
Porth Cwyfan RIGS Site

NRW RIGS no. 143 [SH 33683 68232]

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RIGS Statement of Interest:

Porth Cwyfan RIGS Site exposes glacial sediments and shows a series of rock shore platforms of controversial age and origin.

Porth Cwyfan RIGS Site provides some of the best exposures through glacial sediments on Anglesey's west coast and shows a series of rock shore platforms of controversial age and origin. Exposures through Quaternary sediments at Porth Cwyfan demonstrate one of the main variations of sediment deposited on Anglesey by the Irish Sea ice sheet. The typically brown, sandy and stony boulder clay here has few of the characteristics of the Irish Sea glacial deposits found on Anglesey's eastern and northern coasts where the ice moved onshore. In these areas, the tills are predominantly red, clay-rich and characterised by a preponderance of reworked sea-floor materials including marine shell fragments. Instead, the deposits at Porth Cwyfan are dominated by local rock types, especially angular clasts of local mica-schist, incorporated as the ice stream moved across the island from north-east to south-west and then finally offshore. Two main cliff exposures through unconsolidated Quaternary sediments occur in the bay: one immediately north and south of the main entrance to the beach; and another in the northern part of the bay around Ty-Cwyfan. The exposures reach a maximum height of about 2.5m, although are typically less than 2m, and in places overlie irregular ridges of Precambrian bedrock. The glacial material comprises mostly a sandy, stony till, the lower layers of which are dominated by angular fragments of local mica-schist bedrock. In places, stringers of bedrock rise from the solid outcrop beneath, thinning out into the overlying till, suggesting active incorporation of materials at the base of the ice sheet. The Quaternary sediments tend to become finer-grained towards the top of the sections and, in the central part of the bay, are replaced locally by alluvial sediments and dune sand. Thin cracks, infilled with fine-grained sediment, are common in the till deposits. These are generally no wider than 3–5cm, but extend locally 1–1.5m downwards into the till. These resemble periglacial frost or desiccation cracks commonly seen in coastal sections elsewhere around the Welsh coast. Upper parts of the sections also display evidence of periglacial heaving and former permafrost conditions in the form of evolutions or festoons and numerous vertically aligned stones. The stratigraphical interest is complemented by a series of well-developed shore platforms: a low-lying platform present in most central parts of the bay and submerged at high tide; and smaller areas of strikingly evenly planated rocks, lying a few metres higher and only submerged during the highest tides, for example at SH 33682. Hopley (1963) interpreted the rock surfaces as interglacial wave-cut platforms of Cromerian (c. 500 ka BP; higher platform) and Ipswichian (c. 125 ka BP; lower platform) ages. The latter, including the area underlying St Cwyfan's Church, was believed to support Ipswichian raised beach deposits. These were also thought to occur in an extensive low-lying area landward of the coastal sections. Such an interpretation is speculative, and if raised beach deposits survive in the bay, they are likely to be of Holocene age. Similarly, although the lower platform would appear to be, at least, partially marine-cut, it is possible that the higher surface is primarily glacial in origin. While the ages of the platforms are not known, the sediments and landforms at the site together provide evidence for a complex series of glacial, periglacial and interglacial events that may span much of the Pleistocene Period.

Geological setting/context: About 2.4 million years ago there was a general cooling of the Earth's climate, heralding the onset of the Quaternary "Ice Age", a period of geological time extending to the present day. In reality, the period has seen a number of cold 'glacial' periods interspersed with warmer 'interglacial' periods such as the one in which we now live. Since about 450,000 years ago there have been at least four intensely cold periods during which large parts of upland Britain were covered by ice sheets for long periods. Although Anglesey was probably overrun by ice on these occasions, only evidence from the last major glacial phase – the Late Devensian – is known. Possible evidence from the warm interglacial period before the Late Devensian may locally have escaped the destructive erosional and depositional effects of the last glaciation. During the Late Devensian, around 20,000 years ago, Anglesey was completely submerged by ice. Two ice sheets from different sources were involved. The Snowdonian mountains were the source of ice streams that

moved broadly northwards towards Anglesey, while a massive Irish Sea ice sheet, fed by glaciers from Scotland, Ireland and Cumbria, moved onto the island from the north. The Irish Sea ice stream was dominant, and travelled north-east to south-west across the island, broadly in keeping with its NE–SW-trending, structurally controlled rock ridges. The Welsh and Irish Sea ice streams met in the region of the present-day Menai Strait and produced a confluent south-westward flow. Deposits from the Irish Sea ice tend to contain a wide range of rock types from its diverse source areas and from the varied geology of the seafloor traversed. A red colouration is common, being derived partly from Permian-Triassic rocks offshore. The Irish Sea sediments commonly contain unconsolidated seafloor debris, including sand and shell fragments, dredged from the seafloor by the ice. Tertiary lignite, coal fragments and flint are also a characteristic component of the Irish Sea deposits. Alternatively, deposits from the Welsh ice sheet reflect the geology of its source areas, with a high proportion of Cambrian slates and mudstones, varied Ordovician igneous materials and a blue-grey colouration. Although the broad pattern of the island's glaciation has been understood for nearly 100 years, the exact timing of the arrival and retreat of the different ice masses is poorly understood, as is the relative extent of both ice masses during the Late Devensian. Anglesey contains an exceptional range of Quaternary evidence, in the form of coastal sediment exposures, glacial landforms and erratic boulders, which can be used to reconstruct the glacial history of the island, and elucidate regional variations in ice movement and sedimentary processes. Three separate networks of RIGS have been selected to demonstrate the glacial history of the island. These are: 1) sedimentary sequences; 2) erratic boulders and; 3) glacial/glaciofluvial landforms. Selected sites may belong to more than one of these networks.

Network context of the site: Porth Cwyfan belongs primarily to Network 1, 'Sedimentary sequences' but also contributes to Network 3, for its strikingly planated shore platforms, the origin of which is uncertain. Significant areas of Anglesey are covered by Quaternary deposits, and the island's coastline provides an unusually high degree of exposure. Key sections have been selected as RIGS to demonstrate the most important lithological and sedimentological characteristics of the island's glacial and glaciofluvial deposits. The sites therefore provide important evidence for understanding the origins and patterns of movement of the ice masses that affected the island during the Late Devensian.

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