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# Afon Ystwyth, Ceredigion

[SN 702 718]–[SN 723 721]

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## Highlights

The Ystwyth has a multi-channel (braided) channel pattern that is now very rare in Wales, although it is known to have been more prevalent in the past. Channel pattern changes have been associated with metal mining activities, so that the reach constitutes not only a presently rare channel pattern, but also one which has an interesting and documented history.

## Introduction

This section of the Ystwyth is one of active braiding, where, for approximately a kilometre, the valley floor broadens out. Changes in the planform of the river over the period 1845–1969 have been investigated by Lewin *et al.* (1977). Throughout this period the river had been sweeping across the valley floor, creating a series of abandoned chutes. It has been suggested that the impact of mining in the catchment has led to the high toxicity of derived sediments, leading to a lack of vegetation and therefore to more rapid erosion of banks and floodplain, rather than mining resulting in the input of coarse sediment to the system. Work currently being undertaken suggests that the channel section is rapidly changing in response to high-magnitude floods, but that rates of movement tend to be otherwise slow for braided rivers in general.

## Description

The section of the Ystwyth at Grogwynion is unusual in that it represents one of the very few braided reaches in Wales (Passmore *et al.*, 1993). Studies on downstream sections of the river reveal high rates of lateral channel shift, largely as a result of human activity. Thus, for example, Lewin (1976) noted a return to a sinuous pattern of the Ystwyth at Llanilar following artificial straightening firstly in 1864 (to protect an adjacent railway track), and subsequently in 1969 by the local water authority. Aerial and ground photography and field survey in the affected reach after the latter channelization revealed that within a year a series of point-bar landforms with lobate bar cores had emerged, indicating the initial stages of meander development and therefore the return to a more sinuous channel by bank erosion as a consequence of bar formation. Examination of aerial photographs of the Ystwyth valley floor at Llanilar, and the subsequent computer plotting of such data, revealed a series of abandoned river channels, some recent (i.e. abandoned within the past 50 years), and indicated some former braided channel development, with a floodplain composed of point and braid bars with infilled abandoned channels. It was further suggested that without the constraints of artificial straightening, channel migration and bar formation occurred at flows with a return period of approximately 0.8 year (Lewin and Manton, 1975).

## Interpretation

Historical map and photographic evidence of a reach at Trawscoed (6674) has been used to illustrate variations in channel patterns and changes from a meandering to a braiding pattern, as a result of the large input of sediment from local mining activity and the subsequent reversion following cessation of such mining. There is thus a present-day low-sinuosity channel, and a floodplain with alternations of coarse and fine deposits (Lewin *et al.*, 1983). The highest sedimentation levels were in the 1890s and led to the deposition within the channel of coarse material bars and also of over-bank splays of steep gradient. Subsequently, the gaps between such splays have been infilled with 'fines'.

By 1946 the section had reverted to a 'wandering gravel river' type with a single sinuous channel, eroding the 19th century mining sediments within a constricted area between the railway and a higher terrace level. It was suggested that the present channel has a steeper gradient than the pre-mining floodplain and that the '... river is still in the slope

discharge class of many braided streams' (Lewin *et al.*, 1983). It appears, therefore, as if there were extensive areas of braiding at the end of the 19th century on the Ystwyth. However, it was suggested that the materials deposited in this reach at Trawscoed (downstream of the braided reach at Grogwynion) were not directly the result of coarse sediment input from the mines, but that they were ... derived from the reworking of upstream alluvial deposits, notably from a pocket of alluvial sediment 5 km upstream in the vicinity of the crushing plant for Frongoch ores' (Lewin *et al.*, 1983).

Similar conclusions were reached for the Grogwynion reach by Lewin *et al.* (1977), regarding direct input of fines from the mining activity, changes in sedimentation and planform patterns resulting from the reworking of the coarse deposits upstream, and vegetation destruction and the erosion of finer deposits. The destruction of a stabilizing vegetation cover may in turn result from the high toxicity of metals in the river, so that the pattern is an indirect reflection of the effects of mining activity as well as of the direct effects of the sediment input from the waste heaps at Grogwynion. Variations in channel and floodplain profiles during the period 1845–1969 were investigated through historical maps (Figure 3.26). It was suggested that there was little evidence for the direct input of coarse deposits from either the mine at Grogwynion [SN 714 723] or at Gwaithgoch [SN 710 723], but that the river deposits are derived from the local floodplain. A detailed analysis of changes in channel patterns for a six year period (1969–75) revealed that high-magnitude events have the greatest influence on such variations, and that high flows accentuate the braided pattern, which is not so obvious at lower flows when channels are not occupied by water.

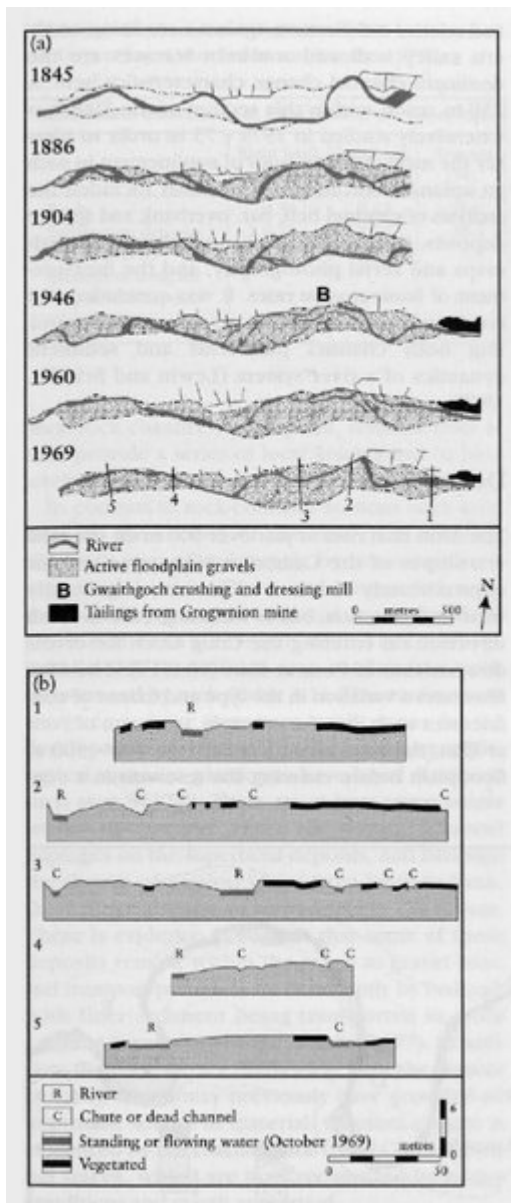
The present-day importance of the reach arises from variations in planform and gravel bar morphology in response to flooding events. These have been monitored and compared with rates of change noted on the River Feshie in Scotland, for example, by Ferguson and Werritty (1983). Despite evidence of more active braiding in the past, there are no comparable sites in Wales that offer such an opportunity for reactivation given a more flood-prone river regime under changing environmental conditions in the future (Passmore *et al.*, 1993).

The reach of the Ystwyth at Grogwynion illustrates the influence of 19th-century metal mining on the sediment and channel characteristics of the river, firstly through the input of toxic metals leading to the destabilization of floodplain vegetation and the subsequent release into the system of coarser material deposited during an earlier phase of activity, and secondly through the direct input from waste and spoil heaps. There is evidence to suggest that other sections of the Ystwyth downstream of this reach, for example at Trawscoed, were formerly braided, but that as a result of the decline in mining activity and of man-made channelization works, the river has returned to a less sinuous pattern.

## **Conclusion**

The Grogwynion GCR site on the Ystwyth is one of the few active, braided reaches of river channel in Wales. Changes have been monitored, with a view to understanding the effect of different-sized flows, allowing comparisons in planform and gravel bar morphology with braided river sites in Scotland to be made.

## **[References](#)**



(Figure 3.26) The Afon Ystwyth: (a) the channel at various dates; (b) the floodplain profiles at Grogwynion in 1969. (After Lewin et al., 1977.)