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# Ogof Gynfor

[SH 3777 9476]–[SH 3793 9500]

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## Highlights

At Ogof Gynfor the Precambrian Mona Complex of Anglesey is overlain unconformably by Ordovician conglomerates and cherry shales. The dramatic folding and faulting of the two sequences is of great importance in the controversy over the stratigraphical, structural, and metamorphic relationships between the two units, which represent one type of relationship between basement and cover in the Welsh Caledonides.

## Introduction

The older rocks at Ogof Gynfor (Figure 4.8) consist of siliceous Gwna Mélange of the Precambrian Mona Complex. It contains a large mass of quartzite which may form a particularly large block within the mélange. The Ordovician conglomerates, of the Torllwyn Formation of the Arenig Series, rest unconformably on this basement and are succeeded disconformably by the Caradoc Gynfor Shales. The Ordovician sequence has been strongly folded, into a series of four synclines and three anticlines, with dips up to the vertical. Both rock units have then been cut by reverse faults, giving some of the folds the geometry of hanging-wall anticlines and footwall synclines; lower-angle thrust splays are present, and finally there are steep northerly-dipping normal faults. A schistosity pervades the Mona Complex and a slaty, or spaced, cleavage the Ordovician rocks.

Matley (1899, p. 648) first described the section in detail, and used it to demonstrate the existence of a sub-Ordovician unconformity in Anglesey, and the presence of thrusting. It was also described and figured by Greenly (1919). Shackleton (1954) drew attention to the basement to cover relationships shown by the faulting, and Bates (1968) recognized the Arenig–Caradoc disconformity, and gave further description (Bates, 1972, 1974).

More recently, controversy has centred on the relationship between the Mona Complex and the Ordovician. Barber and Max (1979) have claimed that, contrary to earlier workers, both sequences were affected by a single deformation event, placing them in their Cemlyn Tectonic Unit.

## Description

The sequence from Llanbadrig Point to the south side of Ogof Gynfor is formed of Gwna Mélange. At the south side of the inlet [SH 3786 9475] a fault with a steep northerly dip downfaults the Ordovician Torllwyn Formation to the north. It rests here unconformably on the Gwna Mélange, but the surface of the unconformity is inaccessible in the cliff. Above is a small quarry in the Arenig conglomerates, with poorly preserved brachiopods. Within the inlet are several fault-bounded masses of Gwna Mélange, Arenig Torllwyn Formation and Caradoc Gynfor Shales (Figure 4.8). On the north side of the inlet a major, vertical, WNW–ESE-striking fault separates this complex from a high ridge of Gwna Mélange and quartzite. This ridge is terminated to the north by another vertical fault, which downthrows the succession once more to bring the Ordovician conglomerates to sea-level.

The cliffs from here [SH 3782 9484] to the north end of the section expose the irregular un-conformity between the Gwna Mélange and the overlying grits. The mélange contains a marked penetrative cleavage, which has a similar steep attitude to the spaced cleavage in the grits above.

Pebbles of Monian rocks occur in the Ordovician. The structure consists of two synclines and an intervening anticline, all faulted to some extent. The north limbs of both synclines are cut by reverse faults, which each give the appearance of footwall synclines. Thus the anticline becomes a hanging-wall anticline; the more northerly fault brings back the Gwna

Mélange to the cliff top, and so no anticline is associated with it. The cleavage in the Ordovician rocks becomes more intense towards these faults. Lower-angle thrusting is also associated with the reverse fault at the northern end of the section.

## Interpretation

The structural interest of this site lies in the relationships between the folding and faulting, particularly the way in which the faults are associated with folds and cleavage in the Ordovician sequence, and the way in which folds in the cover pass down into faults in the basement.

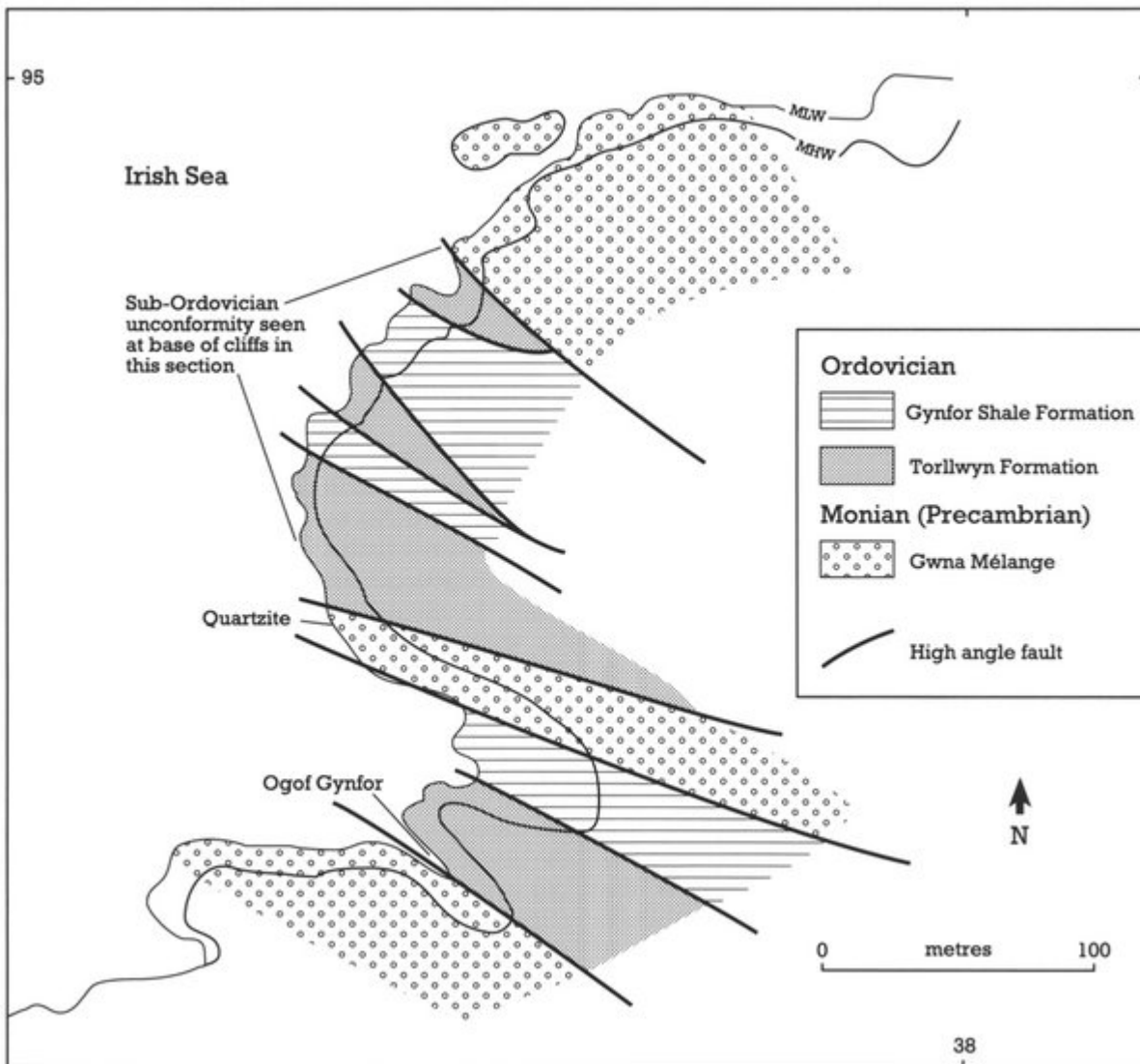
Prior to the work of Barber and Max (1979) all workers were agreed that the Gwna Mélange formed an integral part of the stratigraphical succession of the Precambrian Monian. Although Shackleton (1969) showed that the mélange was of sedimentary origin rather than tectonic, as maintained by Greenly (1919), both he and Bates (1972, 1974) agreed that the Ordovician deposition post-dated the Late Precambrian deformation of the Monian basement. Shackleton (1954, pp. 289, 291) particularly used these exposures to demonstrate the lack of decollement between the Precambrian basement and the Palaeozoic cover and the passage from clean-cut faults in the basement up into shear zones and folds in the cover. Barber and Max (1979), however, have proposed that much of the Monian of Anglesey has only suffered the same deformation history as the Ordovician above. For this reason and, in part, from palaeontological evidence (Muir *et al.*, 1979; Wood and Nicholls, 1973), they argue that the Gwna Mélange (part of their Cemlyn Unit) is of Cambrian age, and that the unconformity does not represent a significant tectonic or metamorphic event. Clearly, this hypothesis is of great significance to both the arguments concerning basement–cover relationships in the Caledonian Orogeny and also to the role of the Monian in the evolution of that orogeny.

The consensus among current research workers regarding the nature of this unconformity is unclear. Some recent publications on the evolution of Anglesey (for example, Gibbons, 1987) make no comment. No doubt, future research will be conducted on this important topic and this site will provide some of the crucial evidence. In particular, the continuity, or otherwise, of the cleavage between the units and their comparative metamorphic state will be important, as will be the deformational and metamorphic history of the Monian pebbles included in the Ordovician.

## Conclusion

Ogof Gynfor provides important exposures of the unconformable contact between the Precambrian Mona Complex rocks and overlying Ordovician conglomerates and shales. Recent interpretations of the structure of Wales place great emphasis upon the significance of faults in the Precambrian basement and their influence, during the Caledonian Orogeny, on strain variation and structural style in the Lower Palaeozoic cover rocks. The structural significance of this site lies in the opportunity that it provides to examine the structural characteristics of and relationship between juxtaposed Precambrian basement and the Lower Palaeozoic, for instance, the way in which folds in the cover pass down into faults in the basement.

## [References](#)



(Figure 4.8) Geology of the Ogof Gynfor site.