
Porth-y-Pwll RIGS site

NRW RIGS no. 244 [SH 24403 79227]

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RIGS Statement of Interest:

Porth-y-Pwll RIGS site is of regional importance as it exemplifies the Precambrian New Harbour Group rocks, in a less complicated manner than other exposures in this formation. The beds are parallel to the schistosity and so are technically called phyllites. The rocks are composed of the minerals, Chlorite, muscovite (white mica), and elongated, sub-parallel grains of quartz and feldspar which helps to make up a strong schistosity. Quartz veins follow the schistosity around the folds and were either injected along the schistose layers or were formed by removal of the quartz from the original rock before or after the folding. The steep limbs of some folds are marked by an earlier generation of tight folds. Looking back from the seaward side towards the cliffs, this is the best place to observe the characteristic large-scale folds of the New Harbour Formation. The context of the structures in this formation is difficult to understand in relation to the other formations, for example, the South Stack Formation shows one major folding event whereas, the New Harbour Group of rocks exhibits two major folding sequences. It has long been thought that the South Stack Group was the oldest, but some current research reverses the proposed age sequence of the groups and considers the South Stack Group to be the youngest in the stratigraphic sequence. The uncertainties involved in the relative ages of the various groups makes this an important player in the controversy and could help stratigraphers to unravel the true sequence of formation of these groups of rocks.

Geological setting/context: The Precambrian basement rocks of Anglesey and south-west Llyn can be divided into several discrete groups, all of which were juxtaposed along a series of steep, brittle and/or ductile faults and shear zones (e.g. Dinorwic and Aber-Dinlle faults; Berw, Central Anglesey and Llyn shear zones) collectively referred to as the Menai Strait Fault System (MSFS). First, the Monian Supergroup consists of a thick sequence of polydeformed metasediments and meta-igneous rocks, comprising the South Stack, New Harbour and Gwna groups, the latter representing the type example of a large-scale submarine debris flow or *mélange* said by some researchers to be of Lower Cambrian age. Ongoing research, however, may suggest a much older date for the Gwna Group with possible Cambrian ages being put forward for the South Stack metasediments. Second, the Coedana Complex of central Anglesey comprises high-grade metasediments, amphibolites and gneisses, and low-grade, thermally metamorphosed hornfelses adjacent to a granite (Coedana Granite), which has recently yielded a late Precambrian zircon age of $614 \pm 4\text{Ma}$. Third, a belt of schists and metabasites displaying blueschist facies grade of metamorphism lies within the MSFS. The metabasites exhibit a strong mid-ocean ridge basalt signature and have yielded ages of 580–590Ma. Fourth, the Sarn Complex in Llyn comprises metagabbros and granite rocks which occur to the south-east of the Llyn Shear Zone (LSZ), a continuation of the MSFS, which separates these igneous rocks from low-grade Monian *mélange* to the north-west. A late Precambrian zircon magmatic age of $615 \pm 2\text{Ma}$ has been obtained from a metagabbro of the LSZ. Fifth, on the mainland of north-west Wales, the Arfon Group comprises a thick sequence of tuffs and volcanoclastic rocks, dated at $614 \pm 2\text{Ma}$, which are conformably overlain by late Lower Cambrian siltstones. Correlatives of the Arfon Group may occur as isolated outliers on Anglesey and, if proven, would provide an important potential lithostratigraphical link across the MSFS. The stratigraphical correlation between the various units has proved highly controversial. The recent recognition of mylonitic rocks, for example in the LSZ, emphasises the presence of tectonic contacts and indicates that each component may represent a so-called 'suspect terrane' which was transported laterally into position along the major faults and shear zones. Ongoing unpublished research suggests, that Anglesey's Precambrian rocks accumulated in accretionary prisms, providing a tectonic sequence rather than a stratigraphic sequence which was formerly accepted. This new research would reverse the accepted stratigraphic order established for the island. This Precambrian basement later formed the north-west margin of the Lower Palaeozoic Basin, the initiation of which was contemporaneous with Arfon Group volcanism. The timing of the inferred fault displacements has also been the subject of debate. Investigations on Llyn have demonstrated that assembly of the basement terranes was completed at least by early Ordovician times since an unconformable Arenig overstep sequence has been identified at several localities such as Wig Bach, Parwyd and

Mountain Cottage Quarry. The Arenig sequence of Anglesey and Llŷn is considerably less deformed and metamorphosed than the underlying basement, although this distinction is not everywhere obvious.

To select RIGS to demonstrate the Precambrian evolution of Anglesey and Llŷn, three separate networks were devised. These are: 1. Precambrian stratigraphy and structures. This network includes two sub-sets: a) Precambrian sedimentary structures; and b) tectonic structures, such as folds and faults, which may have occurred during a tectonic event in Precambrian times or later, for example, during the Caledonian Orogeny; 2. Precambrian palaeontology which includes any life-form and trace fossil, such as stromatolites, sponge spicules, worm burrows and bioturbated metasediments. Current research suggests that some of these fossils may be Cambrian or even Ordovician in age, but as these life-forms were previously held to be Precambrian in age, they have been included in this category; and 3. Precambrian reference sections. These aim to represent all important Precambrian rock types found in Anglesey and Llŷn. They include the major mapped units of Greenly (1920). The aim is to provide the best and most accessible exposure of the rock type. These can be considered as RIGS 'type sections'. Where there is a relevant mineralogical, sedimentary, structural or other change across an outcrop, several representative sites have been chosen.

Network context of the site: Porth-y-Pwll is a critical component of a network of RIGS which demonstrate an important group of rocks the New Harbour Group of Precambrian strata. They belong to Network 1c (above).

References:

BARBER, A. J., MAX, M. D., & BRUCK, P. M. (1981). Field meeting in southeast Ireland, Proceedings of the Geologists' Association, 92, 269–291.

BATES, D. E. B. (1974). The structure of the Lower Palaeozoic rocks of Anglesey, with reference to faulting. Geological Journal 9, 39–60.

BATES, D. E. B. & DAVIES, J. R. (1981). The Geology of Anglesey. Geologists' Association Guide No. 40.

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).

SHACKLETON R. M. (1975). Precambrian rocks of North Wales. In WOOD, A, (ed). The Pre-Cambrian and Lower Palaeozoic rocks of Wales. University of Wales Press, Cardiff, 1–22.

TREAGUS, S. H., TREAGUS, J. E. & DROOP, G. T. R. (2003). Superimposed deformations and their hybrid effects: the Rhoscolyn Anticline unravelled. Journal of the Geological Society of London, 159, 1–20.