Porth Nobla schist

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RIGS Statement of Interest

Porth Nobla Schist RIGS is important for its Precambrian mica schist and its relationship to surrounding metamorphic and igneous rocks. It provides the most accessible coastal exposures of this type of metamorphic rock on the island. Fresh cliff exposures of mica schist are emerging from beneath a cover of till and further foreshore exposures occur on the beach. The rocks are intruded by north-south-trending dolerite dykes. The origin of these schists is not well understood, but Carney et al. (2000) suggested they were formed in a ductile (plastic-type deformation) environment, known as the Central Anglesey Shear Zone (CASZ), located between two distinct areas of rock (terranes) with separate histories. Originally mud-rich deposits, they were buried deep in the Earth's crust. The pressure of the overlying rocks converted the mud-rich rock to a schist containing mica, a silver-coloured plate-like mineral. After the schists formed, they were sheared and suffered plastic deformation as they were transported to their current position. Although no absolute dates are available for these rocks, Carney et al. suggested that the rocks were emplaced around 560–550Ma ago and then sheared along transcurrent faults (displaced horizontally), some time between 560Ma and 485Ma, when Ordovician (Arenig) sediments were emplaced unconformably over the Precambrian sequence. The mica schists are fundamental to understanding the complicated tectonic history of the island.

Geological setting/context The Precambrian basement rocks of Anglesey and south-west Ll■n 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 Ll■n 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 ± 4Ma. 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 Ll■n comprises metagabbros and granite rocks which occur to the south-east of the Ll■n 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 ± 2Ma has been obtained from a metagabbro (LSZ). Fifth, on the mainland of north-west Wales, the Arfon Group comprises a thick sequence of tuffs and volcaniclastic rocks, dated at 614 ± 2Ma, 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 Ll■n 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 Ll■n 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 Ll■n, three separate networks were devised. These are:

1. 1. Precambrian stratigraphy and structures. This category 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 even later, for example, during the Caledonian Orogeny;
2. 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.
3. 3. Precambrian reference sections. These aim to represent all the important Precambrian rock types found in Anglesey and Ll■n. They include the major units mapped by Greenly (1920). The aim is to provide the best and most accessible exposure of the rock type. These can be considered as 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 (Schist) belongs to Network 3 (Precambrian reference sections) and 1b (Precambrian tectonic structures). It is representative of the mica schist which is a major outcrop covering around 30km² between the Coedana Granite to the north- west and the Gwna Group green mica schist to the south-east. It comprises the entire area referred to as the CASZ by Carney et al. (2000). Despite the large size of this outcrop, there are no geological SSSI or other geological designations concerning this particular lithology or its tectonic setting in the CASZ. Although the lithology crops out abundantly in western Anglesey, much of the coastline is steep and inaccessible. Porth Nobla (South) therefore provides the easiest access to this important lithology.

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Site geometry: Site boundary