Afon Mellte downstream of Ystradfellte, Powys

[SN 931 133]–[SN 924 098]–[SN 942 109]

G. Higgs

Highlights

This is a partially dry limestone river, with a notable associated cave system. Valley rejuvenation is also in evidence, so that the influence of lithology and karstic development on such sites can be assessed.

Introduction

The Afon Mellte near Ystradfellte flows for the majority of the time in subterranean channels in Carboniferous Limestone, with the result that for 1 km or so the river bed is more often than not dry. The section has features unique to rivers in karstic environments, as well as waterfalls formed under a range of different conditions ((Figure 3.16) and (Figure 3.17)). Many of these features have, it has been suggested, arisen from the rejuvenation of the Mellte (along with neighbouring tributaries) following capture by the River Neath (North, 1962). There is a strong geological control, since the rocks of the region vary in degrees of hardness and resistance to river erosion. Thus 'the features produced as a result of rejuvenation in the district drained by the River Neath vary according to the nature of the rocks over which the streams flow in successive parts of their courses' (North, 1962).

Description

The Afon Mellte is formed by the junction of the Afon Llia and Afon Dringarth, approximately 1 km NNE of Ystradfellte, and for the first part of its course flows over erosion-resistant Old Red Sandstone. On reaching an outcrop of Carboniferous Limestone near Ystradfellte, the water passes underground such that the river bed is usually dry [SN 933 135]. Downstream, the Mellte enters the Porth-yr-Ogof cave approximately 1.5 km SSE of Ystradfellte [SN 927 122], where it crosses the outcrop of the Carboniferous Limestone. The river emerges a little over 300 m downstream. A few metres outside Porth-yr-Ogof there are fissures communicating with a subterranean channel.

The Mellte once flowed at a higher level than at present but over time it has completely deserted its cut deeper into the sides of the ravine to produce a fairly wide valley with an alluvium-covered floor, only to be confined once more by the vertical sandstone walls of the gorge.

Interpretation

North (1962) discusses the origin of Porth-yr-Ogof. He suggests that the original Mellte flowed at a much higher level than at present, but that subsequent erosion and solution had led to the downcutting of the river. This is supported by the potholes visible at varying levels in the present-day gorge. Such a process was, it is suggested, dependent on the characteristics of different limestone bands. Thus water was able to pass more rapidly through resistant bituminous limestone and resulted in the formation of caverns beneath stretches of dry bed (Figure 3.16). The subsequent collapse of the roofs of such underground channels resulted in the gorge-like appearance of the Mellte Valley (Section A in (Figure 3.16)). At Porth-yr-Ogof, however, the roof is intact and the valley sides are more gradual (Section B). Farther upstream, the bed, to flow in caverns. Subsequently, the roofs of such caverns have collapsed, creating a gorge-like valley downstream of Porth-yr-Ogof. North suggested that the cave system itself was not a single unit. The shape is seen to vary according to the jointing system of the limestone such that ' … the cave is deep and narrow where it is due to the widening of vertical joints, but where it has been developed along bedding planes it is very extensive and has a low flat roof' (North, 1962).

Downstream of the cave system, the narrow gorge rapidly widens out to form a flat shelf on the west bank, with a limestone cliff forming the east bank. The river then flows over Millstone Grit before entering the River Neath at Pontneddfechan [SN 903 075].

Between Porth-yr-Ogof and the confluence of the Mellte and Hepste [SN 925 098] there are three main sets of waterfalls — the Upper Clyngwyn Falls, the Sc■d Isaf Clyngwyn (= Lower) and the Scrod y Pannwr Falls. Each has been formed as a result of differential erosion of shale and sandstone, and their detailed morphology is influenced by the structure of faults and fall migration. For 0.5 km below these falls the river flows over shale and has downcutting process continues to occur and the bed of the Mellte is normally dry (Section C).

The Upper Clyngwyn Falls were developed at a point at which the river passes over a fault that juxtaposed hard Millstone Grit sandstones against soft shales (Figure 3.18). The particular section of fault with which the falls are associated can be clearly discerned and has resulted in the formation of a two-step waterfall, with an initial 5 m fall on to a rocky ledge and then a 15 m descent. Owing to the inclination of the rock strata, there has been a lateral concentration of flow such that more erosion has occurred on the steeper southeasterly cliffs of the gorge (Figure 3.19). Thus there is a wide sandstone pavement on the right bank of the river and steeper cliffs on the opposite bank of the Mellte.

The waterfall at Sc■d Isaf Clyngwyn, downstream of the Upper Clyngwyn, is also the result of differential erosion on the downthrow side of a fault (Figure 3.20). However, in this case the morphology is complicated by the fact that there are two parallel faults, and two falls separated by a pool at different angles to the main flow direction. The complex nature of the falls was discussed by North (1962), and explained on the basis of a fault causing uplift of the sandstone and reorientation of the course of the river at this point, from a north-south to a generally east-west direction. These falls, it was suggested, had receded such that they were now at the head of a deep and narrow gorge. Where sandstone forms the bed of the river, the third major Mellte waterfall (Sdvd y Pannwr) was formed 0.5 km from the confluence with the Hepste. The tilt of the rock strata of the so-called Twelve Foot Sandstone has resulted in a lateral migration of the waterfall as in the upstream waterfalls. The waterfall is again of a composite nature, with two rock ledges separated by a plunge pool.

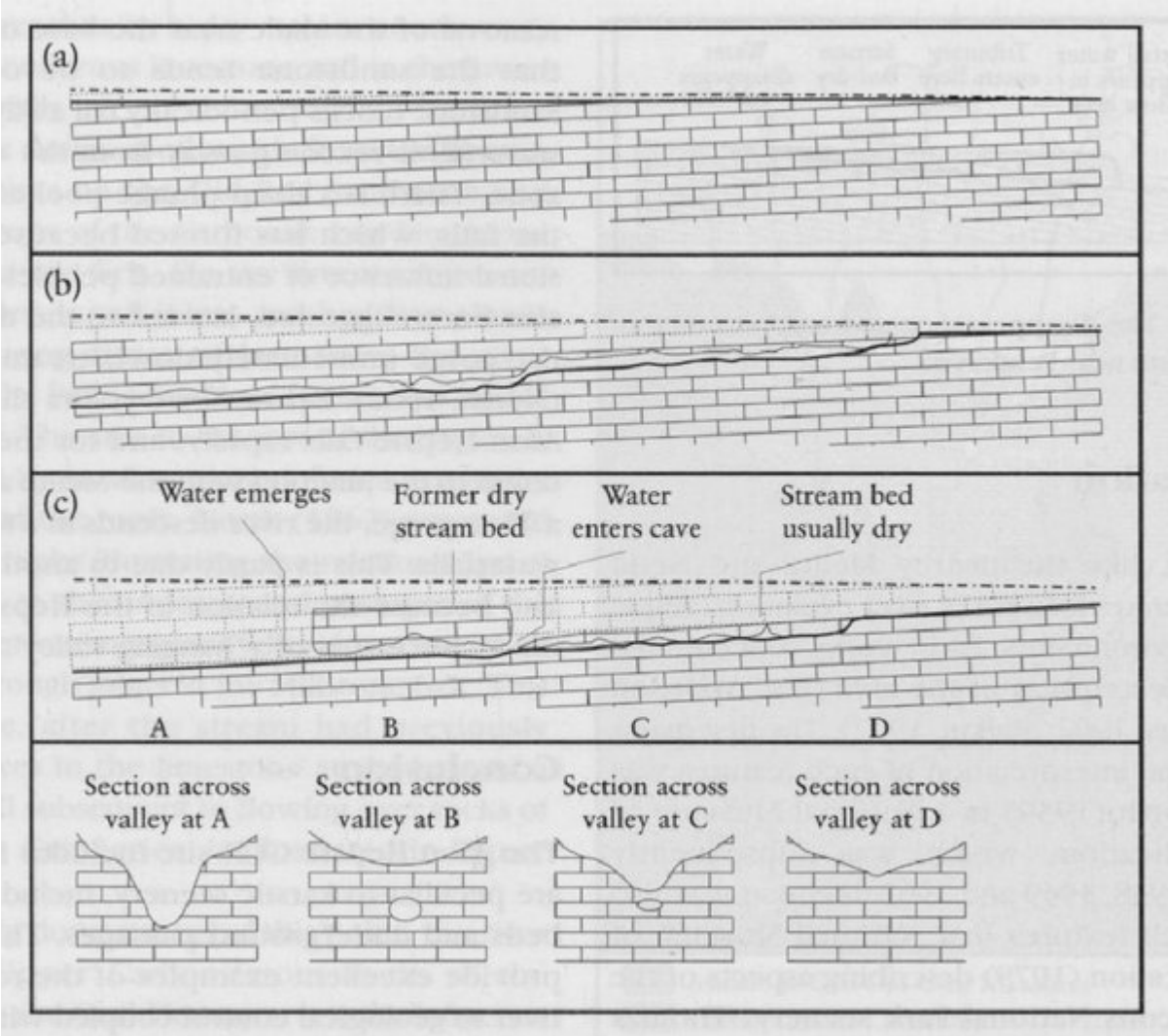
Although the Afon Mellte displays excellent karst-environment features, the geomorphology of the area has been complicated by the rejuvenation of the river following capture of those tributaries that once flowed into the Taff by the River Neath. This event is thought to have occurred in Late Tertiary times (National Museum of Wales, 1979) and it accentuated the already irregular nature of the river. It has also led to downcutting by water through joints in the limestone and thence to the formation of underground passages and caverns which are still preserved at Porth-yr-Ogof but which have largely collapsed, creating a gorge.

The picture is yet further complicated by the system of faults in the area that has juxtaposed rocks that have significantly different degrees of resistance to erosion. Thus within the Millstone Grits of the area there are alternate beds of sandstone and less resistant shale. Water enters joints and bedding planes in the rock, resulting in the formation of fractures. Subsequently, the river erodes the underlying shales of the series, which leads to the formation of waterfalls. These falls, it is suggested, have gradually receded upstream, as is the case with Scwd-yr-Eira on the Hepste. This site is therefore exceptional in showing the combined influence of karst processes, geology and rejuvenation. It is the combined assemblage of features —as well as the individual features themselves — that is exceptional.

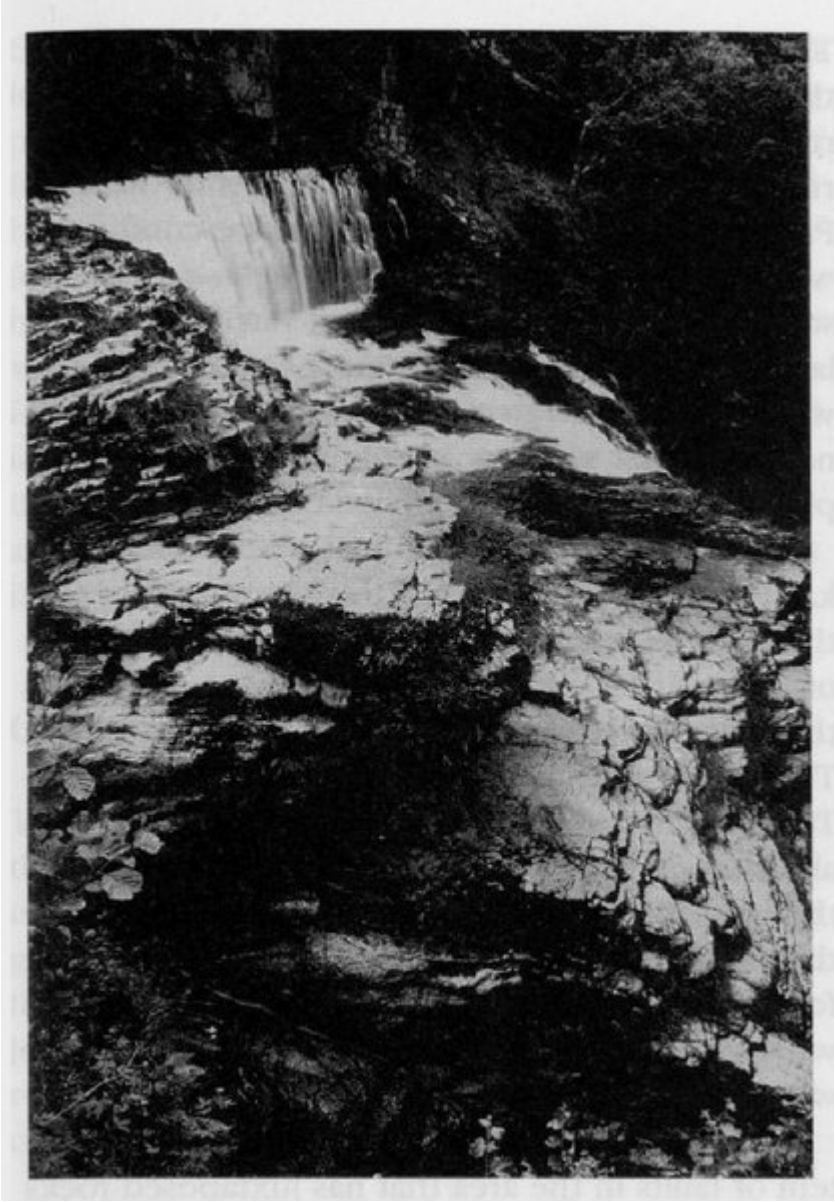
Conclusion

This site comprises a normally dry river bed, where the flow disappears into limestone, an associated cave system, and then a series of waterfalls and gorges downstream, where the river re-emerges. In the downstream section, shale and sandstone are juxtaposed by faults. The fluvial features have resulted from rejuvenation of the system, but are controlled by the geology.

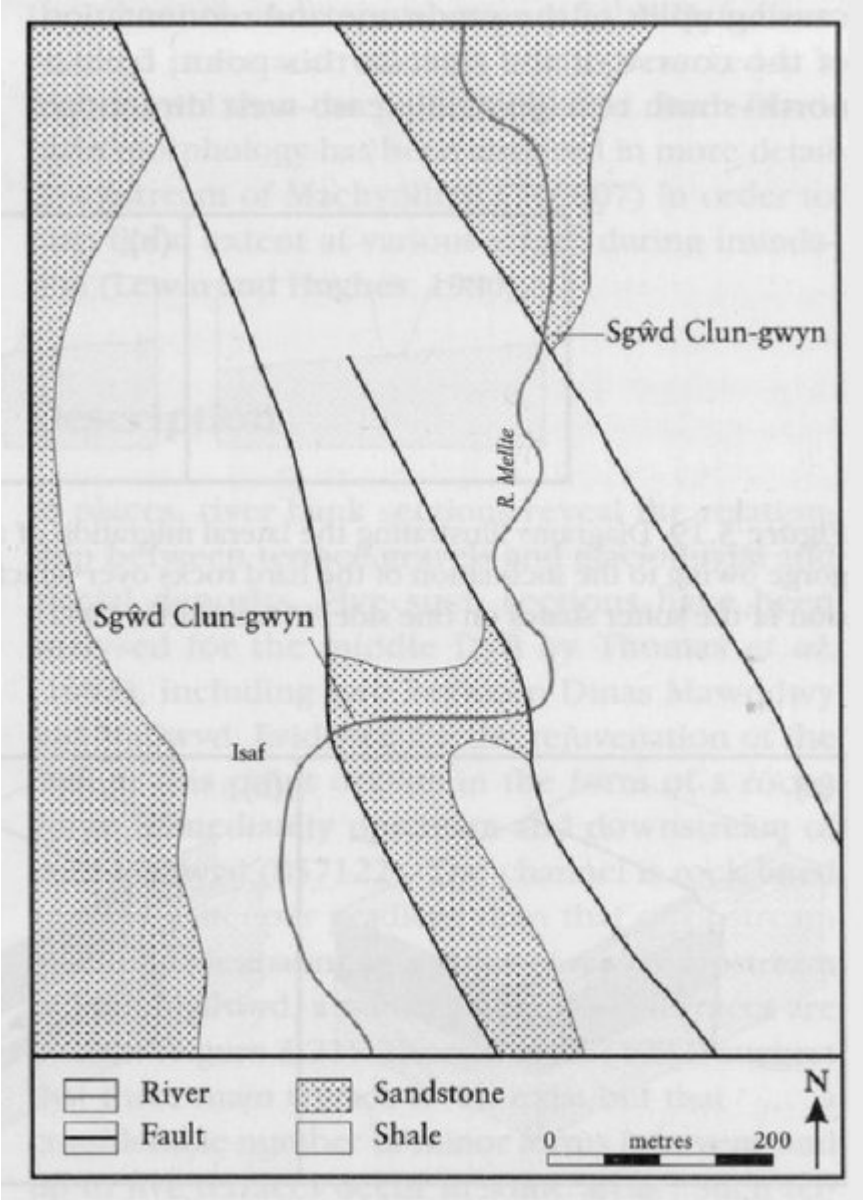
References



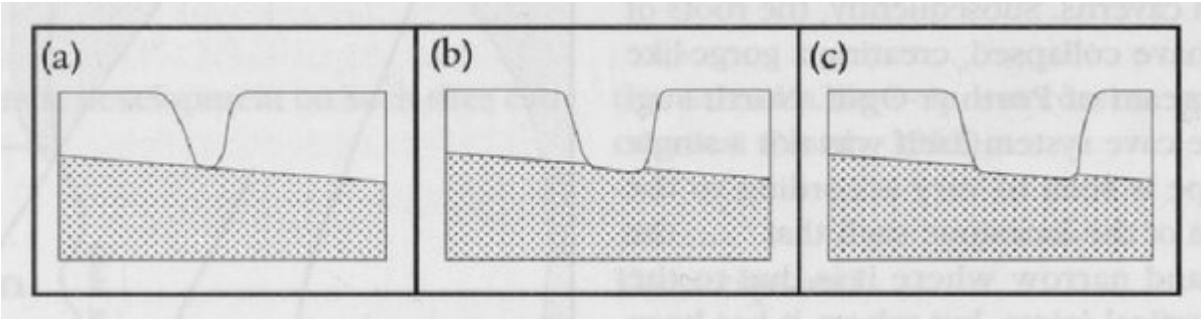
(Figure 3.16) The Afon Mellte: the origin of Porth-yr-Ogof. Stages (a), (b) and (c) are sequential. The sections represent three stages, and are drawn downstream from north to south (from right to left). By the occupation of a long underground channel and the collapse of all but one section of the roof, the river enters and emerges from cave mouths. (After North, 1962.)



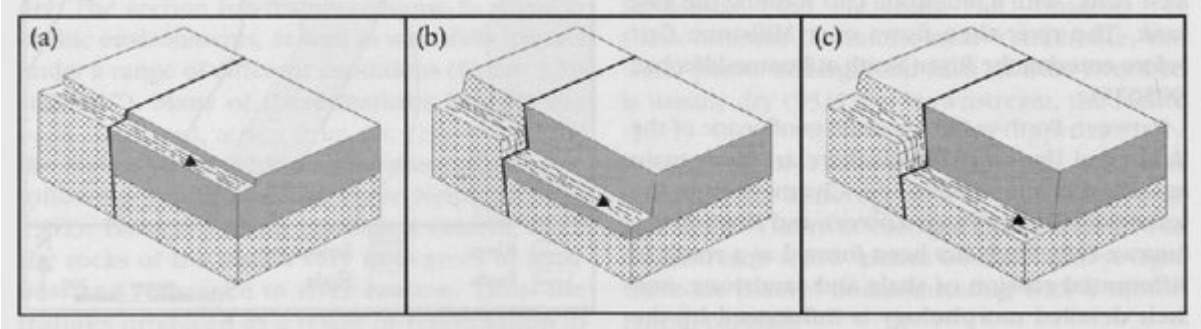
(Figure 3.17) The Afon Mellte. (Photo: S. Campbell.)



(Figure 3.18) The Afon Mellte: waterfalls and their relation to faults.



(Figure 3.19) Diagrams illustrating the lateral migration of a waterfall. The water tends to collect on one side of the gorge owing to the inclination of the hard rocks over which it flows, and the valley grows wider, principally by erosion of the softer shales on one side. (After North, 1962.)



(Figure 3.20) Diagrams illustrating stages in the formation of Sc■d Clyngwyn. The fall has resulted from the removal of comparatively soft shale. (After North, 1962.)