Instructions to authors

*Quaternary Newsletter* is issued in February, June and October. Articles, reviews, notices of forthcoming meetings, news of personal and joint research projects etc. are invited and should be sent to the Editor. Closing dates for submission of copy (news, notices, reports etc.) for the relevant numbers are 1st January, 1st May and 1st September. These dates will be strictly adhered to in order to expedite publication. *Articles must be submitted at least 6 weeks before these dates in order to be reviewed and revised in time for the next issue of QN, otherwise they may appear in a subsequent issue.*

Suggested word limits are as follows: obituaries (2000 words); articles (3000 words); reports on meetings (2000 words); reports on QRA grants (500 words); reviews (1000 words); letters to the Editor (500 words); abstracts (500 words). Authors submitting work as Word documents that include figures must send separate copies of the figures in .eps or .jpg format. In case of the latter, a minimum resolution of 300 dpi is required for accurate reproduction. Quaternary Research Fund and New Researchers Award Scheme reports should limit themselves to describing the results and significance of the actual research funded by QRA grants. The suggested format for these reports is as follows: (1) background and rationale (including a summary of how the grant facilitated the research), (2) results, (3) significance, (4) acknowledgments (if applicable). The reports should not (1) detail the aims and objectives of affiliated and larger projects (e.g. PhD topics), (2) outline future research and (3) cite lengthy reference lists. No more than one figure per report is necessary. Recipients of awards who have written reports are encouraged to submit full-length articles on related or larger research projects.

*N.B:* Detailed guidelines on the formatting of contributions are now available via the QRA webpage and from the editor, including an EndNote style file to help with the formatting of bibliographies for submissions to *QN*


Cover Photograph
The complete skull of a brown bear (in situ, inverted) found in Antler Chamber, Uamh an Claonaite (see the article by Lawson et al. in this issue).
SANNSOUNCEMENT

QRA50: Top 50 UK Quaternary Sites Nomination Form

As part of the 50th year celebrations of the QRA, it seems fitting to highlight some of the key sites and localities that have been fundamental to our understanding of the Quaternary landscape around us.

Over 2014, we are looking to compile a list of the 50 most significant Quaternary sites within Britain as nominated by you, the QRA community. These top 50 sites will be published at the end of the year in the form of a QRA50 full colour booklet and ultimately as a web-based resource available through the QRA web site.

More information as well as downloadable nomination forms are available from www.qra50.org. Alternatively, please ensure that your nomination contains the following information:

· Nominator
· Address
· Email
· Site Name
· Grid Reference
· Photo title and credits
· Site Description (250 word limit not including key references)
· Key references that should be formatted following the Quaternary Newsletter guidelines (available on the QRA website or directly from the editor of QN, Sven Lukas: S.Lukas@qmul.ac.uk)

Any Quaternary site within Britain is eligible and you are welcome to submit more than one site if you have several favourites. Submissions should be accompanied by a photo if possible including any credits.

Please submit your nomination by 30 September 2014 either by post to (QRA50 c/o Dr Emrys Phillips, British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA) or electronically by email to: mytopsite@qra50.org.

If you have any questions, please contact either Barbara Silva (pollenbird@hotmail.com) or Emrys Phillips (erp@bgs.ac.uk).
...and if you need some inspiration, here is our first nominated site by Dr Emrys Phillips from the British Geological Survey.

Site Name: Overstrand, North Norfolk [National Grid reference TG 256 405]

Photo: Rafting of chalk bedrock at Overstrand on the North Norfolk coast (photograph taken by Emrys Phillips)

Overstrand is truly one of the classic sites in the UK for glacitectonic deformation within the Middle Pleistocene glacial sequence exposed on the north Norfolk coast, eastern England. Glacial rafts or ‘megablocks’ are dislocated slabs of bedrock and/or unconsolidated sedimentary strata that have been transported from their original position by glacial action. Such rafts are typically composed of relatively thin slabs of material that may have been transported over distances ranging from tens of metres to hundreds of kilometres. They generally occur as single, horizontal slab-like features, but may be stacked within conspicuous ice-pushed hills of various types. The section at Overstrand is dominated by a large raft comprising Cretaceous chalk bedrock overlain by pre-glacial marine sands and gravels of the Wroxham Crag. The raft is approximately 20-25 m thick and 100 m in length, and was detached, transported and finally emplaced by a major ice sheet flowing from the north, down the North Sea. The chalk and Wroxham Crag within the raft are deformed by a southerly verging anticline which occurs within the hanging-wall of a thrust forming the prominent detachment at the base of the raft. This southerly direct thrust and
the deformation associated with the emplacement of the raft are well exposed at the base of the cliff section.

References


ARTICLES

MIDDLE AND LATE DEVENSIAN RADIOCARBON DATES FROM THE UAMH AN CLAONAITE CAVE SYSTEM IN ASSYNT, NW SCOTLAND

Tim J. Lawson, Ivan R. Young, Andrew C. Kitchener and Steven Birch

Abstract

Faunal remains discovered in Scotland’s longest cave system in the Assynt area of NW Scotland have been dated to three time periods: to a Middle Devensian interstadial, to a period thought to be immediately before the build-up of the Late Devensian ice sheet, and to the Windermere Interstadial. The remains were later sealed in the caves by talus formation during the Loch Lomond Stadial.

Context and Location

In 1995 a chance discovery of an almost complete skeleton of a brown bear (*Ursus arctos*) was made by cave divers exploring the then farthest reaches of Uamh an Claonaite, Scotland’s longest cave. The inaccessibility of the site meant that this important find had to be left in situ until cavers from the Grampian Speleological Group eventually managed to break into this cave system after excavating their way into an adjoining cave, Rana Hole, in late 2007. The passage where the bear skeleton was found lies in a separate cave system some 20 metres below the well-known Creag nan Uamh Bone Caves (Figure 1). However, this cave also falls within the designated area of the Scheduled Ancient Monument as well as the Ben More SSSI and Allt nan Uamh GCR, so permission had to be sought from Historic Scotland and Scottish Natural Heritage before the bones could be brought to the surface; removal of the bones to the National Museum of Scotland occurred in 2008 when consent was granted. Subsequent exploration of the surrounding passages turned up a number of other locations where bone material was present. This was removed in May 2009. This article will describe these finds and report on radiocarbon dates obtained on five samples from the bones found.

The Bones

The bones were found in three separate locations (Figure 2): The main bear skeleton (disarticulated) was in Portobello Promenade, separate finds were located in Legless Highway, and a further concentration in Antler Chamber.
Figure 1. Section through the Creag nan Uamh showing the portion of Clonaite Seven where the bones were found, in relation to the position of Reindeer Cave.
Figure 2. Plan showing the location of the main bone finds.
Almost all of the large bones of the large adult brown bear (probably a male) were recovered (Figure 3). The smaller bones of the bear’s paws were under-represented but these may well have been washed away from the skeleton by subsequent water flow through the passage. Scattered remains were recovered from Legless Highway, including a rib, a vertebra and an ulna – all thought to represent brown bear, and the last-named indicating that we had a further individual present as both ulna bones were recovered at the main site up-passage. This last find was excavated from indurated deposits in the passage rather than from the surface like all the other finds in this area, indicating that this was likely to be emplaced some time before the main bear skeleton.

Figure 3. The brown bear remains retrieved from Portobello Promenade.

The bone remains found subsequently on or close to the surface of water-washed subangular gravel in Antler Chamber, and brought to the surface in May 2009, included the lower jaw of wild horse (Equus ferus), a rib and a broken long bone of an as yet unidentified species, several fragments of reindeer (Rangifer tarandus) antler together with an almost complete antler, in three pieces, a humerus of a brown bear and – perhaps the most striking find – the intact skull of another brown bear, the best-preserved so far found in Scotland (Figure 4).

How did the bones get into the cave?

Both the western end of Legless Highway and small crawl passages leading off Antler Chamber are blocked with clastic debris. Surveying of Claonaite Seven has shown these passages to be only several metres away from the surface of the Allt nan Uamh valley outside, although above the valley floor itself. The deposits at the back of Antler Chamber have angular and subangular clasts of the local dolostone mixed with erratic material, and would seem to be a mixture of till and talus from the overlying free face of Creag nan Uamh which can be seen to cover the valley sides. The skeleton of the bear found in Portobello Promenade, although disarticulated, was recovered from a very small area showing that the bear had either died at this site or its body washed
here before the soft tissues decayed. There is currently no known underground route from the current entrance of Uamh an Claonaite (some 370 metres SSE of this location), nor from the Bone Caves 20 m above, of sufficient size for the bear to have entered Claonaite Seven from these directions prior to death. The only feasible solution is that animals were able to enter this cave from the Allt nan Uamh valley via an entrance or entrances now sealed off by talus. The rectilinear screes beneath Creag nan Uamh have been attributed to frost-shattering and gelifluction processes operating in the Loch Lomond Stadial (Ballantyne, 1995; Lawson, 1995).

Radiocarbon dating

Five samples were chosen for dating and submitted to SUERC at East Kilbride. The results are shown in Table 1.

As surmised from its provenance, the bear ulna from Legless Highway has proven to be much older than the bear skeleton in Portobello Promenade, and is currently the oldest dated specimen from a Scottish site. The close similarity of the dates obtained from Antler Chamber indicates a time when access into this lower cave was possible from the main Allt nan Uamh valley, before the caves were sealed by the formation of talus slopes beneath Creag nan Uamh free face; a Loch Lomond Stadial age for these is supported by the dates obtained.

Figure 4. The well-preserved brown bear skull from Antler Chamber.
Table 1. Table showing the results of the radiocarbon dating of selected samples

<table>
<thead>
<tr>
<th>Number</th>
<th>Description and location</th>
<th>Radiocarbon age BP</th>
<th>δ^{13}C</th>
<th>calibrated (IntCal13) dates BP</th>
<th>Calibrated dates BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUERC-25560</td>
<td>Bear rib, Portobello Promenade</td>
<td>23 650 ± 110</td>
<td>-14.3</td>
<td>27 750 ± 94</td>
<td>25,800 ± 94</td>
</tr>
<tr>
<td>SUERC-26398</td>
<td>Reindeer antler, Antler Chamber</td>
<td>12 110 ± 40</td>
<td>-19.4</td>
<td>13 996 ± 74</td>
<td>12 046 ± 74</td>
</tr>
<tr>
<td>SUERC-26399</td>
<td>Bear ulna, Legless Highway</td>
<td>45 000 ± 1000</td>
<td>-15.0</td>
<td>48 360 ± 1047</td>
<td>46 410 ± 1047</td>
</tr>
<tr>
<td>SUERC-26400</td>
<td>Bear humerus, Antler Chamber</td>
<td>11 625 ± 40</td>
<td>-15.7</td>
<td>13 451 ± 42</td>
<td>11 501 ± 42</td>
</tr>
<tr>
<td>SUERC-26401</td>
<td>Horse mandible, Antler Chamber</td>
<td>11 595 ± 40</td>
<td>-20.7</td>
<td>13 430 ± 43</td>
<td>11 480 ± 43</td>
</tr>
</tbody>
</table>

Conclusion

Five radiocarbon dates have been obtained from bones recovered from Claonaite Seven, part of Scotland’s longest cave system which extends beneath the well-known Creag nan Uamh Bone Caves that have yielded much bone material in the past. The dates group into three time periods: during a Middle Devensian interstadial c. 48 ka BP (c. 46 ka BC); another c. 27.8 ka BP (c. 25.8 ka BC), thought to be immediately prior to the build-up of the Late Devensian ice sheet in this part of Scotland; and c. 13.9-13.4 ka BP (c. 12.0-11.4 ka BC) which equates well with known dates for the Windermere Interstadial (Lawson, 2010). At these times cave entrances must have existed in the side of the Allt nan Uamh valley to allow access for animals into Claonaite Seven; these entrances were subsequently sealed by periglacial processes in the Loch Lomond Stadial. One can surmise that blocking and unblocking of these postulated cave entrances may have occurred on a number of occasions in the past, but since the Loch Lomond Stadial they have remained firmly sealed off from any external access. Brown bear remains have previously been found in other caves in this valley (Reindeer Cave, Bone Cave and Bear Cave; a radiocarbon date of 2673 ± 54 BP was obtained from a femur at the last site (Burleigh et al., 1976)). The additional finds of brown bear skeletal material from this area of Assynt suggests that these cave systems were important as hibernation and denning sites for more than 45,000 years.
Acknowledgements

The authors would like to thank Scottish Natural Heritage for a grant of money to pay for the five radiocarbon dates.

References


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THE USE OF TERRITORIAL GAMMA RADIATION COUNTS TO DISCRIMINATE BETWEEN HEAD AND PARENT MATERIALS AT CORTON, SUFFOLK

Alistair F. Pitty

Abstract
A year’s counts of terrestrial gamma radiation (TGR) of the Pleasure Gardens Till (PGT) are compared with those of unweathered Lowestoft Till (LT). Both have minimal temporal variations, and histograms of both counts are very similar. However, a clear difference in mean values invites reconsideration of the PGT as a so-called ‘flow till’, and its more general significance re-appraised.

Introduction
Field data of terrestrial gamma radiation (TGR) are suited to field studies of soils, soil-parent materials, sediments and regolith. Glacial tills illustrate this possibility well, since their characteristics “…are shared with a number of other deposits with which till is sometimes easily confused” (Flint, 1957, p.122). These include “…soil creep, earthflow, mudflow and landsliding”. Thus, colluvium, traditionally known within the British Isles as Head, is not easily distinguished from in situ parent materials in the field (for example, Edmonds et al., 1968, p.187; Jarvis, 1977, p.42; Worssam and Taylor, 1969, pp.124-5).

The present focus on seasonal changes is essential, as these are well-known in the continental interiors of Eurasia and North America (Bissell and Peck, 1973; Loijens, 1980; Carroll, 1981). Lowestoft Till (LT) was used as a test material because its clay mineralogy is predominantly mica (Perrin et al., 1973), of which potassium is an important constituent, with the isotope potassium-40 a major source of natural radioactivity. With radioactive distintegration in soils, micas can degrade in soils towards 2:1 swelling minerals (Markewich, et al., 1989), as observed during field work and sieving of micaceous sandy soils down hillslopes in North Carolina (Schuldenrein et al., 2004).

LT samples were recent detachments from the eroding cliffs at Corton (Banham, 1971), before further coastal-protection structures were installed. Loose clods of Pleasure Gardens Till (PGT diamicton) were also collected. Both have a similar parent material and mineralogy, come from the same location, and are of approximately the same age. However, the PGT has been interpreted as a ‘chalky flow-till’ (Banham, 1971), and is separated from the LT below by the laminated grey clays of the Oulton Beds (Figure 1). The LT and the PGT,
Figure 1. Simplified and schematic section of the sediments of the Anglian glaciation, which lie above and ‘Crag’ and other Pre-Anglian sands and gravels (based on McBridge and Hopson, 1985, Figure 3, p.132).
however, differ in two obvious respects. First, the LT covers large areas of eastern England, whereas the PGT is apparently restricted to the Corton cliffs. Secondly, unweathered LT is bluish grey, with small chalk clasts, whereas the PGT is yellowish brown, with chalky bands (compare Arthurton et al., 1994, Plate 8, p.56, with Plate 12, p.62).

**Application**

Natural gamma-ray logging is involved in routine subsurface method for identification of lithology (particularly ‘shaliness’), and for down-hole correlations for oil and gas exploration. Initial field measurements of radioactivity of soils and superficial sediments also date back to the 1940s (for example, Hoogteijling and Sizoo, 1948), but follow-up studies are infrequent and usually by air-borne surveys (for example, Carroll, 1981; Cook et al, 1996).

**Method**

TRG field data were acquired using a monitor, with a probe based on a Geiger-Müller tube (Burgess and Iles, 1980) designed specifically to measure the low, in-air levels of environmental gamma radiation (Green et al., 1988, pp.1-2; Quindós et al., 1994). In the present applications, the tube was initially placed on a bedrock shore platform (Pitty, 1990). For later measurements on soils, a shallow groove was chiselled with a geological hammer (for example, Pitty and Roberts, 1991), bringing the probe in contact with the soil throughout its length, but allowing air to circulate freely around it. A vertical surface can be similarly prepared for soil profiles, sediment stratigraphy, and archaeological excavations, with the probe firmly supported by plastic pegs.

For successive recordings, the probe must be placed in the same position. Therefore, a 120-litre PVC container was packed with large clods of unweathered Lowestoft Till (LT diamicton). TRG counting began in August 2001. For comparison, a second container was later packed with detached gravelly clay clods of PGT diamicton. A large number of counts has statistical advantages, so these are reported in counts per minute (cpm), over a 40-minute period.

**Seasonal changes**

The small temporal fluctuations in counts for the two test materials differed little, especially during the summer half of the year (Figure 2). There may be a slight peak in late summer. If so, this could be the effect of desiccation fissuring on gamma-rays release rates from the subsoil. Indeed, fissures can penetrate chalky clay till to a depth of 3 to 4 meters (Corbett, 1987, p.13).
Figure 2. Line graphs comparing the terrestrial gamma radiation (TGR), in counts per minute (cpm), for samples of Lowestoft Till and Pleasure Gardens Till, for 2001-2.

Data analysis

Descriptive statistics

Neither the means nor the standard deviations show significant departures from the ‘normal distribution’. The standard deviation describes the ‘spread’ of the distribution, and is needed for statistical tests for ‘normality’ of the distribution, or for the significance of differences between means (Snedecor, 1956). Non-significant values for skewness (asymmetry) are only listed for comparison with the occasional higher values in Table 1.

All values of kurtosis, whether positive (‘peaked’ and/or ‘long-tailed’) or negative (‘humped’), are listed to demonstrate how the first PGT count is clearly a statistical ‘outlier’, well-removed from the remainder of the sample. Probably, the cohesive LT diamicton, as a soil-parent material, behaves with the marked shrink-swell properties of a ‘vertisol’ (Blokhuis, 1996). In contrast, the more friable PGT diamicton is less cohesive, and the self-mulching of its smaller clods may have taken at least a month to become naturalised. Similarly, it takes a couple of months for the differences between the two means to become established in the 10-12 cpm range, which typify the remainder of the counts.

Frequency distributions

The histograms for the two samples (Figure 3) incorporate all the counts per minute (cpm) for the 21 monitoring sessions. Despite the difference of 9.9 cpm between the two means, the shapes of the two frequency distributions are remarkably similar. This coincidence is consistent with the well-established mineralogical similarity of the PGT diamicton with that of the LT (Bridge and Hopson, 1985; Arthurton et al., 1994).
Discussion

Seasonality

The minimal fluctuations of TGR (Figure 2) during the summer half of the year corresponds with earlier reports from a range of environments (e.g. Stranden, 1977, Ball et al., 1991, Shirav et al., 2000). Therefore, spot samples during this period should adequately represent mean figures for regions not affected by persistent and thick snow cover. Thus, useful mid-summer TGR data has
been collected in other climatic regimes, as on calcrete (‘nari’) in northern Jordan (Pitty, 2000) and in the continental interior of Russia, where the MAT is 3°C (Pitty, 1999).

**Mean counts**

The difference of 9.9 cpm in the mean values of the TGR counts (Figure 3) probably reflects an interlude of weathering and degradation of less resistant radiogenic minerals of the Lowestoft Till. This difference resembles LT soils on a traverse across mid-Norfolk (Pitty, in preparation), in which soil-surface TGR counts were compared with those from 30 cm depths. Of 20 profiles, half recorded an upward decrease in modes between 8.0 and 9.0 cpm. This suggests a period of soil formation lasting for some millennia, and that the PGT could be a colluvial regolith, derived from weathered LT, during such an interval.

**Colluvial till**

Colluvium is a universal, non-genetic term which describes poorly sorted, gravitationally transported material. It is synonymous the term Head, as originally coined in Cornwall nearly two centuries ago. In fact, “boulder clay Head” is widely recognised at plateau edges and on adjoining upper slopes in the dissected till landscape, just inland from Corton. Here, the *Ashley Series* soils are associated with gravitationally reworked Lowestoft Till. They are extensively mapped in the Beccles area (Corbett and Tatler, 1970, p.17) and also on the borders of the Boulder Clay Plateau, south-east of Newmarket (Hodge and Seale, 1966, p.51).

**Hypothetical palaeorelief**

The PGT has not been identified anywhere inland from Corton (Bridge and Hopson, 1985, p.141). Therefore, a Lowestoft Till upland must have existed, offshore in Anglian times, to account for the postulated westward colluviation of the PGT regolith (Figure 1). Probably, this ‘Lothingland Upland’ had “… undulating landforms similar to those preserved today”, with an early Flandrian coastline some 7 km east of its present position (Arthurton *et al*, 1994, Figure 52, p.87).

**Conclusion**

It seems that counts of natural terrestrial radiation (TGR) can characterise ground-surface materials in a single, reliable and reproducible number. Other advantages include being a field method, non-destructive, and with results immediately available on-site. The method has been employed in a geographical range of environments. Although primarily a study of method, its application to interpretations of local glacial stratigraphy is also demonstrated, as both the
LT and PGT test materials feature in the ‘type locality’ for the Anglian Stage (Mitchell et al., 1973). As tills are rarely superposed, the Corton succession appears to be an exception, with the so-called Pleasure Gardens Till being only of local importance (Ehlers et al., 1991, p.225). It is therefore useful to suggest that the PGT is a colluvial till, gravitationally derived from weathered LT. Notably, other ‘tills’ have been similarly re-interpreted, like the ‘Upper Till’ at California Gap (Hopson and Bridge, 1987), which is now “regarded as weathered till on lithological grounds” (Arthurton et al., 1994, p.47).
For soil surveyors, pods of colluvium below the edges Lowestoft Till uplands are widely associated with soils of the Ashley Series, which it otherwise closely resembles. Admittedly, the Pleasure Gardens colluvial till is thicker than most colluvial lobes but, in boreholes for the local Geological Memoir, similar head thicknesses up to 3.5 m have been encountered. Colluvial veneers are also common, a metre or so thick (Arthurton et al., 1994, 70). Such soils and colluvial features are widely observed on sloping ground, and encountered on valley floors, throughout the dissected till landscapes of East Anglia. Therefore, the Pleasure Gardens colluvial till, although localised, may have a regional significance as extensive as that of the sheet and plateau of the Lowestoft Till itself.

Acknowledgements

I’m indebted to Dr Joe Schuldenrein (Geoarchaeology Research Associates, New York), for invitations to join several of his field-work projects, and to Dr P.G. Hoare for an introduction to the Corton cliffs, whilst a visiting lecturer in Applied Sciences at Anglia Ruskin University, Cambridge. As a former Senior Research Associate in ENV, I’m also grateful for continuing access to the UEA Library. Dr Clare Boston invaluably suggested restructuring of a first draft of the text.

References


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GLWG 14: THE CHESHIRE-SHROPSHIRE LOWLANDS,
25th – 27th OCTOBER, 2013

THE GLACIATION OF THE CHESHIRE-SHROPSHIRE
LOWLANDS AND ADJACENT AREAS
THE 14TH GLACIAL LANDSYSTEMS WORKING GROUP (GLWG)

Introduction

This year the Glacial Landsystems Working Group (GLWG) assembled in the Cheshire-Shropshire Lowlands, an area which is currently the focus of a large-scale geomorphological mapping and dating programme contributing to Transect 3 of the NERC BRITICE-CHRONO research consortium. The Cheshire-Shropshire Lowlands would have experienced the maximum extent of the British-Irish Ice Sheet in the West Midlands during the Late Devensian (~28 – 18 ka BP: Chiverrell and Thomas, 2010). The purpose of GLWG 14 was to examine the sediment-landform assemblages resulting from the advance, coalescence and subsequent uncoupling of the Late Devensian Irish Sea ice lobe and the Welsh icecap. The trip, led by Geoff Thomas and co-convened by Richard Chiverrell and Matt Burke (both University of Liverpool), stimulated 1.5 days of dynamic, informal discussion between the 40 or so participants which comprised a good mix of regular GLWGers, local enthusiasts and first-time GLWG attendees.

Friday 25th October

On Friday 25th October the GLWG 14 participants travelled from all corners of the UK to gather at the Field Studies Council’s Preston Montford Field Centre, with the intention of a 1930 hrs introductory lecture. In traditional GLWG style (as we’ve been informed) the meeting commenced somewhat later than originally planned owing to travel delays, with the introductory talk from Geoff Thomas and Richard Chiverrell beginning at 2030 hrs. With the GLWGers eager to make their way to the bar, the talk was kept brief but provided the participants with details of the methodology used in mapping the geomorphology of the area, the sediment-landform assemblages that would be examined over the course of the weekend and the rationale behind the BRITICE-CHRONO sampling sites.
Saturday 26th October: Glaciation at the maximum of the Midlands lobe

Site 1: Glacial Lake Melverley, Preston Montford

The first morning began with a gentle stroll to a nearby exposure on the banks of the River Severn (SJ 432143). Here varved sediments are purported to provide evidence for an expansive proglacial lake referred to as Glacial Lake Melverley, with Geoff Thomas suggesting that Jökulsárlón, SE Iceland represents a good modern analogue for the former glacial lake. Indeed, an illustration produced by David Pannett depicting Glacial Lake Melverley displays remarkable resemblance to Jökulsárlón. Discussion arose regarding the interpretation of the diamict at the base of the sediment sequence: it was suggested that it may represent debris flows, the implication being that the glacial lake would have been less extensive than hitherto proposed.

Site 2: Condover Quarry, Condover

Following a short shopping spree for lunch supplies at a local Sainsbury’s superstore, the GLWG party moved on to Condover Quarry (SJ 495075), where we were joined by James Scourse (Bangor University). The quarry is situated in a landscape dominated by eskers, kames and kettle-hole basins, and is famous for its woolly mammoth (Mammuthus primigenius (Blumentbach)) remains: James Scourse recounted the discovery of the mammoth remains and described their stratigraphic context. For further details the group were referred to Scourse et al. (2009).

Sedimentary sequences exposed in Condover Quarry show stacked cycles with massive gravel bars (Gm) passing rapidly upwards into parallel-laminated sands (Sh), cross-bedded troughs (Gt and SP) and eroded diamicts (Dm). The sedimentology is characteristic of rapid rise and fall in high-discharge floods adjacent to ice-margins. Sediment provenance is sandstones from the Cheshire-Shropshire Permo-Triass basin and from Lake District and Scottish sources. The exposures exhibit well-developed examples of folding and faulting which have been interpreted as evidence for ice-disintegration and in situ melt. However, discussion in the field considered the possibility that these features resulted from ice-overriding.

BRITICE-CHRONO has undertaken sampling for the purpose of optically-stimulated luminescence dating at this quarry site following a lithofacies approach (cf. Thrasher et al., 2009). Discussion arose amongst the group regarding the potential for bleaching, with Geoff Thomas expressing scepticism that OSL dating would be successful as a consequence of insufficient bleaching of grains.
Site 3: Bridgwalton Quarry, Bridgnorth

Following a pub stop, the GLWG party moved onto Bridgwalton Quarry (SO 686928) where the BRITICE-CHRONO project has logged a sequence of sands and gravels overlain by diamict. This sequence has been interpreted as an LGM ice-marginal trough sandur and has been subject to sampling for OSL dating following a lithofacies approach. It is anticipated that the ice was not in contact for an extended period: Richard Chiverrell proposed that the ice would have ‘side-swiped’ the valley. Unfortunately this quarry pit is now disused and has flooded, consequently GLWG were not able to view the section from which the OSL samples were obtained.

The quarry pit examined during the GLWG field meeting, not previously examined by BRITICE-CHRONO, displayed sediments indicative of a delta setting, specifically a well-developed sequence of foreset bedding (Figure 1). Some time was spent here identifying the relationships between a localised till deposit and the delta sediments, which appeared to show injection of till into sands and gravels. The quarry pit also displayed evidence of a thrust, having implications for supposed ice-flow direction: it was suggested that the ice mass may have wound back on itself, pinning in the delta.

Figure 1. A well-developed sequence of foreset bedding at Bridgwalton Quarry. (Photo: Dave Evans).
Site 4: Shrawardine Castle

The first day concluded with a short stop at Shrawardine Castle (SJ 394158) to view the arcuate moraines formed by the advance and subsequent retreat of the Welsh ice lobe in the Severn valley. David Pannett presented a schematic diagram of the former ice mass to the group, with discussion arising regarding the debris content of the ice mass.

Sunday 27th October: Retreat from the LGM limits

Site 1: Hawkstone Park

The GLWG party awoke to clear skies, ready for another day in the field. The first stop was at Hawkstone Park (SJ 577286), a picturesque woodland with cliffs, crags, caves and a series of monuments. The park contains a large Permo-Triassic escarpment which has been fretted by channels of varying scales of magnitude. These channels have been interpreted as meltwater channels by the BRITICE-CHRONO team. Discussion arose in the field as to whether or not these channels represented subglacial meltwater channels.

Further discussion arose in the field regarding terrestrial cosmogenic nuclide (TCN) dating, with GLWG concluding that the meltwater channels would have been unsuitable for TCN dating owing to their steep walls and the resulting shielding. Instead, the BRITICE-CHRONO team selected more precarious sites at the top of the escarpment. However, problems may arise with this particular sampling site owing to easily erodible lithology, thereby potentially giving anomalous age estimates.

Figure 2. GLWG 14 participants, Hawkstone Park. Missing from photo: David Pannett and Geoff Thomas. (Photo: Bethan Davies).
Following dynamic discussion regarding TCN dating, the GLWG party assembled for a group photo (Figure 2) before heading to the café for sustenance. Following this, a number of the GLWGers disappeared to begin their return journeys owing to the impending “hurricane”.

**Site 2: Wood Lane Quarry, Ellesmere**

The remainder of the GLWG party then proceeded to Wood Lane Quarry, passing through the ice-disintegration topography of Wrexham-Ellesmere-Whitchurch. Wood Lane Quarry (SJ 422325) is of historical significance as it was studied as part of John Shaw’s PhD. This research, later published in *Sedimentology* (Shaw, 1972), revolutionised glacial sedimentology in the UK.

The sedimentary sequence at Wood Lane Quarry consists of a series of cross-stratified gravels, laminated fines and rippled sands overlying till, interpreted as ice-marginal and ice-contact sediments in a trough sandur. Evident within the sequence are diamicts of differing provenance, interpreted by Richard Chiverrell as representing Welsh (?) and Irish diamicts. As with the abovementioned quarry sites, this site has been subjected to sampling for OSL dating as part of the BRITICE-CHRONO project following a lithofacies approach.

With GLWG party numbers dwindling and storm clouds drawing in, Richard Chiverrell decided the final site of the GLWG field meeting at Crose Mere, situated in the Ellesmere moraine complex (SJ 404348), would not be visited. Instead, Richard talked the group through a core of Lateglacial and deglacial sediments obtained from Crose Mere whilst at Wood Lane Quarry.

In summary, GLWG 14 stimulated interesting discussions regarding the sediment-landform assemblages resulting from Late Devensian glaciation of the Cheshire-Shropshire Lowlands. An excellent meeting and here’s looking forward to seeing everyone at GLWG 15 next year, perhaps to discuss the Pleistocene glaciation of Dartmoor?

**Acknowledgements**

Special thanks to Geoff Thomas, Richard Chiverrell (University of Liverpool) and Matt Burke (University of Liverpool) for excellent organisation, presentation and explanation throughout. Thanks are also due to James Scourse (Bangor University) and David Pannett for their contributions in the field, and to the staff at Preston Montford Field Centre for their hospitality. Finally, thanks are due to all those who provided vehicles to transport the GLWG participants between field sites.
References


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The 2014 QRA ADM (‘QRA@50’) was held at the Royal Geographical Society (RGS), London, on the 7–9 January, and was organised by Dan Charman (University of Exeter), James Scourse (Bangor University), Antony Long (Durham University), Danielle Schreve (Royal Holloway University of London), John Catt (University College London), Catherine Souch (RGS-IBG), Tom Hill (Natural History Museum), and Danni Pearce (University of Worcester). The meeting celebrated the 50th anniversary of the QRA, and was attended by more than 300 delegates. Oral presentations were given by invited speakers, and more than 120 posters were presented, covering 11 themes relating to the overarching topic of ‘Quaternary Revolutions’.

Day 1:

The meeting began with a session on ‘Causes of Climate change’ (Theme 1) and was introduced by Chronis Tzedakis (University College London), who considered the cyclical nature of Quaternary climate in a talk entitled ‘Towards a unified theory of Quaternary climate variability: the Heroic Age and the modern synthesis’. This was followed by Phil Jones (University of East Anglia), who gave a ‘recent’ perspective by considering ‘Causes of Climate Change over the last 500 years’, and demonstrated that no natural factors (volcanics, solar, etc.) can explain the current warming trend.

Following coffee and posters, attention turned to ‘Measuring Time’ (Theme 2), as John Lowe (Royal Holloway University of London) sadly without Mike Walker (University of Wales, Lampeter), spoke about ‘Measuring Quaternary time: a 50-year perspective’. This was followed by Christopher Bronk Ramsey (University of Oxford) who provided a short history of ‘Radiocarbon dating and its revolutions’; highlighting the importance of AMS and Bayesian modelling. Siwan Davies (Swansea University) presented the final talk of the session, ‘A little goes a long way: the emergence of tephrochronology’, and outlined the new role tephrochronology is playing in Quaternary science.

After some tasty ‘boxes of lunch’, Valerie Masson-Delmotte (LSCE, Gif-sur-Yvette) spoke about ‘Measuring and understanding climate change’ (Theme 3), and was followed by Danny McCarroll (Swansea University) who gave a thought-provoking (and some thought controversial) talk on ‘Measuring and understanding climate change: a brief retrospective’. These talks were
followed by a very lively discussion, often focused on William Ruddiman’s contentions about the onset of the ‘Anthropocene’.

The final session of the day focused on ‘Modelling the Earth System’ (Theme 4), with a talk by Paul Valdes (University of Bristol), who assessed ‘Palaeoclimate modelling: The past, present, and future’. This was followed by Sandy Harrison (Macquarie University & University of Reading), who spoke about ‘Modelling the Earth System: Challenges in using Observations for Model Evaluation’, and urged us not to underestimate the effort and collaboration required for data–model comparisons.

The day closed with drinks and reflections on earlier debates, with some discussing (and tweeting about) the current interglacial and its likely end…it could be a long one (50,000 years), according to Chronis Tzedakis.

Day 2:

Day two began with a session on ‘Ice Sheet Dynamics’ (Theme 5), as Geoff Boulton (University of Edinburgh) spoke about ‘Retrospect and prospect: understanding ice sheets ancient and modern’. This was followed by Richard Hindmarsh (British Antarctic Survey), who spoke about the remote sensing revolution in glaciology/palaeoglaciology. Over coffee, there was a dedicated poster session on ‘Ice Sheet Dynamics’, with many outlining recent work of the BRITICE-CHRONO consortium.

Following coffee, focus turned to ‘Sea Level in Time and Space’ (Theme 6), with a joint presentation by Ian Shennan (Durham University) and Roland Gehrels (University of York). For the subsequent discussion, the speakers were joined by James Scourse and Sarah Bradley to form a formidable and engaging panel. Over lunch, a dedicated poster session considered variations in Quaternary sea level in the UK, Iceland, Australia and elsewhere.

Afternoon talks focused on ‘The oceans’ (Theme 7), and began with the Wiley-Blackwell annual lecture for 2014 by Maureen Raymo (Lamont-Doherty Earth Observatory, Columbia University), who spoke about ‘The Oceans, CO₂, Sea Level and Ice: Four Million Years of Natural Climate Variability’, and provided a quarter-century perspective on “poking holes in the seafloor”. This was followed by Luke Skinner (University of Cambridge), who spoke about ‘Future Challenges for Quaternary Palaeoceanography: from Protists, to Proxies, to Physics’. After an engaging discussion, a dedicated poster session considered global palaeoceanographic records with particular focus on Antarctica and the North Atlantic.

The afternoon sessions continued with an entertaining talk by Pete Coxon (Trinity College Dublin), the incoming president of the QRA, who provided a personal perspective on the association’s 50-year history. Following this
talk, the QRA awards for 2014 were presented. The Lewis Penny Medal was awarded to Andrew Finlayson (British Geological Survey) for work on understanding the Quaternary glaciation of Scotland. The James Croll Medal was jointly awarded to John Lowe and Mike Walker, for their outstanding, and often collaborative, contributions to Quaternary science. Finally, QRA honorary membership was awarded to John Andrews (INSTAAR, Colorado), Clive Auton (British Geological Survey), Andy Currant (Natural History Museum) and John Matthews (Swansea University). Following the presentation of awards, a new book on the history of the QRA, edited by John Catt and Ian Candy (Royal Holloway University of London), was launched, before delegates gathered for the QRA@50 reception and conference dinner, both held at the RGS.

**Day 3:**

The morning after the night before was a treat, with conference attendees waking to wonderful talks by Jim Rose (Royal Holloway University of London) and Phil Gibbard (University of Cambridge), who discussed ‘Terrestrial landscapes and landscape evolution’ (Theme 8), and reminded participants of the importance of stratigraphy, fieldwork, and embracing powerful technological changes that complement our research. Talks were followed by a lively debate, returning to the topic of biostratigraphy and its importance in Quaternary science.

Following the morning poster session, focus turned to ‘Palaeoecology’ (Theme 9), with talks from Mary Edwards (University of Southampton), who touched upon ancient DNA work; Kathy Willis (University of Oxford), who spoke about the importance of palaeoecology and conservation; and Adrian Lister (Natural History Museum), who linked palaeozoology and environmental change (complimenting the preceding talks). A lively discussion followed, with focus on the importance of establishing a palaeoecological baseline for studies of conservation, and the potential importance of small populations of plants and mammals for postglacial recolonisation.

After lunch, a fascinating overview of ‘Human Origins, Environments and Impacts’ (Theme 10) gripped the audience, with talks from Chris Stringer (Natural History Museum) and Wil Roebroeks (Leiden University). These talks provided a humbling overview of how far the science of ancient DNA research has progressed, sparking an interesting debate about knowledge creation and retention in isolated populations.

The final session focused on ‘Insights from Genetics’ (Theme 11), and the audience were given a whirlwind tour of the past 20 years of ancient DNA research, by Terry Brown (University of Manchester), who touched on topics such as ancient DNA contamination, next generation sequencing, and the power of DNA research to compliment a range of disciplines. Ian Barnes
(Royal Holloway University of London) provided an overview of some of the fascinating questions that can be asked and answered through ancient DNA research.

The conference concluded with Terry Brown emphasising the importance of cross-disciplinary collaboration, nicely summarising the rich and diverse research presented and debated throughout the three days…and the preceding 50 years.

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DAVID MAYHEW MEMORIAL MEETING
17 APRIL 2014

David F. Mayhew, 1948-2012, who was a leading practitioner in the field of Pleistocene vertebrate palaeontology, died in Den Haag, The Netherlands, on 3 October 2012. He dedicated himself to the study of small mammals, a group that has been of particular importance to Quaternary research. Their rapid evolution through the last four million years has given rise to both diversity and speciation that is extremely useful in both late Cenozoic evolutionary and biostratigraphical studies. His obituary was published in *Quaternary Newsletter* (Friday and Gibbard, 2013).

A one-day informal meeting of invited presentations to celebrate David Mayhew’s work was held in the Department of Geography, University of Cambridge on 17 April 2014 and was attended by 25 friends and colleagues from Britain, the Netherlands and Germany (Figure 1).

The participants were welcomed to the Department of Geography by Phil Gibbard, after which Adrian Friday, who knew David as a fellow undergraduate and graduate student, talked about David’s early life and work. He was followed by Adrian Lister, who, with Victoria Herridge, presented some of his group’s latest results on the Cretan mice and mammoth fauna. Next to speak was Thijs van Kolfschoten who worked with David in Crete and later in the Netherlands on small mammals.

After lunch the programme continued with Tony Stuart who presented David’s early research on *Trogontherium* (Castoridae, Rodentia) and especially their highly influential joint work on voles of the Lower Pleistocene of East Anglia. This was followed by Simon Parfitt who discussed the details of finds resulting from taphonomic studies of ground squirrel burrows at the Lower Thames site at Crayford, Kent. He highlighted David Mayhew’s contribution to small mammal taphonomy and population dynamics.

Next to speak was Francien Dieleman who presented her exciting finds of small mammal fossils from the coastal and shallow marine deposits of the Zeeland region of the Netherlands. She had been greatly inspired by David’s enthusiasm.

Lutz Maul presented an overview of the state of knowledge concerning the fossil beaver *Trogontherium* and emphasised the timeliness of David Mayhew’s studies which he undertook during his thesis investigations in Cambridge.

Finally, Frank Wesselingh enthusiastically presented his latest views on palaeo-environmental change and biodiversity turnover in the Plio-Pleistocene North Sea Basin.
Figure 1. Participants at the David Mayhew Memorial Meeting on 17 April 2014. From left to right: back row: Tom White, Adrian Friday, Mary Pick, Simon Parfitt, Frank Wesselingh, Chris Jeans; second row: Francien Dieleman, Richard Preece, Adrian Lister, Mareike Zambuto (David’s partner), Kirsty Penkman, Charles Turner; row three: Robert Last, Thijs van Kolfschoten, Chris Pick; front row: Lutz Maul, Glenda and Ian Cruickshank, Phil Gibbard, Tony Stuart.

Several colleagues, including Adam Nadachowski, Alexey Tesakov, Lars van den Hoek Ostende and Jelle Reumer, had hoped to attend but sent their apologies. The participants completed the day by having dinner in a local restaurant before dispersing.

Everyone agreed that the meeting had been memorable and enjoyable, and a very fitting tribute to David.

Reference

NEW RESEARCHERS AWARD SCHEME

STABLE ISOTOPE ANALYSIS OF NEOLITHIC CATTLE AND OVICAPRID BONE COLLAGEN FROM TWO HENGES IN WESSEX

Background

Carbon and nitrogen stable isotopes are commonly used in archaeological research as indicators of human and animal diet. These isotopic ratios, expressed as δ¹³C and δ¹⁵N, indicate plant photosynthetic pathway and marine consumption (δ¹³C), and consumer trophic level (δ¹⁵N). When examining human diet, local fauna are often used as a ‘baseline’ to compare human values to local isotopic variability. This variability has never been explored. This study, supported by the QRA New Research Worker’s Award, forms part of doctoral research to investigate and quantify the influences and their relative impact, with potential to use δ¹³C and δ¹⁵N as an alternative palaeoenvironmental indicator.

The sites of Mount Pleasant, Dorset and Marden, Wiltshire (Figure 1) were chosen for analysis as they are henge monuments dating from the Late Neolithic to Early Bronze Age (c. 2300 – 2000 BC), and faunal isotopic values produced from this period are so far limited. Existing results suggest a depletion in δ¹³C that is not consistent across all sites of this period (Jay, 2012); additional sites would assist in addressing the cause of this variation, in particular whether the influences on carbon values are human or environmental.

Figure 1. location of Mount Pleasant and Marden henges.
Methodology

Fifteen samples were collected from long bones of cattle and ovicaprids from a number of contexts within the sites of Marden and Mount Pleasant. Collagen was extracted following the protocol of Richards and Hedges (1999) and run through an automated carbon and nitrogen analyser coupled in continuous-flow mode to a Finnigan MAT 253 mass spectrometer (Thermo Finnigan, Germany) at the Godwin Laboratory, University of Cambridge.

Preliminary results

Figure 2 presents the results from this study. Marden cattle (n=15) have $\delta^{13}C$ ranging from -23.9 to -22.4‰ (mean -23.1‰), and $\delta^{15}N$ ranging from 4.0 to 6.8‰ (mean 5.2‰). Mount Pleasant cattle (n=7) have $\delta^{13}C$ ranging from -23.2 to -22.2‰ (mean -22.7‰), and $\delta^{15}N$ from 4.1 to 6.1‰ (mean of 5.5‰). Mount Pleasant ovicaprids (n= 8) range from -23.1 to -21.3‰ in $\delta^{13}C$ (mean -21.9‰), and 4.2 to 7.4‰ in $\delta^{15}N$ (mean 6.0 ‰).

![Figure 2](image_url)

**Figure 2.** Stable isotope results from Mount Pleasant and Marden cattle (top), and Mount Pleasant ovicaprids (bottom), compared to other Neolithic and Bronze Age fauna from across the UK.
Significance

The results from Marden and Mount Pleasant fauna are more depleted in carbon than other Neolithic sites. The results are, however, consistent with faunal values from most other Bronze Age sites. This could be due to environmental change between the early and late Neolithic, but differences across both ovicaprid and cattle values would be expected. Figure 2, which includes values from across southern Britain, shows that this is not the case, and suggests differences in human practice rather than environmental reasons to explain the stable isotope results. Future work will compare sites between the Neolithic and Iron Age across central southern Britain to further consider the environmental versus anthropogenic changes in carbon and nitrogen stable isotopes in an attempt to use them as indicators of livestock management.

Acknowledgments

The QRA New Researcher Worker’s Award contributed to the cost of isotopic analysis. Thanks to Heather Ault and the Board of Trustees at Wiltshire Museum and Richard Breward at Dorset County Museum for facilitating access to the archaeological material. Funding for the author’s doctoral research is provided by NERC (NE/J500070/1). Thanks to Dr Tamsin O’Connell, Dr Rhiannon Stevens and Professor Charles French for their continuing support in this project.

References


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Background and Rationale

In comparison to the UK, the extent and thickness of the Last Glacial Maximum (LGM) Icelandic Ice Sheet (IIS) is relatively poorly constrained. At present, there are two contrasting hypotheses of the LGM glaciation of Iceland – maximum and minimum – with an order of magnitude difference in ice volume (Hubbard et al., 2006). Establishing the most likely ice loading scenario is important due to the sensitivity of the northern North Atlantic to changes in oceanic circulation and freshwater input. Relative sea-level (RSL) data can be employed to determine the most likely ice loading scenarios because the two scenarios will yield contrasting RSL histories, particularly in those locations where ice loading differs most. Northwest (NW) Iceland is such a location, having very different ice loading patterns under the two contrasting hypotheses.

In 2013, a combination of isolation basin sediments and raised marine terrace elevations were sampled and recorded in Hornstrandir, Vatnsfjörður, Hrútafjörður and Látrar (Figure 1). These samples allowed the completion of RSL curves for these research locations, adding to existing samples and records for the region (e.g. Rundgren et al., 1997; Norðdahl and Pétursson, 2005; Lloyd et al., 2009; Brader, 2011). Fieldwork expenses were supported by the QRA New Research Workers Award, allowing the shipping of kit and samples for analysis.

Results

In total, 16 isolation basins were sampled during the 2013 Field Season, with raised marine terrace elevations also being recorded in a number of locations. Diatom preservation is generally good within the samples, providing an opportunity to establish the diatomological isolation contact (e.g. Figure 2) at various elevations from the marine limit to present. Some of these have already been dated and preliminary RSL curves have been constructed for a number of the research locations, highlighting patterns of RSL change over the Lateglacial to Holocene.

These RSL curves are being used to constrain glacial-isostatic modelling of NW Iceland in order to test between the two ice loading scenarios.

Significance

Using the samples collected, it is possible to assess patterns in Lateglacial to Holocene relative sea-level changes across and away from potential LGM ice
loading centres in northwest and central Iceland. As a result, the contrasting hypotheses of the LGM glaciation can be tested and assessed to determine the most likely scenarios.

**Figure 1.** Research location demonstrating (A) site locations within northwest Iceland, with Sites 4-7 being sampled in summer 2012, (B) the study area in Iceland and (C) the key to previous (1, 2, 3) and current (4, 5, 6, 7) study sites.

**Figure 2.** Diatom assemblage at Myrar, Hrútafjörður, demonstrating the transition from marine-brackish to freshwater dominance at the site.
Acknowledgements

This research was supported by a QRA New Research Workers Award, RGS-IBG Postgraduate Research Award, BSG Postgraduate Award and Van Mildert College Principal’s Award. Guidance was provided in the field by Dr Hreggviður Norðdahl (University of Iceland). Harry Inman and Christopher Darvill are acknowledged for their assistance in the field. Permission for fieldwork was granted by RANNIS and Umhverfisstofnun. The support of my supervisory team, Dr Jerry Lloyd, Prof. Mike Bentley, Dr Anthony Newton and Dr Natasha Barlow, is also gratefully acknowledged.

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REVIEWS

ULLAPPOOL (SHEET 101E)¹, AVIEMORE (SHEET 74E)²: SUPERFICIAL DEPOSITS (SCOTLAND)
NORTH MULL AND ARDNAMURCHAN (SHEET 51E/52W)³: BEDROCK AND SUPERFICIAL
DEPOSITS (SCOTLAND)

WIGAN (SHEET 84)⁴, ISLE OF WIGHT (PARTS OF SHEETS 330, 331, 344 AND 345)⁵:
BEDROCK AND SUPERFICIAL DEPOSITS EDITIONS (ENGLAND AND WALES).

GEOLOGY OF THE MANCHESTER DISTRICT
: SHEET EXPLANATION (85) 45PP⁶
R.G. CROFTS, E. HOUGH, A.J. HUMPAGE AND H.J. REEVES

Published by : British Geological Survey 2012 ⁶ 2013¹,²,³,⁴,⁵

ISBN 978 0 7518 3636 3 flat 978 0 7518 3637 0 folded and cased ¹
ISBN 978 0 7518 3634 9 flat 978 0 7518 3635 6 folded and cased ²
ISBN 978 0 7518 3604 2 flat 978 0 7518 3605 9 folded and cased ³
ISBN 978 0 7518 3629 5 flat 978 0 7518 3625 7 folded and cased ⁴
ISBN 978 0 7518 3778 0 flat 978 0 7518 3777 3 folded and cased ⁵
ISBN 978 085272701 0 ⁶

1:50,000 sheets £12 each, sheet explanations £9 each and £18 with accompanying
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value of the goods up to maximum of £10).

The Ullapool sheet (101E) follows the publication of the Summer Isles sheet
explanation (Quaternary Newsletter No. 130, 74-75). This pivotal 19 by 29
km half sheet includes varied thrustsed Precambrian terrains, Cambrian and
Ordovician sediments plus a Silurian igneous pluton. These strongly influenced
local topography including the magnificent Suilven 731 m and Canisp 846 m. Though the key shows 23 units, these are mostly pockets of four types of glacial-fluvial gravel alongside spreads of moraines and tills, including a discontinuous veneer of boulders resting on the bedrock, plus blanket peat bogs. Extensive areas of bedrock are often covered with blue lines depicting large scale glacial grooves, coupled with numerous striae directions giving strong evidence of local ice flow dynamics. Esker crestlines and meltwater channels are also denoted along with isolated landslips. It is well worth referring to the 2008 bedrock edition which puts Suilven into context. In the margins there is a beautiful elevation model and simplified bedrock geology map. Better still is the annotated aerial photo of Ullapool, alongside a 10k map of Allt-an-t-Srathain which featured in the 2010 QRA guide to Western Sutherland with approximate heights. Given that spring mean high water is 2.45 m above and low tide 2.05 m below Ordnance Datum, it is a pity this information is not quoted. Rather than boasting about ending systematic geological mapping (Geoscientist Vol. 24 (1) page 20 February 2014), the BGS would be wise to complete a combined 50k sheet for Loch Glencoul (107E) and Point of Stoer (107W), whose 2002 provisional edition looks completely outmoded in comparison.

The rugged topography of the Aviemore sheet (74E) straddles a considerable length of the River Spey right up to Cairn Gorm at 1245 m. Though the superficial deposits and linear features marked in blue, with eskers marked in red, often form complex patterns, an updated bedrock and superficial deposits edition would have been more informative. An extremely well captioned NEXTMap radar image of the area plotted alongside the simplified bedrock geology clearly shows these links. A transect across a partly infilled U shaped valley, at Strathsey, shows a large lens of buried glaciolacustine material some 30 m thick. Because of serious discrepancies along their common margin the adjacent 2004 Tomatin (74W) sheet would benefit from a serious overhaul, given this quantum leap in demarcating glacial features, if it were not that so many other areas have far worse coverage.

The North Mull and Ardnamurchan sheet (51E/52W) includes a portion of the isolated Morvern peninsula. Though the Ardnamurchan igneous Palaeogene central complex has a 1:25,000 special sheet (Geology Today, v. 26, 159-160), most of it has only been revised using photo-interpretation. However, this has still been a very useful exercise, as in addition to quite limited superficial deposits, including raised beaches, a wealth of detailed form lines show the edge of lava flow terraces and where possible former coastlines. This is a vast improvement on the quality of information provided by the provisional maps for Staffa (43N) and the Ross of Mull (43S). Better still, numerous glacial striae lines and roche moutonnée ice flow indicators have been transposed from the original 1928 survey. Though this was a larger sheet size, it could have been extended to show offshore geology, which in places is of considerable interest. Even without revision to the Sea Bed Sediments (1988) and Quaternary (1987)
editions of the Tiree 1:250,000 sheet 56N 08W, adding the offshore bathymetry would have shown a hole in the seabed some 140 m deep between Mull and the Ardnamurchan peninsular underlain by up to over 120 m of superficial deposits.

In northwest England, on the Wigan sheet (84) the former south Lancashire coalfield is mostly blanketed by till and occasional patches of glacial gravels and lake deposits. Though the simplified bedrock geology is clearly delineated, a separate Bedrock edition provides much greater detail. Also, given the district’s industrial history, extensive areas of made, worked, and infilled ground are shown. Towards the west patches of till are interspersed with peat and more widespread “glacio-aolian” fine sand. Across the sheet, a significant number of wide buried channels are shown and an insert map shows Pre-Devensian drainage patterns and rockhead contours, while a well captioned colour-shaded relief image extends a few km beyond its margins. Thankfully, the district was mapped before the plug was pulled, as informed planning policies are even more important given shale gas exploration and the need to minimize risks from surface spills (Geologists’ Association Magazine, v13 (1) March 2014, p.9-11 in press). Sadly the Formby (83) sheet last surveyed over 120 years ago was not included.

The Manchester sheet explanation (85) shows what Wigan will be missing out on. Though it gets quite technical, these booklets were written to be accessible as possible. The Quaternary extends to nine very informative pages, though BP (before 1950) is not explained, nor that calibrated radiocarbon dates appear to be quoted for post-glacial events which could have merited a small figure or table. However, a page does set out the nature and characteristics of different types of superficial deposits, and a map shows their cumulative thicknesses, as in many places these deposits are over 30 m thick. The text also uses bold with the mapping symbols in brackets to great effect along with quoting numerous grid references to pin locations down concisely. Ten more pages are devoted to applied geology including the well tabulated engineering geology and characteristics of rocks and soils.

Finally, the Isle of Wight special sheet shows just what a fresh survey can achieve compared to minor revisions to post-1888 editions. The bedrock geology has been completely overhauled with many boundaries refined and relocated. Numerous faults are now shown, especially along the narrow near vertical chalk monoclines extending towards each end of the island. The enlarged inserts look incongruous without 1:25,000 base maps, and their positioning could have been tweaked along with the extensive and highly informative marginalia to leave slightly more space for its surrounding waters. Sadly the bathymetry is of very limited value compared to offshore charts, showing depths of over 50 m between Hurst Castle and Cliff End scoured out by the powerful tidal stream exiting the Solent, which is left blank without inshore geology, unlike quite a number of recent sheets.
There are no less than four insert maps: not just a well captioned elevation model, but wider areas with sea bed character, simplified bedrock and a stunning sea bed morphology image often reflecting the underlying geology. Given that gravels south of the monocline are naturally subdivided into their river catchments draining through gaps in the chalk ridges, plus Solent River gravels to their north, the key is cleverly arranged with units alongside each other to show clearly their likely equivalents. However, given that the remaining eastern and western river Yar gravels were deposited by rivers flowing parallel to the chalk ridges for many km before traversing their respective gaps, the absence of faulting (Nowell 1999) is rather odd, as Hopson (2011, p.754) stated BGS fieldwork had “substantiated” these faults buried by superficial valley deposits – Freshwater Bay is at least as clear cut as the one at Arish Mell shown on the 2000 Swanage sheet (342 east and part 343). Also, in the introduction to the 2009 QRA guide to the Solent Basin, he stated that all three rivers probably follow north-south faults (p.7) without reference to my published work. Furthermore, my discussion of the buried channels in Poole and Christchurch Bays explained how this pattern of faulting allowed the island to become detached from the mainland during this interglacial.

However, these niggles are trivial compared to ending systematic geological mapping (Nowell 2014): look across the Solent to the other part of the hopelessly outdated Lymington sheet (330), even though it includes very fragile sandy soils within the New Forest National Park. Resurveyed it could include missing offshore geology. Only by drafting and compiling fresh maps can otherwise patchy and incomplete geological evidence be replaced by a coherent overarching synthesis, as part of a geological survey’s public service through which planning and other environmental issues can be addressed.

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QUATERNARY RESEARCH ASSOCIATION

The Quaternary Research Association is an organisation comprising archaeologists, botanists, civil engineers, geographers, geologists, soil scientists, zoologists and others interested in research into the problems of the Quaternary. The majority of members reside in Great Britain, but membership also extends to most European countries, North America, Africa, Asia and Australasia. Membership (currently c. 1,200) is open to all interested in the objectives of the Association. The annual subscription is £20 with reduced rates (£10) for students and unwaged members and an Institutional rate of £35.

The main meetings of the Association are the Field Meetings, usually lasting 3–4 days, in April, May and/or September, a 2–3 day Discussion Meeting at the beginning of January. Short Study Courses on techniques used in Quaternary work are also occasionally held. The publications of the Association are the Quaternary Newsletter issued in February, June and October; the Journal of Quaternary Science published in association with Wiley; and the QRA Field Guide and Technical Guide Series.

The Association is run by an Executive Committee elected at an Annual General Meeting held during the Annual Discussion Meeting in January. Current officers of the Association are:

President: Professor P. Coxon, Department of Geography, Museum Building, Trinity College, Dublin 2, Ireland (email: pcoxon@tcd.ie)

Vice-President: Professor D. Schreve, Department of Geography, Royal Holloway, University of London, Egham, Surrey, TW20 0EX (e-mail: Danielle.Schreve@rhul.ac.uk.)

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All questions regarding membership are dealt with by the Secretary, the Association’s publications are sold by the Publications Secretary and all subscription matters are dealt with by the Treasurer.

The QRA home age on the world wide web can be found at: http://www.qra.org.uk

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ANNOUNCEMENT

ARTICLES

Middle and Late Devensian radiocarbon dates from the Uamh an Claonaite cave system in Assnyt, NW Scotland *Tim J. Lawson et al.*

The use of terrestrial gamma radiation counts to discriminate between head and parent materials at Corton, Suffolk *Alistair F. Pitty*

REPORTS

Glacial Landsystems Working Group Meeting: The Cheshire-Shropshire low-lands

QRA Annual Discussion Meeting: QRA@50: Quaternary Revolutions

David Mayhew Memorial Meeting

NEW RESEARCHERS AWARD SCHEME

Stable isotope analysis of Neolithic cattle and ovicaprid bone collagen from two henges in Wessex

Lateglacial to Holocene relative sea-level changes and the deglaciation of Northwest Iceland

REVIEWS

Various recently-published British Geological Survey map sheets *David Nowell*