Llanddwyn Island

[SH 390 630]

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Introduction

This site, a narrow, tidal isthmus projecting south-west from the Anglesey coastline, exposes some of the best examples of oceanic basaltic pillow lavas in Great Britain. It is the type locality (Figure 7.19) of Greenly's 'Spilitic Lavas', which form part of the Gwna Group mélange, the highest unit in the Monian Supergroup of Anglesey and LlSr'n. The rocks have been designated as belonging to the Llanddwyn Spilitic Formation (Shackleton, 1975; Barber and Max, 1979).

In addition to the lavas, there are various sedimentary rocks that include sandstones, shales, superb red jaspery cherts and prominent manganiferous limestones that are commonly mixed with the dark basalts to produce spectacular lava-limestone breccias. The age of the red cherts that are associated with the Gwna basalts on Llanddwyn Island has been the subject of controversy ever since possible Cambrian microfossils were discovered in them (Muir *et al.,* 1979; Barber and Max, 1979; Barber *et al.,* 1981; Peat, 1984b; Gibbons *et al.,* 1994).

Description

Llanddwyn Island comprises a series of mostly steeply dipping to vertical lavas, limestones and other sedimentary rocks that form successive NNE–SSW-oriented outcrops running the length of the isthmus. The pillow structures in the lavas are commonly slightly deformed and cut by carbonate veins, but nevertheless are superbly preserved in many exposures, commonly showing interstitial jasper and central vacuoles. Notable, and readily accessible, exposures include those near high water mark on the beach north of the island (Figure 7.20). The pillow structures allow the way-up of the sequence to be deduced, so that the sequence can be seen to young towards the south-east. Pale pink and cream limestones, commonly mixed chaotically with brecciated basalt (Figure 7.21), are abundantly exposed down the south-western coast, at the southern tip of the isthmus, and for some distance back up the eastern coast to Porth y Clochydd. Excellent examples of lava-and-limestone breccias are seen, for example, beneath the lighthouse on the western side of Porth Twr mawr and in the exposures below high water mark to the east to Porth Twr bach. Of particular interest are splendid exposures of bedded red jasper along the central western side of the isthmus: these are the best examples of deep-water cherts in North Wales. In the central and southern part of the site, outcrops consist of dark green, fine-grained sandstones that are distinctive enough to have been given the lithostratigraphical name 'Tyfry Beds' by Greenly (1919), later revised to Tyfry Formation by Shackleton (1975). Barber *et al.* (1981) later differentiated the Tyfry Formation from the rest of the Llanddwyn Spilitic Formation. Several undeformed porphyritic dolerite dykes cut the Gwna Group rocks at various localities along the coast, such as in Porth Twr mawr.

Interpretation

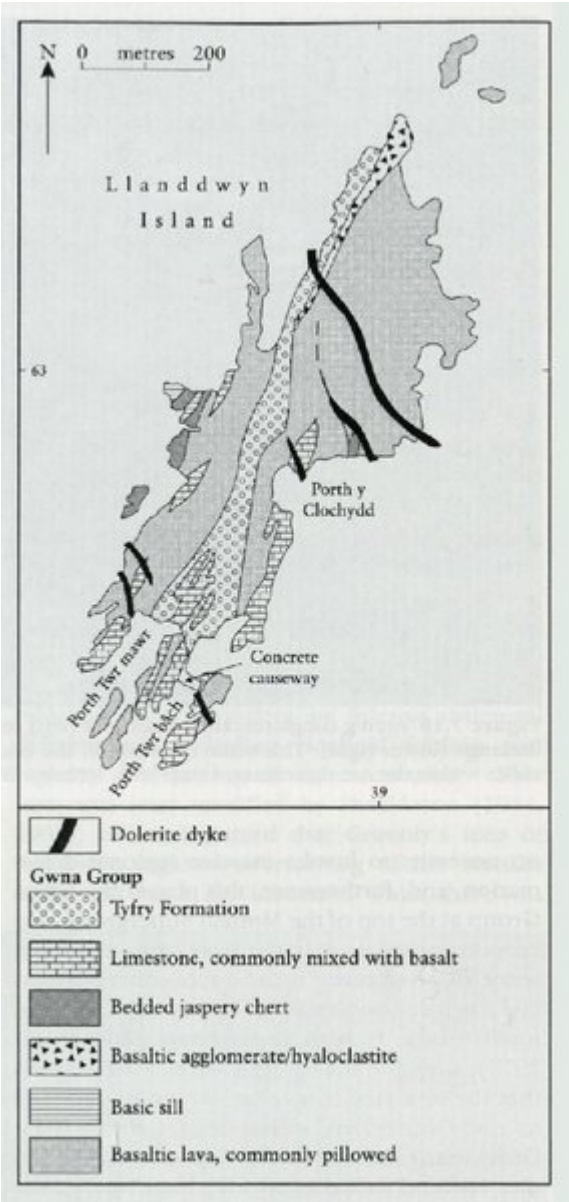
This site is excellent for demonstrating the nature of basaltic pillow lavas, erupted on the sea bed as is well established by observation of modern examples. The oceanic geochemistry of the pillow lavas (Thorpe, 1972c), and the likelihood that the Llanddwyn jaspers represent deep-sea chert, have fuelled interpretation of these rocks in terms of a palaeo-subduction zone (Wood, 1969). Barber *et al.* (1981), who speculated that an unconformity exists between the Llanddwyn Spilitic Formation and the Tyfry Formation, developed this idea. According to such an interpretation, the lenticular outcrops of basaltic lava and associated breccias represent slices of ocean floor imbricated within an accretionary prism in the hanging wall of a subduction zone. The upward-facing sandstones of the Tyfry Formation might then be interpreted as deposited in basins on top of this accretionary prism. The origin of the lava-limestone breccias has not been resolved, although these exposures have a direct bearing on the conflicting 'tectonic *versus* olistostrome' interpretations of Greenly (1919) and Shackleton (1954). The report of supposedly Cambrian microfossils from

Llanddwyn Island (Muir *et al.,* 1979) has proven controversial (Peat, 1984b), and the age of the Llanddwyn Spilitic Formation remains uncertain, although presumably it is either Precambrian or Cambrian.

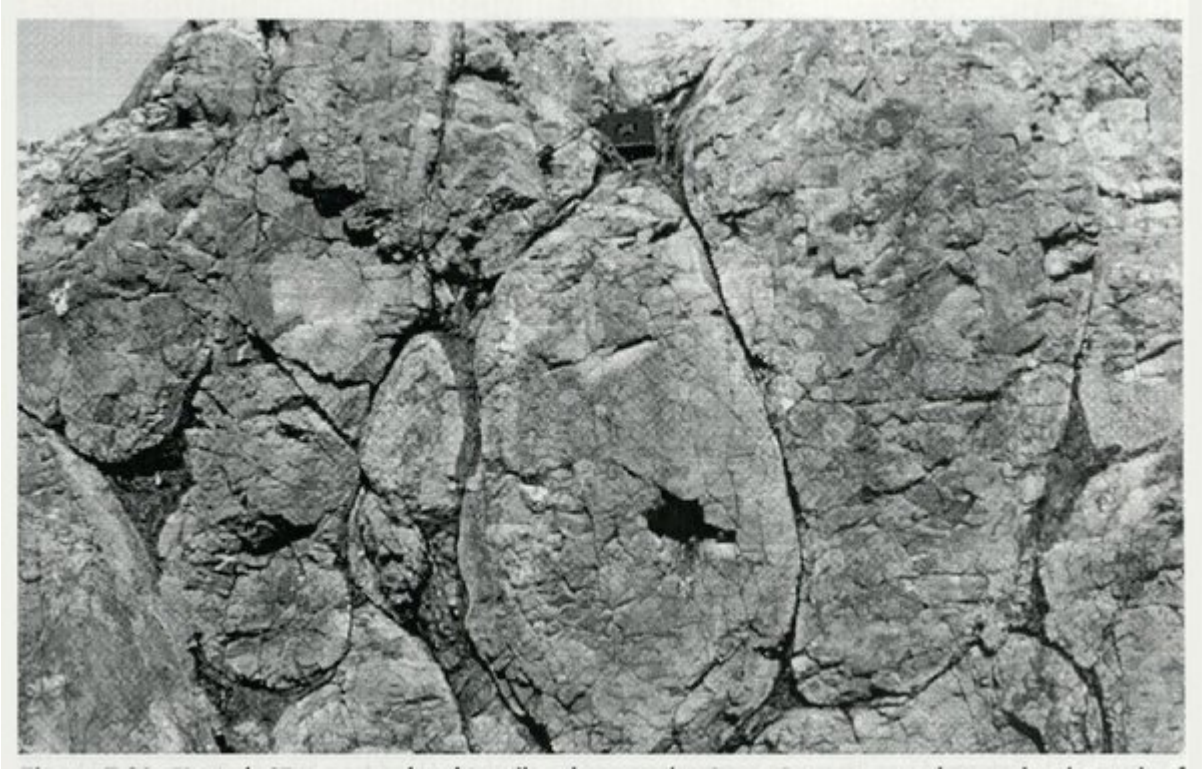
Conclusions

The graphic exposures of steeply dipping jaspery pillow lavas at the Llanddwyn Island GCR site rank among the best of such examples preserved in Great Britain; indeed the site is the type locality for these rocks. This, combined with the spectacularly colourful mixtures of lava and limestone, makes these exposures truly exceptional. The site has also been at the centre of controversy over the age of the pre-Arenig rocks on Anglesey since it provides important (although unconfirmed) evidence for a Cambrian rather than Precambrian age for the Gwna lavas.

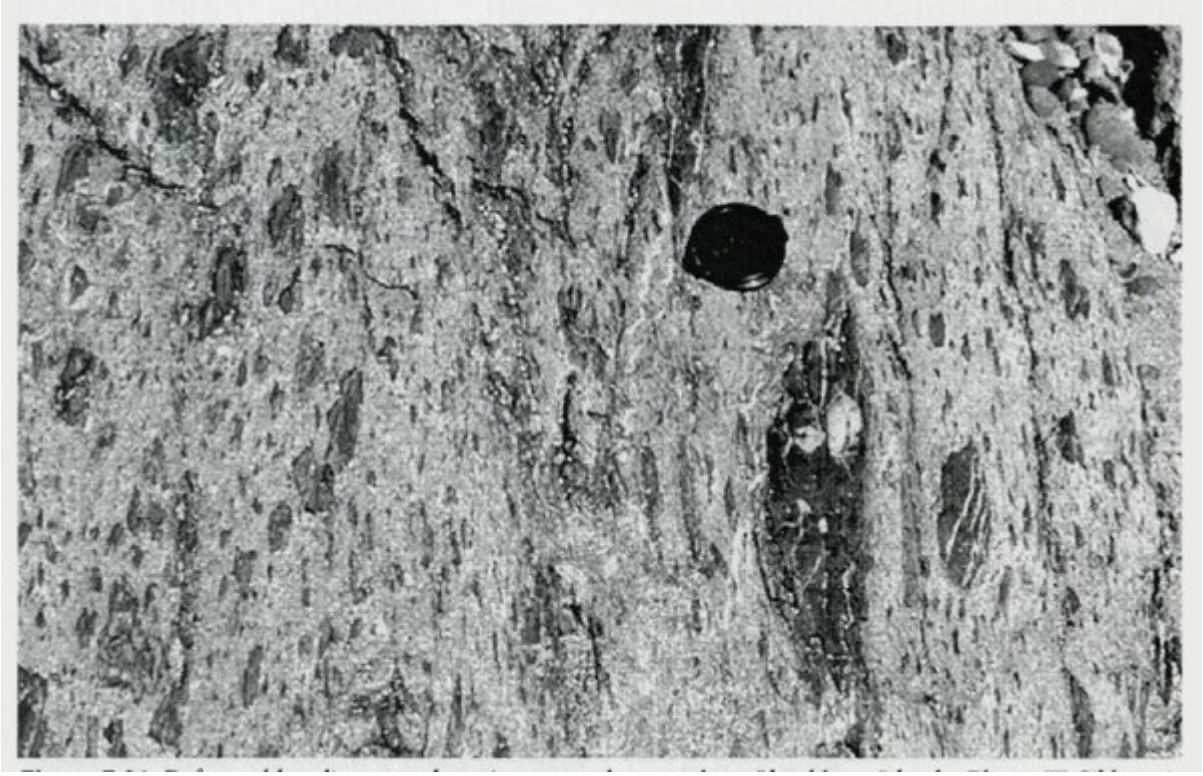
References



(Figure 7.19) Geological map of Llanddwyn Island.



(Figure 7.20) Vertical, SE-younging basaltic pillow lavas in the Gwna Group exposed immediately north of Llanddwyn Island. (Photo: W. Gibbons.)



(Figure 7.21) Deformed lava-limestone breccias exposed on southern Llanddvvyn Island. (Photo: W Gibbons.)