Cae'r Sais

[SH 268 772]

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Introduction

This small site is of interest because it preserves one of the best, and certainly most accessible, exposures of metagabbro and serpentinite in Wales. The exposures at Cae'r Sais lie within an envelope of polydeformed, semi-pelitic metasediment, and together these rocks belong within the New Harbour Group. This unit represents the middle part of the Monian Supergroup, exposed as part of the pre-Arenig basement to Anglesey and south-west Ll■n (Gibbons *et al.,* 1994). Serpentinite–metagabbro complexes are unusual in Great Britain, and these rocks have been subjects of research investigations by numerous workers, from Lhuyd's (1684) note on asbestos, through Henslow's (1822) description and map, to the most recent review by Phillips (1989). Whereas the earlier workers (Bonney, 1881; Bonney and Raisin, 1889; Greenly, 1919) tended to emphasize the petrological interest of these rocks, later researchers of the 20th Century have been mostly concerned with their tectonic and geochemical significance (Dewey, 1969; Wood, 1969; Thorpe, 1972c, 1974; 1979; Thorpe *et al.,* 1984). The most detailed studies in the second half of the 20th Century have been made by Maltman (1973, 1975, 1977, 1979) and Phillips (1989). Despite all this work, the exposures remain enigmatic.

Key questions that have focused on this site concern the tectonic setting represented by these rocks, and whether they should be considered as part of an ancient ophiolite. Geochemical investigations of the serpentinites and gabbros have shown that they are tholeiitic in character and may be classified as sub-alkaline basalts. They have a similar chemistry to serpentinites and gabbros found at the mid-Atlantic oceanic-spreading ridge (Thorpe, 1972c, 1974, 1979; Phillips, 1989).

Description

The eastern side of the site (Figure 7.15) exposes typical serpentinite; it is dark green to black and locally red, with pale green, scaly and undulose foliation surfaces (Maltman, 1977). The protoliths to this metamorphic rock include both dunites and harzburgites, and pseudomorphs after both olivine and orthopyroxene up to 4 mm in size can be detected in some specimens. The present mineral assemblage of the serpentinite is dominantly serpentine (lizardite, antigorite, and bastite after orthopyroxene) and Mg-chlorite, with subordinate tremolite, chromitic spinel, magnetite, pyrite, and chalcopyrite. Locally the serpentine is partly replaced by dolomite to produce the carbonated 'ophicalcite' of Greenly (1919) and Maltman (1977).

The western part of the site comprises pale green metagabbro, which is well exposed in an old quarry face. These rocks, referred to as 'altered gabbros' by Greenly (1919) and Maltman (1977), vary from metamorphosed melagabbros to true metagabbros, and occur as lenticular and rounded isolated bodies within the serpentinite. Igneous textures are well preserved, despite a pervasive greenschist facies metamorphic overprint. Although clinopyroxenes are commonly partly preserved, and demonstrate original igneous poikilitic and ophitic textures, a secondary mineral assemblage is dominant. This latter overprint assemblage comprises: chlorite, actinolite, tremolite, epidote, albite, quartz, white mica, carbonate, and Fe–Ti oxides.

Interpretation

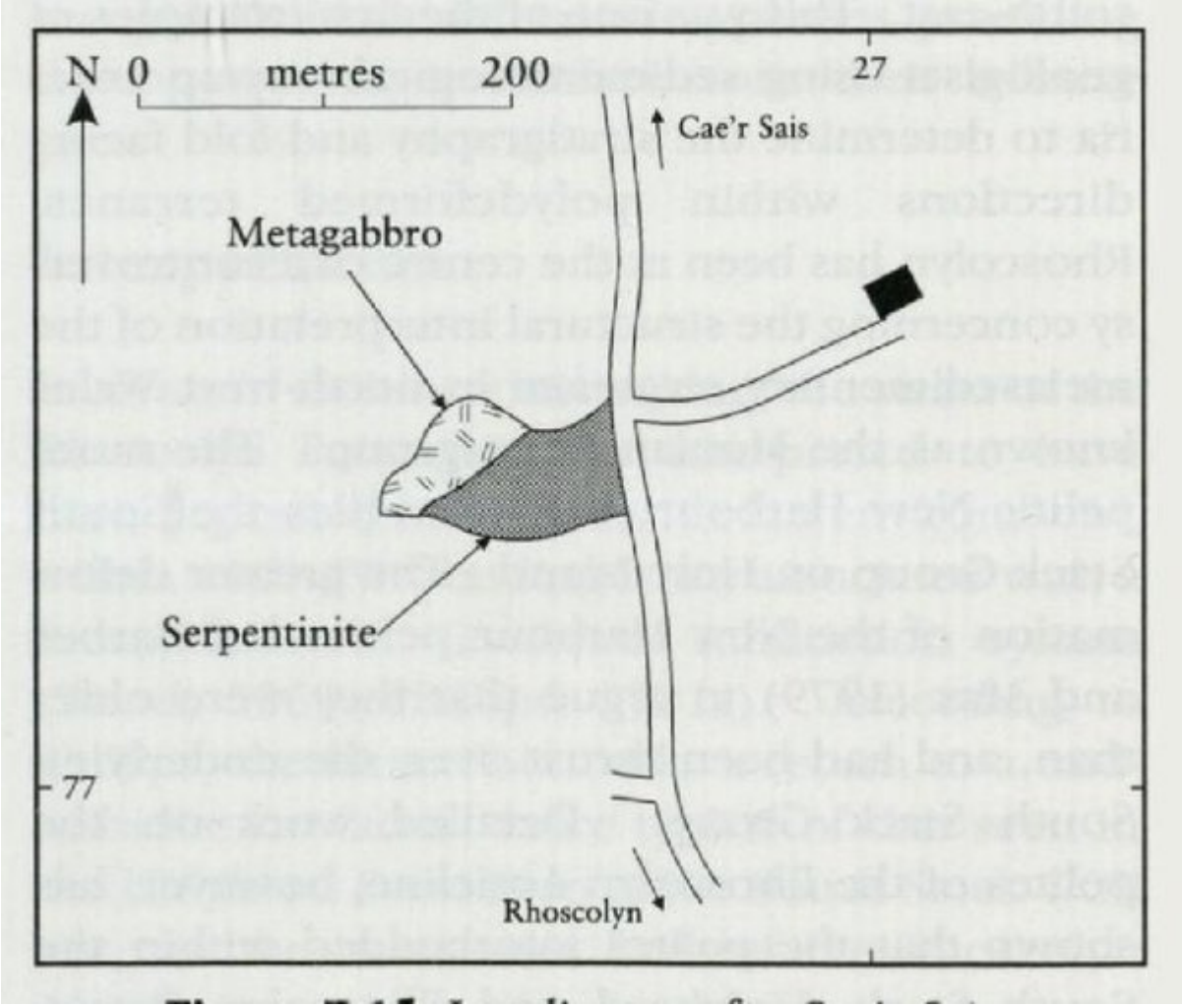
There has been considerable debate over whether the serpentinites and metagabbros exposed on Holy Island were originally intrusive into the New Harbour Group metasediments, or whether they were thrust into their present position. Another suggestion is that they represent a mélange of slices and clasts of disrupted igneous ocks that slid into their present position under gravity (for full discussion see Phillips, 1989). The rocks have a generally high, but also variable, Cr content that has been interpreted as indicating a mantle origin, with some degree of fractional crystallization having

taken place during their genesis. That the ultramafic and mafic protoliths had an originally oceanic origin remains in little doubt, but whether they represent part of a true ophiolite, or had some other origin such as intrusions at the outer rise of a subducting plate (Windley, 1978), remains controversial.

Conclusions

Oceanic igneous rocks are only rarely preserved in the geological record, and these examples at Cae'r Sais rank alongside a small number of broadly comparable exposures in Great Britain, such as those at the Lizard, Cornwall, and along the Highland Boundary Fault in Scotland. Both serpentinites and metagabbros are seen at Cae'r Sais, and the accessibility and lithological peculiarity of the site have made it the centre of attention for many petrological and geochemical studies. It is one of the best sites for viewing the plutonic, metamorphosed igneous rocks that lie within the New Harbour Group.

References



(Figure 7.15) Locality map for Cae'r Sais.