
Penrhos Drumlin RIGS Site

NRW RIGS no. 141 [SH 27661 81331]

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RIGS Statement of Interest:

Penrhos Drumlin RIGS Site provides one of the best and most accessible examples of a drumlin on Anglesey's north coast. It also provides one of the best sections through deposits of Irish Sea origin on the island, and forms part of a network of sites that helps to establish regional patterns of ice movement. Penrhos Drumlin occurs on the west side of Traeth y Gribin, in Penrhos Coastal Park on the outskirts of Holyhead. Its long axis runs 300m NE to SW and its crest rises to just over 20m OD. It has been truncated on its seaward (eastern) side transverse to its long axis, leaving its sediments and internal structures well exposed. The c. 20m-high section mainly exposes a crudely stratified, matrix-supported, clay-rich, grey-brown Irish Sea till (or diamicton). Individual layers within this unit show distinct variations in clast size and concentration. The unit has been interpreted as a subglacial till with both lodgement and melt-out components, and was formed during the process of drumlinisation by an actively advancing ice sheet. It is capped by a thin layer of brown sandier material, interpreted as a melt-out till, formed after drumlinisation during ice stagnation or retreat. Both units are dominated by clasts of local Precambrian rocks, especially schist, sandstone and tuff, although other farther-travelled rock types are also present. The foreshore supports many large erratics washed from the drumlin by the sea. These include boulders of Precambrian chlorite-schist and gabbro, the latter probably having been derived from an offshore outcrop. Small areas of schist bedrock extend a small distance across the foreshore and locally support erratics. These small bedrock areas do not show the same high degree of planation as those at Penial Dowyn (see RIGS 140). Whereas Penial Dowyn demonstrates a better example of a planated shore platform, a larger profusion and diversity of erratics and a fine example of glacially comminuted bedrock, a combination of excellent accessibility and fine quality of exposure make Penrhos Drumlin both a key stratigraphic locality and a reference site for understanding the formation of drumlins.

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: Penrhos Drumlin belongs primarily to Network 1 ('Sedimentary sequences') although it also provides a good example of a drumlin* (Network 3) and a variety 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.

Site geometry: Site boundary