed numbers relate to stop locations discussed in text.

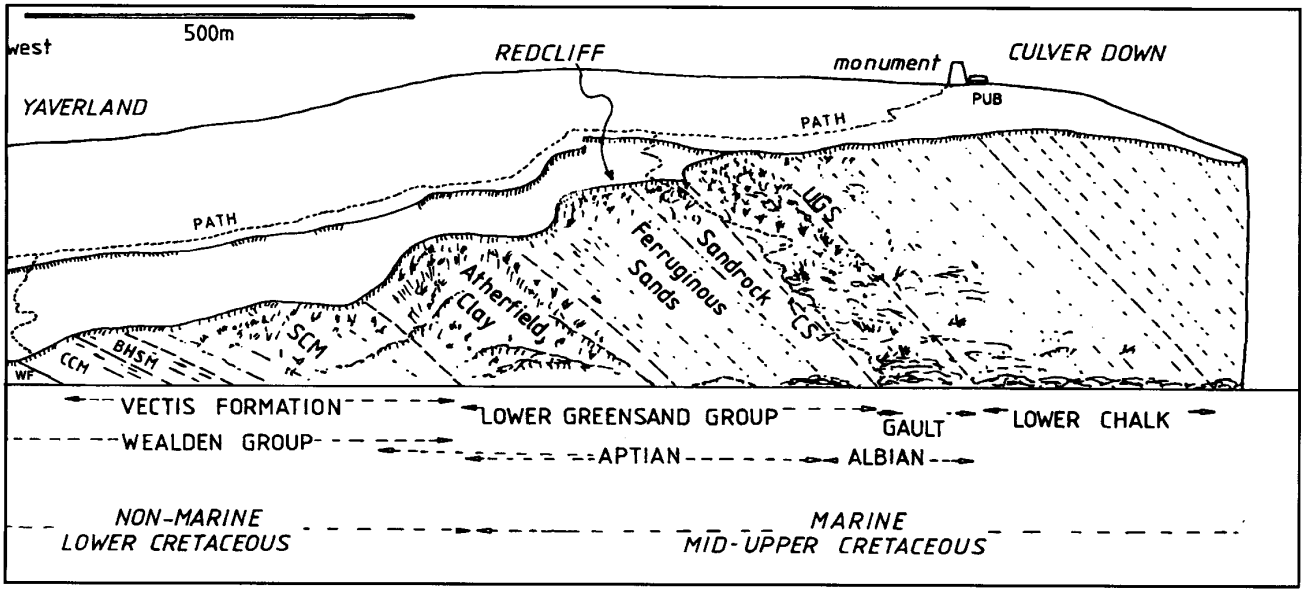

Figure 2. Profile of Redcliff drawn from photographs taken at Shanklin. WF = Wessex Formation; CCM = Cowleaze Chine Formation; BHSM = Barnes High Sandstone Formation; SCM = Shepherd's Chine Formation; CS = Carstone Formation; UGS = Upper Greensand.

exposed the dip is only a few degrees to the north. The widely variable lithologies of the Palaeogene are an indication of changing facies developed under transgressive - regressive conditions

The Lower Cretaceous exposed at Redcliff displays many features of a succession laid down under considerable tectonic influence: the beds abut the Isle of Wight Monocline at depth, a structure active at the time of deposition, and they contain abundant clasts derived from the tectonic uplands to the north. Nonetheless sea-level changes deduced from facies analysis compare favourably with the Exxon "Cycle Chart" model of eustacy. The Cenozoic succession at Whitecliff Bay, although largely vertical through ?Miocene compression, displays similar facies changes that can be matched to world-wide patterns of sea-level change. In both cases, climatic changes may also have influenced sedimentation.

What is noteworthy of the Redcliff - Whitecliff Bay transect, is that in passing across the monocline, nearly horizontal beds of Lower Cretaceous and mid-Cenozoic age are separated by vertical Upper Cretaceous and Palaeocene - Eocene strata. This is an indication of how localised the effects of basin inversion (Cretaceous - Cenozoic) and later compression (?Miocene) may be, lending credance to the concept of the basin development being controlled by active faults underlying the margins of the Channel Basin.

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