Stormy Down, near Bridgend, Mid Glamorgan

[SS 844 809]–[SS 851 810]

Introduction

The Stormy Down road cutting and nearby quarries expose sandstones with subordinate marls belonging to the upper Mercia Mudstone and the Penarth groups. Sandstones in the Penarth Group represent, unusually, a beach deposit. Many fossil taxa have been recovered from this locality, for example invertebrates such as *Rhaetavicula contorta,* and vertebrates, including remains of a megalosaurid dinosaur and several fishes. Stormy Down is important for the interpretation of the Late Triassic palaeogeography of South Wales: it is thought that this locality lay between an island and the mainland.

Stormy Down has been studied for many years, and descriptions of the geology include Tawny (1866), Bristow (1867), H. B. Woodward (1893), Richardson (1905), Francis (1959), Ivimey-Cook (1974), and Wilson *et al.* (1990). Accounts of the invertebrate and vertebrate faunas have also been published by Newton (1899) and Francis (1959), and Dineley and Metcalfe (1999) list the fossil fishes from this site.

Description

The Stormy Down exposures occur in a cutting for the M4 motorway [SS 845 810], in nearby disused quarries, and in a quarry at the Stormy Down Cement Works [SS 852 816].

Sedimentology

The Stormy Down motorway cutting exposes an excellent section of Westbury Formation sediments that are unusual in being dominated by pale yellow, white, or brown, coarse-grained sandstones with thin lenses of conglomerate and dark shales (Wilson *et al.,* 1990). Broadly, the formation consists of lower and upper sandstone units and intervening black shales. The sedimentary log is adapted from Francis (1959), Sykes (1977), and Wilson *et al.* (1990):

	Thickness (m)
Penarth Group; *Lilstock Formation:*	
Langport Member:	
Mottled blue-green, purple-red and buff calcareous mudstone up to	6.0
Penarth Group; *Westbury Formation:* Upper Sandstone ('Quarella Stone'): sandstone, brown, fine-grained, 'jaggy, with clay partings and vertebrate fossils	2.4
Black Shales:	
Shales, dark green, rubbly, with dendritic markings and wood	0.90
Shales, brown, with nodular limestone	0.25
Shales, dark green, with thin nodular limestones	0.30
Conglomerate with abundant vertebrate material	0.1
'Lower Sandstone': sandstone, hard, massive, white and yellow, with vertebrate fossils	5.28
Mercia Mudstone Group	

The basal bed of the Penarth Group rests on a sharp and erosional contact with the upper Mercia Mudstone Group, marked in places by irregular hollows (Wilson *et al.,* 1990). The 'Lower Sandstone' is typically coarse-grained, white, yellowish or buff in colour, and contains thin lenses of quartz pebbles, pieces of wood, and vertebrate fossils. The lower

beds are often quite friable, while those towards the top of the unit are harder and more compact (Francis, 1959). Sykes (1977) recorded galena in this sandstone. In places, the sandstones show well-developed sedimentary structures, including cross-bedding and rippled surfaces. At Stormy Down this unit is between 5 and 6 m thick, though it thins rapidly to the east (Francis, 1959; Wilson *et al.,* 1990).

Resting on an erosion surface at the top of the 'Lower Sandstone' is a thin conglomerate, which forms the basal bed of the 'Black Shales' (Francis, 1959). This conglomerate crops out over a wide area, and contains quartz clasts as well as pebbles of jasper and chert (Wilson *et al.,* 1990). Vertebrate fossils are especially common in this bed, although, generally, they are poorly preserved. The lithology resembles the typical Westbury Formation sediments, being fine-grained and generally having a dark grey or greenish colour. Fossil-bearing nodules associated with a pebbly limestone are common, especially towards the middle of the unit (Francis, 1959). Towards the top of this unit thin beds of sandstone and siltstone appear, forming a passage into the overlying 'Upper Sandstone' (Wilson *et al.,* 1990).

The 'Upper Sandstone', also known as the 'Quarella Stone', includes several distinctive lithologies. At the base, it consists of pale creamy-brown or brown, fine- to medium-grained sandstones, interbedded with thin, brown, blue, and green, mica-rich siltstones and shales (Francis, 1959). In places the sandstones contain flasers. This facies is overlain by medium-grained, light grey, yellow, and pale brown, planar and hummocky cross-laminated, calcareous sandstones. In places there is evidence of erosion (scours) and soft-sediment deformation (flame structures). Some of the more massive beds rest on erosion surfaces, and have thin, coarse-grained lag deposits that fine upwards into laminated sandstones and grey-green micaceous muds and silts. The top of the 'Upper Sandstone' consists of massive sandstones that may contain interbedded sandstones and shales and thin shell-rich limestones. These beds are generally greenish-yellow or pale brown in colour, commonly with a mottled appearance (Francis, 1959; Wilson *et al.,* 1990).

The overlying Cotham Member (Lilstock Formation) is dominated by mottled marls with thin lenses of fine sandstone and silt, nodular dolomite, and micritic and sandy limestones. The argillaceous sediments are mottled, mainly bluish-green, purple-red, and buff; the sandstones are green and red (Ivimey-Cook, 1974; Wilson *et al.,* 1990). The lower beds of the Cotham Member are pale cream in colour and cut by carbonate veins, some of which extend into the underlying sandstones. The upper beds are green, with minor patches of reddish sediment. At the top of the member is a thin limestone, which may be equivalent to the Cotham Marble (Strahan and Cantrill, 1904; Francis, 1959).

In the nearby Stormy Down Lime and Cement Works, a section of Upper Triassic sediments includes approximately 0.3 m of light-coloured limestones thought to belong to the Langport Member (formerly the 'White Lias') of the Lilstock Formation. Below these limestones are approximately 0.5 m of interbedded grey limestones and dark brownish-grey shales, resting on the '*Rhaetavicula contorta*'shales. These overlie approximately 2.7 m of greenish marls (Bristow, 1867; H. B. Woodward, 1893; Ivimey-Cook, 1974). Francis (1959, p. 164) recorded a fault in the quarry, responsible for the deformation of the 'Upper Sandstone'. The fault shows little vertical displacement, although some horizontal movement is suggested by the presence of folds. Small-scale thrusts were also recorded.

Palaeontology

Fossils are common throughout the Penarth Group beds. The 'Lower Sandstone' of the Westbury Formation contains abundant fragments of fossilized wood, as well as fish remains. Fish fossils are also found in the 'Black Shales' where they are preserved in limestone nodules (Wilson *et al.,* 1990). Poorly preserved bone has been recovered from the conglomeratic bed at the base of the 'Black Shales' (Ivimey-Cook, 1974). The fish teeth have been identified as *?Saurichthys* sp., and the scale fragments as *Gyrolepis* sp. (Francis, 1959).

Invertebrates are common throughout the 'Lower' and 'Upper' sandstones, as well as in the intervening shales, especially in the flaggy sandstones at the base of the 'Upper Sandstone' (Francis, 1959). One of the most common fossils (Wilson *et al.,* 1990)is the bivalve *Rhaetavicula contorta,* and other taxa (Ivimey-Cook, 1974) include the gastropod '*Natica*' *oppelii.*

Rare dinosaurian remains have been described from Stormy Down, including a partial jaw attributed to the theropod *Megalosaurus,* although the assignment is uncertain (Benton and Spencer, 1995). This jaw was made the type specimen

of *Zanclodon cambrensis* by Newton (1899).

Interpretation

The Upper Triassic sediments at Stormy Down record a range of palaeoenvironments, some of which differ from those represented at many other Penarth Group localities. The Mercia Mudstone Group offers evidence for dominantly terrestrial conditions, characterized by supra-and inter-tidal and playa lakes and sabkha flats (Wilson *et al.,* 1990).

The Westbury Formation arenaceous and argillaceous facies mark a change to littoral and marine conditions. The base of the 'Lower Sandstone' rests on an erosion surface produced during a period of regression; the overlying sediments were deposited under shallow marine conditions during a phase of transgression (Wilson *et al.,* 1990). Continued transgression is represented by the coarse-grained lag deposit that occurs immediately below the argillaceous lithologies. This conglomeratic deposit accumulated in a littoral environment, probably as a strandline beach deposit (Wilson *et al.,* 1990). The overlying 'Black Shales' are further evidence of continued transgression, and represent deeper-water conditions (Hamilton and Whittaker, 1977; Whittaker and Green, 1983), more typical of the Westbury Formation in Somerset and Gloucestershire.

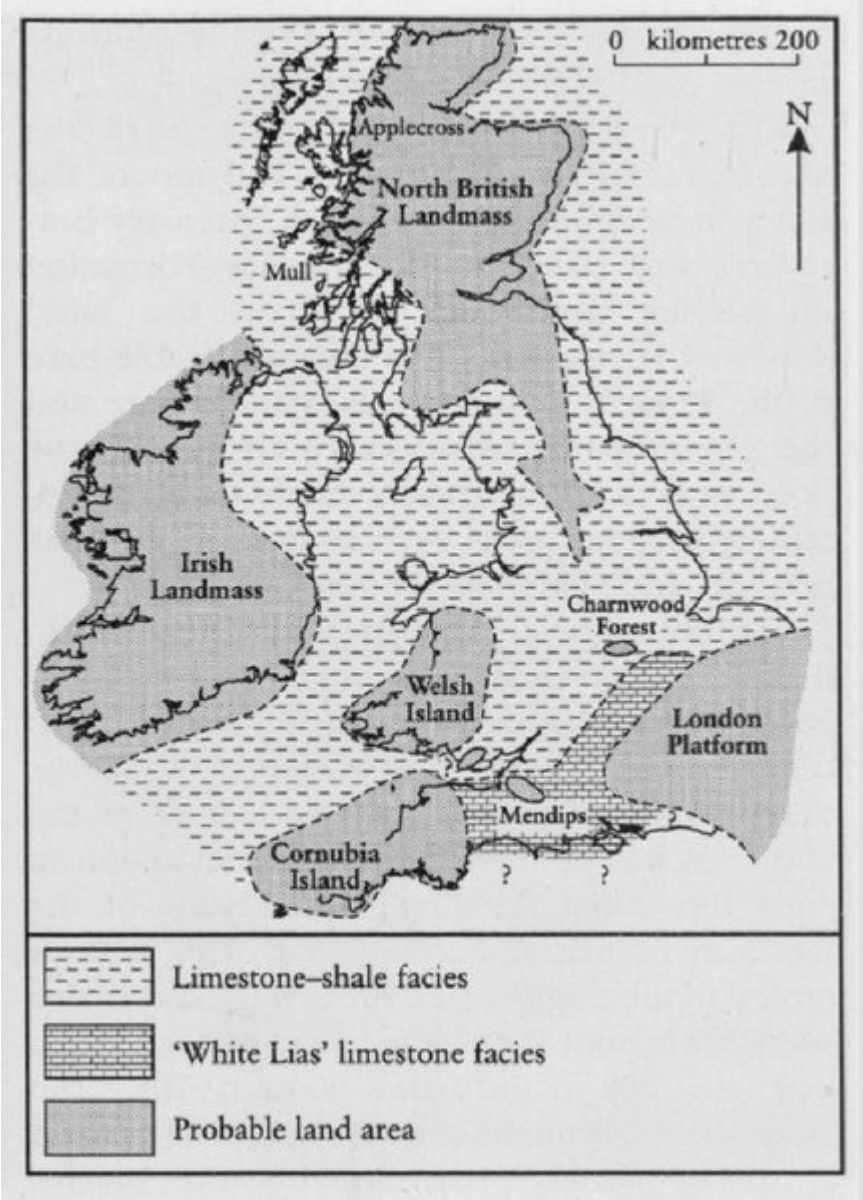
The top of the Westbury Formation sees a change to sandstone deposition, interpreted as a progradational facies, and characterized by a coarsening-upwards sequence that consists of interbedded sandstones and shales; many of the massive sandstone beds contain coarse-grained lags produced during storms. The top of the progradational sequence comprises more massive sandstones with interbedded coquinas (Wilson *et al.*, 1990).

The overlying Lilstock Formation lithologies are indicative of a return to terrestrial conditions after a period of regression. Nodular dolomites in the 'Upper Sandstone' in the Bridgend area may represent pedogenic alteration (Wilson *et al.*, 1990).

Conclusions

The Upper Triassic strata in the quarries and road cuttings around Stormy Down near Bridgend, show unusual features for the Penarth Group. Unlike the marine black mudstone–limestone successions at the majority of Westbury Formation localities in south-west Britain, the Stormy Down sites show sandstones that indicate shallow marine and littoral deposition. The coastal nature of the site palaeogeographically (Figure 4.3), is indicated by the fossils, which include marine forms, as well as a megalosaurid dinosaur, rare in the Rhaetian anywhere in Europe.

References



(Figure 4.3) Palaeogeography of the British Isles during the Rhaetian Age. The classic sections in South Wales, Gloucestershire, Somerset, and Devon accumulated on marginal areas of the Welsh and Cornubian islands. The Langport Member is most fully developed in south. (After Poole, 1979.)