

Set in Stone

The NHM Palaeontology Dept. Newsletter



Rocks and Rioja

Angela Milner visits *Baryonyx* in Spain

Also in this issue
Lorna Steel brings the Dodo back to life
Norm MacLeod on science and religion
Jon Todd on fieldwork in East Africa

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Cover image: Sand Between the Toes: The owner of these Iguanodon-like footprints walked along a beach 120 million years ago in what is now La Rioja, Spain.

Keeper Country Science and Religion: What Scientists Believe

Relations between science and religion are much in the news these days. As any such discussion usually touches on the subject of fossils, that puts palaeontologists directly in the firing line. At the recent International Foraminiferan Congress (FORAMS 2006) I found myself having lunch with Jere Lipps, Steve Culver, and Mark Lekkie when the conversation turned from political politics (e.g., what an embarrassment the current Bush administration has proven to be) to cultural politics in the form of the science-religion dichotomy. My three US colleagues all agreed they were having to be much more careful in their comments during lectures and student advising sessions. It seems the proportion of students holding strong religious beliefs either had grown over the past decade or so, or such students had become less reticent about voicing their objections to being taught mainstream evolutionary theory in front of their fellows. This seemed to me a significant development as my previous experience had been that the science sections of US university campuses had been mostly religion-free zones; quite atypical of the wider US culture in which religious issues have long been an important, though mostly un-discussed, subtext. Then Jere, in his characteristically provocative manner, said something that brought me up short. "I tell my students I don't believe in evolution. It's just the theory that best explains the facts I see. If a theory came along tomorrow that explained the facts better than evolution, that's the theory I'd accept."

On one hand Jere's statement makes perfect sense. Scientists are often portrayed as signing up to a strict, hypothetico-deductive form of reasoning, the 'scientific method'. In short, scientists are said to (1) observe a phenomenon, (2) develop a hypothesis regarding the phenomenon's cause, (3) deduce predictions of observable behaviours or relations that should logically be produced if the hypothesis is correct, (4) collect data that bear on the question of whether these predicted phenomenon exist, and (5) accept or modify their hypothesis in light of their empirical findings. On the other hand Jere's statement begs the questions of what scientists do believe regarding the status of evolutionary theory—is it really as disposable as Jere and strict hypothetico-deduction theory suggest—and whether the strictures of the 'scientific method' allow scientists *qua* scientists to believe anything at all.

Of course, life's not so simple as the textbook scientific method statement would have us believe. Long ago it was recognized that, strictly speaking, deduction would never be sufficient to make anything other than limited, empirical statements about the world. Take Hempel's (1943) raven paradox for instance. Suppose I see a black raven (step 1 above). I might hypothesize that all ravens are black (step 2). From this I could predict that whenever I saw a raven, no matter where, no matter when, it would be black (step 3). If I were really interested in this question I might then set out on a tour of zoos, museums, and raven habitats to determine whether all the ravens I could find were black (step 4). With each black raven I found my confidence in the 'ravens are black' hypothesis would grow (step 5). I could even express this as a probability so rare, atypical observations (e.g., albino ravens) could be taken into account. Sound familiar? However, to a philosopher the statement 'all ravens are black' is formally equivalent to the statement 'all non-ravens are not black'. Thus, if I observe five black ravens and (say) five yellow lemons, both sets of observations are not only consistent with the hypothesis 'ravens are black', but contribute exactly the same amount of support for

that hypothesis; contra 'common' sense. The point is no matter how many ravens you observe, you won't be sure ravens are black until and unless you observe all things, which is impossible. In order to accept the hypothesis 'all ravens are black' something beyond simple deduction is needed, which brings us back to the issue of belief. Is belief—in black ravens, evolution, or anything else—possible for those who subscribe to a scientific view of the world?

Naturally, different people answer this question in different ways. The historical link between the sciences and religion is too well-known to warrant redescription here. The fact that many (but by no means all) scientists also hold strong religious beliefs provides ample evidence that it is possible for science and religion to co-exist, even in the same person. What is less clear is whether religion informs or hinders our understanding of nature in any meaningful way.

In his latest book, *The God Delusion*, Richard Dawkins holds that religious belief is an atavistic cultural trait of a pre-scientific world in which not only all of the marvellous facts about nature we take for granted today were unknown, but the world's most learned scholars were unsure as to how to go about obtaining these facts. As an atheist Dawkins doesn't find comfort in, or inspiration from, the products of religious belief. Because of the history of religion's tolerance of war, bigotry, prejudice, exploitation, even child abuse, Dawkins goes on to make a case not just for its irrelevance to modern concerns, but its active encouragement of some of the most undesirable aspects of human nature. He, also suspects there are a vast number of educated people in the world who, like him, don't have much use for supernatural explanations of the past, present, or future. Dawkins' goal is to try to encourage this silent majority to stand up, be counted, and claim the political power their numbers and societal positions deserve for atheism. At the very least he would like to help make the world the kind of place where an atheist can declare his or her (non)belief without fear of political or cultural reprisal.

Dawkins' arguments are well made and I have a great deal of personal sympathy for his position. However, I doubt they will have the effect he intends. Most people feel a very basic need to believe they are participating in something larger than themselves. This is what Jean-Paul Sartre referred to as a 'god-shaped hole' in human consciousness. Dawkins' basic position is that religious belief is unnecessary; the god-shaped hole either doesn't exist or can be made to vanish through appropriate education. For some this clearly is the case. But for the overwhelming majority, including many who have received the finest education society has to offer, there remains a strong emotional need to belong to a group and, in so doing, support the inter-personal attachments with family and friends that are part and parcel with living in a society. Religion is one of the primary social structures that supports this social cohesion. The empirical evidence suggests Dawkins' offer of faith in a process of obtaining information about the world as a substitute for a shared group narrative—non-belief as a substitute for belief—strikes most as absurd. This relation can be easily quantified by comparing the number of individuals who identify themselves as atheists (according to the 2001 World Almanac 0.5% of the US population, 3.5% of the European population) to those who participate in some form of religion (75% worldwide, <http://en.wikipedia.org/wiki/Religion#Demographics>

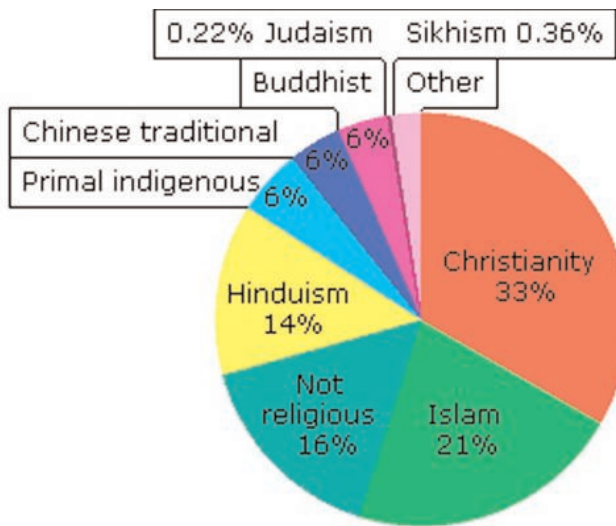


Figure 1. Major religions of the world at a percentage of world population (2005)

see Fig. 1).

If religion is ubiquitous and has been over most of what we know of human history, with atheism the rare exception, Dawkins hypothesis that religion is bad seems to be on shaky ground, hypothetically speaking. After all, if religion served no useful purpose why did it develop and why has it been maintained as an aspect of human populations for such a long time? If it brings out the worst in people why didn't non-religious societies triumph in historical clashes of civilizations?

Daniel Dennett and David Sloane Wilson have taken a different tack from Dawkins. Both argue that religion should be seen as a cultural adaptation and studied so it can be understood just like any other adaptation. Whereas Dawkins mocks religion as a vestigial cultural organ we would do far better without, Dennett and Wilson counter that religion is among the most important of all human adaptations; important enough to be taken seriously from a scientific—specifically from an evolutionary—perspective. Since religion surrounds us and (likely) always has, perhaps the time is right to ask 'What's religion for?'

Of course religious scholars have been doing precisely that for millennia. What can scientists hope to contribute? Potentially quite a lot. Most religious scholars are steeped in the traditions of religion, which, as Dawkins rightly points out, accepts supernatural explanations. Scientists tend to prefer natural explanations and are prepared to work hard to get those naturalistic answers. More importantly though, scientists have a guiding principle that hasn't ever been seriously applied to the study of religion; natural selection theory.

Dennett has been travelling down this road for some time. In *Consciousness Explained* (1991) he posited the novel hypothesis that human consciousness arose through a process of cultural natural selection supported by the massive parallel-processing capabilities of the brain. In *Darwin's Dangerous Idea* (1995) he generalized this argument, likening natural selection theory to a 'universal acid' that 'eats through' traditional (supernatural) beliefs. Then, in *Freedom Evolves* (2003) he extended this theme to one of the last bastions of human exceptionalism, the development of free will. Now, in *Breaking the Spell: Religion as a Natural Phenomenon* (2006) Dennett argues that religion should be subjected to the same sort of analysis so that it may be understood in the context of natural selection.

The fact that natural selection theory can be successfully applied to so many different areas of

inquiry stems from its unusual nature. Unlike (say) the theory of gravity ($F=mg$) or special relativity ($E=mc^2$) which are both statements about the structure of nature that have no precise meaning outside their established contents (e.g., other than as a metaphor there is no such thing as a 'social black hole' and if I hear one more arm-chair physicist/philosopher tell me 'Einstein proved everything is relative.' I think I'll scream), natural selection is a statement about systems; any system, all systems. Indeed, strictly speaking natural selection is really not a theory at all. A theory can be disproved. It may be the case that $F \neq mg$. As a matter of fact, $E=mc^2$ is famous, in part, because it disproved certain aspects of

Newton's theory of gravitation. For these theories disproof as descriptions of nature means they are absolutely disproved because they don't apply anywhere else. Natural selection is different. If a group of objects varies, if this variation is linked to the states of subsequent objects, and if selection is applied such that some proportion of the original group cannot influence the states of subsequent objects, the mean state of subsequent objects will change to reflect the selection. Natural selection is a statement about systems, as valid for business conglomerates as it is for butterflies. Technically, natural selection is an algorithm; a set of rules that always produces the same result regardless of the input.

Even more importantly, Dennett riffs again and again on the *sine qua non* of traditional beliefs, the imposition of order on chaos. Natural selection creates order wherever it applies; highly structured order, all from a natural, mindless process. *Breaking the Spell* is a bit less satisfying than his previous books insofar as Dennett confines himself more to pointing out the directions he'd like to see a scientific research programme in comparative religion take than in reporting on a body established work. Still, it has its moments. I hadn't thought about it before I read Dennett's book, but just like the universes of virtually all science fiction and fantasy stories are populated by humanoids and obvious variants of humanoids (usually speaking English) because those stories really aren't about a long time ago in a galaxy far, far away, religious iconography of the gods is predominately populated by ... people. Profoundly non-people like forms are almost always reserved either for minor deities or unpredictable and usually maleficent monsters. Perhaps the idea of non-human headman is just too scary for most of us to cope with. This also illustrates another of Dennett's themes, that a process of natural selection operates in religions as they develop. "Every minister in every faith is like a jazz musician keeping traditions alive by playing the beloved standards the way they are supposed to be played, but also incessantly gauging and deciding, slowing the pace or speeding up, deleting or adding another phrase to a prayer, mixing familiarity and novelty in just the right proportions to grab the minds and hearts of the listeners in attendance."

While Dennett's book is limited because he hasn't devoted enough time to the topic to come up with more than an entertaining overview of what such an enquiry might look like, David Sloan Wilson's somewhat neglected *Darwin's Cathedral: Evolution, Religion, and the Nature of Society* (2002) delivers the goods, at least in part. Wilson points out that evolutionary investigations of group behavior such

as religion have been blocked since the 1960's by a rejection of group-selection theory. This rejection began with G.C. Williams' *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought* (1966) which, in turn, drew heavily on W. D. Hamilton's ideas about kin selection (the idea that altruistic behavior arises as a result of being nice to people who are genetically related to you, thus give a proportion of your genes a better chance of survival) and reciprocal altruism (the idea that it pays evolutionary dividends to do favors for people who will reciprocate by doing favors for you, thus giving your genes a better chance of survival, see also Alexander 1987). Wilson favors a more contemporary view of natural selection which is not just directed at the individual, but operates across an organizational hierarchy from groups of molecules that 'coordinate' their reactions, to individuals that are themselves now seen as highly integrated 'social groups' of different organisms, and on to complexes of populations, species, and clades. This expanded reference frame for natural selection offers much greater scope for developing testable hypotheses that make different predictions about aspects of human behavior. Thus, religion can be seen as a group-level adaptation that enhances the average fitness of populations that practice it, (with some religions being more successful adaptations than others), an individual-level adaptation that conforms to the predictions of kin selection and reciprocal altruism, or as a meme-level cultural parasite that evolves at the expense of individuals and groups. Non-adaptive explanations are also available under this model with religion being important at an earlier stage of human development, but either irrelevant or maladaptive in the modern world (this seems close to Dawkins' current position) or as a contingent by-product of selection focused on other genetic, individual, or cultural traits. Like Dennett, Wilson also acknowledges that the world is a complex place and that all aspects of organismal behavior—like organismal morphology—aren't single traits, but complex assemblages of traits under the control of selection operating at a variety of levels.

While pursuing Dennett and Wilson's research programme will be complex, the track record for using selection theory to understand complex phenomena is encouraging. In groping toward this desirable end, no one's view need be forced on anyone else. Atheists as well as practicing Christians, Jews Muslims, Hindus, Buddhists, etc. should be as interested in the outcome of this research as scientists. The long history of ecumenical dialogue shows different religions are willing to share information about their history and beliefs with others. Even more importantly, these represent potential sources of funding for genuinely scientific research projects. The relevant point for palaeontologists—and indeed all scientists—is made most eloquently in Wilson's book; that success in understanding religion from a scientific point-of-view will require active collaboration between scientists and religious scholars. The old 'us and them' model for interaction between these communities (and exemplified by Dawkins' writings) not only misses the point, it impedes progress in understanding one of the most significant aspects of the human condition. Much like the outmoded dichotomy between C. P. Snow's 'two cultures', the historical antagonism between 'science' and 'religion' has been overblown and, to the extent it still exists, counter-productive (see S. J. Gould's books *Rocks of Ages* and *The Hedgehog, and Fox, and the Magister's Pox* along with E. O. Wilson's *Biophilia and Consilience*). All scientists, regardless of their stance on religion must believe that understanding natural phenomena is a good and important thing to do. To the extent that natural selection has proven to be a powerful tool for gaining a detailed—though not complete—understanding of a wide variety of natural phenomena, the application of this approach to understanding religion should be sup-

ported. As scientists the responsibility for fostering an intellectual climate in which such investigations can take place falls on us all.

Norm MacLeod
Keeper of Palaeontology

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Research Roundup

Conferences and Meetings

It has been a busy summer for conferences with staff attending a variety of Europe-wide meetings to talk about topics ranging from microfossils to mammals.

Peter Forey gave a keynote address to the *First International Conodont Symposium 19 – 21 June*, held at Leicester University under the auspices of the Pander Society. His title was 'Pander's Silurian Jawless Fishes – Then and Now'. Christian Heinrich Pander (1794 – 1865) started life as an embryologist (he studied with the great Karl von Baer and coined the word blastoderm), but turned to palaeontology and wrote four highly significant monographs on Baltic Silurian and Devonian fossil fishes. The first of these dealt with jawless fishes and included the first description of conodonts. His work was remarkable in its detailed histological information – no doubt due to his embryological studies. Many of the jawless fish taxa that he erected remain today, including the group he called Coelolepiden (hollow scale), that we call thelodonts, and which are used for stratigraphic correlation.

Anjali Goswami and Marcelo Sánchez attended the first and founding meeting of the *European Society of Evolutionary Developmental Biology*, which took place in Prague in August. There were almost 300 presentations in a variety of topics covering vertebrates and invertebrates. The next meeting is planned to take place in 2008 in Spain. Anjali was an invited speaker in a symposium on Modularity. Her talk, entitled 'Macroevolutionary patterns of mammalian cranial modularity', presented quantitative analyses of trait correlations and modules (semi-autonomous sets of highly-correlated traits) in 106 species of Recent and fossil mammals including a discussion of the influence of development and function on cranial modularity. Other talks within the modularity symposium ranged from signalling networks to butterfly eyespots to reproductive organs in plants, providing very diverse views of modularity. Marcelo presented a talk summarizing his research on limb development and evolution in turtles. Thanks to collaborations with labs in Japan in Germany that have breeding programs to obtain specimens for experimental work, it has been possible to conduct comparative anatomical studies on ontogenetic series of several non-model species. This work revealed, for example, different mechanisms for growing paddles, important for propulsion in an aquatic environment, in different turtle clades. It also provided definitive evidence of wrist and ankle bone homologies, based on the conserved patterns of connectivity during development of limb elements that are found in most tetrapods, are also found in turtles. These results are being used to revise the homologies of adult bones in some fossil turtle species basal within major clades.

John Richardson was a keynote speaker at the *Commission Internationale de flora du Palaeozoique Conference* in Prague in early

September. His address was titled 'Lower Devonian Cryptospores and Miospores, Their Distribution Patterns in the Lower Old Red Sandstone of the Anglo-Welsh Basin, & the Habitat of their Parent Plants.' John also gave a second talk entitled 'Palynological Evidence for the Dating and Interpretation of a Late Devonian Sedimentological Event in Northeast U.S.A.: Extraterrestrial, Meteorological, or Glacial?' with Don Woodrow and Violeta Avkhimovitch from Hobart and William Smith colleges, Geneva New York. John was also at the Ludlow Research Group meeting in September to examine sections in Marloes, re-interpreted in the light of a recent PhD thesis.

The *54th Symposium on Vertebrate Palaeontology and Comparative Anatomy* was held in the Ecole Nationale Supérieure des Mines, Paris from 12 - 17 September. Paris is undeniably an attractive conference venue at any time of year and it was particularly pleasant in September with weather warm enough to eat outside until late in the evenings. Jerry Hooker spoke on bipedal browsing adaptations of the Late Eocene-earliest Oligocene tylopod artiodactyl *Anoplotherium*. Bipedal high browsing in this beast represents an adaptation previously unrecognised in European Eocene communities. Alison Longbottom gave a presentation on the use of morphometric techniques in the analysis of intra- and inter-specific variation Paleogene fossil catfish from Mali and Nigeria, comparing results with recent bagrid catfishes material to determine how many species might be present within the Mali and Nigeria catfish faunas. Angela Milner talked about avian brain evolution in fossil birds from the Lower Eocene of England based on 3D CT brain reconstructions of *Odontopteryx* and *Prophaethon* from the Isle of Sheppey, work done in close collaboration with Stig Walsh. Martha Richter and Eduardo V. Toledo presented a poster on the first Triassic lungfish from South America, from the Upper Triassic in Rio Grande do Sul that extends the distribution of the genus to South America. Sally Young and Robert J. Williams gave a poster on cranial anatomy and geographic distribution of the eel genus *Echelus* from the Lower Eocene. Abstracts for all these presentations are available on-line at http://www.svpca.org/years/2006_paris/oralpresentations.php

Paul Taylor was an invited speaker at the *9th Argentinean Congress of Palaeontology and Biostratigraphy*, hosted by the University of Cordoba and Academy of Sciences in Cordoba, 18-22 September. He gave a keynote address on bioimmuration and also ran a short course on the evolutionary palaeoecology of bryozoans. The Congress was attended by almost 300 scientists and students, the great majority being Argentineans, a reflection of the current vigour of palaeontology in that country which has been fuelled particularly by discoveries of dinosaurs and other vertebrate fossils in Patagonia.

Although Lorna Steel has only just joined us cephalopod curator (see "Bringing the Dodo Back

to Life", page 5) she has brought with her varied research interests and expertise, including bone histology of extinct vertebrates. Lorna attended the *Reconstructing the World of the Dodo and Determining the Cause of its Demise Symposium* in the Department of Zoology, Oxford University, 28-29 September and talked about thin-section bone histology of the Dodo femur and tibiotarsus. Old material from previous excavations of the Mare aux Songes, Mauritius, in the 1800s, was badly bio-eroded and histological analysis was not possible. Preliminary results from newly excavated material (obtained in June 2006) show that the histology is well-preserved, with extensive reworking in the weight bearing limb bones. The next step in this research will be to examine other elements of the skeleton, with particular interest in the humerus. Unfortunately this element is rarely preserved. Tortoises are common at the site, and it is hoped that histological analysis of a growth series for this group will also be possible. The project is being undertaken in collaboration with colleagues at NHM Tring and Naturalis (Leiden). Lorna is a member of the Dodo research team and she will be participating in fieldwork in Rodrigues in November 2006, excavating cave sediments and extracting extinct vertebrate remains. Excavated material will go on display in a purpose-built visitor centre run by residents of the island.

Last, but not least, Norm MacLeod has also been traveling, presenting invited lectures at the University of Zurich and ETH, Zurich ('The 'K-T Mass Extinction': Victims, Survivors and Causes' and 'Systematic Implications of a Synthesis Between Morphometrics and Theoretical Morphology' in 31 June and 1 July, respectively), as a featured speaker at the Vienna *MorphoFest 2006* (17-22 July) and a symposium organizer, workshop organizer, and speaker at the *International Foraminiferal Congress (FORAMS 2006)*, in Natal Brazil ('Evolutionary Morphometrics of the Foraminiferal Test in Time and Space' Symposium', Automated Recognition of planktonic Foraminiferal Species' Workshop, and 'Phylogeny and the Evolutionary History of Planktonic Foraminiferal Test Size' presentation); Norm was also a member of the Programme Committee for this Congress. The MorphoFest event was particularly noteworthy in that he, along with Fred Bookstein, Jim Rohlf, Dennis Slice, and Charles Oxnard, were originally scheduled to contribute one presentation each to the week's discussions in front of an audience of students and post-doctoral researchers. At least, that was the plan. Somehow though, Norm ended up contributing presentations on semi-landmarks, modularity and development, size-shape spaces, and neural nets in addition to his assigned topic of 'Morphometrics and Classification', with most of the former presentations being created the evening before they were delivered. Norm will need to return to Vienna sometime to see what the city looks like.

Books and Symposium Volumes
Paul Barrett reports with much relief the final sub

mission of the volume he edited on early sauropodomorphs. This resulted from the Society of Vertebrate Paleontology symposium he organised in 2005 and is entitled *The Evolution and Palaeobiology of the Early Sauropodomorph Dinosaurs*. The volume contains eleven original articles on the phylogeny, taxonomy, palaeobiology and functional morphology of prosauropods and early sauropods and will be published by the Palaeontological Association as a Special Paper in Palaeontology in early 2007.

Chris Stringer's latest book 'Homo Britannicus: The Incredible Story of Human Life in Britain', published by Allen Lane, London, appeared on 5th October. Therein Chris recounts all the fascinating new data on the history of the fauna and human occupation

in Britain over the past 700,000 years that has resulted from the five year Ancient Human Occupation of Britain Project funded by The Leverhulme Trust. A really nice touch is an appendix about each member of the AHOB team including our very own Andy Carrant. Chris has recently appeared at the Cheltenham Book Festival and the Ilkley Literature Festival in support of the book and is due to appear at the Royal Geographical Society imminently. He's also taken part in a 'Nature Live' presentation about the book here at the Museum. Throughout most appearances, Chris has been accompanied by a full-size restoration of a mammoth (a publisher's promotion idea). It is rumoured said beast is likely to preside over the NHM ice rink for the coming season. There is also a 'Homo Britannicus' website at <http://www.homobritannicus.co.uk/> with links to other sites and a mammoth competition.

Grants

Paul Barrett (as a co-Principal Investigator) has been awarded a Linkage International Fellowship funded by the Australian Research Council together with Ben Kear (Principal Investigator) of the University Adelaide. This \$40,306 fellowship, was for a comparative study of Australian and British Early Cretaceous reptile faunas. Paul will visit Australia for several weeks and Ben Kear will spend several months visiting the NHM sometime during 2007.

Angela Milner
Associate Keeper

Collections News

Wandsworth – a word that strikes fear into many a Palaeontology curator's heart, mine included! Like many of us I have always successfully avoided the Wandsworth issue, pushed it to the back of my mind and considered it someone else's problem. Now however, it is very much my problem. I find myself learning the history and problems surrounding the Wandsworth Store, helping ensure it becomes a well-managed extension of our facilities at South Kensington.

Fortunately for me, during our Head of Collections interregnum a departmental Wandsworth Committee was set up under the guidance of Clive Jones and Lorraine Cornish. While Clive has been overseeing the tendering process to purchase new storage furniture over the next five years, Lorraine has been leading the planning of all the outstanding tasks that need doing. The first of these is the unpacking and storage of 13 *Megaloceras* skulls. To achieve this the Collections Division are currently holding their first Wandsworth Week from 6 – 10 November. This will be the first of what we hope will become a quarterly event. After two days work in the Store I have found muscles that I had long forgotten about as a team of us moved several hundred bags of sediment and countless boxes of samples. When I left Wandsworth this morning the team were hoping to install the first *Megaloceras* skull this afternoon.

So what are we trying to achieve? If you have ever had the opportunity to take a peek at Zoology's storage area you will see the type of store we are hoping to realise. We need to create a sensibly zoned working area that we can use effectively for storage and which we can work in too. This isn't an easy task, but one the Department has to work towards to achieve the expansion space and quality of storage it needs.

Despite my horror at the scale of the job I never cease to be amazed by some of the wonderful material we already hold there, fantastic tree stumps, slabs of sea floor with super assemblages, and old dioramas that are interesting from an his-



Figure. 1: Where men fear to tread: Wandsworth before removal of sediment

torical perspective. I am forced to ask myself 'Aren't these specimens as deserving of appropriate care and storage as the collections outside our offices in the Palaeontology Building?'. Yes, I think they are. The coming years will bring challenges to bring our

store up to a standard of care we are satisfied with, but if we do it right the benefit to our collections and our visitors will be great.

Sarah Long
Head of Collections

Bringing the Dodo Back to Life

The dodo, *Raphus cucullatus* Linnaeus (1758), also known by the unbecoming moniker of *Didus ineptus* (Linnaeus 1766), has become an icon of extinction, epitomising human impact on vulnerable island faunas. Although it became extinct in historic times, no one ever made a serious study of its biology or ecology while it was still alive. We cannot turn the clock back - if only we could - but a new project is revealing more about the life and times of this very

special bird.

The physical appearance and habits of the dodo are recorded in contemporary accounts and drawings. Seafarers of several nationalities were probably aware of Mauritius, but it was predominantly the Dutch who occupied the island during the late 16th and early 17th centuries. Some described the animals and plants that they encountered, but many of

these accounts are inadequate, and their descriptions of the dodo are totally unreliable.

Dodos must have been pretty hardy creatures. One captive individual somehow survived the long sea voyage to London, only to be displayed in around 1638 as a curiosity for the paying public. It is likely that it ended up as a stuffed specimen in John Tradescant's collection and in 1659 was transferred



Figure 1. The Dutch team carry out the preliminary excavation.

to Elias Ashmole's museum in Oxford. Huge quantities, and most of the bones were actually from giant tortoises. Furthermore, all excavated material



Figure 2. Reconstruction of the Mare aux Songes before the arrival of humans.

has remained on site, except for a few fragments taken for DNA analysis and bone histology studies. As a further diplomatic gesture, representatives of local governing bodies were invited to attend the excavation and become involved in the resultant publicity.

Mauritius is a nation that has sometimes failed to make the most of its natural heritage; in fact the Mare aux Songes was ignored for 100 years and is not even signposted to assist tourists wishing to make a pilgrimage to the site. The situation can be likened to the English doing nothing to study, preserve and provide directions to Stonehenge! This situation may change in the future though, as the Mon Tresor Mon Desor Sugar Estate is reconsidering plans to develop the site in favour of setting up a visitor attraction where people can watch excavations taking place.

So, what have the invading scientists found? Members of the team have been working hard on

identifying bones and plant remains, analysing pollen, determining the geological history of the area, and so on. Kenneth Rijksdijk (Naturalis, Leiden) believes that the marsh developed in a collapsed lava tube, and opened into the sea. Beth Shapiro (Oxford) is looking for DNA in the bones and in the surrounding sediment. Julian Hume (Tring) has identified skeletal elements from numerous different birds, including rails, owls, flamingos, pigeons and giant parrots. Giant tortoises, skinks and fruit bats are also present. Among the plant material analysed by Vincent Florence (University of Mauritius) and Claudia Baidier (MSIRI) are ebony, the nearly extinct dodo tree (Tambalacoque) and various palms. From this fossil evidence it has been possible to reconstruct life in the Mare aux Songes before humans arrived and trashed Mauritius beyond recognition (Fig. 2).

I am looking at the bone histology of the dodo. Although the bones from the 2006 excavations look rather flaky, their histology is extremely well preserved, as these thin sections produced by our very own Tony Wighton demonstrate. The bone of the femur and tibiotarsus grew rapidly, as would be expected in most birds, but is highly secondarily reworked (Fig. 3). I hope to acquire more material so that comparisons can be made between the histology of leg and wing elements.

Further information on the Mare Aux Songes project can be found at <http://www.dodos.eu>.

Lorna Steel
Curator, Invertebrates and Plants B-Team

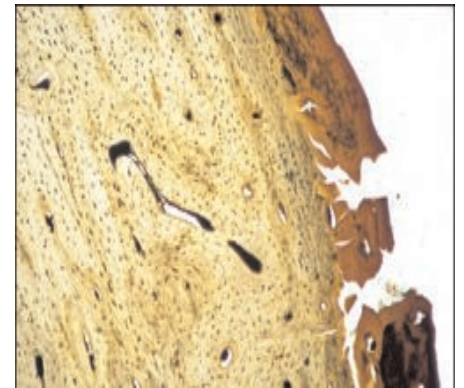


Figure 3. Thin section through dodo tibia (width of image = 1 mm).

Rocks and Rioja

I spent 24 -28 July in La Rioja Province in north-western Spain at the invitation of Luis Viera and Jose Angel Torres of the Sociedad de Ciencias Aranzadi, San Sebastián. The principal objective of my visit was a preliminary appraisal and verification of some recently excavated material of the Barremian spinosaurid dinosaur, *Baryonyx*. Material of this fish-eating theropod, originally recovered from Smokejack's Pit near Ockley, Surrey, and described by Charig and Milner (1986,1997), has been also been found from fragmentary remains in the Barremian in Spain; in La Rioja in 1995 (Viera and Torres, 1995), in neighbouring Castilla y León at Salas de Los Infantes (Fuentes Vidarte et al. 2001). In 2005, most of a hind limb was discovered from La Rioja by a local amateur collector, Pachi Sáez Benito. It was this material that I went to see. The specimen is particularly interesting as it includes all almost all the elements missing in the holotype, but enough overlap to be sure that does belong to *Baryonyx*. Plans are now in hand for a collaborative project to describe

the limb bones.

The material is housed in the Centro de Interpretación Paleontológica de La Rioja at Igea, a small town in eastern La Rioja. This museum, which opened in 2005, has been created largely through the dedicated enthusiasm and expertise of Luis and Jose Angel, together with other members of the Sociedad de Ciencias Aranzadi and much local expertise, enthusiasm and support around Igea. There are two floors of excellent displays dealing with the geology and palaeontology of La Rioja 120 million years ago, a small library and a preparation laboratory – all this in a town with a population of less than 700.

The museum is at the hub of an embryonic tourist industry in La Rioja and the starting point of a long dinosaur trail that winds through the mountain roads of the province. There were over 7,000 visitors to the museum during the first year, quite impressive since La Rioja, despite its renowned



Figure 1. The logo of the museum in Igea.

wines, is little-known as a tourist destination for dinosaurs. The town is clearly very proud of its museum, which also has support from the provincial government of La Rioja This was amply demonstrated in the form of a large press conference held on the Thursday morning, attended by Pedro Sanz, President of La Rioja Province. I gave an extended



Figure 2: Trackways of an ornithomimid (left, walking from top to bottom) and a theropod (right, walking from bottom to top) that crossed coastal ripple—marked sediments 120 million years ago.

address at the conference emphasising the importance of the new material and the work that is going on in the museum and the surrounding area. Virtually the whole town crammed into the museum to witness the event that also stimulated double-page coverage in the local newspapers and a few column centimetres in the national Spanish press.

Igea is so small that it has no hotel and no restaurants. I stayed in the nearest hotel about 15 km away. The museum group solved the catering problem by building their own kitchen-cum-dining room. Whenever the team is in town, a local (and very good) cook prepares the meals. Extended and excellent Spanish lunches from about 2pm to 5pm and dinner beginning anywhere from 10pm to 11 were the order of the day.

There are thousands of square kilometres of Barremian exposures in the hills and mountains of eastern La Rioja, particularly in the Munilla and Enciso areas. These are peppered with dinosaur tracks, many on steep mountain slopes. The exposures were laid down in coastal and brackish flood plain conditions with alternating shallow marine incursions. There are countless tracks of ornithomimids, large and medium-sized footprints generally ascribed to *Iguanodon*, rather less common smaller footprints ascribed to *Hypsilophodon*, some sauropod and many theropod tracks. My

Spanish colleagues tried in vain to convince me the latter were made by *Baryonyx* but, alas, theropod footprints are more difficult to equate with possible trackmakers than are ornithomimids and sauropods.

We visited many of the more accessible trackway sites, some of which have been incorporated into the dinosaur trail, complete with interpretative sign boards (in Spanish only) and full-size fibreglass reconstructions of the track makers (along with some popular dinosaurs that have no place in the Early Cretaceous of Europe). We also scabbled up and down steep rocky slopes covered in wild thyme and rosemary in temperature of 40°C to visit some rather more remote localities – all producing the same footprint assemblages. The area must have been a veritable dinosaur coastal highway 120 million years ago.

Most of the trackways have been discovered and mapped by Luis and Jose Angel during nearly 30 years of dedicated and painstaking fieldwork (Viera and Torres 1984). Despite the vast exposures, few skeletal remains have been found to date, although there are some bivalve and gastropod-rich horizons. There are also some impressive coniferous tree trunks. Sadly, despite being in a locked and covered enclosure on the dinosaur trail, one of the longest trunk sections— more than 11 metres in length— has been damaged by trophy hunters: it

happens everywhere.

My short trip was highly enjoyable. My hosts were the most friendly, warm, generous and hospitable people one could ever have the pleasure to meet. I owe them a great deal of thanks, not only to Jose Angel Torres and Luis Viera but also to Gorka Martin and Susana Rodríguez who acted as translators amid much fun and laughter, the staff of the museum and people of Igea – most of whom knew who I was and the purpose of my visit with five minutes of my arrival in their community!

Angela Milner
Associate Keeper

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Figure 3: This in situ coniferous tree trunk was recently damaged and a large section removed despite being a locked cage. Looking on in some dismay are Jose Angel Torres, one of my principal hosts (top) and Pachi Sáez Benito, discoverer of *Baryonyx* remains near Igea.

Lake Rukwa: Palaeontological Fieldwork in the Basin of a 'Forgotten' East African Rift Lake

East African rift lakes are justly celebrated as model systems for testing speciation hypotheses. Considerable current research is focused on examining the dynamics and driving forces behind the remarkable and in some cases extremely rapid episodes of intralacustrine diversification recorded from a wide range of clades. For example, the largest endemic radiation of vertebrates known—the 500+ cichlid fish species in Lake Victoria—are thought to have accumulated during just the past 12,000 years based on the presence of a well-

dated palaeosol underlying the centre of the lake basin. The debate on mechanisms centres on contrasting the relative importance of allopatric process (e.g., changes in main lake level, isolation in satellite lakes), versus the importance of sexual selection, for which cichlids are renowned.

Despite the hotness of the issue, the temporal context and role of geographic isolates in rift-lake faunal diversification has a surprising lack of hard palaeontological evidence. The rifting process and

the geometry of lakes such as Tanganyika and Malawi means that the sediment piles preserved in their basins (though up to several kilometres thick) are mostly deep under water. A major drilling effort has extracted long cores from Malawi with exciting new data on climate change in East Africa (<http://malawidrilling.syr.edu/>, <http://news.bbc.co.uk/2/hi/science/nature/4505516.stm>). However, the potential to retrieve microfossils through these means is limited, as the area sampled is only a few square centimetres per time slice. Moreover, the

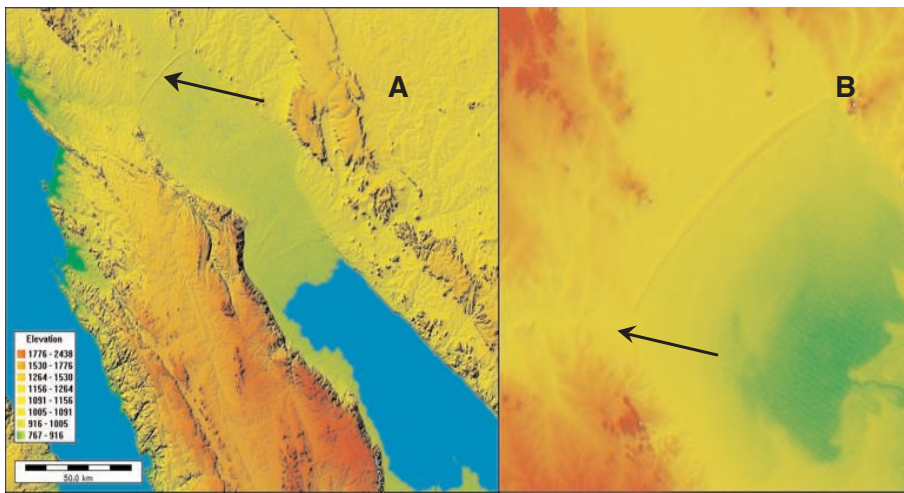


Figure 2. Satellite Digital Elevation Model of the northern part of the Rukwa rift basin and an adjacent part of the Lake Tanganyika basin. A. Prominent NE-SW-trending linear sand ridges are seen to extend across the basin to the north of present day Lake Rukwa. The arrowed Liande ridge extends from Sitalike in the NW to Malambo in Katavi National Park. B. Close-up DEM of the Liande sand ridge. This giant sand dune acted as a barrier to Lake Rukwa as it rose prior to its spillover to Lake Tanganyika through a sinuous channel (arrowed). Our fieldwork shows this saddle between the Rukwa watershed to the SE and the Tanganyika watershed to the NW to lie at 975m. This implies that Lake Rukwa (present lake surface at 802m) may have been at least 175m deeper at highstand compared to its 2006 level. Images courtesy of A. Cohen.

depth of the deposits often means that calcareous skeletons have been lost through diagenetic aragonite dissolution.

Clearly the place to look for palaeontological keys to the rift lake species radiations is in and around neighbouring extant and fossil water bodies. Although some of Britain's most famous explorers made the first expeditions to the areas around these lakes (e.g., Livingstone, Stanley, Burton, Speke), relatively little scientific work has followed in their footsteps. We assembled a small team assembled to undertake reconnaissance fieldwork in the Rukwa rift valley. Our work was based around a major question in rift lake hydrogeological history that bears directly on questions of evolutionary radiation. Lake Tanganyika, the deepest (1470 m), oldest (14 my), and arguably evolutionarily most interesting of the rift lakes (hosting radiations in many metazoan taxa), might have been connected at one time to Lake Rukwa.

Scientifically, Rukwa remains poorly understood though it is sited en echelon between the rift valleys cradling the much more intensively studied lakes Tanganyika and Malawi (Fig. 1). Considering this pivotal geographical and hydrological position, it is possible that Rukwa could have acted as a peripheral region where Tanganyika's endemic species lived together with fluvial relatives normally excluded from the pure lacustrine habitats of Tanganyika. Perhaps more controversially, Rukwa may have had connections with Lake Malawi too. We had clues that a Rukwa-Tanganyika connection might have existed from the historical NHM Palaeontology Dept. collections that comprise the only fossil mollusc collections previously made from this basin. Of these, the only published material was collected by British exploration geologists in the 1930s and described by the Palaeo. Department's mollusc systematist L. R. Cox in 1939. This material was collected from an outcrop in the Rungwe River to the northwest of this currently much shallower lake. These small collections unfortunately lacked stratigraphic and even precise geographic context, but revealed mollusc and ostracod genera that are otherwise endemic to Tanganyika (personal observations), as well as more widely distributed taxa. Furthermore, Digital Elevation Models (DEMs) made from satellite images (Fig. 2a) and geomorphological research (e.g. Delvaux et al., 1998; Fernandez-Alonso et al., 2001) show clear linear sand ridges (probable sand dunes) that parallel the northern shore, indicating a retreat of a formerly much larger lake. Close examination of the most proximal ridge indicates spill-over features (Fig. 2b), including a sinuous

river channel connecting to Lake Tanganyika. This would mean that Lake Rukwa, which is currently mucky (the colour of the Thames) internally drained, and only an average of three or four metres deep despite its 140km length and 40km width, was formerly a much different water body with deep, potentially clear water (as is the case in Tanganyika) and with a connection to the Congo river drainage. Paleolimnological study of cores (e.g., Barker et al., 2002) has indicated changes of this scale and nature in Rukwa during the Pleistocene and Holocene. All of this is very suggestive, but needed ground-truthing and linking with the fossils to make hydrogeologic and palaeontological inferences about the connectivity of these two major water bodies. The timing of this connection appears at present to be restricted to the early Holocene (~10,000-9,000 years ago), but too little data is available currently to be conclusive on this point.

Thus, filled with enthusiasm and funded by the Palaeo. Department Investment Fund and the US NSF-funded Nyanza Project, we assembled a small team to undertake the first detailed micro- and macropalaeontological sampling in the Rukwa Basin. Our aims were straightforward.

1. To reconnoitre field-sites for future detailed faunal, sedimentological, and stratigraphical work;
2. To log and sample fossiliferous (mollusc- and ostracod-bearing) sites

Our team included Drs Andrew Cohen (Univ. Arizona, Tanganyika sedimentology, micropalaeontology, paleolimnology), Hudson Nkotagu (Univ. of Dar es Salaam, hydrogeology) Jon Todd (NHM Palaeo Dept., macropalaeontology) and a support team of Hamisi (driver), Idi Salaamu (game warden), two part-time game wardens and the Nyanza project support team back in Kigoma. Our fortunes were enormously enhanced by the guidance of Britta Meyer, a researcher in Katavi National Park who, through her GIS studies, had noticed the location of a number of highly fossiliferous outcrops in the region. Tanzanian authorities for Rukwa and Kigoma Provinces and the National Parks gave us full research clearance for all our sampled areas.

We rocketed over the recently (somewhat) improved roads of western Tanzania, arriving at one of the country's most beautiful and least visited national parks, Katavi (<http://www.tanzania-parks.com/katavi.htm>) where we made our base at the village of Sitalike at the edge of the park's northern boundary. We were very fortunate in that much of our research area was within the park

boundaries or could be reached only by extensive drives through the park along the only north-south road in westernmost Tanzania. Our daily trips through the park rewarded us with close-up views of crocs, hippos, elephants, giraffes, zebra, various gazelle, waterbuck, Cape buffalo, leopard and many other charismatic mammals, as well as five-foot pythons and the unfortunately ubiquitous tsetse fly. Non-palaeontological highlights included a rather close and all too interactive encounter with an angry bull elephant. Happily, in our five field days in and around the park we managed to evade the unwelcome attention of both the wildlife and its armed poachers. In total we sampled 28 localities and collected 47 lots of fossiliferous material amounting to 45 kg dry weight after sieving. This new material massively augments the few grams previously in the departmental collections.

After unpacking we are just beginning to sort the molluscan fauna. On first examination, the molluscs are intriguing and may provide the data to answer our questions over the timing and nature of the Rukwa – Tanganyika connections. A number of the mollusc species are Rukwa endemics and are identical to, but much better preserved than, those collected over 70 years ago. However, a number are new and include undescribed taxa. Most taxa are small and so finely sculptured that accurate species delimitation will require scanning electron microscopic study. The new material so exceeds our expectations in quality and quantity that we are still preparing for detailed lab research. We expect that the present material will provide new phylogenetic and biogeographic information particularly relevant to continuing re-evaluation of the regional evolution of freshwater molluscan faunas through the Neogene.

Jonathan Todd
Researcher

Ellinor Michel
Zoology Department

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A happy field team returns to base at Kigoma. Left to right: Chief Game Warden Idi Salaamu, Dr. Jon Todd, Dr. Andy Cohen, Hamisi – our driver and Dr. Hudson Nkotagu. Photo courtesy of E. Michel.

Around the Department

Performance Indicators 2nd Quarter

	April/June 06/07	July/Sept 06/07	Running Total 06/07
1. Number of papers in peer reviewed journals	16	31	47
2. Number of specimens for which records have been added to electronic databases	1347	2994	4341
3. Number of users of collections			
a. Number of visitor days	1819	892	2711
b. Number of visitors	1347	599	1946
c. Number of enquiries dealt with	4237	2491	4657
4. Grants - Starting within the reporting period			
a. Number of new grants	0	5	5
Number of grants applied for	13	8	21
b. Total value: the overall value of the award to both the Museum and the collaborators		£149,986	£149,986
c. Value to the Museum: total value (4b) minus the sum owing to the collaborators		£149,986	£149,986
d. Surplus to the NHM		£13,862	£13,862
LOANS			
Number of loans made (total)	17	14	31
Number of loans to English venues	11	5	16
Number of loans to UK venues	12	7	19
Number of loans to international venues	5	7	12
Number of specimens loaned for scientific purposes	668	196	854

Goodbye To

Marcelo Sánchez-Villagra

Marcelo leaves us at the end of November to take up the post of Assistant Professor in Palaeontology in the Paläontologisches Institut und Museum, University of Zürich, Switzerland on 1 December. Marcelo joined us in May 2004 from the University of Tübingen and has collaborated with colleagues here on a wide variety of research projects. Collaborations are set to continue so we shall look forward to welcoming Marcelo back as a regular visitor.

Kim Gale
Departmental Administrator

Publications

GIA

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Dates to Remember

December

Wednesday 6 Palaeo Executive Committee
Thursday 7 Collections Managers Meeting
Tuesday 12 Members Open Day
(Tours of the Department will take place)
Wednesday 13 Researchers Meeting
Friday 15 Palaeo Christmas Party, 4pm
Monday 18 to 20 PalAss Meeting
Monday 26 Christmas Day, Bank Holiday
Tuesday 27 Boxing Day, Bank Holiday

January

Monday 1 New Years Day, Bank Holiday
Tuesday 2 Performance Indicators due
Thursday 4 Collections Managers Meeting
Wednesday 10 Palaeo Executive Committee
Friday 12 Deadline for next SiS
Wednesday 17 Researchers Meeting

Deadline for next issue

Please submit all copy and pictures for the next issue of Set In Stone electronically to Allie Bailey (allb@nhm.ac.uk) by 12th January 2007

Evans, S. E., BARRETT, P. M., Hilton, J., BUTLER, R. J., Jones, M. E. H., Liang, M.-M., Parish, J. C., Rayfield, E. J., Sigogneau-Russell, D. and Underwood, C. J. 2006. The Middle Jurassic vertebrate assemblage of Skye, Scotland. 36–39. In BARRETT, P. M. and Evans, S. E. (ed.). *Ninth International Symposium on Mesozoic Terrestrial Ecosystems and Biotas* Natural History Museum, London, 187 pp. (F)

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Non GIA



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New Year to all our readers!*