
Porth Nobla (Coedana) RIGS Site

NRW RIGS no. 130 [SH 32917 71372]

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RIGS Statement of Interest:

Porth Nobla (Coedana) RIGS Site exposes the Coedana Granite, Anglesey's oldest Precambrian rock, although its age and origin are disputed. Porth Nobla is one of a series of RIGS in Anglesey selected to demonstrate facies variations of the Coedana Granite and its relationship to surrounding metamorphic rocks. The site is of regional importance because it provides the most accessible coastal exposures of the main granite mass on the island, the best exposure through its intrusive margin and a superb example of the metamorphosed country rock (hornfels). These exposures were formerly dune-covered and were not available to previous workers, giving the site much potential for further research. Granite is an intrusive igneous rock. The magma from which the Coedana Granite was formed is believed to have solidified about 614 million years ago, having been derived from much older crustal rocks (1,330 – 1,443 Ma) that melted over 30km beneath the Earth's surface. The granite at Porth Nobla contains smaller crystals than inland exposures because it occurs on the margins of the intrusion, which cooled quickly against the surrounding country rocks. The rocks on the largest island exposed at low tide contain narrow veins of coarser-crystalline material with large orange-coloured feldspars. This material provides many of the beach pebbles in the vicinity of the exposures at this site. Typically, the plutonic margins contain many large xenoliths of country rock, mainly spilite and extensively altered mica schist. The exposures are further complicated by large, hornblende-rich dolerite dykes which have been displaced by later faulting. The close juxtaposition of these different lithologies is typical of plutonic margins.

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 ± 4 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 ± 2 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 ± 2 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 Nobla 1 belongs to Network 3 (Precambrian reference sections; see above) and has been chosen to demonstrate important characteristics and variations within the Coedana Granite Complex (CGC). The CGC, which covers an area of 30km², has 5 RIGS: i) Porth Nobla shows a fine-grained granite at the western margin of the main outcrop and its associated hornfels; ii) Trwyn Cwmrwd at the eastern end of the outcrop illustrates a variation in the CGC where the rock contains sillimanite; iii) Gwalchmai at the centre of the intrusion represents a coarsely-crystalline facies; iv) Tyddyn Gyrfwr shows low-grade metamorphosed hornfels; and v) Maen Gwyn Farm illustrates high-grade metamorphic gneiss.

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