The Gynfor outliers

[SH 378 948], [SH 383 945], [SH 387 952]–[SH 396 948]

Introduction

The Gynfor outliers (Figure 9.13) are of particular interest for the interpretation of Arenig stratigraphy and palaeogeography in Anglesey; and that at Ogof Gynfor, especially, provides an excellent example of the structural relationships between and within Monian and Ordovician rocks, as described by, for example, Bates (1974) and Barber and Max (1979).

A number of small fault-bounded outliers of Ordovician sediments occur within the late Precambrian-early Cambrian Monian Supergroup on the northernmost part of Anglesey, between Camaes Bay and Bull Bay. They were described in detail by Greenly (1919), who assumed that they were entirely of Caradoc age (*gracilis* Zone), but Bates (1968b, 1972) later demonstrated the presence of Arenig as well as Caradoc rocks within the succession.

Description

Three sites have been selected from the Gynfor outliers: Ogof Gynfor, Isallt, and the area between Llanlleiana Head and Porth Cynfor (Figure 9.13).

Ogof Gynfor

Ogof Gynfor is a steep-sided inlet in the cliffs about 1 km east of Llanbadrig. Here the Arenig Torllwyn Formation can be seen resting unconformably on the Gwna Melange of the Monian Supergroup. In turn, the Caradoc Llanbadrig Group lies disconformably on the Torllwyn Formation. The section has been described and illustrated in a number of publications, for example by Blake (1888, fig. 21, p. 519), Greenly (1919, p. 475, fig. 220, pl. 29), Bates (1974, p. 50, fig. 5A) and Barber and Max (1979, p. 417, fig. 7). Bates (1974, p. 50) described part of this section as 'a classic example of the interrelationships that can obtain between folding and faulting'. Not all of the section can easily be seen from the cliffs, and it is best examined from a boat.

The unconformity between the Gwna Melange and Torllwyn Formation is well seen in the deep chasm ((Figure 9.14); Greenly, 1919, pl. 29). Barber and Max (1979, p. 417) noted that both the Gwna Melange and Ordovician show a simple, steeply dipping cleavage, indicating that they were deformed together. The Torllwyn Formation is 25 m thick at Ogof Gynfor and comprises dominantly pale, brown-weathering conglomerates containing quartzite blocks up to 1.7 m across (Figure 9.14), with subordinate partings of shales, siltstones or fine grits. These finer beds have yielded most of the fossils here, predominantly brachiopods including *Ahtiella quadrata* Bates (type locality) and *Rhynchorthis rotunda* Bates, together with pelmatozoan and bryozoan fragments.

Farther north, around the headland from north of the inlet and about 100 m from the unconformity described above, there is a faulted syncline, in the core of which Caradoc (*N. gracilis* Zone) sediments — the Gynfor Shales of the Llanbadrig Group — are exposed. The northern limb of the syncline is cut by fairly steep reverse faults, whilst those on the southern limb are more or less vertical. The Torllwyn Formation is exposed on both limbs of the fold, and the north limb is truncated by a fault that brings it into contact with the Gwna Melange, which is the northern limit of the Ogof Gynfor outlier.

Isallt

Inland, along the same fault complex, Ordovician rocks crop out as far as Isallt [SH 383 945]. Behind and to the south of this point the unconformity at the base of the Arenig can be seen, where it dips at a low angle, and quartzite breccia at the base of the Torllwyn Formation is exposed on crags of Gwna Quartzite. The contact is irregular, and small stacks of

quartzite can be seen, surrounded by breccia (Bates, 1972, p. 33, fig. 3).

Llanlleiana Head to Porth Cynfor

In the outlier of Llanlleiana Head to Porth Cynfor a conglomerate intervenes between the Torllwyn Formation and the Gwna Quartzite. This, the Porth Cynfor Conglomerate Formation, is overlapped by the Torllwyn Formation to the west, as at Ogof Gynfor. The Porth Cynfor Formation rests unconformably upon an irregular surface of Gwna Quartzite, with a 3-m-thick quartzite breccia at the base. This is overlain by 5 m of lavender-coloured and cream-grey shales, alternating with sandstone and conglomerate, and includes a 13 cm band of brown-weathering limestone. Succeeding these beds are 20 m or more of massive purple conglomerates, with white and red quartz and jasper cobbles and boulders, set in a matrix of purple sand and shale, which in some outcrops are altered to a phyllite (Bates, 1972, p. 32). Between Llanlleiana Head and Porth Cynfor the Porth Cynfor Formation is faulted against the Llanbadrig Group and Torllwyn Formation to the north, with the unconformable base forming the southern margin of its outcrop. On the eastern side of Porth Cynfor the Torllwyn Formation conformably overlies the Porth Cynfor Formation. The outcrops on either side of Porth Cynfor represent the type locality for the Porth Cynfor Formation (the 'Hell's Mouth conglomerate' of Bates (1968b, p. 137)).

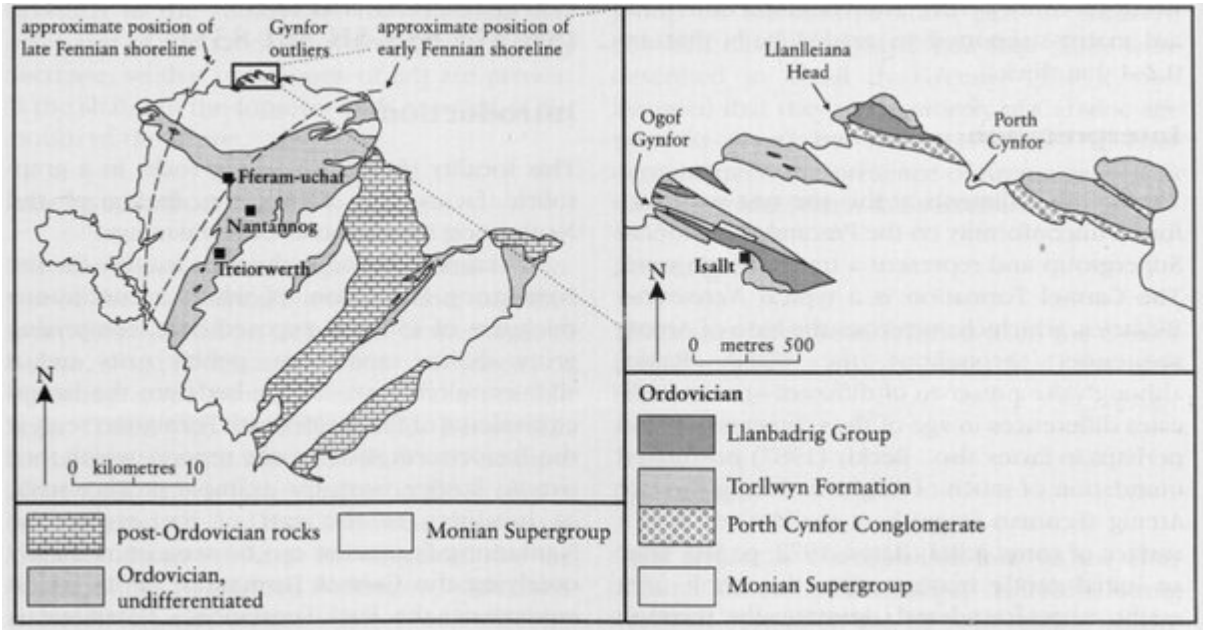
Interpretation

The Porth Wen Group, comprising the Porth Cynfor and Torllwyn formations, consists predominantly of coarse clastics belonging to a transgressive sequence. Bates (1968b, 1972) attributed to it an *extensus–hirundo* Zone age, but Beckly (1987) argued for a late Arenig (Fennian) age for the entire Anglesey sequence, suggesting that the transgression took place wholly during the Fennian and did not reach northern Anglesey until the middle of the late Fennian. If this is the case, the local base of the Arenig is diachronous, with the oldest sediments being the Carmel and Foel formations of the 'Principal Area'. The Porth Wen Group, on Beckly's model, is approximately coeval with the Treiorwerth and lower part of the Nantannog formations. This correlation appears to be supported by the common occurrence in the Treiorwerth and Torllwyn formations of the brachiopod *Rhynchorthis rotunda* Bates. As in the Treiorwerth Formation, the brachiopods of the Torllwyn are mainly coarse-ribbed, robust shallow-water forms (see Treiorwerth site report). No Llanvirn sediments are preserved in the Gynfor outliers, due either to non-deposition (perhaps the area remained under very shallow water or was positive), or subsequent erosion prior to the early Caradoc transgression. Similar cleavage affects the Monian rocks and the Ordovician Porth Wen and Llanbadrig groups, indicating that deformation occurred after the mid-Ordovician.

Conclusions

These localities provide components for the palaeogeographical interpretation of north-west Wales during the Arenig. The rocks were formed in shallow water, like those in the Treiorwerth—Ty Hen area, but deposition began later here, illustrating the diachroneity of the unconformity at the base of the Ordovician on Anglesey.

References



(Figure 9.13) Distribution of Ordovician rocks on Anglesey, from British Geological Survey (1994b), with details of the Gynfor inliers from Bates (1972).

(Figure 9.14) Cliffs of Ogof Gynfor viewed from the sea. On the extreme right, surmounted by pale-weathering quartzite, is the Gwna Melange of the Mona Supergroup. It is overlain unconformably by thick sandstones and conglomeratic horizons of the Torllwyn Formation (Arenig), which are disposed in a faulted syncline; within this is a faulted wedge of dark cherry shales of early Caradoc age. The left-hand fault is vertical, whereas the right-hand one is an overthrust. (Photo: D.E.B. Bates.)