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Field Meeting Report: The glacial geology of the Church Stretton Valley, led by Simon J Cook 18th June 2011

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ROSENBAUM, M.S. (2011). Field Meeting Report: The glacial geology of the Church Stretton Valley, led by Simon J Cook 18th June 2011. *Proceedings of the Shropshire Geological Society*, **16**, 44–50. The purpose of the field meeting was to introduce the variety of geological features outcropping within the Stretton Valley related to glaciation and glacier margins. The maximum extent of the late Devensian Ice Sheet brought glaciers into the Church Stretton Valley which have left excellent examples of deglacial and ice sheet stagnation terrain. Current questions concerning the glaciation relate to its extent within the Valley and its provenance, whether from the north, as part of the British-Irish Ice Sheet, or locally generated from snowfields up on the Longmynd, or even from the west, with Welsh Ice over-riding the plateau.

Even so, the considerable size of the Stretton Valley suggests that glacial erosion by any of the possible contenders alone is unlikely, and that either extensive erosion developed as a result of meltwater pouring from the glaciers or else river action prior to glaciation was in part responsible, possibly assisted by a much earlier (?Anglian) glaciation. However, the age of the V-shaped valley, although suggesting river erosion, may actually be much older still since Lower Palaeozoic sedimentary rocks mantle the Precambrian on the western side.

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HISTORICAL STUDIES

The earliest geological study of the glacial deposits within the Stretton Valley was undertaken by Edgar Cobbold, an engineer and Church Stretton resident more famously known for his detailed investigation of the Cambrian outcrop around Caer Caradoc and exemplary mapping of the Church Stretton fault zone. Two interesting photographs taken by Cobbold of sites no longer visible are available within the GeoScenic archive of the BGS (Figures 1 and 2) and the glacial studies described in volume 1 of his three part description of Church Stretton (Cobbold, 1900).

Systematic mapping in detail of the Quaternary deposits of the Valley had to await the 1950s and the work of the British Geological Survey pioneered by J.E. Wright published a decade later in the Church Stretton Sheet Memoir (Greig *et al.*, 1968) and the Soil Survey of England & Wales surveyed by D. Mackney and C.P. Burnham (Mackney & Burnham, 1964; 1966).

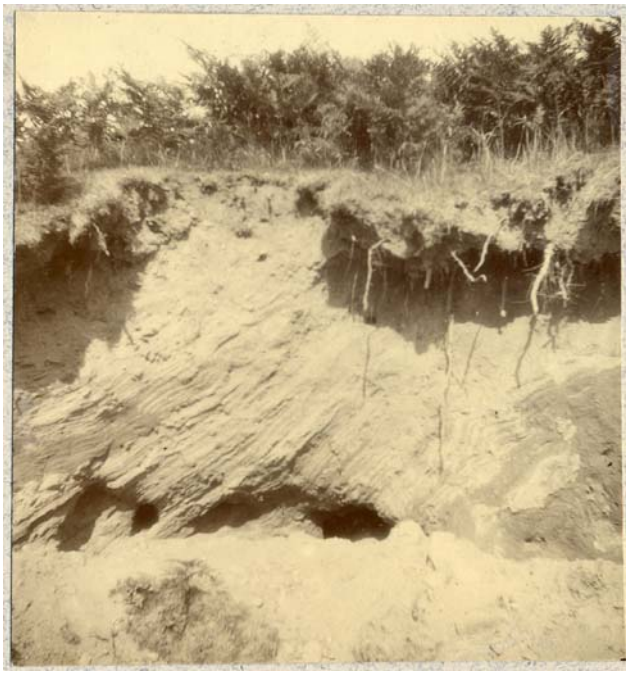

Figure 1: Sandy drift dipping steeply to the north-west. Sand-pit, west slope of Hazler, Church Stretton. [© Photograph from the British Geological Survey GeoScenic archive, photograph P237626 taken by E.S. Cobbold in 1898]

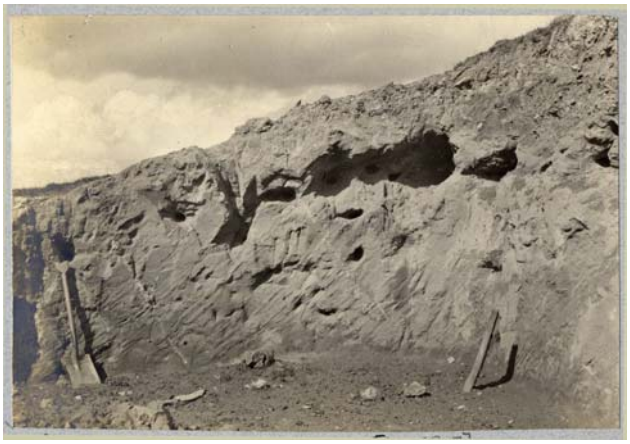

Figure 2. Small faults in drift sand covered by stony clay. 800 yd. NE of Church Stretton Station. [© Photograph from the British Geological Survey GeoScenic archive, photograph P245847 taken by E.S. Cobbold in 1905]

Academic interest was invigorated by T.H. Whitehead of Birmingham University, formerly a BGS surveyor, spurred by the excavation of a deep trench for the new sewage works south of Church Stretton from 1963 until 1965. Unfortunately Whitehead died too young to pursue these observations, but the work was continued by his research student Paul Rowlands under the supervision of Fred Shotton, the head of department and a respected authority on the glaciations of the Midlands (Rowlands & Shotton, 1971).

Opinions regarding the glacial evolution of the Valley were diverse, as indicated by the exchange of views expressed after the reading of Rowlands paper by Shotton at the Geological Society in 1971 and published at the end of their paper: the Survey favouring a more widespread Devensian glaciation and the Birmingham school a more significant component of pre-glacial fluvial development.

Four decades elapsed before renewed studies of the Devensian development of Stretton Valley, utilising remotely sensed imagery and digital elevation models as part of the BRITICE project (Chiverrell & Thomas, 2010). This work is ongoing, but promises useful correlation with detailed studies elsewhere (Hughes, 2008; Cook, 2010; G.S.P. Thomas, *in prep*.).

INTRODUCTION

The field excursion on June 18th, 2011, was led by Simon Cook of the Centre for Glaciology at Aberystwyth University, meeting at the car park on the eastern side of Church Stretton railway station [SO 4560 9355]. The purpose was to introduce the variety of geological features outcropping within the Stretton Valley related to glaciation and glacier margins, and was conducted entirely on foot utilising public rights of way.

The maximum extent of the late Devensian (~28 to 18 ka BP) Ice Sheet brought glaciers into the Church Stretton Valley which left excellent examples of deglacial and ice sheet stagnation terrain; and it experienced the coupling and uncoupling of two great independent ice masses just to the north: the Welsh Ice Cap and the Irish Sea Glacier (Thomas, 1989).

Current questions concerning the glaciation relate to its extent within the Valley and its provenance, whether from the north, as part of the British-Irish Ice Sheet, or locally generated from snowfields up on the Longmynd, or even from the west, with Welsh Ice over-riding the plateau.

The considerable size of the Stretton Valley suggests that glacial erosion by any of the possible contenders alone is unlikely, and that either extensive erosion developed as a result of meltwater pouring from the glacier or that river action prior to glaciation was in part responsible, possibly assisted by a much earlier (?Anglian) glaciation. However, the age of the V-shaped valley, although suggesting river erosion, may actually be much older still since the hillside corresponds with the Lower Palaeozoic sedimentary beds mantling the Precambrian on the western side, so this slope may even date back to the Silurian landscape (Peter Toghill, *pers. comm.*) (see also Toghill, 2011).

LOCALITY 1: Track across open ground by Coles Wood [SO 4555 9285]

The first stop was along the track constructed in 1900 through the open fields flanked by Coles Wood, some 150 m south of the houses constructed in 1990 that had exposed glacial till during excavation of their foundations, including one clast of granite (Peter Toghill, *pers. comm.*).

An essentially horizontal break in slope across the middle of this open ground was suggestive of a terrace. Small trackside exposures and sheep scrapes within this feature revealed fluvioglacial sediments containing clasts that were subrounded and faceted, the former suggesting water transport and erosion, the latter indicating scraping along the bed of a glacier. There was also a component

of local angular clasts that were likely to have been frost-shattered and washed down from the hillside above (Figure 3).

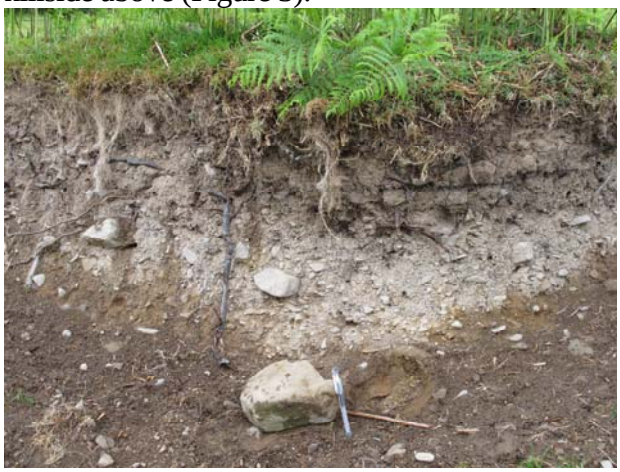

Figure 3: Range of shape shown by larger clasts within fluvioglacial sediment trackside exposure, Coles Wood. [© Michael Rosenbaum, 2011]

Discussion of possible origins converged on the concept of glacial ice marginal water creating localised lakes and streams within which debris accumulated, sluiced from the melting glacier. Other areas nearby show similar features, for example along the B4371 road between Ragleth and Helmeth Hills, towards Hope Bowdler [SJ 472 927], interpreted as a meltwater channel.

Greig *et al*. (1968) suggested that these gravel terraces owed their origin to deposition in an ice-marginal lake which overflowed and spilled through the col known as Sandford Seat, carving a meltwater channel south-east through Hope Bowdler and Ticklerton.

Rowlands & Shotton (1971) listed several arguments against this model. They argued that if these gravels had been deposited in an ice-marginal lake at an elevation of between ~230 to 250 m, then the glacier must have overridden nearby features at lower elevation, such as Allen's Coppice (west side of the valley at ~243 m elevation) and Brockhurst (in the valley bottom at ~216 m elevation). These features, however, show no signs of modification by ice.

Rowlands and Shotton argue also that the end moraine plastered on the southern end of Brockhurst contains sediments of different provenance to those of the gravel terraces on Ragleth Hill and Hazler Hill, so it is difficult to ascribe their origins to the same glacier of the same age.

Instead, Rowlands and Shotton suggested these terraces, and hence the meltwater channel at Sandford Seat, owed their origin to an older glaciation and that the Late Devensian glacier could not have penetrated further than Little Stretton. This contrasts with interpretations by Greig *et al*. (1968) and Wright (1968) who suggested that the glacier reached as far as Marshbrook.

LOCALITY 2: Southern summit of Ragleth Hill [SO 4510 9175]

The next stop was at the southern end of the ridge forming Ragleth Hill, at the ring of Ragleth Tuff blocks marking the summit. From here a magnificent vista of the landscape of South Shropshire could be appreciated.

Attention focussed on the distribution of hummocky terrain, a characteristic feature of glacial ice stagnation as blocks of ice became smothered by fluvioglacial sediments and left hollows when they eventually melted away. A clear example of such terrain lies NNW of the sewage works, SW of Little Stretton [SO 438 915]. Discussion also included an alternative mode of deposition, arising from ice thrusting as warm ice piled up against cold ice frozen to the ground. The subsequent ice buckling thrusts up sediment from the bottom of the ice: englacial thrusting. This could provide valuable evidence for the temperature and thermal regime of the ice, a fundamental parameter for deducing the glacial dynamics.

Comparable terrain is found in the vicinity of Botvyle Farm NE of Church Stretton [SO 476 962], in a similar ice marginal setting to the photograph taken by Cobbold (Figure 2).

The presence of hummocky topography in a deglaciated landscape could indicate ice wastage, or indeed the melt-out of englacial thrusts at the cold margin of a polythermal glacier (e.g. Hambrey *et al*., 1999).

Similarly, other landforms (including possible recessional moraines and meltwater channel terraces) have yet to be mapped and may provide further clues about the nature, age and extent of glaciation in the region (Figures 4b and 4c).

(a)

(b)

(c)

Figure 4: Geomorphological features of the Church Stretton valley: (a) Hummocky topography (possibly hummocky moraine) on the western valley side close to Little Stretton; (b) Bench or terrace (possibly a recessional or dump moraine) near to Little Stretton (photograph taken facing southwards down valley); (c) Possible meltwater channel terraces near Hope Bowdler. [Photographs by S.J. Cook]

LOCALITY 3: Longmynd Hotel and Hopes Wood [SO 449 935]

Following lunch, the group moved across to the western slope of the valley, behind the Longmynd Hotel. The lawn on the west side of the Hotel could be seen to be flat and horizontal, noted by Rowland and Shotton as being a remnant of the pre-glacial valley floor.

200 m down the track (Cunnery Road) the next stop was by a small exposure of Stretton Shale within Hopes Wood [SJ 447 934], exhibiting a thin cover of 'Head' deposits of frost shattered shale that had migrated downslope as a result of periglacial hill creep.

LOCALITY 4: The Owlets [SO 443 927]

Following the track south out of Hopes Wood, the open farmland of The Owlets enabled another sequence of prominent terraces to be examined (Figure 5), as well as providing a good distant view of those seen at Locality 1 below Ragleth Wood, across the valley.

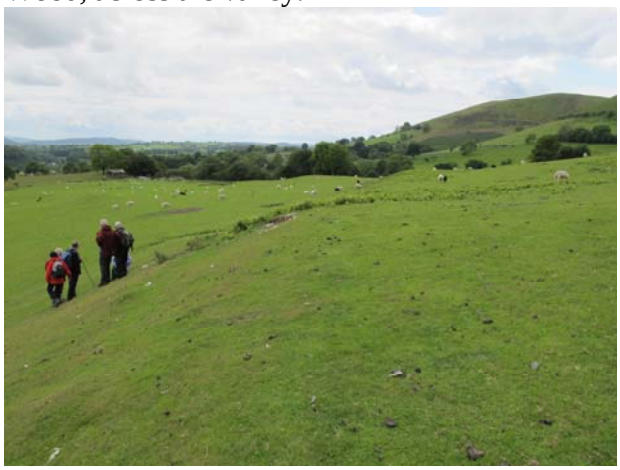

Figure 5: Terraces on the eastern side of Longmynd, looking south towards Ashes Hollow; The Owlets. [Photograph by Michael Rosenbaum, 2011]

The group discovered a number of exotic stones on the surface that could have come from the terrace sediments nearby, including: granite, tuff, and ignimbrite, all reminiscent of igneous rocks in the south-western part of the Lake District and therefore indicative of a provenance via the British-Irish Ice Sheet (Figure 6).

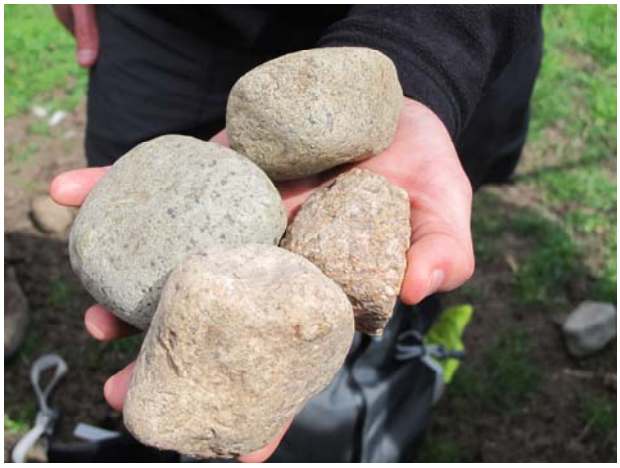

Figure 6: Four clasts of distant provenance from a terrace on the eastern side of Longmynd, The Owlets. Tuff on the left; ignimbrite at the back; granite on the right and at the front. [Photograph by Michael Rosenbaum, 2011]

There are further exposures within the Stretton Valley that portray the impact of the Devensian glaciation and, although not visited on this particular excursion, the details of three are now presented in order to assist the planning of future visits to the area.

LOCALITY 5: Marshbrook [SO 442 898]

The narrow valley of Marshbrook through which run the A49 trunk road and mainline railway has long thought to have been created by the outpouring of large volumes of meltwater from a glacier lodged within the Stretton Valley.

Sediment within the alluvium [SO 4435 8960] reveals many clasts that appear through shape and lithology to have been derived from glacial action, probably via fluvioglacial processes (Figure 7).

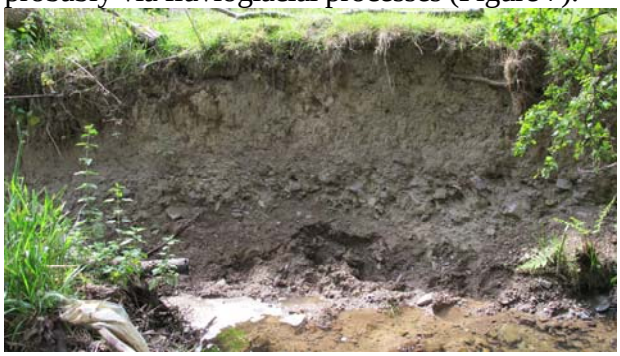

Figure 7: Alluvial clasts reflecting a glacial origin, south of Marshbrook. Strong clast imbrication indicating southward flow, to the left. [Photograph by Michael Rosenbaum, 2011]

A small tributary valley to the west, above Queensbatch Mill, exhibits a number of terraces that reveal similar sediment lithologies [SO 439 904] (Figures 8 and 9). These may be viewed from the two public footpaths that pass through the valley. Similar well pronounced terraces may be seen in the kilometre-long tract to the south, for instance south-west of Marshbrook [SO 442 895].

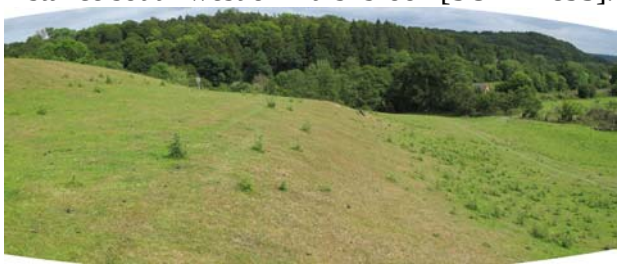

Figure 8: View looking east of terraces on south-facing side tributary valley running west from Queensbatch Mill, Marshbrook. [Photograph by Michael Rosenbaum, 2011]

Figure 9: Clasts within terrace on south-facing tributary valley running west from Queensbatch Mill, Marshbrook. [Photograph by Michael Rosenbaum, 2011]

LOCALITY 6: Brockhurst [SO 447 925]

Although direct public access to Brockhurst is not available along rights of way, this prominent hill forms a distinctive feature of the valley landscape south of Church Stretton and is readily viewed from both sides of the Stretton Valley.

There is no glacial till on Brockhurst but the southern flank of the hill is mantled with sands and gravels that the BGS surveyors in the 1950s believed were glacial till (Greig *et al*., 1968) but are now interpreted as fluvioglacial in origin (Cook, *pers. comm*., 2011).

LOCALITY 7: North of Church Stretton [SO 443 927]

The tract of valley floor north from Church Stretton and east of All Stretton exhibits an impressive display of hummocky ground characteristic of a stagnating glacier (Figure 10). Some of the geomorphological forms have the appearance of drumlins, although their presence would imply a more aggressive depositional environment beneath an advancing glacier, and

may thus be somewhat older than the main bulk of moraine to be seen.

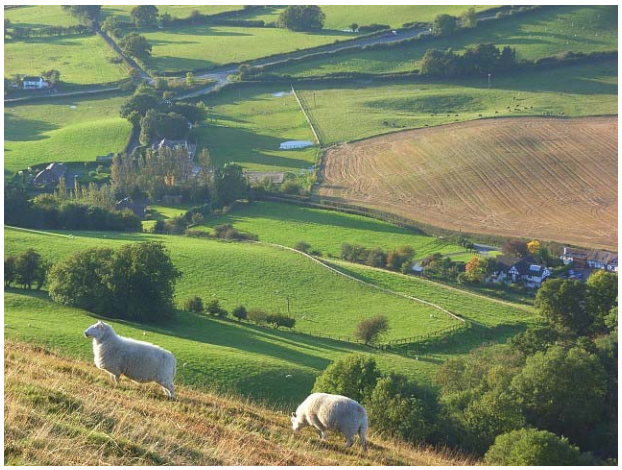

Figure 10: Hummocky ground developed on glacial moraine below (west of) Caer Caradoc, surrounding Botvyle Farm. [© Geograph photograph by Andrew Smith, 2010]

CONCLUDING REMARKS

There is still the problem of limited exposure of Late Quaternary sedimentary sequences in this part of Shropshire. Quarries and pits can be difficult to access, and many have closed or been backfilled since the early investigations of the area. Where sedimentary exposures can be found a renewed effort should be made to test previous interpretations of sediment origin and examine what these sediments tell us given advances in our understanding of glacial sedimentary processes and products since they were originally investigated.

At the moment the moraines (e.g. at Brockhurst and Botvyle) merely tell us that a glacier once stood at a particular position, but we know very little about whether such moraines represent glacier advance, retreat or stillstand, for example. Suitable sedimentary exposures may be key to our ability to reconstruct the extent and dynamics of former ice masses in the Stretton Valley. Advances in technologies such as OSL (Optically Stimulated Luminescence) dating allow the potential to date fluvioglacial sediments, although there are complications with applying this particular technique (e.g. Thrasher *et al.*, 2009).

ACKNOWLEDGEMENTS

The author would like to thank the leader and participants of the field excursion, all of whom made valuable contributions by their observations and searching questions throughout the day. Considerable use had been made of material contained within the leader's recent paper in the *Proceedings* (Cook, 2010).

The leader, Simon Cook, may be contacted at the Centre for Glaciology, Institute of Geography & Earth Sciences, Aberystwyth University, Ceredigion, SY23 3DB, UK. E-mail: smc@aber.ac.uk or basalice@gmail.com

Disclaimer - The information contained in this account has been prepared from notes taken during the field meeting. Its sole aim is to provide a record of what was seen and provide an insight into the diversity of glacial geology outcropping in the vicinity of Church Stretton. It should not be used for any other purpose or construed as permission or an invitation to visit the sites or localities mentioned.

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