

# Cliff stability and coastal landslides

## Rock slide at Beachy Head

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**O**n the 10/11th of January 1999 a rock slide at Beachy Head, East Sussex, took place that received considerable media interest due to the relatively large size of the fall and the prominence of Beachy Head as a tourist attraction. The fall also disrupted the electricity supply to the Beachy Head Lighthouse, founded on the wave-cut platform at the bottom of the cliff, and required deployment of the backup diesel generator.

Beachy Head and the Seven Sisters to the west of Eastbourne are world-famous both scenically and geologically. The chalk cliffs expose the complete sequence of the Chalk from its lowest members up into a high level in the Upper Chalk. They have been studied for well over a hundred years and are now regarded as a type section because of the completeness of the sequence and its accessibility. As a result of the work of Professor Rory Mortimore of the University of Brighton and the BGS, the sequence in the cliffs is used as a standard for mapping across the whole of southern England.

Concern was expressed in the media that part of our coastal heritage was at risk and that, given time, Beachy Head would vanish into the sea. It is true that Beachy Head and the other chalk cliffs in the area are receding due to marine erosion at a rate that has been estimated by various authors at between 0.25 and 1.2 metres per year. However, recession is episodic. The cliffs may recede by several metres at a single fall and then remain stable for

*Making a photographic record of the cliff face from the Gallery of the Beachy Head Lighthouse.*

several years or possibly tens of years. Hence it is difficult to calculate recession rates accurately unless detailed cliff positions are known over a period of many years. It must also be acknowledged that the spectacular topography and whiteness of the cliffs are products of the erosion and, even if recession could be halted, the nature of the cliffs would change to the detriment of their value as notable landscape features.

### Cliff stability assessment

As a consequence of the rock slide the BGS were commissioned by The Corporation of Trinity House to advise them on the likely short-term and long-term stability of the cliff. Only with such information could decisions be made for maintaining the electricity supply to the Beachy Head Light. The BGS carried out an engineering geological survey of the cliff by inspecting and photographing the profile and discontinuities in the cliff face. The work included a geophysical survey of



*The January rock slide almost reached the base of the Lighthouse.*

the cliff top using a high-resolution resistivity imaging technique that looked for significant discontinuities which would impair the stability of the cliff but were hidden from surface inspection. Representative samples of chalk from the debris pile at the foot of the cliff were collected and tested in the BGS laboratories to give values for density, porosity, unconfined compressive strength, cohesion and friction angle.

The data gathered from the field and laboratory work were used as inputs to an analysis of the cliff's stability, using Galena™ limiting equilibrium slope stability software. This indicated its current stability and the results were also used to assist in a long-term stability assessment. The results of this work have enabled Trinity House to plan for the continuing supply of electricity to the lighthouse. Following the initial survey a second minor fall took place on the 8th of April, removing a portion of cliff which had been identified during the survey as highly likely to fall in the near future.



### Coastal landslide hazards in Britain

Landslides are a constant feature of the development of our coastline and at any time there will be active landslides in many places, most are due to natural causes such as marine erosion, high rainfall or the natural weakening of rocks through weathering.

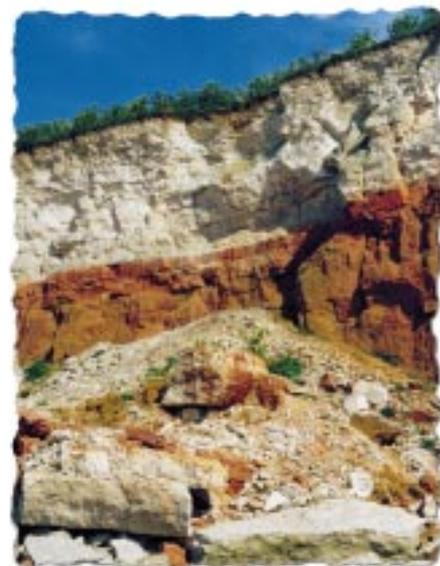
Another large landslide, of a very different character to the Beachy Head slide described opposite, was the Holbeck Landslide, south of Scarborough. This attracted considerable

interest when it destroyed the Holbeck Hall Hotel in 1993. A rotational landslide involving about 1 million tonnes of glacial till cut back the 60 metre-high cliff to a distance of 70 metres. It flowed across the shore to form a semicircular promontory 200 metres wide projecting 135 metres outward from the foot of the cliff. The cause of the slide was attributed to heavy rainfall of 140 millimetres in the two months before the slide took place.



Jim Evans © BGS, NERC MN2778A

A large slump in glacial till led to the destruction of the Holbeck Hall Hotel, Scarborough in June 1993.



Alan Forster © BGS, NERC

Although only the large and spectacular landslides are reported in the news, small landslides are common around our coast and affect a wide range of geological materials such as soil falls and slides in the low till cliffs of Holderness, rock falls from the strikingly coloured red and white chalk cliffs at Hunstanton (*above*) and mudflows from the internationally famous fossiliferous Jurassic cliffs of the Dorset coast.



Jim Evans © BGS, NERC

It is important to take into account the possibility of rock falls from cliffs when enjoying the recreational potential of our coast both by being careful to avoid walking at the edge of unstable cliff tops and taking care to keep away from the base of cliffs which have overhanging rocks on the point of falling. On a larger scale, all construction work near to cliffs should take expert advice on cliff stability issues at the time of construction and projected into the design life of the structure being considered. The cost of such surveys and predictions is money well spent as illustrated by the bungalow at East Cliff, Dorset (*above*) that was carried over the cliff edge by landsliding about one year after its completion.

Jim Evans © BGS, NERC



Mudflows of Lias clay and sand runs from the Upper Greensand form the Black Ven landslide complex on the Dorset coast, east of Lyme Regis.