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Tetrapod World: early evolution & diversification

Newsletter No 3, January 2013



In January the Principal Investigators and a few others met at the University of Leicester to discuss progress. The meeting went on for several hours and there isn't space here to report the discussions in detail, but I hope to give you a flavour of the meeting. The timing was a pite because Jenny has to submit a 6-monthly progress report to NERC, so getting the latest on what everyone was up to was very useful.



The Leicester meeting Photo copyright of Carys Bennett
Standing L to R: Melanie Leng, Tim Smithson, Tim Kearsy, Dave Millward, Jenny Clack, Sarah Davies, Dave Carpenter, Jon Lakin, Janet Sherwin, John Marshall
Seated L to R: Carys Bennett, Ket Smithson, Rob Clack

University of Cambridge

Jenny Clack spoke briefly about the fossils that have been found so far. From the south end of Burnmouth Bay a very small locality has produced an abundance of rather fragmentary bones, mostly rhizodont fish of various sizes, but also lungfish and tetrapod remains. The rhizodont bones seem to be all from the same species, perhaps suggesting a community of individuals of different ages.

One particular block is especially rich in fossil material and Ket is developing her skills in fossil preparation and processing CT scans by working on it. This has revealed some details of what is inside, but it is still very hard to work out how to extract the bones without damaging them.

Two other small localities on the south end of Burnmouth Bay have yielded a new tetrapod species each. Tim and Jenny are working on these.

Other sites in the region have yielded some substantial plant remains, the largest actinopterygian (ray-finned fish) jaw known from the Devonian and Early Carboniferous, and other vertebrate material.

On other matters, she reported that we have received some funding to buy Stan Wood's collection of fossils, and that an application for further funding is pending.

The Cambridge University Research Services is processing tenders for the borehole drilling programme which should take place this spring.

The project website is now live and can be seen at <http://www.tetrapods.org> and <http://www.tetrapods.co.uk>.

When Jenny talked to the Geological Association at UCL last November, she spoke after Professor Iain Stewart, geologist and TV presenter and he expressed interest in the project.

British Geological Survey

Dave Millward explained that borehole drilling is due to start in April. It will be 500m deep and is expected to take 8 - 10 weeks to complete.

The site is near Berwick upon Tweed. Cores obtained from the borehole will help us to understand the environments and habitats in which the tetrapods and other animals lived and died. Checks have now been completed to ensure that we are complying with statutory regulations.

750 people attended the BGS Open Day in Edinburgh in September where a poster describing our project was displayed. This available on the Downloads page of the project website.

Tim Kearsy reported on the GPS mapping he and Carys did in Burnmouth Bay last October. I believe the feeling has returned to their fingers and toes after the extreme cold they put up with.

University of Leicester.

Carys Bennett talked about her work doing rock thin sections, geochemistry, and isotope and microfossil analysis. She has processed 165 of 428 samples collected in October and hopes to finish the rest by the end of February.

She reported that the tetrapod fossils we've found have mostly been in conglomerates, ie sediments consisting of particles of a range of sizes, indicating current-flow at the time of deposition. We had thought they were just mud- and siltstones, which would have been laid down under quite different conditions.

The Burnmouth Bay section contains many hard cement-stone layers. These seem to be more closely spaced at the bottom of the formation and more widely at the top. We don't yet know why this should be. Cutting and polishing these layers has revealed exciting information about their sedimentology and diversity.

Carbon isotope geochemistry will start before the end of January with Melanie Leng at the NERC Isotope Geosciences Laboratory in Nottingham.

Carys has moved the project blog to Google, so it now looks completely different, though the URL has not changed – it's still <http://www.tetrapodworld.com>. She wants to make it more interactive and to exploit it as a way of getting information about the project out into the community.

National Museums of Scotland

Nick Fraser told us that he, Tim Kearsey and Dave Millward had made a GPS survey of the section of the River Whiteadder where we want to excavate and that we now have all the information needed to put the proposal to the Scottish Environmental Protection Agency (SEPA). The River Tweed Commission and Scottish National Heritage are both happy for the project to go ahead.

We hope to excavate in June/July over a period of several weeks, but that is entirely weather-dependent. We'll be putting a bund around the site to divert the river, but if there's lots of rain in May and June, the river will be too deep to do this safely. The salmon in the river mean that's the only time we can operate, so if we miss that window, it will have to be next year.

Andy Ross has been working on arthropods from the period, particularly some he's found in the NMS, including a spider originally discovered in 1893. He'll be taking some material down the Natural History Museum in London to show to Greg Edgecombe and may be able to call in at Cambridge to look at the eurypterid (giant water scorpions, happily, now extinct!) material we found in Burnmouth.

University of Southampton

John Marshall, Sarah Finney and one of John's PhD students, Jon Lakin, went to north-east Greenland in the summer and found tetrapods and fish, including an interesting shark. They were able to track environmental changes through Romer's Gap, showing wet and dry periods which will be interesting to compare with what we find in the Northumberland and the Borders Region.

They saw changes in spore composition showing the collapse of late Devonian vegetation. Large plant fossils all disappear at the end of the Devonian and only slowly reappear through the succeeding 20 million years.

After returning from Greenland, Jon Lakin went to Bolivia, where he was studying the climate during the Late Devonian and Early Carboniferous. He noted that there was a glaciation event shortly before the end of the Devonian and it seems possible the End Devonian Mass Extinction (EDME) was connected with the deglaciation.

Another of John's PhD students, Dave Carpenter, talked about his work on charcoals from which we hope to derive information about atmospheric oxygen levels. High oxygen levels could have sparked wildfires and there should be ways to identify this, although the sparse plant remains immediately following EDME might make this more problematic.

Future Plans

Windfall Films are making a film about Neil Shubin's book *Your Inner Fish* and want to make an episode about the fish-tetrapod transition and to film some of our fieldwork.

National Geographic is also interested in the project and will be talking to Nick Fraser, and coincidentally, Jenny will be

talking to someone else from National Geographic about the evolution of locomotion.

The Cambridge team plan to return to Burnmouth to do further collecting in the spring, and there are a number of other sites where more work could usefully be done.

Tim Kearsey will visit Burnmouth to look at paleosols and may want to do some more GPS mapping.

Sarah Davies will be speaking about the project at the Scarborough Rotunda Museum.

Janet Sherwin has started an MPhil studying the sedimentology of the site where the large actinopterygian fish jaw came from. She will visit the site some time in the spring.

The annual NERC Earth System Science Spring School is to be held in Edinburgh University in April. Dave Millward will be one of the speakers, and he will be joined by Nick Fraser who will talk about some of the specimens we have found.

Jenny will be speaking about the project at various universities, including Glasgow, Bristol, Oxford, Milan and Cambridge, and at the International Congress of Vertebrate Paleontology in Barcelona.

John Marshall will attend the International Congress on Stratigraphy in Lisbon in July.

Carys will go to the International Geological Correlation Programme (IGCP 596) sedimentology conference in Calgary in August.

The Symposium of Vertebrate Palaeontology and Comparative Anatomy (SVPCA) will be in Edinburgh this year, hosted by the National Museums of Scotland. Organiser Nick Fraser, hopes to dedicate the Friday to the memory of Stan Wood. The Cambridge team will attend the Symposium.



Plant fossils in a streambed. Photo copyright of Rob Clack