Trum y Ddysgl

[SH 544 518]

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Highlights

Trum y Ddysgl provides a superb section illustrating a rare example of overturning of strata on the north-west limb of the Snowdon Syncline. This indicates a high intensity of deformation, and it contrasts markedly with the more open structures and lower strain seen in central Snowdonia to the north-east, along the strike of the fold structures. The site also provides important exposures of a thrust plane, a very rare feature in the Caledonian Orogenic Belt of North Wales.

Introduction

The Trum y Ddysgl site lies on the north-west limb of the Idwal–Snowdon Syncline (Figure 4.1) and (Figure 4.4) and provides a contrast in structural style to the Alexandra Quarry, Cwm Idwal and Capel Curig sites. Bedding–cleavage relationships and sedimentary structures in the steeply dipping Cambrian Ffestiniog Beds indicate that the rocks at the base of the cliffs are slightly overturned. The structure is clearly demonstrated (Figure 4.4) by three prominent quartzite horizons. The Cambrian rocks are thrust south-eastwards over Ordovician slate.

Other than the original survey (Ramsay, 1866, 1881), the only detailed description of the site appears in the account of Shackleton (1959, (Figure 4.4)), who presented a line-drawing illustrating the main structural features. He also presented a measured section through the Ffestiniog Beds. The site lies in an area between Snowdon (Williams, 1927) and the Slate Belt (Morris and Fearnsides, 1926) with their contrasting structural styles. It has been described in the field guide of Roberts (1979).

Description

The site consists of an almost 1 km-long cliff section (Craig Trum y Ddysgl) to the north-east of the summit of Trum y Ddysgl. The overall structure of the locality is best observed from a viewpoint to the north-east on the opposite side of the glacial cirque of which Craig Trum y Ddysgl forms the south-west wall. The site is described by means of a traverse from the north-west to the south-east (Figure 4.4).

The north-west end of the cliffs are formed from the Cambrian Ffestiniog Beds. These are dominated by grey slate with minor, thin (<0.01 m) silt layers defining the bedding. The orientation of bedding is variable, lying close to the core of the Cym-y-Ffynnon Pericline, and tight mesofolds can be seen in places for example, at [SH 5430 5208] to which the consistently steep NW-dipping cleavage is axial planar. At this locality, cleavage is refracted through more prominent silt layers around the fold hinge and, on the limbs, 0.02 m-thick sand ribs show incipient boudinage. Elsewhere, the tightness of major folds is implied by the small angle between cleavage and bedding.

Traversing along the crags towards the southeast, silt and sand beds become more common until a prominent quartzite bed is reached. This bed (quartzite 1 on (Figure 4.4)) is the stratigraphically lowest of three prominent quartzite beds up to 20 m thick separated by equivalent thicknesses of shale with thin sandstone beds (Figure 4.4). At the top of the crags, the quartzites dip steeply to the south-east, but at the base they dip steeply to the north-west. Sedimentary structures (cross-lamination and graded bedding) in the shale–silt sequence to the south-east of the quartzite, indicate that the sequence youngs in that direction. The NW-dipping beds at the base of the crags are therefore slightly overturned; here cleavage has the same dip direction but at a lower angle.

Within the thick (sometimes conglomeratic) quartzites, numerous quartz-filled tension gashes can be observed. Some short veins are arranged *en echelon,* while others are more continuous but irregular in orientation; cross-cutting

relationships are common. Between the second and third quartzite, 0.5 m-thick sandstone beds in the shale show incipient boudinage, displacement, and quartz veining. In common with the *en échelon* veining in the main quartzite beds, the sense of displacement of the minor boudinaged sandstone beds indicates that the dominant movement of higher levels is toward the south-east.

Further to the south-east along the crags, the Ffestiniog beds are thrust over dark Ordovician slates. The NW-dipping thrust plane 'climbs' the crag in a small gully. The Ordovician slates in the footwall form a monotonous sequence with steeply NW-dipping cleavage, but little indication of bedding. However, at the base of the shale sequence, just below the thrust plane, a small exposed thickness (-2 m) of mud-pellet sandstone, of possible Arenig age (Roberts, 1979), can be seen dipping to the north-west, again indicating overturning below the thrust.

Interpretation

Whereas the north-east end of the Snowdon Syncline is characterized by open folds of larger wavelength, in the south-west, wavelength becomes less and folds tighten. With this in mind, the site at Trum y Ddysgl has been chosen as a contrast to the structural style displayed in the Cwm Idwal and Capel Curig sites.

In terms of the maximal (major) structures defined by Roberts (1979), the site lies toward the northern termination of the periclinal Cwm Pennant Anticline. Tight folding associated with the Cwm Pennant Lineament is considered to have resulted from relatively intense regional deformation associated with the renewal of movement along the line of a synsedimentary fault (Smith, 1988). North of the Cwm Pennant Anticline, the Arfon Anticline becomes the maximal structure adjacent to the Snowdon Syncline. A sharp contrast exists between the strong deformation exhibited by the Slate Belt rocks (for instance, at Alexandra Quarry) on the limb of the Arfon Anticline and the less-deformed volcanic succession of central Snowdonia.

Thrusting is known from only a few rare examples in North Wales; Smith (1987, 1988) has shown that structures interpreted as thrusts by Fearnsides (1910), and Fearnsides and Davies (1944) are, in fact, the product of pre-lithification processes. The variation in fold style between high interlimb angle with upright axial planes and low interlimb angle and more inclined axial planes was attributed to local variations in shear strain by Wilkinson (1987). This model has been developed by Wilkinson (1988) and Smith (1988) who attribute the lower angle of axial planes of some folds to propagation above the tip lines of thrusts which may flatten into cover detachments, the cover–basement interface, or faults within the basement. The Trum y Ddysgl site represents a very rare location where one of these thrusts extends up to exposed levels.

The site provides an excellent example of the fold style and the more intense deformation which characterize the south-west part of the Snowdon Syncline, more particularly on its north-west limb. The section displays overturning, seen in bedding–cleavage relationships and proved by sedimentary structures. Cambrian strata are thrust southeastwards over Ordovician slates on a NW-dipping thrust plane. Kinematic indicators in quartzite beds of the hanging wall are consistent with the south-easterly overthrusting indicated by stratigraphical relationships.

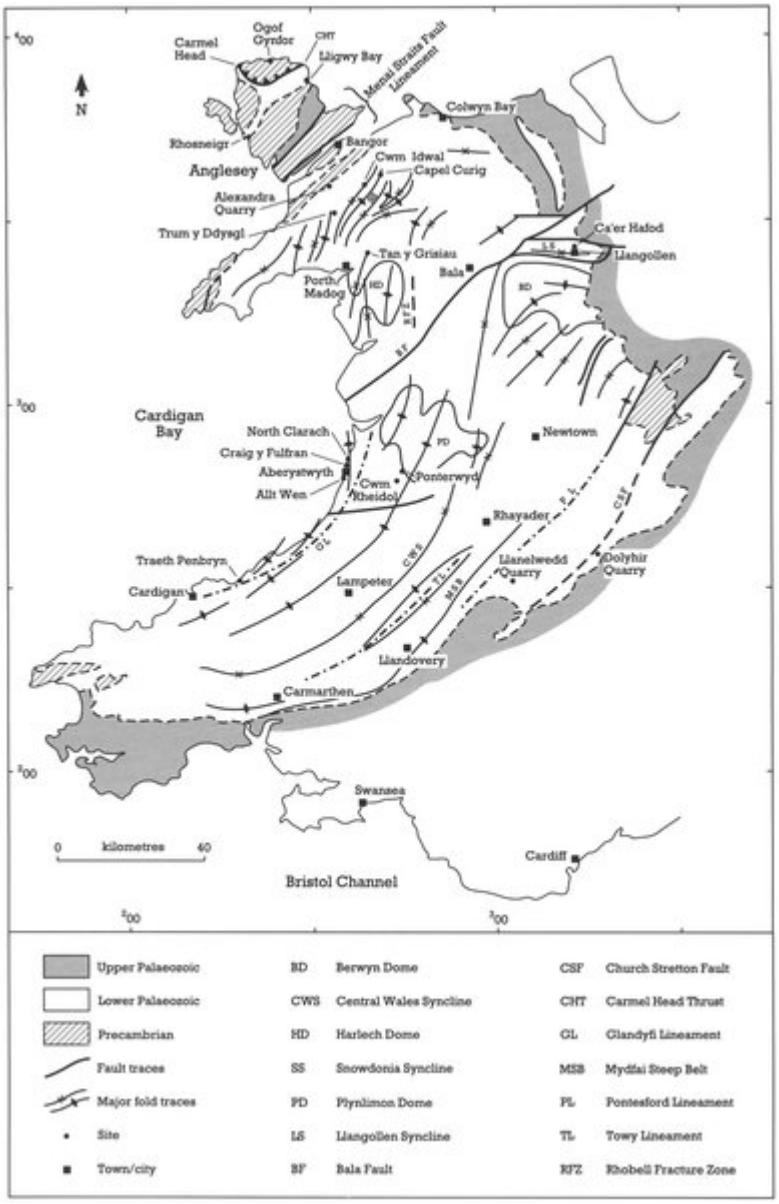
The regional variations in structural style are central to ongoing reinterpretation of the Caledonian Orogenic Belt, both in North Wales and in Britain as a whole. Particular significance is now attached to the relationship between strain intensity, reflected in fold style, and basement faulting, and this site is of special importance because of the coincidence of high strain and thrust faulting at a single locality. The full significance of these features is not yet certain and this site is likely to attract considerable further study and interpretation.

Conclusions

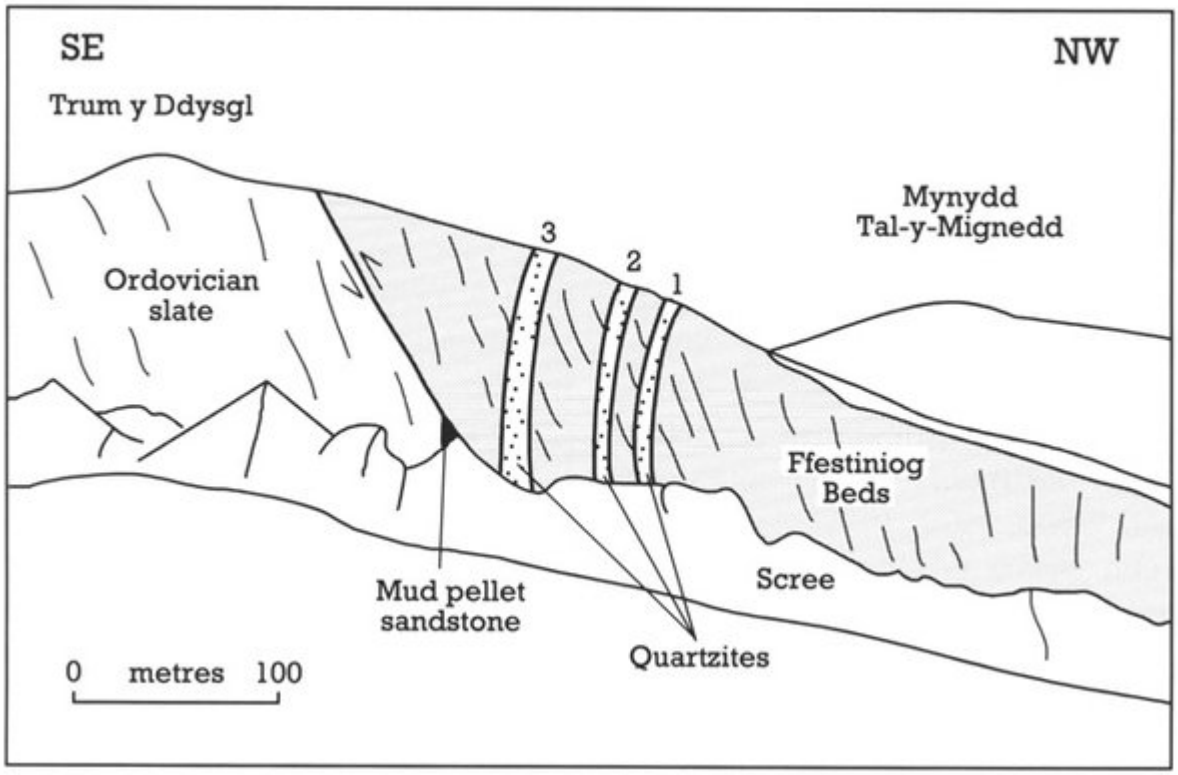
At Trum y Ddysgl, folding and thrusting by low-angle faults, which were formed during the Caledonian mountain-building episode, affect rocks of the Cambrian and Ordovician periods. Cambrian strata are overturned and are thrust south-eastwards over the younger Ordovician rocks, although such thrusts were a rarity in the Caledonian terrane of Wales. The intense deformation seen here, contrasts with other areas of Snowdonia where the effects of the orogeny

were less pronounced.

References



(Figure 4.1) Map showing the traces of the principal folds and faults of Caledonian age in Wales. The localities described in the text are also shown.



(Figure 4.4) View of Trum y Ddysgl looking south-west. Redrawn from Roberts (1979), after Shackleton (1959).