
Ty'n-y-Ffordd Quarry

[SH 8699 6525]

Introduction

This classic locality, an old quarry containing early Ludlow rocks, is on the north side of the A548 Abergele to Llanrwst road and about 2 km SSW of Llangerniew village in, northern Wales.

The site is situated in the Silurian of what was formerly the county of Denbighshire and in a region for which Warren *et al.* (1984) give a detailed modern study. Sedgwick (1843b), Ramsay (1866, 1882), McKenny Hughes (1879, 1885, 1894) and Strahan (1885) all contributed to the initial understanding and classification of Silurian stratigraphy of the Denbigh area, which embraced the contiguous Vale of Clwyd to the east. The early 20th century literature on the Silurian of the region is dominated in numbers and influenced by the work of Boswell (e.g. 1926, 1928, 1931, 1932, 1935a, b, 1937, 1942, 1943, 1953; Boswell and Double, 1934, 1938, 1940) and Jones (1937, 1940, 1943). Over a 40 year period Boswell produced 19 publications about the area (see Warren *et al.*, 1984). His 1932 paper deals with the geology of the vicinity of Llangerniew and his studies culminated in the publication of his 1949 book on the Silurian of northern Wales.

Evidence from this celebrated locality contributed to a famous, long-running and at times fierce geological debate, mainly between Boswell and Jones, concerning the genesis of so-called 'disturbed beds', which occur at many Wenlock and Ludlow horizons, affecting all rock types, in the Denbigh area. The resolution of the problem in favour of a syn-sedimentary slump origin was fundamental to the interpretation of the Silurian geology of the region. Specific mention of Ty'n-y-Ffordd Quarry occurs in, for example, Boswell, 1932, 1935a, b, 1937, 1942, 1949; Jones, 1937; and Warren *et al.*, 1984. More recently Maltman (1987) has studied Ty'n-y-Ffordd as part of his analysis of microstructures (shear zones), which he identified in the deformed sediments of the Silurian of the Denbigh Moors. Eva and Maltman (1994) have estimated palaeoslope directions from slump folds, including data from Ty'n-y-Ffordd.

Description

This excellent exposure consists of 5–6 m of the Elwy Group above about 3 m of almost horizontal beds of the Upper Nantglyn Flags Group (Warren *et al.*, 1984; see (Figure 5.72), (Figure 5.73)). Here the latter are striped, regularly bedded and weakly cleaved silty mudstones, with sporadic thin sandy bands and ribbon-banded mudstones. Warren *et al.* (1984) define their ribbon-banded mudstone lithology as a regular alternation of three lithologies, which probably reflect different modes of formation within a similar environment (see below). Their striped silty mudstone rock-type comprises irregular alternations of silty mudstone and siltstone or fine sandstone.

The Elwy Group here are part of the locally distributed Llangerniew Disturbed Beds of Jones (1937). In the quarry this group is represented by contorted and fragmented (disturbed) silty mudstones that show folds and rolls and contain small ironstone and colophane pebbles, nests of shelly fossils and tabular decalcified siltstone blocks with graptolites. The base of the Elwy Group is irregular and shows downcutting, involving a progressive transgression of the bedding, totalling 1 m, across the exposure from west to east.

All rocks in the quarry are of early Ludfordian age (Warren *et al.*, 1984; see also Cocks *et al.*, 1992). The Upper Nantglyn Flags have yielded a fauna characteristic of the basal Upper *Neodiversograptus nilssoni* Biozone: *Saetograptus chimaera salweyi* (common), together with *Neodiversograptus nilssoni*, *Pristiograptus* cf. *frequens* and the bivalve *Cardiola interrupta*. The Elwy Group here contains the brachiopods *Atrypa reticularis*, *Hyattidina* (common), *Isorthis clivosa*, *Leptostrophia filosa*, *Microsphaeridiorhynchus* cf. *nucula* and *Pholidostrophia*, the nautiloid '*Orthoceras*' *undulocinctum*, the coral '*Syringopora*' *bifurcata* and the graptolites *Pristiograptus dubius*, *N. nilssoni* and *Monograptus uncinatus orbatus*. These Elwy Group graptolites are preserved in relief and are considered to be a derived fauna because they indicate a Lower *Neodiversograptus nilssoni* Biozone.

Interpretation

From Wenlock through to Ludlow times this area lay within the east–west aligned Denbigh Trough in the northern part of the Welsh Basin (Cummins 1957, 1959a, b; see also Siveter *et al.*, 1989, figs 8–10; Dimberline *et al.*, 1990, fig. 1). Sediment supply was mostly from the west and its western margin was probably along the line of the Conway Valley Fault.

The sandstones (greywackes) of the Elwy Group are interpreted as the distal products of turbidity currents (Warren *et al.*, 1984). The latter authors suggested (pp. 22, 46) that deposition of the three components of the ribbon-banded mudstone lithology (e.g. of the Nantglyn Flags) was by weak turbidity currents (silty mudstones), far-travelled turbidity currents (calcareous siltstones) and turbid suspensions (laminated muddy siltstones) in no great depths, largely lacking oxygen and well away from the basin margins. The origin of the laminated muddy siltstone component, with their relatively high carbon content, is especially controversial (Warren *et al.*, 1984). More recent studies have suggested that these laminated hemipelagites in the Upper Nantglyn Flags Group are the product of regular, perhaps annual, pulsing in plankton productivity and silt supply (Dimberline *et al.*, 1990). The striped silty mudstones are considered to be the lateral equivalents of the other beds in the area, such as the sandstones and ribbon-banded mudstones, and are thought to originate on a gentle slope as the distal products of turbidity currents and slump movements; a penecontemporaneous shelf source is indicated for their sporadically distributed shell-rich 'gingerbread' horizons (Warren *et al.*, 1984).

Warren *et al.* (1984; see also Maltman, 1987) followed Jones (e.g. 1937, 1940, 1943) in regarding the disturbed beds of north-west Denbighshire as principally the result of penecontemporaneous, submarine, down-slope, earthquake-generated slumping or sliding, rather than tectonic activity (e.g. Boswell, 1932, 1949, 1953). Eva and Mailman (1994) used slump fold orientations to show that the slump sheets at Ty'n-y-Ffordd moved south or south-east. The disturbed beds originated on the basin slope to the north, hence they mostly consist of striped silty mudstones (Warren *et al.*, 1984). The Ty'n-y-Ffordd example provided the clue to the interpretation, not only of the northern Wales slumped sequences, but also to more extensive examples in mid-Wales (Earp, 1938; Woodcock, 1976a, 1976b), such as at the GCR site of Mithil Brook and Cwm Blithus in Powys.

Of the GCR sites of exclusively Ludlow age in Wales the only ones representative of environments off the shelf and the shelf slope are Ty'n-y-Ffordd Quarry and Clogau Quarry in northern Wales. Ty Mawr, a GCR site consisting of an upper Wenlock and Ludlow sequence of basinal aspect, is also located in north Wales.

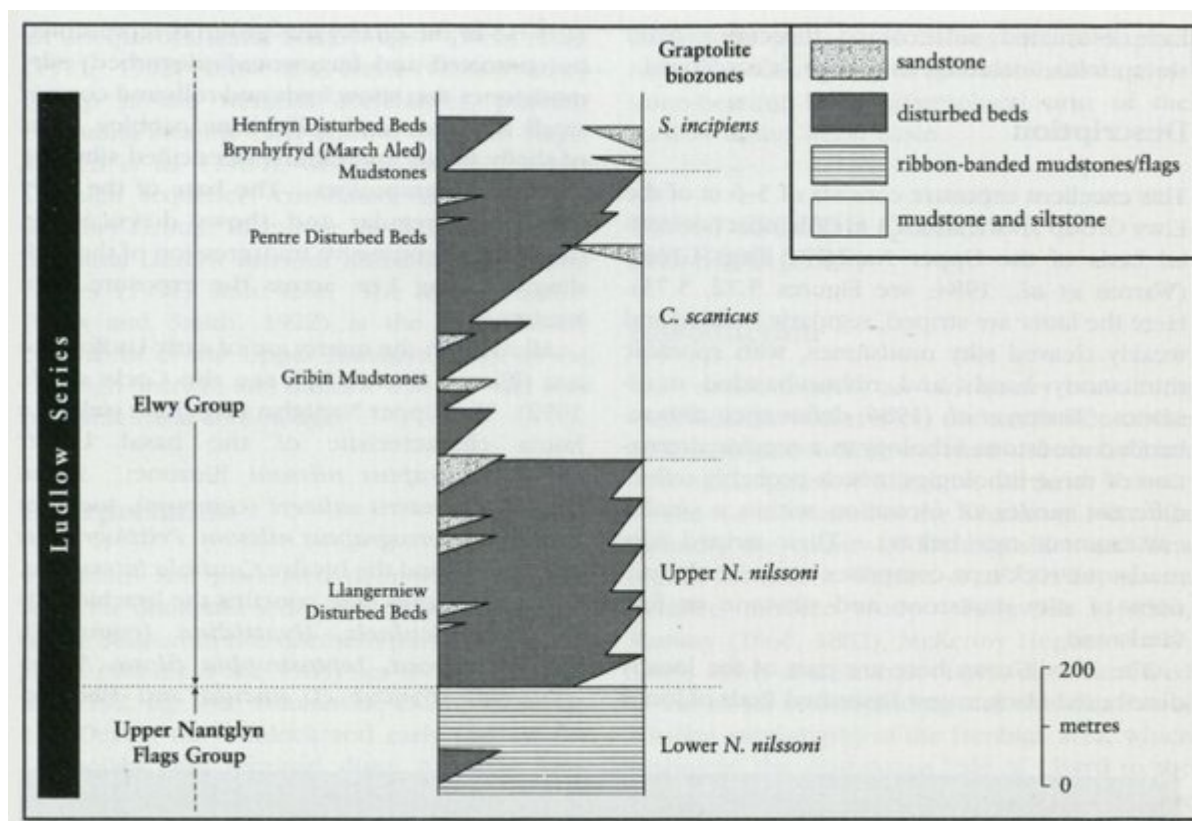
Conclusions

This site displays magnificent examples of post-depositional slumping and associated features that are so prominent in the local middle Silurian sequences and so critical for use in the interpretation of regional palaeogeography and palaeoenvironments. The importance of the locality is attested by its coverage in many key papers about the Silurian geology of Denbighshire. Its significance within the GCR network is that it represents one of only two sites with a truly basinal setting within the Ludlow of the Welsh Basin.

[References](#)



(Figure 5.72) Ty'n-y-Ffordd Quarry near Llangerniew, showing contorted and fragmented (disturbed) beds of the Elwy Group cutting down into the silty mudstones and ribbon-banded mudstones of the Upper Nantglyn Flags Group; note hammer, at bottom right, for scale. (Photo: L1601, reproduced by kind permission of the Director, British Geological Survey, © NERC.)



(Figure 5.73) Generalized succession of the Elwy Group in the Llangerniew area (after Warren et al., 1984). The local formations are after Jones (1937).