River Severn, Buildwas, Shropshire

[SJ 647 042]

Highlights

The River Severn floodplain at Buildwas contains some of the best preserved alluvial terraces in the Severn basin. Deglaciation and pro-glacial evidence at the site suggests that it was instrumental in the formation of Ironbridge Gorge, through which the river flows downstream of the site.

Introduction

This site is set in an area containing the most extensively preserved alluvial terrace deposits on the Severn. The terraces have been related to the glacial chronology, but in the Devensian glacial and Late Glacial periods, the controls on terrace development were complex and not easily decyphered. The Devensian terraces have been associated with the discharge through the Ironbridge Gorge of glacial lake waters concurrent with base-level-induced alluviation in the lower reaches. The Buildwas sands and gravels are ice-contact deposits which resulted from transport and deposition during the deglaciation of the Cheshire-Shropshire basin.

The courses of the Severn and its tributaries have been shown to have been determined by the form of deglaciation and the course of meltwater drainage. The area has been profoundly influenced by the stagnation of an Irish Sea ice sheet, which had advanced over the stagnating blocks of the northern derived ice mass. The nature of the pro-glacial and paraglacial environment is believed to have invoked considerable local control on the nature of sedimentation and erosion.

The combination of the deglacial history and the variations in stream dynamics is believed to have resulted in downstream variations in stream activity which influenced both the degree of floodplain formation and the extent to which palaeofloodplains can now be recognized as terrace remnants. Thus, with the Welsh ice near its Shrewsbury limit, a san-dur developed initially over an ice-free surface. It is proposed that it then entered the stagnating Irish Sea ice mass in the proximity of a buried valley, within which the local controls above introduced substantial downstream variations of aggradation and degradation. This situation is envisaged as prevailing during the development of the upper terrace suite (terraces 6, 5 and 4).

As ice retreated towards the Welsh mountains and the remaining blocks of Irish Sea ice melted, a middle terrace suite developed (terraces 3 and 2). Near Shrewsbury, the confluence of the Rea and Severn sandurs led to substantial aggradation of material over a limited distance, the subsequent incision of which left a terrace (terrace 3) of limited downstream extent. Pro-glacial lakes developed adjacent to the retreating Welsh ice and morainic ridges may have covered much of the Severn valley between Welshpool and Montford Bridge. Outwash fans emanating from the valleys of the Welsh Mountains prograded over the drained lake basins and resulted in the development of the low terrace suite. It may be that some of the floodplain terrace fragments are non-glacial, believed to extend the complete length of the river. Hence sediment supply and sediment removal were consistent with the length of the river.

The most critical problem in the development of Ironbridge Gorge is its relationship to the sediments upstream. Prior to the development of river terraces upstream of the gorge, two geomorphological systems have been proposed:

1. a proglacial lake draining through the gorge as part of a monoglacial explanation;
2. more complex glaciofluvial deglaciation involving stagnant ice wastage.

Description

The river terraces of the Severn valley between the Vyrnwy confluence and Ironbridge are divisible into three suites (M.D. Jones, 1982). The highest terraces (6, 5 and 4) are limited to a 6 km valley section. The middle suite terraces (3 and 2) extend along the length of the valley from the Isle at Shrewsbury to Ironbridge, and are exceeded in length only by the low terrace suite. This comprises the terrace fragments of terrace 1 (the Cressage terrace), at 2–4 m above the floodplain, and the floodplain terrace fragments. The latter are gravel outcrops within the modern floodplain, varying from 1 m above the present silty alluvium surface to 1 m below. The scattered nature of these terrace fragments may reflect more the adjustments of the river to its own aggradation than to a meandering river system.

A kettle hole extends beneath the projected terrace 2 level west of Buildwas Abbey, and suggests the persistence of isolated blocks of Irish Sea ice during the formation of this terrace. The surface that surrounds this hole is 2–3 m above the expected level of terrace 2, and is not thought to be part of it. Rather, it is believed to represent a tributary fan emanating from Farley Brook into the main Severn Valley very similar to that at the top of terrace 2, evidence for which is derived from Buildwas Quarry.

The deposits at Buildwas are in a critical position, since they are just upstream of the entrance to Ironbridge Gorge and downstream of the terrace sequence of the Shropshire Plain. The deposits comprise massive sands and gravels at the base, overlain by a fluvial gravel unit (Figure 6.29).

The deposits at Buildwas illustrate the facies changes which are typical of the zone between the gravel-dominated and sand-dominated units. Shaw (1972) has argued that these sediments represent the ice-walled fluvial sedimentation of meltwater draining to the south-east, as indicated by palaeocurrent measurements. The indicator is that ice-walled sedimentation was characterized by a zone of gravel bars, inferred from horizontal imbricate and foreset gravel units. Flanking this facies assemblage are finer sediments deposited as low flow regime horizontal stratification.

At the top of the quarry, reaching an altitude of 65 m OD, is a gravel unit (Figure 6.29) the provenance of which indicates that 90% of the clasts originate from within the present catchment of the tributary Farley Brook. The gravel unit is up to 2 m thick and consists of a lower well-stratified gravel-sand sequence and an upper poorly sorted, often massive gravel unit. Sand lenses often define gravel sets of 30–50 cm thickness, which are poorly imbricated. The altitude of the gravel indicates that fluviatile drainage was taking place towards Ironbridge Gorge after the cessation of ice-contact sedimentation. Also derived from the quarry is evidence of the avalanche front of a gravel bar. The proximal foresets are of medium to fine gravel with openwork-matrix filled co-sets defining the cross-stratification. Downvalley, the sediment contains more coarse-medium sand. The high percentages of medium sand found in the gravel derived from the Farley Brook are probably reworked from the underlying sands and gravels.

Interpretation

There is no evidence that Ironbridge Gorge was initiated before the Middle Devensian. Two major theories have been proposed.

The pro-glacial lake

Following Howson's (1898) realization of the work of land ice in the creation of the drift deposits of the Midlands, Lapworth (1898) — and more fully Harmer (1907) — proposed that diversion of the Severn took place after the damming of a lake formed by advancing ice. This proposal was recognized by Wills (1924), who mapped deposits and overflow channels. Wills proposed two lakes, glacial lake Newport (Dixon, 1921) and glacial lake Buildwas, which later coalesced to form glacial lake Lapworth; this was then suggested to have drained through a col at what is now Ironbridge Gorge.

This monoglacial explanation was followed by Pocock *et al.* (1938), who stated that although a reddish, loamy, sandy clay, and bedded sands and gravels were distinguished, it was often not possible to prove their chronological relationship. These deposits were thought to have been laid down by the contemporaneous Irish Sea and Welsh ice sheets. As the ice sheets waned, meltwater deposited sand and gravel as kame deltas and fans, and was eventually ponded up by the ice margins and the rim of the Shropshire-Cheshire basin, to form the 300 ft (91 m) stage of Lake Lapworth with its overflow channel at Ironbridge gorge. It was suggested that, at about this time, the Welsh ice-sheet readvanced into the western part of the Shrewsbury district and deposited boulderclay on the outwash sand and gravels of the Irish Sea ice.

Worsley's (1985) reappraisal concluded that 'it is inadvisable to reject the concept of a proglacial lake on the basis of limited sedimentological evidence, especially when this is amenable to interpretation in various ways, none of which necessitates the elimination of glacial Lake Lapworth'.

Stagnant ice wastage

M.D. Jones (1982) summarized the three main lines of evidence for stagnant ice wastage as the explanation of the deposits and features. The gorge is envisaged as a natural continuation of a subglacial drainage system and indicates the presence of ice during the formation of the gorge. Sediment palaeocurrent directions point to the presence of ice at the northern end of the gorge, while water entered at or near its base. Faulting of sediments, incorporated till bodies and their esker-like or kam-iform morphology all point to an ice-contact environment for the sediments that flow into the gorge.

A more likely explanation is that the retreating ice margin ceased and melted ice *in situ,* possibly forming a small pro-glacial Lake Buildwas, and overflowed in the gorge (Hamblin, 1986). This, in combination with the cessation of sub-glacial flow through the Lightmoor channel (to the north-east of Ironbridge Gorge) represents the shift of drainage from the Stour valley to the Severn (Hamblin, 1986). The lack of lacustrine sediments between those around Lilleshall and those possibly at Buildwas suggests that Lake Newport and Lake Buildwas formed adjacent to their respective overflow channels and may not have coalesced, with Lake Buildwas already having drained through Ironbridge Gorge before Lake Newport drained into the River Tern (Hamblin, 1986).

The most significant development of the River Severn, associated with a decrease in slope, is from an unstable multi-thread proximal pro-glacial river to a stable low-sinuosity single-thread river. This increased stability is reflected in a change from sediments representing migrating mid-channel bars to diagonal bar-riffle development. This trend has been attributed to a change in sediment load of the river from a gravel-bedload river to a silt-suspended-load river.

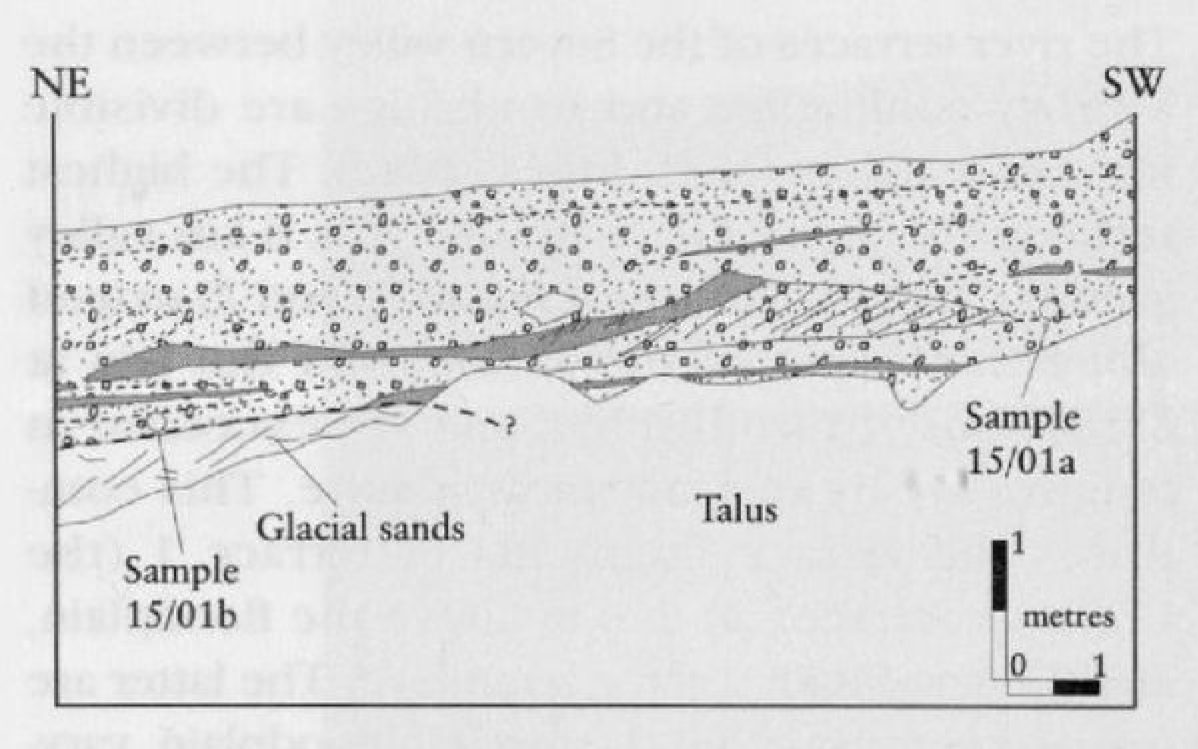
The present river has adopted 'meander' wave lengths that correspond with those of the terrace 1 meanders. Since these channel meanders are not consistent with the modern fluvial regime, the Severn is a classic Osage type underfit. Many of the anomalous channel reaches, such as the straight reach between Shrawardine and Montford, appear likely to have been inherited from the deglacial evolution of the area. The river is now very stable for much of its length, and very little migration has taken place since Roman times.

In character and location, the deposits are important in relation to the interpretation of the late-Devensian history of environmental change in the Severn Basin, in which the Ironbridge Gorge plays a fundamental role. The quarry sediments are essential to the understanding of the origin and development of Ironbridge Gorge, which are subject to continuing debate in the literature. The importance of local controls on sedimentation and erosion in the pro-glacial and para-glacial environments of the Late Devensian give these deposits a unique value in this context.

Conclusions

Competing theories of explanation of the changes in the drainage of the Severn and the formation of the Ironbridge Gorge in the Late Glacial are still debated. Sand and gravel deposits and a river terrace at Buildwas stand at a crucial position in relation to the gorge and the upstream terraces. A complex stratigraphy and key sedimentary features are exposed in the quarry at Buildwas and provide evidence of the sequence of development.

References



(Figure 6.29) Fan gravels at the top of the Buildwas quarry section.