

The
Palaeontological
Association

Newsletter

Number 41

1999

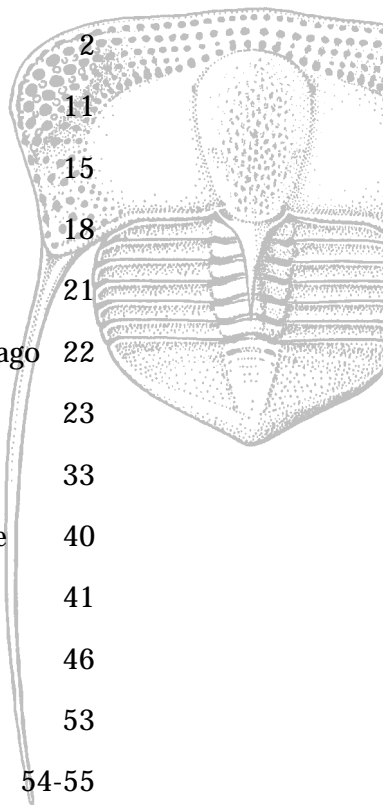
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The Palaeontology Newsletter

41

Contents

News	2
Association Business	11
Obituary: John Thackray	15
Association Meetings Programme	18
<i>Palaeo-Reply</i>	21
Advertisement: Paleontology, Chicago	22
<i>Palaeo-Comment</i>	23
Meeting Report	33
Advertisement: New Nomenclature	40
Future Meetings of Other Bodies	41
Book Reviews	46
The Origin of Flowers	53
<i>Palaeontology</i> vol 42 parts 3 & 4	54-55
<i>Booking form for Pal.Ass.43</i>	<i>centre insert</i>



Reminder: The deadline for copy for Issue no 42 is 15th September 1999

On the Web: <http://www.palass.org/>



news



T. rex and the Crater of Doom

Scientist Walter Alvarez Receives Major Science Prize from Carnegie Mellon

Carnegie Mellon University in Pittsburgh, Pennsylvania (USA) has awarded its Dickson Prize in Science to Walter Alvarez, author of "T. rex and the Crater of Doom" and a Professor of Geology and Geophysics at the University of California at Berkeley.

As part of the prize ceremonies, Alvarez delivered the Dickson Prize in Science lecture, which was jointly sponsored by the university and its neighbour, the Carnegie Museum of Natural History.

The Dickson Prize is a major scientific prize established in 1969 by Pittsburgh physician Joseph Z. Dickson and his wife, Agnes Fisher Dickson. The science prize is awarded annually by Carnegie Mellon to individuals in the United States who make outstanding contributions to science. This year's Dickson Prize included a cash award of \$40,000 and a medal.

Alvarez's lecture detailed the mass extinction of the Earth's plant and dinosaur life by an asteroid impact. He is an expert in the tectonics of the Mediterranean region and the geology of the Quaternary Roman Volcanic Province and its implication for dating glacial cycles. A find in Gubbio, Italy, led Alvarez to propose that an asteroid impact around the time of the dinosaurs may have caused mass extinction of Earth's plant and animal life. The story of that discovery is revealed in his book, *T. rex and the Crater of Doom*.

Alvarez has received many awards and honours during his distinguished career. He is a fellow of the American Geophysical Union and a foreign member of the Royal Danish Academy of Sciences. Alvarez was elected to the National Academy of Sciences in 1991 and to the American Academy of Arts and Sciences in 1993. Astronomers C.S. Shoemaker and E.M. Shoemaker named a minor planet, Alvarez, in honour of Alvarez and his father, Nobel Laureate Luis Alvarez. Walter Alvarez is an honorary citizen of two Italian cities, Piobbico and Gubbio.

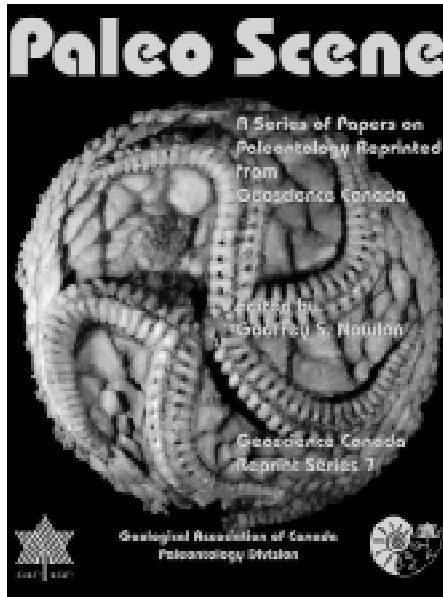
Alvarez earned his doctor's degree from Princeton University and his bachelor of arts degree from Carleton College.

Teresa Thomas
Carnegie Mellon University, USA

news



New publication from the Geological Association of Canada



Paleo Scene, Geoscience Canada Reprint Series No. 7

Godfrey S. Nowlan (Editor). Price: \$29.00 for members of the Geological Association of Canada; \$58 for non-members.

This book deals with the diverse applications of paleontology in earth sciences and presents an overview of the paleontological scene. It is a valuable compendium of papers that will be useful for those needing to know more about paleontological principles and applications. The soft-covered, spiral bound, 308 page book contains a series of articles on paleontology that originally appeared in the scientific journal *Geoscience Canada*. The articles were written for the non-specialist with an emphasis on useful illustrations and practical examples. It is eminently suitable as a supporting text for paleontology courses and has been produced in an inexpensive format to make it readily accessible to students of earth sciences.

The contents are:

Introduction. Paleontology: Ancient and Modern (*Godfrey S. Nowlan*)

Species in Paleontology (*Richard C. Fox*)



Physical and Biological Constraints on the Pattern of Vertebrate Evolution (*Robert L. Carroll*)

Dual Biostratigraphy: Zones and Biofacies (*Rolf Ludvigsen, Stephen R. Westrop, Brian R. Pratt, Pamela A. Tuffnell and Graham A. Young*)

Darwinian Evolution and Developmental Biology: A Brief Review of Current Ideas (*Lars E. Fähræus*)

Geochemistry of Recent Marine Invertebrates (*Joan O. Morrison and Uwe Brand*)

Biogeochemistry of Fossil Marine Invertebrates (*Uwe Brand and Joan O. Morrison*)

Precambrian Biostratigraphy (*Hans Hofmann*)

Biostatistics in Paleontology (*Brian Jones*)

Taphonomic Processes: Information Loss and Information Gain (*Mark V.H. Wilson*)

Paleoecology: Paleoecosystems, Paleocommunities (*Paul Copper*)

Paleobiogeography and Plate Tectonics (*Paul L. Smith*)

Benthic Macrofossils as Paleoenvironmental Indicators in Marine Siliciclastic Facies (*Ron K. Pickerill and Pat J. Brenchley*)

Paleopathology of Vertebrates: Insights to Lifestyle and Health in the Geological Record (*Bruce M. Rothschild and Darren Tanke*)

Organisms and Carbonate Substrates in Marine Environments (*Paul Copper*)

Paleozoic Biostratigraphy (*Alfred C. Lenz, Jisuo Jin, Alexander D. McCracken, John Utting and Stephen R. Westrop*)

Sequence Stratigraphy and Chronostratigraphy: Problems of Definition and Precision in Correlation, and their Implications for Global Eustacy (*Andrew D. Miall*)

Footprints in the Sands of Time. Vertebrate Footprints and the Interpretation of Past Environments (*William A.S. Sarjeant*)

Future Trends in Research on the Ancient Biosphere (*Godfrey S. Nowlan*)

Paleo Scene is available from: Geological Association of Canada
Publications Department G222
Department of Earth Sciences
Memorial University of Newfoundland
St. John's, Newfoundland A1B 3X5
tel (709) 737-7660
fax (709) 737-2532
e-mail gac@sparky2.esd.mun.ca
Web <http://www.esd.mun.ca/~gac>

Pal Ass Web site: new address

There is once again a new URL to remember for the Palaeontology Association's home page on the Web, but at least it's now more succinct: <http://www.palass.org/>

Tim Palmer

The Palaeontological Association

news...



Biology and Evolution of the Bivalvia

Cambridge, UK

14-17 September, 1999

More than 100 people have registered for this meeting. We have been overwhelmed by the number of oral presentations offered on a broad range of palaeontological and geological topics. No more can be accepted! The list of accepted talks can be viewed on the Malacological Society of London's Web site, at <http://www.sunderland.ac.uk/~es0mda/bivalve.htm>

Anybody wishing to participate in the meeting on a daily basis should contact Liz Harper. The day rate will be £25.

Dr Liz Harper

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UK's largest festival of science in Sheffield

British Association for the Advancement of Science, 13-17 September 1999

After a gap of only ten years the prestigious British Association Annual Meeting returns to Sheffield and will be hosted by the two Universities. The one week of festivities has over 400 activities including lectures, exhibitions, field trips and debates. The majority of the Festival is organised by 16 Scientific Sections, of which Geology is one.

By registering for this Festival, Pal. Ass. Members will be able to share in and enjoy a varied geological programme comprising sections on 'Coal, Iron, Steel and Sheffield', 'Geologists in the Service of People' and (for Pal. Ass. Members) 'Dinosaur Behaviour'. The geological programme ends with a day excursion into the field to examine dinosaur tracks in the Middle Jurassic rocks of the Yorkshire Coast. Social events include an informal wine reception and Geology Section Dinner.

Geology Section President: Dr Mike Romano (Sheffield)

Geology Section Secretary: Dr Martin Whyte (Sheffield)

Geology Section Recorder: Dr Peter Doyle (Greenwich)



The session on 'Dinosaur Behaviour' (President's Day) is sponsored by the Palaeontological Association and includes talks by Jim Farlow (Indiana), Kevin Padian (California), Mike Benton (Bristol), David Norman (Cambridge), McNeill Alexander (Leeds), Martin Whyte and Mike Romano.

Further programme and registration information is available from The British Association, 23 Savile Row, London, W1X 2NB, UK (tel +44(0)171 973 3057, fax +44(0)171 973 3051, e-mail sarah.reck@britass.org.uk), Web site <http://www.britassoc.org.uk>).

Mike Romano

Sheffield, UK

West Yunnan Field Excursion

West Yunnan was a part of the Sibumasu block during the Ordovician and Silurian periods. The Ordovician and Silurian rocks and fossils are different from those of Yangtze and Tibet in a certain extent. It may be a key region to correlate these regions with Southeast Asia as well as Australia. The Ordovician and Silurian are well developed on the one hand but not very well studied on the other. We have been told by many colleagues that we should organize a field excursion for the Ordovician and Silurian subcommission colleagues in this region before we really get old.

It is also our own interest to investigate this region, especially the reference sections in the Baoshan area, since it is also a new area for us. Well, Yunnan is a tourist province in China with beautiful lakes and mountains, subtropical climate, rich vegetables and fruits, as well as various friendly minority nationalities. We expect that our colleagues and old friends will share a nice time with us. We are looking forward to hearing from you in the near future!

Circular 1. Stratigraphy and fossil record

The Baoshan area (25.1N, 99.1E) is a classic area for studying the Ordovician and Silurian rocks and fossils in West Yunnan. The Silurian section is at Jenhochiao, 40 km. south of the Baoshan county town, and the Ordovician section is at Pupiao, west of the Baoshan county town. In descending order, the Silurian and Ordovician rocks are as follows:

- Lower Devonian Un-named Argillaceous Limestone (50m, Ludlow-Pridoli) Purple, grey-green marl and limestone with a few black shale interbeds. *Camarocrinus*, *Michelinoceras*, *Spathognathodus eosteinhornensis* etc. have been recorded.
- Upper Jenhochiao Formation (56.5m, Wenlock) Yellow and purple weathered silty shale with graptolites *Cyrtograptus* (rare) and other monograptids. Shelly fauna is mainly trilobites (*Calymene* etc.) and conodonts (*Spathognathodus pennatus* etc.)
- Lower Jenhochiao Formation (250m, Llandovery) Yellowish-brown and black sandy shale. Six graptolite zones, including *M. crispus*, *S. turriculatus*, *S. sedgwickii*, *D. convolutus*, *C. gregarius*, *C. cyphus* zones have been recorded by Mu (1962). Ni et al. (1982) have also found *Akidograptus* sp. at the base of the formation. Llandovery shelly fauna including *Pseudaristocystis*, *Leonaspis* etc. have also been recorded.



- Wanyaoshu Formation (10m, Hirnantian) The type section is at Wanyaoshu, 10 km. southeast of the Luxi County town. It is composed mainly of dark grey and grey-black sandy-mudstone, with calcareous concretions. The lower part of the unit yields a *N. ojsuensis* graptolite fauna and the upper part includes a Dalmanitina-Hirnantia fauna. This is a typical Hirnantia fauna.
- Upper Pubiao Formation (632m, late Caradoc to Ashgill) Purple-red and yellow-green calcareous and argillaceous siltstones and mudstones. Brachiopods *Foliomena*, Trilobites *Nankinolithus*, *Harmatocnemis* and nautiloids *Pleurorthoceras*, *Michelinoceras* etc. have been recorded.
- Lower Pupiao Formation (237m, Caradoc) Yellow-greenish silty mudstone with marls. Graptolites *C. peltifer* and *H. teretiusculus* fauna have been recorded.
- Shihtien Formation (463m, Darriwilian) It consists of yellow-green and yellow-brown silty mudstone and argillaceous limestone. Graptolites *D. (D.) munchisoni*, *A. confertus* and *U. austrodentatus* zones have been reported. Shelly fauna includes mainly trilobites (*Basiliella*, *Nesuretus* etc.), brachiopods and crinoids.
- Bingdou Formation (165m, mainly Lower Ordovician) Variegated shale and siltstone with argillaceous limestones. Dendroid graptolites and trilobites have been reported.

Suggested time and schedule

We have found that late June of 2000 will be convenient for most colleagues. Everybody will first arrive at Kunming, the capital city of Yunnan Province, then we will fly to Baoshan with the local airline on the second day. We will stay in Baoshan and Luxi counties for field work about one week, then spend two days touring around Kunming after we fly back from Baoshan.

Estimated expenses are US\$60 per day (air tickets between Kunming and Baoshan are not included).

Arrangement and organization

This field trip will be organized if more than ten people will definitely participate. So, we need you to reply to us before September of this year. We will distribute the second circular in October. Profs. Chen Xu, Rong Jia-yu and Lo Hui-ling (Yunnan Institute of Geology and Mineral Resources) will be the co-organizers.

We will provide you with a visa invitation. Please let us know if you need a formal invitation letter to apply for financial support from your own country. You may talk with us by e-mail, fax, letters, or just call us. Any suggestions and comments will be very welcome.

We would like to advise you that the West Yunnan field trip will be a very critical field work.

We avoid any meetings, abstracts, official social events etc: most of us are tired of these.

Sincerely Yours, Chen Xu and Rong Jia-yu.

Chen Xu

Laboratory of Palaeobiology & Stratigraphy, Nanjing Institute of Geology & Palaeontology, Academia Sinica, 39 East Beijing Road, Nanjing, P.R. China (tel 0086-25-3375157 (office), tel/fax 0086-25-7713239 (home), e-mail xuchen@jlonline.com)



Palaeontology Down-Under

Interlinked Meetings for the year 2000

Under the auspices of the International Palaeontological Association, the Australasian Association of Palaeontologists, the Macquarie University Centre for Ecostratigraphy and Palaeobiology and IGCP Projects 410 and 421.

There are five interlocking events – three conferences and two IGCP meetings – and associated excursions have been programmed to follow on from the Australian Geological Congress (3-7 July, 2000, University of Technology, Sydney). The conferences and meetings are:

1. Australasian Palaeontological Convention-2000 (APC-2000) – including a celebration honouring Professor Barry W. Webby.
2. The Third International Symposium on the Silurian System (Sir Frederick McCoy Silurian Symposium).
3. The Second Australasian Conodont Symposium (AUSCOS-2).
4. IGCP 410 Meeting – The Great Ordovician biodiversity event: implications for global correlation and resources.
5. IGCP 421 Meeting – North Gondwana mid-Palaeozoic bioevent/biogeography in relation to crustal dynamics.

The venue is Orange, NSW, 260 km west of Sydney, in the heart of the most instructive Ordovician, Silurian and Early Devonian sequences in eastern Australia.

Programme:

Pre-Conference Excursion

Saturday 8 July: Bungonia Group and the Silurian of the Yass Synclinorium.

Sunday 9 July: Wellington: Silurian (Llandoverly-Wenlock): Quarry Creek, Borenore (graptolites/conodonts/corals).

Monday 10 July: Wellington and Orange: Late Silurian-Early Devonian – Wellington, Eurimbla and Nubrigyn (autochthonous and allochthonous sequences: channel deposits, carbonate fans, intermittent platform exposure and grand-scale platform-margin collapse).

Conference

Tuesday 11 July: First day of papers – parallel sessions: APC-2000— general themes; AUSCOS-2 – Cambrian, Ordovician and Silurian conodonts.

Wednesday 12 July: Second day of papers – parallel sessions: APC-2000 – general themes; AUSCOS-2 – Silurian, Devonian and younger conodonts.

Thursday 13 July: Excursion interlude: Three choices will be offered:

1. Day trip to Cliefden and Bowen Park: Late Ordovician shelly faunas/conodonts.
2. Day trip to Wellington. Pliocene-Holocene biodiversity: Wellington Caves phosphate mine/caves vertebrate fauna; Western Plains Zoo (Dubbo); Lake Burrendong Arboretum.
3. Wineries of the central western New South Wales.



Friday 14 July: Third day of papers – parallel sessions: APC-2000 (Mesozoic and Cainozoic papers); Sir Frederick McCoy Symposium papers. Evening: Conference Dinner

Saturday 15 July: Papers for APC-2000/AUSCOS-2/McCoy Symposium continued and Meetings of IGCP410 and IGCP421.

Post Conference Excursion (Part 1)

Sunday 16 July: Tamworth via Scone, Timor and Nundle: examination of Timor and “Crawney” limestones, (shelly faunas, conodonts; autochthonous and allochthonous sequences).

Monday 17 July: Cambrian-Devonian of the Tamworth Belt: Woolomin, Loomberah, Tamworth Hospital Quarry (shelly faunas, conodonts, mainly allochthonous sequences).

Tuesday 18 July: Autochthonous Early and Middle Devonian limestones at Sulcor, Attunga and Yarramanbully (shelly faunas, conodonts; autochthonous and allochthonous sequences); Goondiwindi (via Moree Artesian Spa Baths).

Wednesday 19 July: Biloela. Mid-Palaeozoics at Monto (briefly) en route.

Thursday 20 July: Gladstone: Devonian-Early Carboniferous of Mount Morgan-Rockhampton-Raglan area (Mount Etna, Horrigan Creek, Mt Holly) conodonts, corals; autochthonous vs allochthonous stratigraphy.

Post-Conference Excursion (Part 2)

Friday 21 July: Depart Gladstone 11am for Heron Island by catamaran for Sir Frederick McCoy Symposium Carbonate/Build-up Workshop – focused on carbonate sedimentation and reef-structuring organisms. Convenor: John Jell.

Saturday 22 July to Monday 24 July: three full days on Heron Island.

Tuesday 25 July: Depart Heron Island

For those interested in attending one or more of these events please register on-line at http://www.es.mq.edu.au/MUCEP/auscos/online_form1.htm

To receive the second circular (late 1999), please register as soon as possible – preferably before October, 1999.

Details about the costs of conference and excursion packages can be found at the conference home page at <http://www.es.mq.edu.au/MUCEP/auscos/auscos.htm>

Glenn A. Brock and Peter Cockle

Centre for Ecostratigraphy and Palaeobiology, Dept. of Earth and Planetary Sciences, Macquarie University, NSW 2109 Australia (tel 61-2-9850 8335, fax 61-2-9850 6053, e-mail

Glenn.Brock@mq.edu.au)

news...



Speak at the Young Systematists Forum!

Organised by the Systematics Association

This meeting will be held at the Natural History Museum, London, England on 1st December, 1999.

Workers new to the fields of systematics and phylogenetics are invited to present short (15 minute) talks on aspects of their work which highlight new methods or problems of general interest. The Systematics Association intends this one-day event to be an opportunity for PhD, MSc and post-doctoral students and researchers to discuss their work and research.

The event is organised by Drs. Neale Monks (N.Monks@nhm.ac.uk) and Yvonne Linton, both of the Natural History Museum, Cromwell Road, South Kensington, London, SW7 5BD, UK.

The meeting is free, and a lunch will be provided. There will be a prize for the best talk. Speakers will be asked to submit an abstract to the organisers no later than 1st September 1999.

Contact Neale by e-mail for further details. Please feel free to pass the details on to anyone who may be interested!

Neale Monks & Yvonne Marie Linton

Natural History Museum

New journal: *Evolution and Development*

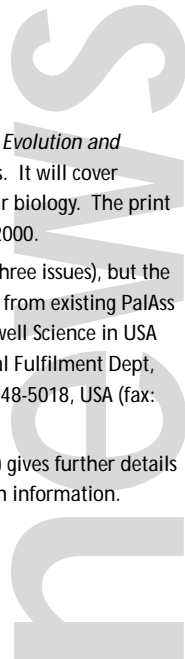
Blackwell Science in the USA is producing a new bimonthly journal titled *Evolution and Development*, which will be available in both print and electronic formats. It will cover palaeontology, population biology, developmental biology, and molecular biology. The print version will be available first; the electronic version will be available in 2000.

The full subscription is \$US 88 for 2000 (\$US 44 for 1999 which has only three issues), but the PalAss has negotiated a discount of 25% on this amount for subscriptions from existing PalAss members. If you are interested in subscribing, you should contact Blackwell Science in USA directly, *not* Blackwell Science in Oxford, England. The address is: Journal Fulfilment Dept, Blackwell Science Inc, Commerce Place, 350 Main Street, Malden, MA 02148-5018, USA (fax: 781-388-8270, e-mail: csjournals@blacksci.com)

The Blackwell Science Web Page (<http://www.blackwell-science.com/ede>) gives further details of the aim and scope of the journal, together with additional subscription information.

Tim Palmer

The Palaeontological Association





Association Business

Annual Report for 1998

Membership & subscriptions. Individual membership totalled 992 on 31 December 1998. There were 674 Ordinary Members, a decrease of 3; 102 Retired Members, an increase of 1; 216 Student Members, an increase of 2. There were 199 Institutional Members in 1998, a decrease of 24 from last year. Total Individual and Institutional subscriptions to *Palaeontology* through Blackwell's agency numbered 411, the same as in 1997. Subscriptions to *Special Papers in Palaeontology* numbered 101 individuals, a decrease of 4, and 74 institutions, a decrease of 25. Orders through Blackwell's agency for *Special Papers in Palaeontology* totalled 61 copies. Sales of back numbers of *Special Papers in Palaeontology* to individuals yielded £2,244.

Income from sales of *Field Guides to Fossils* amounted to:

- *Fossil Plants of the London Clay* – £74
- *Fossils of the Chalk* – £262
- *Zechstein Reef Fossils and their palaeoecology* – £41
- *Fossils of the Oxford Clay* – £379
- *Fossils of the Santana and Crato Formations of North East Brazil* – £148
- *Plant Fossils of the British Coal Measures* – £356
- *Fossils of the Upper Ordovician* – £535

Palaeobiology – A synthesis yielded £128 in royalties and *The Fossil Record 2* yielded £35.

Finance. Volume 41 of *Palaeontology* was published at a cost of £107,227. *Special Papers in Palaeontology* 59 was published at a cost of £4,554. Financial provision was made for the publication of *Special Papers in Palaeontology* 60. The Association gratefully acknowledges the donations from Members to the Sylvester-Bradley Fund, which amounted to £113, and also the generosity of Dr S. K. Donovan who signed over the royalties of two books in aid of the Sylvester-Bradley Fund.

Grants from general funds to external organisations, for the support of palaeontological projects, totalled £2,926.

Publications. The first six part volume of *Palaeontology* (Volume 41) was published during 1998, and comprised 1275 pages. *Special Papers in Palaeontology* 57-58 were published.

The Association is grateful to Cambridge University Press, the National Museum of Wales and the University of Birmingham for providing storage facilities for publication backstock.

Council is indebted to Meg Stroud and Edinburgh University Printing Services for assistance with the publication and distribution of *Palaeontology Newsletter*.

Meetings. Six meetings were held in 1998, and the Association extends its thanks to the organizers and host institutions of these meetings.



- a. **Lyell Meeting.** 18 February. This year's Lyell Meeting comprised 12 papers given at Burlington House on 'Palaeobiology meets geochemistry: concretions as tombs'. The meeting was convened by Dr J. C. W. Cope (Cardiff University) and Prof. C. Curtis (University of Manchester).
- b. **Review Seminar – Molecular Phylogeny.** 4 March. Organized by Dr R. Wood in the Department of Earth Sciences, University of Cambridge, and attended by 48 people.
- c. **Forty-first Annual General Meeting and Address.** 18 March. Held in the apartments of the Linnean Society, Piccadilly, London. The address, entitled 'The evolutionary ecology of mid-Palaeozoic faunas', was given by Prof. C. Brett (University of Rochester, New York, USA). Sylvester-Bradley Awards were made to K. D. Cochrane (University of Birmingham), A. Pinto (University of Oviedo), Dr R. Twitchett (University of Leeds) and Dr J. Wright (BBC). The meeting was attended by 45 people.
- d. **Geoscience 1998 – Exceptionally preserved fossils.** 14 April. A symposium convened by Prof. D. E. G. Briggs as part of *Geoscience 1998* at the University of Keele. The meeting comprised eight talks, including a keynote address on 'DNA in fossils' by Prof. H. N. Poinar.
- e. **Progressive Palaeontology.** 27 May. The annual open meeting for presentations by research students was held in the Department of Geological Sciences, University of Plymouth and organized by Gary Aillud and Mark Hylton. The meeting was attended by 35 people. A field excursion to the Devonian of the Torquay area was held on the following day.
- f. **42nd Annual Meeting.** 16-19 December. Held at the University of Portsmouth and organized by Dr M. J. Barker and Dr D. K. Loydell. The President's Award was presented to both Kim Freedman (University of Leicester) for her talk on '*Jamoytius kerwoodi* White: an unimaginative interpretation' and to Michael Gudo (Forschungsinstitut Senckenberg) for his talk on 'Structural-functional aspects in the evolution of the lid corals (*Rugosa*)'. The Council Poster Prize was awarded to Peta Hayes (University of Leeds) for her poster entitled 'The diverse angiosperm leaf flora of the Late Cretaceous Antarctic Peninsula'. The Annual Dinner was held aboard HMS Warrior following a private viewing of the Mary Rose exhibition, and the programme of talks was followed by a field excursion to the Isle of Wight. The Annual Meeting was attended by 188 people, including a significant and noteworthy number of mainland European workers.

Council. The following members were elected to serve on Council at the AGM on 18 March 1998:

President – Prof. E. N. K. Clarkson.

Vice Presidents – Dr P. Doyle, Dr R. M. Owens.

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 J. Clack, Dr B.M. Cox, Prof. D.A.T. Harper, Dr A.R. Hemsley, Dr D.M. Unwin, Dr R. Wood.

Other Members of Council – Mr F.W.J. Bryant, Dr M.J. Simms.

Dr D. K. Loydell was employed as Technical Editor.



Council is indebted to the Department of Palaeontology, Natural History Museum, the Linnean Society and the University of Portsmouth for providing Council Meeting venues through the year.

Council Activities. The most significant event of 1998 was the appointment of an Executive Officer, following the enabling amendments to the constitution at the 1998 AGM. Dr T. J. Palmer has been appointed to the post and his appointment has been approved by the Charity Commission allowing him to take up post in 1999. Other notable events include the publication of the first parts of *Palaeontologia Electronica*, the first electronic journal in the field, and the switch to publishing six parts of *Palaeontology* per year. In consequence of the latter move, *Palaeontology* 41 contained 1275 printed pages, an increase of 166 pages over the previous volume.

The Hodson Fund, resulting from the kind gift of Prof. F. Hodson, came to maturity during the year and Council has decided, after consultation, that it should be used to fund a new award scheme for young scientists. It has also been decided to institute a companion award, in the form of a medal, for significant contributions to the field of palaeontology. Details of both awards schemes will be finalised during 1999.

M. P. Smith

Secretary

Council 1999-2000

President

Prof. E. N. K. Clarkson (University of Edinburgh)

Vice-Presidents

Dr J. E. Francis (University of Leeds)

Dr R. M. Owens (National Museum of Wales)

Treasurer

Prof. J. Hancock (Shaftsbury, East Dorset)

Secretary

Dr M. P. Smith (University of Birmingham)

Newsletter Editor

Dr S. Rigby (University of Edinburgh)

Newsletter Reporter

Dr P. Pearson (University of Bristol)

Publicity Officer

Dr M. A. Purnell (University of Leicester)

Editors

Dr R. Wood (University of Cambridge)

Prof. D. A. T. Harper (Geological Museum, Copenhagen)

Dr A. R. Hemsley (Cardiff University)



Dr A. King (English Nature)
Dr D. T. J. Smith (University of Derby)

Other Members of Council

Mr F. W. J. Bryant (Maidenhead, Berkshire)
Dr P. C. J. Donoghue (University of Birmingham)
Dr S. K. Donovan (Natural History Museum)
Dr A. L. A. Johnson (University of Derby)
Dr M. J. Simms (Ulster Museum)

Nominations for Council 2000-2001

At the AGM in May 2000, the following vacancies will occur on Council:

President, Vice-President, 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 **Monday 4th October 1999**. They should be sent to the Secretary: Dr Paul Smith, School of Earth Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT.

Sylvester-Bradley Awards 2000

Applications are now invited for the Sylvester-Bradley Awards 2000. Up to five awards will be made 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 2000 award round is **Tuesday 30th November 1999**. The announcement of recipients of the awards will be made at the AGM in May, 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. Please send completed forms to the Secretary.

Paul Smith

The Palaeontological Association



— OBITUARY —

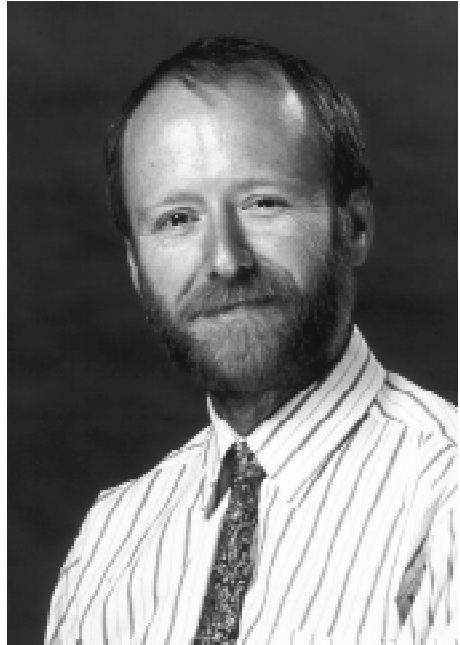
JOHN THACKRAY (1948-1999)

Members will be saddened to learn of the death from cancer of John Thackray who, at the time of his death on 6th May, was archivist at The Natural History Museum in London and honorary archivist of The Geological Society.

In 1969, having graduated at University College London, John joined the staff of the Geological Museum in South Kensington, London, at a time when the museum was part of the Geological Survey of Great Britain. He had a particular liking for fossils and had considered staying in academe to research the ammonites of the Jurassic Ampthill Clay for a PhD degree. Instead, however, he applied his interest to exhibition work at the museum where he also answered hundreds of palaeontological enquiries from the general public. One of the highlights of his palaeontological work at the museum was the major new exhibit on *British Fossils*, which opened in 1980,

and the booklet of the same name published in 1984. He had already written the earlier museum publication *The age of the Earth* (1980) and the book *The Story of the Earth* (1980), published by Ward Lock, for the 11-14 age group. Incidentally, when approached to prepare a second edition of *British Fossils* in the 1990s, he declined with characteristic deference because he felt he was no longer fully 'in touch' with the subject; the second edition subsequently appeared as Sue Rigby's *Fossils - the story of life* (1997).

John's other great interest was the history of geology; this became apparent in his earliest days at the Geological Museum and came to dominate his geological career. He prepared exhibits marking the centenaries of Roderick Murchison (1971), about whom he wrote a number of papers, and of Charles Lyell (1975). The latter exhibit, entitled *Early days of geology in Britain*, travelled from London to Cardiff, Belfast and Glasgow. He acted as secretary to the Charles Lyell Centenary Symposium organized under the auspices of the IUGS International Committee on the History of Geological Sciences and, from 1973, he was secretary of the Society for the Bibliography of Natural History (later Society for the History of Natural History),





a post he held until 1997. As well as his other duties at the Geological Museum, John undertook care of the Geological Survey's archives, and it is largely through his efforts that these (now in the care of the Chief Librarian, Graham McKenna, at BGS Keyworth) are in their present good order. In 1981, he became honorary archivist of the Geological Society and was, until recently, chairman of their History of Geology Group.

In 1985, the long association of the Geological Museum with the Geological Survey ended, and the museum and its staff were transferred to The Natural History Museum. Following the subsequent well-publicised reorganisation and staffing cuts there, John was appointed as their archivist, a post which he greatly enhanced and in which, I like to think, he had found his perfect niche.

John had great personal charm and integrity, and it is a measure of the high regard in which he was held within his profession that *The Times* published an obituary of him on 1st June.

Select bibliography

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Beris Cox

c/o British Geological Survey, Keyworth



Association Meetings Programme

Annual Meeting

University of Manchester 19-22 December 1999

Call for Abstracts

The Annual Meeting 1999 will be held at Hulme Hall, University of Manchester, from Sunday 19th December to Wednesday 22nd December, 1999.

Talks and posters on any subject of interest to Palaeontology are invited. Abstracts, not exceeding 200 words, should be sent to Paul Selden at the address below, by Monday 20th September, 1999. State whether the abstract is for an oral or poster presentation. Abstracts should be submitted in one of the following ways (in order of preference): 1) as an e-mail message or attachment, 2) on disk in ASCII format (other formats may be submitted in addition to ASCII, Macintosh preferred), or 3) clearly printed on white paper. Abstracts received after 20th September cannot be guaranteed inclusion in the meeting.

Talks will take place on Monday 20th and Tuesday 21st December, and be 20 minutes long (or 15 min if demand is high, and to avoid parallel sessions). 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 Poster Prize should indicate this when submitting their abstract.

Accommodation for the meeting will be in single-bedded rooms, some with en-suite facilities. The usual eating and drinking facilities will be available, and Hulme is situated adjacent to Manchester's famous 'curry alley'. The Annual Dinner will be held at Hulme Hall on Monday 20th December, with a reception beforehand at the Manchester Museum.

Field trips will depart on Wednesday morning for either 1) Clitheroe (Dinantian carbonate build-ups) or 2) Palaeontology of Manchester city centre (half-day).

Further details will be available from the Palaeontological Association Web site, or from the organizers. Ask us about Bridgewater Hall concerts, Canal Street, football, or The Trafford Centre!

Organizers:

Dr Paul Selden (Department of Earth Sciences), Dr John Nudds (The Manchester Museum), University of Manchester, Manchester M13 9PL (e-mail: Paul.Selden@man.ac.uk, tel: +44(0)161 275 3296, fax: +44(0)161 275 3947); and Dr Tim Palmer C.Geol., F.G.S., Executive Officer, The Palaeontological Association I.G.E.S., University of Wales, Aberystwyth SY23 3DB, Wales, U.K. (tel: +44(0)1970 622643, fax: +44(0)1970 622659, answerphone: +44(0)1970 627107, e-mail: palass@palass.org, Web: <http://www.palass.org>).

A booking form for this meeting is included in the centre of this *Newsletter*.



Geoscience 2000

University of Manchester 17-20 April 2000

Symposium G200018: Palaeoclimate Reconstructions from Fossils

sponsored by the Palaeontological Association

Fossil plants and animals can provide important evidence for past palaeoclimates, crucial for evaluating climate models and understanding environmental processes in the past.

This symposium will run for one half day during Geoscience 2000. Presentations and posters are welcome on methods used to reconstruct ancient climates from both plant and animal fossils, and on case studies of climate change for specific times in the geological past.

The half-day programme is almost full but posters are welcome. If there is sufficient demand we might ask for a whole day. Registration for contributors will be paid for by Pal Ass and there may be some contribution to travel costs. Please contact Jane Francis, School of Earth Sciences, University of Leeds (j.francis@earth.leeds.ac.uk) if interested.

Other Association Symposia at Geoscience 2000 are:

- Lyell Meeting: Plankton Evolution and Climate Change (contact convenor: Dr James Powell, Dinosystems)
- History of biodiversity (contact convenor: Prof. David Harper, Geological Museum, Copenhagen)
- Workshop: Museum collections and the teaching of palaeobiology to large groups (jointly with GCG)

Other Geoscience 2000 Symposia of interest include:

- Shelf sea palaeoceanography: The Quaternary record (contact convenor: Dr William Austin, University of Durham)
- Climate change in the Mesozoic (contact Convenor: Dr Hugh Jenkyns, University of Oxford)

Dr Jane Francis

School of Earth Sciences, University of Leeds, Leeds LS2 9JT, UK



Review Seminar: Functional Morphology

Department of Geology, University of Leicester November 1999

Why are functional data important in analyses of evolutionary pattern and process? Can functional data have a role in phylogenetic analysis? What are the latest techniques for functional analysis of extinct organisms? How much do we know about the function of extinct arthropods, molluscs, graptolites, conodonts and other micro- and macrofossils?

These and other questions will be addressed during a day of lectures presented by an international group of speakers including Graham Budd (Uppsala), Juliette Dean (Cambridge), Richard Fortey (NHM), Liz Harper (Cambridge), Paul Pearson (Bristol), Mark Purnell (Leicester), Sue Rigby (Edinburgh), Rachel Wood (Cambridge), and Jeremy Young (NHM). Organized by Richard Fortey, Mark Purnell, and Jeremy Young.

For further details check the Association Web site (<http://www.palass.org/>) under "meetings", or contact Mark Purnell, Department of Geology, University of Leicester, Leicester LE1 7RH, UK (e-mail map2@le.ac.uk).

Dr Mark A. Purnell

Department of Geology, University of Leicester, Leicester LE1 7RH, UK



Palaeo Reply

***Onychopterella augusti* – Revisited!**

A further explanation in defence of my previously documented thoughts on the eurypterid *Onychopterella augusti* (Newsletter 39, pp. 12-13) seems appropriate, given the recent reply by Richard Aldridge and Simon Braddy (Newsletter, 40, pp. 14-15). While the arguments used by both researchers in response to my editorial are balanced and sensible, I wish to draw attention to their erroneous assumption that I purposefully set out to ignore geological evidence. I found their accusation to be quite ironic, as I have always preferred the implementation of a synecological approach, as opposed to an autecological approach, when reflecting on the possible lifestyles of extinct organisms. Unfortunately, my problem was due to a *mis*understanding of the geological evidence. At the time that I had formulated my hypothesis, I could not reconcile the presence of reported benthic fossil organisms from the Soom with the supposition that the Soom Shale bottom waters and sediment could have been completely anoxic-euxinic at all times. I reasoned that the anoxic-euxinic conditions could not have been constant, or must have been permanently localized only in certain areas. The recent work of Sarah Gabbott, had it been published *before* I had submitted my editorial for publication in the *Newsletter*, would certainly have been useful in enabling me to clear up my unanswered questions, and correct my assumptions! In addition, it must be said that the exclusion of a benthic lifestyle for *Onychopterella augusti* does not, in itself, explain or account for the eurypterid's morphological specializations.

I should also like to address the expanded point made by Aldridge and Braddy regarding 'those who occasionally denigrate palaeontology as a discipline' because of their erroneous perception that palaeontologists delve into 'historical narratives and unconstrained speculations'. While it is proper for palaeontologists to guard against conforming to stereotypes, any insightful historical narrative should never be perceived as being degrading to the discipline. Attempts at speculation, when bound by reason, should enhance, rather than demean science. Speculations present us with an opportunity to question, or expand upon an hypothesis. Detractors should be reminded that it was Albert Einstein who once said, 'Imagination is more important than knowledge'. While I do not mean to reduce the debate to a simplistic level, I firmly believe that if palaeontology is large enough to integrate applied research with narratives and logical speculations, palaeontologists should hold their heads high. Perhaps those 'other people' who denigrate palaeontology are doing so because their view is too limited and inflexible. In any case, those who choose to denigrate others based on perceived stereotypes should hardly be worthy of our attention. Rather than worrying about converting or appeasing the ignorant, the primary concerns of every palaeontologist should be accumulating knowledge and effectively disseminating it to today's interested and informed public.

Jeffrey M. Minicucci

229 Glen Park Avenue, Toronto, Ontario M6B 2E2, Canada



Situations Vacant

PALEONTOLOGY UNIVERSITY OF CHICAGO

The Department of the Geophysical Sciences seeks applications for a faculty position in paleontology, broadly construed. While we seek applicants in all areas and at any level, we are especially interested in young scholars whose research forms an intellectual bridge between paleontology and one or more of the other areas of earth science represented in our department, including geology and stratigraphy, geochemistry and cosmochemistry, and atmospheric and oceanic sciences.

Applicants should send a letter of intent, curriculum vitae, brief statement of research interests, as well as the names, postal and e-mail addresses, and telephone and facsimile numbers of at least three scholars familiar with their research to: David B. Rowley, Chair; Department of the Geophysical Sciences; University of Chicago; 5734 South Ellis Avenue; Chicago, IL 60637 USA.

Review of applications will begin October 1, 1999. The University of Chicago is an Equal Opportunity/Affirmative Action Employer.

jobs...



Palaeo Comment

Forward to the Cambrian–Anomalocarid studies at the end of the millennium.

Anomalocarid arthropods have been reported from Cambrian fossil Lagerstätten localities around the world. While exceptional fossil preservation, skilful preparators, and comprehensive studies have revealed much about the palaeobiology of some of these formerly enigmatic metazoans, much work still needs to be done in order properly to address the more detailed aspects of anomalocarid anatomy and the interrelationships among the genera and species placed within the family. This brief commentary presents some observations, and raises a few questions for all researchers. My purpose is to clarify old problems before other researchers inundate us with new data. I suggest that all concerned researchers pause and reconsider what is presently known on anomalocarids. Several specimens referred to in this contribution are stored at the Nanjing Institute of Geology and Palaeontology, Academia Sinica (NIGPAS), and the National Museum of Natural History, Smithsonian Institution (USNM).

At the time of this writing, I have consulted published descriptions of genera and species currently accepted as valid anomalocarids. The studies of the mid to late 1990s have presented us with intriguing revelations, and the most complete fossils of these animals. The level of current research and discovery is at its most promising since Whittington and Briggs (1982) pieced together the first reasonable reconstruction of *Anomalocaris*. Collins (1996) has provided a complete account of the history of *Anomalocaris* reconstructions.

While the studies of the previous decade tended to be dominated by the publications of Whittington, Briggs, and Conway-Morris, attention in the mid to late 1990s has shifted towards three investigative ‘blocs’ represented by Hou, and Bergstrom; Chen, Zhou, and Ramskold; and Collins. The studies of these competing researchers are characterized by descriptions of complete anomalocarids, identifications of new anomalocarid genera, and/or more aggressive attempts to define the family systematically (e.g. Chen *et al.* 1994; Collins 1996; Hou *et al.* 1995; Ramskold 1995). Despite the thoroughness of the above studies, questions still remain unanswered. Briggs (1994) and Ramskold (1995) are correct in demanding a phylogenetic analysis of the Anomalocaridae. Since the anomalocarid *bauplan* appears to be more variable than previously assumed, efforts should be directed towards compiling a new, complete list of diagnostic characters for the family. A revised list of diagnostic characters could ultimately affect the relationship between the Anomalocaridae and other possible families within Collins’ (1996) proposed Order Radiodonta and Class Dinocarida. Both of these taxa are important in the effort to place anomalocarids and other similar problematic metazoans (e.g. *Opabinia regalis*, *Kerygmachela kierkegaardii*) into an eventually coherent phylogenetic context.



Of course it remains to be seen whether Collins' conclusions can be supported by a comprehensive cladistic analysis. Chen and Zhou (1997) do not even believe that anomalocarids comprise a family level taxon. Curiously, they place anomalocarids at the phylum level, but without providing a formal, comprehensive diagnosis, or cladistic analysis. Of prime importance is the need to identify and trace morphological trends relating to the acquisition and loss of characters. For example, at some point in their evolution, certain groups of anomalocarids ceased developing biramous trunk appendages in favour of retaining only the lateral lobes. Interpreted in an arthropod context, this change translates into the loss of the endopod and the retention of the exopod. The assumption that the anomalocarid lateral lobe may be a true exopod is partly based on the presence of reported ventral, limb-like appendages being consistent with the gross morphology of the arthropod endopod. Some morphotypes also show an increase in their degrees of tagmosis and sclerotization, while others show the opposite.

Contemporary Studies

Using deductive logic, Rudkin (1979) postulated the existence of a large Cambrian predator responsible for inflicting wounds on individuals of the trilobite *Ogygopsis klotzi*. The association of this trilobite with *A. canadensis* grasping appendages from the Middle Cambrian Stephen Formation (*Bathyriscus-Elrathia* Zone, *O. klotzi* faunule) prompted him to consider the enigmatic *A. canadensis* as the culprit. Other authors have since envisioned *Anomalocarid* a trilobite terror (e.g., Briggs and Mount 1982; Babcock and Robison 1989; Babcock 1993). In direct opposition to such studies, Hou, Bergstrom and Ahlberg (1995) suggest that anomalocarid mouthparts could not 'bite off pieces of trilobites and other arthropods with a hard exoskeleton' (p.181) and further allege that the mouthparts of previously reported anomalocarids were 'not directed ventrally as in previous reconstructions' (p.163). Alleged backward-facing mouthparts present in their *Parapeytoia yunnanensis* specimen are introduced as evidence. A major flaw in their argument is that the evidence derives from an unrepresentative sample. There are assorted complete specimens of other genera confirming the presence of mouthparts in the familiar, ventral position (see Chen *et al.* 1994; Collins 1996). Further, both the illustration (Hou *et al.* 1995, p.173, Fig. 10) and description suggest that the mouthparts of *P. yunnanensis* are, perhaps, different from the typical '*Peytoia*' jaws of other anomalocarids. Both in appearance, and in proposed function, typical anomalocarid mouthparts must have been deadly weapons possessed of substantial cutting and crushing power. Certainly, the fact that mouthparts are more readily preserved attests to their durability. The recommendation of both Chen and Zhou (1997) that anomalocarids should be sorted among different Dinocarid orders because of alleged differences in mouthpart morphology is probably not warranted. Both Collins (1996) and Briggs (1994) have made reference to a robot model of *A. canadensis* built for the Japan Broadcasting Corporation (NHK) television documentary 'Planet of Life'. In order to deduce the biting abilities of *A. canadensis*, the functional, realistic jaws of the robot model are made to bite down on a trilobite model with an 'exoskeleton' composed of a material similar in hardness to the exoskeleton of an actual trilobite. The biting action of the model's mouthparts suggests that the mouthparts of anomalocarids were capable of manipulating trilobites and causing injuries matching those



found in Cambrian trilobites from the fossil record (e.g. Rudkin 1979). The documentary's stunning computer generated images of a 'live' *A. canadensis* attacking trilobites is a speculative, but convincing presentation of the possible predatory behaviour of this animal. The anomalocarid referred to as *Hurdia* by Collins (1992) is described as having mouthparts with an extra set of teeth that would have lined the interior of the buccal cavity (Whittington and Briggs 1985). This configuration, suggestive of a 'pharyngeal mill', could have been even more effective at processing hard-bodied prey.

The majority of conclusions on anomalocarid functional morphology and anatomy in Hou *et al.* (1995) tend to be based on evidence from an unrepresentative sample. The described material of *P. yunnanensis* is hardly complete. Contrary to what Hou *et al.* (1995) clearly state in their paper, their best-preserved specimen of a single genus cannot reasonably serve as a template for redefining or dismissing the reconstructions of other anomalocarids. The ventral reconstruction (p. 180, Fig. 19) is problematical because there is no direct, conclusive evidence confirming the form of the anterior tagmata, and backward-facing position of the mouthparts and grasping appendages. It is ironic that Hou *et al.* choose 'the radial arrangement of circum-oral sclerites' (p. 163) as an homologous feature uniting aschelminthes and anomalocarids, while dismissing a virtual mountain of arthropod characters as irrelevant convergent features. Also problematical is their assertion that anomalocarids were dorsally covered in lanceolate scales. Such structures are allegedly identified in their specimens of *P. yunnanensis*, *Anomalocaris saron*, and *Cucumericrus decoratus*. The scales are almost impossible to identify from the published photographs, casting doubt on the accuracy of the camera lucida drawings. The fact that Chen *et al.* (1994) did not observe the same markings in more complete specimens of the same genera casts even further doubt on the observations of Hou *et al.* (1995). The interpretation by the latter authors of '*Peytoia nathorsti*' (= *Laggania cambria* of Collins 1996) assumes that USNM 274142 represents a dorsal view of the animal showing 'transverse sets of lanceolate scales' (Hou *et al.* 1995, p.179, Fig. 17A). Collins (1996) has successfully proven that this particular fossil represents a *ventral view*, and that the so-called 'scales' are better interpreted as 'flexible rod supports of the lateral lobes' (p. 290). Thus one key piece of evidence for the existence of dorsal lanceolate scales evaporates. Rather than being scales, the markings observed (if they truly exist) in the other above genera could be artefacts of preservation / effects of Neogene weathering, wrinkling caused by decay of the carcass, or a surface wrinkling of the integument actually present in life.

Linear striations present on the surface of the lateral lobes of anomalocarids have been reported in several genera. Chen *et al.* (1994) have interpreted these features as a vein network. Hou *et al.* (1995) simply note them as 'lines'. Collins (1996) suggests that *A. canadensis* and *L. cambria* possess gills on the lateral lobes, but no identifiable gill-like structures appear on the lateral lobes of his photographed specimens. Collins' complete specimens of *A. canadensis* indicate a virtually 'naked' animal, without any surface ornamentation or raised features of any kind on the integument (pers. obs.). Examinations of *L. cambria* material by Whittington and Briggs (1985) suggest the equivocal presence of linear markings on the lateral lobes. Both *A. saron* and *A. symbrachiata* in Chen *et al.* (1994) seem to preserve traces of setae / gill-like structures (in addition to the vein network) on several of the lateral lobes. In these specimens, the alleged setae appear to lie on the ventral surface of



each lateral lobe. Setae performing an alleged respiratory / gill function are usually attached to the distal edge of either a thin or paddle-shaped exopod in Cambrian arthropods and trilobites, but seeing the setae originate from the exopod surface is more complicated to explain (a similar situation exists in *Opabinia regalis*). In order to address the inconsistencies, we must formulate a diagnosis for correctly identifying what constitutes an anomalocarid gill. Hou and Bergstrom (1997) have wisely and justifiably identified problems with the fundamentally colloquial use of the term 'gill' in relation to descriptions of other Burgess Shale-type arthropods. If neither *A. canadensis* nor *L. cambria* possessed external gills, other locations for organs of gas exchange must be found. Further preparation of existing specimens or discoveries of new material should help to settle the issue.

Chen *et al.* (1994) reported the existence of 'two exsagittal rows of segmentally repeated ventral or internal structures of unknown function, preserved as black or light-reflective patches' (p. 1308) in the specimens Hou *et al.* (1995) would later identify as *A. saron* and *A. symbrachiata*. They further allege that these nodular structures are 'composed of bunches of fine, curved threads' (Chen *et al.* 1994, p. 1305) and describe them as 'equalling the nodular mineralized areas' described in *Anomalocaris nathorsti* (p.1306). Collins (1996) mentions the same structures in his discussion of the transverse mineralized strips (lateral lobe supports) on the ventral surface of *L. cambria*. I believe that any attempts to draw a connection between the nodular structures identified by Chen *et al.* with the club-shaped structures found on the ventral surface of *L. cambria* are premature. Such structures appear on the lateral lobes as the terminal ends of the lateral lobe support rods. The nodular structures discussed by Chen *et al.* (1994) are present only on the trunk region, and are isolated from each other, not being transversely connected by mineralized strips. The possibility could exist that the nodular structures represent caeca. In Ramskold *et al.* (1997), the Lower Cambrian petalopleuran xandarellid *Cindarella eucalla* shows evidence of caeca preserved as serially-repeated, dark stains with an 'internal system of approximately transverse or slightly splayed tubules' (p.29). It is tempting to compare the thread-like structures observed by Chen *et al.* (1994) with these. Collins' complete specimens of *A. canadensis* confirm that there was no evidence of trunk annulation or external segmentation in this genus. The trunk region of *A. saron* in Chen *et al.* (1994) is described as having transverse lines, but the 'irregularity and wrinkling of the lines' (p.1305) suggests that these are most probably preservational folds caused during diagenesis and compaction of the carcass. Ramskold (1997) has successfully demonstrated the existence of such misleading folds in naraoiid and tegopeltid arthropods. He has, however, hinted at the existence of certain undescribed genera with higher degrees of tagmosis possessing intersegmental trunk bars (Ramskold 1995). A fact not discussed by researchers is the significant disparity between the virtually 'naked' soft-cuticle condition of *A. canadensis* and the high degree of tagmosis and sclerotization of *P. yunanensis*. According to the fossil evidence, while the most complete specimen of *P. yunanensis* (NIGPAS 115334) represents a substantial body moult (Hou *et al.* 1995), ecdysis in *A. canadensis* would seem to have been limited to moulting of the grasping appendages and mouthparts (Collins 1996). Persistent collecting seems to show that Royal Ontario Museum specimens of *A. canadensis* remains tend to consist of either a complete carcass or isolated mouthparts and grasping appendages (as seen in Collins 1996). Anything in between consists of a smeared blob (pers. obs.). As a



consequence, it can be inferred that *P. yunnanensis* had a more significantly sclerotized cuticle. An increase in the degree of cuticle sclerotization may be correlated with an increased complexity of tagmosis in each genus.

The high degree of anatomical detail preserved in specimens of Chengjiang anomalocarids attests to the quality of Chengjiang fossils. If the criticisms of Hou and Bergstrom (1997) are accepted at face value, it is arguable that the apparently smooth, featureless surface of the soft-cuticle of Collins' Burgess Shale *A. canadensis* is an artefact resulting from comparably inferior preservation associated with fossils from the Burgess Shale biota. The small size of reported Chengjiang anomalocarids correlates with the assumption that their remains represent juveniles, while Collins' described *A. canadensis* specimens represent adult organisms. Whether the preservational environments or different ontogenetic stages account for the differences in visible anatomical details is unclear.

The 'fantail' reported in *A. canadensis* (Collins 1996), *A. saron*, and *A. symbrachiata* (Chen *et al.* 1994) presents a comparative problem. Phylogenetically, it is certainly not homologous with a telson, and no other arthropod has a similar posterodorsally placed structure. The presence of caudal furcae in the Chengjiang material is certainly an arthropodan character, but the 'fantail' complex is a uniquely derived feature. Part of the problem in adequately classifying the anomalocarids is that they developed a significant amount of derived features masking their ancestry after diverging from basal arthropods. Unclear is whether the 'fantail' elements were rigidly fixed in position, or moveable, like the pliable lateral lobes. If the animals could adjust their orientation with respect to the flow of water, they may have stabilized the anomalocarid body in a manner comparable to the way in which rudders stabilize modern American military aircraft in the air.

Recent studies dramatically emphasize the variations found in frontal grasping appendages among anomalocarid genera. Described examples are the relatively stout crushing claws of *A. canadensis* (Collins 1996); the wicked impaling claws of *A. symbrachiata*; and the long, slender claws of *A. saron* (Chen *et al.* 1994; Hou *et al.* 1995). The morphology of the grasping appendages of *L. cambria*, *Cassubia infercambriensis* and the unknown 'appendage F' anomalocarid (Briggs 1979) may militate against the view that all anomalocarids were active hunters (Whittington and Briggs 1985) because such appendages could be interpreted as the instruments of sweep-feeders (see discussion by Dzik and Lendzion 1988, and Nedin 1995). The Emu Bay Shale anomalocarid *Anomalocaris briggsi*, known only from grasping appendages with extensive comb rows on all but the first podomere endites, also seems to be a confirmed sweep-feeder (Nedin 1995). Nedin alleges that the serrated endites on the first podomere were capable of impaling prey caught within the flexed appendage. In sharp contrast to the morphology of the fourth podomere endite on the grasping appendage of the confirmed impaler *Amplectobelua symbrachiata* (Chen *et al.* 1994), these particular endites show no appreciable increase in length relative to the lengths of the other podomere endites, casting some doubt on their effectiveness as impaling organs. The morphological differences between the grasping appendages of *A. briggsi* and those of other species of *Anomalocaris* are probably both sufficient and necessary to warrant assigning this species to a new genus. The grasping appendages of *P. yunnanensis* are worth mentioning because these differ significantly from those of other described anomalocarids. According to Hou *et al.* (1995), a complete appendage



consists of five segments – the lowest number yet reported in any genus. Rather than being composed of several podomeres, the proximal half of the grasping appendage consists of a long, stout podomere, and the arrangement of endites on each subsequent podomere gives the distal half of the appendage an almost chelate appearance. An approximately chelate grasping appendage has not been reported in any other anomalocarid. Superficially comparable are the frontal grasping appendages of the megacheiran fortiforcipid *Fortiforceps foliosa* (Hou and Bergstrom 1997; p.36, Fig. C). The functional morphology and development of the above type of appendage in anomalocarids merits further investigation. The endites are long, but the fact that there are only four probably indicates that they did not form a comb filter-feeding mechanism. Flexing the four distal podomeres would bring them into contact, making the appendages seem better suited for picking and manipulating, as opposed to squeezing and crushing using a deadly ‘bear-hug’ embrace, as suggested by the morphology of ‘typical’ predatory anomalocarid appendages. No less intriguing will be the complete description and analysis of whatever kind of grasping appendages are present in the *Hurdia*-type anomalocarids reported by Collins (1992).

Aside from containing some very misleading syntactical and spelling errors, the spectacular, sumptuously illustrated monograph on fossils of the Chengjiang fauna by Chen and Zhou (1997) presents an extremely brief description and two colour photographs of an alleged anomalocarid from the Chengjiang locality. Although the argument that this fossil represents an ancestral grade of anomalocarid body organization is presented (Chen and Zhou 1997), I cannot help but notice more than a passing similarity between this animal and *Fortiforceps foliosa* (Hou and Bergstrom 1997). The single, preserved grasping appendage, endopods, stalked eyes, telson, and number of tergites of the Chen and Zhou arthropod seem to bear striking similarities to the corresponding structures in *F. foliosa*. The absence of sclerotized, circular mouthparts is also a problem. I have not seen the actual, un-named specimen, and cannot make a final decision, but the preliminary comparisons cast some serious reasonable doubt on the proposed anomalocarid affinities of the Chen and Zhou (1997) arthropod. Are we, in fact, dealing with a second fortiforcipid?

Conclusions

The reported morphological variations present in assorted anomalocarid genera emphatically illustrate the former diversity of these animals. Indeed, preliminary descriptions of very unusual genera with several frontal carapace-like components forming the anterior tagmata (Collins 1992, 1996), and reports of more genera with gnathobasic, biramous appendages (Ramskold 1995) indicate that anomalocarids evolved an assortment of specialized forms, and varying degrees of tagmosis and sclerotization, perhaps enabling them to occupy different feeding guilds. At this juncture, virtually no substantive information has been published on such forms. It appears that all described and even undescribed genera may be sorted according to several distinct grades of anomalocarid body organization. Superficially identifiable are the genera with a soft-cuticle or minimal sclerotization, possessing uniramous trunk appendages (lateral lobes only); the genera with complex degrees of tagmosis and sclerotization, possessing biramous trunk appendages; and the *Hurdia*-type genera, which



radically depart from the two former body designs (see Collins 1992). Assigning the different grades taxonomic rankings, either by assigning each to sub-familial status within the Anomalocaridae, or by erecting family level taxa for each within an Order, depends on how each grade could be proven to be distinct cladistically. More grades of body organization must surely have existed, and are as yet unrepresented or unrecognized in fossil collections. It is, of course, possible that the same type of body organization expressed among similar genera could merely reflect homoplasy in anomalocarids not closely related.

The most obvious benefit to anomalocarid studies of today is the calibre of today's researchers, who represent the most informed, aggressive and competent assortment of investigators presently available. New rising stars, like Graham Budd, represent a fresh breed of researcher capable of meeting future challenges. Cambrian Lagerstätten research has become an area of palaeontological study where many of the personalities involved seem monolithic. As an extreme example, Xianguang Hou appears to have been unofficially elevated to the status of being the 'new Charles Walcott' for his discovery of the Chengjiang fossil deposits. Unfortunately, the dark side to having so many luminaries involved in one area of study is that rivalries, posturing, and polarization between schools of thought have emerged (e.g. Collins, Bergstrom and Seilacher 1991), ultimately degenerating into arguments over whose adopted fossil Lagerstätten locality is actually *better* (e.g. Hou *et al.* 1997). While there is certainly room for competition among researchers, there is certainly *no* room for extreme egos in any meaningful scientific discussion.

Because of the paucity of fossil material, and because anomalocarids have no other arthropod analogues for comparison, the key to understanding them must be objectivity. If we rigidly adhere to a single, preconceived point of view, we eventually become that point of view, and are obliged to waste otherwise productive time defending it. Pontifications aside, the fundamental point to remember is that all researchers concerned are ultimately united by their desire to *understand* these fossil animals. As the hunger for more information increases, publishing formal descriptions of new genera should become a top priority for all researchers. The need to employ cladistic methodology to understand the relationships between anomalocarids is obvious. Demand for new data will certainly reach a fever pitch as researchers continue to improve and diversify their anomalocarid fossil collections – after all, we endured over one hundred years of waiting before obtaining a proper identification of *A. canadensis*. The flurry of current publications indicates that the anomalocarid endgame has potentially reached the stage where waiting for new information is no longer comparable to 'waiting for Godot'.

The three anomalocarid grades. In accordance with the criteria established by Collins (1996), all anomalocarids may be diagnosed as being bilaterally symmetrical, with two distinct tagmata, but other features, such as lateral lobes, grasping appendages, biramous appendages, form of the trunk, and anterior tagmata vary between types of genera. Based only on the current descriptions of anomalocarids, and a casual observation of the available evidence, I have listed several groups possibly comprising distinct grades of anomalocarid body organization. The inadequately described Chen and Zhou arthropod (1997), if it is truly an anomalocarid, could very well represent an ancestral grade of anomalocarid body organization unknown in other described forms. Groups 1, 2 and 3 comprise a grade of



genera possessing a soft cuticle, simple body organization, and uniramous trunk appendages. Group 4 contains the grade of genera with complex degrees of tagmosis and sclerotization, and biramous trunk appendages, while group 5 represents the grade of genera that have made a radical departure from the body designs of the other grades. A thorough cladistic analysis incorporating all described and undescribed taxa will ultimately determine the viability of this concept.

1. Sclerotized mouthparts and grasping appendages; body is 'naked', smooth-surfaced without visible trunk annulation or external segmentation; no apparent external gill-like structures; no body ornamentation or raised features of any kind; 13 pairs of lateral lobes; no jointed trunk appendages, and posterodorsal 'tail' finlets arranged *en echelon*. (after Collins 1996)

Example: *Anomalocaris canadensis*

2. Sclerotized mouthparts and grasping appendages; body is 'naked', smooth-surfaced without visible trunk annulation or external segmentation; no apparent external gill-like structures; ventral, transverse, lateral lobe support 'rods' present. 14 pairs of lateral lobes; no jointed trunk appendages, evidence equivocal concerning presence of striations on the entire ventral surface of the lateral lobes; caudal end of body tapers to blunt extremity. (after Collins 1996)

Example: *Laggania cambria*

3. Sclerotized mouthparts and grasping appendages; diagonal striations on the lateral lobes (interpreted as veins by some authors); setae-like structures present on lateral lobes; two exasagittal ventral rows of serially-repeated, nodular structures; no confirmed trunk annulation or external segmentation; no jointed trunk appendages; tail furcae present; and posterodorsal 'tail' finlets arranged *en echelon*. (After Chen *et al.* 1994; Hou *et al.* 1995).

Examples: *Anomalocaris saron*, *Amplectobelua symbrachiata*

4. Significantly sclerotized body including median sternites, ?dorsal lanceolate scales, gnathobasic biramous trunk appendages, grasping appendages; mouthparts facing backwards; diagonal striations are present on lateral lobes (after Hou *et al.* 1995). Other forms awaiting description by Ramskold (1995) could fall into this group, further expanding its diagnostic criteria.

Examples: *Parapeytoia yunnanensis*, *Cucumericrus decoratus*

5. Anterior tagmata formed of several carapace-like components bearing two sheathed claws on stalks. Below the carapaces, the jaws have an inner set of teeth, and are surrounded by pair of claws; trunk has 11 segments and a tail; gnathobasic, biramous trunk appendages (after Collins 1992, 1996).

Example: *Hurdia* sp., *Proboscicaris* sp.

Cassubia infercambriensis, *Anomalocaris briggsi*, *Anomalocaris pennsylvanica* (incl. cf. *pennsylvanica*), *Anomalocaris* sp. and the 'appendage F' anomalocarid are indeterminate forms based on grasping appendages only. *Amiella ornata* is a *nomen dubium* (Hou and Bergstrom 1997). The named species assigned to *Hurdia* (e.g. *H. dentata*, *H. triangulata*



and *H. victoria*) and *Proboscicaris* (e.g. *P. agnosta*, *P. ingens* and *P. obtusa*) should all be regarded as *nomina dubia*, pending a full description of these genera.

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(That's enough arthropods for a while... Ed.)



Meeting Report



The Lyell Meeting –

Organism & environment feedback in carbonate platforms and reefs

Geological Society, London 1 – 2 March, 1999

“How do interactions between organisms and environments generate the variety and distribution of carbonate facies and geometries in the ancient and modern record?” This was the question proposed by the meeting convenors Enzo Insalaco, Peter Skelton and Tim Palmer. The interactions between organisms and sediments is not exactly a new topic for palaeontologists and sedimentologists. However, the meeting aimed to bring together palaeontologists, ecologists and sedimentologists to discuss what progress has been made towards gaining a better understanding of the many interactions between organisms, sediments and their environments that led to the variety of platform types and geometries developed in the geological record.

Through a combination of presentations and discussion the convenors aimed to assess the advances made within the following subject areas:

- (i) Ecology/palaeoecology of benthic biotas and their influence on growth fabric genesis.
- (ii) Processes and rates of skeletal growth, bioerosion and sediment production.
- (iii) Taphonomy of reef fabrics and sediments.
- (iv) Sequence stratigraphy and its bearing on reefal development.
- (v) Regional and local environmental change and its association with patterns of evolution and extinction.
- (vi) Contribution of carbonate-carbon burial in the global cycle budget and climate feedbacks.

With 22 presentations (including four invited talks) and many posters, discussion time was limited, so the convenors introduced the ‘question box’ for those questions that there was not time for. Several boxes were placed around the Geological Society so participants could place questions, or comments, in the boxes that the discussion time did not allow for (anonymously even!). The idea was that at the end of the meeting there would be time to continue the discussion through addressing the extra questions and comments from the box.

Topics covered:

Over the two days the presentations covered (with a certain amount of overlap) three broad subjects.



1) Controls on growth fabric genesis

This topic was covered through a look at tectonic and environmental controls on growth fabrics.

Tectonic controls

Wolf-Christian Dullo (the first of the invited speakers, who 'kicked-off' the meeting) gave us an insight into how tectonics may control scleractinian growth rates (which was discussed in the form of Bubnoff units, 1 Bubnoff = 1m/1000my or 1mm/1000y) and carbonate production rates in the Caribbean and Indo-Pacific. Dullo showed how the significantly different rates of carbonate production in these two regions can be attributed to change in oceanographic conditions due to the closure of the Panama gateway.

Bassett & Churns demonstrated how lowstand-highstand sediment partitioning during eustatic sea-level fluctuations was the controlling factor in the development of carbonate buildups in the Silurian of Gotland, Sweden; reefs formed only during highstand systems tracts where clastic deposition is suppressed allowing carbonate production.

Bernecker *et al.* cited sea-level change, leading to the development of several karstified surfaces as the main control mechanism for the development of reef growth during the late Triassic in Austria. Karstification was also cited by Gischler and Lomando as a controlling factor on the development of the isolated carbonate platforms off the coast of Belize and SE Mexico. They gave a detailed outline of the distribution of carbonate facies which developed through sea-level fluctuations. These sea-level fluctuations and development of antecedent topography were the result of fault-block rotation at a passive continental margin. The subsequent facies distribution was due to the variation in submarine topography from platform to platform. Variations in sea-floor topography was also a subject discussed by Reigl and Piller as the controlling factor on the distribution of the community structure and framework development of the reefs and coral carpets in the northern Red Sea. They distinguished between the constratal and superstratal growth fabrics of Gili *et al.* (1995), found in the windward and leeward part of the platform respectively. The differences in coral community structure and composition is a response to a complex organism-environment feedback loop controlled by large scale geological processes, oceanography, bottom topography, coral community and framework type. This is important in the fossil record, especially in the Cretaceous where superstratal growth fabrics are extremely rare. Recent studies have shown how the identification of constratal or superstratal growth fabric is related to the relative platform position (Skelton *et al.*, 1997; Insalaco, 1998).

In these times of supposed 'Global Warming' Weidlich posed the question as to whether the major shift from glacial to non-glacial climates and tectonic activity in the Permian could be evidenced by the response of Middle/Late Permian reef ecosystems. Weidlich emphasised the enigmatic nature of Permian reef growth and carbonate production, and suggested that modern counterparts are poor modern analogues, although Weidlich did hint at evidence for algal symbiosis in Permian reefal corals.

Environmental controls

Although the El Niño-Southern Oscillation (ENSO) is a regional scale event that has had a profound effect on a variety of marine and terrestrial environments, Peter Glynn (the second of



the invited speakers) showed in graphic form the devastating effect the 1982-83 and 1997-98 ENSO events had on coral growth fabrics in the Eastern Pacific. After the disaster of the 1982-83 event, which resulted in between 50-95% coral mortality of the coral community in the equatorial eastern Pacific, the 1997-98 event caused widespread bleaching and mortality of the surviving communities. The graphic image of coral bleaching always seems to produce a stunned silence throughout the conference audience. Of the species affected by the events, those that suffered regional extinctions have not reappeared, and the disturbed areas have not been re-colonised by coral communities. Glynn suggests this was probably due to the low coral recruitment and intense bioerosion which limits reef building and reduces carbonate production; a response amongst the communities to the environmental changes caused by the ENSO events.

As well as these regional environmental fluctuations, local environmental fluctuations can have an adverse affect on the composition and distribution of bioconstruction growth fabrics. Clastic and volcanoclastic sedimentation is an environmental fluctuation that in the past was thought to be an inhibitor of carbonate production and bioconstructional development. Wilson and Lokier presented the first of a number of studies which showed the effect that sedimentation can have on bioconstructional development. They described a particular response of the carbonate producers to increasing sedimentation stress; under higher rates of sedimentation, bioconstructional faunas show a distinct change from diverse oligotrophic faunas. The number of carbonate producers is extremely restricted, but individual numbers may be abundant. Where low energy and low light levels predominate, the fauna is dominated by platy corals, flattened larger benthic foraminifera and burrowing organisms.

The platy coral theme was taken up by Rosen *et al.* who showed that this is not a unique phenomenon restricted to certain coral taxa, but is something that has recurred throughout the evolution of the scleractinia. Rosen *et al.* showed how the recurrence of platy coral facies is dependent on the intimate relationship between the coral colony and its algal symbionts. Since the relationship is dependent on light, the platy morphology represents optimisation of phototrophy in response to low unidirectional light levels, or possibly soft sediment substrates. Modern platestones are known from deeper water and/or more turbid reefal environments, which had already been mentioned by Reigl and Piller who described the platy form of *Leptoseris* from reefs in the northern Red Sea. Rosen *et al.* described examples from the fossil record as far back as the Triassic, consistent with the fossil record for algal symbiosis in the scleractinia, where the platestones were either found in deeper water or more turbid environments (e.g. the delta front discussed by Wilson and Lokier). This was also supported by Clack's poster describing the distribution of coral bioconstructional fabrics from the Aptian-Albien of the Neo-Tethyan realm, which included some of the examples discussed by Rosen *et al.* How many more of you out there have coral platestones in your successions? What remains to be seen is how much further back in the fossil record evidence for algal symbiosis can be found; Weidlich had already discussed the possibility of algal symbionts in the corals of the Permian. What about older Palaeozoic bioconstructional platestones: are these a response to algal symbiosis and low unidirectional light?



In the presentation on reef fabrics from the Late Devonian of the Canning Basin, Wood questioned the constructional role of the stromatoporidae sponges (the major 'reef builders' of the time). Wood described the variation in growth morphology which included platy forms similar to the platy corals discussed by Rosen *et al.* As with many of the platy corals, the platy stromatoporidae represent the onset of carbonate sedimentation and colonisation in the deeper water environment. Although stromatoporidae are not thought to have algal symbionts, this does pose the question as to the controls and function of the platy morphology in a similar environment? Nebelsick and Bassi also showed how environmental differences influenced the variation in growth morphology of coralline algal from the Oligocene shelf carbonates from Slovenia.

Finally, Gili & Skelton showed how hippuritid elevator rudist congregations, on the late Cretaceous carbonate platforms of the Tethyan Realm, may have been self-regulating bioconstructions that did not form physical obstacles (i.e. reefs). Initiation of rudist settlement provided more hard substrates for further rudist settlement, and *in situ* formation of sediment, resulting in embedding and consolidation (positive feedbacks); where sedimentation outpaced vertical growth of rudists, rudist settlement and development would have been inhibited (negative feedback). Gili and Skelton also gave us a rather neat insight into the life of an elevator rudist. Through the use of flume tank experiments they showed how rudists leaned with current directions in order to maximise the flow of organic detritus to the commissure.

2) *Bioerosion, sediment production (and dissolution)*

The production of sediment on carbonate platforms plays a major role in the distribution and type of bioconstructional growth fabric developed, and several of the presentations dealt with the process of sediment production. Of these, Schlager (the third of the invited speakers) discussed sediment production on a large scale and related it to carbonate platform growth potential. Schlager subdivided carbonate genesis into three production domains or factories; tropical carbonates formed in the photic zone, cool water high latitudes carbonates and deeper water carbonate mud mounds. He then used these subdivisions to outline some of the paradoxes that occur when comparing sediment production and accumulation rates in modern carbonate environments and the fossil record. The growth potential of modern tropical carbonate platforms shows a paradox in comparison to those in the fossil record. In modern platforms the potential for reef and platform growth exceeds rising sea-level; however, in fossil examples, relative sea-level rise often outpaced platform growth potential. When studying the interaction of processes on modern platforms it is easy to overlook longer term geological processes and as Schlager pointed out the paradox disappears if platform growth potential decreases over time. In the geological record the demise of carbonate platforms (which was dealt with by Masse and Skelton in their presentations) occurs over an extended period of time where the change of growth potential and relative sea-level rise may be able to stress and gradually drown platforms. By gaining a better understanding of the growth and demise of ancient carbonate platforms, the evolution of modern carbonate environments may be more fully understood.



Kiessling *et al.* also discussed sediment production and how it has changed through the evolution of reefs in the Phanerozoic. They presented a database for the Phanerozoic which had been divided into 32 time slices based on second order eustatic sea-level fluctuations. The study looked at the relationship between the diversity of reef builders, sediment production and effectiveness of export, and used factor analysis and the relative magnitude of the correlation coefficients. Their results showed how biological factors are more important than physical factors as a control on the production of sediment throughout Phanerozoic reef evolution.

On a slightly smaller scale, and following on from Gili and Skelton's presentation, Steuber highlighted the intimate link between rudist bivalves and the relatively high sediment regimes in which they lived. Through isotope studies Steuber calculated that rudist communities were rather short-lived and frequently restricted to a single generation with individual life span rarely exceeding ten years. As Gili and Skelton had already pointed out, Steuber also noted that background sedimentation was essential to stabilisation of elevator rudist morphotypes, as they did not form self-supporting growth fabrics.

Perry & Bertling presented the results of on-going work relating the change in composition and role of coral macroborers since the early Mesozoic. They pointed to the considerable amount of data available on modern reef settings; however, ancient settings (pre-Quaternary) macroboring data remains patchy. Early data collected by Perry and Bertling suggests a change in dominant macroboring communities since the early Mesozoic. Worms are dominant in the Triassic and early Jurassic reef settings, with a progressive increase in the role of bivalve borers through the Jurassic. Sponges appear to be rare throughout the Mesozoic, whereas in the Cenozoic macroboring communities are typically dominated by sponges at all depths, with worms and bivalves only significant at shallow water sites. As this is an on-going study, data to explain the nature of these changes is limited, so think about this next time you see bored corals! How do the borings in your corals compare?

After the above presentations of sediment production and destruction of growth fabrics on large scales, Glaub and Gektidis presented a novel palaeobathymetric method based on the distribution of microborers, based on the specific bathymetric ranges of modern microborers. The scheme is related to a photic zonation developed from a study of Jurassic samples and tested on samples from the Silurian, Permian and Triassic of fossil microborers that have modern counterparts. This work was also supported by a poster by Gektidis who described the effect of microborers on mobile and immobile experimental ooids from the Bahamas.

After much discussion on the production of sediment in carbonate platforms, Wright & Churns presented a possible explanation as to why molluscs are sometimes missing or undervalued in the fossil record. They described an example where early silicification resulted in the preservation of a diverse assemblage of molluscs. This was in comparison to a non-silicified fauna of a similar facies which had a molluscan frequency of only 1%, whereas the silicified fauna comprised 50% molluscs. Wright and Churns suggested that rather than the faunal difference being controlled by environmental differences it was apparently the result of localised preservational differences. In modern carbonate



environments early dissolution of aragonite in shallow burial is thought to be a major remover of aragonitic material. Wright and Churns suggested that this may be the process responsible for the preservational difference in their examples; if this is correct then it surely would, as they suggested, have major implications for the completeness of the fossil record and the estimates of carbonate production and sedimentary budgets. As the discussion suggested after, considerably more careful study needs to be done in order to ascertain the implications of this study.

3) *Crisis and demise in carbonate platforms*

Although the demise of carbonate platforms is a large subject and had been touched on by other presenters (e.g. Schlager), the main discussion on this subject was approached by the fourth invited speaker, Jean-Pierre Masse, and one of the meeting convenors, Peter Skelton. Masse presented examples of faunal crisis and environmental change from the two faunal turn-over episodes on the carbonate platforms of the early Cretaceous: the mid-Valanginian and mid-Aptian. Masse showed how the two events affected the dasycladean algae, rudist bivalves and benthic foraminifera, which played a major role as sediment producers on early Cretaceous carbonate platforms. These groups suffered major extinctions (57% and 70% for the two episodes respectively) which were selective to taxa with low specific diversity, restricted palaeobiogeographical distribution, large size and aragonite dominated skeletons. Masse pointed out how these two biological crises coincided with environmental changes. These included a reduction of carbonate platforms (mid-Valanginian) or modification of their palaeogeography and strong modification of ocean geochemistry, most importantly in the form of oceanic anoxic events through major transgressive episodes (mid-Aptian). Masse also emphasised the importance of tectonic and climatic factors in deciphering the exact controls on these carbonate platform extinction events.

To finish the meeting, and in an attempt to address and summarise some of the main aims of the meeting, Skelton presented a model for the cyclic growth and demise of carbonate platforms during the late Cretaceous. In an on-going study with J-P Masse, Skelton showed preliminary calculations that suggest global rates of carbon burial for the Cretaceous significantly exceeded those of the present, the Tethyan realm alone being half that of the total rate today. This means that atmospheric CO₂ levels must have been considerably higher than today and Skelton suggested that super-plume activity in the Pacific could have been a supply. To explain the cyclic (episodic) nature of growth and demise of these carbonate platforms a complex system prone to occasional destabilising feedbacks was developed. Increased levels in volcanic outgassing were shadowed by the growth of carbonate platforms, 'mopping-up' excess CO₂. However, lags in response by the carbonate platforms to increases in CO₂ also led to global warming and sea-level rise. As a consequence, sudden interruptions in volcanic outgassing would have been met by an overcompensation of carbon burial by the enlarged platforms, leading to the decline of atmospheric CO₂ and associated cooling. This would result in a sudden suppression in platform growth rates, which could then have led to drowning of the carbonate platform during sea-level rise. The cycle would then start again when volcanic outgassing was resumed. Skelton also suggested that the frequent cyclicity of prograding mobile sediment dominant platforms may have suppressed the development of reef fabrics and led to the dominance of rudist biostrome fabrics.



Finally the questions and comments from the boxes were revealed. This provided some lively discussion lead by Peter Skelton and Wolfgang Schlager. Unfortunately, time restricted the discussion which emphasised the progress being made, shown by the diversity of presentations, and identified areas that need further attention. Even though the 'question box' idea worked well, time allocated at the end of sessions to review the comments and questions in the box would have allow more subject centred discussion to develop. Putting this minor glitch aside, I would like to congratulate the convenors – Enzo Insalaco, Peter Skelton and Tim Palmer – on what was an extremely enjoyable and well organised meeting, especially as it was good to attend a meeting where the programme approaches the original aims set out by the convenors.

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Skelton, P.W., Gili, E., Rosen, B.R. and Valldeperas, F.X. (1997) Corals and rudists in the late Cretaceous: a critique of the hypothesis of competitive displacement. *Bol. R. Soc. Esp. Hist. Nat. (Sec. Geol.)*, **92**, 225-239.

Gary Aillud

University of Plymouth



Special Notice for Pal Ass members

The NEW International Code of Zoological Nomenclature

The long-awaited new and extensively revised 4th Edition of the International Code of Zoological Nomenclature will be published in September 1999 by the International Trust for Zoological Nomenclature (ITZN). It will come into effect on 1 January 2000 and will entirely supersede the current (1985) edition. Some notes about the forthcoming edition, which contains many new provisions (including some relating specifically to ichnotaxa), can be found on the ITZN Website (<http://www.iczn.org>).

The full price of the 4th Edition will be £40 or \$65, but ITZN is offering a 25% discount to individual members of a scientific society who buy the Code for their own personal use.

However, the Palaeontological Association is a strong supporter of ITZN, and a special arrangement has been made whereby individual members of the Association can buy a copy for personal use at the further reduced price of £25 or \$40 (including surface post).

This amounts to an extraordinary 40% off the price of the volume itself. For Airmail to any part of the world add £4 or \$7.

Copies for delivery in September can be ordered now from the Executive Secretary at the address below. Send cheque with order, either in £ sterling or US dollars (*which must be drawn on a US bank*). If you are outside these currency areas, pay by Visa or MasterCard. Include Number, Expiry date and your home address (or address at which card is held) with your order. Remember that delivery will be by Surface Mail unless you include Air Mail p&p.

E-mail instructions to palass@palass.org are welcome, but this is not secure for credit cards.

Dr Tim Palmer

Executive Secretary, The Palaeontological Association

I.G.E.S., University of Wales, Aberystwyth, Wales SY23 3DB, United Kingdom

This is probably your cheapest way of obtaining the new Code.



>> *Future Meetings of Other Bodies*



Cephalopods – Present and Past

Vienna 6 – 9 September, 1999

To register or for information contact Herbert Summesberger, Museum of Natural History, Vienna (tel (0043) 1 52177/251, fax (0043) 1/52 177/459, e-mail herbert.summesberger@nhm-wien.ac.at).



47th Symposium of Vertebrate Palaeontology and Comparative Anatomy

Edinburgh, Scotland 8 – 11 September 1999

The Symposium will be preceded by the 8th Symposium of Palaeontological Preparators and Conservators, on 7th September 1999.

Both meetings will be hosted by the National Museums of Scotland in central Edinburgh, and organised by the staff of the Department of Geology and Zoology. There will be a reception in the new Museum of Scotland. The provisional venue for the Conference Dinner is the newly-opened independent Dynamic Earth interpretive centre. There will be the usual day field trip on the 11th.

These dates have been arranged to allow delegates to go on to the 'Secondary Adaptation to Life in Water II' meeting in Copenhagen the following week. Daily direct flights are available from Edinburgh to Copenhagen so that both meetings can be attended in entirety.

Enquiries to Mike Taylor, Department of Geology and Zoology, National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF (fax +44(0)131 220 4819, e-mail mat@nms.ac.uk).



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. It will be possible to organise workshops and themed sessions to accommodate those with similar interests.



Registration Fee: £100 (sterling), €90 for members of The Malacological Society, £50 for students.

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).

There are further details at <http://www.sunderland.ac.uk/~es0mda/bivalve.htm>



5th International Congress on rudists

Erlangen, Germany 26 – 30 September 1999

All details, including the post-conference field-trip (1-6 October), are in the Web site at <http://www.geol.uni-erlangen.de/pal/Steuber/RUDIST.htm>



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 Ciencias 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).



International Conference: Where Worlds Collide

UNE Asia Centre, 29 November – 1 December 1999

Where Worlds Collide: Faunal and floral migrations and evolution in SE Asia-Australasia will be held at The University of New England, Armidale, Australia.

The conference will be structured into themes. Some preliminary suggested themes are: Palaeozoic/Mesozoic geology and biogeography; Cenozoic geology and biogeography; Primate evolution and biogeography; Hominoid migration and dispersal; Plant evolution and dispersal in the region; Wallace's Line; and Human dispersals, cultural contacts and change.

Further details from A/Prof Ian Metcalfe, Convenor, Where Worlds Collide Conference Asia Centre, University of New England, Armidale NSW 2351, Australia.



5th International Meeting of the Society of Avian Palaeontology and Evolution

Beijing June 2000

For information contact: Huiling Wu or Yonghong Zhang, 2000 SAPE meeting, P.O. Box 643, Beijing 100044, China, fax 86-10-68337001.



Millennium Brachiopod Congress

The Natural History Museum, London 10 – 14 July 2000

The 4th International Brachiopod Congress – sponsored by The Palaeontological Association, The Systematics Association, The Geological Society and The Paleontological Institute – will include the themes Living Brachiopods and Palaeobiology, Evolution and Phylogeny, Palaeoecology and ecology, Palaeobiogeography and Biostratigraphy, and Molecular Analyses. The Congress will provide an opportunity for scientists from around the world to discuss current research and debate questions stimulated by the present revision of Part H of the Treatise on Invertebrate Paleontology.

There will be pre-Congress excursions to the Palaeozoic of Wales and the Welsh Borderland, and to the Dunstaffnage Marine Station near Oban (for living brachiopods and faunas off the West coast of Scotland), and post-Congress excursions to the Lower Carboniferous, Late Viséan "Reefs" of Derbyshire and to the Jurassic and Cretaceous of South-East England. Organised by Robin Cocks, Howard Brunton, Sarah Long and Alwyn Williams.

Further information and registration forms are available from Sarah Long at The Natural History Museum, Cromwell Road, London, SW7 5BD, UK (e-mail sl1@nhm.ac.uk, tel +44(0)171 938 9448, fax +44(0)171 938 9277).



IV Congreso del Terciario de España
IV Congress on the Tertiary of Spain
Tremp 19 – 21 September 2000

The Unitat d'Estratigrafia (Departament de Geologia) of the Universitat Autònoma de Barcelona, the Ajuntament de Tremp, the Institut d'Estudis Il·lerdencs and the Consell Comarcal del Pallars Jussà are organizing the IV Congreso del Terciario in Tremp (Lleida province), from 19th to 21st September 2000, together with ceremonies in honour of Dr. Joan Rosell Sanuy organized by the Ajuntament de Tremp.

The address for correspondence is Eudald Maestro Maideu or Eduard Remacha Grau, Secretària IV Congreso GET. U. d'Estratigrafia, Dep. Geologia. Fac. de Ciències, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain (tel 935 81 16 03 (E. Remacha) or 935 81 10 85 (E. Maestro) or 935 81 16 09 (Secretària de Geologia), fax 935 81 12 63, e-mail iget3@cc.uab.es or Eudald.Maestro@uab.es)

This First Circular, the forthcoming Second Circular and other useful information are available in the Web page of the Congress, at <http://www.catalunya.net/gettremp2000>



Precambrian-Cambrian International Seminar – Field Meeting
NW Himalayas 30 September – 9th October 2000

This meeting is being arranged under the co-convenorship of Dr O. N. Bhargava and Prof S. B. Bhatia, by Dr Arun D. Ahluwalia, Principal Investigator, DST Project Terminal Proterozoic-Early Cambrian (Krol Belt-Spiti Himalaya), Geology Department, Panjab University, # 2114, Sector 15-C, Chandigarh 160014, India (tel 541740, fax 541409, e-mail ada%phys@puniv.chd.nic.in).

Funding is expected from a number of sources once response is known. Your suggestions and good wishes are solicited. If you are interested please indicate by e-mail and in writing, as a document signed by you would be most helpful for obtaining support. Your passport details etc. will be required to get clearance.

An earlier National Meeting on Mega Events from Blaini to Tal was held from 7th to 10th August, 1998. A brief review of this meeting is published in *Journal of Geological Society of India*, January 1999 (author Vibhuti Rai). Dr O.N. Bhargava gave a keynote address. Other participants were S.V. Srikantia (Secretary, Geological Society of India); B.S. Tewari (President of the Pal. Soc. India); S.S. Kanwar (Deputy Director General, Geological Survey of India); D.K. Bhatt (Director, Pal. Div, Geological Survey of India, Jaipur (India)); Arun Sharma and Jaitinder Sud Simla; Ravindra Kumar (GSI, Jaipur); Nawal Kishore Sharma; D. Ahluwalia (Convenor, RituRaj); Anjali Mehra (Chandigarh); K. Bassi, K.C. Prashra: InderSingh (GSI, Chandigarh).

Abundant help came from the Mine Owners' Association, Sirmaur (H.P.) to all participants, and is also expected for this meeting.



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

Evolution of Tertiary Mammals of North America – Volume 1: Terrestrial Carnivores, Ungulates, and Ungulatelike Mammals.

Christine Janis, Kathleen Scott and Louis Jacobs (editors) 1998. Cambridge University Press. 691 pp. Hardback. ISBN 0 521 35519 2. US\$ 260.00.

This book is amazing, and an absolute must for anyone with a serious interest in fossil mammals. 34 different authors review the interrelationships, characteristics and distribution of North America's Tertiary carnivorous and hoofed terrestrial mammals – the 'macromammals'. By way of 40 chapters, each dealing with a discrete taxonomic group (but see below), the fossil record of all genera known at the time of going to press is summarized: the primary aim of the volume is to document the occurrence within time and space of North America's Tertiary mammal fauna.

Introductory chapters review the chronological, climatic and floral background to the North American Tertiary and there are appendices on localities. The book is large, attractive, and with a very user-friendly, standardized format – the latter being one of the editors' primary aims. Unfortunately, the price will put it beyond the reach of all but the most well-funded.

Each group is introduced with an overview that discusses its history, cranial, dental and postcranial characters, and systematics. Non-specialists will appreciate being brought up to speed on the phylogenetic theories thus far proposed for each group (also, much entirely novel phylogenetic work is presented here for the first time ever – witness Honey et al's camelid cladogram). Complete coverage of diversity within these groups often makes generalization difficult. For example, borophagine dogs cannot all be characterized as hyaena-like scavengers. Lambert and Shoshani point out that Lambert's 1992 conclusion that some shovel-tusker elephants were actually savannah-dwelling browsers by no means invalidates theories that at least some such taxa were marsh-dwelling 'mud-grubbers'. Some strict cladists may frown disapprovingly at the use of the 'Condylarthra' label for Chapter 20, written by J. David Archibald: by necessity, at least some of the chapters deal with paraphyletic assemblages.

Those of us who like pictures will be pleased to see all groups represented by figured skeletal and dental material. Life restorations of exemplar taxa, presumably included to liven up the text (and perhaps help those who don't know what a live arctostylopid may have looked like), range from superbly crafted renderings to laughable cartoon-like images that really are not that helpful. Tables display the temporal ranges of all genera.

Each chapter ends with a section on palaeobiology and the evolutionary trends observed within the group. As is to be expected given the strong historical focus of the volume, there is abundant discussion of the interaction of North American with Asian taxa. There are numerous suggested instances of new lineages ousting similarly-adapted taxa by way of



competitive exclusion. For example, arctoids vs. hyaenodontids, simocyonine raccoons vs. borophagines, tillodonts vs. taeniodonts, taeniodonts and tillodonts vs. artiodactyls, etc. Some of these hypotheses may require testing in light of Michael Benton's (1996) conclusions about the rarity of competitive replacement in tetrapod evolution.

As is thankfully fairly typical of palaeomammalogy, speculations on ecology and behaviour are restrained and rely on careful comparisons with the functional morphology of extant taxa.

A great many issues require further consideration, however. For example, was the creodont *Hyaenodon* a wolf-like pursuit predator, a digging specialist, or a skulking ambush predator? If sabre-toothed cats are specialized for macropredation, exactly what was the lynx-sized nimravid *Nanosmilus* doing with its dirk-like teeth? Little-known speculations, such as that the nimravid *Dinaelurus* was a cheetah-mimicking cursor, that protoceratids may have subsisted on semiaquatic plants, that normally solitary chalicotheres may have grouped together at certain times of the year, or that the camelid *Oxydactylus* may have browsed bipedally, provide much food for thought and will stimulate further studies. Larry Martin provides one of the most lucid descriptions of possible sabre-tooth killing technique yet published (Ch. 12, Nimravidae).

Originally planned as a companion volume to Maglio and Cooke's volume on African mammal evolution, this volume meets and exceeds expectations. It will prove invaluable to those who study fossil mammals, trends and events in Tertiary biogeography and extinction, or are simply fascinated by mammalian diversity and ecology. Volume 2 will make coverage complete by bringing together the marine mammals and all those small-bodied taxa that are not ungulates or carnivores, or superficially reminiscent of them. Dinoceratans for example, though covered in Volume 1, may be more closely related to little rabbit-like anagalids than to anything else (prompting Lucas and Schoch, Ch. 19, to describe uintatheres as 'giant horned bunnies').

Reference

Benton, M.J. 1996. On the nonprevalence of competitive replacement in the evolution of tetrapods. In Jablonski, D.H.E. and Lipps, J.H. *Evolutionary Paleobiology*. University of Chicago Press, pp. 185-210.

Darren Naish (e-mail darren.naish@port.ac.uk)
University of Portsmouth, UK

The fossils of the Hunsrück Slate: marine life in the Devonian

C. Bartels, D.E.G. Briggs, and G. Brassel. 1998. Cambridge Palaeontology Series, No. 3. 309pp. Cambridge University Press, Cambridge.
ISBN 0-521-44190-0. Hardback.

At last here is a book, in English, devoted to one of the most remarkable Palaeozoic Konservat-Lagerstätten, the Hunsrück Slate. Any student who has undertaken a project on exceptional preservation will have heard about it, but would have been hard-pressed to find much information in the average university library. This is in marked contrast to the wealth of information readily available about the Burgess Shale. The discrepancy is due to the fact that



most of the literature on the Hunsrück Slate has been published as discreet papers in German journals.

The Hunsrück Slate is Lower Devonian in age and outcrops in the Rhenish Massif, western Germany. It is remarkable for yielding complete, articulated animals with soft-parts preserved in pyrite. The best-preserved specimens come from Bundenbach. The pyrite preservation enables study using X-rays, revealing fragile structures that may be lost by relatively unsophisticated preparation techniques.

The book commences with an introduction which outlines the history of scientific study. The bulk of the book is divided into three main parts. The first deals with the history of the mining of the slates for roofs; the geological setting of the Hunsrück Slate, including its U. Pragian – L. Emsian age and depositional environment in a shallow basin; and palaeoecology and preservation which suggests that the animals were mostly buried in situ by turbidities.

The second part, which is the longest, is about the fossils and the unique insight they provide into the diversity of Lower Devonian marine life. It is systematically split into six chapters covering plants, sponges to bryozoans, annelids and arthropods, echinoderms, vertebrates, and trace fossils. Each of these chapters is subdivided down to generic level. The sponges to bryozoans chapter also includes cnidarians, ctenophores, molluscs and brachiopods. There is an introduction to each higher taxon, and each genus is given a concise description accompanied by a black-and-white photograph and/or X-radiograph. Some line-drawing reconstructions are also included. The echinoderm chapter is the longest, which indicates that a high diversity of echinoderms inhabited the Hunsrück Basin during the Lower Devonian, particularly crinoids, asteroids and ophiuroids.

The arthropods include some very bizarre forms, such as the marrellomorph *Mimetaster hexagonalis* which has six long radiating spines, superficially looking like a snow-flake with eyes and legs. There is also the stunning arachnomorph *Cheloniellon* with its long, paired caudal furca (tails). The Hunsrück Slate is important for yielding specimens of pycnogonids (sea spiders). This group has only been found at two other localities in the world. Some trilobites are preserved complete with legs.

Part three is about techniques and future research, and covers collecting, preparation and studies using X-rays and geochemistry. New discoveries are being made and there are still taxa that await description. The book ends with a systematic list of taxa, a bibliography and index.

The book is straightforward, and a pleasure to read. A wealth of information is given without being too technical. I only have one minor criticism in that I think it would have been better if each phylum had its own chapter rather than have the sponges, cnidarians, ctenophores, molluscs, brachiopods and bryozoans lumped together – even though these chapters would have been short. Some readers may consider that some of the photographs are a bit bland, but given the difficulty in photographing a dark fossil on a dark rock, the photographers have done an excellent job.

I recommend this book to students (undergraduates and postgraduates), lecturers and researchers alike.

Andrew Ross

Department of Palaeontology, The Natural History Museum, London, UK.



Field Palaeontology, 2nd edition

Goldring, R. (1999): 191 pp; Essex (Longman), ISBN 05-8235-6263, £33.25.

Roland Goldring's *Palaeontology in the Field* obviously received the success it deserved, because the second edition has been published after a relatively short time. One might argue about the necessity to change the title; a cursory glance into the interior shows most of the material to be identical with the first edition.

Major changes in the layout give the book a modern appearance: bold-face and shaded headings structure the text much better than previously, and the two-column, right-justified style is more friendly to the reader's eye. The improved legibility allowed reduction of the letter size to 11 pt, resulting in a volume with 30 pages less than its predecessor despite additional material. Newly introduced are fancy boxes with examples which in some cases, however, interrupt the flow of the text too much – a general problem with this device.

Additional chapters on core analysis, lithostratigraphy, and the field strategy for trace fossils keep the book up-to-date in its contents as well; the section on shell concentrations has been extended, mirroring the recent massive developments in this area of research. Trace fossils now have a chapter of their own, reuniting previously dispersed information.

On the other hand, paragraphs on actuopalaeontology and chronostratigraphy have been deleted, as well as sketches of various fossil groups in the appendix.

All changes make sense in terms of modernization of this book. It has been and still is a very instructive and comprehensive manual of field methods, guiding undergraduates and M.Sc. students alike. Maybe even the more experienced researcher finds an impulse for additional approaches...

I cannot think of any major criticism regarding the contents, so it certainly is value for money!

Markus Bertling

Muenster, Germany

Coniacian and Santonian belemnite faunas from Bornholm, Denmark

Walter Kegel Christensen and Max-Gotthard Schulz

Santonian to Maastrichtian ammonites from Scania, southern Sweden

William James Kennedy and Walter Kegel Christensen

(1997) *Fossils & Strata* no. 44. Scandinavian University Press. 128pp. ISBN 82-00-37695-8, ISSN 0300-9491.

The two papers which form this issue of *Fossils & Strata* perfectly complement each other in their coverage of what to us in southern England are elusive prey, yet in the context of the Northern European Province seem quite abundant, namely post Cenomanian, Late Cretaceous ammonites and belemnites. When found in the British Chalk, they can be of great biostratigraphical value; herein lies the value of this issue to a UK audience.

The Bornholm belemnites paper divides into two parts: Introductory, and Systematic Palaeontology. The introductory section covers the geological setting, localities, stratigraphy



and biostratigraphy, supported by clear maps, sections and tables. The belemnite faunas are placed in their regional and stratigraphic settings. Their evolutionary trends are discussed with reference to Russian, German and British occurrences. The Systematic part begins with a review of belemnite guard morphology and measurements. The diagnostic characters of the guard with specific reference to the significance of surface granulation are discussed.

Throughout the Systematic part, intra specific variation is analysed using univariate and bivariate statistics, with results presented as histograms, scatter diagrams and tables. The following genera are covered: *Actinocamax*, *Gonioteuthis*, *Goniocamax*, and *Belemnitella*. Six new species are described. Besides the profusion of scatter plots and tables, the text is supported by three plates of belemnites, one figure of belemnites and one of an ammonite.

Similarly, the ammonite paper is neatly divided into Introductory and Systematic parts.

Covering a greater time frame, eighteen genera and 34 species are included in this paper, plus aptychi of *Baculites*. Amongst the genera covered are *Gaudyceras*, *Pachydiscus*, *Bostrychoceras*, *Glyptoxoceras*, *Baculites*, *Trachyscaphites*, and *Hoploscaphites*, so there is plenty of interest for the student and collector of Late Cretaceous ammonites. This paper lacks the biometrics of the belemnite paper, but works well as an eye-ball guide, with 35 photographic figures of ammonites, some being full page. Some of the figured specimens are from Germany, France and the UK. This paper therefore serves well as a guide to the later Cretaceous ammonites of northern Europe, thereby commendable to anyone with an interest in the biostratigraphy of the British Chalk.

This number of *Fossils & Strata* meets the very high standard which we have come to expect from this journal. Just one minor criticism: I find the synonymy layout a little hard to follow, though I guess that saves space thereby reducing costs, which benefits the purchaser. Besides their primary function with respect to recording the palaeontology of Bornholm and Scania, this particular number is most welcome as a guide to the ammonites and belemnites of the European White Chalk, and should be on the shelf of every museum, student and collector with an interest in the Late Cretaceous.

Martin C. Munt

Assistant Curator,

Museum of Isle of Wight Geology, Sandown, Isle of Wight, PO36 8AF, UK.

Palaeoecology: Ecosystems, environments, and evolution

Patrick J. Brenchley and David A.T. Harper. 1998. Chapman & Hall (Stanley Thornes). 402pp. ISBN 0 4124 3450 4.

Richard Aldridge commented recently in our *Newsletter* that "Palaeoecology is one of the least exact of sciences, but we are drawn into it because we naturally want to know how our favourite organisms lived". Indeed we do, and while we have to accept inexactitude and uncertainty to some degree, we can still be as scientifically rigorous in this constantly evolving subject as in any other science. This admirable new book greatly conduces to this end.

It is now more than 35 years since Derek Ager's (1963) *Principles of palaeoecology* was published; an influential compilation, and one which did much to develop the science as a discipline in its



own right. In these early days the main focus of interest was in the reconstruction of former ecosystems from assemblages of fossils present in the rocks. This tried and tested approach still continues, as it should, and Stuart McKerrow's (1978) *Ecology of Fossils* was largely based upon this kind of traditional study. In palaeoecology as a whole, though new researches on the interpretation of ecosystems from fossil assemblages are still being undertaken, there has been an overall shift of emphasis, and it is this expanded spirit that Pat Branchley and Dave Harper have so ably captured here. Their own approach is spelt out in the Preface: "... the focus of palaeoecology has been broadening as it has become more fully appreciated that the biosphere is intimately linked to the history of the planet as a whole". They set out to cover, as well as the traditional fields "... the ways in which palaeoecology can contribute to a broader understanding of the evolution of the Earth". These are indeed worthy aims, the authors have tackled them with zest and success, and the result is an eminently readable and lavishly illustrated volume which no palaeontologist should be without. There is, of course, some overlap with other texts, such as Raup & Stanley's (1971, 1978) *Principles of Palaeontology*, Valentine's (1973) *Evolutionary Palaeoecology of the Marine Biosphere*, and with other modern texts on palaeontology. But if the necessary concepts reach a wider audience, then why not?

There are some ten chapters, each with a bulleted list of summary points at the end, and its own bibliography of books and papers for further reading. There are abundant definitions, picked out in bold print so that they are easy to find. Most of the chapters have boxes, concisely recording particular case histories or making specific points, and these make for extra readability.

Chapter 1 *Investigating the history of the biosphere* treats basic concepts in palaeoecology: environments, trophic structures, modes of life etc, and there is a fair and balanced consideration of James Lovelock's Gaia hypothesis.

Chapter 2 *Environmental controls of biotic distribution*. Here we have a clear exposition of the structure of the biosphere, with all the definitions on communities, provinces etc that students would need, as well as discussion of the roles of light, oxygen, temperature, salinity and other factors in ecology.

Chapter 3 *Taphonomy*. This is a concise account of the processes affecting the fate of vertebrate and invertebrate skeletons and a discussion of Fossil-Lagerstätten. With the clear distinctions made here between life, neighbourhood and transported assemblages, nobody should be confused in the future. Likewise, the section on different types of shell concentrations, how they form and how to interpret them is especially useful.

Chapter 4 *Adaptive morphology* deals with autecology and the life strategies of gastropods, echinoids, bryozoans, corals and other groups, interpreted in an evolutionary context. Some of these are fairly well-known examples, but this reviewer was rather pleased to see a special box given to the olenid trilobites of the Scandinavian Alum Shales.

Chapter 5 *Trace Fossils*. This is a concise but effective chapter, and whereas Richard Bromley's (1990, 1996) *Trace Fossils* goes to greater depth, here we have a simple, reader-friendly exposition covering invertebrates and vertebrates, animal/plant interactions and evolution of ichnotaxa.

Chapter 6 *Fossils as environmental indicators* is broad ranging. It has a useful classification of benthic assemblages, and discusses the use of fossils as bathymetric indicators. Included here



also are sections on the ecology of environments deficient in oxygen, and of unusual salinity.

Chapter 7 *Populations and communities* defines what is meant by these terms, how populations and communities are organised, trophic structures, their evolution through time, and how they are re-set by extinction events. And there is a valuable discussion of numerical analysis of palaeocommunities.

Chapter 8 *Palaeobiogeography*. This is a straightforward account of the factors controlling the large-scale distribution of animals and plants, faunal provinces through time, cladistic and numerical methods for their study, palaeoclimatology, and the effects of plate movements. Several examples are presented, though perhaps surprisingly, given the authors' expertise, Loewr Palaeozoic faunal provinces are only briefly touched upon.

Chapter 9 *Evolutionary palaeoecology of the marine biosphere*. Valentine's (1973) book had the same title, and perhaps some other apt phrasing might have been desirable here. But this chapter concerns the same subject: the ecological changes that have taken place in the marine biosphere through time, and how they can be analysed through palaeoecological study. Here we have the evolution of prokaryotes and eukaryotes, the Cambrian explosion, Sepkoski's evolutionary faunas, causes and consequences of mass extinctions, and there are comments on each of the major ones, and on recovery and radiations thereafter.

Chapter 10 *Terrestrial ecosystems*. This is a welcome analysis of terrestrial ecosystems: the invasion of the land by plants and animals and its effects. There are neatly boxed case histories, classic ones like the Rhynie Chert, and the Nyranie and East Kirkton lakes, as well as less well-known scenarios such as the Otter and Cotswold assemblages. These are really very good. And the book ends with expected, but timely, comments upon what we are doing to the environment. Of course, whatever disaster we inflict, the biosphere will surely recover, though probably without us...

This is indeed a very valuable book, especially for students for whom it is intended, but also for their teachers. The writing is clear, concise and lively, the illustrations profuse and neat; the enthusiasm of the authors is manifest. They have covered a great range of topics in this book, but I do not think that they have tried to put too much into the available space. There is nothing superfluous, and most importantly, they have carefully avoided superficiality on the one hand, and excessive detail on the other. The text is definitely pitched at the right level. And the useful reference lists can lead the hopefully inspired student to further reading.

Production standards are high, though the paper is perhaps a little thin, the cover is most attractive, and the illustrations informative. Broad margins for most of the pages would enable students to annotate their own copies with notes. Some of the half tones are a bit dark (why is this such a common fault these days?), otherwise all the line drawings have reproduced well. Misprints are very few, and only one error has been brought to my notice. Or am I confused about survivorship curves (pp 224-5)? Is not the curve shown for *Dielasma* a Type 1 shape, indicative of increasing mortality with age, not high infant mortality as stated? A minor issue, and one that will be easily corrected for the next edition. For such there will surely be.

Euan Clarkson

Edinburgh



The Origin of Flowers

The Annual Address of the Palaeontological Association was this year delivered by Dr Peter Crane, F.R.S., on 12th May. It was held in Leeds, and the event, magnificently organised by Jane Francis, attracted a large audience.



The title was *Palaeontological evidence for the origin of flowers*. Until the 1970s not a great deal was known about fossil flowers. Since then our knowledge has grown explosively. For example, the mid-Cretaceous *Archaeanthus*, from Russell, Kansas, now one of the best-known early flowers, has been the subject of extensive research. The flower is borne terminally on a long axis, and the seeds can be macerated out. The stamens and tepals are known from scars, resin bodies are scattered in the fruit and tepals, and all these features, together with the morphology, indicate an evident relation to the extant Magnoliaceae.

Compression flowers in general, however, are rare, and it is usually only the large ones which are seen. Some years ago, sieving techniques used for Tertiary sediments were applied to the Cretaceous, and yielded a previously unimagined diversity of Cretaceous angiosperm flowers, from sites in North America, Sweden, Portugal, Kazakhstan, and Japan. It is now becoming clear how lineages are related. The earliest pollen is 135 million years old, and many basal eudicot lineages were fully established by about 110 Ma. Insect pollination is overwhelmingly supported by the evidence, and was probably important for enhancing speciation rates. Once started, the radiation of angiosperms, especially in low latitudes, kept rising, and shows no sign of levelling off in the Tertiary.

The lecture was splendidly illustrated, and it was good to see so many students attending. A very happy party concluded an excellent occasion. Peter Crane, after many years in Chicago, is returning to the UK to take up the Directorship of Kew Gardens. We hope we shall see much more of him!

Euan Clarkson

President, Edinburgh



Palaeontology

VOLUME 42 • PART 3

CONTENTS

A new family of Plesiadapiformes (Mammalia) from the Old World Lower Paleogene J. J. HOOKER, D. E. RUSSELL <i>and</i> A. PHÉLIZON	377
The fish trace fossil <i>Undichna</i> from the Cretaceous of Spain JORDI M. DE GIBERT, LUÍS A. BUATOIS, MARÍA A. FREGENAL-MARTÍNEZ, M. GABRIELLA MÁNGANO, FRANCISCO ORTEGA, FRANCISCO J. POYATO-ARIZA <i>and</i> SYLVIE WENZ	409
Feeding habits in trilobites R. A. FORTEY <i>and</i> R. M. OWENS	429
Middle Ordovician bivalves from Mid-Wales and the Welsh Borderland JOHN C. W. COPE	467
The geologically oldest dasyurid, from the Miocene of Riversleigh, north-west Queensland STEPHEN WROE	501
The amphibian <i>Albanerpeton arthridion</i> and the Aptian–Albian biogeography of albanerpetontids JAMES D. GARDNER	529
Chigutisaurid amphibians from the Upper Triassic of Argentina and their phylogenetic relationships CLAUDIA A. MARSICANO	545
Erratum	567



Palaeontology

VOLUME 42 • PART 4

CONTENTS

A new sigillid ostracod from submarine caves of the Ryukyu Islands, Japan RYOICHI TABUKI and TETSURO HANAI	569
A new ichnogenus for etchings made by cheilostome bryozoans into calcareous substrates PAUL D. TAYLOR, MARK, A. WILSON and RICHARD G. BROMLEY	595
Evidence and cause of small size in Bathonian (Middle Jurassic) marine bivalves of north-western Europe ANDREW L. A. JOHNSON	605
The earliest atrypides and athyridides (Brachiopoda) from the Ordovician of Kazakhstan LEONID E. POPOV, IGOR F. NIKITIN and ELENA V. SOKIRAN	625
Late Jurassic ancestry of Recent southern high-latitude marine isopods (Crustacea, Malacostraca) A. BRANDT, J. A. CRAME, H. POLZ and M. R. A. THOMSON	663
A new libelluloid family from the Upper Paleocene of Argentina JULIÁN F. PETRULEVICIUS, ANDRÉ NEL and JAVIER MUZÓN	677
The nautiloid cephalopod order Ascocerida in the British Silurian CHARLES HEPWORTH HOLLAND	683
A conodont, thelodont and acanthodian fauna from the lower Přídolí (Silurian) of the Much Wenlock area, Shropshire C. GILES MILLER and TIJU MÄRSS	691
The gonorynchiform fish <i>Dastilbe</i> from the Lower Cretaceous of Brazil SAMUEL P. DAVIS and DAVID M. MARTILL	715
Sexual dimorphism in a new species of the actinopterygian <i>Peltopleurus</i> from the Triassic of northern Italy CRISTINA LOMBARDO	741



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This publication is not deemed valid for taxonomic/nomenclatorial purposes [see article 8b in the International Code of Zoological Nomenclature 3rd Edition (1985) edited by W.D. Ride et al.]

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All Field Guides to Fossils: *Special Papers* Nos 1-60 (except 39 & 45); and most back parts of *Palaeontology* are still available and can be bought via the Executive Officer. Prices have recently been lowered for many of the earlier titles. See Web Page <http://www.palass.org/> or send e-mail for details.

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Notes for Authors

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Special Papers in Palaeontology is a series of substantial separate works conforming to the style of *Palaeontology*.

