

The Palaeontology Newsletter

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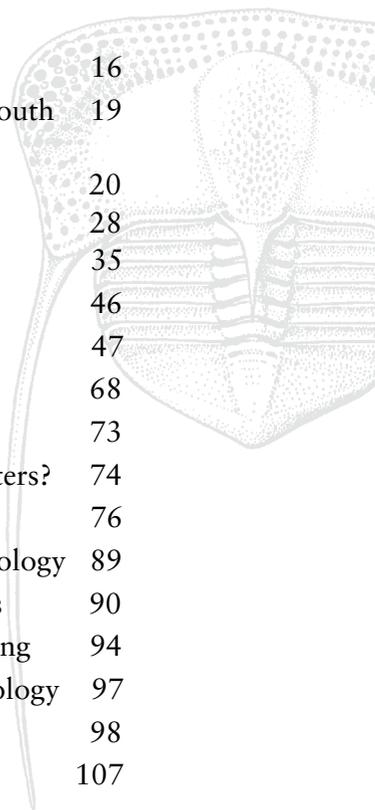
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Reminder: The deadline for copy for Issue no 65 is 18th June 2007.

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Editorial

A new year and the start of a brand new series! Entitled “Outside the Box”, this new series of articles will explore the fringes of our subject and those folk who use or used fossils but aren’t/weren’t palaeontologists or evolutionary biologists (*e.g.* geochemists, structural geologists, what have you). At least, that was my original, somewhat blinkered idea. Fortunately, our very own Newsletter Reporter Al McGowan was on hand to realise its full potential and noted that “such a column would actually chime in well with some of the movements out in the arts world such as ‘Science in Fiction’ as written by the likes of Ian McEwan and Will Self. Ken MacLeod (a hard SF writer who is a fellow Glasgow graduate, although he graduated in the late 1970s then studied biomechanics for his PhD) uses palaeontology, geology and archaeology extensively in his second series of books...”.

So that’s what we envisage, and hope to attract a range of articles from artists, writers, scientists *etc.* Any contributions (or suggestions for contributors) are more than welcome! The series kicks off with an article by Jess Pollitt, who actually used to be a palaeontologist (perhaps deep down she still is?), having studied the MSc in Palaeobiology at Bristol. She’s now a Very Important Person in the Geological Society of London Publishing House, but still, it would appear, putting some of her palaeo-related skills to good use....

Unless you have been living in a deep, dark cave, unconnected to the Internet and with no letter box to receive the Newsletter, you won’t have failed to appreciate that our dear Association is 50 years young this year! There are extensive write-ups in this issue of the Newsletter of the 50th Annual Meeting and Macroevolution Seminar that took place in Sheffield in December. Also, part one of a two-part series on the history of Pal Ass, to be concluded in the next issue.

Finally, an erratum from Newsletter 63, page 53. In the meeting report on the William Buckland 150th Anniversary Symposium, reference was made to his discoveries in “Kirkland Cave”... As pointed out to me by Mr K. Phipps, this should have read “Kirkdale Cave”.

Richard Twitchett

Newsletter Editor

<newsletter@palass.org>



FOREWORD

As The Association already hastens into its second half-century, it is a great privilege and pleasure to have become the 25th President. The 50th Annual Meeting at Sheffield was a fine tribute to the occasion, reflected in the increasing standard of talks and posters that we have now come to expect almost as normal. The high percentage of younger people involved in the presentations is a sign of great health for the future of palaeontology. And what a wonderful setting in the Cutlers Hall for the 50th Annual Dinner. The earlier Annual Address by Art Boucot, and the presentation of Lapworth Medals at the Dinner to Bill Chaloner and Dolf Seilacher, were appropriately fitting parts of our celebrations. We are especially grateful to Charles Wellman and his colleagues for making the Sheffield meeting such a resounding success.



But we are also looking forward to a vibrant future. Membership is growing and we are now a truly international Association with widespread membership from throughout the world. Our journal, *Palaeontology*, and our monographic series, *Special Papers in Palaeontology*, are heavily subscribed and overloaded with submissions, attesting to their high quality ratings. All back issues of the journal are now available online to the membership, and we will be seeking to add to such services over the next few years.

Many people are engaged in putting these programmes into place. Successive Councils, Editors and our Executive Officer work extremely hard to maintain our standards and services. We encourage the Membership at large to become increasingly involved with suggestions and comments via the Association Website and in the Newsletter. Our Overseas Representatives, in eleven countries throughout the world, warrant equal thanks in promoting our international profile.

I must pay one particular acknowledgement, to our immediate Past President, Sir Peter Crane, for the large amount of work that he has done for the Association over the past two years, partly from his peripatetic base in Chicago. His wise counsel and leadership have been instrumental in guiding us into an exciting future; we wish him well in his return to the USA.

And finally, to Uppsala in December 2007, our 51st Annual Meeting. We have met outside the British Isles on two previous occasions, in Copenhagen (2001) and Lille (2004). But Uppsala in the snow and cold will be special – Dr Graham Budd tells me so!! Uppsala has a particularly important place in my life, because I spent almost three years there on separate periods of sabbatical leave, with probably about three more years in total on ‘short term visits’ at different times. It is a lovely city, with long University traditions, and of course it will be the tercentenary of the birth of Linnaeus. Graham assures me that the myth of expensive living in Sweden will be dispelled by the University provision of a new accommodation hostel and new conference centre – so please make every effort to come. Meanwhile, very best wishes to everyone for 2007.

Michael Bassett
President

National Museum of Wales



Association Business

Awards

Dolf Seilacher awarded the Lapworth Medal

Dolf is one of the world's most renowned invertebrate palaeontologists, widely celebrated for his visionary and inspired interpretations of the fossil record. He has made his most significant contributions to four areas of palaeontology: trace fossils, morphodynamics, the study of exceptionally preserved fossil deposits (Lagerstätten), and Ediacaran assemblages. In the latter he is especially recognised for proposing the innovative (and controversial) hypothesis of the Vendobionta. In each of these fields he has stimulated research with fundamental discoveries and iconoclastic interpretations. In 1992 he was awarded the Crafoord Prize by the Royal Swedish Academy of Sciences, which is arguably the closest an earth scientist can get to being a Nobel Laureate.



Some of his most cited work has been in the field of morphodynamics, recently acknowledged at his 80th birthday symposium, organised in Yale. Dolf's major contribution to our understanding of the evolution of morphology was in emphasizing that function is an important but far from complete explanation of organic form. He formalized this realization in 1970 as *Konstruktions-Morphologie* (constructional morphology), recognizing the influence of phylogeny and architecture in addition to adaptation. This 'triangular' approach was very influential at a time when there was little interest in constraints on the evolution of form. In 1990, twenty years on, Dolf expanded the triangle to include an environmental dimension, although this can not be measured directly and is important mainly conceptually. He has applied the methods of constructional morphology to a range of organisms from vendobionts to barnacles, from clams to crinoids. Dolf illuminates his results with the iconography of his line drawings and his unique explanatory terminology.



Dolf's influence on our science is evidenced by the infiltration of his terminology into our everyday working vocabulary – constructional morphology, Lagerstätten and vendobionts. There is no other European palaeontologist more richly deserving of the career recognition that the Lapworth Medal bestows.



Hodson Fund award to Dr Paul M. Barrett (Natural History Museum) and Dr Guy Harrington (University of Birmingham)

Dr Paul Barrett

Paul has become, at the age of 34, an internationally known and leading authority on dinosaur palaeobiology and evolution. The subject of his PhD, completed in 1998, concerned the functional morphology and evolution of herbivory in dinosaurs. Since then, Paul's on-going original and collaborative work on this and other topics has contributed significantly to the UK's science base, especially in terms of macroevolutionary studies, the application of novel techniques to palaeontology – Geographical Information Systems (GIS) and building collaborative networks with partners overseas (China, Japan, South Africa, USA and France). He has tested the utility of GIS in a NERC-funded study of large-scale palaeontological patterns by addressing the biostratigraphy of Late Triassic terrestrial vertebrates from North America and Europe, and demonstrated the effectiveness of GIS as a palaeontological tool over extended spatial and temporal scales. He has built on that work to investigate hypotheses of dinosaur–plant co-evolution and to test ecological associations among Cretaceous dinosaurs and plants on a current NERC grant. In addition to his work on palaeobiology, Paul has published on dinosaur systematics and taxonomy, with an emphasis on faunas from the UK, China, Japan and southern Africa (funded by the Royal Society, the National Geographic Society and other charitable funding bodies). His strong collaborative international links, especially with colleagues in China and, recently, in South Africa, have done much to further research on Early Jurassic faunas, particularly the early evolution of sauropodomorphs in China.



In addition to his research achievements, Paul has been very active in scientific citizenship and service to the palaeontological community. He sits on the editorial boards and councils of several international journals and learned societies, thus helping the UK to maintain its leading position and competitiveness in vertebrate palaeontology. Paul is an associate editor for three scientific journals – *Geological Magazine*, *Palaeoworld*, *Journal of Systematic Palaeontology* – and an editor for one of the leading international vertebrate palaeontology journals, *Journal of Vertebrate Paleontology*. He is a member of five learned societies, has responsible roles as a Council member and Co-Secretary of the Palaeontographical Society, and is a member of the Society of Vertebrate Paleontology's Romer Prize Committee. Paul has co-organized six international symposia in the last



four years including the 9th Symposium on Mesozoic Terrestrial Ecosystems held in Manchester in June 2006.

Because of the popularity of dinosaurs, Paul has inevitably become involved with the media and is an expert communicator to public audiences at all levels. He has undertaken many interviews for television, radio, documentary films and newspapers. He is at ease with the media, handles interviews professionally, and has delivered numerous public lectures. Paul takes a particular interest in the ways in which science is portrayed in the media, and this led to an invitation to address the topic at the British Association for the Advancement of Science meeting in 2004. He has also written four popular books on dinosaurs.

In summary, Paul is an outstandingly able young scientist. He has contributed a great deal of innovative and original work to the field of vertebrate palaeontology in a short time, in addition to which he has given substantial service to the scientific community, and made major contributions to outreach and the Public Understanding of Science. His all-round achievements, quite outstanding for his age, are the result of a sharp intellect, dedicated hard work, an exceptional ability to network and collaborate, and a recognition that outreach is an increasingly important aspect of a scientist's responsibility. I recommend strongly and unreservedly that Paul's achievements merit recognition through a Hodson Fund award.

Dr Angela C. Milner

Dr Guy Harrington

Guy completed his BSc in Geography and Geology at the University of Keele in 1994 and then progressed to an M.Phil. at the University of Cambridge (1995) on the use of spores and pollen as a tool for understanding anthropogenic impact on the eastern Hungarian landscape. He then moved to Sheffield (1999) where he completed his PhD on North American palynofloral dynamics in the late Palaeocene to early Eocene. Notable early contributions in these fields include papers in *Palaios* and *Palaeontology* on vegetation patterns in response to global warming during the Palaeocene/Eocene and *Palaeogeography Palaeoclimatology Palaeoecology* on the floral dynamics of the US Gulf Coast during the Palaeocene. This phase of Guy's career led to an 'honorable mention' from the Outstanding Journal Paper Selection Committee of SEPM's *Palaios*, showing the recognition of this pioneering early work.



Guy's postdoctoral career began with industrially-funded investigations at the University of Sheffield with Dr D. Jolley on dating and characterizing seismic picks in the West Shetlands Basin (UK). Much of this work remains confidential. He then moved to University of Cork developing equivalent palynological correlations in the Rockall Trough. He also furthered work on palaeoclimate, orbital oscillations and agents of floral change at the Palaeocene/Eocene boundary. After his time in Ireland he undertook postdoctoral research at the Smithsonian Institution where he studied pollen and spore distributions across the Palaeocene–Eocene boundary in the US Gulf Coast, Western



Interior and Canadian Arctic. These studies have resulted in some ten substantial papers in international journals.

Since 2004 Guy has been a lecturer at the University of Birmingham, maintaining a high research profile whilst developing an impressive teaching portfolio in palaeobiology. He is currently supervising two research students and is involved in two international research collaborations. One of these has led to publication in *Science*.

Guy's published works are of high quality and include a high proportion of highly cited, single authored papers in high ranked international journals. He is considered by his peers to be one of the foremost in advancing palynology as a tool for understanding and quantifying rates of Cenozoic climate change. Guy can be considered to have a true international presence within his subject and allied disciplines.

Dr J. Hilton

Mary Anning Award – Robert B. Chandler (Whyteleafe, Surrey)

Bob Chandler was born in 1952. After a year as a technical assistant at the Geological Survey in South Kensington he moved to become a laboratory technician in the physiology teaching laboratories of St Thomas' Hospital Medical School in Lambeth. On reaching the highest level in his grade he decided on a change of career. He joined the Science Department at Riddlesdown School, Purley, and rapidly became its chief chemistry teacher. In his spare time he studied for the B.Sc. in Geology with the Open University. One further move took him to nearby Shirley High School, where he is now Head of Science.

As with so many of us, Bob's interest in geology was aroused by one individual, his geography teacher in secondary school, who took his pupils on voluntary field trips. A visit to Bridport was Bob's first contact with the Jurassic Coast, the first of almost annual visits ever since. The Inferior Oolite of Burton Bradstock led to the quarry at Horn Park, a legendary source of superb ammonites. It then took little to show him that there is more to these fossils than collectors' trophies, that their use as guide-fossils in biostratigraphy opens whole new vistas of historical geology and biology at levels of time-resolution having few rivals: a profound stimulus to the imagination. He discovered the epic work of S.S. Buckman a century ago.

This has led to an ever-widening re-examination through intensive field-work of the whole of the ammonite biostratigraphy of the Inferior Oolite of Dorset and Somerset and to a revision of its high-resolution chronostratigraphy. As corollary, Bob has mastered the palaeontology of its ammonites. Both the stratigraphy and palaeontology increasingly involved overseas comparisons, and Bob has built up a wide circle of international collaborators. He stands now undoubtedly as one of the world's experts on the Aalenian and Bajocian Stages of the Jurassic.

Fieldwork. Starting in the early 1980s as hand-digs with a few companions, this grew in the 1990s into major exercises involving large JCB mechanical excavators and the help over several days of an increasing membership of the Wessex Cephalopod Club, both from the UK and abroad. A turnover



of tons of rock yielded thousands of ammonites, all collected from precisely recorded horizons in carefully recorded sections. There have been 15 of these major excavations so far, three of them dedicated to the restoration of SSSIs under the aegis of English Nature, Dorset CC and the Sherborne Estate.

Collections. The specimens have been labelled and catalogued. Fine and important ones have been prepared and photographed by Bob to the highest professional standards. In an arrangement with the Sedgwick Museum, to which the whole collection is ultimately destined, over 200 types, cited or interesting specimens already carry SM numbers. But its main value lies in its basis for the application of the New Systematics to ammonite taxonomy, in terms of variable isochronous evolving palaeobiospecies rather than typological morphospecies. Success has been spectacular: Buckman's 11 'ammonite hemerae' in the Inferior Oolite have grown to 56 today.

Scientific societies. Bob has organized and led some six one- or two-day excursions for the G.A. to Dorset, all highly popular. He has acted as guide for numerous visitors from abroad. He is Liaison Coordinator, representing non-professionals in the International Subcommittee on Jurassic Stratigraphy (ISJS) of the ICS and writes regular reports in its annual *Newsletter*. He has travelled widely and attended international conferences on the Jurassic as school time allowed.

Publications. Bob Chandler is author or co-author of 15 articles in national and international journals. His co-authors are from the UK, Germany and Spain.

Bob Chandler is an unusual man. He is immensely energetic, enterprising, effective, a great organiser, with the gift of inspiring and leading others. It has been my great privilege to know him and work with him. He has rendered our science distinguished service. It gives me great pleasure to nominate him wholeheartedly for the Mary Anning Award for 2006.

Dr J H Callomon

Sylvester-Bradley Awards

Sylvester-Bradley Awards for 2006. 33 applications were received. Awards were approved for Allan, Challands, Donovan, Dunkley-Jones, Herridge, Joomun, Muir, Popov, Zanno and Ghobadi pour Mansoureh.

Nominations for Council

At the AGM in December 2007, the following vacancies will occur on Council:

- President for 2008-2009
- Vice-president
- an Editor Trustee
- at least two Ordinary Members



Nominations are now invited for these posts. Please note that each candidate must be proposed by at least two members of the Association and that any individual may not propose more than two candidates. Nomination must be accompanied by the candidate's written agreement to stand for election and a single sentence describing their interests.

All potential Council Members are asked to consider that:

'Each Council Member needs to be aware that, since the Palaeontological Association is a Registered Charity, in the eyes of the law he/she becomes a Trustee of that Charity. Under the terms of the Charities Act 1992, legal responsibility for the proper management of the Palaeontological Association lies with each Member of Council'. Responsibilities of Trustees can be obtained from <secretary@palass.org>.

The closing date for nominations is **Monday, 1st October 2007**. They should be sent to the Secretary: Dr Howard A. Armstrong, Department of Earth Sciences, University of Durham, Durham DH1 3LE; email: <secretary@palass.org>.

Awards and Prizes

Nominations are now being sought for the Hodson Fund and the Mary Anning Award.

Hodson Fund

This award is conferred on a palaeontologist who is under the age of 35 and who has made a notable early contribution to the science. Nominated by at least two members of the Association, the application must be supported by an appropriate academic case. The closing date for nominations is **1st September 2007**.

Nominations will be considered and a decision made at the October meeting of Council. The award will comprise a fund of £1,000, presented at the Annual Meeting.

Mary Anning Award

The award is open to all those who are not professionally employed within palaeontology but who have made an outstanding contribution to the subject. Such contributions may range from the compilation of fossil collections, and their care and conservation, to published studies in recognised journals. Nominations should comprise a short statement (up to one page of A4) outlining the candidate's principal achievements. Members putting forward candidates should be prepared, if requested, to write an illustrated profile in support of their nominee. The deadline for nominations is **1st September 2007**. The award comprises a cash prize plus a framed scroll, and is usually presented at the Annual meeting.



Nominations are sought for the “Golden Trilobite Award” for prestigious websites

This award is for the best institutional and amateur websites that promote the charitable and scientific aims of the Association, the promotion of palaeontology and its allied sciences. The award will take the form of a statement of recognition that can be posted on the winning sites. Nominations are sought from the membership, and should be sent to the Secretary at <secretary@palass.org> by **1st September 2007**. The websites will be judged by Council members.



Grants in Aid

Grants-in-Aid: Meetings

The Palaeontological Association is happy to receive applications for loans or grants from the organisers of scientific meetings that lie conformably with its charitable purpose, which is to promote research in palaeontology and its allied sciences. Application should be made in good time by the scientific organizer(s) of the meeting on the online application form. Such requests will be considered by Council at the March and October Council Meetings each year. Enquiries may be made to <secretary@palass.org>, and requests should be sent by 1st March or 1st September annually.

Grants-in-Aid: Workshops and short courses

The Palaeontological Association is happy to receive applications for loans or grants from the organisers of scientific workshops or short courses that lie conformably with its charitable purpose, which is to promote research in palaeontology and its allied sciences. Application should be made in good time by the scientific organizer(s) of the meeting on the online application form. Such requests will be considered by Council at the March and October Council Meetings each year. Enquiries may be made to <secretary@palass.org>, and requests should be sent by 1st March or 1st September annually.

Electronic Submission of manuscripts

Please note that manuscripts for publication can now be submitted online. Details (including “Notes for Authors”) can be found on <<http://www.palass.org/>>.



PalAss Website: Members' Area

As you may have noticed, the Palaeontological Association Website (<<http://www.palass.org/>>) has recently been augmented by a Members' Area, which provides discussion boards, a directory of members, and other facilities besides. This article provides an introduction to this new system.

Accessing the Members' Area

All members of the Palaeontological Association will be enrolled onto the system (*i.e.* have user accounts set up) over the next few weeks; you may already have received your account details before you read this. When your account is created, you will receive an introductory e-mail that includes your user name (usually your personal e-mail address) and your password; you can change the latter when you log on. To access the system, follow the links from the navigation bar on the Association website (<<http://www.palass.org/>>), or use the link provided in the e-mail notifying you of your account details. We encourage everyone to try out the system to see what is on offer, and to add/emend your details as appropriate. Use of the Members' Area is governed by a set of terms and conditions, which you should read and follow (see <<http://www.palass.org/modules.php?name=palaeo&sec=membership&page=148>>).

Details of Members' Area facilities

The Members' Area includes these sections: (1) account overview; (2) personal profile; (3) change password; (4) change username; (5) members' directory; (6) Blackwells Synergy; (7) discussion boards; and finally (8) logout. Each of these is outlined below; they can be accessed from the 'Members Area' link on the main navigation bar on the website (currently at the bottom of the list).

- (1) **Account Overview.** This provides a summary of your membership details, including your unique Membership Number (used for PalAss administrative purposes and found on the envelope in which you receive post from the Association), your user name (generally your e-mail address), a summary of your membership category (ordinary, student, retired, *etc.*), the date on which you were registered on the online system, and the time remaining until your Association membership needs renewing. Please note: the membership dates only relate to the members area and we have not included historical records. If we have got any information on your membership wrong, please contact the Executive Officer (<palass@palass.org>).
- (2) **Personal Profile.** This is effectively 'your space' on the website. Contact details, the address of your personal webpage (if any), a photograph, and text describing your palaeontological interests and/or background can all be entered here. This information is linked with the Members' Directory (see 5 below), and is hence viewable and searchable by other members; to opt out of inclusion in the directory (in accordance with UK data protection protocols), untick the 'included' box at the bottom of the page. To alter any information on your profile, simply enter new details and click the 'Update and Save My Profile' button at the bottom of the page. Note that you do not have to complete all fields to participate in the Members' Directory – you only need fill out the information you want to include.

This page also allows you to upload a personalised image (either photograph of yourself or something you like) that will identify you to other users if you participate in the Discussion



Boards (see 7, below). Please note that the image should be less than 50kb in size, and a maximum of 150x200 pixels (*i.e.* a thumbnail image rather than a large high-resolution file).

All details on your interests, background, *etc.* that you wish to include should be entered in the 'My Background' section. This section also is designed to work in a similar way to a word processor, so should be straightforward to use. We hope that this provides a useful service to Association members, and we encourage people to participate in this part of the website. There are at present no set rules to what you can or can not include, but please bear in mind the terms and conditions of the Members' Area.

- (3) **Change Password.** Provides a facility to change the provided password to something more memorable.
- (4) **Change Username.** Provides a facility to change your username. Note that this **MUST** be a valid e-mail address, which the system can use to contact you as and when required (*e.g.* to send you a reminder of your password, should you forget it).
- (5) **Members' Directory.** This provides a list of members who are enrolled on the system, with the exception of those who have opted out of the directory (see above). It provides an image and link to each member's personal profile, enabling you to find out details that they have chosen to share (again, see above). This database is searchable; to search for a member by name or by country or region for example, enter the name or geographical area into the search box and click the adjacent 'Go' button.
- (6) **Blackwells Synergy.** Provides direct links to Association publications on the Blackwells 'Synergy' website. Entering Synergy via this link automatically logs you into the Blackwells system as an Association member, providing full access to journal articles without requiring any further authentication.
- (7) **Discussion Boards.** Provides facilities for you to air your views and to enter into discussion on topics of interest to other Association members. Discussion topics are divided into broad 'areas'. Within each area discussions are organised by 'threads', each thread representing a discussion initiated by a member on a specific subject. All members can browse discussions, reply to other people's postings, and generate new threads; detailed instructions are not provided here, but we hope the system is clear and straightforward to use. Note that a set of 'house rules' governs these pages; these can be viewed with the appropriate link at the bottom of the 'Discussion Boards' page. Please ensure you have read these before posting, and make sure that anything you add complies with the rules. Please bear in mind also that this part of the website is managed by moderators who can delete entries, send warning messages, and if severe breaches occur can exclude members from the Members' Area.

This is a new concept for the Palaeontological Association, but one that is firmly established in many other organisations, and which we hope will develop into a valuable resource for palaeobiologists. If you are new to Discussion Boards, you might want to sit back and watch for a while; alternatively feel free to jump straight in. It may help to read the 'Welcome to the PalAss Discussion Forum' message submitted by the moderators (Jason Hilton, Mark Sutton, Al McGowan) to see what we had in mind when the system was set up.

- (8) **Logout.** Use this link to sign yourself out of the Members' Area.



As there will undoubtedly be teething problems for some users, please bear with us during this period in which responses to enquiries may be slower than normal. For enquiries relating to membership please contact the Executive Officer (<palass@palass.org>); to report any technical problems please contact the Internet Officer (<webmaster@palass.org>). It is important that the Members' Area is 'self administrating' as far as possible, by which we mean that you should be able to do what you need to do via the system interface. If you are seeking technical help for something you can do on the system (such as changing your password, editing your own personal profile, changing your contact details, uploading an image of yourself) your request may not be prioritised.

And finally, Council of the Palaeontological Association hopes that members find this system beneficial and practical.

Good luck!

Jason Hilton

<webmaster@palass.org>

Mark Sutton

<webmaster@palass-hosting.org>

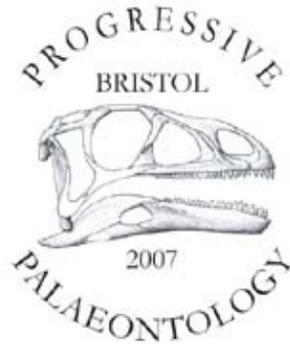


PROGRESSIVE PALAEOLOGY

UNIVERSITY OF BRISTOL

13th – 14th APRIL 2007

SECOND CIRCULAR



Dear Colleague,

The University of Bristol is pleased to invite you to the 2007 meeting of *Progressive Palaeontology*, to be held in the Department of Earth Sciences on 13–14 April 2007.

Progressive Palaeontology is an annual meeting run by, and for, postgraduate students in palaeontology. It offers the chance to present your work in a relaxed and friendly atmosphere and to meet fellow palaeontology students.

The University of Bristol has the largest palaeontology postgraduate community in the UK. A large body of PhD students are joined each year by some 20 MSc students with research interests ranging from vertebrate biomechanics to palaeoembryology.

The Department itself is housed within the Wills Memorial Tower, right next door to the City Museum and Art Gallery. It is within walking distance of the famous Clifton Suspension Bridge as well as the city centre.

Registration is free and is now open at <<http://www.palass.org/>> where you can also find further information about transport and accommodation. Should you have any questions then feel free to contact us at:

<progpal2007@palass.org>

Please note that there are upper limits on numbers for both the evening reception at Bristol Zoo and the Saturday field trip to Aust Cliff: places will be allocated on a “first come, first served” basis so early registration is advised.

We look forward to seeing you in April!

The Organising Committee



SYNTHESYS

SYNTHESYS Project funding is available to provide scientists based in European Member and Associated States to undertake short visits to utilize the infrastructure at one of the 20 partner institutions for the purposes of their research. The 20 partner institutions are organised into 11 national Taxonomic Facilities (TAFs).

The 11 TAF institutions represent an unparalleled resource for taxonomic research, offering:

- Collections amounting to over 337 million natural history specimens, including 3.3 million type specimens.
- Internationally renowned taxonomic and systematic skill base.
- Chemical analysis.
- Molecular and imaging facilities.

SYNTHESYS is able to meet the users' costs for research costs, international travel, local accommodation, and a *per diem* to contribute towards living costs.

Forthcoming deadlines: 16th March 2007
14th September 2007
14th March 2008

For more information visit <<http://www.synthesys.info/>> or contact <synthesys@nhm.ac.uk>.



ASSOCIATION MEETINGS



51st Annual Meeting of the Palaeontological Association
Uppsala, Sweden 16 – 19 December 2006

The 51st Annual Meeting of the Palaeontological Association will be held in Uppsala, Sweden, organized by the Palaeobiology Programme of the Dept of Earth Sciences, Uppsala University. The meeting is in association with the Museum of Evolution, Uppsala University, and the Swedish Museum of Natural History, Stockholm.

The meeting is part of the celebrations of the 300th anniversary of the birth of Carl von Linné, the most famous son of Uppsala.

The meeting will commence with a half-day symposium on the afternoon of Sunday 16th December on the “Origins of Major Groups”, followed by the ice-breaker reception in the Museum of Evolution. The conference proper will commence on Monday 17th December, with a day of talks including a poster session; the AGM, annual address and the annual dinner. Tuesday 18th December will be a full day of talks. Because of the uncertainty about weather, there will be no field-trip on Wednesday 19th December, but rather a programme of Linné-related activities and visits, and a trip to the Swedish Natural History Museum in Stockholm.

Talks will be 15 minutes in length. Parallel sessions will be held if necessary, in adjacent lecture rooms.

Venue and travel

Please see our webpages at <http://www.palass.org/> for details of transport and venue.

Accommodation

A variety of accommodation at very reasonable prices has been reserved in various establishments within a few minutes' walk of the conference locality. See the website for further details.

Registration and Booking

Registration and booking (including abstract submission) will commence on **Monday 30th April**. Abstract submission will close on **Friday 7th September**. Abstracts will not be considered after this date. Registration and booking after Friday 7th September will incur an additional administration cost of approximately £15, with the final deadline of **Friday 24th November**. Bookings will be taken on a strictly first come, first served basis. No refunds will be available after the final deadline.

Registration, abstract submission, booking and payment (by credit card) will be from online forms available on the Palaeontological Association website <http://www.palass.org/> from Monday 30th April.

**Programme:**Sunday 16th December

One-day symposium on “The Origins of Major Groups”.

Evening reception at the Museum of Evolution, Uppsala.

Monday 17th December

Scientific sessions (talks and posters) followed by Annual Address.

Annual Dinner.

Tuesday 18th December

Scientific sessions.

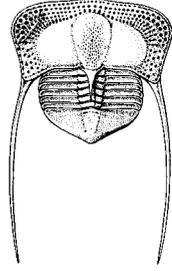
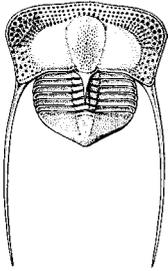
Presentation of awards.

Wednesday 19th December

Linné related visits and trip to Stockholm Swedish Museum of Natural History.

Travel grants to help student members (doctoral and earlier) to attend the Uppsala meeting in order to present a talk or poster

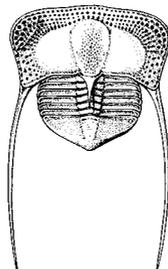
The Palaeontological Association runs a programme of travel grants to assist student members presenting talks and posters at the Annual Meeting. For the Uppsala meeting, grants of up to £100 (or the Euro equivalent) will be available to student presenters who are travelling from outside Sweden. The amount payable is dependent on the number of applicants and the distance travelled. Payment of these awards is given as a disbursement at the meeting, not as an advance payment. Students interested in applying for a PalAss travel grant should contact the Executive Officer, Dr Tim Palmer, by e-mail at <palass@palass.org> once the organisers have confirmed that their presentation is accepted, and before 8th December 2007. No awards will be made to those who have not followed this procedure.



Palaeontology: **CALL FOR SHORT PAPERS!**

From January 2005 *Palaeontology* has been published in A4 size with a new layout. In line with this development, space is reserved for rapid publication of short papers on topical issues, exceptional new discoveries and major developments that have important implications for evolution, palaeoclimate, depositional environments and other matters of general interest to palaeontologists. Papers, which should not exceed six printed pages, should be submitted in the normal way, but they will be refereed rapidly and fast tracked, on acceptance, for publication in the next available issue.

Submission of longer review papers is also encouraged, and these too will be given priority for rapid publication. While *Palaeontology* maintains its reputation for scientific quality and presentation, these developments will ensure that the Impact Factor of the journal reflects its status as a leading publication in the field (rising to 1.19 in 2003).





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The spirit of biodiversity

It's an extinction event like no other. There's not only the dodo, preceded into oblivion by numberless Pacific birds that disappeared, still nameless, unadorned by Linnaean benediction; nor the mammoth, that left the planet not much larger than a St. Bernard dog, in its final Siberian haven on Wrangel Island; nor even the Yangtze dolphin, choking on the economic miracle that may yet claim greater scalps. As the world has been physically conquered by the human blitzkrieg, and lost its horizon to the unblinking gaze of Google Earth (where every river bend and every hilltop can be touched, virtually, by anyone with a home computer and dialup broadband) more victims have fallen: victims of a kind that are more celebrated, but less tangible.

Consider the dragon, a creature that has haunted many widely separated cultures. Why so? For dinosaurs, their most obvious doppelgängers, are too long gone by far. No matter. As the potential hiding places have winked out over the world, one by one, so has this thrilling, fearful, scale-clad possibility died out, by degrees, in the human heart. Likewise, the roc, or rukh, no longer flies across Asian wastes, stray elephants clutched in its talons¹. The seas are larger hiding places, but now their black depths are lit by sonar and traversed by bathyscaphes. So the kraken is no more, or has mutated into the giant squid: an object of curiosity, certainly, but no longer one of dread, a devourer of ships³. There's no coda for the mermaids' siren song, nor can the monstrous *Nessiteras rhombopteryx* continue its long vigil in Loch Ness, allowing itself to be summoned, occasionally, by the unique sonorities of a recently-emptied bottle of whisky. The Himalayan yeti cannot risk the all-seeing eye of the military satellite, while as for the Transylvanian vampire ... well, the stag and hen parties from Luton have proved more deadly than garlic and silver bullet combined.

But here's another one on the alternative Red List that's a little different. For many centuries, it led a fugitive existence across continents, a fleeting apparition that has gathered more names than many a more solid creature. In Germany there were the Irrlichtern, the little lights that lead astray. In France there were the feux-follets, a name suggesting a combination of fire and madness⁴. In Poland, there was the Bledny Ognik – the treacherous little flame. In Finnish synonymy, it was the Lekkiko. In English realms, it was the hinkypunk, the ignis fatuus, the Corpse Candle, Elf-fire, the Jack-o'-Lantern and, most familiarly, the will-o'-the-wisp.

¹ Sinbad had much to say on this bird. But Carrington (1960) also relates how Marco Polo tells of the Great Khan sending an emissary to seek evidence of this phenomenal creature. The emissary duly brought back a feather ninety spans in length, for which he was rewarded with 'great presents'.

² A scam, of course. The feather was in fact a frond of the Madagascan palm *Sagus ruffia*. The source of the legend of the roc almost certainly derives from the same island, where the bones and the eggs of the mighty *Aepyornis* may still be found.

³ But commonly regarded as a pussycat in those days, mostly harmless and with a healthy respect for the church. A passing bishop, it is said, mistook one for an island, rowed across, and consecrated it with a mass. The kraken had the good manners to wait for the ceremony to finish and the bishop to be safe back in his boat before sinking back to the vasty deep. It's all in Carrington (1960).

⁴ A little knowledge is a dangerous thing. It is no excuse, in pages as rigorous as these, to claim that one is falling back on a grandly poetic understanding of the facts.



A finicky beast, this was, a creature of bog and mire and morass, those places where there would be no unwary traveller but many a nervous one as night fell: places where the cry of a giant hound might be heard in the distance ... (aye, Sir Henry had better watch his step). In Polish legend it fed on the emotions of lost travellers, of panic, horror and approaching death, luring them with the pale light that promised shelter but that led them instead to their doom. John Milton invoked it in *Paradise Lost* as

... a wand'ring fire
Compact of unctuous vapour...

that

...blazing with delusive light
Misleads th'amaz'd night-wanderer from his way,
To bogs and mires and oft through pond or pool,
There swallowed up and lost, from succour far...

Today, as the will-o'-the-wisp, it has evolved into metaphor, sometimes even into adjective, and so its ghost lives on. But the real thing seems to be either dead, or dying. And that may be a more serious matter than one might at first think.

Just what was this creature of the night? My Leicester colleague Allan Mills has been hunting it through past and present (Mills 1980, 2000⁵), trying to pin it down with the weapon of disinterested scholarship, a rare enough phenomenon itself these days. The will-o'-the-wisp was real enough; there are enough sober eyewitness accounts from past centuries to demonstrate this beyond reasonable doubt. In marshy ground it was a small luminosity, mostly blue or bluish-yellow, that appeared near the ground, stood still for minutes at a time or skipped from place to place, then disappeared. The glow was pale and mostly cold: it did not, for instance, appreciably heat the brass ferrule of the stick Professor Knorr of Kiev University was carrying when, in the mid-nineteenth century, he observed one over a period of a quarter of an hour or so. One account, though, claims that such a flame did (eventually) set light to a piece of paper held by one Major Blesson of the Berlin Corps of Engineers.

What could behave so? Allan, writing in 1980, briskly despatched the obvious suspects. Fireflies? Not at all. St. Elmo's Fire? Nothing like. Ball lightning? Ditto. Luminous owls? Amazingly, perhaps, sometimes. Rotting wood or fungus can sometimes make an owl's wings luminous, and that might just explain occasional instances of the will-o'-the-wisp. But not all of them. Professor Knorr would have noticed an owl.

Methane might seem an obvious suspect. But not so – at least not by itself. Sure enough, it is the major constituent of the marsh gas that bubbles up through ponds and pools of stagnant water. And it can indeed be ignited with a match – but to give a brief, hot, bright flame, not the steady, ghostly presence of legend and historical observation.

Was there a factor X in there that, by sleight of thermodynamics or chemistry, could summon up the marsh spirit? Long ago, Volta had suggested phosphine (PH₃) as a substance that might make marsh gas self-ignite. Sure enough, make phosphine and spontaneous ignition will occur

⁵ Highly recommended, both. In these, as in so much, the originals are far better than the abbreviated facsimile that lies before you.



– but with a bright flash and clouds of white smoke; and, this particular compound has not been detected in gases emanating from stagnant phosphate-bearing soils. The ghost seems stubbornly absent from this particular machine.

A higher phosphorus hydride? (for Thenard in 1844 elaborated Volta's thesis, by showing that it was trace amounts of P_2H_4 that in fact made the phosphine ignite). 'Cold flames' are produced by ether or carbon disulphide when heated to just below ignition point – could these provide a clue? There were a number of such candidates, mostly unearthed by Allan's scouring of Victorian-era organic chemistry literature. But nothing quite fitted.

An experiment was in order. So, take one gallon of an aqueous suspension of garden soil, peat and well-rotted compost, and incubate this in a dark place. After a few days marsh gas appeared; flammable yes, but devoid – alas – of the true elf-fire. So then the heavy artillery was added: bone meal, diammonium hydrogen phosphate, egg, dried milk and whole fish. More gas followed, this time 'repulsively odoriferous' (Mills 1980) but no more spontaneously luminescent than previously.

Can the creature be caught in its natural habitat? Trapped by experimentalists in a glass tube, and led, palely protesting, to be interrogated by a mass spectrometer?

Now here lies a problem, for the swamps of yesteryear have been, well, improved. Take the Fenland of eastern England. Originally an almost unimaginably huge tract – four thousand square kilometres or so – of bog, reed-swamp, salt marsh, of shallow pools and twisting creeks, a land caught between sky and earth and water. Now Google Earth shows it tamed, cut into thousands of neat rectangles by drainage ditches, its surface as solid as that of any Cotswold field, and producing sugar-beet and potatoes by the bushel. The Netherlands, its cousin across the water, is the same. Follow any of the great rivers of Europe or North America on your computer screen; the once-continuous water meadows appear as the same productive chequerboard, converted into feedstock for a single ingenious and ever more numerous – and ever-hungry – primate species.

And so the swamp-creatures have dwindled: marsh harrier and beaver, bittern and otter. And the will-o'-the-wisp. The last of these is a chemical animal, one might say, and so should not really count among the roll-call of vanished biodiversity. But I would stake a hundredweight of best garden compost and a bottle of beer that the will-o'-the-wisp is not pure chemistry. It must, surely, be – or have been – a bug-creature: produced, shaped, defined and modulated by the activities of the bacteria that govern the dynamics of any soil. And, like a kind of ethereal miner's canary, its demise might just be a clue to a wave of contemporary extinctions (that may or may not be taking place) which are below our scientific radar screens (we have yet to build the right sort of screen) but that might, just possibly, have left echoes in the fossil record.

We look at the natural world and see birds, flowers, insects, foxes. But they (and we) are just baroque excrescences built upon the true biological world, the one that really counts: the world of the microbes. We look at a human and see a person, an individual. Democratically speaking, though, we are mostly convenient substrate for five billion or so microbes⁶ without whom digesting (or making, for that matter) that pint of beer would be *quite* out of the question.

⁶ And that's only *Escheria coli*; it's just the best-known – but not the most common – of our personal microbes.



And that's just us. Out there that landscape is not quite solid microbe: but it's teeming, certainly, in numbers that are astronomically greater than those of any of the larger and more pretentious organisms that inhabit this Earth: they teem at the surface; they are borne in their trillions through the air (and perhaps across the cosmos too, if Fred Hoyle and Chandra Wickramasinghe guessed correctly⁷) and, as we now know, they colonise to kilometres down in that evocatively named deep biosphere⁸. Controlling most of the Earth's chemical cycles, they are not only numerous beyond imagination, they are indispensable too.

But as the world is changing about them, are they changing too? Are the metazoan extinctions now gathering pace being accompanied by waves of microbial extinctions too? And therefore is the will-o'-the-wisp disappearing simply because it was standing on the shoulders of an army of microbe species, now decimated, that had been literally breathing it into life? Search for answers here and (as ever) one simply finds more questions. But I was quite taken aback as to quite how far back one had to step in posing questions that had any ghost of a chance of a remotely sensible answer.

Thus – how many microbe species? Well, a few years back about four thousand had been described, using the standard morphological criteria. Then the genetic analysts got their teeth into this, taking a handful of soil here, a litre of seawater there, and said that, no, there were in fact millions of species – and that was just in those samples. Thus, estimates of the number of bacterial species on Earth have recently stretched out from thousands to billions (Staley, 1997; also Nee, 2004); but then, what is six orders of magnitude between friends?

Now a microbe species is ... just what? Well, the standard rule of thumb for microbe species is that their genetic code is 70% or more its own (Staley, 1997). Compare that with, say, humans and chimps who share 98.6% of their genetic code. Thus, in microbe terms, the entire primate family might be a species. Not only that, but microbes have a shockingly free-and-easy attitude as regards their genes, sharing them with other microbes at the drop of a hat. Thus, it might be hard to say that a microbe species can actually become extinct. Like Terry Pratchett's Igors, who have such a thrifty and ecological way with body parts, they can simply become reconstructed, reappearing as loaned-out bits of genetic code get called back in. What goes around comes around.

Do microbes show biogeographic differentiation? Or is there just local environmental selection, and is everything essentially everywhere, the enormous powers of microbes to spread and reproduce meaning that they can wipe out any trace of evolutionary and ecological history? This question was seriously posited only last year (Martiny *et al.* 2006). After much musing, it seems that biogeographic patterns do exist, and can persist. So we have perhaps reached, with the microbes, about to where Alfred Russell Wallace reached with the Earth's larger and more showy organisms a century and a half ago.

⁷ The earthbound bugs could get quite some way, if they just organised themselves properly. The viruses in the Earth's oceans alone, lying end to end, would span – or so it is claimed (Suttle, 2005) – some ten million light years, or a hundred times the distance across our galaxy.

⁸ Albeit as Rip van Winkle bugs: at a talk a few years back, I recall one speaker estimating that the bacteria of the deep biosphere may have heard of living fast and dying young but refuse absolutely to have any truck with such incautious behaviour, reproducing every thousand years or so. Incredible, and perhaps even true.



And are microbial extinctions taking place (with due regard to their general Igor-ishness)? Again, we seem to have an embarrassment of poverty. Microbes that are obligate pathogens or symbionts of endangered animals or plants will obviously (again, as obviously as Igor will allow) disappear when their hosts do. And the smallpox virus is being allowed to just hang on. But otherwise? The answer, it seems (Staley 1997), is that we don't yet know, and we don't know rather more spectacularly than we don't know how many frog and beetle species are disappearing – undiscovered, unchristened and unlamented – as another square kilometre of rain forest is converted into burger feedstock.

However, with most of the lowlands of the Earth having been effectively terraformed into city and agroscape; with a nitrogen cycle, thanks to Herr Haber's ingenious idea, approximately doubled from pre-industrial times; and with megatons of extra phosphorus sprayed on to the landscape, from Chilean guano (and worse) ... just what is going on in the only part of the Earthly empire that, really, in the end, counts? Nobody corporeal seems to know. But perhaps the last of the will-o'-the-wisps has a story to tell, if we but had the wit to interpret it.

So we stride hugely around, hyper-elephantine Brobdignagians, over the mysterious world of the hyper-small without having any real idea of how that world works, or of how we may or may not be fundamentally altering it. In theory we know that it's a strange world and a non-intuitive one, where food is brought in – on a plate, almost – bounced through aquatic space by molecular collisions (so effectively that many bacteria simply stay put, leaving their more energetic brethren to search for nutritive hotspots), where water is thick as honey and the air is thick as water. Looking in on this world would require a particular type of spectacles. Victor Smetacek, in 2002, placed an *in situ* computerized telemicroscope on his wish list. This hasn't been invented yet. So we must perforce fall back on the power of creative imagination.

This path inevitably leads us to the Hollywood dream machine, traveller through the cosmos and creator of past and future worlds. Has it brought the microscopic one to us? It has, of course. There is the *Amazing Shrinking Man*, which I recall as a film of much existential angst, including the final inexorable disappearance of the unfortunate shrinkee to some mysterious destiny in the nanoworld. It has enough angst, indeed, to render it suitable for discussion on the Seine's more intellectual bank, over an absinthe or three. So that, and its microbial bereftness – or perhaps bereftitude? – rules out this *oeuvre* for serious consideration here.

More germane to the present quest is *Fantastic Voyage*, a faded technicolour memory of mine from some youthful outing to the local fleapit. Very much in the blockbuster mould, this posited the sending of a miniaturized submarine and its crew through the bloodstream of an almost-assassinated Russian defector in a race against time to save his life. It made quite a stir in its day for its portrayal of the human interior as a kind of wraparound Pompidou Centre, only with softer lighting. How would it fare now as a popular introduction to the microscopic world? And how many of our personal billions-strong microbial army would we meet? I tracked down the DVD, and settled comfortably down with a cup of tea to pursue this critical line of socioacademic research.

It ran absolutely true to the Hollywood archetype. The special effects were indeed lavish, and still retain a curious period charm, with myriad drifting blood cells teeming by like an explosion in a lava lamp factory, so translucent and iridescent as to recall ectoplasm rather than



cytoplasm. The lungs blew a gale, the heart pounded like an earthquake in Valhalla, the brain flickered with Christmas lights, and all through this our gallant crew fought to keep a grip on the situation. Alas, they were defeated at every turn by the unspeakable lines foisted on them by the scriptwriter, whose ear – unlike the finely tuned architectural marvel of the Russian defector – was made entirely of cloth.

Raquel Welch was there, as the serious-minded assistant of the Gruff but Brilliant Surgeon, and so – with her notable appearance also in *One Million Years B.C.* – might lay claim to iconic status in the popular science genre. She is less impressive here, though, for reasons that have nothing to do with the replacement of a fur bikini by a plastic boiler suit. Loutishly patronized by the Lantern-Jawed Hero on their first encounter, she merely simpers winsomely, instead of running him through with the high-powered laser she is adjusting. This hopeless demeanour obviously enraged the resident antibodies that, like plastic seaweed with attitude, lurked in the wings. They later fell upon this overly-tolerant heroine in a swarm, doubtless in an attempt to throttle some sense into her. The antibodies, incidentally, had been cue for the one fleeting appearance of microbes in this epic. The latter lasted only an instant before being pounded on by the vigilant seaweed. This was a very clean defector.

All ended happily, of course – with a curious subplot that I had forgotten entirely. The one member of the crew that was flaky and sweaty and ultimately revealed as treacherous to the core (Donald Pleasance at his most twitchy and eyeball-rolling) was also the one who explained the biological marvels around them by invoking natural selection, even giving a reasonable estimate of the duration of the Phanerozoic. Gruff but Brilliant Surgeon and Lantern-Jawed Hero, in response, recited exalted poetry and affirmed Divine Creation. The wicked evolutionist got his just desserts in the end, consumed by a white blood cell that, disguised as a large fluffy eiderdown, had crept up on the submarine. The avenging leucocyte then ate the rest of the submarine for *its* just dessert. Did the young George W Bush watch and cheer, I wonder, in those distant and innocent times?

It's time, of course, for a sequel. One could tempt the Hollywood moguls by telling them that there are still a few evolutionists out there to immolate in expensively reconstructed pits of hellfire and brimstone. The setting, though, needs careful thought. Given oodles of boodle and the freedom of a special effects studio, where might one set the full-blooded action of *Fantastic Voyage II*? Where to best illustrate the strangeness and beauty of the microscopic world?

I'd fly the heroic crew out over a microbial mat, miniaturized video cameras firmly clutched in miniaturized fists. For, individual microbes can do breathtaking tricks – turns sulphate to fool's gold or breathe nitrate or feed on bleach or eat ammonia or breathe metal oxides (Lane, 2006). But when they gang together, the merely extraordinary becomes quite other-worldly: what is intuitively science-fiction is reality inferred using all the tricks in the modern microbiologist's armoury. Microbial mats, say, I had thought of as bacteria simply proliferating over surfaces: the scum on pebbles in ponds and kitchen sinks and unbrushed teeth. But to Kolter and Greenberg (2006) they are akin to miniature coral reefs, with intricate shapes and complex compositions; that tooth, for instance, may be swathed in several hundred microbe species. More surreally, start a mat with just one cell, with one genetic composition, and it will diversify – genetically – into many strains, as the mat grows and micro-niches and nutrient gradients develop within it.



Most microbes, it seems, can switch between a life footloose and fancy-free and one that is settled and respectably mat-bound. How do they know when to settle down? There seems to be a lifestyle switch: tripped, it seems, by the redoubtable bis-(3'-5')-cyclic dimeric guanosine monophosphate, a dead cert if ever I saw one for the local pub quiz. Then signals have to go to other microbes of the same species to join the conurbation – quorum sensing, it's called. And it seems likely that different species can sense each other, allowing or denying entry into Microbe City, with suitable enforcement (cyanide, for example, or home-brewed antibiotic) if necessary. It's a vision of a world with its own sophisticated codes and rules, a world of ... possibilities.

What of this survives into the fossil world? There are stromatolites and wrinkle structures, and just occasionally petrified cells in Precambrian cherts or in the bellies of phosphatized fish. There are the ghosts of microbial enterprises past, the banded iron formations that mark the oxygenation of the world, though as far as I know these have never yielded any of the fossilized microbes that then so dramatically changed the earth. Now transformed into automobiles and such, these microbial products now surround us all (and in a sense are helping to fuel, as it were, a reversal of the transformation in atmospheric chemistry that the microbes wrought in their Precambrian prime). Banded iron formations are striking rocks, visible from far off. From exceedingly far, if Dobson & Brodholt (2005) are correct. They argue that most of these dense and refractory rocks have been subducted down to the core-mantle boundary where they still rest, as low-velocity regions, changing the paths of whole-earth seismic waves to this day. As a permanent monument to a vanished empire, it is some way ahead of the Pyramids and the Taj Mahal.

But this is large, crude stuff, this shape-petrifying eliding into planetary-scale engineering. It is the intimations of complexity of microbial life, of sensing and signalling and behavioural subtlety, that make one wonder just what was lost half a billion years ago, as the world-covering mats were ripped to shreds by the emergent animals. And it gently reinforces the guarded partiality I have for the interpretations of the Ediacara fauna as things akin to stitched and pleated microbial mats, rather than as more conventionally-engineered metazoans. If they were so (a big 'if', admittedly) would they have got further if the animal horde hadn't come charging in at the dawn of the Cambrian? Perhaps not, for *Charnia* and *Co.*, once arrived, showed little morphological sign of an evolutionary arms race.

But perhaps we are looking at the wrong scale. The devil in the microbes is in their detail, and who knows what kind of colonial association, what communication systems – or perhaps even what kinds of organic biocomputers – were being conjured up in the endless Precambrian matworld, before that world was shredded⁹. Blame it all on the coelom. It may have set evolution back by a billion years.

Jan Zalasiewicz

⁹ Far-fetched? But even simple streams of bubbles can encode and decode information and might conceivably be able to form 'thinking devices' (Epstein 2007). So next time you gaze pensively at a glass of beer, be aware that it might be gazing pensively back at ... you. Especially if it has a good head on it.

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Post-scriptum

If you have a fondness for walking through bogs and mires and swamps and know of a place where will-o'-the wisps continue to gather, Allan Mills (c/o Department of Geology at the University of Leicester) would be delighted to hear from you. There's a real enigma there, still waiting to be solved.



Consensus trees and tree support

In this article I will look at two separate issues; consensus trees and support for the nodes on your tree. There is a tenuous link between these as we will see.

Consensus trees

Often, after we have carried out our analysis, the tree building routine (whichever algorithm we use) will report more than one parsimonious tree. In other words the data used is compatible with more than one cladogram/tree. In such circumstances there are two things that we can do. We can choose one of the trees as the one we favour (the criteria by which we do this are varied and usually based on biological/geological arguments). Or we can establish the common elements between the trees – the lowest common denominator if you like. For the second route we make consensus trees. There are several kinds of consensus trees that summarise different pieces of information. PAUP* reports four types, so we will deal with these here (you might like to be aware that there are more – see Kitching *et al.* 1988). Figure 1 steers you to the relevant part of the PAUP* program.

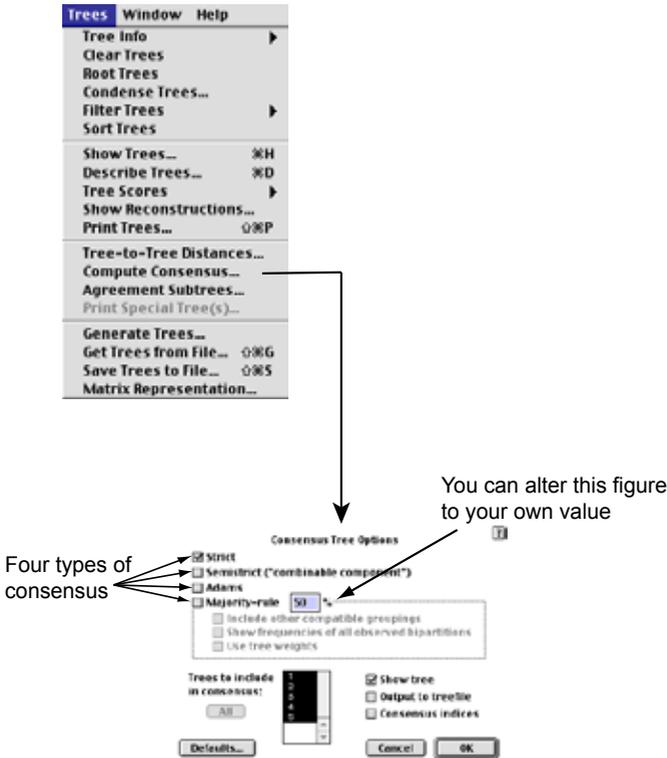
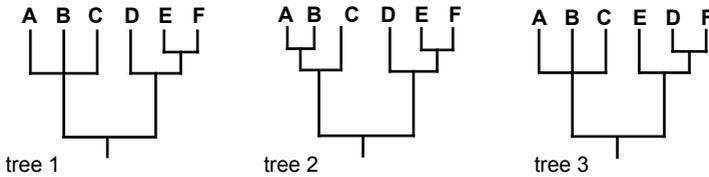


Figure 1. Control for calculating consensus trees is found under the trees menu. The control box appears for you to set options. You would normally include all fundamental trees.



Starting (fundamental) trees



Consensus trees

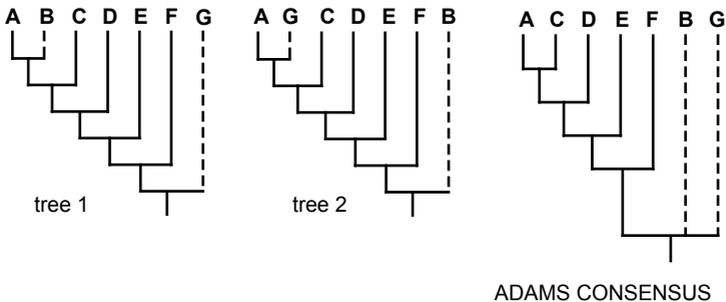
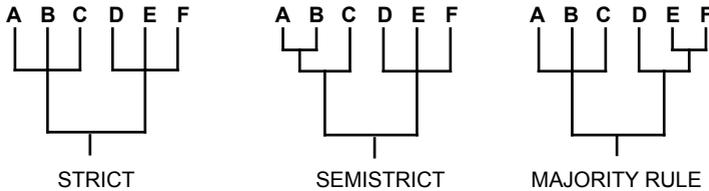


Figure 2. The types of consensus trees calculated in PAUP*. See text for explanation

Figure 2 illustrates the four kinds of consensus tree considered here. Let us assume that as a result of analysis we ended up with three equally parsimonious cladograms shown in the top row in Figure 2. These are called the starting or fundamental trees because they are the three alternatives derived from the analysis of the data.

The simplest way to combine the elements of all three cladograms into one is to show *only* those sister group pairings – or components – that appear in all three cladograms. Any differing solutions among the remaining taxa are shown as a single polychotomy. You will see by scanning across the three trees that relationships differ between A, B and C, and again between D, E and F. But the two groups ABC and DEF are the same in all trees. Therefore if we combine this information we end up with the tree to the left in the second row. This is known as the *Strict*



Consensus method. Many purists believe that this is the only consensus method that should be considered – all others being tainted by concessions that cannot be justified. Other practitioners think otherwise.

If we look more carefully at the starting trees we will see that in tree 1 and tree 3 there is a trichotomy between taxa A, B, C. In other words there is some ambiguity (this may result from conflicting data or perhaps no data, or alternative resolutions of question marks in the data set – palaeontologists beware!). One of the possible resolutions of that trichotomy is that taxa A and B are sister groups, with C the sistergroup of those combined. If we assumed this then all of the cladograms would be similar with respect to these three taxa and, in fact, there may be no conflict between them. [We can do nothing about taxa D, E and F since there is contradiction between the solutions seen in trees 1 and 2 on the one hand and tree 3 on the other.] Therefore another method – the *Semistrict Consensus* tree – will combine all those possible solutions that are not contradicted (this method is sometimes called the combinable component consensus).

The majority rule simply takes those solutions within the starting trees that are found in the majority of the trees. Thus the grouping (A,B,C) is found in two out of three trees and the grouping (D (E,F)) is also found in two out of three.

There is another kind of consensus we could make, and for this I have used two different kinds of starting trees, shown in the third row. This is called the Adams consensus. Let us assume that the result of analysis reported two trees that were the same shape (they need not be) but they differed in the positions of taxa B and G (dashed lines). The mutual relationships among the remaining taxa are the same. In the Adams consensus the taxa that differed in their positions (taxa B and G) are each placed at the most inclusive positions that each occupies in any of the starting trees. Since each of the taxa was positioned at the base of one or other of the starting trees, both are moved to the base of the Adams consensus tree. This type of consensus tree is useful for identifying ‘rogue’ taxa (and there are usually quite a few in palaeontological circles) – those taxa that occupy very different positions in different trees. You may think carefully about deleting such taxa from future analyses (we will return to what might be done in the final article): at the very least it would be wise to enquire as to *why* they occupied such differing positions. Although the Adams consensus may appear useful you should be aware that it is actually making a consensus of trees that were not in the starting line up. For example, one of the resolutions of the Adams consensus shown in Figure 2 is a sistergroup relationship between B and G, but that relationship was never part of the initial parsimony analysis!

Consensus trees are usually reported if more than one starting tree is obtained. BUT, they should not be used to infer anything about evolutionary pathways, rates *etc.* Remember, they are combinations of different theories of evolutionary pathways. They are used in various aspects of cladistic analysis. For instance, they are much used in vicariance biogeography, including palaeobiogeography (*Ed. there's another subject for a series of articles! – not for me though!!*) A common practice is to combine trees through consensus methods of different taxa inhabiting the same areas of the world to check for congruence and infer common explanations for common distributions. Consensus trees are also used to check the phylogenetic signal that may be given by different classes of data. There have been debates among cladists as to whether it is better to combine all the data into one large data set and analyse the lot together (character



congruence), or whether it is better to combine the trees that are produced from different data (taxonomic congruence). The most obvious situations are to use consensus methods to seek the commonality between the phylogenetic signal given by molecular data and that by morphological data, or between larval and adult morphologies. Probably this is less of an issue for palaeontologists. And they can be used for theories of co-evolution say, between hosts and parasites, or between evolutionary histories of flowers and pollinators.

Tree support

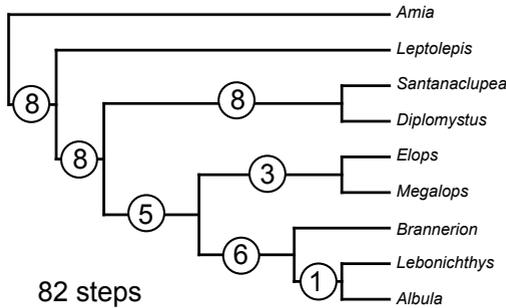
There are many measures that have been devised to try and express how good your tree is. 'Good' does not mean how accurate it is to reality but refers to several parameters of the tree itself. One class of measures estimate how much hierarchical structure there is in the tree. This means, how far away is your tree, in the number of steps, from random data. We came across one of these measures before (Fig. 15 in the *Tree Building* article) as the 'g' value. There are several others: but since they are not usually reported and even less understood we can glide quietly past them.

The other class of measures are those that estimate the support for individual nodes on the tree(s). These are usually reported and much discussed. There are two commonly used methods for morphological data: **Bremer support** and **the Bootstrap**.

Bremer support is by far the most useful for the amount of data we use as palaeontologists (we rarely have more 100 characters). Bremer support is named after the Swedish botanist Kore Bremer, who devised the method, but it is also known as the "Decay Index", for reasons that will become clear. The method asks the question: how much longer should the tree/cladogram be before a particular node collapses? The larger the number the stronger the support for that node. There are specific computer programs that will automatically calculate these numbers for you. But you can do it in PAUP*, and by doing so you will understand the method. As usual, it will be best to explain by example. In Figure 3 top (overleaf) the optimal tree is given for the interrelationships between eight teleost fishes and an outgroup. We are interested in the support for the individual nodes in the ingroup. This optimal tree is 82 steps long.

The first stage in calculating the Bremer support is to re-run the data, but this time we will keep the optimal tree *plus* all those trees *one* step longer. We do this on the tree searching menu. I have shown the Branch and bound menu here but the other searches have similar boxes. You will see that you can type in any number larger than the optimal length. In this case I have inserted 83. Re-running the data under the same conditions yielded two trees in this case. The next stage is to make a strict consensus of the two trees. This tree is shown bottom left in Figure 3. When this is done and compared to the original tree it can be seen that the original node supporting the sistergroup between *Albula* and *Lebonichthys* has collapsed, so that now there is a trichotomy between those taxa and *Brannerion*. This means that the original node supporting the sistergroup *Lebonichthys* + *Albula* collapsed after the addition of one step on the tree.

Now we repeat the process, increasing the number of trees to be saved to 84. In this case three trees were saved but there was no change in topology. At 85 steps, the node supporting *Elops* + *Megalops* collapsed. This is three steps longer than the original tree and therefore that node will be given a Bremer support of three, that we can insert back onto the original tree.



Add a value for trees of length X and less that you wish to save

Branch-and-Bound Search Options

Initial upper bound
 compute via stepwise
 set to

Keep
 minimal trees only
 all trees \leq score

Tree-score frequency distribution only:

Save all optimal trees (Multrees)

Enforce topological constraints
Constraints:
Keep trees that...
 Are Are NOT
...compatible with constraints

Addition sequence
 furthest
 as is
 simple
 max-mini
 max-mini (K)

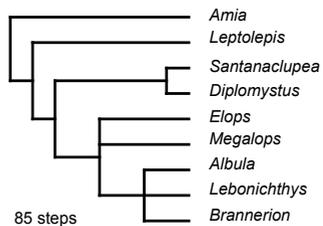
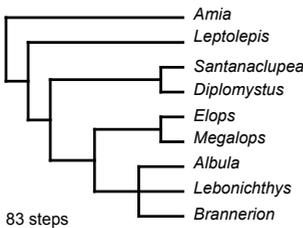
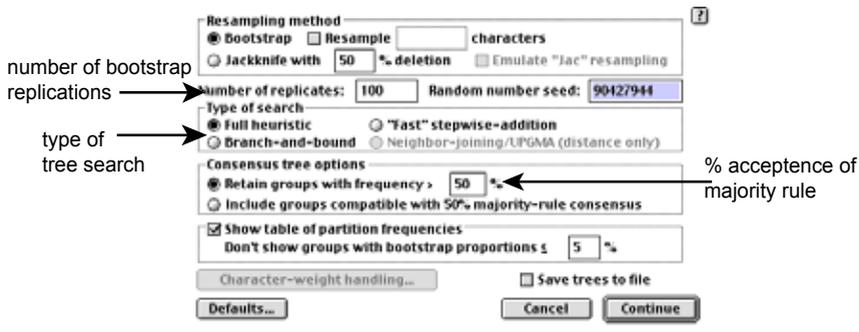


Figure 3. Calculation of Bremer support values shown on top tree. See text for explanation.



partition table

123456789	Freq	%
..**.....	998.75	99.9%
...*****	974.67	97.5%
.....***	974.65	97.5%
..*****	966.08	96.6%
...**...	960.18	96.0%
.....**	705.40	70.5%

50% majority Rule Consensus tree

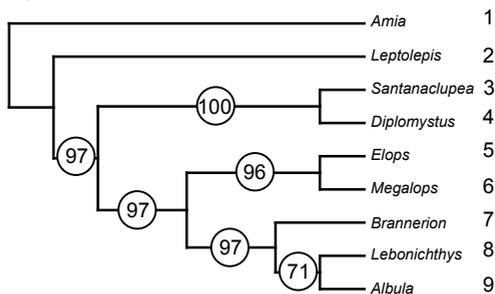


Figure 4 The Bootstrap See text for explanation

We carry on increasing the tree lengths to save by one each time and look for the nodes collapsing. By 90 steps (eight steps longer than the optimum) all nodes had collapsed to a single polychotomy (or unresolved tree). In other words we are deliberately decaying the tree to an unresolved bush – hence the Decay Index. (A common computer program used to calculate these numbers automatically is called TreeRot).

The Bremer support is certainly worth calculating and including in your papers. But it falls somewhat short of perfection because it does not tell you what kind of support each of the nodes has.



For instance, a particular node may have just one character supporting it and a Bremer index of just 1, but that character could be an unambiguous synapomorphy. Alternatively, a node with high Bremer value may be justified only by the weight of many homoplasious characters. You can really only check the quality by looking at the character change output.

Another technique that has been applied to measure node support is **the Bootstrap**. This is a statistical technique where the data matrix is sampled for characters, the data matrix is made up to its original size by duplicating some of the characters remaining, and the analysis performed again to see what groupings are found. This is repeated many times and a majority rule consensus tree computed with numbers against the nodes given from a partition table. The procedure is activated from the Analysis menu. Figure 4 shows the relevant screen where you can set how many replications you would like (I would recommend no fewer than 1000), what kind of tree search you want (Heuristic and Branch & Bound are the only options) and what set level of the majority rule consensus tree you want (you would normally leave this at 50%). After analysis two things appear: a partition table and the Majority rule consensus tree with numbers applied against the nodes. In the lower part of Figure 4 I have carried out a Bootstrap analysis of the same data set used in the previous figure. In this instance I set the number of replications to 1000. The translation between the partition table and consensus tree is obvious. The partition table tells us what percentage of the times of sampling characters particular groups were recovered. So, a grouping of taxa 8 (*Lebonichthys*) and 9 (*Albula*) was recovered in 70.5% of the samplings. A grouping of taxa 3 and 4 was recovered in all samplings, etc.

If you scan between the Bremer support values and the Bootstrap values for the same data set you will see that there is a very broad agreement, but there are anomalies. The Bremer support appears to be more discriminating than the Bootstrap. Many have criticised the Bootstrap being used for morphological data because there are relatively few characters and sampling may simply miss the inclusion of some characters more than others. Perhaps by increasing the number of replications this effect may be lessened. Bootstrap techniques are probably more effective with molecular data in which there are several thousand characters.

For completeness, some of you may notice that there is another sampling option in PAUP*. This is called the **Jackknife**: it is similar to the Bootstrap in that it is a repetitive sampling routine, but it samples taxa rather than characters. I have not seen it used with morphological data.

At the bottom line, Bremer support should be given for morphological data.

Peter Forey

REFERENCE

KITCHING, I. J., P. L. FOREY, *et al.* (1998). *Cladistics*. Oxford, Oxford University Press.

ACKNOWLEDGEMENTS

I would like to express my thanks to Sinaeur Associates, Inc., for permission to use 'screen dumps' from the PAUP* program as part of the illustrated material in this article.



PalaeoMath 101

Groups I

For the last five columns we've looked at the problem of characterizing multivariate data. An implicit assumption that runs across principal components analysis, factor analysis, principal coordinates analysis, correspondence analysis and partial least-squares analysis is that the objects included in the dataset represent independent and randomly selected samples drawn from a population of interest. So long as we were asking questions about the particular assemblage of data (*e.g.*, the trilobite data we've been using as a running example), the results of the analyses we have obtained to date are perfectly valid if largely indicative given the relatively small sample size. For our illustrative purposes these 20 genera were the population and this is how we've been discussing them; as if no other types of trilobites exist. But of course, there *are* other types of trilobites. The time has come to acknowledge this fact and explore the types of analyses we might apply to datasets that exhibit various types of internal structure.

The simplest type of structure is that of subgroups existing within the dataset. Taxonomic datasets are often composed not of a single representative of each group (*e.g.*, genus or species) or multiple representatives of a single group, but multiple representatives of a few well-defined groups. Often in systematics and (palaeo)ecology our problem is not so much one of trying to explain the structure of relations between measurements or observations collected from single groups, as trying to use a common set of measurements or observations to characterize groups of taxa, guilds, *etc.* Indeed, this is the standard problem of systematics: how many groups are there, and how best to distinguish them? Of course we'll need to state these questions a bit more precisely in order to answer them quantitatively.

As usual, I find the best way to discuss the issues involved in group evaluation and characterization is through an example dataset. Our trilobite data are not adequate for this purpose as they don't lend themselves to being collected into groups that make much sense. Instead, we'll reference our discussion to a classic dataset that R. A. Fisher used to explain the concepts behind a set of methods that have come to be known as discriminant analysis (Fisher 1936). Fisher did the obvious when he became interested in the 'groups' question, he went out and obtained some measurements from different groups: in his case four simple measurements on three *Iris* species. Actually, the 'Fisher' *Iris* data weren't collected by Fisher, but rather by *Iris* researcher Edgar Anderson (1935). Regardless, ever since Fisher's first article on these flowers, statisticians, researchers and teachers have been using the 'Fisher *Iris* data' as a reference dataset for developing, testing and illustrating discriminant analysis methods.

The full dataset consists of 50 sets of measurements for four variables collected from each species. However, there's no need to pile up the sample numbers for our simple purposes. The first ten sets of measurements for each species will suffice. These are reproduced in Table 1.



Iris setosa



Iris versicolor



Iris virginica

Figure 1. Photographs of the three Iris species used by Fisher (1936) to illustrate the properties of discriminant analysis. Images courtesy of the Species Iris Group of North America (<<http://www.badbear.com/signa/signa.pl?Introduction>>).

Table 1. First ten specimens from each species included in Fisher (1936) Iris data.

	<i>Iris setosa</i>				<i>Iris versicolor</i>			
	Petal		Sepal		Petal		Sepal	
	Length	Width	Length	Width	Length	Width	Length	Width
1	5.1	3.5	1.4	0.2	7.0	3.2	4.7	1.4
2	4.9	3.0	1.4	0.2	6.4	3.2	4.5	1.5
3	4.7	3.2	1.3	0.2	6.9	3.1	4.9	1.5
4	4.6	3.1	1.5	0.2	5.5	2.3	4.0	1.3
5	5.0	3.6	1.4	0.2	6.5	2.8	4.6	1.5
6	5.4	3.9	1.7	0.4	5.7	2.8	4.5	1.3
7	4.6	3.4	1.4	0.3	6.3	3.3	4.7	1.6
8	5.0	3.4	1.5	0.2	4.9	2.4	3.3	1.0
9	4.4	2.9	1.4	0.2	6.6	2.9	4.6	1.3
10	4.9	3.1	1.5	0.1	5.2	2.7	3.9	1.4
Σ	48.6	33.1	14.5	2.2	61.0	28.7	43.7	13.8
Min.	4.4	2.9	1.3	0.1	4.9	2.3	3.3	1.0
Max.	5.4	3.9	1.7	0.4	7.0	3.3	4.9	1.6
Mean	4.9	3.3	1.5	0.2	6.1	2.9	4.4	1.4
Median	4.9	3.3	1.4	0.2	6.4	2.9	4.6	1.4
Variance	0.1	0.1	0.0	0.0	0.5	0.1	0.2	0.0
S. Dev.	0.3	0.3	0.1	0.1	0.7	0.3	0.5	0.2

	<i>Iris virginica</i>			
	Petal		Sepal	
	Length	Width	Length	Width
1	6.3	3.3	6.0	2.5
2	5.8	2.7	5.1	1.9
3	7.1	3.0	5.9	2.1
4	6.3	2.9	5.6	1.8
5	6.5	3.0	5.8	2.2
6	7.6	3.0	6.6	2.1
7	4.9	2.5	4.5	1.7
8	7.3	2.9	6.3	1.8
9	6.7	2.5	5.8	1.8
10	7.2	3.6	6.1	2.5
Σ	65.7	29.4	57.7	20.4
Min.	4.9	2.5	4.5	1.7
Max.	7.6	3.6	6.6	2.5
Mean	6.6	2.9	5.8	2.0
Median	6.6	3.0	5.9	2.0
Variance	0.6	0.1	0.4	0.1
S. Dev.	0.8	0.3	0.6	0.3



The basic problem these data present can be summarized by plotting all combinations of variables in the form of a matrix of scatterplots (Fig. 2).

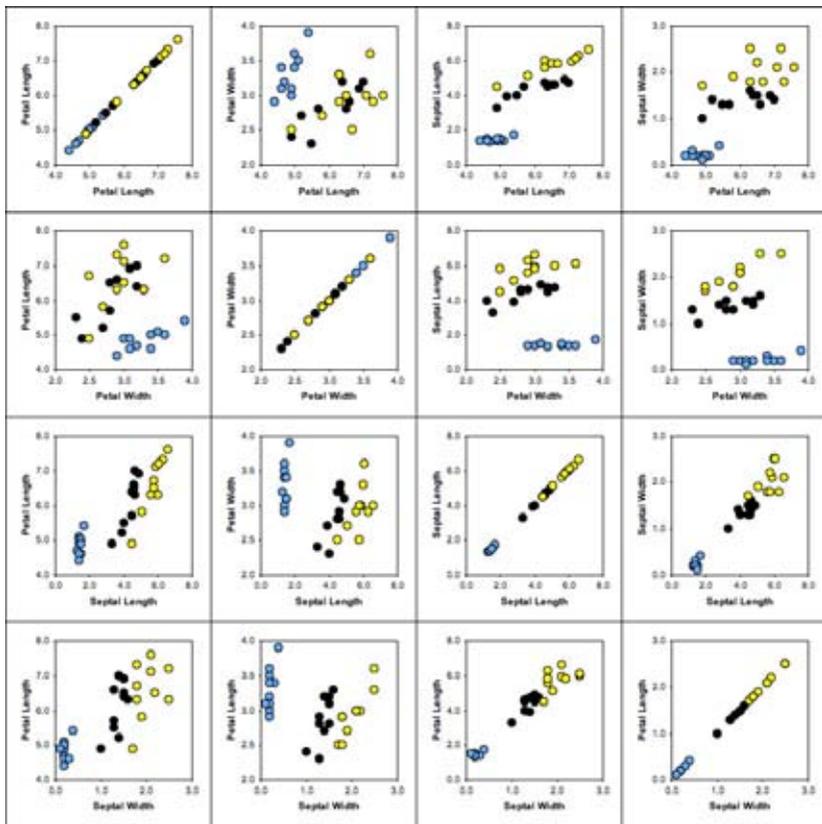


Figure 2. Crosstabulation diagram for Fisher Iris data. I. setosa (cyan), I. versicolor (black), I. virginica (yellow).

Given the bewildering variety of geometric relations between these three groups relative to these four variables, what can we conclude regarding the distinctiveness of the groups? Moreover, if the groups are distinct, can we use these data to construct a model of variation for each group that will allow us to assign unknown datasets to the correct group?

The first step in this process requires investigation of the structure of relations among groups. If all the groups have the same statistical structure our job is going to be much easier and more accurate. Of course, this begs the question of what ‘same structure’ means. Two factors are considered important, (1) the separation of group means relative to the variance of each group across all variables, and (2) the pattern of between-variable covariance of each group. These factors are independent of one another insofar as the means may be distinct among groups whose covariance structure is identical, and *vice versa*.



The standard test for assessing the significance of difference between multivariate means is an extension of the popular single variable, or univariate, Student's *t*-test; the Hotelling (1931) T^2 statistic. Derivation of the statistic is somewhat complex and need not concern us in detail (interested readers should consult Morrison, 2005). The overall form of the statistic, however, is important as we will see variations of it throughout this column and the next.

$$T^2 = n_1 n_2 (\bar{x}_1 - \bar{x}_2)' S_p^{-1} (\bar{x}_1 - \bar{x}_2) / (n_1 + n_2) \tag{10.1}$$

I've deviated a bit from the usual T^2 formula in order to make the relations more explicit and represent the test as a comparison between two samples rather than between a sample and a population. The $(\bar{x}_1 - \bar{x}_2)$ term is simply the difference between the means of two groups, 1 and 2. Because these means involve all measured variables, each contains (in our case) four terms, one for each variable. By mathematical convention these differences are represented as a matrix of one column and number of rows equivalent to the number of variables. These difference matrices can also be regarded as a set of vectors whose directions and magnitudes express inter-group similarities and differences. The difference matrices/vectors for the *Iris* data are shown in Table 2.

Table 2. Difference matrices/vectors for the *Iris* data.

	<i>I. setosa</i> vs. <i>I. versicolor</i>	<i>I. setosa</i> vs. <i>I. virginica</i>	<i>I. versicolor</i> vs. <i>I. virginica</i>
Petal Length	-1.24	-1.71	-0.47
Petal Width	-6.18	0.37	-0.07
Sepal Length	-2.92	-4.32	-1.40
Sepal Width	-1.16	-1.82	-0.66

Inspection of this table suggests the mean values for *I. setosa* are substantially smaller than those of *I. versicolor* and *I. virginica*. Note this agrees with both Table 1 and Figure 1.

The $(\bar{x}_1 - \bar{x}_2)'$ term represents the transposed form of the difference matrices. That is, the transpose of these matrices has one row and four columns of figures. A matrix (X) pre-multiplied by its transpose (X') yields the matrix of squares and cross-products, a standard statistical measure of covariation between sets of variables.

The S_p^{-1} term represents the inverse of the pooled variance–covariance matrix. The inverse of a matrix is used to perform the division operation in matrix algebra. Just as division of (say) 4 by 2 can be performed by taking the reciprocal of 2 (= 0.5) and multiplying that value by 4, one matrix can be divided by another by taking the inverse of the latter and post-multiplying it by the former. Because we are considering two samples in the *Iris* comparison we also need to generate an estimate of these samples' combined covariance structure. This is a simple operation that effectively determines an average of the two group (S_1 and S_2) covariance matrices weighted by the group sample sizes (n_1 and n_2). The following equation specifies this calculation.

$$S_p = [(n_1 - 1) S_1 + (n_2 - 1) S_2] / (n_1 + n_2 - 2) \tag{10.2}$$

Because sample sizes for the *Iris* species groups are the same for each dataset, the pooling calculation simplifies to determining the average of corresponding covariance matrix elements



across the three datasets. Results of pooling the covariance matrices and taking their inverse are shown in the *PalaeoMath 101: Groups I* worksheet (see URL below). Equation 10.1 represents the multivariate analogue of Student’s *t*-test, in which the difference between the mean of a sample is compared to a reference value (theoretically the population mean, but often the mean of another sample) with the result being scaled by the sample size (*n*) and a measure of the samples’ common variance structure.

One final small complication. Whereas the expected distribution of Student’s *t*-values for samples of various sizes is well known, the expected distribution of Hotelling’s *T*² values is more obscure. Fortunately, this is not a problem because the *T*² statistic can be transformed into an equivalent *F*-statistic using the following relation.

$$F = (n_1 - n_2 - m - 1) T^2 / (n_1 + n_2 - 2) m \tag{10.3}$$

Here *n*₁ and *n*₂ are the numbers of specimens in the samples 1 and 2 respectively and *m* is the number of variables in the datasets. Of course, the *F*-test also requires specification of two degrees of freedom (dof). For the Hotelling’s *T*² conversion the numerator dof is the number of variables (*m*) and the denominator dof is the total number of specimens minus the number of variables in the sample, minus 1 (= *n*₁ - *n*₂ - *m* - 1). Applying these equations to the *Iris* data results in calculation of the following values.

Table 2. Results of Hotelling’s *T*² test of comparisons between species-group means.

	<i>I. setosa</i> – <i>I. versicolor</i>	<i>I. setosa</i> – <i>I. virginica</i>	<i>I. versicolor</i> – <i>I. virginica</i>
<i>T</i> ²	4864.41	1956.43	205.56
F	1148.54	461.94	48.54
Prob.	2.87 x 10 ⁻¹⁸	1.66 x 10 ⁻¹⁵	2.08 x 10 ⁻⁸

Obviously the means are rather different from one another, even though the sample sizes are quite small, even for the superficially similar species *I. versicolor* and *I. virginica*. This test confirms the idea that the overall character of the groups, as represented by these four variables, is decidedly different. However, it does not assess whether the groups have a similar covariance structure, whether the groups are best characterized by mutually exclusive or overlapping distributions, which variables are best at characterizing group identity, or whether unknown observations can be assigned to these groups with a high degree of accuracy. To answer these questions we need to perform additional analyses.

Because Hotelling’s *T*² test assumes a common covariance structure for all samples we need to test that next, if only to confirm the previous result. There are a large number of statistical tests that have been proposed for this purpose, far more than are usually described in multivariate analysis textbooks much less a brief column like this. Of these the one I prefer is the likelihood ratio test (Manley 1994) because it is (1) powerful yet relatively easy to calculate, (2) uses some of the same terms we’ll meet later in our discussion of canonical variates analysis, and (3) can be used to test either the equality of multivariate means or dispersion structure.¹

¹ While we could have used the likelihood ratio test to perform the analysis we undertook using Hotelling’s *T*² the null hypothesis would have involved testing the means for all three species-groups simultaneously, not in a pair-wise manner. For exploratory analysis a pair-wise strategy often yields more information.



The equation of the likelihood ratio test is as follows.

$$\phi = [n_t - 1 - 0.5 (m + k)] \ln [|T| / |W|] \tag{10.4}$$

In this expression n_t represents the total number of specimens across all groups ($n_1 + n_2$), m (as before) represents the number of variables, and k represents the number of groups. Also T and W refer to two summary matrices that get to the heart of discriminant analysis. Matrix T represents the total sums of squares and cross products matrix and has the following form.

$$t_{r,c} = \sum_{j=1}^k \sum_{i=1}^{n_j} (x_{i,rj} - \bar{x}_r)(x_{i,cj} - \bar{x}_c) \tag{10.5}$$

In this expression r and c refer to the rows and columns of the T matrix (any cell of which is occupied by a value t). The really important parts of this formula, though, are the variables \bar{x}_r and \bar{x}_c which are the grand means for the entire, combined dataset. In geometric terms the grand mean is the centre of the pooled sample of all measurements. Matrix T , then, summarizes the dispersion of the total dataset about this group-independent, fixed reference.

Similarly, the W matrix summarizes the within-groups sums of squares and cross-products matrix and has the corresponding form:

$$w_{r,c} = \sum_{j=1}^k \sum_{i=1}^{n_j} (x_{i,rj} - \bar{x}_{jr})(x_{i,cj} - \bar{x}_{jc}) \tag{10.6}$$

Once again, r and c refer to the rows and columns of the W matrix (any cell of which is occupied by a value w). Now the variables \bar{x}_{jr} and \bar{x}_{jc} refer to the analogous group-specific means. In geometric terms the group mean is the centre of the cloud of points representing each group in Figure 1. Matrix W , then, summarizes the dispersion of each dataset relative to its own group-specific reference.

To get a handle on this statistic, in your mind's eye think about three clouds of points. The within-groups means are the centres of each individual cloud, and the total groups mean is the centre of all clouds taken together. If the position and orientation of the clouds are just about the same the ratio T/W is going to be a relatively small number. If the position and orientation of the clouds is radically different T will be much larger than W and the ratio will be large. The rest of the terms in equation 10.3 have to do with scaling the ratio for the overall dimensionality of the problem, in terms of numbers of both variables and specimens.

Notice the T and W symbols are enclosed by vertical lines in equation 10.4. Those are the symbols for the determinant of the T and W matrices. Most textbooks define the determinant of a matrix as the sum of all terms in the matrix ($n!$) taken in a highly peculiar order. Those discussions then usually go on for pages about the order in which the terms are taken—the algorithms that facilitate this calculation—and the implications of particular results (e.g., symmetric matrixes have positive determinants, a value of 0.0 means the matrix is singular, which, in turn, means it has no inverse). What they never seem to get around to telling you is that the determinant is nothing more than the 'volume' of the matrix, albeit a highly peculiar



volume (see <<http://en.wikipedia.org/wiki/Determinant>>). If the determinants of the T and W matrices are similar, the structure of their covariance relations will (likely) be similar; if radically different the structure of their covariance matrices will (likely) be different. The ϕ -statistic is distributed according to χ^2 distribution with $m(k-1)$ degrees of freedom.

One last little bit about the likelihood ratio test. If you are going to use it to test the hypothesis of whether the group mean vectors are equivalent, you use the raw data. If you are going to use it to test the equivalence of the group dispersion structures, you must first convert your data to their median deviate form and then apply equations 10.4, 10.5 and 10.6. Since we've already tested the mean vectors using Hotelling's T^2 , the *PalaeoMath 101: Groups 1* worksheet illustrates the dispersion test (see Manly 1994 for an example of an application to mean-vector analysis on a similar simple dataset). Based on my calculations for these *Iris* data, $\phi = 4.28$ which has an associated χ^2 probability of 0.83. Since this probability value is much greater than the traditional 0.05 cut-off, the *Iris* data fail the test and the null hypothesis of no difference in the dispersion (= covariance) structure among species-group datasets is accepted.

To this point in our analysis we've been entirely concerned with questions about whether it is appropriate for us to proceed with a full-blown multivariate discriminant analysis. Those results have told us there are significant differences between the means of all groups but no significant differences in the structure of geometric relations between variables across the same groups. This is the ideal situation; hence the widespread use of the *Iris* data for illustrating discriminant analysis. If your data don't match up to these fairly exacting standards don't throw your hands up in horror. It's not the end of the world. You'll just have to be extra cautious in interpreting results of the procedures I'll describe next and in the subsequent column.

Before we tackle the final analysis for this column and answer the question of how distinctive our species-groups are, though, let's stop for a moment and consider what we mean when we say 'These things form a group.' In taxonomy, ecology, phylogeny, biogeography, what have you, similarity is judged by the objects belonging to a group all sharing some group-defining feature. It really doesn't matter what the feature is. It might be a distinctive structure, a preference for a certain habitat, a mode of locomotion, a behaviour, a colour, sound, or even a smell, *etc.* Whatever 'it' is, members of the group share it, non-members don't. Since this 'it' is a property of organisms, the natural way for a mathematician/statistician to think about 'it' is in terms of a distance. If we represent specimens by some set of measured variables, or even qualitative observations, those that belong to groups should be 'close' to other members of the same group and 'farther away' from members of different groups. Distance is the natural metric for assessing group membership problems.

We've discussed distances before. Euclidean distances play a large role in principal coordinates analysis and various forms of multidimensional scaling. Distances also play a large role in discriminant analysis problems because, like the Q -mode methods we described and discussed earlier, distances are conceptually bound up with the way we usually think about group membership. But just like variables, distances have their problems.

Actually, distances have their problems mostly because there is no way to calculate them except through variables and, as we've seen repeatedly, variables have their problems. The most fundamental of these is that variables tend to exhibit complex patterns of covariation with one



another. If we calculate a distance under the assumption that its constituent variables have nothing to do with one another, and it turns out those variables exhibit similar patterns of variation, the distances that describe both between-groups and within-groups proximity will be mis-represented. Thus, in Figure 2 our three *Iris* species-groups are all more-or-less distinct from one another on certain plots—especially *I. setosa* from *I. versicolor* and *I. virginica*—but much less so in others. These patterns are caused by inter-variable covariance relations. Unfortunately, there is no way to estimate the extent to which raw geometries such as those depicted in Figure 2 are biased by variable covariances without performing some fairly complex mathematics.

Just as in 'real-life', distance calculations involving groups are facilitated by defining reference points. We need to agree on a single reference definition for a group's location in the mathematical space formed by its variables. In terms of classical discriminant analysis this reference location is usually taken as the group's mean or centroid. At first this might seem an unusual choice. After all, the centroid is always embedded well within the group's distribution, not close to its margins. These margins provide the most intuitive definition of the limits of group membership. Nevertheless, the centroid is a much more stable point than any on the distribution's margins, and has the advantage of being able to indicate likely group membership even in cases where the margins of different groups overlap.

As we have seen, the Euclidean distance is widely used as a basis matrix for multivariate procedures. This is fine when the Euclidean distance is coupled with an eigenanalysis or singular value decomposition, because these procedures transform the variables used to calculate distances in a manner that corrects for inter-variable covariances. But what if we don't want to conduct a principal coordinates and correspondence analysis, perhaps because those techniques are formulated to operate on single samples and we have a dataset that contains representatives of multiple groups? Is there a distance metric we can use to cover this situation?

On first pass you might be tempted to standardize the variables in your dataset before you calculate the Euclidean distance. This renders the variance of all variables equal to 1.0, thereby ensuring equal weighting for all variables in the distance calculation.² If your variables are referenced to incompatible units (*e.g.*, composed of variables measured in millimetres, degrees, areas, *etc.*, all lumped together) this will be the only realistic option. However, equal weighting for all variables is, in most cases, as artificial as wildly differential weighting. What is needed is a distance metric that respects the structure of covariance relations between variables.

Prasanta Chandra Mahalanobis introduced a distance measure that does precisely this in 1936, and the 'Mahalanobis distance' has gone on to become a staple similarity index in a wide variety of multivariate data analysis contexts. We've seen the general form of the Mahalanobis distance before.

$$D^2 = (x - \bar{x})' S_p^{-1} (x - \bar{x}) \tag{10.7}$$

Note its similarity to Hotelling's T^2 (equation 10.1). Like the T^2 -statistic, the Mahalanobis distance represents the square of the deviation of an observation from the mean scaled by the inverse of the covariance matrix. This means all information about inter-variable covariances or collections is taken into account in the final value. Like the T^2 -statistic, if more than a single

² Another issue with the Euclidean distance metric that concerns some is that variables with a high variance are differentially influential in determining the final distance value.



sample is being evaluated, the Mahalanobis distance should be based on the pooled covariance matrix so the best possible estimate of the true covariance structure is used, provided the data meet the assumption of no significant differences in covariance structure. The Mahalanobis distance also conforms to the χ^2 distribution with k degrees of freedom; a feature that makes it very useful for making statistical association tests. Thus, an observation with a low Mahalanobis D^2 relative to the group centroid is likely to be a member of that group irrespective of the distribution of the data (recall the χ^2 test is non-parametric), whereas a specimen that exhibits a significantly high Mahalanobis D^2 relative to any (or all) groups in the sample is likely not a member of that group (or those groups).

In interpreting the Mahalanobis distance it is important to remember it is a dimensionless 'distance', and so not expected to conform to a Euclidean distance (which is a scaled distance) in terms of magnitude. Rather, what is looked for is the relative size of the distance between an object and various group centroids (many discriminant analysis programs simply assign objects to groups based on the magnitude of D^2) and, in terms of statistical testing, the relation between D^2 and the appropriate χ^2 critical value.

So, how do our *Iris* groups stack up with respect to the Mahalanobis distance? Table 3 (overleaf) shows results for fitting the data from each specimen in Table 1 to the three species-group centroids using the pooled sample covariance matrix (calculated using equation 10.2, see *PalaeoMath 101: Groups 1* worksheet for computational details). Remember, this fitting is done without an accompanying eigenanalysis to 'clean up' inter-variable covariances. The degree to which each species can be assigned to the correct species-group provides an indication of how distinctive the group data are from one another.



Table 3. Mahalanobis D^2 values for the fitting of all data used to the species-group *Iris* models to the respective group centroids. Bold type indicates group centroids with the lowest D^2 distance. The $\chi^2_{df=4, \alpha=0.5}$ critical value = 4.895.

	Data: <i>Iris setosa</i> Group: <i>Iris setosa</i>	Data: <i>Iris setosa</i> Group: <i>Iris versicolor</i>	Data: <i>Iris setosa</i> Group: <i>Iris virginica</i>
1	1.725	79.869	333.795
2	3.383	31.323	506.995
3	0.343	36.433	640.398
4	1.913	37.274	834.175
5	2.414	50.756	948.785
6	3.954	61.131	1472.194
7	0.969	29.465	1652.406
8	0.289	48.115	2215.220
9	3.970	44.140	2413.238
10	0.899	49.497	188.287

	Data: <i>Iris versicolor</i> Group: <i>Iris setosa</i>	Data: <i>Iris versicolor</i> Group: <i>Iris versicolor</i>	Data: <i>Iris versicolor</i> Group: <i>Iris virginica</i>
1	156.319	3.875	61.294
2	170.640	1.221	47.836
3	194.685	1.560	39.440
4	214.270	5.286	39.434
5	206.608	3.017	38.683
6	221.105	7.730	31.342
7	199.018	3.359	34.704
8	140.126	6.600	73.121
9	175.334	1.323	49.041
10	195.665	2.655	38.219

	Data: <i>Iris virginica</i> Group: <i>Iris setosa</i>	Data: <i>Iris virginica</i> Group: <i>Iris versicolor</i>	Data: <i>Iris virginica</i> Group: <i>Iris virginica</i>
1	484.706	79.869	9.312
2	360.103	31.323	2.476
3	380.165	36.433	3.060
4	369.228	37.274	4.068
5	421.434	50.756	1.119
6	451.259	61.131	4.776
7	337.297	29.465	8.549
8	403.068	48.115	7.168
9	406.199	44.140	3.670
10	400.530	49.497	7.315



As you can see, our results are encouraging. All data used in this analysis fit their appropriate model and only a few individuals exhibit distances to the nearest group centroid that lie outside the $\alpha = 0.05$ confidence interval as assessed by the χ^2 distribution.³ This implies that our species-group data are actually much more discrete than implied by Figure 2. In the next column we'll discuss strategies we can employ for producing an ordination plot that will provide a visual indication of the true distinctiveness of these data.

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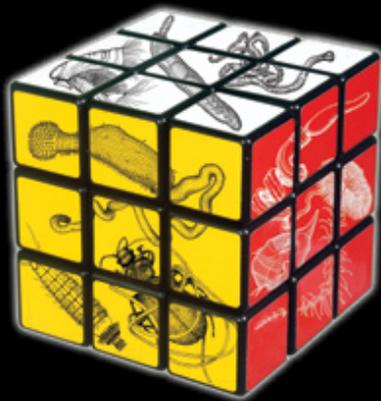
<http://www.palass.org/modules.php?name=palaeo_math&page=1>

³ Given the very small sample size used in our example some error in estimation of the group centroid—yielding a few high Mahalanobis distances—is an expected result.



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IPC 2006: ancient life and modern approaches

Beijing, China 17 – 21 June 2006

“To Tim Palmer” they said, “To PalAss.” They raised their glasses and gulped down yet more Tsingtao. It was the last night of IPC 2006. A group of ten or so PhD students sat happily in a restaurant in Beijing, toasting Tim Palmer and PalAss. They had travelled half way across the world – most by plane, others Tran-Siberian Express steerage class – to attend the **International Palaeontological Congress**. They had done so thanks to a letter from Tim Palmer some months before telling them that they had received monies from the Palaeontological Association to attend the meeting. After a week of talks, workshops and discussions, this group of happy and grateful grant recipients raised their glasses again, “To Tim Palmer, to PalAss.”

Over the past twenty years China has come to the forefront of Palaeontological research. It seems that there is a key fauna or section in China for each important interval in the stratigraphic column and each new aspect of evolutionary palaeobiology. Just pick up any palaeo-journal and you'll likely find feathered dinosaurs from the Jehol, death and disaster at the Permo-Triassic GSSP, or embryos and enigmatica from Doushantuo and the Chengjiang. The importance of China to palaeontology, and indeed the importance of palaeontology to China, was highlighted when the luminaries of Chinese government, science and industry mixed with the senior representatives



The author contemplates the architecture of the Ming Tombs. (Photo Tom Harvey)



of the International Palaeontological Association, International Union of Geological Sciences and Peking University at the opening ceremony.

The first two mornings of the meeting comprised plenary sessions in the main hall of Peking University, with talks highlighting new advances and techniques in topical areas. Major evolutionary transitions have been at the forefront of palaeontological research since Darwin's day, and three of these lectures saw **Doug Erwin** (Smithsonian), **Dianne Edwards** (Cardiff) and **Per Ahlberg** (Uppsala), giving the latest views on the Cambrian Explosion, the greening of the continents and the fish-tetrapod transition respectively. **Zhong Zhou** (Chinese Academy of Sciences, Beijing) detailed new finds from the Jehol biota and used new evidence to reconstruct its food web. Staying with Chinese strata, **Shuzhong Shen** (Chinese Academy of Sciences, Nanjing) gave an overview of the P/T extinction in China and **Roger Summons** (MIT) provided organic biomarker evidence for environmental changes associated with this event. Organic geochemistry also provided the subject of the address by **Derek Briggs** (Yale), who unveiled new techniques for understanding molecular taphonomy, including laboratory maturation experiments. With new experimental and analytical techniques emerging, the range of information we can extract from fossils continues to grow; this was nicely illustrated by **Else Marie Friis** (Swedish Museum of Natural History) who used x-ray tomography to unveil the secrets of Cretaceous flowers.

Aside from these plenary lectures the rest of the meeting comprised special seminars, topical symposia and general sessions, held over four days as parallel sessions around the Peking University Campus. Some 500 talks and 200 posters were presented at the meeting by its 800 delegates. In a large international meeting like this it is impossible to catch everything you would like to, or indeed to report everything that was said and done. So, the remainder of this write-up will focus on presentations made by recipients of the PalAss grants, and this should provide a representative view of the meeting's flavour.

The Ediacaran period is increasingly seen as the root of the Cambrian explosion, with palaeobiologists and stratigraphers coming together to search for the earliest animals in a pre-Cambrian post-Snowball Earth. The affinities of these ancient fossils can be problematic and at times controversial, and various contributions focused on assessing fossils from this interval. In a session on Neoproterozoic geobiology, **Sebastian Willman** (Uppsala) used TEM to examine Ediacaran organic-walled microfossils to try to improve their classification. Moving into the Cambrian, **Tom Harvey** (Cambridge) showed the earliest evidence of crustacean-grade organization by recovering specialized mandibles and filter plates from his palynological preparations from the Mount Cap Formation. In the same session we met the ancestors of these 'protoshrimps' when **Ma Xiaoya** (Leicester & Yunnan) unveiled new reconstructions of spinose, armoured lobopods from Chengjiang. The transition from the Ediacaran mat-world to the world of complex shrimps and worms crawling around was the focus of a talk by **Katharine Marenco** (Southern California), whose trace fossils record the origin of large size and complex locomotion, when creatures first crawled on the early Cambrian seafloor.

Exceptionally preserved fossils are vital to our knowledge of early animal evolution, and the taphonomy of such fossils has received a lot of attention recently. **Alex Page** (Leicester) reassessed models of fossil preservation in the Burgess Shale, showing how late diagenesis and metamorphism mask evidence of early post-mortem processes. The Soom Shale of South Africa was the focus of **Rowan Whittle's** (Leicester) talk, which illustrated newly recognised jelly fish, arthropods and



Palaeontologists visiting a well-known boundary marker. (Photo Tom Harvey)

worms from this lagerstätte. With Soom Shale fossils only coming to prominence over the last ten years or so, it is not unsurprising that many new families and orders are being found. However, **James Tarver** (Bristol) showed that though the fossil record of trilobite families shows a high degree of completeness, even well-studied taxa such as trilobites have a markedly incomplete fossil record at the genus-level.

The Mesozoic vertebrates of China have done a lot to increase the completeness of the vertebrate fossil record, either filling “missing links” or showing different taphonomic modes. For example, **Brian Andres** (Yale) reviewed rare occurrences of pterosaurs in terrestrial strata, with the Jehol biota yielding many key examples. **Jingmai O’Connor** (Los Angeles Natural History Museum) showed us a new sparrow-sized bird from the Jehol, preserving a highly complete skeleton and impressions of feathers. And in the same session, **Lindsay Zanno** (Utah) documented therizinosauroid life history based on a catastrophic mass burial deposit, laterally equivalent of the Jehol.

After the first two days of talks, the meeting moved from the lecture theatre to The Friendship Hotel, Beijing for the conference banquet. This lavish feast went some way in allowing us to eat our way through vertebrate evolution. Though I can heartily recommend the hot and sour fish or peking duck, it would take quite some persuasion to encourage me to eat swim bladder again. After the dinner, **Dick Aldridge** (Leicester) gave an address as President of the International Palaeontological Association, and **Bill Schopf** (UCLA) gave a talk on the stromatolites he had recognized amongst the building stones of Beijing. Dick’s address focused on teaching us key phrases in Chinese and English – “you have beautiful eyes,” and “how much does that cost?” are two examples that spring to mind – before we were treated to a display of traditional song and dance. I supped another glass of green tea as bottles of highly alcoholic firewater were passed around the table. I tried to practise some



of the phrases I'd learnt in Dick's speech; I wasn't entirely successful. Maybe I'd had too much fire water.

The meeting's middle day consisted of field trips or excursions to local sites of cultural interest. Some headed to the Forbidden City or the street markets of Beijing, but I opted for the Ming Tombs and Great Wall. Both the Wall and the Tombs are major tourist spots with signs in English and shops everywhere. The signs very helpfully guided us around the catacombs on the way to the crypt, with every hall and chamber fully labelled and described. However, my lasting memory is not of the tombs or the sarcophagus, but of the large sign clearly reading "Back side passage" at the entrance of one of the underground corridors. The linguistic confusion continued on the Great Wall when I tried to buy a cooling drink but managed instead to get a music-playing Chairman Mao cigarette



Tom Harvey visiting Chengjiang (it's behind you, Tom!)

lighter, although the vendor did offer me the consolation that it was sold at "best mate price." So, having seen as many sights as we could in one day, we returned to Peking University, in anticipation of the last two days of IPC.

Computers and fish provided the theme for a set of talks on vertebrate evolution. **Ben Davies** (Leicester) used computational fluid dynamics and wind tunnels to investigate how ostracoderms swam, whilst **Rob Sansom** (Bristol) used cladistic techniques to examine the biogeographical evolution of this group of jawless fishes. Meanwhile, **Graeme Lloyd** (Bristol) examined the cladograms of living fossil vertebrates, testing Westoll's theory of the evolution of lung fish and examining the origin of 'living fossils'. Similarly, **Matt Friedman** (Chicago) examined transition from fins to limbs, asking whether living fossils such as coelacanths were truly

representative of the tetrapod ancestor. Then we moved up the evolutionary lineage into early tetrapods, as **Sarah Sahney** (Bristol) examined changes in the diversity of tetrapods and terrestrial communities through the Palaeozoic.

Vertebrates are not the only things that such computer techniques can be used on, for example **Mena Schemm-Gregory** (Senckenberg) examined the phylogeny and palaeobiogeography of Devonian brachiopods based on a large database of specimens from Europe and China. **Melissa Grey** (British Columbia) performed detailed morphometric analysis of Jurassic–Cretaceous bivalves, whilst **Louise Longridge** (British Columbia) gave two presentations on early Triassic ammonoids. We stayed in the Triassic as **Emily Hopkin** (British Columbia) used palaeobiogeography to constrain the position of the Wrangellia terrane in the Early Triassic, whose position is uncertain



given palaeomagnetic data alone. However, palaeomagnetic data can be of great use to correlation as shown by **Brian Kraatz** (Berkeley) when he discussed the magnetostratigraphy of Oligocene land mammals from Mongolia.

And so, having toasted Tim Palmer and PalAss over dinner on the last night of IPC, the group of PhD students who did the toasting awoke with sore heads and departed. Some went on field trips around China, others returned home. But all were please to have been. It was a privilege to attend a stimulating meeting in such an interesting country. It was noticeable that China is changing fast, and construction works for the Olympics were apparent across Beijing. When I talked to Chinese students they were often interested in picking up English colloquialisms and learning cool new phrases. You never know, but if our toasting was overheard in the restaurant, “Tim Palmer” or “PalAss” could become the latest buzz words in a certain quarter of Beijing.

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Progressive Palaeontology 2006

University of Cambridge 21 – 23 June 2006

It seems that everything that was ever important began in Cambridge's famous Eagle Pub – the discovery of DNA, the winning of WWII and, one evening late last June, the opening reception for **Progressive Palaeontology 2006**. Stephen the stegosaur and several rowdy Cantabridgians donning cowboy hats greeted some of the nearly 40 postgraduates who would convene for the yearly conference.

The next morning, after passing out folders containing such intellectual necessities as doctorate planning kits and dinosaur erasers, the conference was officially opened by **Dr Nick Butterfield**. He illustrated the legacy of Cambridge palaeontology using sepia-coloured photos of the Sedgwick Club stretching back over a century and comparing them to Sepkoski's three great evolutionary faunas. First up was **Richard Callow** (University of Oxford) who presented the Lower Cambrian Chapel Island fauna of Newfoundland, with wonderful SEM images of pyritized fossils. His talk answered many questions regarding the pyritization process but did leave us wondering what in the world these things were. **Allison Daley** (Uppsala University) then told us how various Burgess Shale organisms, including the ominously-named ‘Appendage F’, could be referred to the genus *Hurdia*, and how her work describing its morphology and re-examining other dinocaridids will help clarify relationships within this group and within arthropods. **Carys Bennett** (University of Leicester) demonstrated how detailed biostratigraphy and isotope analysis in the Lower Carboniferous Midland Valley of Scotland is helping researchers trace the transition of ostracods from the marine to the non-marine realm. A highlight in audience participation came with **Imran Rahman's** (Imperial College London) talk as we excitedly donned 3D glasses to view virtual models of carroids constructed using CT-scanning. These models showed the presence of what are best interpreted as internal gills that may have been used in deposit feeding. Imran is hoping such evidence will help



Lara Shychocki waxes philosophical on tyrannosaurid cranial biomechanics during Progressive Palaeontology 2006. (Photo: Laura Porro)

answer the question of carpodid systematic position – are they most closely related to echinoderms, chordates, or Chicken McNuggets?

A mid-morning coffee break allowed delegates to view poster contributions from **Benjamin Kotrc**, **Jennifer Morris**, **Emma-Louise Nicholls**, and **Mark Phipps**. After the break, we reconvened to hear **Andrea Cobbett's** (University of Bath) argument for including fossil taxa in phylogenetic studies. Neontologists say 'nay': fossils introduce missing data and can be difficult to interpret. Palaeontologists (for obvious reasons) say 'yea': fossils represent intermediate forms and exhibit unique character combinations. Using two different methods to look at the impact of both extinct and extant taxa on phylogeny, Andrea concluded that there is no reason to exclude fossils from phylogenetic analyses (so we all still have jobs!). Then one of our zoological brethren from the far side of Downing Street, **Esther Sharp** (University of Cambridge), took to the stage to share with us the plight of the British lungfish. While most studies have focused on Devonian or modern lungfish, Esther is trying to sort out the validity of British taxa from the Carboniferous. With the promise of plesiosaurs and lovely illustrations of them, **Adam Stuart Smith** (University College Dublin) delved into the problematic rhomaleosaurids, which refuse to fit neatly into either plesio- or pliosauiromorphs. To resolve this issue and test the validity of the four *Rhomaleosaurus* species, Adam is looking at the type specimens and new material, sometimes preparing them further and sometimes literally taking them apart! The final presentation of the morning was by **Emma-Louise Nicholls** (University of Bristol) who is attempting to construct the first supertree of the entire Order Crocodylia using both morphological and molecular data.

After a pizza lunch at the nearby Cow (a pub, not a culinarily-talented bovine), **Dr Liz Harper** kicked off the afternoon session by saying that Prog Pal is 'no longer just a dry run for Palass but a scientific conference in itself.' **John Orcutt** (University of Bristol) talked about collection biases and the completeness of the dinosaur fossil record, using a collector curve to see which factors have skewed our understanding of dinosaur diversity. His results showed that the dinosaur fossil record is largely incomplete and that geography remains the major bias. Next **Karl Bates** (University of Manchester) walked us through (or, more appropriately, flew us through) the Fumanya dinosaur tracksite,



demonstrating how LIDAR (light detection and range) technology can be used to preserve these unstable trackways digitally in three-dimensions. At last, a member of the home team – **Susannah Maidment** (University of Cambridge) – introduced us to the stegosaurus of the world. Her project is producing the first cladistic analysis based on direct observation of all specimens (talk about frequent flyer miles!), helping her make sense of the biogeography and phylogenetic relationships of this group. Got a single large sauropod vertebra and don't know what to do with it? Talk to **Michael Taylor** (University of Portsmouth) – his research into BMNH R2095, a well-preserved but woefully neglected sauropod vertebra, revealed that it differs from all other known sauropods and may represent not only a new genus but perhaps even a new sauropod family.

One more cup of tea later and we were into the final stretch. **Lara Shychoski** (University of Bristol) began the late afternoon session with her study of cranial variation in tyrannosaurids. Using both geometric morphometrics and finite-element analysis, Lara demonstrated how cranial design reacts to mechanical loading at both small and large scales. **Claire Slater** (University of Cambridge) then presented her work on mammalian supertrees. She reminded us that supertree construction, as a method, is still in its infancy, and evaluated a number of supertree construction methods to compare their effectiveness. The final talk of the day was given by **Sarah Joomun** (Royal Holloway, University of London) who is investigating the climatic and faunal chaos associated with the 'Grande Coupure' – the extinction of the endemic European fauna at the Eocene–Oligocene boundary. Sarah will be using tooth wear and facet development to investigate diet in the various ungulate groups with the aim of determining if climate or competition was primarily responsible for the extinction.

With the end of the oral presentations and all this talk of tooth wear and feeding, delegates eagerly moved down to the Sedgwick Museum for nibbles and a wine reception as well as a welcome by **Dr David Norman**. Afterwards, we trekked out of the city centre to Selwyn College for the evening



Conference organiser Susannah Maidment (left) and fellow Cambridge PhD student Hilary Ketchum (right) enjoy dinner at Selwyn College. (Photo: Laura Porro)



Field trip participants outside the brick pits. (Photo: Susannah Maidment)

meal which included deep-fried camembert, caramelised duck breast, and a white chocolate bombe. Those delegates who still had the ability to stand staggered to the Anchor Pub after dinner for pints and conversation along the banks of the Cam.

Saturday dawned a gorgeous day and a dozen conference-goers led by **Leslie Noe** headed out to the King's Dyke and Bradleigh Fen (Star) pits for a day of fossil collecting. It was an impressive haul – large belemnites, ammonites, and even some isolated vertebrate remains (a vertebra, two plesiosaur teeth, fish teeth, and a rib). Adam Stuart Smith won the “Biggest Belemnite Competition” and was awarded a box of chocolates. After a satisfying day spent in the mud, the party celebrated with a pub lunch in nearby Whittlesey.

So with that, Progressive Palaeontology 2006 drew to a close, the end of a unique conference which gives postgraduate students a venue to present their research and discuss new ideas amongst their peers. With the gathering of so many bright minds representing the future of palaeontology, it is just possible the old Eagle may end up adding yet another famous assemblage to its history.

The conference organizers would like to thank the Palaeontological Association, Oxford University Press, Blackwell's, the Cambridge Department of Earth Sciences, and the Sedgwick Museum for sponsoring Prog Pal 2006. Thanks also to Nick Butterfield, Liz Harper and David Norman; to Leslie Noe for leading the field trip; and to Hanson Brick for allowing access to quarry sites.

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**Primitive Life, Ancient Radiations International Symposium**

Dijon, France 7 – 8 December 2006

The Palaeontological Association, as many of you will know, occasionally subsidises specialist meetings for members of the Association. One such meeting, entitled “Primitive Life, Ancient Radiations”, took place in Dijon on 7–8 December 2006 as a special English-speaking symposium within Réunion des Sciences de la Terre (RST), a major biennial meeting of francophone earth scientists. It advertised keynote lectures by four outstanding researchers – **Andy Knoll** (Harvard University, Cambridge, USA) on Proterozoic primary production, **Stefan Bengtson** (Swedish Museum of Natural History, Stockholm, Sweden) on the origin of multicellularity, **Werner Müller** (Johannes Gutenberg-Universität, Mainz, Germany) on the role of sponges in the origin of metazoans, and **Jean Vannier** (Université Claude Bernard, Lyon, France) on the origin of early ecosystems – and thus promised to be a state-of-the-art wrap-up of the important issues surrounding major early radiations in the history of life. And because the venue of Dijon, the old capital of the Dukes of Burgundy, offered plenty of opportunity to combine scientific value with cultural tourism, the symposium certainly promised to be more than just a prelude to the Palaeontological Association’s Annual Meeting in Sheffield. So, after struggling through the all-French online registration, we booked the Eurostar and looked forward to some red wine and mustard.

After a brief introduction by **Frédéric Marin**, who with **Bertrand Lefebvre** had organized the symposium, **Andy Knoll** started off Thursday morning’s session with his 50 minute keynote on “Evolution and primary production in Proterozoic oceans”, an integrated, overarching review of the current thinking on photosynthetic plankton in the Palaeozoic and Proterozoic oceans – much of which draws its data from molecular biomarkers – and its relationship to grand-scale evolutionary and geological processes. **Guillaume Le Hir** *et al.* then presented “A geochemical modelling study to investigate seawater modifications due to global glaciations,” followed by **Christophe Dupraz** and co-workers who made stromatolites grow with their computer model during their presentation on the “Biosphere–lithosphere interface: the microbially-mediated carbonate cycle in microbial mats”.

After a coffee break the session continued with **Frances Westall** *et al.* and a 3.4 Ga old fossilised microbial mat with shrinkage cracks that was interpreted as having formed by periodic dehydration in an intertidal environment. Staying in the microbial world but studying living bacteria, **Olivier Braissant** followed with a talk on exopolymers from sulphate-reducers and their role in the precipitation of carbonate minerals.

With **Emmanuelle Javaux** the topic moved from prokaryotes to eukaryotes as she reviewed the “Biological innovations and diversification of early eukaryotes,” exploring the potential of combining morphological, ultrastructural and microchemical analyses of microfossil cell walls. The remaining half of this session left behind astrobiology, geomicrobiology and micropalaeontology to arrive at macroscopic Ediacarans. **Jonathan Antcliffe** and **Martin Brasier** investigated the troublesome genera *Dickinsonia* and *Charnia* which they conclude cannot be assigned to any extant phylum. Moving from the siliciclastic to the carbonate environments of the Ediacaran, **Richard Callow** and **Martin Brasier** then explored the “Ediacaran calcification and the onset of biomineralization,” suggesting that *Cloudina* was lightly mineralized whereas *Namacalathus* only calcified during early diagenesis. The session concluded with a sedimentological assessment of the “Paleobathymetric influence on the late Ediacaran Yangtze Platform” by **Elodie Vernhet** who showed that bathymetric conditions ranged from intertidal to deeper water with no wave influence.



A generous two-hour lunch break was followed by **Stefan Bengtson**'s keynote on "The early history of multicellularity," which he presented as a number of case studies including 2 Ga years old trace fossils that he interpreted as the traces of genuine multicellular mobile organisms. The notable gap between these first patchy signs of multicellularity and the first appearance of complex body fossils in the upper Neoproterozoic in the form of phosphatised embryos was explained by multiple dead ends in the evolution of multicellularity before the Ediacaran. We advise Stefan that he risks losing the focused attention of at least some audience members by incorporating feline sound effects and photographs of kittens and puppies (particularly if they are *that* cute!). **Sören Jensen** was up next, with a report on "New fossil finds from the Ediacaran–Cambrian of central Iberia" which is fairly continuous sequence with trace fossils, *Cloudina*, various small shelly fossils and archaeocyathids. The latter were then the subject of a talk co-presented by **Françoise Debrenne** and **Adeline Kerner** entitled "Actualité des archéoyathes," in which they described and demonstrated a computerised key for the identification of archaeocyathids from thin sections. Questions from **Werner Müller** resulted in a lively debate with Françoise Debrenne; this came to resemble a surreal sponge-themed duet as a microphone passed back and forth between them.

A coffee and a croissant later, we reconvened for a presentation by **Bernard Teyssède**, who combined data from molecular phylogeny and the Precambrian fossil record to reconstruct the radiation of the green algae. For anyone feeling alienated by all this talk of non-deuterostomes, relief was at hand from presentations by **Bertrand Lefebvre** and colleagues on large-scale patterns in the taxonomic and morphological diversification of early Palaeozoic echinoderms, from **Elise Nardin** (with Bertrand Lefebvre) on the role of the Cambrian substrate revolution in this process, and from **Sergeï Rozhnov** and **Andrey Yu Ivantsov**'s intriguing echinoderm-like fossils from the Proterozoic of the White Sea. Next, a presentation by **Oldřich Fatka** and collaborators related associations of Middle Cambrian from the Czech Republic to sedimentological and palaeobathymetric gradients, and presented some important new discoveries of more unusual Cambrian groups. **Uwe Balthasar** finished the day with a talk on the origination and early evolution of shell formation in brachiopods.

Following this presentation, most delegates left the room. Do people really find brachiopods that offensive? No – it was the end of the session: time to head out to the magical and exceptionally well-preserved old town centre and sample some of the famous gastronomic delights of the region. Having not yet done the local cuisine justice (we had rather inappropriately ended up eating *pizza* and *poulet curry* on previous dining occasions), it was now time to slurp down some *oeufs en meurette* and of course some *boeuf bourguignon*, and did we mention mustard? All this is washed down very nicely, we discovered, with a glass or two of *kir*, or indeed, any other drink one might fancy, so long as it is flushed pink with *cassis*. We recommend the *cassis* and wheat beer combination, though we caution that it is possible to end up feeling a little flushed oneself, especially if simultaneously attempting to sample, as we did, 'the most strong cheese in France'. This, while delicious, appeared determined to evade capture as it roamed around the cheeseboard.

A strong coffee the next morning, and all was put right again. **Werner Müller** got Friday's session off to a lively start with his keynote presentation entitled "Porifera as model systems for early metazoan radiation: the genetic complexity of sponges." This was an inspiring sprint through several decades of sponge research, discussed in the context of the Proterozoic fossil record. The following presentation, by **Huang Diying et al.**, illustrated the most beautifully preserved fossil



worms anyone could hope to see. The focus was on taxa from the Cambrian Chengjiang fauna, but the opportunity was also taken to show off some remarkable new material from the Jurassic. Our host **Frédéric Marin** then stepped in with an unscheduled presentation detailing his molecular work on the organic fraction of molluscan skeleton.

We were all sad to learn that **Jean Vannier** was unable to be at the meeting to present his keynote on the “Early Cambrian origin of modern marine ecosystems.” However, **Jean-Yves Sire** was able to step in and deliver an extended version of his presentation “The origin and evolution of enamel mineralization genes.” In describing some careful molecular work tracking the phylogenetic distribution of related genes, this talk valuably contributed to the interdisciplinary treatment of biomineralization which was to emerge as a highlight of this symposium. Next on stage was **Thomas Servais**, and it was rather a long time before he left it again. For reasons which remain obscure to us, he was to give not the customary one, but rather two talks. We were first given the chance to ponder some putative Palaeozoic calcareous plankton, the subject of a study by Thomas Servais and Axel Munneke, and afterwards were shown the results of a collaborative project documenting acritarch diversity trends through the Palaeozoic. Potential consumers of phytoplankton were next under the spotlight, as **Nicolas Esprit** described radiation patterns among Ordovician bivalve molluscs. The session finished with **Zivile Zigaite**'s account of the diversity and palaeoecology of Siberian and central Asian vertebrates during the Early Silurian; this lent a satisfying phylogenetic balance to the symposium.

The oral sessions now brought to a close, we had an opportunity to devote some attention to the many interesting posters on display. Several delegates had to leave urgently in order to accompany Bertrand to an official RST wine-tasting event, though we do not recall that this inconvenienced them to any great extent.

Having said our goodbyes to Dijon, and having had one last stroke of the lucky owl on the gargoylestudded Notre Dame, all that remained was for us to negotiate, once more, the underground rail systems of two capital cities. We decline to say which system we judged the more efficient and easier to use. But honestly, it is a miracle that we are not still trundling around, disorientated, on the green RER...

We would like to take this opportunity to extend our thanks, on behalf of all the delegates, to Bertrand and Frédéric for organizing this valuable and truly international symposium, and to the Palaeontological Association for sponsoring it. We very much hope that similar symposia might be incorporated into future RST meetings.

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50th Annual Meeting of the Association
Sheffield, UK 18 – 21 December 2006

MACROEVOLUTION SEMINAR

To commemorate the fiftieth anniversary of the Palaeontological Association, the Council chose to celebrate one of the key scientific contributions made by palaeontology over the life of the Association by organising a seminar on macroevolution. This consisted of nine invited talks by some of the real superstars of macroevolutionary research and took place on the eve of the fiftieth annual meeting in Sheffield.

My own morning got off to an inauspicious start as I was seduced over breakfast by the Newsletter Editor with promises of fame and glory – and I rashly agreed to write a report of the seminar. After a frantic scuffle for pen and paper on my part (Charlie Wellman allegedly having taken the commendable step of omitting such items from delegates' packs so that a greater proportion of the conference budget could be spent on beer), the seminar began with some opening remarks by organisers **Phil Donoghue** (Bristol) and **Kevin Peterson** (Dartmouth). Both did a fantastic job of arranging not only the seminar itself, but also the special edition of *Palaeontology* containing the proceedings (volume 50, issue 1), which should have dropped through members' letterboxes by the time you read this.

The first talk was by philosopher **Todd Grantham** (Charleston) who asked whether macroevolution is anything more than successive rounds of microevolution. Todd began by introducing 'emergence': the idea that properties of one level of organisation, in this case a species or higher taxon, cannot be attributed to properties of the lower levels of organisation of which it is comprised, in this case individuals. He then outlined the various emergence concepts that have been used and emphasised 'weak emergence', which he showed to be a particularly useful concept for studying macroevolution. Todd argued that the size of species' geographical ranges may be weakly emergent and that, if they are, this can block attempts to explain macroevolutionary phenomena in terms of microevolutionary processes. This suggests that macroevolution really is more than 'microevolution writ large'.

Next were two discussions of species interactions, one with an emphasis on shallow time studies and the other with a deep time perspective. Mr Shallow Time was **Mark McPeck** (Dartmouth) who examined the macroevolutionary consequences of ecological differences among species. He used a model system to show that introducing species that are similar to one another increases the time taken to drive species to extinction. Mark used a boxing analogy to help explain this: if there is a mismatch as in Mohammad Ali vs. Sonny Liston a short contest results, while an even match like the Thrilla in Manila produces a much longer bout. More similar species thus increase the overall species richness because there are more transient species. The deep time view came from **Richard Bambach** (Harvard), who introduced us to the 'ecospace cube'. This is a cube of six tiering levels by six motility levels by six feeding strategies, giving a total of 216 possible modes of life for marine animals. He then used the cube to examine how ecospace has been filled since the Ediacaran. He found that in today's oceans 91 of the 216 possible modes of life are actually utilised and that 62 of these are used by animals that are readily fossilized. He also showed that ecospace use has increased markedly from the Ediacaran (12 modes) to the Early and Middle Cambrian (30 modes, 11 of which are only known in exceptionally preserved soft bodied biotas), increased again to the Late Ordovician (30 modes in skeletal animals) and increased once more to the Recent.



Next **Nick Butterfield** (Cambridge) stressed the importance of macroecological studies, contrasting a pre-Ediacaran biosphere populated almost exclusively by microscopic organisms and with low diversity, evolutionary stasis and no biogeographical partitioning, with a post-Ediacaran world with a diverse macroscopic biota with dynamic evolution and provinciality. Nick argued that these differences could be explained by the re-writing of the macroevolutionary rulebook by eumetazoans as they arose in the early Ediacaran and radiated into the pelagic realm in the early Cambrian. He particularly emphasised the importance of the evolution of multitrophic foodwebs and said the main point of the talk could be summarized as ‘big fish eat little fish’.

Mike Benton (Bristol) asked how life became so diverse. He began with a detailed discussion of the quality of the fossil data that is used to address this question. He emphasised the importance of distinguishing between perception and reality in this respect, neatly illustrating this point using the classic *Father Ted* scene in which Ted is explaining perspective to Dougal: “Now concentrate this time, Dougal. These [plastic cows on the table] are very small; those [real cows in the distance] are far away...” Mike argued that, while tracking of sea level and the fossil record was a real phenomenon, the divergence in the last 100 million years identified by Andrew Smith makes it hard to explain patterns in the fossil record entirely as artefacts of the rock record. Mike then suggested that the evidence supported a damped equilibrium model, rather than a logistic model, for the diversification of life. **Brent Emerson** (East Anglia) also examined diversification but he concentrated on a much shallower time scale. He discussed diversification on islands: good places to study the dynamics of diversification because they start off empty and acquire diversity. Using examples from his work on the beetles of the Canary Islands, Brent showed that islands with more species experience more speciation, which is strong evidence that *in situ* interactions and evolution play a key role in creating and structuring communities.

The next pair of talks outlined contrasting perspectives on the origin of morphological disparity.

Doug Erwin (Smithsonian) asked why there are so many gaps between successful body plans, and why so many potential organisms do not actually exist. Doug emphasised the role of the ‘kernels’ of gene regulatory networks, which are conserved parts of the regulatory network that perform vital upstream functions. Doug (along with Eric Davidson, and apparently in order to indulge their joint hobby of “annoying as many people as they could”) has argued that such kernels are responsible for phylum-level morphological features. By comparison, **Kevin Peterson** (Dartmouth) emphasised the importance of microRNAs (miRNAs), which are non-coding RNA molecules that negatively regulate the expression of protein-coding genes. He showed that miRNAs are often expressed in specific organs and are only found in organisms with those organs, and that 18 core miRNAs are only found in protostomes and deuterostomes – not in sponges or cnidarians. He argued that these findings suggest that miRNA-mediated regulation could play an important role in the origin of eumetazoan organs and body plans.

The final speaker of the day was **David Jablonski** (Chicago), to whom Phil Donoghue had given the job of “trying to make sense of everything that has gone before”. David chose to centre his synthesis on discussion of scale (both spatial and temporal) and hierarchy (focusing on species selection and clade-level selectivity at mass extinctions) in macroevolution. He brought together a wide range of case studies and showed how the expansion of spatial and temporal scales and the use of a hierarchical framework allow us a far richer understanding of evolutionary processes. It was the fitting conclusion to a fascinating seminar. The Council had apparently opted for the seminar over



an early suggestion that they celebrate the Association's fiftieth year by having a London cab re-sprayed gold, in recognition of the golden anniversary of the legendary taxi ride in which the idea of the Association was first conceived. Having witnessed the excellent seminar, there is no doubt they made the right decision!

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PALAEONTOLOGICAL ASSOCIATION ANNUAL MEETING, SHEFFIELD 2006

And so it turns full circle: 50 years after the Palaeontological Association's first meeting in Sheffield, the Association returned to South Yorkshire for its Golden Jubilee meeting. It is with this sense of history in mind that I start my report. Two years ago, **Liam Herringshaw** (then Birmingham now Aberdeen) took up an offer from **Phil Donoghue** (then lowly Newsletter Editor now big cheese) to write the report of the Annual Meeting in Lille on the understanding that he would receive payment by way of plastic dinosaur and half pint of fizzy lager. Even though payment for Lille was not forthcoming, Liam again penned the review for last year's meeting at the Oxford Museum of Natural History. He clearly hoped that festive cheer and the proximity of the museum shop would see him receiving a veritable herd of *Invicta* Plastic models. He appeared to have a job for life. However, Phil was cast as Scrooge in the Christmas pageant, and neither plastic dinosaur nor fizzy lager arrived. At this point industrial relations broke down and Liam refused to write. The present editor, **Richard Twitchett**, had even made a generous offer of a life size recreation of all the Dinosaurs in the Crystal Palace gardens in return for the article, but Liam would not budge.

Rather than calling in the arbitration service ACAS, Richard showed his iron fist and looked for substitute writers to cross the picket line. Loath to take up the pen for fear of being labelled a line-crossing scab, I kept a low profile for most of Monday, only arriving in Sheffield in the evening. But, by the third beer on Monday night Richard convinced me that Herringshaw was little more than a dinosaur-craving *prima donna* and that even Yorkshire miner's leader and PalAss Newsletter devotee Arthur Scargill would praise my write up. So, here goes.

As old friends reminisced, enjoying the local beers and canapés at the Members' Reception in the glasshouses of the Sheffield Botanical Gardens, **Professor David Lewis** (Chair of the Board of Trustees of the Sheffield Botanical Gardens and Former Pro VC of the University and HOD of the Dept of Animal & Plant Sciences) formally welcomed the delegates to Sheffield. He wryly noted, in his overview of palaeontological research in the University of Sheffield, that the city's most eminent geologist Henry Sorby was self taught. **Richard Fortey** (Natural History Museum and all good bookstores) pun-ishly noted that his daughter Lemon Sorby might have been quite tasty. And, as kegs drained, the crowd departed to the bar of the Tapton Hall of Residence, seeking nutriment and further refreshing. Thankfully, the UK's new, relaxed licensing laws have given us continental café culture rather than irresponsible binge drinking, and learned discourse and late night ramblings continued into the early hours.

After a hearty breakfast, which aided the downhill stroll to the Auditorium in the Students' Union, **Charles Wellman** (Sheffield) welcomed delegates to the meeting and introduced the two days of



oral and poster presentations. Continuing on the theme of macroevolution from yesterday's special seminar, **Dolf Seilacher** (Yale) offered a discursive contribution detailing how parasite networks may contribute to the long-term stability of incumbent faunas. Dolf argued that evolutionary innovation and faunal overturn only occur when large-scale environmental events break down parasite networks. Next, **John Marshall** (Southampton) showed how oceanic events recognised in Devonian acritarchs may be reflected in lacustrine fish-bearing deposits in the Orcadian basin. Staying with lacustrine vertebrates, **Gareth Dyke** (University College Dublin) showed that of an ecologically cosmopolitan Cretaceous avian fauna, it was largely the water-dwelling birds that survived the K/T mass extinction.

Continuing up the stratigraphic column, **Kenneth Johnson** (NHM) showed that Caribbean reef-coral diversity was inversely related to reef building throughout the Cenozoic. This tropical field area seems rather appealing, and certain audience members may have been thinking about sampling Caribbean cocktails rather than coral taxa. However, the next talk by **Jason Hilton** (Birmingham) went to the root of the problem of the root of seed plant phylogeny, a phrase that could perhaps be used to identify whether one had indeed been sampling a few too many exotic beverages. It seems that the basal relationships of the seed plants are poorly resolved, especially when molecular and fossil data are combined, and their last common ancestor is uncertain. There are few more uncertain relationships than those of Ediacaran fossils. With this in mind, **Jonathan Antcliffe** (Oxford) critically reassessed the supposed relationship between the *Dickinsonia* and annelid worms. Using high-tech laser and photographic techniques, he suggested that the alleged metazoan affinity for *Dickinsonia* may be an example of a *Mofiotyof* diagnosis. Rather than referring to some sort of sinister Tzar, a *Mofiotyof* diagnosis is an acronym for my-oldest-fossil-is-older-than-your-oldest-fossil, Jonathan told us. And in the case of *Dickinsonia*, he argued that the desire to find the oldest animal ever may have led to previous workers misinterpreting its complex wrinkles and beguiling surface artefacts as representing metazoan-grade organisation. And so, with this timely example of how the casual eye may overlook key information, it seemed not only responsible but almost imperative to head to the poster hall for a restorative coffee.

A refreshed audience returned to the auditorium to hear **Maggie Cusack** present the work of her co-authors **Jennifer England** and **Alberto Pérez-Huerta** (all Glasgow). Using Electron Back Scatter Diffraction analyses and the sort of diagrams usually found on adverts for Mensa, they showed that biomineralisation mechanisms in craniid brachiopods have not altered since the Ordovician. Conversely, **Thalassa Matthews** (Inziko South African Museum) illustrated a transition in the Mio-Pliocene micromammal fauna of South Africa with relic Tertiary communities displaced by modern genera. Likewise, **Aaron O'Dea** (Scripps) showed that the criapulid bryozoans of the Caribbean evolved to adopt a predominantly sexual rather than asexual reproductive strategy in response to changes in productivity due to the rising of the Panama Isthmus. With the audience still wowed by the previous talk's video of foxtrotting bryozoans, **Leyla Seyfullah's** (Birmingham) excellent illustrations of fossil seed plants kept all enraptured. She showed that cupulate organisation is primitive in seed plants, with multi- and uni-ovulate cupules co-occurring at the base of her phylogeny.

From basal seed plants we moved to 'basal' molluscs; though the inverted commas were placed by **Mark Sutton** (Imperial), some of the enigmatic fossils he discussed may bear their own inverted commas as their remains generate much controversy regarding certain Cambrian 'molluscs' (more



of this later). Nevertheless, his cladistic analysis of fossil and extant molluscs placed the Cambrian animals *Wiwaxia* and *Halkieria* basally as a stem group to the worm-like aculiferans within the molluscan crown group.

The phylogenetic position of Burgess Shale-type fossils provided the theme for the next talk, in which **Tom Harvey** (Cambridge) reported his discovery of organic-sheathed Early Cambrian hexactinellid sponge spicules. This talk introduced the various hypotheses for the origin of sponge spicules and their biomineralisation, a hot topic that provided the subject matter for a further two talks in the meeting. The morning session was rounded off by **Gary Mullins** (Leicester), who discussed phytoplankton diversity patterns in the Palaeozoic, analysing the differing responses of prasinophytes and acritarchs to changes in the ocean–atmospheric system, and discussing their significance for differing theories of their photosynthetic mechanism.

After a hearty Yorkshire lunch of mushy peas and paella (gravy optional), I returned to the auditorium to hear a pair of talks on feeding and prawns respectively, how appropriate.

Vince Williams (Leicester) used a detailed analysis of tooth microwear to test hypotheses of feeding habits and jaw mechanics in ornithomimid dinosaurs. Judging by his animation, which showed dinosaur feeding in action, a modern analogue for ornithomimid jaws may be found amongst the cast of TV's *South Park*. The next talk also featured fossils animated in full 3-D Technicolor glory; this time the star was a Triassic shrimp with all its entrails and squidgy bits. **Aoife Braiden's** (University College Dublin) SEM and X-ray microtomographic study showed the preservation of guts, muscle blocks and fibres, internal organs and nervous tissue – the result of polyphase mineralisation in earliest diagenesis. Moving from 'livers' to liverworts, **Ben Fletcher** (Sheffield) detailed the technique he has developed to calculate ancient atmospheric CO₂ levels using the carbon isotope fractionation of fossil bryophytes. His data are consistent with model estimates of atmospheric CO₂ over the last 200 Ma and confirm that atmospheric CO₂ has been a primary control on global temperature over this interval.

We returned to Cambrian sponges as **Stefan Bengtson** (Swedish Museum of Natural History) reassessed the mineralogy of spicules in *Eiffelia*, arguing that these spicules had a siliceous core surrounded by a carbonate envelope. Though graphoglyptid-like structures are made in modern intertidal flats by polychaete worms, graphoglyptid trace fossils are only known from deepwater environments in the fossil record. Well, at least that was the case until **Nicholas Minter** (Bristol) reported the first undoubted occurrence of graphoglyptids from an Early Permian intertidal flat. The session ended with **Graham Lloyd** (Bristol) analysing character acquisition over geological time, showing that a pattern of rapid diversification occurred at a clade's origin, after which character change within that clade is relatively slow.

After a short break for tea and posters, the meeting reconvened with **Lars Holmer** (Uppsala) detailing the first occurrence of a linguloid brachiopod preserving a pedicle in the Burgess Shale. Then, being far from inarticulate, **Jennifer McElwain** (UCD) assessed the response of plant fossils to environmental changes associated with the Triassic/Jurassic mass extinction, showing that the terrestrial ecosystem underwent rapid ecological change and extinction just before the T/J boundary. From log distribution curves we moved to mite morphology as **Jason Dunlop** (Museum für Naturkunde, Berlin) re-examined the mites of the Rhynie Chert, in a presentation that provided a good exemplar in anticipation of the Annual Address. These specimens all occur inside plant



spores and as the whole gamut of growth stages have been found in these plant spores it appears there is a strong palaeoecological link.

The AGM and Annual Address provided the second half of the post-tea session. I will not dwell too much on the AGM, leaving this task to a more reputable scribe. However, towards the end of proceedings, an interesting comment was made to me by a Chinese colleague who noted that all of the motions were being passed unanimously without debate or challenge. This was western democracy, I explained. Once business was done and dusted, it was time for the incoming president, **Mike Bassett** (Cardiff), to hand over to his fellow brachiopod worker **Art Boucot** (Oregon) to give the Annual Address. Noting that an animal either extant or extinct is far more than just its basic morphology, Art argued that we ought to augment our taxonomic descriptions with other details. For example, details of ontogeny, ecological associations and preservational style may provide important information, and inferences on autecology may add interest, he commented in his informative address.

From food for thought at the Annual Address the emphasis shifted simply to food. Glad rags were donned and the grand setting of the Cutlers' Hall provided a suitable backdrop for the 50th PalAss Annual Dinner. After a mulled wine reception we sat down for a three-course feast of Winter Soup, Roast Beef or Vegetarian Option, and a pudding (the exact nature of this course escapes my memory, although I remember it complemented the wine well). After toasts and the presentation of the Association awards, **Charles Holland** (Trinity College Dublin), a founder member of PalAss, gave an overview of the origins of the Association. It turned out that PalAss evolved from a palaeontologists' dining club. Charles's chronology revealed that though the dining club was conceived shortly after a ride in a London cab, this was several years before PalAss began. The kibosh had been put on the taxi-ride creation myth. **Euan Clarkson** (Edinburgh) fell off his chair.

I woke up bright and breezy, having sloped off early from the post-dinner party held by the Birmingham PhD students, to find I'd received a text message reading 'Wuss' from **Beth MacDonald** (party convenor in chief). Clearly she felt I was too much of a big girl's blouse to party late. So with my masculinity besmirched, I loaded my breakfast with an extra slice of bacon and shunned the fried tomato to restore my sense of meat-chomping manliness. Bacon devoured and feeling very manly, I headed towards the talks. Or so I thought. Leaving in good time, I spotted a burly fleece-wearing sort just in front of me. A Palaeontologist, I thought. I ditched my map and followed her down the hill. A few skids later – my loafers weren't too smart on the icy slopes – I had nearly caught up with her. I eventually did and struck up a conversation about molluscs. After ten minutes of talking at cross purposes, she disappeared into her place of work saying "well that's me, enjoy your day." Bugger. I was left at the bottom of a slippery hill in an unfamiliar city, no crampons for my loafers and no idea of where the auditorium was. Hell's bells. Beth was right, I was not only a wuss but also a prat and no amount of fried food could make any difference.

Would that my supposed palaeontologist were **Martin Munt** (Dinosaur Isle Museum, Isle of Wight): then I could have had an informed conversation about molluscs and I could have got to the talks on time. But she wasn't. So while Martin talked about patterns of origination and extinction in Palaeogene gastropods, I slipped and skidded my way around the backstreets of Sheffield. Martin, I apologise. I did however arrive in time for the talk by **Andrew Scott** (Royal Holloway) on lava trees, which occur as 'fossil forests' in the basaltic lava flows of Kilauea in Hawaii. Likewise, ancient ash



deposits can produce remarkable fossils such as those from the Silurian lagerstätte of Herefordshire. **David Siveter** (Leicester) reported the latest find from this locality, a female ostracod preserving eggs and juveniles within its carapace. As well as showing evidence of parental broodcare, the specimen showed mydocopid morphology in a straight-hinged shell, urging extreme caution in the shell-based classification of Palaeozoic ostracods. Cripes.

The Miocene Libros fauna of Spain also shows evidence of juveniles co-existing with adults in the form of tadpoles and frogs. **Maria McNamara** (UCD) showed that these exceptionally-preserved tadpoles had a benthic lentic ecomorphology, consistent with phylogenetic evidence that lentic ecology is a conserved feature in ranids. Next, **Daniela Schmidt** (Bristol) compared the recent and fossil distributions of cryptic species of planktonic forams with those of their traditional morphospecies. These cryptic species occurred in different proportions in different places at different times dependent on their environmental context. This was, she argued, because these subspecies track certain habitats as climate changes, providing an insight into their potential long-term evolution. To round off the session, **Rob Raine** (Birmingham) described the rise and demise of microbialites, which dominate the shallow-water carbonate successions of the Cambro–Ordovician such as those exposed in the Durness Group. However, these microbialite-dominated ecosystems undergo a major decline in the Ordovician, in part due to the rise of metazoan grazers.

And so, with grazing and avoiding decline in mind, we debarked for coffee, biscuits and posters.

Feeding remained on the menu as **Dave Baines** (Leicester) used tooth microwear patterns to re-examine the feeding habit of pycnodont fish. This group had previously been considered shell-crushers, however Dave's data showed that their dentition was also capable of complex mastication. Whether they nibble on pan-fried prawns is uncertain; however, if they did, the monocular crustaceans of the Orsten fauna must have been pretty glad that pycnodonts weren't around in Upper Cambrian. **Joachim Haug** (Ulm) reassessed these one-eyed critters, reconstructing their ontogeny and placing them in the crustacean stem group based on their limb morphology. The next talk on the graptolite synrhabdosomes was given by **Me** (Leicester/Cambridge). I thought it went pretty well. No one fell asleep.

We stayed in the Early Palaeozoic for a talk on chitinozoan biozonation by **Jan Vanmeirhaeghe** (Ghent). This provided a biostratigraphic framework for correlating between the Brabant Massif and the Condroz Inlier, allowing a lithostratigraphic correlation to Baltoscandian sea-level curves in to Ordovician. However, this good correlation was less marked in the early Silurian due to the Avalonia–Baltica collision. Though the origin of the ammonoids is well understood, their non-ammonoid contemporaries have received relatively little study. That is, until **Björn Kröger** (Museum für Naturkunde, Berlin) got there. His large bed-by-bed collection of non-ammonoid cephalopods showed that the nautilitids and bacritoids appeared at the same time as the ammonoids originated, representing a late Early Devonian pulse of cephalopod evolution.

We moved from sea to shore as **Phil Manning** (Manchester) used finite element analysis to investigate dinosaur trackways. This technique uses computer simulations of stress and strain, and was developed to replace many costly and expensive experiments such as car crash simulations. And crashing cars is very expensive. Phil knew all too well. His wife had crashed two in the past week. Happy Christmas. Phil's computer simulations showed how impressions of dinosaur footprints distort as they are transmitted through the sediment, showing the importance of



considering trackways as morphologically variable subsurface features. Staying below the sediment, **Vanessa Thorn** (Leeds) used studies of phytoliths and their relation to their parent flora at the present day to improve interpretations of fossil phytolith assemblages. And after a packed morning, I slipped out for a cheeky snifter over lunch at a nearby boozier. I felt I deserved it.

Paul Wignall (Leeds) kicked off the afternoon proceedings, with a talk on extinction and anoxia in the Early Jurassic. Unlike the end-Permian event where the-biggest-mass-extinction-ever™ is associated with the globally synchronous onset of anoxia, the Early Jurassic mass extinction is a relatively small event. Paul showed that the onset of dysoxia and extinction in Tibet is significantly later than it is in Europe. He suggested that this diachroneity may account for the relative difference in severity of this event with regard to the end-Permian event. Rather than looking at extinctions, **Rob Sansom** (Bristol) examined the radiation of the osteostracan fish in full phylogenetic and palaeogeographic glory. These fish evolved rapidly, and five endemic, monophyletic clades had emerged by the middle Silurian. However, the paucity of their record in the early Silurian hinders our understanding of how the clades themselves originated and migrated. Shucks.

We returned to the Cambrian for the next three talks. The first of these saw **Jakob Vinther** (Copenhagen/Yale) expand on his earlier phylogenetic assignment of *Halkieria* as a mollusc by comparing its shell histology with the microstructure and growth patterns of fossil chitons. With an increasing number of previously problematic Cambrian animals shoehorned into the stem or crown groups ('was *Wiwaxia* a mollusc?' I hear you cry), the Cambrian explosion is looking increasingly rapid. To establish the rate and timing of the transition from small shellies to a diverse fauna of higher bilaterians, **Bjorn-Gustaf Brooks** (Iowa State University) presented a new high-precision U/Pb date of 533 Ma for a volcanic horizon in southern China that separates these two faunas. Though Cambrian spores lack a trilete mark, **Paul Strother** (Boston College) argued that his palynological preparations of estuarine and nearshore material contain non-marine crytospores which may represent the remains of thalloid plants of an evolving bryophyte complex. To finish the penultimate session, **Steffen Kiel** (Leeds) examined the whale-fall communities preserved in the middle Tertiary deep-water strata of Washington State. Steffen highlighted a change from chemosymbiotic opportunists to fully sulphophilic communities that accompanied the significant increase in cetacean body size in the Miocene. And with this fully in mind, a crowd of opportunistic scavengers headed for coffee and posters for one last time.

The meeting's final session began with **Eric Sperling** (Yale) presenting a molecular phylogeny and early evolutionary scenario for the sponges – early sponges are as hot as Hell's inferno, I had to stand back for fear of being burned; this showed that Porifera is paraphyletic with spiculation evolving convergently. As such, Eric argued that we should consider sponges as a grade rather than a clade, with its separate classes evolving independently in an Ediacaran environment that favoured benthic filter-feeders. **David Steart** (Royal Holloway) presented a paper detailing the occurrence of seasonal wildfires in the Palaeocene–Eocene Thermal Maximum, before we returned to the Cambrian once more. Using 3D internal imaging of Cambrian embryos, **Neil Gostling** (Bristol) detailed subcellular preservation in phosphate. This revealed structure akin to organelles, yolk granules or lipid vesicles, and he interpreted paired reniform structures as representing the nuclei of cells about to undergo division. Though they can get to the thousand-cell stage, there is no evidence of epithelialization, suggesting a stem-metazoan affinity for the embryos.



Working on recent Bryozoans, **Stephen Hageman** (Appalachian State University) showed that a greater degree of variation in zooecia morphology occurs within colonies on small spatial scales than between colonies on larger spatial scales. This result in modern animals should reassure palaeontologists working on morphospecies. Contrastingly, **Craig Harvey** (A/S Norske Shell) reassured the many students in the audience that there was hope after PhD if they were willing to call fossils 'bugs' and become a 'geo' in the hydrocarbon industry. **Nick Butterfield** (Cambridge) asked eager questions and seemed highly interested in this option; after all, there'd been talks suggesting that *Wiwaxia* was a mollusc not an annelid, and perhaps things were getting too much. In the penultimate talk of the day, **Sandra Jasinowski** (Bristol) used finite element analysis and bone histology to assess the cranial mechanics of dicynodonts. This suggested that taxa with specialised morphology had a more powerful vertical bite and may have fed on more resistant vegetation. Staying at the interface between engineering and palaeontology, **Alberto Pérez-Huerta** (Glasgow) assessed how the biomineral fabrics and material properties in brachiopods related to their modes of life.

And so, after a one-day symposium, two days of talks and too many beers, the 50th Annual meeting of the Palaeontological Association drew to a close. The President's Prize for the best talk by a young palaeontologist was jointly awarded to **Vince Williams** (Leicester) and **Ben Fletcher** (Sheffield), and the Council Prize for best poster by a young palaeontologist was awarded to **Ma Xiaoya** (Leicester/Yunnan). It was almost time to go. Though some stayed for an extra day to go down a mine with **Ken Dorning** (Sheffield) to look for Carboniferous plants, most delegates departed to trains, cars and local bars, happily chatting about talks, collaborations and issues of palaeontological importance. The interest and stimulation generated by the meeting is a fitting tribute to **Charles Wellman** (Sheffield) and his team of helpers, who deserve thanks for organising an excellent and enjoyable meeting. Three cheers.

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The above-ground part of the fieldtrip. (Photo: Jakob Vinther)



The origin and early evolution of the Palaeontological Association (or, who was really in the taxi?)

The account below was written as a personal account by Professor Frank Hodson of the University of Southampton, at the time of the 25th Annual Meeting in Sheffield in 1982. The documents on which the text is based are kept with the Association's archives at the Lapworth Museum of Geology, University of Birmingham, and are available for study.

The story of the Palaeontological Association starts on a Wednesday in the Autumn of 1954. Bill Ramsbottom and I emerged from the, then, Geological Survey Museum into Exhibition Road to bump into Gwyn Thomas coming down from Imperial College, and the three of us caught up with Bill Ball leaving the Natural History Museum. We were all on our way to the South Kensington tube to attend a meeting of the Geological Society of London at Burlington House. It seemed a reasonable economy, important in those days, to share a taxi. During the journey through the slow-moving traffic, talk, as usual, centred on the then current inadequacies of the Geological Society of London. The two papers permitted on a single evening might deal with completely disparate sub-disciplines. Questions were answered only after all of them had been put to the speaker. Of course, here were no 'seconds', no cut and thrust, no repartee, all very formal and often so diplomatic that real discussion was hardly forthcoming. The place was always crowded. When two diverse topics were to be aired on the same evening, specialist devotees doubled the attendance and the old parliamentary seating arrangements were very inconvenient. In addition, an archaic election and voting procedure for Fellowship held up the scientific business.

Palaeontologists had been particularly exasperated by the lack of publication facilities in the UK for papers which demanded illustration; in particular Goldring's Pilton trilobite paper had appeared in Germany. Hudson's stromatoporoid papers were being published in France, and Parkinson's statistical investigations of Carboniferous Brachiopoda had been rejected by the Geological Society, ultimately to appear in the American *Journal of Paleontology* and to be judged as the best paper to appear in that particular year in the prestigious journal.

It was generally felt (probably wrongly) that the bane of the Society was its Dining Club, to which only the elite had access and where the inherited cautious policy of the Society was perpetuated. Certainly suggestions to the ruling hierarchy of the time were abruptly dismissed as impious. For instance, a suggestion that the QJGS [*Quarterly Journal of the Geological Society*, which later metamorphosed into the *Journal of the Geological Society*] should be replaced by half a dozen specialists' journals (of which one should be palaeontological) and of which the subscriptions entitled a Fellow to any two, was rejected without being put to Council as an impractical dream made by innocents with no knowledge of financial matters. When we now see how essentially the same policy has not bankrupted Pergamon, Elsevier and Springer-Verlag, one cannot help regretting that the Society failed to realise that free copy and editorship might be a useful base on which to build a profit-making publishing venture.

However, the upshot of the taxi-ride was a somewhat derisive resolution to ape our betters and start a palaeontological dining club. Bill Ramsbottom, as a central London resident, was asked to find a



place at which we could afford to eat, and call upon a few other palaeontologists to do so. He chose the Gardenia Restaurant on Gloucester Road. The proprietor was a polite, foreign gentleman who placed an upper floor at our sole disposal for the evening and generously agreed reasonable corkage for our own wines. Meetings were held after certain meetings of the Geological Society. Frank Hodson acted as recorder and D.J. Carter as wine-steward. [The records of these dinners, of which the first was on 15th December 1954, are available in the archives].

At the sixth dinner, held on 10th October 1956, it was resolved 'to ask Dr R. G. S. Hudson to dine with the Club and to explain his proposals for the Palaeontologists' Society'. In fact Hudson had no proposals for such a Society, never having heard of such an organisation, but Ramsbottom and the writer knew that he would by the time he ate his dinner. Even so we left it rather late. Having accepted the invitation to eat with the Club he was told by telephone that Bill and I wanted a few words with him. It was thus that the pair of us called at the offices of the Iraq Petroleum Company on the afternoon of 21st November 1956. We had often discussed the formation of a palaeontological society during our Wednesday meetings, when we could spare the time from goniatites which were the *raison d'être* for our meetings. It was clear that we needed someone of senior status but retaining an element of juvenile irresponsibility. Hudson fitted the specification exactly. The dilemma was that we could not expect a sizeable membership without a quality journal but we could not afford a journal without a sizeable membership. What was needed was an established, apparently sober palaeontologist, who would sign an order for a publication on behalf of a Society, long before the Society had funds to pay for it. Hudson we felt would do this and break the vicious circle. There was however, a particularly difficulty – the embryonic proposals required about ten minutes to explain and no one had ever been able to speak to Hudson for ten minutes without him interrupting and taking over the narrative. On one occasion (at the Annual Meeting of the Palaeontographical Society) I seconded a motion proposed by him, only later in the discussion to find him speaking and finally voting against it. Knowing this idiosyncrasy, Bill Ramsbottom volunteered to get him to be quiet for ten minutes and to keep him to it whilst I briefed him on what he had to say in a few hours time.

Bill did a magnificent job, putting his finger to his lips on a number of occasions. Hudson was surprisingly meek. At the conclusion of the diatribe, which had dissected the sins of the Geological Society as seen by the younger palaeontologists and expanded on the subjectively assessed need for a Society and journal devoted solely to exhibiting the virtues of a neglected group of geologists, he merely said 'Alright' and launched into a lengthy and rapid exposition of the Middle East Mesozoic stromatolites illustrated by prints, enormously enlarged, of cellulose peels of sections which happened currently to be engaging his attention. Characteristic of the times, they were destined to be published in France.

We hurried back to South Kensington to telephone Norman Hughes and Stuart McKerrow at Burlington House where they were attempting to raise the small voice of palaeontology above the scream of grinding axes. They were asked to call at the Geological Survey offices before going on to the Gardenia Restaurant in Gloucester Road. When they eventually arrived at the Survey, they were treated to a repeat performance of that which Hudson had suffered and asked first to nod approvingly at what Hudson would say and secondly, if asked, to accept the job of Vice-President and Treasurer respectively and to agree to Hodson being Secretary and Ramsbottom the Editor. All this agreed, we went to eat. As Hudson rose to speak, we were a bit apprehensive. A busy



man, who could forget his own proposal during the short time it was debated, he might well have forgotten his briefing of a few hours ago. But all was well, everything emerged as it had been presented – indeed, quite a chunk of it was *verbatim*.

The upshot of the matter was that an Interim Committee was formed, the composition being as follows: Dr R. G. S. Hudson (Chairman), Dr F. Hodson (Secretary), Dr W. S. McKerrow (Treasurer), Dr W. H. C. Ramsbottom (Editor), Mr N. F. Hughes, Dr J. T. Temple and Dr Gwyn Thomas. At a later date, Professor Alwyn Williams was co-opted. A similar account of subsequent proceedings has been printed in *Palaeontology*, Vol. 1, pt. 4, 1959. The Interim Committee was instructed to consider in detail the ways and means of founding a Palaeontological Association, to obtain estimates of the cost of publishing a new journal, to submit proposals for a constitution, and to call a meeting in January 1957. Virtually unanimous support was received from leading palaeontologists in Britain.

On 1st January 1957 a document known as the First Circular was issued and widely distributed amongst palaeontologists and geologists in Great Britain. It outlined proposals for the formation of an Association, and contained an invitation to a Public Meeting to be held in the Royal School of Mines, London, at 5.00pm on 30th January 1957. The response to the Circular was very heartening; slips were returned from over 50% of the 460 copies which had been distributed; over 150 persons signified their firm intention of joining the proposed Association and about 60 others wished the Association well but were unlikely to subscribe.

Seventy persons attended the Public Meeting on 30th January 1957, where Dr R. G. S. Hudson, who was in the Chair, outlined the need for a Palaeontological Association. Mr N. F. Hughes, acting as spokesman for the Interim Committee, described the events which had led up to the meeting and explained the proposals which were being put forward. It was announced that a second meeting would be held in the near future formally to inaugurate the Association, adopt a Constitution, elect a Council and empower it to collect subscriptions. A full discussion ensued concerning the name and aims of the proposed Association, its relationships with existing societies, the holding of meetings, the proposed subscription, the financial aspects of establishing a new journal offering adequate illustration, and the format of such a journal. A Resolution proposed by Dr E. I. White FRS, and seconded by Dr F. W. Anderson, 'that an Association to further the study of Palaeontology be formed' was carried unanimously. A second Resolution, proposed by Mr R. V. Melville and seconded by Professor O. M. B. Bulman FRS and Mr W. S. Bisat FRS, 'that Dr F. Hodson, Dr R. G. S. Hudson, Mr N. F. Hughes, Dr W. S. McKerrow, Dr W.H. C. Ramsbottom, Dr J. T. Temple, Dr Gwyn Thomas and Professor Alwyn Williams are elected as an Organising Committee, and are requested to report progress at a meeting to be called in the near future'; also that 'this Committee has power to co-opt' was carried unanimously. The writer continued as Secretary.

The Second Circular, distributed on 13th February 1957, reported the resolutions carried at the Public Meeting, and contained an invitation to the Inaugural Meeting of the proposed new Association to be held at 2.30pm on 27th February 1957 in the Royal School of Mines to adopt a Constitution.

At this Inaugural Meeting, attended by 49 persons, the 'Proposed Constitution' was discussed in detail. The following people contributed to the discussion from the floor in the order listed: Messrs Eames, Shirley, Westoll, Thomas, Swinton, Wood, Gill, Ramsbottom, Melville, Eames, Melville, Westoll, Sylvester-Bradley, Barnard, Ainsley, Swinton, Sylvester-Bradley, Curry. With some



amendments, it was unanimously accepted. The following were then elected as Officers and Council of 'The Palaeontological Association' for 1957. *President*: Dr R. G. S. Hudson, *Vice-Presidents*: Dr E. I. White, Mr N. F. Hughes, *Treasurer*: Dr W. S. McKerrow, *Editor*: Dr W. H. C. Ramsbottom, *Secretary*: Dr F. Hodson, *Fourteen other members of Council*: Dr F. W. Anderson, Dr T. Barnard, Professor O. M. B. Bulman, Dr F. E. Eames, Mr G. F. Elliott, Professor T. N. George, Dr Dorothy H. Rayner, Mr P. C. Sylvester-Bradley, Dr J. T. Temple, Dr Gwyn Thomas, Professor T. S. Westoll, Professor W. F. Whittard, Professor Alwyn Williams, and Professor Alan Wood. It was resolved that the Council be authorised to publish a journal containing works of palaeontological interest, and that the Officers of the Association be authorised to act as an Executive Committee of the Council. The Third Circular gave a report of the Inaugural Meeting and called for subscriptions.

The first Council Meeting was held in the Board Room of the Geological Survey Museum at 11.00am on 1st May 1957. Finance, Publications and Meetings Sub-Committees of the Executive Committee (with powers to co-opt) were established to carry out the business of the Association. Appeals for funds to finance the Association, and particularly its proposed new journal, had already been initiated. It was agreed that the name of the Journal should be 'Palaeontology', and that two parts a year should be published initially, that it should be Crown Quarto size, and that it should be printed by the Oxford University Press with colotype plates. Arrangements were made for the first Demonstration Meeting to be held on 29th June at Bedford College, London, and the first Discussion Meeting on Carboniferous palaeontology on 13–14 December at Sheffield.

At the second Council meeting on 29th June 1957, Dr F. Hodson resigned the duties of Secretary of the Association. Item 2a(ii) of the Council minutes reads: 'Dr Hodson expressed his desire to resign from the post of Secretary due to pressure of other work. The council reluctantly accepted his resignation, and recorded its thanks to Dr Hodson for the services which he had rendered, and also its appreciation of his enthusiasm as one of the founders of the Association. Dr Gwyn Thomas was elected to fill the vacancy, as from 29th June 1957. It was decided that Dr Hodson should remain on the Executive Committee'.

Hodson felt that the embryonic and infant stages of the Association had been successfully accomplished. The membership had reached 191 (185 individual and six institutional members) and there would be enough money in the bank to pay for Volume 1, part 1 of *Palaeontology*. There were other things to do. Dr Gwyn Thomas guided the Association through its juvenile stage to maturity so that by the end of 1957 membership was over 300, and by the end of 1958 had reached 412, and this less than two years after the inaugural meeting.

The first Anniversary meeting was held at Sheffield University on 13–14 December 1957. Forty-five people sat down to the first Anniversary Dinner ominously held on Friday 13th, and by that date, members had in their possession the first part (published 1st November) of Volume 1 of *Palaeontology* – probably the finest printed and illustrated scientific publication in the world (subsequently to be exhibited and win an award at the Frankfurt book fair). It had cost £568 and its successors in twenty-five years enriched palaeontological literature with 19,137 pages and 2,661 plates, a ratio of one superb plate to 7.26 pages of OUP print. It is the Association's biggest asset. How glad we are that we resisted the blandishments of a certain publisher to initiate it for us and let members have it cheaply if institutions could be made to pay through the nose. It was a seductive proposal. Its rejection by the Executive Committee of Council was their wisest decision.



R. G. S. Hudson was decisive. Having no certainty of being able to pay, he unhesitatingly signed an order for it. 'What happens if we don't get the cash?', someone asked. 'You will have to dig into your pockets', replied R. G. S. unhesitatingly and with a conviction which showed he believed it. This could not be said about some of his early assurances made to create optimism amongst various people. I used to try to convince myself that he was not really being untruthful, but merely representing a state of affairs as he honestly saw it, a very charitable view; but the Association would not exist but for Hudson's particular style in getting things moving.

Returning to the Malthusian growth rate in membership in the early years, it was clear that an empty ecological niche had been identified for colonisation. Such growth had eventually to slow down. At the time, it was thought that the carrying capacity (K) of the growth equation might be about 1,000. It is gratifying that 25 years have shown us that this was an underestimate. Perhaps 1,600 is now a better guess, but the initial 'r' mode population growth has ended [not a bad estimate in 1982 – the total membership for 2006 was 1,445]. A punctuated equilibrium type of evolution has been succeeded by phyletic gradualism in which we must seek new needs to be catered for. We must do all we can to leave no unfilled wants. If we do, then another competitor will do what we did twenty-five years ago.

Professor Frank Hodson

University of Southampton

1982



Volunteer Placements 2007



North East Yorkshire Geology Trust is one of the leading geoconservation organisations in the country. We are dedicated to protecting our geodiversity and more importantly to sharing this with as wide an audience as possible. The Trust holds over 200 events per year, attracting over 6,000 people. Over the last few years many new graduates have worked with the Trust and have gone on to some fantastic opportunities in industry as a result.

We will be running a series of public events between 30th July and 31st August 2007. We are looking for volunteers to help to run these events and to take part in a week of training which will follow. You will be helping to run our Dinoday extravaganza, one of our most popular activities for adults and children, as well as assisting with guided walks, fossil hunts and other aspects of our work. These events will run at various locations in North East Yorkshire throughout the five weeks.

In return your accommodation and food will be provided in the beautiful Robin Hood's Bay with some of its own fantastic geology. You will receive high levels of training throughout the placement, developing both specialist geological and transferable skills from some of the country's most experienced geoconservationists.

If you are available for the whole period (29th July – 9th September), have a background in geology and would like to do something different to strengthen your CV, please apply to Jane Worrall, e-mail <jane@neyorksgologytrust.com>, by sending your full CV.





Soapbox

Tea and biscuits, or tea and posters? Thinking in the abstract

The 50th Annual Meeting of the Association in Sheffield has come and gone. Exceptionally, oral sessions extended over three full days, with the first devoted to a seminar on macroevolution with nine invited papers. This increased the number of talks to 57, perhaps something of a record, yet even more impressive was the number of posters, a whopping 80 being included in the abstract volume.

It is commonly easier to write and organise a talk for oral presentation than to prepare a conference poster. Further, a PowerPoint presentation can be submitted electronically or carried on a pocket-sized CD, whereas a poster tube is awkward to take on public transport. Yet many contributors who would give talks at the Annual Meeting give poster presentations due to the shortage of slots for speakers. Part of the justification for this is the Association's desire to avoid parallel sessions of talks for diverse reasons. Nevertheless, at every Annual Meeting there are invariably parallel sessions of presentations between talks and posters.

Posters have almost always been a slightly awkward sideshow at the Annual Meeting. They are welcomed, but are never allowed to become a focus of attention. They are commonly scheduled to be examined during tea and coffee breaks, sometimes even lining the route to the toilets. Such an arrangement is inappropriate and impractical. The primary function of tea and coffee breaks is to allow the audience and speakers to take refreshment and come up for air after a period of concentrated attention. You have to queue for your drink, which can take ten minutes or so. There is also the chance to catch up with colleagues that you may not have seen since the last Annual Meeting or longer. Other distractions include bookstalls.

In truth, tea and coffee breaks are best left as breaks, giving delegates a chance to relax and slow down. Delegates don't need to take on board the information supplied by posters during this period. What is needed is an alternative time for viewing posters, making them part of the core business of the meeting, thus enhancing their value to delegates and authors alike. Now that posters are appreciably more numerous than talks, they should receive a fairer portion of the limelight. The unspoken assumption that posters can be 'fitted in' somehow by the delegates is wrong; posters are more time efficient than talks, but they still require time to be read (Davis 2005, pp. 192–194).

I advocate a separate session of 1½ to 2 hours devoted solely to poster presentations. During this session, presenting authors could (wo)man their posters, providing answers to questions from interested delegates and, in turn, gaining relevant insights and opinions from these discussions. This could be similar to the format of the poster sessions at regional and annual meetings of the



Geological Society of America or other large societies (Day 1998, pp. 189–190; Davis 2005, pp. 191), where each poster is exhibited for half a day in a theme session, such as palaeontology. Even if running parallel to a series of talks on palaeontology, the poster session is well attended, lively and well thought of.

The obvious problem is how to fit another session into an already congested meeting schedule. If parallel sessions of talks are frowned upon, then it is unreasonable to suggest either replacement of a session of talks by posters or a more organised poster session in parallel to talks. Rather, I advocate trying to find an alternative time slot for such properly peopled poster presentations (PPPP). Perhaps posters could be set up in the hall of residence for PPPP after dinner one evening, with discussion gently lubricated by a cash bar? Or could talks start a little earlier and/or finish later in the day, with slightly shorter refreshment and lunch breaks, to permit a poster session to be inserted? Whatever, it would be more constructive for delegates and presenters if posters were displayed for a single session that was arranged to maximise viewing and scientific interaction, than to leave them up for two or three days of cursory examination as at present. If 57 talks are worthy of three days of collective effort by delegates and presenters, then perhaps it is time to recognise that the other 80 presentations are deserving of their own, shared 90 minutes of attention.

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>> **Future** Meetings of Other Bodies

Please find below a list of known meetings from other bodies. Help us to help you! *Send announcements of forthcoming meetings to:* Meetings co-ordinator (<meetings@palass.org>). The Palaeontological Association Future Meetings website is updated regularly; it is at <<http://www.palass.org/modules.php?name=palaeo&sec=meetings&page=55>>.



First Mediterranean Herpetological Congress (CMH1)

Marrakech, Morocco 16 – 20 April 2007

This meeting is also devoted to palaeontologists interested in palaeobiodiversity and evolution of Amphibians and Reptiles, and the dynamics of palaeo-environments in Mediterranean-type regions. Our principal aim is to promote the conservation of present and past herpetofauna as an integral part of the natural heritage of Mediterranean-type regions. For more information, please consult the first circular on the meeting's website at <<http://www.ucam.ac.ma/cmh1>> or contact the meeting organizer, Prof. N. E. Jalil, at <cmh1@ucam.ac.ma>.



Annual Address of the Palaeontographical Society

Natural History Museum, London 25 April 2007

Prof. Richard Fortey FRS: "Lifestyles of the trilobites"; 4:30pm, Wednesday 25th April 2007, Flett Lecture Theatre, The Natural History Museum.

Join world-famous palaeontologist Prof. Richard Fortey as he reveals the intimate secrets of the trilobites in the first Annual Address of the Palaeontographical Society. Attendance at the lecture is free, but is limited to members of the Palaeontographical Society and Natural History Museum members. Tea and coffee will be served beforehand in the foyer area of the lecture theatre. Details of the Palaeontographical Society can be found at <http://www.nhm.ac.uk/hosted_sites/palsoc/>.



23rd Argentine Meeting of Vertebrate Paleontology

Trelew (Patagonia) 21 – 24 May 2007

The Museo Paleontológico Egidio Feruglio (MEF) will host the 23rd Argentine Meeting of Vertebrate Paleontology. These meetings are held annually and gather the vertebrate palaeontology community of Argentina and neighbouring countries. Abstracts focused on all aspects of vertebrate palaeontology research are welcome, including systematics, palaeoecology, taphonomy, and biogeography. This meeting will be held in the city of Trelew (Eastern Patagonia) between 21st and 24th May 2007. A post-meeting trip will be organized to visit some of the most important Tertiary outcrops located along the Chubut River Valley.

For more information, please consult the meeting's website at <<http://www.japv23.org.ar/>> or contact the meeting organizers via <info@japv23.org.ar>.

**The Global Triassic**

Albuquerque, New Mexico, USA 23 – 25 May 2007

This international symposium will be devoted to all aspects of the Triassic System, with particular focus on the Triassic timescale and Triassic biotic events. It will be an official meeting of the IUGS Subcommittee on Triassic Stratigraphy, and a final meeting of IGCP 467 on Triassic Time and Correlation. The meeting will be three days of talks and posters at the New Mexico Museum of Natural History in Albuquerque. Planning for pre-meeting and post-meeting field trips is under way, and the trips will be announced in the second circular. They will afford an opportunity to visit several classic marine sections including Fossil Hill (A–L), South Canyon (L–C), and New York Canyon (T–J), as well as classic nonmarine Triassic sections in New Mexico–Arizona. For further information please contact Spencer G. Lucas, New Mexico Museum of Natural History, 1801 Mountain Road N. W., Albuquerque, NM 87104, tel 505-841-2873, fax 505-841-2808, <spencer.lucas@state.nm.us>.

**Palaeobotany and the Evolution of Plants: Current Issues**

Paris, France 23 – 25 May 2007

The aim of this symposium is to provide a forum for the discussion of recent developments in palaeobotany, palaeoecology, the evolutionary biology of plants, and the use of fossil plants in the reconstruction of palaeoenvironments and palaeoclimates.

The focus will be on new results, new reviews of particular problems, new techniques, *etc.* Young researchers are encouraged to take part. Both oral and poster presentations are welcome, on a wide range of topics, with the emphasis on interdisciplinary approaches linking fossil plants and: systematics and phylogenetic classification (morphological and molecular approaches); vegetation biodiversity dynamics; plant–insect interactions; palaeobiogeochemistry; palaeomagnetism; palaeogeography; climate modelling; computer-aided identifications; database and other computerized systems *etc.* Presentations will be in English or in French, in which case the speaker will be asked to produce English-labelled slides.

On 26th May it is planned that there will be a visit to the palaeobotany collections of the Museum National d'Histoire Naturelle in Paris for interested participants.

As a “séminaire” of the Collège de France, there will be **no registration fees for the meeting**. There will be a reception dinner in the “quartier latin” on 24th May, for which there will be a fee for those wishing to attend.

There will be an opportunity to publish contributions, after peer review, in a thematic volume Palaeobotany–Palaeoecology of Comptes-Rendus PALEVOL de l'Académie des Sciences de Paris (Elsevier), in English or French (manuscript to be deposited during the symposium, details in the second circular).

Contacting the organizers: M. Berthelin & J. Broutin, Paléobotanique-Paléoécologie, Université Paris 6, Case courrier 1201, 12 rue Cuvier, F-75005- Paris, France, fax +33 (0)1 44 27 65 13, <mberthel@snv.jussieu.fr>, <jean.broutin@upmc.fr>.



**Fourteenth Annual Symposium of the International Work Group for
Palaeoethnobotany**

Kracow, Poland 17 – 23 June 2007

We are pleased to invite you to the 14th IWGP Symposium.

Local organisers

Dr Aldona Bieniek (W. Szafer, Institute of Botany, Polish Academy of Sciences, Kraków)

Dr Marek Nowak (Institute of Archaeology, Jagiellonian University, Kraków)

Consultative group

- Prof. K. Wasylkowa
- Dr. M. Badura
- Prof. J. Chochorowski
- Dr. M. Hajnalová
- Dr. J. Jarosinska
- Dr. L. Kubiak-Martens
- Dr. M. Litynska-Zajac
- Prof. Z. Mirek
- Dr. A. Wacnik

Location: Kraków: Palac Larischa, Bracka 12.

Registration Fee: €95 (includes symposium dinner and excursion). It is our intention to reduce the Registration Fee for students.

Language: English. Proceedings will be published in *Vegetation History and Archaeobotany*.

Themes

- Regional Archaeobotany: Regional studies; Archaeobotany in environmental reconstructions.
- Methods and Analytical archaeobotany: Methodology, Taphonomy, Molecular analyses, qualitative and quantitative analyses.
- Crops and Crop cultivation: Spread of farming, gathering and cultivation, crop diversity.
- Ethnobotany: Collection, Husbandry and use of wild plants, Traditional agricultural methods.
- Open session: Other subjects

Two afternoons will be devoted to laboratory demonstrations for the examination and presentation of archaeobotanical material and poster sessions.

Field excursion

The field excursion will examine different aspects of landscape and anthropogenic vegetation in the loess areas of the Malopolska Upland and a selection of archaeological sites in the region. Transport by bus will be provided. Maps and other details are available on the website.



Accommodation

Accommodation will be arranged at the hotels of the city within ten minutes' walking distance of the meeting centre and in a hostel located at a distance of 15/20 minutes by tram. Every room in the hostel is equipped with bathroom, and breakfast can be served.

Website

Information regarding the 14th symposium, (location, travel, excursion *etc.*) is available via the IWGP website at <<http://www.palaeoethnobotany.com/>>, which will be updated as regularly as possible. Copies of this circular and the registration form are also available directly from <<http://www.ib-pan.krakow.pl/iwgp/>>.

Registration

The preliminary Registration Form can be downloaded from the website. Hard copies can be posted to:

IWGP Symposium,
Institute of Botany, Polish Academy of Sciences,
Lubicz 46,
PL 31-512 Kraków,
Poland
Tel 0048 12 4241705
Fax 0048 12 4219790
E-mail: <iwgp@dlg.krakow.pl>.



XVI ICCP
Nanjing, China 21 – 24 June 2007

The XVI International Congress on the Carboniferous and Permian (XVI ICCP) will be held in Nanjing, China. Proposed sessions include:

- S1 (Carboniferous and Permian palaeobotany and palynology).
- S2 (Carboniferous and Permian macro- and micro-fossils).
- S3 (Devonian F–F mass extinction and Mississippian recovery).
- S4 (Biotic turnovers during the Mid Carboniferous boundary).
- S11 (Stratotypes, boundaries, and global correlation).

Important dates are:

31st December 2006 (Deadline for return of reply from First Circular).

1st February 2007 (Second Circular e-mailed and available online).

1st April 2007 (Deadline for pre-registration and abstract submission).

1st May 2007 (Third Circular available online).

31st December 2007 (Deadline for manuscript submission to the proceedings volume).



First International Palaeobiogeography Symposium

Paris, France 10 – 13 August 2007

The research unit 'Paléobiodiversité et Paléoenvironnements' (UMR 5143) cordially invites you to attend the 1st International Symposium on Palaeobiogeography. The Symposium will be held at the Université Pierre et Marie Curie (Paris 6). The Symposium will be held in collaboration with the IGCP project 503 meeting. Full details are available on the meeting website at <http://sgfr.free.fr/rencontrer/seances/s07-07paleobiogeo.html>.

The Symposium is officially sponsored by:

- CNRS (Centre National de la Recherche Scientifique)
- UPMC (Université Pierre et Marie Curie, Paris 6)
- MNHN (Muséum national d'Histoire naturelle, Paris)
- PF (Association Paléontologique Française)
- APLF (Association des Palynologues de Langue Française)
- SGF (Société géologique de France)
- IGCP project 503 (International Geological Correlation Programme)
- SFS (Société Française de Systématique)

The topics of the Symposium are intended as research priorities in the area of palaeobiogeography, *i.e.* the contribution of fossil data to the reconstruction of the Phanerozoic biogeographic history and the use of fossils to propose palaeogeographic reconstructions.

While the biogeographic signature of Pangaea break-up is still evident in the Modern World biosphere, the Palaeozoic one is still debated. Fossils offer important constraints in palaeogeographic reconstructions, particularly to those of Palaeozoic. The Modern World Biogeography is the result of a long history characterized by vicariant events and also phases of biotic interchanges that need to be discussed and analysed. The research for areas of endemism and area monophyly is relevant to the whole Phanerozoic, and increasingly needs the use and the development of analytical tools: this gives scope for a topic dedicated to the analytical methods.

Proposed Topical categories and Special Sessions:

- 1 - Palaeozoic Palaeobiogeography
- 2 - Biogeographical Constraints in Palaeozoic palaeo-reconstructions
- 3 - Mesozoic Palaeobiogeography and the break-up of Pangaea
- 4 - Shaping Modern Biogeography
- 5 - Biotic interchanges
- 6 - Analytical methods in biogeography

Publication of Conference Papers

We expect to publish the proceedings as special issues in international peer-reviewed journals.



Registration Fees

Before January 30th 2007:

- Full Registration €150
- Student Registration €100

After January 30th 2007:

- Full Registration €190
- Student Registration €100

The registration fee will include Symposium programme and abstract, an icebreaker party and coffee breaks. Delegates are expected to provide their own lunches.

An additional late registration fee of €50 will be incurred for registrations made after 30th June 2007.

Please note that all refunds (including non-attendance) will incur a 25% charge.

Information regarding payment procedures will be outlined in the next circular.

Accommodation

Participants are expected to arrange their own accommodation during their stay. Paris offers a large range of hotels, guesthouses, and student accommodation. We do however urge participants to book early (at least six months in advance) as accommodation in Paris is very difficult to find at short notice during the Summer period.

We recommend that participants search the web for accommodation or book through a travel agency. For those who wish to book student accommodation, please check out the following websites: <<http://www.cisp.asso.fr/>> and <<http://www.fiap.asso.fr/>>.

More information regarding accommodation and how to get to Paris will be available in the next circular.

The Official languages of the symposium will be French and English.

Conference Secretary: Monique Troy
Université Pierre et Marie Curie – Paris VI
4, place Jussieu – case 117
F-75252 Paris Cedex 05, France
Tel +33 1 44 27 47 86, Fax +33 1 44 27 38 31
E-mail: <palstrat@ccr.jussieu.fr>



40th Anniversary Symposium on Early Vertebrates/Lower Vertebrates
Uppsala, Sweden 13 – 16 August 2007

In August 2007, Uppsala University will be hosting the Symposium on Early Vertebrates/Lower Vertebrates, the latest in a series of meetings initiated in Stockholm in 1967 by the Fourth Nobel symposium, “Current Problems of Lower Vertebrate Phylogeny”. The meetings are not linked to any society, but have been hosted by institutions in different countries on a running 3–4 year rotation. In 2004, the symposium was held in Gramado, Brazil; previous symposia have included Paris 1995, Miguasha (Québec) 1991 and Beijing 1987.



The Symposia on Early Vertebrates/Lower Vertebrates are the only recurring international meetings targeted specifically at the Palaeozoic vertebrate research community. As such, they draw a broad international field of very high profile speakers, including most of the acknowledged leaders in early vertebrate research. The meetings are friendly and informal, usually with no more than about 100 delegates, making them outstanding venues for young researchers to meet the established figures in their fields and build up contact networks.

Poster and platform presentations are accepted on an open competitive basis (there is usually room for all the posters); there are normally no invited speakers. Topics of presentations usually range from the earliest chordates, through Palaeozoic agnathans and fishes, up to the origin and early radiation of tetrapods. Platform presenters are invited, but not required, to contribute papers to a symposium volume. Past volumes such as “Current Problems of Lower Vertebrate Phylogeny” (ed. Ørvig, 1968), “Early Vertebrates and Related Problems of Evolutionary Biology” (eds. Chang, Liu & Zhang 1991) and “Studies on Early Vertebrates” (eds. Arsenault, Lelièvre & Janvier 1995) have all become major landmarks in this area of palaeontology.

2007 is not only the 40th anniversary of the first Symposium, but also the 300th anniversary of the birth of Linnaeus – Professor of Botany at Uppsala University and one of the most influential biologists of all time. In this jubilee year, we are delighted to invite you to Uppsala, to attend what we hope will be an outstanding meeting on the early evolution and palaeontology of the Vertebrata.

- Pre-registration deadline: November 30th, 2006
- Abstract submission deadline: February 28th, 2007
- Registration deadline: April 25th, 2007

Symposium e-mail address: <EarlyVertebrates2007@ebc.uu.se>.

Organising committee:

- Per Ahlberg: <Per.Ahlberg@ebc.uu.se>
- Catherine Boisvert: <Catherine.Boisvert@ebc.uu.se>
- Henning Blom: <Henning.Blom@ebc.uu.se>
- Daniel Snitting: <Daniel.Snitting@ebc.uu.se>
- Martin Brazeau: <Martin.Brazeau@ebc.uu.se>
- Gaël Clément: <Gael.Clement@ebc.uu.se>
- Rose-Marie Löfberg: <Rose-Marie.Lofberg@ebc.uu.se>



WOGOGOB 2007

Rättvik in Siljan, Sweden 17 – 20 August 2007

Next year, the 9th WOGOGOB meeting will take place at Rättvik in Siljan. This marks the 20th anniversary of WOGOGOB – an acronym for Working Group on Ordovician Geology Of Baltoscandia. We invite presentations on all aspects of Ordovician geology and palaeontology of Baltoscandia. Two days for technical sessions are scheduled (18–19 August), and abstracts and field guides will be published in a volume of the Swedish Geological Survey Bulletin. A one-day pre-conference excursion (17th August) in the Siljan area, and a two-day post-conference excursion (19–20 August)



to Jämtland will be offered. The meeting is held in collaboration with IGCP project 503, Ordovician Palaeogeography and Palaeoclimate.

Please visit <<http://www.palaeontology.geo.uu.se/Mainpages/WOGOGOB/Layout.htm>> for first circular and preliminary registration.



40th AASP Annual Meeting

Panama City, Panama 8 – 12 September 2007

The 40th AASP annual meeting will be held at the Smithsonian Tropical Research Institute in Panama City, Panama.

Events

- Opening mixer
- Pre-meeting field trip to Barro Colorado Island or to the Canopy Crane at Metropolitan Park
- Tour of the Miraflores Locks at the Panama Canal

Guidelines

- Contributions accepted until July 5th
- Student financial aid available
- Hotel rooms reserved at discount rate at the Hotel El Panama

Further information is available from Carlos Jaramillo by e-mail to <jaramilloc@si.edu> and from the meeting website at <<http://www.striweb.si.edu/aasp07>>.



Flugsaurier – The Wellnhofer pterosaur meeting

Munich, Germany 10 – 14 September 2007

We are now taking abstracts for a meeting to be held in Munich's famous Bayerische Staatssammlung für Paläontologie und Geologie (Bavarian State Palaeontological Collection – BSPG) for 10–14 September 2007. The meeting will be focused on the pterosaurs and their world to celebrate the works of Dr Peter Wellnhofer.

The foremost authority on pterosaurs for the last four decades, Dr Wellnhofer spent much of his career in Munich as a curator at the BSPG, so it is appropriate that the meeting celebrating his work will be held in this world class collection. It is rightly considered one of the best pterosaur collections in the world and includes the 'Zittel wing', Anurognathus, and the 'Munich Pterodactylus', among other fossil treasures such as the Munich Archaeopteryx.

Many of the world's foremost pterosaur researchers have confirmed their attendance and a full proceedings volume based upon this meeting is planned for the journal *Zitteliana*. This international meeting will consist of two days of talks (in English), a day of open discussions and poster sessions, and a field trip to the world famous Jura Museum in Eichstätt.



Short abstracts (of one side A4, single-spaced 12 point text) can be submitted to David Hone (by e-mail or post) with a closing date of 31st May, 2007. Further details are available from David Hone at the address below or at <<http://flugsaurier.blogspot.com/>>.

Dr David W.E. Hone
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Germany
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Fax: +49 / (0)89 / 2180 6601



Seventh International Symposium, Cephalopods Present and Past
Sapporo, Japan 14 – 17 September 2007

We are pleased to send you the first circular of the 7th International Symposium, Cephalopod – Present and Past. As shown in the first circular and on our website at <<http://www.cephalopod.jp/>>, registration will start in March 2007. We would appreciate your attendance at the symposium.



Joint Meeting of CIMP Spores, Pollen and Acritarchs Subcommissions
Lisbon, Portugal 24 – 28 September 2007

This meeting will involve three days of technical sessions at the Geological Survey in Lisbon, followed by a two-day post-meeting field trip in southern Portugal.

The meeting will be organized by INETI (Portuguese Geological Survey) and held in the Portuguese Geological Survey headquarters in Lisbon.

Further details are available at <<http://e-geo.ineti.pt/CIMPLisbon07>>, or contact Zélia Pereira by e-mail to <zelia.pereira@ineti.pt>.



International Conference on Geology: Indian Scenario and Global Context
Kolkata, India January 7 – 11 2008

About the conference

The conference is a part of the Platinum Jubilee celebration of the Indian Statistical Institute to be held during 2007–2008, which is also the 50th year of the establishment of the Geological Studies Unit in this Institute. The conference aims to provide a platform for interaction between Indian geologists and the global geological fraternity.



The conference will be focused around Precambrian geology of cratons and orogenic belts, Proterozoic and Gondwana basin studies, Gondwana and related vertebrate faunas, alluvial depositional systems, and quantitative analysis of geological data and numerical simulation. The conference will be held at the Indian Statistical Institute, Kolkata, India.

Accommodation

The organizers will arrange modest on- and off-campus accommodation. ISI Guest House accommodation rate is Rs. 250/- per day, per person. Some expensive off-campus accommodation may be arranged.

Academic Sessions

Session I: Quantitative Analysis and Numerical Simulation in Earth Science

Quantitative data analysis and numerical simulations are increasingly being used in almost all branches of Earth Science to test the models against ground geological facts and to explore newer understandings of process–product relationships. This session of the conference intends to address the present state of the art and identify newer directions for future research.

- Themes:
- Size and shape analysis of geological objects including fossils
 - Methods of geological data analysis
 - Application of remote sensing techniques in geology
 - Application of GPS and GIS techniques in geology
 - Modelling of geological processes

Session II: Precambrian Terranes and Tectonics

The session will focus on tectonic evolution of the Precambrian orogenic belts and the associated cratonic sedimentary basins occurring in different parts of the globe. The conference aims at evolving a better understanding of the tectonic processes during the Precambrian that had driven the supercontinent cycle. In this context, special emphasis will be on the Eastern Ghats Granulite Belt and the neighbouring sedimentary basins of the Indian shield.

- Themes:
- Metamorphism, structure and tectonics in Precambrian continental fragments
 - Collisional tectonics and related basins
 - Fold-and-thrust belts
 - Proterozoic cratonic basins: depositional systems, palaeogeography, sequence stratigraphy, tectono-sedimentary evolution

Session III: Evolution and Diversity of Late Palaeozoic and Mesozoic Terrestrial Vertebrates

The terrestrial vertebrate communities of the Late Palaeozoic and Mesozoic eras witnessed several important ecological and evolutionary events including the emergence and extinction of several lineages of the amphibians, amniotes and the mammals. The present conference aims to consolidate and exchange fresh ideas on the diversity, evolution and distribution patterns of the Late Palaeozoic and Mesozoic vertebrate communities of the Gondwana and their relatives from the Laurasia, change in the nature of the vertebrate communities during the Late Mesozoic due to the rifting of the continents and finally the emergence of the mammalian and avian faunas.



- Themes:
- Origin, evolution and extinction of the Late Palaeozoic and Mesozoic terrestrial vertebrates
 - Functional anatomy and systematics
 - Diversity and distribution patterns
 - Biochronology, taphonomy and palaeoecology

Session IV: Evolution and Diversity of Late Palaeozoic and Mesozoic Terrestrial Vertebrates

Modern fluvial systems are known to be responsive to the surface gradient, amount and fluctuation of discharge, and sediment load supplied to the system. These factors are in turn controlled by tectono-geomorphology of the terrain, climate and provenance. Thus geological records of ancient fluvial systems are considered to be a useful tool for basin analysis and palaeoclimatic studies. The recent work on the alluvial systems and their deposits has two major trends: 1. Study of the modern alluvial systems in different climatic and tectonic settings to evolve a generalised relation between the alluvial system and tectono-climatic regime, and 2. Study of the ancient alluvial deposits to infer through inductive logic, the probable tectono-climatic regime in which they formed. The focus is on the study of modern fluvial system and ancient fluvial deposits that attempts to recognize the signatures of climatic and tectonic influences on the alluvial system.

- Themes:
- Modern and ancient alluvial deposits
 - Mud-dominated alluvial systems
 - Climatic and tectonic controls on fluvial systems
 - Palaeosols in fluvial deposits

Post conference workshops

Two post-conference field workshops are proposed, which will be held concurrently, on 13–19 January 2008. Fees for each trip: Rs. 3000/- (Indian participants), US\$ 200 (foreign participants and same for accompanying members). The fees include Kolkata-Field-Kolkata train fares, cost of field vehicles, food and lodging.

Field workshop 1:

Geo-traverse across the Eastern Ghats Belt, adjoining terranes and the South Indian craton

The Eastern Ghats Belt along the eastern margin of the Indian peninsula, ranging in age from Archaean to late Proterozoic, represents a deeply exhumed collisional orogen with multiple events of magmatism, high-grade metamorphism and deformation. This belt, south of the Godavari graben, is flanked successively westward by the Nellore Schist belt, Prakasam alkaline province, and the Nallamalai fold-thrust belt. Features of Nal-lamalai fold-thrust belt is comparable to the external part of an orogen. A traverse across the Eastern Ghats Belt to the cratonic Cuddapah basin through the Schist belt, the alkaline province and the fold-thrust belt is planned.

Contact: Dilip Saha, e-mail <dsaha@isical.ac.in>

Field workshop 2:

Sedimentology and vertebrate palaeontology of the Satpura Gondwana succession, central India

Permo–Jurassic Gondwana succession is excellently developed in a number of basins spread across the Peninsular India. The Satpura Basin is one of the major Gondwana basins of India that preserves about 4 km of sedimentary strata representing one of the longest and most complete



records of Gondwana sedimentation spanning over a period from Permian to Jurassic. Excellent exposures of Permian glacio-marine deposits, fluvio-deltaic coal measures, lacustrine strata, Triassic mud-dominated alluvial deposits with calcareous palaeosols and horizons with vertebrate fossil assemblages are the key attractions of the Satpura Gondwana succession. The field workshop would provide excellent scope for observing records of different sedimentological processes, climatic fluctuations and sediment–biota interactions as preserved in this basin. The trip will cover different spots spread across three districts and over more than 120 km.

Contact: Tapan Chakraborty, e-mail <tapan@isical.ac.in>.

Meeting Contact

Prof. S. Bhattacharya
Geological Studies Unit, Indian Statistical Institute,
203, B. T. Road,
Kolkata-700108, India
E-mail: <gsu2008@isical.ac.in> or <dgsu50.isi75@gmail.com>
Telephone: +91-33-25753150, +91-33-25753157
Fax: +91-33-2577-3026
Meeting website <<http://www.isical.ac.in/~gsu2008>>.



International Federation of Palynological Societies

Bonn, Germany *August 2008*

The next International Palynological Congress will be in August 2008, in Bonn (Germany). For further details refer to <<http://www.geo.arizona.edu/palynology/ifps.html>>.



8th International Workshop on Agglutinated Foraminifera

Cluj-Napoca, Romania *September 7 – 13 2008*

The Grzybowski Foundation and the Department of Geology, Babes-Bolyai University are pleased to announce the dates of the next International Workshop on Agglutinated Foraminifera. The workshop is open to all participants interested in the taxonomy, ecology, evolution and stratigraphy of the Agglutinated Foraminifera, and follows workshops previously held in Amsterdam, Vienna, Tübingen, Kraków, Plymouth, Prague, and Urbino over the last 27 years. The workshop will consist of three days of technical sessions, followed by a field excursion in the spectacular Transylvanian Basin and Southern Carpathians.

The meeting will be held in the Department of Geology, Babes-Bolyai University, situated in the former Roman town of Cluj-Napoca, Romania. The conference room offers modern projection facilities, and lunchtime meals will be taken in the University Restaurant opposite the Geology Department. Microscopes will be available for working groups and demonstration purposes.



Costs:

The registration fee for the conference is estimated to be approx. €120 euros, and a discount will be given to student participants. The fee will cover conference materials, refreshments at the meeting, and the welcoming reception. Field trip costs will be calculated separately. The Grzybowski Foundation will make available a limited number of travel grants for participants from eastern European countries. Accommodation will be at local hotels near the central square, at the discount rate of approximately €50 a night. Full details of costs will be made available in the second circular.

Preliminary Program:

Sunday 7th September: arrival and welcoming reception

Monday 8th September to Wednesday 10th: Technical Sessions

Wednesday 10th September: Conference Dinner

Thursday 11th September to Saturday 13th: Field Excursion (Transylvania, Carpathians).

Information and Registration:

Sorin Filipescu, Department of Geology, Babes-Bolyai University, str. Kogalniceanu 1, 400084 Cluj-Napoca, Romania, e-mail <sorin@bioge.ubbcluj.ro>.

Mike Kaminski, UCL, e-mail <m.kaminski@ucl.ac.uk>.



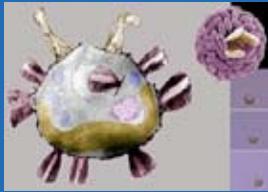
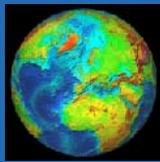
International Symposium on the Cretaceous System

Plymouth, UK 6 – 12 September 2009

The International Symposium on the Cretaceous System will be held at the University of Plymouth, on 6–12 September 2009. The conference will be followed by a number of field excursions visiting Cretaceous locations in the UK. Themes for the meeting may include: 200th Anniversary of the birth of Charles Darwin, sequence stratigraphy and sea level change, Cretaceous oil and gas exploration in the N.W. European Continental Shelf, Cretaceous stratigraphy, palaeontology, isotope stratigraphy, biotic and other events, regional geology and palaeoclimates. Papers will be solicited for peer-reviewed publication with submission of manuscripts *at the meeting*.

For more information contact Prof Malcolm Hart, School of Earth, Ocean & Environmental Sciences, University of Plymouth, Drake Circus, Plymouth PL4 8AA, e-mail <mhart@plymouth.ac.uk>.

Please help us to help you! Send announcements of forthcoming meetings to
<newsletter@palass.org>.



MSc in Micropalaeontology

Jointly run by:

Department of Earth Sciences, University College London
Palaeontology Department, The Natural History Museum

Unique training in a critical specialisation

Subject: Micropalaeontology is the study of microfossils, such as foraminifera, coccoliths and plant pollen. It is a core discipline within modern academic and industrial geology since it provides the prime basis for biostratigraphic dating of drill-core samples, and a wide range of proxy data for palaeoceanography and climate change research.

Course Structure: A 6-month taught course provides intensive tuition in the major microfossil groups and their application in modern geology, this includes a 1 week fieldtrip (this year to Languedoc, SW France). There is then a 2 week work placement and 4.5-month research project. **Tuition is by world authorities, including many guest lecturers.**

Research Project: The projects are practical-based, typically using previously unstudied material to address real biostratigraphic, palaeobiological or palaeoenvironmental problems. Projects are written-up to a rigorous deadline, and many subsequently lead to publications.

Natural History Museum Link: The course is run jointly with the NHM, providing a very strong teaching base and access to the outstanding facilities in the NHM. The taught course is based at UCL, with many opportunities to visit the museum. Projects are based at both UCL and the NHM.

Entrance qualifications: Minimum of a second class degree or equivalent in a relevant subject.

Funding available: The course is currently supported by 3 NERC Masters' Training Grants and a Curry Fund scholarship.

How to apply: See www.es.ucl.ac.uk/graduate_teach.htm for application procedures (and fees); contact the course director, Dr Paul Bown (micropal@ucl.ac.uk) for details, or visit the course website. www.es.ucl.ac.uk/graduate/micropal/UCL-NHM_MSc.html



About us: UCL is one of the top UK research universities: named "**Sunday Times University of the Year**" for 2004. The Department of Earth Sciences was rated level 5 in the last Research Assessment Exercise and has been graded "Excellent" for its teaching.

The NHM is an international leader in the scientific study of the natural world with ca. 400 scientific staff, unrivalled collections, first-rate facilities and outstanding libraries.





Gray's Anatomy of Modern Beliefs and Delusions

Evolutionary theory has attracted interest from its share of philosophers, both philosophers of science (David Hull, Daniel Dennett, Elliot Sober) and political philosophers (Karl Marx, Herbert Spencer, Bertrand Russell). Marx sent Darwin a personally inscribed copy of *Das Kapital*, which Darwin did not appear to have gotten around to reading, as most of the pages were uncut.

What is striking about the first three philosophers of biology and the first three political philosophers who came to mind is that two of the three political philosophers were 19th century thinkers, while Bertrand Russell did most of his work in the early 20th century. By contrast, the first three philosophers of science are all still active and started their research careers in the 1970s. Has evolutionary theory disappeared from political thought, and been left to the scientists and philosophers 'midst the dreaming spires'?

John Gray, Professor of European Thought at the London School of Economics, as part of his wider work on western thought, makes a persuasive argument that evolutionary theory, and science in general, has not disappeared from western political thought. Instead, science and technology have become deeply embedded within the expectations of what political programmes, whether from left- or right-wing parties (labels that Gray argues are now defunct), will deliver. His collection of essays from the *New Statesman* – published as *Heresies Against Progress and Other Illusions* – offers an accessible introduction to his ideas and work.

Philosophers are sometimes perceived as asking awkward and irrelevant questions about science that scientists shouldn't bother themselves too much about. We should remember that most philosophers are well-trained in logic, and can dissect an argument with more clarity than most scientists – and take their points seriously. Philosophers, and social scientists, also give us some insight into how scientific work is regarded in the wider marketplace of ideas. Perhaps the most crucial information they can convey to us is how scientific ideas and theories are regarded by non-scientists, including the use of science to bolster political and social ideas and movements.

Gray has three themes that are of particular interest in trying to understand the relationship of evolutionary biology, and palaeontology as its most explicitly historical element, to the wider public. The first theme is progress as a religion. The late Stephen J. Gould was well known for railing against the portrayal of evolution as an inevitable march towards the appearance of *Homo sapiens*. One of his most often repeated quotes comes from his presidential address to the Paleontological Society in 1988:

“Progress is a noxious, culturally embedded, untestable, nonoperational, intractable idea that must be replaced if we wish to understand the patterns of history.”

Hunt (2006 a, b) developed a maximum-likelihood method for testing whether morphological evolution in lineages through time was best explained by a directed trend, a random walk, or stasis. In his sample of lineages he found that less than 10% were best explained by a directed trend.



Gray offers us this view of Darwinism in the essay *Science as a Vehicle for Myth*:

“So far as Darwinism is concerned, the world has no built-in tendency to improvement. The natural selection of genetic mutations may lead to more complex life forms, but equally it may wipe them out.”

So far so familiar. Gray’s insights into the roots of the cultural embedding of progress in the next section of his essay are valuable in aiding those who cannot understand the survival of the notion of progress in evolution, particularly in the public imagination, in the face of over three decades of research into long-term trends in the fossil record that has only thrown up a few examples of robust, directed trends.

“This is much too austere a vision ever to be popular. The hopes bequeathed by Christianity are too deep and pervasive in the culture for such a vision of purposeless change to be accepted. As a result, Darwin’s theory has been turned upside down and used to prop up prevailing notions of progress.”

The historical use of elements of Darwinism to underpin Spencer’s Social Darwinism and the appropriation of Darwinism to support eugenic policies varying from encouraging “the right sort of people” to have more offspring to genocide have been well-documented, but if we are to take Gray seriously, we have to appreciate that part of the success of such political ideas is that they fulfil a cultural need. In western societies the addition of a veneer of science is *de rigueur* to flatter the self-image of people who believe themselves to be “modern”. The continuing appeal of the few cases of long-term trends, Gould’s ‘right-tail’ of complexity, lies in the congruence of this rare pattern of evolution with a worldview that has been constructed around the idea of progress.

Another aspect of human behaviour that puzzles many scientists is that exposure to new technologies, the tangible proof of the validity of scientific theories, is not sufficient to alter the fundamental beliefs of many people who come into contact with such products towards a scientific worldview. The essay *Progress, the Moth-Eaten Brocade* sets out Gray’s explanation for the resistance of many people to a western, Enlightenment view in the face of what is the apparently incontrovertible evidence of the progress of technology. Gray uses the image of a Taliban commander directing military operations via a mobile phone as an example of the co-option of technology to further a fundamentalist cause. Adoption of technology does not result in the acceptance of the worldview that produced the technology.

Gray stresses the fundamental fact that most humans apparently have no difficulty in reconciling logical inconsistencies between their beliefs and actions. The science that leads to the technology that makes their lives easier and more comfortable can be rejected when it presents them with unpleasant truths. The current debate about global climate change is another example of this behaviour within western societies that supposedly share the rational, scientific outlook of the scientists who have just produced the latest IPCC draft report. The current debates about global climate change, environmental degradation, and a coming era of resource scarcity are all points that Gray touches upon. However, the pattern of behaviour described here can also be recognized in advocates of creationism and intelligent design, who will often use modern technology – as a quick web search will reveal – to promote their views.



Gray takes co-option of science and technology to serve political and social projects as a means of delivering the promises of eternal life and salvation that were apparently denied by the Enlightenment's undermining of Christian faith. Gray emphasizes this is a need implanted in western societies during the Enlightenment, and its belief in the rational nature of humans in general. As superstition was replaced by scientific knowledge, the world would become a better place for all. In *Sex, Atheism and Piano Legs* Gray argues that religiosity has not been eradicated from secular societies, but repressed in the way that the Victorians repressed sex. Gray argues that religion appears to be a species-wide trait of the human species, based on biology and anthropology, and that most humans have a need for some form of religion to give meaning to a meaningless world. He regards liberal humanism and its projects, which have their roots in Christianity, as surrogates for open religious belief. His view is well summarized in the introduction to the collection essays:

“In calling belief in progress an illusion, I do not mean that we should – or could – simply reject it. When Freud described religion as an illusion, he did not imply that it was wholly false, nor was he suggesting that humanity could do without it. Illusions are not mere errors. They are beliefs to which we cling for reasons that have nothing to do with truth.”

Throughout the essays Gray does not argue for the truth of religion or progress, simply that we accept that they are part of the evolutionary inheritance of *Homo sapiens* that has to find expression. The essays offer some well-argued explanations of why people behave as they do – particularly in reaction to certain areas of science – that I, and I am sure many other scientists, find deeply bemusing. They also offer a warning to all scientists to be vigilant of how their science is represented and used, particularly in the wider public sphere, to bolster myths of progress and delivering from social problems through the twin engines of science and technology.

Al McGowan

Newsletter Reporter

Acknowledgments:

I thank Robin Armstrong for directing me to Gray's work.

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Anyone who would like to know more about Gray and his work can find useful links to a number of his essays through a Wikipedia entry on Gray:

<[http://en.wikipedia.org/wiki/John_Gray_\(LSE\)](http://en.wikipedia.org/wiki/John_Gray_(LSE))>



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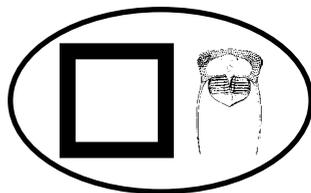
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New series: Outside The Box



Scientific publishing: a step into the world of words

Introduction

Palaeontologists are, by their very nature, often pedantic souls. It seems a mandatory trait for those of us who have spent long days counting the hairs on Palaeozoic arthropodian limbs or collecting tens of microfossils from kilograms of sediment. In addition, we often cherish our books – little windows of palaeontological history shedding light on our current research – as exemplified by the wide-eyed throngs of people straining to see Stuart Baldwin's bookstand at the Annual Meetings. What better than that musty smell with its powdery traces? And how many of us own a book we know we'll never read just because we had to have its hand-painted leather cover?

A love of books tends to bring with it a love of words ... and, indeed, logophiles often possess the palaeontological peculiarities: a hunt for ancestry, an eye for detail and a need to uncover accuracy and novelty.

As a young child, I used to look up the same entries in different reference books and compare their factual content to see if I could catch any of them out. If I spotted dissimilarity, the publishers would get a (red-crayoned) letter informing them. (Did anyone else used to do that? Cringe.) So, with hindsight, I suppose my publishing career started early. Little did I know that it would lurk. When a lack of requirement for professional trilobiters in our job-market drove me to explore other routes, it re-ignited ... and, well, the rest is history.

Publishing is a varied field. Meetings make for an eclectic group of persons: blonde, sleek marketing girls, slightly crumpled ex-academics (me), computer-geeky graphic designers and shiny advertisers. But most people know instinctively where they will sit best before entry to the field. I knew that I would be with the editorial production staff from the outset: red biro poised. However, the beauty of being in a flexible, large and fast-moving field affords you some choice as you learn and feel your way forward. This piece of writing refers to general publishing but has a slant towards academic scientific-publishing.

Publishing roles: what to expect

The field in general is divided into: STM (Scientific, Technical and Medical) books and journals, educational (*e.g.* textbook), reference works (*e.g.* OED); trade publishing (*e.g.* fiction paperbacks); newspapers and the rapidly-growing area of children's books. All of these areas generally divide into several departments: commissioning, editorial, production and typesetting with the related areas of marketing, sales and distribution.



There are many layers and facets to these posts, but I shall condense them to a couple of lines. Commissioners are in charge of guiding title lists and developing new editions with new authors: this post generally carries with it high responsibility (their jobs can sink in a commercial setting if copies of their commissioned titles sell less well than predicted) and their salaries will reflect this. This role requires a close connection to the relevant field as it involves identifying and assessing the publishing market; it can be a desirable position for someone who wishes to stay academically involved with the moving front of their field. However, it is worth remembering that the entire Oxford University Press employs only six scientific commissioning editors. Publishing firms are very triangular in structure and, in so being, are highly competitive at the top.

Editorial staff generally manage the process of eagle-eyeing the text (copy-editing*) and that of the reviewing process, and production staff will manage the text and illustrations through the setting process (making a neat, clean PDF/print copy from the manuscript) and deal with the typesetters and printers. (Salaries of editorial/production staff will match, if not precede, those of the academic world.)

Things to think about

In this section I'll discuss some broad points about employers and posts which can, I imagine, be generalized to other job areas too. Publishers vary between small, very-specialised publishing houses (like The Geological Society) to the multi-squillionaire businesses of Wiley, Elsevier and Blackwell. And, of course, these offer wholly different experiences: smaller organizations may offer a general position involving many different skills whilst larger companies will often have much more specific or specialised positions with lower diversity.

On a related note, you could choose to work for either a non-profit, charitable company or a commercial and lucrative business. Both smaller charitable companies and larger commercial companies offer valuable, but probably very different, experiences: smaller companies can often not match the salaries or flexibility of larger companies but corporate firms often lack the close-training, personability and wide-variety within each job-role.

Choosing whether to work in either book or journal production is another important consideration: some books are in production for many, many years as the text is constantly being revised (especially in rapidly-moving fields such as genetics) whereas some journals are printed every week (with manuscripts sometimes being submitted the day before printing). The latter scenario makes for a more hectic, faster-paced environment, but the former allows you to really get your teeth into something and to build strong relationships with the authors.

How to get your foot in

There's lots of helpful advice on the Blackwell Publishing site:

<<http://www.blackwellpublishing.com/careers/start.asp>>

Various publishers (e.g., Penguin and Blackwell) run a work-experience scheme: this would be invaluable experience and is highly recommended. My personal experience is that a keen interest in the field related to the job, a strong degree/research qualification and a well-written cover letter/CV are enough to capture the eye of a recruiting employer. It is highly important that



you are organized and can work carefully and calmly under tight deadlines: these qualities are vital and should not be under-estimated!

Publishing rewards

Although this field is competitive and not as well paid as perhaps it should be, its rewards vastly make up for these drawbacks. It allows you to sit comfortably between the world of business and scholarship; to stay connected to your chosen field; it is demanding and challenging – with a very wide range of skills across the whole activity; it is rewarding and fun; and it is intrinsically satisfying to produce something of value and beauty.

The future of publishing is strong and holds many opportunities. People with specialist academic knowledge are desirable as are those with excellent computing skills. The latter category of people is particularly desirable at present as the field moves quickly towards an electronic, online future. In addition, there are many prospects for work abroad – as many firms are starting to utilise typesetters and printers in the Far East – and, additionally, many opportunities for freelancing as qualified copy-editors or proof-readers.

For people who, like me, enjoy minutiae, read literature whilst silently correcting it and love the rustle of a book's pages – this is the ultimate job. And I secretly welcome any crayoned letters from cheeky young upstarts...

Jessica R. Pollitt

The Geological Society of London Publishing House

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*The curious art of copy-editing is a valuable one to learn. It looks like a language invented by demented ancient Egyptians and is the editor's way of making the text ready for the typesetter. House-rules, formatting, spelling, grammar and content are all dealt with here. It requires the ability to detect rogue commas and all the 'F's in the phrase:

'FINISHED FILES ARE THE RE-
SULT OF YEARS OF SCIENTIF-
IC STUDY COMBINED WITH
THE EXPERIENCE OF YEARS.'

(That's six, by the way.)

Useful links:

- The Publishing Training Centre: <<http://www.train4publishing.co.uk/>>
- The Association of Learned and Professional Society Publishers: <<http://www.alpsp.org/>>
- Society of Young Publishers: <<http://www.thesyp.org.uk/>>
- Inspired Selection (Recruitment agency): <<http://www.inspiredselection.co.uk/>>
- The Guardian newspaper on Mondays (job ads repeated on Saturday)
- The Independent newspaper on Wednesdays.

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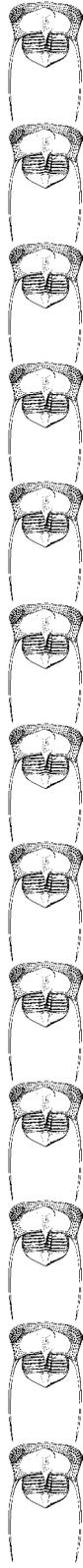
If the answer is YES then please check out the home page of the Palaeontological Association (<<http://palass.org/>>) and follow the link to “Careers & Postgrad Research”.

These pages will be updated regularly over the coming months, so don't forget to check back at regular intervals!

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For available PhD titles please include the title, the names of all academic advisors and a contact email address. For MSc and other graduate courses please include a brief descriptive paragraph, a link giving details of admission procedures and a contact email address or telephone number.



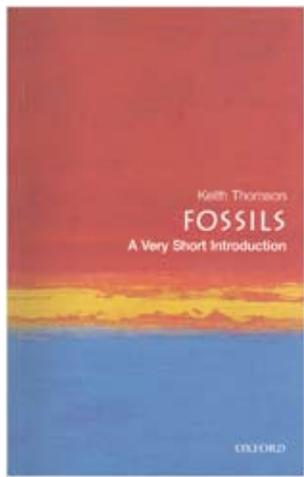


Book Reviews

Fossils. A very short introduction

Keith Thomson (2005). Oxford University Press, Oxford, ISBN 9780192805041 (paperback) £6.99.

The OUP 'Very Short Introductions' series now runs to over 150 titles – others of specific interest to palaeobiologists include texts on 'Darwin', 'Dinosaurs', 'The Earth', 'Evolution', 'Global Warming', and 'Human Evolution'. Like the others, this example is short (140 pages of text) and pocket-sized (less than A5 in size). As Thomson notes, 'Few sciences have been as successful as palaeontology in remaining serious and yet broadly accessible at the same time (p.35)'. His book illustrates well both the scope of palaeontology and why it continues to fascinate so many – it's a great little read. The book comprises ten chapters. A brief introduction to its scope is followed by a more substantive chapter that treats the development of the concept of palaeontology. A resumé of key works by Hooke and Steno is followed by discussion of the religious and philosophical context in which such pioneering studies were undertaken, debate that perhaps could be said to be on-going (*e.g. Kansas puts evolution back on the curriculum, Nature 445*, p. 807, 22 February 2007). Thomson identifies the late 18th century as an interval of accelerated change in thinking, flagging contributions by Erasmus Darwin, Lyell and Lamarck. By the 1830s the ideas such authors were espousing had 'become unstoppable'; the delay is blamed on 'the establishment's' response to the challenge to the structure of society and established thought posed by the French Revolution. This sets the scene for Charles Darwin's contributions, with which this section concludes. A separate section deals with the development of the concept of geological time, touching, of course, on works by Ussher and Kelvin. It also summarises Hutton's remarkable insights, notably the implications of the rate at which surficial processes operate for our understanding of geological time. Hutton, of course, among others in the late 18th and early 19th centuries, should also be acknowledged for the prescience of views on the concept of evolution (see Pearson 2003).



The first part of Chapter Three, '*Fossils in the popular imagination*,' mentions in passing the activities of various palaeontologists from Britain (Mantell, de la Beche, Conybeare and Owen) and elsewhere (Cuvier). The principal characters, however, are William Buckland (he of the pet hyena) and, especially, Mary Anning; Thomson neatly summarises the poignant story of a woman who, although wealthy patrons vied to purchase her finds and palaeontologists competed to describe them, 'always lived in the edge of poverty and a rigid class system kept her at the fringe of intellectual palaeontology'. In the second part of the chapter attention switches to the other side of the Atlantic and the pioneering days of 'dinosaur hunting', firstly in the mid-west (typified by Cope and Marsh), the Canadian badlands (Sternberg), then further afield (Gobi desert, Andrews).



Chapter Four, enigmatically titled '*Some things we know, some things we don't*,' summarises the palaeobiology of key intervals of geological time, working backwards through the Cenozoic, Mesozoic, Carboniferous and Devonian Periods, then collectively the Cambrian, Ordovician and Silurian ('trilobites, brachiopods, the odd graptolites, and even stranger creatures called conodonts ... which may have been chordates'). The constraints imposed by the size of the book mean each of these sub-divisions can be little more than a list of the main faunal elements. The following section '*In the beginning*' works up the geological column, culminating in a more comprehensive treatment of Ediacaran faunas and the Cambrian Burgess Shale and Chengjiang exceptional faunas. Chapter Five, '*Against the odds*,' comprehensive in both its scope and depth, reviews the processes involved in fossilisation under the headings '*What is a fossil?*', '*Before burial*', '*Burial and diagenesis*', '*Chemistry*', and '*Becoming rock*'. The chapter concludes with short sections on trace fossils (various types are mentioned but only 'trackways' are described, briefly) and two pages on various methods of preparation in the field and laboratory.

Chapter Six ('*Bringing fossils to life*') includes the section '*The living organisms*', the first paragraph of which lists the variety of ecological information that can be drawn from fossils – including, for animals, information about diet, process of mastication, terrestrial locomotion, methods of burrowing, sexual dimorphism and ontogeny. For plants, the shapes of leaves are noted to be characteristic of the environments in which they live. The bulk of the text, however, is a review of changes over time in how dinosaurs have been reconstructed, and aspects of their locomotion. The Middle Jurassic trackway assemblage from Ardley quarry near Oxford is treated at length, but unfortunately the accompanying illustration (a full page of the book) is a simple, fuzzy, line drawing, with an unlabelled scale bar. Chapter Seven, '*Evolving*', is much more substantive, although, at 24 pages long, not considerably longer than many of the others. Its more comprehensive treatment of the subject matter is largely because there is less illustration of the concepts by reference to particular exemplars. The concepts discussed include the quality of the fossil record ('*More gap than record?*'), Global Phanerozoic diversity, 'background' and 'mass' extinction, including brief mention of possible causes of examples of the latter ('*Extinction: the world of the Red Queen*'), '*The tempi and modes of evolution*', punctuated equilibrium versus gradualism ('*The shape of evolution*') and '*Major evolutionary transitions and the macro-evolutionary problem*'. There's still room to throw in sections on '*Living fossils*' and '*Missing Links*'!

Chapter Eight, '*Of molecules and man*', primarily treats the skeletal evidence for human evolution, but also acknowledges the contribution of molecular biology to various topics, including the 'Out of Africa' versus 'multiregional' models for the origin and dispersion of *Homo sapiens* and whether Neanderthals and *H. sapiens* interbred. Chapters Nine and Ten are a great read. Nine, '*Fakes and Fortunes*', focuses on the 'Piltdown', 'Beringer' and '*Archaeopteryx*' 'debates', with the section rounded off by a summary of the supposed half bird/half dinosaur *Archaeoraptor*. Chapter Ten is a speculative look forward – to what the fossil record of today might be: will today's extinction event register in the fossil record? Will human activities be recorded as a distinct stratigraphic interval – 'the Dustbinian Formation'? How to explain the sudden appearance of species such as the modern horse in disparate parts of the globe? And finally (tongue-in-cheek, I suspect): 'On a positive note' ... our vast deposits of organic matter – notably paper and sewage – could be the basis of a new suite of hydrocarbon deposits. Every cloud has a silver lining! Thomson's point, it is difficult to predict what the record and its physical scale will be, is well made: the same variables that will



shape the geological and palaeobiological records are those that have done so in the past, thus explaining some of the (current) limitations in our knowledge.

Quibbles? A few; applied aspects of palaeontology, notably biostratigraphy (especially with the book's historical perspective) and the extraction of climatic signals from *e.g.* microfossils, could have been considered further. The emphasis on vertebrate, particularly dinosaur, biology at the expense of other sources of data is, given the intended audience, perhaps understandable. The *Further Reading* section lists over twenty other texts, valuable all, but does not summarise their contents or the intended audience; a sentence or so on each would have helped the general reader choose his/her next foray into the subject.

The book, of course, is not designed as a textbook; its brief is more general: 'Ideal for train journeys, holidays, and as a quick catch-up for busy people who want something intellectually stimulating' (OUP website: <<http://www.oup.co.uk/general/vsi/>>). Even so, Chapters Five and Seven, the heart of the book, with Chapter Eight bringing up third place, could serve as supplementary reading matter to an 'early level' undergraduate lecture. There is the sense that this book is a retrospective, a look at what palaeontology was, with somewhat less emphasis of what it has become – today's concept of palaeobiology. This is neatly encapsulated in a couple of Thomson's sentences: "The prevailing popular image of the palaeontologist is of the rugged individualist. The noble explorer pits himself against the wilderness and brings back fabulous things." Thomson is at pains to point out, perhaps with a hint of regret, that this is a misconception, and has been for some time: "it is an image that carries a great deal more weight than the reality of the man or woman in a white lab coat", working "in less than glamorous conditions and concerned (with) most undramatic organisms like graptolites and brachiopods". Today's rugged individualist is as likely to be wrestling images from the depths of an SEM, she is working long hours in a biomolecular laboratory, he is synthesising data from disparate sources into the definitive cladistic analysis. Less romantic perhaps, but, nevertheless, the reason why palaeobiology is the vibrant, expanding, multi-disciplinary subject it is.

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Dawn of the Dinosaurs: Life in the Triassic

Nicholas Fraser, illustrated by Doug Henderson (2006). Indiana University Press, Bloomington. 307pp. ISBN 0-253-34652-5, \$49.95 (hardback)

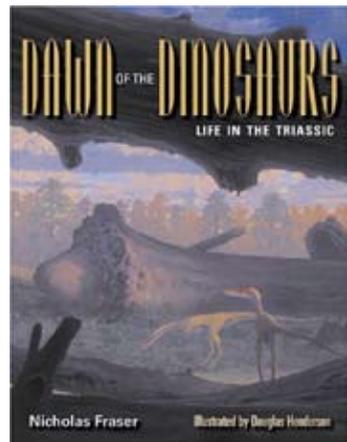
The Triassic was undoubtedly a crucial period in the evolution of life on earth. Book-ended by the drama of the end-Permian and end-Triassic mass extinctions, the Triassic witnessed the origins of nearly all modern vertebrate groups (including mammals, salamanders, frogs, sphenodontians, turtles and crocodiles) and the origin and ascent of the great Mesozoic reptiles: the dinosaurs,



pterosaurs, plesiosaurs and ichthyosaurs. Furthermore, the Triassic is iconic for its panoply of unique and bizarre tetrapods, such as *Longisquama*, with its frankly weird array of elongate, featherlike appendages arrayed along the length of its back, the vaguely lizard-like *Drepanosaurus*, with its hugely enlarged and trenchant manual phalanx and a spike at the end of its prehensile tail, or *Tanystropheus*, with its preposterously elongated neck more than twice the length of the trunk. New and distinctive Triassic tetrapod groups are still discovered on a regular basis: see for example the recent discovery that many of the isolated leaf-like teeth previously believed to pertain to ornithischian dinosaurs actually belong to an unusual crurotarsan archosaur, *Revueltosaurus* (Parker *et al.*, 2005), or that some Triassic crurotarsans show extreme convergence with Cretaceous ornithomimid dinosaurs (Nesbitt and Norell, 2006). Such a rich hunting ground for palaeontologists proves a rich source for Nicholas Fraser's excellent book *Dawn of the Dinosaurs: Life in the Triassic*.

In *Dawn of the Dinosaurs* Fraser provides a natural history of the Triassic, discussing in particular those areas with spectacular and well-known faunas and floras. Although clearly aimed at a popular audience, the lucid text is rich in information and certainly not over-simplified. Its focus is unashamedly (and unsurprisingly, given Fraser's own speciality) on the diverse terrestrial vertebrate faunas; however, substantial coverage is also given to marine vertebrates, invertebrates (particularly insects) and plants. The book is subdivided into four parts (representing a temporal division of Early, Middle, early Late, and late Late Triassic) and twelve chapters, with many of the chapters focusing on a single ecosystem. Information on chronostratigraphy, basic vertebrate anatomy, cladistics and sedimentology are tucked away in appendices at the end of the book: a welcome move, as nearly all of this information (with the possible exception of the overwhelming number of proposed chronostratigraphic divisions) will be familiar ground for most palaeontologists. The book is richly illustrated, with numerous beautiful colour plates by Doug Henderson showing whole ecosystem reconstructions that give a genuine sense of the Triassic landscape, with vertebrates and invertebrates often taking second billing to topography and plants. The reproduction quality of the figures is excellent, and certainly an improvement on that seen in some other recent books in the IUP *Life of the Past* series.

The opening chapter sets the scene, describing Triassic palaeogeography and climate, and dealing very briefly with the end Permian extinctions. Chapter 2 provides a brief introduction to Triassic flora and fauna, a task that could easily have filled the book by itself. One of the problems for the casual student of Triassic vertebrates is the bewildering number of clades (e.g. nothosaurs, placodonts, trilophosaurs, procolophonids, trematosaurids, rhynchosaurs, diademodontids *etc.*), and one feels that the coverage given to this diversity is not always fairly distributed: groups such as thalattosaurs receive only a cursory glance, while other groups such as procolophonids and the basal dinosauriform *Agnostiphys* are perhaps over-indulged. Although an archosaurian cladogram is provided, this reader would certainly have benefited from a more general vertebrate cladogram summarising the relationships of many of the more obscure groups, ideally calibrated to the stratigraphic record.





Subsequent chapters deal with the rather depauperate faunas of the Early Triassic (Chapter 3), the well-known Middle Triassic marine faunas (Chapter 4), and the much more poorly understood terrestrial faunas from the same epoch (Chapter 5). Chapter 6 examines some entertaining early Late Triassic oddities, including the controversial *Sharovipteryx* and *Longisquama* from Kyrgyzstan, and the Italian drepanosaurids, while Chapters 7 to 11 focus on the famous and diverse Late Triassic ecosystems, including those from the Newark Supergroup of the eastern USA, the UK (the Lossiemouth Sandstone of Elgin and the fissure fill deposits of Wales and southwest England), and Gondwana (the Maleri, Molteno, Santa Maria and Ischigualasto formations). The chapter on the Late Triassic of the southwestern USA is particularly beautifully illustrated, with no less than 19 plates. Finally Chapter 12 reviews the evidence (or lack thereof) for the timing, severity and cause of the poorly understood end-Triassic mass extinctions.

The title of the book seems a touch unfortunate: there is already a popular book from 1988 entitled *Dawn of the Dinosaurs: the Triassic in Petrified Forest*, which is also illustrated by Doug Henderson (in fact, many of Henderson's plates used in the 1988 *Petrified Forest* work are reproduced in Fraser's book) and is in the process of being reissued (not to mention the similarly titled technical volume *Dawn of the Age of the Dinosaurs in the American Southwest*). Perhaps the alliteration of the title was too tempting to resist. Such minor quibbles aside, *Dawn of the Dinosaurs: Life in the Triassic* is a well-written and reasonably priced book that should appeal to anyone interested in this fascinating period in Earth history.

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Macroevolution. Diversity, disparity, contingency. Essays in honor of Stephen Jay Gould

Elisabeth S. Vrba and Niles Eldredge (eds) (2005). Supplement to *Paleobiology* Volume 31(2). The University of Chicago Press. ISBN 1-891276-49-2 (Paperback), \$25.00/£17.50

In a proclamation of unparalleled ambition, Kurt Vonnegut recently summed up his view of life's purpose in his delightful little book *A man without a country. A memoir of life in George W. Bush's America*: "we are here on Earth to fart around. Don't let anybody tell you any different." There could hardly be a motto less apt in capturing the life and work of Stephen Jay Gould. Spending countless hours hunched behind his trusted typewriter, Gould rang up an impressive grand total



of popular and professional publications of almost 1,000 items (Shermer, 2002). On a webpage (<<http://asrlab.org/archive/jillPage.htm>>) of befriended author and photographer Jill Kremontz (incidentally Kurt Vonnegut's wife) you can see a photo of Gould hammering away at his old Smith-Corona typewriter (sadly, the Smith-Corona company went bankrupt in the mid-1990s, Gould's herculean appetite for typing notwithstanding). I think it is safe to say that with his enormous output, Gould inspired more intellectual work, entertainment, and appreciation of nature's diversity and scientific adventure than any other contemporary professional in the natural sciences.

Macroevolution. Diversity, disparity, contingency is the last time the triumvirate of Stephen Jay Gould, Niles Eldredge and Elisabeth Vrba convenes between the covers of a single book, this time organized as a tribute and farewell to the most prolix of these self-proclaimed musketeers (Gould, 2002). Reviewing this book, however, is no secure as it presents a panorama of breathtaking breadth, taxonomically, geographically, temporally, and conceptually. Twenty-seven authors dish up essays on topics as diverse as the Cambrian explosion, the history of Darwinism, species selection, whale barnacles, the evolution of complexity, the evolution of the nucleus, the neutral theory of biodiversity, the nature of evolutionary stasis, and more. The editors bravely attempted to structure the book into three sections on "Generating disparity," "Generating diversity," and "Macroevolutionary patterns within and among clades," but given the immense scope of the contributions, this is merely one of several possible taxonomies to give the book some semblance of formal organization. However, this is the inescapable result of trying to do justice to the vast domain of Stephen Jay Gould's learning that reduces most conceptual taxonomies to at least some degree of arbitrariness.

For me to expertly review all that lies within the covers of this book is practically impossible for three reasons. First, it would require a contribution equalling the book in length. Second, it would require an erudition of truly Gouldian dimensions; and third, it would not be fair because the contributions that I found most interesting and about which I am least ignorant would disproportionately bear the brunt of my criticisms. As a whole this volume exemplifies the momentous challenges of accurately and reliably reconstructing pattern and process in deep time. And it is without doubt that these challenges are indeed momentous. In a recent lecture I tried to give students some visceral sense of what deep time really means. Familiar metaphors of the relationship between human civilization and deep time, such as the layer of paint on top of the Eiffel Tower, or the impact of a single stroke of a nail file on the length of an extended arm, do convey some sense of the relative insignificance of human time scales in nature's geological theatre, but they are missing the crucial ingredient of time itself. I therefore asked the students to join me on a road trip from hell. Assume you would be able to drive a car into the past at 100 kilometres per hour, with each kilometre representing a century, and further assume that you would drive for eight hours straight every single day, weekends and holidays included. How long, say, would it then take you to get to the Burgess Shale? Travelling with this speed you'd be scarcely off the parking lot before you have reached the time that George W. Bush was inaugurated as president of the USA for the first time, and just 13 seconds into the journey you would pass the point where mankind visited the moon for the first time. After 54 seconds, barely enough time to light your first cigarette or open a Coke, you would whoosh by the year 1859, entering the dark ages of pre-Darwinian superstition. After half an hour you would pass the first evidence of writing and after an hour in the car you may wish to have your first pee break at the Rancho La Brea Tar Pits, California, which started to



trap unsuspecting animals almost 40,000 years ago. After an hour and 18 minutes you would see the first evidence of village life, some 13,000 years ago, and between the second and sixth day of your journey you would be able to witness the evolution of species in the genus *Homo* to modern *Homo sapiens* in the Middle Awash valley of Ethiopia. After approximately two and a half months in the car you would pass the point where the last common ancestors of Bubbles and George Bush separated. Fast-forwarding this journey, it would take you over 17 years to reach the Burgess Shale! And if you would be interested in visiting the time when the major lineages of invertebrates started to diverge, you'd better refuel (although I expect gas stations to be decidedly rare at this time, which actually wouldn't matter that much because by this time the large oil reserves produced by dead organic matter would still be a thing of the future...) and get back into the car for a few more years. So deep time is indeed VERY deep.

It is therefore no wonder that evolutionists sometimes desperately grope around for any props that may assist in hauling them on top of their theoretical edifices. But all too frequently, what first seemed to be secure buttresses, in reality turn out to be treacherous skyhooks, liable to give way at any moment, causing the poor conceptual architects to fall helplessly into a jumbled heap of partial building blocks. But such is the inevitable nature of the game. Out of necessity our motto can often only be "it is because we see little, that we have to imagine much," a phrase coined by the Victorian playwright, actor and polymath George Lewes. Yet, Lewes did not intend this statement as a licence to distort and fabricate, but rather as an inescapable and essential part of the scientific endeavour (Carignan, 2003). And so we weave intricate chains of implications from what is often a less than optimal empirical foundation, so as to arrive finally at 'a' conclusion. However, it should be realized that the strength of any single conclusion of a densely inferential and synthetic analysis depends on the corroboration of the many assumptions that provide the conclusion's life support. Consequently, developing a clear view of the assumptions that feed into the conclusions crowning the papers in this volume is a necessary exercise that provides the error bars required to comprehend how much confidence we may accord the results. And sometimes these error bars turn out to be rather large.

As one example, in a chapter that I enjoyed a lot, Peterson *et al.* provide an elegant hypothesis for early metazoan evolution based on integrating phylogenetic, morphological, fossil, genomic, and molecular clock information. They argue that the earliest triploblasts were small, benthic, directly developing animals with internal fertilization, modelled on the living acoelomorphs (Acoela and Nemertodermatida). However, the rationale presented for extrapolating from acoelomorphs to the earliest triploblasts is that the acoelomorphs are the sister group to the remaining triploblasts. According to the authors this suggests that the last common ancestor of both acoelomorphs and remaining triploblasts is like an acoelomorph. Obviously, both sister taxa are equally informative about their last common ancestor, so this conclusion is really a consequence of arbitrarily labelling one of two sister taxa as 'basal', with its attendant assumptions of primitiveness. This seductive strategy, albeit very common, is theoretically unsupported (Jenner and Wills, in press). Designating basal taxa in this way illegitimately introduces time's arrow where none exists. It is, however, an understandable strategy as a single time axis is indispensable for any narrative, evolutionary or otherwise. It is merely one example of many in the recent literature of what I call 'ancestrology' in the service of supporting evolutionary scenarios. In reality such attempts merely provide skyhooks masquerading as legitimate inferences.

Another example of a hidden error bar from the same paper is the claim that, from the fact “that the earliest known bilaterian macrofossil, *Kimberella*, is a benthic animal,” it can be concluded that “the benthos is the primitive site of animal evolution.” Such attempts to wring water from stones should be approached with great suspicion. The bearing of *Kimberella* on the problem of the earliest triploblasts that the paper estimates must have lived over 20 million years earlier (a road trip of two hundred and fifty days) is not without problems. Given this discrepancy and the vagaries of preservation, to imbue *Kimberella* with this significance seems to me the epistemological equivalent of calling the late night news the first television programme of the day after having just flipped on the television at 11pm.



These examples do show the very real problem faced by all contributors to this book. We need to bridge the gaping ravines that separate islets of empirical data in our quest to understand evolution in deep time. In order to make progress we have to dare to jump. However, jumping without a safety line can be dangerous. But then again, this and the other papers in the book are entirely in the spirit of Gould. Gould himself was certainly never shy to go out on a limb, beyond the safe shores of empirical facts, or even, dare I say, compelling logic. Saying nothing, after all, is the only guarantee of being right. In this sense Gould reminds me of the pathologically prolific historian Roy Porter, who also died too young just two months before Gould. Both Gould and Porter were epitomes of the pursuit of excellence, phenomenally productive (both, incidentally, published their first books in 1977, with Porter publishing his important study on the history of geology), possessed of an enviable writing style, and both pressing an ineradicable stamp on their disciplines. However, their very productivity probably played a role, as they surely must have realized (Allmon, 2002; Neve, 2002), in sometimes producing a less than perfectly polished product. But this observation dissolves into insignificance before the service they did to their disciplines. I think Gould’s greatest contribution to science was to inspire thinking and new research. As Richard Bambach puts it, Gould was “more successful than most in forcing people to improve their thinking” (Princehouse, 2003: 252). The papers assembled in this book are therefore a fitting tribute to the science of Gould, in all their messiness, uncertainty, and potential.

I’d like to end on a personal note. For me Gould was tremendously important. As an undergraduate I bought *Hen’s teeth and horse’s toes*, and was immediately enthralled with Gould’s wide-ranging musings. I soon came to the sad realization, however, that Gould the generalist was in reality a specialist. Especially during my graduate years it became increasingly clear that many colleagues behaved like Darwin’s beloved barnacles. Sturdily attached to a small scrap of disciplinary substrate, scientists all too often surround themselves with the calcified armour of disciplinary specialisation, being merely interested (due to time constraints no doubt) in taking in what is passively delivered by the professional journals in one’s little corner of the trade. Gould, however, behaved more like a rhizocephalan root-head, actively plunging his tentacles deep within the corpus of science and literature, seeking intellectual nourishment anywhere he could, and contributing prodigiously to both professional and popular literature. Remarkably, however,



professional cirripedes in bars over the world sometimes feel it is necessary to declare their superiority over the lowly root-head, who should know better than to dilute his output with popular writings and dare to be famous for it to boot. Perhaps this is the expected behaviour of sessile creatures with enormous penises, but excusable it is not. Two words in conclusion: Gould ruled.

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SPECIAL PAPERS IN PALAEOLOGY | 77

Evolution and palaeobiology of early sauropodomorph dinosaurs

Edited by PAUL M. BARRETT *and* DAVID J. BATTEN



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