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Tetrapod World: early evolution & diversification

Newsletter No. 9, January 2015

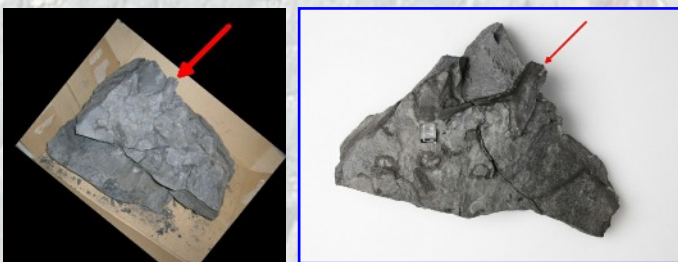
Training

In December, Maggie Wood, alongside Vicen Carrió (NMS) and Anna Jerve (Imperial College, London) spent a couple of weeks in Cambridge learning different types of fossil preparation techniques and getting some hands-on experience, under the watchful eye of Sarah Finney, Geological Conservator at the Sedgwick Museum, Cambridge.

Tim Smithson had provided some Burnmouth mudstone on which they could practise. Both the rock and the fossils it contained, crumbled very easily, and it was quite a challenge to prepare, requiring frequent application of a liquid consolidant to bind it together and a very gentle preparation technique, with no mechanised tools.

Using a tungsten-carbide needle mounted in a pin-vice, Maggie delicately removed the overlying matrix, exposing shoulder girdle bones of a rhizodont fish. She had to avoid exposing the rock to water, as it would simply have disintegrated. The whole exercise was complicated by the presence of many fossil fragments within the rock, making it difficult to prepare anything other than those exposed on the surface. Often, she had to seek advice about what to conserve, as surface fossils overlay other, more significant specimens.

Back in Scotland, Maggie now works as a volunteer preparator at the NMS, under the supervision of Vicen, who is starting to prepare some of the material from Willie's Hole. These rocks are old friends, says Maggie, as they were found by her late husband, Stan, and had spent a long time in her front room!



Before and after preparation! The red arrow indicates the bone. If you click the picture, it will take you to a full-sized image.

Team Meeting

We had our biannual team meeting in Edinburgh in early December, where everyone spoke about what they'd been doing over the preceding six months. There was far too much to mention everything on two sides of A4, so this is more a flavour of what's been going on than a comprehensive report. There was also not much in the way of graphics that I could use in the newsletter, so I've included mugshots of the inmates.



Jenny Clack and Tim Smithson talked about some of the lungfish material that has been found and also described extensive work on tetrapod limb bones they've been doing with Jason Anderson (Calgary). The three of them have submitted a paper describing their work on these to a scientific journal (PLOS One) which has since been accepted for publication.



There was quite a bit of discussion of detailed humerus anatomy, and it seems our previous ideas about some of these humeri might need to be revisited. This is, of course, what science is about.

The Scottish and Nova Scotia material shows there was a wide diversity of tetrapods in Romer's Gap, in marked contrast to our understanding before the project started.



Becky Bennion (Cambridge) is using dilute acetic acid to extract bones and sharks' teeth from rocks collected at Whitrope Burn and Coquetdale as her final year project. She has extracted what might be a tetrapod jaw, using this process.



Jenny's masters student, Ben Otoo, from the USA, is working through a large sample of matrix collected by Tim Smithson from the south end of Burnmouth in 2013, systematically looking for whatever fossils have been preserved.



We congratulate Kelly Richards (Cambridge) on receiving the Stan Wood Award from the Palaeontological Association to conduct fieldwork in Northumberland in the summer of 2015, looking for more chondrichthyan material.



Andy Ross (NMS) reported that there is a new species of scorpion in the Chirside material. There are other specimens which might be related, but that is unclear so far.



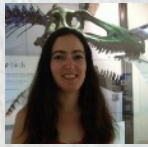
Altogether there are five specimens from Chirside, plus fragments from Coquetdale, Burnmouth and the bore hole core. The picture (hyperlink) shows a pair of scorpion chelicerae from Coquetdale and is copyright Tim Smithson..



Neil Clark has been working on our shrimps, comparing them with others from the Forest of Dean and Glencartholm and it looks as though we definitely have new species coming to light. A species called Tealliocaris was reported from Chirside in 1984, but Neil has other specimens

from all three localities which seem to be different from that, possibly different enough to be an entirely new genus.

There are also shrimps coming from Coomsden Burn and Whitrope Burn, and it will be interesting to see how they group with the other species.



Carys Bennett (Leicester) has been looking at the borehole core and has found many roots, mud cracks, ostracods and bivalves, suggesting periods of dessication followed by rapid recolonization when wetter conditions return.

Intriguingly, many of the bedding planes are populated by juvenile bivalves, but no adults, suggesting the conditions changed too rapidly for these shellfish to mature.

She has also done a lot of work comparing the sediments in the core with those at Burnmouth, Crumble Edge, Eddington Mills and Chirnside, examining many aspects, looking for correlations and trends. It is clear there is much still to be done.



Andy Howard (BGS) talked via a video link about the trace fossils he's found in the borehole core. Many animals could leave a trace looking like a wormhole, for example, and there's no way of knowing what really made it, though there is a consensus about what caused some of them and what environments they lived in.

Trace fossils are more difficult to identify in a core than in exposed beds, but his general conclusion, with many caveats, is that they all represent near-shore marine environments.



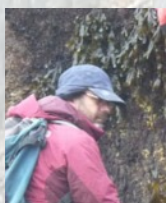
Tim Kearsey (BGS) described the four different categories of paleosol and explained that they appear in different proportions in the different localities, and said that the real proportions of the different soil types can only be indicated by the core.

He showed us a provisional interpretation of the landscape, being a low-lying flood-plain with many ponds, lakes and rivers, with large areas of low vegetation and marshland, and occasional isolated areas of woodland. This is consistent with the other analyses, of a low-lying fresh water environment suffering occasional, brief, marine incursions.



Janet Sherwin (Leicester) and Kelly Richards (Cambridge) have been working on the chondrichthyan (sharks and rays) diversity and distribution. Before the project started only two Tournaisian chondrichthyan sites were known in Britain, but now there are four. The range and types of shark teeth indicates a

much greater diversity of chondrichthyans than was previously known. Peter Brand (BGS) will be looking at the bivalves which might have formed part of the diet of these fishes.



John Marshall (Southampton), working on spores told us that the Greenland sequences seem to correspond pretty well with those from Canada, but that the Scottish sequences don't yet seem to fit in as well.

There are some fish groups that were thought to cross the Devonian-Carboniferous boundary into the Early Carboniferous. These now appear to become extinct at the boundary and this helps us position the boundary more accurately.



Emma Reeves (Southampton) has extracted spores from hundreds of samples from the core, of which over 80% were productive, and her next task is to identify them. She has eight types of megaspore, of which one is unknown. These are relatively immobile, so they give clues about the plant life near to where the spore was found. The megaspore distribution indicates episodic return to lycopod forested landscape.



Dave Carpenter (Southampton) has been studying the charcoals in our sediments. There are several different types of charcoal, produced by different intensities of fire. The charcoal he has found indicates high oxygen abundance in our sediments, in contrast to some recent hypotheses which suggested the reverse.



John Marshall, Sarah Finney and Jon Lakin were in Greenland in the summer where they experienced some exceptionally warm weather. This photo ([hyperlink](#)) featured in the National Geographic Explorer Moment of the Week page

recently. Ed Fleming takes a dip!



Sam Giles (Oxford) has scanned a very large [actinopterygian](#) fish braincase from Blue Beach, which shows the full anatomy, and there is more information to be gleaned. Larger actinopterygian specimens have been found, but this is the biggest such braincase.

Futures

Nick Fraser (NMS) has started planning the major project exhibition for March, 2016, in which there is a lot of interest already. We hope for displays at the NMS, Cambridge, Selkirk, Leicester, the Natural History Museum in London, the Hunterian in Glasgow and at Blue Beach or Fundy in Nova Scotia. These will probably be partial duplicates, so the exhibitions can run concurrently. They are also looking at the possibility of a virtual exhibition which could be hosted at a variety of websites, and investigating proposing a subset of the exhibition for display at the Royal Society Summer Science Exhibition in London.

We still hope to have our major excavation at Chirnside in the summer, of 2015. This is weather-dependent and more mechanised than envisaged, so opportunities for volunteers will be fewer.

There will be a meeting of the Yorkshire Geological Society at Keyworth, Notts, in March, 2015, where Jenny Clack and Tim Smithson will talk about the palaeontology, and Sarah Davies and Dave Millward will speak about the palaeoenvironment. The borehole core will be on public display.

The Royal Society of Edinburgh have agreed to publish a Stan Wood celebration volume based on talks given at the Symposium of Vertebrate Palaeontology and Comparative Anatomy in 2013.