RIVERS THROUGH GEOLOGICAL TIME

The Geologists' Association Two Day Meeting 2012

13 and 14 October 2012, The Royal Albert Memorial Museum, Exeter

Richard Pollock

This one day conference consisted of lectures and posters devoted to fluvial rocks, sediments and environments as represented throughout the geological column. It was followed on the Sunday by a field excursion visiting localities revealing Triassic, Pleistocene and Holocene fluvial sediments.

The morning session started with a series of six lectures on the older and harder rocks and highlighted the fundamental differences between the predominance of braided systems in the Pre-Cambrian to Silurian and the later dominance of meandering fluvial systems during the Devonian to the present day predating the 'greening of the continents'. Martin Gibling from Dalhousie University, Halifax, Canada spoke on the landscape in Palaeozoic systems and Geraint Owen from Swansea University spoke on the Neoproterozoic Torridonian of NW Scotland. These systems both illustrate the sandstone rich sedimentation typical of this period.

The late morning session concentrated on the more local Devonian to Triassic fluvial deposits in an around Devon, starting with an example of a mud-dominated Old Red Sandstone fluvial system in south west Wales by Susan Marriott of the University of Bristol, confirming the influence of vegetation. This was followed by Chris Cornford comparing the depositional similarities of the recent deltas of the Bideford Bay to the preserved Carboniferous sediments of the Westward Ho! and Bideford Formations. Contrasting present and past allows a reinterpretation of the Bideford Formation as deposits of delta-top channels cutting intertidal mudflats. The last two lectures of the morning session concentrated on the Permian and Triassic sediments close to Exeter. Richard Scrivenor outlined the post Variscan Orogenic setting during the deposition of the Permian Exeter Group, which took place in arid continental conditions with sporadic high precipitation giving rise to ephemeral fluvial conditions with coarse sediment transport and the building of extensive outwash fans. Later finer sediment deposition of the Aylesbeare Group in temporary lakes was followed by coarser sediments of the Budleigh Salterton Pebble Beds resulting from east-west extension in this area.

Malcolm Hart ended the morning session with a fascinating discussion on some of the vertebrate finds from the mid-Triassic Otter Sandstone Formation. The Otter Sandstone starts with a series of aeolian sandstone passing upwards into a series of river channel deposits flowing northwards. This sequence has yielded a number of Rhynchosaur vertebrate remains.

The afternoon session concentrated on the Tertiary fluvial systems of southern England starting with Andrew Newell setting the scene on the Palaeogene fluvial systems forming on the 'blank canvas' of the Cretaceous Chalk. The other controlling features are the wet and warm tropical climate, a lowland river system influenced by the rise and fall of sea level and tectonic compression related to Alpine mountain building. These all resulted in a complex series of Palaeogene fluvial sediments forming the Reading and Bracklesham Beds.

There followed three more talks on the more modern fluvial sequences of the Pleistocene, Holocene and Anthropocene across southern England and how they have been influenced by landscape evolution, vertical crustal motions and properties and occupation by Hominids.

I was unable to listen to the final papers of the day, which comprised the importance and added value of our river systems in repositories of vertebrate fossils, as important petroleum reservoirs and closed with a discussion on 'Exeter and its river'.

A poster session accompanying some of and additional to the talks, including one by Elizabeth Devon 'Rock Circus in the village of Box, Wiltshire'.

RIVERS THROUGH GEOLOGICAL TIME FIELD TRIP

Geologists' Association Conference, October 2012

Elizabeth Devon

The conference was organised by the Devonshire Association and the Geologists' Association. On Saturday we were treated to excellent lectures based on fluvial rocks, sediments and environments from Precambrian to Quaternary. Field trips to Budleigh Salterton, Lympstone and Bramford Speke were organised for Sunday. The following is a brief account of these visits with GPS co-ordinates for anyone wishing to visit the localities.

Budleigh Salterton

This is the Triassic part of the 'Jurassic Coast World Heritage Site'. These dramatic red rock cliffs are distinctive and the geology here records conditions on land between 250 and 200 million years ago. Although there are no fossil clues, there are many other indicators that reveal desert environments with sand dunes, salt lakes, lagoons and rivers. Iron minerals have weathered to produce the spectacular colour of the cliffs and this is the first clue that these rocks formed in hot, arid conditions.

The Budleigh Salterton Pebble Beds Formation (BSPB), Lower, or possibly, Middle Triassic in age, can be seen in the cliffs to the west of Budleigh Salterton. These cliffs are eroding fast so it is wise to view them from a distance. The BSPB include up to 26m. of red-brown horizontally-bedded gravel. The gravels of well-rounded pebbles, cobbles and boulders are dominantly metaquartzite, but vein quartz, sandstone, chert and other rocks can be found. The distinctive grey and brown metaquartzite pebbles are identical to 440 million year-old (Ordovician) pebbles, 250km away in Brittany. The pebbles were deposited here by a large braided river system flowing north into the Triassic desert about 240 million years ago. The bulk of the beach is now made of these pebbles. Exquisite Ordovician fossils, brachiopods and trilobites can be found in some of the pebbles.

Junction of Otter Sandstone and Budleigh Salterton Pebble Beds

At N50°37.650 W003°19.634 is the junction of the Otter Sandstone and BSPB, photo 1. The top of the BSPB is marked by a Triassic fossil soil deposit with dreikanters and desert varnish. The Otter Sandstone overlies it unconformably and is shown dramatically by the yellow sandy-clay layer. The yellow colour is due to the reduction of ferric oxide minerals, possibly by vegetation that was growing on the surface. The Otter Sandstone is up to 120m thick and is a red-brown fluvial sandstone mostly showing cross-bedding. These sands are an important aquifer in East Devon and the main reservoir rock for the Wych oilfield to the east.

A fault can be seen near this location, N50° 37.647 W003°19.634.

If you walk west along the beach to around N50°37.544 W003°19.946, you can see the continuation of the junction between the BSPB

Fault in Otter Sandstone and Budleigh Salterton Pebble Beds

with the the Otter Sandstone Formation (Middle Triassic). Beneath the BSPB (masked by landslip) you can see the Littleham Mudstone Formation (late Permian, early Triassic age). It comprises red-brown mudstone and siltstone beds and may have formed in a lacustrine environment with periods of desiccation and the formation of evaporite minerals.

The story told by the cliffs here is an interesting one as, at first we see a lacustrine environment with intermittent sandy deposits indicating cyclical change. This gives way to a huge deposit of river gravels from rivers from the south. After this, desert conditions prevail with wind-blown deposits and dreikanters and, maybe, a sparse cover of vegetation. The area then returns to a fluvial environment with huge deposits of cross-bedded sandstones.

Exe breccia, Lympstone

Lympstone

Turn down the lane in Lympstone at N50° 38.860 W003°25.887. The locality is at N50° 38.900 W003°26.011. The tides need to be checked before visiting here. We were looking at the Exe Breccia, uppermost unit of the Exeter Group, late Permian in age. It overlies the Dawlish Sandstone Formation which is dominantly a wind-blown deposit. The cliff section here shows interbedded units of orange-red sandstone and sedimentary breccia with clasts up to 10cm in the coarser units. Bedding is discontinuous and lensoid, with channelling evident in the coarse breccias. The matrix of many of the breccia beds appears to be dominated by fine sand and silt. The clasts include hard Culm (Carboniferous) sandstone and siltstone with more friable mudstone. We found fragments of vein quartz and hornfels and some quartz-porphyry. Fragments of k-feldspar (murchisonite in some older publications) and granite have also been found but we were not lucky. This deposit indicates a reactivation of coarse clastic sediment deposition. Is this the base of the Trias? The Exe Breccia indicates a braided system with lots of sediments, scour marks and lag deposits.

At the top of the cliff, there is a Quaternary terrace overlying the Exe Breccia. It contains rounded clasts of Cretaceous flints.

Brampford Speke

At N50°46.559 W003°31.398 walk down the footpath. The village of Brampford Speke is built on river Terrace 4 (BGS), the gravels from which can be seen on the left of this

Quaternary terrace on top of Exe Breccia

footpath. Many pebbles are vertical because of frost heave. At the bottom of the path, the Permian bedrock of the Exeter Group of New Red Sandstone is exposed above the floodplain.

N50°46.692 W003°31.320 route marker

At about N50°46.752 W003°31.275, the geomorphology of the Late Pleistocene river terraces and Holocene floodplain is well exposed. Both sides of the valley, seen to the east and west of the floodplain, are capped

with Terrace 4 deposits. In the Exe system, Terrace 4 is separated from Terraces 1, 2 and 3; these lower three abut on the floodplain. Optically stimulated luminescence dating (OSL) dates Terrace 4 at c. 59,000 years, i.e. Devensian age.

The wide floodplain here (Netherexe Basin) covers an area 5km in length and up to 1.5km in width on bedrock of Dawlish Sandstone (Permian) with sandstones and shales of the Crackington Formation (Carboniferous) to the north and south. The difference in valley shape between the broad basin on the Permian rock and the narrow valleys overlying the more competent Carboniferous rock, is noticeable. The floodplain sediment consists of gravels overlain by silts. The clasts in the gravel, slates and sandstones with occasional pieces of quartz, all appear to be derived from between here and Exmoor.

Part of the basin valley floor is an SSSI for its geomorphology. Many palaeochannels can be seen; we were fortunate in that all the recent wet weather had meant that these were filled with water on our visit and so were clearly visible. From recent research it seems that avulsion, (rapid abandonment of one river channel for another), has been the dominant process of floodplain formation.

Palaeochannels of River Exe

Acknowledgements
Grateful thanks to our field leaders Dr. Jenny Bennett, Dr. Sarita McVicar Wright and Dr. Richard Scivener"

Exam Howlers

Without rocks, then the standard of living with cars and central heating would not be happening

The three main types of rock are sedimentary, ingenious and metaphoric

If the soil is contaminated the polluter may become airborne and be inhaled by organisms

Without the lithosphere, there would be no ground to stand on

Taphonomy is the burial rights

(Continued from page 1)

Geologists' Association
Local Societies Meeting

The major outcome, I thought, from this meeting this year was the emphasis on intra group relationships; let's get to know our neighbours in the geological arena and maybe work together more. The BGS is certainly doing this with our joint Field Trip programme. There was also the suggestion that the local groups forge links with other groups such as the Ramblers, Forestry and RSPB for example. I think that our association with the Avon Wildlife Trust at Brown's Folly is an excellent example of this already working extremely well in our area.

The GA also realises that as an organization it is very London centred, and that is one of the reasons that the last two Annual Meetings have been held outside London, at Worcester and Exeter. This will continue next year with the 2013 meeting being held in Durham. There was some discussion that we could also hold the 'Festival of Geology' again outside London, as in Liverpool a few years back. Time will tell!