

---

# Afon Cynfal at Rhaeadr y Cwm and Rhaeadr Cynfal, Caernarfonshire and Merionethshire

[SH 701 413]–[SH 714 409] and [SH 735 414]–[SH 741 417]

G. Higgs

## Highlights

This series of confined bedrock channels and rapids, with associated features such as potholes, is thought to have been formed by successive incision of the channel over a long timescale. As such, it is a good representative of what is termed 'poly-cyclic' river development.

## Introduction

The Afon Cynfal between Rhaeadr y Cwm and Rhaeadr Cynfal provides an excellent example of an integrated river system with a sequence of waterfalls and rapids set within two steep-sided gorge sections (Cwm Cynfal and Ceunant Cynfal; (Figure 3.6)) separated by a low-gradient section with more active planforms and with a range of depositional features. There are thus important contrasts between the upper and lower reaches of the river as well as between the characteristics of the two sets of waterfalls themselves. The river provides a good example of 'polycyclic relief' (Howe and Thomas, 1963) and it has been suggested that the river has responded to at least three distinct base levels, with two main platform levels at 400–500 m and at 200 m.

## Description

The Afon Cynfal drains westward from Migneint in an area composed of Cambrian rocks and which is characterized by prominent platforms or 'surfaces' in the relief.

The Afon Cynfal, like the nearby westward-flowing Teigl and Prysor rivers, displays a long profile characterized by conspicuous knickpoints (breaks of slope) separated by wider river valley sections. It rises at 500 m at the Migneint moorland region (in Llyn Dywarchen) and for the first 3.5 km flows over a 400–450 m plateau as a low-gradient stream, with banks dominated by fine peaty materials and with pools separating rapids resulting from outcrops of resistant Cambrian grits and shales. Approximately 500 m west of Pont yr Afon Gam, the first prominent knickpoint on the Cynfal is evident as a gorge section culminating in Rhaeadr y Cwm [SH 736 415]. The gorge is approximately 600 m long and separates the upland plateau from a 200–250 m platform at Bont Newydd [SH 714 408]. The river drops 125 m in this gorge before assuming a low-gradient course at Cwm Farm [SH 734 413]. There are six major cascades with minor rapids lower down the gorge.

The river is largely rock-lined, although in places there are local deposits of coarse gravel derived from adjacent scree slopes — especially those on the right bank. The bed is lined by boulders, some over 1 m in diameter, and transport processes are dominantly of the bedload type. The largest fall in the series is approximately 20 m, over two stages, with a vertical drop over a protruding bedrock bench of about 15 m. Plunge pools separate cascades, which appear multi-branched at low flows. Approximately 100 m downstream of the lower falls, the river fans out into a wider valley section. Here the river is characterized by depositional forms such as mid-channel bars (e.g. at Cwm Farm), some of which have been vegetated. The river at this point is tree-lined and has created a small floodplain.

The river then flows over this 250 m platform for 2 km. However, another conspicuous knickpoint is seen in the gorged section of Ceunant Cynfal downstream of Bont Newydd [SH 714 408], where again there are large-scale sequences of cascades and waterfalls controlled by bedrock. This tree-lined gorge of the Cynfal extends to 100 m in depth at the Cynfal falls [SH 704 413]. In places, flow is confined by slot gorges to approximately 1 m in width. This has concentrated

erosion in downstream sections so that there are local embayments within the gorge with etch marks at varying levels 2–3 m above low flow, indicating erosion at high flood flows. In places, material has slumped into the river creating localized deposits of boulders, some 2 m in diameter. In other places, for example 20 m downstream of a footbridge [SH 705 412], angular blocks of material derived from the adjacent slopes are present at the base of the gorge. Between this footbridge and the Cynfal falls there is a column of bedrock rising 7–8 m above the stream, known locally as Hugh Lloyd's Pulpit. Upstream, there is a series of rapids resulting from the presence of resistant beds of the local Cambrian slates. The section also provides examples of potholes at a variety of scales, which are clearly visible at low flows. The reach is dominantly bedrock, although there is evidence of local deposition downstream of the railway bridge [SH 709 409] and where tributary valleys enter the main gorge of the Cynfal. Below the 20 m falls at Rhaeadr Cynfal the river enters a 100 m gorge, before entering the Afon Dwyrdd 2 km downstream.

There are minor falls (generally less than 5 m) upstream of the railway bridge. The gorge narrows to less than 5 m wide at such falls and has resulted in embayments in the sides of the gorge immediately downstream, in which cobble-sized material is deposited in low flows. The river broadens out in a reach approximately 20 m upstream of the railway bridge but is again confined to a 10 m wide section. There are three main sets of falls downstream of the railway bridge; the first of these are 2–3 m in height, and the second set is a two-stage fall about 10 m in height with a prominent plunge pool in which have been deposited boulder deposits, downstream of which the river is confined to 1 m in places, suggesting much lower width : depth ratios in this reach than those further upstream. At 100 m below this footbridge the Cynfal falls down three steep declivities of rock for a total of about 20 m. The stream is approximately 7–8 m wide at the top of these falls, but narrows again so that embayments at varying levels are obvious at low flows in this section. The gorge section downstream of Bont Newydd is approximately 1200 m long and the river eventually joins the Dwyrdd at 10 m above OD, providing an important contrast to those reaches of Cwm Cynfal where the channel is less constricted and features are depositional rather than erosional.

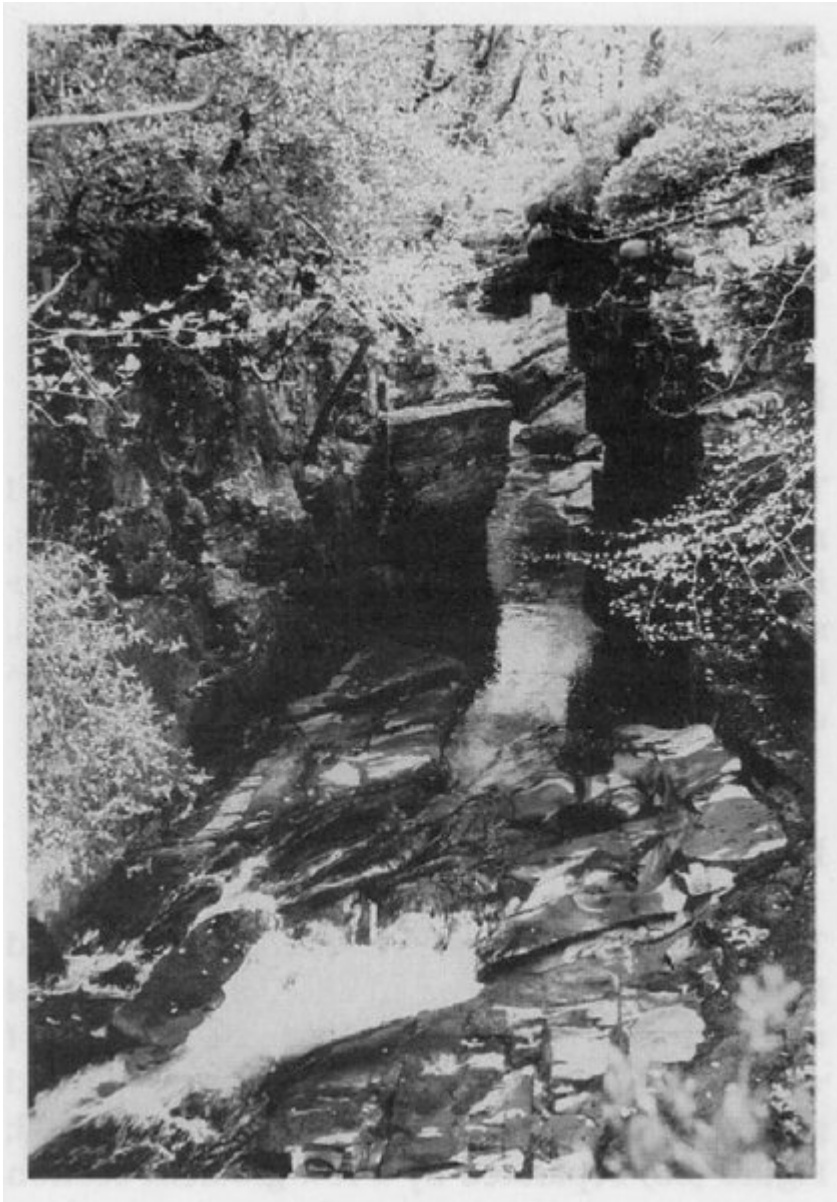
## Interpretation

The long profile of the Afon Cynfal represents the response of the river to rejuvenation that developed over a considerable period of the Quaternary. Such a process occurred at three base levels, as suggested by the two prominent steepenings, interpreted as knickpoints at Rhaeadr y Cwm and Rhaeadr Cynfal adjusted to base levels associated with the 400 m, 250 m and near present surfaces respectively. The rejuvenation has led to a dramatic change in river character at these points, and has created a range of features that contrast with those of reaches flowing over the intervening plateau areas. The channel morphology also provides an example of the response of a river to bedrock control in its lower reaches, with flow being confined to 1 m in places and embayments forming immediately downstream where erosion has been concentrated at varying levels. There has been considerable channel steepening, leading to the formation of prominent stepped waterfalls and rapids in the lower Cynfal. In addition, the nature of the gorge leads to high velocities in flood flows such that large boulders have been deposited in some sections. Further evidence of rejuvenation appears in the form of tributary streams (e.g. at [SH 738 417]) which have a hanging valley relationship to the main stream. Howe and Thomas (1963) suggest that these features of a stepped long profile are common to the westward-flowing rivers of North Wales, and in particular to the Teigl and Prysor rivers, and that '... the Cynfal thus presents a superb example of polycyclic relief with three distinct base levels' (Howe and Thomas, 1963).

## Conclusion

At this site there is a series of confined bedrock sections and falls with associated features such as potholes. The confined sections occur at different levels, separated by the falls. It is thought that each represents a phase of development related to that base level and that the falls were formed by incision to the next lower level. As such, the whole is interpreted as a particularly good representative of what is termed polycyclic development, which has resulted in these large-scale stepped profiles, characteristic of westward-flowing streams in North Wales.

## References



*(Figure 3.6) A steep-sided gorge section of the Afon Cynfal. (Photo: S. Campbell.)*