Rhosygadar RIGS site

GeoMôn Global Geopark original webpage

RIGS Statement of Interest: Rhosygadar RIGS site provides the best single location for demonstrating key features of Tertiary mafic dyke intrusion on Anglesey. Contact relations with the mica schists of the country rock are clear and two phases of magma injection into the single intrusion are demonstrated. The first phase of intrusion has angular external boundaries because it faithfully follows planes of weakness in the schists. This igneous rock is fine grained, due to chillling against the relatively cold country rock. The second, larger volume, intrusion phase occupied the interior of the dilating dyke, and shows less correspondence to the dyke margin geometry — the early phase “plastered over” irregularities in the dyke wall. The second phase is also much coarser grainer, presumably both because the wall rocks were already heated by phase 1 (and so did not impose a significant initial chilling effect), and also because the second phase intrusion volume was much larger and so would cool more slowly on geometric grounds. The intrusion has developed particularly well-defined cooling columns perpendicular to the dyke margin.

The site is not large, and is presently in excellent condition. It is most important that the site is protected from disfigurement by unauthorised sampling or palaeomagnetic coring. Geological setting/context: Anglesey is the only part of Britain south of Scotland that shows a significant number of geologically young (Tertiary) igneous dyke intrusions and much older (Palaeozoic) igneous dykes in close proximity. The dyke swarms of Anglesey have played a key role in the history of geology. This was one of the first places in the world where the nature of igneous intrusions, and their thermal effect on surrounding rocks, was documented. This work was published in 1822 by John Stevens Henslow as part of a little-known but remarkably insightful piece of geological mapping. Henslow was the Cambridge mentor for the young Charles Darwin. Geological fieldwork in North Wales introduced Charles Darwin to new geological concepts, including the enormity of geological time, which helped Darwin develop the theory of evolution. Anglesey again set a world class standard for geological mapping in 1919, when the British Geological Survey published a detailed geological map by Greenly, which continues to be used to the present day. Greenly noted that many of the dykes mapped by Henslow were not visible, having been quarried out or buried by land-fill in the intervening hundred years. It was only in 1996, when airborne magnetic surveys conducted for oil and gas exploration were published, that the existence of some of Henslow's missing dykes could be confirmed. This illustrates the particular sensitivity of dyke sites to loss, and emphasises the need to preserve those key sites that remain.

The dykes of Anglesey are now known to include two main groups. One poorly understood group is associated with the Caledonian Orogeny that gave much of the folding and faulting seen in Snowdonia. It seems likely that this interval, some 350–500 million years old, encompasses several discrete phases of dyke injection, but insufficient scientific work has yet been done to clearly define these separate events. The second set, some 40–60 million years old, was caused by the plate tectonic stresses and igneous activity associated with the onset of rifting and continental drift which led to formation of the North Atlantic Ocean. This younger set is part of the same phase of igneous activity that formed the columnar basalt 'Giants Causeway' of Ireland. The dykes of Anglesey represent a potentially rich source of geological data that is not available elsewhere in Wales and England. The dykes can be dated radiometrically, and the orientation of the dykes and the nature of the intrusive displacements can be measured. From these observations the state of stress in the Earth's crust during intrusion can be deduced.

The temperatures in the Earth's interior can be inferred from the dyke rock chemistry and mineralogy. This in turn means that data from the Anglesey dykes will enhance our knowledge of the Plate Tectonic evolution of western Britain. The regional heating associated with the younger dyke swarm may have 'cooked' organic-rich sediments to yield the oil and gas now exploited off North Wales, and may have helped formed some mineral deposits such as the copper at the Great Orme.

The associated changes deep beneath the Earth's crust, and the tectonic stresses associated with rifting and continental drift, contributed to the crustal uplift which has created the mountains of Snowdonia. The underlying mechanisms that trigger the modern earthquakes in North Wales are poorly understood. The geometries of the younger dykes suggest that

the magma was intruded up NW–SE fissures in the Earth's crust, which dilated in response to NW–SE compression.

Analysis of earthquakes shows that North Wales continues to be affected by NW–SE compressive stresses — so study of the dykes may help shed some light on our modern earthquakes. In summary, the dyke swarms of Anglesey need to be preserved for their significance in the historical development of geology, as educational localities, and for continued research of both academic and economic significance.

Network context of the site: In selecting RIGS to demonstrate the Tertiary igneous characteristic of Anglesey, two separate networks were devised. With practice, it is possible to discriminate Tertiary dykes from Palaeozoic dykes at outcrop. However, it is useful to identify sites where the intrusions can be demonstrated unambiguously at outcrop to be post-Palaeozoic in age. Consequently two networks are developed: 1. Tertiary intrusions into the Carboniferous and younger sequences; 2. Tertiary intrusions into pre-Carboniferous sequences. Rhosygadar belongs to Igneous Network 2. Tertiary intrusions into pre-Carboniferous sequences.

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Site geometry: Site boundary