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The Ice Age Legacy in North Shropshire

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PANNETT, D. (2008). The Ice Age Legacy in North Shropshire. *Proceedings of the Shropshire Geological Society*, **13**, 86–91. An 'arctic' landscape has been unveiled in North Shropshire by geologists, making it an ideal area in which to demonstrate the role of Ice Ages in the origin of our landscape.

The classification of glacial deposits on published geological maps is shown to have both helped and hindered subsequent research. Boreholes for mineral assessment, construction and groundwater studies have enlarged a picture once restricted to exposures in gravel pits and small river, road or rail cuts. Progress has been made by appreciating that glacial deposits are three dimensional systems produced in varied depositional environments. Patterns in the hidden surface of the bedrock are also revealed, as is the impact on local river systems. These aspects are discussed in relation to the evolution of theories concerning glacial lakes.

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BACKGROUND

Hidden beneath the 'green and pleasant' land of North Shropshire there lies an 'arctic' landscape born of harsher conditions now only seen in mountains and higher latitudes (Figure 1).

Figure 1. Crosemere: an arctic landscape produced by waning glacial ice – the meres of North Shropshire are lakes within kettle holes, hollows formed where large blocks of glacial ice remained stagnant whilst moraine continued to be deposited around their margins, the hollows being left when the ice finally melted.

Creationists still claim lack of (complete) knowledge as a reason for disbelieving all the evidence pertaining to the Ice Age, its origin and development. They would appear to prefer a biblically short timescale for the origins of the landscape, refuting the geoscientfic approach in favour of Robert Ord's theory (Ord & Coote, 1994) that Noah's Flood is the cause and conveniently ignoring the problem of low evaporation rates and consequential low precipitation in cold climatic conditions at a time of supposed heavy rainfall, quoting as defence Job **37**:10 and **38**:22.

Geologists will be the first to admit that there are still gaps in their understanding of the Ice Age, but the evidence is overwhelming in support of climatic deterioration for the past 2½ million years leading to cold climate geological processes worldwide. Initially, disbelief in the effectiveness or indeed the possibility of British glaciations during the early nineteenth century, e.g. Joshua Trimmer's paper (1834) which noted sea shells discovered within Shropshire's gravel pits – thought at the time to have been indicative of "a rush of sea" across the West Midlands, but now believed more likely to have been the result of being scraped from the Irish Sea floor by glacial ice.

The origin of the igneous Bell Stone in Shrewsbury was said to be a mystery at the time it was visited by the young Charles Darwin, but is now known to be a glacial erratic, probably from North Wales or the Lake District – indicative of extensive ice cover that had moved south for some considerable distance (Figure 2). However, early glacial ideas were dominated by experiences of visits to the Alps, with geologists trying to fit their observations to concepts evolved from study of processes and deposits in confined upland valley glaciers. It was not until much later that the concept of continental-wide glaciers on the scale of a Polar ice was extended to the British situation.

Since then, geologists have for nearly two hundred years been steadily discovering and

interpreting the region's complex features which could only have been produced by the actions of ice (Figures 3 and 4). Meanwhile farmers and builders have had to wrestle with various practical problems posed by the resulting deposits.

Shropshire has a wealth of glacial features, indeed textbook-quality examples abound. Important moraine systems exist across the north of the county, notably Ellesmere, Barr Hill, Ironbridge, and west of Shrewsbury. Irish Sea glacial ice interacted with glacial ice flowing across from North Wales, depositing moraines and outwash plain deposits. There are also overflow channels within the Shropshire Hills across cols that were not glaciated, with consequent impact on river diversions and leaving terraces stranded on the hill sides (Figure 5).

The classification of glacial deposits on published geological maps has both helped and hindered subsequent research. The Old Series Geological Survey mapping did not record the Quaternary deposits other than the river alluvium. The New Series paid more attention to what was formerly called 'Drift' but now known as 'Superficial Deposits', the products of the Ice Age. However, problems have arisen since the New Series did not distinguish between sands and gravels laid down by low lying rivers, terraces or moraines. The lack of correlation between topography and mapped deposits inhibited interpretation. It was not until John Shaw's studies (1972a, 1972b) that new theories evolved to satisfactorily explain the distribution of the Superficial deposits.

Figure 2. The Bell Stone, Shrewsbury – a glacial erratic derived from the Lake District which puzzled many at the time of the young Charles Darwin. Despite the notice on the wall above, this is not a granite; but it is igneous, probably a volcanic tuff from Snowdonia or the Lake District © Copyright 2007 David Pannett

GLACIAL HISTORY

The general setting of the Quaternary Period and its local impact, including the waxing and waning of glaciers across Shropshire, is described by Peter Toghill in his recent book *Geology of Shropshire* (2006).

Anglian ice must have passed this way half a million years or so ago but the succeeding Wolstonian cold period no doubt helped to remove much of the evidence. *[Although small fragments from the Anglian remain to the south, in North Herefordshire (Richards, 1998), it is not at all certain that Wolstonian ice as such came as far as the Welsh Marches, but the cold conditions would certainly have led to significant weathering by periglacial processes such as ice heave and solifluction – Ed.]* Subsequently Devensian ice encroached, just a few tens of thousands of years ago, both from Wales and the Irish Sea, and it is these ice sheets that were responsible for developing much of Shropshire's landscape as seen today.

The Devensian glacial period takes its name from the Roman name for Chester, in recognition of the clear evidence that is present across the North Shropshire-Cheshire Plain. The landscape of the Ellesmere area is one well known example. Lesser known is the Severn Valley itself, where a Welsh glacier has left a 'textbook' pattern of lake basins, moraines, outwash plains and river terraces, and even buried sub-glacial channels. The latter have particular implications for the development of Ironbridge Gorge.

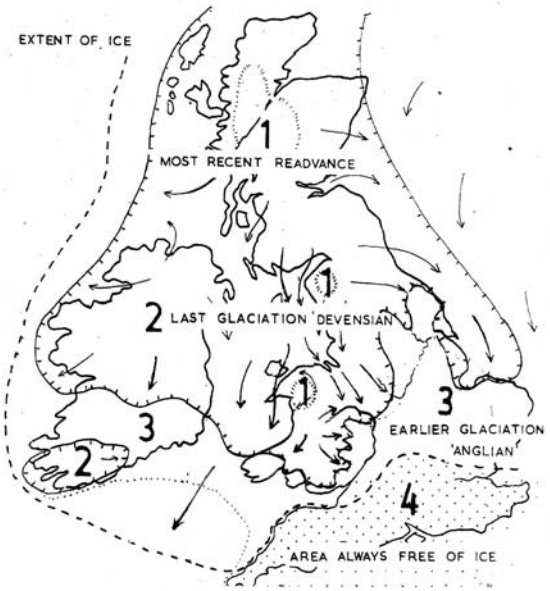

Figure 3. The location of Shropshire in relation to successive glaciations of the British Isles, the most recent being the Devensian). © Copyright 2007 David Pannett

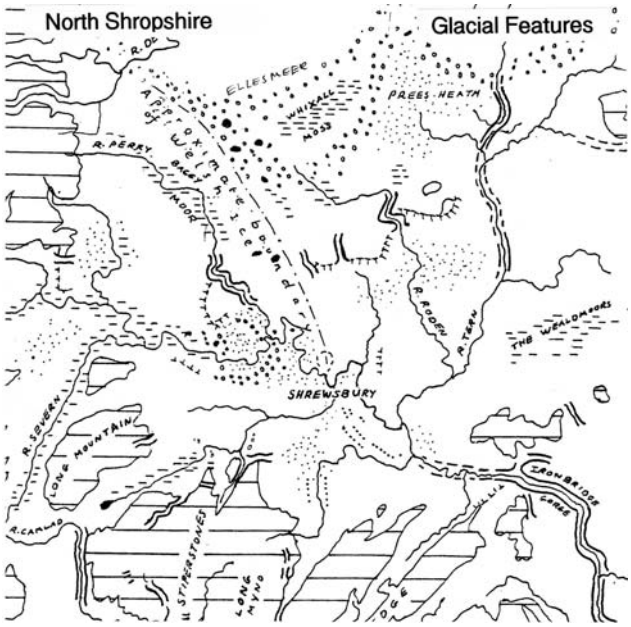

Figure 4. Glacial features in North Shropshire brought in during the Devensian. © Copyright 2007 David Pannett

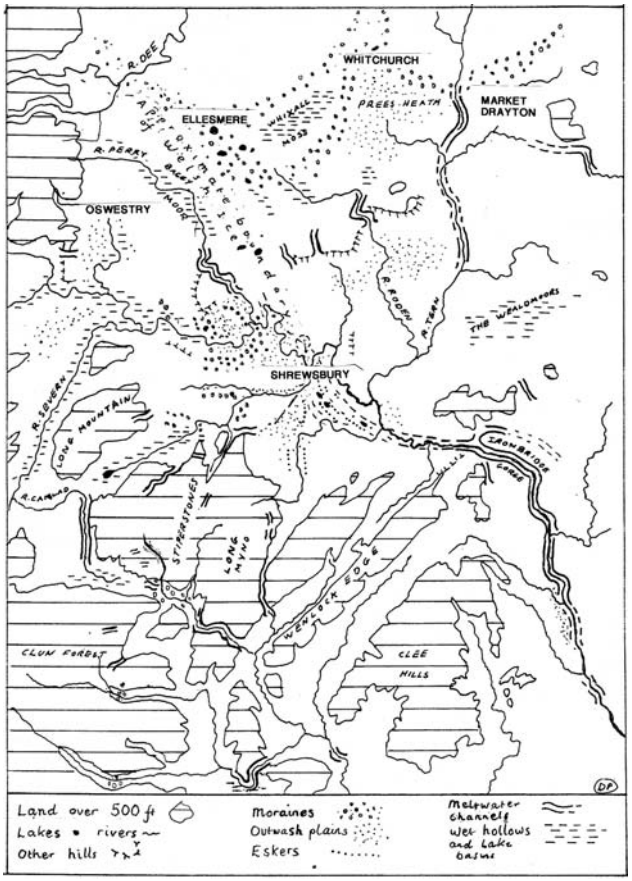

Figure 5. Glacial features across Shropshire, mostly of Devensian age. © Copyright 2007 David Pannett

GLACIAL LAKES ?

Local river systems, like so many in the country, are still dominated by their Pleistocene inheritance. One example of this, which captured the popular imagination in the early 20th century, was recognition of the unusual course of the River Severn. Based on evidence of shorelines around Newport at around 100 m AOD in the north of the county, E.E.L. Dixon of the Geological Survey of England & Wales (now the British Geological Survey) suggested a vast ice-dammed lake had filled up here (Dixon, 1920; 1921), later named "Lake Lapworth" by Leonard Wills (1924). This supposedly overflowed to form the Ironbridge Gorge and thereby establishing a new route for the river, southwards instead of northwards to the Dee Estuary as hitherto.

Although the "Lake Lapworth" model is associated with Wills, it was really the Geological Survey who promoted it, following contemporary ideas influenced by examples in North America. They subsequently extended the lake as far as Manchester in order to explain the distribution of Superficial Deposits that they had mapped, but this has shrunk considerably in recent years!

Above Ironbridge the Severn Valley is broad and gentle, has a bedrock floor, and gradients that are generally indicative of flow NW rather than SE, i.e. opposite to the present-day direction of surface water flow. It is still partially choked with Buildwas sands and gravels, upon which the river has developed a classic meander belt, for example at Leighton (Figure 6).

Figure 6. The open form of the Severn Valley immediately upstream from the Ironbridge Gorge, Leighton View, Buildwas, with a bedrock floor that is sloping west, towards the camera. © Copyright 2007 David Pannett

The origin of the valley at Leighton puzzled Wills as its rock floor appeared to slope west (Figure 7). It is now appreciated that it was the product of subglacial erosion and forms part of a network extending westwards to Shrewsbury and beyond where it lies buried and hidden from view. It is mainly filled with fine sand similar to that

surviving at Buildwas and is exploited in several pits (Figure 8). Shaw was able to demonstrate that most of this had been deposited to a base level similar to that of the present gorge while still in an ice-contact environment. This means there need not have been a Lake Lapworth.

Quarrying has also revealed small buried channels (Figure 9) while boreholes, especially for the Shropshire Groundwater Scheme, have clarified the extent of the network (Figure 10).

Figure 7. Fluvioglacial sands and gravels, Buildwas, revealing the remains of an infilled subglacial channel (which was initially a real puzzle). © Copyright 2007 David Pannett

Figure 8. Fluvioglacial sands and gravels, Shrewsbury, filling a subglacial channel. © Copyright 2007 David Pannett

Figure 9. Subglacial channel (centre, middle distance, and foreground) cut into the Uriconian bedrock, Leaton Quarry. © Copyright 2007 David Pannett

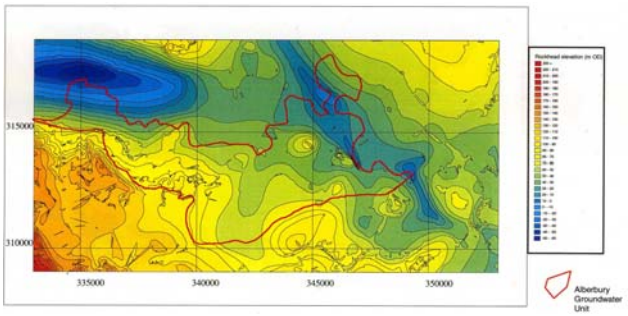

Figure 10. Elevation of the Bedrock surface around Shrewsbury (located centre right); blue is below present-day sea level. Taken from Bridge *et al.* (2001) and reproduced with permission of the BGS. (IPR/81-33c British Geological Survey © NERC 2008)

IMPACT ON LAND USAGE

At Shrewsbury there are practical implications arising from the network of subglacial erosion features. The River Severn loops around the town, incising its valley into both Superficial Deposits and Bedrock in such a way as to be explained by superimposition from stagnant ice (Figure 11).

Figure 11. The Severn meander through Shrewsbury celebrated at the same time as the author's birthday! © Copyright 2007 David Pannett

Beneath the Superficial Deposits under the town centre, the buried channel takes the bedrock down to almost sea level, requiring foundations for major buildings to employ very long piles (Figure 12).

Where valley sides in soft sand have been steepened by river erosion, slopes can become unstable (Figure 13).

The other bedrock hollow revealed in Figure 10 lies upstream of Shrewsbury, where the river meanders across a plain of alluvium above deep glacial lake clays. It exhibits a deep narrow channel almost devoid of gravel (Figure 14), so helping navigation of vessels, which managed to reach up river almost as far as Welshpool.

The meander pattern is now stable but locally, due to additional loads resulting from road building and construction of a stone wharf, some bank failures have occurred. The toes of such rotational slips have exposed the clays on occasion, as ramps have been pushed up through the river bed, as at Melverley (Figure 15).

From time to time, flood water is deep enough to temporarily bring the old "Glacial Lake Melverley" back to life (Figure 16).

Figure 12. Continuous flight auger being used to install a 30 m bored pile for a new building foundation in central Shrewsbury, over a buried channel. © Copyright 2007 David Pannett

Figure 13. The location of a substantial landslide on the north bank of the Severn in central Shrewsbury, induced by high groundwater pressure caused by flow through the sand of a buried channel. © Copyright 2007 David Pannett

Figure 14. The River Severn meandering across silt and clay filling a glacial lake basin, west of Shrewsbury. © Copyright 2007 David Pannett

Figure 15. Clay ramped up through the bed of the Severn by landsliding, Melverley, west of Shrewsbury. © Copyright 2007 David Pannett

Figure 16. The River Severn in flood, view from Breidden towards Llandrinio, west of Shrewsbury, so bringing the old "Glacial Lake Melverley" back to life. © Copyright 2007 David Pannett

Below Shrawardine, around Montford and Montford Bridge, the landscape changes to a pattern of arc-shaped moraines, outwash plains and kettle holes (Figure 17). Through this glacial landscape the river has incised large-wavelength valley meanders.

Figure 17. A sandur (outwash plain) with kettle holes, near Montford, North Shropshire. © Copyright 2007 David Pannett

CONCLUSIONS

The overview of glacial features in North Shropshire has revealed a rich variety. The value of the area lies not only in the opportunities it presents for fundamental research but also the evidence for a clear message to the layman about the significance of Ice Ages in the development of our landscape, at a time when consideration of climate change is to the fore.

ACKNOWLEDGEMENTS

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