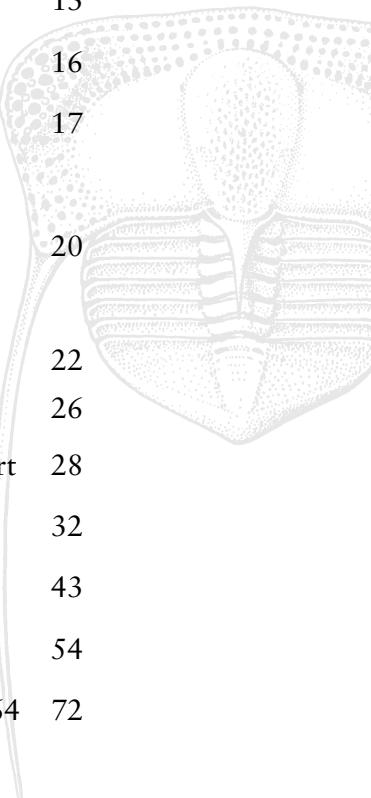




The Palaeontology Newsletter

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Association Business

Annual Report for 2000

Nature of the Association. The Palaeontological Association is a Charity registered in England, Charity Number 276369. Its Governing Instrument is the Constitution adopted 27 February 1957, amended on subsequent occasions as recorded in the Council Minutes. Trustees (Council Members) are elected by vote of the Membership at the Annual General Meeting. The contact address of the Association is c/o The Executive Officer, Dr T.J. Palmer, Institute of Geography and Earth Sciences, University of Wales, Aberystwyth, SY23 3DB, Wales, U.K.

Membership & subscriptions. Individual membership totalled 1,082 on 31 December 2000, an overall increase of 61 over the 1999 figure. There were 704 Ordinary Members, an increase of 28; 120 Retired Members, an increase of 10; and 258 Student Members, an increase of 23. There were 181 Institutional Members in 2000, an increase of 1 from last year. Total Individual and Institutional subscriptions to *Palaeontology* through Blackwell's agency numbered 395, a decrease of 3. Subscriptions to *Special Papers in Palaeontology* numbered 133 individuals, the same as last year, and 104 institutions, an increase of 35. Regular orders through Blackwell's agency for *Special Papers in Palaeontology* totalled 63 copies. Sales to individuals through the Executive Officer of back numbers of *Special Papers in Palaeontology* yielded £10,925.

Income from sales of *Field Guides to Fossils* amounted to: *Fossil Plants of the London Clay* – £233; *Fossils of the Chalk* – £976; *Zechstein Reef Fossils and their palaeoecology* – £124; *Fossils of the Oxford Clay* – £1,277; *Fossils of the Santana and Crato Formations of North East Brazil* – £395; *Plant Fossils of the British Coal Measures* – £877; *Fossils of the Upper Ordovician* – £659; *The Jurassic Flora of Yorkshire* – £1,590; *Fossils of the Rhaetian Penarth Group* – £2,370. *Palaeobiology – A synthesis* yielded £85 in royalties.

Finance. Publication of *Palaeontology* and *Special Papers in Palaeontology* is managed by Blackwell, who also continue to make sales and manage distribution on behalf of the Association. Their fee plus expenses was £27,669. The Association gratefully acknowledges the donations from Members to the Sylvester-Bradley Fund, which amounted to £122.54.

Grants from general funds to external organisations, for the support of palaeontological projects, totalled £5,470. A subsidy of £9,000 was paid towards the hiring costs of the Conference Centre that was used for the Annual Conference in Edinburgh.

Publications. Volume 43 of *Palaeontology*, comprising 1,179 pages in total, was published at a cost of £75,066. *Special Papers in Palaeontology* 63 (Maastrichtian and Palaeocene echinoids: a key to world faunas. A.B. Smith & C.H. Jeffery, 325pp.) was published at a cost of £18,722, and *Special Papers in Palaeontology* 64 (Inoceramid faunas and biostratigraphy of the Lower Turonian - Lower Coniacian, U.S. Western Interior. I. Walaszczyk & W.A. Cobban, 80pp.) was published at a cost of £6,780. Two issues of *Palaeontology 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. Four meetings were held in 2000, and the Association extends its thanks to the organisers and host institutions of these meetings.

a. **Geoscience 2000.** 17th-20th April. Three meetings, including this year's Lyell Meeting, were convened on behalf of the Association at Geoscience 2000. Prof. M.J. Benton and Prof. D.A.T. Harper organised a symposium on the 'History of biodiversity' with Sir Robert May FRS, Prof. P. Sheehan, Prof. P. Crane FRS and Dr A.B. Smith as the keynote speakers; and Dr J.E. Francis and Dr M.P. Smith convened a symposium on 'Palaeoclimate reconstruction from fossils' with Prof. G.R. Cope as the keynote speaker. The Lyell Lecture was given by Prof. H. Thierstein (ETH, Zurich) and was entitled 'The climate-plankton link: when models confront evidence'; an associated symposium, organised by Dr J. Powell, was held on the theme of plankton evolution and climate change.

b. **Forty-third Annual General Meeting and Address.** 10th May. The address, entitled 'Exceptional preservation of Cambrian Örsten type fossils', was given by Prof. D. Walossek of the University of Ulm, Germany, and was attended by over 150 people. The meeting was held at the University of Leicester and organised by Dr M.A. Purnell.

c. **Progressive Palaeontology.** 14th-15th June. The annual open meeting for presentations by research students was organised by Jo Snell, Rosie Widdison, Joe Botting and Nick Clack at the University of Birmingham. A field excursion to the Much Wenlock Limestone Formation of the Dudley area was held on the following day.

d. **43rd Annual Meeting.** 17th-20th December. The Annual Meeting was held at the Edinburgh Conference Centre at Heriot-Watt University and organised by Prof. Euan Clarkson and Vicen Carrió-Lluesma. The President's Award was presented to Miss Joanna Snell (University of Birmingham) for her presentation on the 'Phylogenetic relationships of Wenlock fenestrate bryozoa'. The Council Poster Prize was presented to Miss Jodie Howe (University of Leeds) for her poster on Cretaceous palaeoclimates and floral ecosystems in the Antarctic. On the final day, field trips were undertaken to examine the building stones of Edinburgh city centre and the Devonian-Carboniferous of the Midland Valley. The Annual Meeting was attended by 202 delegates.

Lapworth Medal. The award of the Lapworth Medal, for '...outstanding original contributions...' to the science of Palaeontology, was made for the first time. The recipient was Professor H.B. Whittington FRS of the University of Cambridge.

Awards. Sylvester-Bradley Awards were made to Ms K. Crosby (University of New South Wales), Mr A. Kouchinsky (University of Uppsala), Ms Jane Retter (University of Bristol) and Ms R. Widdison (University of Birmingham). The Mary Anning Award was presented to Mr R. Forrest of Radcliffe-on-Trent at the AGM.

Council. The following members were elected to serve on Council at the AGM on 10th May 2000:

President: Prof. C.R.C. Paul.

Vice-Presidents: Dr J.E. Francis, Dr M.J. Barker.

Treasurer: Prof. J. Hancock.

Secretary: Dr M.P. Smith.

Newsletter Editor: Dr P.C.J. Donoghue.

Newsletter Reporter: Dr P. Pearson.

Publicity Officer: Dr M.A. Purnell.

Editors: Dr R. Wood, Dr J.A. Clack, Dr S. Evans, Prof. D.A.T. Harper, Dr A.L.A. Johnson, Dr C.H. Wellman.

Other Members of Council: Dr S.K. Donovan, Dr S.E. Gabbott, Dr E. Harper, Dr D.K. Loydell. Dr H.A. Armstrong and Dr I.J. Sansom were co-opted as members of Council during the year.

At the AGM on 10th May 2000 the following members stepped down from Council:

Prof. E.N.K. Clarkson (President);

Dr R.M. Owens (Vice-President);

Dr S. Rigby (Newsletter Editor);

Dr A.R. Hemsley and Dr A. King (Editors);

Mr F.W.J. Bryant and Dr M.J. Simms (other Council Members).

Dr T.J. Palmer continued to serve as the Executive Officer of the Association (gross salary for Year to 31 March 2001 = £13,711.46), and Prof. D.J. Batten (University of Wales, Aberystwyth) as the Technical Editor (gross salary for Year to 31 March 2001 = £13,364.00).

Council is indebted to the Natural History Museum, the University of Leicester and Heriot-Watt University for providing Council Meeting venues through the year.

Professional Services. The Association's Bankers are Nat West Bank, 42 High Street, Sheffield. The Association's Independent Examiner is G.R. Powell BSc FCA, Nether House, Great Bowden, Market Harborough, Leicestershire.

Reserves. The Association holds reserves of £413,957 in General Funds. These Reserves enable the Association to generate additional revenue through investments, and thus to keep subscriptions to individuals at a low level, whilst still permitting a full programme of meetings to be held and publications to be produced. They also act as a buffer to enable the normal programme to be followed in years in which expenditure exceeds income, without increasing subscription costs.

Council Activities. The re-organisation of the Association's administration, which started in 1997, was completed in 2000 with the appointment of a Technical Editor as a half-time post on the same salary scale as the Executive Officer. These two positions now account for much of the day-to-day running of the Association's activities, though many invaluable activities are still carried out by Council members as volunteers. The activities of the paid officers have been successful in increasing overall membership, in bringing the publications programme back onto schedule, and in meeting the demand from purchasers of the Association's publications with minimum delay.



Over 250 back copies of *Special Papers in Palaeontology* were sold in the members' sale that was held in the second half of 2000. *Palaeontology* is being made available in electronic version to members and subscribers, starting with Volume 44.

Forthcoming plans. In 2001, a similar programme of meetings and publications will be carried out as in 2000, and an additional joint meeting with the Systematics Association will be held in September. A recruiting drive will be carried out at the North American Paleontological Convention in Berkeley, California. Council intends to make increased donations, from both Designated and General funds, to permit individuals to carry out research into palaeontological subjects and to disseminate their findings in print and at meetings held for the purpose. The Hodson Fund, an award for palaeontologists under the age of 35 who have made an outstanding achievement in contributing to the science through a portfolio of original published research, will be made for the first time. Free copies on CD of the first two volumes of *Palaeontology Electronica* will be circulated to members. It is hoped that electronic versions of early volumes of *Palaeontology* will be produced in the near future. It is also intended that two new *Field Guides* will be published within the year: Number 10, on the Lower Cretaceous Dinosaurs of the Isle of Wight (Martill, Naish, and Hutt); and the 2nd edition of 'Fossils of the Chalk' (ed. A.B. Smith).

Paul Smith

Secretary

<m.p.smith@bham.ac.uk>

Nominations for election to Council 2001-2002

Vice-President

Dr M. P. Smith

Proposed: Dr M. J. Barker

Seconded: Dr J. E. Francis

Secretary

Dr H. A. Armstrong

Proposed: Dr M. P. Smith

Seconded: Prof. S. K. Donovan

Ordinary member

Dr C. Milsom

Proposed: Prof. S. K. Donovan

Seconded: Prof. C. R. C. Paul

Paul Smith

Secretary

<m.p.smith@bham.ac.uk>

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31st DECEMBER 2000

		General Funds	Designated Funds	TOTAL FUNDS	TOTAL 1999
INCOMING RESOURCES					
Subscriptions		58,415	0	58,415	51,732
Sales:	<i>Palaeontology</i>	118,840			
	<i>Special Papers</i>	17,519			
	Offprints	2,974			
	<i>Field Guides</i>	8,500			
	Postage & Packing	1,241			
Total Sales		149,074	0	149,074	147,902
Investment Income & Interest		21,699	2,984	24,683	20,239
Donations		2,500	664	3,164	2,699
Sundry Income		2,975	0	2,975	4,740
Total		234,663	3,648	238,311	227,312
RESOURCES EXPENDED					
Publications:	<i>Palaeontology</i>	75,066			
	<i>Special Papers</i>	25,502			
	Offprints	4,344			
	<i>Field Guides</i>	2,844			
	<i>Newsletters</i>	11,716			
	Carriage & Storage	1,995			
	Management	40,008			
		166,627			
Scientific Meetings & Costs		14,470			
Grants		3,675	1,853		
Total Charitable Expenditure		184,772	1,853	186,625	145,737
Marketing & Publicity		5,152		5,152	1,548
Administrative Expenditure		30,806	0	30,806	27,210
Total		215,578	1,853	217,431	172,947
NET INCOMING RESOURCES					
BEFORE TRANSFERS		19,085	1,795	20,880	54,365
TRANSFERS		-45,000	45,000	0	0
NET INCOMING RESOURCES		-25,915	46,795	20,880	54,365
INVESTMENT GAINS/LOSSES					
Realised Loss		-2,216			
Unrealised Gain		957			
		-1,259	0	-1,259	15,691
NET MOVEMENT IN FUNDS		-27,174	46,795	19,621	70,056
BROUGHT FORWARD		441,131	50,981	492,112	422,056
CARRIED FORWARD		413,957	97,776	511,733	492,112
		=====	=====	=====	=====



THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

BALANCE SHEET AS AT 31st DECEMBER 2000

	1999 £	2000 £
INVESTMENTS		
283,001 At Market Valuation		315,475
CURRENT ASSETS		
219,431 Cash at Banks	243,755	
10,105 Field Guide Stocks at Valuation	7,302	
<u>3,481</u> Sundry Debtors	<u>2,812</u>	
233,107 Total	253,869	
CURRENT LIABILITIES		
13,552 Subscriptions in Advance	9,037	
<u>10,354</u> Sundry Creditors	<u>48,574</u>	
23,906 Total	<u>58,011</u>	
<u>209,111</u> NET CURRENT ASSETS	<u>196,258</u>	
<u>492,112</u>	<u>511,733</u>	
Represented by:		
441,131 GENERAL FUNDS	413,957	
DESIGNATED FUNDS		
32,038 Sylvester Bradley Fund	62,182	
11,962 Jones-Fenleigh Fund	13,204	
<u>6,981</u> Hodson Fund	<u>22,390</u>	
<u>50,981</u>	<u>97,776</u>	
<u>492,112</u>	<u>511,733</u>	

These financial statements were approved by the Board of Trustees on 7 February 2001.

C.R.C. Paul J.M. Hancock M.P. Smith

Notes to the Financial Statements for the Year Ended 31st December 2000

1 Accounting Policies

The principal accounting policies adopted in the preparation of the financial statements are set out below and have remained unchanged from the previous year and also have been consistently applied within the same financial statements.

1.1 Basis of preparation of financial statements

The financial statements have been prepared in accordance with the Statement of Recommended Practice No. 2 (Accounting by Charities), and include the results of all the charity's operations, all of which are continuing.

The effect of events relating to the year ended 31st December 2000 which occurred before the date of approval of the statements by Council have been included to the extent required to

show a true and fair view of the state of affairs at 31st December 2000 and the results for the year ended on that date.

1.2 Income

The charity's income principally comprises subscriptions from individuals and institutions and sales of scientific publications.

2 Analysis of Financial Resources Expended

	Staff Costs £	Other Costs £	Total £
Provision of services	10,845	168,775	179,620
Marketing & Publicity		5,152	5,152
Management & Administration	<u>16,305</u>	<u>14,501</u>	<u>30,806</u>
	27,150	188,428	215,578

2.1 There were 2 employees of the charity during the year (1999 - 1).

2.2 The Independent Examiner's remuneration amounted to £250 (1999 - £250).

2.3 The Scientific Meetings and Costs figure includes a grant of £9,000 towards the running of the Annual Conference in Edinburgh.

2.4 The Administrative Expenditure figure includes the one-off sum of £3,016 for design and production of the Lapworth Medal.

3 Stocks

Stocks of Field Guides have been included at net realisable value.

4 Debtors – All Receivable within One Year

	1999	
	£	£
Accrued Income	2,662	3,481
Prepayments	<u>150</u>	<u>0</u>
	2,812	3,481

5 Creditors – Falling Due within One Year

	1999	
	£	£
Trade Creditors	16,550	3,487
Social Security Costs	5,014	0
Accrued Expenditure	19,010	4,367
Other Creditors	<u>8,000</u>	<u>2,500</u>
	48,574	10,354



Independent Examiner's Report to the Trustees of the Palaeontological Association (Reg. Charity No 276369)

I report on the accounts of the Palaeontological Association for the year ended 31 December 2000, which are set out in the preceding pages.

Respective responsibilities of trustees and examiner

As the charity's trustees you are responsible for the preparation of the accounts; you consider that the audit requirement of section 43 (2) of the Charities Act 1993 does not apply. It is my responsibility to state on the basis of procedures specified in the General Directions given by the Charity Commissioners under section 43 (7) (b) of the Act, whether particular matters have come to my attention.

Basis of independent examiner's report

My examination was carried out in accordance with the General Directions given by the Charity Commissioners. An examination includes a review of the accounting records kept by the Charity and a comparison of the accounts presented with those records. It also includes consideration of any unusual items or disclosures in the accounts, and seeking explanations from you as Trustees concerning any such matters. The procedures undertaken do not provide all the evidence that would be required in an audit, and consequently I do not express an audit opinion on the view given by the accounts.

Independent examiner's statement

In connection with my examination, no matter has come to my attention:

1. which gives me reasonable cause to believe that in any material respect the requirements to keep accounting records in accordance with section 41 of the Act; and to prepare accounts which accord with the accounting records and to comply with the accounting requirements of the Act; have not been met; or
 2. to which, in my opinion, attention should be drawn in order to enable a proper understanding of the accounts to be reached.

G.R. Powell B.Sc., F.C.A.

Nether House, Great Bowden, Market Harborough, Leicestershire.

18 February 2001



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Holdings and Chang										
Holding		Investment Portfolio 2000					Income in 2000			
Account	Holding	Cost (bought pre 2000)	Value 31/12/1999	Proceeds (sold in 2000)	Cost (bought in 2000)	Gain realised during 2000	Value End 2000	Gain unrealised during 2000	Income in 2000	
£6,765 7% Treasury Stock 2001	£ 7,115.00	£ 6,908.00				£ 6,924.00	£ 16.00	£ 473.56		
£37,000 6 1/4% Treasury 2010	£ 34,235.00	£ 39,667.00			£ 41,371.00	£ 1,704.00	£ 2,312.50			
£11,773 Treasury 5% Stock 07/06/2004	£ 11,669.00	£ 11,326.00			£ 11,740.00	£ 414.00	£ 588.64			
£ 3,029.71 CILF Charities Fixed Interest Fund	£ 25,000.00	£ 23,784.79			£ 24,365.35	£ 580.56	£ 1,658.72			
2,800 Shell Transport & Trading Ord 25p shares	£ 4,671.00	£ 14,406.00			£ 15,372.00	£ 966.00	£ 397.60			
8,000 Legal and General Ordinary 25p shares	£ 2,965.00	£ 13,480.00			£ 14,760.00	£ 1,280.00	£ 344.80			
1,200 Electrocomponents Ordinary 10p shares	£ 2,817.00	£ 8,226.00			£ 7,944.00	-£ 282.00	£ 144.00			
7,000 Vodafone Group Ord \$ 0.10 shares	£ 3,442.00	£ 21,473.00			£ 17,185.00	-£ 4,288.00	£ 93.45			
1,000 Lloyds TSB Ordinary 25p shares	£ 7,952.00	£ 7,745.00			£ 7,080.00	-£ 665.00	£ 278.00			
1,500 Unilever Ordinary 1.4p shares	£ 7,751.00	£ 6,505.00			£ 8,182.00	£ 1,677.00	£ 185.21			
600 Glaxo Smithkline Ordinary 25p shares	£ 16,608.00	£ 18,400.00			£ 19,940.00	£ 1,540.00	£ 349.50			
650 Hays Ordinary 1p shares	£ 6,048.00	£ 12,818.00			£ 10,036.00	-£ 2,782.00	£ 92.04			
875 Cable and Wireless Ordinary 25p shares	£ 5,862.00	£ 9,179.00			£ 7,901.00	-£ 1,278.00	£ 131.26			
600 British Telecom Ordinary 25p shares					£ 3,432.00	-£ 1,713.39	£ 79.20			
1,050 Powergen Ordinary 50p shares	£ 9,426.00	£ 4,673.00			£ 6,636.00	£ 1,963.00	£ 365.40			
460 Pearson Ordinary 25p shares					£ 8,069.00	£ 7,314.00	£ 755.00			
4,500 BAE Systems 7 3/4% (N) 25p CCR shares	£ 4,155.00	£ 8,899.00			£ 8,483.00	-£ 416.00	£ 348.76			
5,720 M & G Charifund Units	£ 4,073.00	£ 55,793.00			£ 61,823.00	£ 6,030.00	£ 2,792.38			
4,000 Edinburgh Small Companies Trust 25p					£ 7,670.00	-£ 375.28	£ 30.00			
1,775 SocGen Technology Units					£ 4,466.00	-£ 3,153.13	£ -			
1,000 Sand P Japan Growth Fund	£ 1,958.00	£ 5,388.00	£ 3,236.57	-£ 2,151.43						
2,000 Gartnmore European Growth Fund	£ 3,516.00	£ 6,077.00	£ 6,012.65	-£ 64.35						
1,450 Gartnmore European Select Opps Fund					£ 8,006.31	£ 8,127.00	£ 120.69			
690 Baring European Growth Trust					£ 6,097.61	£ 5,264.00	-£ 833.61			
5,000 Credit Suisse A UK Transatlantic Fund	£ 8,197.00	£ 8,253.00			£ 9,460.00	£ 1,207.00	£ -			
TOTAL	£ 167,460.00	£ 283,000.79	£ 9,249.22	£ 42,982.72	-£ 2,215.78	£ 315,475.35	£ 956.84	£ 10,665.02		



Free electronic access to *Palaeontology* for Association members

Members are now entitled to access the electronic version of *Palaeontology*, which has been set up on behalf of the Association by Blackwell Publishers, through Ingenta. It is a condition of membership that the access details and password are not divulged to non-members of the Association. You will need to remember a username and a password. The procedure is as follows:

1. Go to <<http://www.ingenta.com/journals/browse/bpl/pala/>>
2. Enter username: pala2001
3. Enter password

Naturally, we are not printing the password here. It consists of a 3 letter + 3 number code. It is printed on the address label of the envelope that this Newsletter was delivered in, on the line above your name. The number will be changed every year and will be communicated to you in this or a similar way.

It is quite possible that you will have thrown away the envelope by the time you read this – in which case, send an email entitled ‘Password’, containing as text your initials, name, and address, to <palass@palass.org>. We will get back to you as soon as we have checked your membership status and entitlement.

Tim Palmer
Executive Officer
<palass@palass.org>

Colour Postcard Set

The Association, in a joint venture with The Lapworth Museum at the University of Birmingham, has produced a series of 16 high-quality colour postcards. They are sold in shrink-wrapped sets and are suitable for use with or without envelopes. They are ideal for offprint requests, teaching, and all general uses. They may be retailed and the images may be reproduced for teaching purposes.

The captions are:

- Venerid, bored by clionid sponges and encrusted by corals. Tertiary. U.S.A. x1.1
- *Thallograptus*, a dendroid graptolite. Wenlock, Silurian. Dudley, England. x1.2
- *Hemicyklaspis murchisoni*, a heterostracan agnathan. Pridoli, Silurian. Dudley, England. x1.2
- *Lepidodendron* leaf cushions on stem (external mould). Westphalian, Carboniferous. Dudley, England. x1.3
- Brachiopods. M. Jurassic. Normandy, France. x1.1



- Spines of *Balanocidaris*, a regular echinoid. U. Jurassic. Portugal. x1
- *Acervularia ananas*, a rugose coral. Wenlock, Silurian. Dudley, England. x1.2
- *Pecten*. Tertiary. Sicily. x0.9
- *Skolithos* (Pipe Rock). Early Cambrian. Assynt, Scotland. x1.1
- *Viviparus* (Purbeck Marble). L. Cretaceous. England. x1.7
- Silicified araucariacean cone. Jurassic. Argentina. x2
- *Placostyites forbesianus*, a carpoid. Wenlock, Silurian. Dudley, England. x4
- *Calymene blumenbachii*, trilobites. Wenlock, Silurian. Dudley, England. x1.6
- Dragonfly wing (part and counterpart). Westphalian, Carboniferous. Dudley, England. x2
- Stromatolite showing seasonal banding. Purbeck, U. Jurassic. Portland, England. x1.5
- Crinoid columnal gravel. L. Carboniferous. Derbyshire, England. x1.4

Sets can be obtained from The Executive Officer (see address inside front cover; for further details email <palass@palass.org>). Costs include Air Mail Postage and Packing:

UK: 1 - 5 sets, £2.50 each; more than 5 sets, £2.00 each.
Europe: 1 - 5 sets, £3.00 each; more than 5 sets, £2.50 each (Credit Card payment preferred).
USA and Canada: 1 - 5 sets, \$5.50 each; more than 5 sets, \$5.00 each
(US Dollar cheque preferred, or Credit Card).
Rest of World: 1 - 5 sets, £3.50 each; more than 5 sets, £3.00 each
(Credit Card payment preferred).

Persuade your Museum Shop to stock them for sale as sets or individually, and receive a free set for your own use!





Association Meetings Programme

PalAss AGM and Annual Address

Date: Wednesday 2nd May 2001

Time: AGM at 2pm, to be followed by the Annual Address

Place: The Royal Society (Wellcome Suite), 6 Carlton House Terrace, London SW1Y 5AG

Speaker: Prof Richard Fortey FRS (Natural History Museum), the award-winning author of 'Life: an Unauthorised Biography' and 'Trilobite!' and former President of the Palaeontological Association.

Title: "Deducing life habits of Trilobites: science or scenario?"

Abstract: Attempts to reconstruct the life habits of extinct animals were recently described by a popular science writer as "little more than cocktail party chatter". In this talk, Richard Fortey will summarize some of the work on trilobite functional morphology over the last 25 years, and will show that it is possible to make scientifically robust hypotheses about the habits of long-extinct organisms. Examples positing feeding and swimming habits are capable of being independently tested, by experiment, or in the field. We are beginning to understand how and why so many different trilobites were capable of living together.

Non Members are welcome!!!

Free Entry!!!!

NB Royal Society security arrangements require all meeting attendants to have their names recorded and to be issued with a name badge. Please arrive in plenty of time to allow this.

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.

Progressive Palaeontology

Liverpool John Moores University 16 - 17 May 2001.

Both poster presentations and oral presentations are welcome. Attendance is free and we would like to encourage all interested postgraduates to make the most of this opportunity to present your research in a relaxed, friendly environment. Abstracts on all aspects of palaeontology should be submitted to us *as soon as possible*.

Details of the meeting can be found at:

<http://cwis.livjm.ac.uk/bes/admiss/ProgPaleo/ppc.htm>

Alternatively, please feel free to contact Hannah O'Regan <BESHOREG@livjm.ac.uk> or Sally Reynolds <BESSREYN@livjm.ac.uk> for further details.

Molecules and Pal Ass at the Systematics Association Biennial

Imperial College, London 3-7 September 2001

This year's Biennial Meeting of the Systematics Association will include a one-day symposium sponsored and organised by the *Palaeontological Association*. The symposium *Telling evolutionary time: molecular clocks and the fossil record* has been organised by Phil Donoghue and Paul Smith (University of Birmingham) under the auspices of *The Association* and features invited speakers, both national and international, who will discuss aspects such as the mechanics of molecular clocks, the quality of the fossil record, and the use and abuse of palaeontological data. The symposium will also include a series of case studies in which speakers will address match and mismatch between palaeontological and molecular estimates of the timing and tempo of major evolutionary radiations, most notably, within animals and plants. A list of papers is given below. Discounted registration rates are available to members of the Palaeontological Association; registration is also available on a daily basis. Further details regarding the meeting, as well as registration forms for attendance can be obtained from <<http://www.systass.org/biennial2001/index.html>>.

- Molecular Clocks: Whence and Whither (Francisco Ayala *UC Irvine, USA*)
- The quality of the fossil record and reconciling differing molecular and morphological dates (Mike Benton *University of Bristol, UK*)
- Placing constraints on divergence times using the fossil record: problems and prospects (Andrew B. Smith *Natural History Museum, UK*)
- Ghost ranges: real or imaginary? (Chris Paul *University of Liverpool, UK*)
- Towards an integration of molecular clocks, Earth history, and the fossil record (Blair Hedges *Pennsylvania State University, USA*)
- Episodic evolution in foraminifera, evidence from molecular and fossil data (Jan Pawlowski *Universite de Geneve, Switzerland*)
- Molecular clock calibration from comparing molecular and stratophenetic phylogenies of coccolithophores (Jeremy R. Young¹, Alberto Saez², Linda Medlin², Ian Probert³ (¹*Natural History Museum, UK*; ²*Alfred Wegener Institute, Germany*; ³*Université de Caen, France*))
- Dating the origin and early diversification of land plants: evidence from fossils and molecules (Charles Wellman *University of Sheffield, UK*)
- Title to be announced (¹Susana Magallon & ²Peter Crane (¹*University of California, Davis*; ²*Kew Gardens, UK*))
- Angiosperm divergence times: What use are molecules? (Niklas Wikstrom *Natural History Museum, UK*)
- Title to be announced (Richard Fortey *Natural History Museum, UK*)
- Written in stone? Fossil evidence for the origin of animals (Graham Budd *Uppsala Universitet, Sweden*)
- Origin and early evolution of chordates: reconciling molecules and fossils (Philip Donoghue, Paul Smith & Ivan Sansom *University of Birmingham, UK*)
- Bones, clocks and crown tetrapods origins (Mike Coates¹, Blair Hedges² & Marcello Ruta¹ (¹*University of Chicago*, ²*Pennsylvania State University*))
- Molecular clocks and the fossil record: the radiation of modern birds (Gareth Dyke *AMNH, USA*)

Annual Meeting of the Palaeontological Association

Geological Museum, University of Copenhagen 15 - 19 December 2001

The Annual Meeting of the Palaeontological Association will be held between 15th and 19th December 2001, in the Geological Museum, with field trips to Bornholm (pre-conference), Stevns Klint and Faxe Quarry (one-day post-conference excursion, 18th December). (Delegates intending to visit Bornholm should contact Richard Bromley to make arrangements <rullard@geo.geol.ku.dk>). Lectures will be held in the Museum's lecture theatre (16th and 17th December) and space will be provided in the adjacent galleries for poster displays. The Museum has substantial collections of Palaeozoic, Cretaceous and Paleogene fossils; type material will be available for study by prior arrangement.

Copenhagen is a relatively small and compact European capital but with many attractions.

Cultural aspects of the city are described on the 'Wonderful Copenhagen' Web pages <<http://www.woco.dk/>>. The Geological Museum <<http://www.geological-museum.dk/>> is Denmark's National Museum for geology, but it also forms a network within the Science Faculty of the University of Copenhagen, together with the Botanical Gardens, Botanical Museum and Zoological Museum. The Museum is also part of the Copenhagen Geocentre that combines the Museum, the Geological Institute and Geological Surveys of Denmark and Greenland (GEUS) together on Øster Voldgade, adjacent to the King's Gardens, the Botanical Gardens, the Art Gallery and the Rosenborg Palace.

The Museum is a 15 minute train journey from Copenhagen's international airport, Kastrup, but is also accessible by rail and road from other parts of mainland Europe. There is now a fixed link to Sweden across the Øresund Bridge. There are flights from many European cities. Cheap flights from the UK are available with GO from Stansted <<http://www.go-fly.com/>>.

Accommodation, near the Museum, is being reserved in the 'Cabin Inn Scandinavia' group of hotels. The following prices are approximate and include breakfast:

Single room £40 per person

Double room £25 per person

Triple room £20 per person.

Registration will be £20.

Further information about alternative accommodation at a wide range of prices is available on the 'Wonderful Copenhagen' Web pages.

Copenhagen is a popular conference and tourist venue around Christmas. It would be very useful to know at an early stage the number of delegates wishing hotel accommodation. Brief expressions of interest can be sent to the conference e-mail address:

<palass2001@savik.geomus.ku.dk>

Dave Harper (chair), Walter Kegel Christensen, Finn Surlyk, Svend Stouge and Nina Topp.

— OBITUARY —

JEREMY RICKARDS

1968-2000

Jerry Rickards was a young man of great promise and achievement, who died suddenly just before Christmas. His work on graptolite fluid dynamics, which he undertook with his father, Chris Swales from the University of Bristol, and myself, was published in *Palaeontology*, 41 (4) in 1998.

Jerry was born in 1968 and trained as an aeronautical engineer in Bristol, through a BSc, PhD and post-Doctoral study. His continuing passion for cars led him to a job designing engines for Arrows' Formula 1. This interest in the modern and fast did not stop Jerry from having strong ideas about the old and very dead graptolites. His absolute view of their shapes as cyphers for fluid dynamic function was a breath of fresh air. His slightly tired patience as Barrie and I wrestled with the implications of his observations was a joy to see.

It was Jerry who inveigled us onto the high-tec. LDA array in Bristol. Three mutually orthogonal lasers, in rather swish colours, focus on a single point in a wind tunnel, through which particles of dust travel. The trajectories of the dust as they are deflected around a model, in this case of *Saetograptus*, demonstrate the flow patterns of their fluid medium. About 100 particles need to travel through the focus point before the data are considered secure. A two-dimensional screen for interpretation has around 200 points. This level of accuracy was unprecedented in graptolite modelling work. It showed us in unique detail how elements of graptoloid morphology affected flow. It was also unbelievably tedious to collect. Jerry had set up an ancient TV next to the laser and computer hardware, and watched weary hours of sport while the dust was zapped. Every few minutes he would get up and delicately change the setting of the laser, then go back to snooker or horseracing. His intense professionalism, held under a mask of relaxed insouciance, seemed to be the hallmarks of his personality.

His major achievements lay elsewhere, but there are few 30 year olds who have a paper published in *Palaeontology* just for fun. I will never forget Jerry, and I will always miss him.

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Read all about it: What the papers have to say about Palaeontology...

Palaeontology certainly seems to have struck a chord with the general public. In fact, scarcely a week goes by without the newspapers printing something on the subject. This is in stark contrast to what little news coverage we used to get, and it is really satisfying. Not all the articles can be considered relevant, and they are by no means up to the scientific standards of *Nature* or *Science*, but they are interesting, enjoyable and easy to read. Furthermore, if it means that what we do as palaeontologists gets a wider press, and perhaps encourages more people to take an active interest, then it can only be good. That's why I'm going to get the bad press out of the way first, and not even this can be considered *really* bad.

Fakes are something we all have to be aware of, but unfortunately they even beat the experts sometimes, as *The Guardian* and *The Times* reported last year. Do you remember the story of *Archaeoraptor liaoningensis*, the supposed fossil that had people up in arms over whether it was a dinosaur or a bird, and what implications this had for the relationships between the two groups? Well, it turned out to be a fake, a composite fossil composed of a dinosaur body and a bird tail (*Guardian* 7.2.2000). By that stage though, the *National Geographic* (November 1999) had already proclaimed it a new species, and as a result had to suffer the indignity of a retraction (February 2000). Then there was the fishy tale of the coelacanth picture, taken by American scientists but reportedly doctored by the French in a bid to claim credit for its discovery (*Times* 14.7.2000). This turned out to be the latest incident in a bitter row between the two sides over who claims to have been the first to discover the fish in Indonesian waters, previously known only from the Cormoros Islands off West Africa.

One of the most critical articles that I came across was a *Guardian* review (24.11.2000) on a *Horizon* programme entitled 'Extreme Dinosaurs'. This documentary followed palaeontologist Dr Phil Currie on his quest to establish behavioural patterns among a group of dinosaurs found in South America. I got the feeling the author really didn't like palaeontologists, and as a result, what could have come across as an interesting and informative article became highly patronising and almost insulting in places. Do some people really still think that all palaeontologists do is sit and dig, for years sometimes, on that quest for the latest discovery? Well, maybe some of us do, but do we really want someone who knows nothing about the subject telling us that? Regrettably, Per Ahlberg's *Horizon* got a similar slaying only a couple of weeks ago in another *Guardian* review. Is good science not enough for some people?

The last article that caught my attention for the 'not great press-coverage' category was the story on Bernard Buigues, and his discovery of what he thought was a complete woolly mammoth in ice from the Arctic (*Sunday Times* 5.3.2000). He was hoping to find cloneable DNA, but as it turns out only fragments of soft tissue, a handful of bones and tufts of hair were discovered (*Times* 5.1.2001). It was more of an embarrassment really, than anything else.

Next, the stories everyone should know about. In January last year *The Times* (15.1.2000) featured an article on a skeleton of an ape-like child, discovered in Ethiopia and dated at nearly 3.5 million years old, which scientists are hoping will provide the missing-link between man and ape. The new skeleton is hoped to help fill in a gap between an adult female skeleton dated at 3.2 million years old, and a similar hominid species from Tanzania, dated at 3.7 million years old.

Early man seems to have been quite a hot topic last year, with *The Guardian* (30.3.2000) reporting on DNA analysed from the ribs of a Neanderthal child who died about 29,000 years ago in southern Russia. This article was really well written, perhaps because the author was Henry Gee (it's a shame that there aren't more scientists writing popular science articles). This was the second Neanderthal DNA sequence to be analysed (the first was the Feldhofer DNA) and it provided some incredible results, backing up the previous data that Neanderthal man was unlikely to have contributed to the modern human gene pool (Ovchinnikov et al. 2000. *Nature* 404:490).

Per Ahlberg made a couple of appearances in the national newspapers last April (*Guardian* and *Independent*), although he does look a little fierce in them both. Together with colleagues in Latvia and Estonia he was working on a new fossilized vertebrate jawbone that has helped to increase the knowledge we have on how fins made the transition to limbs (Ahlberg et al. 2000. *Palaeontology* 43:533). A couple of other interesting items were reports in *The Times* and *The Independent*. The first was on what was thought to be a fossilized dinosaur heart discovered using X-ray scanning, and which helped to enforce the implication that dinosaurs were warm-blooded, fast-moving creatures (*Times* 2.4.2000) (Fisher et al. 2000. *Science* 288:503). However, doubts have since been raised over the authenticity of this heart, although this has gone unreported in the papers (Stokstad 2001. *Science* 291:811). The second story was on the search for *Aepyornis'* natural habitat in Madagascar (the Elephant bird), in order to search for physical remains and any evidence of man's relationship to it (*Independent* 20.6.2000).

Another of the big scoops hitting the headlines last June (*Independent*, *Times* and *Scotsman*) was the story of *Longisquama insignis*, an archosaur that would have lived about 75 million years ago in the forests of what is now central Asia. Scientists believed that they had proved that the long appendages associated with the reptile were hollow, shafted, quilled feathers, identical to those of modern birds and contradicting the widespread belief that birds are the direct descendants of dinosaurs (Jones et al. 2000. *Science* 288:2202). However, in November (as reported in *The Times*) the creature was once again at the centre of a renewed debate, with Canadian researchers concluding that the 'feathers' are in fact highly unusual scales, and therefore the reptile could not be the distant ancestor of birds (Reiss & Sues 2000. *Nature* 408:428).

Some of the other exciting pieces from the papers last year included the discovery of the longest dinosaur tracks in Britain, even if they were then covered up with landfill (*Independent* 9.10.2000), and a new hypothesis on how plesiosaur limbs functioned in the water (*Guardian* 16.11.2000). One of the articles I particularly enjoyed, even if not all the evidence is there yet, is Andrew Parker's explanation for the Cambrian explosion of life (*Times* 1.3.2000). He believes that the evolution of vision meant that animals had to evolve and adapt rapidly in order to escape a predator's line of sight. Dr Parker is not without his critics, as you can imagine, but his theory is certainly one that catches the eye.



I thought I'd finish with some of the stories that are of a slightly more unusual nature, but nevertheless, just as interesting. It's my 'science that can appeal to anyone' category, including the Queen, as shown by her visit to the Yorkshire Museum last July to see a display based on the BBC's *Walking with Dinosaurs* series. Her picture wasn't that flattering either, in fact she looked just as glum as the T-rex she was pictured with (*Guardian* 28.7.2000). Maybe dinosaurs aren't really her cup of tea. Something much more tasteful was the article on fashion and the ichthyosaur, reported in *The Guardian* last March. The 'bias-cut', a method of tailoring fabric to give that streamlined, clinging appearance, has been used to help explain how modern tunas, sharks and dolphins are able to achieve such high speeds in the water. This in turn has been applied to some ichthyosaur remains that have been preserved with skin tissue. Apparently, the arrangement of fibres within the skin is orientated like cloth cut on the bias. Consequently, when the ichthyosaur would have been swimming, the fibres in the skin would have tightened, increasing the stiffness and flexibility of the animal, which in turn would have allowed the ichthyosaur to move through the water with less disturbance (Lingham-Soliar 1999. *Proceedings of the Royal Society of London B* 266:2367).

Another enjoyable item was the feature on dung beetles unearthed during a housing excavation in Hackney (*Times* 25.2.2000), and which have been used to confirm that southern Britain was enjoying a heat wave 20,000 years ago. As a result, scientists believe that they can infer the presence of elephants and rhinoceroses in this area during that time. Can you imagine it, elephants and rhinoceroses in Hackney?

Just in case anyone was stuck for Christmas present ideas, *The Observer* featured an article on the cost of a dinosaur in December, at least a staggering £18,000 (not forgetting the cost of membership for the Palaeontological Association, £28 incidentally), and that's if you're happy to go and look for your own one!

The most recent article to feature in the papers was a story on the naming of a new dinosaur, *Masiakasaurus knopfleri*, a theropod from the Cretaceous (*Times* 25.1.2001) (Sampson et al. 2001. *Nature* 409:504). The aim of the article was not to report on the scientific importance of the latest find, but the reason behind its name. Any guesses? Well, apparently the scientists who uncovered the bones were listening to Dire Straits at the time, so, in tribute to this groundbreaking discovery, they named it after Mark Knopfler, the lead singer and guitarist of Dire Straits. If anything it has given me some ideas for the names of my new bryozoan species...

There were so many articles in the newspapers last year that I couldn't mention them all here. Even though dinosaurs are as popular as ever, probably more so, there are a lot of other stories that made it to the papers as well. Even the writers from *HELLO!* magazine (a glossy, gossipy magazine, for the uninitiated) are reporting on palaeontology, as their article last month on dinosaurs in Niger proved (I should point out that I am not an avid reader of this magazine, I just happened to spot it, honest!).

Palaeontology has clearly made its mark on the press.

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A Millennial Tribute to Steve Gould

At the turn of what, on good scholarly grounds, he regards as the new millennium, Steve Gould has published his last monthly article in the magazine *Natural History*. There have been 300 such articles, beginning in 1974 under the general title *This View of Life*, taken from the last paragraph of *On The Origin of Species* ('there is grandeur in this view of life.....'). Such has been their popularity that they have been anthologised into no fewer than nine books, starting in 1977 with *Ever Since Darwin*. The theme of this concluding article is Steve's sense of awe at the continuity of life through 3.5 billion years, without a single microsecond of disruption.

A sense of awe is indeed a persistent theme of the articles, embracing evolution as the central issue and using an extremely wide range of examples from natural history. Characteristically he seizes upon some apparently odd feature of organisms, or quirk of nature, to illustrate, often with great ingenuity, some evolutionary theme. Thus certain essays of this kind have been used as titles for his books, such as *The Panda's Thumb*, *The Flamingo's Smile* and *Hens' Teeth and Horses' Toes*. The essays betray an enviably wide range of learning and intellectual curiosity, ranging from homely analogies to the most arcane byways of historical scholarship. I do not know, and can hardly conceive of, another scientist who shares a love of medieval stained glass windows, as best exemplified by Chartres Cathedral, and Wagner (the music, not the man) with a passion for baseball. Who else could even have thought of utilising baseball statistics to make serious scientific points? The standard of writing, in these and his other books, with his exceptionally rich vocabulary, racy phraseology and command of metaphor compares more with great novelists like Saul Bellow or John Updike than the common run of scientists or journalists, and has indeed impressed the literati. For a short while he wrote a column on baseball for *Vanity Fair*. I wonder what the average baseball fan made of his prose? Still, it was *Vanity Fair* and not the *New York Daily News*.

All of his popular writings are suffused with a warmth and generosity of spirit, and liberality of social attitudes, which reflect well the man himself by those who know him personally. Back in the earliest days he told me he wished to reach as wide an audience as possible. If displays in airport bookshops are a good criterion, then he has certainly long since made it. A couple of years ago I spotted several of his books on display at the magnificent new Hong Kong airport, along with John Grisham and Jeffrey Archer but not, I noted, either Bellow or Updike. So why stop now? Although his sheer staying power over more than a quarter of a century takes my breath away, it is not for want of further subjects to pursue. Rather it follows his boyhood hero Jo DiMaggio's desire to 'quit while they still want you.' Back in the early 1980s, when Steve was seriously ill with the life-threatening disease mesothelioma, I was very touched to learn from him that someone had arranged that DiMaggio send him a personally autographed baseball.

Steve Gould's reputation as one of the outstanding popular science writers of his day is secure, but what of his achievements as a professional scientist? Here the picture is rather more



controversial. He has had a long-standing ambition to challenge what he perceives as the reductionist, panadaptationist programme of conventional neodarwinian evolutionists, who he refers to as the ultras, but so far has had only limited success. He is most associated in the public mind with the theory of punctuated equilibria, with its concomitant long periods of evolutionary stasis of species. Whereas population geneticists were not unduly perturbed by punctuated lineages, they never predicted stasis, and most have come round to a rather grudging acknowledgement that there may be something in this idea. He has gone on, however, to promote actively a hierarchical model of evolution involving species, as opposed to individual, selection. Here he has been less successful and I for one, though a strong supporter of punctuated equilibria, remain very sceptical about species selection. At the beginning of the 1980s Steve went so far as to flirt with Goldschmidt's idea of evolutionary saltation, but quickly backed off following a volley of fire from the geneticists. Such is his way with words, the written retreat was covered by some elegant phraseology, which led one of his unkindest critics to remark in my presence that Steve could be compared in one respect anyway to a squid – when attacked he disappears in a cloud of ink.

In more recent years the emphasis in his writings has shifted to the contingency of evolution throughout history, and the constraints imposed by the Bauplan. As a student of mass extinctions, I heartily support the former, and as regards the latter I follow with keen interest progress in the new subject of developmental genetics. Since my undergraduate days at Cambridge I have thought that there was a huge gap in evolutionary thought, because of our failure adequately to understand morphogenesis. Natural selection was, in other words, a necessary but not sufficient condition for understanding how such immense diversity in the organic world has arisen through geological time. When Steve published his classic book *Ontogeny and Phylogeny* in 1977, he laid the foundation for the modern study by palaeontologists of heterochrony, but no research programme was evident at the time for the geneticists. Now, with the ubiquitous recognition of Hox genes, all that has changed. Furthermore, an increased respect for what the fossil record can tell us has become evident among evolutionary biologists. The 'deep homologies' across metazoan phyla, proclaimed impossible in theory by Ernst Mayr in 1963, have now established internal constraints and channels as significant causes of evolutionary change in their own right, thus vindicating important components of the most reviled archetypal theories of early 19th century biologists. Such internal constraints can act as positive forces in evolution by setting channels to accelerate or reinforce the action of natural selection.

Classic cases of apparent convergence based on the power of natural selection can be seen rather as parallelisms constrained by homology of generating developmental patterns – that is, largely set by internal channels rather than by external selection alone. This subject will be a major theme of Steve Gould's forthcoming book on macroevolution, to be published by Harvard University Press, which we can expect to be as scholarly and historically sophisticated as *Ontogeny and Phylogeny*. In my view, the future for Steve as an evolutionary theorist is looking a good deal brighter than it did late in the last century.

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From our Correspondents

Shifting around, uneasily

"But as to the fable that there are Antipodes, that is to say, men on the opposite side of the earth, where the sun rises when it sets to us, men who walk with their feet opposite ours, that is on no ground credible...it is too absurd to say, that some men might have taken ship and traversed the whole wide ocean, and crossed from this side of the world to the other, and that thus even the inhabitants of that distant region are descended from that one first man."

St Augustine, City of God (c.427 AD), Chapter 9

Pity Augustine. Already burdened with the Sack of Rome and the Donatist Controversy, he somehow also found himself fretting over the problems of biogeography. His difficulty was this: if all humans were descended from an original pair, then how could there be human races on continents on the other side of the world? Quite apart from the fact that (as he points out) the sheer existence of such places was a matter of speculation with no science to back it up, it just seemed impossible to imagine humans actually getting there. Therefore: either there were no humans there, or if there were they were not descended from Adam and Eve – in flat contradiction to Scriptural evidence. As in so many other areas, Augustine's thoughts here are strikingly modern, even to the point of being compelled by biogeographic methodology to unlikely conclusions (in this case, the non-existence of Australians): a grand tradition carried on to the present day. Is there light at the end of the tunnel though? And can fossils have something to say about any of this?

Of course, it has been known for a long time that animals and plants are different in different parts of the world, and that their distribution shows a certain degree of order, often for example, demonstrating striking patterns of 'disjunct' co-occurrence (groups of taxa that share the same widely separated distribution). Traditional trains of thought in historical biogeography, however, focused almost exclusively on explaining the individual history of particular taxa, a trend set in motion by Linnaeus himself (Uppsala University seems to have had a long-term and continuing interest in this subject). Such research programmes are often called 'dispersalist', because they concentrate on explaining how a particular organism spread or dispersed from an assumed 'centre of origin'. G.G. Simpson was instrumental in developing some of the theory behind this approach, invoking florid terminology such as 'sweepstakes', 'filters' and 'corridors' to explain why (for example) a lake might be rather difficult to cross if you are a slug, but rather simpler if you happen to be lucky enough to have turned out as a crow.

As with most traditional ways of doing things, this whole approach went down terribly badly with the cladists when they came on the scene in the 1960s, building on work that had been carried out in the 1950s, truly in splendid isolation, by lone voices such as Leon Croizat (who resorted to publishing his theories privately). Simply put, the main complaint was that



dispersalist theories only explained individual distributions on an *ad hoc* and narrative basis, and were thus essentially immune to falsification; they led to few or no general predictions, and were thus in general a bad thing. 'Vicariance' biogeography, on the other hand, took as its starting premise that present distributions were to be explained by past splitting apart of ancestral areas (e.g. by rifting, raising of mountain ranges etc). These areas were assumed to be 'full' of taxa to start off with, with no vacuum-filling dispersal spreading out from centres of origin. Such splitting events would affect a whole biota simultaneously, and thus explain the degrees of relationship between faunal regions, with the history of individual taxa being shifted out of the spotlight. Of course, vicariance theories received an enormous boost from the advent of Plate Tectonics – indeed, disjunct fossil distributions were partly instrumental in generating continental drift theories. Snappy new terms like 'Viking Funeral Ships' and 'Noah's Arks' soon invaded the literature. More usefully, fossils were used from the 1970s onwards as a way of testing palaeogeographic reconstructions, for example in Ordovician trilobites, although it is unclear to me how such tests would cope with ancient disjunct distributions – e.g. an Ordovician distribution that reflects past (Cambrian?) vicariance events.

The pathway to a cladistic methodology was a rocky one that was traversed slowly; but the principles were soon in place: patterns of taxon divergence as elucidated by parsimony methods reflect past vicariance events, or, to put it more concisely, 'species and spaces evolve together'. Although various methods exist, the basic technique is to generate 'area-cladograms' based on the phylogenies of the taxa spread among the geographical areas in question. One popular version is to treat geographical areas as 'taxa' themselves, with absence or presence of 'real' taxa (as deduced from phylogenetic analysis) being the characters (Brook parsimony analysis).

This conceptually powerful method of levering out historical biogeography from extant phylogenies and distributions (it needs hardly be said that, in general, fossil relationships and distributions were puritanically excluded from the early efforts) has, over the last few years, begun to make its way into the palaeontological literature. Like all intellectually compelling methods though, this one also suffers from several flaws, perhaps the most serious of which is that its starting premises seem to be too mad to be taken seriously. Humorists have not been able to resist the (slightly unfair) notion of organisms being forced to wait for the next rift to come along instead of walking, swimming or flying around the world. Readers may be able to generate some feeble witticisms of their own along these lines. Apart from this, one central criticism is as follows. In order to generate widespread and uniform ancestral populations that are the starting point of vicariance analysis, there must have been dispersal. Having assumed dispersal acting at some (early) point in a clade's history, though, vicariance methods typically go on blithely to ignore it. This seems to suggest a certain incoherence. Further, what happens to the paradox that, under the assumptions of the methods, the ranges of descendant species must inevitably become smaller and smaller? And what about historically documentable events such as the 'Great American Biotic Interchange' or the restocking of Europe after the last Ice Age where dispersal patterns can be distinguished in the fossil record – shouldn't or couldn't they be used in any general explanation of current biogeographic pattern? Unlike homoplasies in a



phylogenetic analysis, it does not seem possible simply to ignore dispersal in biogeography, because it has to be an essential aspect of historical biogeography, not simply annoying distraction. Predictably enough too, the cladistic methodologists fell out amongst themselves, leading to the usual ugly spats within the pages of *Systematic Zoology/Biology* and *Cladistics* that only cladists seem to be able to generate.

In retrospect, the trouble seems to have been that methods based only on patterns of biogeography were unable to unravel what had actually led to the pattern: it was not, in general, possible to interpret inconsistencies in vicariance analyses in a straightforward manner. In addition, other disturbances such as extinctions and sympatric speciations (i.e. cladogenesis that was not related to vicariance, a subject I hope to return to in a later *Newsletter*) prove tricky to cope with. One is therefore left with the unpalatable explanatory options of 'vicariance' or difficult-to-interpret 'noise'.

In the last few years though, solutions (naturally enough of a controversial nature) have started to emerge. One is 'reconciliation' (Page (1994) for the interested); but a more radical 'root and branch' shift has been away from pattern-based methods to those based on events of given cost, whilst retaining the same basic phylogeny-based technique. If one wants to have vicariance as a 'default' option, then one makes vicariance events have zero cost, and make dispersal and extinction events have (e.g.) a cost of 1 per unit area affected by them (the gruesome details of this 'dispersal-vicariance analysis' are in Ronquist 1997), and then minimise total cost. Because it is possible to map extinction and dispersal onto the trees derived from the analysis, one can generate parsimonious and explicit hypotheses for these events, generally treated fuzzily if at all by pattern-based methods. Further, one does not need to assume that the areas in question have a hierarchical relationship, another confining feature of previous methods.

Although these methods are best developed for single taxon, it is possible to extend them to entire faunas. In such a case, other data such as known palaeogeography could be used for adjusting the relative cost of dispersal at different times. Fossils could (finally) actually come into their own here. By using fossils to place minimum dates on nodes within the trees generated for various taxa, one could construct a pleasing time-series analysis of the relative frequency of vicariance, extinction and dispersal, which could then be compared to independent geological scenarios (Ronquist 1997). Quite apart from anything else, this introduction of a time element (molecular clocks are another possibility – Voelker 1999 is a good example) removes the possibility of mistakenly clumping together similar patterns of cladogenesis into the same vicariance events when they are actually of differing ages. This could provide powerful constraints on historical hypotheses.

The very idea of extracting reliable dates from fossil occurrence and placing them in any sort of cladistic analysis at the start is naturally anathema to some, which seems in itself to be a recommendation. Actually, methods of quantifying uncertainty in stratigraphic-based ages of taxa and branching events are becoming increasingly sophisticated, and the usual complaints that fossils are too 'unreliable' to be allowed to sully anything as pure as a cladistic analysis are beginning to sound increasingly hollow. If these methods ever become widely fashionable, then fossils could finally be placed back in the centre of the historical subjects – phylogeny and biogeography among them.



When writing this, I looked back over a set of notes given out at a course I attended in the NHM in 1991 on cladistic methods. The notes confidently trumpet: 'Thus, cladistics allows us to discard another deeply-seated convention in biogeography, that it is necessary to have fossils to reconstruct the distributional history of a group'. Next to this, a co-attendee of the course (I won't name her) has scrawled '...as long as you're not bothered about what sort of answer you get'. New time- and event-based methodologies may yet provide answers even palaeontologists are happy with.

References and further reading

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The symbolism of silphium



The coins depicted above show an extinct species of plant known as silphium and its seed-pod, as represented on ancient Greek coins from Cyrene. Here I pass on the story of this plant on the grounds that it is an example of a historical extinction that deserves to be better known.

The Oracle at Delphi obviously knew a thing or two, as on the occasion it advised the over-crowded inhabitants of Thera (also known as Santorini) to found a colony in Libya. The city of Cyrene was founded in about 630 BC and prospered greatly as a result of a healthy export trade in a local plant called silphium (not to be confused with the extant American prairie sunflower of the same name). This plant is mentioned enthusiastically by a wide variety of classical authors, and seems to have been something of a panacea, used in the cure of everything from dysentery to infections, toothaches, and intestinal wounds. It was also used in cooking. Its main attraction, however, seems to have been that it was both an aphrodisiac and a potent contraceptive.

It has been argued, with I don't know what validity, that the love-heart we see on modern Valentine cards is derived from a classical love symbol which was in fact a representation of the seed pod of the silphium plant (which would explain, at least, why it looks nothing like a heart). The wonder plant also makes an appearance in the following poem of Catullus to his lover Lesbia, which might itself be seen as a prototype of the sickly Valentine card verses:

*You ask, Lesbia, how many of your kissings for me
Are enough and more than enough.
As great as the number of the sands of Libya
Lying in silphium-bearing Cyrene
Or as many the stars, when the night is silent (etc. etc.)*

Apparently silphium grew wild on the north-facing hills overlooking the sea, but resisted attempts at cultivation. The harvest seems to have been initially strictly controlled and it survived for many centuries. A spectacular early Greek pot has been unearthed which supposedly shows the king of Cyrene himself supervising the weighing of bundles of



silphium on a gigantic balance. But by Roman times it had become very scarce and literally worth its weight in silver, reputedly being stored under armed guard in the treasury along with the precious metals. Strabo and Pliny blamed its decline on sheep grazing in the silphium pastures, but the modern theory is that the strict controls on harvesting went out of the window when Cyrene came under Roman control in 74 BC. It was customary for Roman governors to exploit their colonies for all they were worth. Pliny records that one of the last batches was sent to the emperor Nero around 60AD, but the final supposed occurrence comes 300 years later still, in the 4th century, when Bishop Synesius of Cyrene said in a letter to his friend Pylaemenes that he had prepared a gift including saffron, wine and "a great deal of silphium juice" ("even you know of the silphium of Battus").

Depictions of silphium on the coins of Cyrene have allowed botanists to identify it tentatively as an extinct species of giant fennel in the genus *Ferula*. As a non-botanist but occasional cook this seems plausible to me, but if anybody has a better idea then please write in. It occurred to me (inspired by the thought of biotechnology billions) that it might still be worth a quick check of the hills around Cyrene (modern Shahat). But expeditions have in fact been dispatched to no effect. Climate change may have played a part in the extinction of silphium, because North Africa is much more arid now than in ancient times, but principally the plant appears to have been a victim of over-harvesting. Which means that silphium, so long symbolic of human love, might better be regarded as a symbol of environmental destruction.

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Sylvester-Bradley Award 2000 Report

The Evolutionary History of the *Turborotalia cerroazulensis* Lineage from the Type Locality, Possagno, Italy.

Turborotalia is a lineage of planktonic foraminifera, which evolved over a period of approximately 10Ma during the Eocene. It contains six distinct morphospecies, that appear to have evolved slowly and gradually before becoming extinct at the close of the epoch. Research history dates to the early 1900s when the first members were named, but it was not until the 1970s that more interest was shown.

In 1970, Toumarkaine and Bolli (1970) conducted the most thorough investigation of the lineage, from field studies at Possagno, nestled at the foothills of the Dolomites. The village was chosen for its remarkable and almost complete terrestrial section; almost 1km of Upper Cretaceous to the Lower Oligocene sediment is exposed. Each new morphospecies is unique and morphologically distinct, and this discovery led to development of a complete evolutionary sequence (figure 1). These discoveries conveyed Possagno to type locality status, hence my travels to assess the impact of thirty intervening years.

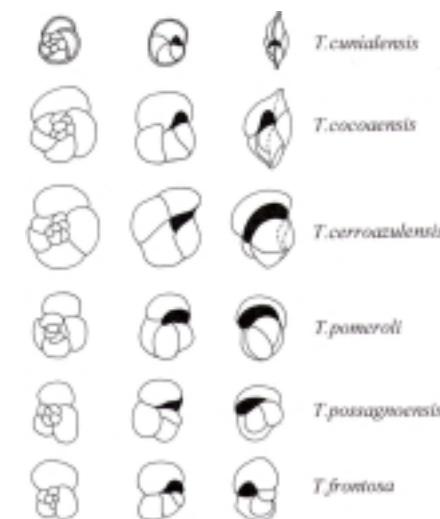


Figure 1

Members of the *Turborotalia cerroazulensis* lineage. From left to right: spiral view, aperture view, edge view. Sketches taken from Toumarkaine & Bolli (1970) illustrate the progression from least derived (bottom) to more derived (top) individuals.



Early on a misty April morning I headed from Bristol, bound for Basel, to fulfill my intent. At Basel, I was helped immensely by Dr Michael Knappertsbusch, whose kind permission enabled me to view the specimens of Toumarkaine and Bolli. The collections had paid for their years and were in a rather sorry state, many had fallen on their mounts and inevitable measurement difficulties arose. Nonetheless I was able to obtain sketches, images and measurements (Retter, 2000). In possession of a growing cache of data, I headed for Italy. The train wound slowly through snowy Alpine peaks on a clear, crisp morning as I found myself en route to Possagno, a small village sustained by manufacture of tiles and bricks. Unfortunately, what makes good bricks also makes for immaculate *Turborotalia*. Relentless production over the past thirty years means that type sections have all but gone, only to be replaced by landscaped mounds or much expanded, gaping quarries. Fortunately, I was able to recover samples from the meagre exposures remaining.

Fieldwork continued to the backdrop of a grand, chocolate-box vista. Finally, with map complete, frustration alleviated, and data in hand, I headed home.

I began with a test – the basic accuracy of the lineage. *Turborotalia* is defined well by morphology, but how well? Using basic measurements of maximum height and depth (in edge view) of type specimens, I was able to reveal that *T.possagnoensis* is an oddity, more primitive than its predecessor, *T.frontosa* (Figure 2), and considered by some (Primoli Silva & Boersma, 1988) not to be a member of the lineage at all. In addition, I determined that *T.cunialensis* is also quite distinct from other species currently residing in the genus. Both lines of evidence are clearly supported by analysis of populations from the type locality (Retter, 2000).

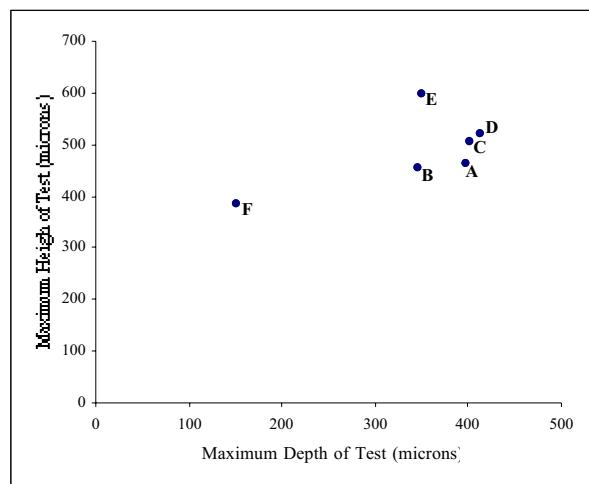


Figure 2

Scatter plot, showing maximum depth against height for figured *Turborotalia* (Toumarkaine & Bolli, 1970, Pl.1). A = *T.frontosa*, B = *T.possagnoensis*, C = *T.pomeroli*, D = *T.cerroazulensis*, E = *T.cocoensis*, and F = *T.cunialensis*.

Cita (1975) worked at Possagno subsequent to Toumarkaine & Bolli, and logged sections for a paper which appeared in a monograph on the village in 1975. Her data show approximately 48% of section to be missing at the time, consequently my logs represent a mere 7% of total section (Retter, J.L, 2000). Collation of all these data allowed production of a section log, which was then used to determine confidence intervals for each morphospecies, using the method of Marshall (1990), defining first and final appearances and finally, type species horizons.

Decrease in confidence since 1970 is not significant: larger intervals merely reflect lack of horizons but, once more, validity of *T.possagnoensis* as a separate entity is questioned. With addition of confidence limits on its stratigraphic distribution, the range of *T.possagnoensis* lies entirely within its predecessor, suggesting that it is closely related to, if not one and the same as, *T.frontosa*.

Cluster analysis, using combinations of eight different morphological measurements (Retter, J.L, 2000), for example, aperture height against aperture width and spire height against umbilical inflation, were applied to remaining in-situ populations. Results indicate that, upon excluding *T.possagnoensis*, evolution of the lineage is identical to that suggested by Toumarkaine & Bolli (1970).

Turborotalia's Type locality is all but gone, so understanding of evolution at this site cannot be further enhanced, at least not accurately, in relation to original studies. It is a shame that more cannot be learned from this site; instead our understanding will have to suffice with existing data and information from other locations. An entirely accurate picture of *Turborotalia* evolution is still elusive.

Acknowledgements

I would like to thank Dr Pearson, Dr Knappertsbusch and all in Possagno for their help in the success of this project, which would not have been possible without the Sylvester Bradley Award, for which I thank the Palaeontological Association. Finally thanks to my family and friends for their support.

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Meeting REPORTS



Palaeontological Association Annual Meeting 2000
Edinburgh 17th - 20th December

I arrived in Edinburgh after a weekend in the company of conodontophiles. Quite how a Ph.D. student of Wenlock oddballs ended up on the Microvertebrate Group field trip to Fife is unclear, but a most convivial time was had by one and all. This was despite our hotel in Leven being occupied by an amateur boxing competition on Friday night, then subjected to the dulcet tones of the district's 'top vocalist' (Westlife watch out) the following evening.

Saturday was spent scouring the coastline of Pittenweem under the guidance of Mark Dean (BGS), and Sunday morning turned into a pilgrimage as we searched for the Holy Grail, sometimes known as the Granton Shrimp Bed. Phil Donoghue was most King Arthur-like, but no conodont animals deigned to appear and we left for Riccarton.

Having put bags in unexpectedly en-suite rooms, the lure of bright lights and curry proved too much and we were tempted back to town. By the time we returned to campus, everyone else had scarpered to the pub. We followed in the minibus and after a few wrong turns chanced upon an inn packed to the rafters with eminent fossil-hunters. It seemed as good a place as any to stop, and an unspecified quantity of alcohol was merrily consumed, although I was a mite unnerved by a poster behind the bar advertising a 'sensational vocalist' appearing soon.

Monday 18th December

Session 1

Monday morning, and time for the serious business to begin. Indeed the opening talk was serious business, as Mike Benton (Bristol) brought to our attention the PhyloCode, a recently proposed re-haul of taxonomic classification. This new system would replace Linnean binomials with a rather more rigidly linked name and definition, based on cladistic characters, and could only be altered via a 'lengthy legalistic procedure'. Mike denounced the PhyloCode as 'nonsense', but as Graham Budd pointed out afterwards, the compatibility of the present Linnean hierarchy with cladistics has to be examined, since the latter is presumably here to stay. An argument with some mileage left yet.

The remainder of the session was less polemic, as Andrew Smith (NHM) discussed the role of surface area in Earth diversity over time. Though the two correlate well, sampling bias and a far-from-uniform rock record leave the true relationship unresolved. Chris Little (Leeds) used the presence of fossilized submarine vent communities in the Cretaceous ophiolites of Cyprus to question the Cenomanian-Turonian anoxic event, whilst Sarah Tibbs (Bristol) looked at soft-part pyritization in the Hunsrück Shale – thixotropic clays smothered the fauna, and anomalously high iron content allowed rapid in-situ pyritization. Ever attentive, I noticed that Sarah's second slide was of an exquisitely preserved starfish, which went down particularly well with the Silurian asteroid worker in the audience (i.e. me).



Personally, the most intriguing presentation of the first half-dozen was by **Dmitri Grazhdankin** (Cambridge), who has been studying immobile Pre-Cambrian infauna, notably *Inaria* from the end-Proterozoic of Northwest Russia. Dmitri showed that although infaunal behaviour is not well documented in Ediacaran fossils, it could be inferred here, since, despite current scours around specimens of *Inaria*, there is no evidence of transportation of the animals, suggesting cohesion to the soft mud by bodily secretions. It was also proposed that closely packed associations of *Inaria* might have helped stabilize the substrate, making subsequent colonization easier.

Jose Alvaro (Lille) gave the last talk before caffeine replenishment, on coelobiontic (cavity-dwelling) Lower Cambrian beasts from Southern Spain. The cavities were remnants of a Pre-Cambrian andesite topography that became submerged, allowing a novel and diverse marine biota to flourish.

Session 2

On our return to the auditorium, it appeared the concept of sticking to time had been left outside with the teacups as, despite the best efforts of chairman Derek Briggs, both talks immediately after the interval rather over-ran their allotted 15 minutes. All could almost be forgiven though, as **Jean Vannier**'s assertion that complex food chains were functioning in the early Cambrian, and **Nick Butterfield**'s revelations on the 3-d phosphate preservation of mid-gut diverticula in Burgess Shale arthropods were both such fascinating topics. Nick was as effervescent as ever, but an added element of excitement came as the clock on the wall signalled time, and Derek loomed hawk-like beside the podium:

Nick: "How am I doing for time?"

Derek: "You're finished."

Cue Peter O'Sullivan-speed commentary from Nick, with two more minutes of interpretation, until:

Nick: (imploringly): "Am I really done?"

Derek: (unmoved): "You have to stop."

And, reluctantly, he did.

The audience was certainly enjoying the show, but I'm not sure what it was doing to the nerves of the remaining speakers. Next up was **David Harper** (Copenhagen) to delineate the changes in disparity and diversity over time of the orthide brachiopods. The impunctate orthides (orthidines) reached maximum diversity during the Ordovician, and were most disparate during the Caradoc, but suffered more than the punctate orthides (dalmanellidines) at the end-Ordovician extinction, and were replaced by them, both in terms of diversity and disparity.

Now, I'm not a betting man, but as soon as **Joanna Snell** (Birmingham) completed her lucid look at the use of phenetics and cladistics in resolving the problematic phylogeny of Wenlock bryozoans, I was prepared to put money on her claiming the President's Prize. I realize that Jo resides in an office a few doors from mine and would obviously poison my tea if I made any disparaging remarks, but intra-departmental sycophancy is not a hobby of mine – I just enjoy seeing palaeontology being presented in near-faultless manner. That said, Chris Paul's

agreement has saved me from having to point out too many things that were impressive (don't want Miss Snell getting too big for her boots).

And from bryozoans we moved to corals, as **Hans-Georg Herbig** (Köln) examined the Lower Carboniferous reefs of Blue Pool Bay, South Wales, and **Brian Rosen** (NHM) tested the role of geology in reef coral diversity in the Indo-West Pacific. 37 Ma before the collision of Australia and Indo-China, there were no corals in Sulawesi, but by 21 Ma (post-collision) corals were common, albeit of limited generic diversity. In some ways, Brian's subject linked with Andrew Smith's talk earlier in the morning, with further work to be done before concrete relationships between diversity and geology can be established. And so to lunch.

Session 3

Anyone still eating as the afternoon sessions began would have been put right off their food by the title of the first talk, as **Andrew Ross** (NHM) opened a can of Jurassic-Cretaceous cockroaches. At the beginning of his presentation, Andrew said he wished he hadn't started the work, such was the non-existent literature and awful taxonomy, coupled with the fact that modern biological classification of cockroaches does not use wing morphology and wings are the only parts preserved in the Purbeck-Wealden beds. However, despite these limitations, he was beginning to make sense of specific and generic variability.

Paddy Orr (Galway) then demonstrated that even in Lagerstätten, preservation of fossils (in this case Carboniferous arthropods) is not always complete, and apparent disparity between forms from different horizons may in fact be taphonomic in origin. Appendages of conchostracans from the Castlecomer Lagerstätte of Eire can be entirely absent, with no suggestion of ever having been present. If this is also the case in other exceptional horizons, such as the Burgess Shale, conclusions about biological affinities may need revising.

Back on land, Carboniferous arthropods were getting pretty enormous, with *Arthropleura armata* attaining lengths of up to two metres. **Heather Wilson** (Maryland) discussed this monster in combination with *Microdecemplex*, a new arthropleurid 1000 times smaller, showing that arthropleurids could now be allied strongly to the chilognath millipedes. New ventral features were unearthed on *Arthropleura* using an exciting new excavation method, whereby a specimen in Saarbrücken fell off the wall and split. This fortuitous technique is soon to be employed in museums the world over.

Steve Fayers (Aberdeen) described a new chilopod from the Windyfield Chert near Rhynie, with repeated thin sectioning enabling many new features, such as tergite pleurotergy and lithobiomorph-like tracheae, to be identified. Associated palynological data suggest an environment similar to modern-day Yellowstone springs. **Rod Taylor** (Cambridge) then employed fossils from Canada, Greenland and China to support his hypothesis that unrelated Cambrian arthropods may have evolved the same waptiid body plan.

It was time for a change of tack, leaving arthropods and moving to dendroid graptolites. **Kate Saunders** (Portsmouth) has been working on exceptionally preserved material from the Silurian of North America, hoping to uncover their biostratigraphical value, as well as resolving the palaeoecology and taxonomy. The dendroids are rarely found in association with crinoids, corals or bryozoans, usually occurring with algae and worms, and are thought to have grown in 'meadows' in shallow marine conditions.



John Evans (St. Andrews) gave the session's final presentation on the Holocene marine sediments of the North Sea off Northumberland. Benthic foraminifera and stable isotope data show that the ocean fluctuated between mixed and stratified waters on a seasonal basis.

Session 4

Monday's fourth quarter began with **Ken Dorning** (Sheffield) explaining that, despite being the dominant Palaeozoic microflora, acritarchs are still of uncertain affinity. Specimens with processes are the most common, but can be very hard to separate from dinoflagellates.

Dianne Edwards (Cardiff) displayed the Midas touch in her wonderful talk on preserving plants in pyrite, as she attempted to turn celery into gold (albeit fool's gold). Sadly, the pyritization was not total – imagine the commercial possibilities if it was! – but the patterns of precipitation were very similar to those seen in Devonian plant fossils. Eocene material from the London Clay has pyritized lignin, however, implying that the processes involved are not always the same.

Andrew Scott (Royal Holloway) then debunked the notion that a global fire occurred at the K-T boundary. Forest fires were a common and important part of terrestrial ecosystems in the Cretaceous, and well-preserved woody horizons from Nova Scotia and New Mexico do not show pronounced charcoal peaks at the K-T boundary, suggesting no change from the normal system.

Last, but certainly not least, was **Lesley Rantell** (Edinburgh), examining the function of thecal spines in graptolites. The spines were not protective and wind tunnel experiments reveal that they increased feeding efficiency by diverting nutrient flow towards the thecae. Lesley's captivating presentation showed that spine angle was very important in terms of entraining flow, and that an abundance of spiny graptolites in the Caradoc may tie in with an increase in oceanic productivity.

The day's talks over, we were given an hour or so to scrub up before meeting up again. The Annual Dinner was being held at the National Museums of Scotland, necessitating a coach trip into town, but blimey was it worth it! A grand and atmospheric venue, fine food and splendid company, along with two giant indoor fishponds where the mildly inebriated postgrad could find entertainment in harassing catfish. What more could one ask for? I haven't enjoyed myself so much in a long time, and on our return the merriment continued into the wee small hours.

Tuesday 19th December

Session 5

Many casualties were reported the next morning, but having survived on a Thatcher-esque number of hours sleep, I made it to the first lecture of Tuesday. **Charles Wellman** (Sheffield) looked inexplicably bright and breezy for his 9am slot, discussing the plants of the Rhynie Chert. Our understanding of early terrestrial ecosystems is highly dependent on the Rhynie assemblages, but just how representative are they of life on Earth in the early Devonian? Charles said that species from Rhynie are found elsewhere in less unusual lithologies, suggesting that the plants were not freaks and can be used as general indicators of Devonian palaeobotany.

A combination of animal, vegetable and mineral was used by **Margaret Collinson** (Royal Holloway) to interpret terrestrial palaeoenvironments of the Eocene of Southern England. Exotic fruits and arboreal mammals show that the area was once a tropical forest, but cooling by the late Eocene led to the woodland being replaced by wetland vegetation and ground-dwelling animals. In order to improve on this general explanation, a new set of techniques, most notably direct laser fluorination, were used to extract phosphate and oxygen isotope data from rodent teeth. Although small tooth size and diagenetic alteration posed problems, the method has given a palaeotemperature of 21°C (\pm 6°C) for the surface water in the late Eocene, a value which will be further refined as the work progresses.

Alistair McGowan (Chicago) then looked at the evolutionary patterns of Triassic ammonoids, and, in a change to the schedule, **Kenneth Monsch** (Bristol) detailed a new cladistic analysis of fossil and Recent billfish that shows that they are closely related to scombrids. **John Callomon** (UCL) described a new and prolific ammonite locality from the Middle Jurassic of Greenland, before **Liz Harper** (Cambridge) began hunting the killer octopus. Before I review Liz's talk, I feel it is necessary to sort out a question that has been troubling me a lot in recent times, the question being 'What is the plural of octopus?' In a recent pub quiz, my team was asked that very question, and I confidently answered 'octopuses' since I had been perusing *The Variety Of Life* by Colin Tudge that very afternoon, and read, on page 225, the following declaration:

"On a note of pedantry, the *pus* in 'octopus' is Greek, not Latin: and the anglicized plural is therefore '-puses' and not '-pi'."

Well, of course, the quizmaster disagreed and informed all and sundry that the correct plural is 'octopi'. That was it, I had to know one way or the other who was right. After literally minutes of painstaking research, I can now say with certainty that I'm still not absolutely certain. However, I chanced upon a Web site devoted to all things cephalopod-related, at:

<http://www.dal.ca/~ceph/TCP/>

and it suggested this explanation:

"The word 'octopus' is derived from Greek 'oktopous', which is formed from 'okto' meaning 'eight' and 'pous' meaning 'foot.' The *Greek* plural of 'pous' is (roughly) 'podes' and we see this form in such English words as podiatrist. (The real Greek root or combining form is really 'pod-' IOW.) Thus the *Greek* plural of 'octopus' is 'octopodes.' This is the 'correct' English plural if you want to be pedantic and think that English should adopt plurals along with words adopted from other languages (as Hebrew 'seraphim' as a plural for 'seraph'). 'Octopi' is all wrong: it mistakes the -us ending for a *Latin* termination and the word isn't derived from Latin at all...Personally I prefer the plain English 'octopuses' formed according to the normal rules for plurals in English."

So there you go. And don't say I never do anything of scientific use.

Octopuses are, not surprisingly, very poorly known from the fossil record, but Liz enlightened us by demonstrating that their presence can be inferred from drill-holes made in shells. Modern Octopoda use this approach to inject toxins into prey, and may drill numerous holes in very precise locations on the shell (e.g. around the adductor muscles of bivalves). Liz's engrossing talk showed that the octopuses have employed drilling since at least the Albian.



The session's seventh speaker was **Walter Christensen** (Copenhagen) who examined the microevolutionary patterns of Belemnitella in the middle Campanian of North-West Germany, before a half-hour break, which allowed various slackers to grace us with their belated presence.

Session 6

Lesley Cherns (Cardiff) began the session, comparing the fauna of an inshore-offshore carbonate succession near Bridgend. The shallow water limestones contained molluscs that were initially preserved as aragonite, being changed to calcite during diagenesis, whereas the deeper-water aragonitic forms were dissolved early, leaving only calcitic or bi-mineralic species. The absence of aragonitic forms in the offshore facies is only revealed by occasional silicified beds where specimens are preserved.

It is easy to make an interesting topic dull, but somewhat harder to make an apparently uninteresting one come to life. **Bob Henderson** (James Cook University) showed it to be possible with an exuberant performance in explaining why coquinas of *Inoceramus* are found in association with oil shales in the Cretaceous of East Australia. Beginning with a memorable introduction ("my slides are monochromatic, but I intend to make up for it by using colourful language"), Bob explained that the dinner plate-sized bivalves had specialized to live on the soft muds in oxygen-deficient conditions, probably feeding on nutrients disturbed from the organic-rich substrate.

It seemed greedy to ask for three engrossing presentations in a row, but after initial trouble with a temperamental computer, **Mark Sutton** (Oxford) picked up where he left off in last year's President's Prize-winning talk. Twelve months ago, Mark had partially reconstructed a soft-bodied worm-like animal from the Wenlock of Herefordshire. Now he returned with a simply amazing, complete, 3-d model of 'spiny worm' (or 'Spiny Norman' as I wanted to call it, recalling a giant cartoon hedgehog in a Monty Python sketch) which turns out to have stronger affinity with chitons and aplacophorans, notably in its spines, posterior plate arrangement and absence of foot.

Next, **John Hudson** (Leicester) used strontium isotopes preserved in *Praemytilus* shells to calculate palaeosalinity in the Jurassic Great Estuarine Series of the Inner Hebrides. Most water in the basin was fresh, with isotopic variations controlled by evaporation, but there had to have been a sea connection. **Peter Skelton** (Open University) spoke on the architecture of Cretaceous carbonate platforms and their episodic development. Rudists were abundant, sometimes forming vast meadows, up to 40km wide, but only tens of centimetres thick, where they were preserved in life position. Session chairman Steve Donovan pounced, and it was time for **Sara Marcus** (Kansas) to re-examine the ontogeny of Palaeozoic camerata crinoids. Some juvenile specimens assigned to *Synbathocrinus* and *Cyrtocrinus* were reinterpreted as micro-crinoids of allagecrinoid affinity, thus extending the range of the superfamily. However, the ontogenetic series is not clear, and crinoid phylogeny remains problematic.

Session 7

I must confess I found much of the penultimate session difficult to get enthused by, but this was more a product of my limited sphere of palaeontological knowledge, twinned with sleep deprivation, than a lack of quality talks. In fact, the opening discourse from **Joe Botting**

(Cambridge) on the nature of chitinozoans, with reference to possible chitinozoan animals from the Ordovician of mid-Wales, was an eye-opener. Helical chains and organic sheaths – were they pseudocoelomate worms? I trust Joe will keep us abreast of developments.

Bill Austin (St. Andrews) examined benthic foraminifera to test whether they were better palaeoenvironmental indicators than organic carbon, **Andreas Maas** (Ulm) looked at soft-part preservation of Cambrian phosphatocopinids, **Gary Mullins** (Leicester) correlated chitinozoan and graptolite biozones in the Llandovery-Wenlock, and **Gareth Dyke** (American Museum of Natural History) tried to work out exactly how many waterfowl taxa there were in the London Clay.

To complete the session, **Ian Jenkins** (Bristol) and **Jenny Clack** (Cambridge) took a close inspection of the skulls of early tetrapods. Since there is a Ph.D. student in my research group working on such beasts, I am clearly not the man to review the two talks, but Ian assessed the functional significance of the cranial biomechanics of synapsids – they must have eaten more like cats than dogs – and Jenny showed that Devonian tetrapod skulls were massively over-engineered, giving them great biting strength.

Session 8

A proportion of the audience sneaked off in the interval, like football supporters leaving for the car-park with five minutes remaining, and missed the palaeontological equivalent of an injury-time winner, as in many ways the final session was the most interesting. **Phil Donoghue** later described to me as 'rubbish' his talk on thelodont phylogeny and I shall not argue with the newsletter editor, even if I strongly disagree. Either way, the excellence of **Mark Purnell**'s follow-up was unquestionable. Dazzling SEM pictures, entertaining overheads and a pair of giant green gloves to show how the heterostracan mouth worked made me want to call the BBC and say "scrap the next series of 'Walking With Dinosaurs', let this man present 'Eating With Ecterostracans' now!" Sadly, I can't see them paying me any attention.

Thijs Vandenbroucke (Ghent) gave the afternoon's third chitinozoan talk, this time using Girvan specimens to divide the Ordovician biostratigraphically and to calibrate with Silurian graptolite biozones, followed by **Hannah O'Regan** (Liverpool John Moores) and some rather large Pleistocene felines. *Acinonyx*, an over-sized cheetah, vanishes then reappears in Europe during the Pleistocene and may have been out-competed by *Homotherium*, a sabre-toothed lion, in similar fashion to modern lions and cheetahs.

Remaining in the Pleistocene, and indeed with Liverpool John Moores, **Sally Reynolds** gave an absorbing account of South African cave deposits. Lincoln Cave, part of the Sterkfontein cave system, shows three sedimentary horizons (breccia between two flowstones) containing hominid artefacts and fossils, along with many other mammalian remains. There is a major discrepancy in age between the artefacts and many of the fossils, interpreted as strong evidence for cycles of deposition, erosion and re-deposition within the cave system.

Having begun PalAss with a smattering of controversy, it seemed appropriate to end in similar vein, as **Michael Gudo** (Frankfurt) ambitiously tried to discuss the changes in engineering involved in the Bauplan transformations of metazoans, as a path towards explaining the evolution of animals. Fifteen minutes wasn't really long enough to cover fifteen hundred million years.



And that was about it. Our esteemed leader gave his closing remarks, noting the ever-improving quality of talks and posters, a sentiment with which I wholeheartedly concur. The President's Prize for best presentation went to Jo Snell, with commendations for Lesley Rantell and Sally Reynolds, and the Council Poster Prize was awarded to Jodie Howe (Leeds). The panel also gave special mentions to Ludovic Stricanne, Thomas Servais (Villeneuve d'Ascq) and Jean-Marc Mussard (Perpignan) for their poster on Cambro-Ordovician acritarchs, Chris Little (Leeds) for his on filamentous microfossils in hydrothermal jaspers, and yours truly for some strange Silurian starfish. I confess that I failed to peruse the posters as closely as I might have, but I cannot now question the Council's choices. I wouldn't have liked to select the winners myself, though, such was the consistently high quality on display.

This was only my second PalAss, but the consensus suggested that this was just about the best, which gives great credit to Vicen Carrio-Lluesma, Euan Clarkson, Mark Dean and the rest of the organizing team. My only quibbles would be the jumbled page order in the abstract volume, and the lack of time available for questioning after talks, but with so many positives I don't wish to dwell on a couple of negatives. Anyone out there who failed to make it to Edinburgh missed out on a cracker - better make sure you can get to Copenhagen in twelve months' time.

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The 24th Annual Field Museum Symposium. Historical Patterns of Biodiversity: A Memorial Symposium in Honor of J. John Sepkoski, Jr. The Field Museum, Chicago 7th October 2000

This latest Annual Field Museum Symposium was run as a tribute to the late Jack Sepkoski, who died suddenly in May 1999. Peter Wagner and Scott Lidgard of the Field Museum of Natural History, Chicago did most of the organizational work. Many thanks go to them for putting together an excellent symposium. They did an excellent job of packing the programme with speakers whose talks balanced paying homage to Jack's seminal work (the "Three Evolutionary Faunas" curve was much in evidence), with fine presentations on the exciting new directions that their own research is moving in. John Flynn (Field Museum of Natural History) opened the meeting with a short summary of the contributions that Jack Sepkoski had made during his short, yet stellar, career to the understanding and quantification of biodiversity.

Arnold Miller (University of Cincinnati) and Sean Connolly (James Cook University) on their study investigating the influence of substrate types in shaping the diversification patterns of the Ordovician Radiation, using data that included spatial and palaeoenvironmental information. They drew special attention to the rise in prominence of articulate brachiopods in the Mid and Upper Ordovician, which they related to the preference of a particularly diverse subclade for siliciclastic substrates during a period when there was an increased influx of siliciclastic sediments. This was an excellent demonstration of the power of palaeogeographic and palaeoecological data to increase our understanding of global diversity patterns.

Mark Patzkowsky (Penn State University) continued the Ordovician theme with a presentation on his use of articulate brachiopod community data to test the concept that the Palaeozoic Plateau was a biological response to the increased occupation of global ecospace. Mark looked at both the structure of articulate brachiopod communities and their global diversity patterns. The analysis indicated that local communities were saturated by the Late Ordovician. However, the lack of a steady rise in regional diversity contradicted the hypothesis of ecospace saturation. He concluded that local diversity was controlled by regional diversity. No strong support for biotic factors driving the structuring of communities during the Ordovician Radiation and the Palaeozoic Plateau was found.

Kaustuv Roy (University of California, San Diego), James Valentine (University of California, Berkeley), and David Jablonski (University of Chicago) detailed their progress on trying to resolve the problem of the latitudinal gradient in species diversity. They presented an update on their ongoing attempts to use spatial and palaeobiological data on marine molluscs to understand the interaction of biotic and physical factors on determining the latitudinal range of marine molluscs.

John Huelsenbeck (University of Rochester) discussed his efforts to reconcile the estimates of evolutionary rates based upon molecular and palaeontological data. John noted the problems inherent in both methods, and then tried to resolve the problem of estimating lineage divergence times by using a Bayesian approach, which used the two lines of evidence in a complimentary fashion to improve estimates of divergence times.

Sean Nee (University of Edinburgh) spoke about the assumptions used in the modelling of clade divergence in molecular and palaeontological systematics. By comparing the resulting molecular and anatomical phylogenies of primates and salamanders, and using more theoretical examples, he presented a clear discussion on how to fuse these two lines of evidence together.

Susana Magallon and Michael Sanderson (University of California, Davis) presented their work on the relationship between the age and species diversity of angiosperm clades. They determined analytically the range of possible diversities for the angiosperm clades, then compared these predictions to the observed diversities. They found that the species diversity of angiosperms was very different from the analytically expected distribution. They closed on their future plans to use this information to test putative traits that have been proposed as causes of rapid diversification in angiosperms.

John Alroy (National Center for Ecological Analysis and Synthesis) talked about his work on testing Sepkoski's "Three Evolutionary Faunas" hypothesis, an icon that appeared in so many of the talks at the meeting. Sepkoski's genus-level database and John's own North American mammal database were analyzed. John noted that both data sets showed a decrease in the volatility of rates towards the present. Among the mammals the change was attributed to the removal of Paleogene "archaic" taxa. The pattern from analysis of the genus-level compendium was a complex one. The outcome was that the evolutionary faunas did not behave as coherent units but were behaving as individual groups decoupled from the other elements of their evolutionary fauna, contrary to what Sepkoski's "Three Evolutionary Faunas" hypothesis predicts.



Roy Plotnick (University of Illinois at Chicago) spoke on the use of fractals to characterize and analyze patterns from the fossil record. He provided a comprehensive and useful review of how non-linear models have been used to analyze various data sets. The second part of his talk concentrated upon the process-based models used to explain palaeontological patterns, and explored the validity of the assumptions of these models.

Scott Lidgrad (Field Museum of Natural History) made a presentation on his continuing work on the role of competitive displacement in shaping diversity in the fossil record. He demonstrated that most of our understanding of competition in the fossil record is based on large-scale interactions at higher taxonomic levels. He questioned the validity of using higher taxa, and drew attention to the assumptions of such models. A comparison was made with ecological studies of competition, which tend to focus on abundance and the population-level. The conclusion was that palaeontologists should make more of an effort to utilize ecological methodology, and be more cautious in inferring competition from taxonomic diversity patterns at higher taxonomic levels.

Todd Grantham (College of Charleston), a philosopher of biology, was an interesting addition to the symposium. He discussed some of the philosophical issues raised by the debate about the use of paraphyletic taxa in Sepkoski's "taxic" palaeontology. Todd offered some tests for deciding whether lineages are "real". On these grounds some paraphyletic taxa are real, but many are not. Todd indicated that he thought this undermined Sepkoski's approach. The other question that was addressed was the reliability of inferring species-level diversity from higher taxa. His conclusion was that paraphyletic groupings can outperform cladistics in inferring diversity, there is no theoretical understanding of how and why the use of paraphyletic taxa produces this better performance.

Charles Marshall (Harvard University) was unfortunately unable to present his paper in person, so John Alroy gamely stepped in to discuss the development of a database of marine faunal lists by the Phanerozoic Marine Diversity Working Group of the National Center for Ecological Analysis and Synthesis (NCEAS). The resulting Palaeobiology Database is located at

<http://www.nceas.ucsb.edu/public/pmpd/>

and is well worth a visit. The practicalities and challenges of building a database for both



Jack Sepkoski



public access and on-line entry of data were outlined. A hint of the potential fruits of this labour was given in a discussion of the comparison between Sepkoski's curve of Phanerozoic marine diversity with the Palaeobiology Database curve showed some similarities. The points of conflict between the curves were viewed as a means of exploring sampling issues. The database is a fantastic resource for palaeontologists, and we should all try to support this project.

Anna Behrensmeyer (National Museum of Natural History, Smithsonian Institution) and **Susan Kidwell** (University of Chicago) considered the possibility that there may be a succession of recognizable "taphonomic domains" within the Phanerozoic which would be the largest-scale units for understanding taphonomic biases. These units were envisioned as spanning periods of >10 M.y., and extending across provincial and global spatial scales. This concept was presented as a means of understanding how variations in the biotic and abiotic processes at the global-scale have influenced preservation potential throughout the Phanerozoic, and as a means for evaluating the relative effects of taphonomic processes on our understanding and interpretation of the fossil record.

Peter Wagner (Field Museum of Natural History) dealt with the evolutionary rates of soft parts among gastropods. Palaeontological analyses had determined that the most rapid rates of shell evolution were found among the Late Cambrian-Early Ordovician snails. The subsequent decline in the rate of morphological evolution was mainly among characters related to soft anatomy. By combining data and phylogenies relating to extant snails with palaeontological and stratigraphic information Peter established that most of the morphospace occupied by extant forms was established before the close of the Paleozoic. Likelihood tests of different evolutionary rates found that a four-rate model with two periods of rapid morphological evolution, interspersed with two periods of background rates best fit these observations.

I hope I have managed to convey the breadth of the talks presented at the symposium, and the timeliness of many of the questions the speakers sought to address. Anyone interested in particular talks can find the meeting abstracts at:

[<http://pjw3.fmnh.org/SepkoskiSymposium/MainPage.html>](http://pjw3.fmnh.org/SepkoskiSymposium/MainPage.html)

I extend my congratulations to the speakers for providing a very stimulating series of talks. Much credit is due to Peter Wagner and Scott Lidgrad, and all of the other Field Museum personnel who were involved, for organizing the meeting and taking care of the needs of the speakers and delegates, and to the Field Museum of Natural History for hosting the event.

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>>Future Meetings of Other Bodies



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).

Further details can be obtained from <<http://www.oum.ox.ac.uk/wwwcirc3.htm>>



**Mid-Palaeozoic bio- and geodynamics:
The North Gondwana – Laurussia interaction
15th International Senckenberg Conference**
Frankfurt am Main 11 – 21 May 2001

A joint meeting of the 'International Geological Correlation Programme (IGCP) 421' and the 'Subcommission on Devonian Stratigraphy (SDS)' hosted by the 'Senckenbergische Naturforschende Gesellschaft' (SNG), Frankfurt am Main, will take place at the 'Forschungsinstitut und Naturmuseum Senckenberg' in Frankfurt am Main (Germany), 15–17 May. In addition to the technical sessions, there will be two pre-symposium field trips and one post-symposium field trip. Field trips prior to the lectures will go to the Belgian Ardennes, 11–12 May, and to the Rheinisches Schiefergebirge, 13–14 May. After the technical sessions in Frankfurt, a field trip will go to the Thüringisches Schiefergebirge (18–19 May), and to the Barrandian area of the Czech Republic (20–21 May). During these trips, a broad variety of rocks generated in different facies inter-tidal to pelagic will be visited – mainly Devonian, but also Carboniferous, Silurian, and Ordovician. A session of the IGCP 421 will be held in the morning of 17th May, and a meeting of the SDS will take place in the afternoon of 16th May.

Conference registration will be open starting from the afternoon of 14th May at the 'Naturmuseum Senckenberg', 2nd floor, room number 209 and the 'Icebreaker Party' is scheduled for that evening, beginning at 7.00 p.m. in the 'Dinosaur Hall'. A welcome party by the city of Frankfurt and by the 'Senckenbergische Naturforschende Gesellschaft' will take place in the evening of 15th May. Those participants who want to see specific Senckenberg collections are asked for early information prior to the conference. Please note that late requests, i.e. during the conference, can not be considered. Climate during the German Spring in Frankfurt and in the areas of excursions may be temperate (about 20°C), but cooler conditions – including rain showers – must be considered.

The 3rd circular with the final program will be distributed to those participants who will reply to the 2nd circular and who will have paid the fees in March, 2001. Please find a link to all forthcoming information via the Senckenberg home page:

<<http://www.senckenberg.uni-frankfurt.de/fis/sngc15.htm>>

WOGOGOB-2001

Øresund Region, Denmark 16 – 20 May 2001

Geological Museum, Copenhagen, Denmark; Geological Survey of Denmark and Greenland, Copenhagen, Denmark; and Department of Geology, University of Lund, Lund, Sweden

This is our first invitation to participate in the WOGOGOB-2001 meeting in Copenhagen and the succeeding field excursion in the vicinity of Lund, Sweden. This first circular gives general information and aims to obtain an estimate of the approximate number of Ordovician workers who wish to participate.

The WOGOGOB meetings traditionally focus on the geology of the Baltoscandic area; however, non-Baltic and non-European Ordovician workers are always very welcome to participate in both the meeting and the field excursion.

The WOGOGOB-2001 meeting will be held in Copenhagen from 16th May (evening) to 18th May 2001, followed by a post-meeting field trip from Lund on the 19th and 20th.

Programme: Presentations. Two days will be allocated to talks and posters on any of the following areas of Ordovician geology: stratigraphy and palaeontology; biodiversity changes in the Ordovician of Baltoscandia; sedimentology, sea-level changes and sequence stratigraphy; palaeobiogeography, tectonics and related subjects are also invited.

Programme: Post-meeting field trips. The technical sessions will be followed by post-meeting field trips, which will take place from Lund, Sweden. 19th May: Österlen, Scanian stratigraphy and palaeontology of Ordovician rocks in the Komstad and Simrishamn areas. Principal leader K. Larsson; day trip from Lund. 20th May: Lower to Upper Ordovician stratigraphy and palaeontology, sections at Fågelsång will be visited. Fågelsång is a GSSP candidate for the base of the international Caradoc or Upper Ordovician Series. Principal leaders K. Larsson and C. Pålsson; half-day trip from Lund. The afternoon will be spent at the Institute of Lund, where type material and collections at the Institute including core material from shallow wells in Scania will be on display.

Note: If there is sufficient interest from the contributors, a volume of papers, or a thematic set in an international journal, from the meeting will be published.

Dates and preliminary programme. The evening of 16th May will include registration and a welcome reception at the Geological Museum, Copenhagen. Talks will take place at the Museum on the 17th and 18th, and each will last 20 minutes including questions and change-overs. If there is a high demand then talks may be cut to 15 minutes to avoid parallel sessions.

Posters will be on display during the two days of technical sessions.

Cores of shallow wells and selected deep wells, covering parts of the lower Palaeozoic succession of Denmark and Scania, Sweden, including Ordovician strata, will be on display at the Geological Museum during the meeting.

All the lectures and poster presentations will be given in the main lecture hall at the Geological Museum, where there are adjacent display and presentation facilities.

On the 17th the Conference Dinner, preceded by a wine-beer reception, will be held at the Geological Museum.

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In the late afternoon of the 18th all participants for the field trips will travel to Lund from Copenhagen (travel time about 40 minutes).

Accommodation. The Geological Museum <<http://www.geological-museum.dk/>> is situated a couple of kilometres from the City Hall in Copenhagen on both bus and S-train routes. Car parking is available at the Museum and at the nearby Geological Institute. More details about Copenhagen are to be found on the 'Wonderful Copenhagen' Web page at <<http://www.woco.dk>>.

A limited amount of accommodation will be reserved in relatively low cost single and double bedrooms: current quoted rates are approximately DKK 445 for a single room and DKK 550 for a double room. Breakfast at the hotel is 75 DKK. A limited amount of Hostel accommodation (students) may be arranged at low rates if available.

Higher quality hotels and bedrooms or a wider range of accommodation are available at higher costs but should be arranged individually through a travel agency or may be booked at this Web site <<http://www.visitcopenhagen.dk/>>.

More details and accommodation forms will be sent to all who respond to this circular.

Registration. Fee: Industry/academics DKK 500; Students DKK 200; Field excursion SEK 300
The price includes the abstract volume, field guide, lunch, and coffee/tea.

Organisers. **Svend Stouge**, Geological Survey of Denmark and Greenland, Thoravej 8, DK-2400 Copenhagen NV, Denmark; **David A.T. Harper**, Geological Museum, University of Copenhagen, Øster Voldgade 5-7, DK-1350 Copenhagen K, Denmark; **Kent Larsson**, Department of Geology, Division of Historical Geology and Palaeontology, University of Lund, Sölvegatan 13, SE-223 62 Lund, Sweden.



GAC/MAC 2001

St. John's, Newfoundland, Canada 27 – 30 May 2001

The Geological Association of Canada/Mineralogical Association of Canada will launch the new Millennium by holding their Joint Annual Meeting in St. John's, Newfoundland, Canada, North America's oldest city. It lies at the eastern extremity of the North American Craton, facing the Atlantic Ocean. Visiting scientists will appreciate the St. John's trans-Atlantic link to exotic Gondwanaland and the trans-Appalachian link to the ancient Canadian shield of Laurentia. Four symposia and twenty special sessions are being organised including palaeontological-directed special sessions on the IUGS sponsored, Late Neoproterozoic evolution of the Earth and Life, and Recent Developments in Early Palaeozoic Stratigraphic palaeontology of the North Atlantic Borderlands, Appalachian-Caledonide Orogen. Further details and registration information can be found at the conference Web site at <<http://www.geosurv.gov.nf.ca/stjohns2001/>>.

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Earth Systems and Processes Conference
Edinburgh, Scotland 24-28 June 2001

A theme session (no. T6) entitled 'Controls on Phanerozoic diversifications and extinctions: long-term interactions between the physical and biotic realms' is being organized by Norm MacLeod and Andy Knoll for the upcoming Earth Systems and Processes Conference, 24-28 June 2001, Edinburgh International Conference Centre, Edinburgh, Scotland (sponsored by the Geological Society of America and the Geological Society of London). Details of the meeting can be found at <<http://www.geosociety.org/meetings/edinburgh/index.htm>>.

Details about the theme session can be found at <<http://www.geosociety.org/meetings/edinburgh/themeses.htm>>.

This interdisciplinary topic is of perennial interest to all geologists and particularly to palaeontologists. If you have any questions about the theme session please contact Norm MacLeod <N.MacLeod@nhm.ac.uk>.



North American Paleontological Convention 2001 (NAPC 7)

UC Museum of Paleontology, Berkeley, California 26 June – 1 July 2001

NAPC 2001 continues a tradition begun in 1969 at Chicago and continued at five other sites since then. NAPC 2001 is the seventh meeting of North American paleontologists. In addition to our Mexican, Canadian, and American colleagues, we also welcome those from other countries. Sponsored by ANAPS, the Association of North American Paleontological Societies, and hosted by the Museum of Paleontology of the University of California at Berkeley, NAPC 2001 will be held in the beautiful San Francisco Bay area of northern California. The meeting will be organized into theme and volunteer sessions with workshops, field trips, special programmes for K-16 educators, tourist excursions, and programmes for the general public planned to complement the meeting.

As we enter a new Millennium the Organizing Committee anticipates a lively discussion on the role of paleontology in the future as well as reflections on past accomplishments. We are especially interested in the importance of integrative approaches that use multiple lines of evidence to test hypotheses and solve complex problems in the history of life, that apply paleontological information to other fields, and that use methods and data from other fields to answer questions in paleontology.

Further details are at <<http://www.ucmp.berkeley.edu/napc/general.html>>



6th International Congress of Vertebrate Morphology

University of Jena, Germany 21 – 26 July 2001

The congress will be hosted by the Institut für Spezielle Zoologie und Evolutionsbiologie in the new convention centre of the Friedrich-Schiller-Universität in Jena, Germany. The congress is



designed to make the most current research available to the international community of vertebrate morphologists, and to provide a basis for a synthesis between vertebrate morphology and other fields of biology. The scientific program of ICVM-6 includes ten half-day sessions with a variety of symposia and workshops, contributed oral and poster papers, and a plenary lecture by a distinguished scientist each day. In addition, the congress offers opportunities to present films, wet labs, imaging and computing facilities, and other demonstrations. A number of cultural events, excursions, and pre- and post-congress tours will be organised that introduce you to outstanding historical and cultural sites in the region, to the natural habitats around Jena, and to the internationally recognised centres of optical industry in Jena.

The second circular is available from <<http://icvm-6.zoo.uni-jena.de/>>.



Recent Advances in studies on Elephants and other Proboscideans

Sun City, South Africa 12 – 17 August 2001

This symposium is planned during the 8th International Theriological Congress (ITC); the co-organizers are Jeheskel Shoshani <hezy@eol.com.er>, William J. Sanders <wsanders@umich.edu>, and Pascal Tassy <ptassy@mnhn.fr>. Please write to any of us as soon as possible with your topic/title on evolution, ecology, and conservation of proboscideans to allow us to plan this symposium expeditiously. Selection of participants will be based on a diversity of topics and on a first-come, first-served basis. Oral presentation are limited; posters are welcome. Abstracts are due by the end of February 2001.

The registration form is available at <<http://www.eventdynamics.co.za/itc/>>. Otherwise, please contact Dana Plotz or Sandra Collier, Event Dynamics, PO Box 98009, Sloane Park, South Africa 2152; Telephone: 27 11 706 5010; Fax: 27 11 463 7195; e-mail <dana@eventdynamics.co.za>, Web <<http://www.eventdynamics.co.za/>>.



Third International Meeting on Mesozoic Fishes

Serpiano, Switzerland August 2001

Systematics, Palaeoenvironments and Biodiversity

We are pleased to host the third international meeting on Mesozoic Fishes in one of the most famous sites for these fossils, the Monte San Giorgio-Besano area. The organization of the meeting is supported by the Dipartimento di Scienze della Terra of the Milano University (Andrea Tintori), the Museo Cantonale di Storia Naturale in Lugano (Markus Felber), and the Palaeontologisches Institut und Museum der Universitaet Zuerich (Heinz Furrer).

Prof. Andrea Tintori, Dip. Scienze della Terra, Università degli Studi di Milano, Via Mangiagalli, 34 I-20133 MILANO, tel: +39.02.23698202, fax: +39.02.70638261, e-mail: <andrea.tintori@unimi.it>.



8th Congress of the European Society for Evolutionary Biology

Aarhus, Denmark 20 – 26 August 2001

The eighth Congress of the European Society for Evolutionary Biology will be held in Aarhus, Denmark, from 20th to 26th August 2001. The structure of the Congress will be similar to previous meetings, each day starting with a plenary keynote speaker, followed by parallel symposia. Besides, there will also be a few contributed paper sessions. The Congress will cover the field of evolutionary biology in a wide sense but with emphasis on processes and mechanisms of evolutionary phenomena.

Details are at <<http://www.biology.au.dk/eseb/>>.



Spore-Pollen Subcommission of the Commission Internationale du Microflore du Paleozoique

Cork, Ireland 3 – 7 September 2001

The first meeting of the Spore-Pollen Subcommission of the Commission Internationale du Microflore du Paleozoique (CIMP) will take place at University College Cork, Cork, Ireland in September, 2001.

The conference itself is from 3rd to 5th September, 2001, inclusive, and is followed by a field excursion to South Waterford and South Wexford, on the 6th and 7th, to examine Cambro-Ordovician and Devonian-Carboniferous sections.

University accommodation will be available in the Castlewhite Apartment Complex at a cost of IR£24 for single room and continental breakfast (per day). There is plenty of other accommodation close to UCC: a list will be provided so that participants may book their own if they wish. Approximate costs are, for Guest Houses, IR£35 B&B per day, and Hotels from IR£50 to £100 B&B per day.

The approximate cost of the field excursion is IR£50, which will include return travel by coach to South Wexford along with accommodation, evening meal and breakfast in Fethard on Sea, Co Wexford.

The deadline for submission of titles of presentations (oral or poster) is 1st April 2001, and the deadline for abstracts for presentations is 1st May 2001.

Please submit expressions of interest and/or titles for presentations in the first instance to Duncan McLean <d.mclean@sheffield.ac.uk>.



Systematics 2001

London 3 – 7 September 2001

The biennial conferences of the Systematics Association are intended to provide a forum for systematists from different disciplines to present and discuss their research. The Third Biennial Conference, to be held at Imperial College, London, will continue in the spirit of



previous meetings by providing a mixture of open and focused thematic sessions. The organisers are keen to stress that the conference is open to everyone, and especially research students and younger post-doctoral fellows, whatever their chosen subject.

Thematic sessions currently under preparation include "*Milestones in Systematics*" (Organisers: Peter Forey & David Williams), "*Telling the evolutionary time: molecular clocks and the fossil record*", (Organisers: Philip Donoghue & Paul Smith), "*From macro to micro: the challenge of soil biodiversity*" (Organiser: Paul Eggleton), and "*Organelles, Genomes and Eukaryote Phylogeny*" (Organisers: Robert Hirt & David Horner). However, please remember that contributions can be on any topic whether submitted as talks or posters. Substantial prizes in the form of book tokens will be awarded to the best talk and poster by a student at the conference.

Conference organising committee: Gordon Curry (Treasurer of the Society, University of Glasgow), Peter Forey (The NHM, London), Julie Hawkins (University of Reading), Chris Humphries (Chairman of the Organising Committee, The NHM, London), Paul Kenrick (The NHM, London), Andrew Milner (Birkbeck, University of London), Russell Seymour (The Institute of Zoology, London), and David Williams (The NHM, London).

Timetable

Monday 3 September 2001

14.00-17.30 Registration – Mechanical Engineering Concourse, Level 2, Booking into accommodation at Linstead Hall.

Tuesday 4 September 2001

8.30-9.30 Welcome tea, coffee

9.30-17.30 Scientific presentations, including "Milestones"

19.00-21.00 Evening Reception at the Linnean Society of London (to be agreed and finalised)

Wednesday 5 September 2001

9.30-16.00 Scientific presentations, including "*From macro to micro: the challenge of soil biodiversity*" and "*Telling the evolutionary time: molecular clocks and the fossil record*"

19.00-21.00 Evening Reception at the Natural History Museum (to be agreed and finalised)

Thursday 6 September 2001

9.30-17.30 Scientific presentations – including contributed papers

19.30 Conference Dinner (Venue to be arranged)

Friday 7 September 2001

9.00-12.00 Closing Scientific presentations – including "*Organelles, Genomes and Eukaryote Phylogeny*"

12.00 Award presentations

12.15 Concluding Remarks and Departure

Contact

For more information including registration and booking details see <<http://systass.org/biennial2001/>>, or e-mail <systematics.association@nhm.ac.uk>, or fax +44 (0)20-7942-5529.



The 49th Symposium of Vertebrate Palaeontology and Comparative Anatomy (SVPVA) and the 10th Symposium of Palaeontological Preparation and Conservation (SPPC)
The Yorkshire Museum, York 3 – 7 September 2001

The SVPVA is from 3rd to 5th September 2001, and the PPC is on the 6th and 7th September. Details and booking form: Jane Clarke, 65 Oakmount Road, Chandler's Ford, Hampshire SO53 2LJ UK (tel 023 8025 2309, Fax 023 8090 4364, e-mail <jane@geoden.demon.co.uk>).



Two hundred years of Pterosaurs: a symposium on the anatomy, evolution, palaeobiology and environments of mesozoic flying reptiles
Toulouse, France 5 – 8 September 2001

This occasion seems a good opportunity to take stock of recent developments in the study of pterosaurs and to discuss current problems concerning this group of extinct vertebrates. The symposium will deal with all aspects of pterosaur palaeontology: anatomy, phylogeny, palaeobiology, ichnology, palaeoecology and the history of pterosaur research. Papers are invited on all these topics, as well as on other extinct flying or gliding reptiles and on the geological environments in which pterosaur remains are found.

Accommodation is available in numerous hotels with a large range of prices (details will be sent in the second circular).

Excursions to: The Late Jurassic 'Pterosaur Beach' at Crayssac (Lot), where both pterosaur footprints and bones have been found. The Esperaza Dinosaur Museum (Aude), which houses remains of Late Cretaceous pterosaur bones, and to nearby pterosaur localities.

Organising committee: Jean-Michel Mazin (Poitiers), Jean-Paul Billon-Bruyat (Poitiers), Eric Buffetaut (Paris), Francis Duranthon (Toulouse), Michel Bilotte (Toulouse).

For more details and the second circular please contact: Jean Michel Mazin, Laboratoire de Géobiologie, Université de Poitiers, 40 avenue du recteur Pineau, F-86022 Poitiers Cedex <jmmazin@univ-poitiers.fr>.



Early Palaeozoic Palaeogeography and Palaeobiogeography of Western Europe and North Africa
Lille 22 – 29 September 2001

After a very successful meeting on the topic *Palaeozoic Palaeogeography and Palaeobiogeography of western Europe*, held at Lille in 1992, the Laboratory of Palaeontology of Lille invites you to participate in and contribute to a conference on early Palaeozoic Palaeogeography which will take place at Lille in September 2001. A pre-conference field trip to visit the Lower Palaeozoic of Belgium and a post-conference field-trip to the southern Montagne Noire (Languedoc, southern France) will be organized.



The conference topics are designed to address various subjects related to the Lower Palaeozoic palaeogeography and palaeobiogeography of western Europe and north Africa, and include:

- 1- The geodynamic and tectonostratigraphic framework of western Europe and north Africa during early Palaeozoic times.
- 2- Relationships between the northwestern Gondwana margin and related terranes (Ossa-Morena, Armorica, Perunica, Avalonia, etc.).
- 3- Palaeomagnetic versus palaeobiogeographical data.
- 4- Biostratigraphic improvements of the Proterozoic-Cambrian transition and the Lower Palaeozoic (Cambrian to Silurian).
- 5- Lower Palaeozoic geochemical anomalies and palaeoclimatology.
- 6- Palaeogeographical controls on biodiversity patterns.
- 7- Volcanoclastic events and geochronological framework.
- 8- Evolutionary trends in early Palaeozoic ecosystems.
- 9- Event stratigraphy and radiation/extinction turnovers.
- 10- Sea-level changes, cyclicity and palaeoenvironments.

Dates:

Conference: (3 days) Université des Sciences et Technologies de Lille, Villeneuve d'Ascq, 24-26 September, 2001.

Pre-conference excursion: (2 days) Lower Palaeozoic of Belgium: 22-23 September, 2001.

Post-conference excursion: (3 days) Lower Palaeozoic of the southern Montagne Noire: 27-29 September, 2001.

Important Dates:

May 2001: deadline for Abstracts and registration

July 2001: third circular, programme and final arrangements

Please send correspondence to: *José Javier Alvaro* or *Thomas Servais*, USTL – Sciences de la Terre, UPRESA 8014 CNRS, Cité Scientifique SN5, F-59655 Villeneuve d'Ascq cedex (France), tel: (+33) (0)3 20 33 72 20, (+33) (0)3 20 33 63 92, fax: (+33) (0)3 20 43 69 00, e-mail: <Jose-Javier.Alvaro@univ-lille1.fr>, <Thomas.Servais@univ-lille1.fr>.



History of Palaeobotany 2001

London, UK 24 October 2001

The Linnean Society's Palaeobotany Specialist Group and the Geological Society's History of Geology Group are organising a joint meeting on The History Of Palaeobotany at the Linnean Society, Burlington House, Piccadilly, London, on Wednesday, 24th October, 2001. Offers of papers have been received to date from Andrew C. Scott, Bill Challoner, Hugh Torrens, Barry Thomas and Christopher J. Cleal. There is still space in the programme for other papers on this subject. Please contact the Convenor, Richard Wilding, 175, Whitton Road, Twickenham, TW2 7QZ (tel 020 8892 3123, e-mail <ricval@lineone.net>).



Taphos 2002 3rd Meeting on Taphonomy and Fossilization
Valencia, Spain 14 – 16 February 2002

The "International Conference Taphos 2002" is a meeting about the problems relating to the formation of the fossil record and its dynamics. This Conference follows the two previous meetings held in Spain on these subjects under the heading "Reunion de Tafonomía y Fossilización" (Madrid, 1990 and Zaragoza, 1996 respectively). The success of the two earlier meetings (with many foreign attendants) has convinced us to give an international character to our forthcoming Conference, and we expect a high level of participation.

The "International Conference Taphos 2002" will be held in Valencia on the 14th, 15th and 16th of February 2002. The meeting will be mainly supported by the "Universidad Internacional Menéndez Pelayo", in collaboration with the "Ayuntamiento de Valencia" and the "Universitat de Valencia".

We propose five broad topics and encourage contributions to them:

- Taphonomy in archaeology
- Taphonomy in analysis of patterns of evolution and extinction
- Taphonomy in biostratigraphy
- Theory of taphonomy
- Taphonomy in other fields: palaeoecology, sedimentology, exceptional preservation, and so on.

The official languages of the Conference are English and Spanish, with simultaneous translation. Oral presentation of contributions can be in Spanish or English.

Three invited lectures of one hour will take place during the Conference. There will also be eight invited talks of half an hour about the suggested topics. Ordinary contributions will be presented as posters in special sessions devoted to them. The text of the posters should be written in English. A chairman will lead each session. Discussion will follow a short presentation of the poster lasting five minutes.

Ordinary contributions will be edited in a special volume with the title "Taphonomy and fossilization" published by the Ayuntamiento de Valencia. This book will be delivered to the participants at the beginning of the Conference. Original manuscripts will include up to a maximum of eight pages of text, with 30 lines per page and 70 characters in each line. In these eight pages you must include figures, tables and bibliography. In a new circular, you will have new instructions about address and sending of manuscripts.

The deadline for sending manuscripts is 15th July, 2001. Manuscripts will be reviewed by two specialists before definitive acceptance.

The price for subscriptions is about 20,000 pts. (\$110/€120); students will pay about 10,000 pts. (\$55/€60).

Correspondence about the Conference has to be addressed to the Secretary of Taphos 2002: Dr Margarita Belinchon, Museu de Ciències Naturals. C/ General Elio, s/n; Jardins del Real, E-46010 Valencia, (SPAIN), e-mail <Taphos2002@paleopolis.rediris.es>.



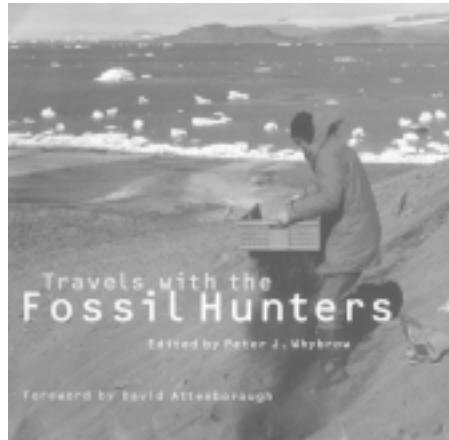
Jurassic Symposium 2002
Sicily 12 – 22 September 2002

The First Circular for the 6th International Symposium on the Jurassic System has been circulated. The Symposium will be held in Sicily from 12th to 22nd September 2002. These dates include pre- and post-Symposium field trips. If you have not received the First Circular (return due by 1st March 2001) you can contact the Symposium Secretary Dr Luca Martire (Torino), e-mail <martire@dst.unito.it>. You can also get further information from the Web site at <<http://www.dst.unito.it/6thISJS/>>.

Book Reviews

Travels with the Fossil Hunters

Whybrow, P. (ed.) 2000. 382 pp. Natural History Museum/ Cambridge University Press, Cambridge. ISBN 052166301 6 (hbk), £19.95



This book is a delight to read, and provides a vicarious peek over the shoulder of palaeontologists in the field, those lucky few individuals whose job it is to explore this planet and discover its ancient and long-extinct denizens. For those of us who are fortunate enough to have made it into this profession, how wonderful it is to break open a rock, and be perhaps the first ever to see some weird and wonderful fossil, whether it is a shell, a cast-off exoskeleton, a leaf, an insect or even a bone. Haven't we all felt a surge of excitement at that moment of discovery? It's all in this

book, which brings a rare opportunity for the interested reader to share these moments of revelation, as well as all the associated emotions such as the anxieties of entering politically troubled regions, and the unplanned bureaucratic and logistic nightmares that are sometimes experienced. Professional palaeontologists may unwittingly have one of the most enviable professions; movie makers have made millions idolizing them in recent years (if only we could cash in!)

That excitement is encapsulated in the foreword by Sir David Attenborough, and continues unabated through the book. Which is perhaps why I wouldn't recommend sitting down and reading it from cover to cover (it would be far too exhausting!). Instead, keep it in an obvious place, next to your comfy armchair perhaps, find some quiet time and savour each chapter for its own sake. It's an adventure book for grown-ups. You can assail Tibet by jeep and horse, hunt dinosaurs in the desert (Sahara or China; you choose) or in the frozen wastes of Antarctica. You can explore the caves of Gibraltar for ancient human bones, dig in Latvian woods for the remains of the earliest limbed vertebrates, and dodge bullets in Sierra Leone, thirsting for fossils while mosquitoes thirst for you. Take a palaeontological passage to India ("do not smoke near explosives"; "do not crimp detonators with your teeth"), or to the disputed Kashmir region to find early human artifacts. Relive the excitement of finding fossilized mammal bones by the hundreds, literally falling out of a Turkish hillside, or explore the Yemen for fossil frogs!



Renowned scientists on staff at the Natural History Museum have written each chapter. The book therefore inevitably focuses on the work at that great institution, and some may view it as an attempt by the Brits to emulate their transatlantic colleagues (a few of whom have certainly succeeded in creating almost star-like images in the public eye!). But so what? These adventures are equally glamorous and appealing to the lay public as some of the glitzy field projects “over here”, and this book is all the better for presenting something different (as somebody said recently here, “haven’t we been dinosaured to death?”). Nothing wrong with dinosaurs (there are some in this book, too), and they have certainly grabbed the public’s attention, and provide an important conduit to funding, exhibition and educational programs linked to palaeontology. But the spirit of adventure is much broader-based in palaeontology, and I bet we all have tales that would be worthy of publication in a book such as this.

John Maisey

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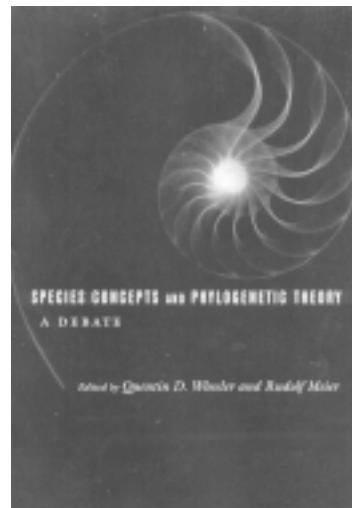
Species concepts and phylogenetic theory: a debate

Q. D. Wheeler & R. Meier (eds) 2000. 230 pp. Columbia University Press, New York. ISBN 0-231-10142-2 (hbk) £37.00; ISBN 0-231-10143-0 (pbk) £15.50.

A rose by any other name (would still be a matter of bitter dispute)

There can be no more contentious issue than what constitutes a species in organismal biology. The debate in its current format is not about facts and figures but about the philosophical underpinning of science. Specifically it is a debate about the relative importance of ontology and epistemology in systematics. This debate goes back a long way but was recently brought into sharp focus by Sober (1988). Sober pointed out that a complete philosophy of science must contain both a theory of causality (ontology) and a method by which we can gain knowledge of that reality (epistemology). So for Linneaus species were the designs of God (ontology) and that plan was discovered through observing the distribution of characters (epistemology). When species transformation began to be accepted by Darwin and others our ontological concept of what a species represents changed but the epistemological framework was left untouched.

In the 1980s the cladistic revolution was in full flow and a diversity of opinion started to emerge separating Hennigian or evolutionary cladists on the one hand from pattern cladists on the other. Pattern cladists were ruthless in stripping out



as much unnecessary theoretical overburden from systematics as possible while Hennigian cladists sought to justify their approach by couching what they were doing in terms of Darwinian ideas and evolutionary theory. Of course all observation is founded on theory and it would be foolish to think of anything being theory-free, but some theory-laden terminology can be avoided by taking a more epistemological approach in systematics. So, for example, a clade can be defined as the latest common ancestor of two terminal species and all its descendants (an ontological definition, since neither ancestry nor descent can be observed directly and have to be inferred from other observations), or as the group of operational terminal units (species) defined as sharing a suite of putative homologous character states (an epistemological definition). Here we distinguish between what we think a clade represents (the evolutionary scenario) from how in practice we gather the information from which to posit the evolutionary scenario. Although pattern cladists are sometimes portrayed as anti-evolutionists, this is not true. Their main goal is to divorce the assimilation of pattern as much as possible from any subsequent theory of process that might be posited to explain the observations.

So much for the background – what is this book all about? Well cladists are not known for being shy and retiring when there is disagreement in the air, and for the past decade there has been a fiercely fought battle between the various factions. Nowhere is the debate brought into sharper focus than in this book, where five different species concepts are brought head to head. The design of the book is superb. In the first five chapters each of the protagonists outlines the basis for their species concept. In the next five chapters they are given free range to point out the weaknesses of their rivals positions. Then finally each replies to the criticisms that have been laid at their door and summarises their stance. Although all contributors profess to use a phylogenetic basis for defining species, the differences are stark and the battle-lines clearly drawn.

Two of the camps promote ontology-driven species concepts while two have strong epistemological leanings. Thus for Meyer a species is entirely conceptual and only makes sense if it is defined in terms of what it represents in theory (a group of potentially interbreeding individuals). There is simply no thought given to how this is recognized operationally (no sea urchin has ever been observed to mate in the wild since reproduction is through spawning and fertilization takes place in the water column). Meier and Willmann promote an alternative ontological viewpoint – that species represent the smallest internal and terminal branches of the tree of life. Fine in theory but again with serious operational problems.

On the other side we have two species concepts that are solidly epistemological in approach, with Mishler and Theriot and Wheeler and Platnick arguing for species being defined by how we recognize them in practice. The primary difference separating these two camps resides in whether species are designated on the basis of phenetic clustering independent of a cladistic phylogeny (Wheeler & Platnick) or whether species only emerge as autapomorphy-based units subsequent to cladistic analysis (Mishler & Theriot).

A fifth proposal from Wiley & Mayden sits uncomfortably somewhere in between and has neither a clearly defined ontological basis (species as lineages – where one theory-laden concept ‘lineage’ is used to define another theory-laden concept ‘species’) nor clearly defined operational rules for how to identify these ‘individual lineage units’.



I enjoyed this book immensely, and it is the perfect format within which to sharpen your own ideas and those of your students. The battle moves back and forth and blood is drawn with more and more ferocity as the book progresses. But the reality is that by the end of the book all camps are just as firmly entrenched as they were at the start. Not one centimetre of ground is given by anyone. But then I also remained fully convinced in the correctness of my preferred species concept over the other four! We need both a theory of what species represent and a means of identifying them in practice – so there are no winners and losers. However, there is also a clear precedence of epistemology over ontology. We have to establish ground rules for how species are recognized in practice before we can tell how well they conform to predictions derived from competing theories of what they represent or how they have arisen. Of course changing the ground rules for how we recognize species might also change the fit in favour of a different theory of what a species represents, but science can only progress if we rigorously maintain a clear distinction and are aware of both sides of the coin. This is the sort of debate that will run and run, and indeed it has already spilled over in the arguments concerning whether nomenclature should follow the system of Linneus (with an epistemological definition of taxa) or the phylocode (where nomenclature is based on evolutionary theory). I can think of no better book where the opposing principles are so clearly laid out for all to see.

Reference

Sober, E. 1988. Reconstructing the past. Cambridge, MA: MIT Press.

Andrew B. Smith

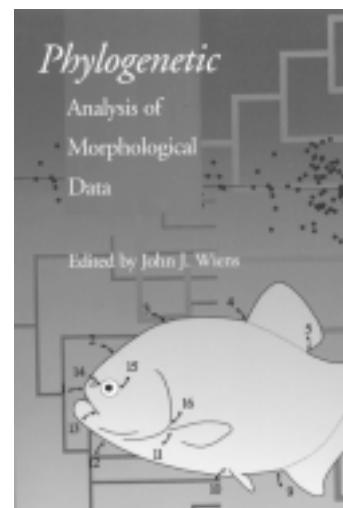
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Phylogenetic analysis of morphological data

Wiens, J.J. (ed.). 2000. 220 pp. Smithsonian Series in Comparative Evolutionary Biology, Washington: Smithsonian Institution Press. ISBN: 156098841X (hbk) £32.95/\$49.95; ISBN 1-56098-816-9 (pbk) £17.95/US\$26.

We've all been there – we've constructed our nice shiny symmetrical Lego model of beautifully integrated bricks: yet we are left with a flotsam of curiously-shaped fragments at the bottom of the box. Somehow they ought to be integrated – yet their very awkwardness defies use. This collection of essays, resulting from a meeting held in Saint Louis, Missouri, in 1996, takes a closer look at the bottom of the character box. While not original (most has been previously published in journal articles) it stimulates us to think more carefully about the data we use to



construct phylogenies and encourages us to incorporate awkward data such as ontogenetic, polymorphic, continuously variable, stratigraphic and morphometric characters.

Readers of this Newsletter are almost exclusively concerned with morphological data in their attempts to discover the phylogenetic relationships of their favourite groups. Morphology has been the bedrock of systematic biology and quite rightly. Morphological variety is limitless (contrary to the statement of Hillis & Wiens, p. 2): the limit is imposed by our inability to articulate such variety into characters. This volume opens up several potentially uncomfortable areas; but in doing so it stimulates thought and not a little reflection. It is very timely because there has been a series of papers in recent systematic literature concerned with ways in which we translate our morphological observations into data that can be used in modern phylogenetic systematics.

The editor of this volume is a morphologist who has been concerned with the fact that most of us simply throw away much morphological data as unusable. As he writes in chapter two, the crime is that reasons are rarely given for this action. Each and every one of us invokes some intuitive filter to sort what we consider a variation and to admit or reject it from our analysis. Rarely is the filter acknowledged and even more rarely is it questioned, never is it cleaned. The most usual kind of data that are filtered out are continuous variables (counts of vertebrae or different shape parameters) because they cause difficulties in coding a continuum as discrete states. But, as this book points out, there are ways of incorporating this data. And as long as the caveats and ways are spelled out, the merits of the analysis can be assessed. Coding is a serious issue because it is often the way observations are coded that causes the mismatch between one phylogenetic analysis and another.

Wiens deals with polymorphic coding and he gives a good theoretical and practical overview of the ways in which authors treat polymorphic coding. Through empirical studies and simulation experiments he concludes that, for parsimony analysis, coding polymorphisms as frequencies of the different states in each of the terminal taxa and applying a step matrix to that character will yield the most accurate result. This is an interesting idea even though it does have the disadvantage that it favours evolution of smaller gaps between frequencies over larger gaps and no biological justification is given for this.

The problem of coping with morphometric data is covered by Zelditch, Swiderski and Fink and is a summary of several papers they have produced over the last few years. Morphometric data is often thrown away as unusable because it is difficult to see how a ratio between parts – say 3:2 – can be homologous to another ratio. But Zelditch and her co-authors are very explicit and they explain that morphologically homologous landmarks must be assumed at the outset. Once these are chosen then warp analysis, using the thin plate spine as a grid, can reveal phylogenetic characters. The method is heavily dependent upon choosing the reference shape (taxon) from which the 'distortions' (warps) are measured and translated to cladistic characters and may be criticised for this. But in my view they are on to something that may open up a wealth of new characters.

The chapter by Huelsenbeck and Rannala is potentially the most interesting for palaeontologists because they tackle the issue of incorporating time (stratigraphic occurrence) into phylogenetic analysis. They discuss the measures of fit of phylogeny to known stratigraphic records. There are a variety of these and all have strengths and weaknesses although they are not usually used to



reject or support theories of relationships. That action is embraced under the schools of stratocladistics and stratolikelihood; it is much more contentious, and forms the substance of this chapter. Stratocladistics is a method which measures the amount of time which must be assumed to have been unrepresented by a fossil record given a particular tree based on morphological evidence. This ‘unrepresented time’ is translated into a character and computed along with all other characters. Similar computations are carried out on other trees, some suboptimal solutions and a choice of the final tree is made on overall parsimony. Thus a morphological suboptimal solution but with a better fit to stratigraphy may turn out to be the preferred solution. There are several objections to this approach including its extreme sensitivity to how finely we divide the stratigraphic column in the first place (Smith 2000). But the most serious is that stratocladistics expects the time character to behave like any other cladistic character: that is, to contain hierarchical information. Time does not.

Stratolikelihood is similar but computationally much more complex because it tries to estimate the fossil ranges from the actual observations we make. But it goes further in that it estimates a maximum likelihood based on the morphological data given certain models of evolution. The final tree is a product of the stratigraphic and morphological likelihoods. Although mathematically elegant there is a severe drawback since as the authors say (p.184) “...the likelihood of the morphological data may often be difficult to calculate due to the lack of an appropriate model describing the evolution of morphological characters.”.

Ontogeny is the subject of Mabee’s chapter. Mabee is not a fan of the biogenetic law (what occurs earlier in ontogeny is taxonomically more general) which is used to polarise characters *a priori*, and spends some time explaining why. Instead she opts for a view of the ontogenetic trajectory as the character with the observations of stages and the states. I recommend Mabee’s chapter – not because I agree – but because she stimulates considerable thought on the concept of homology.

In the last chapter de Queiroz digs back into his doctoral thesis to cover some logical problems. Most workers carry out phylogenetic analysis in order to say something about evolution of characters etc. But the phylogeny is estimated using those characters and this has an uncomfortable ring of ‘reciprocal illumination’ or, less kindly, ‘circularity’. He tries to break the circle – and I will do no more than let you make up your own minds.

Two further chapters may be of less value to readers of this Newsletter but they nevertheless provide a good read. One concerns the problems for recognition of homology raised by hybrids; the other gives a very well balanced account of the principal differences between morphological and molecular data and is excellent student handout material.

All round this is a very good book, well written and edited to a consistent style. Both authors and editor are to be congratulated. And, in the end I think that they have gone some way to trying to use those odd-shaped bricks.

Reference

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Phylogenetic systematics

Willi Hennig. 1999. (Translated by Dwight D. Davis and Rainer Zangerl; foreword by Donn E. Rosen, Gareth Nelson and Colin Patterson), xiii + 263pp. University of Illinois Press. ISBN 0-252-06814-9 (Pbk). US\$35, £23.95.

Science seldom produces classics. The present text, however, has been published, in various forms, six times in the last 50 years:

- 1) In 1950 came the first German version.
- 2) In 1966, the first American edition was published, translated by Dwight Davis and Rainer Zangerl from Hennig's emended German text.
- 3) In 1968, a Spanish translation, by Horstpeter Ulbricht, of the 1950 German version was published in Buenos Aires.
- 4) In 1979 the American translation was reprinted with a foreword by Rosen, Nelson and Patterson.
- 5) In 1982, Paul Parey published the German text on which the American translation had been based.
- 6) And here, published in 1999, we have a reprint of the Davis & Zangerl translation, identical with the 1979 reprint except for being smaller (x94%).

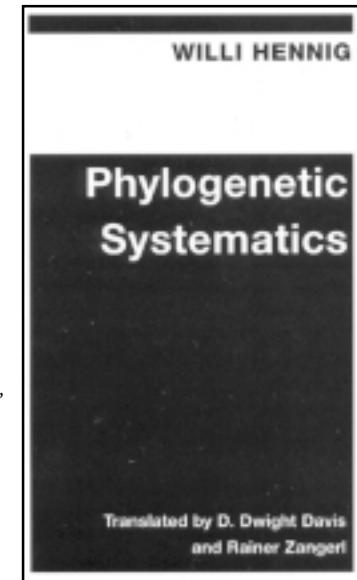
This is a remarkable record for a highly technical book, indicative of its status as the seminal text of late 20th century systematics. A scientific classic this book certainly is.

So this is the text in which Hennig's methodological views were first presented at length to a non-German-speaking readership. His argument is now so widely accepted by systematists that any attempt to repeat it is redundant. The essence is given, however, on pp. 21-23 where Hennig asserts that the best natural system of organisms will be a partition hierarchy based on phylogeny, since all other systems will have direct relationships to this historical, phylogenetic system, but will not usually have direct relationships to each other.

The book's originality is evident merely from its effect on our terminology, since this is the source from which modern systematics takes its usage of such terms as: ‘monophly’ (pp. 72, 90, 146); ‘paraphly’ (p. 146); ‘sister group’ (p. 139); ‘time of origin’ and ‘time of differentiation’ (p.162) for a monophyletic group; ‘synapomorphy’ (p. 89); and ‘symplesiomorphy’ (p. 89).

Hennig's scientific impact is also evident in some opinions of his which are now generally accepted among systematists, but which were radical fifty years ago. For example:

- He contends that higher taxa should be regarded as individuals, in the ontological sense, rather than as classes (p. 200).





- He defines relationship strictly in terms of recency of common ancestry (p. 74), rather than overall morphological resemblance.
- He makes a clear distinction between circular reasoning and reciprocal illumination (p. 21).
- He warns against the facile assumption that an extant group will be, in all or most features, consistently less or consistently more primitive than its extant sister group (p. 194).
- And he rejects the notion that any science can validly be divorced from theory in the name of objectivity.
- Perhaps the greatest of all his insights is the appreciation, evident in almost all the figures, that phylogenetic trees ought to be dichotomous

Some features of present-day cladistics are lacking or almost so. One of these is the name 'cladistics' itself which was invented, with pejorative intent, by Sneath and Sokal (1973). As regards fossils, the 'stem group' is mentioned on p. 213 but not defined and the '*' group' ('crown group') is not even mentioned. These two concepts were first formally defined by Hennig in 1969 (see also Adrian Pont's English translation of 1981). In the present text, however, Hennig seems to be converging on the stem group concept with his distinction between 'time of origin' and 'time of differentiation' for a monophyletic group (p. 162). A surprising feature, for a present-day reader, is that Hennig never mentions parsimony, while the related concept of the outgroup comparison is alluded to only by implication, when Hennig (p. 99) quotes with approval the text of Maslin (1952) with the words: "If one extreme of a morphocline resembles a condition found in the less modified members of related groups of the same rank, this extreme is primitive." In fact, the concept of the outgroup comparison was not originated by Hennig but first made explicit by Watrous and Wheeler (1981).

The least satisfying part of this brilliant book is probably the attempt to tie the categorial rank of a group to the absolute age of that group (p. 183). Indeed, there seems to be no satisfactory way of fixing categorial rank in an objective manner, and the best approach is to abandon it entirely, as Ax recommended (1984, 1987).

The book is not easy to read. Somehow the author gives the impression of struggling with his subject matter, rather than being entirely master of it. (Note, for example, the way in which the fundamental concept of the sister group is introduced, without warning or emphasis, in the middle of a paragraph on p. 139.) To say this is no insult to Hennig, since the struggle was due to depth of penetration and by it the whole field of systematics was revolutionised.

To sum up, this is the seminal text in which nearly all the basic concepts of modern systematics were introduced to an international audience (with the striking exception of parsimony). Despite its age, systematists should still read it, for here is the brain in action which turned systematics into objective science.

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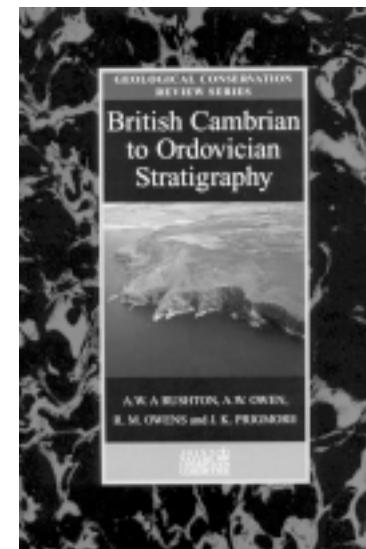
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British Cambrian to Ordovician Stratigraphy

A.W.A. Rushton, A.W. Owen, R.M. Owens & J.K. Prigmore. 2000. 446 pp. Geological Conservation Review Series, Joint Nature Conservation Committee (JNCC). ISBN: 1861074727 (hbk). £75.00.



We need books like *British Cambrian to Ordovician Stratigraphy*, because, though the geological record may be incomplete, it demonstrates how our understanding of the 100 million years or so of history that these two geological systems encompass, has greatly improved.

As the title indicates, the volume is one of the Geological Conservation Review Series. Its overall function is to document, essentially in a monographic form, Cambrian and Ordovician sites of geological importance for the purposes of conservation. Despite this worthy, but perhaps dry remit, the book retains its fluency through the provision of a series of dynamic 'coat-hangers' – early Palaeozoic palaeogeography, the temporal setting, key fossil groups, modern geography – which make it easier to relate to each site description. For this reason the most readable



part of the book is the General Introduction, which covers most of the above themes together with an explanation of the philosophy of the series. The value of this chapter is supplemented by introductory chapters to Cambrian and Ordovician stratigraphy.

The descriptions of individual sites are organized into chapters which relate to their modern geographical distribution and also to the various Lower Palaeozoic terranes that comprise Britain. Thus, the Avalon Terrane of Britain is covered by several chapters dealing with the Cambrian and Ordovician of Wales and England. The four chief Laurentian terranes of Scotland are each given a separate chapter, the Highland Border sub-terrane being discussed with the Grampian Terrane. This format is useful, because, rather than reading through this book from front to back, most people will dip into it at many points, choosing the themes and places most useful to them.

The individual site descriptions are lucid, precise, and plump with detail. They follow a standard pattern for these volumes, comprising introduction, description (often a rich source of palaeontological information), interpretation and conclusion. A good example of one of the sites described is Fuaran Mor in the Hebridean Terrane of northwest Scotland. My only journey to this place is through the words and pictures of this book, but there is enough palaeontological, geographical and bibliographical information (including fossil names and grid references) to get me interested, particularly as there are many lower Cambrian arthropods described from here. Personally, I would have enjoyed a few more historical touches in the introductions to the various sites, because, after all, in many cases it is the characters who discovered them that contribute to their importance.

There is a statement in the note about 'Access to the Countryside' at the beginning of this book which says that it is 'not intended for use as a field guide' (apparently this statement is present in all of these volumes). However, you may feel differently. Amongst its many useful sketch maps of the geology – the majority adapted from primary sources – those for the Cautley district of northern England and the Girvan district of southwest Scotland have already benefited me in the field. Nevertheless, some of the maps could do with a little more detail, for example the annotation of fossil localities for Solva Harbour. Furthermore, the inclusion of the national grid would have made all of the sketch maps more user-friendly, particularly as many now regularly take hand-held GPS devices into the field with them.

Many of the sketch maps are accompanied by photographs of the pertinent outcrops, useful to visualize these localities if you haven't visited them, or good memory jogs if you have. The stormy day at Caerfai Bay, Pembrokeshire reminds me that it was hailing when I last collected there, and the picture of Dob's Linn recalls a snowy day in the Southern Uplands sustained by the contents of Adrian Rushton's hip flask. On a few of the photographs a clearer scale would benefit the reader.

There are a number of useful photographs of key fossils in this volume, though some have printed too pale. Thus, the reproduction missed much of the detailed morphology of the Ordovician graptolites from the Southern Uplands presented in figure 15.7. On the other hand, there are many good pictures, such as the enormously spinose *Eodiscus punctatus* of figure 4.8 and the trilobite 'graveyard' of figure 9.21.

The 33 pages of references, with over 800 works cited, make this a source-book of massive proportions. Indeed, the references read like a 'Who's Who' of British geology, there being

enough characters here to populate several 'Premier League' (geological) football teams. The General index provides a route to all of the key lithostratigraphical and biostratigraphical units discussed in this book and the Fossil index is similarly useful. Within the glossary I found definitions as diverse as 'ostracod' and 'olistostrome', making this a friendly book for non-geological disciplines.

With its recently published sister volumes for the Precambrian and Silurian, this book represents more than just a list of geological localities for conservation. If it was simply that, it might run the risk of being 'piped music'. Rather, it represents the key to an enormous source of data, to a natural museum bigger than that of Victorian buildings, visiting the localities from which the Cambrian and Ordovician systems were first conceived. Though price may preclude its access to many, it should be on every University library shelf where there are people interested in geological time, and in major municipal libraries for reference purposes.

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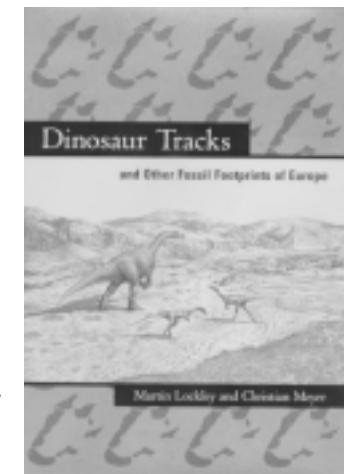
Dinosaur Tracks and Other Fossil Footprints of Europe

Martin Lockley and Christian Meyer. 2000. 342 pp. Columbia University Press, New York. ISBN 0231107102 (hbk). £19.50.

Lockley and his numerous collaborators have propelled the study of footprints and body traces to the forefront of vertebrate palaeontology over the past two decades. Through a combination of high profile research publications and various popular books, it has been demonstrated that ichnological evidence can tell us more about the behaviour of extinct animals than the majority of body fossils. This volume confirms the use of abundant trackway data in understanding the ancient vertebrates of Europe.

Following the success of 'Dinosaur Tracks and Other Fossil Footprints of the Western United States', Martin Lockley, this time in collaboration with Christian Meyer, provides a comprehensive examination of European trackway localities. As before, much of the book is based upon research in which the authors have been directly involved, which inevitably places an emphasis upon dinosaur trackway data; this is, however, stressed in the book's title and is therefore to be expected. Nevertheless, a wide range of trackmakers is discussed at length, from Palaeozoic arthropods to the mammals and birds of the Miocene, and finally Pleistocene hominids.

The book begins with a clear introduction to ichnology; its methods, vocabulary, field techniques and the interpretation of footprint data. This opening is aimed at those





'without...specialized knowledge and vocabulary' and indeed the writing style throughout the volume remains informal and accessible. The following chapters chart the characteristic fauna of each period chronologically, giving a range of examples based around a number of localities. Each section begins with a short history of the tracksite discovery, followed by systematic descriptions of the footprints and related sedimentary features; the picture is completed by lucid palaeoenvironmental interpretations. Where possible, each footprint assemblage is correlated with similar tracks both in Europe and abroad. Whilst the level of detail given in these palaeontological descriptions is easily sufficient to provide specialist ichnologists with an effective synthesis to the trackways of Europe, the book is perhaps best aimed at the non-specialist wishing to gain a steady background in the topic.

Given the obvious amount of research that has gone into writing this volume, it is a shame that it is occasionally let down by the lack of information supporting the diagrams. Scale-bars are often omitted, and many of the pictures and drawings would benefit from more comprehensive annotations. On rare occasions, there are discrepancies between text and the supporting diagrams.

Nevertheless, I would certainly recommend this book as a thorough, extensive review of both recent and historical European trackway discoveries, representing excellent value for money. Whilst providing a comprehensive introduction to European ichnology for those with little prior knowledge, such a well-compiled volume must certainly form an excellent foundation for future research.

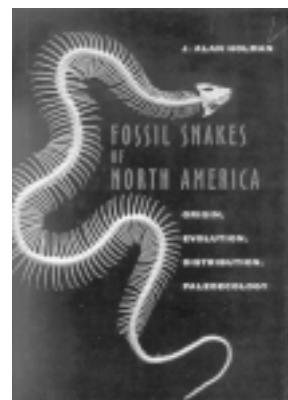
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Fossil Snakes of North America: Origin, Evolution, Distribution, Paleoecology

J. Alan Holman. 2000. 528 pp. Indiana University Press, Bloomington and Indianapolis. ISBN: 0253337216 (hbk). £ 45.00 / US \$ 69.95



This book is Alan Holman's crowning achievement, summarizing the results of decades of research on the Tertiary herpetofauna of North America, with particular emphasis on snakes. There is nobody who would be in a better position than Alan Holman to summarize and synthesize the current knowledge on fossil snakes of North America. And there is no better reference to suggest to anybody who has an interest in the fossil snakes of North America, their diversity, their distribution in time and space, and their significance for the understanding of extant faunas.

The book begins with a brief review of the history of investigation of fossil snakes, followed by a summary of

major specialization of snakes. A cautionary account of current theories on snake origins leads up to an illustrated review of snake osteology with particular emphasis on those characters that are of prime importance in the identification of fossil remains. Many more general readers probably feel that the understanding of studies of the Tertiary record of fossil snakes is fraught with difficulty because of the complex nomenclature that is being used in the description of the highly specialized snake vertebrae. Here, Holman does an admirable job, providing the reader with an exhaustive, clear and easy to follow description of the characters used by him and others in the treatment of fossil snakes that are mostly known on the basis of isolated vertebrae.

These introductory paragraphs are followed by an encyclopaedic review of fossil snakes from North America, and of the localities that have yielded those fossils. These compilations, which constitute the main part of the book, will probably be of primary interest to a more specialized readership. But the following chapter, which reviews evolutionary, zoogeographic and palaeoecological patterns that emerge from the Tertiary record of snakes, certainly is of more general, broader interest. I particularly enjoyed Holman's discussion of ice age population adjustments in snakes!

Holman's treatment of fossil snakes from North America may be perceived to suffer from some drawbacks such as the inequality of the illustrations that are drawn from a variety of sources, or the lack of reference to modern methods of phylogeny reconstruction or of historical biogeography. Evolutionary as well as biogeographic patterns are read directly off the fossil record, which, as Holman emphasizes, must be assumed to be incomplete. However, there can be no doubt that Holman's "Fossil Snakes of North America" will become the standard reference on the subject for years to come for anybody interested in the temporal and partial distribution of this very diverse group of reptiles.

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Evolution of herbivory in terrestrial vertebrates: perspectives from the fossil record

Sues, H.-D. (ed.). 2000. 256pp. Cambridge University Press. ISBN 0521 594499 (hbk). £50.

This is a neat, octavo-sized, quality book that states its aims in the preface. This aim is to review the nature and acquisition of the craniodental features suitable for feeding on high-fibre plant material, in various major lineages of herbivorous tetrapods. It clearly states that is not a comprehensive account and is simply a review of current research on some key issues for advanced students of evolutionary biology, historical ecology and palaeobiology; and as a stimulus for further research. So, exactly which echelon of 'advanced students' will be able to afford its £50 price tag? Perhaps we will have to wait for a





softback version. Besides, all books invariably stimulate ideas for further research to some extent. This one certainly will, by virtue of its review nature, as there is much to add to it. Eight chapters cover herbivory in the following groups: vertebrates generally, ancient tetrapods, dinosaurs, Palaeogene mammals, and Cenozoic grazers. The introduction is a nice basic overview of herbivory, some fossil forms and some fundamental tenets. The chapter by Reisz and Sues on Permo-Triassic herbivorous tetrapods is a hugely welcome addition to the limited corpus of literature on these fascinating animals. Diadectomorphs, caseid and edaphosaurid pelycosaurs, tapinocephalid dinocephalians and much else are covered. This is from a traditional 'functional morphological' and 'niche occupation' viewpoint. My gripes about this chapter are that the 'functional' assertions in many (too many) places are distinctly loose. These are thrown in with little basis in demonstrated fact, and their use of the term 'shearing' with respect to tooth occlusion is especially misleading. In addition, the very important and extremely derived herbivorous eucynodonts get the briefest and most cursory of mentions. The overall feeling with respect to the lack of detail regarding eucynodonts is that the authors ran out of time, energy or word allocation.

Paul Barrett has produced a well-rounded account of a very topical subject – just what were prosauropods feeding on, and how? It is a very sensible account and draws on the problems encountered when using a traditional method for interpreting feeding patterns in extinct tetrapods – that of the tooth form analogy. He is very thorough in his literature synthesis and thoughtful in his conclusions. However, the statement that iguanine tooth form is perhaps a poor paradigm for prosauropod tooth form and function is then negated in the same section when he states that they can be used to generate empirically based inferences. He agrees with Weishampel in that ahistorical biomechanics are used for assessing function when the phylogenetic approach is not feasible. This is grossly misleading; the phylogenetic approach to function in fossils is – and has been shown to be – extremely limited, especially in view of the current controversies in character definition and assessment. However, the current approach employed by the better practitioners of biomechanics is the most rigorous and powerful tool available for assessing 'function' in fossil organisms. Furthermore, the word 'ahistorical' sounds like yet another grim Americanised hybrid. Why not just say 'non-historical'. In any case, biomechanicists do analyse their fossil subject in an historical context.

Paul Barrett teams up with Paul Upchurch to produce a hugely detailed and meticulous account of the patterns observed in the evolution of feeding mechanisms in sauropod dinosaurs. This is excellent stuff and covers a range of details such as tooth form, tooth wear facets, jaw function, skull form and the importance of sauropod whole-body form. With a superb phylogenetic framework within which to work (generated from the research of Paul Upchurch) they produce excellent ideas about trophic partitioning among sauropods. This is the sort of meticulous and attentive study that can act as a great framework for biomechanical or ecomorphological studies into these important tetrapods.

Weishampel and Jianu, in a short chapter, look at ghost ranges with a view to assessing evolutionary patterns in more herbivorous dinosaurs. However, fortunately a plethora of dinosaur studies is nipped in the bud with the very next chapter. In it, John Rensberger covers a host of biomechanical and functional approaches to the study of herbivory in Palaeogene mammals. Not only are these critters an immensely fascinating group of herbivores, but they

are of huge importance in the evolution of the distant beginnings of our modern mammalian herbivore communities. Mechanisms, efficiency, occlusal geometry, enamel mechanics and reinforcements are all covered in an excellent synthesis. Rensberger even includes some Finite Element Analysis (FEA) of tooth crown morphology (yippee). He suggests that Palaeogene mammalian herbivores were constrained by their origination from insectivorous precursors and that the shearing component of the teeth was lost as compression between the occlusal surfaces became the dominant mechanism. In the following chapter, Christine Janis continues the Palaeogene mammal theme begun by Rensberger, taking the approaches of temporal ranges, taxonomic data, time intervals, dental structure, dietary categories, body masses and size distributions. She demonstrates a paucity of lophed taxa in the Palaeocene, a diversity increase in the late middle Eocene, and the patterns of interaction between size categories and dental types during these periods.

In the final chapter, Bruce MacFadden examines the origin and evolution of New World Cenozoic grazers. This is a novel and interesting chapter, because he synthesises dental evidence with Carbon isotope studies. His findings make interesting reading. He finds that grasslands and the grazing guild originated in South America earlier than in North America, and the earliest spread of grasslands began with C3 grasses and not the common C4 grasses of today. The decline in grazing diversity after the Late Miocene appears to have been related to increased aridity and lower productivity of grasslands, relative to those prior to the Late Miocene.

This is a super book. All the chapters are well written and easy to read. It is packed with useful and relevant information and there is a good illustration count, although even more could, perhaps, have been included in some places. It certainly meets its remit, and does not state too much for itself. Cambridge University Press has a wonderful 'in-house' style for their palaeobiology books and this one is no exception; they continue to knock spots off Oxford University Press in this regard. It is a smallish book, and at £50 will make many people think twice about forking out for it. Certainly any decent department that contains active vertebrate palaeobiologists should get their library to invest in a copy. Nevertheless, as super-expensive palaeontology books go, this one more-or-less represents 'value for money'. Because of its review style, it is sure to serve as an excellent starting point for additional studies in these animals and this subject. I'm already drooling over which fossil material I now want to examine.

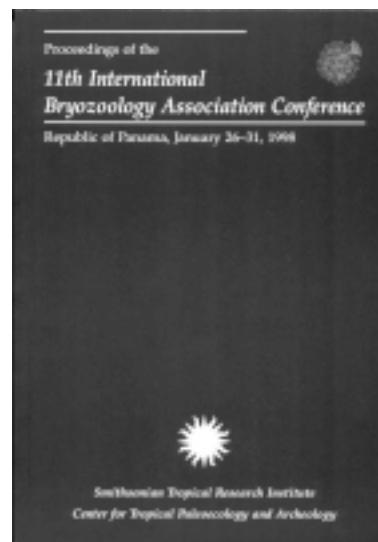
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Proceedings of the 11th International Bryozoology Association Conference

A. Herrera Cubilla and J. B. C. Jackson (eds). 2000. 448 pp. Smithsonian Tropical Research Institute, Balboa, Republic of Panama. ISBN 1-891276-13-1 (pbk). \$60.



It is difficult to know where to begin a review on such a diverse work, such as this conference volume on Bryozoa. Published by the Smithsonian Tropical Research Institute, the book contains a wealth of information on this important group of animals, all of which was presented at the 11th International Bryozoology Association Conference in Panama, 1998. Within this 448, glossy-page paperback, topics as wide-ranging as phylogenetics, systematics, ecology and functional morphology are covered and well illustrated (black and white figures only), and in some considerable detail.

The book begins with a tribute to the late Gilbert Larwood, to whom the volume is dedicated, and is perhaps a humble means of introduction: after all, it was this great palaeontologist who helped make bryozoans as important and recognized in palaeontological and zoological studies as they

are today. This is followed by the eight longest papers of the publication, the plenary presentations, and then by 37 much shorter papers, all from a variety of contributors. A taxonomic index at the end of the book provides a quick reference guide to those just seeking information on a particular species.

The plenary papers seem to focus mainly on phylogenetic relationships within the Bryozoa, with preliminary reviews on the Cheilostomata (Gordon), Fenestrata (McKinney), Entoprocta and Ectoprocta (Nielsen), Cyclostomata (Taylor) and Ctenostomata (Todd). This is clearly a reflection on the substantial progress that has been made in this area over the last few years, and it is satisfying to know that the bryozoologists are not going to be left behind. The papers by McKinney, Taylor and Todd were especially well explained, with the authors recognizing their limitations and the need for further research. It was slightly disappointing that not all the authors included appendices of the characters that were coded and the method of coding though, often a useful reference point. However, all these articles will provide a valuable information source for those interested in bryozoan systematics, and hopefully trigger further research in this key area. The three other plenary papers look at the Neogene history of cheiostome Bryozoa in tropical America (Cheetham and Jackson), the ecology of cave and cavity dwelling bryozoans (Harmelin) and the metapopulation biology of freshwater bryozoans (Okamura). Cheetham and Jackson look at the distribution of cheiostome species and growth forms and how these have changed over the past 15 million years, allowing significant revision of the geographic and temporal ranges of a number of species. Although there are numerous statistics within this paper, it was nevertheless an enjoyable read. Harmelin looks at the

different cryptic habitats inhabited by bryozoans from the Mediterranean area and how species composition, form and avicularia vary among them, together with the controlling environmental factors. I found this to be one of the most enjoyable papers within the book. Okamura's article on metapopulation structure was, perhaps, the hardest to read, due to the lack of diagrams. On the whole though, most of these plenary papers cover some interesting ground and present some new conclusions. They are generally well-illustrated with, in particular, some superb S.E.M. photographs.

The contributed papers are by no means less informative, and cover a wide variety of topics (life cycles, growth rates, colonization, palaeoenvironments, the fossil record of bryozoan species diversity, fouling patterns, seasonality, skeletal ultrastructure, to name but a few) within about 5-10 pages. I cannot begin to review every paper here though, but on the whole I thought that they were interesting and well illustrated; again there were some first-rate S.E.M. photographs.

This book is a wonderful reference point for the most recent advances in bryozoology, and a very worthwhile read for all those interested in bryozoans. However, for a newcomer wanting to learn more about bryozoans as a whole, or for teaching purposes, this book is probably rather too detailed. It is not always an easy read, and with so many topics being covered, a general understanding of bryozoans to begin with would not go amiss. However, this book was written by bryozoologists, and probably mainly for bryozoologists, and as much as I would love to think anyone could read and enjoy this book, I think I would be disappointed. It is, however, a valuable reference book and therefore a must for all university libraries and smaller palaeontological and zoological libraries. At \$60 a copy it is a small sum for such establishments to pay, though perhaps out of the price range of most individuals.

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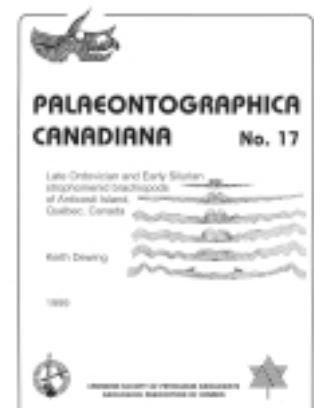
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Late Ordovician and Early Silurian strophomenid brachiopods of Anticosti Island, Quebec, Canada

Keith Dewing. 2000. 143 pp. *Palaeontographica Canadana* 17. US\$62.00.

The Ordovician-Silurian transition is a critical interval in the history of the diverse, morphologically-varied strophomenide clade. Keith Dewing's monographic research has demonstrated a series of turnovers within the strophomenides in the late Rawtheyan, at the base and top of the Hirnantian and within the Aeronian.

This monograph contains 32 species of strophomenids assigned to 21 genera; the fauna includes one new family and four new species. The brachiopod assemblages are discussed within a well-documented lithostratigraphical framework, supplemented with lithofacies data and a detailed sea level curve for the region. The detailed





taxonomic studies have formed the data for a series of informal brachiopod-based biostratigraphical assemblage zones. There is no doubt these strophomenide zones may be of some use in regional correlations if not farther afield. Stropheodontids, for example, have been developed for correlation within both the Llandovery and Wenlock elsewhere.

There is a substantial amount of focused information in the systematic section. A useful primer in strophomenide morphological terminology heads up the section. Basic dimensions of many of the taxa are displayed graphically on bivariate plots together with the formulae for best-fit curves.

Particularly interesting are the serial sections for some of the taxa. These are not fashionable in strophomenide studies; nevertheless the evolving relationships of key features of the hinge such as the cardinal process and chilidium in the dorsal valve and the pseudodeltidium, teeth and dental plates in the ventral valve can be seen through a series of developmental phases. There are good synonymy lists and clear well-organized descriptions. Dewing has also addressed, where relevant, many issues of strophomenide taxonomy. Some discussion of the characteristic features and the content of many of the strophomenide families are included.

But Dewing has not restricted himself only to the taxonomy of the Anticosti strophomenides; the material has allowed some views and opinions on some of the wider aspects of the systematics of the group, e.g. the status of the subfamily Craspedinae Cocks and Rong, 1989, the synonymy of *Ygerodiscus* with *Eoplectodonta*, *Thaerodonta* with *Eochonetes*, *Katastrophomena* with *Pentlandina*, *Schmidtomena* and *Similoletaena* with *Leptaena*, the identities of *Coolinia*, *Fardenia* and *Saughina*, and the inclusion of the subfamily Glyptomeninae within the Oepikinidae. A list of species assigned to the true *Strophomena* is particularly useful.

A very substantial part of this monograph consists of plates, in fact the plates and plate descriptions account for over 40% of the publication. Most in my copy such as plate 22 are excellent but the quality is variable with some too dark (pl. 11) and some lacking in contrast (pl. 10). But in general the illustrations do this important fauna justice. There are few obvious errors such as 'Ruddanian' rather than 'Rhuddanian' in Text-figures 2 and 3; on the same diagrams there is reluctance to use any chronostratigraphic unit against the Ellis Bay Formation, which may reflect a true omission or the problems of correlation associated with this unit.

Keith Dewing has presented us with some new and important data through a high profile interval in earth history. These data provide not only new information on the taxonomy of Early Palaeozoic strophomenide brachiopods but also such information forms the basis for our phylogenetic, biogeographical and ecostratigraphical models during this interval. Such studies continue to emphasise the need for basic taxonomic work on both new faunas and those many in substantial need of revision in modern terms. There is no doubt much published and museum material is in dire need of revision in addition to substantial faunas as yet entrapped in the more remote and inaccessible parts of the world (Boucot 2000).

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Special Papers in Palaeontology No. 64

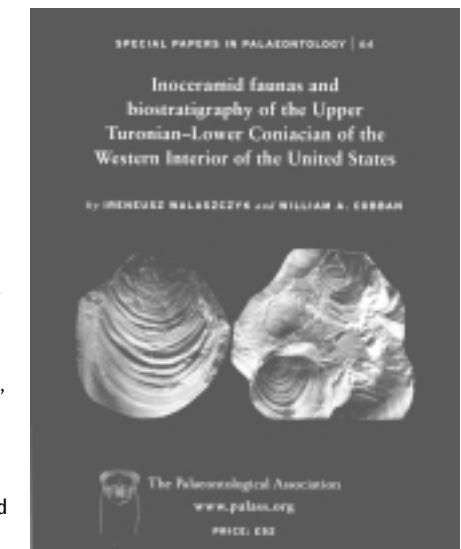
Inoceramid faunas and biostratigraphy of the Upper Turonian-Lower Coniacian of the Western Interior of the United States

Ireneusz Walaszczuk & William A. Cobban (2000). pp. 1-118, 32 plates, 2 tales, 27 text-figures. £52 nonmembers, £26/US\$52 members.

Abstract:

Twenty-seven inoceramid species and subspecies of the genera *Inoceramus* J. Sowerby, 1814, *Mytiloides* Brongniart, 1822, *Cremonoceramus* Cox, 1969, and *Tethioceramus* Sornay, 1980 are described from the Upper Turonian and Lower Coniacian of the Western Interior of the United States. One *Inoceramus* species, *I. dakotensis*, and two *Mytiloides* species, *M. ratonensis*, and *M. bellefourchensis*, are described as new, and four forms are left in open nomenclature. Four widely used North American species, *I. dimidiatus* White, 1874, *I. perplexus* Whitfield, 1877, *C. deformis erectus* (Meek, 1877), and *C. deformis deformis* (Meek, 1871), are thoroughly discussed for the first time and illustrated. The inoceramids allow a subdivision of the Upper Turonian and

Lower Coniacian into eight zones, and their precise correlation with the European succession and the standard substage subdivision of the Turonian and Coniacian, as well as with the ammonite zonation used in the US Western Interior. The base of the Upper Turonian, corresponding to the base of the European *I. costellatus* Zone, corresponds to the base of the *I. perplexus* Zone, and to the base of the *Scaphites whitfieldi* ammonite Zone. The Upper Turonian is divided into zones of *Inoceramus perplexus*, *I. dakotensis*, *Mytiloides incertus*, *M. scupini*, and *Cremonoceramus waltersdorffensis waltersdorffensis*. The Lower Coniacian has the zones of *Cremonoceramus deformis erectus*, *C. deformis dobrogensis*, and *C. crassus crassus*. In the upper part of the *erectus* Zone and in the *dobrogensis* Zone, the *Tethioceramus wandereri* and *Cremonoceramus crassus inconstans* zones may be distinguished. *Cremonoceramus deformis erectus* (Meek) is the basal member of the *deformis* lineage and the proper name for forms referred to *C. rotundatus* (*sensu* Tröger 1967 *non* Fiege 1930), and, accordingly, is the basal boundary marker of the Coniacian. So defined, the first *Forresteria* have already appeared in the topmost Turonian. The Turonian/Coniacian boundary is marked by a series of short-lived events better recognised in Europe (*Didymotis* I Event, *waltersdorffensis* Event, *herbichi* Event, *erectus* Event).



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