
Penial Dowyn RIGS Site

NRW RIGS no. 140 [SH 28860 83344]

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RIGS Statement of Interest:

Penial Dowyn RIGS Site provides one of the best sections through a drumlin in north-west Anglesey's famous drumlin 'swarm' and demonstrates the typical elliptical drumlin morphology. In addition, the site provides an excellent example of a glacially planated rock platform and a diverse suite of large erratics derived by progressive coastal erosion of the drumlin. The drumlin at Penial Dowyn occurs on the east side of Traeth y Gribin. Its long axis runs north-east to south-west for about 500m and its crest rises to 24m OD. A fine coastal section occurs around part of the drumlin's perimeter on its western side, although only its most westerly and highest part is free of scrub vegetation. The c. 15m-high section mainly exposes a crudely stratified, matrix-supported grey-brown Irish Sea till (or diamicton) containing clasts of local schist, tuff (possibly from Church Bay), limestone, quartz, jasper and various farther-travelled lithologies. Most of the clasts are pebble-sized although some larger cobbles and boulders occur in the clay-rich matrix. Locally, small sand and gravel lenses are present. This bed is overlain by a clast-rich unit possessing a sandier matrix, a wider range of rock types and frequent boulder pavements. The foreshore around the coastal section is densely littered with large erratics washed from till in the drumlin by progressive Holocene marine erosion. One erratic, measuring c. 4.5m (L) x 3m (H) x 3m (W), occurs at the foot of the coastal section and is perched on a series of smaller erratics that in turn lie on a planated schist platform. The large erratic is composed of ultrabasic minerals, particularly garnet and olivine, and may have been derived from Scotland [check]. A small area of evenly planated schist protrudes from the base of the coastal section and extends a small distance across the foreshore. Schist fragments derived from the platform locally form 1–1.5m of the basal layer of the drumlin, and the coastal section shows a rapid dilution of these locally derived materials upwards into the overlying tills. Penial Dowyn RIGS therefore provides an assemblage of features that provides evidence for interpreting the geomorphological evolution of Anglesey. Its rock shore platform appears to have been fashioned by the south-west-moving Irish Sea ice stream which both incorporated local bedrock fragments in its lower layers and deposited till. The site also provides an excellent example of a typical drumlin landform in north-west Anglesey's magnificent drumlin swarm. Rising Holocene sea levels have since liberated a wide range of large erratics from the till.

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: Penial Dowyn belongs primarily to Network 1 ('Sedimentary sequences') although it also provides good examples of a drumlin* and a planated shore platform (Network 3) and a profusion of large glacial erratics (Network 2). 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. *Drumlins are elongated elliptical hills or mounds consisting of unconsolidated glacial materials, sometimes with a core of bedrock. They commonly occur in swarms and can reach 60m high and 200m long. They are formed under ice sheets and very broad valley glaciers, but their precise mode of formation is still highly controversial. Nonetheless, their long axes lie approximately parallel to the direction of ice movement and drumlins therefore provide useful indications of former ice movement directions. Some drumlin swarms contain as many as 10,000 drumlins (as in central New York State, Wisconsin and Canada). In Britain, they are profuse in Northern Ireland and Cumbria where some of the best examples occur. In Wales, they are less common although northern Anglesey and the Denbigh Moors have the most extensive of Wales' drumlin fields. Anglesey's drumlins are some of its most characteristic and important landforms. Over 200 drumlins were mapped by Greenly (1919) in the north and west of the island alone and one, at Hen Borth near Cemlyn Bay, has been notified as a SSSI. This superb example, demonstrating a 300m-long coastal section parallel to the long axis of the drumlin, is complemented by two RIGS at Penial Dowyn and Penrhos which occur on opposite sides of Traeth y Gribin near Holyhead. Other Anglesey RIGS partly selected for their drumlin landforms include Beaumaris and Mermaid Inn on the Menai Strait.

References:

CAMPBELL, S. & BOWEN, D.Q. (1989). Quaternary of Wales. Geological Conservation Review Series No. 2. Nature Conservancy Council, Peterborough, 237pp.

GREENLY, E. (1919). The geology of Anglesey. Memoirs of the Geological Survey of Great Britain. HMSO, London, 980pp. (2 vols)

GREENLY, E. (1920). 1:50,000 (and 1 inch to 1 mile) Geological Map of Anglesey. Geological Survey of Great Britain, Special Sheet No. 92 and (93 with parts of 94, 105 and 106).

HOPLEY, D. (1963). The Coastal Geomorphology of Anglesey. Unpublished M.A. thesis, University of Manchester.

WHITTOW, J.B. & BALL, D.F. (1970). North-west Wales. In: Lewis, C.A. (ed.) The Glaciations of Wales and adjoining regions. Longman, London, 21–58.

WILLIAMS, A.J. (2003). The sedimentology of Late Devensian glacial deposits in Anglesey, North-West Wales. Unpublished Ph.D. thesis, University of Liverpool.