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# Afon Llugwy between Swallow Falls and Betws-y-Coed, Aberconwy and Colwyn

[SH 764 577]–[SH 791 568]

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## Highlights

Scenically valuable waterfalls in the Welsh landscape are often associated with glacially deepened valleys. The Llugwy has an assemblage of characteristic forms within a small area, which provides typical examples of geomorphologically important fluvial features.

## Introduction

The section of the Afon Llugwy between Swallow Falls and Betws-y-Coed represents the response of the river to the headward extension of the River Conway. There are four major knickpoints (breaks of slope) on the river, set within a glacially overdeepened valley (Figure 3.2). Such deepening occurred, it is suggested, through subglacial drainage rather than glacial scouring (Howells *et al.*, 1978). This has resulted in hanging valley features just west of Betws-y-Coed at Rhiwddolion [SH 777 566]. Knickpoints in the Llugwy Valley are at Pont-y-Pair [SH 791 567], near Miners' Bridge [SH 779 571], Swallow Falls [SH 765 577] and Cyfyng Falls [SH 735 571]. These falls are probably the result of the difference in the level between the Conway and the captured stream (Howe and Thomas, 1963); a similar series of four knickpoints can be seen on the Afon Lledr and Afon Machno, although at different levels, which can similarly be attributed to river capture by the Conway.

The source of the Afon Llugwy is in the Carneddau Range at 800 m — just above the remote lake of Ffynnon Llugwy. Like many of the river valleys of the Snowdonia area, the general pattern of the Llugwy seems to be unrelated to the geological structure of the country, in that it cuts across the geological 'grain' of the country and flows in a direction opposite to the prevailing dip of the strata. However, downstream of Swallow Falls, faults of an easterly to ESE trend partly control the course of the Llugwy. Between Pont Cyfyng and Pont-y-Pari the river descends 150 m in a 7.5 km reach over a series of cataracts. The river flows over slates of the Upper Carneddau Group (Ordovician) as well as igneous intrusions (of the Crafnant–Snowdon Volcanic Group) in which had been cut a series of gorges (e.g. at Swallow Falls and Miners' Bridge). These gorges were formed by a combination of glacial overdeepening and increased fluvial activity through a rejuvenation of the Llugwy by river capture (Howe and Thomas, 1963).

## Description

At Pont Cyfyng [SH 735 571], 1 km downstream of Capel Curig, the river changes from a low-gradient, non-confined stream with depositional features such as point bars and boulder islands (e.g. at [SH 732 576]) where the banks alternate between bedrock and fine sediments of alluvial or lacustrine origin, to a 50 m reach immediately downstream of the road bridge where the river is confined, to 3–4 m in places, and falls obliquely over a series of rock steps for a combined height of approximately 20 m. Resistant beds stand out to produce a series of rapids, which are separated by deep pools. There are three main cascades, the largest being approximately 5 m in height, separated by confined sections of river. Downstream of these falls the river resumes a low-gradient course with deposits of boulders in mid-channel (e.g. the Stepping Stones at [SH 742 572]). Downstream of Ty-hyll [SH 756 575] the river has a rejuvenated appearance with 2–3 m banks of fine sediment which, it is suggested, may represent lake deposits formed by the ponding of meltwater behind the knick point of Swallow Falls [SH 765 577] (Howells *et al.*, 1978). Before entering the 50 m gorge, the river widens and forms a series of rapids. There are also depositional features such as mid-channel islands (some of which are vegetated) in this section.

The river flows through the gorge at Swallow Falls for approximately 100 m. Within the gorge there are three main falls, the upstream one of which is the widest. This is a multi-branched fall of about 15–20 m in total where the river falls over two main rock benches. The two remaining downstream falls are narrower and more confined. They are also lower in height — 10 m and 5 m respectively — although of a similar type, and are separated by pools in which some deposition of boulder-size material has occurred. Immediately below the gorge the river flows over a series of rock ledges as rapids. There is also a series of embayments where the river has exploited weaknesses in the rock downstream of the falls.

Overdeepening of the main river valley has resulted in the formation of smaller falls on tributary streams, such as the Afon Rhiwddolion [SH 777 568] at Rhaeadr Garth. The stream enters the Llugwy at Miners' Bridge, falling over a 12 m precipice, and provides evidence for the rejuvenation of the main Llugwy. Upstream of Miners' Bridge there is a 150 m bedrock-lined section containing a series of rapids. At Pont y Pair in Betws-y-Coed, downstream of a vegetated boulder island, the river crosses a hard sandstone band as a multibranched 3 m fall. The river then becomes confined at the road bridge before becoming more depositional in nature upstream of the confluence with the Conway [SH 798 574].

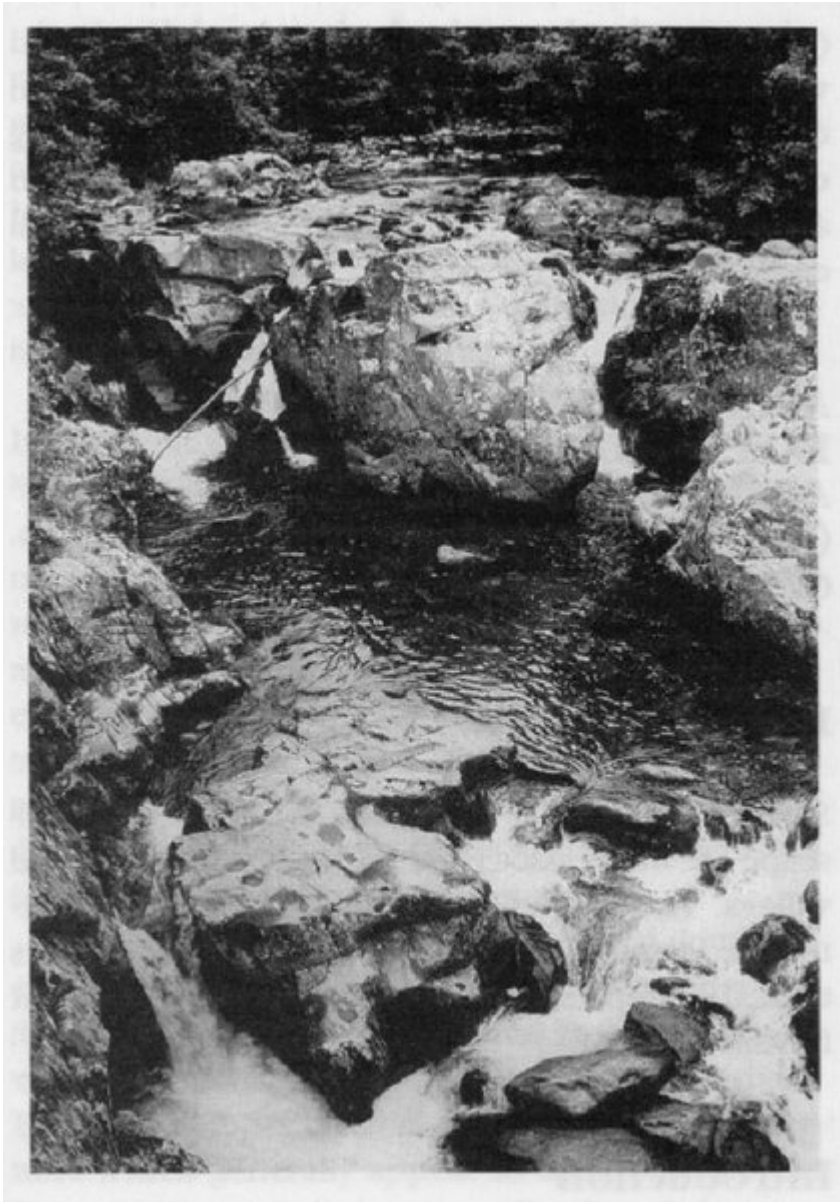
## **Interpretation**

The features of the Llugwy downstream of Ty-hyll are the result of the Afon Conwy retreating along the faulted junction between Ordovician volcanics and the overlying Silurian sediments, and capture of the headwaters of the proto-Dee near Betws-y-Coed. This rejuvenation led to increased river erosion in an already glacially overdeepened valley and to spectacular gorge sections at Pont Cyfyng, Swallow Falls and Miners' Bridge, gorge sections which are also mirrored on the Lledr and Machin) tributaries of what is now the Afon Conwy (Figure 3.3). Such overdeepening, it was suggested, was achieved 'by subglacial drainage rather than glacial scouring' (Howells *et al.*, 1978). Few tracts of boulder clay remain in the present valley of the Llugwy. However, fine sediments exist upstream of the four knickpoints of the Llugwy, in the form of lacustrine deposits which are now being reworked by the present river. Further evidence for the overdeepening of the river valley occurs in the form of the tributary streams which enter the main stream as waterfalls. The importance of this site therefore arises from the overall assemblage of features within a relatively confined area, and from the three sets of falls separated by more typical mountain torrent zones.

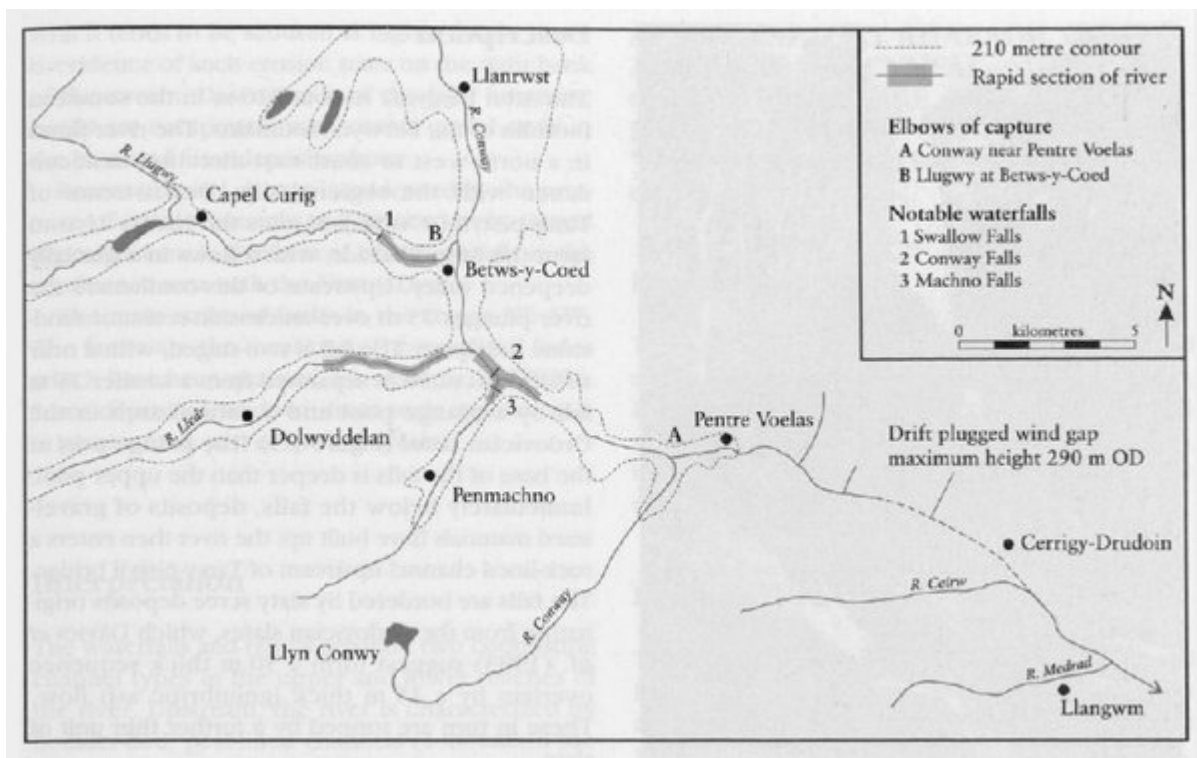
## **Conclusion**

The Llugwy site comprises a series of waterfalls and gorges separated by low-gradient, less confined reaches. These features were formed by steepening due to river capture and glacial overdeepening of the valley, and are excellent representatives of such landforms, which are quite common in Wales, particularly in Snowdonia.

## **References**



*(Figure 3.2) At this GCR site, there is an assemblage of characteristic fluvial landforms within a small area, representing the response of the Afon Llugwy to the headward extension of the River Conway, associated with glacial deepening. (Photo: S. Campbell.)*



(Figure 3.3) The Afon Ugwy: capture of the proto-Dee by the Afon Conwy.