PALAEONTOLOGY NEWSLETTER

The Newsletter for members of the Palaeontological Association
Number 38 1998

http://www.nhm.ac.uk/hosted_sites/paleonet/PalAss/PalAss.html

Newsletter copy

Information, whether copy as such or *Newsletter* messages, review material, news, emergencies and advertising suggestions, can be sent in writing to Dr Sue Rigby, Dept of Geology and Geophysics, Grant Institute, West Mains Road, Edinburgh EH9 3JW; fax 0131 668 3184; email `Sue.Rigby@ed.ac.uk`. It would be helpful if longer items of copy could be sent on a $3^1/_2$" disk with text in Microsoft Word, ClarisWorks or ASCII format. Disks clearly marked with the owner's name and address will be returned as soon as possible. The *Newsletter* is produced by Meg Stroud, and printed by Edinburgh University Printing Services.

Deadline for copy for Issue No. 39 is 9th October 1998.

Palaeontological Association on the Internet

The Palaeontological Association has its own pages on the World Wide Web, including information about the Association, and copies of the *Newsletter*. Site-keeper Mark Purnell can be reached by email at `map2@leicester.ac.uk`. The locator is:

`http://www.nhm.ac.uk/hosted_sites/paleonet/PalAss/PalAss.html`

Advertising in the Newsletter

Advertising space in the *Newsletter* will be made available at the rates given below to any organisation or individual provided the content is appropriate to the aims of the Palaeontological Association. Association Members receive a 30% discount on the rates listed.

All copy will be subjected to editorial control. Although every effort will be made to ensure the bona fide nature of advertisements in the *Newsletter*, the Palaeontological Association cannot accept any responsibility for their content.

£75 for half a page £130 for a full page

These rates are for simple text advertisements printed in the same type face and size as the standard *Newsletter* text. Other type faces, line drawings etc. can be printed.

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1100 copies for worldwide distribution	£230
850 copies for worldwide distribution exclusive of North America	£200
600 copies for U.K. circulation only	£150

Front cover: Median section through *Iteria cabaretiana* (d'Orbigny); a nerineoidean gastropod from the Upper Kimmeridgian of the Jura (France). Graphics by Mark Purnell, after a drawing by Mike Barker from an acetate peel. Text graphics by Mark Purnell and Lori Snyder.

PALAEONTOLOGY NEWSLETTER

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No. 38

(The Palaeontological Association is a Registered Charity)

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Reminder

The deadline for copy for Issue no 39 of the *Newsletter* is
9th October 1998

The Palaeontological Association

EXECUTIVE OFFICER

0.5 Full Time

The Palaeontological Association is the largest learned society in Europe dedicated to the promotion and advancement of palaeontology, and a substantial proportion of its members are professional palaeontologists. The Executive Officer will be responsible for managing the finances of the Association, together with marketing, membership (both individual and institutional), general administration and enquiries. The ideal candidate will have experience of operating within a learned society or similar charity, particularly in relation to finances and marketing. Good communication skills are essential and palaeontological experience is highly desirable. The salary will be up to a maximum of £12,500 for the half-time post. He/she will be accountable to the Council and Trustees. The appointments of all paid officers of the Association are reviewed on an annual basis. The successful candidate will work from home.

Please apply in writing with full CV and the names of two referees, to Prof E.N.K. Clarkson, Department of Geology & Geophysics, University of Edinburgh, West Mains Road, Edinburgh EH9 3JW.

The closing date for applications is 31st July 1998.

The Palaeontological Association is a Registered Charity (No. 276369).

ASSOCIATION MEETINGS PROGRAMME

Annual Meeting

University of Portsmouth; 16-19 December 1998

CALL FOR PAPERS

Lectures will be held on Thursday 17th and Friday 18th December. Talks and posters on any aspect of palaeontology are invited. Abstracts of not more than 200 words should be sent to Dr David K. Loydell, School of Earth, Environmental and Physical Sciences, University of Portsmouth, Burnaby Road, Portsmouth PO1 3QL by 18th September. Abstracts sent by e-mail (to `David.Loydell@port.ac.uk`) are particularly welcome. Speakers and poster presenters who are under the age of 30 at the time of the meeting, are members of the Association and wish to be considered for the President's Award and/or Council's Poster Prize, should indicate this when submitting their abstract. If demand is particularly high, lecture duration for some (or all) sessions will be reduced to 15 minutes. There will not be parallel sessions.

The annual dinner will be held on Thursday 17th December aboard H.M.S. Warrior. A reception will be held at the Mary Rose Exhibition (enabling examination of aspects of modern taphonomy!). Field trips to (1) Highcliffe and Hordle and (2) the Isle of Wight will run on Saturday 19th December.

Further details are available from Dr David Loydell or Dr Mike Barker (postal and e-mail address as above, fax +44 (0)1705 842244), and will appear on the Association's Web site during the summer.

The 1999 Lyell Meeting

ORGANISM - ENVIRONMENT FEEDBACKS IN CARBONATE PLATFORMS AND REEFS

1st - 2nd March, 1999
The Geological Society,
Burlington House, Piccadilly

Aims and themes of the meeting

This international meeting aims to bring together palaeobiologists, ecologists and sedimentologists to address questions on how interactions between organisms and environments have generated the variety of carbonate platform facies and geometries seen in the ancient and modern record. All hierarchical levels of interaction are to be considered, ranging from that between organismal growth and ambient conditions, via growth fabric development in response to climate and the provision of accommodation space, to the interplay of global and evolutionary change. Themes will include:

- Ecology and palaeoecology of benthic faunas particularly factors influencing growth fabric genesis
- Processes and rates of skeletal growth, bioerosion and sediment production
- Taphonomy of reef fabrics and sediments
- Sequence stratigraphy of carbonate systems and its bearing on reefal development within them
- Regional to global environmental change and associated patterns of evolution and extinction
- Contribution of carbonate-carbon burial in the global carbon cycle budget and climate feedbacks

Keynote addresses

Keynote speakers include Peter Glynn (Miami, USA), Wolfgang Schlager (Amsterdam, Netherlands), Wolf-Christian Dullo (Kiel, Germany) and Jean-Pierre Masse (Marseille, France)

Call for papers

Oral and poster presentations addressing these themes are invited. Papers dealing with patterns and processes, concepts and dynamics are particularly welcome. Abstracts (no longer than 400 words) should be sent to Enzo Insalaco by 1st October 1998.

Conveners

Dr. Enzo Insalaco (The University of Birmingham)
Dr. Peter Skelton (The Open University)
Dr. Tim Palmer (The University of Wales, Aberystwyth)

Sponsors

The Palaeontological Association
The Geological Society
The British Micropalaeontological Society
The Palaeontographical Society

For further information contact Enzo Insalaco, School of Earth Sciences, The University of Birmingham, Edgbaston, B15 2TT, UK (Tel: 0121 414 6163; e.insalaco@bham.ac.uk).

ASSOCIATION BUSINESS

Report of the Annual General Meeting

At the AGM on Wednesday 14th March 1998 the amendments to the constitution and alterations to subscriptions, outlined in *Palaeontology Newsletter* Number **37**, were approved unanimously. A copy of the new constitution is included within this newsletter.

Council 1998-1999

Changes to Council

At the AGM, Prof. D. Edwards FRS (President) and Dr P.D. Lane (Vice-President) retired from Council and the following were elected:

President:	Prof E.N.K. Clarkson (University of Edinburgh)
Vice President:	Dr R.M. Owens (National Museum of Wales)
Editor:	Dr J. Clack (University of Cambridge)

Continuing Members of Council 1998-1999

Vice-President: P. Doyle

Treasurer: Dr T.J. Palmer

Membership Treasurer: Dr M.J. Barker

Institutional Membership Treasurer: Dr J.E. Francis

Secretary: Dr M.P. Smith

Newsletter Editor: Dr S. Rigby

Newsletter Reporter: Dr P. Pearson

Marketing Manager: Dr A. King

Publicity Officer: Dr M.A. Purnell

Editors: Dr B.M. Cox, Dr D.A.T. Harper, Dr A.R. Hemsley, Dr D.M. Unwin, Dr R. Wood

Other members: Mr F.W.J. Bryant, Dr M.J. Simms

Nominations for Council 1999-2000

At the AGM in March 1999, P. Doyle (Vice-President), T.J. Palmer (Treasurer), M.J. Barker (Individual Membership Treasurer), J.E. Francis (Institutional Membership Treasurer), A. King (Marketing Manager) and B.M. Cox (Editor) will come to the end of their terms of office. The appointment of an Executive Officer (see this issue) will replace some of these posts on Council, and at the AGM the following vacancies will occur:

Vice-President, Honorary Treasurer, Editor, Ordinary Members (x3)

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.

Nominations must be accompanied by the candidate's written agreement to stand for election and a single sentence describing his/her 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."

The closing date for nominations is Wednesday 30th September 1998. They should be sent to the Secretary: Dr Paul Smith, School of Earth Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT.

Sylvester-Bradley Awards 1999

Applications are now invited for the 1999 Sylvester-Bradley Awards. Up to five awards will be made in 1999 to assist palaeontological research (travel, visits to museums, fieldwork etc.), with each award having a maximum value of £500. Preference will be given to applications for a single purpose (rather than top-ups of other grant applications) and no definite age limit is applied, although some preference may be given to younger applicants or those at the start of their careers. The award is open to both amateur and professional palaeontologists, but preference will be given to members of the Association. The closing date for the 1999 award round is Monday 30th November 1998. The announcement of recipients of the awards will be made at the AGM in March 1999, following a decision by Council. Application forms may be obtained from the Association's Web site or from the Secretary: Dr Paul Smith, School of Earth Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT.

Mary Anning Award 1999

Council has decided that the Amateur Palaeontologist Award will be renamed the Mary Anning Award. The award will be 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.

The closing date for the 1999 Mary Anning Award is Monday 30th November 1998. The award will comprise a cash prize plus a framed scroll. It will be presented to the winner at the AGM in March 1999. Nominations should comprise a short statement (up to one page of A4) outlining the candidate's principal achievements. Members putting forward candidates should also be prepared, if requested, to write an illustrated profile in support of their nominee. Please send your nominations to the Secretary.

Dr Paul Smith (Secretary)

NEWS

Recent Palaeontology Publications from the Geological Survey of Canada:

Bulletin 428. Toarcian (Early Jurassic) ammonoids from western North America; G.K. Jakobs. 1997. $17.00 (*$22.10).

Bulletin 502. Taxonomy and biostratigraphy of Middle and Late Triassic elasmobranch ichthyoliths from northeastern British Columbia; M.J. Johns, C.R. Barnes, M.J. Orchard, 1997 $31.60 (*$41.10).

Bulletin 503. Atlas of common benthic foraminiferal species for Quaternary shelf environments of western Canada; R.T. Patterson, S.M. Burbidge, J.L. Luternauer. 1998. $17.45 (*$22.70).

Bulletin 511. Biostratigraphy and systematics of Upper Carboniferous Cerioid rugose corals, Ellesmere Island, Arctic Canada; E.W. Bamber & J. Federowski. 127 p. $25.60 (*$33.30).

Bulletin 512. Geology of Hvitland beds (Late Pliocene), White Point Lowland, Ellesmere Island, Northwest Territories; J.G. Fyles, D.H. McNeil, J.V. Matthews, Jr., R.W. Barendregt, L. Marincovich, Jr., E. Brouwers, J. Bednarski, J. Brigham-Grette, L.E. Ovenden, K.G. Miller, J. Baker, E. Irving. 1998. $17.50 (*22.75).

Bulletin 513. Late Ordovician brachiopods and biostratigraphy of the Hudson Bay Lowlands, Manitoba and Ontario; J. Jin, W.G.E. Caldwell, B.S. Norford. 1997. $21.85 (*$28.40).

Bulletin 522. Middle Devonian brachiopods, conodonts, stratigraphy, and transgressive-regressive cycles, Pine Point area, south of Great Slave Lake, District of Mackenzie, Northwest Territories; A.W. Norris and T.T. Uyeno. 1998. $31.75 (*$41.25).

Bulletin 523. Paleocene-Pliocene deltaic to inner shelf palynostratigraphic zonation, depositional environments and paleoclimates in the Imperial Adgo F-28 well, Beaufort-Mackenzie Basin; G. Norris, 1997. $17.90 (*$23.30).

* price for orders shipped out of Canada, not including shipping and handling

Publications can be ordered from:
Geological Survey of Canada (Calgary), 3303 - 33 Street NW, Calgary, Alberta T2L 2A7
tel (403) 292-7030, fax (403) 299-3542, e-mail `gsc_calgary@gsc.NRCan.gc.ca`

For Catalogue of Publications, Information Circular and Contributions to Outside Publications, see:
`http://www.nrcan.gc.ca/gsc/gicd/pubs/publish3.html`

CRICKET AND COPE'S RULE

Grandpa Fred used to talk of the cricketers of the past with reverence and awe. He was especially proud to have witnessed the great Australian batsman Don Bradman score a century at Lords in the 1930s. This was by no means unusual. The Don's batting average in his 52 Test matches (internationals) was an astonishing 99.94. The nearest to him in history is the South African R.G. Pollock at a "mere" 60.07, and he played in less than half the number of games. Fred always insisted that today's cricketers are not quite up to the heroic standards of the past. But is it true? And what has it got to do with fossils?

Fans of the American palaeontologist and popular writer on evolution Stephen Jay Gould will know that he has a talent for illustrating important concepts using esoteric subjects. On the occasion of his presidential address to the Paleontological Society 10 years ago, Gould chose to talk about baseball statistics (an updated account can be read in his recent best-seller "Life's Grandeur", available in all good bookshops). Baseball is of course a variant of rounders. Gould focused on the phenomenon of the "0.400 hitter". Once upon a time, this score was a mark regularly achieved by the best. But since the 1930s, it has been a rarity, and now it seems to be entirely extinct. So have the batters gone soft?

Gould argues his case as follows. At first sight, we are naturally tempted to agree with the old timers and admit that there has been a general decline in hitting standards. But let us not forget that what is being considered is merely the tail-end of a statistical distribution. We should not think of 0.400 hitting as a "thing" in itself (as Plato would have viewed it, according to Gould, had he been interested in baseball). If we look at the average of all the data, not just the top scores, we find no significant change. All that has happened is a reduction in the variance (that is, the spread of the data).

Why? Gould argues that the lack of 0.400 hitters today reflects an overall improvement in the standard of the game. Modern players are better trained, fitter, more dedicated, better rewarded, better equipped, tactically more sophisticated, and have a greater pool of baseball lore to draw on. Consider just one example. One day on the practice ground, maybe by accident, somebody invented a new way of pitching the ball called the "split fingered sideball". This cunning delivery, which sounds as if it might be a distant cousin of the googlie, was immediately seized upon, experimented with, emulated, and honed to perfection. Nowadays, to the irritation of the batters, any pitcher worth his salt can produce one to order. The recent appearance of "reverse swing" in cricket tells a similar story. As Gould himself says, "slowly, by long distillation of experience, players moved toward optimal methods of positioning, fielding, pitching, and batting". Everyone is now so uniformly skilful, it is more difficult to excel relative to the rest than it once was.

This surely makes a great case study in progress, with standards driven gradually onward and upward by competition for fame and dollars in a process very like natural selection (i.e. the discovery of new tactics and their selective retention and refinement). Not for Gould. He believes that progress is a "noxious, culturally embedded, untestable, nonoperational, intractable idea that must be replaced if we wish to understand the patterns of history", and that natural selection makes "no statement whatever about progress".

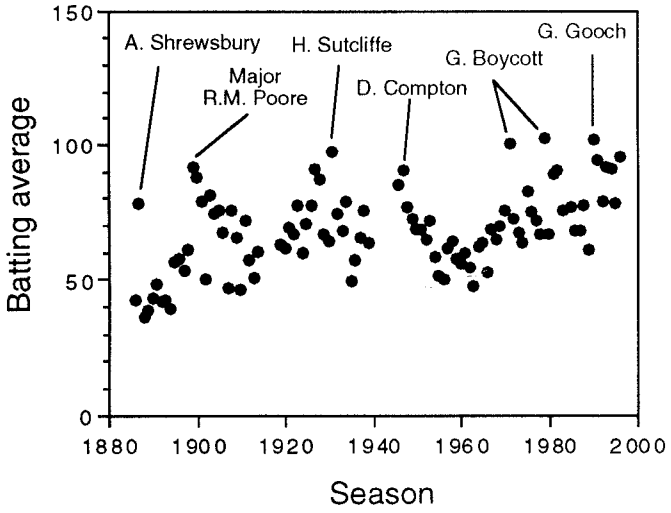
To explain Gould's message, it is at last time to turn to palaeontology. In the previous century, Edward Drinker Cope (who is never referred to simply as Edward Cope) claimed that body size in mammals tends to increase with evolution. Cope's rule of size increase is the most famous of the many supposedly "progressive" patterns of evolution that were widely accepted until the 1970s. Then Steve Stanley

proposed a different explanation. If we look at any clade (that is, a group of related species - horses, rhinos, whatever) we see them diversify through time from a single ancestral species, which is often quite small. Some species in the group will evolve to bigger size, some smaller. If we simply concentrate on the biggest at each time interval, they will of course appear to "increase" in size because there are more species to choose from in a diversifying clade. This will occur even if there is no net tendency towards bigger size at the time of speciation. In a sense we have been duped by concentrating on the tail-end of the data, as we were in the baseball scenario.

Gould seeks to generalise "Stanley's Rule" to life as a whole. When we look at the history of evolution we are tempted to recognise intrinsic trends towards higher organisation, complexity, encephalisation or whatever. But what is really happening is just an increase in the variance. Hence the denial of progress.

The problem with this is that Stanley's effect works whether or not there is an actual trend towards larger size at speciation. It is not in itself a refutation of Cope's Rule, just one plausible explanation for the pattern. What is needed are detailed statistical studies of pairs of fossil species, ancestors and their descendants. A definitive study of body size evolution in mammals at last appeared very recently (in May of this year) in what I think is going to be one of palaeontology's classic publications (*Science*, vol. 280, pp 731-734). John Alroy of the US National Museum considered over 1,500 North American mammal species and compared the body size (as estimated from tooth size) of inferred ancestral and descendant species pairs. He found that there was an average increase in size of a whopping 9% associated with speciations, thus vindicating Cope (and many others too). Alroy's study might be telling us something profound about evolution. At the very least, it tells us that Stanley's effect is not the whole explanation for Cope's Rule, and likewise it may not be the explanation for the increasing complexity of life either.

However we interpret the patterns of evolution, Gould's baseball statistics remain interesting (perhaps not to everyone I admit). His study inspired me to make my librarian's day by ordering every copy of Wisden's Cricket Almanac since the last century. Have top batting averages declined over the years, just as in baseball? Consider the data:



Onward and upward? Top domestic (1st class) batting average in each season since records began

We see that if anything there is a general increase in the top average, the highest being Geoffrey Boycott's 102.53 in 1980 (note that this is domestic cricket, not the more demanding international game as in Bradman's 99.9). All the lowest scores occurred in the last century.

Can we use the cricket data to make the claim that batsmen have improved year on year? Probably not. I agree with Gould that we really should look at the whole data set, not just one extreme, but that would be very time consuming. In any case, there have been so many rule alterations and changes in the length and type of match being played that I hesitate to come to any conclusion at all. Nevertheless, if we cast our mind back to that antique film of the portly W.G. Grace standing on one foot and wafting his bat around at 45 degrees from the vertical, it is not difficult to imagine what would happen if he had to face a few balls from the likes of Curtley Ambrose.

Paul Pearson
University of Bristol

SYLVESTER-BRADLEY REPORT

Sylvester-Bradley Award 1997

The Ichnology of the Robledo Mountains Ichnofauna: using fossil trackways to assess the diversity, palaeoecology and behaviour of Permian Arthropods

The Robledo Mountains ichnofauna of southern New Mexico is the most abundant and diverse assemblage of Lower Permian terrestrial trace fossils in the world (MacDonald 1994). Although the vertebrate trackways have received the most attention, the invertebrate trackways are equally diverse (e.g. Braddy 1995, in press). The traces occur within the Abo Tongue Member of the Hueco Formation (Late Wolfcampian, Lower Permian), representing a marginal marine setting including tidal flats, non-marine red beds and possible freshwater conditions. The arthropod trackway ichnogenera include Diplichnites, Diplopodichnus, Dendroidichnites, Paleohelcura, Octopodichnus, Permichnium, Palmichnium, Kouphichnium (Braddy 1995), Eisenachichnus, Robledoichnus and Shalemichnus (Kozur and Lemone (1995), Isopodichnus, Pterichnus and Punctichnium (Braddy, in press), representing a diverse arthropod community including myriapods, scorpions, spiders, eurypterids, xiphosurans, crustaceans and several morphologies of insect.

This award enabled the Robledo Mountains ichnofauna (c. 500 invertebrate traces in the New Mexico Museum of Natural History and Science (NMMNH&S) collection) to be studied in detail and allowed the collection of new material from the 'insect hill' and 'conifer forest' localities, which have produced most of the best invertebrate traces. This work has enabled various new ichnotaxa to be described, including new ichnospecies of insect resting trace (two discovered during my fieldwork), and various enigmatic arthropod trackways. In addition to the exciting new discoveries of invertebrate ichnotaxa, various traces catalogued as 'invertebrate' within the NMMNH&S collection were reinterpreted as vertebrate traces. These traces include a trail probably made by a larval amphibian and various examples of side-winding snake-like trails, possibly produced by a limbless reptile or amphibian (e.g. aistopod).

This work has greatly increased our knowledge of Lower Permian terrestrial trace fossils (arthropod and vertebrate) and contributed towards our understanding of the diversity and palaeoecological distribution of Late Palaeozoic terrestrial arthropods. This work is ongoing, and further analysis of the data collected is still required, including computer modelling to help investigate the types of arthropods responsible for these trackways. One paper has already been produced (Braddy, in press) and further publications will follow on the descriptions of the new vertebrate and invertebrate ichnotaxa in this ichnofauna and comparisons with other (European) ichnofaunas. The potential of the Robledo Mountains ichnofauna has by no means been exhausted. Considerably more collecting can be done and some localities have received only a superficial examination. It is likely that the Robledo Mountains ichnofauna will contribute as much to studies of Lower Permian terrestrial arthropod trace fossils as the Burgess Shale has advanced studies in Cambrian arthropod diversity.

This research was supported by a Sylvester-Bradley Award 1997. It forms part of a larger project on Palaeozoic terrestrial arthropod trackways, funded by the Leverhulme Trust (awarded to D.E.G. Briggs, University of Bristol).

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Braddy, S.J. 1995. A new arthropod trackway and associated invertebrate ichnofauna from the Lower Permian Hueco Formation of the Robledo Mountains, southern New Mexico. In: Lucas, S. G. and Heckert, A. B (eds). Early Permian Footprints and Facies. New Mexico Museum of Natural History and Science Bulletin, 6, 101-105.

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Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, UK.

Palaeo-Comment

Graham Budd, in his description of the Palaeontological Association meeting (PalAss *Newsletter* **37**, 1998) commented with approval on Richard Fortey's most recent efforts in his Quixotic "Save the British Ordovician" campaign (p. 29-30). Evidently Richard and Graham are not alone in their belief that "certain of our colleagues from across the Atlantic" have in mind a wholesale replacement of British Ordovician series. Dr. P.M. Allen, Chairman, BGS Stratigraphy Committee, in October of 1997 wrote an impassioned letter to his colleagues in the EuroGeoSurveys (an association of EU geological surveys), expressing his dismay at the attempt said to be afoot in the IUGS to introduce American names for chronostratigraphic units to be used in the emerging global time scale. In the face of this consternation among my British friends and fellow Palaeontological Association colleagues, I would like to comment on this situation from my perspective from across the Atlantic. I believe that recent IUGS actions and discussions leading up to those actions do not support this fear. I make this claim based on my experiences as a member of the Ordovician Subcommission and someone who worked actively with the issues surrounding the Llanvirn Series.

Adoption of the Darriwilian Stage

The interval traditionally recognized in Great Britain as the Llanvirn falls within the span of the Darriwillian Stage, recently adopted by the IUGS as the second stage of the Middle Ordovician Series. The GSSP for the Darriwilian stage is a section exposed at Huangnitang, in the Zhejiang Province of south east China ("JCY area," so called for the county towns of Jiangshan, Changshan, and Yushan that surround the stratotype section). The work leading up to this proposal was organized by Professor Chen Xu, of the Nanjing Institute of Geology and Palaeontology, Academia Sinica, in direct response to discussions of the Ordovician Subcommission, "Llanvirn boundary working group" convened by David Bruton, particularly discussion that took place at the Sidney Australia meeting of the Sixth International Symposium on the Ordovician System (see *Ordovician News* No. **9**, pg. 17, 1992). In addition to Chen Xu and myself, the scientists who joined the JCY working group were Zhang Yuandong, Wang Zhi-hao (both of the Nanjing Institute of Geology and Palaeontology, Academia Sinica, China), Stig M. Bergström (the Ohio State University, USA), Donald Winston (University of Montana, USA), Florentin Paris (Université de Rennes, France), and Jörg Maletz (Universität Greifswald, Germany).

In July of 1996 the Darriwilian GSSP proposal was overwhelmingly approved by the voting members of the Ordovician Subcommission (17 votes in favour, 1 against, 2 abstentions, and 1 no response, for a 94% majority). Subsequently, the Darriwilian GSSP was also approved by the ICS, and finally, ratified by a unanimous vote of the IUGS Executive Committee at its January, 1997 meeting. Much of the work leading up to this decision as well as discussion of alternatives more in keeping with the traditional sense of the Llanvirn were described in issues of the *Ordovician News* and in letters circulated among the members of the Llanvirn boundary working group. The Darriwilian Stage, traditionally based on rocks in Australia, may be in some sense from "across the Atlantic," but it is certainly not North American.

Neither, I submit, does the sequence of events described above look much like the operation of an American conspiracy. My impression of the current efforts of the "Arenig Working Group" to find a suitable GSSP for the stage to be fixed at the base of the *Tetragraptus approximatus* Zone is similar

(see for example, *Ordovician News*, No. **14**, p. 33-51). The leading candidate sections are in Newfoundland, championed by Henry Williams and Chris Barnes, and in Sweden, promoted by Jörg Maletz, Anita Löfgren, and Stig Bergström; a group that contains one Canadian and one adopted American among them.

Why not retain the name Llanvirn?

Graham Budd suggested that there were a "myriad of historical, aesthetic, and scientific reasons why one might wish to retain terms like Llanvirn" (PalAss *Newsletter*, p. 29-30). First the name is not lost. It presumably will remain in use in the United Kingdom as a local series name – albeit not in its traditional sense, given the recent changes introduced by British geologists.

Secondly, it seems to me that the value of an historical name attaches primarily to the continuity of meaning and understanding it carries with its familiar sound. If this meaning is changed markedly (as the Llanvirn would be – first dragged upwards to include the Llandeilo and then downwards to include most of the Fennian), then the very familiarity of the name works against understanding. How many students still today find themselves baffled when they discover seemingly familiar Ordovician units referred to in the older literature as Lower Silurian? Does this reflect a different view of the correlation of the units or the use of the terms? It takes great effort to sort this out. Furthermore, new usages spread slowly through the literature so that not even the age of the reference is of much help. As late as 1912, Rudolf Ruedemann published a description of Caradoc-age strata in New York State under the title "The Lower Siluric Shales of the Mohawk Valley." I understand the attraction of the familiar, but I much prefer the clarity of a new name to the familiar sounding, but silently altered term that hides its strangeness. At least when I encounter a new name I am certain that I do not know what is meant, and so am forewarned to do my homework. The JCY Working Group chose the name Darriwilian because of its historical importance within the Ordovician of the Pacific region, where its GSSP is located. Thus, it is not an entirely unfamiliar name depending on your country of origin and area of expertise. But more importantly, we chose it because its historical usage fit precisely the biostratigraphic scope of the proposed unit: its familiarity rings true.

Finally, although some may see the forsaking of the term Llanvirn as a national insult, I think this is precisely backwards. What could be more disrespectful than to take a nationally valued term, change its meaning to something quite different and ill-suited to its original use, and then tell the original owners they've been honoured? Expanding the Llanvirn downward to the base of the *Undulograptus austrodentatus* Zone moves the base of the unit downward into the Arenig by nearly an entire stage – down to a level where graptolites are very rare in the Welsh succession and from which the zonal indices have never been reported. British geologists would be faced with the Stage the base of which they can not locate precisely, and the apparently familiar name of which is fixed to a Chinese GSSP and defined on the basis of a set of fossils that are largely absent from the historical type area of the unit! Yet this is the unit that has proved to be the most useful in this interval for international correlation. As the old saying goes, be careful what you wish for!

Science and Nationalism

Concerns of national pride and personal prestige are clearly significant motivators in all scientific work. It is fully appropriate that we should each champion our local sections, regional units, and favourite fossils. However, once a GSSP proposal is submitted, the appropriate role of nationalism is ended. The British Ordovician series have indeed served long stead as an international lingua franca,

and it is widely accepted that in the interests of effective scientific communication we should employ these terms wherever possible. However, the British series names will become a part official international standard only to the extent that concerned scientists document their case. Although it was perfectly clear to the entire Ordovician Subcommission membership that a decision on the *U. austrodentatus* Zone versus *D. artus* Zone issue was immanent, no serious scientific case was put forward for the traditional Llanvirn. The membership of the various Ordovician Subcommission working groups appears to me simply to reflect the nature of the particular population of folks working on the various levels and the inclinations of these folks to invest their time in the hard work of boundary definition. If you would like to see a different outcome, you are going to have to get more involved in the process.

National Sovereignty

Another concern that I have heard expressed is that individual countries should not be dictated to about what names they should apply to their own rocks on their own maps. Fair enough. Local stage and series names rightly should be retained to meet local needs. However, so far as I know, no one is obliged to employ the international units where they are not useful, or at all for that matter. Similarly, we are free to speak our own languages (say Esperanto, for example) in our own countries. But, if we want to be understood among the non-Esperanto-speaking world-at-large, we are obliged to provide some translation as well. This and no other is the purpose the international units serve. If, as is our privilege, we choose simply to carry on in our own private language and not provide that translation, we will then be wrong to blame anyone but ourselves for the lack of understanding we receive in return.

Dr. Charles E. Mitchell,
Professor, Department of Geology, State University of New York at Buffalo, Buffalo, NY 14260, USA.

Palaeo-Reply XCVII

A.E. Trueman and Liassic Oysters: Lies? – Damned lies? – Statistics? – Or perhaps, simply stimulating specimen-based research!

In one of his remarkably catholic and incisive monthly essays reflecting on 'this view of life', Steven Jay Gould (1981) commented that "In 1922, British palaeontologist A.E. Trueman published the most famous paper of our century on a supposedly unbroken lineage of evolving fossils". This, of course, is a reference to Trueman's work on his interpretation of evolutionary coiling in early Jurassic oysters and the inferred orthogenetic progression from *Ostrea* [*Liostrea*] through successive species of *Gryphaea*. To be sure, Gould then went on to describe how Trueman's conclusions had been shown almost 40 years later to be erroneous, but few would dispute the 'fame' of the 1922 paper and its stimulus towards palaeontological thinking and research.

Now, however, Professor Tony Hallam (***Palaeo***-Comment, *Newsletter*, **37**, pp.22-23) has cast an amazing slur at Trueman's work, not because of the scientific conclusions but because of the veiled assertion "that Trueman had concocted the whole story" as there were no specimens "that he claimed to have collected" in support of his results. According to Hallam, following his own research via institutions in Swansea, Glasgow, Cardiff and London, there simply "was no Trueman collection".

Nonsense (fact not interpretation).

Obviously Prof. Hallam did not pursue his quest to find a Trueman collection with quite the same zeal as he now reports the 'concoction' theory. I don't know who he contacted in the Department of Geology at University College of Swansea (presumably in the later 1950s) but there were enough people there who certainly knew the true story – including well known palaeontologists/stratigraphers like the late T.R. (Dick) Owen and V.G. (Vic) Walmsley, plus F.H.T. (Frank) Rhodes who joined as Professor following the death of Duncan Leitch. They were all certainly aware of the scope and extent of the palaeontological collections, not only because they were used for teaching but also because much of the material was meticulously catalogued, in three large, foolscap, hard backed ledger volumes. Each group of fossils had an identification code, with the letter L prefixing the numbered sequence of *Lamellibranchiata*.

The catalogues were started by Trueman himself when he became the first Professor at Swansea in 1921, arriving from Nottingham, briefly via Cardiff. Most of the early entries are in Trueman's own fine, neat small handwriting – a testimony to the value he placed on building up well documented collections for research and teaching. He clearly brought material with him from his Nottingham days, including Liassic oysters. In fact in the lamellibranch catalogue there are over 20 pages of entries by Trueman, totalling some 600 specimens. Many are specimens identified as *Gryphaea* and *Ostrea*, from well-known lower Jurassic localities throughout the U.K. and abroad, including Nottinghamshire, Yorkshire, Somerset, Dorset, Lincolnshire, Gloucestershire, etc. On one page is an entry simply labelled the '*Ostrea-Gryphaea Series*'.

If Professor Hallam had pursued his enquiries even more assiduously at Swansea he would have discovered the late Trevor Marchant, then the Senior Technician in the Department, who had joined as a junior on the same day as Trueman over 30 years previously. Trevor would have delighted in telling his stories of how he and Trueman cycled regularly the 35 miles or so from Swansea to the Vale of

Glamorgan to map out the Liassic rocks, and of course to collect fossil oysters from such well known localities as Nash Point, Llantwit Major and Southerndown.

Over the years many of the collections became incorporated in teaching sets, but nevertheless, basement store cupboards continued to hold large collections of 'reserve and study material'. Beginning in 1970, material identified via the catalogues as including type and figured specimens was transferred to the National Museum of Wales in Cardiff, and this exercise was completed following the eventual closure of the Swansea department. Today in Cardiff there are four drawers of Jurassic oysters from Swansea, some still bearing the original L catalogue code. Some have labels in Trueman's handwriting. I should also add that there are also Jurassic ammonites and many Upper Carboniferous bivalves transferred from Swansea, again reflecting Trueman's care and methodical book-keeping of his substantial collections. The original catalogues are now also in Cardiff.

In his critical remarks, Tony Hallam states that Trueman claimed "it was necessary to collect at least 50 specimens from each horizon". In fact this is also not so, because what Trueman emphasised in 1922 was that in "using *Gryphaea* **in the field** [my emphasis] it is advisable whenever possible to record the coiling of not less than fifty, and preferably more than a hundred, adult specimens, from a particular horizon … and it is not usually necessary to preserve large numbers of specimens". It is easy to forget that Trueman's paper was not written as a study in evolutionary theory, but as an analysis of temporal changes in *Gryphaea* for use in correlation; he saw the exercise as a tool for use in the field. The generation of large collections to take back to Swansea was not then of prime importance; nevertheless, the catalogued evidence outlined above indicates that substantial collections were a product of the exercise.

In his own comprehensive paper on *Gryphaea* published by the Royal Society in 1968, Hallam reports that his work "entailed the collecting and measurement of over a thousand specimens". In the infancy of statistical palaeontology 46 years earlier, in an exercise designed for biostratigraphy, Trueman's paper of 1922 seems to me to be 'not a bad effort', especially when his collections in those 'primitive' days provably numbered in the hundreds. I note too that even with his greater amount of statistical data, Hallam's 1968 conclusions still accepted Trueman's views that Liassic *Gryphaea* "has no close relationship to the Triassic gryphaeas but evolved from *Liostrea* in the only region where it is abundant, namely north-west Europe". This is not quite in keeping with his comments (***Palaeo***-Comment) that "within a few years … diminutive *Gryphaea* … were reported from the Upper Triassic of the Arctic … [having] evidently migrated into the British area in the late Hettangian, as I had maintained". Those 'few years' allowed Prof. Hallam access to a whole range of world-wide data that it would have been inconceivable for Trueman to dream of in the 1920s. Trueman's conclusions are now well and truly laid to rest, and rightly so in the light of properly researched modern data; this is exactly how research should progress and should not belittle pioneering studies. In this case the facts of Trueman's collections speak for themselves, and Prof. Hallam's lack of knowledge in this regard does nothing to justify his ill-founded comments. For my part, I return to Steve Gould's remark as to the 'fame' of Trueman's paper; would it be that any of us could engender such stimulating debate that enlivened and enhanced palaeontology for over 25 years from the late 1950s, and in which Prof. Hallam played such a leading role as to make his recent assertion unnecessary, at best … let alone incorrect.

Michael G. Bassett
National Museum of Wales

Palaeo-Reply XCVIII

Tony Hallam's calumnious attack on Sir Arthur Trueman (*Newsletter*, **37**, 22-23) is surely unworthy of any scientist. It is all too easy to be wise after the event. To Trueman, observing that the beds below those of the Blue Lias yielding the incurved *Gryphaea* were full of flat and often curved *Liostrea*, it seemed a logical conclusion that the former had evolved from the latter. Trueman's (1922) paper was a classic because it was one of the first published documented cases of evolution, and the conclusions seemed reasonable at the time. The fact that no-one challenged the work for 37 years until Hallam (1959) demonstrates that it had considerable acceptance. We all know now that Trueman's statistics were flawed and that in any case *Gryphaea* was an immigrant from the Arctic, but this does not mean that Trueman did not do the research, as Hallam implies – in fact this is how science advances, by putting up hypotheses which are then subject to test, and if found unable to withstand a test, rejecting them in favour of better hypotheses.

As for the claim that the collections never existed – this is another calumny. When I joined the Swansea Geology department in the early 1960s, Trueman's *Gryphaea* collection was stored along with all the other of Trueman's and the other research collections. Trueman probably started the collections for this work whilst he was on the staff in Cardiff; he went to the Chair of Geology in Swansea in 1920, and one of his first appointments was a junior technician. This man, the late Trevor Merchant, who went on to be Chief Technician, told me how he used to cycle out to the Vale of Glamorgan cliffs collecting *Gryphaea* for Trueman and came back regularly with his rucksack laden with specimens. During the 1970s and 1980s Vic Walmsley and I oversaw the transfer of the Swansea research collections (including the Trueman *Gryphaea* collection, the Tutcher and Trueman Radstock ammonites and the Trueman and Davies Westphalian bivalves) to the National Museum of Wales where they remain to this day.

I am sure that if Tony Hallam had asked to see these collections there would have been no problem – everyone in the department, headed at that time by Frank Rhodes, would have known where to find them. Trevor Merchant served for 53 years (1920-1973) in the department, and was around when Hallam was doing his *Gryphaea* work. The former departmental curator, Mr H.A.H. (Bert) McKee, tells me that no-one requested sight of, or borrowing rights to, these *Gryphaea* collections, and that he would have remembered had anyone done so. He was on the staff from 1956 until the 1980s.

Thus it seems that Tony Hallam's memory is at fault here, as I suspect it may be over his report on L.R. Cox's remarks about Trueman. I find it scarcely credible that such an ingenuous man as I knew L.R. Cox to be could have said what he is reported to have said.

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MEETING REPORTS

Palaeontological Association Review Seminar: Molecular Phylogeny

Cambridge

4 March 1998

"Forget fossils, the key to understanding the explosion of animal life half a billion years ago lies in our genes" New Scientist 18th October 1997, p. 30. Whilst overblown statements like this in popular magazines will obviously grate on many members of this Association, we must be aware of the multitude of developments in the genetic and molecular fields, and how a marriage of palaeontological, morphological and molecular data can provide solutions to many problems, and pose numerous questions the resolution of which may lie in the fossil record. This was a theme that was taken up by many of the speakers at this recent PalAss review seminar.

Cautionary tales abounded, highlighting the need to use all available data, rather than excluding either morphological or molecular information; the methodology of combining datasets and testing resultant cladograms being elegantly discussed in Andrew Smith's (NHM) presentation on various approaches to echinoderm phylogenies. Metazoan and arthropodan diversifications provided the basis for talks by Andre Adoutte (Paris Sud), Mike Akam (Cambridge) and Simon Conway Morris (Cambridge). Adoutte discussed many aspects of metazoan molecular phylogenies, with particular emphasis on the use of 18sRNA and Hox genes in resolving relationships within the [[Lophotrochozoa, Ecdysozoa]Deutrostomata]. What was particularly interesting about this presentation was the suggestion that these lineages diverged roughly 650 Mya – but the Cambrian 'explosion' is evident in all three, probably demonstrating the influence of external selection pressures. The role that Hox gene expression played in the development of arthropodan bauplans formed the basis for Akam's talk, with emphasis placed upon tagmosis and its intimate link with Hox differentiation, and how it is possible to use Hox deployments to explain arthropod diversity during the Cambrian and their subsequent Phanerozoic record.

Vertebrates made an appearance after lunch, with Charles Marshall (UCLA) discussing the ins and outs of character evolution with several examples from the vertebrate record, and how morphological and molecular approaches may be used to test phylogenies. Erika Hagelberg (Cambridge) showed how mtDNA provided evidence for the human settlement of the Pacific during the Pleistocene, where the overwhelming evidence suggested that the message was to "Go East".

Simon Conway Morris brought the formal session to a close, with a talk highlighting the molecular problems that palaeontology may be able to solve. Included amongst these are congruence between molecular clock and fossil based divergence times, and how certain 'weird' molecular trees may be resolved by palaeontological research. This may be particularly important when one considers the depaupaurate nature of many extant phyla.

Following these presentations, the peace and harmony between the palaeontological and genetic camps started to fracture (for those of you who weren't there, the general tone of the conversation can be gathered from the numerous discussions about molecular phylogenies on the `vrtpalaeo` or `palaeo` listservers). I guess that we will see a lot of this until both communities realise that neither has the ultimate answer and that combined work really is the future.

The local organisers had assembled an impressive list of speakers, and the only complaint can be the relatively limited pre-publicity, which led to a somewhat geographically restricted audience of 48. Undergraduates and researchers alike had much to gain from this meeting, which, after all, is the main aim of these meetings.

Dr. Ivan J. Sansom,
School of Earth Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT

FUTURE MEETINGS OF OTHER BODIES

International Symposium: Palaeodiversifications, land and sea compared
Lyon, France
6 – 8 July 1998

The Conference is held under the auspices of the UMR 5565 of the CNRS and is organised by Mireille Gayet, UFR des Sciences de la Terre, Université Claude Bernard, Lyon I, 27-43 bd du 11 novembre 1918, 69622 Villeurbanne cedex, France (tel +33 (0)4 72 44 83 98, fax +33 (0)4 72 44 84 36, e-mail gayet@univ-lyon1.fr or lysiane.thevenod@univ-lyon1.fr).

5th International Symposium on the Jurassic System
Vancouver, B.C., Canada
17 – 20 August 1998

Organised by the IUGS Jurassic Subcommission. There will be pre- and post-meeting field trips to the Canadian Rockies, the Coast Mountains, the Queen Charlotte Islands and Nevada. Contact Paul L. Smith, Earth and Ocean Sciences, University of British Columbia, 6339 Stores Rd., Vancouver, B.C. V6T 1Z4, Canada (tel (604) 822-6456, fax (604) 822-6088, e-mail psmith@eos.ubc.ca).

Symposium Website: http://www.eos.ubc.ca/jurassic/announce.htm

46th Symposium of Vertebrate Palaeontology and Comparative Anatomy
Bournemouth, UK
9 – 12 September 1998

The Symposium will be preceded by the **7th Symposium of Palaeontological Preparators and Conservators**, from *7th to 9th September 1998*, both meetings at the University of Bournemouth.

Contact: Jane Clarke, 65 Oakmount Road, Chandler's Ford, Hants SO53 2LJ UK (tel +44 (0)1703 252309, fax +44 (0)1703 904364, e-mail jane@geoden.demon.co.uk).

VII Congreso Argentino de Paleontología y Bioestratigrafía
Bahía Blanca
4 – 9 October 1998

Under the auspices of A.P.A., organized by the Departamento de Geologia, Universidad Nacional del Sur. Further information: Dra. Mirta E. Quattrocchio, Laboratorio de Palinología, Depto. Geología, U.N.S., Alem 1253 (8000) Bahía Blanca, Argentina (fax (54-91) 556756).

British and Irish Graptolite Group Meeting
Leicester
31 October 1998

If you would like to attend this meeting, please contact Jan Zalasiewicz, Department of Geology, University of Leicester, University Walk, Leicester LE2 7RL.

Life and Environments in Purbeck Times
Dorchester, Dorset, UK
19 – 22 March 1999

A multidisciplinary symposium sponsored by the Palaeontological Association, to be held at Dorset County Museum. Three days of papers and discussions and a one-day field excursion to classic Purbeck localities. For first circular, contact Dr Andrew Milner, Department of Biology, Birkbeck College, Malet Street, London WC1E 7HX (fax +44 (0)171 631 6246, e-mail a.milner@biology.bbk.ac.uk).

5th International Ichnofabric Workshop (IIW-5)
Scarborough and Manchester, UK
15 – 20 July 1999

As with the four previous, highly successful workshops, the purpose of this meeting is to bring together trace fossil workers to consider the applications of ichnofabric (trace fossil-sediment) analysis in facies recognition, event correlation, palaeoenvironmental and palaeoecological reconstruction. The workshop will be field-based on the rocks of the Yorkshire coast, and linked to a preceding conference "Ichnofabrics in Petroleum Geology 1999" at Aberdeen, 12 - 14 July 1999. This provides a unique opportunity to exchange and develop understanding and applications of ichnofabric analysis between academia and industry. The meeting terminates in Manchester, considering the educational and museum aspects of trace fossil studies.

To request further details please contact: J.E. Pollard, Dept. of Earth Sciences, University, Manchester, M13 9PL, UK (tel +44 (0)161 275 3817, fax +44 (0)161 275 3947, e-mail john.pollard@man.ac.uk) (IIW-5) or M.J.F. Lawrence, Z & S Geoscience, Campus 2, Balgownie Drive, Bridge of Don, Aberdeen, AB22 8GU, UK (tel +44 (0)1224 8222555, fax +44 (0)1224 823777, e-mail mark.lawrence@zands.com) (Ichnofabrics in Petroleum Geology).

The biology and evolution of bivalves
University of Cambridge, UK
14 – 17 September 1999

Organised on behalf of The Malacological Society of London by E.M. Harper, J.D. Taylor and J.A. Crame.

An international meeting to focus solely on the Bivalvia. The organisers welcome papers and posters on all aspects of the biology and palaeontology of bivalves, in particular studies of the ecology, phylogeny and palaeobiology of the class. The Society hopes that the proceedings of the meeting will be published as series of refereed papers.

The meeting is to be held over three days in the historic and picturesque city of Cambridge (UK) within the ancient university. This is the first call for offers of papers and posters. It will be possible to organise workshops and themed sessions to accommodate those with similar interests.

Registration Fee: to be announced.

For offers of contributions and to request further details please contact: E.M. Harper, Dept. of Earth Sciences, Downing St, Cambridge, CB2 3EQ, UK (tel +44 (0)1223 332846, fax +44 (0)1223 333450, e-mail emh21@cus.cam.ac.uk), or J.D. Taylor, Dept. of Zoology, The Natural History

Museum, Cromwell Rd, London, UK (e-mail J.Taylor@nhm.ac.uk), or J.A. Crame, The British Antarctic Survey, High Cross, Madingley Rd, Cambridge, UK (e-mail JACR@pcmail.nerc-bas.ac.uk).

VII International Symposium on Mesozoic Terrestrial Ecosystems
Buenos Aires, Argentina
26 September – 2 October 1999

A wide-ranging scientific programme and several field trips are planned; further information from the Secretary to the Symposium at Museo Argentino de Clencias Naturales "B. Rivadavia", Avda. Angle Gallardo 470, 1405 Buenos Aires, Argentina (tel/fax 54-1 983 4151).

7th International Symposium on Fossil Algae
Nanjing, China
13 – 17 October 1999 + excursions

Themes cover a wide range of studies on benthic algae, cyanobacteria and stromatolites through time, including taxonomy, biostratigraphy, evolution, palaeoecology, sedimentology, ultrastructure, and biomineralization.

Pre- and post-symposium excursions will visit Jixian (Proterozoic), Jinan (Cambrian), and Guilin (Devonian).

For details contact: Xi-nan Mu, Nanjing Institute of Geology and Palaeontology, Academia Sinica, 39 East Beijing Road, Nanjing 210008, China (fax +86 25 335 7026, e-mail algae@pub.nj.jsinfo.net).

Third International Conference on Trilobites and their relatives
Oxford, UK
2 – 6 April 2001

There will be a pre-conference field trip to Scotland and Northern England, and a post-conference trip in Wales and the Welsh Borders. Organiser-in-chief: Derek Siveter (Oxford).

BOOK REVIEWS

Fossils of Ohio

Rodney M. Feldmann, Editor-in-Chief; Merrianne Hackathorn, Managing Editor. 1996. The Ohio Department of Natural Resources, Division of Geological Survey. Bulletin 70, 577pp. ISBN 0-931079-05-5. US$18.00.

Although a guidebook to the fossils of Ohio may not be the first title to catch your eye on the palaeontological bookshelf, this comprehensive volume, by a multi-author team, has a lot to recommend it. Running to nearly 600 pages, it contains a huge amount of taxonomic and palaeoecological information, and spans a range of fossil groups from conulariids to mammoths on the one side, and acritarchs to seed ferns on the other. A series of simple introductions and short diagnoses within each group, together with copious illustrations, make this a valuable taxonomic reference.

As those of you familiar with the geology of Ohio will know, this is an essentially Palaeozoic story. Late Ordovician strata crop out in the south-western corner of the state in the Cincinnati Arch, and on the eastern and north-western flanks of this structure progressively younger beds are exposed. Devonian and Carboniferous (Mississippian and Pennsylvanian herein) beds are particularly well represented, and in the south-eastern corner of the state there is a small area of Permian rocks. There is then a very large stratigraphic gap until the extensive Pleistocene glacial and fluvioglacial deposits. Serious palaeontological investigations in Ohio can be traced back to the publication, in 1873 and 1875, of John Strong Newberry's two pioneering Ohio Geological Survey memoirs.

The book has the ambitious aim of trying to cater for all levels, from novice to professional. Much of the introductory three chapters is indeed rather basic, but in the following systematic sections the brief taxonomic descriptions and keys will be of value to the practising palaeontologist. The plates alone, which are numerous and produced to a uniformly high standard, make the book an easy-to-use taxonomic source.

Marine invertebrates are particularly well covered by some 17 chapters. Among groups to catch my eye were the corals, and especially those of the Brassfield Formation which comprise the earliest known major Silurian coral fauna of North America. There is a rich Devonian coral assemblage too, with over 60 rugose and tabulate species being known from north-western Ohio alone. The trilobites are impressive, especially the Cincinnatian (Upper Ordovician) *Isotelus*, which may have exceeded 50 cm in length, and the beautiful *Phacops rana*. Groups such as the brachiopods, bryozoans, cephalopods and echinoderms are all well covered. Lots of nice pictures here of spiriferids, rhynchonellids, crinoids, starfish, and so on, plus one or two less orthodox ones such as the Pennsylvanian nautiloid with predatory bite marks!

Nevertheless, it is probably vertebrate fossils for which Ohio is best known, and in particular the spectacular placoderms from the Upper Devonian Ohio Shale. At least 22 species of arthrodires are now known from this unit, including the fearsome *Dunkleosteus* which reached about 5 m in length and weighed in at over a ton. *Titanichthys* was even bigger, and is now thought to have been the largest Devonian vertebrate. Of at least equal palaeontological importance are the Pennsylvanian amphibians from the famous Linton locality in Jefferson County. This has now produced a variety of lepospondyls, an aquatic labyrinthodont, and a terrestrial amphibian bearing a remarkable resemblance to modern frogs. This same locality has also produced some of the best known early reptiles, including lizard-like captorhinids and a small pelycosaur.

The palaeobotanical section of the book is very much the story of the extensive Pennsylvanian Coal Measures. There is a section on Upper Devonian progymnosperms, and non-vascular plants are well covered too; but it is the coal-swamp communities, and their reconstruction, which take pride of place. There are some particularly important coal-ball floras from Ohio, such as the Steubenville, which is of mid-Conemaugh (i.e. Late Pennsylvanian) age and comprises at least 55 macrofossil taxa from five major plant groups. The illustrations include nice reconstructions of types such as *Lepidodendron* and the tree fern *Psaronius*.

This well-written and profusely illustrated volume has been concisely edited by Rodney Feldmann and Merrianne Hackathorn. It is a bargain too, at a price of only US $18.00 (plus postage) (enquiries from the Division of Geological Survey, Ohio Department of Natural Resources; e-mail `geo.survey@dnr.state.oh.us`).

Alistair Crame
British Antarctic Survey

History of the Coelacanth Fishes

Peter L. Forey, £99.00, NHM Press/Chapman & Hall, ISBN 0 412 78480 7.

This is a strange book; a mixture of general review and original data. It begins with a brief historical review of the field and a discussion on what questions a study of the coelacanths may hope to answer (particularly those concerned with the origins of the tetrapods). It then goes on to cover the 'natural history' of the living coelacanth, *Latimeria chalumnae*; anatomy, behaviour, ecology, conservation and so on. Although there are thorough references to the pertinent scientific literature, the detail of the text would not require an extensive knowledge of fish biology and it is by no means a technical review.

The next (somewhat larger) section systematically details what is known of the morphology of all coelacanths, fossil and Recent, with plenty of figures illustrating the material. The descriptions are clear and concise, but you'd need to be comfortable with anatomical terminology to get much beyond the first page. There follows a discussion of various previous attempts to elucidate the interrelationships of the group, a list of characters and finally an analysis, producing cladograms for both the relationships within the group, and the group's relationships to other sarcopterygians.

The final section is a comprehensive review of all published coelacanth taxa, with diagnoses, lists of known material and detailed remarks for each species.

This sort of book is rarely a success. Mixing detailed, original research and general review, falling somewhere between popular and technical, usually pleases no-one. However, for me, the *History of the Coelacanth fishes* is an exception. The text is clear and lively, and Dr Forey's enthusiasm for the subject comes across. It also helps that he is one of the acknowledged world experts in the field.

The figures are consistently excellent and were prepared by the author especially for the book. They are clear and uncluttered, with prudent use of labelling. My only complaint about them is the cryptic abbreviations used for the labels: just what *is* the 'f.br.s.opth'? Or the 'o.v.pr.Pa'?. This is a fault common to many books, but is a particular shame here as there is obviously room to use longer, clearer abbreviations, if not the full words themselves. Trying to compare between two diagrams with one finger stuck in the 'abbreviations' appendix can become irritating! There is no use of colour in the figures; this in no way lessens their impact, but is possibly tacit recognition that they are likely to be photocopied and reproduced repeatedly in the lecture handouts and presentations of the future (photostatting being truly the sincerest form of flattery…).

As with any book of this size there are a few errors in the text (mostly typos) but these are not a major problem.

The section on phylogenetics was quite fascinating. It assumed a complete lack of knowledge of cladistic methodology (there is a beginner's guide to Hennig *et al*, along with a glossary, in the introduction). The subsequent discussion of characters, analysis of the data matrix with *PAUP* and *Hennig86*, the resolution of various ambiguities and the eventual arrival at a final, single phylogenetic tree held my interest throughout. Perhaps because of the extra space the book format allowed, the discussion is unusually thorough and frank, explaining the reasons why a few 'rogue taxa' could upset the topology of the whole tree, how and why the consistency and retention indices ('CI' and 'RI' respectively) could be used to analyse the weak-points of the tree, and how some parts of the tree were much less certain than others. It all formed an intriguing case-study of the use (and limitations) of cladistic methodology to resolve phylogenies.

This step-by-step approach to the phylogeny section perhaps reveals one of the main audiences for the book. It would be a real help to postgraduates attempting to use cladistics for themselves for the first time – the principles are easy, but the practice can often be quite intimidating. Dr Forey's very readable style helps to remove much of the 'mystery' from the process. Besides this, as a sort of *Haynes Manual* for coelacanths, it would be invaluable to any researcher working on sarcopterygian fishes. It is regrettable, then, that it is priced out of the reach of most of them. When the Net Book Agreement collapsed in September 1995 there were fears that specialist books would become much more expensive because of the general decrease in publishers' profit margins. The price of the *History of the Coelacanths*, at just under £100, seems to confirm this. The book is well laid out and presented, but even as an academic book I'd have expected it to cost around £50-60 – for example there are no photographic plates, colour or otherwise. The only concession to its price seems to be the use of faked blue and white stitch-binding on the spine.

In conclusion, Dr Forey has produced a well-written, interesting and useful book. It will undoubtedly remain a standard work on coelacanths for many years to come and will be heavily cited by future researchers. However the price could prove prohibitive (unless a paperback edition is due), and many palaeontologists will have to rely instead on a well-thumbed library copy!

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Dinosaurs: the encyclopedia

Donald F. Glut, 1997. McFarland & Company, Inc., Publishers, Box 611, Jefferson, North Carolina 28640, U.S.A. xii + 1076 pp. ISBN 0-89950-917-7. Price US$145

I teach vertebrate palaeontology to first year and third year university classes; not surprisingly, dinosaurs loom large in my expositions. I also plan, build and write scripts for museum exhibitions about dinosaurs from time to time. As a dyed-in-the-wool invertebrate palaeontologist I was therefore not surprisingly replete with anticipation when this book thumped on my desk for review – here surely was the easy vehicle for culling all that I could want with minimum effort to pass on to the unsuspecting masses (I say 'thumped' because at 1,088 pages and weighing 2.8 kg this is not lightweight reading).

My appetite and my growing anticipation for an easier life were whetted even further on reading the Preface. "The purpose of this book is twofold: To provide a handy reference tool for use by

palaeontologists, students, and libraries, and to offer information of a less technical nature to the amateur paleontologist, casual dinosaur enthusiast, or interested general reader."

At page 37 I came down from my heady anticipation with another thump (that word again – ref. 2.8 kg). 'Less technical' ... 'amateur' ... 'casual dinosaur enthusiast' ... 'interested general reader'. Page 37 is a point to stop and re-group.

The first 33 pages take you through A Background, The Mesozoic Era, Dinosaur Origins and Relationships, Birds and Dinosaurs, Dinosaur Success, Warm-Blooded versus Cold Blooded Dinosaurs, and Dinosaur Extinctions. All O.K., quite readable, lots of photographs, somewhat historical in approach, but I felt that I was on my way.

Then Page 37, Wham! [by the way, pages 33-36 are blanks]. For the next 973 pages we are engulfed in Dinosaurian Systematics, Dinosaurian Genera, Nomina Nuda, and Excluded Genera. The whole thing seems to be styled on a dinosaurian version of a volume of *The Treatise on Invertebrate Paleontology*, with diagnoses (or even emended diagnoses!) of higher taxa of dinosaurs, followed by alphabetically-based diagnoses of every known dinosaur genus under the Mesozoic sun – complete with information on derivation of name, type species, geographical occurrence, age range, type material, generic diagnosis, comments, and key references. My favourite is *Dryosaurus*, which goes on for five pages – enough said!

Lots of drawings, lots more photographs, a somewhat short (only seven pages) glossary, and a useful 34 page bibliography. But who on earth is it intended for? This is the book that the ultra-specialist will want to consult from time to time when he/she wants to assess the subtle nuances of diagnostic characters of dinosaur genera/higher groups. It has its place, but to claim the purposes outlined in the Preface tests credibility to the limit (no, I confess, beyond the limit).

At the risk of being boring … heavy, heavy, heavy in every sense. Good to have on your rich library shelf, but not a book I imagine even the most ardent vertebrate palaeontologist will rush out and buy as a personal copy. It will inevitably be tested by comparison with the Currie & Padian volume (1997) *Encyclopedia of Dinosaurs*. I certainly remain at square one in my search for an easier teaching life. Ah well!

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Treatise on Invertebrate Paleontology, Part L, Mollusca 4 (Revised). Volume 4: Cretaceous Ammonoidea

C.W. Wright with J.H. Callomon and M.K. Howarth and edited by R.L. Kaesler. 1996. The Geological Society of America, Boulder, Colorado and the University of Kansas, Lawrence, Kansas. 362 pp. ISBN 0-8137-3112-7. Hardback. Available in the U.K. from Geological Society of London Publications, Bath, £45; members of the Geological Society of London, £36 (p&p extra).

It is now over 40 years since the publication of the original single part *Treatise* covering the Ammonoidea by W.J. Arkell *et al.* (1957), to which C.W. Wright was one of the original contributors. That work has been undergoing expansion and revision to four volumes, including an Introduction, Palaeozoic and Triassic, and Jurassic parts. Wright has been responsible for the final volume covering the Cretaceous ammonites, but which is the first to be published. This welcome study must be used in conjunction with the original volume for the introductory sections until the revised first volume of Mollusca 4 becomes available.

Wright's *magnum opus* commences with an editorial preface which has been extensively revised from previous *Treatise* volumes. It contains a valuable section on taxonomic nomenclature, and with short notes on biogeographical regional names in a rapidly changing modern world, range charts, suture terminology, bibliographic citations, and chinese and cyrillic author spellings. The main part is concerned with the generic and higher level systematics of the Cretaceous Ammonoidea for which Wright is responsible. Some groups, such as the Phylloceratace and the Lytoceratace, have their origins in pre-Cretaceous strata. These superfamilies are dealt with only in outline in this volume, but will be covered fully in the forthcoming Jurassic ammonite Treatise. Howarth wrote the section on Tetragonitaceae and the lists of Phylloceratina and Lytoceratina; Callomon co-authored the Craspeditidae.

Almost all the accepted genera and subgenera are described and illustrated, with type species designations, listing of synonyms, quoted sources, diagnoses, stratigraphic and geographic distributions. The volume concludes with a short Cretaceous correlation chart, a table of stage by stage ranges for all supraspecific formal divisions of the Ammonoidea, a glossary of morphological terms and references.

The value of the volume (277 pages) lies in the comprehensive review and diagnoses of all supraspecific taxa. One may disagree at some point or other in the volume because for example a particular genus has or has not been synonymised with another, but that is subjective. Wright was well aware that cladistics can further aid the classification of the ammonites but it is clearly too early for a comprehensive approach in a form suitable for the *Treatise*. The quality of illustration is usually very high considering the variable quality sources. The summary correlation chart is strongly European oriented and shows the Mediterranean and Submediterranean vs northwest European ammonite zonal succession and the Jurassic-Cretaceous boundary succession of the Volga basin and Russian Platform vs northern Siberia. Unfortunately it is unreferenced and the Ryazanian is too closely equated with the Berriasian Stage and the Volgian with the Tithonian Stage. The Jurassic-Cretaceous boundary at the base of the Berriasian is no longer regarded as equivalent to the base of the Ryazanian. The summary stratigraphic distribution table distinguishes boreal Ryazanian taxa as well as tethyan Berriasian forms; some Volgian genera are also included. Unlike the original volume, the references are much more thoroughly and completely treated and well over 1,000 articles and books are listed. Journal titles are now printed in full, but it is disappointing that accents have been removed from them. Italics have now been removed from the journal and book titles which makes life easier for the *Treatise* editors, although it loses some clarity in presentation. It is also noted with surprise that one James Sowerby appears to have been still publishing in 1913!

Despite the continued growth in the use of micropalaeontology in stratigraphy, a certain Southampton micropalaeontologist has been quoted as saying that the *ammonites are still the policemen of Mesozoic biostratigraphy*. This volume on the Cretaceous ammonites is going to be used heavily by professional biostratigraphers as well as taxonomists. But the work demonstrates a life-time's meticulous study of Cretaceous ammonites by one who is a particularly gifted amateur. But what an amateur!

The Cretaceous Ammonite *Treatise* is an essential work for **all** Cretaceous ammonite workers' desks. It will not gather dust on bookshelves. The price represents excellent value, even for non-ammonites by Callomon, coming shortly.

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Graptolites in Colour

Edited by Sue Rigby and Barrie Rickards, written by members of the British and Irish Graptolite Group (BIG G). Designed and produced by Visual Resources, University of Edinburgh. Sponsored by the Curry Fund of the Geologists' Association and the Palaeontological Association. Available at £25 + p&p from Sue Rigby: e-mail Sue.Rigby@ed.ac.uk.

Palaeontology is a very visual subject; arguably the most lucid and popular lecture courses are supported by good illustrative material. Although a number of the larger laboratory and teaching supply companies offer good slide sets, there are relatively few, focused, stand-alone teaching packages. This is surprising since small sets, such as Derek Ager's exposé of palaeoecology, have proved useful and quite popular. The BIG G, however, has broken the mould with a teaching pack comprising comprehensive coverage of a major taxonomic group at an introductory level.

The pack is divided into four sections: graptolite slides, graptolite slide legends, graptolite descriptions and graptolite references. There are 40 slides, most in colour and beautifully produced. The slides are mounted in transparent envelopes with potentially 15 to a page; behind each envelope each slide is schematically shown, avoiding the need for a viewer or a dash to the nearest window before the next lecture. The slide set is quite comprehensive although perhaps transparencies of complete *Cephalodiscus* and *Rhabdopleura* together with a figure of a complete, fully mature graptolite rhabdosome would aid the introductory sections. Some of the figures, for example 27-30 and 34-40 appear to lack indications of magnification. But generally the slides are of a high quality, taken from good specimens.

The second section contains a clear and concise description of each slide with annotated diagrams – an extremely useful guide through the available material. The core of the package, labelled 'graptolite descriptions', contains 12 sections each arranged in one or two pages. Topics ranging from morphology through skeletal construction and diversity changes to palaeogeography and of course graptolites in stratigraphy are briefly covered by a number of different contributors. Each was clearly constrained by the space available and some contributions are better presented than others. Admittedly individual graptolite workers have their own favourite studies. Arguably, however, the section on functional morphology could include discussion of vanes, web structures and spines (Mitchell and Carle, 1986; Urbanek, Koren and Mierzejewski, 1982) together with modifications of the thecal aperture. Aside from the long debate between the Aberystwyth and Cambridge schools on the life modes of the graptolites, some other studies merit mention (e.g. Melchin and De Mont, 1995), as do some of the studies by Bates and Kirk on the retiolites. Recent work on graptolite palaeobiogeography by, for example, Cooper and others (1991), has increasingly emphasised the role of water depth as a distributional control. And moreover not all graptolite workers agree with Jaeger's Mediterranean Province during the Wenlock. Although some authors cross-reference sections through card numbers, pagination in a future edition would be useful.

The package is well produced, housed in a robust loose-leaf folder, and will no doubt prove very popular with teachers at all levels. Graptolites have already featured in the Denis Bates video, and now prove every bit as exciting on stills. Hopefully *Graptolites in Colour* can act as a template for future slide packages across the other invertebrate groups.

Cooper, R.A., Fortey, R.A. and Lindholm, K. 1991. Latitudinal and depth zonation of early Ordovician graptolites. *Lethaia* **24**, 199-218.

Jaeger, H. 1976. Das Silur und Unterdevon vom thuringischen Typ in Sardinien und seine regionalgeologische Bedeutung. *Nova Acta Leopoldina* **45**, 224, 263-299.

Melchin, M.J. and DeMont, M.E. 1995. Propulsion modes in Graptoloidea: a new model for graptolite locomotion. *Paleobiology* **21**, 110-120.

Mitchell, C.E. and Carle, K.J. 1986. The nematularium of Pseudoclimacograptus scharenbergi (Lapworth) and its secretion. *Palaeontology* **29**, 373-390.

Urbanek, A., Koren, T. and Mierzejewski, P. 1982. The fine structure of the virgular apparatus in Cystograptus vesiculosus. *Lethaia* **15**, 207-228.

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Before the Backbone: Views on the Origin of the Vertebrates

Henry Gee. 1996. 346 pp. Chapman & Hall, London. ISBN 0-412-48300-9. Hardback. £35

These are exciting times in the study of early vertebrates and protochordate-craniate relationships. In the past five years, hardly a month has gone by without the publication of additional information germane to the subject, be it from a Cambrian Konservat-lagerstätte or from molecular and developmental fields. Henry Gee is in an enviable position when it comes to discussing the origin of vertebrates since much of this work has been published in *Nature*.

Virtually all modern texts on vertebrate biology and palaeontology portray vertebrate origins as a simple story, following the urochordate ->> cephalochordate ->> craniate path. This is largely based upon the study of extant forms and, as Gee points out, was highly controversial at its inception during the 1890s. *Before the Backbone* presents a critical historical perspective on craniate origins and also serves to bring the calcichordate thesis to a wider audience.

The relevant taxonomic groups, deuterostome phylogeny, and concepts such as symmetry and coelom arrangement are introduced in a refreshingly imaginative way: has a tub of haldi ever been illustrated in a palaeontological/biological text before? Cladistic concepts, a framework over which much of the rest of the book is draped, are also presented in a clear and concise fashion in Chapter 1. The absence of some key illustrations in the first chapter, in particular relating to embryological development, was disappointing, as was the layout and reproduction of a number of the figures. However, these are minor points of criticism.

Having run through the taxonomic rolecall, a detailed discussion of the ideas of Patten, Gaskell, Berrill, Garstang and Goodrich clearly demonstrates how their hypotheses developed through time, reflecting shifts in the popularity of Haeckelian recapitulation and Darwinian natural selection. Gilsen's attempts at introducing some fossils, the carpoids, into the debate is also highlighted, providing an historical background to the calcichordate theory – a topic to which Gee later devotes roughly one-third of the book.

Before grappling with the carpoids, Balfour's segmented head, Romer's somaticovisceral animal and the "New Head" hypothesis of Gans and Northcutt are presented in an excellent Chapter 3. The influence of genetics, and the role played by homeobox genes in metazoans, provide a modern developmental slant and Gee offers an interesting and up-to-date overview of the exciting work that is proceeding apace in this field. The recognition that amphioxus possesses a homologue (AmphiHox3) of the vertebrate Hox-b3 gene suggests that the "new head" may not be the panacea that it initially appeared to be. Recently, studies of the regulatory Manx gene (Swalla and Jeffery, 1996, *Science* vol. **274**, 1205-1208), and its role in vertebrate architecture suggests one fruitful line of investigation.

The calcichordate thesis is presented as a flowing narrative in Chapter 4, discussing the evolution of Jefferies' ideas, and the debate between critics and the principal advocate of the "monsters". Whatever one's initial prejudice about the calcichordate theory, and I know that I came to this book with a heavy bias against it, *Before the Backbone* presents a reasoned, if somewhat sympathetic, description of Jefferies' thesis. This chapter is particularly useful as it documents the history of a scientific theory in great detail. It is important to note that Jefferies' is prone to a degree of circularity that Gee doesn't bring to the fore. This is particularly evident in the 1986 book (*Ancestry of the Vertebrates*) where possible interpretations become fact as the page is turned. Gee also hammers home the point that phylogenies can and are reconstructed with a degree of independence of appearances in the fossil record. Jefferies is presented as someone who has adopted a purely character-based approach, yet, in *Ancestry*, he suggests that *Palaeobotryllus* cannot be a tunicate due to its appearance prior to the mitrate *Peltocystis*. Until 1995, the debate over the validity of the calcichordate theory has focused on the interpretation of ridges and grooves in the carpoid skeleton. Peterson (*Lethaia*, vol. **28**, 25-38) provided a phylogenetic test of the calcichordate theory. Running Jefferies' dataset through a parsimony program, it was found that the carpoids probably fall among the echinoderms, and the urochordate ->> cephalochordate ->> craniate transition appeared to stand. Since the publication of *Before the Backbone*, Jefferies (*Lethaia*, vol. **30**, 1-10) has responded to Peterson, pointing out that if you accept the calcichordate characters, and code them correctly, PAUP will support Jefferies' trees.

Gee is unashamedly an admirer of Jefferies, and I do wonder if *Before the Backbone* would have offered support to the calcichordate theory had Peterson's analysis not been published. Jefferies' studies offer a great deal to the wider community, even if the conclusions appear to be somewhat unorthodox and probably erroneous. Dexiothetism, and the demonstration of asymmetries in deuterostomes, has largely been overlooked: it partly took the detailed study of the cornutes by a zoological polymath to bring this problem to a wider audience. Gee observes that certain structural features of the cornutes, rather than challenging their classification amongst the echinoderms, requires the palaeontologist and the biologist to adopt a fundamentally different mindset when it comes to the classification of long extinct curios. Characters may well have had a wider genetic expression in the Palaeozoic than at the present time.

Gee admits that he doesn't offer a new synthesis, but what *Before the Backbone* does provide is an extremely stimulating and thoughtful text. The narrative is backed up with extensive footnotes and references, which provide an excellent resource for exploring the subject further. This book stands not only as a summary of ideas on the origins of vertebrates, but also as a documentary on the development of scientific theory. It thus has an extremely broad appeal, and, although a touch pricey at £35, it can be firmly recommended to those with any interest in chordate phylogeny and the history of science, and as a text on which to develop advanced lectures and tutorials.

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Vertebrate Palaeontology

Michael Benton. 1997. Second Edition, Chapman and Hall, 452 pages. £24.99 pb.

The second edition of Benton's *Vertebrate Palaeontology* has finally arrived, and I suspect that most of you will be buying it and recommending it to undergraduate students no matter what any reviewers say. Rightfully so, as *Vertebrate Palaeontology* is still one the best introductory texts around. But I have a confession to make: I preferred the first edition. Benton mark one did its best

to pretend it wasn't a textbook. The book was innocuous-looking enough that one could get away with reading it anywhere, even lying on the beach, and not look like a complete nerd. One, moreover, wanted to read it on the beach, because reading it didn't feel like work. The second edition… well, if your biceps are looking a bit flabby, three sets of 20 lifts a day ought to have you in shape for next field season.

Not only has *Vertebrate Palaeontology* put on 75 pages, but a few centimetres of width as well. Although quite a bit of the text hasn't changed very much, the second edition really does differ from the first and reading it is a bit more of an effort. Some of the additions work extremely well. A new chapter on 'How to study fossil vertebrates', for instance, covers practical aspects of palaeontology that undergraduates probably won't encounter elsewhere. More familiar material, such as plate tectonics and geological time, is brief and interspersed with enough titbits to keep them interested. The second edition also boasts exquisitely drawn chapter openings by John Sibbick.

Other changes are not as successful. One major change to this book has been the inclusion of cladograms for major taxa. The cladograms create three sets of problems. First, the cladograms, as well as other vignettes on vertebrate biology and lagerstätten, are placed in boxes that really break the flow of the text. Unlike the first edition, where the boxes nearly always coincided with the end of a normal text section, the boxes in the second edition usually fall in the middle of a section. This placement means that at some points in the book, I found myself flipping up to six pages ahead to find the figures that matched the text I was reading and then flipping back to read several boxes and then back to the main text… This kind of reading is more work, and less zealous undergrads may not bother with all that flipping.

The second problem with the cladograms is cladistics. Because the relationships among most taxa are still controversial, up to six cladograms for each clade discussed have to be presented in order to cover the various analyses by various workers using various methodologies. Sometimes, *Vertebrate Palaeontology* gives its own "consensus" cladograms, but it not clear if these are strict consensus trees or the general consensus of several different analyses. Also, the synapomorphies for each cladogram are presented and often the characters haven't been discussed in the text (although skeletal characters have usually been labelled in a figure).

All this confusion leads to the third problem. Although Benton covers cladistics briefly in the 'How to study fossil vertebrates' chapter, this account does not really explain the workings of cladistics very thoroughly. Although providing a simplified account of cladistics is probably impossible anyway, by including the results without really explaining the technique, students may not understand how the results of cladistic analyses differ from traditional phylogenies. The incorporation of cladograms also required additions to the main text to get it in keeping with cladistic terminology. There are also plenty of corrections and updated information, but, because so much has been added to this edition, quite a few little typos and errors do still appear. And, if spotted, there is an email address to which corrections can be sent.

Despite these quibbles, sometimes I found myself so engrossed, as when reading the 'Human evolution' chapter, that I shooed people from the room so that I could read and later found that I had forgotten to make any notes. The second edition of Benton's *Vertebrate Palaeontology* certainly deserves a place on your bookshelf. Undergraduates with year-long vertebrate palaeontology courses must have this book, too, but those undergraduates doing term-long courses might find it a little heavy, in more ways than one.

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Notes for Authors

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