Locality 8. South of Locality 7 the unconformable junction between the lowest beds of the **Jurassic** rocks, here represented by the **Sutton Stone,** and the underlying Carboniferous Limestone is clearly exposed. The layers of Sutton Stone seem almost flat on top of the limestone but, in reality, are banked up against the hillside. The Sutton Stone is a creamy-white limestone that is coarsely conglomeratic at its base but becomes finer higher up. It was laid down very close to the shore as the Jurassic sea flooded a land surface eroded over the Carboniferous Limestone. It has no prefered way of splitting and can be cut or sawn at any angle. Rock with such properties is known as 'freestone' and is highly prized by stone-masons for use in ornamental carvings. Sutton Stone was used widely for such purposes, especially during the Medieval period , and was extracted from the many quarries that litter the hillside.

Continue carefully along the cliff top to a point just past the valley of Pant y Slade where the cliff platform comes to an abrupt end.

Locality 9. South of Locality 8 the Carboniferous Limestone is cut by deep fissures eroded along joints. At high tide, on a stormy day, waves entering the fissures are forced upwards where the fissures narrow to produce spectacular blow-holes.
The boundary between the Sutton Stone and the Carboniferous Limestone gently rises and falls. At the end of the platform there is a steep drop to beach level. This marks the edge of an 'island' of Carboniferous Limestone which was covered by Sutton Stone deposits: you have been walking across the surface of an island! The Sutton Stone is well exposed here and its coarsely conglomeratic nature can clearly be seen.
Looking south towards Seamouth Bay many caves are eroded in the Sutton Stone. The Sutton Stone is gradually replaced, both laterally and vertically, by thinly bedded limestones of the **Southerndown Beds** and these in turn by prominent, thicker limestones and shales of the normal **Blue Lias.**

Take the path up into Pant y Slade.

Locality 10. The **Southerndown Beds** are well exposed in the steep sides of this dry valley. They are thinly bedded, finely conglomeratic limestones separated, in places, by thin partings of shale. They were deposited farther offshore than the Sutton Stone.

Walk back down the valley and continue north until Locality 8 is reached. Just above the path, behind a bench seat, is an old quarry.

Locality 11. The quarry exposes the **Sutton Stone**. Amongst the debris on the quarry floor a range of fossils can be found, including the scallop-like shell of **Chlamys valoniensis.**
This quarry also marks the site of the old Ogmore Down lead mine and pieces of **galena** can be found in the quarry debris.

Retrace your steps back to the car park

Produced by the Geologists' Association, South Wales Group
S.R.Howe, National Museum of Wales. March 1996

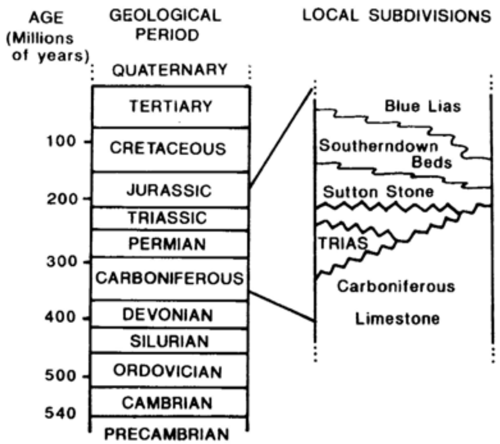
OUTLINE OF THE GEOLOGY

The rocks exposed along this stretch of coast were laid down between 340 and 195 million years ago. They are all **sedimentary rocks,** which were originally deposited as lime, mud, sand and coarse pebbles. Over long periods of time these were compacted and solidified into rock. Three main types occur here - limestone, shale (compacted mud) and conglomerate (an assortment of generally rounded pebbles).

The oldest rocks are hard, grey limestones that make up the **Carboniferous Limestone**. These were laid down in a warm, shallow, sub-tropical sea and are rich in fossils, especially corals, crinoids (sea lilies) and brachiopods. More rocks were formed on top of the limestones, but about 300 million years ago movements in the Earth's crust deformed and bent (**folded**) the rocks and erosion began to occur. No new rocks formed here during the period of erosion and the rocks above the Carboniferous Limestone were worn away. Deposition resumed during the **Triassic** Period when the area was a desert with hills of limestone, and a dry plain where the Bristol Channel is now. Short, violent storms carried debris down the hillsides and deposited it as alluvial fans of coarse, red conglomerate at the edge of the plain. Because of the gap in time, these Triassic rocks are said to lie **unconformably** on the Carboniferous Limestone.

About 205 million years ago, at the beginning of the **Jurassic** Period, the sea began to drown the land and the limestone hills became islands before finally being submerged. The **Sutton Stone,** with pebbles of Carboniferous Limestone, represents rocks deposited close to the shore of these islands. In deeper water the **Southerndown Beds** were deposited. Finally, when deep water covered the area the alternating limestones and shales of the **Blue Lias** were deposited.

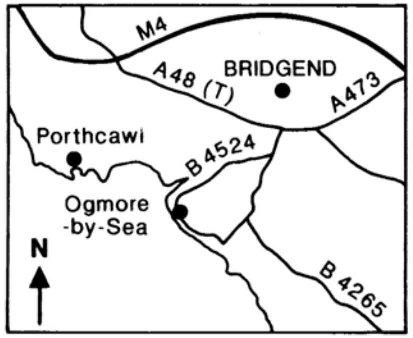
After the early Jurassic no evidence of geological events is preserved until near the end of the last **Ice Age** (about 10,000 years ago). Fluctuating sea-levels caused by the growth and melting of ice sheets affected the shape of the landscape, and the present day coastline has been moulded into its present shape by both subaeriel and marine erosion, both of which continue today.



Geological walks in Wales

Ogmore-by-Sea, Vale of Glamorgan

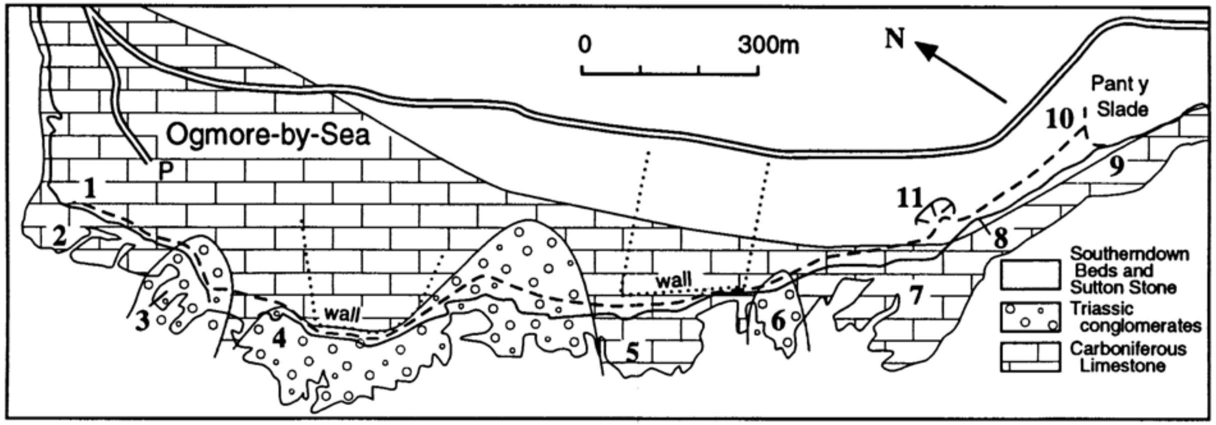
This short walk examines the rocks, fossils and landscape along the coast from Ogmore-by-Sea to Pant y Slade. The walk begins at the lifeguard post in the large car park, off the B4524, at Ogmore-by-Sea (SS 862 754) and the return distance between the farthest localities is approximately 4 km. Although the main parts of the walk can be undertaken along the cliff-top path, many localities are better viewed from beach level which requires a low tide.



Location.: Ogmore-by-Sea is on the coast 7 km south-west of Bridgend.
Maps. O.S. 1:50,000 Landranger Sheet 170 (Vale of Glamorgan), O.S.Pathfinder Sheet SS 87/96/97 (Bridgend South and Porthcawl), British Geological Survey 1:50,000 Sheet 261/262 (Bridgend).

WARNING: Although the cliffs are low along this route care should be taken when near the edge, and also on the rocks of the foreshore which can be slippery when wet. The rock platform near Pant y Slade is cut by many deep fissures. Great care should be taken and it is advisable to keep to the cliff-top path during high tide, especially on stormy days.

Sponsored by the Committee on the Public Understanding of Science



From the lifeguard post look across the estuary of the River Ogmore to the sand dunes of Merthyr Mawr Warren.

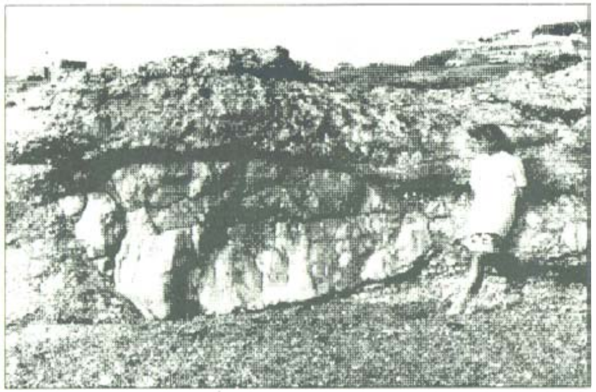
Locality 1. The sand dunes of Merthyr Mawr Warren block the lower reaches of the Ogmore estuary. The sand is derived from glacial debris which was deposited in the bay and later blown onshore, particularly in the sixteenth century during a prolonged period of strong westerly winds. At the estuary mouth a sand spit, formed by the southward longshore drift of beach material, deflects the river to the south side of its valley. Note that the valley is much larger than would be expected for the size of river it contains. This is because it was widened at the end of the last Ice Age, when the river was swollen by waters from melting ice sheets.

From the lifeguard post walk down the slipway to the beach.

Locality 2. The slipway cuts through a platform of almost horizontal beds of grey **Carboniferous Limestone.** These have been eroded by the sea to form the low, wave-cut platform at the base of the cliff. Some fissures in the limestone alongside the slipway have been filled by pink sandstone and conglomerate of **Triassic** age.

Walk back up the slipway and turn right (south). Just beyond the public toilets is a small bay. Descend to the headland on the south side of the bay.

Locality 3. The rocks forming this headland are coarse beds of red **Triassic conglomerate** lying **unconformably** on top of grey **Carboniferous Limestone**. They fill a gully cut into the limestone and are composed of rounded and sub-angular pebbles mainly of grey Carboniferous Limestone, set in a matrix of red sand and silt. They represent debris deposited by streams pouring down gullies or **wadis** in the sides of the hill during short periods of torrential rain in an otherwise semi-arid climate. Some layers contain much bigger pebbles than others, showing that the flow of water varied in strength. In the small gully in the middle of the headland is a particularly large limestone boulder that measures over 1.5m across.



Continue south to the end of the car park and descend onto the headland.

Locality 4. This headland marks the outcrop of a second, much larger tongue of Triassic conglomerate which extends south for about 1 km. The Triassic rocks lie on top of gently tilted beds of Carboniferous Limestone. The pebbles are generally small and angular, which indicates that they were not transported very far.
In places the fragments are encrusted by layers of pink and white crystals. The crystals also occur in sheets (**veins**) cutting through the rocks. They consist of the minerals **baryte** (pink) and **calcite** (white) which were deposited after the rocks were formed. Close examination will also reveal patches of a metallic grey mineral that, in places, has formed little cubes. This is **galena**, the main ore of lead.

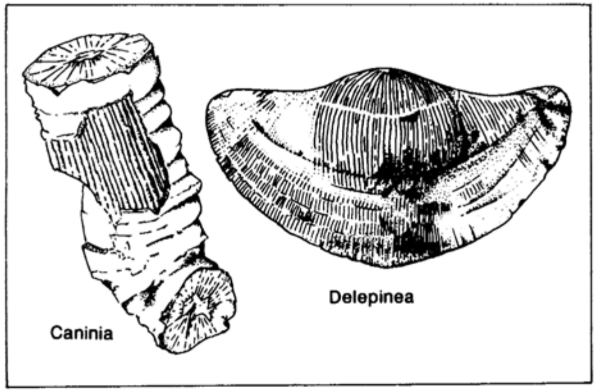
Return to the cliff top and continue south across the next bay. At the beginning of the next set of walled fields, descend on to the headland.

Locality 5. This headland marks the end of the outcrop of Triassic conglomerate seen at Locality 4. Here the beds of Carboniferous Limestone are tilted (**dipping**) gently to the south. The beds are quite thick and are cut by two sets of prominent vertical cracks (**joints**). Some of the surfaces (**bedding planes**) of the limestone are rich in fossils, especially of corals, crinoids and the large **brachiopod Delepinea**.

Continue south to the end of the walled fields and descend onto the headland.

Locality 6. This is the third and smallest outcrop of **Triassic conglomerate.** The rocks are not as red as the previous outcrops and can be seen to be draped over steps in the underlying limestone. The pebbles are well rounded, which indicates transport over some distance, and generally quite large. Some boulders are over 2m across and must have been transported during a period of intense water flow.
On either side of the headland the Carboniferous Limestone is well exposed and the bedding surfaces are rich in fossils especially the brachiopod **Delepinea** and a range of corals, including single, small, horn-shaped **Zaphrentites** and long, cylindrical **Caninia**. Many of the latter, which grew vertically from the sea bed, are bent almost at right-angles which suggests that they fell over and then began to grow upwards again. This was probably the result of strong currents on the sea bed, possibly as a result of storms affecting the warm, shallow seas in which they lived. Further evidence for such events comes from the numerous clumps of colonial corals, many of which have been broken.
The limestone is also cut by thin fissures filled by red Triassic sediments.

Continue carefully along the bedding planes, which exhibit spectacular fossils, or along the cliff top for about 150m to the next headland.



Locality 7. Here the Carboniferous Limestone dips fairly steeply to the NNE. The beds undulate gently as a result of the Earth movements that tilted them. Thick beds of limestone are separated by thin beds of mud (**shale).** The large bedding plane which descends to beach level is covered with horizontal burrow traces which stand out since they are filled by darker sediment than the surrounding rock. The coiled shells of **Euomphalus,** a gastropod (marine snail), are common here.

From this point southwards great care should be taken when walking on the rock platform as it is cut by numerous deep fissures.