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# Langden Brook, Bowland Fells, Lancashire

[SD 576 507]–[SD 624 505]–[SD 595 481]

## Highlights

This valley has unstable braided reaches, which are relatively rare in north-west England, and has Holocene alluvial fans with good exposures and dating of the sedimentary sequences.

## Introduction

The Langden valley is an important fluvial site, exhibiting one of the most active unstable cobble-bed, mainly braided channels in northern England, and preserving a valuable record of Holocene erosion and deposition in a series of dated tributary alluvial fans and cones. Only recently has the Holocene and contemporary fluvial geomorphology received much attention. Previous work on the area deals with Devensian glaciation and has been summarized by King (1976) and by Johnson (1985b). In the past 30 years the Holocene fluvial geomorphology of the area has received considerable attention including four PhD studies from the University of Liverpool (Wilcock, 1967b; Hitchcock, 1977b; Thompson, 1984; Miller, 1991) and one from Newcastle upon Tyne (Wilkinson, 1971). Fluvial studies have previously related to hydraulic geometry (Wilcock, 1967a, 1971), sediment transport and channel changes (Hitchcock, 1977a; Harvey *et al.*, 1979; Thompson, 1985, 1986, 1987) but have also included studies of the Holocene fluvial sequence (Harvey, 1985a; Harvey and Renwick, 1987; Miller, 1991).

## Description

The channel of Langden Brook is an active, unstable, cobble-bed channel, with a high rate of coarse sediment transport (Wilkinson, 1971; Hitchcock, 1977a) (Figure 4.14). Two reaches have had a long history of switching between single and braided channels. Changes at both reaches have been monitored over a period of more than 10 years (Hitchcock, 1977a; 1977b; Harvey *et al.*, 1979; Thompson, 1984; 1985; 1987) and documented over a c. 100 year period (Hitchcock, 1977b; Thompson, 1984).

Major sediment supply is from Carboniferous gritstone bedrock, exposed especially in the 'canyon' reach in the upper valley, and from periglacial slope deposits derived from this same bedrock. In the upper reaches, gullies cut through the periglacial deposits into underlying bedrock and are a major current source of sediment. In the highest reaches, blanket peat preserves an, as yet unstudied, history of accumulation and dissection.

The major Holocene landforms include a large landslip below Holdron Moss and a series of river terraces in the upper part of the valley. The most interesting Holocene forms are a suite of tributary junction alluvial fans, some of which include organic deposits, for which a series of radiocarbon dates have been derived (Figure 4.15).

## Interpretation

Thompson (1984, 1985, 1986, 1987) has analysed the role of different-magnitude events in producing changes in the channel pattern. He interprets the Langden channel as part of a braided to meandering continuum of cobble- and gravel-bed channels, the patterns of erosion and deposition of which reflect the relationships between pool–riffle units and secondary flows. Different-magnitude events and the sequence of flows have been shown to have a profound effect upon the degree of braiding.

The radiocarbon dates, obtained from organic layers within the Holocene alluvial fans, suggest two major periods of Late Holocene fan formation, one between c. 4000 BP and c. 2000 BP and one at c. 1000 BP (Harvey and Renwick, 1987; Miller, 1991). The younger phase coincides with a period of fan formation in the Howgill Fells further north (Harvey *et al.*,

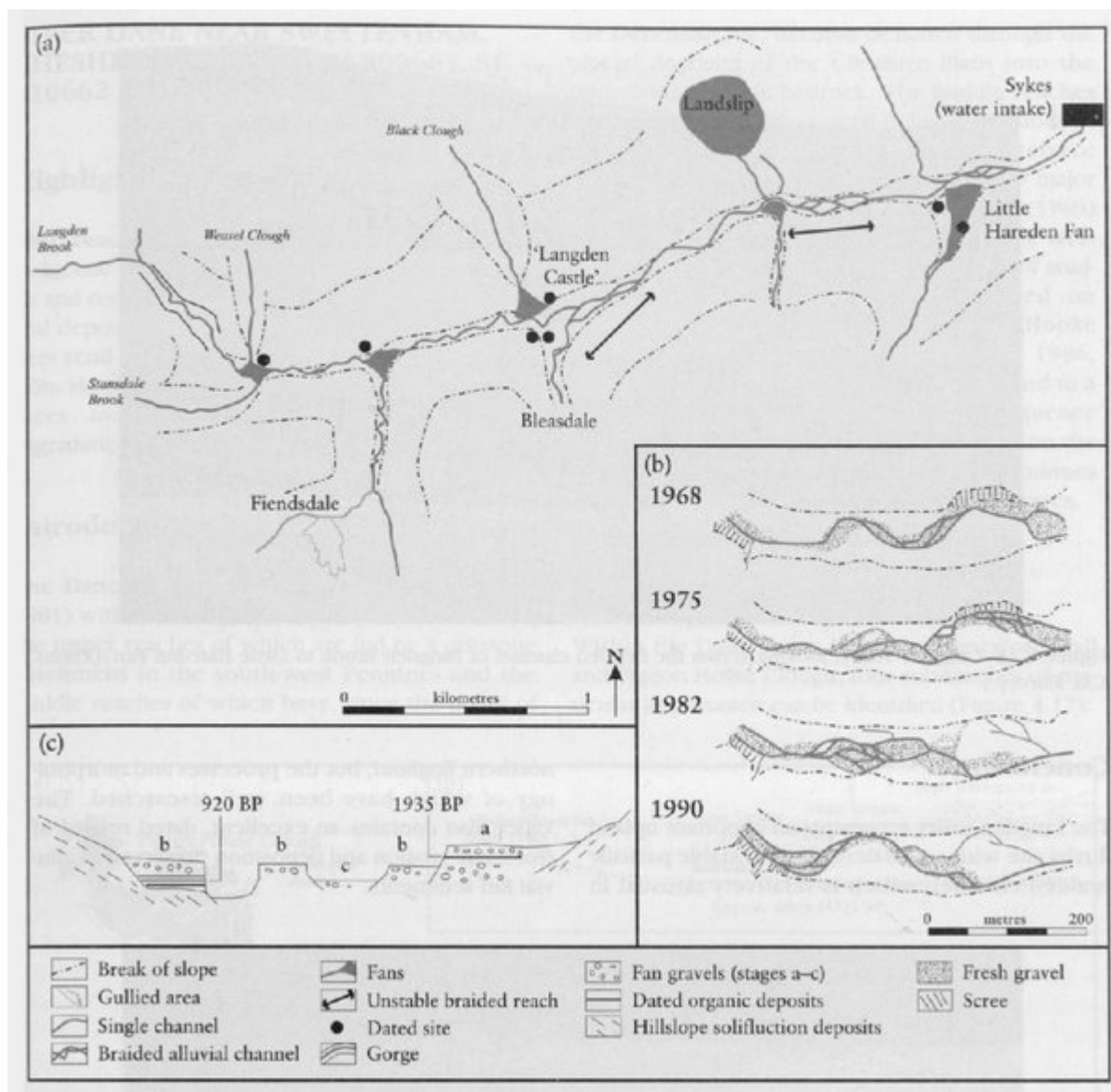
1981; Harvey, 1985a, 1992b, 1996; Miller, 1991), and is attributed to accelerated erosion following deforestation in Viking times. The dated fans are at Weasel Clough, Fiendsdale, Langden Castle and Little Hareden Clough (Figure 4.15). A soil chronosequence has been established in relation to the Holocene geomorphic sequence, and put into the context of the Holocene vegetation sequence (Miller, 1991).

Langden Brook is an important site for fluvial geomorphology, primarily because it provides an excellent example of an unstable cobble-bed channel (Figure 4.16) with a history of switching between single-thread and braided habits. It has received a considerable amount of detailed study, which has contributed to our understanding of the relationship between hydraulic geometry, sediment transport and channel stability. It also exhibits a valuable record of Holocene erosional and depositional sequences, preserved in the alluvial fan deposits.

## Conclusion

The Langden valley represents an important upland fluvial site with a well-developed unstable partially braided channel, which is relatively unusual in northern England, but the processes and morphology of which have been well researched. The valley also contains an excellent, dated record of Holocene erosion and deposition preserved in alluvial fan sediments.

## References



(Figure 4.14) Langden (a) geomorphological map. (b) Sequence of channel change upstream of Little Hareden, 1968–90. (After Thompson, 1987.) (c) Stratigraphic relationships of dated sediments at Little Hareden Fan. (After Harvey and

Renwick, 1987.)



(Figure 4.15) Langden Valley, looking across the braided channel of Langden Brook to Little Hareden Fan. (Photo: A.M. Harvey.)



(Figure 4.16) The braided cobble-bed channel of Langden Brook. (Photo: A.M. Harvey.)