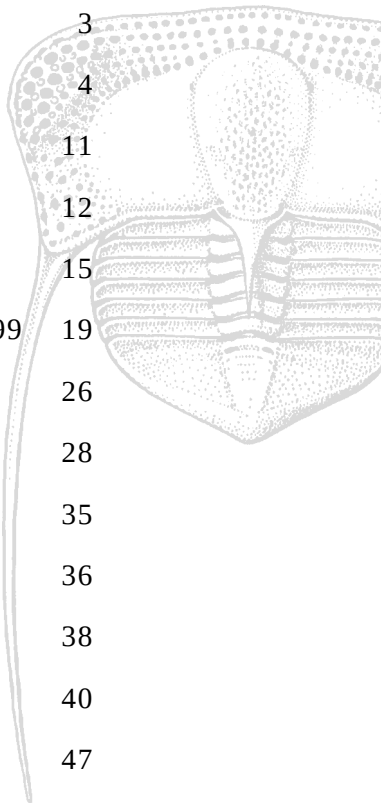
The Palaeontology Newsletter

43

Contents



Reminder : The deadline for copy for Issue no 44 is 20th May 2000

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

Editorial

This is the last *Newsletter* I will be editing, as my three-year term as Editor has now expired. It has been a rewarding experience dealing with so many members of the palaeontological community, and I am very grateful for all the help and input the *Newsletter* has received over the last dozen or so issues. I am also very grateful for the technical help and support of Meg & Nick Stroud, Stuart McLean and Emma Davies. The new design and prompt printing of the *Newsletter* are their achievement rather than mine.

As notices of future meetings, book reviews and news items have come to my computer, I have been struck by the vibrancy of our community. Who can forget the 26 Palaeoreplies on the subject of specimens in private collections, for example? At a time when University resources are being squeezed and we are being channelled so tightly between research and teaching imperatives, it seems that palaeontologists are still managing to meet and talk, and to discuss issues through print and electronic media.

The *Newsletter* offers a forum for informal debate and communication. It is ephemeral. Yes, I mean it, old newsletters should be thrown away when read. Take one to read on the loo in the morning and stop your library from cataloguing them. We should be able to speak our minds in this organ without it necessarily coming back to haunt us in years to come. And we should continue to do so whatever other pressures may assault our time, because we need to air issues and debate them together even when we can't meet in person. There, I have been wanting to say that for ages, now I can lay down my red pen and go back to marking exams…

Sue Rigby
University of Edinburgh

(Until another Editor is appointed, copy for the *Newsletter* should be sent to Meg Stroud via N.Stroud@ed.ac.uk.)

The Palaeontological Association

Annual Address & AGM

University of Leicester, New Building
2.00 pm, Wednesday May 10, 2000

For further details contact the Executive Secretary, Dr Tim Palmer, Institute of Earth Studies, University of Wales, Aberystwyth, Dyfed SY23 3DB, UK. <palass@aber.ac.uk> or check the Association's website @ http://www.palass.org

Exceptional Preservation of Cambrian 'Orsten' Type Fossils

New Understanding of Crustacean Morphology, Phylogeny and Evolution

Dr Dieter Walossek, University of Ulm, Germany

In every sense of the word, the preservation of 'Orsten' type fossils from the Upper Cambrian of Sweden is exceptional. The fossils are preserved in three-dimensions and have remained undeformed by diagenesis. The cuticle of the fossils is replaced by calcium phosphate and is so well preserved that the finest details of limbs, eyes, hairs and pores can be examined under the high magnification of a scanning electron microscope, just as in living animals of similar size. And a range of developmental stages, including larvae, is preserved, revealing details of structural development and growth.

'Orsten' type fossils are rare, but since the first discoveries by Klaus Müller in the mid 1970's, they have been found wordwide in deposits ranging in age from the Lower Cambrian to the Lower Cretaceous. The 'Orsten' type of preservation seems to favour small arthropods, and the crustaceans provide a particularly good example of how detailed analysis of these fossils is reshaping our understand of the evolutionary history of the arthropods. The 'Orsten' has yielded a range of forms representing different but coexistent evolutionary steps in crustacean evolution, with some forms representing members of the crown group Crustacea. The phylogenetic distribution of the 'Orsten' forms predicts that additional fossil Crustacea were present but have yet to be discovered. All recognized novelties and their further development indicate that most significant evolutionary changes affected the locomotory and feeding apparatus of the head region: indeed food, food capture, and escape from enemies may have been the major evolutionary forces.

Orsten fossils are now known to range back to the earliest Cambrian, some 540 Million years ago, and thus confirm that the Crustacea (and the Arthropoda in general) must have evolved well before the Cambrian. The crustacean record is still poor, but it must be remembered that Burgess-Shale type and 'Orsten' type deposits are our only major sources for exceptionally preserved Cambrian arthropods, and our current view is restricted by the limted number of ecological and preservational windows. I predict that our knowledge of Cambrian crustacean diversity and evolution is in a growth phase and that once people start to investigate additional suitable environments and lithologies of the 'Orsten' type more representatives of more taxa will be discovered.

Association Business

Nominations for Council 2000-2001

President

Prof. C. R. C. Paul (University of Liverpool)

Proposed: Prof. E. N. K. Clarkson

Seconded: Dr M. P. Smith

Vice-President

Dr M. J. Barker (University of Portsmouth)

Proposed: Dr J. E. Francis

Seconded: Dr R. A. Wood

Other Members of Council

Dr S. E. Gabbott (University of Leicester).

Proposed: Dr M. P. Smith

Seconded: Dr J. E. Francis

Dr E. M. Harper (University of Cambridge)

Proposed: Dr R. A. Wood

Seconded: Dr A. L. A. Johnson

Dr D. K. Loydell (University of Portsmouth)

Proposed: Prof. E. N. K. Clarkson

Seconded: Dr J. A. Clack

Annual Report for 1999

The Palaeontological Association

Membership & subscriptions . Individual membership totalled 1,021 on 31 December 1999, an overall increase of 29 over the 1998 figure. There were 676 Ordinary Members, an increase of 2; 110 Retired Members, an increase of 8; and 235 Student Members, an increase of 19. There were 180 Institutional Members in 1999, a decrease of 19 from last year. Total Individual and Institutional subscriptions to *Palaeontology* through Blackwell's agency numbered 398, a decrease of 13. Subscriptions to *Special Papers in Palaeontology* numbered 133 individuals, an increase of 32, and 69 institutions, a decrease of 5. Regular orders through Blackwell's agency for *Special Papers in Palaeontology* totalled 62 copies. Sales of back numbers of *Special Papers in Palaeontology* to individuals yielded £7,059.

Income from sales of *Field Guides to Fossils* amounted to: *Fossil Plants of the London Clay* – £524; *Fossils of the Chalk* – £1,546; *Zechstein Reef Fossils and their palaeoecology* – £128; *Fossils of the Oxford Clay* – £1,293; *Fossils of the Santana and Crato Formations of North East Brazil* – £699; *Plant Fossils of the British Coal Measures* – £864; *Fossils of the Upper Ordovician* – £986; *The Jurassic Flora of Yorkshire* – £1,067; *Fossils of the Rhaetian Penarth Group* – £680. *Palaeobiology – A synthesis* yielded £69 in royalties and *The Fossil Record 2* yielded £15.

Finance. Volume 42 of *Palaeontology* was published at a cost of £73,697. *Special Papers in Palaeontology* 61 and 62 were published at a cost of £14,790. Publication of both titles is now managed by Blackwell, who also continue to make sales and manage distribution on behalf of the Association. They were paid a fee of £24,024, whereas in previous years they withheld 23% of the income that they generated from sales. The Association gratefully acknowledges the donations from Members to the Sylvester-Bradley Fund, which amounted to £398.

Grants from general funds to external organisations, for the support of palaeontological projects, totalled £5,673.

Publications. Volume 42 of *Palaeontology* was published in six parts during 1999, comprising 1,145 pages in total. *Special Papers in Palaeontology* 60 (Cretaceous fossil vertebrates edited by D. M. Unwin; 219 pp. For 1998), 61 (Cretaceous fossil rudists of Boeotia, central Greece by T. Steuber; 229 pages) and 62 (Exceptionally preserved conchostracans and other crustaceans from the Upper Carboniferous of Ireland; 68 pages) were also published. Two new volumes in the *Field Guides to Fossils* were produced – *The Jurassic flora of Yorkshire* by J. H. A. van Konijnenberg-van Cittert and H. S. Morgans, and *Fossils of the Rhaetian Penarth Group* by A. Swift and D. M. Martill. Two issues of *Palaeontologia Electronica* were issued during the year.

The Association is grateful to the National Museum of Wales and the University of Birmingham for providing storage facilities for publication backstock. Council is indebted to Meg and Nick Stroud and Edinburgh University Printing Services for assistance with the publication and distribution of *Palaeontology Newsletter*.

Meetings. Five meetings were held in 1999, and the Association extends its thanks to the organisers and host institutions of these meetings.

a. Lyell Meeting. 1-2 March. This year's Lyell Meeting was entitled 'Organism and environment feedback in carbonate platforms and reefs' and was held at Burlington House, London, convened by Dr Enzo Insalaco (Elf-Total), Dr Peter Skelton (Open University) and Dr Tim Palmer (Palaeontological Association). Twenty-two presentations were delivered over the two days.

b. Progressive Palaeontology. 28-29 April. The annual open meeting for presentations by research students was organised by Trevor Cotton, Aaron O'Dea, Lucy McCobb and Gareth Dyke at the University of Bristol. The meeting was attended by 55 people. A field excursion to the Lower Jurassic of Blockley, Gloucestershire, and the Upper Triassic of Aust Cliff was held on the following day.

c. Forty-second Annual General Meeting and Address. 12 May. Owing to changes in charity law, the AGM and Annual Address were this year moved to their new position in May, and were held at the University of Leeds, following Council's decision to hold the meeting in locations

throughout the UK. The address, entitled 'Palaeontological evidence for the early evolution of flowers', was given by Dr P. R. Crane FRS (Field Museum, Chicago). The meeting was attended by over 200 people, a considerable increase on previous years.

d. Review Seminar – Functional Morphology. 3 November. Organised by Dr M. A. Purnell in the Department of Geology, University of Leicester, with a programme of eleven speakers, including overseas representatives. The meeting was attended by 65 people.

e. 42nd Annual Meeting. 19-22 December. Held at the University of Manchester and organised by Dr P. Selden and Dr J. Nudds. The President's Award was presented to Dr M. D. Sutton for his innovative presentation entitled 'Grinding out the morphology – new approaches to serial sectioning'. The Council Poster Prize was awarded to Ms A. Lane (University of Bristol) for her poster entitled 'The walking techniques of Burgess Shale arthropods: a quantitative assessment'. The programme of talks was followed by field excursions to examine the building stones of Manchester and the Dinantian carbonate build-ups of the Clitheroe district. The Annual Meeting was attended by 208 delegates.

Awards. Sylvester-Bradley Awards were made to Ms M. Browne (University of Bristol), Mr A. Butcher (University of Portsmouth), Ms A. Lane (University of Bristol) and Dr C. Milsom (Liverpool John Moores University). The Mary Anning Award was made to Mr R. Davidson of Aberdeen.

Council. The following members were elected to serve on Council at the AGM on 12 May 1999:

President – Prof. E. N. K. Clarkson.

Vice Presidents – Dr J. E. Francis, Dr R. M. Owens.

Treasurer – Prof. J. Hancock.

Secretary – Dr M. P. Smith.

Newsletter Editor – Dr S. Rigby.

Newsletter Reporter – Dr P. Pearson.

Publicity Officer – Dr M. A. Purnell.

Editors – Dr R. Wood, Dr J. Clack, Prof. D. A. T. Harper, Dr A. R. Hemsley, Dr A. King and Dr D. T. J. Smith.

Other Members of Council – Mr F. W. J. Bryant, Dr P. C. J. Donoghue, Prof. S. K. Donovan, Dr A. L. A. Johnson and Dr M. J. Simms.

Dr D. K. Loydell was co-opted as a member of Council during the year.

Dr T. J. Palmer continued to serve as the Executive Officer of the Association, and Prof. D. J. Batten (University of Wales, Aberystwyth) was appointed as the Technical Editor.

Council is indebted to the Natural History Museum, the University of Bristol, the University of Leeds and the University of Manchester for providing Council Meeting venues through the year.

Council Activities.

Following the appointment of an Executive Officer in 1998, the last year has seen a number of re-arrangements to the operational structure of the Association. These have now been satisfactorily and smoothly completed, and 1999 proved to be a very successful year. All routine administrative matters related to sales, marketing and memberships are now looked after by the Executive Officer. The changes to the printing arrangements have led to considerable cost savings and, together with a marked increase in sales, have contributed to an increasingly well-founded financial position. The challenge for the year ahead is to determine how best to utilise this position in order to support palaeontology and palaeontologists. In addition, Council decided during the year to institute a new senior medal for major contributions to the science of palaeontology, to be called the Lapworth Medal; and a new award for young palaeontologists, to be entitled the Hodson Award. The Association's presence on the Internet was strengthened by an extensive redesign of the Web site and the inauguration of a new domain name (www.palass.org) which, in addition to its other benefits, is considerably shorter than the old Web address.

M. P. Smith

Secretary

Proposed Subscription Changes

Council has approved the following increased rates for subscription to *Palaeontology* for the year 2001. The proposals will be put to the membership at the AGM.

Institutional Membership of the Palaeontological Association: £102 / US$204

Cover Price for individual parts of *Palaeontology*: £47

There will be no changes to the subscription rates for Student, Ordinary or Retired Members.

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.
Phone/Answerphone: +44 (0) 1970 627107
Fax: +44 (0) 1970 622659
Secretary: +44 (0) 1970 627107
E-mail: palass@palass.org
Web: http://www.palass.org/

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31 DECEMBER 1999

			General Funds £	Designated Funds £	TOTAL FUNDS £	TOTAL 1998 £
INCOMING RESOURCES						
Subscriptions			51,732	0	51,732	47,449
Sales:	Palaeontology	119,741				
	Special Papers	14,790				
	Offprints	4,986				
	Field Guides	7,787				
	Postage & Packing	598				
Total Sales			147,902	0	147,902	91,817
Investment Income & Interest			17,736	2,503	20,239	22,874
Donations			0	2,699	2,699	2,165
Sundry Income			4,740	0	4,740	1,549
	Total		222,110	5,202	227,312	165,804
RESOURCES EXPENDED						
Publication:	Palaeontology	73,697				
	Special Papers	14,448				
	Offprints	2,997				
	Field Guides	8,812				
	Newsletters	9,693				
	Publications Admin	24,024				
Carriage & Storage		2,475				
Scientific Meetings & Costs		5,960				
Grants		1,310		2,321		
Total Charitable Expenditure			143,416	2,321	145,737	142,890
Administrative Expenditure			27,210	0	27,210	13,026
	Total		170,626	2,321	172,947	155,916
NET INCOMING RESOURCES BEFORE TRANSFERS			51,484	2,881	54,365	9,888
TRANSFER			0	0	0	0
NET INCOMING RESOURCES			51,484	2,881	54,365	9,888
INVESTMENT GAINS						
Realised		5,048				
Unrealised		10,643				
			15,691	0	15,691	36,525
NET MOVEMENT IN FUNDS			67,175	2,881	70,056	46,413
BROUGHT FORWARD 375,643				373,956	48,100	422,056
CARRIED FORWARD			441,131	50,981	492,112	422,056

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No 276369

BALANCE SHEET AS AT 31 DECEMBER 1999

1998 £					1999 £
		INVESTMENTS			
	267,718	At Market Valuation			283,001
		CURRENT ASSETS			
177,080		Cash at Banks	219,431		
6,157		Field Guide Stocks at Valuation	10,105		
10,417		Sundry Debtors	3,481		
193,654		Total		233,107	
		CURRENT LIABILITIES			
32,200		Publication Provisions	0		
512		Subscriptions in Advance	13,552		
6,604		Sundry Creditors	10,354		
39,316		Total		23,906	
	154,338	NET CURRENT ASSETS			209,111
	422,056				492,112
		Represented by:			
	373,956	GENERAL FUNDS			441,131
		DESIGNATED FUNDS			
31,866		Sylvester Bradley Fund		32,038	
9,599		Jones-Fenleigh Fund		11,962	
6,635		Hodson Fund		6,981	
	48,100				50,981
	422,056				492,112

These financial statements were approved by the Board of Trustees on February 9 2000.

E.N.K. Clarkson M.J. Hancock M.P. Smith

Independent Examiner's Report to the Members of The Palaeontological Association

Report on the accounts for the year ended 31 December 1999 set out on this page and on the previous page.

The Charity's trustees are responsible for the preparation of the accounts. My work was conducted in accordance with the Statement of Standards for Reporting Accountants and my procedures consisted of comparing the accounts with the accounting records kept by the charity and making such limited enquiries of the trustees as I considered necessary for the purposes of this report.

In my opinion: The accounts are in agreement with the reporting records kept by the charity; The accounts have been drawn up in a manner consistent with the requirements of the Charities Act 1993 and the charity is exempt from an audit for the period under review.

G.R. Powell Dated 10 February 2000
Chartered Accountant
Market Harborough

Amount	Holding	Original Price (bought pr e 1999)	Value End 1998	Proceeds (sold in 1999)	Cost (bought in 1999)	Gain r ealised during 1999	Value End 1999	Gain unr ealised during 1999
£4,000	8% Treasury Loan Stock 2002/06	£ 2,192.00	£ 4,526.00	£ 4,114.00		-£ 412.00		
£6,765	7% Treasury Stock 2001	£ 7,115.00	£ 7,242.00				£ 6,908.00	-£ 334.00
£7,000	8% Treasury Stock 2003	£ 6,863.00	£ 8,017.00	£ 7,556.00		-£ 461.00		
£37,000	6 1/4% Treasury 2010	£ 34,235.00	£ 43,451.00				£ 39,667.00	-£ 3,784.00
£11,773	Treasury 5% Stock 07/06/2004				£ 11,669.00		£ 11,326.00	-£ 343.00
£18,029.71	COIF Charities Fixed Interest Fund	£ 25,000.00	£ 26,069.15				£ 23,785.00	-£ 2,284.15
190	Saatchi and Saatchi Ordinary 10p shares	£ 1,049.00	£ 261.00	£ 540.00		£ 279.00		
190	Cordiant Ordinary 25p shares	£ 1,059.00	£ 203.00	£ 397.00		£ 194.00		
2,800	Shell Transport & Trading Ord 25p shares	£ 4,671.00	£ 10,339.00				£ 14,406.00	£ 4,067.00
8,000	Legal and General Ordinary 25p shares	£ 2,965.00	£ 15,610.00				£ 13,480.00	-£ 2,130.00
1,200	Electrocomponents Ordinary 10p shares	£ 2,817.00	£ 4,836.00				£ 8,226.00	£ 3,390.00
7,000	Vodaphone Airtouch USD 0.10	£ 3,442.00	£ 13,664.00				£ 21,473.00	£ 7,809.00
1,000	Lloyds TSB 25p shares	£ 7,952.00	£ 8,550.00				£ 7,745.00	-£ 805.00
1,600	Unilever Ordinary 1.25p shares	£ 7,751.00	£ 10,784.00				£ 6,505.00	-£ 4,279.00
600	Glaxo Wellcome Ordinary 25p shares	£ 8,798.00	£ 12,408.00				£ 10,500.00	-£ 1,908.00
650	Hays	£ 6,048.00	£ 6,858.00				£ 12,818.00	£ 5,960.00
1,000	SmithKline Beecham	£ 7,810.00	£ 8,400.00				£ 7,900.00	-£ 500.00
875	Cable and Wireless	£ 5,862.00	£ 6,466.00				£ 9,179.00	£ 2,713.00
1,050	Powergen Ordinary 50p shares	£ 9,426.00	£ 8,295.00				£ 4,673.00	-£ 3,622.00
4,500	British Aerospace 7 3/4%(N) 25p CCRP	£ 4,155.00	£ 11,228.00				£ 8,899.00	-£ 2,329.00
5,720	M & G Charifund Units	£ 4,073.00	£ 52,328.00				£ 55,793.00	£ 3,465.00
1,700	S and P Japan Growth Fund	£ 3,328.00	£ 2,219.00	£ 7,667.00		£ 5,448.00		
1,000	S and P Japan Growth Fund	£ 1,958.00	£ 1,305.00				£ 5,388.00	£ 4,083.00
2,000	Gartmore European Fund	£ 3,516.00	£ 4,659.00				£ 6,077.00	£ 1,418.00
5,000	Credit Suisse A UK Transatlantic Fund				£ 8,197.00		£ 8,253.00	£ 56.00
	TOTAL	£ 162,085.00	£ 267,718.15	£ 20,274.00	£ 19,866.00	£ 5,048.00	£ 283,001.00	£ 10,642.85

***** STILL** at a *SPECIAL* **PRICE FOR PAL ASS MEMBERS *****

The **NEW** International Code of Zoological Nomenclature

The Association's offer on the new and extensively revised 4th Edition of the International Code of Zoological Nomenclature, which came into effect on 1st January 2000, proved to be extremely popular. Not surprising when there is no cheaper way of obtaining this essential text.

This offer is still open.

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 is £40 or $65. 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 **£5** or **$8**.

Copies for immediate delivery can be ordered now from the Executive Officer 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 the card is held) with your order. *Remember that delivery will be 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 card transactions.

Dr Tim Palmer
Executive Officer, The Palaeontological Association
I.G.E.S., University of Wales
Aberystwyth, Wales SY23 3DB
United Kingdom

THIS IS UNDOUBTEDLY YOUR CHEAPEST LEGITIMATE WAY OF OBTAINING THE NEW CODE

ASSOCIATION MEETINGS PROGRAMME

PalAss AGM

University of Leicester 10 May 2000

The speaker will be Professor Dieter Walossek, Centre for Biosystematic Documentation, University of Ulm, Germany, on "Exceptional Preservation of Cambrian 'Orsten' type Fossils". The talk will cover the exquisite soft-bodied preservation of the highly spectacular Orsten fauna, and will discuss the evolution of Crustacea along their stemline toward the Eucrustacea, embracing all extant groups. Professor Walossek will discuss his work on the innovations along the Crustacean line and other views of what it is to be 'crustacean'. The validity of such views impacts upon the current arguments that relate to the origin of the group and the reliability of a 'Cambrian explosion'.

Further details are on page 3, and will be posted on the PalAss Web site nearer the time (under "meetings" at http://www.palass.org/).

Mark Purnell
University of Leicester

Progressive Palaeontology 2000

University of Birmingham 14 - 15 June 2000

This informal meeting is particularly intended for postgraduates, and first-year postgrads are encouraged to join in.

Joe Botting, Nick Clack, Jo Snell and Rosie Widdison.
School of Earth Sciences,
The University of Birmingham,
Edgbaston,
Birmingham B15 2TT UK

Tel: +44 121 414 3486 (Direct), +44 121 414 6751 (Messages only)
Fax: +44 121 414 4942
E-mail: R.E.Widdison@bham.ac.uk
Web: http://www.bham.ac.uk/EarthSciences/research/palaeo/index.htm

Full details on facing page.

Progressive Palaeontology 2000

14th-15th June 2000

The University of Birmingham

An informal 2-day meeting intended for postgraduates to get together and present short talks, or posters, on their current research, but all are welcome to attend.

We are particularly interested in hearing from first year postgraduates.

There will be a wine reception in the Lapworth Museum at the end of the first day, followed by supper in a local restaurant. The fieldtrip on the Thursday will visit some local palaeontological sites.

Registration is free.

To register, submit abstracts, or for further information about the meeting or accommodation, please contact Jo Snell or Rosie Widdison at:

J.F.Snell@bham.ac.uk
R.E.Widdison@bham.ac.uk
Telephone: 0121 414 3486
Fax: 0121 414 4942

School of Earth Sciences,
The University of Birmingham,
Edgbaston,
Birmingham B15 2TT

Deadline for abstracts: 31st March 2000

This is a meeting of the Palaeontological Association.

Organised by:

Joe Botting, Nick Clack,

Jo Snell and Rosie Widdison.

http://www.bham.ac.uk/EarthSciences/research/palaeo/index.htm

Annual Meeting 2000

Edinburgh, Scotland 17 - 20 December 2000

The Annual Meeting of the Palaeontological Association will be held at the Edinburgh Conference Centre, Heriot-Watt University, Riccarton Campus, Edinburgh.

Delegates will arrive on Sunday 17 December, lectures will be on the 18th and 19th, and there will be local field excursions on the 20th.

The local organisers are Prof. Euan Clarkson (Edinburgh University), and Vicenta Carrio-Lluesma (National Museums of Scotland).

Sue Rigby
University of Edinburgh

Lyell Meeting 2001

London, UK February 2001

The Lyell meeting, at the Geological Society of London in February 2001, will be on the theme of:

Palaeobiogeography and Biodiversity Change

First call for contributions.

Particular emphasis will be placed on the links between palaeobiogeography and biodiversity change during the Ordovician and Cretaceous-Tertiary as periods of marked provincialism, major continental break-up, sustained biodiversification and episodes of mass extinction. Presentations on faunas (marine or terrestrial) and floras from other periods or on widely applicable techniques will also be included.

If you are interested in contributing to the meeting, please let either of us know as soon as possible, giving a provisional title and letting us know whether you would like to give a talk or present a poster. If there is sufficient interest from the contributors, a volume of papers from the meeting will be published, so please let us know this as well.

Alistair Crame
British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK
e-mail: A.Crame@bas.ac.uk

Alan Owen
Division of Earth Sciences, University of Glasgow, Gregory Building, Lilybank Gardens, Glasgow G12 8QQ, UK
e-mail: a.owen@earthsci.gla.ac.uk
Web: http://www.earthsci.gla.ac.uk/

news

Two new Web sites related to micropalaeontology

Early Cretaceous Tethyan Stratigraphy

The broad objective is to build up a detailed knowledge of the Early Cretaceous stratigraphy in the Tethyan realm. The approach will be systematic through the integration of basin reference sections (stratotypes), basin or platform control sections, biostratigraphic data, and sequence stratigraphy (plus any information which should support correlations).

Keywords: Geosciences, Geology, Stratigraphy, Cretaceous, Stratotype, Sequence, Paleontology, Fossils, fossil, Algae, Alga, Foraminifers, Echinids, Ammonites, Platform, Basin, Jura, Vercors, Provence, Chartreuse, Tethys

The URL is http://www.angelfire.com/sc2/cretace/

PETRALGA (Permian and Triassic Algae) Project

The PETRALGA (PErmian & TRiassic ALGAe) Project was launched in order to build a solid database for the fossil Algae from the Permian and Triassic epochs. A main, ongoing sub-project deals with a catalogue for the Dasycladales.

Keywords: Geosciences, Geology, Paleontology, Stratigraphy, Fossils, fossil, calcareous, green, Algae, Alga, Dasyclads, Dasycladales, Systematics, Limestone, Dolomite, Tethys, Permian, Triassic.

The URL is http://www.angelfire.com/fl3/alga2000/

Bruno Granier
e-mail: bgranier@adma.co.ae

Fossilium Catalogus I: Animalia: New editorial board, new publishers

Prof Dr Frank Westphal (Tübingen, Germany) has been editor of the "Fossilium Catalogus I: Animalia" since 1961. This journal was at that time published by W. Junk bv at The Hague, The Netherlands. After Werner Quenstedt passed away, Frank Westphal succeeded him as editor and continued his editorial work for 39 years. He edited volumes 99 to 136 (1961-1999). One of the most famous volumes of this period is Pars 102 "Clavis bibliographica", a posthumous work of W. Quenstedt, dealing with several famous palaeontological monographs of the 19th century. The publication dates of these monographs are given very precisely with all bibliographic details. After the release of Pars 136 on Triassic reptiles, in March 1999, Frank Westphal expressed the wish to step down as editor, and in consultation with him the Publishers appointed Dr W. Riegraf as his successor.

Backhuys Publishers are sincerely thankful for Frank Westphal's long editorial effort, and hope that he will now enjoy his retirement as emeritus.

Frank Westphal was born in Berlin in 1930. He studied geology, palaeontology and zoology at the universities of Berlin and Freiburg i. Br. With a thesis on a vertebrate-palaeontological theme he attained his doctoral degree in 1956. In 1957 he became scientific assistant at the Geologisch-Paläontologisches Institut, Tübingen University, southwest Germany, where he was appointed lecturer in 1961. From 1972 until his retirement F. Westphal was professor of geology and palaeontology at the same university. During these years he took over various administrative duties in the institute beyond his scientific work, for example in the library and museum collections, and also was co-editor of the "Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen/Monatshefte" (Stuttgart). He published on various Triassic and Jurassic reptiles, Tertiary amphibians, and "fossillagerstätten" (fossil bonanzas) like the Lower Toarcian Posidonienschiefer Formation of Holzmaden or the Miocene Randecker Maar.

In 1998 the "Fossilium Catalogus I: Animalia" changed from Kugler Publishers (Amsterdam) to Backhuys Publishers (Leiden), and the opportunity was taken to introduce a new cover for the periodical.

Scientists who are interested in submitting palaeontological manuscripts to the "Fossilium Catalogus I: Animalia" are requested to contact the new editor, enclosing specimens of their text and of the letter size they want to use:

Dr. Wolfgang Riegraf,
Brüggefeldweg 31,
D-48161 Münster,
Germany.

news

Irish Stamps: Extinct Animals Series

On Monday, 11th October 1999, An Post (the Irish postal service) issued its annual Fauna and Flora series of commemorative stamps. This year, the theme is Extinct Irish Animals and the issue consists of four stamps featuring a Giant Deer (30p and 45p), Mammoth (30p and 45p), Wolf (30p only) and Brown Bear (30p only). The stamps are available in various formats including all four animals in a sheet depicting an interglacial scene of 30,000 years ago. A pictorial First Day Cover can be purchased featuring an Arctic fox. Postcards of each stamp are available as well as a special Presentation Pack. Full details are available by post from Philatelic Department, An Post, GPO, O'Connell Street, Dublin 2, Ireland or on their Web site at http://www .anpost.ie/Phila telic/e xtinctanimals/animals .html

N. T. Monaghan
Geological Section, National Museum of Ireland, 7-9 Merrion Row, Dublin 2, Ireland
e-mail: natmusmr@indig o.ie

Free fossil publications

I wish to let your members know that they can download from our Web site two free fossil publications.

They are:

1) A 184 page publication titled: "Macrofossils, their localities in Alberta"

2) A 79 page publication titled: "A guide to macrofossils of Libya, Africa".

These can be downloaded from http://www .diploma tsinter national.com/

Jacques LeBlanc
e-mail: management@diploma tsinter national.com

UK palaeontologist honoured in Sweden

At its special Jubilee Promotion on 22nd January 2000, Uppsala University conferred an honorary doctorate on Professor Michael G. Bassett (National Museum of Wales, Cardiff) in recognition of his long-term contribution to Swedish geology and palaeontology through his association both with Uppsala and with its University.

As befits the home of Linné and Celsius, the ceremony in Sweden's oldest university (founded in 1477) was accompanied by cathedral bells and cannon salutes. In addition to receiving the gold ring of the Faculty of Science and Technology, Mike Bassett was crowned with a laurel wreath made from the leaves of trees planted by Linné more than two centuries earlier, prior to an evening banquet in Uppsala Castle.

In recent years, similar honorary doctorates have been awarded by Uppsala University to Else Marie Fries (Stockholm) for her studies of fossil angiosperms, Andrew Knoll (Harvard) and Simon Conway Morris (Cambridge).

John S. Peel
Professor of Historical Geology and Palaeontology, Department of Earth Sciences, Uppsala University, Sweden

news...

Hudson Meeting

A sedimentological and palaeontological celebration of the work of

Professor J. D. Hudson

who retired in September 1999.

Date: 17th May 2000

Venue: Department of Geology,
University of Leicester, U.K.

Organisers: Dr J. Andrews (UEA)
Prof. A.D. Saunders (Leicester)

For meeting and registration details, please contact:

Rosie Cullington
School of Environmental Sciences,
University of East Anglia,
Norwich, NR4 7TJ, U.K.

Tel: +44 (0)1603 592560
Fax: +44 (0)1603 507719/507714
E-mail: r.cullington@uea.ac .uk

Andrew Saunders
Professor of Geochemistry, Department of Geology, University of Leicester, Leicester LE1 7RH United Kingdom
Web: http://www .le.ac.uk/g eolog y/ads/adsne w.html

Sylvester-Bradley Awards

1998

A high resolution biostratigraphy for the Lower Triassic of northern Italy

Strata of the Werfen Formation (Upper Permian and Lower Triassic age) are very well exposed in the Dolomites region of northern Italy and provide an important and continuous record through the Permian-Triassic extinction and recovery interval. The faunal and palaeoenvironmental changes of the Werfen Formation are well known and have been intensively studied over the last two decades. A major problem, however, is the absence of a rigorous biostratigraphic scheme to enable correlation with other areas world-wide.

To date, the only published conodont biostratigraphy for the Lower Triassic of the Dolomites is that of Perri (1991). Unfortunately, her lithostratigraphic interpretation of the key locality (a road section near Bulla) is highly contentious and probably incorrect. Perri (1991) states that the section records continuous deposition from the basal Tesero Oolite Horizon to the Campil Member (Smithian in age), whereas Twitchett (1997) regards the top of the section as upper Siusi Member and hence only Dienerian in age. This opposing view drastically alters the duration and age of some of Perri's (1991) conodont zones (Fig. 1).

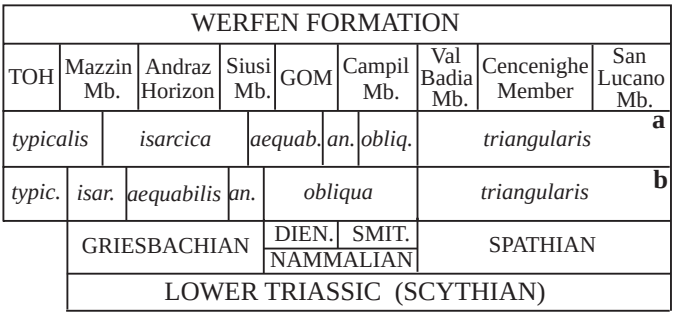


Figure 1 Conodont biostratigraphy of the Werfen Formation (**a**) from Perri (1991), (**b**) from Twitchett, (1997). TOH = Tesero Oolite Horizon; GOM = Gastropod Oolite Member; *an.* = *anceps*; DIEN = Dienerian; SMIT = Smithian.

Outcrops of the Lower Triassic Servino Fm. in eastern Lombardy provide a good opportunity to test these conflicting views. The Servino Fm. is the lateral equivalent of the Werfen Fm. and yet has received very little study since Cassinis (1968). Deposition occurred in a shallow marine, mixed carbonate-clastic ramp setting. It is much thinner than the Werfen Fm. (the

result of lower subsidence rates in Lombardy) which makes sampling of the whole Lower Triassic much easier. Smithian age sediments are easily recognisable, and almost identical to those of the laterally equivalent Campil Member of the Dolomites (Fig. 2). In addition, some trace fossils can also be used for correlation within this region; e.g. monospecific assemblages of *Diplocraterion* characterise the upper Siusi Member (cf. Twitchett and Wignall, 1996). Conodont ranges between Lombardy and the Dolomites can thus be compared in order to test Perri's (1991) scheme.

With the financial support of the Sylvester-Bradley Award, a total of three sections were sampled, including the complete section described by Cassinis (1968) at Passo Valdi, and two sections near M. Rondenino (Fig. 2). This study represents the first attempt to sample the Servino Fm. systematically for conodonts.

A total of forty samples were collected for conodont analysis. The lithologies that tend to yield most conodonts (>100 per kg) are the so-called "gasteropodi a ooliti" beds of previous workers. These are sharp based, decimetre thick, silty pack-grainstone tempestites which are usually composed of >50% microgastropods. Other common intraclasts include ooids, thin shelled bivalves and small flat pebbles. The beds are usually pink-red in colour due to the presence of a thin iron oxide coating around the clasts. Storm induced winnowing processes were probably responsible for concentrating the conodont elements within these beds.

To date, 30% of the samples have yielded conodonts. This figure is on a par with results from other published Werfen Fm. analyses (see Twitchett, 1997). The Servino Fm. specimens have CAI values of 5, which shows that these sediments have suffered greater burial/heating than equivalent strata of the Werfen Fm. (CAI 1.5 - 3). To date, the following taxa have been recovered from the Servino Fm.:

(1) *Hadrodontina anceps*, a species which ranges throughout the Werfen Fm.

(2) *Pachycladina obliqua*, a zonal species which Perri (1991) restricts to a short range from mid-Smithian to Spathian.

However, if the revised biostratigraphy of Twitchett (1997) is correct then the actual range of this taxon is base Dienerian to Spathian. The Servino specimens have been found in both Campil and pre-Campil equivalent units, suggesting this latter view is correct. Also present in the Campil-equivalent strata are Pa elements which may belong to a *Furnishius-Foliella* assemblage, which has been recorded in the Campil Mb. of the Dolomites (Twitchett, 1997) and equivalent Smithian age sediments of Slovenia (Kolar-Jurkovsek and Jurkovsek, 1995).

Sample analysis is continuing, but initial results suggest that the current biostratigraphic scheme of the Lower Triassic of northern Italy is in need of some revision. To aid this biostratigraphic study, additional samples were collected for palynological analysis (something never before attempted on Servino Fm. sediments). Unfortunately, all seventeen samples proved to be barren (C. Looy, pers. comm. 1998). Finally, one other notable find has been the discovery of fragments of a large (for the Lower Triassic!) marine reptile (probably nothosaur) from the upper (Spathian) units of the Servino Fm. (Fig. 2):

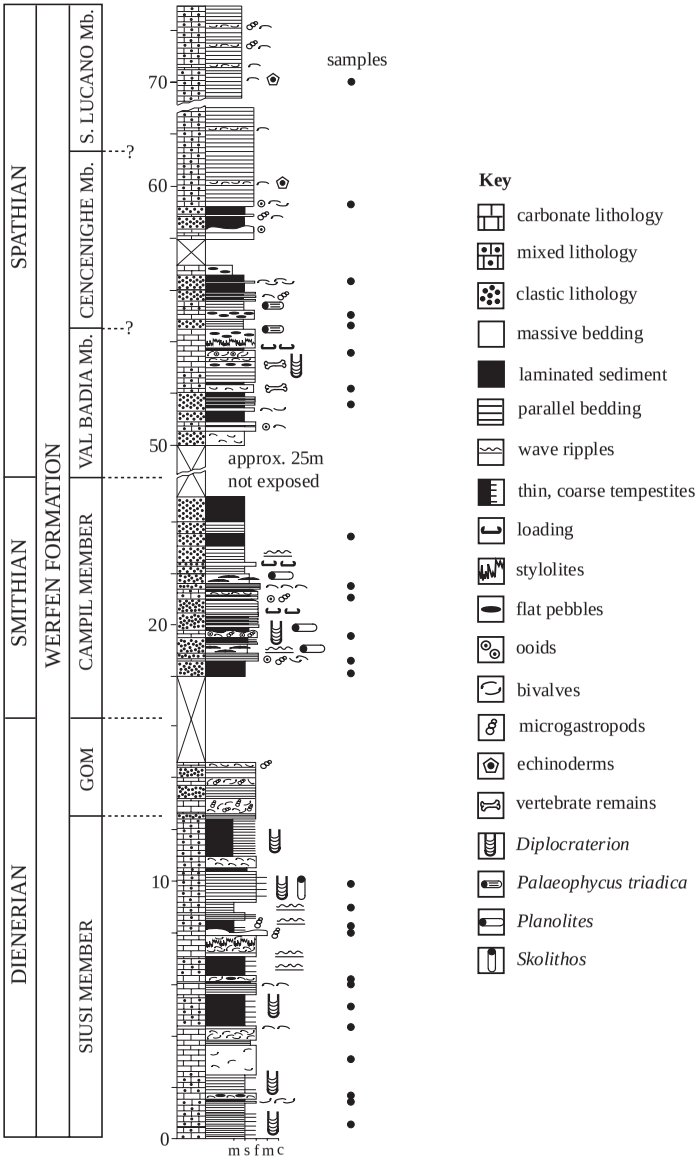


Figure 2 Correlation of road section SW of M. Rondenino, Lombardy (from Twitchett, 1997).

This is believed to be the first such record from the Lower Triassic of northern Italy.

I would like to thank the Palaeontological Association for funding this project, also Cindy Looy of Utrecht University for palynological analysis and Tanya Powell for assistance in the field.

REFERENCES

Cassinis, G., 1968. Studio stratigrafico del "Servino" di Passo Valdi (Trias inferiore dell' alta Val Caffaro). *Atti dell' Instituto Geologico della Università di Pavia*, 19: 15-39 [in Italian].

Kolar-Jurkovsek, T., and Jurkovsek, B., 1995. Lower Triassic conodont fauna from Trzic (Karavanke Mts., Slovenia). *Eclogae Geologicae Helvetiae*, 88: 789-801.

Perri, M.C., 1991. Conodont biostratigraphy of the Werfen Formation (Lower Triassic), Southern Alps, Italy. *Bolletino della Società Paleontologica Italiana*, 30: 23-46.

Twitchett, R.J., 1997. Palaeoenvironments of the Lower Triassic of the Dolomites, northern Italy. Unpublished PhD thesis, Department of Earth Sciences, University of Leeds, Leeds, UK.

Twitchett, R.J., and Wignall, P.B., 1996. Trace fossils and the aftermath of the Permo-Triassic mass extinction: evidence from northern Italy. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 124: 137-151.

Richard J. Twitchett
School of Earth Sciences, University of Leeds, Woodhouse Lane, Leeds LS2 9JT, UK.
e-mail: R.Twitchett@earth.leeds.ac.uk

1999

Burgess Shale arthropods – walking techniques and fossil trackways

The 'Cambrian explosion' metazoan radiation event represented by such exceptional fossil assemblages as the Burgess Shale and Chengjiang faunas is paralleled by a diversification of trace fossils in the Lower Cambrian. Information about the producers of these traces adds to our understanding of the radiation event and the resulting faunas.

The Lower Cambrian Tapeats Sandstone and Middle Cambrian Bright Angel Shale Formations of the Grand Canyon contain a diverse and abundant ichnofauna, including many fossil trackways. The trace fossils have tremendous value in indicating the presence of animals in these strata where their body fossils are not preserved. Previously collected trackways from these formations have been attributed to trilobites (Walcott 1918, Gilmore 1928) or unspecified arthropods (Martin 1985), although one unusual specimen was interpreted by Elliott and Martin (1987) as belonging to the Burgess Shale arthropod *Habelia optata*.

This award enabled examination of trackway specimens housed at the U.S. National Museum of Natural History and the Museum of Northern Arizona, and collection of new material from the Tapeats Sandstone and Bright Angel Shale Formations of the Grand Canyon, revealing a wide range of trackway morphologies preserved in these Cambrian deposits. The range

encompasses traces that were obviously produced by animals with a 'trilobite-like' body plan, as well as those with morphologies that require an alternative interpretation. An investigation of possible producers was achieved by computer modelling the walking techniques of several Cambrian arthropod species known from the Burgess Shale assemblage. The modelling quantified the range of optimal techniques available to each arthropod in terms of stability and power efficiency. Hypothetical trackways were generated according to these gait parameters, which could then be compared with the fossil trackways (Lane 1999). *Merostomichnites* and *Petalichnus*-like trackways, both from the Tapeats Sandstone, are comparable to the hypothetical trackways produced by the Burgess Shale arthropods *Canadaspis perfecta* and *Sidneyia inexpectans* respectively, therefore identifying them as potential producers of these trace fossils.

The combination of quantitative biomechanical modelling of fossil arthropods and comparisons of theoretical with fossil evidence in this way is a useful new tool for the identification of trace fossil producers and the analysis of their walking techniques. Such an approach is important in advancing our knowledge of the Cambrian metazoan radiation, and our understanding of the palaeobiology and behaviour of these extinct animals.

References

Elliott, D. K. and Martin, D. L. 1987. A new trace fossil from the Cambrian Bright Angel Shale, Grand Canyon, Arizona. *Journal of Paleontology*, 61, 641-648.

Gilmore, C. W. 1928. Fossil footprints from the Grand Canyon: third contribution. *Smithsonian Miscellaneous Collections* 80 (8), 1-16.

Lane, A. A. 1999. The walking techniques of Burgess Shale arthropods: a functional and ichnological investigation. Unpublished M.Sc. thesis, Bristol University, U.K. 109 pp.

Martin, D. L. 1985. Depositional systems and ichnology of the Bright Angel Shale (Cambrian) eastern Grand Canyon, Arizona. Unpublished M. S. thesis, Northern Arizona University, Flagstaff, U.S.A. 365 pp.

Walcott, C. D. 1918. Cambrian geology and paleontology. No. 4 – Appendages of Trilobites. *Smithsonian Miscellaneous Collections*, 67, (4), 116-216.

This work was funded jointly by a Sylvester Bradley award 1999 and the Geological Society (Timothy Jefferson Field Research Fund), and forms part of a Master of Science project supervised by Dr. Simon J. Braddy and Prof. Derek E. G. Briggs at the University of Bristol.

Abigail Lane
Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, U.K.
e-mail: Abby.Lane@bris .ac.uk

Planktonic Foraminifera of the London Clay Formation: occurrence and palaeoenvironmental significance

The London Clay Formation consists of marginal and shallow marine sediments that were deposited during the Ypresian (Lower Eocene) in the London and Hampshire Basins. Deposits range from proximal silty sands to more distal silty clays. One of the best exposures of the more distal facies within Hampshire Basin is at Whitecliff Bay in the Isle of Wight, which was situated near the western limit of the London Clay sea.

The succession at Whitecliff Bay is one of the most complete of the Hampshire Basin and is composed largely of alternating beds of brown silty clays and sandy clays. Planktonic foraminifera have previously been identified from this succession using relatively low resolution sampling, and their occasional occurrence has been interpreted as representing either increased depth of the London Clay sea, or increased connection to the open ocean (Wright (1972), Murray and Wright (1974)).

This research formed part of my M.Sc. in Palaeobiology at the University of Bristol and was supervised by Dr. Paul Pearson. I undertook high resolution sampling of the lower London Clay Formation in Whitecliff Bay to examine in detail the occurrence of planktonic foraminifera in association with changing lithology (e.g. the variations in glauconite, pyrite, quartz and mica). The benthic foraminifera and ostracod assemblages were also examined. Intensive sampling has recorded a more diverse planktonic assemblage than previously reported, and I have used these occurrences to interpret the palaeoenvironment of the lower London Clay Formation.

Wright (1972) recorded the first appearance of planktonic foraminifera at 41m from the base of the London Clay formation. This so-called 'planktonic datum' at Whitecliff Bay has been used for correlation with similar successions in Alum Bay and Bognor Regis in the Hampshire Basin and North Sea basin. In my study, the first appearance of planktonics was actually found to occur at 35m from the base. The limited number of individuals found, and the dependence on high resolution sampling, make this occurrence unreliable for correlation.

I found three strong "pulses" of planktonic foraminifera within the lower London Clay formation. The first pulse was characterised by a large abundance of the biserial *Chiloguembelina* and limited numbers of *Subbotina* and *Parasubbotina* species. The occurrence of the low oxygen, shallow water, opportunistic *Chiloguembelina* species and the deeper water *Subbotina* and *Parasubbotina* species, together with a high percentage of unidentified juveniles and an abundance of pyrite and mica, indicates that this was a stratified, warm shallow sea, with low oxygenation.

The second and third pulses are very different from the first in terms of planktonic assemblage, but similar to each other. They are characterised by a dominance of *Acarinina* species and are interpreted as warm, shallow, well-oxygenated seas with fluctuating depositional energy.

Detailed results are currently being prepared for publication.

I am very grateful to the Sylvester-Bradley Fund (1999) for supporting my fieldwork.

References

King, C. 1981. The stratigraphy of the London Clay and associated deposits. *Tertiary Research*, Special Paper, 6.

Murray J. M. & Wright, C. A. 1974. Palaeogene Foraminiferida and Palaeoecology, Hampshire and Paris Basins and the English Channel, *Special Papers in Palaeontology*, 14, The Palaeontological Association, London.

Wright, C. A. 1972. The recognition of a planktonic datum in the London Clay of the Hampshire Basin. *Proceedings of the Geological Association*, 83, 413-419.

Margaret Browne
Department of Earth Sciences, University of Bristol, Queens Road, Bristol BS8 1RJ, UK
e-mail: ma_browne@hotmail.com

From our own Correspondent

APalaeo

Mad scientists are renowned for attempting to create life, and one way of doing this is in a computer. To create Artificial Life (or ALife as the practitioners like to call it) you must design a system that encapsulates the Darwinian processes of replication, mutation, struggle for resources and survival of the fittest. It is possible to make digital organisms that inhabit a virtual world, each with its own "genetic" instructions in the form of computer code. Then you run your program and – hopefully – watch the critters interact, mutate, and in time evolve novel survival strategies and adaptations. At this point you can claim to have created life artificially and fantasise that some day your creations may take over the virtual universe.

A couple of years ago I blundered by accident into a conference of ALifers and decided to attend some of the talks. Strategies for making ALife range from abstract communities of interacting computer "agents" (the serious end of the subject) to more obviously lifelike objects such as lovingly rendered artificial fishes in virtual fish tanks. There is also a commercial side to the subject, and you can buy digital pets that evolve on your hard disk and have cybersex with others of their species that they meet on the Internet.

What interested me most, however, were the researchers who were trying to trace the evolutionary patterns down the generations. The essence of this approach (which I hereby designate as "APalaeontology") is continuously to record the genetic make-up of the agents as they evolve. Your virtual fossil record can then be analysed at leisure. At the conference there was a whole session on the evolutionary dynamics of ALife simulations, including debates on whether evolution is gradual or punctuated, cyclic or progressive, and to what extent separate runs of the simulations are predictable or contingent on chance events. Not surprisingly, everybody's system has its own characteristics, and there is no grand consensus to report.

Real life and real fossils are of course much more interesting than artificial ones, for the time being at least. Nevertheless there are some intriguing angles to APalaeo research. For instance, one pair of researchers (D. Cliff and G.F. Miller) conducted experiments in transplanting virtual organisms from one period of their evolution to another to see if they could compete. This is like letting trilobites loose in the Jurassic. Some rich patterns of fitness evolution emerged from their experiments, including directional trends and cycles. However, they found that in general virtual organisms cannot compete successfully with their future descendants, and concluded that something akin to evolutionary progress probably occurs in all but the simplest evolving systems.

Darwin, of course, would have predicted this result. He hypothesized in the *Origin of Species* that a modern fauna would exterminate an Eocene one if they could be brought into

contact, and that Eocene organisms would exterminate Mesozoic ones, and so on: "I do not doubt that this process of improvement has affected in a marked and sensible manner the organisation of the more recent and victorious forms of life, in comparison with the ancient and beaten forms; but I can see no way of testing this sort of progress". Now we have a way of testing this proposition, virtually.

Cliff, D. and Miller, G.F. 1995. Tracking the Red Queen – measurements of adaptive progress in co-evolving simulations. *Lecture Notes in Artificial Intelligence* 929:200-218.

Husbands, P. and Harvey, I. (eds). 1997. Fourth European Conference on Artificial Life, Proceedings. MIT Press.

Paul Pearson
Department of Earth Sciences, University of Bristol, Queens Road, Bristol, UK BS8 1RJ
e-mail: paul.pearson@bristol.ac.uk
Web: http://palaeo.gly.bris.ac.uk/personnel/Pearson/Pearson.html

Meeting REPORTS

Biology and Evolution of the Bivalvia
14-17 September 1999
Cambridge

Bivalves at the High Table

Mid September in Cambridge saw one of the largest and most successful meetings ever organised by the Malacological Society. This symposium, organised by Liz Harper, attracted over 120 bivalve researchers from some 21 countries. A most important part of the meeting was the mix of palaeontologists and biologists. An especially distinguished participant was Norman Newell, the doyen of American bivalve palaeontologists.

Bivalves have a long and rich fossil history, and their shells are often amongst the most abundant of fossils. Moreover, the shells of bivalves through their shape, muscle attachment scars, hinges, ligaments, growth lines, microstructure and chemistry reveal more information about the life habits of the animal than for any other molluscan class. A continuous and detailed record of the whole life history of the bivalve from the larva to the adult is contained within the shell. Additionally, the life environment leaves chemical and structural signatures in the shell which can be used to interpret both the ontogenetic and palaeoenvironmental history. For these reasons palaeontologists have long been to the forefront of evolutionary and functional studies of bivalves.

The three day meeting was packed with papers and posters from a remarkable diversity of different topics. In order to accommodate all the participants, talks (68 in all) were strictly limited to 15 minutes only. It was soon apparent that this, combined with a judicious mixing of topics in the programme, was one of the great successes of the meeting. Additionally, 27 poster presentations were on display and these were viewed at special lunchtime sandwich and beer sessions. Video sequences of bivalve feeding were also shown during another lunchtime “feeding” session.

The papers presented at the meeting covered an extraordinarily varied range of topics which ranged from functional morphology of shells, bodies and organs, molecular and morphological phylogeny, physiology, ecology and palaeoecology, global biogeography, and taphonomy.

As might be expected, phylogenetic studies were prominent at the meeting, and new molecular phylogenies were presented at the broad level for all bivalves (Campbell) and the Pteriomorphia (Steiner). The early radiation of the bivalves is being investigated through careful studies of newly discovered Lower Palaeozoic bivalves (Cope, Ratter). New

morphological phylogenies were also presented for the Anomalodesmata (Harper *et al.*), for the rudists (Skelton) and Triassic cementing bivalves (Hautmann). Molecular phylogenies are providing a framework for testing adaptational hypotheses such as the evolution of reproductive strategies in oysters (O'Foighil & Taylor) or the evolution of cementation in Unionoidaea (Bogan & Hoeh). At a more detailed level, molecular studies are being used to unravel the complex relationships of living *Mytilus* species (Daguin *et al.*), brackish and freshwater cockles (Schneider & Magyar), *Crassostrea* species (Boudry & Huvet), and threatened freshwater mussels from the southern USA (Lydeard *et al.*). New morphological characters are being developed with great potential in phylogenetic analysis including: the ultrastructure of bivalve sperm (Healy, Keys), gill structure (Benninger, Kornuishin), ligament growth patterns (Carter & Campbell, Thomas, Johnston & Collom), and larval shell form (Malchus, Yancey & Heany).

Biogeographic patterns and processes were addressed by both zoologists and palaeontologists. The structure and origin of latitudinal gradients in diversity continue to fascinate (Jablonski *et al.*; Crame). But the data upon which these analyses depend need painstaking work to assemble as for the Florida Keys (Bieler & Mikkelson) and for the analysis of longer term faunal change in the Caribbean (Todd & Jackson). Molecular techniques are now being employed to unravel biogeographic histories as demonstrated in pearl oysters *Pinctada* (Arnaud *et al.*) and deep sea protobranchs (Zardus *et al.*).

Functional studies of bivalves included the experimental analysis of swimming in scallops (La Barbera), *in situ* endoscope studies of gill structure (Dimock) and particle processing (Levinton, Benninger), flume experiments on the hydrodynamics of hippuitid rudists (La Barbera) and an analysis of metabolic rates in Antarctic animals. Functional morphology studies included a review of the structure and function of bivalve eyes (Morton), anatomical adaptations to chemosymbiosis by Lucinidae (Taylor & Glover), tube formation in clavagellids (Savazzi), rib formation in oysters (Checa & Jimenez) and from the Mesozoic, reconstructions of the mode of life of the weird *Opisoma* (Aberhan), the Retroceramidae (Damborenea & Johnston) and large inoceramids (Seilacher *et al.*).

Ecological and palaeoecological studies included a review of marine mussel ecology and adaptations (Seed & Richardson); the colonization by bivalves of hydrothermal vents (Lutz *et al.*); the ecology of freshwater mussels (Aldridge); burrowing behaviour (Edelaar & Welink) and reproductive output (Beukema & Honkoop) of *Macoma*; the effect of reproduction on the performance of *Chlamys* (Brokordt *et al.*); the population density of the coral-associated Pedum (Kleemann); naticid predation on Miocene corbulids (Arpad); the distribution of Mesozoic and Cenozoic bivalves from Japan (Kondo *et al.*), and the association of giant bivalves with Cretaceous cold seep sites (Kelly *et al.*). The relation of bivalve death assemblages to the living community was considered by Kidwell, and the causes of shell scars on Glycymeris shells investigated by Ramsay *et al*.

The ontogenetic record embedded in the shell was used to measure growth rates as a test of ideas about how heterochrony influenced adult morphology in Jurassic *Gryphaea* (Jones) and the shape changes with age were analysed in Cenozoic *Spissatella* (Crampton). The use of ontogenetic changes in shell chemistry as a record of environmental changes was demonstrated using scallops (Johnson) and mytilids (Richardson & Seed).

Wine receptions were held amongst the exhibits of fossils in the Sedgwick Museum, and the more recently dead in the Zoological Museum, and the conference banquet took place in the historic dining hall of Gonville and Caius College.

The general impression from participants at the end of the three days was that the meeting had been highly successful. It brought together an interesting mix of researchers from widely different disciplines. The format of 15 minute talks, loosely arranged by approach rather than subject, avoided "ghettos", for example, of palaeontologists or "unionid papers".

Everyone comes away from meetings with different impressions but here are a couple of my own. It is clear that the molecular analyses being produced by different research groups will soon provide a robust phylogenetic framework for the classification of the bivalves and for the testing of ideas concerning the evolution of particular organs or morphological features. At a more detailed level, molecular phylogenies will be increasingly available for particular families and clades allowing investigation of evolutionary and biogeographic histories, speciation rates etc. Integration of morphological phylogenies and Lower Palaeozoic fossils in particular with these new molecular phylogenies will be a difficult and exciting challenge.

Despite the new techniques, exciting discoveries are still being made by simple field work and careful observations. It is less than twenty years since the discovery of either carnivory or sulphide-oxidising chemosymbiosis in bivalves, and new living animals with unusual lifestyles are still being found. Palaeontologists, also, continue to unearth wonderful and extraordinary animals which truly extend our concepts of morphological disparity amongst the bivalves. It is salutary to be reminded that animals living today are only a limited subset of the possible evolutionary range of bivalves.

Liz Harper and her team at Cambridge are to be congratulated on a stimulating and well organised meeting.

The abstracts from talks at the meeting can be viewed at

http://www .sunder land.ac .uk/~es0mda/msl1.shtml

John Taylor
Department of Earth Sciences, Downing Street, Cambridge CB2 3EQ, United Kingdom

XV Jornadas de Paleontología
October 1999
Spain

At the end of October the 'Instituto Tecnológico Geominero de España' and the 'Escuela de Minas' hosted the annual meeting of the 'Sociedad Española de Paleontología' on 'HISTORIA DE LA PALEONTOLOGIA ESPAÑOLA y Simposios de los Proyectos PICG 393, 410 y 421'.

The meeting was organized by the 'Instituto Tecnológico Geominero de España-Museo Geominero' (that celebrated this year its 150th anniversary) and the 'Sociedad Española de

Paleontología', and was attended by a crowd of colleagues from the entire Iberian Peninsula (about 180 palaeontologists). 24 presentations (7 posters) were made on the Monographic Subject ('HISTORIA DE LA PALEONTOLOGIA ESPAÑOLA'); 54 (24 posters) on the free session; 23 (10 posters) on the 'Patrimonio Paleontológico' session; 8 on the 'Aula Informática'; 8 (1 poster) on the PICG 393 Symposium; 13 on the PICG 410, and 14 (2 posters) on the PICG 421.

The first morning, at noon, there was a reception at the 'Museo Geominero' and the presentation of a special volume, well edited by María Luisa Martínez-Chacón, of the 'Revista Española de Paleontología' on homage to Professor Jaime Truyols (Universidad de Oviedo). The inspired semblance given by Sánchez de Posada of Prof. Truyols provoked lots of emotions and feelings among those present.

On the last day, Saturday 30th October, a palaeontological excursion was organized to Molina de Aragón under the theme: 'Tras las huellas de Torrubia por el Señorío de Molina'. This was a good opportunity to visit the Lower Jurassic outcrops on classic localities for Spanish palaeontology, such as Turmiel, Anchuela del Campo, Concha, Pardos, etc. already visited by José Torrubia (1698-1761, author of the first palaeontological treatise written in Spain: 'Aparato para la Historia Natural Española', Madrid 1754) in his trip from Paris to Madrid in 1750 and on subsequent occasions. During the excursion, the participants unveiled, in the 'Real Convento de San Francisco de Molina de Aragón', a plaque devoted to Torrubia's memory, and also had time to enjoy the culinary excellences of the region.

Conference proceedings were very elegantly published (and distributed at registration) in a big volume of the 'Temas Geológico-Mineros ITGE' divided in two parts well edited by Isabel Rábano. For more information contact Isabel Rabano at Museo Geominero Instituto Tecnológico Geominero de España, Rios Rosas 23, E-28003 Madrid (Spain) (http://www.itge.mma.es/ , e-mail i.rabano@itg e.mma.es) or Angeles Sacristán (e-mail a.s.rizos@mx3.r edestb .es).

Fernando Alvarez
Departamento de Geologia, Universidad de Oviedo, Oviedo
Tel: + 34 98 510 31 38, Fax: + 34 98 510 31 03, e-mail: fernando@asturias .geol.unio vi.es

Review Seminar on Functional Morphology
Leicester
November 1999

Nearly 100 people crammed into a lecture theatre in the Department of Geology, University of Leicester, to hear talks on recent advances in the interpretation of life habits and function from the form of fossil organisms. This highly successful review seminar was organised by Richard Fortey, Mark Purnell and Jeremy Young. We were treated to 11 wide-ranging presentations, all of a high standard, showing how novel techniques have contributed to the recent, relatively unsung palaeobiological revolution in functional morphology.

Thanks to Mark Purnell, webmaster of the Pal Ass Web site (http://www .palass .org/), all the abstracts were available in advance on the net, each with a pithy bibliography, and pages could be printed out in an attractive format. As these abstracts are going to remain available on the net, I will limit this account to a few points about each talk.

Liz Har per (Cambridge) discussed how she and others have been testing various hypotheses relating to bivalve shell microstructure and mineralogy. In particular, experiments on the relative solubilities of calcite and aragonite have shown that both crystal size and the proportion of organic matrix can be more important in determining solubility than polymorph type. Calcite, which evolved independently at least four times, is purely a feature of epifaunal bivalves, and it never makes up all the shell (there is always some aragonite). Liz concluded from various experiments that outer calcitic layers are *not* adaptations against shell dissolution in Recent 'aragonite' seas.

Sue Rigb y (Edinburgh) entertained us with the results of experiments on graptolite models in wind tunnels. Using a sophisticated technique called laser doppler anemometry, she studied the detailed movement of particles around model graptolites of different form. The technique revealed how features such as spines, hooks and other projections could influence colony stability and initiate local vortices that assisted feeding. Certain shapes of thecae caused food to be concentrated in little whirlpools beside the apertures. This, Sue declared, was 'the ultimate in TV dinners', as the zooids stayed put within the shelter of their thecae whilst the induced vortices simply directed food towards them.

In a talk richly illustrated with beautiful slides of reef organisms, Rachel Wood (Cambridge) reviewed the factors influencing the functional morphology of clonal groups. Strategies to survive partial mortality are very important, especially with voracious predators around, such as the bumphead parrotfish, individuals of which can erode 5 tonnes of coral reef per year. Modular forms, which often have awesome powers of regeneration, tend to dominate open surfaces, whereas solitary or non-encrusting, non-modular forms are characteristic of cryptic communities found under surfaces. The increasing modularity through time observed among many sponges, corals and bryozoans is consistent with the adaptive value of evolving a clonal habit.

Mark Pur nell (Leicester) showed how recent work has produced a far better understanding of the function of conodont elements. For example, SEM studies clearly reveal distinct patterns of microwear and recurrent patterns of damage, confirming that conodont elements functioned as slicing, crushing and grasping teeth. Most living vertebrates shed teeth, but the available evidence suggests that conodonts were retained for long periods, and not shed. A new cladogram of early Palaeozoic vertebrates suggests that the first vertebrate hard parts may have evolved not for defence but for teeth.

Richard Fortey (Natural History Museum) summarised the many recent developments in the understanding of trilobite feeding adaptations. The form of the hypostome, particularly, provides clues to feeding strategy, often enabling a distinction between predatory/ scavenging, filter-feeding and particle-feeding trilobites. Richard also discussed his most appealing hypothesis that some trilobites of 'black shale' environments, especially olenids, were chemoautotrophic symbionts, cultivating sulfur bacteria on their undersides, eating the bacteria or directly absorbing nutrients from them. Such forms, he postulates, can be

recognised by their wide thoracic pleurae, narrow axes, thin cuticles and degenerate hypostomes, as well as a characteristic distribution and abundance in low-oxygen settings.

Graham Budd (Uppsala), referring to Cambrian arthropods and their sister-groups, reviewed some general, rather tricky issues concerning the connections between functional morphology, phylogeny and evolutionary processes. He argued that it is possible to work out a logical order of dependence of different functional systems on each other, and thus infer an evolutionary sequence. He criticised the orthodox approach which assumes that adaptations of a hard exoskeleton were the driving force of early animal evolution. He proposed that the 'shoulder-pads' and spines on some Cambrian animals were plates first evolved for attachment of powerful walking muscles, not for defence. Overall, he favoured the 'correlated progression' model of evolution often applied to vertebrates, in which large-scale constraints are overcome by an intimate combination of preadaptation and functional redundancy.

Juliette Dean (Cambridge), echoing Graham Budd's emphasis on the importance of good phylogenies, discussed the use of cladistics to shed light on early asterozoan phylogeny, morphology and ecology. She generated a cladogram on the basis of her study of 160 characters from all 38 known Ordovician asterozoan genera – a massive undertaking, and one crucially dependent on the correct identification of homologous plates. Her results show that the earliest asterozoans were dominantly epifaunal deposit-feeders, and that during the Ordovician ophiuroids underwent a marked evolution to a mobile carnivorous lifestyle, whilst asteroids remained mainly deposit-feeders and chance whole-prey ingestors.

Jeremy Young (Natural History Museum) discussed the challenges of trying to interpret the functions of mineralized structures in planktonic protists, which are far from self-evident. In culture, coccolithophores lacking coccoliths often occur and remain, surprisingly, as viable as calcified cells. Apparently a single cell can sometimes exhibit two very different coccolith shapes, suggesting that the precise architecture of coccoliths – so spectacularly beautiful under the SEM – may not be too important. He concluded that protection is the primary, but not sole function of most coccoliths; flotation modification, light concentration and carbon fixation are among likely secondary functions.

Michael Gudo (Forschungsinstitut Senckenberg, Frankfurt) gave a superbly illustrated account of how a biomechanical approach can be used to reconstruct the soft parts of fossil organisms. This involves looking at the parts of an organism in much the same way as an engineer would look at an engine in terms of its structural parts and their functional connections. Applying this reverse engineering method to the two types of Palaeozoic lid corals, especially *Calceola* and *Goniophyllum*, he was able to deduce details of their individual polyp development and show, unexpectedly, that they belonged to two quite separate evolutionary lineages.

Paul Pearson (Bristol) presented a joint talk (with Helen Coxall, Bristol) entitled 'Functional morphology of planktonic foraminifera. Is there such a thing?'. Similar basic morphologies of planktonic foraminifera shells have evolved over and over again, so it is tempting to seek functional explanations for the most common shapes. Paul stressed the importance of setting up *falsifiable* hypotheses of function, and showed that many of the most obvious

hypotheses (e.g. that particular forms are related to depth stratification) had now been falsified using geochemical evidence. In conclusion, he confessed to being somewhat mystified about the relationship between form and function in planktonic forams. Using a suitably busy overhead to make an important point, he suggested that in general, whatever the organisms, form and function are rarely simple 1:1 relationships: multiple functions are common and these functions relate to each other in complex ways.

Ian Jenkins (Bristol) talked about cranial biomechanics and jaw function in Late Permian carnivorous mammal-like reptiles. As part of a multidisciplinary approach, he had borrowed the technique of finite element analysis used by engineers to solve problems of structural mechanics. Like Michael Gudo, he argued that biomechanics, based on engineering principles, was the most rigorous of current procedures. As an example, the skulls he studies often show both sites of extra bone deposition and sutures (which act as shock absorbers), revealing where forces acted on these Permian carnivores as they fought, captured and ate their prey.

As Euan Clarkson (Edinburgh) said so aptly in his summing up, 40 years ago the functional morphology of fossils was not taken very seriously; today, by contrast, it is. There is now a minimum of unsubstantiated speculation: all sorts of engineering, analytical, photographic and computing techniques are available, often in parallel, and cladistic analysis has produced more robust conceptions of relationships. During the meeting I was struck by how often a deeper understanding of the broadest possible themes such as evolutionary processes, evolutionary history and palaeocommunity structure can emerge from what at first might be seen as attention to trivial morphological details. Thanks to all concerned for an inspiring day.

Peter Sheldon
Department of Earth Sciences, The Open University, Milton Keynes, MK7 6AA, UK
email: P.R.Sheldon@open.ac.uk

Correspondence

Pal. Ass. Newsletter No. 42: Abstracts for 43rd Annual Meeting

I don't know who is editorially responsible for these abstracts, but I was sorry to see that the paper on "Rhynchonellid brachiopods …" by Adel Ali Hegab *et al* includes the names of a number of new species.

I know there is a "taxonomic disclaimer" in each Newsletter, but all the same I consider the publication of new names in abstracts to be undesirable. I hope it can be avoided in future.

Yours sincerely,

Desmond Donovan
Department of Geological Sciences, University College London, Gower Street, London WC1E 6BT

I am responsible for the editing of the Newsletter*, and accept full responsibility for the inclusion of this abstract.*

The alternatives to including these new names in the abstract from Ali Hegab et al *would have been to omit them (a little draconian?) or to change the title of a talk as printed, so that the* Newsletter *conflicted with the booklet of meeting abstracts.*

Perhaps the new Editor will welcome comments and suggestions on this theme.

Sue Rigby

—— OBITU ARY ——

CHARLES DO WNIE 1923 – 1999

Members of the Association will be saddened to learn of the death in July 1999 of Charles Downie, one of the pioneers of British palynology. His scientific career began after wartime service in the navy, when he enrolled at the University of Glasgow, his home city, to read geology. He was taught stratigraphy and palaeontology in his early years at Glasgow by Leslie R. Moore. In 1949, Moore was appointed to the Sorby Chair in the University of Sheffield where he quickly established a research school with stratigraphy and palynology as major components.

After graduating, Downie stayed in Glasgow and started research on the sedimentology of the Kimmeridge Clay, but in 1952 followed Moore to Sheffield to take up an appointment as Lecturer in Geology. Intrigued by Moore's palynological work on the Carboniferous, Downie commenced a series of experiments to try to recover dinoflagellates and "hystrichospheres" from the Jurassic. His results were to lay the foundations for the development of marine palynology in Britain.

In 1957 he transferred his attention to the Lower Palaeozoic and initiated a new dimension in palynological research with the investigation of the morphology and potential stratigraphical application of hystrichospheres in the Shineton Shales of Shropshire.

By the late 1950s, the progress made by Downie and his Late Palaeozoic spore colleagues in Sheffield had already led to the Sheffield laboratory becoming internationally recognised as a major research facility. Whilst Leslie Moore had clearly been the visionary of British palynology, it was Charles Downie who was emerging as the driving force. He developed a research group which was to become a major influence in palynological thinking over the next three decades. In 1976 Downie succeeded Moore as the fourth Sorby Professor of Geology at Sheffield.

Many of his important publications where initially directed at the classification of dinoflagellate cysts, but it was the taxonomy and stratigraphical distribution of acritarchs to which he probably devoted most of his time. He examined material extensively in the United Kingdom, particularly from the Welsh Borderland, Lake District and the Southern Uplands, but was no stranger to acritarch assemblages elsewhere in Europe and North America.

Few people were aware of the other side of Charles Downie's geological career. In 1956 he took part in the Sheffield expedition to Kilimanjaro to study the East African Volcanic Complex.

He later made two further trips and in 1972 he was responsible, with Peter Wilkinson, for the preparation of the definitive memoir on the geology of Kilimanjaro.

Charles was a founder member of the Association. His achievements in palynology were widely recognised. The University of Glasgow conferred on him the degree of Doctor of Science in recognition of his contribution to stratigraphical knowledge. The Yorkshire Geological Society awarded him the John Phillips Medal in 1980 for his work in the fields of micropalaeontology and stratigraphy, and in 1984, the Geological Society awarded him the Prestwich Medal.

Charles Downie was one of the most respected of palynologists.

Bernard Owens & Bill Sarjeant

Palaeo comment

Time for the Deep Time Team?

The infamous "Walking with Dinosaurs" showed, yet again, that the public really is interested in palaeontology. Every time a fossil-based offering is televised, from David Attenborough to Jurassic Park, the public response is tremendous. The same applies to the few, but excellent, paperbacks of recent years. This must be testament to some inherent fascination of fossils, since, to be blunt, much of palaeontology really doesn't *matter* in the way that other sciences perhaps do. We represent that rare thing – a science that cannot be transformed into a technology. While biology, physics and chemistry are now dominated by lucrative research of immediate public benefit, the prime motivation for much of palaeontology remains its inherent interest. Although we should never disparage or downplay the practical benefits of biostratigraphy, palaeoecology and so forth, we should also remember that intellectual appeal is our most valuable resource.

This is why it is particularly worrying that most of palaeontology has moved so far from the layperson's perspective as to be almost incomprehensible. Repeatedly, following WWD, I was told that most of the reconstructions were blatantly made up. Much of this was justified, but in other cases (e.g. cannibalism), what to us is clear evidence simply does not occur to the audience. Even engineering principles are not immediately thought of as relevant. When not confused with archaeologists, palaeontologists are thought of as people who stick bones together, with little consciousness of the capabilities of the field, or of its achievements.

This is combined with an almost complete lack of awareness of anything other than dinosaurs, "ice ages", dinosaurs and the K-T, birds and dinosaurs, and occasionally, the Burgess Shale. It isn't as if everything else is uninteresting; quite the contrary, in fact. The problem is more a lack of basic knowledge. The public has no reference point for graptolites, lycopods, rudist bivalves or Tully Monsters. However, anyone who discovers these lesser-known topics almost invariably responds with delight and fascination. Even the processes of fossilisation – just the less bizarre mechanisms – seem to have an unnaturally persistent grip on the public interest. Unfortunately, anyone without an academic library to hand is unlikely even to be aware of the existence of most fossil groups, let alone their significance in evolution, ecology or earth history. The greater the achievements of palaeontology become, the less they will be understood by the public – by whom we are, after all, employed. I don't think this problem should be underestimated. An American colleague once commented, with great gusto, that palaeontologists are very privileged; I couldn't agree more, and, I suspect, neither could the public.

Archaeology had a similar problem a few years ago. They invented "The Time Team," and now most people have a far better idea of archaeological procedures than of almost any other science. In the process, they have demonstrated a substantial demand for academic interest as a source of entertainment – despite what most of the media would have us believe. Palaeontology has huge potential in this type of arena. We have an ideal subject matter. The audience is willing (as we know from any fossiliferous programme in recent years). And now, if

ever, has to be the opportunity. The most significant aspect of "Walking with Dinosaurs" was perhaps the controversy it provoked. Fossils were abruptly snatched from the "oooh" contingent, and placed firmly among the "hmm" brigade. This interest was very good for the subject, but I have a horrible feeling that the words "palaeontologist" and "charlatan" are being spoken with a greater propensity for juxtaposition than previously… Also, if we wait too long to display our wares, the subject will advance too far for an easy bridge to be built to the masses, and interest may be depleted. Before now, the public demand was far less obvious, as was the opportunity.

Although literature enables greater depth (and lasts longer), in today's world, the only viable medium has to be television. As to format, the archaeologists have already shown us – in "The Time Team" and (grudgingly) "Meet the Ancestors." A mini-series creates brief, intense excitement, but a more permanent (or at least episodic) programme has far greater impact. Such a series acquires devotees, and feels less like education. Possible themes could include reconstructing communities, or individual creatures within their environments, or approaching a wide range of more specific problems, set amid a "Time Team"-like presentation. Not only would this add a "real" flavour to the proceedings – the audience can see the site, the extraction process, and the methods used (well, those we don't want to hide) – but what better way to increase the level of background knowledge? The baffling, like graptolites or eurypterids, could be seen as reconstructed organisms, with plentiful opportunity for brief asides, and thereby make far more sense than if treated as individual fossils.

The primary challenge would lie in avoiding the magazine mentality; a half-hour slot would probably be insufficient to do us justice. Similarly, as we all know, a site investigation usually takes somewhat longer than a couple of days. Nevertheless, such factors need not be problematic, as long as they remain exposed; agreements on the content and level of complexity would need to be established as a priority.

The benefits to palaeontology would be extensive. Those fiddly moralistic ideals are satisfied, and a measure of protection is provided against our own future extinction. Immediate benefits are also obvious. How many sites have been lost decades ago, without the funding or opportunity to re-excavate? How many more have been barely investigated, despite obvious potential? As funding and workloads maintain their inverse proportionality, the situation will only get worse. A development such as the "Deep Time Team" has the potential to slow down or even reverse these trends. It's just a pity they took our name.

These are my thoughts, for what they're worth. I know that others among you share them, but this is not something which can be initiated by one person, and certainly not by a humble post-grad! I would like to ask that you consider whether such a proposition has potential. I would be happy to collate any replies and report again at a later date. In case an interest is expressed, I suggest we start thinking about the practicalities. I have no experience of television, or the processes by which programmes come about. Such approaches would obviously be better handled by a willing volunteer with substantially more clout, but I'm happy to be secretary, at least until it disappears or is taken from my hands.

Well, I've had my say. Over to you.

Joseph P. Botting
School of Earth Sciences, University of Birmingham, Birmingham B15 2TT UK
tel: +44 (121) 414 3486
e-mail: J.P.Botting@bham.ac .uk

>>*Future* Meetings of Other Bodies

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.

EPA Workshop 2000: Stable Isotopes in Palaeontology
30 June - 2 July 2000
Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany

The purpose of the workshop is to discuss the role of stable isotopes in palaeontology, and to evaluate their potential and limitations for palaeoenvironmental reconstructions and solving palaeontological questions. In addition, the role of biomarkers will be addressed. The meeting will be organized as a true workshop rather than a conference. For each theme, the keynote lecture will be followed by presentation of posters (introduced by each contributor with a five minute speech) and general discussions.

Deadline for registration: 17th April. Extended abstracts of poster presentations (up to three pages including figures) must be submitted by 17th April 2000 on paper and on diskette (winword 97/98, figures included).

Workshop fee (in Euro):

EPA members	€50
Non-members	€65
students	€25
Field trip on July 2nd	€25

Provisional program

Thursday, 29 June
Icebreaker at the Dinos

Friday, 30 June
delta^{13}C and delta^{18}O isotopes and organisms: vital processes versus physico-chemical influences
Isotopic signatures in redox-related systems (C, N, and S isotopes)
Biomarkers
General Assembly of the European Palaeontological Association
Field trip to Messel (Eocene Oil Shale and its fossils) followed by dinner

Saturday, 1 July

delta^{13}C and delta^{18}O isotopes in the Neogene

delta^{13}C and delta^{18}O isotopes: temperature and productivity events in the Palaeozoic and Mesozoic

Strontium: stratigraphy and temperature

Sunday, 2 July

Field trip to Palaeozoic rocks of the Rhenohercynian fold belt (Rheinisches Schiefergebirge)

If you would like to attend the workshop, please register (before 17th April) with Prof. Dr. F. Steininger, Forschungsinstitut und Naturmuseum Senckenberg, Senckenbergallee 25, 60325 Frankfurt a.M., Germany (e-mail: fsteinin@sng .uni-frankf urt.de), indicating if you wish to present a poster (please give title), attend the icebreaker party (included in workshop fee), or take part in the field trip.

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 Visean "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 sll@nhm.ac .uk, tel +44(0)171 938 9448, fax +44(0)171 938 9277).

IGCP Project 406 "Circum-Arctic Lower and Middle Palaeozoic vertebrate palaeontology and biostratigraphy" conference

Syktyvkar, Russia 12-15 July, 2000

First Cir cular

Invitation. All interested Palaeozoic workers are invited to attend the IGCP Project 406 conference (CAPV-2000) in Syktyvkar, Russia, 12-15 July 2000. The conference will be devoted to the evolution of Early and Middle Palaeozoic faunas and sedimentary basins, and palaeotectonical development of the Circum-Arctic regions.

Programme

Excursions

Two excursions (pre-conference and post-conference) are planned:

1. Pre-conference excursion: 7-11 July.

The excursion will take the participants to South Timan, where they can study a number of Late Devonian sections exposing different strata (including the type section of the well-known "Domanic facies", and several fish-bearing strata).

The maximum number of participants is 40.

2. Post-conference excursion: 16-26 July.

This excursion takes the participants to the Lower and Middle Palaeozoic sections in the Subpolar Urals, Kozhym River. Ordovician, Silurian, Devonian, Carboniferous and Lower Permian strata, representing various sedimentary environments, can be examined. At the end of the excursion the participants will visit Ukhta, where several core sections (exposing Lower and Middle Palaeozoic strata) from the Pechora Syneclise will be demonstrated at the Timan-Pechora Scientific Research Centre. The maximum number of participants is 20.

Scientific sessions 12-15 July

Sessions will be held in Syktyvkar, in the Institute of Geology, Komi Science Centre, Uralian Division of Russian Academy of Sciences.

The main topics of presentations will be:

A. Palaeontology and biostratigraphy;

B. Sedimentology and sequence stratigraphy;

C. Tectonics and basins.

Both talks and posters are welcome.

Abstracts

Extended abstracts in the form of short papers should be submitted before 15th April, 2000. The contribution (in English) should not exceed six A4 pages, including references and illustrations. However, as a guide and for consistency, it is suggested that the text be submitted in 12pt Times New Roman, double-spaced, with genus and species names in italics. The abstract title and the author name(s) (in capital letters) should be followed by the address(es) of the author(s). The maximum size for drawings and photographic plates is 160x220 mm. (Note: only one photographic plate per article). The line drawings can be sent as computer files (.tif or .pcx format bitmaps), photo-plates only as high-quality hard copies. Abstracts will be published in special publications of the *Ichtyolith Issues*.

Estimated costs

Considering prices at the moment, the estimated costs are as follows:

- registration fee: $50 (includes excursion guide, abstract volume, programme, coffee during the sessions, and ice-breaking party);
- accommodation in Syktyvkar: $10-30 per person per day;
- conference dinner: $30;
- pre-conference excursion to South Timan: $180;
- post-conference excursion to the Subpolar Urals: $490.

An attempt will be made to reduce prices for students and to provide some financial support to other participants. Also, we are trying to find sponsors. Any suggestion concerning sources of financial support will be greatly appreciated.

Preliminary registration

In order to know the number of interested persons and to start with organization, please notify:

Anna Antoshkina
Institute of Geology, Komi Science Centre,
Uralian Division of Russian Academy of Sciences
54 Pervomayskaya St.
167610 Syktyvkar
Russia

Fax: 821 2 425 346
e-mail: Antoshkina@geo.komi.ru

The Second Circular will be sent only to those who have pre-registered.

Tiiu Märss
Institute of Geology at TTU, Estonia Ave. 7, Tallinn 10143, Estonia

SVPCA 2000
Portsmouth, UK 28 August - 1 September 2000

The 48th Symposium of Vertebrate Palaeontology and Comparative Anatomy, with The 8th Symposium of Palaeontological Preparation and Conservation, will take place in Portsmouth, UK, from 28th August to 1st September 2000.

SVPCA 2000, co-sponsored by the University of Portsmouth and the Museum of Isle of Wight Geology, is being held earlier than in previous years due to the early start of the teaching semester and the availability of accommodation prior to the start of the academic year.

As usual there will be three days of lectures and posters and a post-meeting field excursion. SPPC will take place before SVPCA.

Organisers

Dr David M. Martill (Portsmouth) SVPCA (e-mail: david.martill@port.ac.uk)
Dr Mike Barker (Portsmouth) SVPCA (e-mail: michael.barker@port.ac.uk)
Mr Steve Hutt (Isle of Wight) SPPC (e-mail: steve@miwg.freeserve.co.uk)

Dave Martill & Mike Barker
School of Earth, Environmental and Physical Sciences
University of Portsmouth
Portsmouth PO1 3QL UK

Steve Hutt
Museum of Isle of Wight Geology
High Street
Sandown
Isle of Wight PO36 8AF UK

Invitation for papers and posters

We are expecting an increase in the number of requests for oral presentations, so we would remind presenters to consider seriously the rather more relaxed atmosphere of the poster display. You do not have to decide now, but after the second circular we will be offering oral presentations on a first come first served basis.

This year for the first time we intend to produce a booklet of abstracts. Further details will be sent in the second circular.

If you would like further information, or would like to receive the second circular, please e-mail david.martill@port.ac.uk as soon as possible.

The second circular will include a booking form for accommodation in the University halls of residence.

Diary, 28th August – 1st September

Monday 28th	Evening: SPPC and SVPCA registration begins
Tuesday 29th	SPPC papers and demonstrations; SVPCA registration in lecture theatre
Wednesday 30th	SVPCA papers. Evening Reception
Thursday 31st	SVPCA papers. Symposium Dinner
Friday 1st	SVPCA papers
Saturday 2nd	Field excursion: Cretaceous VP of the Isle of Wight
Sunday 3rd	Additional field excursion: Palaeogene VP of the Isle of Wight

The Jones-Fenleigh Memorial Fund

Established in 1989 in memory of Ted Jones-Fenleigh of Invicta Plastics of Leicester (makers of excellent model dinosaurs), the fund will pay a bursary to cover some of the costs of accommodation, meals and field excursion (travel costs will not be paid) of two (perhaps three) people attending the conference. People with no other source of funding, whether amateur, professional or student, are encouraged to apply. Special consideration will be given to those presenting a paper for the first time. Deadline for applications for the JFMF is 1st April. Please send applications to Dr Dave Martill at the above address.

For further information regarding SVPCA please contact one of the organisers.

Dr. D. M. Martill
Dept. of Geology, University of Portsmouth, Burnaby Road, Portsmouth PO1 3QL
e-mail: David.Martill@port.ac.uk

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, Secretaría 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 (Secretaría de Geología), fax 935 81 12 63, e-mail iget3@cc .uab.es or Eudald.Maestr o@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 .catalun ya.net/g ettr emp2000

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%ph ys@puni v.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: Inder Singh (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

Homology

Gregory R. Bock and Gail Cardew (editors). Novartis Foundation Symposium 222. 1999. John Wiley and Sons. viii + 256 pp. ISBN 0 47198493 0.

Every biologist (and palaeontologist) has an intuitive sense of what homology means, but as this useful and topical book shows there are unexpected shallows, whirlpools, and even doldrums to catch the unwary navigator. And not only that, shimmering on the horizon is the fata Morgana: what *exactly* is homology? Certainly this distinguished band of authors differ in their opinions. David Wake, for example, begins his chapter with the simple question "Why are we still talking about homology?" This, however, is largely rhetorical in as much as he wonders first if we have actually made any progress, and second whether the protracted and convoluted discussions surrounding homology do little more than distract us from the real problems of evolution, a list of which Wake duly provides.

Axel Meyer, in characteristically and enjoyably provocative mode, adopts a position not so far from equating homology and homoplasy when he argues (p. 150) that they "may not be all that different, or may be at least partly caused by the same mechanism: the ubiquitous evolutionary retention of genetic potentiality", and despite cries of protest in the following discussion Meyer has a point that is actually central to the purpose of this book. This is because the principal reason homology is so much back in fashion is because of the irruption of molecular data, and here things are now taking a very interesting twist. Not so long ago it would have been taken for granted that classic cases of evolutionary convergence, such as the eyes of squid and vertebrate, would also be reflected in quite different genes. Now we know better, and as the production of ectopic monsters demonstrates, the formation of the eye in squid, vertebrate, as well as fly (and probably all metazoans) is determined by master-control genes, of which the most famous example is known as *Pax-6*.

These discoveries, which were little short of sensational (is that a telephone call from Stockholm? the handshake of a King?), initiated a period of considerable confusion as to whether the eyes of cubozoan jellyfish, *Drosophila* and humans are homologous. And while the *Pax-6* story is the most celebrated, the literature has been bulging with reports of common genes for features such as axial specification, heart, dorso-ventral orientation, and embryonic gastrulation. Not only that, but the similarities extend to entire complexes as may be seen in the remarkable similarities in gene expression pattern in the imaginal disc of the fly wing and limb-bud of the mouse. Are these two structures really homologus?

Now, perhaps, is the time to curb our enthusiasm. Recall that things sticking out of the side of a body, be it a wing or arm, need above all else determination of axes, i.e. dorso-ventral, proximal-distal and anterior-posterior. Perhaps what appears to be an unassailable homology is actually a sort of homoplasy dependent on unique (or at least highly constrained) restrictions imposed by the genetic "toolbox". This, of course, begs all sorts of questions, and

to complicate matters further there is now abundant evidence for pervasive co-option where part of a "toolbox" is re-employed for some new pattern of expression. In principle, this should not surprise us. The switching gear on my microscope lamp is basically the same that illuminates the opera house, but we have hardly begun to understand how, why and when co-option occurs, and accordingly how I might see some dull, little acritarch or the closing act of *Parsifal*.

Homology is, therefore, a book well worth reading, and several chapters are very helpful syntheses. The one by Greg Wray, for example, is a highly effective summary of how orthology, paralogy, analogy, and homology intertwine in a series of both predictable and unexpected ways. Also very helpful is Rudy Raft's succinct summary on larval homologies, and here too there are sobering insights into the plasticity of development and what this must imply for the definition of the underlying gene networks.

Not surprisingly the famous *Hox* genes are also a topic of discussion. Frietson Galis, for example, begins to throw light on the peculiarity of why mammals almost always have seven cervical vertebrae (giraffe to shrew), whereas in other vertebrates the number is much more labile. Why, then, this restriction? It transpires that the relevant *Hox* gene also has links to rib development and embryonic cancers. In mammals this is not a gene to be meddled with. Peter Holland addresses the evidence and implication of gene duplication, especially in the vertebrates. The potential importance of such duplications is obvious in as much as the "new" gene can be seconded to novel functions, and this may go some way to explain modifications of the vertebrate bodyplan. But as Holland shows, the rules are variable, and in the case of certain *Pax* genes, both the genes of a duplication event diverged in function. And this is one of the problems that haunts molecular evolution: where are the general rules of conduct and engagement?

It is sobering to look at the first figure in Alec Panchen's chapter which effectively outlines the history of the concept of homology. Here human and bird skeleton are juxtaposed, with a bone-by-bone correspondence. Nothing odd about that, except that the diagrams derive from a sixteenth century volume written by Belon. There is homology before our eyes, and in this sense the arrangement was just as familiar to the anti-evolutionist Richard Owen. To us the homology speaks of evolution, yet prior to Darwin no such message was read. The irony now is that whilst the reality of evolution cannot be doubted, what underlies it seems more mysterious than ever.

Simon Conway Morris
Department of Earth Sciences, Cambridge CB2 3EQ, U.K.

The tracks of Triassic vertebrates: fossil evidence from North-West England

Geoffrey Tresise with William A.S. Sarjeant. 1997. 204 pp. Stationery Office ISBN 0-11-290498-X. Hardback. £65.

It is difficult to know where to start with a review of this book, as it is something of a curate's egg. The title of the book suggests an authoritative piece of academic work, whereas most of the text represents a historical and biographical discussion of footprint discoveries in the New

Red Sandstone of the Cheshire Basin. And, as a documentation of the history of footprint studies in the area, it is a notable success. However, the title of the book is misleading and one is left with the feeling that it represents an opportunity missed.

Virtually all of the volume is dedicated to the historical record of the discovery of trackways from such localities as the classic Storeton quarries and elsewhere in the Cheshire basin, together with a number of biographical vignettes of luminaries such as Morton, Beasley, Lomas and Maidwell. Thus, it would appear that the authors are aiming at a populist market, but little information is presented to demonstrate the "state-of-the-art" of ichnological studies. Only the identity of the *Chirotherium* trackway maker (not an animal named *Chirotherium* as erroneously claimed in the caption for fig. 16.2) is discussed at any length, and more could have been made of the environment and preservation of the footprints for example. The presence of an expanded listing of the Beasley catalogue suggests again that rather than dealing with 'fossil evidence' the authors are aiming for a historical review.

The volume contains a wealth of illustrations, including colour photographs of key specimens and black and white prints taken from various historical sources. However, few of these are of any scientific use as they do not include scale bars, possibly sacrificed at the altar of aesthetics.

Although this book is worth having on the bookshelves for those of us interested in the history of British geology and the study of the tracks from the Cheshire Basin, it is difficult to recommend it more widely as a must-have volume for either University libraries or those teaching ichnology and/or vertebrate palaeontology. Shame really, as it is an extremely attractive volume and a considerable amount of effort in digging through the archives has obviously gone into compiling this book.

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

Functional Morphology in Vertebrate Paleontology

J. J. Thomason (editor). 1997. 277pp. Cambridge University Press.
ISBN 0-521-62921-7. Paperback.

How organisms 'work' as mechanical units, the reductionist or constructional paradigm, has become increasingly integrated into vertebrate palaeontology in recent years. The modern prevalence of functional morphology is reflected here in a book resulting from a symposium held at the 1992 SVP meeting in Toronto: as the editor states in the preface, it provides 'A current snapshot of functional studies of fossil vertebrates in North America'. First published in 1995, and now thankfully available in paperback, Thomason is an invaluable volume with 12 case study chapters as well as four discussions of the philosophy behind our understanding of the subject. By no means is coverage of groups comprehensive – there is a notable bias here towards mammals and reptiles (I suppose because work on these groups attracts most attention) – but there is something of interest for everyone.

Eloquent in its simplicity is Keith Thomson's chapter on dermal skull bone patterns and how these might relate to skull function. I also found Emily Giffin's (now Buccholtz) contribution on palaeoneurology particularly interesting. The dense neural innervation of the forelimbs of

the theropod dinosaurs *Allosaurus* and *Deinonychus* would indicate that their manipulative ability was high, as the osteology suggests. Analysis of neural anatomy in pinnipeds reveals a dichotomy between forelimb-swimming otariids and hindlimb-dominant phocids: intriguingly, the Miocene *Allodesmus* clusters with hindlimb swimmers, in contrast to previous interpretations of it as an otariid-like forelimb swimmer. Not noted by Giffin is the fact that this is in agreement with recent phylogenetic hypotheses in which *Allodesmus* is regarded as closer to phocids than to otariids (Wyss 1987), again in contrast to previous interpretations.

Alfred Crompton's contribution on form and function of the therapsid jaw joint is insightful and comprehensive, and provides a most useful synthesis of this topic for students. Virginia Naples' article on the bizarre teeth of living sloths must also be viewed in the broader perspective of what the case study tells us about the generation of wear patterns on all mammalian teeth. Work on the functional morphology of mammalian teeth is, in fact, healthily represented with papers by Janis on the craniodental morphology of ungulates, Rensberger on stresses in enamel, and Bryant and Russell on carnassial function in sabre-toothed Carnivora. Two of the archosaur studies in the book, Stephen Gatesy's review of theropod hindlimb and tail function, and Arthur Busbey's examination of crocodile skull shape, have already become widely-cited 'classics' in their respective fields.

However, other areas covered here remain controversial and are still under evaluation. Johnson and Ostrom, for example, focus on the forelimb carriage of ceratopian dinosaurs from the perspective of a new *Torosaurus* specimen. They conclude that sprawling forelimbs are more likely than the erect or semi-erect model proposed by other workers. Aspects of their reconstruction which have a direct bearing on the orientation and position of the pectoral girdle, and therefore of the forelimb, do not appear consistent with evidence from articulated ceratopian specimens, however. For example, they give *Torosaurus* vertical ribs and sternal plates that diverge markedly from one another caudally. In contrast, articulated ceratopians have backswept ribs and sternals that are in contact for much of their length (Brown 1906, Lull 1933). Also, Johnson and Ostrom's four-fingered, hyperphalangic reconstructed manus bears no resemblance to any described ceratopian manual skeleton, while their suggestion that the animal's head may have accounted for a third of its total weight (!) appears questionable (though the head is huge, most of it is frill).

In his discussion on the historical context of the form-function dialectic, Kevin Padian digresses to add thoughts on terrestrial locomotion in pterosaurs. Padian opines that the evidence, both functional and phylogenetic, indicates erect-limbed bipedality for pterosaurs, and that those who argue otherwise must overturn this evidence. Perhaps this statement was an inspiration to those who have recently published new data on pterosaurian quadrupedality. Regardless, Padian's socio-cultural approach is useful and of great interest to those intrigued by the history of our science.

In short, this book includes many chapters that will be of direct interest to researching vertebrate palaeontologists and anatomists. The approaches and models applied are widely applicable and will form the foundation for much future work.

References

Brown, B. 1906. New notes on the osteology of *Triceratops*. *Bull*. *Amer*. *Mus*. *nat*. *Hist*. 22: 297-300.

Lull, R. S. 1933. A revision of the Ceratopsia or horned dinosaurs. *Mem*. *Peabody Mus*. *Nat*. *Hist*. 3 (3): 1-175.

Wyss, A. 1987. The walrus auditory region and the monophyly of pinnipeds. *Am*. *Mus*. *Novitates* 2871: 1-31.

Darren Naish
School of Earth, Environmental and Physical Sciences, University of Portsmouth, Portsmouth P01 3QL
e-mail: darren.naish@port.ac.uk

Warm Climates in Earth History

B.T. Huber, K.G. MacLeod and S.L. Wing (eds.) 2000. 462 pp. Cambridge University Press. ISBN 0-521-64142-X. Hardback.

As the century unfolds, the concentration of carbon dioxide in the atmosphere will double, and in the longer term the level will probably at least double again. The inevitable result of this activity will be global warming, with much attendant misery. Exactly how the climate and biosphere will respond are unknown. Therefore it is important to study the warm climates of the distant past in search of clues and analogies. Another reason to study ancient climate states (and how they change) is scientific curiosity. The subject has always interested geologists, but since attempts are now afoot to distort the global economy to reduce greenhouse gas emissions, there is a slightly greater dribble of funds into palaeoclimate research. Some of that money even makes its way into palaeontology.

Edited compilations of research papers are usually variable in quality and only partly cover the topic of interest. However, this one is uniformly excellent and represents a good distillation of current research by the best and most active scientists in the field. The 14 papers are put together in a sensible and logical way, all the authors write very well and the book is stylishly produced, so my recommendation is unreserved. Congratulations to all involved.

We start with some general considerations and approaches to studying warm climates. Paul Valdes brings the subject into sharp focus by highlighting the most important issues in a comprehensible way. Robert Deconto and colleagues explain the fundamentals of climate modelling and describe the current state of the art of General Circulation Models (a useful introduction to many of the later studies). Thomas Crowley and James Zachos focus on what is currently the number one puzzle of past warm climates, the fact that heating appears to have been concentrated at the poles without producing higher tropical temperatures. All modelling attempts fail to reproduce this effect adequately, which only goes to prove the usefulness of the modelling approach in helping frame the key questions. The difficulty has long been known to palaeontologists and in my opinion the resolution may lie partly in the fact that much of the low latitude material used in isotopic palaeotemperature studies may be

diagenetically altered – not to the extent of being useless, but enough to affect the absolute values.

The Cenozoic chapters deal with warm Paleocene and Eocene climates in general and also the curious "Late Paleocene Thermal Maximum" event on which much research has concentrated in recent years. Karen Bice and colleagues discuss attempts to model early Eocene climate and compare their results with oxygen isotope palaeotemperatures, thereby helping tease apart the various factors responsible for heating the planet. Ellen Thomas and colleagues use combined micropalaeontological and geochemical approaches in the study of the late Paleocene event and similar "hyperthermals" in the early Eocene that have only recently been recognised. This is perhaps the most interesting paper of all, because it hints that many unknown global climate events await discovery by the application of high-resolution stratigraphy. Richard Norris and colleagues discuss the effects of mountains on Eocene climate and suggest new ways of measuring palaeoelevation, which is perhaps the most difficult aspect of reconstructing ancient worlds. Scott Wing and colleagues debate botanical and isotopic evidence for a cool period just prior to the hottest part of the Eocene, demonstrating that useful high resolution climate records can be obtained from terrestrial as well as marine sediments.

The Mesozoic papers employ many of the same techniques. Kenneth Macleod and colleagues use geochemical and palaeontological evidence (such as the distribution of inoceramids and planktonic forams) to reveal that warm salty intermediate and deep waters were prevalent in the Cretaceous Atlantic and Indian Oceans. Robert Deconto and colleagues discuss their sophisticated attempts to model the climate of the Campanian and in particular they show that their model can be made to fit the data best if the effect of vegetation (especially high latitude forests) is taken into account. Peter Rees and colleagues also deal with the distribution of vegetation, this time in the Jurassic, using it instead to constrain climatic conditions. This paper is a tour de force, showing exactly what can be achieved when palaeobotanical data sets are compared and contrasted with climate models using a global perspective.

The Palaeozoic papers are inevitably more generalized and perhaps more patchy in their coverage, but the results are arguably proportionally more interesting as this more alien world starts to come into focus. Edith Taylor and colleagues have recovered wonderful specimens of Permo-Triassic fossil trees from Antarctica and deduce from their presence and their rapid growth that the climate must have been warmer than previously envisaged. Adam Murphy and colleagues focus on the evidence for global climate revolution in the Middle to late Devonian, relating their results to palaeontological records of groups like brachipods and cephalopods. Mark Gibbs and colleagues consider the clearest anomaly that confronts the "CO_2 paradigm" of Phanerozoic climate, namely the Late Ordovician glaciation which occurred at a time of reputedly high atmospheric carbon dioxide. They show by climate modelling that this glaciation is explicable even under conditions of 14x modern CO_2 because the continent of Gondwana straddled the south pole.

The book ends with an excellent review by Thomas Crowley of the hypothesis that carbon dioxide variations have been the prime driver of Phanerozoic climate change. This conjecture seems to be strongly supported by current research, but Crowley reminds us that a host of

other factors must also be taken into account, of which palaeogeography and solar luminosity are in the first rank. Crowley outlines the path of future research in the field by ordering the various possible influences and suggesting how testable hypotheses that take them into account can be framed – to avoid the "proliferation of ad hoc explanations" that has tended to hamper palaeoclimate research in the past.

Palaeoclimate research has dramatically leapt forward in the last few years thanks to increasingly sophisticated use of geological, palaeontological and chemical datasets and the advent of more affordable supercomputing. To all palaeontologists, this book is of great importance, not just because many of the papers use palaeontological data, but also because in order to understand past life we obviously need to appreciate the world in which it evolved and thrived.

Dr Paul Pearson
Department of Earth Sciences, University of Bristol, Queens Rd, Bristol BS8 1RJ, UK
e-mail: paul.pearson@bristol.ac.uk
Web: http://palaeo.gly.bris.ac.uk/personnel/Pearson/Pearson.html

Sudden origins: fossils, genes and the emergence of species

Schwartz, J.H. (1999). John Wiley & Sons Ltd, New York.
ISBN 0-471-32985-1. $27.95

I accepted the task of reviewing '*Sudden origins*' with relish. With that name, another glorious romp through the wonderland of extinct phyla, five-eyed monstrosities, 'disparity' and 'constraint' was surely in store. But, what severe shocks awaited – no 'Ediacaran oddities' chapter, no 'riots of unparalleled experimentation' – in short, this is a book about sudden origins that *isn't about the Cambrian explosion*. If only this had been the only disappointment.

In brief, Schwartz's programme is to examine both the history of evolutionary thought and recent advances in developmental biology, and thus to solve certain outstanding evolutionary problems, most notably that of the origin of novelties and species. It falls into three broad sections, the first being a sort of historical review of the fossil record of humans, in which Piltdown Man rubs noses with the Taung Child. The second, equally long, is an account of evolutionary thought from Aristotle to recent past. The final, short section is Schwartz's own view of 'how evolution really works'. Indeed, the press release bills the book as having finally solved one of the major problems in evolutionary biology – how species come about.

One odd feature of the book is its uncertain intended audience. Schwartz, at least when he remembers to, carefully describes basic phenomena such as mitosis, and language is sometimes aimed at the 'lay' reader. But at other times he seems completely to forget popular appeal. The section on human origins, for example, goes into considerable detail, describing numbers of specimens of different ages from around the world. As he nowhere provides any sort of summary chart, all the teeth and toebones rattle around in the text in a most confusing manner. Further, who apart from a scientific audience would be interested in such a detailed account of evolution, where the importance lies in the technical points? The curious overall impression is that Schwartz, rightly fearful of the Scientific Establishment, is making a pitch

over its head to The People about his novel views. Perhaps he sees himself as a sort of genetical Wat Tyler leading a makeship army of pitchfork-brandishing peasants up to (say) Brighton and Stony Brook, where up in the secret tower of each is not Aristotle on Comedy, but Bateson on Variation.

After rushing through the pre-Darwinian history of evolution, Schwartz settles down to the interesting story of what happened After Darwin. This is genuinely engaging, although somewhat frustrating in his hinting at where he thinks people are going wrong, without quite coming clean about it (one might read one of Peter Bowler's books as a corrective). His basic line is that the geneticists who – at least initially – included workers who saw evolution occurring in leaps and bounds, rather than the creeping way that Darwin envisaged it, were basically engulfed by a Neodarwinian flood, and as a result their insights were lost. Schwartz is particularly critical of the 'species concept' of Ernst Mayr, whom he always writes about in the past tense. Not surprisingly, Mayr seems to have relished writing a critical review of this book (Mayr 1999). This section of the book raises all those interesting old questions: what is the relationship (if any) between morphological change and speciation? To what extent can we regard a species as a construct or a real phenomenon (compare: is Pluto a planet or an asteroid?)? Why – and this is where the fossils come in – does the fossil record apparently so rarely record 'intermediates'?

Schwartz at this point tries to help out the 'saltationists' (who have a familiar chorus line of Goldschmidt, Schindewolf and Løvtrup as a support act) by positing homeotic mutations as the heritable driving force behind macroevolutionary jumps: in this world-view, there are simply no intermediate fossils to be found. As a reminder, homeobox genes – the most familiar of which are the homeotic genes themselves – are now known to play an important role in development. Rather than building parts of the body directly, their products often act as traffic wardens, directing and coordinating shoals of other genes so that everything gets built in the right place at the right time. Mutations in homeotic and other body-patterning genes unsurprisingly often lead to more or less gross alterations in development, leading to flies with extra wings or eyes in odd places. The question is: so what? Like many other authors, Schwartz simply extrapolates from the laboratory into evolution: for him, such striking rearrangements are how major steps in evolution actually took place. This, then, is a full-blown Hopeful Monsters scenario. In order to get around the problem of having no-one to mate with, Schwartzian Hopeful Monsters appear in job lots; the homeotic mutations that produce them are initially recessive, and thus only start affecting the phenotypes when there are enough around to produce double-recessives, of which there will be many. The final stage of the process is – I hope I understand it correctly – that the recessive genes then evolve into being dominant.

I have written elsewhere what I think of this sort of notion (Budd 1999). Schwartz thinks that homeotic genes and their ilk are necessarily tied to particular types of morphology, so that all one needs to do to produce teeth is to turn on a particular gene, and the cascade of effects it (now) controls will automatically follow. Indeed, one of the few diagrams in the book illustrates just this process going on in a previously toothless fish. In Schwartz's words: 'Since the homeobox genes that are active during tooth development – the *Dlx* gene family – are also present, but silent, in tunicate larvae, the first species of toothed vertebrate would have been

the bearer of a mutation that merely activated this gene cluster' (p. 371). Quite apart from his reliance on the (probably wrong) Garstang theory of vertebrate origins, is Schwartz *really* suggesting that we should all live in daily fear of being mauled by delinquent sea-squirts? How did the 'teeth' genes manage to get assembled into the precise order and scope of operation to build a tooth without ever having actually produced one: just a lucky break? No wonder Schwartz muses over what these 'novelties' might look like when they first appear. The evidence is that such structures require precise interactions between hundreds of genes, and these interactions must have been *evolved* at some point. After all, the only thing homeotic genes do is tell other genes where and when to be operative, so mutations in them only shuffle around structures that already exist, not create new ones. Another problem is the idea of genes 'evolving dominance', as if dominance and recessiveness were little flags attached to the genes, rather than the product of the relative environment in which genes find themselves (brown eyes are dominant over blue because, crudely put, the brown allele makes something, whereas the blue one doesn't – so how could blue evolve to become dominant over brown?). His reliance on the gaps in the fossil record pointing to instantaneous change is also highly problematic, because it must apply to all levels of the taxonomic hierarchy. Not only would species origins need to be explained by saltation, but also, in increasing rank of implausibility, those of families, orders and phyla (thus, apparently, Gellon and McGinnis 1998), as if a single mutation (or perhaps a couple) could conjure up a brand new, integrated and functional body plan.

Despite my profound misgivings about this ill-conceived framework, it seems clear that 'change in allele frequency through time', which for selectionist diehards is really all there is to say about evolution, is failing to tell us something important. As Conway Morris (1998) hints, the physical environment and its strictures probably places strong limits on what is 'allowed' to happen, and the running of ecosystems may also conform to similar, as yet only partially understood ground-rules. The key to understanding the role of development in evolution – which is clearly an important one – is to see what kinds of change in the genome are compatible with these ground-rules. In other words, rather than expelling Darwin – seen especially in his ecological aspect – from our understanding of evolution of development, we need to bring him closer to the action. It seems a pity that Schwartz, after his historical musings, fails to recognise this.

As an endnote, a brief comment on the historical section of the book. Despite its amiable tone, *Sudden Origins* offers some shocking distortions, especially in its Chapter 2, which deals with Greek and Medieval 'science' – accusing Augustine of being a pop-eyed flat-earther, for example (this is such a misleading representation that one wonders if Schwartz has in fact read the original source). These misunderstandings (of which there are many) would perhaps be excusable if they were just that. But close inspection reveals Schwartz knitting his inaccuracies together to tell a polemical and misleading tale: decline from the intellectual highs of antiquity to the oppressive and anti-intellectual valley of the medieval period, from which we only emerged with Descartes as our guide. In a book largely about history, it is again disappointing to see history being taken so lightly: but the lack of seriousness to which this deception points is, sadly, the pattern of the entire book.

References

Budd, G.E. (1999). Does evolution in body-patterning genes drive morphological change – or vice versa? *BioEssays* 21, 326-332.

Conway Morris, S. (1998). *The Crucible of Creation*. Oxford University Press.

Mayr, E. (1999). Sudden origins. *BioEssays* 21, 978-979.

Gellon, G. & Mcginnis, W. (1998). Shaping animal body plans in development and evolution by modulation of Hox expression patterns. *BioEssays* 20, 116-125.

Graham Budd
Uppsala University, Sweden
e-mail: graham.bud d@pal.uu.se

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

Edited by Christine M. Janis, Kathleen M. Scott, and Louis L. Jacobs. 1998. Cambridge University Press. 691 pp. Hardback. ISBN 0 521 35519 2. US$ 260.00.

The diversity and distribution of large mammals today is underpinned by a fascinating evolutionary history. Not only does such a historical perspective show long term trends initiated millions of years ago, it also reveals recent phenomena that bear little relation to the distant past. It is a great challenge to produce an overview of how past events have influenced an evolving fauna, and in turn it is an enormous aid to our understanding of mammalian diversity. This book focuses on the evolution of North American mammals, documenting the Tertiary fossil record from 65 million to 1.8 million years ago. Although the book describes in detail the mammalian radiations which took place in the New World, such a task can only be achieved with frequent reference to Old World mammals as well. The book is a fine compilation of faunal locality, descriptive taxonomy and stratigraphic range data of the larger mammals of the North American Tertiary. The information is presented in a palaeobiological context, highlighting broad-scale evolutionary patterns and the timing of adaptive radiations.

The first part of the book provides an overview of the North American chronostratigraphy, palaeogeography, palaeoclimate and vegetation during the Tertiary. This background information, especially the chronological framework, is essential to the following chapters which cover the evolution of the various mammalian taxa. The subsequent parts of the book deal separately with carnivorous mammals, archaic ungulates, artiodactyls and perissodactyls and proboscideans respectively. Each part begins with a summary chapter, then proceeds to document the defining features, systematics, descriptive taxonomy, biology and evolutionary patterns of each taxon. The wealth of data for all taxa is presented in a standardised format to facilitate the comparison of faunal localities, taxonomic levels and stratigraphic ranges.

This is a comprehensive reference manual compiling an extraordinary amount of fossil information. Moreover, the book's value as an academic reference source is supplemented by intriguing glimpses of mammalian evolutionary history. There are examples of evolutionary

homologues, such as sabre-toothed carnivores that independently evolved in distantly-related families, and the pronghorn "antelope" that evolved in isolation in North America to parallel the evolution of Old World gazelles. There are also some surprising examples of New World radiations which are not reflected in current day mammal distributions. The camel is now associated with the deserts of Africa and Asia, even though it evolved for over 36 million years in North America. Historically, the rhinos were also an extremely successful group of North American mammals that became extinct in the New World around 4.5 million years ago, whereas the extant tapirs of tropical forests, with their bizarre prehensile probosces, are considered to be "living fossils". Finally, the elephants (proboscideans) now absent from North America are regarded as keystone species in the Tertiary faunas. The pattern of proboscidean diversity mirrors the pattern observed for North American ungulates. It is postulated that proboscideans helped maintain a grassland savanna state during the Miocene which enabled a high diversity of ungulate species to coexist.

It is only possible to provide an overview of the complex evolutionary history of North American Tertiary mammals in a well structured volume such as this. I am certain that this book will be an extremely important text for many years to come.

Eleanor Weston
Dept of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ UK
e-mail: emw1004@her mes.cam.ac .uk

(For another review of this book, see Newsletter *no 41, page 46. Ed)*

Palaeontolog y

VOLUME 42 • PART 6

CONTENTS

Palaeontolog y

VOLUME 43 • PART 1

CONTENTS

Overseas Representatives

Argentina: Dr M.O. Manceñido, Division Paleozoologia invertebrados, Facultad de Ciencias Naturales y Museo, Paseo del Bosque, 1900 La Plata. *Australia:* Dr K.J. McNamara, Western Australian Museum, Francis Street, Perth, Western Australia 6000. *Canada:* Professor S.H. Williams, Department of Earth Sciences, Memorial University, St John's, Newfoundland A1B 3X5. *China:* Dr Chang Mee-mann, Institute of Vertebrate Palaeontology and Paleoanthropology, Academia Sinica, P.O. Box 643, Beijing. Dr Rong Jia-Yu, Nanjing Institute of Geology and Palaeontology, Chi-Ming-Ssu, Nanjing. *France:* Dr J.-L. Henry, Institut de Géologie, Université de Rennes, Campus de Beaulieu, Avenue de Général Leclerc, 35042 Rennes Cédex. *Germany:* Professor F.T. Fürsich, Institut für Paläontologie, Universität, D8700 Würzburg, Pliecherwall 1. *Iberia:* Professor F. Alvarez, Departmento de Geologia, Universidad de Oviedo, C/Jésus Arias de Velasco, s/n. 33005 Oviedo, Spain. *Japan:* Dr I. Hayami, University Museum, University of Tokyo, Hongo 7-3-1, Tokyo. *New Zealand:* Dr R.A. Cooper, New Zealand Geological Survey, P.O. 30368, Lower Hutt. *Scandinavia:* Dr R. Bromley, Fredskovvej 4, 2480 Holte, Denmark. *USA:* Professor A.J. Rowell, Department of Geology, University of Kansas, Lawrence, Kansas 66044. Professor N.M. Savage, Department of Geology, University of Oregon, Eugene, Oregon 97403. Professor M.A. Wilson, Department of Geology, College of Wooster, Wooster, Ohio 44961.

TAXONOMIC/NOMENCLATURAL DISCLAIMER

This publication is not deemed to be valid for taxonomic/nomenclatural purposes [see Article 8.2 of the International Code of Zoological Nomenclature (4th Edition, 1999)].