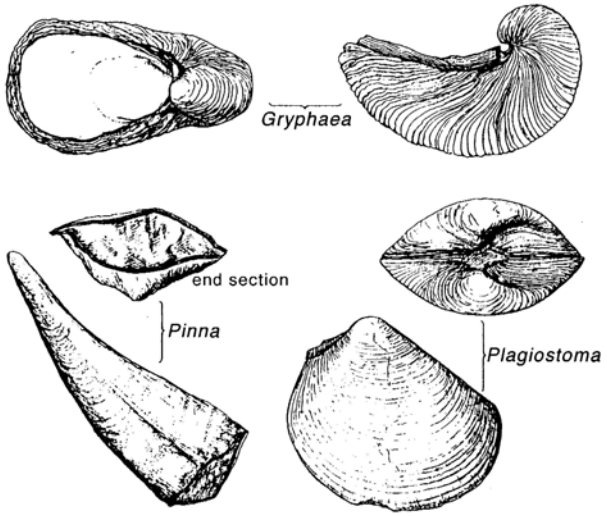
The bending has created smaller **parasitic folds**, on some of the bedding surfaces. At the unconformity there is a line of weakness along which a cave has been developed by marine erosion. The Southerndown Beds crop out at the top of the cliff.

If the tide permits, proceed south round the tip of the promontory and walk back towards the beach. If this is not possible, return to the car park and walk through the park to the viewpoint at Stop 12 and descend to the beach by the steps.

Stop 6 Here can be seen the shallower dipping southern limb of the anticline in the Carboniferous Limestone, which forms the core of Trwyn y Witch, and its unconformity with the Sutton Stone.

Stop 7 A small fault in the Southerndown Beds here has a downthrow of about 3.5 metres to the south.



Stop 8 At the bottom of the steps from Dunraven Park the Southerndown Beds can be examined, now dipping gently southwards. Note the rather small pebbles in the conglomeratic beds. Fossils are common, particularly bivalves such as ***Plagiostoma.***

Stop 9 Faults and small folds affect the Southerndown Beds in this area. Some of the bedding planes are wavy and are cut by vertical cracks (**joints**). In places sheets of white **calcite** (calcium carbonate) with fine, parallel ridges can be found on the surfaces of faults, bedding planes and joints. These striations are caused by the movement of adjacent bodies of rock and indicate the direction along which movement occurred. Here there were several directions. South from here typical Blue Lias is seen in the cliff face.

Stop 10 Minor folding has distorted the Blue Lias beds into a shallow dome-like structure that is clearly picked out by the pattern of the rocks on the foreshore.

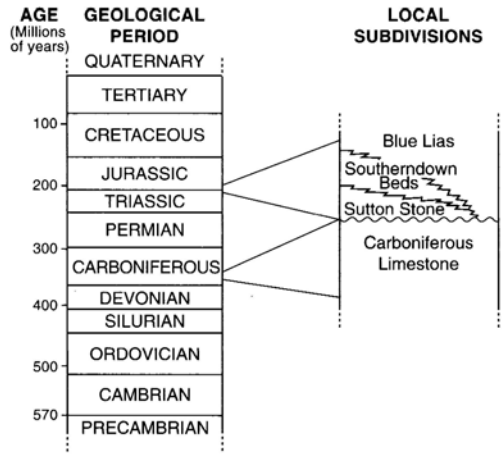
Return to the steps (8) and leave the beach.

Stop 11 Near the top of the steps, where the path meets the cliff top path, a small exposure of gently folded Blue Lias limestones and shales occurs in the hillside. The left-hand path leads to the end of Trwyn y Witch where excellent views north into Dunraven Bay and south to Nash Point can be obtained.

Take the right hand path and turn right at the gate. Follow the track to the viewpoint.

Stop 12 The viewpoint offers a splendid panorama along the coast towards Nash Point. The effects of minor folding and faulting in the cliffs are conspicuous, particularly in the rock platforms exposed on the shore at low tide. Note also how the valleys that dissect the coastline have been truncated by the erosion of the cliffline. These are called **hanging valleys**.

Follow the track around or through the walled gardens back to the car park.



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S.R.Howe, National Museum of Wales, June 1998

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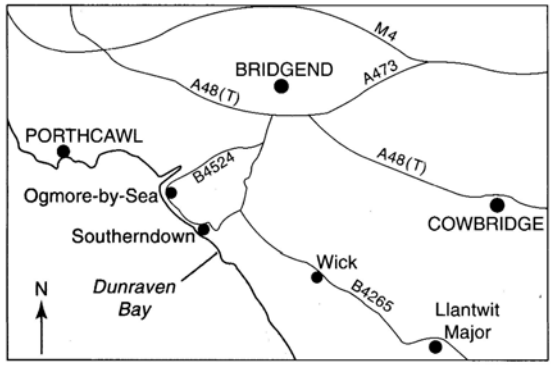
Geological Walks in Wales 3

DUNRAVEN BAY, SOUTHERNDOWN

This short walk examines rocks and fossils around the coast of Dunraven Bay, Southerndown; it begins and finishes at Dunraven car park. In order to visit all of the localities **from beach level** it is necessary to undertake this trail on a **falling spring tide**. During neap tides access to the south side of Trwyn y Witch is only possible via the cliff path through Dunraven Park gardens and the steps to the beach.



Location Dunraven Bay is situated on the Vale of Glamorgan coast 7 km south-southwest of Bridgend, 10 km northwest of Llantwit Major and 1km south of Southerndown.

Maps O.S. 1:50,000 Landranger Sheet 170 (Vale of Glamorgan and Rhondda area); O.S. 1:25,000 Pathfinder Sheet SS 87/96/97 (Bridgend [South] and Porthcawl); British Geological Survey 1:50,000 Sheet 261/262 (Bridgend).

Parking Parking is available in Dunraven Park (SS 885732)

Walking Distance The complete walk covers approximately 2.5 km.

WARNING: Most of this walk is along the beach which is rocky and slippery in places and access to the beach south of Dunraven Castle is steep. Check the tide tables before setting out because you could be cut off by a rising tide. The cliffs along this stretch of coast are dangerous; do not hammer or stand too close to them. Remember to follow the Geological Code of Conduct.

INTRODUCTION

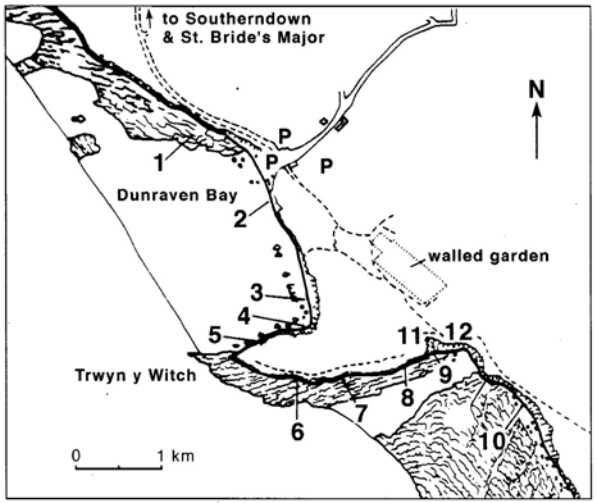
All the rocks exposed in this area are **sedimentary rocks.** They were laid down as deposits of mud, silt, sand and lime that, over long periods of time, were compacted and solidified into rock. Three types occur here - **limestone, shale** (compacted mud) and **conglomerate** (a rock comprising rounded pebbles of various sizes).

The oldest rocks are hard, grey, often shelly, **Carboniferous** limestones. These were laid down in a warm, shallow sea during the early part of the **Carboniferous Period** (355-325 million years ago) when Wales lay just south of the equator. More rock layers were deposited on top but, about 300 million years ago, movements in the Earth's crust bent (**folded**) and fractured (**faulted**) them and, during the next 100 million years, as Wales drifted north of the equator, they suffered extensive erosion. These Earth movements left the upfolded Carboniferous limestones as an area of high ground, extending through what is now the Vale of Glamorgan.

The climate became hot, dry and desert-like but, about 205 million years ago, during the early **Jurassic Period** (205-135 million years ago), a shallow sea spread northwards over the land. As the water deepened the higher areas became islands before they finally became inundated. The water depth influenced the kinds of sediments that were deposited. Rocks formed close to the shore (**Sutton Stone** and **Southerndown Beds**) are strikingly different from the **Blue Lias**, which was deposited at the same time but farther offshore. The **Sutton Stone** consists of massive, white, conglomeratic limestones with pebbles of black **chert** (silica) and Carboniferous limestones. The overlying **Southerndown Beds** are blue/grey conglomeratic limestones and limy sandstones with thin shale partings. The Sutton Stone and Southerndown Beds pass laterally into, and are overlain by, the alternating blue-grey limestones and shales of the **Blue Lias**. The Jurassic rocks are generally rich in fossils. Shells of **bivalves**, and **ammonites** (extinct coiled-shelled relatives of the squids and octopus), fragments of **crinoids** ('sea lilies'), **corals** and pieces of carbonised **fossil wood** are quite common.

During the last 200 million years further Earth movements have caused folding and fracturing of the Jurassic rocks and, since the end of the last Ice Age (about 10,000 years ago), the present coastline has been shaped by subaerial and marine erosion, both of which continue today.

ITINERARY



*From the beach car park descend to the beach via the slipway and turn north (right) onto the surfaces (**bedding planes**) of the rocks at beach level.*

Stop 1 These rock surfaces belong to the **Southerndown Beds.** They are hard, conglomeratic limestones interbedded with very thin beds of soft shales. The limestones contain many pebbles of black chert and grey Carboniferous limestones. Fossils are common, and pieces of black carbonised fossil wood are prominent in places.

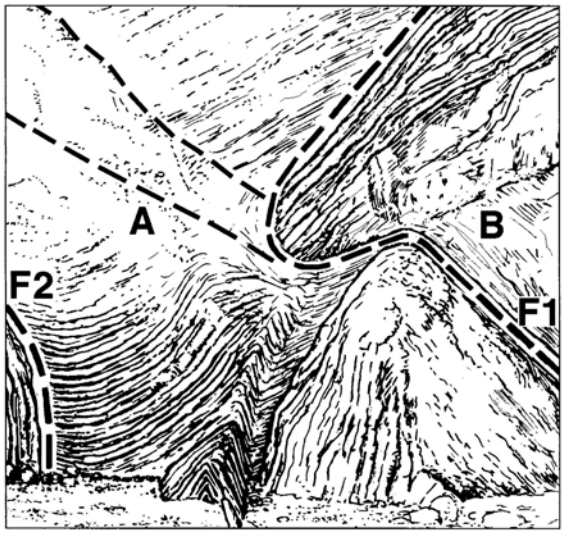
Looking up at the cliff (do not go close) the Southerndown Beds pass up into the rythmic limestones and shales of the **Blue Lias**. A prominent, four metre thick band of limestones near the top of the cliff is the **Seamouth Limestone** which is a useful 'marker horizon'.

Retrace your path back to the slipway and walk south towards the headland of Trwyn y Witch.

Stop 2 Here the Blue Lias is well seen. Note the regular alternation of limestone and shale and the thick Seamouth Limestone, all of which are tilted (**dipping**) gently to the south. The bedding planes on the foreshore are rich in fossils. Groups of the curved oyster ***Gryphaea*** are common as well as other bivalve shells along with the coiled, ribbed shells of ammonites and, in places, star-shaped segments of the stem of the crinoid ***Pentacrinites.***

Stop 3 A small fault brings the Seamouth Limestone to beach level. By measuring the displacement of this horizon across the fault, it can be shown that the rocks to the south have moved downwards by about 2.5 metres. The line of the fault (**fault plane**) can be traced across the foreshore. The top surface of the Seamouth Limestone contains numerous fossils of the bivalve ***Pinna,*** which is easily identified by the diamond-shaped pattern that the shells make on the surface of the limestone.

Stop 4 this corner of the bay the effects of the large **Dunraven Fault** (F1) are spectacularly displayed. Movement of 45-60 metres along the fault has brought the Sutton Stone (B) alongside the younger Blue Lias (A) and crushed the rock close to the fault plane. Adjacent to the fault plane the pressures exerted by the movement have produced tight folds in the Blue Lias. Looking up at the cliff face it is noticeable that the dramatic affects of the fault become less obvious higher up the cliff. Movements on this large fault have occurred at several different times. Close by another, smaller fault (F2) cuts the Blue Lias.



The Sutton Stone can be examined in the mass of fallen blocks just to the west of the Dunraven Fault where some of the conglomeratic beds contain very large pebbles.

Stop 5 Proceeding west along the north face of Trwyn y Witch the Sutton Stone can be seen to be draped over folded Carboniferous Limestone. The contact between these different aged rocks is called an **unconformity,** with the gap representing a period of about 100 million years. The hard, pink and grey Carboniferous limestones here make up the north limb of an assymetrical **anticline** which forms the core of Trwyn y Witch. The beds become very steeply tilted before they bend over southwards beneath the promontory.