The Palaeontology Newsletter

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Reminder: The deadline for copy for Issue no 50 is 28th June 2002

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

Association Business

Annual Report for 2001

Nature of the Association. The Palaeontological Association is a Charity registered in England, Charity Number 276369. Its Governing Instrument is the Constitution adopted on 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, UK.

Membership & subscriptions. Individual membership totalled 1,136 on 31 December 2001, an overall increase of 54 over the 2000 figure. There were 739 Ordinary Members, an increase of 35; 130 Retired Members, an increase of 10; and 267 Student Members, an increase of 9. There were 170 Institutional Members in 2001, a decrease of 11 from last year. Total Individual and Institutional subscriptions to *Palaeontology* through Blackwell's agency numbered 398, an increase of 3. Subscriptions to *Special Papers in Palaeontology* numbered 140 individuals, an increase of 7 on last year, and 107 institutions, an increase of 3. Regular orders through Blackwell's agency for *Special Papers in Palaeontology* totalled 28 copies. Sales to individuals through the Executive Officer of current and back numbers of *Special Papers in Palaeontology* yielded £10,144.

Income from sales of Field Guides to Fossils amounted to: *Fossil Plants of the London Clay* – £273; *Fossils of the Chalk* – £256; *Zechstein Reef Fossils and their palaeoecology* – £108; *Fossils of the Oxford Clay* – £592; *Fossils of the Santana and Crato Formations of North East Brazil* – £365; *Plant Fossils of the British Coal Measures* – £779; *Fossils of the Upper Ordovician* – £475; *The Jurassic Flora of Yorkshire* – £822; *Fossils of the Rhaetian Penarth Group* - £683; *Dinosaurs of the Isle of Wight* – £5,557.

Finance. Publication of *Palaeontology* and *Special Papers in Palaeontology* is managed by Blackwell, who also make sales and manage distribution on behalf of the Association. In addition to the fee that they take directly from the subscribers, the Association paid them a further fee of £3,363. The Association gratefully acknowledges the donations from Members to the Sylvester-Bradley Fund, which amounted to £491.94. Grants from general funds to external organisations, for the support of palaeontological projects, totalled £17,163.

Publications. Volume 44 of *Palaeontology*, comprising 1,246 pages in total, was published at a cost of £68,935. *Special Papers in Palaeontology* **65** (*Cambrian–early Ordovician brachiopods from Malyi Karatau, the western Balkhash region, and Tien Shan, Central Asia*. L.E. Holmer, L.E. Popov, S.P. Koneva and M.G. Bassett, 180 pp) was published at a cost of £6,158, and *Special Papers in Palaeontology* **66** (*Angiosperm woods from British Lower Cretaceous and Palaeogene deposits*. M. Crawley, 100 pp) was published at a cost of £4,665. Two parts of *Palaeontologia Electronica* were issued during the year.

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

Meetings. Five meetings were held in 2001, and the Association extends its thanks to the organisers and host institutions of these meetings.

a. **Lyell Meeting**. "Palaeobiogeography and Biodiversity Change" was convened on behalf of the Association by Dr A.W. Owen and Dr A. Crame.

b. **Forty-fourth Annual General Meeting and Address**. 2nd May. The address, entitled "Deducing Life Habits of Trilobites: Science or Scenario", was given by Prof. R.A. Fortey (Natural History Museum) and attended by over 70 people. The meeting was held at the Royal Society and organised by Dr M.P. Smith and Dr T.J. Palmer.

c. **Progressive Palaeontology**. 16th-17th May. The annual open meeting for presentations by research students was organised by Hannah O'Regan and Sally Reynolds at the John Moores University.

d. **Systematics Association 3rd Biannual Meeting**, Imperial College, London. Palaeontological Association symposium on "Telling the evolutionary time—molecular clocks and the fossil record." Dr P.C.J. Donoghue and Dr M.P. Smith convened the meeting.

e. **44th Annual Meeting**. 17th-20th December. The Annual Meeting was held at the Geological Museum and Geological Institute, University of Copenhagen. Prof. David Harper with much local support organised the meeting. The President's Award was presented to Karen Henriksen (Geological Institute, University of Copenhagen). Council Poster Prizes were presented to Lauren Tucker (University of Birmingham) and Sarah Stewart (University of Glasgow). Susan Hammond and Simon Jackson were commended. On the final day a field trip was undertaken to examine the Cretaceous-Tertiary boundary section at Stevns Klint. The meeting was attended by 230 delegates.

Awards. Sylvester-Bradley Awards were made to Peter Alsen (University of Copenhagen), Howard Falcon-Lang (BAS), Susan Hammond (University of Cardiff), George Iliopoulos (University of Leicester), Ian Jenkins (University of Bristol), Alistair McGowan (University of Chicago), Lance Morrissey (University of Bristol), Ireneusz Walaszczyk (University of Warsaw), Adam Yates (University of Bristol) and Michael Zuykov (St Petersburg State University). The Mary Anning Award, to a person not employed in palaeontology who had made an outstanding contribution, was made to Joe Collins for his work on fossil crabs and barnacles. 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, was awarded for the first time to Dr P.J. Orr and Dr I.J. Sansom.

Council. The following members were elected to serve on Council at the AGM on 2nd May 2001: Dr M.P. Smith (Vice-President), Dr H.A. Armstrong (Secretary), Dr C. Milsom (Ordinary member). Dr P.J. Orr was co-opted as an editor during the year.

At the AGM on 10th May 2001 the following members stepped down from Council: Prof. E.N.K. Clarkson (President); Dr J.E. Francis (Vice-President) and Dr M.P. Smith (Secretary) to become a Vice-President.

Dr T.J. Palmer continued to serve as the Executive Officer of the Association, and Prof. D.J. Batten (University of Wales, Aberystwyth) as the Technical Editor until March, and as Editor-in-Chief from April onwards.

Council is indebted to the Natural History Museum, Imperial College, the Royal Society, the University of Birmingham, John Moores University and the University of Copenhagen (Geological Museum and Geological Institute) for providing meeting venues through the year.

Professional Services. The Association's Bankers are NatWest 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 £381,643 (2000: £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, and new initiatives to be pursued, without increasing subscription costs.

Council Activities. The Association is now reaping the full benefits of the re-organisation of the Association's administration, which started in 1997, and has now initiated a formal policy of forward planning. The Council held the first strategy meeting in July. *Palaeontology* is now available in electronic version to members and subscribers; electronic versions of some back issues of *Palaeontology* are now available and further back issues are being scanned. Major improvements and developments to the *Newsletter* have been made. A new *Field Guide* was published within the year: Number 10, on the Lower Cretaceous Dinosaurs of the Isle of Wight (Martill and Naish). Free copies on CD-ROM of the first two volumes of *Palaeontologia Electronica* have been made available to members. The Sylvester-Bradley Fund continues to attract a large number of quality applications and ten awards were made this year. Council now awards up to two undergraduate prizes to university departments in which Palaeontology is taught at a post-1st year level. Grants in aid were made to the renovation of the Crystal Palace Dinosaurs and the Sheffield Botanic Garden. Grants were also made to postgraduates attending and presenting at the Annual Meeting. The B.G.S. Collection Advisory Committee is now working successfully, an initiative stimulated by concerns expressed by Council and the Joint Committee for Palaeontology. The Executive Officer represented the Association at the North American Paleontological Convention held in Berkeley, California, in June 2001.

Forthcoming plans. In 2002, a similar programme of meetings and publications will be carried out as in 2001, including sponsorship of the Lyell Meeting and symposia at the British Association for the Advancement of Science, Leicester and the Eighth European Conodont Symposium, in Toulouse and Albi. Council will continue to make substantial donations, both from Designated and General funds, to permit individuals to carry out research into palaeontological subjects and to disseminate their findings in print and at conferences. It is hoped that additional electronic versions of early volumes of *Palaeontology* will be produced in the near future. Council is currently reviewing its Web-based activities and the production of a new Symposium Series directed at frontier topics in palaeontology. It is intended that one new Field Guide will be published within the year: the 2nd edition of *Fossils of the Chalk* (ed. A.B. Smith). The Association will publish the joint venture book, *Telling the Evolutionary Time: Molecular clocks and the fossil record* with the Systematics Association. It is planned to circulate the *Newsletter* to Institutional members as part of their subscription.

Howard A. Armstrong
Secretary
<secretary@palass.org>

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31st DECEMBER 2001

			General Funds	Designated Funds	TOTAL FUNDS	TOTAL 2000
			£	£	£	£
INCOMING RESOURCES						
Subscriptions			60,037	0	60,037	58,415
Sales:	*Palaeontology*	102,353				
	Special Papers	16,768				
	Offprints	4,726				
	Field Guides	9,910				
	Postage & Packing	1,278				
Total Sales			135,035	0	135,035	149,074
Investment Income & Interest			13,963	4,669	18,632	24,683
Donations			0	938	938	3,164
Sundry Income			1,206	0	1,206	2,975
	Total		210,241	5,607	215,848	238,311
RESOURCES EXPENDED						
Publications:	*Palaeontology*	68,935				
	Special Papers	10,823				
	Offprints	4,373				
	Field Guides	4,877				
	Newsletters	15,609				
	Carriage & Storage	1,375				
	Management	22,359				
Total Publications			128,351	0	128,351	161,475
Scientific Meetings & Costs			9,819	0	9,819	14,470
Grants			7,344	10,207	17,551	5,528
Total Charitable Expenditure			145,514	10,207	155,721	181,473
Marketing & Publicity			2,453	0	2,453	5,152
Administrative Expenditure			33,855	0	33,855	30,806
	Total		181,822	10,207	192,029	217,431
NET INCOMING RESOURCES BEFORE TRANSFERS			28,419	-4,600	23,819	20,880
TRANSFERS			0	0	0	0
NET INCOMING RESOURCES			28,419	-4,600	23,819	20,880
INVESTMENT GAINS/LOSSES						
Realised Loss		-7,352				
Unrealised Gain		-53,191				
			-60,543	0	-60,543	-1,259
NET MOVEMENT IN FUNDS			-32,124	-4,600	-36,724	19,621
BROUGHT FORWARD			413,957	97,776	511,733	492,112
CARRIED FORWARD			381,833	93,176	475,009	511,733

Notes to the Financial Statements for the year ended 31st December 2001

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 revised Statement of Recommended Practice published in October 2000 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 2001 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 state of affairs at 31st December 2001 and the results for the year ended on that date.

1.2 Fund Accounting

General funds are unrestricted funds which are available for use at the discretion of the Council in furtherance of the general objectives of the charity and which have not been designated for other purposes.

Designated funds comprise unrestricted funds that have been set aside by Council for particular purposes. The aim of each designated fund is as follows:-

Sylvester Bradley Fund: Grants made to permit palaeontological research;

Jones Fenleigh Fund: Grants to permit one or more students annually to attend the meeting of the Society of Vertebrate Palaeontology and Comparative Anatomy (SVPCA);

Hodson Fund: Awards made in recognition of the palaeontological achievements of a worker under the age of 35.

1.3.1 Income

The charity's income principally comprises subscriptions from individuals and institutions which relate to the period under review and sales of scientific publications which are brought into account when due.

1.3.2 Resources Expended

All expenditure is accounted for on an accruals basis and has been classified under the appropriate headings.

Charitable expenditure is that which is incurred in furtherance of the charity's objectives. Administrative costs are those incurred in connection with the administration of the charity and compliance with constitutional and statutory requirements.

1.4 Investments

Investments are stated at market value at the balance sheet date. The Statement of Financial Activities includes net gains and losses arising on revaluations and disposals throughout the year.

2. Analysis of Financial Resources Expended

	Staff Costs	Other Costs	Total 2001	Total 2000
Publications	17,124	111,227	128,351	161,475
Scientific Meetings & Costs		9,819	9,819	14,470
Grants		17,551	17,551	5,528
Marketing & Publicity		2,453	2,453	5,152
Administration	16,833	17,022	33,855	30,806
	33,957	158,072	192,029	217,431

3. Staff Costs

	Salary	National Insurance	Pension Contribns	Total 2001	Total 2000
Publications – 1 employee (2000 – 1)	14,209	1,162	1,753	17,124	10,845
Administration – 1 employee (2000 – 1)	13,948	1,132	1,753	16,833	16,305
	28,157	2,294	3,506	33,957	27,150

4. Trustees Remuneration and Expenses

Members of Council neither received nor waived any emoluments during the year (2000: nil)
The total of travelling expenses reimbursed to 20 Members of Council amounted to £4,102 (2000 - £3,947)

5. Costs of Independent Examiner

	2001	2000
Examination of the accounts	250	250
Accountancy and payroll services	950	950
	1,200	1,200

6. Stocks

Stocks of Field Guides have been included at the lower of cost or net realisable value.

7. Debtors – All Receivable within One Year

	2001	2000
Accrued income	6,606	2,662
Prepayments	0	150
	6,606	2,812

8. Creditors – Falling Due within One Year

	2001	2000
Trade Creditors	0	16,550
Social Security Costs	2,583	5,014
Accrued Expenditure	3,319	19,010
Other Creditors	0	8,000
	5,902	48,574

BALANCE SHEET AS AT 31st DECEMBER 2001

2000 £				2001 £
	INVESTMENTS			
315,475	At Market Valuation			313,398
	CURRENT ASSETS			
243,755	Cash at Banks	170,523		
7,302	Field Guide Stocks at Valuation	17,140		
2,812	Sundry Debtors	6,606		
253,869	Total		194,269	
	CURRENT LIABILITIES			
9,037	Subscriptions in Advance	26,895		
48,574	Sundry Creditors	5,902		
58,011	Total		32,797	
196,258	NET CURRENT ASSETS			161,472
511,733	TOTAL			475,009
Represented by:				
413,957	GENERAL FUNDS			381,833
	DESIGNATED FUNDS			
62,182	Sylvester Bradley Fund		57,788	
13,204	Jones-Fenleigh Fund		13,994	
22,390	Hodson Fund		21,394	
97,776				93,176
511,733	TOTAL			475,009

These financial statements were approved by the Board of Trustees on February 6th 2002.

C.R.C. Paul **J.M. Hancock** **H.A. Armstrong**

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 2001, 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: (i) to keep accounting records in accordance with section 41 of the Act; and (ii) 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.

13 February 2002

Palaeontological Association — Investment Portfolio 2001 — Holdings and Changes

Amount	Holding	Cost (bought pre 2001)	Value 31/12/2000	Proceeds (sold in 2001)	Cost (bought in 2001)	Gain realised during 2001	Value end 2001	Gain unrealised during 2001	Income in 2001
£6,765	7% Treasury Stock 2001	£ 7,115.00	£ 6,924.00	£ 6,765.00		-£ 159.00			£ 473.56
£19,000	6 1/4% Treasury 2010	£ 17,580.14	£ 21,244.57				£ 20,671.00	-£ 573.57	£ 1,187.50
£18,000	6 1/4% Treasury 2010	£ 16,654.86	£ 20,126.43	£ 20,048.69		-£ 77.74			
£11,772.70	Treasury 5% Stock 07/06/2004	£ 11,669.00	£ 11,740.00				£ 11,860.00	£ 120.00	£ 588.64
£12,750	Treasury 2% I/L Stock 2006				£ 29,979.85		£ 30,837.00	£ 857.15	£ 314.93
£18,029.71	COIF Charities Fixed Interest Fund	£ 25,000.00	£ 24,365.35				£ 24,058.84	-£ 306.51	£ 1,586.60
2,800	Shell Transport & Trading Ord 25p shares	£ 4,671.00	£ 15,372.00				£ 13,216.00	-£ 2,156.00	£ 413.00
8,000	Legal and General Ordinary 25p shares	£ 2,965.00	£ 14,760.00				£ 12,640.00	-£ 2,120.00	£ 388.80
1,200	Electrocomponents Ordinary 10p shares	£ 2,817.00	£ 7,944.00				£ 6,432.00	-£ 1,512.00	£ 165.60
3,500	Vodaphone Group Ord $ 0.10 shares	£ 1,721.00	£ 8,592.50				£ 6,291.00	-£ 2,301.50	£ 74.06
3,500	Vodaphone Group Ord $ 0.10 shares	£ 1,721.00	£ 8,592.50	£ 5,058.39		-£ 3,534.11			£ 24.08
1,000	Lloyds TSB Ordinary 25p shares	£ 7,952.00	£ 7,080.00				£ 7,460.00	£ 380.00	£ 315.00
1,428	Unilever Ordinary 1.4p shares	£ 7,751.00	£ 8,182.00				£ 8,054.00	-£ 128.00	£ 190.21
1,055	Glaxo Smithkline Ordinary 25p shares	£ 16,608.00	£ 19,940.00	£ 3.66		£ 3.66	£ 18,178.00	-£ 1,762.00	£ 402.90
2,600	Hays Ordinary 1p shares	£ 6,048.00	£ 10,036.00				£ 5,441.00	-£ 4,595.00	£ 105.82
875	Cable and Wireless Ordinary 25p shares	£ 5,862.00	£ 7,901.00				£ 2,892.00	-£ 5,009.00	£ 144.37
780	BT Group Ordinary 5p shares	£ 4,409.00	£ 2,402.00		£ 378.00		£ 1,973.00	-£ 807.00	£ 52.20
780	MMO2 0.1p Ordinary shares		£ 1,030.00		£ 162.00		£ 675.00	-£ 517.00	
1,050	Powergen Ordinary 50p shares	£ 9,426.0	£ 6,636.00				£ 7,928.00	£ 1,292.00	£ 556.50
460	Pearson Ordinary 25p shares	£ 8,069.00	£ 7,314.00				£ 3,639.00	-£ 3,675.00	£ 100.74
4,500	BAE Systems 7 3/4%(N) 25p CCRP shares	£ 4,155.00	£ 8,483.00				£ 7,380.00	-£ 1,103.00	£ 348.76
5,720	M & G Charifund Units	£ 4,073.00	£ 61,823.00				£ 57,414.00	-£ 4,409.00	£ 2,862.67
4,000	Edinburgh Small Companies Trust 25p	£ 8,045.28	£ 7,670.00	£ 4,337.20		-£ 3,332.80			£ —
1,775	SocGen Technology Units	£ 7,619.13	£ 4,466.00				£ 2,927.00	-£ 1,539.00	£ —
1,450	Gartmore European Select Opps Fund	£ 8,006.31	£ 8,127.00				£ 6,753.00	-£ 1,374.00	£ —
690	Baring Europan Growth Trust	£ 6,097.61	£ 5,264.00				£ 3,913.00	-£ 1,351.00	£ —
5,000	Credit Suisse A UK Transatlantic Fund	£ 8,197.00	£ 9,460.00				£ 8,134.00	-£ 1,326.00	£ —
15,000	Fleming Worldwide Zero Div Pref 25p shares				£ 9,914.95		£ 10,275.00	£ 360.05	£ —
9,500	Inv Trust of Inv Trust Zero Div Pref shares				£ 9,936.46		£ 5,178.00	-£ 4,758.46	£ —
10,500	Govett High Inc IT Zero Div Pref 10p shares			£ 9,534.08	£ 9,785.92	-£ 251.84			£ —
9,500	Europ Growth & Inc Trust Zero Div Pref 10p shares				£ 10,104.70		£ 5,273.00	-£ 4,831.70	£ —
42,500	M & G Equity Inv Trust Cap 1p shares				£ 9,579.73		£ 6,056.00	-£ 3,523.73	£ —
8,250	Martin Currie I & G Cap 25p shares				£ 9,861.82		£ 4,331.00	-£ 5,530.82	£ —
7,000	Special Utilities Cap 1p shares				£ 9,644.24		£ 9,030.00	-£ 614.24	£ —
3,000	Themis FTSE all-SM 25p shares				£ 5,004.22		£ 4,628.00	-£ 376.22	£ 60.00
	Total Stocks and Shares income	£ 204,232.33	£ 315,475.35	£ 45,747.02	£104,351.89	-£ 7,351.83	£313,537.84	-£ 53,190.55	£ 10,355.94
	Tax Credits								£ 432.10
	Total Investment Income								£ 10,788.04
	Interest Receivable								£ 7,844.61
	Total Investment Income & Interest								£ 18,632.65

Nominations for election to Council 2002-2003

President: Prof. D.E.G. Briggs
Proposed: Prof. C.R.C. Paul
Seconded: Dr M.P. Smith

Vice-President: Prof. D.A.T. Harper
Proposed: Dr H.A. Armstrong
Seconded: Prof. S.K. Donovan

Editor: Dr P.J. Orr
Proposed: Dr R. Wood
Seconded: Dr C.H. Wellman

Publicity Officer: Dr P. Manning
Proposed: Prof. C.R.C. Paul
Seconded: Dr M.A. Purnell

Newsletter Reporter: Dr G.E. Budd
Proposed: Dr H.A. Armstrong
Seconded: Dr P.C.J. Donoghue

Ordinary Members: Dr M. Cusack
Proposed: Dr A.W. Owen
Seconded: Prof. E.N.K. Clarkson
Dr J. Hilton
Proposed: Dr D.K. Loydell
Seconded: Prof. S.K. Donovan

Awards and Prizes

At the last meeting of Council the rubric and deadlines for the Association awards and prizes were revised. Nominations are now being sought for the Hodson Fund and Mary Anning Award.

Hodson Fund

This award, comprising a fund of £1,000, is conferred on a palaeontologist who is under the age of 35 and who has made a notable early contribution to the science.

Candidates must be nominated by at least two members of the Association and the application must be supported by an appropriate academic case. Closing date for nominations is **1st September 2002**. Nominations should be submitted to the Secretary and will be considered and a decision made at the October meeting of Council.

The presentation will be made at the Annual Dinner.

Mary Anning Award

The award is open to all those who are not professionally employed within palaeontology but who have made an outstanding contribution to the subject. Such contributions may range from the compilation of fossil collections, and their care and conservation, to published studies in recognised journals. Nominations should comprise a short statement (up to one page of A4) outlining the candidate's principal achievements. Members putting forward candidates should also be prepared, if requested, to write an illustrated profile in support of their nominee. The deadline for nominations, which should be submitted to the Secretary, is **1st September 2002**. The award comprises a cash prize plus a framed scroll, and is usually presented at the Annual meeting.

The Annual Meeting: views sought

The PalAss Annual Meeting is probably the high point in the Association calendar. The meeting is always most enjoyable, and the recent events in Copenhagen were no exception. For the last few years, however, each organiser has been faced with a problem: how can all the talks submitted be accommodated in two days of presentations? Shorter presentations? Parallel sessions? More posters? This is a difficult and widely discussed issue, and we would like to get a better feel for the opinions of the people who attend the Annual Meetings.

So now is your chance to have your say. A questionnaire has been posted on the PalAss website (<**www.palass.org/**> click on the 'information' button) asking a few questions about the meeting. Simply cut and paste this into an email massage, delete the answers that you disagree with, and send it to <**webmaster@palass.org**>, under the subject heading 'PalAss Questionnaire'.

For many of the questions, you may agree with more than one possible response. In such cases, just delete those you disagree with. The responses will be compiled, but individual replies will then be deleted. If you do not attend the Annual Meeting, please do not return this questionnaire, but if your non-attendance is a reflection of the way this meeting is organized, your constructive criticism may be useful. If you have already replied to the email that was sent to participants at this year's meeting, thank you (please don't send another response).

Mark Purnell, on behalf of Council
<**webmaster@palass.org**>

Subscription increase

Council has agreed to increase the subscription rate for Institutional Members for 2002-2003, from £105p.a. to £120 ($235, €235) p.a., and to send the *Newsletter* to Institutional Members from the next issue onwards.

Members' access to 'Palaeontology' online for Volume 45, 2002:

1. go to <**www.ingenta.com/journals/browse/bpl/pala/**>
2. Enter the username and password in the boxes at the bottom left of the screen:

   Username: **pamembers**

   Password: ********

   The password is the 4-letter + 4-number combination that is printed on the top left-hand corner of the address panel of the envelope that this newsletter was mailed in. Members can send an e-mail entitled 'password' to <**palass@palass.org**> to receive a reminder.
3. Click 'Enter'
4. Select article, click 'Full Text Availability', then click 'Download PDF'

N.B. This is a service made freely availably to members by Blackwells, and the password must not be disclosed to any non-members.

Association Meetings

Annual General Meeting

Wednesday, 8th May 2002

Barber Institute of Fine Arts, and Lapworth Museum of Geology, University of Birmingham

Formal business will begin at 3pm and will be followed by the Annual Address given by Prof. Hugh Torrens (Keele University), on "The life and work of S.S. Buckman (1860-1929) geobio-chronologist, and the problems of assessing the work of past palaeontologists." The AGM will be followed by a wine reception at the Lapworth Museum of Geology (School of Earth Sciences).

Abstract

Buckman was an English stratigrapher active at the interface of 'amateur' and 'professional' geoscience over a long, active career spanning 50 years. In 1889 he published a first 'milestone' paper, demonstrating how extensive (both geographically and chronologically) diachronism was, within lithologically similar Jurassic sands in the south of England. In 1893 he published another, on the detailed biochronology of Middle Jurassic sediments there, whereby he demonstrated how highly condensed and episodic their original deposition was. By 1901 he was attempting a biochronological "time table, of worldwide application… [as] a means whereby Jurassic events over a large part of Europe can be exactly dated now; and there is good reason to think that the same may be said of a far wider field in the future".

But the value of all these papers had been immediately questioned by the 'English Geological Establishment' and Buckman came to feel more and more isolated in his opinions. After a breakdown in health in 1904 caused by too much fieldwork on bicycle, Buckman abandoned this, the one element which had been so vital to his early work. He now published much of his work privately away from referees, and started work as a 'consultant biostratigrapher'. Since he was paid per genus/species that he determined, his latest work was understandably characterised by a proliferation of new names.

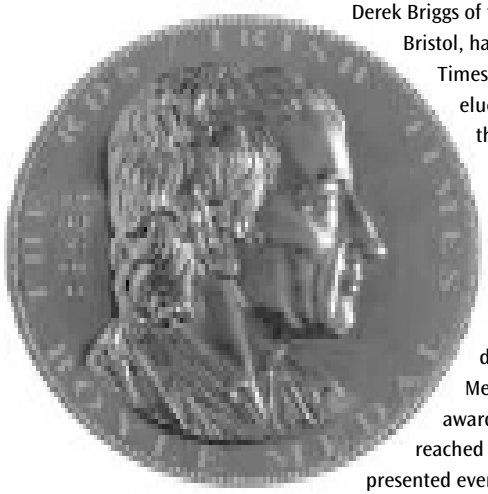
Doing "amateur" research to "professional" standards was, before palaeontology established itself as a profession, fraught with difficulty. In this Buckman faced exactly the same problem as his father, forced to resign in 1862 for doing experimental research in botany in support of Darwinian evolutionary ideas...! SSB was soon offered a consulting post with the Canadian Geological Survey, then busy exploring the more outlandish parts of Canada and Hong Kong, at $2,000 (Canadian), for six months such work, a year. But Buckman's invitation was abandoned with the start of the First World War. Then in 1923 A.W. Grabau (1870-1946) announced the discovery of ammonites of supposed Lower Cretaceous age, "a discovery of exceptional interest and importance in Chinese geology." Buckman was asked, because of his Canadian link, to identify further Hong Kong material and in 1926 showed that these ammonites were of Lower Jurassic age. His concept of a 'worldwide ammonite time table' was vindicated by this work alone.

This lecture attempts to re-assess Buckman's work and tries to point out how vital it is that historical skills are fully used in such attempts.

Further details can be obtained from the Executive Officer <**palass@palass.org**> and the local secretary <**m.p.smith@bham.ac.uk**>

news

Professor Derek Briggs FRS awarded the 2001 Boyle Medal



Derek Briggs of the Department of Earth Sciences, University of Bristol, has been awarded the Royal Dublin Society /Irish Times Boyle Medal for 2001, for his work in elucidating the evolutionary origin of animals through the study of fossil lagerstätten, and unraveling the chemico-physical basis of 'exceptional' fossil preservation.

The Boyle Medal was initiated by the Society in 1895 to 'encourage worth in different branches of science' and is named after Robert Boyle (1627-1691), father of Chemistry and discoverer of 'Boyle's Law' (1662). The first Boyle Medal was awarded in 1899, and it had been awarded to 31 others by the time the Society reached its centenary year in 1999. Traditionally presented every two years to recognize exceptional work carried out by an Irish scientist working in Ireland, the medal programme was reorganized in 1999 such that on every other occasion the medal will be presented to an Irish scientist working abroad. Derek is the first recipient of the medal in this category. He was selected from a shortlist of four, by an international panel of judges chaired by Lord Jack Lewis FRS. The medal was presented at a ceremony in Dublin in late January.

Kent RIGS: sites wanted

Do you know of any geological sites in Kent? If so, we would like to hear from you. The Kent RIGS (Regionally Important Geological Sites) Group has recently completed a list of potential RIGS based on local information; it's just possible that we've missed out some, *e.g.* filled-in 'historic' sites.

Kent is rich in coastal sections ranging from the white Chalk Cliffs of Dover to the pyritous London Clay of Sheppey, but information on inland localities is patchy. Many people visit Kent to do geology. So, if you have information on geological exposures past or present, we will be pleased to share it with you. Contact: Mrs Diana Franks, Kent RIGS, Leighbridge Farm, Headcorn, Kent, TN27 9PD, tel: 01622 890283; fax: 01622 892172; email <**DianaFranks@btinternet.com**>.

Palaeontological Association Undergraduate Prize Awardees 2001

University of Aberdeen: F. Robertson
Birkbeck, University of London: F.A. Tabor
University of Bristol: H.L. Mundy, E. Nunn
University College Cork: M. Keating
University of Edinburgh: K. Davis
University of Greenwich: S.J. Stevens
Imperial College London: S. Maidment
University of Leicester: S. Beardmore, K. White
University of Manchester: H. Hughes
Oxford Brooks University: F. Jenner
Royal Holloway, Univ. of London: R. Stephens
Staffordshire University: M. Cooke
Anglia Poly: C. Eldridge
University of Birmingham: L. Brazenell, J. Venus
University of Cambridge: R. Wade
University of Derby: N. Wing
University of Glasgow: C. Whitelaw
Kingston University: F. Hunt
University of Leeds: N. Chamberlain
University of Liverpool: S.C. Haddad
University of Oxford: C. Stalvies
University of Plymouth: K. Hannant
University of Sheffield: C.J. Berryman
Trinity College Dublin: N. Douglas

Happy Brachiopods for the New Year 2002…

The Brachiopod List exists …

Messages to this list should deal with brachiopods and information to brachiopodologists related to brachiopods. Please keep in mind that this list is not only for palaeontologists and information is widely distributed to marine biologists and to related lists. Feel free to use the brachiopod list for any pertinent information to be share by the brachiopodologist community.

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<**http://www.com.univ-mrs.fr/EuroBrachNet/**>

Très cordialement à tous!

Christian Emig
<**Christian.Emig@com.univ-mrs.fr**>

news…

Sylvester-Bradley Award Recipients 2002

David Allen (University of Bristol, UK) £350: *Cladistic redescription of* Terrestrisuchus *and assessment of synonymy with possible palaeobiogeographic implications*

Colin Barras (University of Bristol, UK) £570: *Ichnofaunal changes during the Triassic-Jurassic interval*

Simon Braddy (University of Bristol, UK) £560: *Trace fossils of southwestern Australia*

John Cunningham (University of Bristol, UK) £354: *Stomatopod phylogeny and systematics*

Heather Jamniczky (University of Calgary, Canada) £700: *Patterns of turtle cranial foramina: implications for systematic relationships among extinct and extant Testudines*

Kathy Keefe (University of Glasgow, UK) £480: *Late Ordovician provincial breakdown: disentangling palaeoecology from palaeobiogeography*

Hannah O'Regan (Liverpool John Moores University, UK) £730: *A review of fossil felid specimens in the collections of the Naturalis Museum, Leiden, The Netherlands*

James Renshaw (University of Bristol, UK) £726: *Biostratigraphical and evolutionary studies of* Turborotalia *(planktonic foraminifer) from the Eocene of Spain*

Sally Reynolds (Liverpool John Moores University, UK) £880: *A key element approach to reconstructing palaeoecology of East African and South African hominid sites*

Blair Steel (Royal Holloway, University of London, UK) £756: *First genetic assay of planktonic foraminifera from the mid-Pacific*

Sebastian Steyer (Université ST Lille, France) £500: *New discoveries in the Permian vertebrate fauna of Niger and the first temnospondyl amphibian from Central Africa*

Mikhail Surkov (Saratov University, Russia) £1,000: *Evolution of the anomodont basicranium and its systematic significance*

Oive Tinn (Tartu University, Estonia) £1,000: *Arenig ostracodes of Siberia*

Lauren Tucker (University of Birmingham, UK) £975: *Ichnological Evidence for the Development of Carboniferous and Permian Terrestrial Tetrapod Faunas*

David Waterhouse (University of Bristol, UK) £830: *The phylogeny of charadriiform birds: combining osteological and morphological data from selected fossil taxa*

James Wheeley (University of Bristol, UK) £600: *A comparative study of Early Triassic gastropods from Italy and Oman*

Wanted: back issues of Palaeontology Newsletter

Two members are trying to complete their sets of *Palaeontology Newsletter* as historical documents in the history of geology. If anyone can help them in their quest they have offered to reimburse any costs incurred. Please contact the newsletterophiles directly.

Stuart Baldwin is missing *Newsletters* 13, 26, 35, 38, 43, 44, 46, and can be contacted at Fossil Hall, Silver End, Witham, Essex CM8 3QA <**sbaldwin@fossilbooks.co.uk**>

William A.S. Sarjeant is looking for copies of *Newsletters* 1-10, 19, 20, 37, and can be contacted at the Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon SK S7N 5E2, Canada (Tel: 306 966 5683; Fax: 306 966 8593)

A fossil treasure from Aberystwyth arrives at BGS

Part of the fossil collection of the University of Wales, Aberystwyth, has been rehoused at the British Geological Survey, Keyworth. A veritable 'fossil menagerie', the collection includes everything from the Cambrian to the Crag. Amongst the highlights there are: Lower Cambrian fossils from the Comley area of Shropshire collected and identified by Cobbold, including brachiopods, trilobites and hyolithids; graptolites from the Rheidol Gorge (Jones coll.), Llansawel (Slater & Drew coll.) and Towyn areas (Jehu coll.) which underpin published work on the geology of Wales; Carboniferous corals and brachiopods from northern England collected by Lewis; and ammonoids of the Neaverson collection. Some of the material is from temporary excavations in Wales and the Welsh Borderland, including several trays of Caradoc shelly faunas from excavations at Hope Bowdler in Shropshire. Though most of the material is primarily of Welsh interest, it also counts amongst its ranks fossil Devonian fish from Caithness (now placed in the BGS collections at Edinburgh), high-spired gastropods from the Pliocene of East Anglia, and shelly faunas from the Devonian of southwest England. In the coming months we hope to incorporate all of this material into the Palaeosaurus database at BGS and to make these fossils accessible to the wider palaeontological community.

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One of the ammonites from the Neaverson collection (BGS LZB7755). Scale bar on the right is in millimetres

news

Meeting REPORTS

12th International Conference of the International Bryozoology Association
Trinity College, Dublin *16–21 July 2001*

The International Bryozoology Association (IBA) has met once every three years since 1968. The 12th IBA conference took place during July 2001 at Trinity College, Dublin, hosted by Patrick Wyse Jackson. Patrick and his team arranged just about everything to perfection, excepting the weather which was the coldest I can ever recall for a July week in the British Isles. Climate apart, Trinity College is an ideal venue for such a conference—the calm, academic atmosphere inside the College is optimal for the formal sessions, while immediately outside the College gates the bustling city centre of Dublin caters for all that is necessary after a long day listening to lectures.

IBA conferences showcase bryozoology in all its guises. Dublin followed this tradition, with an eclectic mix of neontological, palaeontological and mixed pedigree papers, covering all major groups of marine and freshwater bryozoans as well as entoprocts which some bryozoologists still group with the main (ectoproct) bryozoans. The conference atttracted more delegates than any previous IBA conference, with at least one country (Taiwan) being represented for the first time. It was encouraging to see so many new students intermingling with the established names from the global community of bryozoologists, including several senior figures who had missed the previous two conferences in Wellington (NZ) and Panama.

The trend towards a decline in proportion of papers on fossil bryozoans (particularly Palaeozoic) evident during recent IBA conferences was arrested somewhat at Dublin. Of the 70 papers read, 27 concerned fossil bryozoans. The conference opened with a five paper session on Ordovician bryozoans, something which would not have been possible in Wellington or Panama where Palaeozoic bryozoans were scarcely mentioned. Rather than attempting to review all 70 papers, I will focus on just a few and offer my apologies to the authors of the many equally relevant papers that have been passed over.

Bryozoology has been extremely slow to embrace the molecular revolution. A pitifully small number of the 6,000 living bryozoans have been sequenced, and there is as yet no equivalent of the molecular phylogenetic framework worked out so impressively for brachiopods, a fellow lophophorate phylum of far less importance in modern ecosystems. Part of the problem has been in obtaining genuine bryozoan sequences rather than contaminant sequences from the numerous symbionts that live in association with bryozoans.

Several molecular papers were read in Dublin, including the presentation by **Africa Gómez** (University of Hull) which was awarded the Larwood Prize for the best paper by a newcomer. Africa's work concerned the 'well-known' cheilostome *Celleporella hyalina*—molecular data allows eight separate clades to be distinguished and suggests that the *C. hyalina* species complex originated back in the Miocene. The molecular phylogeny of *Alcyonidium* constructed by **Jo Porter** and colleagues from the University of Wales Swansea partitioned this difficult genus into two main clades, one containing entirely planktotrophic species and the other a mixture of planktotrophs and non-planktotrophs.

Of particular palaeobiological interest, **Matt Dick** (Middlebury College) reported the results of his research with Amalia Herrera Cubilla and Jeremy Jackson on the molecular phylogeny of free-living, cupuladriid cheilostomes on either side of the Panamanian Isthmus, a biogeographical barrier established about three million years ago between the Pacific and Caribbean. Only one pair of trans-isthmian sibling species was identifiable. Genetic differentiation in cupuladriids was shown to correspond with differences in skeletal morphology. Of the two genera abounding in the fossil record, molecular evidence shows that *Discoporella* is monophyletic and nests within the paraphyletic *Cupuladria*.

Mark Erickson (St Lawrence University), with **David Waugh** (Kent State University), pointed out the similarities in colony-form between Cincinnatian trepostomes and Recent scleractinian corals, and made the bold suggestion that these Ordovician bryozoans possessed the capacity to build major reefs but lacked the opportunity to do so because storms were too frequent, subsidence insufficient, and slope morphology unsuitable. Non-hypothetical bryozoan reefs, or more strictly bryozoan-sponge mounds, have recently been discovered in the subsurface of the Great Australian Bight. These structures, which were thought to be Miocene coral reefs prior to coring, were described by **Yvonne Bone** (University of Adelaide). Consisting mainly of delicate branching bryozoans, the reefs apparently grew on the shelf edge during glacial lowstands when upwelling occurred off southern Australia. That bryozoans are not a 'reefally-challenged' phylum was underscored by **Hans Arne Nakrem** (Paleontologisk Museum, Oslo) who described another bryozoan reef: a 20 metre high, fenestrate-dominated bioherm from the Upper Carboniferous of Svalbard.

Beth Okamura (University of Reading) is leading a new programme of research into the myxozoan parasites of freshwater phylactolaemate bryozoans. Most myxozoans are fish parasites but bryozoans appear to be the ancestral hosts for one class (Malacosporea) belonging to this enigmatic phylum. Beth's student **Sylvie Tops** reported how a myxozoan which normally parasitizes bryozoans causes Proliferative Kidney Disease in salmonid fishes. This disease costs the UK trout industry an estimated £1.8 million per year.

Perhaps the most controversial paper was read by **Judy Winston** of the Virginia Museum of Natural History, and co-authored with Ruth Dewell and Ken McKinney of Appalachian State University. Entitled 'Deconstructing bryozoans', this paper proposed the hypothesis that the uniquely catastrophic metamorphosis of bryozoans has had profound implications—post-metamorphic bryozoans seemingly lack endodermal tissues, and have a coelom and gut that is not homologous with those present in other metazoan phyla. Evolutionary events leading to this peculiar ontogeny may have occurred during the Cambrian (or before) and placed major constraints on the subsequent evolution of the phylum. Now we know why these glorious animals haven't achieved world domination!

A successful one-day symposium on the history of the study of bryozoans was co-organized with *The Society for the History of Natural History* at the end of the main conference. Making his bryozoological debut for this symposium was **Hugh Torrens** (University of Keele). Hugh

entertained us by reading a paper, co-authored with Judy Winston, on Eliza Jelly, a Victorian 'lady's companion' who was the first woman to publish on bryozoans. **Roger Cuffey** (Penn State University) chronicled the Cincinattian school of palaeobryozoologists, of whom E.O. Ulrich and R.S. Bassler were the most prolific, while **Caroline Buttler** told us the fascinating tale of impoverished corset maker G.R. Vine who found enough time away from lingerie to publish 75 papers on British fossil bryozoans between 1877 and 1893. Providing a historical perspective on the Dublin IBA Conference, **Alan Cheetham** (Smithsonian Institution) charted the history of the IBA from its conception in 1965 during a time of increasing internationalism and optimism for the future, to the present day.

The conference proceedings will be published by Balkema, and a separate volume will contain the historical papers. A lot of water will have flowed through a lot of lophophores before the next IBA conference in Concepción, Chile during 2004. The conference organisers will have their work cut out bettering Dublin.

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44th Annual Meeting of the Palaeontological Association 2001

Copenhagen *15–19 December 2001*

It didn't seem like a year since Edinburgh, but it was cold again, the days were short, and the supermarkets were doing a roaring trade in large dead birds, so there could be little doubt that twelve months had passed. Thus it could only mean one thing—that it was time to see whether PalAss could cope with the first annual meeting to be held outside the UK or Ireland.

With registration not until late afternoon, I spent the day exploring Copenhagen with a select band in cohort. There was no plan, so it was purely by chance that we stumbled across the changing of the royal guard at Amalienborg Palace. Had we not done so, we'd never have discovered that one is not allowed to be photographed within five feet of a royal soldier, so it was lucky we did. It took us a while to get from there to the Little Mermaid, thanks to following a rather elaborate route, but finally we found her and I am glad to say that she is indeed little and a mermaid, thus fulfilling the Trades Description Act (Aquatic Hominoid Artwork Section).

And after all that fun, it was time to put on our scientific hats and go to the geological museum to register our arrival. We were early, but it seemed suspiciously devoid of palaeontologists and on returning to the hotel we found out why. Most of Europe's finest chroniclers of lithified organisms were trying to sign in at a desk staffed by one over-worked receptionist, forming a queue comparable to those normally seen outside Virgin Trains' customer service offices, albeit one rather more dignified.

Thankfully, all were freed in time to attend the Ice-Breaker and partake in the consumption of enough wine to warm not only the cockles, but also the mussels and oysters, of everyone's hearts. Then it was off to town for a bite to eat and another glass or ten of fermented grape juice.

Minik Rosing (Geological Museum Chairman) breaking the ice at the ice-breaker.

Sunday 16th December

Session 1

However, it turned out that vast consumption of alcoholic beverages was an integral aspect of the conference, as in his welcoming address, Henrik Jeppesen assured us that 'the beer companies give money to science', thus enabling those nursing pounding headaches to justify their early morning fragility.

First up was **Stefan Bengtson**, examining the biomineralization of animal sclerites. In an excellent talk, Stefan showed that there is convergence between the dermal sclerites of early organisms such as halkieriids and tomotiids and unrelated modern animals. However, the type of mineral used reflects the environment of evolution. Hence, Indian Ocean gastropods living around submarine vents have a 'halkieriid' foot covered in scales made of aragonite, pyrite and the highly magnetic greigite. Clearly the acquisition of dermal sclerites is a simple evolutionary step.

Graham Budd then stained the brains of modern onychophorans (thankfully not live on stage) to see how their eyes and antennae develop, for a better understanding of the head structures of problematic arthropods such as *Canadaspis*, providing us with 'yet another model for arthropod head assemblages' (Graham's words, not mine).

Next, **Mark Sutton** revealed another Wenlock wonder from the Herefordshire lagerstätte. *Offacolus*, a chelicerate, is the most numerous species in the deposit, enabling four specimens to be serially ground. Preliminary results from the exquisitely preserved material suggest that *Offacolus* may be most closely related to horseshoe crabs, but with a few significant differences, particularly the tail-spine articulation and the unusually few opisthosomal segments. There's plenty more still to come…

Abby Lane then had the unenviable task of being the first PhD student to give a presentation (and, I later noticed, the only one forced to talk to the whole audience). If Abby was daunted it didn't show as she explained the use of ghost taxa in understanding ancient biodiversity—computer simulation of ghost ranges based on phylogenetic analysis gives a better approximation to true diversity than traditional taxonomic methods.

Poor **Tim McCormick** must have sensed fate wasn't on his side when session chair Chris Paul inadvertently forgot he was next to talk, but any doubt was removed when he immediately suffered total projector meltdown as he tried to introduce us to the new BGS database, 'Palaeosaurus'. **Paul Taylor** was luckier as he looked into the absence of Cambrian bryozoans. For such an abundant element of the post-Cambrian Palaeozoic it seems rather odd for them to be missing, but perhaps early forms had no hard parts. Ordovician ctenostomes are derived, so bryozoans probably were present in the Cambrian, just that we've not found any yet.

Session 2

Part two began with **Sven Lange** attempting to unravel the mystery of the Thylacocephala. Are they decapods or thecostracans? Sven had used repeated sectioning to reveal internal morphology, and found a digestive system like decapods and cuticular structures like thecostracans, so he's still not sure.

From there it was but a couple of crotchets and a quaver to **Peter Skelton** and his musical scale bars (four centimetres to one octave), accompanying a crescendo of Cretaceous conglomerates. Rudist bivalve orientation was used to show that large blocks of limestone within the conglomerates were olistoliths; then it was rudists again with **Thomas Streuber** and his study of morphological variation in *Vaccinites*.

Simon Kelly was off to Greenland, showing that reliable biostratigraphy for the Albian/Cenomanian boundary can only be obtained via integration of micro- and macro-palaeontology and sedimentology, before **Eckart Håkansson** described the first Neogene 'sclerosponge' from the Mediterranean.

Jon Todd completed the session by asking what molluscan palaeoecology can tell us about modern Caribbean faunas. The uplift of the Panamanian isthmus (3 Ma) appears not to have directly affected the fauna as there is a gap of 1 my between its appearance and a major turnover, and that turnover may be linked to reef development.

And then it was lunch in the Geological Institute, allowing us to get our bearings before the parallel sessions began.

Quaffing amidst the poinsettias at the ice-breaking party.

Scenes of conference at the conference reception.

Session 3A

Advances in modern technology have been insufficient to enable me to clone myself, much to the relief of many, so in order to review some of the parallel sessions, I relied on a more traditional technique—delegation. Rosie Widdison kindly took notes for session 3A, and I apologize to her and the speakers if I have utterly transmogrified the observations she made.

Duncan Cleary showed that, for the bryozoan genus *Stenophragmidium*, cluster analysis is preferable to cladistics since it is more objective and defines groups better. **Arne Nielsen** compared the opportunistic trilobite assemblages from the mainly dysoxic Alum Shale of Sweden and Norway, then **Alison Bowdler-Hicks** discussed the taxonomic value of the variety of fringe swellings shown by Ordovician trinucleids—many of the variations are due to geography, but there are taxonomically useful patterns within each area.

George Sevastopoulo explained that trilobite accumulations in Carboniferous mud-mounds are probably preserved 'havens' where the animals went to moult (or retreat from a bad hangover), then **Jason Dunlop** described the oldest harvest spider, from the Rhynie Chert, showing that many features of harvestmen have persisted for 400 my. With a male and female specimen it stretches sex on the Web back rather longer than even the earliest Internet search engines.

And from the oldest harvest spiders to the oldest millipedes, as **Heather Wilson** unearthed Silurian, Devonian and Carboniferous examples. When analysed phylogenetically these specimens move the origins of modern forms back much further into the fossil record.

Session 3B

The first fossil decomposers—Cambrian nannobacteria—were the subject of **Malgorzata Moczydlowska**'s talk, noting their morphological similarity to modern cyanobacteria. Unfortunately, things then began to go awry, as the next two presenters had their talks wrecked by major technical problems. Both **Dave Gelsthorpe** and **Lucy Muir** struggled valiantly against projectorial anarchy, but we were to be sadly denied the chance properly to find out about either Dave's use of Gotland acritarchs better to understand the Silurian Ireviken extinction event, or Lucy's research into the nature of graptolitic disappearances at the end of the *lundgreni* biozone.

Workers on Danish forams were more fortunate, although the forams might disagree, since **Malcolm Hart**, then **Claus Heinberg**, documented the nature of the microfossils' extinction. The picture is very complex, since only 8.5% of benthic species disappear at the K/T boundary, but in combination with isotope stratigraphy Malcolm is forming a more complete picture. Claus then showed that, amongst planktonic species, biserial forms are dominant just above the K/T, before spiral forms take over. **Ahmed Kassab** brought the rather fraught session to a close by calibrating macro- and microfossil biozones to define the Cenomanian/Turonian boundary in Egypt.

Session 4A

It was molluscs galore in the afternoon's last session, as **John Cope** used bivalves to look at Ordovician palaeolatitudes, then **Olga Bogolepova** found a diverse Lower Silurian fauna, notably 'Bohemian-type' bivalves, in Siberia. **Michael Amler** hunted larval rostroconchs in the Superfamily Conocardioidea, before **Desmond Donovan** tried to resolve the affinities of *Eoteuthis* from the Hunsrück Shale. It probably isn't a squid, belemnite or orthocone nautiloid, but remains a 'very unsatisfactory animal'.

With the talks finished, and the hotel a speck on a rather distant horizon, myself and a triumvirate of like-minded souls retired to a nearby hostelry before returning to the Institute for the Annual Dinner. As ever, frivolity was much in evidence, and the in-house band was a well-received addition to the usual entertainment. With lakes of wine, the festivities went on well into the night, but with having to give my inaugural PalAss talk the following day I eventually decided to retire.

Some delegates will do anything to recover the registration costs! Entertainment at the conference dinner provided courtesy of the Danish chapter of the conodont mafia.

Monday 17th December

Session 5A

I know staggeringly little about vertebrate palaeontology, despite sharing a house with a worker in the field, but my knowledge has been considerably increased thanks to the talks in Monday's first session. **Per Ahlberg** began with new insights into two genera of tristichopterid fishes from the Devonian of Australia, *Eusthenopteron* and *Mandageria*. The latter was pretty large, being up to 1.6m long, and had a mobile neck joint similar to that of tetrapods. However, it still lacked adaptations necessary for it to have been terrestrial.

Henning Blom moved on to *Ichthyostega* from Greenland, defining two morphotypes, before **Jenny Clack** introduced us to Peter, a 'mummified' tetrapod that plugs a 30 my gap at the Devonian/Carboniferous boundary and provides the first evidence for terrestrial locomotion. Next, **Peter Mackovicky** looked at 'a hell of a lot of rubble' to produce a taxonomic revision of horned dinosaurs from the Cretaceous, showing that there were at least three dispersals in North America and Asia.

The Danish 'Wealden' fauna was the topic of **Niels Bonde**'s talk, finding the first European dromaeosaur of that age, then **Gilles Cuny** revealed a diverse selection of freshwater sharks from Thailand and Tunisia. Last but not least came the birds, as **Gareth Dyke** used Eocene fossils to clarify the systematics of galliforms (turkeys, chickens, quails and other delicious forms) to demonstrate that they are monophyletic.

Session 5B

(**report by David Gelsthorpe**)

After some confusion involving technical problems for the later PowerPoint presentations, **Thomas Servais** began the morning in auditorium B taking the safe option of overheads. He outlined the difficulties in speciating galeate acritarchs at the Cambro-Ordovician boundary and showed the statistical analysis carried out, which defined new groups probably related to water depth.

Second up was **Christian Skovsted** who took us to NE Greenland. He outlined his work on the newly described Lower Cambrian shelly fauna, which is shedding new light on Laurentia. Staying in the Cambrian, **Uwe Balthasar** showed us the enigmatically brachiopod-like *Mickwitza* and how the fantastic preservation has helped him identify it as a possible stem group brachiopod.

Widening the implications of the morning's discussions, **Taniel Danelian** speculated about the origin of silica secreting marine organisms. He suggested it was probably an anciently acquired character, only retained in some organisms. Then, with some outstanding field photos, **Svend Stouge** presented his taxonomic and biogeographic conodont studies from South China.

Possibly the best illustrated talk of the morning was given by **Mark Purnell**, who discussed the constraints controlling complexity in conodonts. His analogies, which compared a Swiss army knife to individual separate tools, were particularly powerful. Maintaining the high standard, **Karen Henriksen** presented her analysis of coccolithogenesis using Atomic Force Microscopy, illustrating the potential of this technique in providing new information on coccolith biomineralization.

President's Award winner Karen Henriksen (Copenhagen) and doting supervisor Jeremy Young, just after the award-winning presentation.

Kindly, Dave volunteered to continue his reviewing after the coffee break, but only on the condition that he could sit in on my talk and heckle if necessary.

Session 6B

(**report by David Gelsthorpe**)

After coffee, **Bill Fone** presented a very interesting talk on the spiral holdfasts of the Ordovician crinoid *Iocrinus* Hall. His very convincing speculation that there was ligament failure on one side of the wedge-shaped ossicles was well received. Next, expanding on the work of Kaufmann (1933) on the trilobites *Olenus* and *Homagnostus*, **Bodil Wesen Lauridsen** presented her statistical analysis. Her re-examination suggested that a gradual evolution interpretation was unfounded and should be replaced with a Plus-ça-change model.

Poster Prize winner Lauren Tucker (Birmingham) and her award winning poster.

In a particularly well illustrated talk, **Liam Herringshaw** gave us a tour of his spectacular Wenlock starfish. The 13 arms possessed by these specimens was discussed and possible explanations explored including modern analogues. Staying in the Silurian, **Ole Hoel** presented his work on the leptaenid brachiopods of Gotland. They prove to be a diverse group and are probably widely environmentally influenced.

Moving to the K/T boundary, **John Jagt** presented a comprehensive comparison of the echinoderms of the Maastricht and Denmark, which can be interpreted as a migration across the basin. To finish the morning session, **Richard Twitchett** gave a talk on the taphonomy, palaeoecology and distribution of Early Triassic ophiuroids. He also presented previously unreported occurrences in North America at this time.

Thanks again, Dave, and such kind words. I did offer an unusual slant on a session by reviewing the audience during my talk, but then realized that was a very silly idea. So we scarpered for lunch, then moved back to the Geological Museum for the final two sessions. Pat Brenchley and I were reluctant to concentrate on geology, though, for we needed to know whether England had beaten India in the Second Test and found a disappointing lack of cricket coverage in the Danish media. No one was able to tell us, though, so we battled bravely on.

Session 7

The audience now reunited in a single room, **Richard Bromley** gave a fascinating talk that proved palaeontology is not just about death, but also life. A mysterious multi-level trace fossil from California was shown to be the work of a tellinid bivalve as it moved and fed, producing a truly glorious object. Which leads neatly on to **Steve Donovan**. Steve used the ichnofauna of the Miocene Grand Bay Formation from the Caribbean to suggest that the sediments were laid down in deep water, primarily on the basis of strong similarities to the deep-sea chalks of the Cretaceous.

Andrew Smith moved on to land, examining two morphotypes of Devonian arthropod trackway. In-phase, swimming-like motions displayed in the trackways suggest that the myriapods that produced the prints could adopt amphibious habits, probably in freshwater channels. We were then treated to a double act as **Martin Whyte** and **Mike Romano** took one half of a talk each. Martin introduced us to the lithologies of the Cleveland Basin around Whitby and Scarborough, before Mike followed the trails of king crabs that occur in some of the sandstones.

Before anyone dashed off for refreshments, Chris Paul stepped up to announce the prize-winners for best talk and poster produced by a palaeontologist under 30 years of age. He noted that once again it was a difficult task with so much excellent research on show, but that the President's Prize for best talk should be awarded to **Karen Henricksen** and her revelatory approach to coccolithogenesis. The Council Poster Prize, meanwhile, was shared by **Sarah Stewart**, for her work on Ordovician biodiversity patterns, and **Lauren Tucker**, with her Carboniferous tetrapod trackways. Congratulations to all three winners.

Session 8

And after one last coffee break, it was time to bring another fossiliferous conference to a close. **Sören Jensen** began the final session with his work into Lower Cambrian medusoids, arguing that concentrically ringed trace fossils were created by the rotation of a tubular organism, rather than by an impression of a circular animal. **Peter Van Roy** studied Ordovician problematica from Morocco, and **Dave Harper** remained in that period of time to look at the limestone faunas of Laurentian Greenland—they were distinctly different from other contemporaneous assemblages around the Iapetus Ocean.

Stephen Hesselbo selected the mass extinction at the Triassic/Jurassic boundary for investigation, looking for signals that might provide an explanation of cause. Carbon-13 values from marine and terrestrial environments correlate well, showing a synchronicity in faunal turnover that ties in well to a massive initiation of volcanism at the boundary. And the privilege of bringing the meeting to an end went to **Peter Doyle** and his belemnite 'battlefields'. Massive concentrations of belemnites are known from a number of localities and have various interpretations, from post-spawning mortality to predation by sharks. A new example from the Oxford Clay is more puzzling, although if the BBC website is to be believed as a reliable source of information, Peter has now interpreted it as a stunning example of ichthyosaur vomit. Fantastic.

Sarah Stewart (Glasgow) being awarded this year's joint Council Poster Prize by Association President Professor Chris Paul.

So that's all folks, I hope you enjoyed it as much as I did. Copenhagen is as wonderful as its reputation, and the Geological Museum and Institute made for a great setting. It was an enormous pity that there were so many technical problems during the talks, since it took the gloss off some speakers' enjoyment of the conference, but it would be churlish to dwell on the occasional negative when there were myriad positives. Much thanks go to Dave Harper, Walter Kegel Christensen, Finn Surlyk, Svend Stouge, Nina Topp and all the other members of the organizing team for their sterling efforts. See you in Cambridge!

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Images kindly provided by Helje Parnaste (Geological Institute, Tallinn Technical University, Estonia <**helje@gi.ee**>*) who has a large gallery of additional images from the meeting which can be viewed at* <**http://www.gi.ee/~helje/**>. *Some additional images were provided by the editor.*

——OBITUARIES——

Joan Eveleen Mary Sylvester-Bradley (1917-2002)

Joan Sylvester-Bradley, wife of the late Peter Sylvester-Bradley, the first F.W. Bennett Professor of Geology at the University of Leicester, died on 8th February aged 84, after a short illness. She was an understated but staunch supporter of many palaeontological activities, and with her passing our science and The Palaeontological Association have lost a much valued friend.

Born in Jamaica, Joan Sylvester-Bradley also spent part of her childhood in India. Her mother was a nurse and her father was in the Royal Engineers. Planning, organization and travel formed a backdrop to family life; that, and the encouragement of her father to fulfil anything that she was capable of provided Joan with what she later considered to be a marvellous apprenticeship for being the wife of a geologist. She had no formal education until the age of nine, but clearly that proved to be no lasting hindrance. In 1938 she took a first in Geography from Oxford as a 'home student', at a time when there were no women colleges. Having graduated with little obvious idea what she wanted to do, after a brief flirtation with possible entrance into the Civil Service she secured a lectureship in Geography at Reading. While there she became a friend of the mineralogist Phoebe Walder, a meeting that was to determine her future life. It was Pheobe who acted as match-maker when asked by the ex-naval officer Peter Sylvester-Bradley to "suggest a wife" for him. Apparently Pheobe's coffee mornings were "especially hilarious when Peter turned up".

Joan Sylvester-Bradley's priorities were as a family-maker, home-maker and friend to many, matters in which she energetically excelled. If Peter Sylvester-Bradley was the one who thought up expeditions to collect fossils from far away places, Joan was the quartermaster who provided the support and logistics to make such professional and domestic activities happen. A dream team indeed. She shared in Peter's boyish enthusiasm of fossils and in many of his other scientific interests; she was passionate about flowers and gardening. No one who experienced the hospitality provided at 'Noon's Close', not least countless grateful students at regular gatherings, could have doubted that here was a loving home, and that of a geologist. Books, papers, maps and reference lists galore (it was a great help to Peter to have a trained and willing librarian as a wife!), and thousands of fossils, especially oysters, from all over the world were testimony to that.

Whether as a volunteer at the Citizens Advice Bureau or at the libraries of various hospitals in Leicester, or as a wise voice in her village and church community, Joan was always at hand, offering her help generously. It was characteristic of many things that she did when, on Peter Sylvester-Bradley's death, Joan determined to support palaeontology by approaching The Palaeontological Association in order to establish funds for the now eponymous award that supports young palaeontologists in their research activities. For her exceptional services to The Palaeontological Association she received an Honorary Life Membership in 1997.

Caring, warm, and with a sense of purpose, she was much loved and respected by all. She will be sorely missed not least by her wide circle of friends and colleagues at home and around the world. She embarked on her marriage wanting four children. She is survived by her daughter and three sons from her marriage to Peter Sylvester-Bradley, and by their six grandchildren and two great-grandchildren.

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Franco Rasetti (1901-2001)

Franco Rasetti was a master in diverse fields of physical and natural sciences. As a student at Pisa University in Italy he began to study engineering, but changed to physics because of his friendship with Enrico Fermi, who later won a Nobel Prize in physics. As a Professor in Rome University, Rasetti was a prominent member of Fermi's team, and the author in 1936 of an early textbook on nuclear physics. The actions of Mussolini's government led to the break-up of the team, Fermi going to the United States to work on the Manhattan project at the University of Chicago developing the atomic bomb. Rasetti was also anti-fascist and left Italy in 1939 to take up a chair in physics at Laval University, Quebec, Canada; he refused to take part in the Manhattan project.

At Laval, and later (1947-1968) at the Johns Hopkins University in Baltimore, Rasetti continued to teach physics and undertake research in the subject, while also continuing his work in natural sciences. In Italy he had studied cave beetles, and began to collect them in Quebec. Soon, however, he discovered another kind of "beetle", the trilobites in boulders of the conglomerates near Quebec City. His papers on these Cambrian and early Ordovician trilobites began to appear in 1945, and thereafter came a stream of papers on North American Cambrian trilobites, largely published in the *Journal of Paleontology* and the S*mithsonian Miscellaneous Collections*. Illustrated by excellent photographs and accurate drawings, concisely and carefully presented, this work made Rasetti a leader in this field, and the author of important contributions to the 1959 *Treatise* on trilobites.

In his work on the conglomerate boulders of Quebec, Rasetti was careful to keep the material collected from each boulder separate and to record the faunal assemblage in it, a procedure which enabled him to work out the exact horizon and succession of zones present. This lesson was not lost on C.H. Kindle and me in our work in Newfoundland, and makes Kindle's collections from Cambrian boulders of great value.

From his early days Rasetti was an expert mountain climber in the Alps, experience which he noted made his work on the Cambrian of the Canadian Rockies possible—even if he had to climb 5,000 feet and walk 10-15 miles in a day! He brought a detailed zonal stratigraphy into the succession, including the precise dating of the Burgess Shale.

Franco's collections were also a lesson in curatorship. From the beginning he used flat fifty-cigarette tins ($5^{3}/_{4}$ x $4^{1}/_{4}$ inches in size and $^{3}/_{4}$ inch deep, the lid hinged). Cutting out a rectangle from the lid, and placing a sheet of glass below it, the type, figured and additional material was placed on cotton in the box, the glass lid closing it, with pins at each side to fasten it. A neat, typed label and reference, and occasionally a photograph, were enclosed. When I saw this collection in Baltimore, the rows of tins were in steel filing cases, in alphabetic order of genus and species. Thus in discussion he could immediately pull open a drawer and find appropriate examples. The portion of his collection originally at Laval is now in the keeping of the Geological Survey of Canada, much other material is in the Natural History Museum, Smithsonian Institution, Washington DC. After his retirement the remainder of his collection was purchased by the Natural History Museum, London. Some is still kept there in the original tins, as it is in Ottawa.

After retirement from the Johns Hopkins University, Rasetti lived first in Italy. He extended his work on Cambrian rocks with a detailed re-investigation of the strata in Sardinia. He also continued to botanize in the Alps, photographing the flora in colour, and producing a book on alpine plants, which was published by the Accademie Nazionale dei Lincei, Roma, in 1980.

It was a privilege to have the friendship of this remarkable man, whose modesty concealed such extensive and varied abilities. His studies of Cambrian trilobites place him among the greats in that field, as he was in physics.

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Ronald Pearson Tripp (1914-2001)

Although Ron Tripp, who died on 29th December 2001, was in the main a self-taught amateur palaeontologist, he was in his heyday one of the most distinguished and prolific trilobite workers in this country, or indeed in the world.

In his boyhood, encouraged by his science master at school, he became an enthusiastic fossil collector, mainly from the Tertiary rocks of Suffolk and later, sometimes in the company of

Raymond Casey, the Cretaceous of Kent and Sussex. Later he was in the employ of British Oil and Cake Mills and in 1937 was transferred to their Glasgow branch. There he joined the Glasgow Geological Society and met the distinguished amateur collector and trilobitologist James Begg. They formed a team, with Begg supplying his first-hand knowledge of key fossil localities in the Girvan area, which he had inherited from knowing the Gray family's preferred collecting-sites, and Ron supplying willing hands and eyes, and transport in the form of an old car. Their collecting enhanced the fossil collections of the Hunterian Museum in Glasgow and, among other things, supplied F.R.C. Reed with new material to enhance some of his later papers that were supplementary to the monographs of the Girvan trilobites that he had already written.

After the war, during which Ron trained as a Spitfire pilot, he and Begg made collections of an undescribed trilobite fauna from shales (later known as the Kiln Mudstones) at Craighead. Ron decided to write this up, though it entailed learning a new craft. He was encouraged by Archie Lamont, then of the University of Edinburgh, who in particular helped with photography. The paper appeared in 1954 and was the first of many on the trilobites of Girvan to be published by the Royal Society of Edinburgh.

During the Craighead work Ron had wrestled with species of the curious Lichid trilobites. At that time the first edition of the *Treatise on Invertebrate Paleontology* was in preparation, but Elsa Warburg, who was to contribute on the Lichids, died before her work was complete. At the suggestion of C.J. Stubblefield, Ron took on the responsibility for this group, which he did with characteristic courage. Of the 60-odd named genera, Ron recognised a mere 25, suppressing 35. At about the same time he made a particular study of the Encrinurid trilobites, pioneering a technique for identifying individual glabellar tubercles for taxonomic purposes—an example of true scientific insight in seeing order in apparent chaos. This led to revision of some classic species and later (1979) he and his long-time friend John Temple reviewed the whole group using multivariate statistical techniques. Ron's Girvan work received a new impetus when Alwyn Williams, while mapping the Barr and lower Ardmillan (Caradoc) rocks of the Girvan area, found many new fossil localities, from which he and Ron made large collections. Over the years Ron systematically wrote up all these faunas in a series of papers. One of the faunas, from the thin unit called the Superstes Mudstone, is remarkably diverse with over 70 species! His work was recognised by the award of the Worth Prize of the Geological Society of London in 1963 and election to fellowship of the Edinburgh Geological Society in 1965.

In 1958 Ron, whose work for many years was in the fields of animal feedstuffs and agricultural chemicals, was promoted at work and moved to Kent. Unfortunately, however, about 1970 he suffered a severe blow—he was made redundant, a very depressing experience for one so active and dedicated. However in 1975 he was appointed a Research Associate in the Natural History Museum (NHM), and from this base his research gained new impetus. Through Harry Whittington he was encouraged to help Bill Evitt, who had collected an enormous number of silicified trilobites from the Ordovician of the Appalachians, but who had not written them all up. Together they wrote a large joint paper in 1977, and several shorter contributions. The six or seven years that Ron spent at the NHM were very productive, partly from the stimulus offered by his colleagues, notably Richard Fortey, and partly through the co-operation and co-authorship of Sam Morris on a number of papers. He also worked jointly with, among others, Euan Clarkson,

Chris Gass, Yvonne Howells, Keith Ingham, Alan Owen, Adrian Rushton, John Temple and Steve Tunnicliff. He also met the affable Zhou Zhiyi, which led to another friendship and four visits to China to work jointly on mid-Ordovician faunas there. As if that were not enough, he was for many years honorary Treasurer to the Palaeontological Association.

In May 1980 Ron's wife Doris, whom he had met in his years at Glasgow, died, and he moved out of his beautiful house in Kent, passing it over to his daughter Daphne and his twin grandchildren, of whom he was very proud. In December 1981 he married Phyllis Forrest and moved to Canada. There he was made an Associate of the Royal Ontario Museum. Despite deteriorating eyesight, he kept up his research, now assisted by Rolf Ludvigsen and David Rudkin. David, in particular, gave Ron enormous help at a time when he most needed it. In 1993 Ron graduated from the University of Toronto with a B.A. in English Literature. He also took a course in Latin, having retained from school days a knowledge of and interest in that subject. All who knew him marvelled at his resilience in the face of failing eyesight, and from his vivid description of the joys of a canoeing holiday taken on Canadian lakes it is hard to believe that he could barely see.

One of Ron's most engaging features was his enthusiasm, both for his own research work and that of his friends. His vigour was such that he liked to push forward his research projects as quickly as possible, leaving some of the fine details to be filled in later. We suspect that some of his over-cautious or perfectionist colleagues seemed slow to him, though he seldom showed the exasperation he must sometimes have felt. He was always ready to exchange ideas or dispense his accumulated knowledge, and although he would engage in argumentative discussion, it was always in a friendly, open-minded spirit of give-and-take. He did not like dogmatism.

A feature of Ron's field-work was the thorough way he collected fossils. Besides collecting good hand-specimens he pioneered (at least in Lower Palaeozoic palaeontology in UK) the practice of collecting bulk samples and breaking them up at home or in the lab, so that he could count each sclerite of each species in a fauna. He sometimes collected while wearing special magnifying spectacles to detect small specimens, such as those that abound in the Superstes Mudstone.

Ron knew the fossil localities of Girvan intimately and was well known to many of the locals as a regular visitor. There are tales of Ron's alarming way of driving around the narrow lanes of the Girvan area. He knew the roads well, and he would drive unexpectedly fast, sometimes rounding a blind bend, talking the while and gesticulating to make his point more emphatically. His hand-writing was famously difficult to read and he took to writing key words, or (when his eye-sight began to fail) whole letters, in capital letters; unfortunately these were almost as difficult to read as his cursive script. Chris Gass used to wonder if it was Ron's way of making people scrutinise things more carefully!

Ron Tripp contributed enormously to trilobite studies in the UK, and he leaves many friends in Britain, China and Canada. He will be very greatly missed.

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We thank many people, especially Phyllis Forrest and Daphne Paterson, for their help with this memorial.

Dr Raymond Casey writes:

News of the recent death of Ronald Tripp released a flood of memories. In my formative teenage years he brought new dimensions to my fossil-collecting and helped to foster my life-long interest in palaeontology. We first met through the pages of "The Exchange & Mart", a journal accessible to me as a 15 year-old newspaper boy and bookstall attendant. Among the advertisements for selling or exchanging everything from grandma's old ear trumpet to a discarded rat-trap, was one from a certain Mr R. Tripp of Ipswich offering to trade fossils. He was so taken with the box of Cretaceous duplicates I sent him from my native Folkestone that he immediately proposed a meeting and a joint field trip. One day in the early '30s the Sunday morning peace of Dover Street, Folkestone, was shattered by an unsilenced motorbike. Ronald Tripp had arrived. And there he was on the doorstep, a tall, red-faced youth of 19. We set off at a cracking pace on a tour of the Lower Greensand quarries which in those days dotted the Kentish countryside between Folkestone and Ashford. Riding shotgun on the stagecoaches of the old Wild West was nothing compared with riding pillion on Ron Tripp's motorbike, with every exhilarating moment threatening to be your last.

In the field his collecting technique resembled a vacuum cleaner (and was scarcely more discriminating), the inscription on his collecting bags betraying his workaday occupation in the cattle-cake business. Anything he did not want to keep for himself went towards his trading stock. So far as I can recall, his personal interests did not then go below the Cretaceous. Much of the unwanted material that came his way was bounced on to me along with the regular supply of fossils from the East Anglian Crags. He also generously passed on the names and addresses of foreign correspondents. Thanks to Ron's enterprise, I became the proud possessor of a suite of ammonites from the Lias of Lyme Regis, a beautiful set of shells from the Miocene Yorktown Formation of Virginia, giant sharks' teeth, whales' ear-bones and other exotic things I had only read about in books.

We drifted apart before the decade was out. In 1939 I obtained a job with the Geological Survey in London and was later swallowed up in the war. In the meantime, Ron's firm had exiled him to the hardrock country of Scotland. In one of his letters he told me he had become resigned to his fate and was even developing an interest in trilobites. It must have been almost 35 years since our first meeting that our paths crossed again at the Geological Survey in South Kensington. He was now fully committed to the Palaeozoic and trilobites, while my roots had taken a firmer grip on the Mesozoic. No doubt he will be remembered by most for his work in the Palaeozoic rather than for his early days as a softrock fossil-collector and entrepreneur.

Whatever heaven is reserved for palaeontologists, I am sure Ronald Tripp will be up there charging around on that noisy motorbike of his. Give 'em hell, Ron!

Correspondence

We've had the 'silly' season—now comes the 'fallacy' season…

Whether it's species (Budd) or evolution (Paul) you surely need to define first what game you are playing. Species exist no more nor less than any other categories in the linnean game. If you define species as living organisms reproducing after their own kind by exchanging genetic material and your chosen organisms perform accordingly, then you have a species. If they reproduce asexually, or not at all (fossils), then you need another definition if you are to broaden the game. But what does it matter whether you are a representative realist, berkeleyite or naive realist to give platonism etc their more modern names? Surely that's another game after we consider (heaven forbid) empiricism, reductionism…? [I'm happy if my students can identify a few given species before they graduate…]

Likewise with ancestors: such plesiomorphic organisms can't be classifed cladistically so effectively don't exist cladistically. The fossil record is not on trial any more than the biological record. The reason is that systematic knowledge is based on sampling the natural world. The game is how you assemble, analyse and interpret your samples. Cladistics is a pictorial game using morphological and molecular data to show taxic relationships based on a notion of parsimony—it's not an evolutionary history. If nothing else, cladistics has shown the pitfalls of mixing pattern and process. The same might be said for methodology and epistemology… I look forward to the season of 'enlightenment'.

Ed Jarzembowski

Association Meetings

Lyell Meeting 2002: Approaches to reconstructing phylogeny

Wednesday 5th June 2002

Geological Society of London, Burlington House, Piccadilly, London

organised by

Andy Gale (University of Greeenwich) and Philip Donoghue (University of Birmingham)

Currently used approaches to the reconstruction of phylogeny are very diverse, and are determined by the tradition of study (often itself particular to an individual group of organisms), the philosophical approach adopted and partly by the quality of the data available. Extremes are illustrated by studies in which lineages are identified from a direct stratigraphical reading of the fossil record, to those which consider that phylogeny can only be reconstructed by time-independent cladistic analysis of morphological and molecular data. This meeting seeks to illustrate this diversity of approach and provide a forum for discussion and comparison of methodologies.

Speakers will include:

- Jon Adrain (University of Iowa, USA): Time and phylogeny reconstruction
- Alan Cooper (University of Oxford, UK): Molecular evidence for the phylogeny of ratites
- Philip Donoghue (University of Birmingham, UK): Conodonts meet cladistics: phylogenetic systematics and the microfossil record
- Andy Gale (University of Greenwich, UK) & Andrew Smith (Natural History Museum, UK): Rock-record bias and phylogenetic reconstruction
- Paul Kenrick: Palaeobotanical approaches to reconstructing phylogeny
- Chris Paul (University of Liverpool, UK): What use is the fossil record?
- Paul Pearson (University of Bristol, UK): Title TBA
- Paul Upchurch (University of Cambridge, UK): Cladistic biogeography and phylogeny
- Peter Wagner (Field Museum of Natural History, Chicago, USA): Likelihood tests of general phylogenetic hypotheses: a case study with bellerophont molluscs.
- Mark Wilkinson (Natural History Museum, UK): Consensus trees and consensus supertrees.
- Jeremy Young (Natural History Museum, UK): Nannofossil phylogenies

For further details, please contact the organisers, <**asg@nhm.ac.uk**> and <**p.c.j.donoghue@bham.ac.uk**>.

From our Correspondents

Naming of parts

Henry Reed's famous WWII poem of this name has sometimes been considered to be an ironic parody of the second creation account in Genesis, where Adam hands out names to the various parts of creation. One of Reed's aims, I suppose, is to point out the clumsy, artificial and unsatisfactory attempts by the soldiers he describes to give order to their weaponry, compared to the natural harmony that exists both in the world around, and in that primordial garden. I suspect modern systematists will ruefully identify with the soldiers here, and cladistics, the latest attempt, is no more harmonious than many others. Cladistics has had a mixed press, with one of the most persistent criticisms being this: what is the point of having complex treatment of data without worrying about what data you are dealing with? Everyone dutifully types in their character matrix: neat rows of "1"s and "0"s, with a few "?"s and even "-"s thrown in if one is feeling game. Then the machine starts shaking, lights flash, steam pours out of the back and before one knows it, one only has a six-week wait while the bootstrap analysis finishes before one can rush one's exciting new tree into print. Incidentally, one of my favourites of these was the splendidly named "The guinea-pig is not a rodent" paper in *Nature* a few years ago.

And yet, in this new Eden of systematics, there is a snake, neatly coiled around the tree. Reading some papers, one would think that typing in the characters to start off with is something like Spiritualist attempts to transmit new Schubert quartets: one simply relaxes (perhaps in a darkened room), and everything flows through you. Wiser systematists have realised this is far from the truth however, and that sorting out character states is a labour of sweat and effort, often involving repeatedly shuffling back and forth between matrix and tree.

Why are things so difficult? One reason of course, is that no-one really knows how to select characters in the first place. In fact, if we did, we wouldn't need to do the analysis afterwards, for there could be no character conflict, and all characters would simply have a totally congruent distribution with each other. This may sound absurdly idealistic, but some systematists (especially in Germany) hold exactly this view, and as a result think of "computer cladistics" as merely a somewhat undignified attempt to squirrel away bad character analysis. The missing word in all this is of course "homology": that mysterious and imponderable quality that infuses two things linked by being states of the same character. That much we might agree on, but what is it we are really agreeing on, and how do we discover it? The dilemma is well known. Purists might want to argue that homology is something that cladistic analyses are meant to discover, by (technically) equating it with synapomorphy. That is all very well, argues the other camp, but one needs to put characters into the analysis in the first place. A little thought, or even better, experimentation, reveals that a certain degree of selection must go on at this point. For example, most readers might be happy to say that their hand was "homologous" with the manus of, say, a horse.

But if homology is the thing that comes out of the analysis, why not try all the options before, and let the analysis do the work for you? Why not put in the potential homology "human liver –horse hoof" for example? Several moderately good reasons suggest themselves. First, the number of characters and states would become nearly infinite, and secondly, all of our instincts tell us that the vast majority would be worthless noise acting merely to swamp out the "real" signal. In other words, it makes sense to think of homology as something that has at least some sort of independent life outside of synapomorphies on a tree. The big question is: what life? The whole debate about homology has been hopelessly muddled, partly because people have seemed convinced that homology is out there waiting to be discovered, rather than being a useful word waiting for a definition to be agreed.

I think homology should be defined in a way that makes it useful—what other reason for having it is there? And so, for a long time, I have been a supporter of what might be called the "straight rule" in homology. Homology is the relationship features of two or more taxa have if they are descended from the same thing present in their last common ancestor. As a palaeontologist, one might very well like this approach: it is a simply based, apparently morphological criterion, and it is useful in systematics. Unfortunately, and to my horror, I was recently persuaded that it may not do the job. Why not? Well, there are both simple and complex objections to this simple approach. One simple objection might be that it is unreasonable to exclude behaviour from homology. That is not too bad though: one could perhaps argue that behaviour—if "hard wired"—is simply a reflection of morphology (*i.e.* brain architecture!), and inherited homologous brain structure would give homologous behaviours. Learnt behaviour, one might imagine, is almost by definition not homologous apart from in a convoluted sort of way. I think the straight rule survives this sort of attack.

On the other hand, a much more serious (and annoying) criticism has come from Louise Roth and (especially) Günter Wagner. Why is it we want to say that two limbs might be homologous, but that a leg and a kidney are not? Wagner argues that the reason is that, in any species, there is variation within a feature, but that this variation is limited. This is obviously true—otherwise we wouldn't be able to name parts at all, for morphology would be an amorphous mess. Homology, for Wagner, is thus a statement, not about similarity or descent as such, but fundamentally about the limits of variation. Given the way the world is going today, it must come as no surprise that there is a reason behind this lack of variation in homologous structures; and that reason is a developmental one. This "biological homology concept" thus brings in one of the constant features of the homology debate, an insistence on the importance of development. Homologous structures are not simply ones that are separately inherited from a common ancestor, but are also ones that share the same developmental package that acts as guarantor of morphological continuity by constraining variation.

What is one to make of this approach? Clearly, there is a point to it. If organisms were not chopped up into distinct parts, then we couldn't talk about homology at all apart from at a boring "this organism is homologous to this one" level. So there must be more to homology than mere common descent. I give this round to the biological homology concept. However, I become suspicious when it insists that the boundaries drawn around the characters must be developmental ones. For a start, in fossils, and in nearly all other organisms as well, we have no clue about development, yet no one feels they cannot talk sensibly about whether or not the glabellas of different trilobites are homologous just because their development is largely unknown. We might very well think two homologous characters, being well-defined, have their own development (the word, apparently, is "quasi-autonomous"), but that is an inference from homology, not a criterion for it.

Any way, there is a completely different case to be made for the existence of characters that is rarely featured in the endless arguments about homology—so I will give it an airing here. The basic line of attack here is to point out that developmental constraint might not be the only thing that keeps a character from varying too much. For example, members of the same species have a global constraint on them because they have to be able to interbreed, and this may often place tight limits on what variation is allowed. More pertinently, my own view is that the whole debate has been carried out in a sort of vacuum, without much reference to other topics that are sometimes thought to be of some relevance—ecology, for example. So let me come clean: I think characters exist because they exist as specialisations to allow the organism to do the ecological things it needs to. Characters remain identifiable within and between lineages because of strong functional pressures acting on them. When these pressures change, the characters change too. This, I believe, is known as "natural selection" in the trade. Characters, in this view, are not "quasi-autonomous developmental packages" but functional specialisations.

An interesting research programme for palaeontology would be to test these ideas by looking at the relationship between character stability and the degree of "coordinated stasis". Given the hypothesis that many features of an organism's environment are provided by the community it lives in, then character and community stasis should be inextricably linked. As Art Boucot suggested many years ago, differing positions within the community should lead to different degrees of stabilizing selection, so that the character lability of particular organisms should be, to a degree, predictable. If so, then development of different features will be beside the point.

I started with cladistics and ended up with community evolution, and still did not need to talk about any genes (apart from to complain about them). Having thus covered nearly everything, this leads me to the following conclusion, most conducive for a palaeontologist: genes are not important in evolution. Well, not really, anyway.

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Morphology, Embryos, and Fossils: Palaeontology and Evo-devo

Traditional developmental biology doesn't need palaeontology any more (or less) than hard-core palaeontology needs developmental biology. The approaches of the two fields are entirely different, as is the training that individuals acquire to pursue lives as developmental biologists or as palaeontologists. Both fields will undoubtedly continue along independent paths, practitioners happily pursuing the study of morphology along their own particular time scales. Nevertheless, the two disciplines have begun to find common ground in the bourgeoning field of evolutionary developmental biology, or evo-devo. The specific goals and aims of evo-devo are to understand:

- the origin and evolution of development;
- how modifications of development lead to novel features;
- the adaptive plasticity of development in life-history evolution; and
- how ecology affects development

So why have we, an evo-devo biology lab, been asked to write a regular column for the Palaeontological Association *newsletter*? An obvious answer is because fossils can be studied on gels and microscope slides, and embryos can be encased in stone. Perhaps more profoundly, several of the aims of evo-devo directly affect palaeontology, including identification of constraints, relations between micro- and macroevolution, and potential conflicts between molecular data and the fossil record (see Hall 2002, *Palaeontology* **45**(**4**) in press for details). And in an absolute sense, because evo-devo, like palaeontology, ultimately concerns the study of morphology.

Our emphasis on morphology may seem, at first glance, a bit heretical. Evo-devo is often seen as the grand reunification of development with evolution (or at least with the Modern Synthesis). Thus, evo-devo tends to focus on genes and all things "-genetic," such as developmental genetics, epigenetics, phenogenetics (the relationship between the genotype and phenotype). What can the fossil record possibly contribute to such a dialogue?

Embryology and palaeontology are chief among the fields that show us how the forms of organisms change during their descent with modification. A true evolutionary developmental biologist must therefore embrace both, for development plays a role both in the production of morphology (morphogenesis) and in the production of evolutionary novelty or innovation (evolutionary morphology). To understand the latter process, one must document morphological patterns over geological time, a task for which palaeontologists are supremely and uniquely qualified.

The links between the two fields are deep and strong, harking back to Charles Darwin and the very foundations of the theory of evolution and the classes of evidence upon which it is based. Chief among Darwin's classes of evidence were morphology (homology), embryos, and then fossils. C.H. Waddington, who began his career with the study of ammonites, switched to experimental embryology and genetics because, he argued, "the evolution of organisms must really be regarded as the evolution of developmental systems" (1975, *The Evolution of an Evolutionist*. p. 7). Just last year, Henry Gee, in a column in this newsletter,

revealed that: "If I could pick a research area for palaeontologists, it would be [evo-devo], in which palaeontologists contribute to the general aim of elucidating the origins of morphological novelty—working alongside molecular developmental geneticists and geneticists" (2001, The Palaeontological Association *Newsletter* **48** p. 62).

Given the potentially dichotomous paths that developmental biologists and palaeontologists might choose to pursue, we have offered to write this column because we are a broadly integrated evo-devo lab. This year, two graduate students with palaeontological training, Matt Vickaryous and Tim Fedak, have joined the lab; Matt with an M.Sc. in palaeontology from the University of Calgary, and Tim with a Fine Arts degree and several years experience as preparator and lab manager for the Fundy Geological Museum. There are other, more tenuous links to palaeontology in the lab. Wendy Olson, a post-doctoral fellow, began her graduate studies in palaeontology and so brings the "palaeo" perspective to her developmental studies on the dwarf African frog, *Hymenochirus*. Jon Stone, another post-doctoral fellow, has a strong background in theoretical modelling, morphospace analysis, and invertebrate morphology. Brian Hall, as a zoology undergraduate specializing in embryology, took palaeo for as long as he could in a system that did not encourage such boundary crossing. Given the present composition of the lab, we felt that we were in an ideal position to explore the potential interactions between evo-devo and palaeontology, both through research projects and more formal classes. To this end, we have organized a special topics graduate class with a major emphasis on intersections between vertebrate palaeontology and evo-devo—this in a biology department which lacks any type of palaeontologist.

The class has a mixed group of attendees. To the aforementioned (motley) crew, we add several other graduate and undergraduate students, bringing in backgrounds as diverse as marine and invertebrate biology, developmental and molecular genetics, neuroscience, as well as a newly appointed faculty member from the Philosophy Department.

As a launching point for discussion, we are using Robert Carroll's *Patterns and Processes of Vertebrate Evolution* (1997, Cambridge University Press), an authoritative, comprehensive text that aims to integrate palaeontology and evo-devo. The second half of the course will consist of presentations, in which each participant will draw upon developmental, molecular, and palaeontological evidence to explore topics broadly related to his or her own research. A final group presentation and discussion will address the question "which came first, the chicken or the egg?" This session/debate, which will be open to anyone in the department, will explore whether different classes of evidence (developmental, molecular, palaeontological) suggest different answers to this age-old question. We will discuss the outcome of the class and the group presentation in the next column, as well as ways to facilitate interactions between evo-devo and palaeontology; increase the distribution and accessibility of data; venues for publication; attendance at meetings, and so forth.

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Prof. Ed's Media Chat

Back in the twentieth century, I asked a major TV company why archaeology and wildlife got so much coverage and palaeontology so little. Eventually I got an indirect, informal reply: "that's because fossils are dull-coloured, don't move, and are dusty." They were clearly talking about someone else's museum.

The rapid advances in computer technology over the past decade have challenged all that. Hype-aside, Spielberg's 'Jurassic Park' was surely a visual and virtual watershed. I remember being dragged reluctantly to the cinema to see the film on the big screen and I'm glad I went after all. I was still half-expecting the dinosaurs to be animated modelling clay, but my jaw dropped in the dark (just like the actors' on screen) as the first dinosaur, a sauropod, came into view. The restored fossil looked decidedly plausible, at least to a palaeoentomologist. Others agreed, and we've since had two sequels and Disney's dinosaurs.

Equally significantly, fossil vertebrates have made a successful transition to the small screen. These include BBC TV's 'Walking with Dinosaurs' and Channel 4's 'Extinct' series. Event-type programmes are still in the development phase (*Newsletter*, 48, 18). Non-vertebrates have at least been cast in supporting roles.

But is it palaeontology? Just like archaeological restorations, virtual fossils are a combination of science fact and make-up. It's the latter that worries the professionals. But as a beleaguered producer once said to me "at the end of the day, we've got to be entertaining…". In the short term, at least, the productions raise public awareness. The audience figures verge on the astronomical. It's a sobering thought, but a lifetime's talking to local community groups is numerically equivalent to less than one successful programme. Still, it's a different quality experience …

Ratings figures aside, each new film or programme seems to raise the stakes for the next one. Perhaps I'm just an eternal optimist, but I already detect a bit of a natural selection operating in favour of authenticity. Instead of the main feature, in 'Walking with Beasts' (2001) I could easily have spent the evening watching the 'evidence' and listening to 'in depth narration' of the digital interactive. Website information is now a standard broadcasting accompaniment, although Web chat is still likely to suffer from congestion.

Programming is also important. We've all done a day's recording only for it to be knocked out by something more 'newsworthy'. On the other hand, Radio 4's 'Commuter Belt Killer' (2001) series was cleverly broadcast immediately after the high-ratings 'Gardeners' Question Time'. I was left wondering, however, how many Agatha Christie fans tuned in not expecting Wealden palaeontology.

Behind the dumb-downed education-entertainment, producers still have a vested interest in involving scholarly palaeontologists. They freely admit (and often freely get) our knowledge and credentials to make the films in the first place. If you still have reservations about science and the media, then note that the Royal Society has included science communicators amongst its Fellows from the nineteenth century to the present day.

So please let me have your news and views, as well as popular books, press cuttings, videos and Oscarite nominations for the next palas superstar. (Jane Francis need not apply.) Unlike in systematics, memory is short in the media, like lead-in time. As the *Newsletter* is a relatively infrequent publication, please let me know about your proposals in the early stages. The official press releases may be just too late.

Coming soon: coffee-table books and the press.

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My computer is a museum piece, so jpeg images please to <**PJAusten@ukgateway.net**>.

SYLVESTER-BRADLEY AWARD:

REPORTS

The basal therapsid Hipposaurus *from South Africa and its implications for the origin of gorgonopsid craniodental morphology.*

Gorgonopsids are a clade of terrestrial therapsids, which are restricted temporally to the last ten million years of the Late Permian, in Russia and South Africa. During this time they are profoundly dominant as the main apex carnivores and heavily influence the evolution of many co-existing terrestrial tetrapods. Their skulls are characterised by long heavy rostra, craniofacial buttresses, flared temporal fenestrae, expanded symphyseal region of the lower jaw and most of all by their sabre-toothed dentition (Kemp, 1982; Jenkins, 1998, 2001, Jenkins *et al*, 2002). Along with early therocephalians (lycosuchids and scylacosaurids) they are the first sabre-toothed terrestrial tetrapods to appear on the Earth, some 210 million years before Cenozoic sabre-toothed 'cats'. These carnivorous therapsids contribute the main bulk of one of the most complex and successful predator communities ever to have existed (Jenkins, 1998, 2001). Gorgonopsids' short-lived but tremendous supremacy as predators is due (at least in part) to the sabre-toothed adaptation. However, this highly characteristic morphology appears *de novo* in the fossil record in much the same way as do snakes and ichthyosaurs. The sister-group to gorgonopsids is the herbivorous dicynodonts; in terms of cranial design about as disparate from the gorgonopsid skull bauplan as it is possible to be. This grouping arises because of the shared characteristics of a temporal roof that is reduced in width compared to basal therapsids and a laterally expanded temporal fossa (Hopson, 1991). Given the completely different feeding mechanisms of gorgonopsids and dicynodonts, this would appear to be convergent, a functional requirement to increase the external adductor musculature and bite force.

Cladistic analysis shows that dicynodonts occupy an unresolved grouping with dinocephalians (Hopson, 1991). Despite the predatory cranial architecture of anteosaur dinocephalians, the skulls of these therapsids also are not similar to gorgonopsids. Structurally, the nearest skull design to the gorgonopsid case is that of basal therapsids. Basal therapsids such as *Biarmosuchus* (Russia) and *Hipposaurus* (South Africa) possess canine sabres, developed to a greater or lesser degree. Some confusion arises from Boonstra (1963) who considered hipposaurids as specialised gorgonopsids and Sigogneau (1970) who suggested that they are primitive gorgonopsids!

In view of this, a structural/biomechanical appraisal of well preserved hipposaurid skull material in the South African museum (SAM) Cape Town is undertaken in order to shed light on the biomechanical origin of the gorgonopsid skull. A suite of non-metric anatomical features is composed; this is secondary to a series of detailed linear, angular, areal and volumetric measurements. These measurements are analysed in a comparative framework against the great variety of gorgonopsid skulls preserved in the SAM. Furthermore, all of the specimens

are compared to the skull of the sphenacodont pelycosaur-grade synapsid *Dimetrodon* since this animal is the sister group to all therapsids and is an obligate carnivore. The preliminary biomechanical analysis suggests a number of functional interpretations. An hypothesised precursor for a gorgonopsid (*i.e.* intermediate between *Dimetrodon* and a basal gorgonopsid) should have a somewhat expanded symphyseal region of the lower jaw, incipient sabres, a rather deep rostrum of sub-rounded cross section and an insertion point for the anterior pterygoideus muscles that is not close to the jaw joint. *Eotitanosuchus* from Russia is closest but no lower jaw is known.

The application of Second Moments of Area (the mathematical expression of cross-sectional geometry of a tube—or a skull) to hipposaurid rostra show them to be strong in dorsoventral bending at the region of the posteriormost teeth. This results from the ventral bulging of the primary palate, a condition seen in *Dimetrodon*. But anteriorly the snout of *Hipposaurus* is very different from that of *Dimetrodon*, it is very low and structurally much less strong (lower Second Moments of Area value). This less robust architecture is reflected in the design of the symphyseal region of the lower jaws; the contact between the two sides of the lower jaw is small and it is low in height. Recent work has shown that the expanded gorgonopsid symphysis serves to increase the penetration of the sabres, to resist axial jaw torsion and to give a stable bite where both sides of the adductor muscles contribute (Jenkins *et al.*, 2002). Hence the hipposaurid anterior rostrum and symphyseal area is functionally very different from that of gorgonopsids. Further application of Second Moments of Area show the hipposaurid lower jaw to be much less strong than that of *Dimetrodon* and gorgonopsids. Resolution of forces mathematics are applied to the reconstructed lever system of the hipposaurid jaw and show that, compared to gorgonopsids, the velocity ratio of the lower jaw is high (fast adduction) but the mechanical advantage is low (small bite force). This is because the anterior pterygoideus muscles are inserted close to the jaw joint.

In sum, the snout, weak in torsion and dorsoventral bending at its anterior region; the small symphysis—hence insubstantial against the forces imposed by prey; the fast but lower-power jaw adduction show that hipposaurids have a very different carnivorous habit than those of *Dimetrodon*, anteosaurs, early therocephalians and gorgonopsids. It indicates an incapacity to be able to disable and kill large prey; rather it appears to be a highly specialised and unusual predatory therapsid that evolved to tackle smaller components of the prey fauna. In this respect hipposaurids are comparable to modern small canids and viverrids (civets and genets) rather than medium-sized felids and mustelids. Despite having sabre-teeth and being implicated as a specialised (Boonstra, 1963) or primitive gorgonopsid (Sigogneau, 1970) prior to its identification as a basal therapsid (Hopson, 1991), this preliminary work indicates that *Hipposaurus* and the very similar biarmosuchids do not represent a gorgonopsid-like precursor. Despite their substantial size, they are specialised small-prey carnivores and thus add a new component to carnivore guilds of the Permian.

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Brachiopod Platystrophia *(Orthida, Plectorthidae) from the Ordovician of the East Baltic*

The rhynchonelliformean brachiopod *Platystrophia* is widespread in the Ordovician and Lower Silurian sequences of the Baltoscandia, Laurentia (North America), Avalonia (England, Wales, eastern Canada and eastern USA) and China. *Platystrophia* is a highly variable genus embracing about 150 taxa formally established or described in the open nomenclature. Among them up to fifty-six taxa came from East Baltica and its margins.

The study of these East Baltic *Platystrophia*, including field work and subsequent laboratory study, was supported by a Sylvester-Bradley Award for the year 2001. More than 2,000 specimens of *Platystrophia* from the museums of Tallinn (Estonia) and St. Petersburg (Russia), as well as from author collection, were studied. This collection includes about 200 specimens that were sampled in five localities in the western St. Petersburg region and North Estonia from the Idavere to Rakvere stages (Caradoc) during the summer of the year 2001.

The East Baltic Ordovician and Silurian sequences contain the most complete record of evolutionary history of the genus, which corresponds to its whole known stratigraphic range. In the East Baltic the earliest known *Platystrophia* was reported from the lower Volkhov Regional Stage (*Baltoniodus triangularis–B.navis* conodont Biozone, late Arenig) of the St. Petersburg region, Russia (Rubel, 1961; Zuykov, 1999). During the upper Arenig–middle Llanvirn *Platystrophia* was represented by several taxa in each regional stage. The Caradoc was the time of diversification of *Platystrophia* in Baltica. It is reported from the Caradoc deposits of Podolia (Ukraine), Pre-Polar Urals, Pai-Khoi, Vaigach Island and Novaya Zemlya. Taxonomic diversity of the genus declined considerably in the East Baltic by the end of the Ashgill, but it remained relatively common in the North Estonian and Lithuanian confacies belts. The early Silurian *Platystrophia* represents a rare component of the brachiopod assemblages. It disappeared completely in the East Baltic by the end of the Wenlock.

Unfortunately, species discrimination in *Platystrophia* has traditionally been based mainly on external features, which demonstrate a significant intraspecific variability, whereas details of the internal morphology and, in particular, characters of cardinalia have usually been ignored. Up to now, the internal morphology of *Platystrophia* has not been a subject of specific study, but examination of the well preserved shells of seven Baltic species indicates considerable variations in the morphology of dorsal cardinalia such as shape and size of brachiophores, angle of their inclination and divergence, as well as in a shape of the notothyrial platform. However, more research is needed to determine the significance of these variations, which will be used for reconstruction of phylogeny. Therefore careful examination of the external and internal morphology of *Platystrophia* from different biogeographical provinces with special attention to the intraspecific variability and detailed morphology of dorsal cardinalia must be conducted.

The shells of East Baltic *Platystrophia* are of moderate size which usually does not exceed 20 mm width, though adults of *Platystrophia lynx lynx* may be up to 40 mm wide. Radial ornament of the majority of Baltic *Platystrophia* is characterized by simple costae, but bifurcation and intercalation of costae in the sulcus and on the fold was established in some early Llanvirn species as a rare individual variation. Later it becomes a diagnostic feature of some species, *e.g. P. lutkevichi* and *P. quadriplicata* from the Rakvere Stage (Late Caradoc) of St.Petersburg region. By contrast, bifurcation of costae in the median fold and sulcus is rather characteristic of the Laurentian species of *Platystrophia*. Although thin spines are usually not preserved on external surface of *Platystrophia*, this feature is clearly visible in many specimens from the East Baltic.

This is a preliminary report on some results obtained after the Summer 2001 field season, under financial support of the Palaeontological Association (Sylvester-Bradley Award). At the present time, the investigation of shell structures of East Baltic *Platystrophia* using SEM is in progress. More details will be presented in a separate publication, which is currently in preparation. Collected specimens will be deposited in the Central Scientific-Research Geological Exploration Museum named after F.N. Tscherernyschew (CNIGR Museum), St. Petersburg, Russia.

I am very grateful to Dr Linda Hints (Tallinn) for her generous help in organization of fieldwork in Estonia.

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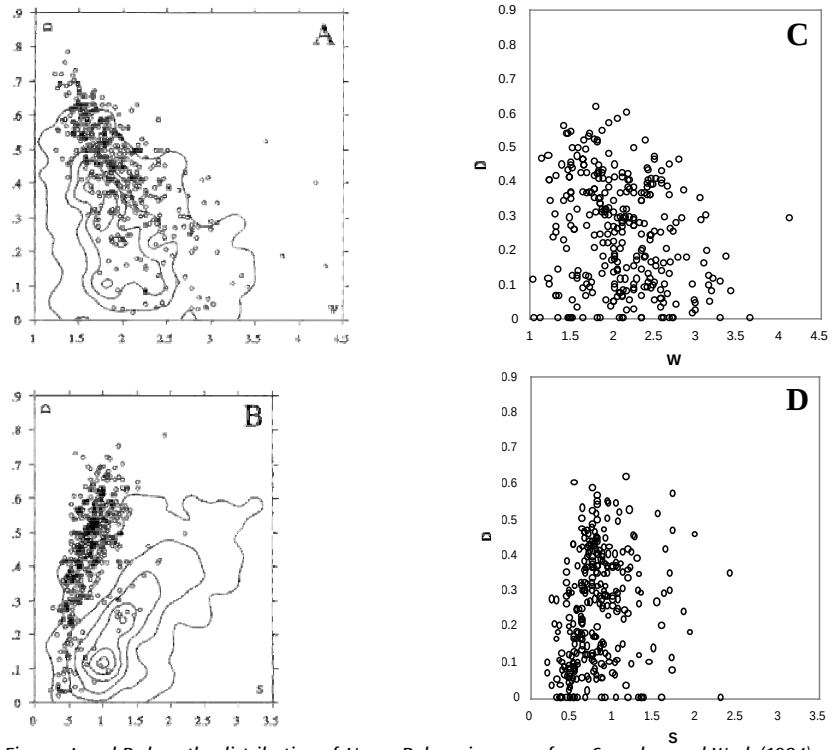
The macroevolution of Triassic ammonoids

Between June and Septemeber 2001 I carried out a series of visits to museum collections in support of my Ph.D. research on the macroevolution of Triassic ammonoids. The Triassic ammonoids are an excellent group on which to conduct macroevolutionary studies as they span a transitional period in ammonoid evolution, which commences after the Permo–Triassic, and ends with the turnover at the Triassic-Jurassic boundary. Within the Triassic the group experienced three periods of accelerated turnover, at the Smithian-Spathian, Spathian–Anisian, and Upper Carnian–Lower Ladinian boundaries. This makes them an excellent group to study patterns of morphospace occupation and disparity in relation to taxonomic

evolutionary rates. The Palaeontological Association was kind enough to aid me in this research through the granting of a Sylvester-Bradley Award, which covered my expenses while I was undertaking research at the Natural History Museum in London during July 2001.

Research carried out using Sylvester-Bradley funds: I collected morphological data from 150 specimens, representing 101 genera, held in the collections of the Natural History Museum, London. This involved taking measurements of the W, D, and S coiling parameters (see Raup, 1967 for a full description of these parameters) of the specimens, as well as further information on the strength and distribution of shell ornamentation. The specimens were also scored for shell characters used by Dommergues *et al.*, (1996). The purpose of these measurements was to compare the morphological evolution of Triassic ammonoids both among Triassic substages, and with their precursor Paleozoic taxa, and the Lower Jurassic groups that characterized the recovery from the Triassic-Jurassic boundary event.

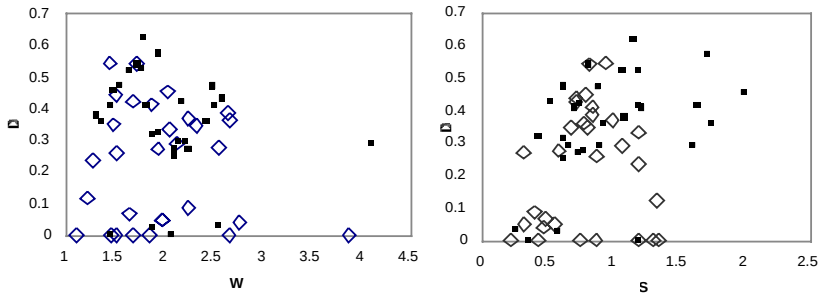
Some preliminary results: The preliminary results for the W versus D and S versus D distributions of 309 genera of Triassic ammonoids are shown below (Fig 1 A-D). These data, collected from photographs and specimens, represent about 60% of all of the valid Triassic ammonoid genera described in the literature.



Figures A and B show the distribution of Upper Paleozoic genera from Saunders and Work (1984) as contours, and 436 Lower Jurassic species from 156 genera measured by Dommergues et al., *(1996) as dots. Figures A and B are reproduced with the permission of the Paleontological Society. Figures C and D show the 309 Triassic genera measured to date as part of this project.*

Visual comparison of the Triassic plots with those of Dommergues *et al.*, (1996; Fig 14 A & B) revealed an interesting pair of patterns. The distribution of Triassic ammonoids in W versus D space remains similar to that of the Upper Paleozoic, while their distribution in S versus D space is closer to that of the Lower Jurassic. This decrease in S indicates a shift to more compressed morphologies, that is shells with narrower cross sections. The simplest interpretation of this shift in coiling morphologies is that such a shape would act to reduce drag during swimming (Chamberlain, 1981).

A series of plots have also been compiled to evaluate the distribution patterns of Triassic ammonoids in WDS morphospace at the substage level. Space constrains me from showing a large number of these plots, but to give some idea of the potential information these plots contain, below are a pair of plots for the Spathian-Lower Anisian. The Spathian-Anisian boundary marks the transition between the Lower and Middle Triassic, and there is a considerable turnover in ammonoid genera at this boundary. What is particularly remarkable about these plots (Figure 2 A and B) is that the two boundary crossing genera lie at extreme values of D. From these "rootstock" genera the distribution that is generated is similar to that of the preceding Spathian substage, rather than clustering in the morphospace close to the boundary crossing genera.



These plots of W versus D (Fig. A) and S versus D (Fig. B), show the distributions of Spathian (diamonds; n=29) and Lower Anisian (squares; n=30) ammonoids. The positions of boundary crossing genera are labelled.

Future Work: The next major step in the analysis of these data will be multivariate analyses using principal components analysis and cluster analysis to attempt to understand the interrelation of the different shell characters. Further analysis of the substage plots using multivariate statistics to compare the distribution of ammonoid family centroids better to understand the evolution of Triassic ammonoid disparity will also be undertaken. I would be most happy to discuss my ongoing research with any interested persons.

Acknowledgements: These data have come from specimens in the collections of several institutions. I would like to thank the following people for their help during my visits to these institutions. Jean Dougherty (Geological Survey of Canada), Tim White (Yale Peabody Musuem), Steve Baker (Natural History Museum, London), Franz Stojaspal, Franz Tatzreiter, and Christoph Hauser (Geological Survey of Austria), Herbert Summesberger (Naturhistorisches Museum, Vienna), Alexander Liebau and Holger Nass (Universität Tübingen). This work has received financial support from the Paleontological Society, the Geological Society of America, and the Charles Schuchert Award from the Yale Peabody Museum.

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Association Meetings

Progressive Palaeontology: Leicester 2002

12th & 13th June 2002

Progressive Palaeontology is a conference for postgraduate research students to be held at the Department of Geology, **University of Leicester**.

The aim of this two-day event is to provide a friendly and relaxed environment for palaeontology postgraduates to present their research within a conference setting. Also it represents an excellent opportunity to meet with other students, listen to new areas of research and discuss ideas.

The first day of the meeting (12th June) will be dedicated to 15 minute presentations and viewing of poster displays on any aspect of palaeontology. New research students are especially welcome to present an outline or aim of their proposed project. Powerpoint, slide projectors and overhead facilities will be available.

On the second day there will be a free fieldtrip to important palaeontological sites in Leicestershire and again plenty of opportunity to chat with other students.

If you are interested please visit the website at <**http://www.le.ac.uk/geology/dng1/PP.html**> or for further information contact the organising committee:

Dave Gelsthorpe <dng1@leicester.ac.uk>, Natalie Thomas <nt25@le.ac.uk> and **George Iliopoulos <gi6@le.ac.uk>**
Department of Geology, University of Leicester, UK.

>>*Future* Meetings of Other Bodies

Fossil Molluscs
Earth Sciences, Open University, Milton Keynes *5 June 2002*

10.30am–4.30pm. A meeting of The Malacological Society of London organised by Peter Skelton with six talks including: Alistair Crame 'Evolution of polar molluscan faunas', Andy Johnson 'Growth line studies in fossil bivalves', Simon Kelly 'Polar molluscan vent faunas: examples from the Jurassic of the Antarctic and the Cretaceous of Greenland', Crispin Little 'Hydrothermal vent and cold seep molluscs: view from the fossil record', Neale Monks 'Whatever happened to the shelled cephalopods?' 10.30 arrival/coffee. Talks begin at 11.00. Please let Peter know if you are coming <**P.W.Skelton@open.ac.uk**> so that he can estimate numbers for tea etc. Updates on <**http://www.sunderland.ac.uk/MalacSoc/**>

Molecular Evolution: Evolution, Genomics, and Bioinformatics
Hilton Sorrento Palace Congress Center, Sorrento (Naples)
13 – 16 June 2002

SME (International Society of Molecular Evolution) and SMBE (Society for Molecular Biology and Evolution). See <**http://193.205.231.160/molevol02/**>

ECOS VIII Eighth European Conodont Symposium
Toulouse and Albi *13 June – 1 July 2002*

For the first time the International Conodont Symposium held in Europe (ECOS VIII) will take place in France and Spain. As well as the scientific sessions, two other important events will take place: the final meeting of International Geological Correlation Program (I.G.C.P.) 421, and a meeting of the Subcommission on Devonian Stratigraphy (S.D.S). The meeting will be hosted by the Université Paul Sabatier in Toulouse and Albi. The Scientific Conference will focus on all aspects of conodont research; a special Session on "Bias and Completeness in the Conodont Fossil Record" will be organised by Mark Purnell (Leicester, UK) and Philip Donoghue (Birmingham, UK). An eight-day pre-conference field trip to visit Palaeozoic sequences of Cantabrian Zone, Iberian Chain and East Pyrenees (Spain) will take place 13-21 June, 2002. A six-day post-conference field trip to Montagne Noire and Pyrenees (France) will take place from 26th June to 1st July. Both excursions are planned for a maximum of 35 participants.

For further details contact Marie-France Perret-Mirouse, Laboratoire de Dynamique des Bassins, 38 rue des Trente-six Ponts, Toulouse, France (tel: +33 (0)5 61 55 84 41, fax: +33 (0)5 61 55 82 50) e-mail <**mfperret@cict.fr**> <**www.le.ac.uk/geology/map2/con-nexus/ECOS/ECOS_VIII.html**>

Society for the Study of Evolution—Society of Systematic Biologists Annual Meeting 2002

University of Illinois at Urbana-Champaign *28 June – 2 July 2002*

Symposia include: New physiological approaches to the study of the cost of reproduction organised by Anthony Zera, Green evolution: evolutionary theory and results in agriculture systems, organised by Jay Evans and Sonja Scheffer, Untangling evolutionary history, organised by Kevin Johnson and Dale Clayton, and Visualizing the phylogenetic complexity of species radiations, organised by Sydney Cameron, James Whitfield and Peter Lockhart. The local host committee is chaired by May Berenbaum <**maybe@life.uiuc.edu**> and Stewart Berlocher <**stewartb@life.uiuc.edu**>. Information about the meeting is posted at <**http://nautilus.outreach.uiuc.edu/conted/**>; please refer to this url if you wish to contact the organising committee and/or for information on registration and presentation.

First International Palaeontological Congress

Sydney, Australia *6 – 10 July 2002*

The First International Palaeontological Congress, sponsored by the International Palaeontological Association, and hosted by the Australasian Association of Palaeontologists and the Macquarie University Centre for Ecostratigraphy and Palaeobiology, will take place in Sydney on 6-10 July 2002. It is programmed to follow on from the Australian Geological Congress (30 June-5 July) to be held in Adelaide. Formal sessions of IPC-2002 will take place principally at Macquarie University.

Coupled with the Congress will be meetings of IGCP 410 The Great Ordovician Biodiversity Event: implications for global correlation and resources and IGCP 421 North Gondwanan mid-Palaeozoic bioevents/biogeography patterns in relation to crustal dynamics. The Congress will be an appropriate venue for showcasing other activities of IUGS subcommissions on stratigraphy, and IGCP projects with a significant biochronologic focus. Suggestions of associated meetings and workshops, and additional or alternative symposia, are welcome. Associated with the Congress will be a Symposium in honour of Prof. Geoffrey Playford's sustained contribution to palynology and micropalaeontology, and the Jane Gray Memorial Symposium celebrating Jane's lifetime commitment to innovative research.

To receive the second circular fill in the form at <**http://www.es.mq.edu.au/mucep/**> or e-mail <**IPC2002@mq.edu.au**>.

Paleobiology: invertebrate taphonomy

Friday Harbor Laboratories, University of Washington

15 July – 17 August 2002

Organised by Mike LaBarbera and Michal Kowalewski, this field course in taphonomy is at the graduate student level, but exceptionally qualified undergraduate students are encouraged to apply. We also encourage applications from foreign institutions.

This course will present students with an introduction to field-based research in taphonomy—the post-mortem history of organisms. The diversity of taphonomic processes provides a rich source of biological and environmental information relevant to palaeontologists, biologists, and geologists. This course will emphasize experimental and practical field approaches to taphonomic research. The lectures will deal with the mechanics of mineralized skeletons, taphonomic and biological signals recorded in skeletal remains, the hydrodynamics of skeletons as biogenic sedimentary particles, temporal resolution (time-averaging) of bioskeletal accumulations, and the utility of taphonomic signals in reconstructing the long-term history of marine ecosystems and environments. Lectures and laboratory exercises are integrated and a group project involving the entire class is used to illustrate the methods and potential of taphonomic research. Students are also required to conduct a small, independent research project during the course. Several field trips are included to acquaint students with practical aspects of taphonomic research and modern environments before they pass through a taphonomic filter. The field trips will also serve to obtain data for the group and individual projects. Enrolment limited to 12. For more information visit the course Web page at <**http://www.geol.vt.edu/paleo/fieldtaph.htm**> or contact one of the course instructors: Mike LaBarbera at <**mlabarbe@midway.uchicago.edu**> or Michal Kowalewski at <**michalk@vt.edu**>.

Applications are due by 1st March and financial aid is available for qualified applicants (anticipated expenses may include tuition, room and board, travel and other education or living expenses). To download forms and obtain more information visit <**http://depts.washington.edu/fhl/classinfo.html**>. If you have any questions regarding application and financial aid procedures, please contact FHL at <**fhladmin@u.washington.edu**>.

Third International Congress on Environmental Micropaleontology, Microbiology and Meiobenthology

Institute of Paleontology, Vienna, Austria *1 – 6 September 2002*

The conference will cover a wide range of topics, with special focus on: micro- and meioorganisms as indicators of past and recent environments; micro- and meioorganisms as indicators of pollution for ecological risk assessment; industrial application of micro- and meioorganisms; application of micro- and meioorganisms to archaeology and medicine.
Dr. Irena Motnenko Osorno Enterprices, Inc., Suite 301, 162-2025 Corydon Avenue, Winnipeg MB R3P 0N5, Canada Phone: +1 (204) 488-1538; fax: +1 (204) 488-1566; e-mail <**congress@isemmm.org**>.

50th Symposium of Vertebrate Palaeontology & Comparative Anatomy; Symposium of Palaeontological Preparators & Conservators
University of Cambridge, UK *9 – 15 September 2002*

SVPCA 50 will be held at the Sedgwick Museum & Department of Earth Sciences, Downing Street, University of Cambridge, CB2 3EQ, UK, with accommodation provided at Emmanuel College, Cambridge.

The organising committee is composed of David Norman <**dn102@esc.cam.ac.uk**>, Paul Upchurch <**pupc98@esc.cam.ac.uk**>, Leslie Noe <**lnoe01@esc.cam.ac.uk**>, Alison Allen <**alison@esc.cam.ac.uk**> (administrator), and Sarah Sangster <**ss348@esc.cam.ac.uk**> (postgraduate student contact).

For further information and initial contact, please contact Alison Allen via e-mail, by telephone (+44 (0) 1223 333459), or by fax (+44 (0) 1223 333450).

Exploration biostratigraphy
University College London *11 – 13 September 2002*

The American Association of Stratigraphic Palynologists (AASP), the Micropalaeontological Society (MS) and the North American Micropaleontology Section of SEPM (NAMS) are holding a joint meeting in September 2002 at University College London. The theme of this international meeting will be recent developments in applied biostratigraphy. Contributions are invited on four main themes: sequence biostratigraphy, reservoir/development studies, deep-water exploration, outcrop analogues. There will also be an open session with emphasis on post-Palaeozoic palynology. The vision for the meeting is to encourage trans-Atlantic exchange of ideas, ultimately to seed new research initiatives. In particular, we aim to develop an integrated multidisciplinary approach in both the academic and industrial realms. There will be no taxonomic, stratigraphical or geographical restriction on contributions. Posters are invited on any micropalaeontological, nannopalaeontological, palynological or biostratigraphical theme. A post-meeting excursion is planned to the Isle of Wight (Cretaceous –Paleogene) led by Statoil's Iain Prince and Bruce Tocher. The meeting is being convened by Jamie Powell (Dinosystems), Chris Denison (ChevronTexaco), Tom Dignes (ExxonMobil), Alan Lord (UCL), Rachel Preece (ChevronTexaco) and Jim Riding (British Geological Survey). Details on abstract submission (deadline 26 April 2002) and registration (deadline 26 July 2002) can be found at the BMS website <**http://www.bmsoc.org/**> or by contacting MS Secretary, Jamie Powell <**ajp@dinosystems.co.uk**>

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 <**www.dst.unito.it/6thISJS/**>.

Evolution and Development 2002
University of Reading, UK *17 September 2002*

Organised by Seb Shimeld, Peter Holland and Marty Cohn. This is the third such meeting, and follows on from those held in Sunderland in 2000 and Cambridge in 2001. Talks will start at 11am to allow time for travel and, as in previous years, we have a relatively relaxed schedule to allow plenty of time for discussion. Buffet lunch and coffee will be provided. A more detailed schedule with titles will follow later, in the meantime please mark the date in your diaries and let me know by email if you intend to come. Further details on registration, travel etc can be found below.

The programme of speakers is: Peter Currie (Edinburgh), John Bishop (Plymouth), Hazel Smith (UCL), Chuck Cook (Cambridge), Phil Donoghue (Birmingham), Jukka Jernvall (Helsinki), Jean Deutsch (Paris), Marty Cohn (Reading). There is no formal pre-registration, but you must let the organising committee know by email if you intend to come. A registration fee of £10.00 (students, postdocs, academics etc) or £50.00 (non-academics) will be payable on arrival to cover coffee, lunch, *etc*. Cash or cheques only please. Receipts can be provided if necessary. A number of poster boards will be available for those wishing to present posters. These will be allocated on a first come-first served basis; please let me know if you would like to display a poster. As an incentive, Nature Publishing have kindly offered a year's subscription to *Nature Reviews Genetics* as a prize for the best poster. A poster board will be available for anyone wishing to advertise jobs or studentships. The meeting is sponsored by *BioEssays* and *Nature Reviews Genetics*. For full details on the various ways to get to Reading, please see the University Web site <**http://www.reading.ac.uk/Maps/whiteknights.htm**> and the School Web site <**http://www.ams.rdg.ac.uk/info/whereareweb.html**>. For further details contact Seb Shimeld <**s.m.shimeld@reading.ac.uk**>

3rd European Meeting on the Paleontology and Stratigraphy of South America

Université P. Sabatier, Toulouse, France *19 – 20 September, 2002*

The objectives of the meeting are to gather geoscientists interested in fossil and sedimentary records, evolutionary processes, biostratigraphy, chronology or geological history. We specially encourage contributions addressing integrated stratigraphy, and correlations between Latin America and other parts of the world. Abstracts must be in English and not exceed two pages. Details for the abstract presentation will be given in the 2nd circular, to be sent in March 2002. The deadline for submission will be 1st May 2002. Languages: English, Spanish and French. Registration fees: Euros 110 ($US 100, £ 65) until 1st May 2002; €155 ($US 150, £100) after this date. Students : €55 ($US 50, £35) until 1st May 2002; €80 ($US 75, £55) after this date.

Information for contributors: Oral and poster presentations will be planned. Information regarding the pre- and post symposium field trips will be provided in the 2nd circular. Anyone wishing to attend or contribute a talk or a poster to the Meeting should complete and return the form enclosed with this circular before 1st March 2002. Further details of a possible publication arising from the symposium will appear in a later circular to be sent to all who have responded to this first circular. The 3rd European Meeting on the Paleontology and Stratigraphy of South America will immediately follow the 5th International Symposium on Andean Geodynamics—ISAG02, to be held on 16-18 September 2002. Pre-registration 1st March 2002; second circular March 2002; abstract submission and registration 1st May 2002; third circular July 2002.

Correspondence and enquiries: ISAG, IRD, 38 rue des 36 Ponts, 31000 Toulouse, France <**ISAG@cict.fr**>. Etienne Jaillard <**Etienne.Jaillard@ujf-grenoble.fr**>, <**ejaillar@ecnet.ec**> and Peter Bengtson <**Peter.Bengtson@urz.Uni-Heidelberg.de**>

Fresh- and brackish water (palaeo)ecosystems, European Palaeontological Association, Workshop

Fribourg, Switzerland *23 – 25 September 2002*

The workshop consists of two parts. The first part will be a general introduction to Recent fresh- and brackish water ecosystems (sedimentology, fauna and flora, geochemistry, stable isotopes). This part will provide the theoretical basis for the second part that deals with fossil examples from the Palaeozoic to the Tertiary. Keynote lectures by invited speakers will be supplemented by posters of other participants. The aim of the workshop is to improve our understanding of fossil fresh- and brackish water ecosystems and to discuss the appropriate study methods. For further information contact Prof. Dr Jean-Pierre Berger, Institut de Géologie, Université de Fribourg, CH-1700 Fribourg, Switzerland; tel +41 26 3008975; fax: +41 26 3009742; <**jean-pierre.berger@unifr.ch**>

6th International Congress on Rudists

Institute of Geology and Faculty of Science, Department of Geology and Palaeontology, Zagreb, Croatia *September 2002*

The conference is dedicated to the exchange of knowledge on rudist taxonomy, shell structure, biostratigraphy, evolution, palaeobiogeography, palaeobiology, stable isotope analysis, palaeoecology, and modern analogues, as well as sedimentology and stratigraphy of rudist strata and associated microfossils.

Alisa Martek, Institute of Geology, Sachsova 2, 10000 Zagreb, Croatia (tel +385 1 6160786, fax +385 1 6144718, e-mail <**amartek@igi.hr**>).

Geological Society of America 2002 Annual Meeting & Exposition

Denver, Colorado *27 – 30 October 2002*

The programme of symposia is currently being composed but already includes the following:

Phenotypic Variation: Discriminating Evolution from Environment (sponsored by the Paleontological Society). The ability to document changes in phenotype through time and space is one of the unique contributions that palaeontology provides to evolutionary biology. The challenge of interpreting causal factors of phenotypic variation within and among fossil species can be addressed by morphometric analyses. The goal of this session is fourfold: (1) expose the palaeontological community to recent advances in applications of morphological analysis as applied to questions of evolution, palaeoecology and development; (2) to provide a common forum that includes both palaeontologists and neontologists who are exploring similar questions using the phenotype of organisms; (3) to include results and methods from invertebrate palaeontology, vertebrate palaeontology, palaeobotany and micropalaeontology; (4) to provide an overview of phenotypic variation and analysis suitable for all palaeontologists to bring to their classroom or research. The symposium is organised by Steve Hageman, Appalachian State University <**hagemansj@appstate.edu**> and Peter Kaplan, University of Michigan <**kaplanp@umich.edu**>

Web site: <**http://www.geosociety.org/meetings/2002/**>

Society for Integrative and Comparative Biology (SICB)

Sheraton Centre, Toronto, Ontario *4 – 8 January 2003*

Please see <**http://www.sicb.org/meetings/**>

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

Website review: The Echinoid Directory

Systematic research forms the backbone of the biological sciences. It provides the framework that allows scientists to communicate with one another, and it defines the biological units from which all evolutionary patterns are deduced. Put simply, systematic research is fundamental to our understanding of the natural world.

Over the past 20 years or so, systematics has undergone a major revolution with the widespread acceptance of cladistic methodology. The resulting classification schemes are not only more rigorously constructed than ever before, but they explicitly reflect evolutionary relationships. Standard references to invertebrate taxonomy, such as the *Treatise on Invertebrate Paleontology*, were compiled long before the cladistic revolution and many sections of the *Treatise* are now woefully outdated and in need of revision. To this end, Andrew Smith of the Natural History Museum in London has begun to revise echinoid systematics (Part U of the *Treatise* (Moore 1966)), making his results more readily accessible than ever before by publishing them on the World Wide Web. The result is *The Echinoid Directory:*

<http://www.nhm.ac.uk/palaeontology/echinoids/index.html>

At present, the site covers about 30% of known echinoid genera, with keys, diagnoses and identification guides to almost 300 genera and higher taxa. Plans are already underway to increase coverage to 70% of echinoid genera over the next 18 months. In addition to well-illustrated, easy-to-follow keys at all taxonomic levels down to genus, the site provides authoritative introductory information on echinoid functional morphology and lifestyles. The core of the site is composed of taxonomic information, accessed either via dichotomous keys or via an alphabetical index. Each genus and higher taxon has its own page, where details of authorship are listed along with diagnostic characters and stratigraphic and geographic distribution data. Each page is copiously illustrated, with photographs and line drawings of taxonomically critical features, and Smith has taken this opportunity to provide new illustrations for previously inadequately illustrated taxa. All thumbnails link to high-quality, full-page images. Extensive cross-linking allows easy comparison between taxa, as well as rapid access to introductory morphological information.

There are many advantages of a site like this over traditional printed resources. Not only can the information be accessed instantly from anywhere in the world, but it is also possible for the site to be updated as new information becomes available. In this way, advances and revisions in echinoid systematics are immediately available to all interested parties. In addition, there are no limits to the number and size of illustrations that can be accommodated.

With the increased awareness of the importance of systematic research in all areas of biology, it is to be hoped that more taxonomists will seize the opportunity to develop comprehensive yet user-friendly sites in this mould.

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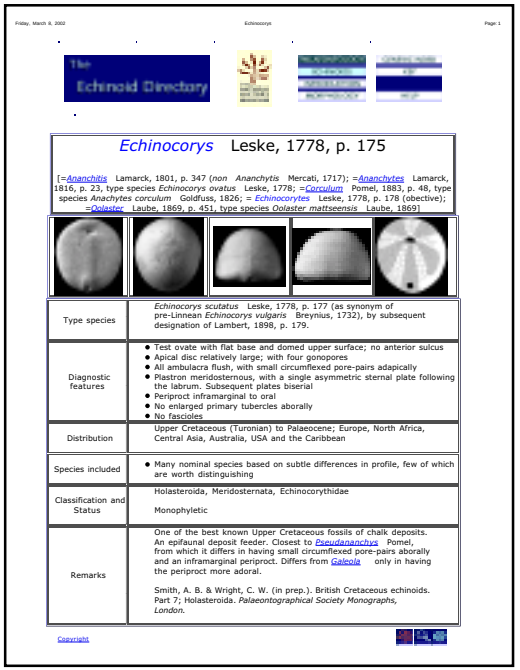
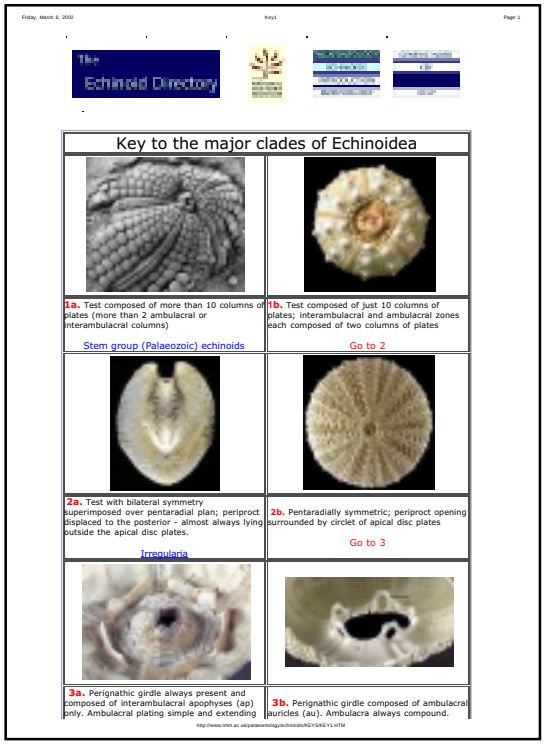


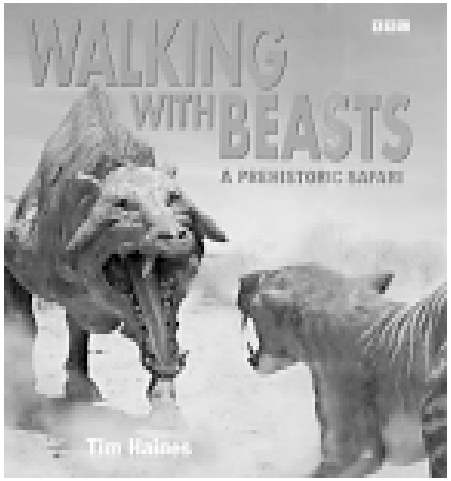
Sample pages from The Echinoid Directory



Walking with Beasts: A Prehistoric Safari

A review of the TV series and book tie-in

Tim Haines and Daren Horley. 2001. 264pp. BBC Worldwide Ltd.
ISBN 0-563-53763-9 (hbk) £19.99.



The book *Walking with Beasts: a Prehistoric Safari* is but one of the pieces of merchandise accompanying the six-part series that graced our television screens towards the end of last year. The book and the television series are not designed to be mutually exclusive—so how do they both fare? The series adopts a wildlife documentary format entirely devoid of the underlying fossil evidence—however does the book salvage some of the wonder and mystery that these reincarnated beasts should inspire? The book does partially fulfil this role and provides a much-needed point of reference to accompany the series. For instance, having been inspired by a glimpse of a basking *Ambulocetus* on screen, the book provides further information on the "beast of your choice", in easily accessible boxes isolated from the main text. However, the main body of text is a descriptive fairytale. For example the chapter that accompanies the first episode is a portrayal of a "day in the life" of an Eocene forest. This format of story-telling with source material segregated in boxes is adopted throughout the book. You cannot help yearning for more boxes and less story—but is this just a scientist's perspective?

In terms of the coverage, there is an inevitable pull towards the present with three episodes confined to the Plio-Pleistocene (3.2 million–30,000 years ago) and the other three episodes providing snap shots from the Eocene and Oligocene (49 million–24 million years ago). The first episode in the series is based on Messel's fossil treasures that provide a wealth of early Eocene source material that has been skilfully brought back to life. The second episode transports the viewer thirteen million years later to follow the fascinating journey of an early whale, *Basilosaurus*, across the ancient Tethys ocean. The ocean shores are littered with some intriguing mammals such as herds of browsing brototheres and an amphibious early elephant, *Moeritherium*. However, episode three, the Oligocene "Land of Giants", is a good example of how spectacular computer graphics still need to be accompanied by good dialogue. This programme though visually very appealing suffered from a narrative that dragged on—the prolonged attempt of a baby indricothere to scramble up a slippery riverbank does not provide gripping viewing. The series then jumps to the Pliocene, focusing on one of man's next of kin *Australopithecus*. Here, independent of how australopithecines would have walked, the graphics seem less convincing. Nevertheless, reconstructing early human behaviour is guaranteed to provide a more compelling story-line. The penultimate episode features the sabre-toothed cat *Smilodon* and other bizarre South American mammals that roamed the plains one million years ago. Once again a rather dull narrative failed to do justice to the remarkable beasts featured. In contrast, the final episode a "Mammoth Journey" was a visual spectacle with silhouettes of mammoths trekking against snow capped mountains—these majestic beasts stumbling into two species of man as they ventured across what is now the North Sea to more southern ice-free vegetation. The story is a little farfetched in places but this is made up for by some awe-inspiring cinematography.

The adoption of a script in the format of a present-day wildlife documentary has a lot to answer for, especially when we have at our disposal some remarkable fossil evidence documenting the prehistoric life of these creatures. Mammals beat the dinosaurs hands down in this context but the audience is left none the wiser. Interestingly, the main criticisms voiced about the improbability of the events documented are frequently unwarranted. The Egyptian Fayum fossil assemblages indicate that contrary to what you would expect the huge whale *Basilosaurus* really did venture into quiet shallow estuaries to prey on breeding populations of smaller whales. Likewise the bizarre bipedal gait of the giant sloth *Megatherium* that walked on the edge of its feet with its claws turned inwards is not just inferred from living relatives but from spectacular trackways preserved in Argentina. However, the omission of such scientific evidence during the television series arguably make the stories less compelling, the average viewer being left frustrated by what can only be perceived as a hypothetical scenario.

Having come to terms with the style of the production, how do the contents bear up? It is important not to forget that this is the first time many of these prehistoric mammals, with the aid of models and computer animation, have been brought back to life and this alone has to be applauded. Sometimes it was difficult fully to appreciate the scale of the beasts. For instance the mesonychid *Andrewsarchus* is supposedly the largest carnivorous land mammal ever (up to five metres in length) and yet this was not conveyed well visually. Another tendency was to reconstruct the animal's external marking to resemble the coats of supposed living analogues. The scavenging *Andrewsarchus*—this extraordinary hoofed carnivore—was given the marking of a spotted hyena and the bizarre Oligocene chalicothere was given black eye patches similar to those of a panda. Whether beasts of independent origin would have evolved similar markings to living mammals with similar behaviour or diet is unknown but these kinds of assumptions can detract from the uniqueness of the beast being portrayed.

Setting aside the "safari story", this reasonably priced book is a splendid picture gallery with some interesting fossil anecdotes thrown in. The series has to be commended on its pioneering attempt to bring these beasts back to life; however, there is a great deal left to be revealed before these prehistoric mammals can truly have their day.

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For more on WWB, visit <**http://www.bbc.co.uk/beasts/**>

Book Reviews

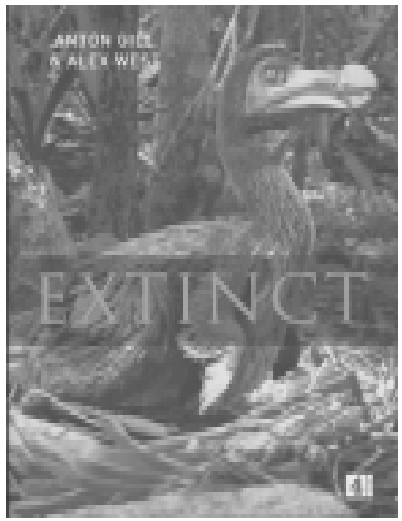
Extinct

Anton Gill and Alex West. 2001. Channel 4 books (Pan Macmillan Ltd); ISBN: 0-7522-6162-2 (hbk) £20.00.

In the Introduction to this popular book on extinctions, Alex West recounts the dread he experienced when, as an archaeology student at Sheffield University, he took a course from a professor who was in the habit of posting intellectual howlers taken from the latest crop of first-year exam papers prior to posting the exam results. Such an experience should have taught West, along with his co-author, the historian and biographer Anton Gill, to check their facts carefully before committing them to print. However, in this book—where we learn among other things that Darwin's theory of natural selection is synonymous with the doctrine of gradualism, that the overwhelming majority of evolutionary research is aimed at understanding the process of speciation, that background extinction rates are constant, and that the concept of adaptive fitness is an unchanging species-specific attribute—the lesson appears to have been ignored. Rarely have I read a book on any scientific subject that contains so many factual errors, oversimplifications, and misrepresentations. Indeed, even the list of acknowledgements contains gross errors (*e.g.*, the well-known mammoth palaeobiologist Daniel C. Fisher of the University of Michigan is listed as 'Dean Fisher').

In the publishing business this sort of book is known as a 'tie-in'; a work that attempts to capitalize on the popularity of another product usually for the purposes of revenue generation. Of course, in this instance *Extinct* (the book) ties into *Extinct* the television series that aired in the UK during the Autumn of 2001. Tie-ins between fictional movies and books have been commonplace for many years. Tie-ins between television documentaries and books are also not new. What is new, however—and what this book represents—is a tie-in between a television program that purports to be a documentary but is in reality largely a work of fiction (*i.e.*, composed of artificial reconstructions of scenes from an inaccessible past time and featuring live action sequences with actors playing roles and uttering wholly made-up dialogue) and a book whose rationale is to provide factual background material that underpins and extends the reconstructed visual set-pieces featured in the programme.

Of course, *Extinct* is of a piece with the BBC's 'Walking with Dinosaurs' and 'Walking with Beasts' tie-ins. All three series (and books) have been enormously popular. All three have also generated considerable controversy among the palaeontological communities owing to the liberties taken with factual material that were necessary in order to accommodate these series' narrative storylines. This emphasis on narration stands in stark contrast to the style of most previous nature documentaries (*e.g.*, the David Attenborough series, 'Earth Story', both of which take their storylines from the 'education' of a naïve presenter who represents the audience) by conversations with individual scientists and the first-hand witnessing of actual natural phenomena. Professional scientists have traditionally been supportive of the latter



approach to natural history filming because it mirrors to a very large extent their own education and the experiences they try to provide for their own students. The former approach, however, is necessarily limited in that there is no room for the alternative interpretations that constitute the lifeblood of scientific investigation and because the narratives are organized along simplistic, classical lines with feature roles that must be filled regardless of current states of knowledge. The result is an inevitable heightening of the tension between the presentation of hard-won information and gratuitous spectacle.

In this book, as in the series, six examples of species extinction events are discussed, including the extinctions of *Mammuthus columbi* (the Columbian Mammoth), *Smilodon fatalis* (one of the so-called 'sabre-toothed' tigers), *Megaloceros giganteus* (the Irish Elk), *Raphus cucullatus* (the Dodo), *Pinguinus impennis* (the Great Auk or Shearwater), and *Thylacinus cynocephalus* (the Tasmanian Tiger). Actually, the extinction-related information concerning these species represents a distinct minority of each chapter with the greater part being given over to descriptions of each species' ecology, mode of life, environment, and history of relations with humans. Interspersed among these animal-based chapters are shorter sections on aspects of the concept development and technology used to create the computer-graphic animations that formed the heart of the programme series (*e.g.*, animatronics, locations, backplate filming, computer modelling-animation).

The animal-based chapters largely recount the material presented in the programmes, with some additional space provided for quotes by the series' group of scientific consultants. Also, a fair amount of editorialisation on 'what it all means' is indulged in throughout these chapters. Crucial to the latter theme is a long introductory chapter in which the authors set their view of current extinction research in historical, cultural, and political contexts. This introductory material was almost wholly lacking in the series. This is unfortunate because it really does provide a penetrating insight into the reasons for making the series and the authors' level of success at grappling with their scientific subject matter.

Most of the really obvious mistakes of commission and omission are to be found in the Introduction. Here, for example, we learn that, while busy working on mainstream biological problems (presumably to do with the process of speciation) "science hadn't really noticed much at all [about extinction]" (p. 9); that extinction is both common (p. 10) and exceedingly rare (p. 21); that the lineage to which dinosaurs belong is extinct (p. 21); and that the magnitude of the modern extinction is "easily comparable to any of the big five mass extinctions of the past." (p. 26). Some mistakes are simply due to a poor choice of words (*e.g.*, "at the time that the dinosaurs disappeared around 40 per cent of *all land-based species* also

perished."; p. 22, emphasis mine), while others are due to the use of out-of-context and/or out-of-date statistics. For example, the figure of 40 per cent extinction of all land-based tetrapods at the Maastrichtian–Danian boundary cited by Gill and West as evidence that the K-T event qualifies as a 'mass extinction' is actually comparable to the extinction loss for this group across the Campanian–Maastrichtian boundary (see Archibald 1996). In the same vein, a recent review of biodiversity shows the 50 per cent species extinction over the next century figure cited by Richard Leakey in *The Sixth Extinction*—and used by Gill and West to support the idea that human activity will denude the planet of all but the simplest life-forms—to be a gross overestimate with the real figure, assuming demonstrated extinction rates over the past 400 years are extrapolated into the future, being closer to 0.016 per cent (see Lomborg 2001).

The hero of Gill and West's extinction story—for it seems they always think in terms of narrative storylines—is David Raup, who they describe as the foremost contemporary student of extinctions. In particular, Gill and West are intrigued by Raup's 'field of bullets' idea which they describe variously as a 'thought experiment' and a 'test' of the hypothesis that the process of extinction during mass extinction events is random (in the sense of being unrelated to the selection pressures that result in adaptation) and extremely violent. In point of fact, Raup's scenario is nothing more than metaphor used to explain the concept of statistical randomness at it applies to taxic richness metrics. Certainly his scenario's violent imagery has nothing to do inherently with the nature of extinction causes. Inexplicably, Gill and West go on to contrast Raup's 'field of bullets' metaphor with Darwin's fairly mundane description of extinction biogeography from *Origin of Species*—'species and groups of species gradually disappear, one after another, first from one spot, then from another, and finally from the world'—implying that these represent polar opposite views of extinction causes. Space considerations in this review prevent the complete untangling of this convoluted juxtaposition. However, since Darwin's model purposefully fails to specify a time frame over which the geographical contractions leading to a final extinction must take place, I doubt their contrast of these logically compatible models would be subscribed to by either Raup or Darwin. This illogical edifice is then related to the main book chapters with the claim that "Finding out what went wrong for [the species discussed in this book] is a compelling mystery which, in each case, suggests that the Darwinian picture is an oversimplification.' (p. 20).

Turning to the individual species chapters, though, we soon learn that nothing could be further from the truth. For example, Gill and West's discussion of extinction biogeography for the Columbian mammoth reads as follows:

> "…the wooly mammoth seems to have been extinct in Europe by about 12,000 years ago. It hung on longer in Siberia—much longer in the case of a dwarf group on Wrangel Island. In North America the Columbian mammoth seems to have hung on until about 10,600 years ago." (p. 54).

Similarly, in the case of the Great Auk:

> "…Bird Rocks seems to have had no [Auks] left after 1700… They had disappeared from St. Kilda by 1760; a last bird was reported killed in the Faeroes in 1808 … the last pair on Papa Westbury were destroyed in 1812." (p. 198-199).

Of course, the last known living representative of this species was killed on Eldey Island on 3rd June 1844. The other animal-based chapters deal strictly with local populations, so cannot

be used to test the validity of either Darwin's or Raup's scenarios. Granted, the extinction of all these species was relatively sudden given their stratigraphic longevity, but such is almost always the case. Despite Gill and West's claim to the contrary in their Introduction, these authors fail to document a single example of an extinction pattern compatible with their preferred 'field of bullets' model for any of the species they discuss. Instead, in each case they provide much evidence that directly supports the standard Darwinian model of progressive biogeographical extinctions due to a loss of relative fitness resulting from climate change, shifting vegetation patterns, and the introduction of new species to local ecosystems.

Last, but by no means least, the book is illustrated by a large number of stills from the computer animations used in the programme series. This turns out also to have been a bad idea in that the low quality of these computer models are rendered even more obvious in the stills than they were in the series. The mammoths in particular look like Goreyesque cardboard cutout drawings that have been propped up on alpine landscapes, while even a cursory inspection of a full-page spread depicting a thylacine running toward the viewer reveals its teeth to be a series of two-dimensional child-like zig-zags, without either the elongated canines or the diastema that are so prominent in classic photographs of this species.

Given these deficiencies there is little to recommend in *Extinct* (the book) to serious students of natural history or extinction, other than to serve as a warning to those who might be tempted to believe that a few conversations with scientific consultants and a quick read through a few popular books written by scientists qualify them to write treatises on scientific subjects. The study of extinctions in the fossil record is one of the most complex and fast-moving of all contemporary palaeontological research programmes. Its data, history, controversies and concepts demand sustained intellectual effort to understand and rhetorical skill to present to a popular audience. Over the last several years many good titles that cover these topics have appeared authored by scientists themselves and by experienced professional science writers. Gill and West's *Extinct* should be placed on an entirely different shelf.

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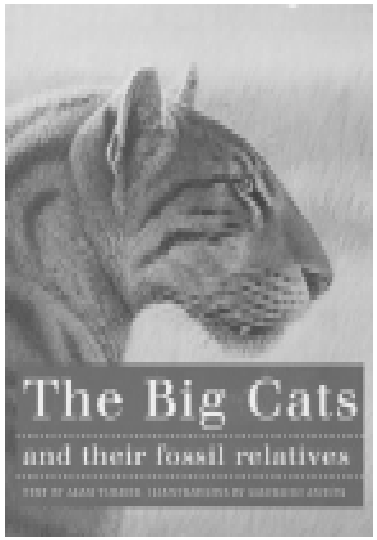
Big cats and their fossil relatives

Alan Turner & Mauricio Anton (illustrator) 2000. 254 pp. Columbia University Press; ISBN: 0231102291 (pbk). £11.50.

When browsing through the lists of popular books published on palaeontological subjects, one could be excused for thinking that we are living in the age of dinosaurs. The sheer number of books for all ages published on these quintessential extinct animals is simply staggering. As a



sometime publisher's reviewer and translator, I suppose I shouldn't complain too much, but it remains a fact that the only palaeontological books with which I have been involved in these capacities deal with dinosaurs or palaeoanthropology (the latter generally disguised by publishers in my part of the world as 'archaeology'). Never have I translated or even been approached about a book on fossil mammals. And this in the language market that produced such classic books by Björn Kurtén as 'The Age of Mammals' and 'The Cave Bear Story', both of which saw Swedish editions before the English-language ones.

Sadly, even if publishers in my back yard were amenable to publishing books on fossil mammals, they wouldn't have much to choose from. (The recently published *Walking With Beasts* doesn't help.) Nevertheless, despite these complaints, one 'seriously popular' book on fossil mammals has been published in recent years. And it is a giant—not in stature but in content. The book is 'The Big Cats and Their Fossil Relatives' by Alan Turner (text) and Mauricio Antón (illustrations), and it is one of the most thoroughly researched, and profusely and wonderfully illustrated popular books to emerge in many years. Alan Turner, who is Reader in vertebrate palaeontology at Liverpool John Moores University, is a longtime student of fossil carnivores, especially those of Africa and Eurasia, and has published many papers on fossil cats from those areas of the world, as well as many other papers with palaeomammalogical themes. Mauricio Antón is a Spanish artist who in the past decade has emerged as one of the premier palaeoartists in the world. His reconstructions of fossil mammals have appeared in many publications, including National Geographic Magazine.

All things considered, of course, it is no surprise that if a popular book on fossil mammals were to be published, it would be on cats. This group of animals not only occupies many of our lives and thoughts daily in the form of small, furry domestic terrors, but has also captured the imaginations of many aficionados of palaeontology in the form of sabretooth 'tigers' (which are neither tigers nor have sabres for teeth). So with all this going for it, how could such a book miss?

Well, fortunately it can't. In a series of chapters ranging from behaviour to faunal evolution, the author and artist do full justice to their chosen subject. The style is readable without becoming breezy (in complete contrast to this review, you will say) and the illustrations provide accurate and aesthetic views of just about every aspect of the appearance and behaviour of fossil cats.

The book starts with a chapter on the place of cats in nature. This is a brief chapter and the title doesn't really provide a precise indication of the contents, as the meat of this chapter is a consideration of what fossils are and how they are formed and dated. The information on cats *per se* is limited to showing their place in the Linnaean hierarchy and to an overview of anatomy.

The second chapter is entitled 'Evolution and the origin of the Felidae'. This is a more precise description, as this chapter presents an overview of carnivore phylogeny and the evolution of cat-like ecomorphs among the Carnivora and other orders of mammals. The culmination of the chapter is a discussion of the origin and earliest radiation of cats: the genera *Proailurus* and *Pseudailurus*. These genera remain poorly known, with a number of described species that differ mainly in size rather than in any significant features of morphology. Only in the last few years has some progress been made in this area, thanks to the efforts of North American colleagues Bob Hunt Jr. and Tom Rothwell. In the present volume little is said about them, simply because there is little to say.

This is not true of other groups of cats, as the third chapter shows. Here the authors present an overview of the later Neogene big cat radiations of the subfamilies Machairodontinae (sabretooths) and Felinae ('conical-toothed' cats). [A digression: At this point some readers not versant with the fossil record of cats may wonder why, when all this effort was made, the authors did not also include the small cats in their book. The reason for this is simply that pitifully little is known about the evolution of small cats (with the possible exception of the genus *Lynx*, which might, in fact, have been included in this book). A volume entitled 'All We Know About Fossil Small Cats' would be a slim one indeed (rather on the order of 'Jokes from Da Ali G Show You Can Tell Your Mother' or 'The Collected Wisdom of Victoria Beckham').]

The fourth chapter is in many ways the meat of the book. It provides an overview of the evolutionary anatomy of the big cats, including the coat, the senses, the skeleton, the teeth, the feet and claws, as well as reconstructions of movement based on explicit anatomical and biomechanical principles. The chapter also includes a discussion of the principles of how to reconstruct fossil animals. It is in this chapter that the illustrations really come into their own. Points of anatomy and function that are difficult or impossible to get across using words only become eminently clear from illustrations. Particularly impressive are the illustrations depicting the running sequences of *Hoplophoneus*, *Megantereon*, and *Miracinonyx* (p. 145).

Chapter five extends the previous chapter into the realm of ecology and behavior. Again, the illustrations come to the fore, with a series of kill sequence illustrations as the centrepiece of the chapter.

The final chapter deals with faunal and climatic change. Despite some wonderful illustrations of carnivore and herbivore guilds from different geographic regions and times, I find this chapter the least satisfying. The writing seems less clear and the points are made less incisively. In part this may be due to the large amount of information that has to be imparted to the reader in order to make comprehensible a discussion of faunal change. However, the logic seems a little more muddled here than elsewhere and there are points to challenge even if one is not a cat specialist. There seems, for example, to be some confusion between issues of causation and issues of randomness with regard to extinctions (p. 213). Also, cats, and even carnivores, sometimes are lost from sight in the discussion. Much is, for example, made of faunal changes in Africa between 3 and 2 million years ago (pp. 202-208). Yet, whatever the reality behind this phenomenon (and it is a hotly debated topic to which the author has contributed some important papers), it seems to have affected carnivores less than any other well-studied group, and the cats emerge from this time interval practically unscathed. The topic is important, but seems out of place here.

Quibbles can be raised about other things as well. I find myself in disagreement with points of taxonomy (and the author is well aware of this). Some discussion of function, behaviour, and ecology is also rather idiosyncratic without this being pointed out. However, these are the sorts of issues on which specialists will always differ. They in no way detract from the value of the book to the interested amateur, student, or professional alike. Two slightly more important issues have to do with the publishing and editorial aspects of the book. Many of the illustrations are placed a ridiculous number of pages away from the accompanying text (sometimes as much as ten pages). This results in a lot of flipping back and forth—sometimes enough to make one wish that they had published the running sequences in the margins and made this a true flip-book. Clearly, with the number of illustrations that this book has, it is not a simple matter to space the text around them, but surely a better solution could have been found. The second issue is that the colour plates, wonderful as they are, lack the colour brilliance of the originals. The result is a rather Burian-like sombreness in which the sky is always dark even when the sun is shining brightly (in fact, very much like the Stockholm February sky outside the window of the café in which I am writing this). This is a little unfortunate, but I suppose we should be pleased that colour plates are provided at all.

All-in-all, this is a terrific book and the paperback edition is wonderful value for money. I made all my students buy copies. Now I will make all of you buy copies. I is not joking. Too right. Respect.

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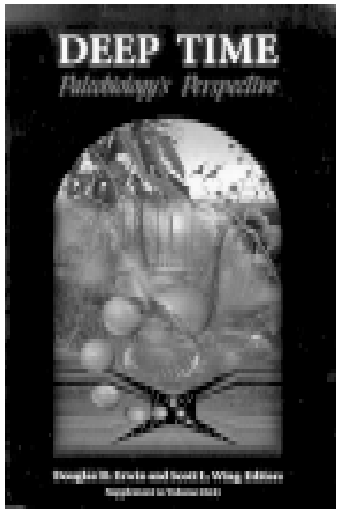
Deep Time: Paleobiology's Perspective

eds Douglas H. Erwin and Scott L. Wing. Lawrence, Kansas: The Paleontological Society, 2000. Supplement to vol. 26 no. 4 of *Paleobiology*. ISBN 0967755425 (pbk) £16; ISBN 0-9677554-3-3 (hbk) £38; ISSN 00948373

A lot can happen in a quarter of a century. In 1975, Saigon fell to the communists, bringing the Viet-Nam war to an end; Pol-Pot set up shop in neighbouring Cambodia; Fransisco Franco, Haile Selassie and Dmitri Shostakovitch were united in death, while the Soviet Union and the United States were united in orbit, with the docking of Soyuz and Apollo spacecraft. One Margaret Hilda Thatcher succeeded Edward Heath as the leader of the pro-European Conservative Party, as the Europhobe Labour government campaigned to remove Britain from what was once known as the Common Market; Sony and Matsushita introduced video cassette recorders—in crazily competing (and equally unintelligible) formats; cinéastes thrilled to big rubber fish in *Jaws*, while *One Flew Over The Cuckoo's Nest* swept the Oscars; Suriname became a member of the UN Security Council (bet you never knew *that*) and—perhaps most importantly of all, at least to this reviewer (then aged 13)—rock band Queen had a number 1 hit with *Bohemian Rhapsody*.

Elsewhere, IBM marketed their first personal computer, the Model 5100: the term 'personal computer' was coined in the same year for the long-defunct Altair home computer kit—which had no screen, no keyboard, no offline storage and a massive 256k memory. The World Wide

Web (whence I retrieved most of the above in a matter of minutes) wasn't even a glimmer in the eye.



A lesser known event of that year (below *Bo Rap*, but above Suriname) was the foundation of *Paleobiology*, a bravely multidisciplinary journal, by the Paleontological Society. *Paleobiology* is thriving still, and its Silver Jubilee in 2000 was marked by a volume of magisterial, specially commissioned papers, surveying the past and future of the field. For in 1975, things were moving, too, even in palaeontology, where there's not so much News as Olds. After a long period of not much happening, a new generation of palaeontologists was coming to terms with continental drift, while Hennig's phylogenetic systematics was rumbling, like an appendix, just offstage. Dinosaurs danced, for the first time since T.H. Huxley; and the new molecular biology was just acquiring the tools with which to forge a revolution. It was in 1975 that Edwin Southern invented his eponymous Blot—a convenient, chromatographic way of sorting DNA fragments. The completion of the draft sequence of the human genome in 2000 built directly on Southern's foundation.

The fifteen papers in *Deep Time* vary in tone from the cheerfully conversational (Arnold Miller's "Conversations about Phanerozoic global diversity") to the robustly theoretical (Peter Wagner on "Phylogenetic analyses and the fossil record") and cover the waterfront, but—as one would expect—they emphasize *Paleobiology's* particular preoccupations. For example, there is a great deal of deep thought on matters such as the perceived completeness of the fossil record, and the estimation of biodiversity through time. The work of the late, very-much-lamented Jack Sepkoski is a towering presence, and the book is—rightly—dedicated to his memory. Like mammals scuttling beneath the feet of the dinosaurs, there are essays on other topics, from taphonomy to functional analysis. The presence of phylogenetic systematics, which has had a shattering impact on the field, is far less explicit than its importance might demand—the exception being Wagner's paper, which comes to bury Hennig rather than to praise him. Wagner closes the volume by looking forward to a range of probability-based approaches to phylogeny, already revolutionizing other areas of biology, and which could yield dividends when applied to paleobiological problems. As an aside, the genesis of Wagner's deeply scholarly essay was a discussion hosted by *Nature's* website entitled "Is the Fossil Record Adequate?", created largely at the instigation of this reviewer, incensed at the contents of a book entitled *The Adequacy of the Fossil Record* (ed. S.K. Donovan and C.R.C. Paul, published by Wiley).

Another essay—"Fossil, genes, and the origin of novelty" from Neil Shubin and Charles Marshall—looks at the emerging field of evolutionary developmental biology (evo-devo to its friends), but it seems curiously detached from the rest of the volume. Genomics will indeed have an impact in biology, as the authors assert—but its relevance to palaeontology is, at present, hard to grasp. I sense that the role of evo-devo in palaeontology is analogous to that of the Altair computer in the lives of most people in 1975—a harbinger of things to come, of an importance and ubiquity we cannot possibly guess.

Given the events of the past 25 years, who dares venture an opinion about the likely contents of the Golden Jubilee edition of *Paleobiology?* Not me, but here are some likely pointers. By 2025, the genomes of thousands of animals and plants will be recorded, and this information—together with advances in modelling, robotics and computation—will have permitted fairly strong constraints to be placed on the interaction between genotype and phenotype. This is where palaeontology—essentially, a record of possible phenotypes—will have an invaluable part to play, by illustrating the range of the possible, and constraining the paths by which forms can evolve. The catch will be that such insights will apply only to the planet Earth, and not to life generally—I predict that in 2025, there will still be no unambiguous signs of present or past life beyond the Earth, against which we can test these ideas.

In 2025, this reviewer (who, if still alive, will be 63) will look forward keenly to the arrival of the 50th anniversary edition of *Paleobiology*. And *Bohemian Rhapsody* will still be on the quantum optical nanodisk player.

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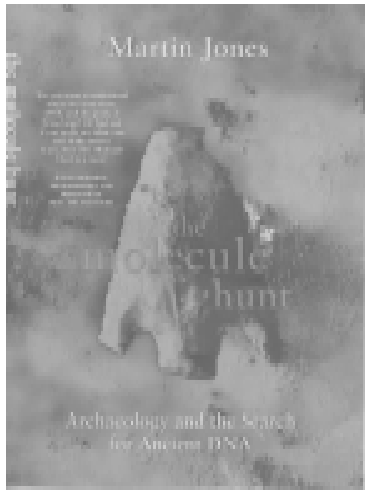
The Molecule Hunt – archaeology and the search for ancient DNA

Martin Jones 2001. Allen Lane, The Penguin Press. 280pp. ISBN 0713994231 (hbk). £18.99



Pity the science writer trying to document a new field as complex and confusing as that of Ancient Biomolecule research. It is fortunate for us, that Martin Jones can not only communicate science but, as chairman of the NERC Ancient Biomolecules Initiative, was a central witness to the molecular revolution in archaeology. The sub-title of the book—archaeology and the search for ancient DNA—undersells its contents. What Martin Jones has successfully done is to describe and interpret the growing body of data which has emerged in the last decade as chemists and molecular biologists applied the tools of their trade to all sorts of ancient remains.

The first part of the book is a narrative, the molecular hunt of the title. Beginning with Martin washing and sifting dirt to recover pots and ancient plant remains from soggy Somerset soil, the story accelerates along an increasingly complex path towards the biomolecular 'excavation' on tiny quantities of ancient DNA. The path is littered with tantalising cul-de-sacs, dead ends and the odd hairpin bend but Martin deftly manages to craft a path which illustrates the tangle but maintains a clear trajectory. For those wishing to follow any of the stories further, the book is well referenced throughout, although in places the reader could have been helped by the use of some illustrations or diagrams.

The story of the hunt is a fascinating one, which beings with the analysis of museum skins and Egyptian mummies. The advent of PCR which permits analysis of minute quantities of DNA is first a story of false starts (including dinosaur bones) and then real success with the amplification of Neanderthal DNA. The story is a roller coaster ride, the more thrilling for being true, which Martin uses both to introduce the debate between anthropologists on the origin of the modern human species and to examine the problems with applying conventional biochemical methods to ancient samples. From here on the path radiates and we are taken down diverse avenues, each illuminating the contributions of ancient biomolecular research to archaeology and anthropology. Unfortunately palaeontology receives little mention; most molecules decay too rapidly to contribute directly to fossil analysis.

In the first of these next sections, Martin returns to his (research) roots, describing the contribution made by ancient biomolecules to the study of plant domestication. The area is one of real successes. Selective breeding and domestication have left many molecular clues, whilst seeds and pollen are 'designer capsules' for DNA storage. Molecular evidence has pinned down the origins of modern wheat to the mountains of south-east Turkey; or has it? The concept of 'revolutionary' changes in archaeology is one to which Martin returns often; such revolutions make for testable hypotheses but often ignore archaeological evidence. Successes in the study of wheat domestication are recapitulated in domestication stories from both south-east Asia and in the Americas. Next in his journey Jones tackles the way in which ancient DNA has provided information on animal domestication, including the fascinating story of man's best friend: analyses of bones from Bolivia and Mexico showed common ancestry with Old World dogs, indicating that the ancestors of these dogs came to America, not as wolves, but walking alongside their owners, probably sometime more than 14 thousand years ago.

The application of large-scale analysis of sequence variation in the mitochondria, a materially inherited part of the genome, has contributed much to our understanding of patterns of relationships. Martin illustrates the way that archaeology, linguistics and molecular biology are now being combined to provide fascinating and detailed insights into the patterns of migration and inter-relationships between modern human populations. From a palaeontological standpoint, it is remarkable how quickly this new species spread across the globe and there are many "great journeys" to recount. Jones discusses the migration into the new world of humans (with their dogs) and the extraordinary crossing of the Pacific Ocean, island-hopping from west to east. The paternally inherited Y chromosome also reveals a much more recent and surprisingly large European 'contribution' to the Polynesian gene pool. A great controversy surrounding the spread of agriculture and people into Western Europe is revealed (as are other key turning points) by a description of a scientific meeting in which conflicting views were aired. Jones suggests that despite the huge data-sets on modern sequence variation, targeted ancient sequences provide some of the most powerful arguments in favour of the view that the last great migration across Europe was of farming technology not farmers.

Having used ancient DNA to illustrate the evolution and impact of ancient biomolecular research, Martin Jones then turns his attention to other molecules. He discusses the remarkable claims that blood stained on stone tools can be analysed by immunological methods to identify the victim species. Proteins in bone and hair appear more promising and have been successfully used to investigate diet. The conflicting claims that the Ice Man, Oetzi,

was a vegetarian and a meat eater are examined, in terms of the time-span of different isotope signatures from hair and bone. In one of his more fanciful passages, Jones imagines Oetzi driven to climb in a hunt for meat which he has failed to catch—unlikely given the recent finding of meat in his stomach and an arrowhead in his back. The greatest success has been achieved by directly analysing the diet, as the remains of food trapped in ancient cooking and serving pots is illustrated by studies of lipids. Like protein analysis, the use of stable isotopes is beginning to refine the identification and interpretation of samples, most notably the identification of milk lipids and hence milk. And not just milk, the microscopic and molecular analysis of ancient plant remains led to a recipe for Egyptian beer—on sale in Harrods at £50.00 per bottle.

Martin Jones details the success that ancient DNA has had in application to forensic science, including the identification of the remains of Joseph Mengele and the Russian Royal Family. Fine-scale resolution of relationships within family groups—kinship analysis—has great potential benefits for archaeology was well as forensic science. Finally—and by this time you are left wondering what areas of archaeology have not been touched by molecular analysis—ancient diseases are discussed. The presence of disease organisms in human and animal bone now made possible from both DNA and lipid analysis provides evidence for the origin, identity and spread of disease such as tuberculosis and 'plague'.

In his conclusion Martin argues that despite the widespread success of the analysis of individual molecules, integration of research will yield still greater benefits. The molecule hunt becomes the molecules hunt. As an illustration he cites the value of combining DNA, lipid and protein analysis in the study of the early origins of dairying. Jones ruefully concludes that the field of archaeology has been much changed by molecular research. Instead of washing dirt from ancient pots, fragments of pot are being extracted and even digested away to enable molecular analysis of the dirt. Other leading archaeologists have claimed that molecular studies will revolutionise archaeology in the 21st centaury. For those wishing to join the revolution, this book is an excellent primer, as well as being a good read. As for palaeontology, so far the molecule hunters have mostly returned home empty handed, but Martin does give a few helpful pointers, and you know, you never know…

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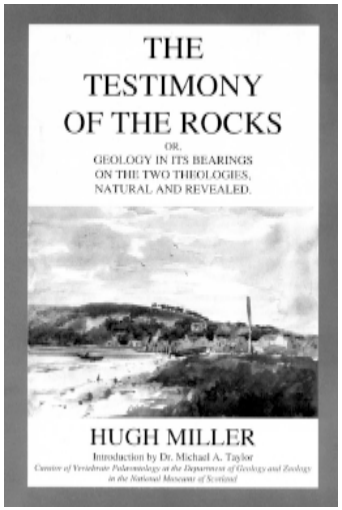
The Testimony of the Rocks, or, geology in its bearings on the two theologies, natural and revealed

Hugh Miller 2001. With an introduction by Michael A. Taylor. St Matthew Publishing, Cambridge. ISBN: 190154611X. £8.99.

Hugh Miller was born on 10th October 1802, and in 2002 there will be several celebrations of his bicentenary, covering the different aspects of his life. To the geologist, his best-known work is certainly the 'Old Red Sandstone' (1841), but 'Testimony of the Rocks' (1857) and 'Cruise of the Betsey' (1858) are also excellent sources of historical geological information. If you have ever visited the areas about which Miller writes, you can hardly fail to learn



something new from his writings. For example, leafing through one of the 12 'lectures' that comprise this volume I was surprised to find that fossil coral and calcitised wood found in the Helmsdale Boulder beds was once so common on the beach at Helmsdale that cartloads were gathered and burnt for lime. The same fate befell the fish-bearing nodules of the Old Red Sandstone at localities such as Edderton and Lethan Bar.

But I digress from review! Twelve 'lectures' make up the 'Testimony', but not all were ever delivered orally; educational science books in the 19th century were frequently presented as a series of lectures, or conversations. The lectures have titles that include 'The Noachian Deluge', 'The two records, Mosaic and geological', 'The Mosaic Creation', and 'The geology of the anti-geologists'. The last of these, indeed the whole book, should be required reading for creationists, providing a first-hand account of problems of the reconciliation of biblical accounts with the geological evidence that God had revealed to man. Most surprising, at first sight, is that such a book should lead with two lectures on the palaeontological history of plants and animals. However, this was the essential evidence on which Miller's arguments were built, and it is presented as required knowledge. It matters little that some of the 'fucoids' are now recognised as trace fossils; Miller clearly demonstrates the development of plant and animal life through the succession of strata, as had been pronounced by William Smith earlier in Miller's lifetime. Miller armed his audience with the information required to support discussion of the heated religious debates of the day, and palaeontology was thus a cutting-edge science of great social significance.

The study of palaeontology was a worthy occupation in Miller's time: not only did it provide exciting finds to advance geological argument, but it fuelled the religious arguments of the day, particularly in relating biblical accounts to the Lord's work as made manifest in nature. Indeed, Hugh Miller, as editor of the Free Church newspaper 'The Witness', was demonstrating that belief in the facts and deductions of the science of geology was compatible with a Christian life. Michael Taylor, in his brief but erudite introduction to this new edition, suggests that Miller was the last of the 'scriptural geologists'. Miller died in 1856, correcting some of the proofs of 'The Testimony' on the last day of his life. Three years later Darwin's 'Origin of Species' was published. What a pity that the world was denied Hugh Miller's contribution to the debate that followed!

For those with knowledge of the history of geological thought, the lectures of the 'Testimony' provide a fascinating commentary on discoveries and arguments that were of both scientific and religious importance 150 years ago. However, the reader who knows little of the history of palaeontology might pick up some major misapprehensions. A few of the more important points are noted by Michael Taylor in his introduction, but there are many more! Hardly a page goes by without the need for a note of explanation or context. The ordinary reader,

maybe even one with an honours geology degree, will struggle to appreciate Miller's work without marginal notes of explanation and references to the literature; but it still makes interesting reading.

The book is 'reproduced', not 'edited'. Both the text and figures are taken from the original. Reproduction of the figures is reasonable, with definition close to the original, but the 'genealogy' (range) charts (*e.g.* Fig. 53) are not well reproduced—but this is a minor point.

And finally, the cost! At £8.99 the book is a relative bargain. In the 13 years from 1857 to 1870 some 37,000 copies were sold, and the 'popular edition' of 1870 cost 5 shillings (25p), at a time when weekly wages for most were one or two pounds. Alternatively, secondhand 19th century copies are not scarce, and currently cost £10-15 for a good readable copy; even a first edition should not set you back more than about £50. I advise purchase of the new edition; the front papers reveal a printing of only 2,000 copies—with printing and binding in Minsk, Belarus! It might be scarcer than an original in a few years! I do wonder how many will be bought and actually read, or will they sit beside the originals on the bookshelves of Hugh Miller's fans? I hope not: the *Testimony* deserves to be read, especially by those who believe that the Earth was created in 4004 BC, and that the only correct record is Genesis.

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Palaeobiology II

Derek E.G. Briggs, and Peter R. Crowther, eds, 2001. Blackwell Press, 583 pp. ISBN 0632051477 (hbk). £110, $200

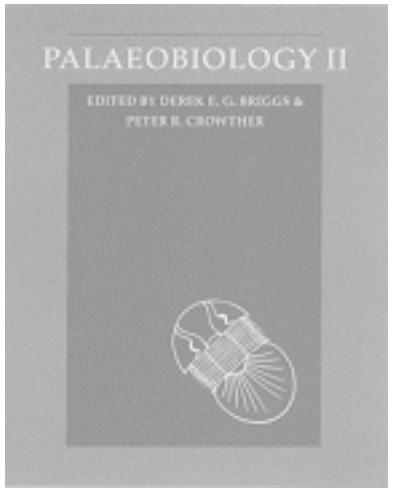
The production of new encyclopedias has reached a rate where one could do little else but churn out contributions to satisfy insatiable publishers, although at some point someone might notice that nothing new had been discovered to warrant yet another encyclopedia. This compilation has an eager audience, however. In the absence of a principles-oriented textbook on this side of the pond, publication of *Palaeobiology II* has been eagerly awaited. Once the publishers finally produced a more inexpensive paperback version, the first edition became an important resource for undergraduate and graduate students, and vital for teachers updating lectures. This new edition could achieve a similar niche.

A comparison of the two editions (hereafter I and II) reveals much about the evolution of our field. The first four sections remain the same (Major Events in the History of Life, Evolutionary Process and the Fossil Record, Taphonomy, and Palaeoecology) but the fifth section in I (Taxonomy, Phylogeny and Biostratigraphy) has mutated into Systematics, Phylogeny and Stratigraphy. This has allowed the editors to eliminate coverage of the rules of nomenclature, aspects of biostratigraphy and sections on the IUGS. Even more fortunately, the final section in I, on Infrastructure of Palaeobiology, has entirely vanished. Thus for the same number of pages the editors have provided a far richer volume. Coming as I do from the US, I am expected to count things whether there is any point to it or not, so: The number of major events has increased by nine and the number of pages by 40, principally through a better

appreciation of events in the Palaeozoic and the Cenozoic. Understandably, the Taphonomy section has grown by over 40 pages to accommodate our far more detailed understanding of this area. Even more significant is the change in organization. The previous edition was more about the "what" of taphonomy: transportation, types of preservation and fossil lagerstätten. The new edition emphasizes the nature of fossilized materials, including biomolecules, processes of fossilization and how preservation occurs in different habitats. Not surprisingly given the interests of the senior editor, the number of Lagerstätten has increased by a third. The Palaeoecology section of the new edition retains the flavour of the earlier edition, favouring some fascinating vignettes of behaviour over more general treatments. The concept of paleofoodwebs, barely covered by I, has vanished entirely from II just as new approaches by ecologists promise a resurgence. Noticeably absent from the Palaeoecology section are treatments of broader spatial and temporal patterns which have received widespread attention as macroecology. The greater emphasis on quantitative approaches is evident in the wholly revised Systematics section, with the introduction of sections on morphometrics and estimating diversity. The triumph of the phylogenetic method is evident in the expansion of this section and elimination of discussion of evolutionary section and stratophenetics. In contrast to I, the coverage of II has broadened to include greater coverage of organic geochemistry, isotopic geochemistry and molecular approaches, all of which are most appropriate.

One of the great strengths of the volume is the combination of focused treatments of well-studied areas (Taylor on locomotion in Mesozoic marine reptiles or Trewin on the Rhynie Chert) with discussion of broader principles (the late Jack Sepkoski, to whom the volume is dedicated, on competition in macroevolution or Cerling on the evolution of modern grasslands). Whether intentional or not, this approach provides both the general patterns and processes behind the history of life as well as the richness of unique events.

The endpapers of the two volumes provide another indication of changes over the past decade. Both reproduce the most recent IUGS international stratigraphic chart. That from 1989, compiled by Cowie and Bassett, includes the standard chronostratigraphic units, radiometric dates (*sans* any uncertainties) and generalized magnetostratigraphic information. That many of the claimed dates are illusionary or even fictions is not indicated, although a few dates are helpfully placed in parentheses. Where GSSPs or stratigraphic working groups have been established they are also indicated. The 2000 edition of the IUGS chart follows a similar format, but distinguishes between accepted, semi-formal (coat and tie?) and informal international stratigraphic names. More importantly, the chart provides both the Odin and IUGS subcommission numerical ages with, *mirable dictu*, estimated uncertainties. Many of the dates are still not up to date, but at



least the compilers have had the sense not to interpolate dates during intervals utterly lacking in adequate geochronologic control.

The first edition was most appropriately subtitled "A Synthesis", although this is curiously lacking from the present edition. Synthesis it is, and the editors and authors have produced a most authoritative treatment of the field, a perceptive bouillabaisse of case studies and the broader conceptual principles. The greatest drawback of the volume is the ridiculous price, which may be difficult even for libraries to afford. The paperback of the first edition sells for $116, suggesting the paperback version will remain expensive. It is probably too much to hope that by the third edition a decade hence European publishers in particular will grasp that they would sell far more copies with more appropriate pricing.

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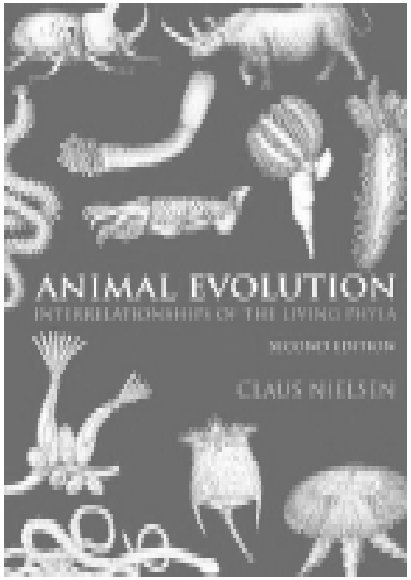
Animal Evolution: interrelationships of the living phyla

Claus Nielsen 2001. Oxford University Press, 2nd Edition. 574 pp.
ISBN: 0198506821 (pbk). £29.50.



There comes a point in everyone's career—it may not have happened to you, but it will—when the urge to discover what a gastrotrich's nephridia are like will become overwhelming. I have overcome this myself, but only with the help of one book: Claus Nielsen's *Animal Evolution*. Nielsen is one of the few living zoologists—Reinhardt Reiger and Ed Ruppert are two other names that come to mind—that really know about the material they place in their text-books. Even more helpfully, one does not need to wade through a vast brick of (sometimes dubious) information to discover such helpful facts: indeed, his book is a masterpiece of compression.

Of course, such brevity comes at a price—one needs to have at least some grip on the matter at hand before the book is fully comprehensible, nor is there much attempt at surveying biodiversity. More disappointing for a palaeontological readership is the general lack of reference to the fossil record. In the first edition, this lack passed uncommented on: now, an apologetic pair of paragraphs is tacked on the end of the introduction on the subject, together with a slight expansion of coverage of the subject in the rest of the book (from the bias of this coverage, one can suspect determined lobbying by certain colleagues). I have previously commented on the general lack of impact that invertebrate palaeontology has had

on phylogenetic studies (Budd 2000), and Nielsen is living proof of this, but also of the progress that is beginning to be made in this area.

Nielsen has added two chapters to the end of the book, one on cladistic results, and one on molecular methods. In the first edition, both received rather short shrift, with especially molecules being rather sniffily dismissed in two short paragraphs. I strongly suspect that even the newly-expanded coverage (which is, again, far from being positive towards molecular results) will fail to satisfy fanatics. In both cases, Nielsen is rather unconvinced: "Numerical cladistic analyses" as he titles the chapter, is criticised for (as I read him) being obsessed with statistical tree support and less with the massively biased character sets that go into such analyses. Nevertheless, as disarming as ever, he modestly states at the beginning of the chapter that "the following considerations are the result of my work with animal phylogeny, and not the result of a scrutiny of the impressive literature on cladistic theory" (p. 498). And who can blaim him? Nevertheless, unlike the first edition, which was criticised for being too subjective (Nielsen and others later brought out a cladistic analysis of the data present there), there is a hefty data matrix and some trees presented, which nevertheless unsurprisingly closely accord with the "subjective" analyses presented in the various chapters.

Molecular work gets a similarly rather brusque treatment: although Nielsen has fun pointing out the rather poor support even in the molecular literature for current phylogenetic darlings such as the Ecdysozoa. More important, he points to the problem that if ancient splits took place rapidly, then a slowly evolving molecule (like 18S rRNA) is necessary to retain some signal; but is unlikely to have enough precision to be able to resolve the relationships of the various phyla (Philippe *et al.* 1994). Even I think this is a little unfair: the molecular results, even if one mistrusts them, have been highly stimulating in getting people to look a second and third time at supposed homologies, and other characters once thought to be homologies by morphologists but currently out of fashion. This chapter then wanders into a discussion of the timing of origin of the various phyla, concluding that as "a number of the recent phyla…were well established at the Early Cambrian", the relevant radiations appear to have taken place "well before" the Cambrian. I must respectfully dissent. Finally, there is an interesting section on "evolutionary developmental biology" that discusses the increasingly prominent role that developmental studies are playing in determining homology relationships.

What of the coverage of the phyla themselves? Nielsen has shown himself to be susceptible to moderate criticism. Hence, his first edition placement of the ctenophores as sister-group to the deuterostomes is abandoned (without a backward glance, as far as I can find!), and he weakens his continuing Quixotic support for Bryozoa = Ectoprocta + Entoprocta (although he takes with one hand what he gives with the other; the concept is at the same time elevated into a chapter title). There is less emphasis on the Trochaea theory (see the first edition for details). The section on "five enigmatic taxa" at the end remains, but attentive readers will note that it is a different five—*Xenoturbella* has been shuffled out (prematurely, some might say), and Symbion, the astonishing representative of Peter Funch's and Reinhardt Kristensen's Cycliophora, is slotted in instead. Micrognathozoa, another Kristensen description, apparently arrived too late on the scene for inclusion. Perhaps there is no departmental coffee in Copenhagen.

I may sound as if I am carping above, but I am not. Quite simply, Nielsen's book is the most serious short treatment of animal morphology and its implications in English. His engaging style and endless useful details make it both a quarry to be patiently worked and a guide for future efforts. Indeed, one of the more charming aspects to the book are the challenging "areas for future research" that are listed at the end of each chapter. Perennial favourites like "kinorhynch embryology" feature in both editions, but a few ("formation of the mucous net by the endostyle" in urochordates) have vanished. In that case, the "solving" of the problem seems to be Nielsen's dscovery of an ultra-obscure previous reference dealing with the problem; but there are genuine new advances too, such as "chemical composition of the cuticle" of loriciferans. We are about to cross another one off the list here in Uppsala, but still, there are lots left for those who might have developed a sudden interest in, say, entoproct nervous systems or the sipunculan tentacle coelom.

What, then, are the conclusions to be drawn about animal evolution—and indeed *Animal Evolution?* As Nielsen notes, the "attentive reader will have noticed that the picture of animal evolution presented in this book is seen through the eyes of a morphologist" (p.523). That in itself will be enough to render the book of little interest to some. These eyes still see the traditional categories; Articulata, not Ecdysozoa; and the "big" Deuterostomia, not Lophotrochozoa; but perhaps a little blurred with a regretful tear at their iminent demise. Nevertheless, just because there has been a phrenetic (but certainly not phenetic) rush to embrace the new results of molecular analyses does not render the results from classical morphological of no interest. Indeed, the apparent conflict renders them even more interesting. Somewhere, someone has been terribly wrong about animal phylogeny. It is thus no paradox that the gigantic numbers of molecular data swilling out of labs around the world have resulted in a revival of interest in morphology, for the two must in the end be reconcilable. But until that time, (to steal John Henry Newman's words about Authority and Private Judgement) that "awful, never-dying duel" between morphology and molecules will be fought out, largely by the pages of Nielsen and perorations in German lecture theatres on the one hand, and in the shiniest new labs of America and the opinion columns of the *Trends* journals on the other.

PS: the solution to the gastrotrich problem is on p. 325.

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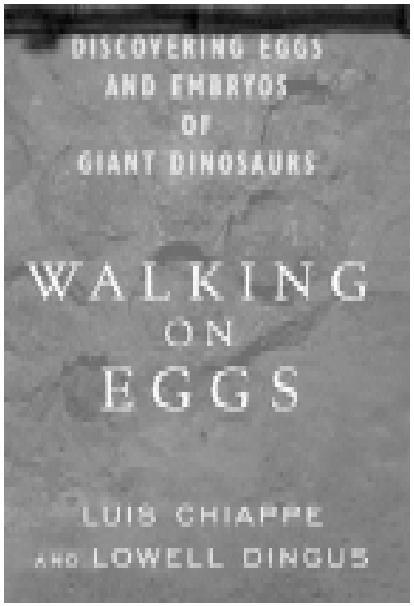
Walking on Eggs: Discovering the astonishing secrets of the world of dinosaurs

Luis M. Chiappe and Lowell Dingus. 2001. 219 pp. Little Brown and Company. ISBN 0-316-85489-1 (hbk). £16.99.



The Mesozoic sediments of southern South America have yielded copious remains of dinosaurs, mammals and marine reptiles, and represent one of the greatest repositories of vertebrate palaeontological data in the world. Nevertheless, the importance of this region, though frequently acknowledged by specialists, has largely escaped popular attention as it has been generally overlooked by the press, which has tended to place more of an emphasis on North American and East Asian discoveries. Recent popular books have dealt with palaeontological field programmes and expeditions in the USA, Malawi, Niger, Laos, Australia and Mongolia, but none has addressed the highly successful fieldwork that has been carried out in South America over the past 40 years. The accelerating rate of palaeontological discovery in Argentina and Brazil over the past 15 years in particular makes this deficit even more obvious. Although a semi-popular compilation of Argentine dinosaur discoveries has already been published (Bonaparte, 1996), *Walking on Eggs* is a welcome addition to a recently revived tradition of popular, yet scientifically literate, travel writing.

Chiappe and Dingus relate the circumstances surrounding the discovery, excavation and subsequent study of dinosaur eggs, embryos and nests at the Auca Mahuevo locality in central Patagonia. Their expeditions to the site revealed the existence of a huge nesting colony that was once frequented by those dinosaurian giants, the sauropods, during the latest Cretaceous. Here they found sauropod nesting structures and sauropod embryos *in situ* within eggs—both palaeontological firsts. They also exhumed partial skeletons of the adult sauropods that were responsible for laying the eggs and of two species of large carnivorous dinosaurs, one of which rivalled *Tyrannosaurus* in size. We are taken through the process that led to these discoveries step-by-step, from prospecting the site, through the problems of carrying out large-scale excavations in remote, difficult terrain, to the delicate preparation of the fossilised embryos in the laboratory. The book contains a strong element of travelogue, and the landscapes and local people are introduced and described to the reader in an enthusiastic, but unromantic, fashion. The various members of the fieldcrew are also introduced in passing but, if you are expecting rounded biographies that might give some insight into the kind of people who indulge in such fieldwork, you will be disappointed. That is not to say that the authors are

unsympathetic or uninterested in the people: they have just chosen to make the geology and the dinosaurs the stars.

The prose is well-paced and clearly written, making it a good, though not taxing, read. The scientific background information is well-expressed and does not come to dominate huge chunks of the book. This is a useful achievement, as in many popular accounts of palaeontology the narrative is often broken by lengthy diversions to provide context, including accounts of plate tectonics, the process of fossilisation etc. While this is an admirable aim (using the dinosaurs as an introduction to other aspects of science), it should be realised that many of the readers of such books (amateur palaeontologists and natural historians, students, professional biologists/geologists) are usually familiar with the basic principles of these subjects. There are a large number of clear figures that are useful in explaining phylogeny, egg structure, biogeography and anatomy, several beautifully drawn reconstructions of life at Auca Mahuevo in the Late Cretaceous, and a selection of photographs taken in the field and laboratory.

One aspect of the book that does cause me some concern is the fact that it contains a lot of information that has not yet been described in detail in the specialist literature. To my knowledge, only two scientific papers have been published on the Auca Mahuevo material, both of which deal with the remains of the sauropod embryos. However, the book contains a vast amount of speculation on nest structure, nesting site fidelity and other aspects of sauropod reproductive behaviour. Although the authors are careful to mention that this is speculation, and they do present evidence in favour of the scenarios they propose, there is a danger that this book will become much quoted as a source of primary information, which does not appear to be its main aim. It may be that technical papers dealing with these other issues are in preparation or in press, but it seems a little unwise to rush out scenarios of this kind without a body of published scientific work to support them. Similarly, perhaps due to publication delays, the authors have created a *nomen nudum* for one of their theropod taxa, *Aucasaurus*, which is not good practice.

These criticisms notwithstanding, *Walking on Eggs* is a lively, readable account that succeeds admirably in conveying hitherto unpublicised aspects of dinosaur biology and helps to redress the prevailing geographical bias in the production of popular dinosaur books. The appetite for books of this kind shows no sign of diminishing, and I am sure that many other volumes, dealing with expeditions currently underway, will soon be flooding our bookshelves.

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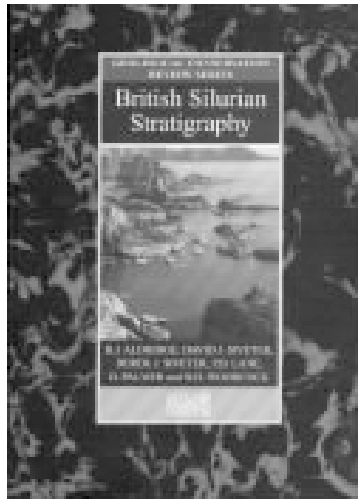
British Silurian stratigraphy

R.J. Aldridge, David J. Siveter, Derek J. Siveter, P.D. Lane, D. Palmer and N.H. Woodcock. 2000. Geological Conservation Review No. 19. Joint Nature Conservation Committee. xviii + 542 pp. ISBN 1861074786 (hbk). £76.



Given the small size of the country, the variety of geology to be found in Great Britain is quite extraordinary. The great diversity of rocks, structures and fossils that occur provided a rich source of inspiration for initial investigations by the early scientific geologists, and fresh results being produced by currently active research programmes show that the British geological database is far from exhausted. To document and assess Great Britain's most important geological sites, the Geological Conservation Review was initiated in 1977. The resulting publications will ultimately make up a 42-volume series describing these key geological sites, and summarizing their current condition. The series will thus provide a firm basis for the proper scientific and historical management and conservation of sites in future years. The present volume, prepared by a group of authors who have made substantial contributions to study of the Silurian, is a most welcome addition to the series.

It was from Britain, of course, that Silurian rocks were first described and recognized, the publication of Murchison's *Silurian System* in 1839 making the system one of the first to be formally defined. Britain has continued to have particular importance for Silurian studies because it contains the historic type areas for the Llandovery, Wenlock and Ludlow series. Of the eight boundary stratotype sections used to define the bases of the major Silurian stratigraphical divisions, seven occur in Britain. As well as being formally significant, British Silurian successions have considerable intrinsic interest. There occur sediments that formed in environments ranging from fluvial to oceanic, including such palaeontologically celebrated units as the Much Wenlock Limestone Formation. Volcanic and intrusive igneous rocks of various kinds are found, and there are structures formed in the later stages of convergence between Laurentia and Eastern Avalonia + Baltica. It is therefore not surprising that the book includes descriptions of around a hundred significant sites, all of which have been proposed for nomination as Sites of Special Scientific Importance.

Two introductory chapters preface the site descriptions. The first provides an overview of the stratigraphical framework: the early development of Silurian stratigraphy, aspects of lith-, bio- and chrono- stratigraphy, changes in sea level and climate, tectonism and palaeogeography, are admirably and succinctly reviewed. This chapter ends with a summary of the rationale underlying site selection, which emphasizes chronostratigraphical position, palaeogeographical setting and international importance as the key criteria. Chapter two gives an

authoritative overview of Silurian palaeontology, evaluating the contributions of the various fossil groups to the correlation of Silurian rocks and improved understanding of Silurian times. The discussion takes account of ecological and geographical controls on the distribution of biotas, and there are also sections on taphonomic matters, community ecology and reef development.

Chapters three to six make up 70% of the book, and deal respectively with sites exposing rocks of Llandovery, Wenlock, Ludlow and Prídolí age. For each site, a thoroughly referenced account is given of the geology, its context, and the scientific justification for conserving the site concerned. A conclusions section for each site highlights its most important features. With the aid of the glossary given at the back of the book, these sections will be understandable by interested but non-geological readers. The authors have chosen their sites well, and I could identify no obvious omissions. The discussion is clear and authoritative, taking full account of the literature published until 1998, and some account of publications from 1999. The text is illustrated by excellent maps and line diagrams. Not all the photographic illustrations have reproduced well, however. The book ends with separate fossil name and general indexes.

This book is a credit to both its authors and to the Joint Nature Conservation Council. As well as serving its intended purpose, it will be an indispensable reference for all engaged in advanced studies of the Silurian. Its high price makes the volume primarily a library purchase, but it will be regularly consulted by professionals and advanced students for many years to come.

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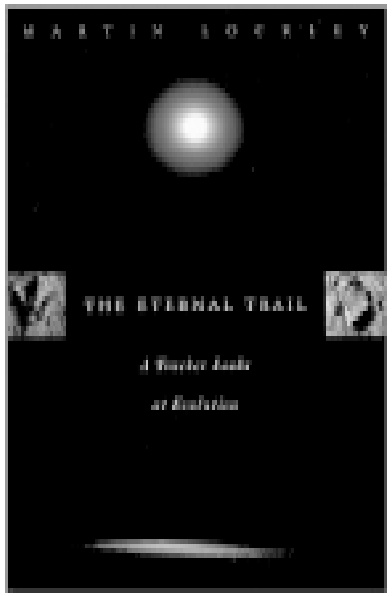
The Eternal Trail: A Tracker Looks at Evolution

Martin Lockley. 1999. 334pp. Perseus Books. ISBN 0738201650 (hbk). £17.95.

This was a frustrating book to review. Within its covers enjoyable reading on tracks and trackers cohabits with some rather clouded philosophy. Martin Lockley, Professor of Geology and Paleontology at the University of Colorado, Denver, is perhaps best known to a wider range of readers as the author of several engaging books on vertebrate tracks, including "Tracking Dinosaurs". Parts of *The Eternal Trail* cover ground that will be familiar to those who have read his previous books, including the author's relatively simple but effective drawings.

However, as may be surmised from the coda to the title, *The Eternal Trail* is a more ambitious project. This ambition is boldly stated in the preface, including some rather purple prose "I offer it only as my signature—another footprint on the eternal trail, a booklike image projected through the holographic negative of Earth's trampled skin." (p. xiii).

The underlying reasoning and philosophy of this book are, I believe, to look at evolution based on a combination of holistic, mystical and religious approaches, and to integrate these into an evolutionary paradigm. This appears to apply in particular to the evolution of the human



sphere but, you see, everything is connected. "And what a dance ensued as the biosphere evolved! Once Precambrian organisms became emancipated from their primitive sedentary existence they expressed their mobility by leaving highly ordered tracks and trails… Then in the twentieth century the biosphere gathers momentum for the quantum leap to noosphere and the eternal trial leaves the planet. Mind adds another layer to the yet unfathomed intricacies of the biosphere…. For all that we might view the signs, spoor, and language of animals as simple in comparison to our own, we barely understand even them. In fact, we need higher consciousness to fathom the deeper mystery." (p. 6-7). It should be clear that this is a view strongly based on that of Teilhard de Chardin, who is referred to in this book as one of the greatest thinkers of the twentieth century. Evolution is perceived as directional, driven by vital forces. To sing from the same hymn sheet as the author we furthermore have to be comfortable with palmistry, astrology, and psychic archaeology. Lockley clearly wants to challenge the concepts of what is science and what is not scientific. "Any departure, however tangential, from the scientific underpinnings of research into fossil footprints is proposed simply as an exploratory first step. Having reported what we think we know, for us it is logical to ask 'Where do we go from here?'. The old adage holds that there is no such thing as a stupid question. To this end I have perhaps raised too many unanswered questions, or naively asked whether certain tenuous connections have any meaning. My ruminations about possible connections are just that; they are not statements that these connections are known to exist. But as almost everything is connected in some way, perhaps I have probability on my side." (p. xiv). And of tenuous connections there certainly are aplenty.

Starting with individual footprints we learn, not unreasonably, that being an integral part of the animal, impressions of the feet can yield diverse information about an animal. Here Lockley draws heavily on the work of Wolgang Schad, who has expanded on Goethe's ideas on a phenomenological approach to animal form. In brief, starting from the senses, the animal is viewed holistically. Thus, examining the footprints of animals not only gives us information about the foot morphology but also about the morphology of the animal as a whole as well as its metabolic system *etc*. This is rather interesting, and reasonable within limits, though I get the sense that the case is overstated and generalized from a few cases, including examples where there are similarities in the shape of horns and hoofs. Here, as through much of the book, the problem is that the author takes a holistic viewpoint to preposterous extremes where almost anything, being part of the greater entity, has a meaning for the greater whole. This apparently is based on the assumption that all living beings are part of a cosmic force.

"The noosphere, like a sleeping giant, is awakening, becoming conscious and self-aware…. We are aware not just of our own special human incarnation in the 'image of God' but also are becoming aware that all life was created in the divine image." (p. 297).

The book abounds with bizarre comparisons that are presented not as nephelococcygian fun, but as being of significance. Some Ediacaran fossils are said to be reminiscent of magnetic fields, trilobite trails are compared to Celtic art. Speaking of Celts we are told that based on relative proportions of their feet we can deduce that "… ancient Celts were more intuitive and mystical, whereas Saxons more practical and down to earth." (p. 23). On p. 223 we learn that Iris was the goddess of the rainbow in Greek mythology, that Iris was also the name given to the seventh discovered asteroid, that the iris (of the eye) regulates flow of energy between the observer and the observed universe, that homepathists reported that patients given iridium saw visions of rainbows and became preoccupied with the number seven. We are also informed that a meteorite crater has the three-dimensional morphology of an eye—in reverse. There are additional connections that are too painful to relate. The attentive reader will no doubt already have figured out that this relates to the K-T extinction, and that these are all, somehow, significantly connected. There is some very strange logic on display; "Bigfoot either exists or used to exist as *Gigantopithecus* or a relative. Had it never existed, how did it ever get so much press!" (p. 267). Does the same reasoning give the ludicrous "Face on Mars" story merit?

A running theme of the book appears to be an attempt to blur or eradicate the boundaries between faith and science. Though the question as to what should be considered scientific clearly is not … err … completely set in stone, there are clear-cut principles guiding scientific thought. Science has over the last several hundred years been able to explain mechanistically phenomena that at one time or another would have seemed explicable only as of mystical or divine origin. There is no reason to expect that this expansion of knowledge has come to an end and that there should be a need to resort to mystical explanations in science. The study of life appears to introduce elements of emergent properties that may be particularly challenging but which nevertheless can be studied using traditional scientific principles. Being a man of faith, Lockley appears to feel that his beliefs need to be justified, that it has to be embraced by science and that science need to embrace faith. But confusing the issues of Science and faith "Some people consider talk of God and spirituality unscientific. But a mystical or intuitive approach to understanding existence is not incompatible with the scientific one." (p. 3), is counter-productive. Without going too deeply into my own position on this matter, science and faith clearly can coexist but as they deal with different aspects of existence the one should not be used to explain the other.

As promised above there are passages of this book that are enjoyable. There are short vignettes on vertebrate tracks and the people who studied them, including a presentation of seven important trackers that the author calls the "magnificent seven". We get to follow some of their explorations and their interactions with the non-tracking society. This section includes examination of some contentious issues such as whether there is track evidence for tetrapod predatory interactions (not good) and the validity of claims of pterosaur walking tracks (here given the thumbs up). As a somewhat light-hearted excursion, I was pleased to see reference to dinosaur collectives. The plethora of animal collectives is a delightful aspect of the English

language, with vivid images conjured by a business of flies, a convocation of eagles or a tittering of magpies, or, with reference to a current issue of *Geology*, the stranding on a Cambrian shore of a smuck of jellyfish. Lockley suggests a few neat dinosaur collectives such as an orchestration of ornithopods and an appearance of apatosaurids. Looking for additional positive sides to this book I have sympathy for the humanitarian message that Lockley is advancing, for example on p. 297: "As a counterbalance to excessive materialism the tide of conscious spirituality is on the rise." Throughout the book Lockley also shows commendable respect for life, big and small, and for the Earth as a whole.

Returning to the noosphere. What, if any, could be the impact of a book such as this one? Sadly, it is difficult leave this book with any other impression than that of a scientist gone New Age. To his credit Lockley bares it all in the preface, probably making quite a few potential readers direct their time toward other activities. Unfortunately, this type of book may most attract those who should be least encouraged. Creationists, of various creeds, are becoming increasingly sophisticated in attempting to present their beliefs and preconceptions as science, and conversely in attempting to discredit evolution. By presenting this type of muddled evolutionary philosophy as scientific, Lockley, as a scientist of some repute, is sending a rather dangerous message that may well be seized upon by Creatonists.

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Fossil Woods and other geological specimens

Andrew C. Scott and David Freedberg 2000. The Paper Museum of Cassiano dal Pozzo (Series B, Part 3). 424 pp. Harvey Miller Publishers. ISBN 1872501915 (hbk). £150.00.

One may question the relevance to modern palaeontology of a collection of early 17th century engravings of fossil woods. The issues raised by those responsible for them, however, are pivotal to the science of palaeontology. The questions asked, techniques utilized and conclusions reached in these fledgling studies were a vital phase in the historical development of our science. These were not just a bunch of keen natural historians, they were serious scientists, and their number included a certain Galileo Galilei.

In 1603 Frederico Cesi founded the first scientific society in modern Europe (Accademia dei Lincei). By 1611 membership totalled six and included Galileo. An early project of the Lincei, and one that was actively investigated for many years, was the study of some peculiar fossilized wood that was found on a locality within Cesi's estate in Umbria, Italy. Cesi employed a professional draughtsman to draw hundreds of specimens of the woods, associated fossil animals, and field sketches. He intended to publish many of these illustrations along with a discussion on their origin, but sadly he died prematurely. The only publication relating to the fossils was written up following Cesi's death by fellow member of the academy, Francesco Stelluti. This short paper outlined Cesi's/Stelluti's hypotheses and including a small number of illustrations.

Cesi's work was methodical for the day. The engravings include annotated locality maps and field sketches. This has enabled palaeobotanist Andrew Scott to ascertain from which strata, and indeed likely localities, Cesi obtained his fossils. Scott has visited Umbria and applied modern palaeobotanical/geological knowledge and techniques to a study of the fossilized wood. The relevant deposits are of late Tertiary age and accumulated in a large freshwater lake bordered by coniferous forests. The fossil woods are abundant and preserved in a variety of preservational modes (even within a single specimen). Such is their interest to palaeobotanists, recently discovered localities are being considered for designation as a world heritage site.

However, the most interesting aspect of these early studies is the debate the fossil woods provoked regarding how they actually formed. Do fossils represent the remains of once living organisms, or are they formed inorganically? This was one of the central questions in early palaeontological studies, however amusing we may consider such ignorance nowadays. Stephen Gould has discussed this aspect of Cesi/Stelluti's work in a couple of short essays (see Gould 2000) and Andrew Scott considers it in detail in this book and in another briefer publication (Scott 2001). Essentially Stelluti came to the wrong conclusion—in his publication he presented evidence demonstrating that the fossil woods were formed from stone and not "once living". Gould demonstrates that he got it wrong because, although he interpreted the sequence of diagenetic events correctly, he interpreted them back-to-front (*i.e.* earth – petrified wood – real wood, rather than vice versa). Scott argues that Stelluti interpreted the evidence incorrectly because at this time so little was understood of sedimentation and the fossilization process. Scott points out a number of examples of this, including: (i) because he only found trunks in the horizontal position and they were compressed, Stelluti concluded that the weight of earth prevented them growing upwards; (ii) no trees in this area today grow to the large size of the fossil trunks, suggesting that they could not possibly be of local origin. Interestingly, Scott has hinted that Stelluti's interpretation may have been influenced by pressures from the Vatican (the publication appeared shortly after Galileo had run into major trouble with the authorities after publishing *Discourses*) (see Scott 2001).

Both Gould and Scott note that the point here, however, is not that Cesi/Stelluti got it wrong, rather that they were asking the right questions and addressed them in a scientific manner. This is one of the first palaeontological investigations to integrate and properly record field and collection-based observations to solve a problem. And the problem was one central to palaeontology.

So what exactly is the nature of this book? Again we must turn to history. Cassiano dal Pozzo joined the Accademia dei Lincei in 1622. He was a patron of the arts but with a deep interest in antiquities and natural history. He spent much of his time collecting together his so-called "Paper Museum". Essentially this was a vast collection of paintings, drawings *etc*. representing not only the arts, but also materials illustrating antiquities and natural history. Pozzo collected together much of the illustrative material produced by the Accademia dei Lincei, including Cesi's illustrations, following his untimely death. The Paper Museum was eventually purchased by the British Royal Family in 1762 and is today housed in Windsor Castle. This book is part of an ambitious project devoted to reproducing the Paper Museum of Cassiano dal Pozzo (the final catalogue will consist of 30-or-so volumes subdivided into Series A: Antiquities and Architecture and Series B: Natural History).

The entire group of 199 engravings relating to Cesi's fossil wood project is reproduced in this book (in black-and-white or colour depending on the original). Full and extensive catalogue details are provided, including notes on watermarks. However, this is not just an art catalogue. There are a number of contributions outlining the historical background. Other contributions include a modern interpretation of the geology of the localities and nature of the fossils, in addition to an explanation of their relevance to modern science. All these contributions are extremely interesting and very well executed.

Now the sting—this book is very very expensive. In producing such a book, however, it is pointless sacrificing production quality for cost. The main aim of the book is to reproduce in full and archive, for the first time, these exquisite illustrations. The book is wonderfully produced and achieves this aim. Scholars concerned with the historical development of scientific illustration, or indeed anyone seriously interested in this subject, will not require me to recommend purchasing this book—they will already own a copy. On the other hand, I doubt I will persuade many palaeontologists to blow their book budget on such a luxury item. However, this book is a luxury, and if you can find a copy to peruse it will not disappoint. The historical aspects are fascinating, and Andrew Scott has done a marvellous job explaining its relevance to the history of palaeontology, including a detailed integration of current geological/palaeobotanical knowledge. Alongside the wonderful original engravings, we have photographs of the field sites as they are today, and examples of the fossil wood as it can still be collected. If you get a chance, I thoroughly recommend spending a little time with this volume. And for those not enchanted by fossil wood, there are even some engravings of ammonites.

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Rock of Ages – Sands of Time

Barbara Page 2001. University of Chicago Press, 376 pp. ISBN: 0226644790 (hbk). US$45.00, £32.00.

This work can be described as a 350 page landscape format book that contains full colour reproductions of 544 contiguous painted panels by New York artist Barbara Page representing the history of life on earth from the Pre Cambrian to the late Quaternary. The published synopsis describes the visual content as showing '…fossil plants and animals depicted at the same scale and in association with each other, just as they might be found by a paleontologist in the field'. The paintings have been specially commissioned for a permanent exhibition at the Museum of the Earth, Ithica, New York.

There is an accompanying text by Warren Allman, Director of the Paleontological Research Institution in Ithica.

The first impression I had of this book is that it is a beautifully crafted product: excellent reproduction, quality design and layout with binding and paper to match.

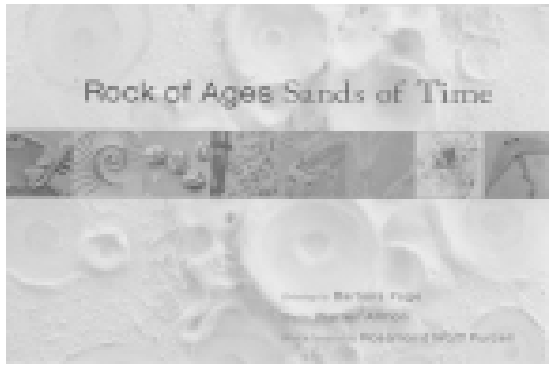
However I do have reservations. 'Trade' books on palaeontology, which is the merchandising classification you would put this one in—as opposed to purely educational text books—normally range from being for the serious informed reader through to children. They are often about dinosaurs only. These products tend to sell because of the quality of the illustrations which as well as providing information, are also there to entertain.

This book does nothing to put it into that category. For me it is an example of 'vanity publishing' and fulfills what appears to be no more than a catalogue for an exhibition. It is an 'art book' whereby the images are really fine art paintings as opposed to illustrations. There is a deep-rooted difference between the two disciplines—fine art is subjective and sells itself. Illustration is objective and sells something else—and in this instance would be palaeontology.

I genuinely think the concept for this book is a great idea—but an opportunity missed. I would have loved to have seen (and I may even nick this idea for myself), fully rendered, life-like reconstructions of animals in their environment—not necessarily 'Walking with Dinosaurs', but images with aesthetic considerations and personal nuances that elucidate the evolutionary sequences of the history of life on earth.

This is great subject matter. In spite of the credence scientific research and facts give certain aspects there is always the facility through the illustrations to provide an element of surprise and mystery. Sometimes there is the need to incite debate and argument regarding some feature or other which might be to do with colour and markings, physique, gesture and gait, environment and habitat.

All of this is clearly missing from the book. Why produce what appear to be superficial renderings of fossilized forms, which in terms of the visual language employed don't know whether to be abstract or representational? Style-wise this imagery rests uncomfortably in the middle. I find that although the work is decorative, has interesting compositional notions, is textural with good use of colour—they work best in the back of the book reproduced at postage stamp size and shown all together in sequence. In this context they would make a good graphic backdrop to a more detailed visual concept showing the evolution of life.



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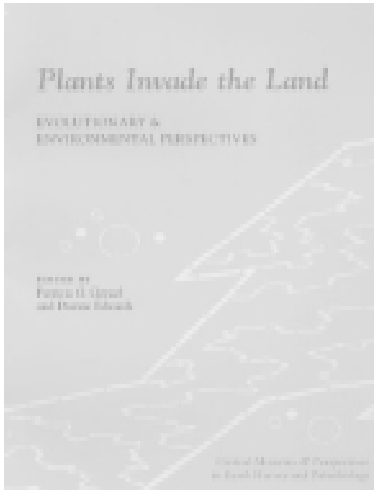
Plants Invade the Land: Evolutionary and Environmental Perspectives

Edited by Patricia G. Gensel and Dianne Edwards, 2001, in Bottjer, D.J., and Bambach, R.K., (Series Editors), Critical Moments and Perspectives in Earth History and Paleobiology Series, New York, Columbia University Press. 316 pp. ISBN 0231111606 (hbk) £46.50; ISBN 0231111614 (pbk). £23.00.

What is the connection between plant roots and the Permo-Carboniferous glaciation? The answer is the long term or geochemical carbon cycle. Well, that's part of the answer, according to Robert A. Berner. Who would have thought that the humble root—the hidden half of the land plant—was to have such a profound effect on global climate? Here's how it works. Studies of modern vegetation indicate that well-developed root systems contribute significantly to the weathering of calcium and magnesium silicates in soils. Weathering involves the conversion of CO_2 gas from the atmosphere into dissolved HCO_3—in soil and ground water and its transport along with calcium and magnesium ions via rivers to the ocean, where they are precipitated as limestone and dolomite. The release of this rock-bound CO_2 to the atmosphere eventually occurs via thermal breakdown of buried carbonates, resulting in degassing to the earth's surface. But, completing the cycle takes tens to hundreds of millions of years. Thus, the weathering of silicates together with the burial of organic matter in sediments draws down carbon from the atmosphere, removing it from the biosphere long-term. These effects accelerated following the evolution of roots during the Devonian Period, leading to a very large decrease in atmospheric CO_2. The result was greenhouse induced global cooling during the mid-Palaeozoic, which was, Berner argues, a major contributing factor to the Permo-Carboniferous glaciation. And there, in a nutshell, is his explanation.

Berner's paper is one of a baker's dozen in this proceedings volume, which is based on a symposium held at the Fifth International Organisation of Palaeobotany Conference in 1996. *Plants Invade the Land* represents a marked departure in style and organisation from previous works in the Critical Moments and Perspectives Series, which are mostly single or joint author books on subjects such as "Principles of Paleoclimatology" (Thomas M. Cronin), "The Great Paleozoic Crisis: Life and Death in the Permian" (Douglas H. Erwin), and "Theoretical Morphology: The Concept and Its Application" (George R. McGhee, Jr), to name three. These works have a coherence and a continuity that inevitably is absent from an edited book. Most of the papers in *Plants Invade the Land* are reviews of topics relevant to the origins and early development of the land flora and the consequences this had for terrestrial and marine environments of the mid Palaeozoic.

If Berner is right about roots, then we'll all have to do some more digging, because as several papers in this volume show there is much to learn. In fact, reading through *Plants Invade the Land* one is struck by the attention that these overlooked organs are now gaining in palaeobotanical and geological investigations. Root mediated weathering is a major plank of Berner's GEOCARB II model, and the main cause of his predicted decrease in atmospheric carbon dioxide during the Devonian-Carboniferous. A few words of caution here though. Although Berner's models have been used as a baseline in many studies of atmosphere evolution and its effects on the biosphere, there are those who question their reliability,



particularly as they apply to the Early Paleozoic. Elsewhere, Boucot and Gray (2001) have recently provided a detailed critique and a challenging alternative viewpoint. The main thrust of their objection is that the Berner model does not fit well with some other CO_2 proxies, especially the distribution of climatically sensitive rocks (*e.g.*, evaporites, coals, bauxites, kaolins, calcretes, tillites). Also, with respect to roots, Boucot and Gray (2001) point out that plugging values for weathering into this model is not straightforward. Plant size, the extent of vegetation cover, and the very nature of roots themselves changed enormously during the critical Devonian Period. Soils also underwent huge developments. Some of these issues are brought out very clearly in other contributions to this volume.

From a botanical perspective the Devonian Period can be divided broadly into an early part characterised by an herbaceous flora and a later part which is marked by the appearance of large trees and forests. In a chapter reviewing the fossil evidence of root traces in paleosols, Driese and Mora conclude that there is a progressive increase in size and depth of root penetration that parallels this general trend of increasing plant size. Beginning in the Late Silurian, root-like trace fossils are minute, millimetre size features, but by the Late Devonian we see trees bearing sturdy roots over 1.5m in length. All this is consistent with what is known from macrofossils, and there is some truly remarkable evidence, as Kerp, Hass and Mosbrugger are at pains to point out. In a chapter devoted to the fossil plant *Nothia aphylla* from the famous Rhynie Chert, Kerp *et al.* provide a blow by blow account of rhizome anatomy, which although unlikely to appeal to the general reader is a mine of fascinating information. Like many Early Devonian plants, *Nothia* didn't have true roots. It had a prostrate rhizome that bore minute hair-like rhizoids. Kerp *et al.* reinterpret *Nothia* as a geophyte —that is, a plant with a long-lived underground rhizome and ephemeral aerial parts. *Nothia* was a small plant in a land vegetation that at the time rarely exceeded about a metre in height. Gensel, Kotyk and Basinger, in a chapter reviewing the morphology of early plants, show that at the larger end of the scale, rhizomes also bore specialised multicellular roots. These were bigger than rhizoids but rarely exceeded 10cm in length. Add to this the fact that the photosynthetic aerial parts of these plants were devoid of true leaves, and it would seem that estimating rates of silicate weathering in the Early Devonian based on modern analogues is at best a risky business.

The evolution of truly large plants involved at least an order of magnitude increase in size. This development occurred during the mid-late Devonian and was made possible by the appearance of the cambium, which is a meristem that enables increase in girth. Since the cambium is expressed in roots as well as stems, an increase in stature above ground often went hand in hand with larger subterranean parts. And so the evolution of forests was accompanied by a remarkable revolution underground, in which soils and the rhizosphere took on a more modern aspect. In a chapter examining how the spread of plants affected

weathering, marine biotas, and climate change, Algeo, Scheckler and Maynard argue that the Late Devonian saw the development of extensive soil profiles, increased root-mediated weathering, and the spread of plants to upland sites. In their view, these events had implications that reached well beyond the terrestrial into the marine realm.

So what about the marine realm? Well, while plants were going from strength to strength on land, tropical shallow-marine benthic communities were suffering a protracted crisis. This mid-late Devonian mass extinction lasted from 20 to 25 million years and comprised at least eight to ten separate events. Various extinction mechanisms have been postulated, and Algeo *et al.* have their own hypothesis. They argue that the extinctions were probably related in some manner to the development of widespread anoxic bottomwater conditions in epicontinental seas, and that this in turn was caused by the rise of complex soil communities on land. In brief, massive soil and root development raised the levels of soil solutes transferred to freshwater and ultimately to marine systems. This promoted eutrophication in shallow seas, leading to trouble for benthic communities.

Meanwhile, back on land there was a rustling in the undergrowth as the plant invasion was followed by waves of mostly small animals. One striking feature of early land faunas is the preponderance of carnivores and detritivores (eaters of dead plants that have already been partly processed by fungi and bacteria) and the absence of herbivores. Shear and Selden—in an interesting chapter marred only by the absence of illustrations—review the fossil evidence and note that this pattern is repeated again and again in groups as diverse as the predatory scorpions, trigonotarbids (spider-like arachnids lacking silk-spinning organs), true spiders, pseudoscorpions, scutigeromorph centipedes and early tetrapods. These mostly miniature predators were accompanied by a menagerie of detritivores or fungivores including mites, millipedes, arthropleurids, and springtails. Thus, the early terrestrial food chain seems to have been based on detritivory, a feature it shares with modern soil ecosystems.

No book of this sort would be complete without an analysis of the botanical innovations that turned the plant colonisation of the land into such a success. Unlike animals, which universally inherited their basic body plans from their aquatic ancestors, plants seem to have evolved most of their morphology on land. They cobbled together a defence against the onslaught of the atmosphere from an unpromisingly small morphological armoury. As Graham and Gray point out, phylogenetic treatments speak with a single voice in placing the mantle of land plant 'ancestor' firmly within the charophycean algae, and what a strange group these are. For one thing, they have no sporophyte. This is the spore or pollen bearing part of the life cycle that makes up the overwhelming bulk of land plant biomass. It appears that the land plant evolved a biphasic life cycle along with the all-important sporophyte more or less from scratch, and Graham and Gray review some of the characteristics of charophycean algae that may have made this possible. It is also worth pointing out that this phylogenetic evidence provides an answer to a conundrum that has challenged generations of palaeobotanists. Why is there so little macrofossil evidence of the transition between algae and land plants? The answer is that the erstwhile algal ancestor was small, of very simple morphology, and likely lacked a sporophyte.

Despite the absence of transitional macrofossils, there is an abundance of microfossil evidence pointing to a land flora in the Early Silurian and perhaps also in the Ordovician. The chapters by Graham and Gray on charophycean algae and by Edwards and Wellman on early land floras

review the fossil evidence. This is mostly in the form of dispersed spores and more controversially fragments of tissues such as cuticles and banded tubes. The fact that anything is preserved at all is in part due to the land plant's formidable chemical arsenal of phenolic compounds. These include lignin, cutin, suberin, sporopollenin, flavoinoids, and others. Many of these were early innovations that combined with developments in morphology to produce a workable package, allowing plants to regulate their water economy, control their dispersal, and contributing in many ways to growth in size. It is clear from the chapter by Cooper-Driver, which reviews some key biochemical pathways, that although much is known about the biosynthesis of phenolic compounds there is still a huge amount to be learned about how various pathways link up, their genetic controls, and how they evolved. Some of the genes implicated in the synthesis of these secondary metabolites have been sequenced and show homologies with enzymes involved in primary metabolism, hinting at co-option and modification of metabolic genes. Here, as elsewhere, a phylogenetic context will prove critical to disentangling the network of related events.

This book also contains useful reviews of Middle Devonian floras (Berry and Fairon-Demaret) and a summary of the important Early Devonian Psosongchong flora from China (Hao and Gensel). Hotton *et al.* provide an interesting palaeoecological study of the famous Battery Point Formation of Gaspé Bay, Canada. The ecology of Early Devonian autochthonous plant assemblages is rather poorly known. The Hotton *et al.* analysis uncovers what could be some of the earliest evidence of clade-related niche partitioning in plants. Zosterophylls apparently preferred stable wetland sites, whereas rhyniophytes and trimerophytes occupied more ephemeral near-channel environments. The ecological preferences of zosterophylls would therefore seem to foreshadow those of their better known Carboniferous relatives, the tree clubmosses.

This is not a book that you will sit down and read cover to cover. It's an eclectic mix of review and research papers that you will dip into, depending on your interests. Palaeontologists will find valuable syntheses of early fossil evidence of plant and animal life from the Ordovician to the Devonian. There are also some provocative and controversial ideas here, particularly in the papers by Berner and Algeo *et al.* These are not new—they have already been stated elsewhere—but they are interestingly brought together and developed in this volume, cheek by jowl with relevant papers on the fossils. Missing but of interest are chapters summarising developments in land plant phylogeny, plant biomechanics, and the fossil record of mycorrhizae (fungal root symbionts). The take-home message of this book is that roots are emerging as major players in a variety of contexts. And, the book exposes the need for a greater understanding of the evolution of these overlooked organs and their impact on early terrestrial and marine ecosystems. It's a bargain at £20.50.

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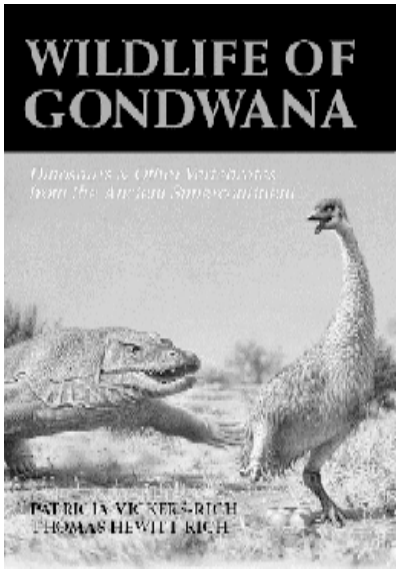
Wildlife of Gondwana: Dinosaurs and Other Vertebrates from the Ancient Supercontinent

Vickers-Rich, P. & Rich, T.H. 1999. Indiana University Press. 276 pp (October 1999). ISBN 0253336430; £45.00.

This is, simply put, a wonderful book. It contains superb wildlife photographs, images of dreamy and awe-inspiring landscapes, wonderful naturalistic paintings, cartoon-like yet highly informative diagrams, colourful maps, palaeotectonic charts, exquisite pictures of animals and plants—both living and extinct—and a striking lack of match between title/subtitle and content. It delivers much more than its title suggests. This an unexpected and pleasant surprise. There are several other surprises. It is refreshing to find that the book deals only in part with those wonderful Mesozoic non-avialan stem-group birds—dinosaurs I think they are called—mentioned in the subtitle. Dinosaurs are abundant and beautifully illustrated/photographed. But you will find many more organisms. I hope my readers will forgive me if I mention temnospondyls as an example. I have never seen so many crisp, detailed, lavish photographs of representatives of this group in one book before. Wonderful ridges and pits on the skull roof, nice palatal vacuities, and … but I am digressing. Back to the book!



It is very difficult to explain in short what its content is about. The authors, both of whom are prominent and acclaimed experts on Mesozoic faunas from Gondwana, take the reader on a journey through time in the realm of the ancient supercontinent of Gondwana. The book opens with a discussion of the historical, geological and palaeontological frameworks of the Gondwana concept, offering a neat and pithy introduction to plate tectonics. Here, you discover the first of several good qualities of the book. There is no such a thing as a narrowly focused, unidirectional, monothematic treatment of a subject. Rather, the authors are keen to remind the readers of the multidisciplinary aspect of palaeontological studies, and they do so by starting from scratch, fossils, fossilization, taphonomy and all the basics that you read in the first two chapters of your palaeontology text-book.

The introductory chapter is a condensed summary of the major evolutionary steps in the history of life. In this part, the book reveals the only good match between title and content, in that invertebrates are discussed only briefly. In fact, the only important reference to invertebrate palaeoworld is made in conjunction with the still poorly understood issue of the origin of chordates. The introductory chapter also presents a palaeogeographical perspective of the emergence of vertebrates and ends with a concise summary of the uniqueness of the

Australian fauna. But wait! Do not be misled by this if you decide to flick casually through the first pages. The book is not only about Australia, although a discussion of the geology and palaeontology of the continent certainly dominates the pages. You will find that the book develops as a complex and well-integrated approach to understanding faunal and floral relationships (in space and time) across the whole of the Southern Hemisphere. Likewise, pictures of australian fossils are abundant, but you will find also representatives of fossil faunas from South America, South Africa, Antarctica, *etc*. And no, the book is not a trove of Mesozoic wonders only. It discusses Palaeozoic and Caenozoic as well. And no, it is not only about palaeontology. It discusses history, explorations, voyages, and details the emergence of the vertebrate palaeontological school in Australia (and not only Australia). The introductory chapter combines scientific rigour and a taste for the detail with the charm of a romantic age novelist's works. And that is only the beginning of the book.

The following chapters maintain much of the flavour of the introductory part. The first chapter is, not surprisingly, a glorification of fish diversity throughout most of the Palaeozoic. Another good quality of the book emerges in this context. As the pages are turned, it becomes increasingly difficult to focus on the content without getting distracted by the beauty of the illustrations, the quality of which is comparable to, and sometimes even better than, that of the most acclaimed and highly respected palaeontological journals. Photographs of superb specimens are interspersed with rather unusual, although visually appealing, light purple diagrammatic (yet essential) reconstructions of extinct organisms. Artistic renditions of several organisms may appear to be almost cartoon-like in places, but they are essential, and convey an immediate impression of their proportions and overall appearance. Images of small or difficult specimens are reproduced neatly, without sacrificing details. Photographers Francesco Coffa and Steven Morton are to be praised for having provided a perfect balance between light and dark in each of their photographs. The choice of a black background for most of the fossil specimens seems to have worked beautifully. Artist Peter Trusler's reconstructions of extinct animals in their habitats have an intrinsical, almost mesmerizing beauty. They are not only accurate and realistic, but reveal also a profound knowledge of the anatomy. Among my favourite ones are: the deep blue, effectively monochromatic rendition of the dipnoan *Griphognathus* and the arthrodire *Eastmanosteus* quietly swimming on pages 90 and 91; and the giant monitor *Megalania* attacking the emu-like bird *Genyornis* and its nest on pages 200 and 201. The latter image combines the tension and drama of a tragic encounter (presumably, tragic for *Genyornis*) with the smoothness of the surrounding vegetation in an overheated landscape.

As usual, the continuity of the main text is broken by interesting, short windows on the geographical, geological and stratigraphical settings of various important fossil sites, on the palaeobiogeographical importance associated with several palaeoichthyofaunas, especially from the Devonian, and on the currently debated phylogenetic position of various important groups of extinct fish. All this paves the way to a discussion of that large chunk of terrestrial bony fish that have been around since the late Devonian, the tetrapods.

The issue of 'becoming terrestrial' is synthesized in a couple of pages covering most of the essential aspects of the fish-tetrapod transition. I expected to find a passing reference to *Acanthostega* in this revised edition of the book, but I only found an outdated sketch of

Ichthyostega, and the discussion of the fin-limb transition (and the anatomy of the pair appendages) was frankly too old. But this is only a minor criticism. If one skips (or pretends to be unable to see) this introduction to the terrestrialization of early vertebrates, the following pages are certainly a refreshing, rich kaleidoscope of images of fish and early tetrapods. Permo-Carboniferous taxa are dealt with, in my opinion, too briefly, but the account of early Mesozoic faunas is excellent. One minor quibble: I think (but several of my colleagues may not approve of this) that the word 'labyrinthodont' should definitely be banned. I am fully aware of the historical reason that, even today, led to its acceptance, and of the difficult task of getting rid of a widely used name. I can only offer my apologies for my strong bias against the use of names referring to paraphyletic groups. In fact, most (I think all) of the labyrinthodonts discussed in the Triassic section of the book are temnospondyls. This in itself is a term that refers (at least in some authors' views) to a paraphyletic assemblage of stem-lissamphibians. However, its use may not be as easy to eradicate as the use of 'labyrinthodonts'. A very insignificant flaw in an otherwise excellent book, anyway.

The dinosaur chapter seems to be the most 'Australia-centric' in the whole book, with only a few pages devoted to other Gondwana faunas in the Afterword at the end of the book. However, this section provides a good summary of the state-of-the-art in Australian dinosaur discoveries (as well as other Mesozoic diapsids). Mesozoic mammals are porly covered, but this is hardly surprising, considering that all recent discoveries in this field would make an attempt to summarize our present body of knowledge depressingly redundant and maybe scarcely comprehensive.

Tertiary faunas (especially mammals and reptiles) are discussed in great detail, but I wish there was more space devoted to birds. Accurate comparisons between mammal faunas across the supercontinent are excellent, but obviously necessarily limited. A brief chapter on living vertebrates (in fact, chiefly amniotes) in Australia is an ideal complement to the introductory chapter and may be read in conjunction with the latter without sacrificing continuity of information in the text. The book ends with a synthesis of our knowledge of Gondwana vertebrates from the Palaeozoic to the Recent. Considering that the book aims to reach a trade-off between scientific detail and presenting a wide audience with a pithy summary of our knowledge of Gondwana, the authors have reached their goal successfully. The slightly unbalanced treatment of some topics may simply reflect the authors' own interests and expertise, but all in all, the book covers a lot of topics and pesents the argument in a simple, very readable style.

I have one or two minor remarks concerning the illustrations. As I said, these are simply excellent. However, some specimens are not centred in the photographs. In other cases, small portions of the specimens have been cut off. Also, the numbering is awkward in several places. It toom me a while to figure out which numbers referred to which figures. In future editions of this book, it may be advisable to reduce slightly the size of some figures to make room for numbers, or, even better, numbers could be put directly on the bottom-right corner of the photographs.

I do not hesitate to recommend the book to all people (from high school students to professional academics) with an interest in Gondwana as well as a more general fondness for palaeontology and historical biology. The book is not terribly expensive, considering that its

rich and lavish iconography represents one of its greatest qualities. General as well as specialized libraries ought to have one or two copies of this book available. If you decide to travel down under (or elsewhere in the Southern Hemisphere) for your next holidays or professional business, make sure you take this book with you. If you do not fancy reading it, at least allow yourself to slip quietly into the dream world evoked by its images.

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PaleoBase: Macrofossils Part 1.0

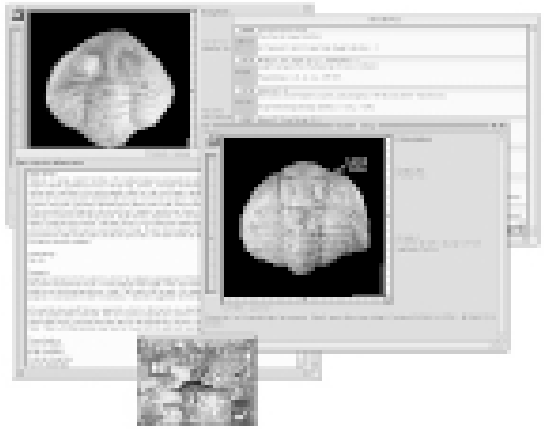
MacLeod, N. (editor) 2000. Part 1 – Arthropods, Brachiopods, Bryozoa, Trace Fossils and Graptolites. Blackwells Science. ISBN 063205641X. £25.00.

Fossils have hitched a ride on the information superhighway. In collaboration with the Natural History Museum, Blackwells Science are producing a set of CD packages that are meant to represent "the coupling of a world-class paleontological collection—based on the macrofossil collections of The Natural History Museum, London—and the knowledge of world-renowned experts on macrofossil systematics, presented in a state-of-the-art relational database."—according to the instruction manual that comes with the CD, that goes on (perhaps a trifle unfortunately) to welcome the user "to the future". Given the subject, I would have thought a welcome to the past would be more appropriate.

Of course, the title of the package immediately jars: why "Paleo" and not "Palaeo"? British publishers, London NHM, a tie-in with Clarkson's *Invertebrate Palaeontology*—it is incomprehensible. It will be pelecypods before we know it. You have been warned.

Any case, to business. As usual, I played around with PaleoBase for a while without looking at the instructions, as one can imagine most users doing. The thing is easy to install and run, with the only slightly misleading thing for a Mac user being the "READ ME FIRST!!!" file that does not open. It is only after fiddling with it and the program that I gave up and opened the more sedately named "PBUser's Guide (Mac).pdf" This calmly listed out the potential problems I had already encountered in the program, implying that I should really have bothered looking at it first.

What does the package offer? Two windows open up when you run the program, one with an intro that gives the title and coverage, together with the name of the Editor, Norman MacLeod (ah-hah!). The other is a floating palette (which appears smack on top of the other one, so you have to move it) that gives a number of enticing possibilities from "groups" to "about CompuStrat". Balloon-help is by default turned on, so that by holding the cursor over these (and other options) a helpful little phrase appears telling you what clicking each option will do



for you. The meaty option is "groups" that brings up a new window with a complete alphabetical list of the taxa contained in this version, some 355 of them, covering arthropods (including trilobites), through to graptolites, brachiopods, bryozoans and trace fossils. The menu at the top allows you to manipulate the list in various ways, including doing taxon, habitat, geographic or age filters, certainly a powerful tool. The programme also allows you to list out the taxa in various ways, including alphabetically, pictorially, and so on.

By various manoeuvres, it is possible to bring up the images of the various fossil taxa, first as small thumbnails, and then in larger and adjustable sizes. I must admit to being a little disappointed by several of them (*e.g.* the far from overwhelming *Kootenia* and *Obolella*). No doubt the selection was dictated by the specimens available in the NHM. Perhaps this is in line with the "BM philosophy" that I understood an eminent employee of the place once announced, *viz.* "if it isn't in the BM, it doesn't exist." Maybe so, but nicer specimens might do. Of course, one can always argue that indifferent specimens are exactly what students and everyone else are likely to encounter…

Specimens are accompanied by a blurb with their basic taxonomy and key references, together with a brief description of the taxon and (slightly more buried) a morphological key (which seems to be of rather uneven coverage). With such a multi-authored compilation it is always going to be easy to find points of disagreement, and in the few groups I have some familiarity with, I dug some up quite quickly. Why, for example, is *Ungula* listed as *Obolus*, even though in the text, it is admitted that taxa from the "Obolus sandstone" (where the illustrated specimens come from) are in fact not *Obolus?* Why does the age range not coincide with that given in the Treatise? And with *Canadaspis*—why give Schram's *Crustacea* as the *primary* reference? Why is its now questionable status as a true crustacean not even mentioned? And why is Nozovhilov given as the author of the genus, when he was actually the author of the family? And … so on. The suspicion must be raised that, in some groups, experts will find several mistakes that have avoided both the initial compilation and subsequent reviewing filters. That is of course disappointing.

What then, is the overall impact of the package? First, I should say that the software is impressive. It is easy to use with only a tiny amount of effort (good for people like me) and seems to be genuinely powerful in allowing quick linking together of taxa united by disparate criteria such as shared ecology or range. I managed on several occasions to end up with far too many windows open as one critique. However, the quality of the images and of the taxonomy placed in the database seem to be fairly variable (a variation that is of course easily

correlated to the in-house expertise of the NHM—the trilobites seem to be excellent, for example). Another potential problem—but one that is rather easily dealt with in the future — is that at the moment, so few taxa are present in the database that it has the feel of only an illustrative example. It is not clear exactly what criteria were used for selection, apart from perhaps "they happen to be in the NHM". The manual claims that they were selected for being "common and stratigraphically important macrofossil genera", which doesn't exactly convince. So the impression one has is somewhat like looking at an extremely well-made machine with its motor purring—but lying on its back, with its wheels (as yet) spinning somewhat aimlessly in the air.

I started out determined to write rather a bad review of PaleoBase, but I was considerably mollified by the end of my effort. Perhaps that is in itself a reasonable recommendation of the package!

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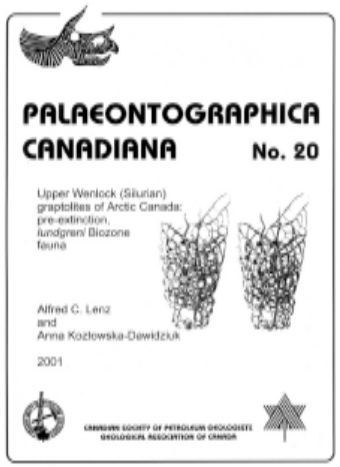
Upper Wenlock (Silurian) graptolites of Arctic Canada: pre-extinction, lundgreni Biozone fauna

Lenz, A.C. & Kozlowska-Dawidziuk, A. 2001. 61 pp. Palaeontographica Canadiana 20. ISBN 0919216757 (pbk). US $29.

Everyone reading this review will be aware of the late Ordovician extinction that dramatically decreased the diversity of life on this planet. Some of you may not be so familiar with a later extinction event, during the late Wenlock, which resulted in global graptoloid graptolite diversity being reduced to a mere handful of species. The purpose of Alf Lenz and Anna Kozlowska-Dawidziuk's monograph is to document the exceptionally preserved pre-extinction fauna of Cornwallis Island, Arctic Canada. This of course is a region that most of us can only dream of visiting. Not only does it have magnificently exposed, continuous sections, but it also boasts beautifully preserved graptolites in abundance. These graptolites are preserved in limestones and can thus be freed from the rock by acid dissolution. The 19 plates of mostly SEM images demonstrate how much more can be seen in these chemically isolated specimens than ever is revealed by examination of flattened material on bedding surfaces. For all workers on Silurian graptolites this monograph is undoubtedly a 'must have'.



The graptolites illustrated may be divided into three groups: the dendroids, the uniserial monograptoideans and the retiolitids. The few dendroids illustrated are left in open nomenclature, but highlight for those engaged in the study of these complex and beautiful creatures the futility of attempting taxonomic work on anything other than chemically isolated specimens. Mid Wenlock uniserial graptolites are, in general, not the most inspiring—there is little of the thecal flamboyance that makes working on late Llandovery or early Ludlow 'monograptids' such a delight. So there are few surprises in the descriptions and plates (three) of these uniserials. It is slightly disappointing that not all taxa are illustrated in this section: *Monograptus flemingii*, *Cyrtograptus hamatus brevis* and *Testograptus testis*, although clearly present in the collections according to the range charts, are conspicuous by their absence from the systematic section.

The bulk of the descriptive palaeontology and most (15 of the 19) plates are devoted to those most remarkable and complicated of graptolites, the retiolitids. Workers on these fabulous meshworks have adopted one of two strategies: presenting either highly detailed accounts (such as that of Bates and Kirk 1997, in which two taxa were described in 168 A4 pages, including 135 text-figures and 15 plates) or briefer descriptions illustrated primarily by views of complete rhabdosomes. With 13 retiolitid taxa described, the authors have understandably adopted the latter approach. No doubt, more detailed studies of these retiolitids are planned.

This work has been written by graptolite enthusiasts for graptolite enthusiasts and will be much used for many years to come. All Silurian graptolite workers will need a copy; other palaeontologists (especially those who think that we graptolithologists study 'black smudges') might like to peruse the copy on your library's shelf to marvel at these stunning Silurian fossils.

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Reference

Bates, D.E.B. and Kirk, N.H. 1997. The ultrastructure, construction and functioning of the genera *Stomatograptus* and *Retiolites*, with an appendix on the incremental construction of the rhabdosome in *Petalolithus*, and its comparison with that of the thecal framework in *Retiolites* and *Stomatograptus*. *Publication of the Institute of Geography and Earth Sciences, University of Wales, Aberystwyth*, **10**, 1-168.

Mesozoic Vertebrate Life

Darren H. Tanke and Kenneth Carpenter (eds). 2001. 577 pp. Indiana University Press. ISBN 0253339073 (hbk). £38.00

Continuing both the honourable tradition of Festschrift volumes in vertebrate palaeontology and of IUP's commendable production of quality palaeontological texts, *Mesozoic Vertebrate Life* is a weighty multi-authored contribution produced as a celebration of Philip J. Currie's 25 years in vertebrate palaeontology. Currie is best known for his work on predatory dinosaurs and for his documentation of duckbilled and horned dinosaur mass death assemblages and tracksites, so it is fitting that most of the 33 papers in this work are written by Currie's colleagues and mostly concern these areas. However, there are also sections on sauropods,

faunas, palaeopathologies and on historical aspects of the study of dinosaurs. In short, something of interest to everyone who works on dinosaurs. Despite the fondness many vertebrate palaeontologists have of illicit gossip, this work was compiled and completed without Currie ever finding out, and was only revealed to him at a special party held in his honour. The question is, is *Mesozoic Vertebrate Life* a treat for the rest of us?

Some of the papers here are long-awaited, and those on the systematics, phylogeny and morphology of theropods make the volume something of a must-have (or at least must-photocopy) for theropod workers. Four new dinosaur genera are named in this volume. One of these, the primitive thyreophoran *Bienosaurus* from the Lower Lufeng Formation of China, is regarded by its describer as a scelidosaurid (that is, most closely related to *Scelidosaurus* and some supposedly allied forms). Frustratingly, this assignment is not justified by reference to any shared derived characters at all. Those fond of cladistics need not despair though, as the volume also includes papers (by Thomas Holtz and Peter Makovicky) devoted entirely to the phylogenetic classification of dinosaur taxa.

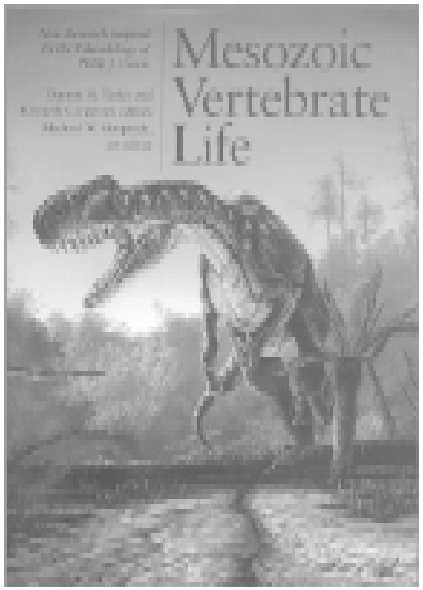
I found Thomas Lehman's paper on dinosaur provinciality at the end of the Late Cretaceous thought-provoking, especially in view of recent papers on the correlation between the evolution of large-bodied animals with area, a topic that has also been addressed by those considering dinosaur physiology. Lehman suggests that many of the Late Cretaceous dinosaurs were highly specialized in their habitat requirements and were strongly provincial. Farlow *et al.* (1995) wondered if this might explain how large dinosaur taxa could thrive (at high population sizes) on smaller landmasses than those inhabited by fossil and recent large mammals, though the concept of ectothermic large dinosaurs *vs* endothermic mammals was ultimately favoured. It might be that big mammals are not analogues for the dinosaurs though because fewer of the large-bodied mammals are/were habitat specialists (Owen-Smith 1988).

Late Cretaceous dinosaur provinciality is also described in David Trexler's review of the Two Medicine Formation. Trexler's paper is significant in suggesting chronological range extensions for several Two Medicine dinosaur taxa previously regarded as metataxa unique to the upper part of the formation. Horner *et al.* (1992) hypothesised that these species were the anagenetic descendants of older Two Medicine species whose evolution was 'forced' by key palaeoenvironmental effects. While this is an attractive hypothesis that has received much interest, Trexler's data are contradictory (though not necessarily for all the lineages involved). The problem is that Trexler's additional records do not seem to be convincingly documented, leaving this area open to future argument.

I also enjoyed David Spalding's article on 'Charles H. Sternberg's lost dinosaurs'. This contains much biographical information on Sternberg and his professional relationship with the British Museum (notably with Arthur Smith Woodward) and provides, at last, a comprehensive discussion of the 1916 sinking of *SS Mount Temple*. This event is famous in dinosaur lore because it resulted in the loss of one of Sternberg's best *Corythosaurus* specimens. Incidentally, Spalding notes that this is the same *Mount Temple* that reportedly responded in 1912 to the SOS of the *Titanic*.

Other highlights in *Mesozoic Vertebrate Life* include Nadon's paper on the impact of sedimentology on vertebrate tracks (Nadon controversially argues that the idea of 'transmitted prints', 'ghost prints' or 'underprints' is untenable from a sedimentological perspective),

Carpenter and Smith's study on the forelimb of *Tyrannosaurus*, Molnar's review of theropod palaeopathologies and Padian *et al.*'s review of the integumentary structures seen on the Yixian theropods. The latter work is intriguing to those following the discussion of proposed secondary flightlessness in the non-avian theropods, if only because Padian *et al.* note that secondary flightlessness appears to be the simplest explanation when seeking to explain the presence in non-avian theropods of complex feathers with barbs and barbules.



A bibliography of Currie's work is included (look carefully for the surprises) as is a very brief biography by Robert Carroll. The book includes a selection of colour plates featuring both artwork and close-up photos of the Chinese feathered theropods. A few minor typos are present and in one case an outdated generic name is used for an extant bird. However, overall the quality of editing is very high and the format is attractive.

'Dinosaurs', 'Cretaceous' and 'North America' are clearly the key words for this volume and it seems tailor-made for Currie's current research interests. But what of its wider appeal? The volume certainly does not live up to its name, as there is more to Mesozoic vertebrate life than just dinosaurs. Not one paper in the volume discusses marine reptiles, lepidosaurs, pterosaurs, non-dinosaurian archosaurs, synapsids or non-amniotes, though tracks made by synapsids are described in one of the ichnology papers. This is a bit disappointing and perhaps indefensible seeing as Currie is interested in (and has published on) marine reptiles, pterosaurs, squamates, synapsids and non-amniotes. Despite its title, *Mesozoic Vertebrate Life* is thus yet another volume produced for dinosaur workers and enthusiasts. For them, however, it is certainly an impressive and reasonably priced contribution.

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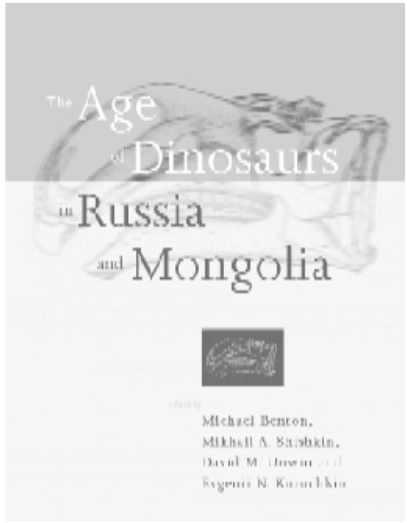
The Age of Dinosaurs in Russia and Mongolia

Edited by M.J. Benton, M.A. Shishkin, D.M. Unwin & E.N. Kurochkin. Cambridge University Press, 2000. 696pp. ISBN 0521554764 (hbk), £95.00.



Russia, Mongolia, and the states of the former Soviet Union contain some of the richest, most important, and most extensive fossil-bearing deposits in the world. As such, this region provides a unique archive of predominantly terrestrial or freshwater localities (plus rare marine horizons). Over the last thirty years, the work of Polish-Mongolian expeditions, and more recently the Canadian- and US-Mongolian joint projects, have increased our familiarity with the phenomenal dinosaur, lizard and mammalian assemblages of the Mongolian Cretaceous. In contrast, much of the Russian work in the same area has remained relatively inaccessible to western scientists because so much of the key literature is in Russian and is spread through a series of specialist or local journals. The same is true of the Russian Permo-Triassic, and the Mesozoic of Central Asia.

The editors of 'The Age of Dinosaurs in Russia and Mongolia' have set out to redress this problem by bringing together a series of articles on the Permian and Mesozoic assemblages of these regions. They also include valuable listings giving the correct spellings/transliterations of localities, authors, and Russian journals: this alone should improve the quality of our citations.

With a total of 30 chapters covering all major groups, as well as aspects of biogeography and palaeoecology, it is inevitable that the individual articles vary somewhat with respect to the depth and breadth of their coverage, and in their phylogenetic approach ('traditional' *vs* cladistic). Nonetheless, each achieves a basic goal of providing an overview of the group in question and an entry into the key relevant literature, provided the reader does not always take the classification/ terminology employed, nor the ideas expressed, at face value.

Modesto and Rybczynski's overview of Permian amniotes of the Russian Platform will be particularly welcome to anyone who has tried to grapple with the assemblages and stratigraphy of that region. Similarly, help is at hand for those that have struggled with the multiplicity of the localities and horizons of the Mongolian Cretaceous, and their relative chronology. The papers of Shuvalov and Jerzykiewicz together help to place the spectacular Cretaceous assemblages of Mongolia into a clearer temporal and ecological context.

In summary, the editors are to be congratulated on putting together a singularly useful volume that will deepen western understanding and appreciation of the tetrapod assemblages of Russia, Mongolia and Central Asia, and should, hopefully, increase scientific interchange and cooperation. The book is expensive, but with nearly 700 tightly-written pages, it is a volume that most serious Mesozoic palaeontologists would want on their bookshelves.

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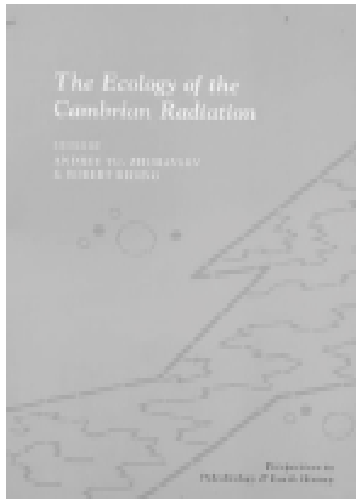
The Ecology of the Cambrian Radiation

Edited by A.Yu. Zhuralev and Robert Riding 2001. Columbia University Press: New York. ISBN 0-231-10612-2 (hardback), £51/$80; ISBN 0231106130 (pbk), £25.50/$40

"The Cambrian radiation, which commenced about 550 million years ago, arguably ranks as the single most important episode in the development of Earth's Marine biota." So, with conviction, begins this book in the form of the opening declaration, by the two editors, Andrey Zhuralev and Robert Riding. They are evidently unfazed by the vociferous minority who insist that the radiation, or 'explosion,' is an artefact of preservation, with little relationship to metazoan phylogeny and possibly ecology.

This volume, with its 21 chapters, has little time for such ideas, and for all its imperfections is the best available guide to this remarkable event, that rightly is attracting increasing attention amongst molecular and evolutionary biologists. For those less fortunate in having access to a well-stocked library this book will provide a valuable source-book, and several chapters are ideal for graduate discussion groups.

Nevertheless, the book falls short of perfection. First, it has long been in the press, and its topicality is already slightly tarnished. Second, the chapters, perhaps inevitably, are of variable quality. Some are frankly pedestrian, and in the case of Eerola's account of climate change across the Neoprotozoic-Cambrian interval seems strangely divorced from what has excited most people's interest in the last decade. Others are little more than a retread of earlier reviews and articles, and accordingly lack a certain glitter. But several chapters are outstanding: incisive and full of analysis, they help to convey the excitement of this area. Of particular importance are those by Nick Butterfield (on Cambrian plankton), Nigel Hughes (on Cambrian trilobites), and Graham Budd (on Burgess Shale-type arthropods). Each contains new information and new insights, each stimulates the reader's intellect and transcends the rather descriptive tenor of much of the volume. Also valuable is Alan Smith's depiction of Cambrian biogeographies, again showing a shrewd and keen analysis in an area too often associated with jig-saw mentalities and a trusting faith in palaeomagnetics. So too Michael Moldowan and colleagues' contribution on biomarkers is a timely, if



already acknowledged, contribution to the importance of chemical evidence, specifically concerning the history of dinoflagellates.

This is a book about ecology, yet as Nigel Hughes, for example, emphasises, much will remain problematic in the absence of 'improved phylogenies' (p. 395). So too the big questions, not least levels and type of oceanic productivity and the influence of taphonomic feedbacks on benthic communities as skeletal input grew, tend to fall between the cracks. Thus the contributions by Martin Brasier and John Lindsay, and Nick Butterfield, are partly complementary but also partly contradictory. The former largely address the role of palaeo-oceanography, as revealed in isotopic systems, and plate tectonics to depict in a broad brush way changes in the environment that might, ultimately, have triggered the Cambrian 'explosion'. In contrast, as already noted, Butterfield emphasises the book's theme, that of ecology. Clearly there must be connections, but for the most part the two chapters talk past each other. So too with the topic of taphonomic feedback, Mary Droser and Xing Li's analysis of sedimentary fabrics in the Cambrian is exemplary even if it largely travels over fairly well-known territory. Other chapters, especially those by Sergei Rozhnov (on hardgrounds) and Thomas Guensburg and James Sprinkle (on echinoderms) have their own relevance, but once again the opportunities for a synthesis are missed. But opportunities missed are opportunities offered. This book may well serve its main purpose if it can encourage one or more individuals to write a definitive synthesis of the Cambrian radiations. Gentlemen and ladies, to your word-processors please!

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Brachiopods Past and Present

C. Howard, C. Brunton, L. Robin Cocks and Sarah L. Long (eds) 2001. 451 pp. The Systematics Association Special Volume Series 63. Taylor & Francis, London and New York. ISBN 0748409211 (hbk). £80.

This Volume is the result of the (somewhat pompously named) Millennium Brachiopod Congress held in London in July 2000, where over a hundred ora and poster presentations were made.

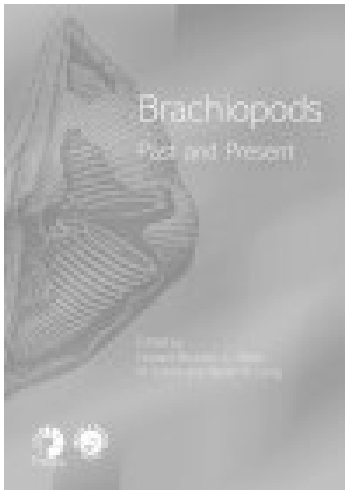
In the foreword, the editors state that their intention is to offer "a structured book which would stand alone in its own right and not just a mishmash of symposium contributions linked only by the single word brachiopod." Therefore, they have opted not to publish all of the contributions they received.

So, have they succeeded?

The book consists of 41 papers by 61 authors. These are conveniently placed into five parts; a) Living brachiopods and palaeobiology (11 papers); b) Advances in molecular studies (5); c) Evolution and Phylogeny (9); d) Palaeoecology and ecology (4); and e) Palaeobiogeography and biostratigraphy (12). Each part is headed by a useful introduction summarising the different papers.

It is apparent from the contributor list that brachiopodology (or rather all palaeontology) is very much a North Atlantic enterprise, although the location of the conference of course has

some influence on the mix of nationalities. Of the 61 contributors, 37 are from Europe (14 nations), 10 from North America (7 from USA, 3 from Canada), 2 from South America (both from Argentina), 4 from Asia (all Japanese), 9 from Oceania (8 from New Zealand and one Australian), and none from Africa.



Alwyn Williams contributes an interesting introduction where he graphically illustrates the shift in emphasis of brachiopod studies by taking the papers published from the four international congresses (from the last 15 years) and grouping them in the same way as in the present volume. The shift is especially evident in the increase in biological and genetic studies and the relative demise of ecological and taxonomic ones. This trend is especially welcome in the area of brachiopod study, as this, more than that of almost any other animal group, has suffered from being the playground of almost exclusively palaeontologists. Biologists seem to have shunned brachiopods almost completely until the last few decades. This has been very unfortunate; most published ideas about brachiopod life have originated from the study of fossils, but can only really be tested against living animals. Still, most studies on modern faunas use palaeontological methods of study, like that by Lee *et al.* on terebratulids and Logan & Long on craniids; both teams study morphological variation in living populations by using only shell material. Rather few articles address problems in a purely neontological way, like those on lingulate spermatozoa by Fukumoto, larval setae by Lüter and larval settlement behaviour by Peck, Meidlinger and Tyler. These are very good studies on areas unavailable to palaeontologists

The part of the book concentrating on molecular studies has several important reports. The studies by Cohen and Saito *et al.* report that both 18S rDNA-, and cox1-sequences in terebratulids mostly confirm phylogenetic conclusions based on morphology, *i.e.* the placing of brachiopods within Metazoa is addressed in two papers on mitochondrial sequences by Stechman and Endo. They both conclude that the brachiopods belong in a cluster with molluscs and annelids, but where the amino acid sequences do not yield any resolution within this group, the gene order dates seem to place brachiopods closer to the annelids than the molluscs.

Regrettably, many ideas about brachiopod biology and relationships cannot be verified in this way, as the present diversity of the phylum leaves much to be desired. The more impressive contributions then are those that address such questions (and solve them) based solely on fossil material. There are nine papers on evolution and phylogeny in this volume. These studies address both high- and low-level taxonomic problems: Bassett *et al.* on functional morphology of the articulation of Cambrian rhynchonelliforms and Manceñido and Owen's review of post-Palaeozoic rhynchonellids, *versus* Mackinnon on the role of heterochrony in Megathyriodiid terebratulids and by Jin on microevolution in stricklandiids.

Palaeoecology seems to be a field in decline, with only four contributions, two of which address recent and subrecent faunas. The two papers in the "paleo"-component of this section both highlight correlation between substrate type and brachiopod assemblages.

The final section consists of 12 papers on palaeobiogeography and biostratigraphy, thus proving that this most fundamental part of brachiopod studies is alive and well. The use of brachiopods for palaeobiogeography is nowadays much more important than their use in biostratigraphy, as their role in the latter has been taken over by more easily dispersed planktonic groups. This is well illustrated by only three of the papers dealing with pure biostratigraphy, a few more address questions of evolutionary patterns, while the majority concern biogeography and tectonic reconstructions.

So, what about our original question: Have the editors succeeded in producing a book that adequately represents the state of the art in brachiopodology? Actually, I think they have. The volume is varied, but mostly has a good balance between the different geological periods, groups of brachiopods and topics of investigation. At £80, the price tag is quite heavy, but I think this is a volume that most brachiopod workers will benefit from having on their shelf (not to mention actually reading it).

Now, aren't we just waiting for the BBC's next big palaeo-animation series: "Swimming with Brachiopods"…

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Encyclopedia of Paleoherpetology, Part 3B: Stereospondyli

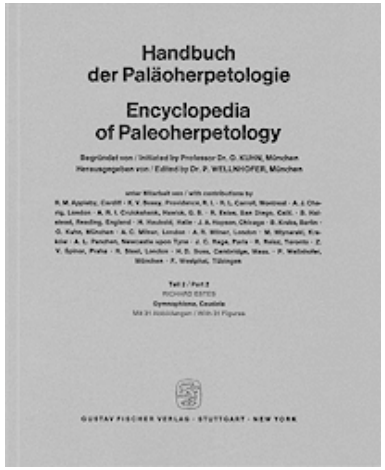
Schoch, Rainer R. & Andrew R. Milner 2000. 220 pp. ISBN 3931516776 (hbk). €76,70, US$100.00. <**http://www.pfeil-verlag.de/**>

As a child, I remember the joy, mingled with terror, of imagining giant swamp-crawling amphibians lurking for potential prey. The stereospondyls, representing all of the giant and most of the larger amphibians, certainly belong to the wide range of prehistoric animals that would look at us as something more than just an unusual intruder on their territory. For all of us that still share such imaginary fascination for these unfortunately extinct but extraordinary beasts, this handbook is highly welcome. For the more down to earth scientists, Rainer Schoch and Andrew Milner have in this much needed volume summarized 150 years of research, forming an essential foundation for future studies on early tetrapods in general and stereospondyls in particular. Stereospondyli is a rather neglected group of temnospondyls that, apart from showing a great size variation, also show a great diversity of forms, including short-snouted salamander-like and long-snouted gavial-like forms. Being such a diverse group of early tetrapods, stereospondyls and the volume in question should attract a range of scientists, from palaeontologists with early tetrapods as a specialty to evolutionary and ecological biologists.

Encyclopedia of Paleoherpetology, Part 3B: Stereospondyli is a handbook, and as pointed out in the preface the taxonomical part is intended to be the most important. For the non-specialist, however, the four-part sectioned introduction is ideal, and most readers new to the subject will be relatively well introduced to the stereospondyls and their evolution. The first section takes us concisely and pleasantly through the definition of stereospondyls, the fairly long history of research originating in the mid 19th century, and the first finds in Germany. It is followed by a morphological section, which goes through the general features of the skull and post-cranial skeleton, as well as the soft-part anatomy and functional morphology. This is indeed a very important part of the book, and although the authors have tried to keep it short and compact it is satisfying to see that so much space has been devoted to it. Nevertheless, in the effort of saving space, some parts may appear slightly confusing and not as clear as one might wish for. This is most obvious in the general description of the endocranium and other parts dealing with complex anatomical structures.

Taxonomic and systematic chapters are in general, as many of us have experienced and others might imagine, not always straightforward and easy to read. Schoch and Milner have, however, arranged the systematic section into something more than just listings of taxa, their diagnosis and distribution. First they have grouped the section into four parts: stem-stereospondyls, basal stereospondyls and the two main stereospondyl families, Trematosauroidea and Capitosauroidea. Each part starts with a concise and clear introduction, describing and listing characters that are most important for the suggested taxonomy and phylogeny. This is all very cleverly put in an anatomical context by a complementary morphological description of each group. The subsequent necessary general listing of taxa and their details is followed by phylogenetic discussions and illustrative cladograms. Research on stereospondyl phylogeny is characterised by various views and disagreements, and the trees presented here represent the authors' conclusions on relationships rather than a widely held consensus, which simply does not exist. To avoid spacious and boring data matrices many good references are given for details about the work behind the trees and for further reading. Such arrangement reads well and is beneficial for the reader.

Many of the taxa listed in the taxonomical section are accompanied by very good and informative drawings. It must also be said that the whole book is, with very few exceptions, excellently illustrated. In a volume of this magnitude it is almost inevitable that some of the figures do not correspond perfectly to the actual description, but these instances seem to be very rare.



The whole book ends with a summary on palaeogeography and stratigraphical distribution. This is the only case of bad arrangement, and this part could preferably have been put earlier in the introductory part of the book together with "Palaeoecology" and "Stereospondyl-bearing deposits".

This is indeed a handbook with taxonomy as its main approach, but written with non-specialists in mind. Nevertheless, the taxonomy and phylogeny

do overshadow the morphological introduction and other general issues, which is perhaps a pity for readers new to the subject. On the other hand, if Schoch and Milner had chosen to fill in all the gaps in background information, extending the book to almost perfection (something I am sure they would have preferred to do) the volume would have ended up so thick and expensive that hardly anyone would choose to buy it. I am still afraid that at a price of US$100, this 203-page, 106-figure and 16 plate volume will not reach so many bookshelves as it deserves. Despite the high price and some of the space-saving drawbacks I am still inclined to say that this is an excellent handbook. Specialist and amphibian fans will certainly enjoy and use it for a long time in the future.

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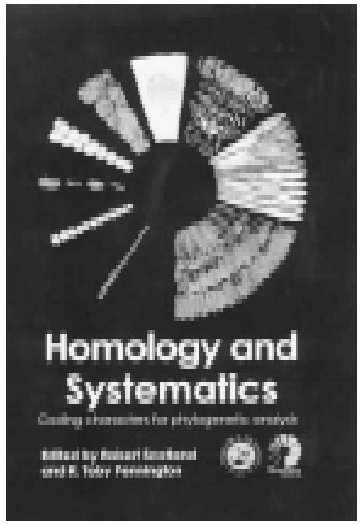
Homology and systematics: coding characters for phylogenetic analysis

R. Scotland & R.T. Pennington 2000. Systematics Association Special Volume 58. Taylor & Francis, London. 217 pp. ISBN 0748409203 (hbk). £70.00



The background of *Homology and Systematics* is a symposium on character conceptualization and coding at "The First Biennial International Conference of the Systematics Association" in Oxford in 1997. Toby Pennington (editor) states in the introduction that the problem tackled by the book relates to the fact that the outcome of a phylogenetic analysis relies upon the constituent parts of a data-matrix, and he is so-right. The data-matrices in phylogenetic analyses are composed of characters that are coded in a way that is appropriate on a case-by-case basis. How these characters and their states are coded depends upon how they are analysed and interpreted, and this turns out to be crucial for the outcome of the analysis itself. This issue has become more and more important in systematics as cladistics has turned into one of the most important tools for resolving evolutionary relationships among organisms.

12 authors have been involved in producing the 217 page book, including an introduction and nine chapters. The introduction is quite long (nine pages including references), and Pennington covers and discusses the contents of the book comprehensively. To a certain degree it is more like a review of the book itself and not an introduction to its contents. It would have been a very good and encouraging chapter if it was published elsewhere and could have had attracted people either to read or to buy *Homology and systematics*. It leaves one with little energy for the other chapters in the book, and the reader with general interest in the aspects of coding characters for phylogenetic analysis will probably leave the book there. Those that persevere will discover that the general disposition of the book is good,

beginning with existing definitions of homology and character concepts, continuing with a discussion on multistate coding, and the reinterpretation of characters, and finishing with the homology concept driven to its acme in three-item analysis.

Different aspects of coding molecular and morphological data are discussed in this volume (Stevens, chapter 4) and I found that very useful as it gives a broader understanding of the two different data, how they are analysed and interpreted compared to each other. Stevens successfully compares the two different kinds of data and addresses issues such as the difference between characters and character states, overlapping and non-overlapping variation. Throughout the chapter he discusses weaknesses in molecular and morphological data, such as sequence alignment and subjective coding. Stevens continues to discuss the effect of overlapping variation and delimiting of characters, and makes a few points that are worth considering when coding continues characters in morphological data.

Several chapters discuss the issue of how different authors code characters. In Chapter 2, Julie A. Hawkins emphasizes that, with the confusion surrounding the primary homology assessment and the term "character", it is not surprising that character and character states are conceptualized in different ways.

Re-evaluating existing homologies in an analysis compared with an independently derived phylogenetic analysis is discussed by Paula Rudall in Chapter 6. She demonstrates how morphological homologies can be re-evaluated with the help of a phylogeny derived from molecular data. This is an important approach in our search for THE ultimate phylogenetic tree and to get a better understanding of our morphological characters.

What are the implications when the characters in a data matrix are coded in different ways? This important issue is discussed by Peter Forey and Ian Kitching in Chapter 3, and it is clear that different ways of coding can lead to different outcomes of your phylogenetic analyses. In the beginning of the chapter they stress the fact that the character concept is the backbone for how a character is coded and in the end the outcome of a phylogenetic analysis. After reading the chapter it is clear that if you include unspecified and unexplained characters, and also do not explain the motives for your chosen method of coding, it can lead to complications when evaluating different phylogenetic hypotheses.

Many of the chapters begin with a brief discussion or description of what a character is and this might cause confusion among some readers, but it does point out how important this issue is to code characters in the most appropriate way. One reflection that really struck me after having read the book is that to understand how to code your characters, you should be aware of the consequences of your coding.

Is it worth the £70 (hardback) you have to pay for it? Well, there are few books that are worth that much money, and considering that this book only has 217 pages and only black-and-white pictures it will certainly be a fact that will prevent many postgraduate students and researchers from buying it. But as it is a good book which illustrates that the most basic problems within systematics today are also the most important ones, you had better hurry to the library if you want to get hold of a copy!

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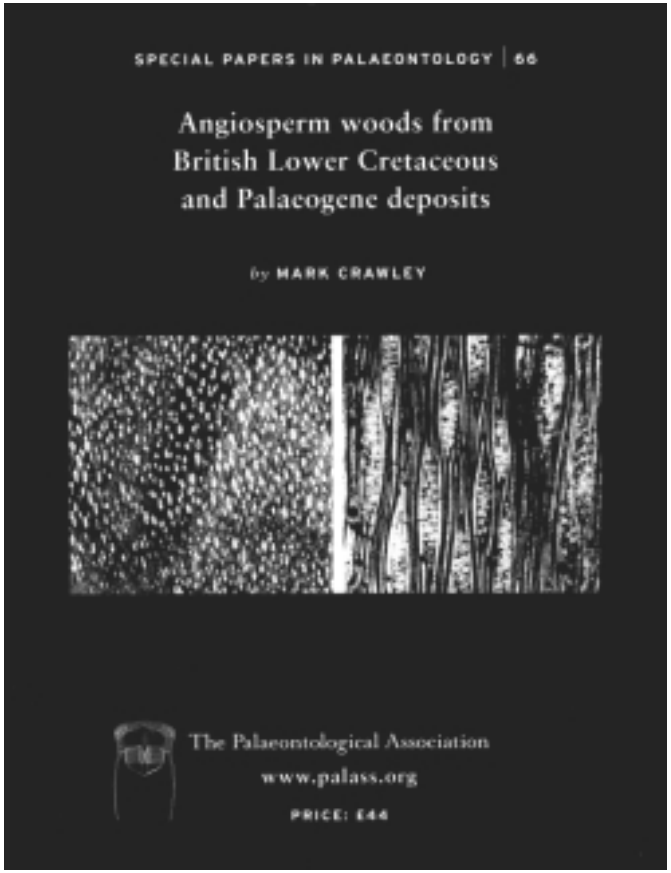
Angiosperm woods from British Lower Cretaceous and Palaeogene deposits

Special Papers in Palaeontology No. **66**. 100 pp. ISBN 0901702765. £44

Mark Crawley

ABSTRACT: Four of the five putative British Lower Cretaceous angiosperm woods *Aptiana, Cantia, Hythia, Sabulia* and *Woburnia* (Stopes 1912, 1915) are re-evaluated. *Aptiana radiata* Stopes, 1912 is accepted as Lower Cretaceous (Aptian/Albian) and is, therefore, regarded as the only valid British Cretaceous angiosperm wood. New material of *Cantia*, *Hythia*, and *Sabulia* has allowed an original provenance of Palaeogene for all specimens representing these taxa. They also show similarities to Betulaceae (*Cantia*), Icacinaceae, Platanaceae or Fagaceae (*Hythia*) and Lauraceae (*Sabulia*). Fifteen new species are described: *Anacardioxylon maidstonense, Apocynoxylon? Oldhavenense, A. sapotaceoides, Canarioxylon lewisii, Castanoxylon philipii, Dryoxylon calodendrumoides, Entandrophragminium lewisii, Euphorbioxylon hernense, Flacourtioxylon oldhavenense, Iliocoxylon? Prestwichii, Meliaceoxylon collinsonae, Paraphyllanthoxylon chievleyense, Polyalthioxylon oldhavenense, Tetrapleuroxylon oldhavenense* and *Tilioxylon lueheaformis*. Three new combinations of Palaeogene wood are also described. The new species and new combinations show feature sets found in Recent Anacardiaceae, Annonaceae, Meliaceae, Lauraceae, Lecythidaceae, Sapotaceae and Tiliaceae. All British Palaeogene material is reviewed from wood and tree evolution, palaeobiology, palaeobiogeography, and palaeoclimatology. The anatomical results show increased diversity by the latest Palaeocene, including the oldest known wood with spiral thickening of the vessels, and support a trend of increasingly warm temperatures with less seasonality and structures more typical of Recent tropical regions by Late Palaeocene/Early Eocene times in the British area.



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