Set in Stone

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Keeper Country: Peter Forey: A Retrospective

As this issue of Set in Stone goes to press, Peter Lawrence Forey, palaeoichthyologist, evolutionary biologist, phylogenetic systematist, recipient of a BBSRC Individual Merit Promotion, former Head of the Vertebrates and Anthropology Division, and all-round valued member of the Palaeontology Department and NHM scientific staff, will be starting a well-earned retirement after some 30 years of service. Peter grew up in Buckinghamshire during the privations of the 1940s and 50s. Even then, his twin interests in natural history and art were much in evidence. At his retirement party on 5 May, Peter alluded to trips he'd made to the NHM as a child with a local drawing club where, much to the surprise of his fellow students, he became intrigued by the odd

shapes and even stranger life-styles of deep-sea fish specimens then on display alongside the more familiar and charismatic lions, tigers, and bears. Peter's formal training was passed in England, first at Dr Challoner's Grammar School in Amersham, after which Peter made his way to London. Managing to avoid the more distracting enticements of the 'swinging' middle and late 1960s capital, Peter read Botany and Zoology at the South West Essex Technical College where he graduated in 1967 which an additional minor qualification in Geology. Peter then moved to Queen Elizabeth College where, in 1971, he completed a PhD in vertebrate palaeontology. Fish were not the only fossils on Peter's mind, though. In 1968 he spent three months in the Upper Triassic and Lower Jurassic of Lesotho, southern Africa, collecting mammals and dinosaurs. This, and other, field experiences captivated him and Peter continued field collecting in a variety of settings for the remainder of his career.

Graduation presents former students with many problems, not the least of which is how to make a living doing what one has come to love now that student bursaries are no longer an option. Peter solved this dilemma as young men traditionally have, he went west; taking up an Assistant Professor's position at the University of Alberta in Edmonton in 1971. While at Alberta Peter's interest in fish phylogeny focused on elopiforms, a primitive group related to eels whose most familiar modern representative is surely the gamefish *Tarpon*. Elopiforms were much more diverse in ancient oceans than they are today, especially in the watery world of the Mesozoic. In 1973 Peter published his fist major ichthyological monograph in the *Bulletin of the British Museum (Natural History) (Geology)*, entitled *A Revision of Elopiform Fishes, Fossil and Recent*. While Peter employed a method of phylogenetic analysis in this work he would later repudiate, this monograph quickly became the standard work on elopiform comparative anatomy and remains widely cited to this day. Throughout the 1970s Peter continued his writings on primitive teleost systematics along with nurturing an interest in a new method for analyzing phylogenies that had been causing quite a stir since being first proposed by the German entomologist Willi Hennig.

Peter and his wife, Pam, enjoyed life in Canada, but the NHM was never far from his mind. Accordingly, in 1975 Peter jumped at the opportunity to apply for a Scientific Officer position under the venerable Colin Patterson. Much to Peter's surprise and the NHM's good fortune, an offer was made and duly accepted. As a result, the new decade saw the Foreys re-emigrating to the land of their fathers.

At this time, the NHM in general, and the Palaeontology Department in particular, was a locus of intense intellectual ferment centered around the topic of cladistics. David Hull's (1988) widely read history of systematists in collision (and collusion) captures something of the spirit of the times. For those with an interest in the theoretical foundations of systematics, working at the NHM in the 1970s must have been a singular experience. And Peter was in the thick of it, plotting strategy, organizing the faithful, writing articles and reviews supporting the true faith, rebutting false dogmas, and debating with acolytes, heretics, and recidivists long into the night.

Through it all Peter continued his string of fundamental monographs. These include the famous 'Gang of Four' paper entitled *Lungfishes, Tetrapods, Palaeontology, and Plesiomorphy* (published by the *Bulletin of the American Museum of Natural History*, 1981) which many point to as a seminal publication in both cladistic theory and palaeontology insofar as it questioned the role of palaeontological data as the final arbiter of all ancestry questions. Peter, along with his colleagues Don Rosen, Brian Gardiner, and Colin Patterson took the (for that time) unusual position that information on stratigraphic ordering had nothing in particular to contribute to the evaluation of phylogenetic hypotheses and that all systematists would be better off focusing on evidence from comparative morphology *sensu stricto* (including molecular evidence). While this position was seen as being badly out of step with both tradition and 'common sense' at the time by many throughout the vertebrate palaeo. community, it has since been vindicated as the only reasonable and internally consistent way of approaching phylogenetic inference. Moreover, this article made its argument on the basis of tetrapod phylogeny which many had supposed to be well understood using the traditional methods evolutionary systematics. During the 1980s, Peter also began publishing on the systematics and phylogeny of coelacanth fish, a group with which he is inextricably linked among the ichthyological cognoscenti.

The cladistics wars raged throughout the 1980s which led, inevitably to the 1990s and a period of relative quiescence and consolidation. 'Relative' is the key word here, for levels of productivity and insight continued to be extraordinarily high. Looking back, it was a time when, after phylogenetic systematics had achieved widespread theoretical acceptance throughout large parts of the systematics community, the power of the method was explored to its full extent. For Peter this meant, once again, expanding his research programme into new territory, this time through a concerted attack on the question of earliest fish phylogeny and the origin of jawed vertebrates. This work, done in collaboration with Phillipe Janvier of the Muséum National d'Histoire Naturelle in Paris, produced a *Nature* article entitled *Agnathans and the Origin of Jawed Vertebrates*, which Peter regards as one of his most significant pieces. In it, Peter and Phillipe demonstrated that primitive 'jawless' fish groups previously placed in the Agnatha (e.g., lampreys, hagfish, both groups ironically now facing extinction after having survived in one form or another for several hundreds of millions of years) had little to do with one another in an evolutionary sense. In a classic example of why systematic groups should not be based on characters the constituent species lack, Peter and Phillipe demonstrated that lampreys are more closely related to jawed vertebrates and either is to hagfish. Who cares? Well, since these fish represent the primitive stock thought to have given rise to all jawed vertebrates, these results had dramatic implications for our understanding of basic vertebrate relations, including the evolution of the olfactory organs, the tail, the lateral lines and electroreceptive systems, the endoskeleton and the evolution of hard tissues, as well as the origin of separate fins and fin muscles.

During this decade Peter also began to set down his ideas about the evolutionary history of coelacanth fish, producing a score of important works, including *Latimeria chalumnae and Its Pedigree* (1991, published in the journal *Environmental Biology of Fishes*) and the magisterial *History of the Coelacanth Fishes* (1998, published by Chapman and Hall). While both addressed fundamental issues of coelacanth systematics and functional morphology, both were also noteworthy well beyond fish palaeobiology, especially insofar as Peter's was one of the earliest—and remains one of the most successful—demonstrations of how morphometric data can be used to inform a phylogenetic analysis. Peter accomplished this feat by using cladograms as a map to understand more quantitative changes in the proportions of the coelacanth body in a historical context. This, in turn, led to hypothesis tests and conclusions supported by this novel combination of a phylogenetic tree informing the interpretation of geometric data.

As the 90s gave way to the new century these two themes—primitive fish relations and combined phylogenetic-geometric analyses continued to dominate Peter's research, leading him to consider the question phylogenetic affinity between vertebrates and the ever-enigmatic conodonts (in collaboration with Phil Donoghue and Dick Aldridge) and co-organizing a well-received Systematics Association symposium and volume dedicated to exploring the relations between morphology, shape, and phylogeny (in collaboration with myself).

The 00s were also a time when Peter's chickens came home to roost in the form of awards and an increasing number of administrative commitments. In addition to taking a leading role in revealing the mysteries of phylogenetic systematics to new generations of students, first as organizer of the popular Cladistic Methodology course (1991-1997, for which he co-wrote the textbook *Cladistics: the theory and practice of parsimony analysis*, now in its second edition) and later as a leader of the NHM-IC

second edition) and later as a leader of the NHM-IC Biodiversity and Systematics MSc cladistics modeule, which, in large part, grew out of the former course (1998-2005). Peter was also Head of the Palaeontology Dept. Fish Section (1985-1994), Head of the Evolution of Vertebrates Research programme (1999-2001), NHM Graduate Student Coordinator (1998-2001) and Head of the Vertebrates and Anthropology Division (2002-2004). Peter served as Assistant Editor for the *Zoological Journal of the Linnean Society of London* (1989-2005), was an Editorial Board member of the *Journal of Vertebrate Paleontology* (1981-1986), served as a Council Member/Trustee of the Palaeontological Association (1985-1987), Systematics Association (1990-1992), and Willi Hennig Society (1989,1999). Peter was president of the Systematics Association from 1997-2000) and was awarded an Individual Merit Promotion by the BBSRC in 2001.

It hasn't all been nose to the grindstone stuff though. The now legendary cladist's country walks with secret cashes of *Carlsberg Special* Brew have become part of NHM folklore. In addition, Peter's considerable skill as an artist is not confined to illustrating his technical articles. His drawings and painting have brought great pleasure to all those who have received such works over the years.

Although this brief review captures but a snapshot of Peter's many scientific activities, I hope it does give a sense of the man and his contribution. What it does not give, and what I can but feebly express in words, is the pleasure I've had in working alongside Peter since I arrived in the Museum. Always generous with his knowledge and his time, always ready to lend a helping hand no matter how large or small the request, always placing the needs of his friends and his colleagues, usually before, and at least on a par with, his own, Peter Forey is highly respected across the NHM and much loved in the Palaeontology Department. He will be sorely missed. Then again, since he's promised to show up 2-3 days per week to continue his work as a Scientific Associate, perhaps we won't miss him that much after all. ;-> Regardless, Here's to you Peter, with a big 'Well done!' and an even bigger "Thank you!" from all your friends and colleagues in the NHM and beyond.

Norman MacLeod
Keeper of Palaeontology

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Research Roundup

Fishing expeditions

Lionel Cavin, who has recently completed his Marie Curie Fellowship, finished a large study with Peter Forey on the association between a rise in taxic diversity of ray-finned fishes and increasing surface and deep-sea temperature in the middle Cretaceous. During the course of this project they attempted to distinguish between a real biological radiation and the effects of differential preservation. Peter Forey is retiring in early May but is continuing to work with Lance Grande of The Field Museum on extinct relatives of the humble herring and now has several new taxa to add to the 20 or so already described. They too, show interesting biogeographic relationships (see below).

Capturing Crocs with CT

Emily Rayfield recently won a competition run by *Simpleware*, a software company specialising in the conversion of 3D images into a mesh format suitable for engineering analysis. The prize was free conversion of the winner's chosen dataset. Emily is working with Angela Milner on a short-term postdoctoral grant to look at the comparative biomechanics of long-snouted spinosaurid dinosaurs and crocodiles. Emily's competition entry was a proposal to convert CT scan data of the *Baryonyx*' snout into a finite element analysis mesh that can be manipulated to investigate the snout's biomechanical properties. *Simpleware* is now in the process of performing the conversion, which has saved Emily many hours of work. Emily and Angela paid a visit to the Royal Veterinary College (RVC) at Potters Bar, in conjunction with Dr. John Hutchinson of the RVC *Structure and Motion Laboratory*, to capture further data on their new medical CT scanner. Skulls of a huge Gharial and *Crocodylus cataphractus* (by kind permission of Colin McCarthy in the NHM Zoology Department) were scanned and excellent results were achieved with a fragile *Spinosaurus* snout without having to remove it from its plastic storage box – such are the joys of CT. Emily and Angela were also given a tour of the impressive RVC laboratory facilities. Unfortunately, there were no ostriches running on the treadmill that day but both were intrigued by the real-time *X*-ray study of a horse's problem stifle (a knee joint in plain non-horsy anatomy). Paul Barrett is now wondering whether he might try to take a look at ostrich neck flexibility with this apparatus. Advice from RVC colleagues is encouraging, "It's all very easy really. You just grab the head and the rest of the ostrich follows!".

Embryology of the green turtle

Many textbooks emphasize how conservative the turtle body plan is and how stable it has remained since (at least) the Triassic, the time from which the oldest stem-group turtles are known. Even though all turtles have a shell and lack teeth as adults, Marcelo Sanchez finds the textbook claim to be misleading, as diversity is found in lifestyles and size and shape in a group comprising around 260 living species (a similar number of species to that of another fascinating group of vertebrates of interest to Marcelo - the marsupials). One example, found

at the extreme side of the range in variation is the green turtle (*Chelonia mydas*), one of seven species of extant marine turtles. This animal shows, as expected, a series of features associated with a marine life. One that intrigues Marcelo is hyperphalangy – a derived increase in the number of phalanges, correlated with having flippers for propulsion. Different clades of tetrapods have a specific phalangeal formula (we humans are 2.3.3.3.3, plesiomorphic for mammals). Few tetrapod groups have managed to overcome what seems to be a fundamental design constraint and increase the number of phalanges of their ancestors. Whales have done it among mammals, so have ichthyosaurs, plesiosaurs and mosasaurs among fossil reptiles. Marcelo had read in older original anatomical literature and in more recent reviews, that marine turtles also have evolved hyperphalangy. Recently he was able to observe this when Colin McCarthy from NHM Zoology took him to the osteological collections in Zoo. Store 1. Although the 2.3.3.3.2 formula of the green turtle is not very impressive in comparison to ours, their long and slender phalanges and their increased number in comparison with that of more basal turtles (probably 2.2.2.2.2) are more so.

Looking at development is fundamental to understanding the development of hyperphalangy and how such an animal is put together. For example, insights could also be gained as to what went on with fossil marine reptiles. With this in mind, Marcelo was lucky to find in a famous embryological collection in Utrecht—now based at the Naturkunde Museum, Berlin—a wonderful ontogenetic series of the green turtle. Together with his SYNTHESYS visitor Christian Mitgutsch, previously in the Zoology Department at Jena and now on his way to San Francisco for a post-doctoral position, Marcelo spent four weeks in March-April starting to document several aspects of the development of this animal. With the kind help of Alex Ball they have been using the NHM-EMMA SEM facilities to document the beautiful developing external morphology. Using cleared and stained preparations made by Christian during his stay, together with histological sections of several specimens that technicians kindly prepared for Marcelo at the University of Tübingen, they have been documenting details on how flippers develop and will continue to look at this and other aspects of the postcranial anatomy. Marcelo's goal is to integrate different kinds of data to examine heterochronies in skeletal formation in these animals. For that comparative material is needed, so work is being done and materials are being organised for other turtles. As Marcelo says "as always, too much to learn, too little time".

A Can of Worms

Paul Taylor and Olev Vinn, a SYNTHESYS visitor from the University of Tartu, Estonia, have been looking at the Phanerozoic history of *Spirorbis*, a serpulid worm. *Spirorbis* produces those familiar encrusting spiral worm tubes seen on any seashore hard substrate, from bryozoans to rocks. Paul and Olev have discovered that the Ordovician to Jurassic spirorbid, *Microconchus*, has a quite different tube

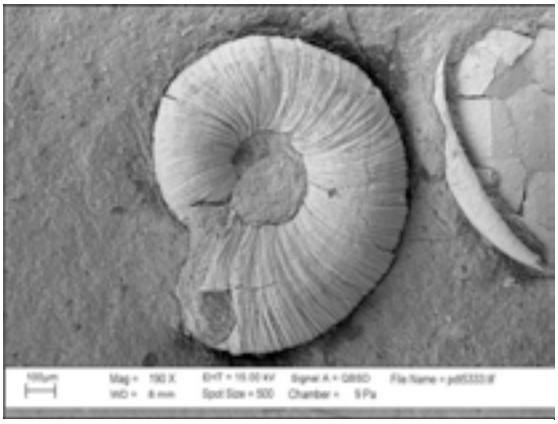

Figure 1. Scanning electron micrograph of *Microconchus pusillus* (Martin) from the Carboniferous, 'Calciferous Sandstone' of somewhere in Britain, regd No. 52871, x 190.

microstructure with pores in the tube wall, rather like those of bryozoans (Fig. 1). Thus, the Palaeozoic to Jurassic-type tube morphology is not of the serpulid type at all and the tube builders were lophophorate 'worms', probably phoronids (horseshoe worms). Paul and Olev have concluded that parallel niche adaptation occurred some time between the Jurassic and Cretaceous, with the annelids becoming dominant encrusters from the Cretaceous onwards.

Angela Milner
Associate Keeper of Palaeontology

Collections Management

Across the museum a huge amount of collective effort is going into the MOA Project and Programme. The MOA Project is directly concerned with the transfer of existing databases to the new system. The MOA Programme will take in everything to do with collections management including policies and processes. For the next few months we have an opportunity to look at the way we do things and the reasons why we do them with a view to streamlining our activities and changing those things that are currently either wrong or inappropriate.

With Paul Ensom leaving us as Collections Leader, Norm MacLeod has taken the reins as MOA supremo for Palaeontology, and things are moving fast. Each division has a MOA representative so if you want to know more about the MOA project or the programme go and talk to them.

MOA will have an impact on everybody in the science departments, not just those directly involved in collections management. Familiar things will change; there will be new protocols and a lot of things that were a bit sloppy in the past will have to be a lot more rigorous in the future. In particular, there will be a much stronger requirement to deal efficiently with specimen entry data, particularly the

legal transfer of ownership of objects and collections to the museum. Our Registrar, Paul Davis, is currently working on the policies relating to collection acquisition and disposal. Keep an eye out for news of what is going on in this field, and, if you see or hear something that seems wrong, please do something about it by bringing it to the attention of your MOA representative. Problems that have not been ironed out could conceivably make life difficult for everyone, so there will be no prizes for anyone who says "told you so" when there is no actual trace of them lifting a finger when it mattered.

Another issue dear to my own heart is that of space to store our collections. When the new Palaeontology Building was opened in 1976 an allowance was made for something like 20 years expansion. It is now nearly 30 years since we moved into our new quarters, and things are getting extremely tight in some areas. The Wandsworth G3 Store has been available to us for many years, but it has tended to be used as a second-class store for things we really don't want to deal with. Within the last few months the Collections Managers have gathered in the G3 store and talked through the options about how we might make better use of the place in future.

Like it or not, this is likely to be our only realistic option for collections expansion in the foreseeable future and we can't go on using it as we are at present. The best option would appear to be a compactor storage system that could take some existing cabinets, shelving units and drawer-holding units that could take the same kind of drawers that we use throughout the department at South Kensington. This is going to cost some money, and at present it isn't even on an agenda. So there is some work to do. Many of the existing storage units at Wandsworth, particularly the old mahogany A cases, are no longer appropriate or practical. The collections managers have long felt that most of these should be disposed of. Then there is the problem of multiple use. At present the same storage facilities are being used to store back numbers of journals, sediment samples, moulds for casting, old exhibition armatures and of course specimens, both accessioned and unaccessioned. We need to re-allocate the space and perhaps rethink whether some of this material might better be stored elsewhere or even disposed of altogether. We need to make an inventory of what is in the G3 store, where it comes from, who is responsible for it and whether it is of any further use to us or anyone else.

As a department, there are a lot of collections issues that have not really been aired much beyond the level of divisions. With the upcoming appointment of a new Collections Leader we should be formulating ideas about where we want to go with collections development and storage so that whoever gets the job can take up cudgels on our behalf to seek the resources we need to fulfil our vision.

A few words about our recently departed Collection Leader Paul Ensom. From conversations around the Department I think it is true to say that Paul will be very genuinely missed. He has been immensely kind to many individuals and has put up with our collective angst with great forbearance. It is probably little appreciated that he was an excellent curator – his Purbeck collection, which even now he hopes to find time to work on, is immaculately documented. One of Paul's many passions is books, and it was perhaps inevitable that they would one day lure him away from a life devoted to museums and collections. I hope you will join me in wishing him every happiness and success among the leather bindings.

Andy Currant
Collections Manager, Vertebrates
and Anthropology Division

Slicing Through History

Every now and again a new technique for extracting information from intransigent fossils appears and catapults our science to a new level. Recently, the advent of CT scans has provided spectacular insights into seemingly inaccessible areas of fossil specimens and our staff and students have been right in there (Angela Milner, Jamie Robinson, Dick Jefferies). And there is even now the construction of spectacular virtual images built up from sections, scanned and edited through graphics programs, replacing the fossil itself (e.g., Sutton *et al*. 2001).

Figure 1. *Paleospondylus gunni* Traquair, 1890, Middle Devonian, Caithness. BMNH P.59334. Literally thousands of these can be found on a single bedding plane. They all look very similar to one another even though they range in size from 8 – 50 mm. Scale bar equals 5 mm.

The NHM fish collection contains the physical legacy of a 19th century technical breakthrough, made by sequentially grinding through a specimen, making drawings of the revealed sections, and translating these into a wax model, many times the size of the original. William Johnson Sollas (1849–1936)[1], a Professor of Geology at Oxford, and his daughter, Igerna, pioneered the technique using serial sections. He initially made models of fossil brittlestars (ophiuroids) and graptolites that were exhibited at the British Association in 1901.

Around 1900 Sollas turned his attention to producing a wax model of an enigmatic fossil found in the Middle Devonian flagstones of Achanarras Quarry in Caithness (Sollas and Sollas 1903, Fig. 1). These deposits were laid down in the extensive

Orcadian lake, home to many primitive fishes (Trewin 1986). The species had been described in 1890 as *Paleospondylus gunni* by the Edinburgh surgeon, Ramsay Heatley Traquair, and was known from literally thousands of specimens ranging in size up to 50 mm.

Figure 2. *Paleospondylus gunni* Traquair, 1890. Wax model of head and anterior part of trunk in dorsal view. BMNH P.9856. Scale bar equals 50 mm.

The abundance of these fossils was matched by the many speculations as to their identity. The squashed squiggles on bedding planes encouraged fertile minds, and many suggestions had been put forward. Here was a true fossil - 'data in need of interpretation'. Everyone agreed that it was a vertebrate—it showed a vertebral column, fins, and a specialised head skeleton. Beyond that, the field was open. The popular belief of the time was that this fossil belonged to a jawless vertebrate, related to a lamprey or hagfish. But these groups do not have an ossified backbone. Other suggestions labeled *Palaeospondylus* as a larval herring (herrings did not appear for another 250 million years), a larval lungfish, a tadpole, and a shark. Even the venerable T. H. Huxley proclaimed it to be a larval placoderm, using nothing but his personal authority to support his case.

With Igerna, Sollas slowly ground his way through specimen after specimen, and equally slowly built wax model after wax model so that he could disentangle separate parts of the skeleton. By so doing he corrected many (mis)interpretations of anatomy. Despite this he came to no systematic conclusions, which is a shame because the synapomorphy with lungfishes was clearly there, before his eyes: two rods projecting back on either side of the head, are a dead giveaway for the cranial ribs of lungfishes (Forey and Gardiner 1981). The lungfish *Dipterus* is one of the most common fishes in the Achannaras fauna. *Palaeospondylus* has been most recently reanalysed by Thomson *et al*. (2004), where a virtual three-dimensional image was made. It is a comforting thought that the virtual and wax sections are practically identical. Affirmation of *Palaeospondylus* as a larval lungfish has come about by interpretation, not revelation.

Sollas made models of many fossils. Sadly, few appear to have survived. Jamie Robinson showed me a very fine example of the Carboniferous microsaur, *Lysorophus*, in the reptile collection (Sollas 1920), this time rendered in plaster. Sollas' Method, dignified by his name, was later exploited masterfully by the Swedish comparative anatomists Eric Stensiö and Eric Jarvik, who made magnificent models of cephalasids as well as the sarcopterygian fishes *Glyptolepis* and *Eusthenopteron*. This allowed these fossils to be known in as much detail as a modern skeleton. The technique was modified by Dick Jefferies in the 1960s to reconstruct calcichordates such as *Placocystites* and *Mitrocystella*. Dick's modification was to use polystyrene instead of wax for the replication of the sections. These models remain, magnificent in a glass-topped wooden cases, in the echinoderm collection where they sit in systematic discomfort.

Wax models had been made from Recent material a few years before Sollas adapted it for fossils. Beautiful models of Recent embryos were the stock in trade for university departments when I was a student and their educational and research value cannot be underestimated. But they are extremely time-consuming to produce (the wax model of the head of *Eusthenopteron* took 15 years of two technicians time to produce). A digital camera, a bit of software and carborundum paper can now do the same job in weeks. Progress on a grand scale.

Peter Forey
Merit Researcher, Vertebrates and
Anthropology Division

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[1]Sollas was a geologist-palaeontologist with diverse interests. He was taught by Thomas Henry Huxley at the Royal School of Mines and by Thomas Bonney at Cambridge. Sollas secured a job at Bristol University where he was also a curator at the Bristol Museum. He left to become a Professor of Geology at Trinity College Dublin, but returned to England to take a chair at Oxford in 1897, where he stayed. Sollas worked with his two daughters, Igerna mentioned above and with Hertha, who helped him

translate into English the influential geological work of Eduard Suess (*Der Antlitz der Erde*). His interests encompassed mineralogy, petrology and anthropology. Sollas was known to have a penchant for playing around with chemicals and his name has been mentioned in connection with the Piltdown fraud. Apparently he became increasingly eccentric in older age, but the nature of his eccentricity is not recorded.

Omo Kibish: the Earliest Modern Humans?

The idea that our species originated in Africa, with modern people subsequently spreading out from there (the *Out of Africa* theory), has continued to gain support. But much of that support has come from genetic analyses of people today, and from fossil and archaeological discoveries dating from the last 100,000 years, long after our species is thought to have originated. Hard evidence for our African origins has remained elusive, until recently, since some of the fossil evidence was fragmentary and others were uncertainly dated.

The latter problem applied to finds made at Kibish, near the Omo River in Ethiopia, in 1967. A partial skull and skeleton (Omo 1) and a skull lacking its face (Omo 2, Fig. 1) were discovered at separate localities, but the preliminary dating then available suggested that they might be about 130,00 years old. In 1982 I conducted a study of the fossils with Michael Day and we concluded that Omo 1, at least, represented a modern human. At over 100,000 years old, Omo 1 was likely to be the oldest modern human fossil known, and was important in laying the groundwork for the *Out of Africa* theory by supporting the idea that modern humans had appeared earliest in Africa. However, it was evident that the finds needed better dating. In 2003 further support appeared when two partial and one nearly complete modern human skulls were described from Herto in Ethiopia, dated at about 160,000 years old. Given the uncertainties still surrounding the Omo material, these were hailed as the oldest relatively complete and well dated finds of our species *Homo sapiens*.

In recent years an international team has returned to the Kibish region, relocated the 1967 find-spots, and recovered further fossils that have yielded better dating evidence. In a paper published in *Nature* on 17 February 2005, McDougall and colleagues report that volcanic sediments just below the level of the Omo finds have been dated by an argon isotope method to about 196,000 years. Furthermore, they argue that other evidence, including the dating of cyclical fluctuations in the development of local river systems, suggests that both the Omo skulls are only slightly younger than this determined age – about 195,000 years old. If correct, this re-establishes the position of Omo 1 as the oldest clearly modern human fossil. In comparison, the less modern-looking Omo 2 skull, like the most complete one from Herto, shows resemblances to more primitive African fossils such as the Broken Hill skull ("Rhodesian Man", from Zambia) in the shape of the back of the skull - this may be evidence of the ancestry of the earliest modern people. Through my work with Michael Day we have bone samples from Omo 1 and 2 as well as a number of additional finds from Kibish, and we are now collaborating with other researchers to conduct further dating analyses on this important material.

Figure 1. Lateral and frontal views of a replica of Omo 2. NHM Picture Library.

Although most workers now accept that modern humans originated in Africa within the last 300,000 years, there is still much uncertainty about how, when, and where this origin occurred. Because of Africa's huge area and limited fossil record, it is unclear whether the evolution of *Homo sapiens* occurred rapidly in only one region, or was a more widespread and gradual process. The Omo and Herto finds confirm that East Africa was a key area in this story and now has the oldest clear evidence of modern human origins. However, archaeological finds from southern Africa suggest that region may have played an important part in the development of modern human behaviour, also part of what defines us as a species. So, we will need further evidence from the whole continent to build up a complete picture of how our species began. Nevertheless. the new dating confirms the place of the Omo fossils as landmark finds in unravelling our origins.

Chris Stringer
Merit Researcher, Vertebrates and
Anthropology Division

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Palaeontology under the Big Top: Lyme Regis Fossil Festival (8-9 April 2005)

The coasts of Dorset and East Devon have been famous fossil collecting sites for almost 200 years. Founding figures in palaeontology, such as William Buckland and Mary Anning, worked on material from these strata. Such is the importance of the area, both scientifically and in terms of the history of geology that it has been designated a UNESCO World Heritage Site: the *Jurassic Coast*. In 2004, the Department was asked to contribute to the Lyme Regis Fossil Festival 2005, which took place on 8-9 of April. This invitation afforded the Department an excellent opportunity to engage in its long-standing tradition of extra-curricular public outreach. Members of the Department were involved in a 'Fossil Roadshow' to identify fossil material

brought in by the public (figs 1-2). On the evening of the 8th, Angela Milner, Paul Taylor, Paul Kenrick and Jeremy Young presented lectures in a local hotel on marine reptiles, fossils and folklore, fossil plants, and climate change. There was standing room only and the lectures could have been sold out ten-times over.

Figure 1. Identifications by members of the Fossil Roadshow Team.

Paul Davis, picked up his geological hammer, and returned to his favourite field area to lead a number of fossil and geology walks. Around 70 visitors back at the NHM in London got involved through two live-broadcast links back to the Darwin Centre with Angela and Jeremy providing the seaside reports. Darwin Centre Live visitors also had the opportunity to examine fossils from the *Jurassic Coast* that are held in the Department collections.

The Fossil Roadshow answered over 380 requests for identifications of fossils brought in by the public to the marquee beside the Marine Theatre. Much of the material was fresh from the beaches, with ammonite material dominating. However, specimens from as far away as Oman and South Carolina were also brought in for identification, and a wide range of taxa from plants to plesiosaurs was represented.

Putting names to specimens was only a small part of the exercise. The Roadshow gave the public a chance to interact with Department staff to find out a good deal more information than the name of the fossil. The team fielded questions about curation of fossil material, what A-levels to take in order to study palaeontology, and how fossils are formed. Scott Moore-Fay of the Palaeontology Conservation Unit dispensed preparation advice and displayed an ichthyosaur, *Leptonectes moorei*, that was collected at Charmouth in 1995. A few months ago Scott and Paul Davis collected what may turn out to be only the second specimen of this species known to science from the same horizon.

In addition, there was collaboration between the *Discover Microfossils* activity organized by Adrian Rundle and his team from the Learning Department and the palaeontologists. Children brought across their specimens freshly sieved from the local sediment for a look down the binocular microscopes of the fossil identification team. In return, the Explainers from the Learning Department gave us some hints about interacting with the younger visitors. David and Alison Ward ran a second, hugely popular hands-on activity to sieve Eocene Abbey Wood matrix sample and pick out take-away fossil shark's teeth. A selection of NHM publications, posters and copies of *PaleoBase* were available for sale as well. Richard Lane, Director of Science, came down to see the

Figure 2. The Discover Microfossils stations.

temporary Lyme Regis branch of the NHM for himself on Saturday, and joined a mixed field party of NHM staff and local collectors on Sunday morning. The marquee was a veritable microcosm of the South Kensington site.

Among the many specimens brought in, several were of considerable scientific interest. On Day 1 a large spirifierid brachiopod with incredible alar projections (Fig. 3) from the famous Viséan (Carboniferous) Treak Cliff locality in Derbyshire was brought in and wound up being donated to the Museum. A woolly rhinoceros tooth found in the Cotswolds Water Park came in later, much to Andy Currant's delight. Day 2 saw considerable excitement for Angela Milner before we had even opened officially for business. A quarry-worker from the Isle of Purbeck brought in a turtle skull from the lowest Cretaceous Purbeck Beds. Finds of skulls associated with shell plates, as this one was, are rare. Lyme Regis is famous for its ammonites and didn't disappoint. Paddy Howe, the resident geologist at Lyme Regis Museum, brought in a large piece of an ammonite body chamber that contained what he thought might have been a crustacean. Joe Collins, our on-site crustacean specialist, decided it wasn't a crustacean. However, since debate among six palaeontologists couldn't settle what it was, the specimen has been brought back to the Museum for further study. Many of the team were also able to venture out onto the beaches at some time over the weekend to look over the *Jurassic Coast*. Even on the beaches we had a number of enquires about fossils that had just been collected.

An event of this scale required a tremendous amount of organization and help from a large number of people. Paul Davis made a terrific effort to brief the team on the stratigraphy and the common ammonites of the area, and identified a considerable number of specimens. Thanks go to the on-

Figure 3. Spiriferid brachiopod with large alar extensions donated during the Festival. Photo by A. McGowan.

site team; Jon Todd, Andy Currant, Angela Milner, Scott Moore-Fay, Joe Collins, Veronica Hunt, David Lewis, Claire Mellish, Alison Longbottom, Noel Morris, Solene Morris, Joe Collins, Paul Kenrick, Jeremy Young, Jackie Skipper, Dave Ward, Alison Ward and Paul Taylor. Such was the flow of fossil specimens that Ellinor Michel and Piotr Kuklinski ended up being drafted in as well. Rob Symmons helped load equipment for the Festival. Paul Barrett and Ewan Laurie took care of the London side of the Darwin Live link-up, with Andy Ross and Sarah Long providing specimens that were displayed in the Darwin Centre. Adrian Rundle and his team of Explainers - Louise Bishop, Sally Collins, Sarah Hone, Rachel Prebble and John Robins are probably going to be responsible for a spike in applications for micropalaeontology courses in ten years time. In between handling the Lyme Regis end of the Darwin Centre link-up, Aoife Glass and Chloe Kember helped out on the Discovering Microfossils activity. Phil Hurst from NHM Image Resources filled his portable hard drive with images of the proceedings. Thanks also go to the Lyme Regis Development Trust for the invitation to participate in the festival.

The Festival was an excellent opportunity for us to raise awareness of the work of the Department and the wider Museum among the general public, staff from the local museums along the Jurassic Coast, and the professional collectors we met during the Festival. Most importantly though, a good time was had by all.

Alistair J. McGowan
Postdoctoral Researcher, Invertebrates
and Plants Division

Glass Conservation Training in Florida

In connection with my work on the Blaschka glass microfossil models, I attended an *International Academics Project* course on the conservation of glass in Florida from 20-25 March 2005. International Academics Projects Ltd. was formed in London in 1989 as an international educational charity whose aims are to promote education, training and research into conservation, archaeology, anthropology and other related fields. The company was initially based at the Institute of Archaeology, University College London; since 1998 it has been operated by a larger organisation and now co-operates with institutions and colleagues abroad to provide training courses for museum, archaeology and conservation personnel.

The course was located at Sydonie Estate House, Zellwood, Florida and covered the principles and practice of historical and archaeological glass cleaning, care, conservation and restoration. It was organized by John Maseman, the Director and Chief Conservator of the South Florida Conservation Centre and Stephen Koob, Conservator of the Corning Museum of Glass. Stephen is a specialist in the conservation of ceramics and glass and a fellow of both the American Institute for Conservation (AIC) and the International Institute for Conservation (IIC). Lectures were given on aspects of deterioration, restoration methods and proper conditions for storage and display. The training provided hands-on practical conservation sessions including the use and choice of techniques and particular materials.

The first day started with a lecture given by Stephen Koob on the chemistry of glass which covered preservation and deterioration. During this session, Stephen described the development of glass manufacture and the factors which can contribute to the deterioration of glass. Glass manufactured around the 16th to 19th century is particularly susceptible to deterioration. The ratio of glass constituents is of fundamental importance. If there is an imbalance in the composition, for example an excess of alkali (soda, potash, or a mixture of these two compounds) and a deficiency in stabilizers, the most common of which is lime (calcium oxide), glass can be susceptible to attack by moisture. If subjected to high humidity for a prolonged period of time, alkali ions will migrate out onto the surface. This is sometimes termed hydrated glass and can be seen as droplets of water, creating the 'weeping' phenomenon. If the alkali layer is not removed from the surface it will eventually attack and dissolve the silica, causing the glass to develop cracks or 'crizzling'. The first stage of crizzling may be a slight hazy or cloudy appearance on the surface of the glass. The Blaschka models have been analysed as having high levels of sodium in the glass.

Consequently, it is important they are stored in relative humidity that is maintained at a constant level, to prevent the glass from "weeping" or worse still develop crizzling.

During the afternoon, we were given a brief introduction to various tools and materials required for setting up a laboratory and to glass cleaning (washing glass to thought to be beneficial in that it prevents a build up of alkali on the surface), before embarking on our individual projects. I was given two objects to repair, a glass vase which was deliberately broken (Fig. 1).

Tuesday morning began with a lecture on the chemical and physical properties of different types of adhesives used in glass conservation. Assembling and bonding glass is not as easy as for ceramics; the surfaces to be joined are smooth and have no bite leading to problems of drifting during setting. In addition, glass is very unforgiving; you have to be absolutely precise in joining the fragments, for one small misalignment at the outset will be magnified by the final stages. Selecting an adhesive appropriate for the repair of glass will depend on a number of factors, the setting time, ease of application, reversibility, viscosity (it should be thin enough to give a tight join) and the glass transition temperature.

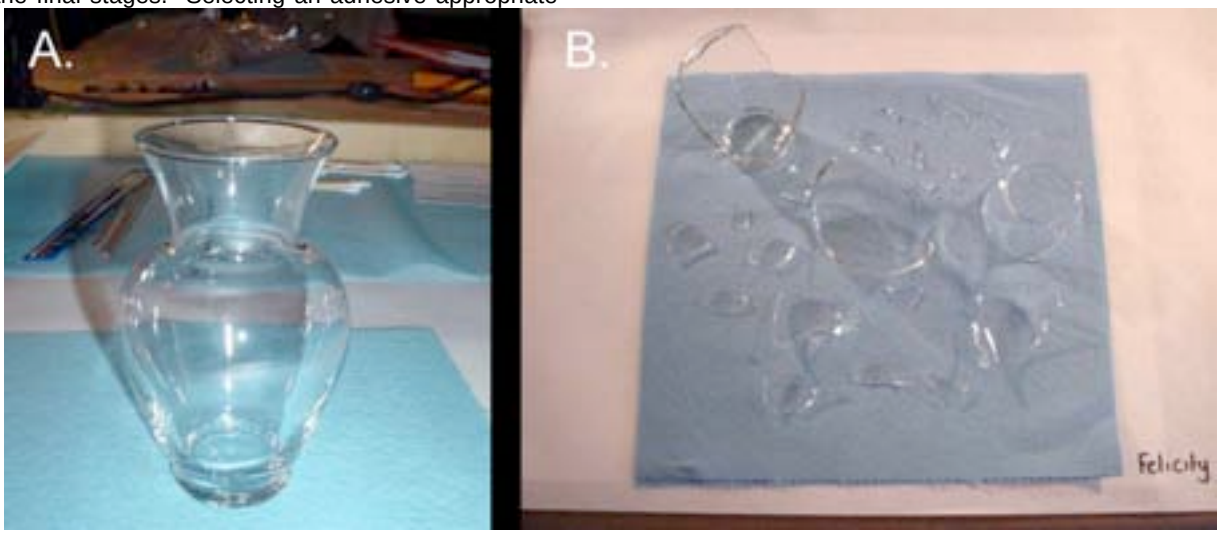

Figure 1. Glass vase before (A) and after (B) the 'accident'.

During the afternoon, we experimented with adhesive application techniques and chose a suitable method for repairing our vessels. Stephen discussed the relevance of refractive indexes for the conservation of glass. Glass is visible because it refracts light and light passing through glass is refracted at various angles. If the adhesive and the glass under repair do not have a similar refractive index, the repair will be an obvious distraction – so it is important to choose an adhesive appropriate to the refractive index of the glass. Past restorations have used opaque glues, which can leave visible cracks. Ageing of some epoxy resins have yellowed which is not aesthetically pleasing.

A visit to the Morse Museum of American Art in Winter Park, Florida was a welcome mid-week break. The museum is known internationally for its collection of art produced by American artist and designer Louis Comfort Tiffany (1848-1933). Its treasures include paintings, jeweliery, blown glass, leaded glass, enamels, pottery, mosaics and objects from the most personal design project of his career, his long Island home, Laurelton Hall. The Morse also houses American decorative art from the mid-19th century to the early 20th century with important examples of art from the Arts and Craft movement. The purpose of the trip was to gain an insight and appreciation of other works of glass and to view John Maseman's conservation work on the treatment and installation of the Tiffany chapel in a new wing of the Morse Museum.

Later in the course, we looked at ways to handle and pack fragile glass. I was pleased to see that the majority of the techniques I apply to packing fragile specimens in the Museum are also used by Corning Museum of Glass. Stephen showed us examples of suitable packing materials, which included 'Plastazote' (polyethylene) and 'Tyvek' (high density polyethene) to protect glass against abrasion. To transport collections, he suggested wrapping glass in bubble wrap and acid free tissue paper, with the exception of items that have additional loose parts. The Blaschka models are a good example of the latter and are too fragile to be packed in bubble wrap or tissue paper!

During this session, the handling of fragile glass was discussed. We were made aware of correct handling procedures and the arguments for and against wearing gloves. We were informed that wearing gloves gives much less sensitivity to the wearer and greater risk of slippage. However, gloves do prevent contamination from dirt and sweat in the skin. They should never be worn if the glass has a flaking or crizzled surface. My preference is against the use of gloves unless the glass is

Figure 2. The broken vase reassembled with 'Magic' tape. Adhesive was applied to joins by capillary action using a wooden cocktail stick. Later, a mould was required in order to replicate missing fragments.

etched or has metal attachments (rims, bases, handles or fittings).

On the final day, we were free to spend time completing our outstanding projects. Time was limited, so there was no room for mistakes in completing my conservation of the vase and light bulb. I had a couple of hours left to spare before leaving for the airport, so we watched a film *The Glassmakers of Herat*. This was about ancient glass making, and the way of life of the glass craftsman and their fellow villagers in Afghanistan.

I found the course to be very worthwhile experience. It has given me the opportunity to increase my knowledge and practical skills, enabling me to experiment with a range of different materials, which I have not previously used in glass conservation. It has also provided me with further solutions to conserving the Blaschka glass models and this has been extremely beneficial. I had taken photocopied photographs of the Blaschka glass models to the course and I was able to discuss with the other conservators the problems they present.

Felicity Bolton
Contract Conservator, Palaeo.
Conservation Unit

Roving Eye *T. rex*

Anyone who has ventured along the walkway in the Museum's Dinosaur Gallery since mid-March will have encountered the latest in a long line of *Kokoro* animatronic dinosaurs – their newest and most sophisticated *Tyrannosaurus rex* yet! This one has built-in motion sensors, looks you straight in the eye and, rather disturbingly, is capable of tracking you round the walkway. How does it work? Well, that's a trade secret. But the sensors are not in the eyes as you might think, but cunningly hidden up each nostril!

Tyrannosaurus rex is the new denizen of the 'dino-pit' as a result of overwhelming public demand following the successful temporary exhibition *T. rex - The Killer Question* in summer 2003. Faced with the inevitable as scientific advisor, I persuaded the exhibition development team to enhance the display by including a lower jaw of our NHM specimen in celebration of *T. rex's* centenary that coincidentally, and very conveniently, falls in 2005. Henry Fairfield Osborne (1905)coined the iconic binomen, *Tyrannosaurus rex* for a specimen excavated in Montana by Barnum Brown in 1903 that belongs to the Carnegie Museum in Pittsburgh. Barnum Brown also discovered (unknowingly at the time) the first *T. rex* in western Wyoming in 1900 when he unearthed some incomplete remains that amounted to less than 20 per cent of a skeleton. Henry Osborn named that material *Dynamosaurus imperiosus* in his 1905 paper alongside *T. rex*. The next year, 1906, Osborn decided that both specimens belonged to the same taxon and *Dynamosaurus* sank into the relative obscurity of synonymy. A pity – I rather prefer that grand and imposing name.

Dynamosaurus originally belonged to the American Museum of Natural History (AMNH) and joined the NHM's collection in 1960. The then curator at the AMNH, Edwin (Ned) Colbert, decided that they did not need two *T. rex* specimens and, since Barnum Brown had collected a much more complete specimen in 1907-8 for the AMNH, he offered *Dynamosaurus* to the NHM. To this day, it is the only *T. rex* material held outside North America. The original bones were incorporated into a right half-skeleton mount that was displayed here in the old dinosaur gallery from the mid-1960s until 1978. Since then it's all been behind the scenes in the sub-basement but used frequently for teaching, demonstrations and TV appearances.

Coming back to 21st century animatronics, the *Kokoro* beast in the pit is about three-quarter scale. Many people ask why they are not built full size. The simple answer is lack of space in most museum venues. I took advantage of the size issue to engage the public in some very recent science - research on growth rates by Erickson et al. (2004) Our *T. rex* model represents a 'teenager' in it's exponential growth phase. Erickson et al. calculated that *T. rex* achieved its gigantic size by growing at the rate of 2.1k g per day between about the ages of 11 to15 years. Needless to say, the public has found that to be very engaging!

Developments in animatronics are continuing apace. Public expectations are geared towards the spectacular following the *Jurassic Park* genre of films and it seems inevitable that we have to satisfy that demand to attract more visitors into the Museum. Museum displays will never match the computer-generated dinosaurs of the cinema screen but freely moving animatronic models will be walking around the galleries within the next year or two. *Kokoro* has roaming *rex* well under development.

Angela Milner
Associate Keeper of Palaeontology

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GBIF/TDWG Consortium Funding Proposal to the Gordon and Betty Moore Foundation Successful

In recent years there has been greatly increased interest in improving access to biodiversity-related data, in areas from basic research in taxonomy, evolution and biogeography, to the more applied fields of conservation, crop improvement, and pest control. As a consequence, there are many international and regional projects that require internet-based access to biodiversity information. A number of these projects have been developing their own tools for publishing and integrating data across thematically or regionally defined sets of data resources. As each tool set is developed independently, there is not only a risk, but a near certainty, that time and effort will be wasted through development of incompatible systems that will require subsequent, redundant investment in software development and system administration.

The solution to these problems is the development and promulgation of IT standards relevant to biodiversity information. Two organizations currently operate at the international level with remits to address the complete range of basic biodiversity information, the Taxonomic Databases Working Group (TDWG) and Global Biodiversity Information Facility (GBIF). TDWG and GBIF work toward the same goals, but do not compete because their structures and constituencies are sufficiently different. Cooperation has been natural and beneficial to both organizations

Despite recent successes, neither GBIF nor TDWG have the resources or administrative capacity to meet the needs of the growing number of biodiversity informatics projects. These projects would best be supported by development of a comprehensive and interoperable set of standards for biodiversity data. To do this, TDWG needs to enhance and modernize its standards development processes and infrastructure. To this end, key officers of TDWG (Stan Blum, retiring Chair) and GBIF (Donald Hobern, Programme Officer for Data Access and Database Interoperability) have led a successful approach to the Gordon and Betty Moore Foundation for large-scale funding.

The following statement was released by the GBIF Secretariat on 21 April 2005:

> "*GBIF worked with TDWG to develop a proposal to the Gordon and Betty Moore Foundation to fund a two-and-a-half year project to modernise TDWG's processes and infrastructure for standards development. This project aims to establish a more formal process for development and maintenance of each TDWG data standard and includes funding to implement online collaboration tools.*
>
> *Two dedicated staff will be recruited and contracts will be placed to develop documentation and software tools to support the existing TDWG standards. The project will also include two international workshops to develop a model for globally unique identifiers for use in biodiversity informatics and to establish central services to support such identifiers. During the project period, TDWG's ongoing requirements for staff and infrastructure will be reviewed and a long-term support model will be developed for the organisation. The Moore Foundation has just approved nearly 1.5 million dollars to support these activities*."

The successful proposal is for a 30-month project to modernise TDWGs infrastructure for supporting standards development, and to ensure that all of its working groups have well-managed processes, including documentation and software components where applicable. During this same period, the core activities for which TDWG will require ongoing support, and funding sources to support these activities, will be identified.

Also addressed is a particular technical requirement shared by most of the TDWG subgroups. Successful development of distributed networks of data resources requires users to be able to relocate data items at later dates. This requires that they should be able to find related data items which may have been served as part of a different data resource. A third requirement is to be able to recognise situations in which multiple data resources include information about the same entity. All of these requirements can best be addressed by implementing a shared system for assigning Globally Unique Identifiers (GUIDs) to data items and for using these to reference elements. GBIF and TDWG have jointly already carried out some preliminary investigations into user requirements and potential technologies and wish to implement a solution during 2005-2006. In order to ensure that such a solution meets the differing needs of all interested parties, the proposal includes a plan to organise two workshops during 2005. The first of these will be to document requirements and review technologies and will lead to the establishment of a set of small working groups to produce recommendations on different aspects of a solution. The second workshop is intended to address any outstanding issues and agree an implementation plan.

Additional information is available at: http://www.tdwg.org/moore_announce.html

Adrian Rissoné
Database Coordinator

INTAS Progress Report: The Terrestrial Fauna and Flora of the Insect Bed, Isle of Wight - Interpreting the Climate Near the Eocene-Oligocene Boundary

The International Association for the Promotion of Cooperation with Scientists from the new Independent States of the former Soviet Union (INTAS) awarded 149,998 euros to this project, which commenced 1 March 2004. The first year of this three-year project is now over and the results so far are very exciting.

The Insect Bed of the Isle of Wight, UK is remarkable for its exquisite preservation of fossil insects and spiders. It lies near the base of the Bembridge Marls and crops out on the north side of the island. This unit is a very fine-grained limestone that has enabled the preservation of delicate structures in 3D on a micron scale. The exceptional 3D preser-

vation has lead to this limestone being called ‘opaque amber’. Some fossil leaves, seeds and bird feathers have also been recorded from this bed.

The NHM has the most important historical collection of Insect Bed material, about 4000 pieces of rock (many have more than one insect preserved) collected by Edwin A’Court Smith (purchased 1877 and 1883), Rev. Peter Brodie (purchased 1898) and R. Hooley (purchased 1924). Other historical material is housed at the Dinosaur Isle Museum (Isle of Wight) and Smithsonian Institution (Washington). Additional material has been collected by Ed Jarzembowski (Maidstone Museum) and local collectors. Much of this new material is in Maidstone Museum, with other material at the NHM, Dinosaur Isle, Booth Museum of Natural History (Brighton), University of Portsmouth and in private collections. The first paper recording insects from the Insect Bed was written by Smith (1874). Since then, 16 orders and 89 families of insects have been recorded in the literature, and 179 have been named or identified. Most of the insects were described by Theodore Cockerell from 1915 to 1922, however most of these require revision. Jarzembowski (1980) gave an overview and described the then known specimens of five of the rare insect orders.

Thirty-three scientists are involved in the project. Most are Russians, with additional members from Poland, France, Germany, Spain and the UK. The original plan was to have a field trip for everyone in the first year and then have them over to study specimens during the following two years. Unfortunately there were delays in getting the money transferred from INTAS so the field trip had to be postponed until May this year. Instead, last year’s money was used for 12 project members to visit the UK for two weeks to study specimens at the NHM, Booth Museum and Maidstone Museum. Most of them opted to spend the full two weeks at the NHM, as that is the location of the largest collection.

My first task was to identify all the specimens in the NHM collection to order level and re-organise the collection accordingly. Some re-boxing was also required. This initial work took about six months, during which time it became apparent that for many specimensboth parts and counterpartshad been separated and registered under different numbers. I have identified over 4,000 insects belonging to 18 orders. While writing the grant proposal two years ago, I was fortunate enough to find the wing of a praying mantis (Order Mantodea), which, as well as being a new ordinal record for the Insect Bed, is the first fossil record of this group in the UK (Fig. 1).

Alexandr Rasnitsyn from the Palaeontological Institute, Moscow (PIN) (who is also a Palaeo. Dept. Honorary Research Fellow) was the first member of the project to visit and he arrived at the end of July 2004. Alex quickly went through most of the Hymenoptera (ants, bees and wasps), nearly 1,300 specimens, and identified them to family level where possible. Subsequent visitors have taken these further or identified the families of other insect orders. Mikhail Kozlov (Zoological Insitute, St Petersburg) found a wasp, which he identified as belonging to the family Encyrtidae. The remarkable thing about this specimen is that it is only 0.3mm long! This is the smallest fossil insect in rock (excluding amber) in the world! He also identified a specimen as belonging to the Agaonidae, which is the second oldest fossil fig wasp in the world (Fig. 2). This family of wasps have a very close relationship with fig trees; figs can only be pollinated by these wasps and in turn the figs provide a place for the wasp larvae to develop. This specimen has also stimulated interested in a doubtful fossil fig leaf that was described from the Insect Bed and will be studied by Prof. Margaret Collinson (Royal Holloway) in due course. Alexander Antropov from Moscow State University (MSU) identified the first leafcutter bee (Megachilidae) from the Insect Bed and Gennady Dlussky (MSU) identified many ants.

Figure 1. The first UK praying mantis fossil (Mantodea: Mantidae), from the Insect Bed, Isle of Wight. Photo by Phil Crabb.

Figure 2. The second oldest fossil fig wasp (Hymenoptera: Agaonidae) in the world, from the Insect Bed, Isle of Wight. Photo by Phil Crabb.

As a result of the work by the 12 project members who have visited so far, and my own identifications, we now have a list of 147 families or higher level taxa of insects present in the Insect Bed. The biggest rise has been with the beetles (Order Coleoptera). Only eight families were previously recorded and only two species have been described. Alexander Kirejtshuk (Zoological Insitute), Alexander Ponomarenko (PIN), Anatoly Alekseev (PIN) and Vadim Grachev (PIN) identified many more families and we now have a list of 33 families or superfamilies of Coleoptera with many new species awaiting to be described. Nearly 700 families of insects are known to have lived during the Oligocene (most of which are still living today), so it’s likely that many more families will be identified from the Insect Bed as the project progresses.

Figure 3. The mole cricket *Pterotriamescaptor* (Orthoptera: Gryllotalpidae), from the Insect Bed, Isle of Wight. This genus is only known from the Oligocene. Photo by Phil Crabb.

When the project commenced it was uncertain whether the Insect Bed was Upper Eocene or Lower Oligocene in age. Andrew Gale (University of Greenwich) has concluded that the Insect Bed is Lower Oligocene in age based on magnetostratigraphy. This age is supported by the insects in that several taxa have been identified that are not known prior to the Oligocene, e.g., the mole cricket *Pterotriamescaptor* (Orthoptera: Gryllotalpidae) (Fig. 3), identified by Andrej Gorokhov (Zoological Institute). Initially it was expected that the Insect Bed fauna would show some similarities with that of Baltic amber (Upper Eocene). However, the study so far has shown that the faunas of the Insect Bed and Baltic amber have little in common. Some groups that are relatively common in the Insect Bed are very rare or absent in Baltic amber and visa versa. For large insects such as dragonflies (Odonata) and grasshoppers (Orthoptera) it is not surprising that these are more common in the Insect Bed as there is a bias against large insects getting trapped in amber. Given that we now know that the Insect Bed is younger than Baltic amber these differences are not surprising.

Information is emerging on the likely sedimentary environment, palaeoecology and palaeoclimate. Gale and his students have been studying the sedimentology of the Insect Bed and have made some interesting discoveries. Initially it was thought that the Insect Bed was deposited as channel fills in a brackish water lake. However, it has been found that the Insect Bed is concretionary and the presence of large salt pseudomorphs indicates that the lake was hypersaline. This is supported by the fact that there are only a few aquatic insects in the Insect Bed.

Figure 4. The weaver ant *Oecophylla* (Hymenoptera: Formicidae), from the Insect Bed, Isle of Wight. This is the most common insect in the Insect Bed and indicates that there was a forest growing nearby. Photo by Phil Crabb.

Gale's MSc student, Angela Self, has discovered that the bed consists almost entirely of coprolites, presumably from anostracans (brine or fairy shrimps) that are also present in the bed. The 3D preservation of the insects suggests that the fine calcite cement formed extremely quickly, probably induced by bacterial release of CO_2 from decaying organic matter. The soft parts of the insect then decayed, leaving a void that sometimes filled with calcite crystals.

Figure 5. The large termite *Mastotermes* (Isoptera: Mastotermitidae), from the Insect Bed, Isle of Wight. This genus was cosmopolitan during the late Paleogene and early Neogene, however today it is restricted to a relict population in Australia. Photo by Phil Crabb.

The insects and other evidence indicate that there were four habitats in close proximity: 1) The hypersaline lake where the bed was deposited, 2) freshwater reed marsh at the outskirts of the lake, 3) meadows inhabited by crickets and 4) forest dominated by weaver ants (*Oecophylla*), which is the most abundant insect in the Insect Bed (Fig. 4).

A picture is emerging on the likely climate. The abundance of weaver ants, presence of four families of termites (Isoptera, e.g. Fig. 5), particular families of damselflies (Odonata, identified by André Nel, Paris, e.g. Fig. 6) and planthopper bugs (Hemiptera: Fulgoroidea, identified by Jacek Szwedo, Warsaw), suggest a tropical climate. However, the presence of aphids is contrary to this as they are primarily temperate today. A big surprise has also emerged with the beetles; those that are present are predominantly temperate. Alexander Ponomarenko (PIN) has suggested that this is due to a more equable climate (i.e., reduced thermal seasonality) at this time.

It is likely that many more discoveries will be made in the next couple of years and a more complete picture will emerge on the terrestrial environment in Isle of Wight area during the Lower Oligocene. These results will be submitted as a thematic set of papers to *Special Papers in Palaeontology*.

Figure 3. A small damselfly wing belonging to the family Protoneuridae (Odonata) from the Insect Bed, Isle of Wight. This specimen is the first Oligocene record of this family, which only occur in the tropics today. Photo by Phil Crabb.

Andrew Ross
Curator, Invertebrates and Plants Division

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Around the Department

Welcome to;

Dr Ken Johnson, Researcher, Bio constructional Ecosystems joined the department in April after being appointed to the post last July. Ken, has moved him from the Natural History Museum of Los Angeles.

Dr Peta Hayes, Curator, joined us from Zoology as the Palaeobotany curator in Invertebrates & Plants Division.

Dr Alistair McGowan started in March on a project called: 'Testing the effect of geological and phylogical biases on marine diversity' with dr Andrew Smith. The project runs for three years and is worth £116,762.

Goodbye to:

Paul Ensom, left the Department in April after 7 years. Paul originally worked in the department in between 1974 and 4 as a scientific officer and rejoined in 1998 as the Head of Curation.

Dr Lionel Cavin here for two year fellowship funded by the Swiss government completed his project working with Peter Forey and returned home in March.

Kim Gale
Palaeo. Department Administrator

Dates to Remember

24 May: H&S Meeting 2pm

25 May: Imaging Suite launch 3pm

1 June: Head of Divisions meeting 10am

10 June: State of Department talk:, 10am Palaeo Demo Room (followed by drinks in Common Room at lunchtime)

22 June: Deadline for submitting bids for Palaeo Research Fund and Training budget

29 June: Bids meeting 10am

6 July: Head of Divisions meeting 10am

19 July: H&S Meeting 2pm

7 September: Head of Divisions meeting 10am

21 September: H&S Meeting 2pm

26 September: Visiting Group to Palaeontology -

Kim Gale
Palaeo. Department Administrator

Dept. Performance Indicators

Quarterly Performance Indicators (1 January – 31 March 2005)	
Number of papers in peer-reviewed journals	45
Number of specimens added to electronic databases	3,735
Collections Users	
Number of visitor days	576
Number of visitors	326
Number of enquiries dealt with.	3,617
Grants (starting within the reporting period)	
Number of new grants	3
Number of grants applied for	10
Total value	£474,711
Value to the Museum	£224,011
Surplus to the NHM	£16.913

New Publications

Department of Palaeontology Publications (1st October to 31st December 2004)

BARRETT, P. M. 2004. Sauropodomorph dinosaur diversity in the upper Elliot Formation (Massospondylus range zone: Lower Jurassic) of South Africa. South African Journal of Science, 100, 501-503. (C)

BARRETT, P. M. 2004. Dinosaur herbivory: from functional morphology to macroevolution. Palaeontological Association Newsletter, 55, 98. (E)

BARRETT, P. M. 2005. The diets of ostrich dinosaurs (Theropoda: Ornithomimosauria). Palaeontology, 48, 347-358. (C)

Bown, P. R., Lees, J. A. and YOUNG, J. R. 2004. Calcareous nannoplankton evolution and diversity through time. 481-508. In Thierstein, H. R. and Young, J. R. (ed.). Coccolithophores from cellular process to global impact. Springer Verlag, (C)

Crudeli, D., Kinkel, H., Steph, S. and YOUNG, J. R. 2004. Oceanic distribution of the biodiversity of very small reticulofenestrids (Lower Pliocene). Journal of Nannoplankton Research, 26(2), 27-28. (E)

Crudeli, D., YOUNG, J. R., Erba, E., de Lange, G. J., Henriksen, K., Kinke, l. H., Slomp, C. P. and Ziveri, P. 2004. Abnormal carbonate diagenesis in Holocene-Late Pleistocene sapropel-associated sediments from the Eastern Mediterranean; evidence from Emiliania huxleyi coccolith morphology. Marine Micropalaeontology, 52, 217-240. (C)

DARRELL, J. G. 2005. The William Smith collection. Set in Stone, NHM Palaeontology Departmental Newsletter., vol 2 no 4, 6-7. (E)

FEIST-BURKHARDT, S. and Dodsworth, P. 2004. Palynology Group report. Newsletter of Micropalaeontology, 70, 19. (E)

FEIST-BURKHARDT, S. and Dodsworth, P. 2005. Palynology Group report. Newsletter of Micropalaeontology, 71, 19. (E)

FEIST-BURKHARDT, S., DUNN, J., EATON, G. L. and KENNAWAY, G. 2004. Die Wandstruktur fossiler Dinoflagellatenzysten und ihre Bedeutung für die Phylogenie phototropher und heterotropher Eukaryonten. REITNER, J., REICH, M. & SCHMIDT, G. [Eds] Geobiology, 74th annual meeting of the Paläontologische Gesellschaft, October 02 - 08, 2004, Göttingen, Abstracts of talks and posters. p. 81-82 Göttingen (Universitätsdrucke Göttingen). (E)

FOREY, P. L. 2004. Renaming means chaos. Letter. New Scientist, (E)

FOREY, P. L. 2004. Dr Bobb Schaeffer (1913-2004): a personal perspective. Set in Stone, NHM Palaeontology Departmental Newsletter., 2(2), 15 - 16. (E)

FOREY, P. L. 2004. The spawning of the fossil fish collection. Set in Stone, NHM Palaeontology Departmental Newsletter., 2(3), 11- 13. (E)

FOREY, P. L. 2005. Biological radiations and speciations. 266-279. In Selley, R. C., Cocks, L. R. M. and Plimer, I. R. (ed.). Encyclopaedia of Geology. Elsevier, Amsterdam (C)

FOREY, P. L. What is the first known vertebrate? On-line AccessScience, McGraw-Hill Encyclopedia of Science &Technology (G)

FORTEY, R. A. 2005. Decine and Fall (Book Review of Collapse, by Jared Daimond). The Lancet, March, (E)

FORTEY, R. A. and COCKS, L. R. M. 2004. A late Ordovician global warming event? Erlanger geologische Abhandlungen, 5, 37. (E)

Geisen, M., Langer, G. and YOUNG, J. R. 2004. Coccolithophore calcification response to marine pCO2 - where reality confronts models. Journal of Nannoplankton Research, 26(2), 45. (E)

Gibbs, S., Shackleton, N. J. and YOUNG, J. R. 2004. Orbitally-forced climate signals in mid Pliocene nannofossil assemblages. Marine Micropaleontology, 51, 39-56. (C)

Gordon, D. P. and TAYLOR, P. D. 2005. The cheilostomatous genera of Alcide d'Orbigny - nomenclatural and taxonomic status. 83-97. In Moyano G., H. I., Cancino, J. M. and Wyse Jackson, P. N. (ed.). Bryozoan Studies 2004. Balkema, Leiden (C)

Götz, A. E., FEIST-BURKHARDT, S., Ruckwied, K. and Russell, J. W. 2005. Stratigraphic record of Anisian sea-level changes (Germanic Basin, N Switzerland): Palynofacies patterns, acritarch diversity and stable isotope signatures. Abstracts of the 13th meeting of Swiss sedimentologists, SwissSed, January 29, 2005 in Fribourg, Switzerland., 28. (E)

Götz, A. E., FEIST-BURKHARDT, S., Ruckwied, K., Szulc, J. and Török, Á. 2005. Stratigraphic record of Anisian sea-level changes (Central Europe): Sedimentary features, palynofacies patterns and stable isotope signatures. Abstracts of the 24th Meeting of sedimentology in Muscat, Sultanate of Oman, 10th-13th January 2005,, 1. (E)

Götz, A. E., FEIST-BURKHARDT, S., Török, Á. and Szulc, J. 2005. Correlation of Anisian third-order depositional sequences of the Germanic and Tethyan realm by means of palynofacies signatures. Abstracts of the 13th meeting of Swiss sedimentologists, Swiss Sed January 29, 2005 in Fribourg, Switzerland., 29. (E)

Götz, A. E., Russel, J. W., FEIST-BURKHARDT, S. and Ruckwied, K. 2004. Palynofacies patterns, acritarch diversity and stable isotope signatures in the Lower Muschelkalk of the Benken well (Middle Triassic, N Switzerland): Evidence of third-order cyclicity. REITNER, J., REICH, M. & SCHMIDT, G. [Eds] Geobiology, 74th annual meeting of the Paläontologische Gesellschaft, October 02 - 08, 2004, Göttingen, Abstracts of talks and posters. p. 93-94 Göttingen (Universitätsdrucke Göttingen). (E)

Götz, A. E., Szulc, J. and FEIST-BURKHARDT, S. 2005. Eustatic history of the N Peri-Tethyan realm: A case study of the Anisian (S Poland). Programme & Abstracts, Sediment 2005 in Berne, Switzerland,, 1. (E)

GRAY, D., CHAPMAN, S. D., DOYLE, A. D. and MILNER, A. C. 2005. Hylaeosaurus Reveals It's Secrets 170 Years On. Set in Stone, NHM Palaeontology Departmental Newsletter., 2 (4), 7-8. (F)

Grimes, S. T., Collinson, M. E., HOOKER, J. J., Mattey, D. P., Grassineau, N. V. and Lowry, D. 2004. Distinguishing the diets of coexisting fossil theridomyid and glirid rodents using carbon isotopes. Palaeogeography, Palaeoclimatology, Palaeoecology, 208, 103-119. (C)

Grimes, S. T., HOOKER, J. J., Collinson, M. E. and Mattey, D. P. 2005. Summer temperatures of late Eocene to early Oligocene freshwaters. Geology, 33, 189-192. (C)

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Henriksen, K., Stipp, S. L. S., Marsh, M. E. and YOUNG, J. R. 2004. Coccolith polysaccharides: influence on genesis and diagenesis. Journal of Nannoplankton Research, 26(2), 57. (E)

Henriksen, K., YOUNG, J. R., Bown, P. R. and Stipp, S. L. S. 2004. Coccolith biomineralisation studied with atomic force microscopy. Palaeontology, 47, 725-743. (C)

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KENRICK, P. 2004. Gymnosperms. 443-454. In Selley, R. C., Cocks, L. R. M. and Plimer, I. R. (ed.). Encyclopedia of Geology. Elsevier, Amsterdam (C)

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