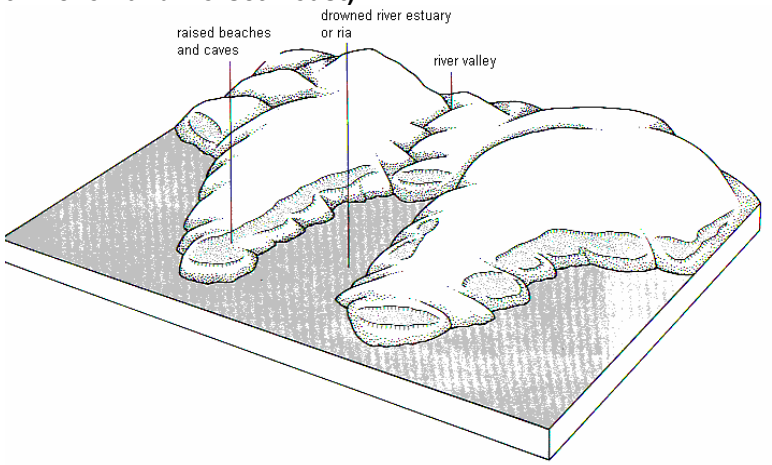
AS Geography 1.3 Coastal Environments *Student Notes*

Landforms of submergence and emergence, to include rias and fjords, raised beaches and abandoned cliffs.

You should be able to describe and explain the formation of each landform listed. You must be able to use annotated diagrams and sketches in your descriptions and explanations. You need to know located examples, primarily, but not exclusively, from two contrasting stretches of coastline (North Devon and Dorset Coast).



Rias in South and North Devon

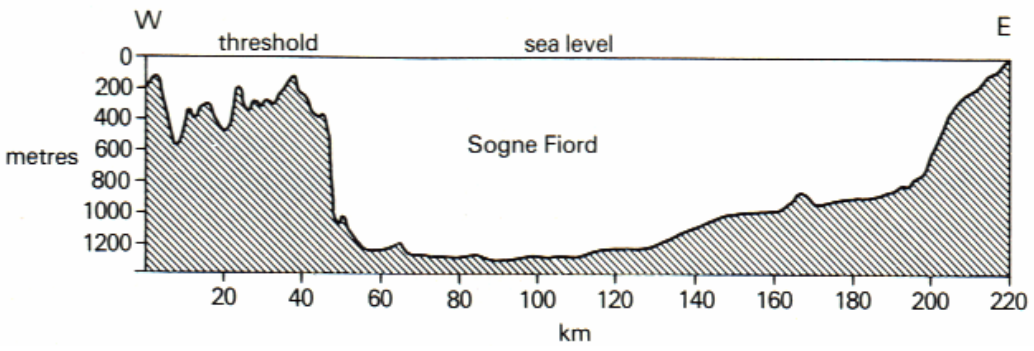
Rias are river valleys that were formed when sea level was lower. The rivers cut down to a **base level** (sea level) as much as 100m below the present sea level. These valleys were then flooded as the sea level rose in the **Flandrian transgression**. Many rias have a **dendritic** (tree like) pattern, reflecting the pattern of the drowned valley and its tributaries. Rias are common throughout southwest Britain and include Milford Haven in southwest Wales and the Fal estuary in Cornwall, which extents some 18km from the open sea. In North Devon, the shared estuary of the Taw and Torridge Rivers is effectively a ria. As time passes, rias will gradually sit up with fluvial sediments.

Possible Origin of Poole Harbour. It is probable that Poole harbour in Dorset was once part of a river valley that was drowned by post-glacial sea level rise.

Fjords in Norway, Chile, South Island New Zealand, Alaska and British Columbia

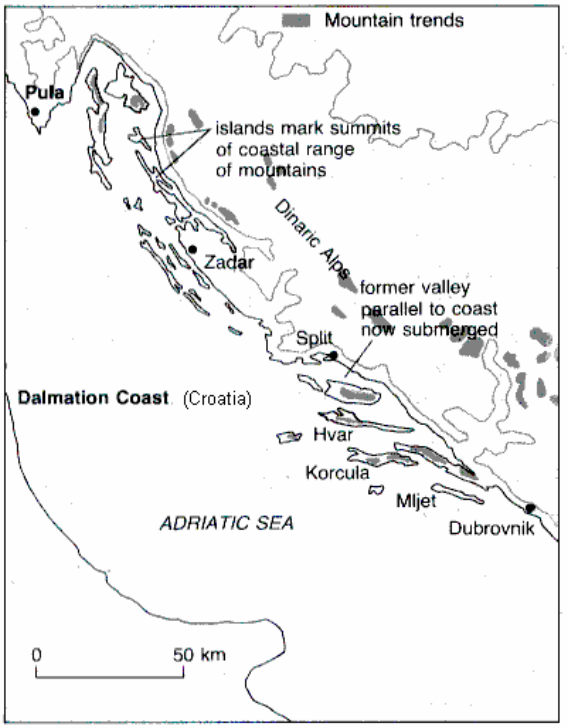
Fjords (or Fiords), such as the Songne Fiord in Norway, were formed by glaciers that eroded deep glacial troughs below the present sea level. The eustatic post-glacial sea level rise has flooded these troughs to create long, narrow, steep sided inlets with hanging valleys (often marked by waterfalls). The glaciers probably formed in pre-glacial river valleys. Unlike rias, the fjords are deeper inland and shallow towards the seaward end. A rock bar marks the shallow “threshold”. There may have been less glacial erosion at the threshold as the glacier may have started to melt and thin, or to float on the sea, therefore reducing its erosive powers. Some thresholds may be **terminal moraines** where the glacier deposited rock debris. The Songne Fjord extends 195km from the open sea and reaches a depth of 1308m

Long profile of Sogne Fiord, Norway



Fiard Coastlines.

These are drowned glacial lowlands, such as Strangford Lough in Northern Ireland or on the Baltic coast of Sweden. It is characterised by a large number of islands. Fiards are wider and shallower than Fjords



Dalmatian Coasts in Croatia

Dalmatian coasts are similar to rias, except their rivers run parallel to the coast. On Croatia's Adriatic coast, parts of the Dinaric Alps have been drowned creating a series of parallel islands, which represent the summits of the former coastal mountain range.

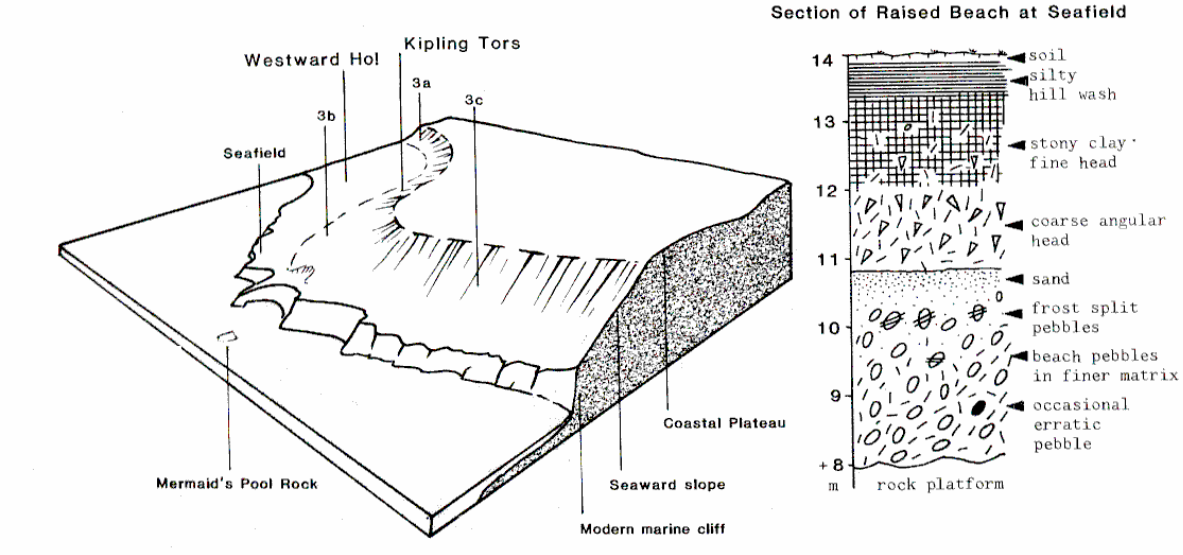
The sea level rise here was partly eustatic, but also isostatic. Like many parts of the Mediterranean Basin, there is gradual subsidence taking place in this part of the Adriatic, caused by the reduction in compressive forces between the African and Eurasian tectonic plates.

Raised Beaches

As sea level falls, wave-cut platforms and their beaches are "raised" above the reach of wave activity. Many raised beaches are recognised by a line of a degraded cliff, fronted by what was once a wave-cut platform, often with beach deposits resting on it. On the Isle of Arran in Scotland, there are many other relict landforms including wave-cut notches, caves, arches and stacks.

Most raised beaches in Britain are either a result of post-glacial isostacy, particularly in Scotland, or a result of former higher global sea levels in the Ipswichian interglacial or earlier. Those in southern Britain fall into the latter group.

Raised Beaches at Westward Ho! (North Devon) and on the Isle of Portland (Dorset)



The raised beach at Westward Ho! is about 8m OD (*Ordnance Datum* - above sea level) at it is now being exposed by modern coastal erosion. About 8m above the modern beach, the rocks in the cliff

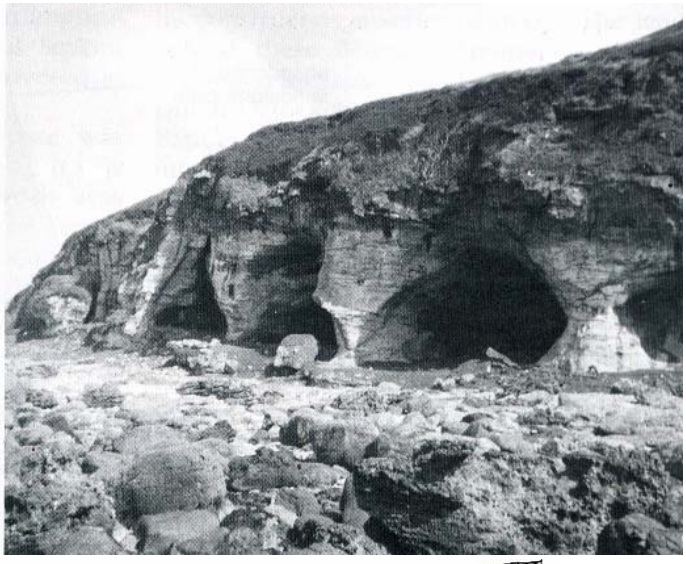
face stop abruptly. This is the surface of an ancient wave-cut platform. Above this, the cliff consists of well-rounded pebbles in a fine sandy matrix. This is remarkably similar to the modern beach material. Some pebbles are erratics: they are made of rocks that are not of local origin that may have been brought in by earlier glaciers or by longshore drift. About 50m behind the modern cliff is a larger degrading cliff, which was probably active when the beach and wave-cut platform were being formed.

After the beach had been formed there is evidence of a climatic deterioration. Towards the top of this deposit, some pebbles have been shattered by frost. On top of this is material described as coarse angular head. This is material brought down from the old degrading cliff by periglacial process such as frost action and solifluction. Above the head is the modern soil. From this evidence we can tell that the cliff predates the last Devensian glacial and is probably Ipswichian (130,000 B.P).

In Dorset, raised beaches can be found at the southern end of the Isle of Portland, one at 16m and one at about 8m OD. The first was probably formed in an earlier interglacial (the Hoxnian) about 210,000 years ago. The 8m beach is probably Ipswichian and about the same age as the raised beach at Westward Ho! (125,000-130,000 years old).

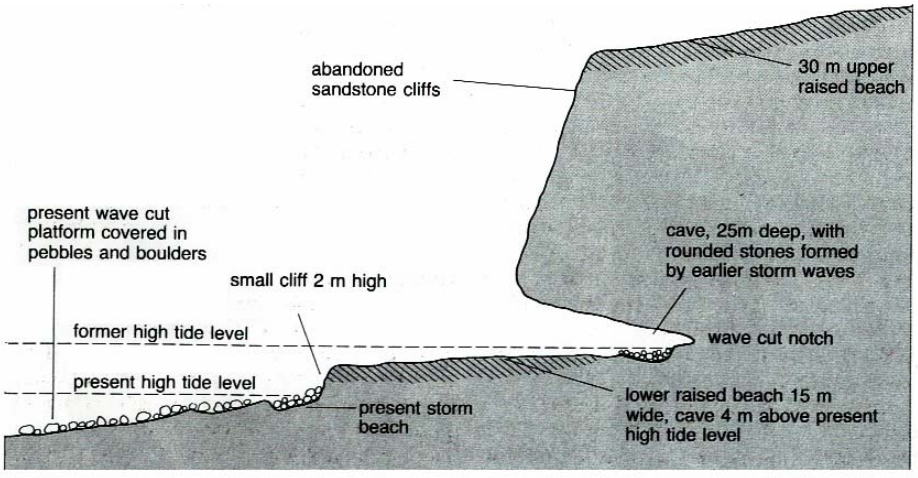
Abandoned Cliffs on the Isle of Arran

On the Isle of Arran, there are at least three raised beach levels at 8m, 15m and 30m but because of isostacy, the levels vary considerable across the Island. For example, the so-called 8m beach is often only 4m OD. More recent raised beaches are rich in shell fragments that can be carbon-dated.



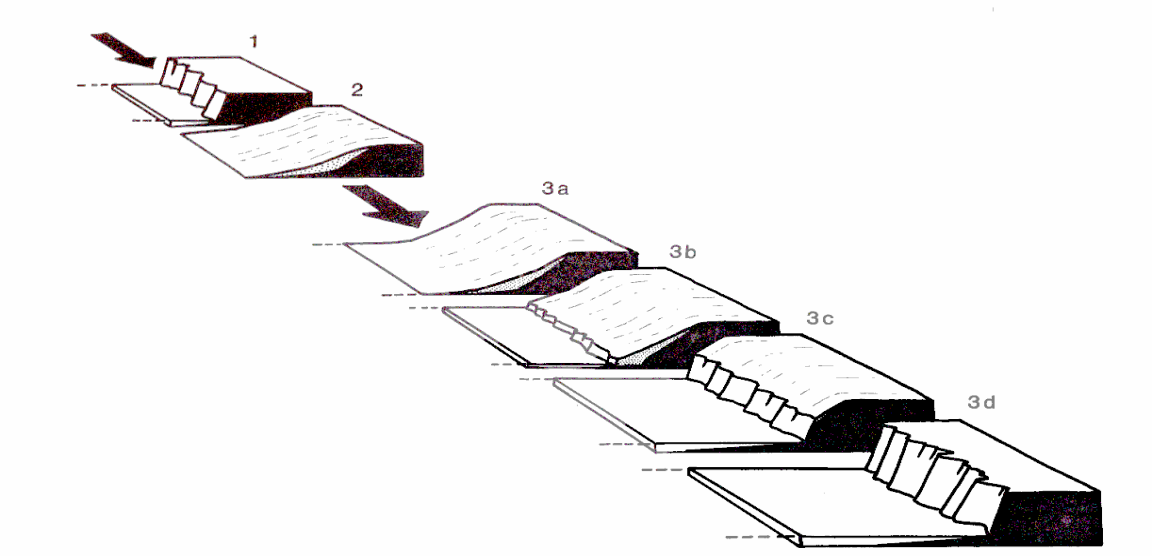
The photograph shows the abandoned cliff line at King's Cave with its 8m raised beach.

The diagrammatic cross section on the next page shows the relationship with modern sea level.



Slope-over-Cliff Profiles in North Devon

Many cliffs in southwest Britain, including north Devon show two distinct slopes in their profiles called slope-over-wall cliffs. The lower steep face is a result of present-day wave cliff erosion. The gentler upper gradient was formed when the climate was colder and the sea level much lower. Periglacial processes, such as solifluction, degraded the cliff. In some cases, modern marine processes have removed the resulting head deposits. The diagrams below show the sequence of events:



1. An early interglacial cliff, which formed when sea level was similar, or higher than it is now.

2. Sea level falls; the cliff is abandoned by the sea and degraded by frost action, solifluction and other periglacial processes. The eroded material or “head” collects at the base of the slope.

3. Sea level rose again in the Flandrian transgression.

    a) In sheltered locations, such as in the Taw/Torridge estuary, there has been little change to the cliff slope.
    b) In less sheltered locations, waves have excavated small cliffs in the head deposits.
    c) In exposed location, such as at Baggy Point, waves have cut new cliffs but leave remnants of the periglacial degraded cliff.
    d) At very exposed locations, such as Hartland Quay, modern marine processes have completely removed the degraded periglacial slope.