Blue Anchor–Watchet–Lilstock, Somerset

[ST 034 436]–[ST 070 438] AND [ST 116 435]–[ST 169 455]

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Introduction

The southern cuffed coastline of the Bristol Channel between Blue Anchor and Hinckley Point contrasts with the higher hog's-back cliffs of the Exmoor coast and the low, estuarine, wide mudflats and fringing dunes around the mouth of the River Parrett to the east. This site, which comprises two areas east and west of Watchet, is characterized by cliffs rising to a maximum of 84 m and fronted by a particularly well-developed series of intertidal platforms varying in width from 120 m to over 500 m. At St Audrie's Bay, the cliff has been proposed as the type locality and section for the base of the Jurassic System (Warrington *et* ed., 1994). The base of the Hettangian Stage at the base of the *Planorbis* chronozone is placed at the horizon in which ammonites of the genus *Psiloceras* appear.

The platforms are veneered in part by shingle, sand and mud, and reflect in detail the variable resistance to erosion of the Turassiched Marls, Penarth Beds and Lower Lias bedrock. A key feature of the platforms is their development in a macrotidal environment and their different exposure from narrower platforms in similar rocks on the northern side of the Bristol Channel at Nash Point. Whereas there has been considerable research into the nature of the platforms on the northern side of the Bristol Channel, it has been singularly lacking on the southern coast. Ussher (1908) was the first to describe the main features and Steers commented that the cliffs and shore features were of 'considerable interest' (Steers, 1946a, p. 211).

Description

The western part of the site extends from the eastern end of the sea-wall at Blue Anchor [ST 034 436] to just west of Watchet [ST 070 438]. Near-vertical cliffs rise eastwards to Blue Anchor Point [ST 040 437] where they give way to higher cliffs that are much affected by many small landslips. From their highest elevation of 84 m, they fall steadily towards sea level at Watchet. At Warren Bay [ST 057 434], they truncate a valley that is left hanging about 25 m above the base of the cliffs.

The alignment of the coastline of the western part of the site has little relationship to the direction of wave attack from the Atlantic Ocean. The coastal plan is primarily a function of the varying strengths and structures truncated by the cliffs and platforms. Differential erosion is a dominant force both in the general form and the detail of the coastal features. The platform varies between 300 m and 500 m in width. The general slope of the platform reflects the process of marine planation in cutting across the outcrop, but the varying strength, dip and strike of the beds give rise to a varied micro-relief. Parts of the platform warrant the description 'washboard-like relief', a form that has been described elsewhere (for example, Suzuki *et al.,* 1970), but rarely reported in Britain (Figure 4.8).

The eastern part of the site extends from the eastern side of St Audrie's Bay [ST 116 435] to Lilstock [ST 169 455]. Much of the cliff is near-vertical, rising from about 25 m to over 50 m in height at Quantocks Head. The cliffs decline in height to near sea level at Kilve Pill [ST 143 444] and then maintain a height of about 30 m to the eastern boundary of the site. The platform is between 120 m and 300 m in width, and demonstrates similar relationships between rock type, structure and micro-relief to the area west of Watchet. This part of the site, however, shows a stronger relationship to the prevailing direction of wave attack from the WNW both in the alignment of a shingle beach on the eastern side of St Audrie's Bay and in the alignment of the cliffs to the north-east of Kilve Pill.

Interpretation

Although the coastline is one on which erosion dominates, there have been few measurements of change. Mackintosh (1868) estimated the rate of cliff retreat on the Lias cliffs as 1.2 m a^{-1}. Retreat is far from uniform, with very little change at some points whereas others attain current rates of change comparable to those noted by Mackintosh. The platforms here are of considerable interest and they warrant further investigation. Both the platforms and the cliffs in the Lias on the northern side of the Bristol Channel have been investigated in some detail (see GCR site report for Nash Point below). Although the Watchet sites lie in a similar tidal regime to that of Nash Point, they are much less exposed to the high wave-energy levels reported by Williams and Davies (1987). The maximum fetch of this site is just over 300 km to the WNW whereas Nash Point has a maximum fetch of 5000 km to the south-west. Atlantic waves approaching the Watchet sites undergo considerable refraction and approach the shore at an angle, whereas Nash Point receives the full undiminished energy of Atlantic storms. In the less vigorous environment of Watchet, processes of intertidal weathering are more important and there is less movement of particles broken from the bedrock.

The detailed nature of the platform reflects the minor structures of the rocks forming it, as well as the dip of the strata (Figure 4.8)a. For example, parts of the platform are distinguished by a blocky structure in which large numbers of small vertical joints about 0.25 m to 0.35 m apart create a series of irregular three- to six-sided polygons. The platform cuts across folded strata that dip variously seawards, landwards (Figure 4.9) and alongshore, and there are important variations in both the platform morphology and its effects upon wave action and shingle and cobble movements. Where the strata dip landwards, for example east of Kilve, the intertidal area is characterized by a series of micro-cuestas, up to 1 m in height (Figure 4.8). As the edges of these up-tilted strata have been broken up by marine erosion and intertidal weathering, they form a cobble field between the minor cuestas. The size of material in the cobble fields varies from the almost unaltered newly-quarried blocks, through sub-rounded and rounded blocks and pebbles to sand. Because the beds are rarely horizontal and often lie at an angle across the beach, many of them also show signs of the action of flowing water along the base of the micro-cuesta dip-slope. The blocky nature of the beds also imposes a maximum height on the micro-cuestas. As soon as a block is partly undermined it begins to slide along the joint surfaces and frequently topples forward. Wave action is insufficient to remove most of the blocks, which appear to remain close to their original site, until they have been worn down to a threshold size and shape which allows movement.

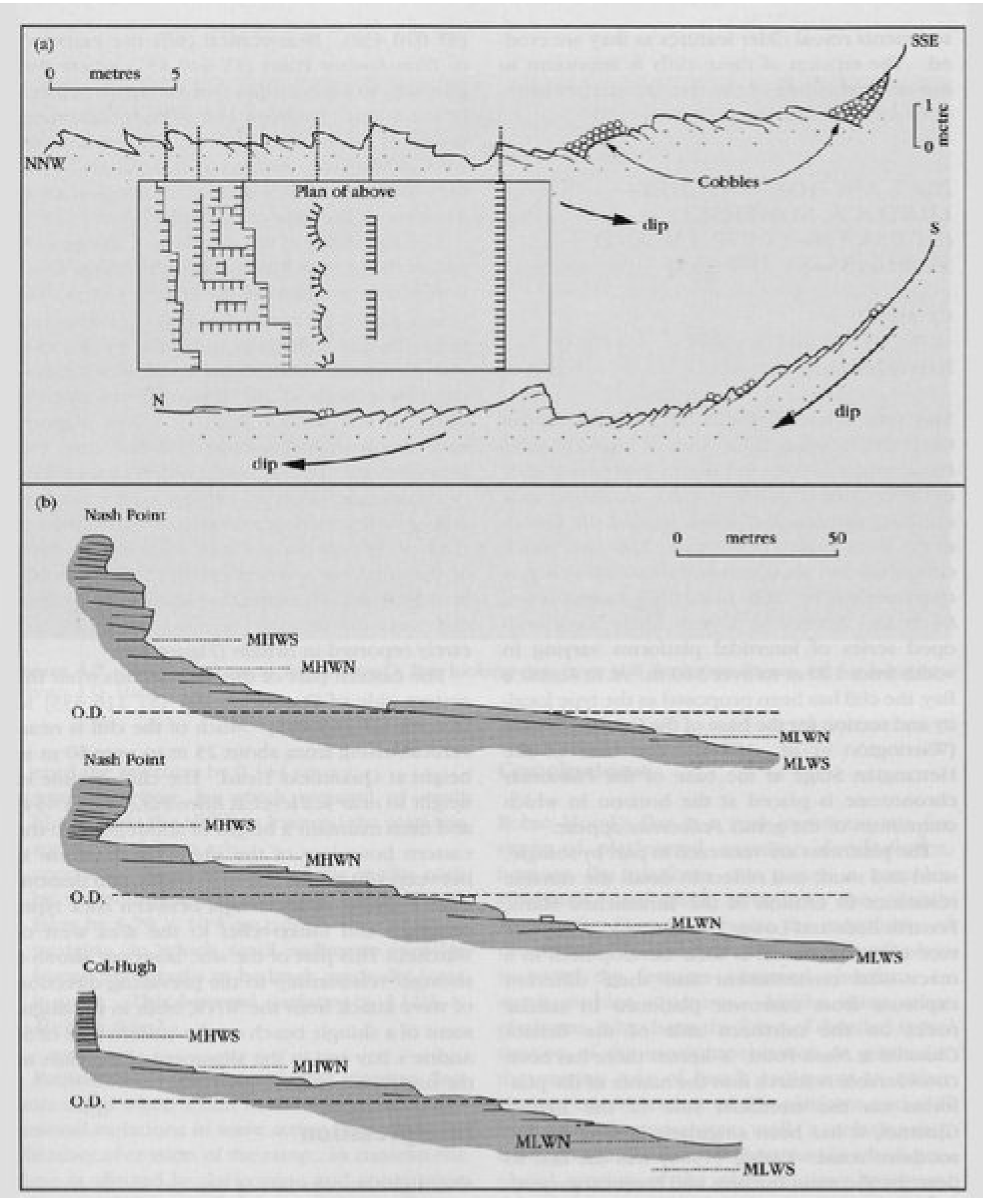
Where the strata dip seawards, for example, west of Watchet and between Quantocks Head and Kilve, the lower cliff sometimes forms a sloping rampart formed by unbroken strata. On the platform, micro-cuestas are formed with the scarp facing landwards, and large accumulations of shingle and cobbles are retained on the landward side of the micro-cuestas. Most erosion of the scarps is achieved by wetting and drying processes; the erosional product is readily transported along the sloping micro-vales. The scarps are very effective in preventing shingle and cobbles moving down the slope of the platform towards the sea. Even where the scarp is no higher than 0.1 m, its alignment is clearly marked by the line of cobbles resting against it.

Where the strata dip alongshore, the platform is also marked by micro-cuestas, but this pattern allows waves to reach well up the shore along the micro-vales between ridges. The most active parts of the cliffs characteristically coincide with these more exposed locations, for example to the west of Lilstock. Although they differ between seaward-and landward-dipping topographies, the large inter-cuesta sediment fields in this site contrast very strongly with comparatively bare platforms on the northern side of the Bristol Channel. Although this probably reflects the lower wave-energy environment of the Watchet sites, the morphology and slope of the platforms is also important. Most of the clasts are subangular. The only smoothed surfaces occur on the more resistant strata at the foot of the cliff, which are commonly cloaked by large beaches of more rounded clasts.

The platforms in this site show a morphological pattern in which the harder and wider, jointed and bedded strata form the upstanding forms. Suzuki *et al.* (1970) found that, In contrast to the generally expected relationship of rock hardness or strength to the extent to which strata protruded above the platform, the micro-cuestas at Arasaki, southern Japan, were formed in an apparently weaker tuff than the surrounding mudstones. The ability of the mudstone to absorb greater quantities of water, and the greater stresses that occurred as a result, caused them to be eroded more efficiently than the tuffs, which became the micro-cuestas. On the Watchet sites, the micro-relief is strongly controlled by the thickness of the in-situ strata, so that only those beds that are thicker than about 0.25 m form micro-cuestas. The variation (between 0.5 m and 0.02 m) in bed thickness, which characterizes the Lias in this site, thus appears to be the critical factor in the development of the washboard-like relief of these platforms. They warrant detailed study to develop a fuller understanding of the complex relationship between platform relief and the role of sediment as an abrasional agent.

Conclusions

This is a fine example of shore platforms developed in a macrotidal environment. The site includes one of the best examples in Britain of 'washboard' platform relief. The development of the platforms depends on the way in which the cliffs retreat. Although the site has received very little attention in the literature, the rapidity of retreat along much of this coastline is important for geomorphological study. Similar features have not been described elsewhere on the British coast, partly because platform studies have concentrated upon the gross morphology of platforms rather than their micro-forms, but also because such forms are comparatively rare. The platforms at Robin Hood's Bay are comparable, but are affected by a tidal range almost half that of this site. The other shore platforms, especially those in the Chalk, lack the resistant strata to produce micro-cuesta topography, and the platforms in the Carboniferous Limestone and Portland Stone are more commonly affected by weathering by dissolution. This site is thus important to the network of active platform sites both in its macrotidal location and its varied morphology.



(Figure 4.8) (a) Cross-sections, showing characteristic forms of the platform east of Watchet, where the dip of strata to landward or seaward strongly affects the pattern of micro-cliffs, (b) three characteristic platform profiles at Nash Point, Vale of Glamorgan (see GCR site report in the present chapter) where dip of strata is more uniform than at Watchet. Mean high- and low-water spring tide levels (MHWS and MLWS) and mean high- and low-water neap tide levels (MHWN and MLWN) are shown. (Part (b) is after Trenhaile, 1972.)

(Figure 4.9) Cliffs and shore platform at Kilve, Somerset (Photo: V.J. May)