The Islands (Alston Shingles), River South Tyne, Cumbria

[NY 716 441]–[NY 716 454]

Highlights

This is an important locality for the study of river channel planform change and terrace formation associated with mining activity and a series of major flood events in the 19th century. In addition, late 19th to early 20th century age river terraces, severely polluted by heavy metals, provide a habitat for rare metallophyte plants.

Introduction

The Islands (Alston Shingles) is one of a series of historical alluvial sedimentation zones (*sensu* Church, 1983) in the upper and middle reaches of the South Tyne basin that have experienced lateral and vertical channel instability coincident with mid- to late 19th century metal mining (Macklin and Lewin, 1989; Passmore *et al.,* 1993; Macklin *et al.,* in press). Deposition and reworking of metalliferous mine waste conditioned floodplain sedimentation and channel change, as well as riparian vegetation development (Macklin and Smith, 1990), particularly of a group of metal-tolerant plants that grow mainly on floodplain sites contaminated by heavy metals (Richards *et al.,* 1989). The importance of this site in terms of conservation is considerably enhanced by a combination of landscape and floristic elements that are of both geomorphological and botanical interest.

Description

The Islands site on the River South Tyne is located 1 km south of Alston. It is a relatively large alluvial basin (1.3 km long and between 150 and 250 m wide), in which most of the valley floor dates from the mid-19th century. Preserved on the valley floor adjacent to Scalebank farm (Figures (Figure 5.1) and (Figure 5.11)) are a series of gravel bar forms typical of those found in a multi-channel, braided river system (Figure 5.12). Trace metal analysis of fine sediment incorporated within these bars (Figure 5.11) shows them to be severely contaminated by lead (3750–4500 $mgkg^{-1}$) and zinc (6750–36 350 $mgkg^{-1}$). However, they do provide the habitat for uncommon metallophyte plant communities that include species such as *Thlaspi alpestre* and *Minuartia verna* (Richards *et al.,* 1989). The source of these metals is a large number of disused lead mines in the upper South Tyne and Black Burn catchments. Lichenometric-based age estimates of these bars show them to date from 1872–1907 (Figure 5.11), with no met-allophyte plants recorded on older or younger deposits at the site (Macklin and Smith, 1990).

Serial historical maps and aerial photographs over the period 1860–1975 show a complicated pattern of channel change (Figure 5.13). In the middle 19th century the River South Tyne at the Islands reach was a single-thread channel of comparatively low sinuosity, with side, point and mid-channel bars. By 1898, however, this was replaced by a multi-channel river that divided around large (200–300 m in length), lozenge-shaped bar complexes. The western channel, into which Brown Ghyll presently drains ((Figure 5.13); first shown on the 1898 map), appears to have been formed by an avulsion across the floodplain some time between 1862 and 1874 (lichenometric age estimates).

Channel transformation occurred during a period of valley floor incision (Figure 5.14) that had begun some time before the mid-19th century. The height of bed material sedimentation decreased rapidly in the late 19th century, to a level approaching that of the present channel. Since the turn of the century, construction of bank protection structures in the upstream part of the reach, and further bed incision, have prevented the western anabranch from being re-occupied (Figure 5.11). The present channel is similar in form to that of 1860, but has significantly less active gravel and is of lower sinuosity.

Coarse-grained alluvium deposited in the 19th and early 20th centuries is inset into two older valley fills. The youngest lies between 3 and 4.5 m above the present river bed level, and comparatively high lead concentrations in sediments

within the upper part of this unit suggest it was deposited, at least in part, during mining times. Both this alluvial terrace and the historical floodplain are confined by extensive glaciofluvial deposits that form a prominent terrace *c.* 10 m above the present river bed.

Interpretation

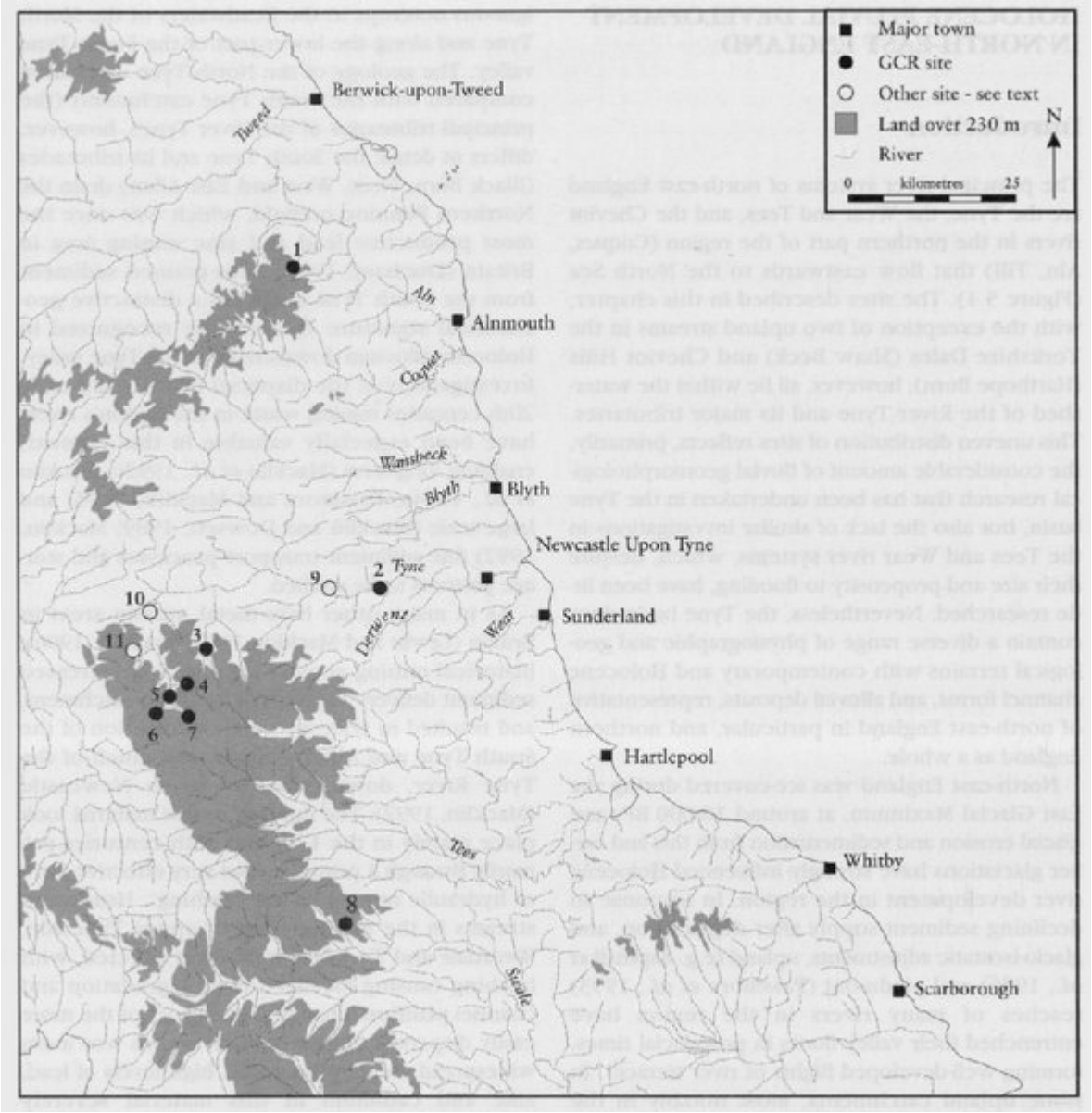
The Islands site illustrates many of the alluvial land-forms and sediments that characterize mining-related river transformation within a series of alluvial basins (sedimentation zones) in the South Tyne valley, all of which have experienced high rates of lateral and vertical channel erosion over the past 100 years or so (Macklin and Lewin, 1989; Passmore *et* al., 1993; Macklin *et al.,* in press). Detailed lichenometric dating, in conjunction with trace metal analysis of alluvial sediments, allows the intimate relationship between metal mining and floodplain sedimentation to be elucidated. Historical river planform metamorphosis of this kind, with the exception of the metal mining areas of Mid-Wales (Lewin, *et al.,* 1983), has not been documented outside the Northern Pennines.

Many rivers in the Northern Pennines appear to be close to a channel stability threshold. An increase in sediment supplied to the valley floor during mining times, as well as changed flood frequency and magnitude in the latter part of the 19th century (Macklin and Lewin 1989; Rumsby and Macklin, 1994), together induced river metamorphosis. Following the closure of mines shortly before World War Two, the South Tyne and most of its tributaries affected by historical mining (Black Burn and Rivers Nent, West and East Allen) have incised through mining age alluvium which now forms a terrace 1.5–2.5 m above the present channel, on the surface of which braided palaeochannel traces are common. This comparatively brief but well documented episode of mining-related alluviation in the Northern Pennines, well illustrated by the Islands reach of the River South Tyne, may provide a useful analogue for terrace formation processes in other coarse-grained fluvial systems.

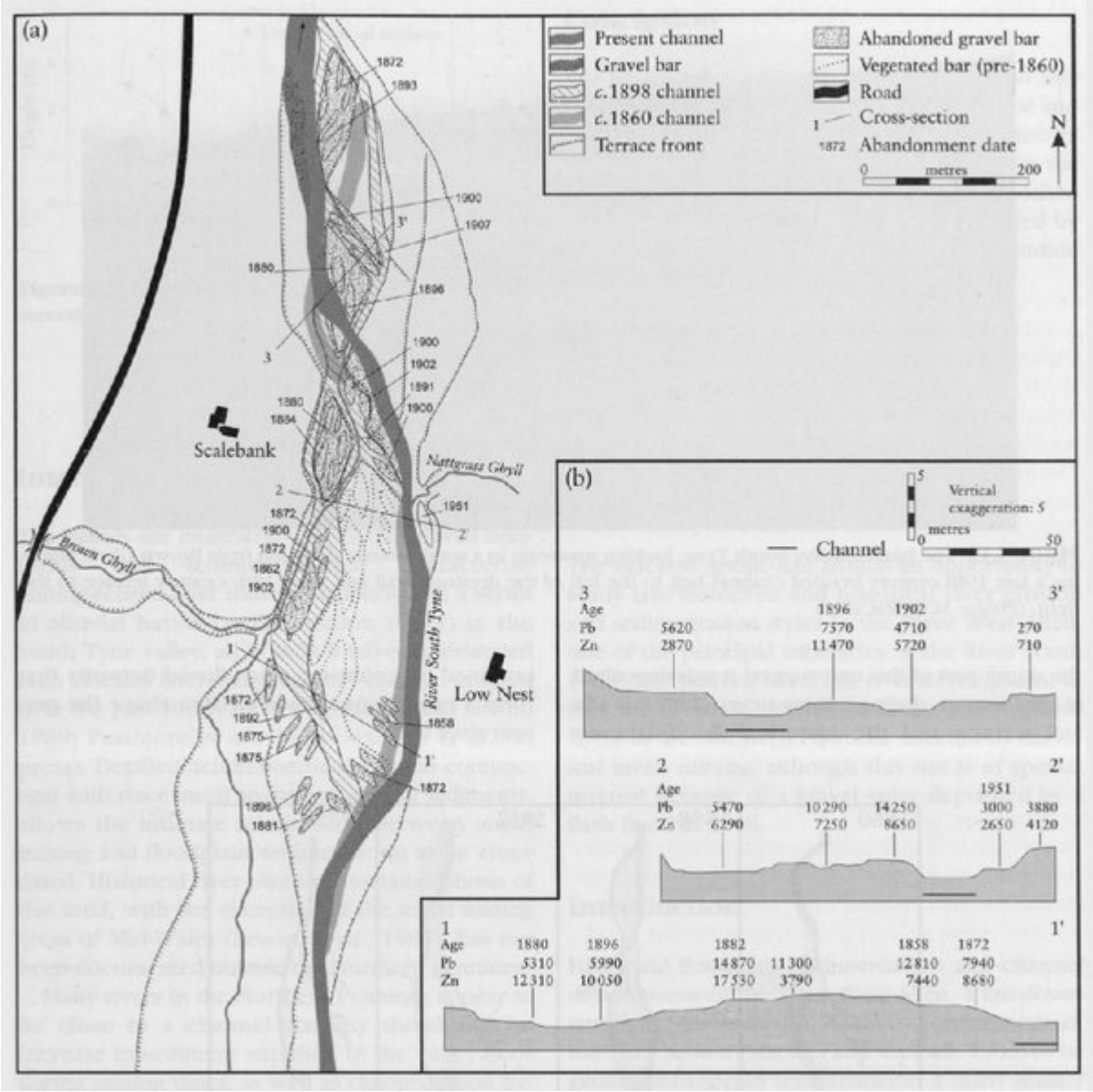
Conclusion

The Islands reach of the River South Tyne is an alluvial basin that experienced accelerated lateral and vertical channel instability associated with historical metal mining and altered flood regimes at the end of the 19th century. Alluvial gravels deposited during this period are severely contaminated by heavy metals, but provide a habitat for uncommon metallophyte plants.

References

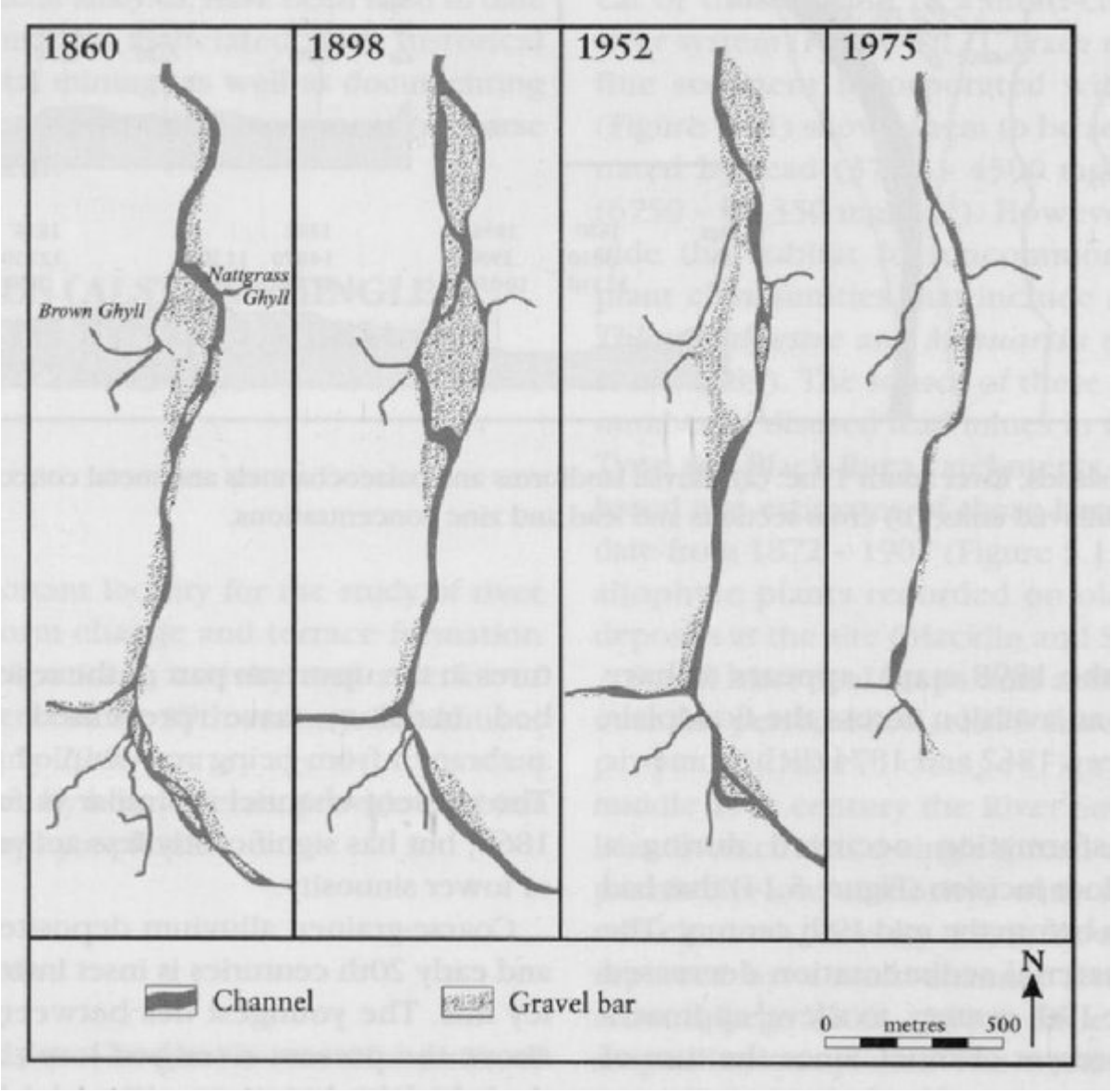


(Figure 5.1) The major river systems and relief of north-east England. GCR Sites: 1 Harthope Bum; 2 Low Prudhoe; 3 Blackett Bridge; 4 Blagill; 5 The Islands, (Alston Shingles); 6 Black Burn; 7 Garrigill; 8 Shaw Beck. Other sites descibed in the text: 9 Farnley Haughs; 10 Lambley; 11 Thinhope Burn.

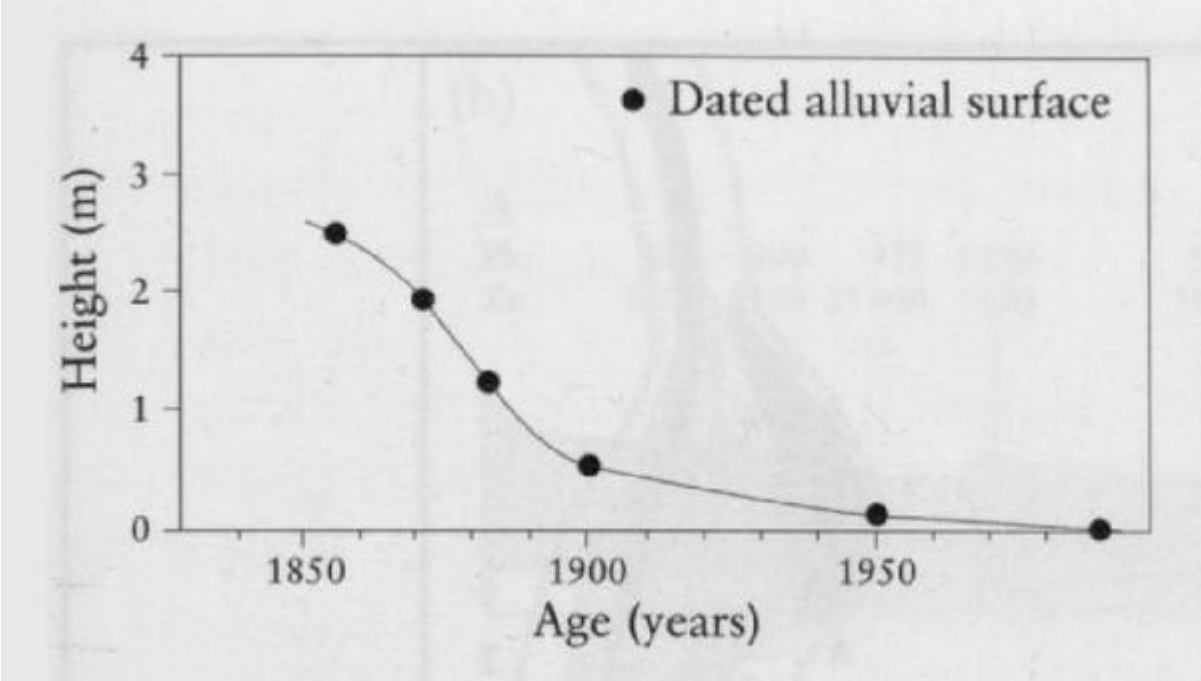


(Figure 5.11) The Islands, River South Tyne: (a) alluvial landforms and palaeochannels and metal concentrations in historical and earlier alluvial units; (b) cross-sections and lead and zinc concentrations.

(Figure 5.12) The Islands, River South Tyne, looking upstream in a southeasterly direction from Brown Ghyll, showing a late 19th century braided channel belt to the left of the drystone wall and a pre-19th century terrace to the right. (Photo: M.G. Macklin.)



(Figure 5.13) Channel change at the Islands, River South Tyne, 1860–1975. (After Macklin and Lewin, 1989.)



(Figure 5.14) Changes in the height of bed material sedimentation at the Islands, 1858–1987.