
Llansadwrn Roadside Wall RIGS site

NRW RIGS no. 191 [SH 55780 77098]

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RIGS Statement of Interest:

At Llansadwrn Roadside Wall RIGS site important blue schist specimens can be seen at the crossroads of the B5109 with the Llanddona Road. The site is important because the rocks contain the largest known crystals in the blue schists of Anglesey. This rare rock, originally a deep sea basalt (pillow lava), was metamorphosed at great depth below the earth's surface as it descended at a destructive plate margin, into a deep sea trench and beneath the continental crust. This put the rock under enormous pressure that converted the original mica, hornblende, olivine, augite and feldspar minerals into the rare glaucophane/crossite amphibole schists. Unusually, these minerals indicate that the rocks did not undergo significant heating at these depths and therefore provide important information about the environment in which these rocks formed. It is thought that these are best examples of large crystals in glaucophane schist in Anglesey. The wall has been built some two miles south of the Mynydd Llwiarth, a glaucophane schist outcrop in Pentraeth.

Network context of the site: The Precambrian basement rocks of Anglesey and south-west Llŷn 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 Llŷn 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 Llŷn comprises metagabbros and granite rocks which occur to the south-east of the Llŷn 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 of the bedded succession, the South Stack Group, the New Harbour Group and the Gwna Group established for the island by Robert Shackleton. This Precambrian basement later formed the north-west margin of the Lower Palaeozoic Basin, the initiation of which was contemporaneous with Arfon basement terranes and 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.

Network context of the site: Llansadwrn Roadside Wall is a critical component of a network of five RIGS which demonstrate key features of the Greenly's Precambrian Penmynydd Zone of metamorphism (more recently termed the

Eastern Schist Belt by Horák and Gibbons) in Anglesey. The 5 mile long, NW–SE fault-bounded belt of blueschists and associated rocks is famous worldwide for preserving some of the oldest, yet mineralogically fresh, blueschists on Earth. Blueschist metamorphism typically indicates intense metamorphism, producing a flat-lying foliation, isoclinal folds and a north to south trending mineral lineation. The geochemistry of these basic rocks shows that they were formerly mid-ocean-ridge-basalts (MORB) representing a slice of Precambrian oceanic crust. These fresh blue, amphibole-bearing schists formed when the basalt was subducted into oceanic trenches along destructive plate margins, where 'cold' rocks are quickly buried and subjected to high pressures whilst remaining 'refrigerated' at relatively low temperatures. Anglesey's blueschists are among the oldest of their type in the world. They have been dated at 560–550 Ma. Such ages are interpreted as having been produced during rapid uplift of the blueschists during oblique movements on the MSFS. The schists are in regional, unconformable or tectonic contact with the Gwna Group Mélange and are interpreted as having belonged to a Precambrian accretionary prism. It is possible that all Precambrian rocks in southern Britain were part of the same Avalonian subduction system as Nova Scotia, Newfoundland and Canada. Apart from the blueschist at the proposed GCR site, Marquis of Anglesey's Column (currently a RIGS), four other RIGS have been chosen for their varying importance. Llanfair P.G. represents the freshest exposures of blueschists anywhere on the island. Mynydd Llwydiarth will not be documented until the exposures can be located precisely. It is known to be important for research purposes. Castellior Farm which has several outcrops in the field adjacent to the farmhouse. These were said by Dennis Wood to be the best exposures in Anglesey. The wall at the junction of the B5109 with the Llanddona Road in Llansadwrn which contains the largest crystals visible in the schists and the rocks adjacent to the B5109 in Pentraeth (currently obscured by vegetation) which are important for demonstrating that the schists were originally pillow lavas.

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. Some current research suggests that some of these fossils may be Cambrian or even Ordovician in age, although this is refuted by other geologists. 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. In this study, Llansadwrn Roadside Wall belongs to Network 3 (RIGS Precambrian reference sections; see above) and has been chosen to demonstrate the only known large crystals in glaucophane schist within the Eastern Schist Zone of Anglesey.

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