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SHORE PLATFORMS AND MASS MOVEMENT: A NOTE

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Abstract

Shore platforms and mass movement phenomena are important elements in the coastal scenery of the British Isles. Both features are particularly well developed along the English Channel coast. Where mass movement is of major importance it tends to inhibit the exposure of shore platforms. Under certain conditions it may temporarily protect the platform from further erosion. The factors which encourage the formation of shore platform and mass movement differ. Mass movement appears to be a secondary process, and does not seem to participate directly in either the primary formation of the shore platform or in its subsequent evolution.

In a recent article (*Earth Sci. Jnl*, Vol. 2, No. 1) McLean and Davidson suggest that along the Gisborne coastline of New Zealand there is a genetic connection between the distribution of mass movement phenomena and shore platforms. Work by the present author on the shore platforms of the coasts of Britain does not confirm this observation. In fact the reverse situation is more common, shore platforms frequently being absent from, or at least only poorly developed along coastal areas dominated by large-scale, discrete types of mass movement such as falls, flows and slides.

Along the English Channel coast areas with such well developed large-scale mass movement features are quite sharply demarcated. A particularly large complex slide occurs between Dover and Folkestone at Folkestone Warren. Good examples are also to be found around the Isle of Wight, especially at Bouldnor on the northern coast of the island and at Undercliff on the southern coast. It is, however, along the Dorset and East Devon coast that major mass movement features are best displayed. Along the South Dorset coast they occur near St. Albans Head and Chapman's Pool, at Houns-tout, Gad Cliff and along the cliffs in Ringstead Bay. Further examples occur around the northern part of the Isle of Portland, and they reach their finest development along the predominently Lias Limestone cliffs of the West Dorset and East Devon coast (Fig. 1). Almost all cliffs, however, are subject to change by mass movement processes of very local extent. The Chalk cliffs of the Isle of Thanet, the South Foreland, the Seven Sisters, and their westward extension to Brighton provide almost annual examples of rock falls and yet the cliffline is not dominated by them, remaining for the most part a sheer, near-vertical face, with the scars and talus cones essentially of secondary significance. On these cliffs and others, small scale mass movement phenomena, involving fragments that weigh ounces and pounds rather than tons, and have a volume measured in cubic inches rather than in hundreds of cubic yards, also occur. Following a frost the fall of such miniscule fragments is particularly pronounced, the process being particularly effective during the cold winter of 1962/63. (Whether they are quantitatively more important in effecting cliff retreat awaits investigation.)

The upper portion of the cliffs of the English Channel coast between Kent and East Devon and elsewhere around the British Isles undoubtedly retreat in part at least (and probably principally) through the agency of mass movement processes. Within the area of wave attack at the cliff-base, however, processes more closely

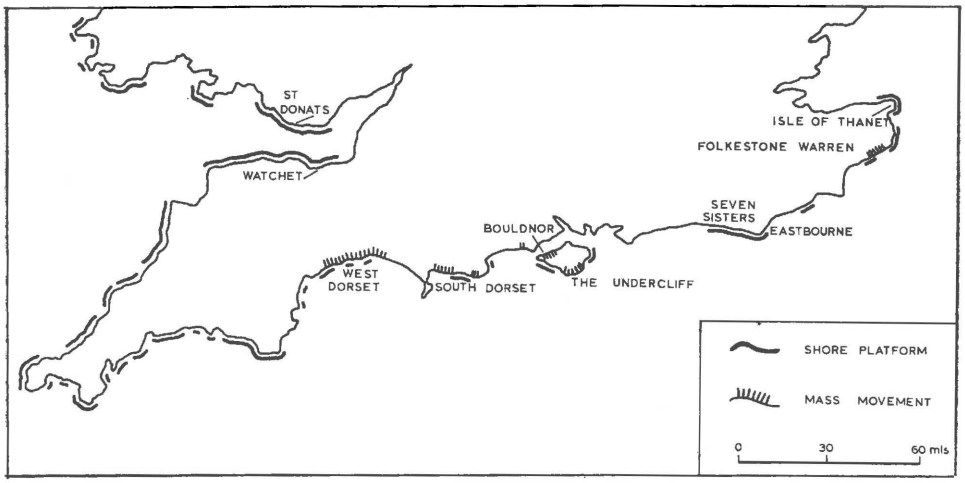

Figure 1. Distribution of shore platforms and major mass movement features in southern Britain.

related to marine action effect the retreat of the cliff. In this zone wave quarrying, hydraulic action and abrasion are important, the effects of these processes being particularly clearly visible along much of the Chalk coastline where the fresh, white chalk of the newly exposed and abraded faces contrasts strikingly with the green, algae covered, or brown, downwash stained chalk of the non-eroded areas. Mass movement scars on the other hand are rare in this cliff-foot zone, although debris derived from above does occur.

It is in areas where small scale movement phenomena or isolated medium scale features occur that shore platforms are best developed. This is particularly well illustrated by the Isle of Thanet coast where platforms range from about 200 ft to over 1000 ft in width, along the Sussex coast between Eastbourne and Brighton, along the southwest coast of the Isle of Wight where Wealden rocks of an essentially clay and marly character occur and along the South Dorset coast near Kimmeridge Bay where the alternating clays and limestones of the Kimmeridge Beds outcrop. Along the Bristol Channel coastline good examples occur in Bridgewater Bay, at Watchet and Hinkley Point, and at St Donats, west of Cardiff. Shore platforms that are often well over 1000 ft wide and backed by low cliffs of Lias occur in both localities. (The great width is partly due to the large tidal range which in this area exceeds 30 ft at spring tides.)

Somewhat different conditions pertain where individual mass movement features or mass movement complexes reach major proportions as at the localities outlined above. In such areas shore platforms are, on the whole, not well exposed. Although the type of mass movement may vary the effects are broadly comparable. A vast quantity of material is injected into the intertidal zone; an irregular talus slope replaces the graded slope of the shore platform so that abrasive action is temporarily reduced; the near vertical face of the cliff-foot zone, against which waves may break with considerable force, is superceded by an irregular, lower angled slope on which wave energy is dissipated. Counterbalancing this to some extent would be the weaker nature of the mobilised rock following the complete or partial break-up of bedding and joint planes during movement. Destruction of the talus slope by marine action is, however, not always rapid. Initially at least the ungraded slope and fragments will impair erosion, particularly where the fragments moved to the intertidal zone are considerably larger than those normally present. Furthermore the undermining or removal of the toe of the talus cone may possibly cause additional falls from or movement of the talus material thereby

slowing the rate of retreat. Other things being equal the destruction of a slide predominantly of clay will be more rapid than a slide composed chiefly of blocks of limestone or sandstone.

Some support for these suggestions is forthcoming from the Chalk coastline of the South Foreland between St Margaret's Bay and Dover, where several discrete falls have occurred. The resultant talus slopes are now bing trimmed by wave action and some are seen to rest on a platform surface often several feet higher than the exposed surface on either side. This clearly indicates that at least some mass movement phenomena temporarily protect the platform upon which they come to rest. Along the southwestern coast of the Isle of Wight falls and slides derived from the Wealden Clay are rapidly removed and exert almost no protective action. The contrast between the piles of algae covered debris that occur at the base of the Chalk cliffs, and the number of scars but relatively few debris slopes that occur along the Wealden cliffs of the Isle of Wight is quite striking. However, more work is required upon this topic.

Typically the large-scale mass movement features of the English coastline produce so much material that the platform is effectively obscured. This is well shown by the mass movement complex in the north coast of the Isle of Wight, at Bouldnor, and along the South Dorset coast near St Albans Head and Houns-tout. Others, notably the landslips at Folkstone Warren (Osman, 1917) and Beer, in East Devon (Arber, 1940) not only provide material to the intertidal zone but are so deep seated that the surfaces of sliding intersect the pre-existing platform well offshore, thus raising the level of the platform (and breaking up its surface, thereby encouraging its rapid destruction by subsequent marine action.)

Shore platforms are not always absent from areas of large-scale movement. At both Folkstone Warren, and along the Lias coast of Dorset near Lyme Regis platforms do occur. In the former case they are actually cut into the slumped mass, reflecting the lack of disturbance of the bedding and joint planes within this very large-scale feature. In the latter case the platform is exposed where the supply of debris to the intertidal zone from large-scale slides and flows is restricted by the undercliff developed below and seawards of the point of origin of the mass movement. In both instances, however, the platforms are but poorly developed when compared with areas of comparable geology that lack large-scale falls, slides or flows such as the Seven Sisters coastline, and the Lias coast of Bridgewater Bay.

Much work remains to be carried out on the retreat of cliffs. This is clearly a complex topic involving geologic, topographic and marine factors and additionally climatic considerations. Equally, the intensive studies of shore platforms must continue. The relationship between cliff-retreat and the landward extension of shore platforms may at first sight appear to be a simple one. This is not the case since the processes operating above the level of wave attack differ from those occurring below it. The extent to which one group interacts on the other is presently obscure and will probably remain so until many detailed field studies and quantitative investigations are carried out. Preliminary work on the shore platforms of the English Channel coast has shown that such characteristics as distribution, width, the amount of superficial cover, and the height of the cliff/platform junction relate to such factors as lithology, structure, height of cliff, offshore topography, the exposure of the coast, wave and tidal conditions, the strength of longshore drift, and so forth. Mass movement phenomena are an additional and complicating factor since they disrupt geological structures and interrupt the ordered conditions so common along almost the whole of the intertidal zone. Along the English Channel coast these features are entirely secondary to the development of shore platforms. They occur because the geologic and *topographic* conditions are unstable, i.e. the retreat of, or removal of material from, the cliff-base is producing or maintaining an over-steepened, unstable slope. They occur not because a cliff

has a shore platform at its base but because a cliff is a favourable (possibly the most favourable) site for movement. Shore platforms on the other hand occur primarily where geologic, and *marine* conditions, in a variety of combinations, encourage erosion without the production of a vast quantity of detrital material. Subsequently they are attacked by a variety of marine and sub-aerial processes. Mass movement, however, is very rarely, if ever, concerned in either the primary production of the platforms or in its subsequent modification and development.

SUMMARY

i) Examples of both shore platforms and coastal mass movement phenomena occur along the coastline of England and Wales.
ii) Retreat of that part of the cliff-face above the level reached by wave action is effected in large part by mass movement processes.
iii) Retreat of the cliff-foot within the zone of wave action is primarily the result of marine erosion of various types (abrasion, wave quarrying, hydraulic action, etc.)
iv) Where mass movement is on a relatively small scale it may provide useful 'tools' that encourage erosion at the cliff-base.
v) Where mass movement is on a large-scale it tends to obscure the shore platform and possibly slow the rate of cliff retreat.
vi) The accumulation of debris at the cliff-base following mass movement may protect the cliff and shore platform from marine erosion for some time.
vii) Shore platforms along the coastline of England and Wales are to be correlated with various aspects of geology and marine conditions.
viii) Mass movement features are to be correlated with (other) geologic and topographic conditions.
ix) There is little or no evidence to support the view that mass movement processes actually form shore platforms or assist in their development.

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