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# Blaen Onneu Quarry, Powys

[SO 155 169]–[SO 158 169]

Potential GCR site

## Introduction

The Blaen Onneu Quarry site is a disused limestone quarry [SO 1550 1690]–[SO 1575 1685], 5 km north of Beaufort. It provides a world-class section for understanding the sedimentary processes that operated at the margin of an ancient tropical sea and how to recognize the great variety of features that develop in newly formed carbonate sediments as they become subaerially exposed during periods of sea-level fall. The locality is a priceless teaching resource of national and international significance. The section extends from the top of the Pwll y Cwm Oolite, through the Pantydarren Beds, Blaen Onnen Oolite, with locally preserved Coed Ffyddlwn Formation and the Llanelly Formation. Included within it are ancient nearshore carbonate sand shoals, peritidal microbial developments (oncooids and stromatolites), a variety of exposure features (palaeosols and palaeokarsts) relating to episodes of subaerial weathering and indicating climate changes as well as ancient river channel and floodplain deposits.

The site is of particular stratigraphical importance because the Arundian Llanelly Formation here overlies a Courceyan succession consisting of the partially preserved Coed Ffyddlwn Formation and the Blaen Onnen Oolite, with the Chadian Gilwern Oolite having been removed by erosion before the Llanelly Formation was deposited. This local unconformity is probably related to uplift caused by faulting in the area (George, 1954). Informative site details are provided by Wright (1981a) and Dickson and Wright (1993).

## Description

The main quarry face is in the Clydach Valley Group (Barclay, 1989). At the base are up to 5 m of the Pwll y Cwm Oolite overlain by some 4 m of the Pantydarren Beds (Barclay, 1989) (Figure 9.10). Barclay identifies the latter unit in oolitic grainstones but over most of its outcrop it consists of dolomites. However, at the top is a distinctive metre-thick development of lensoid ferroan dolomites and large calcite spherulites, set in a green to black shale.

This is overlain by 14 m of the Blaen Onnen Oolite, the top 3–5 m of which is rubbly (Figure 9.11) and riddled with green clay-filled fissures and solution pipes. This horizon is well exposed in the lower part of the first bench where large blocks of limestone lacking fissures and pipes can be seen within the highly altered zone. Small thicknesses of the Coed Ffyddlwn Formation were recorded here before recent quarrying (see Barclay, 1989). At present, the accessible outcrops lack this unit and the rubbly top of the Blaen Onnen Oolite is erosively overlain by a coarse, sandy bioclastic grainstone at the base of the Llanelly Formation, a few centimetres thick with oolite lithoclasts. This limestone is capped by a thin clay band, some 0.2 m thick, containing horizontally elongate centimetre-sized nodules of micrite and microspar resembling calcrete (Figure 9.12). This nodule-bearing clay is sharply overlain by a metre-thick bioclastic grainstone with oncooids composed of *Garwoodia*. This horizon was regarded as the equivalent of the Hendre Bed of the Cheltenham Limestone Member of the Llanelly Formation by Wright (1981a) (Figure 9.12) and is penetrated by numerous millimetre- to centimetre-wide, sub-vertical micritic 'stringers' which increase in density upwards into the grey, buff-weathering Cwm Dyar Geosol (Figure 9.12). This bed has a brecciated fabric, locally with millimetre-sized spherulites of replaced gypsum (Wright, 1982b). This is overlain by a coarse, sandy bioclastic grainstone containing centimetre-sized clasts of the Cwm Dyar Geosol and is the local equivalent of the Uraloporella Bed, at the base of the Penllwyn Oolite Member (Figure 9.12). It is capped by a thin horizon of loosely cemented oncooids in a buff clay, passing up into an oncooidal limestone up to 0.6 m thick. The oncooids are commonly up to 8 cm in diameter and consist of laminae of micrite with porostromate microbial growths, and irregular layers of fascicular optic calcite (Wright, 1981a,c). Many of the oncooids have nuclei that were originally partly open cavities, now filled with calcite cement. The overlying peloidal and sandy oolitic limestones display very clear low-angle cross-stratification, some of which is overturned. Near its top is a 15 cm-thick band of stromatolites which nucleated off ripple marks (Wright and Wright, 1985).

The upper bench exposes the Gilwern Clay Member of the Llanelly Formation, which is exposed to a height of 6 m, and is replaced laterally by the cross-stratified conglomerates and coarse sandstones of the Garn Caws Sandstone, up to 10 m thick (Barclay, 1989). The detail visible in the Gilwern Clay Member is dependent on the degree of slumping, but Wright *et al.* (1991) were able to provide a detailed description following trenching. The unit has a prominent calcrete nodule horizon at the base, overlain by clays with haematite and goethite nodules. Sandstone-filled desiccation cracks up to 2 m in depth occur at the top of the member, some of which are connected to thin sandstones which are probably extensions of the main Garn Caws Sandstone section (see Wright and Robinson, 1988).

The Blaen Onnen Oolite is Courcayan in age (Barclay, 1989), with the base of the *Pseudopolygnathus multistriatus* Zone within the unit. The Llanelly Formation has produced foraminifera (Barclay, 1989) and conodonts (Stone, 1991) indicating an Arundian age.

## Interpretation

The oolitic limestones of the Pwll y Cwm Oolite and Blaen Onnen Oolite represent shallow-water shoal deposits. The dolomites of the Pantydarren Beds were interpreted by Searl (1988c) as probable marsh precipitates, whereas the spherulitic calcites represent an unusual form of calcrete (Searl, 1989b). Thus the shallow-water phase of deposition represented by the Clydach Valley Group was interrupted by at least one period of subaerial exposure.

The absence of the Gilwern Oolite and patchy presence of the Coed Ffyddlwn Formation has been interpreted as the result of erosion followed by overstep by the Llanelly Formation (George, 1954). The piping and dissolution seen at the top of the Blaen Onnen Oolite has been interpreted as a palaeokarst by Wright (1982a).

The thin oncoidal unit capping the palaeokarst may represent the Hendre Bed equivalent. The thin nodular horizon at the base of the Llanelly Formation resembles calcretes recognized elsewhere at this level (Wright, 1982b). The overlying bioclastic horizon represents a short-lived marine incursion and the unit is capped by calcrete stringers and the more massive calcrete of the Cwm Dyar Geosol (Wright, 1982b). The transgressive base of the Penllwyn Oolite Member is marked by the Uraloporella Bed and the overlying oncoids had a complex growth history with phases of microbial calcification and marine cement encrustation (fascicular optic calcite) (Wright, 1982a,c).

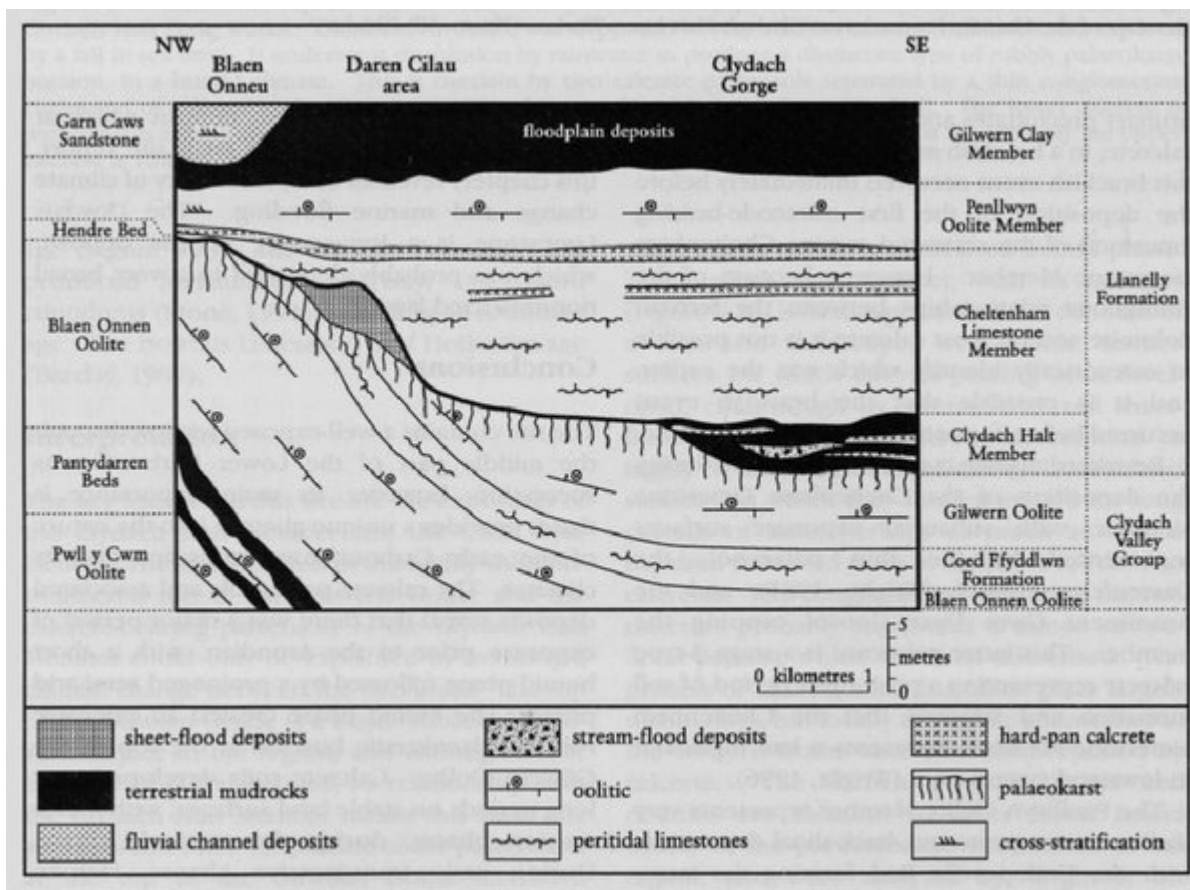
The low-angle cross-stratification in the overlying limestones is similar to beach lamination and probably represents the top of a sand bar. The stromatolites here are of particular interest in that they preserve very fine details of diurnal lamination (Wright and Wright, 1985).

The Gilwern Clay Member is a floodplain deposit with palaeo-Vertisols (see Wright and Robinson, 1988), which reveal evidence of having developed under two different climatic regimes (Wright *et al.*, 1991). The Garn Caws Sandstone is a river channel deposit, possibly of a large, high-sinuosity river. Both these units provide further evidence of yet another prolonged period of lowered sea level in Arundian times.

## Conclusions

Blaen Onneu is a very special site that is unrivalled in showing a wide range of features indicating fluctuating sea levels during Courcayan and Arundian times. A remarkable range of exposure-related features are present, including pedogenic dolomites, calcretes, palaeosols and palaeokarsts. Microbial limestones, with oncoids and stromatolites, are also well exposed. The section also allows the full effects of the pre-Arundian unconformity to be assessed.

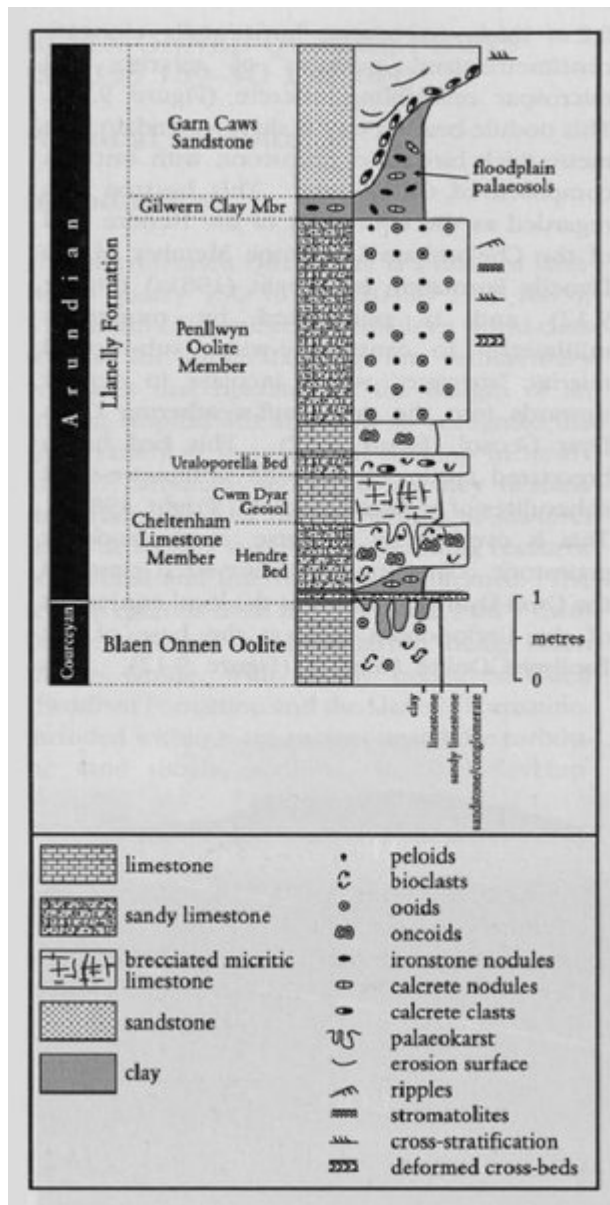
## [References](#)



(Figure 9.10) Stratigraphical relationships of the section at Blaen Onneu Quarry and the sections to the east towards the Clydach Gorge, showing westerly overstep by the Llanelly Formation.



(Figure 9.11) Section of strata at Blaen Onneu Quarry showing massively bedded bioclastic and oolitic grainstones of the Blaen Onnen Oolite (BOO) with a 3–5 m thick rubbly palaeokarst zone (r) at its top (just above centre) penetrated by irregular clay-filled pipes and fissures, capped by well-bedded, bioclastic, oncoidal and oolitic limestones of the Llanelly



(Figure 9.12) Sedimentary log of the Llanelly Formation succession at Blaen Onneu Quarry