Porth Wen RIGS site

NRW RIGS no. 196 [SH 40202 94646]

GeoMôn Global Geopark original webpage

RIGS Statement of Interest:

Porth Wen RIGS site is another site demonstrating key evidence and concepts concerning the long-term geomorphological evolution of the island. It shows Precambrian quartz- and felspar-rich rocks of the Gwna Group which have been ‘rotted’ or altered to a depth of at least 15m. Greenly (1919) regarded them as important vestiges of a weathered pre-glacial land surface that had locally survived the effects of Pleistocene glaciation. Surprisingly, the highly altered bedrock at Porth Wen has not been studied in detail. Although both interglacial and pre-glacial ages have been speculated for the ‘weathering’ at this and other sites, it is also possible that the rocks have been subjected to hydrothermal and/or pneumatolytic alteration processes facilitated by intense folding and faulting in the strata. It is tempting to suggest that the protracted weathering of the rocks, both here and elsewhere in the region, is related to the development of a Tertiary saprolite*, remnants of which are seen at nearby Trwyn y Parc. The latter indicates that the broad landform of Anglesey and Snowdonia seen today was established before the end of the Miocene. At Porth Wen, the altered rock was excavated, crushed and fired on-site. Silica bricks were exported by ship from a small quay, some being used in the ore-smelting operations at nearby Parys Mountain. The site is also famous for glazed tiles and bricks produced in the early 1900s by the Japanese artist and tile-maker, Cozo Nakamura. Brick making ceased at the start of the First World War. * a deposit of clay and disintegrated rock fragments, formed by the weathering and ‘rotting’ of rock in situ.

Geological setting/context: Long-term, pre-Pleistocene landscape development There is significant evidence that Permo-Triassic erosion effected the primary shaping of the present relief of the Palaeozoic rocks of western Britain. The broad outline and form of Anglesey’s coastline and landscape thus appear to have been fashioned by that time. Although the landforms and deposits which adorn the present landscape are the result of processes (especially those of glacial and cold climates) operating in the Pleistocene, the landscapes of western Britain were in fact fashioned over the many millions of years between the Permo-Triassic and the Pleistocene, by a wide range of non-glacial processes operating under diverse, including tropical and sub-tropical, climatic regimes. Depositional evidence for the intervening Jurassic, Cretaceous and Tertiary is, of course, well represented elsewhere in south and eastern Britain, but deposits of these ages were either not deposited or have since been removed from substantial parts of Wales and south-west England. At the very best they have been selectively preserved on-land in narrow fault-controlled basins (e.g. the Eocene and Oligocene deposits found in the Bovey-Tracey and Petrockstow basins) and offshore (e.g. the Jurassic and Tertiary deposits found in the Cardigan Bay, Central Irish Sea and St George’s Channel basins). The weathering and shaping of the landmass we see today has therefore been a protracted process. Much of the evidence for the geomorphological processes that operated and shaped the landscape during these times was modified or removed by the Pleistocene glaciations and periglacial processes, particularly in Wales, and the vast bulk of the evidence for these pre-Pleistocene events is erosional in nature and lends little precision to the interpretation of events. The denudation chronology of the British landscape has been detailed in a wide range of publications (see Campbell et al., 1998 for a review). Traditionally, geomorphologists have viewed the early to mid-Tertiary as a time when the landmass of Wales and south-west England was subjected to alternating phases of marine inundation and planation and subaerial exposure and weathering: these conditions were used to account for a multiplicity of perceived erosion surfaces – ‘staircases’ of these surfaces were widely invoked throughout Wales (e.g. Brown, 1960) and south-west England (e.g. Balchin, 1937). Recent evidence, particularly from St Agnes Beacon in west Cornwall and Trwyn y Parc in Anglesey, shows Miocene and mid-Oligocene deposits overlying a prominent erosion surface at between c. 75–131m OD. This suggests that surfaces above this general level can be no younger than Miocene and lends much support to the view that large areas of the south-west Peninsula and Wales have existed, more or less, in their present forms since perhaps as early as the Eocene. Landscape evolution subsequent to this is likely to have been slow, the sole depositional evidence for a marine incursion onto these ancient landmasses being a minor transgression of late Pliocene age at St Erth, Cornwall. In recent years, there has been an increasing tendency to invoke only one complex polygenetic erosion surface (e.g. Coque-Delhuille, 1982; Battiau-Queney, 1984), the constituent landforms having been shaped in tropical and sub-tropical environments (Upper Cretaceous and Palaeocene) and uplifted since the late Miocene (Green, 1985). In Wales, this inherited landform has been deeply dissected by Pleistocene glacial activity; in south-west England, periglacial processes appear to have been the chief Pleistocene land-shaping agents. In view of the above, sites where depositional evidence for pre-Pleistocene land-shaping events is preserved take on a disproportionate importance. In Wales and the Borderlands, evidence for long-term, pre-Pleistocene landscape evolution is represented by a network of RIGS where evidence of Tertiary weathering, the formation of weathered regoliths, saprolites and palaeosols is preserved and has a bearing on the development of specific landforms (e.g. tors) or major landscape features (e.g. erosion surfaces). At some of the sites, evidence for supergene weathering may be superimposed on bedrock previously altered by hydrothermal or pneumatolytic processes associated with intrusive igneous activity. These structurally compromised materials have been susceptible to subsequent exploitation by erosional processes and given rise to distinctive landscape features such as bays and inlets and specific landforms such as tors. The selective preservation of these weak rotten rock masses is something of a miracle, and they provide important clues for interpretations of landscape evolution. Network context of the site Porth Wen RIGS is one of four sites on Anglesey selected to demonstrate key evidence and concepts concerning the long-term geomorphological evolution of the island. Together with Porth Swtan RIGS and Porth Padrig RIGS the site is geomorphologically significant in providing an important example of highly altered bedrock possibly partially related to non-supergene processes (e.g. hydrothermal activity). Trwyn y Parc RIGS demonstrates a fossil flora of Miocene age with major implications for understanding the age of Anglesey’s land surface (see also Rhes-y-cae RIGS, north-east Wales). Collectively, the sites have major importance for understanding the long-term geomorphological evolution of Anglesey’s, and indeed Wales’, landscape.

References:

BALCHIN, W.G.V. (1937). The erosion surfaces of north Cornwall. Geographical Journal, 90, 52–63.

BATTIAU-QUENEY, Y. (1984). The pre-glacial evolution of Wales. Earth Surface Processes and Landforms, 9, 229–252.

BISHOP & Co. (1822). On the Porcelain clay and Buhr stone of Halkyn Mountain. Philosophical Magazine, 59, 404.

BROWN, E.H. (1960). The Relief and Drainage of Wales. Cardiff.

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

CAMPBELL, S., HUNT, C.O., SCOURSE, J.D. & KEEN, D.H. (1998). Quaternary of South-West England. Chapman & Hall, London, 439pp.

COQUE-DELHUILLE, B. (1982). Importance de l’érosion differentielle et de la tectonique tardi-Hercynienne dans le massif du Dartmoor (Grande-Bretagne). Hommes et terres du Nord, 3, 9–26.

GREEN, C.P. (1985). Pre-Quaternary weathering residues, sediments and landform development: examples from southern Britain. In: Geomorphology and soils (eds K.S. Richards, R.R. Arnett, and S. Ellis), George Allen and Unwin, London, 55–77.

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).

MAW, G. (1865). On some deposits of chert, white sand and white clay in the neighbourhood of Llandudno, North Wales. Geological Magazine, 2, 200.

MAW, G. (1867). On the distribution beyond the Tertiary districts of white clays and sands subjacent to the boulder clay. Geological Magazine, 4, 241 & 299.

MORAWIECKA, I.M., SLIPPER, I.J. & WALSH, P.T. (1996). A palaeokarst of probable Kainozoic age preserved in Cambrian marble at Cemaes Bay, Anglesey, North Wales. Zeitschrift für Geomorphologie N.F. 40, 47–70. STRAHAN, A. (with parts by C.E. De Rance) (1890). The Geology of the neighbourhoods of Flint, Mold, and Ruthin. Memoirs of the Geological Survey of England and Wales, HMSO, 119–125.

TRAILL, T.S. (1821). Observation on the mineralogy of Halkin Mountain, in Flintshire; with a particular account of the recently discovered Buhrstone and porcelain-clay of that place. Edinburgh Philosophical Journal, 4, 246–261.

WALSH, P.T. & BROWN, E.H. (1971). Solution subsidence outliers containing probable Tertiary sediment in north-east Wales. Geological Journal, 7 (2), 299–320.

WALSH, P.T., MORAWIECKA, I.M. & SKAWIÑSKA-WIESER, K. (1996). A Miocene palynoflora preserved by karstic subsidense in Anglesey and the origin of the Menaian Surface. Geological Magazine, 133(6), 713–719.

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.

Site geometry: Site boundary