River Severn between Welshpool and the confluence of the Vyrnwy and Severn, Powys

[SJ 269 127]–[SJ 281 150]

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Highlights

As a highly sinuous but now laterally stable reach, this part of the Severn has one of the most tortuous multi-loop river reaches in the inland valleys of Britain. The floodplain is dominated by overbank sedimentation, rather than the lateral accretion in evidence at many other sites.

Introduction

The Severn downstream of Welshpool provides an example of a relatively inactive lowland river section. The river at this point is laterally stable and is particularly prone to flooding, although those floods up to a five year return period are contained by flood embankments ('argae'). This contrasts with the section of the Severn upstream of Pool Quay, which historical maps demonstrate has undergone lateral movement (e.g. at Welshpool [SJ 237 069]; Ashworth, 1982). Cross-sections in the confluence areas have low width : depth ratios and occur in silty sediments. The bankfull channel capacity is lower than that farther upstream such that the proportion of high-magnitude discharges flowing outside the channel is larger (Lewin, 1983). A particularly stable meandering reach is known locally as the Roundabout [SJ 273 129]. At this point the channel is narrowly entrenched into alluvium deposits: in places it is 7 m below the floodplain (Humphries, 1979). Sedimentation is predominantly overbank at a rate locally in excess of 1 cm per year (Thompson, 1982). The relatively stable nature of the channel inhibits the erosion of fine deposits, suggesting that there has been a net aggradation in the area (Lewin, 1983).

Description

The Severn between Pool Quay [SJ 257 116] and Llandrinio [SJ 300 167] is particularly stable. The floodplain is over 2 km wide in places and is slightly convex in cross-section (Thompson, 1982). The channel itself has a very low gradient (0.0003) and a low width : depth ratio (< 10) (IGCP, 1983), such that in a survey of 14 cross-sections of the Severn between the source and the confluence with the Vyrnwy (95.7 km), sections downstream of Welshpool showed lower bankfull channel capacities, lower width : depth ratios and lower rates of lateral change than those further upstream (Lewis, 1982). Thus, for example, a cross-section surveyed just downstream of Newtown [SJ 112 914] yielded a bankfull channel capacity of 112 m, a width : depth ratio of 15 and an average lateral rate of change of 0.15 m year^{-1}, as compared with values of 99, 8 and zero respectively for a cross-section downstream of Welshpool upstream of the confluence with the Vyrnwy (Lewin, 1983). In addition, comparisons of channel change for two cross-sections between Welshpool and the confluence for the period 1844–1973 with those upstream in the Welshpool area, using historical maps and aerial photography, illustrate that there has been very little lateral change in the former area in historical times (Lewis, 1982), whereas in the Welshpool area (Ashworth, 1982) several cutoffs date from the past 200 years, and zones of sedimentation dating from 1844 onwards exist along the main channel, both in point bar environments and in abandoned channels (IGCP, 1983).

The fact that the channel in this reach of the Severn has entrenched as much as 6 m into its floodplain has meant that in a study of the downstream variation in peak discharges associated with particular return periods in the upper Severn Catchment (Higgs, 1987), flood events of 10 and 20 years return periods had a higher discharge at Abermule than the downstream station at Montford (Figure 3.32), confirming the trend noted by Hey (1975). This was explained by the effect of channel and floodplain storage in the reaches between the two stations, which effectively delays the flood wave and thus reduces the peak discharge. This is particularly the case for the more extreme discharges. It has thus been

suggested … that the floodplain here is naturally adjusted to take a higher proportion of high magnitude flows than upstream where the steeper channel is cut into coarser less cohesive sediment' (Lewin, 1983). In such an environment, overbank sedimentation of fine deposits dominates, since the overbank flows are more frequent (Lewin, 1983). Figures presented by Thompson (1982) for rates based on such deposits burying ditches (e.g. at [SJ 268 136]) and on pottery of Roman origin, suggest net aggradation rates of anything between 0.03 cm per year (outside the Tirymynach embankment) and in excess of 1 cm per year (within such argae), although the tentative nature of such figures is stressed.

The section of the Severn outlined includes a particularly stable reach — the 'Roundabout' —which is a multi-looped meander consisting of two arcs. The neck of this meander is approximately 10 m wide. The river banks in this section are dominated by finer materials, although some gravel deposits exist in the form of bars. The section tends to be tree-lined and this fact, together with the presence of old roots, tends to add to the natural stability of the reach.

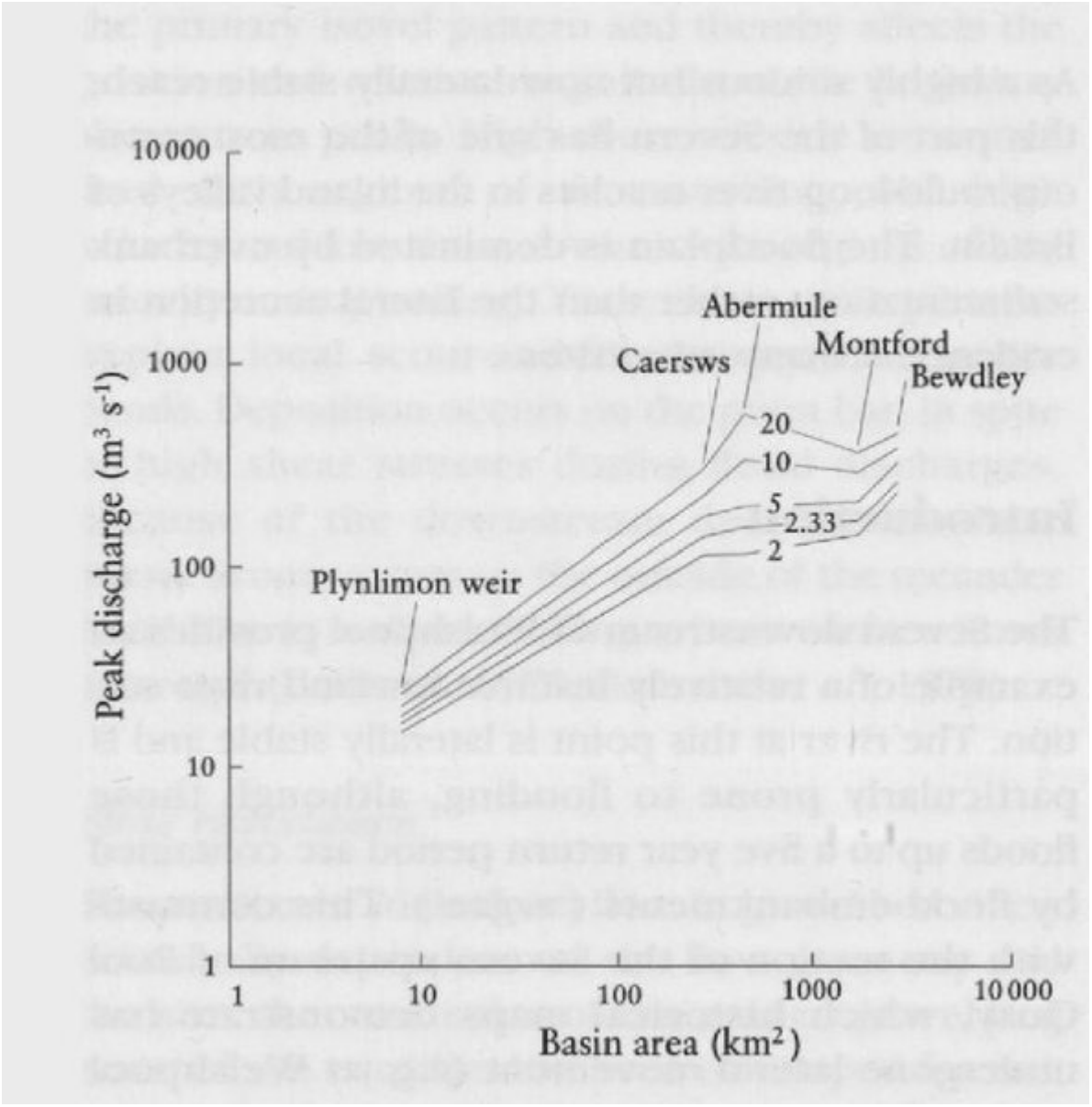
Interpretation

The River Severn downstream of Welshpool has features unique to a laterally stable channel where channel migration has not been in evidence (at least since the 1950s; Lewis, 1982). The site provides a direct contrast to those upstream sections of the Severn at Caersws (Thorne and Lewin, 1979) and Welshpool (IGCP, 1983) where channel mobility has involved the lateral translation of meander loops, and sedimentation dominated by in-channel processes (e.g. point bars) and within cutoff environments. The section has low width : depth ratios and lower bankfull capacities compared with those farther upstream owing to the cohesive nature of the sediments. The greater proportion of flows outside the main channel has led to the overbank sedimentation of fines (up to 1 cm a year). It has been suggested that such processes may preserve a record of the flooding history of the Severn at this point (Lewin, 1983), although little work has been done in this area to date. The channel itself has features unique to such an environment, having a low gradient (average of 0.0005) and a low width : depth ratio (generally under 10), since the channel has been cut up to 6 m into its floodplain. The banks are dominated by fines and, for the majority of the section, are tree-lined. At low flows, gravel bars are observed on the inside of the meander loops, which in places are complex multi-loop features. The gravel depositional features, however, are dominated by finer materials than those farther upstream.

Conclusion

This is a site at which the channel has a tortuous but now stable pattern. The channel is relatively deep and narrow, entrenched in fine sediments. It has a lower capacity than reaches upstream and so floods more frequently. This flooding results in a process dominance of overbank deposition on the floodplain.

References



(Figure 3.32) The upper Severn catchment: downstream flood frequency variations. (After Hey, 1975.)