St Anne’s Carpark

[SH 55544 72088]

GeoMôn Global Geopark original webpage

RIGS Statement of Interest:

St Anne's carpark RIGS is typical of the Gwna Green Schist, an entirely mud-rich sediment with sparse inclusions of quartzite all of which has been metamorphosed, predominantly by the pressure of burial, at moderate depths in the Earth's crust. In most areas it is matrix-rich with very few large inclusions. This rock represents about a quarter of the Precambrian metamorphic sequence on the island and is host to large lenses of glaucophane (blue) schist which originated as spillitic (pillow) lava. The greenschist was metamorphosed by pressure to a lesser degree than the blue schist which must have been subducted down an oceanic trench to greater depths. In places, other rocks appear within the schist as discrete masses similar to the Gwna Mélange. The Gwna Mélange however, is almost entirely comprised of a chaotic jumble of rock inclusions, whereas the Green Schist is predominantly a matrix of chlorite, mica-schist rock with rarer inclusions, such as the large quartzite masses to be seen at Henblas and opposite Ty'n Llan about half a mile away. These large rock inclusions are considered to have been 'rafted' in, having been broken off from a nearby continental landmass and dropped down into the sea basin.

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 of the 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 &apossuspect 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 Ll■n is considerably less deformed and metamorphosed than the underlying basement, although this distinction is not everywhere obvious.

Network context of the site: St Anne's Car Park is a critical component of a network of two RIGS which demonstrate key features of the Greenly's Precambrian Gwna Green-schist (more recently termed the Monian Supergroup by Horák and Gibbons) in Anglesey. The other site Henblas and Carreg y Alltwen represents large quartzite inclusions in the green schist. The 5 mile long, NW-SE fault-bounded belt of greenschists and blueschists and associated rocks is famous worldwide for preserving some of the oldest, yet mineralogically fresh, blueschists on Earth and in this area it bounds the Green-schists with tectonic junctions on two sides . The Blue-schists have been dated at 560-550 Ma but no date has been given for these Green-schists. Such ages are interpreted as having been produced during rapid uplift of the blueschists during oblique movements on the MSFS. Both Green- and Blue-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.

To select RIGS to demonstrate the Precambrian evolution of Anglesey and Ll■n, 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 Ll■n. 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, St Anne's Car Park belongs to Network 3 (RIGS Precambrian reference sections; see above) and has been chosen to demonstrate a typically matrix-rich part of the Gwna Green-schists in Anglesey.

References:

BLAKE, J.F. (1888) On the Monian system of rocks. Quarterly Journal of the Geological Society of London, 44, 271–290.

CARNEY, J.N., HORÁK, J.M., PHARAOH, T.C., GIBBONS, W., WILSON, D., BARCLAY, W.J., BEVINS, R.E, COPE, J.C.W. & FORD, T.D. (2000) Precambrian Rocks of England and Wales. Geological Conservation Review Series No. 20. JNCC, Peterborough, 252pp.

FITCH, F. J., MILLER, J. A., & MENEISY, M. Y. (1963). Geochronological investigations on rocks from North Wales. Nature, London, 199, 449–451.

GIBBONS, W. (1983). Stratigraphy, subduction and strike-slip faulting in the Mona Complex of North Wales — a review. Proceedings of the Geologists' Association,94, 147–163.

GIBBONS, W. & BALL, M. J. 1991. A discussion on Monian Supergroup stratigraphy in northwest Wales. Journal of the Geological Society of London, 148, 5–8.

GIBBONS, W. & HORÁK, J. (1990). Contrasting metamorphic terranes in northwest Wales. In : D'LEMOS, R. S., STRACHAN, R. A. & TOPLEY, C. G. (eds) The Cadomian Orogeny. Special Publication of the Geological Society of London, 51, 315–327.

GIBBONS, W. & MANN, A. 1983. Pre-Mesozoic lawsonite in Anglesey, northern Wales; preservation of ancient blueschists. Geology, 11, 3–6.

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).

MILLER, J. A. & FITCH, F. J. (1964). Potassium-argon methods with special reference to basic igneous rocks. Quarterly Journal of the Geological Society of London, 120S, 55–69.

MOORBATH, S. & SHACKLETON, R. M. (1966) Isotopic ages from the Precambrian Mona Complex of Anglesey, North Wales (Great Britain). Earth and Planetry Science Letters, 1, 113–117.

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

SHACKLETON, R. M. (1975). Precambrian rocks of Wales. In: HARRIS, A. L., SHACKLETON, R. M., WATSON, J., DOWNIE, C., HARLAND, W. B. & MOORBATH, S. (eds) Precambrian. A correlation of Precambrian rocks in the British Isles. Geological Society Special Report 6, 76–82.

TUCKER. R.D. & PHARAOH, T.C. (1991). U-Pb zircon ages for Late Precambrian igneous rocks in southern Britain. Journal of the Geological Society of London,148, 435–43.

WOOD, D. S. (1974). Ophiolites, melanges, blueschists and ignimbrites; early Caledonian subduction in Wales? In: DOTT, R. R. & SHAVER, R. H. (eds) Modern and Ancient Geosynclinal Sedimentation. Society of Economic Palaeontologists and Mineralogists, Special Publication, 19, 334–344.

Site geometry: Site boundary