

---

# River Dee at Llangollen, Denbighshire

[SJ 182 425]–[SJ 177 443]–[SJ 191 433]

G. Higgs

## Highlights

These incised and ingrown meanders are classics of the British landscape. They are large-scale features and a major component of the landscape, but have not been studied in depth in recent years.

## Introduction

Bedrock meanders, incised perhaps hundreds of metres into plateau surfaces, are a common feature of upland Europe. Meanders may have been developed on the original plateau surface, and then been vertically incised into bedrock. Commonly, however, bedrock meanders have continued to develop their loops during the process of incision such that outer bends are cliff-like, whereas inner bends are ramped, mirroring the direction of channel lateral migration while erosion was proceeding. Meanders may also be dismembered during this process, leaving high-level abandoned curving valleys. Such features are well preserved on hard, permeable rocks, such as on the River Dee limestones.

These features would appear to be pre-glacial, possibly relating to warmer Tertiary conditions and the block uplift of present plateau areas. Incised loops were over-run by glaciation, involving deposition and partial blocking of some sections. However, it also has been suggested that much higher glacially-related discharges could have been responsible for the bedrock excavation of large-scale meanders, the discharges necessary being much larger than ones available to present-day rivers. The examples found on the River Dee, which bear comparison with those on the lower Wye, are best developed along a 15 km section of the valley around Llangollen.

## Description

The River Dee upstream of Llangollen has examples of incised meanders of the ingrown type which are amongst the most well studied of such features in Wales (Figure 3.12). The river meanders across a broad floodplain upstream of Corwen, but at Glyndyfrdwy is rejuvenated and enters a deep gorge. Lateral erosion as well as vertical erosion has taken place such that the river valley is asymmetrical in cross-profile. Thus, for example, at Rhewl [SJ 183 448], on the northern side of the river, the valley side is steep, whereas on the inside of the meander loop there is a much gentler slope, suggesting that rejuvenation was progressive. On the inside of the bend, gravel deposits have been built up, whereas there are 2–3 m bank scars on the outside. There are also local examples of abandoned channel loops at Llantysilio and just south of Llangollen. The section provides a direct contrast to those entrenched meanders of the Lower Wye.

## Interpretation

Mention was made of river sections in the Vale of Llangollen in early papers regarding the evolution of the River Dee (Ramsay, 1876; Lake, 1900; Wills, 1912; Embleton, 1957). However, the most detailed fieldwork in the area between Llanrwst and Llangollen was done by Wilkinson and Gregory (1956). They investigated a series of remnant surfaces in the area and concluded that between Corwen and Llangollen a flight of four series of terrace remnants may be distinguished, at c. 300, 350, 400 and 430 m (although there is a west-east gradation in heights). It was suggested that the various levels corresponded to periods of standstill of the Dee. Lateral erosion in the form of the meandering river was still taking place such that all protuberances within the valley were eroded. In addition, there were periods of vertical incision corresponding to lowerings of base level, which Wilkinson and Gregory (1956) suggested could possibly be the result of river capture further downstream, namely that of the 'Proto-Trent' by the Lower Dee. It was also suggested that the incision since the formation of the 300 m terrace remnant (their Stage 4) must have been rapid since '... the river has

become incised *in situ* and there has been insufficient time since the incision to remove the protuberances between' (Wilkinson and Gregory, 1956). This has resulted in the abandonment of incised meanders at a higher level than the present river; three upstream of Llangollen and one downstream. The 300 m surface is associated with the summits of the cores of such meanders. Wilkinson and Gregory suggest that these four stages of terrace remnants are best preserved in the section of the Dee, between Glyndyfrdwy and Llangollen.

The superficial deposits in two of the abandoned meanders of the Dee have been examined by Kelly (1976), namely those of the Llantysilio abandoned meander (to the north-west of Llangollen) and the Pengwen abandoned meander (to the south-east of the town). The former meander is over 30 m, and the latter approximately 45 m above the present river level. They were developed in the softer beds of the Lower Ludlow (Silurian) series. Wills (1912) also investigated the deposits within these meanders and discussed their mode of origin, and suggested that the material was glacial drift with patches of alluvium and gravel filling in the pre-glacial valley. Kelly (1976), however, suggested that the preferred stone orientation of deposits in the meanders indicated that the majority of the exposures were deposits of solifluction and they therefore did not comply with the ideas of Wills. However, much of Wills' analysis was of deposits at greater depths using boreholes, and included more sites.

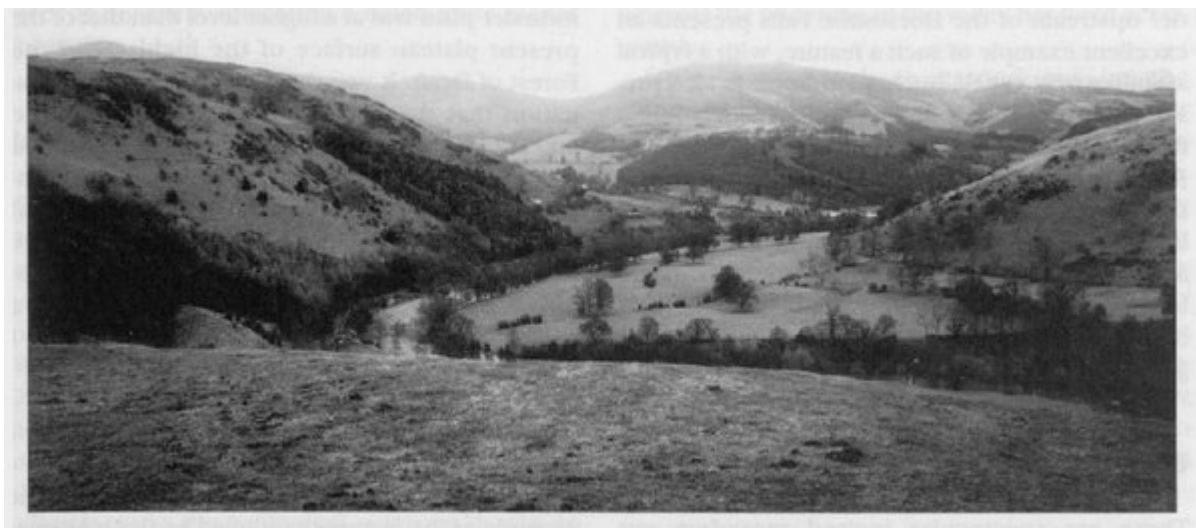
With regard to the origin of these abandoned meanders, there is evidence for a glacial interference. During glaciation of the middle Dee gorge, ice was channelled along the valley and carved troughs across the necks of four meanders. When this ice melted, the post-glacial River Dee followed the course of these deepened troughs, so abandoning the old meander beds at a higher level, (c. 300 m) than the present valley.

The River Dee between Glyndyfrdwy and Llangollen provides the best examples of ingrown incised meanders in Wales. The present-day meander upstream of the Horseshoe Falls presents an excellent example of such a feature, with a typical asymmetrical valley. Such a landform is also preserved as two abandoned incised meanders found to the north and south of Llangollen, at a level 300 m above that of the present day, formed by the short-circuiting of spurs during the last glaciation. It is suggested that the periods of vertical incision creating such features may have resulted from the lowering of base level corresponding to the capture of the Proto-Trent by the Dee during the last glaciation rather than a lowering of sea level.

## Conclusion

These are spectacular incised meanders cut approximately 300 m into bedrock. They are classic examples of this type of feature and were the subject of much study in the early 20th century. They were affected by glaciation, and related to previous large-scale changes in the regional drainage system.

## References



(Figure 3.12) General view of the River Dee at Llangollen. (Photo: S. Campbell.)