Pantymaes Quarry, Powys

[SN 914 265]

Potential GCR site

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Introduction

Pantymaes Quarry 3 km south of Sennybridge, Powys (Figure 5.19) is an important site in providing a superb inland exposure of a fluvial sandstone complex within the St Maughans Formation of the Lower Old Red Sandstone. The level of exposure has allowed a detailed analysis of the facies and sedimentology of the sandstone unit (Owen and Hawley, 2000). The quarry is also internationally known for its early arthropod trackways (Smith *et al.,* 2003).

Description

The long-abandoned Pantymaes Quarry (Figure 5.20) exposes a main face 25 m high and 275 m long in strata belonging to the Lower Old Red Sandstone. It has been described in detail and interpreted by Owen and Hawley (2000). These authors referred the section to the upper (Dittonian) Red Marl Group; more recent mapping by the British Geological Survey (Barclay *et al.,* in press) assigns it to the St Maughans Formation, of Lochkovian age. A description of arthropod myriapod trackways at the quarry has been given by Smith *et al.* (2003), who also provide sedimentological logs of eight vertical transects along the quarry face. Hassan (1982) carried out a palynological study.

The strata dip gently southwards in most of the quarry, but are horizontal along a synclinal axis in the southern part, with north-easterly dips to its south in the hanging-wall of a small NW-trending fault at the southern end of the quarry (cf. Owen and Hawley, 2000). The succession comprises a lower sandstone unit (the Sandstone Facies Association of Owen and Hawley, 2000) up to about 15 m thick (its base is not exposed) and an overlying red mudstone about 15 m thick (the Mudstone Facies Association of Owen and Hawley) (Figure 5.21). An erosion surface separates these units. Thin sandstone beds overlie the mudstone unit at the top of the quarry face.

The following account summarizes that of Owen and Hawley (2000). The sandstone unit consists predominantly of grey-green, micaceous, fine- to coarse-grained sandstone (Facies S2 of Owen and Hawley). Bedding is mostly planar, horizontal to gently inclined parallel lamination, with some trough cross-bedding. Erosive bounding surfaces of individual sandstone bodies define a complex of nested channels. Some bodies fine upwards, with intraformational calcrete clast conglomerate lenses (Facies S1 of Owen and Hawley) at the base and cross-lamination at the top. Plant debris, including *Parka deczpiens,* occurs in flaggy, micaceous sandstones and at the bases of fining-upward units. Arthropod tracks are recorded from the finer sandstones. Grey siltstone (Facies S3 of Owen and Hawley) occurs as clasts in intraformational conglomerate and as interbeds up to 1.5 m thick.

The sandstone body is traversed by a series of erosion surfaces, the most extensive of which can be traced for over 100 m. These are major (first-order) bounding surfaces that separate discrete channelized complexes, within which are less extensive second-order erosion surfaces. Five channel complexes (A to D) are recognized and described in detail by Owen and Hawley (2000).

The 15 m-thick red mudstone unit overlying the erosion surface that truncates the lower sandstone unit comprises, in detail, three facies. Facies M1 is a finely laminated mudstone with repeated horizons of bioturbation in the form of vertical burrows and horizons of calcrete nodules. Desiccation cracks are also present and seen best in fallen blocks. Facies M2 is predominant and comprises red, purple and blue, massive, friable mudstone with scattered calcrete nodules and a prismatic to blocky ped structure. There are some shallow, curved, slickensided slip surfaces and bioturbation by *Skolithos*-type vertical burrows. Facies M3 is a succession of upward-fining, red, micaceous siltstone-mudstone units, each about 0.55–0.7 m thick and consisting of a basal centimetre-thick sandstone, weakly cross-laminated, burrowed siltstone, and an upper 0.25–0.35 m-thick bed of upward-fining, intensely bioturbated siltstone-mudstone with thin blue-grey vein-like structures and desiccation cracks. *Skolithos*-typevertical burrows occur in the cross-laminated siltstones, as well as some ovate, horizontal burrows packed with pellets. Lobate sub-horizontal burrows are present at the top of some of the siltstones and arthropod trackways are present on parting surfaces. The topmost units have vertical burrows with a range of diameters and lengths of between 0.25 m and 0.35 m. Arthropod trackways are seen in fallen blocks of facies similar to these units.

The majority of arthropod trackways described in the quarry are seen in an isolated west-facing outcrop in the floor of the quarry. The outcrop is 5 m long and 3 m high and surrounds a pool in the centre of the quarry (Smith *et al.,* 2003). It consists of grey planar-laminated and ripple-laminated, micaceous, fine-grained sandstones and siltstones. The trackways (Figure 5.22) occur in 0.5 m of siltstones, which are overlain by cross-bedded, medium- to coarse-grained sandstones. They arc assigned to two types (A and B) of *Diplichnites gouldi,* Type A probably being a kampecarid myriapod and Type B a coarthropleurid myriapod.

Interpretation

The intraformational conglomerate (Facies Si) lenses and beds are interpreted by Owen and Hawley (2000) as the deposits of high-energy channel-fills and bars. The sandstones (Facies S2) are interpreted as the fluvial deposits of braided river channelized flows with variable discharge, the dominance of planar lamination over cross-bedding suggesting a high-energy, perhaps flash-flow regime. Owen and Hawley interpret the grey siltstones (Facies S3) as wet, alluvial-floodplain deposits, high water-table allowing preservation of plant debris. It also allowed preservation of the trackways of the arthropods that inhabited and crawled over the floodplain.

The red mudstone with calcretized horizons (Facies M1) is interpreted as an overbank deposit, its occurrence above the erosion surface that truncates the underlying Sandstone Facies Association suggesting accumulation in an abandoned channel. The limestone nodules are Stage II calcrete soils (Machette, 1985), indicating prolonged carbonate soil formation and a semi-arid, seasonally wet climate. The red, purple and blue calcretized mudstone (Facies M2) represents flood basin overbank deposition of muds, the sediments being subject to repeated wetting and drying and carbonate soil formation. The upward-fining red siltstone units (Facies M3) are interpreted by Owen and Hawley as flood basin overbank deposits. Marriott and Wright (2004) suggest rapid deposition from crevassing events for similar heterolithic, fining-upward sequences in the Moor Cliffs Formation of Pembrokeshire. These authors stress the importance of deposition of pedogenic mud aggregate bedload-transported sediment in the accumulation of mudrock sequences in the Old Red Sandstone, and a similar origin for some of the mudrocks at Pantymaes is possible. They also suggest the presence of semi-permanent depressions on the floodplain in which ephemeral lakes formed after floods and which trapped dust from frequent dust storms. It is possible that some of the laminated mudstones (Facies M3) may have had a similar origin.

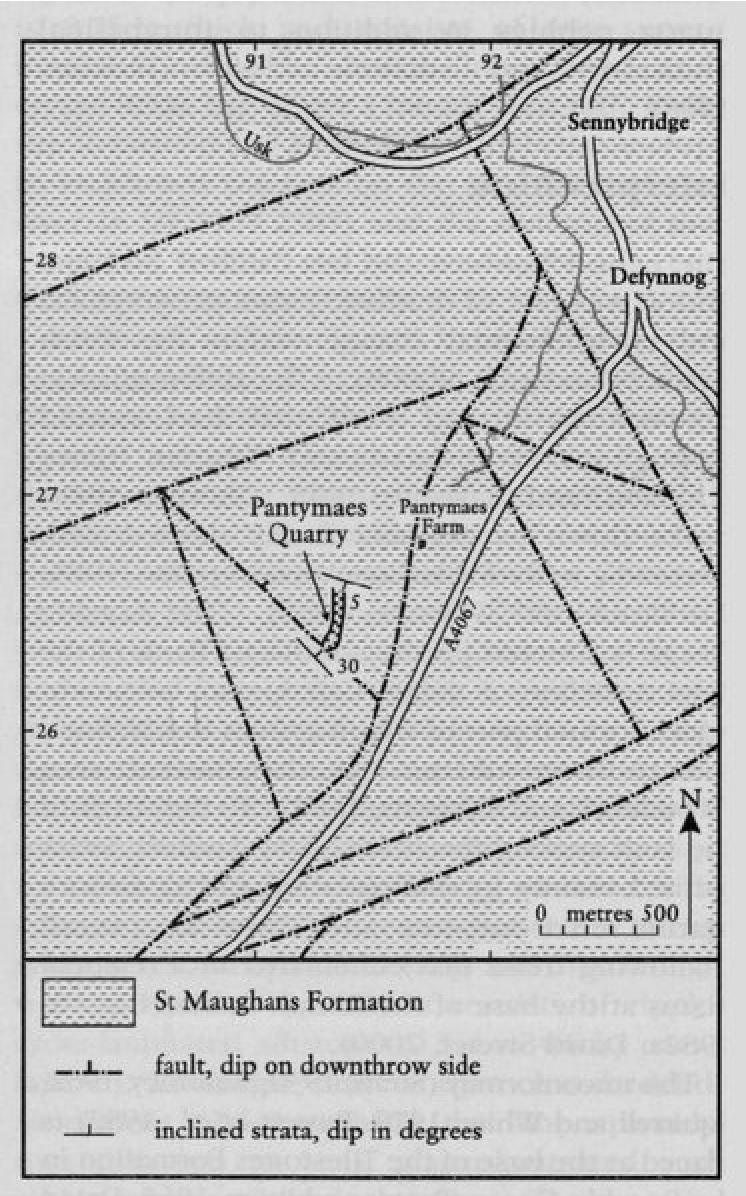
The quarry is important in exposing a sequence of facies that is markedly different from the fining-upward, autochthonous sandstone–mudstone alluvial cycles that characterize the St Maughans Formation elsewhere in south-east Wales and the Welsh Borderland (e.g. Allen, 1963b, 1970) and equivalent successions in Pembrokeshire (Conigar Pit Sandstone Member (Williams *et al.,* 1982) and Gelliswick Bay Formation (Allen and Williams, 1978)). Owen and Hawley (2000) suggest an allocthonous, external, tectonic trigger for the change from the Sandstone Facies Association to the Mudstone Facies Association and the intervening erosion surface.

The channel complexes of the Sandstone Facies Association show major differences in fluvial style, suggesting to Owen and Hawley (2000) that it is not a multi-storey channel sand-body representing the punctuated infilling of a single channel, but that it represents distinct phases of fluvial development. Northward-stepping of successive erosion surfaces in several channel complexes further suggests tectonic control, each complex representing a response of the fluvial system to a pulse of tectonic movement. Owen and Hawley (2000) suggest that the sporadic movements on the Carreg Cennen Disturbance about 2 km to the north-west may have disrupted the general southerly drainage, producing an increase in stream gradient across the fault zone, braiding of the drainage to the south of the fault, and input of coarser intraformational bedload. Dextral strike-slip movement along the fault may have caused the migration of successive channels towards the north. Recent mapping by the British Geological Survey (in press) suggests the presence of several faults of north-east trend between Pantymaes and the Carreg Cennen Disturbance, and these may also have exerted control on sedimentation.

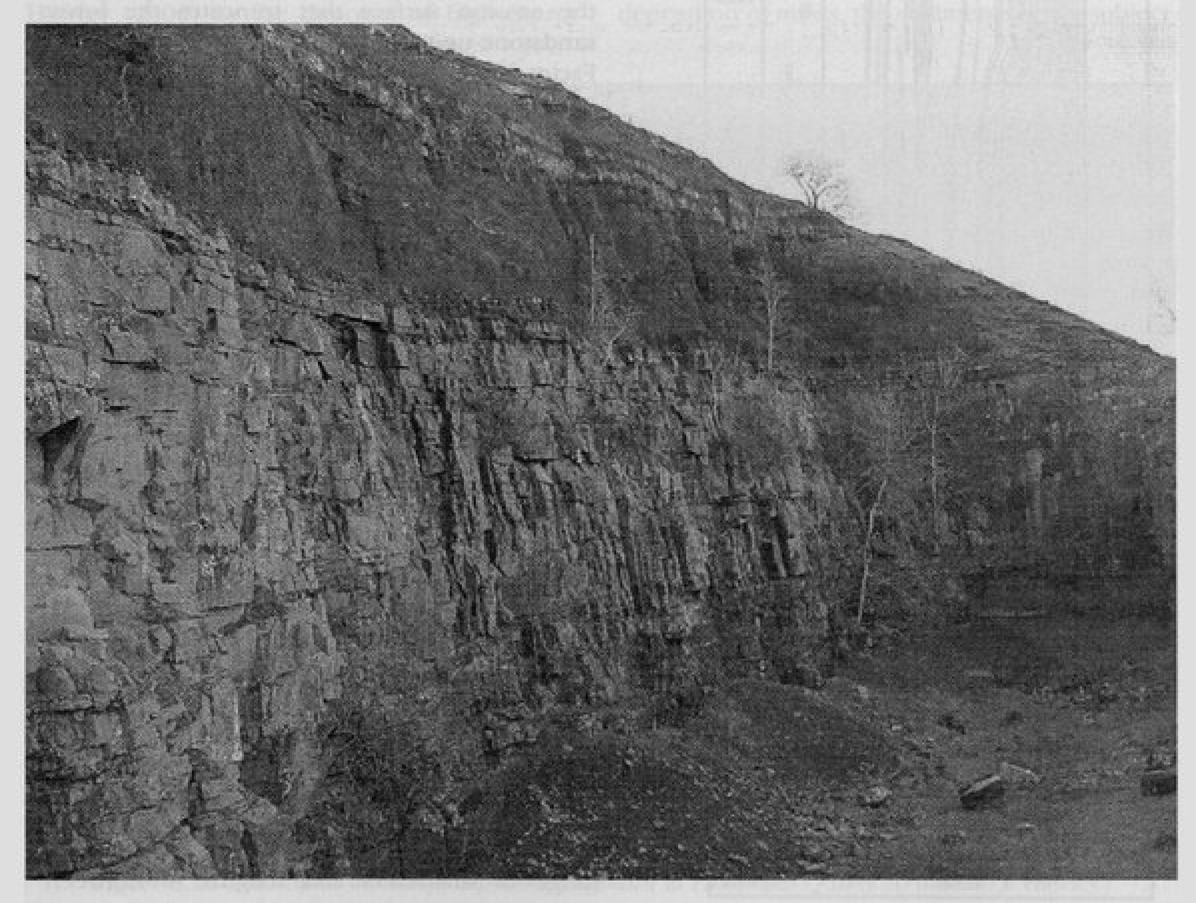
Conclusions

Pantymaes Quarry is a site of national and international importance, and worthy of consideration for protected status. Its conservation value lies in it being almost unique in the Anglo-Welsh Basin in providing a large, accessible inland section of the St Maughans Formation where lateral facies variations in a sandstone complex can be demonstrated. It also shows a style of facies architecture quite different from that seen elsewhere at this level in the basin, perhaps indicating pulsed movement on the nearby Carreg Cennen Fault and local tectonic control on drainage development. The well-preserved, internationally known arthropod traces also merit protection, providing valuable information on our understanding of the earliest known land animals that colonized the alluvial plains of the Early Devonian.

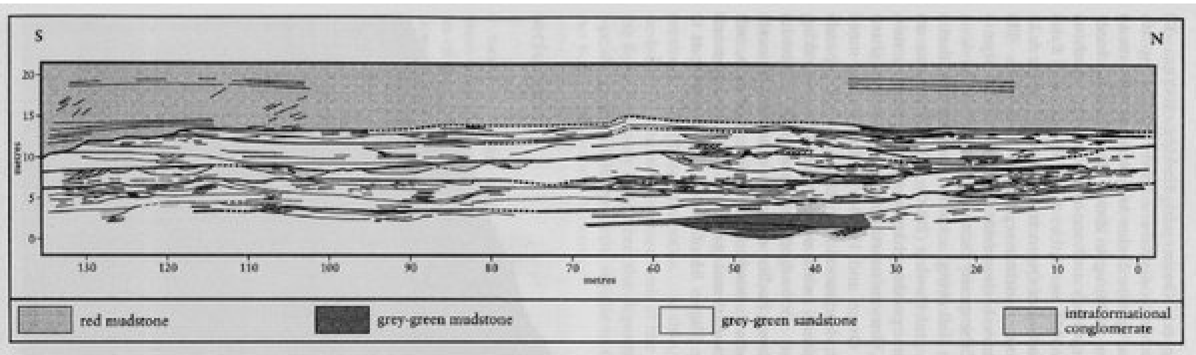
References



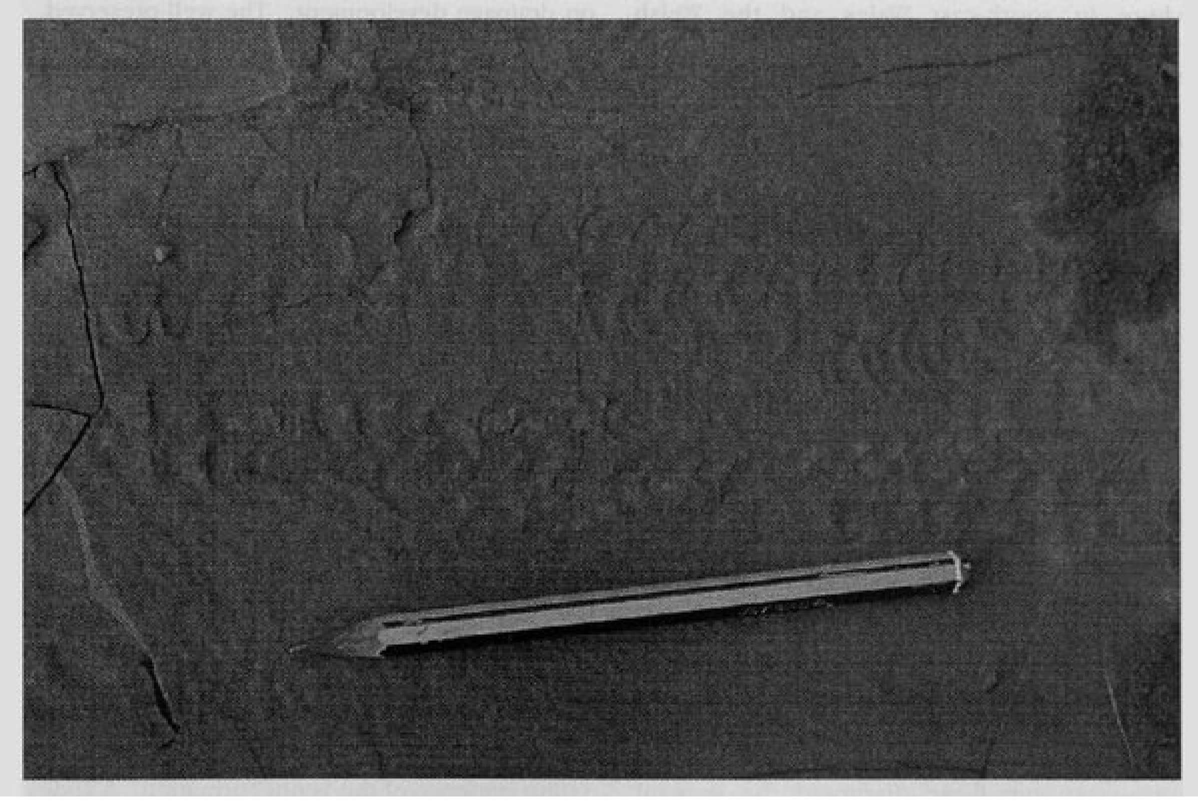
(Figure 5.19) Geological map and location of Pantymaes Quarry. After British Geological Survey 1:50 000 Sheet 213 (England and Wales), Brecon (in press).



(Figure 5.20) Main face of Pantymaes Quarry. Lower sandstones are overlain by mudstones with thin sandstone beds at their top. The lower sandstones are 15 m thick. (Photo: D.J. Hawley.)



(Figure 5.21) Main face at Pantymaes Quarry showing the main sedimentary bounding surfaces in the Sandstone Facies Association. After Owen and Hawley (2000).



(Figure 5.22) Arthropod trackways Diplichnites gouldi in Pantymaes Quarry. (Photo: D.J. Hawley.)