Geology of Shrewsbury

Talk by David Pannet & Stewart Sutton - November 13th 2002

The geology of Shrewsbury is not just an academic curiosity but is of great practical concern for builders and the current designers of flood defences. Thanks to numerous boreholes seeking suitable foundations we can seek to understand the complex situation beneath the surface.

The Severn illustrates a common problem of landscape interpretation: school textbooks tend to discuss the work of water, ice and the sea as separate chapters. In reality, however, our rivers owe so much to their 'Pleistocene Inheritance', in which glacial and periglacial processes moulded their upper reaches, while fluctuating sea levels affected their mouths. It is therefore important to look at that glacial environment as illustrated by surviving glaciers and ice-sheets. Older textbooks presented a picture of clear retreating ice fronts leaving moraines and outwash deposits, but in reality the situation is more complex: meltwater streams flow in and under ice before emerging as ready made rivers, while beyond the present snout masses of stagnant dirty ice may lay abandoned influencing drainage and deforming the surface during melting.

With these thoughts in mind we can look at the very complex pattern shown by the published geological map of Shrewsbury and recognise the deposits and shapes related to the river, ice and solid rock respectively.

The river flows in an incised meandering valley whose meander geometry reflects larger flows of a meltwater river rather than the present regime. The manner in which it appears to have been superimposed across both deep drift and upstanding ridges of solid rock suggest some role played by stagnant ice. The gravel bed of the original river still forms low terraces on the inside of the great bends and underlies both the later silty floodplain and post glacial shrunken channel. The 'Old River Bed', cut off about 5,000 years ago shows that these typical features had already formed by this time, since when only minor changes have taken place. In this context such a 'cut-off' should not have occurred and can only be explained by the fortunate location of soft sands and a glacially deformed surface around the former neck which made change easy.

The glacial and fluvio-glacial deposits have three components: a general spread of boulder clay draped like a blanket over the undulating rock surface; a belt of sand and gravel running NW to SE filling a deep channel or trench; extensive terraces of outwash gravel spreading from the Rea Brook Valley into the Severn Valley and forming a sort of staircase recording cycles of deepening and infilling within the valley leading to its present shape.

The buried channel or trench is of particular interest, as it descends to sea level under the town and then rises eastwards to emerge as the Ironbridge Gorge. Such a situation is by no means unique, as similar channels have been found to underlie Central Scotland and the North German Plain where they have been appreciated as aquifers. They must have been eroded by water flowing under pressure beneath a thick ice sheet rather like the larger cave systems in limestone. As ice thinned more infilling would take place, both sand and locally some cake clay. Ice also fell in only to melt later to create kettle holes. Although out of sight, the trench has a profound influence on central Shrewsbury: the Darwin Centre must stand on 30m piles while High Street and Princes Street are built around a peat filled 'kettle hole'.

For most of the time ice reached Shrewsbury from the Irish Sea bringing characteristic Scottish erratics such as the 'Bell Stone'. As this ice stagnated however it was overridden by a surging Severn Valley glacier from the west. Perhaps for this reason a hummocky boulder clay plain dominates the landscape upstream in contrast to the wide smooth spreads of outwash downstream. Such differences have influenced many details of suburban development as inhabitants of Copthorne and Monkmoor know.

Beneath all this material, and exposed only around Kingsland and Belvidere lie red sandstones, conglomerates and marls of the Keele Beds, of Upper Carboniferous/Permian age. Harder beds were exploited in the Middle Ages for building stone so that there are many opportunities for us to appreciate its varied 'semidesert flash flood' lithology.

At this very moment engineers designing and building flood defences at Frankwell must face up to the problems caused by all this mixture of material, especially in the way it influences groundwater. Building a wall along the river bank would be relatively easy, but as experience shows, it is water coming up through the underlying gravel which must also be dealt with. The resulting wall is therefore made of sheet piling descending over 5 meters down through the gravel into the underlaying fluvio-glacial deposits. These also transmit groundwater but tests have shown that there are sufficient fines in the sand to slow this flow to manageable proportions. By contrast, the porosity of the gravel is such that every possible gap must be plugged, however difficult it may be to insert piles around buildings, the Welsh Bridge and essential services. Fortunately the ends of the wall reach around 'inland' to reach higher ground beyond the floodplain where they cannot be easily overflanked.

If all goes well there could be a further political problem. People's expectations would then be raised but then disappointed by the sheer technical and financial problem posed by a similar scheme in Abbey Foregate.

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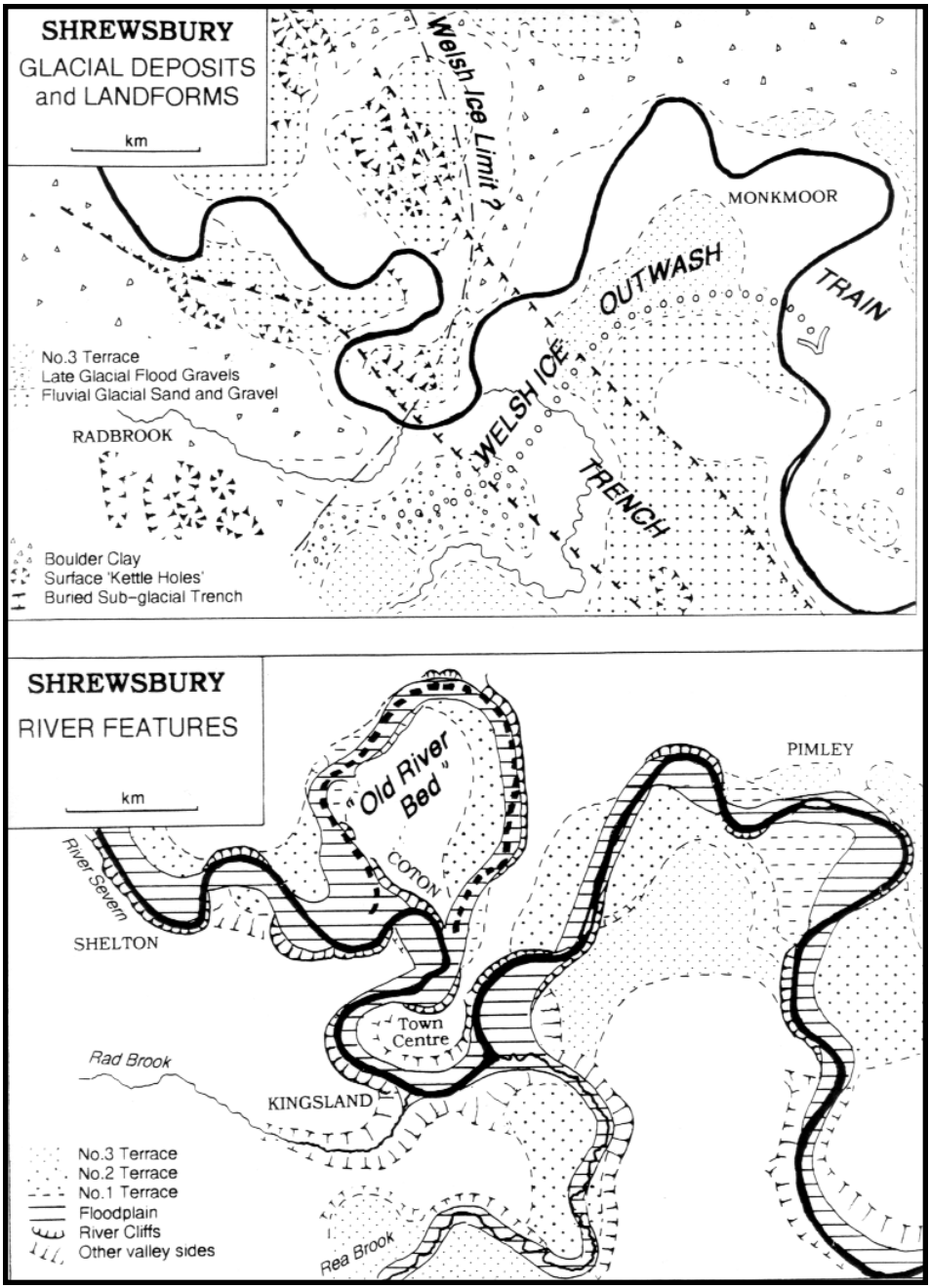
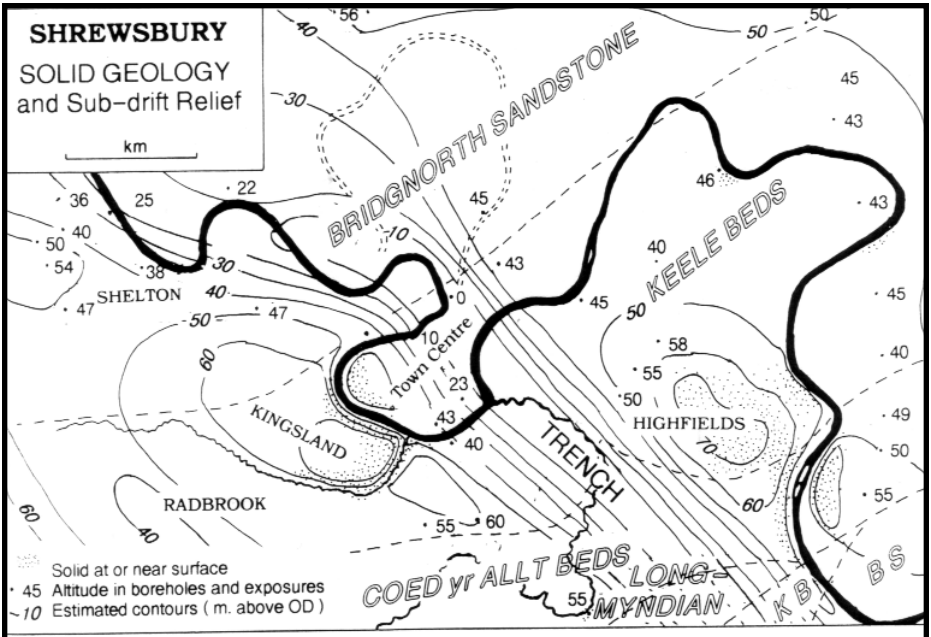
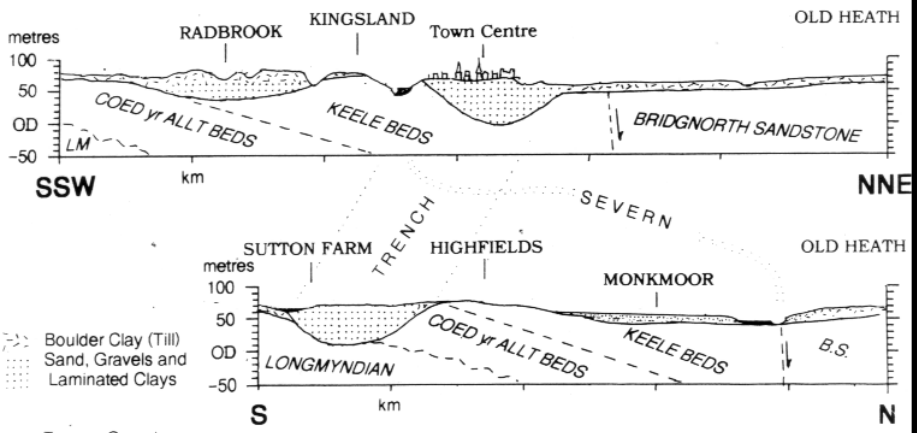

SHREWSBURY
GLACIAL DEPOSITS
and LANDFORMS
km
Welsh Ice Limit ?
MONKMOOR
OUTWASH
TRAIN
WELSH ICE
TRENCH
No.3 Terrace
Late Glacial Flood Gravels
Fluvial Glacial Sand and Gravel
RADBROOK
Boulder Clay
Surface 'Kettle Holes'
Buried Sub-glacial Trench
SHREWSBURY
RIVER FEATURES
km
"Old River Bed"
PIMLEY
River Severn
COTON
SHELTON
Town Centre
Rad Brook
KINGSLAND
Rea Brook
No.3 Terrace
No.2 Terrace
No.1 Terrace
Floodplain
River Cliffs
Other valley sides



SHREWSBURY Sections based on Geological Maps and Boreholes



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