Sea Cliffs

Photo: Malcolm Farrow

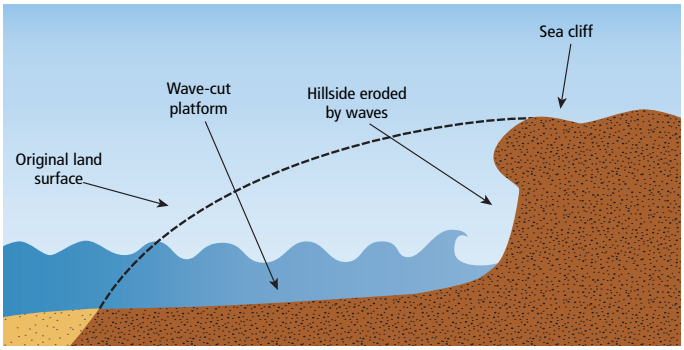
The Suffolk Coast and Heaths

- An Area of Outstanding Natural Beauty

How Do Sea Cliffs Form

Sea cliffs are not only found on the rocky west coast of Britain but also on the softer coastline of Suffolk. Steep slopes of earth or rock face form where higher land meets the sea. Their characteristic shape is caused by waves eroding the base, creating a near vertical and occasionally overhanging face or a sloping face. Cliffs are subjected to greater erosion and tend to retreat more rapidly than other landforms.

The creation of sea cliffs depends on both the nature of the underlying rock type and the processes by which they were formed. In particular the underlying geology of coastal areas is key in determining landforms such as tall cliffs and low lying marsh land.



Suffolk's Sea Cliffs

In Suffolk there are approximately 44km of soft sea cliffs. These soft rocks of clay and sand often deposited as the ice sheets retreated are eroded by the waves of the North Sea that constantly batter the coast. This erosion is evident along Suffolk's cliffs – the landscape is faced with constant change and debris such as trees and masonry can be seen at the cliff base. Suffolk's cliffs are characteristically low and crumbly, also contain orange-brown crags (2.8 million years old) along the coast.

Some soft cliffs form less steep slopes, and are therefore more easily colonised by vegetation and are home to a number of bird species. Others provide excellent nesting sites for sand martins, which burrow into vertical cliff faces. There are also invertebrates which are rarely found elsewhere.

Main factors affecting sea cliffs in Suffolk

Erosion – Cliffs are an important feature for biodiversity and geology. Erosion is a natural process which keeps the geology exposed, and much wildlife is able to adapt to the change. It is however a major issue for land owners as land is lost or it can no longer be safely used.

Coastal protection – Eroding cliffs are sometimes protected by man-made defences. This stops natural processes exposing the faces and can stop vital material being washed along the shore to replace other eroded material, so altering coastal processes elsewhere.

Building development – there have been a number of cliff top developments of varying sizes along the Suffolk coast, including Sizewell power station. These developments may lead to pressure for the construction of more coastal protection.

Agriculture – With post-war intensification of agriculture, much natural/semi-natural vegetation from cliff tops has been lost with fields now cultivated as close as possible to the edge

Recreational use – Some cliffs have suffered increased erosion as a result of the popularity of the coast as an area for recreation.

The erosion of Suffolk's crumbling cliffs feeds the deposition of sand and shingle beaches which characterise much of the Suffolk coastline. This movement of material, known as 'long shore drift', has built important features along the Suffolk coastline: – the spit of Orfordness, Landguard Peninsula, Thorpeness and Benacre Ness. (A ness is where the coast forms a point into the sea. These nesses are often mobile and slowly move along the shore.)

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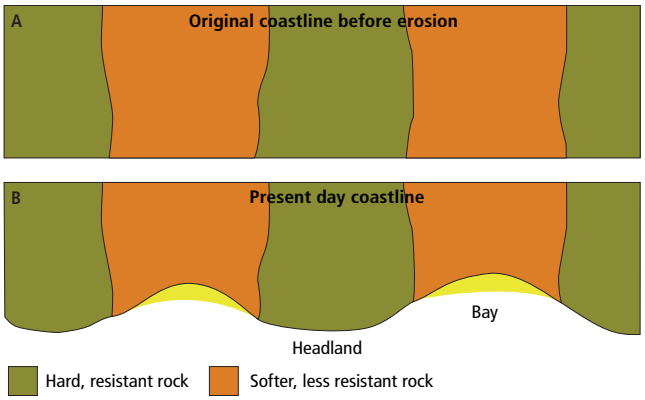
Shingle barriers have also been formed in front of small rivers creating brackish (slightly salty) lagoons and broads – including: Benacre Broad, Easton Broad and the intermittent lagoons at Shingle Street.

Coastlines which are fairly straight for many miles occur where the rocks are similar or of one type and run parallel to the shore, whilst coastlines where headlands and bays have formed will have rock types with varying resistance to erosion, and at an angle to the sea.



Erosion

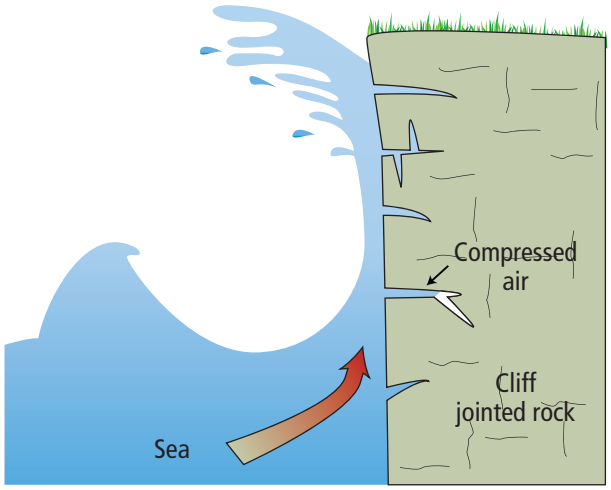
Rocks are broken down over time by a range of weather related and marine processes.

Coastal erosion is a natural process of interaction between land and sea - waves erode cliffs and deposit sediment, such as sand, on beaches further up or down the coast. However, in recent years, rising sea levels, bigger storms and higher waves have accelerated the rate of erosion.

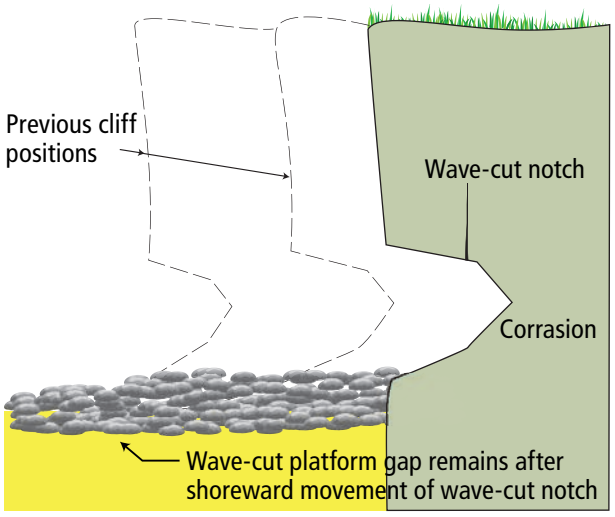
The processes most commonly affecting cliffs and coastlines are:

Corrosion/Solution – to various degrees all rocks are soluble in water. When rock is dissolved by chemical solutions in sea water it is called corrosion. This is most obvious in rocks such as limestone (calcareous rocks); acids that dissolve it (carbonic acids) are found in sea water. In addition sea salts are left by evaporating seawater which expand within the cracks of rocks and weaken their structure.

Hydraulic Action/Pressure – Joints and cracks form lines of weakness within the cliff structure. When water is thrown against the cliff face, pockets of air may become trapped in these cracks. The air is compressed with considerable force into these joints and cracks, leading to a weakening or cracking of the rock. This mainly occurs with hard rocky cliffs.



Corrasion/Abrasion – Material such as sand, shingle, pebbles and boulders are carried in waves and the repeated pounding of these wear away the cliffs, particularly at the base. This may create a 'wave cut notch' which undermines the cliff face and can lead to its eventual collapse. The cliff face is unstable in soft rocks which have a tendency to slump or collapse.



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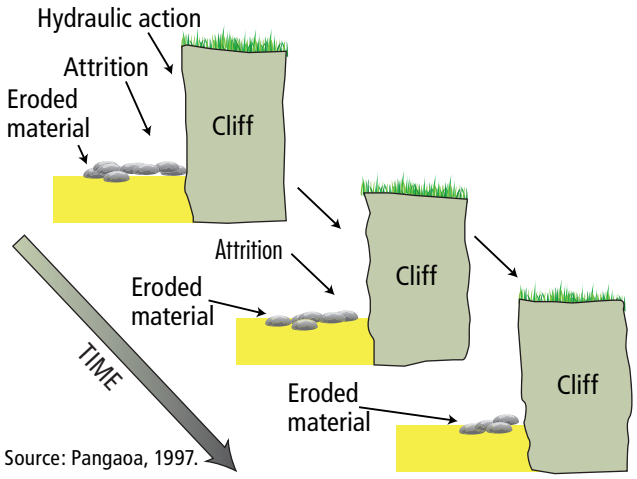
Attrition – Material on the beach is continually moved around by the turbulent swash and backwash of waves and becomes worn down by repeated impacts between particles. Larger boulders can also be worn down by the repeated impacts of smaller particles. Beach material becomes smaller, smoother and more rounded over time. This in turn allows the beach to be washed away so making the cliffs more vulnerable.



Sub-aerial – These are coastal erosion processes that are not linked to the action of the sea. Erosion is caused by rain, weathering by wind, and frost. The result can be mass movement, either as soil creep on gentle slopes or landslides on steeper slopes.

Human activity – Removal of beach material and continuing building developments on the tops of cliffs have contributed to more rapid erosion.

Influences on the rate of erosion:

The rate at which a stretch of coastline is eroded is related to:

The point at which the waves break

- If a wave breaks at the foot of a cliff, the cliff is subject to maximum energy (force) and the greatest erosion.
- If it hits the cliff before it breaks there is less energy released as the wave never reaches its full energy level.
- If the wave breaks before it hits the cliff then the energy level is less, as the wave will have lost energy travelling over the beach.

Steepness of the waves

- When a wave is created nearer the coast it is steep and therefore has more energy. Swell (bigger, slower waves), which is created miles offshore, has less energy and will therefore have less ability to erode.

Depth of the sea, fetch and aspect

- The steeper the shelving of the beach is, the higher and steeper will be the waves created.
- The wider the sea, the longer the period the wind has to blow over it (its 'fetch') and the more the energy that can be put into the wave. A long fetch therefore creates a more energetic wave.
- Headlands with vertical cliffs increase energy by reflecting and refracting the waves.

Beach width

- A wide beach protects a cliff more than a narrow beach because the waves' energy is reduced as they run up the beach.

Rock type and structure

- Hard rock such as granite is far more resistant to erosion than soft rock such as clay.
- Well jointed and faulted rocks are also likely to erode.
- If a cliff is made up of different rocks of various resistance, erosion may also be rapid.

The table below shows some typical rates of erosion and cliff recession for different rock types.

Rock type	Typical rates of cliff erosion
Boulder clay and sands (typical of Suffolk)	1 to 4 metres per year
Chalk	0. 3 metres per year
Shale	0. 09 metres per year
Granite	0. 001 metres per year

The Coastal Knowledge Fact Sheets have been produced by the Suffolk Coast and Heaths Unit
www.suffolkcoastandheaths.org
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