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# Vale of Neath

## Highlights

The Vale of Neath exposures provide the best available section through the Millstone Grit on the north crop of the South Wales Coalfield, showing a full range of sedimentary facies. Also present is the best known exposure of the Subcrenatum Marine Band in South Wales, which marks the boundary between the Namurian and Westphalian series.

## Introduction

This site covers various exposures along the headwaters of the River Neath, near Pont-Nedd-Fechan, West Glamorgan and Powys [SN 890 093]–[SN 081 077], and [SN 915 079]. They provide an excellent sequence through the Basal Grit, Middle Shales and Farewell Rock formations on the north crop of the South Wales Coalfield, near the Neath Disturbance. The geology has been described by Jones (1958, 1971), Jones and Owen (1957), Owen and Jones (1961), Owen *et al.* (1966) and is covered by British Geological Survey memoirs (Robertson, 1932; Barclay *et al.* 1988).

Included within the site are the remains of the Dinas Silica Mine. Up until the early 1960s, this was worked for a 2 m thick bed of exceptionally pure quartzite, used for making foundry bricks which were extensively exported.

## Description

### Lithostratigraphy

The sequence exposed here is summarized in (Figure 4.7)(b). Exposures near the Silica Mine show quartzites of the Millstone Grit Group lying on Lower Carboniferous (Brigantian) limestones. Owen and Jones (1961) noted numerous pods and stringers of quartz pebbles in the limestones below the contact, which they used as evidence that it is conformable. However, the contact is sharp and sometimes undercut, suggesting that the sands flowed over a fissured limestone surface.

The Basal Grit Formation here is 40 m thick and consists mainly of sandstones, with occasional thin shales. The sandstones bodies are tabular or wedged, although X-ray photographs of thin slabs often reveal parallel laminations. Some are white or pale yellow, and consist of up to 99.5% silica (these are the quartzites that were worked commercially). Others, however, are grey due to a higher carbonaceous content, and often have rootlets. Accumulations of pebbles are often found towards the top of the sandstones. Kelling (1974) noted that similar inverse grading also occurs in Recent beach and barrier sands, and he used this (among other factors) to argue that the Basal Grit Formation represents littoral deposits. Palaeocurrents indicate a northerly source for the sediments.

Overlying these predominantly arenaceous strata are c. 90 m of Middle Shales Formation. They reflect a complex pattern of sedimentation, with alternating marine and non-marine facies (Oguike, 1969; Kelling, 1974). The marine deposits are mainly shales and mudstones, and form the marine bands used for stratigraphical correlation (see next section). The non-marine facies include lagoonal shales, littoral sandstones, fluvial sandstones, and floodbasin lake sediments (sometimes including non-marine bivalve assemblages). Two of the sandstones have proved persistent throughout much of the north crop of the coalfield and are thus useful marker horizons: the Twelve Foot Sandstone and the Cumbriense Quartzite, 9 m and 55 m, respectively, above the base of the Middle Shales Formation. The presence of *in situ* rootlets in some of the sandstones shows that they represent emergent conditions.

The highest marine shale in the Middle Shales Formation (the Subcrenatum Marine Band) was shown by Thomas and Bloxham (1971), Bloxham and Thomas (1969, 1970) and Bloxham (1974) to include a range of facies, from brackish to fully marine.

The top of the sequence here shows massive sandstones of the Farewell Rock Formation (Figure 4.14). As over most of the north crop of the coalfield, palaeocurrents indicate a sediment provenance from the north (Bluck, 1961). A number of sedimentological features were described by Kelling *in Owen et al.* (1966), and interpreted as the result of movement of the sands due to vertical loading.

## Biostratigraphy

### Marine bands

Several marine bands have been recognized in the sequence exposed here, as shown in (Figure 4.7). Three occur in the Basal Grit Formation. The lowest contains *Homoceras* sp. and, although a fully diagnostic assemblage has yet to be reported, it probably indicates a position in the Chokierian or possibly Alportian. About 9–13 m above this level are two marine shales the lower of which yields a diagnostic assemblage of the Reticulatum Marine Band (Upper Kinderscoutian).

The base of the Middle Shales Formation here is placed at the Superbilinguis Marine Band, indicating the upper Marsdenian. Higher in the formation, marine shales with Yeadonian assemblages occur, including the Cancellatum and Cumbriense marine bands. At the very top of the formation is the Subcrenatum Marine Band (Figure 4.15), which marks the boundary between the Namurian and Westphalian series.

Other marine bands have also been reported from here, in addition to those with biostratigraphically diagnostic ammonoids. The most significant is found between the Superbilinguis and Cancellatum marine bands, and is known as the Anthracoceratites Marine Band. It has been recognized at several other localities along the north crop of the coalfield, but it never develops beyond the *Anthracoceras* and *Dimorphoceras* phase' of Archer (1968), and thus does not yield a biostratigraphically sensitive fossil assemblage.

Some 9 m above the Cancellatum Marine Band is another marine bed, this time containing a number of bryozoans, including *Fenestrellina* and *Rhombopora*. Such bryozoans are extremely rare in the Millstone Grit of Britain.

### Non-marine bivalves

From mudstones between the Cancellatum and Cumbriense Marine Bands, Jones and Owen (1957) report *Carbonicola lenicurvata* Trueman and *C. cf. bellula* (Bolton). It compares with assemblages from the Yeadonian of the Pennines (e.g. Eagar, 1952b, 1954, 1964), although it cannot as yet be integrated into the wider model of pre-Westphalian non-marine bivalves distribution established by Eagar (1977).

### Plant macrofossils

A mudstone near the base of the Basal Grit Formation has yielded fragments of the lagenostomalean frond *Lyginopteris porubensis* (Trapl) Gothan (Jones, 1958, 1971; Jones and Owen, 1957). Outside of Wales, this species is only known from the Arnsbergian of Upper Silesia (e.g. Purkyfiova, 1977).

Plant macrofossils have also been reported from immediately above the Cumbriense Quartzite (Crookall *in* Robertson, 1932; Owen, 1971b). *Alethopteris* and *Neuropteris* are reported present, but the material has not been described in detail.

## Interpretation

This is the best available section through the Millstone Grit Group on the north crop of the South Wales Coalfield. There are other complete successions, such as that exposed along the River Twrch, but they tend to be complicated by repetitive folding and are not as accessible. The sequence can be combined with that shown in the nearby Cwm Gwrelych–Nant Llyn Fach site, to provide an unrivalled section through the Arnsbergian to Duckmantian of Europe.

The Millstone Grit here is more condensed than further west on the north crop. There is only a very limited development of pre-Kinderscoutian deposits, due to the then limited geographical extent of the depositional basin (Jones, 1974). There are also probably non-sequences within the Kinderscoutian to Yeadonian succession, although they have not yet been recognized in the field. Nevertheless, most of the Kinderscoutian to Yeadonian marine bands, recognized elsewhere along the north crop, are present near Pont-Nedd-Fechan; the only significant exception is the Sigma Marine Band, such as is present at Llandebie (Jones, 1974). The attenuation of the Millstone Grit near Glyn Neath may be at least partly due to contemporaneous activity along the line of the Neath Disturbance (Kelling, 1974).

Further east, such as at Brynmawr, the Millstone Grit Group is even more condensed (Jones and Owen, 1967). The depositional basin did not extend this far east until the Marsdenian, probably due to uplift along the Usk Axis (Jones, 1974).

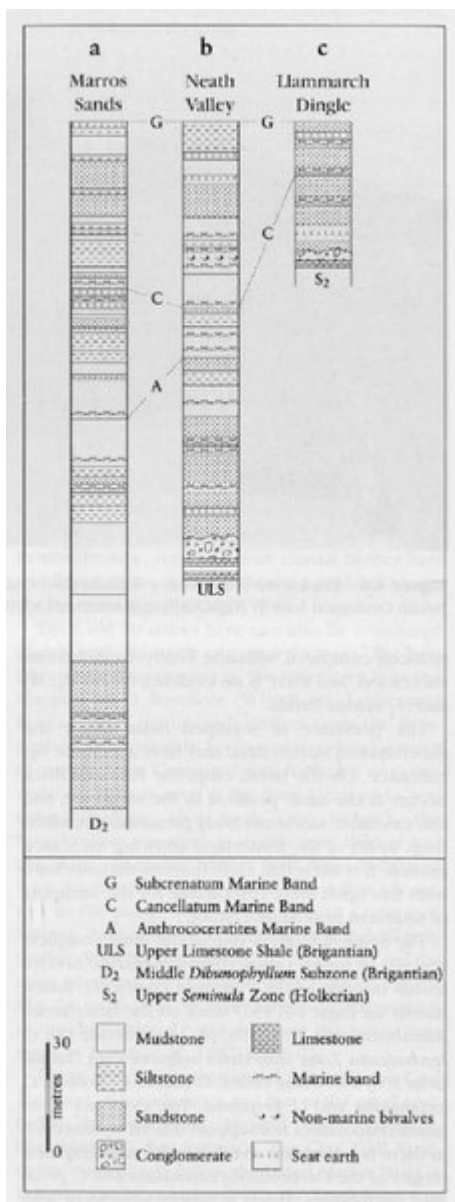
The north crop Millstone Grit differs significantly from that found on the south crop, such as at Barland Common. The latter occupied a position nearer the centre of the depositional basin, and consists predominantly of marine mudstones and shales.

Exposures at Pont-Nedd-Fechan played a central role in the palaeontological and geochemical analysis of the Subcrenatum Marine Band by Thomas and Bloxham (1971), Bloxham and Thomas (1969, 1970) and Bloxham (1974). Only here was it possible to recognize the full range of facies-types in the marine band, from brackish water to off-shore marine, and it thus provided a standard with which the other sites could be compared. The work of Thomas and Bloxham revealed a sequence of events in the development of the marine band, apparently correlated with water depth and post-depositional oxidation conditions. They were also able to show that organic material within the marine band was land-derived, probably mainly pollen and spores. This is the only published detailed work to have been carried out on an Upper Carboniferous marine band in South Wales.

## **Conclusions**

The headwaters of the River Neath expose the best sequence through rocks known as the Millstone Grit in South Wales. They are the remains of a mixture of river delta deposits (mainly sands and siltstones) and marine deposits (mainly mudstones and shales), originally laid down about 315 million years ago (the Namurian Epoch). A wide variety of fossils occur, including those of plants, and non-marine and marine animals. These allow the sequence to be correlated in detail with the rocks of similar age elsewhere in Europe and North America, and especially with the standard succession of Namurian rocks in northern England (the Pennine Basin). It allows the evolution of this part of Britain during the Namurian to be charted in considerable detail, and for it to be placed in a wide national, and international, context.

## **References**



(Figure 4.7) Millstone Grit successions of the north crop of the South Wales Coalfield. All after Jones (1974, fig. 24).



*(Figure 4.14) Farewell Rock exposed behind Angel Inn, Vale of Neath GCR site. Reproduced by permission of the Director, British Geological Survey: NERC copyright reserved (A11957).*



*(Figure 4.15) Vale of Neath GCR site. Subcrenatum Marine Band. (Photo: C.J. Cleal.)*