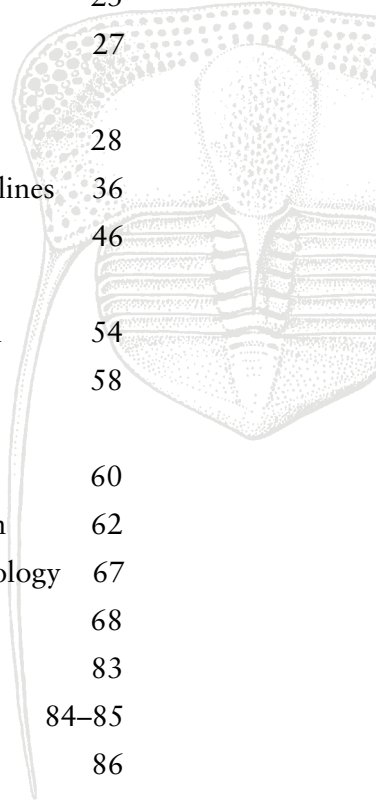


The Palaeontology Newsletter

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Reminder: The deadline for copy for Issue no 78 is 3rd November 2011.

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

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Association Business

Annual Meeting 2011

Notification is given of the 54th Annual General Meeting and Annual Address

This will be held at the University of Plymouth on 18th December 2011, following the scientific sessions.

AGENDA

1. Apologies for absence
2. Minutes of the 53rd AGM, University of Ghent
3. Trustees Annual Report for 2010
4. Accounts and Balance Sheet for 2010
5. Election of Council and vote of thanks to retiring members
6. Report on Council Awards
7. Annual address

DRAFT AGM MINUTES 2010

Minutes of the Annual General Meeting held on Saturday, 18th December 2010 at the University of Ghent.

- 1 Apologies for absence:** *Prof. J. C. W. Cope*
- 2 Minutes:** *Agreed a correct record*
- 3 Trustees Annual Report for 2009.** Proposed by Dr L. R. M. Cocks and seconded by Prof. G. D. Sevastopoulo, the report was agreed by unanimous vote of the meeting.
- 4 Accounts and Balance Sheet for 2009 .** Proposed by Prof. J. Francis and seconded by Prof. M. P. Smith, the accounts were agreed by unanimous vote of the meeting.
- 5 Election of Council and vote of thanks to retiring members**
Prof. R. J. Aldridge extended a vote of thanks to the following members of Council who were retiring this year: Prof. J. C. W. Cope, Dr T. Servais, Dr M. A. Purnell, Dr M. Sutton, Dr P. Orr, Prof. Donovan, Mr W. Fone, Prof. D. A. T. Harper, Dr A. Rasmussen, Dr E. Rayfield and Dr G. Harrington. Dr L. Anderson was retiring as a scientific editor. The following members of Council were elected to serve on Council:



<i>President:</i>	Prof. J. Francis
<i>Vice Presidents:</i>	Dr P. Orr and Prof. J. W. Cope
<i>Treasurer:</i>	Mr P. Winrow
<i>Secretary:</i>	Dr H. A. Armstrong
<i>Chair of Publications Board:</i>	Prof. M. P. Smith
<i>Editor Trustee:</i>	Dr P. C. J. Donoghue
<i>Book Review Editor:</i>	Dr C. Jeffrey-Abt
<i>Publicity:</i>	Dr E. Rayfield
<i>Newsletter Reporter:</i>	Dr L. Herringshaw
<i>Newsletter Editor:</i>	Dr R. J. Twitchett
<i>Web Officer:</i>	Dr M. Sutton (for a second term)
<i>Ordinary Members:</i>	Dr C. Klug Dr W. Renema Dr T. R. A. Vandenbroucke

Mr D. Ward was co-opted to assist with outreach and Dr M. A. Purnell was co-opted to complete outstanding projects. Dr Twitchett will organise the Annual Meeting in 2011 at the University of Plymouth.

6 Association Awards: The following awards were made:

- Lapworth Medal to Dr L. R. M. Cocks
- President's Medal to Dr N. Butterfield (University of Cambridge)
- Hodson Award to Dr T. R. Vandenbroucke (University of Ghent)
- Mary Anning award to Mr Daniel Vizcaino.

Honorary Life membership was awarded to Prof. Edwards, Prof. Bassett and Dr Skelton. Sylvester-Bradley Awards were made to Cotton, Halliday, Koot, O'Brien and Young. It was noted that a number of proposals this year were either incomplete or had not followed the guidelines and these could not be considered. The President's Award was made to Abigail Clifton (University of Leeds) and the Council Poster Prize was presented to Tom Harvey (University of Cambridge).

The Annual Address entitled "Ancient origin of the deep sea fauna: new evidence from the fossil record" was given by Prof. A. Gale (University of Portsmouth).

Trustees Annual Report 2010

Nature of the Association . The Palaeontological Association is a Charity registered in England and Wales, Charity Number 276369. Its Governing Instrument is the Constitution adopted on 27th February 1957, amended on subsequent occasions as recorded in the Council Minutes. The aim of the Association is to promote research in Palaeontology and its allied sciences by (a) holding public meetings for the reading of original papers and the delivery of lectures, (b) demonstration and publication, and (c) by such other means as the Council may determine. 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 Aberystwyth, Aberystwyth, SY23 3DB, Wales, UK.



Trustees. The following members were elected to serve as trustees at the AGM on 21st December 2009: *President:* Prof. R. J. Aldridge; *Vice Presidents:* Dr T. Servais and Dr P. Orr; *Treasurer:* Prof. J. C. W. Cope; *Secretary:* Dr H. A. Armstrong; *Chair of Publications Board:* Prof. M. P. Smith; *Editor Trustee:* Dr P. Orr and Dr P. C. J. Donoghue; *Book Review Editor:* Dr C. Jeffrey-Abt; *Publicity:* Dr M. A. Purnell; *Newsletter Reporter:* Dr L. Herringshaw; *Newsletter Editor:* Dr R. J. Twitchett; *Web Officer:* Dr M. Sutton; *Ordinary Members:* Mr W. Fone, Prof. S. K. Donovan, Dr C. Underwood, Dr E. Rayfield, Dr C. Buttler and Dr D. Schmidt. Dr Harrington and Dr Vandenbroucke remained on Council as Annual Meeting organisers. *The Executive Officer:* Dr T. J. Palmer and *Editor-in-Chief:* Dr S. Stouge continued to serve Council but are not Trustees.

Membership. Membership on 31st December 2010 totalled 1,197 (1,184 at end 2009), and did not appear to have been significantly affected by the subscription increases that were introduced at the beginning of the year. Of these 745 were Ordinary Members, 162 Retired and Honorary Members and 290 Student Members. There were 78 Institutional Members and 89 institutional subscribers to *Special Papers in Palaeontology*. Wiley Blackwell also separately manage further Institutional subscribers and distribute publications to these Institutional Members on behalf of the Association.

Professional Services. The Association's Bankers are NatWest Bank, 42 High Street, Sheffield S1 1QF. The Association's Independent Examiner is G. R. Powell BSc FCA, Nether House, Great Bowden, Market Harborough, Leicestershire LE16 7HF. The Association's investment portfolio was managed by Quilter (formerly Citi Quilter), St Helen's, The Undershaft, London EC3A 8BB.

Reserves. The Association holds reserves of £673,871, in General Funds, which 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, publications produced and the award of research grants and grants-in-aid. 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. The Association holds £86,551 in Designated Funds which contribute interest towards the funding of the Sylvester-Bradley, Hodson Fund and Jones Fenleigh awards, and which will contribute interest towards the funding of the new Callomon and Whittington awards. Funds carried forward to 2011 totalled £760,422.

Finance. Total charitable expenditure in 2010, through grants to support research, scientific meetings and workshops, was £288,764. Governance costs were £13,107. Total resources expended were £325,745. The Association continues its membership of the International Palaeontological Association and remains a Tier 1 sponsor of *Palaeontologia Electronica*, and the *Treatise on Invertebrate Paleontology*. During the year the Association received bequests totalling £30,000.

Risk. The Association is in a sound financial position. Succession planning for executive officers remains a concern and will be considered as part of the Annual Review of Officers in 2011.

Charitable Activities. The Association continues to increase its range and investment in charitable activities. We have continued to provide funds to support student and speaker attendance at our own and international meetings.

Grants. Palaeontological Association Research Grants were awarded to Dr B. Lomax (University of Nottingham), "SporoMALDI-resolving terrestrial palaeoecosystem responses to perturbations in the global carbon cycle using isolated single sporomorphs"; Dr J. Wheeley (University of Birmingham), "Nitrogen and organic carbon isotopes of Ordovician conodonts"; Dr J. Antcliffe (University of Bristol) "Integrating the White Sea Ediacara into a global framework"; Dr J. Zalasiewicz (University of Leicester) "Exploring new stratotypes for Silurian (Llandovery) stages in Wales."



Grants-in-aid. The Association provided funds to support the following meetings: Siluria Revisited (IUGS); 8th International Symposium, Cephalopods present and past; 9th International Congress of Vertebrate Morphology (ICVM); 2nd International Sclerochronology Conference July 2010; PalaeoDbase course in Glasgow 2011. The Association provided a grant of £44,000 to the Third International Palaeontological Congress, held in London. This caused a substantial increase in the amount of money paid out in Grants, compared with 2009.

Sylvester Bradley Fund. A review of these awards was made in 2010. Application guidelines were changed and the amount per award increased. Fifteen proposals were received. Seven were recommended for funding. These included proposals from Brewer, Butler, Hopley, Lecuona, Nunn, Peralta-Medina and Sallan.

Online activities. The online activities of the Association continue to expand. During the year new server provision was made and a new system for advertising PhD studentships was developed. Funding was provided to develop palaeontological outreach through the website. The Association continues to host mirror sites for the PaleoDbase, *Palaeontologia Electronica*, the EDNA fossil insect database, the Palaeontographical Society website and a database of fossils from Kent produced by the Kent RIGS Group.

Public meetings. Three public meetings were held in 2010, and the Association extends its thanks to the organisers and host institutions of these meetings:

54th Annual General Meeting. This was held on 17–20 December at University of Ghent.

Dr Vandembroucke with much local support organised the meeting which included a symposium on “Biological proxies in climate modelling” and comprised a programme of internationally recognised speakers. There were 221 attendees. The Annual Address entitled “Ancient origin of the deep sea fauna: new evidence from the fossil record” was given by Prof. A. S. Gale (University of Portsmouth). The President’s Award for best oral presentation from a member under 35 was made to Abigail Clifton (University of Leeds). The Council Poster Prize was presented to Tom Harvey (University of Cambridge). Due to the severe weather the post-conference field trip was to the Royal Belgium Institute of Natural Science, Brussels.

British Science Festival, Palaeontological Association Symposium. This is an annual forum for presentations to the public and general scientists. The Symposium “Firsts for life: Different views on the origins of animals and plants” was organised by Dr Purnell (University of Leicester) and funds were provided in support of four internationally renowned speakers.

Progressive Palaeontology. The annual open meeting for presentations by research students was organised by Aude Caromel, Roger Close, Alex Dunhill, Jenny Greenwood, Duncan Murdock and Rachel Warnock, and was held at the University of Bristol.

In addition to hosting public meetings the Association manages the Stuart Baldwin Lecture Series. This enables amateur societies to fund visiting speakers. Two awards were made in 2010.

Publications. Publication of *Palaeontology* and *Special Papers in Palaeontology* is managed by Wiley Blackwell. Volume 53 of *Palaeontology*, comprising six issues, was published. *Special Papers in Palaeontology* 83, “Silurian conodonts from the Yangtze Platform, south China,” edited by Wang Cheng-Yuan and Richard J. Aldridge; and *Special Papers in Palaeontology* 84, “Evolution and Development of the Brachiopod Shell,” edited by F. Alvarez and G.B. Curry, were also published during the year. Two field guides, on “Fossils from the Lower Lias of the Dorset Coast,” edited by Alan R. Lord and Paul G. Davis, and “Fossils of the Gault Clay,” edited by J. R. Young, A. S. Gale,



R. I. Knight, and A. B. Smith, were published. The Association is grateful to the National Museum of Wales and the Lapworth Museum (University of Birmingham) for providing storage facilities for publication back-stock and archives. Council is indebted to Meg and Nick Stroud for assistance with the publication and distribution of *Palaeontology Newsletter*.

Publicity. The Association continues to promote palaeontology and its allied sciences through press releases to the national media, radio and television.

Awards. The Lapworth Medal, awarded to people who have made a significant contribution to the science by means of a substantial body of research, was presented to Dr L. R. M. Cocks (Natural History Museum). The President's Medal for a palaeontologist in recognition of outstanding contributions in his/her earlier career, coupled with an expectation that they will continue to contribute significantly to the subject in their further work, was awarded to Dr N. Butterfield (University of Cambridge). The Hodson Award, for a palaeontologist under the age of 35 who has made an outstanding achievement in contributing to the science through a portfolio of original published research, was awarded to Dr T. J. Vandenbroucke (University of Ghent). The Mary Anning Award, for an outstanding contribution by an amateur palaeontologist, was made to Mr Daniel Vizcaino. Council also awards an undergraduate prize to each university department in which palaeontology is taught beyond Level 1. Honorary Life membership was awarded to Prof. Edwards, Prof. Bassett and Dr Skelton. The "Golden Trilobite Award" was made to <www.bryozoa.net>, a high-quality, information-rich amateur website which provides a wealth of carefully collated information.

Governance. The Association continues to improve its administration with further improvements to the *Newsletter* and website. Trustees were members of the Joint Committee for Palaeontology; Prof. Aldridge (Chair) and Dr Servais represented the Association. Dr Armstrong acted as the Association representative on the International Palaeontological Association. During the year the Association responded to requests for information from the HEFCE consultation on the Research Excellence Framework, NERC and the BGS.

Forthcoming plans. Council will continue to make substantial donations, from both General and Designated funds, to permit individuals to promote the charitable aims of the Association. Resources will be made available from General Funds to support the Association Research Grant, Grants-in-Aid, provided to carry out research into palaeontological subjects, to disseminate findings in print and at conferences and support the provision of palaeontological workshops. The Association will continue to recognise the contribution individuals have made to palaeontology and associated sciences through its awards. A similar programme of public meetings and publications will be carried out in 2011. Funds will be made available to further develop the website aimed at encouraging outreach. It is intended that one new *Field Guide to Fossils* will be published within the year. The 55th Annual meeting will be held at the University of Plymouth. Progressive Palaeontology will be held at the University of Leicester. The Association will sponsor a symposium at the British Science Festival, "Paradise Lost? Strange environments and major events from the geological past," and provide travel grants for the Congress of the European Geosciences Union. The Association will host the Lyell Meeting in 2011 on the topic of "Island faunas, migration and evolution." During 2011 the Association will amalgamate the storage of back-stock and its archive to a new office in Aberystwyth.



Nominations For Council

At the AGM in December 2011, the following vacancies will occur on Council:

- President elect
- Vice-President
- Chair of the Publications Board
- Secretary
- Editor Trustee
- Book Review Editor
- Newsletter Editor
- Meetings Coordinator
- Two Ordinary Members

Nominations are now invited for these posts. Please note that each candidate must be proposed by at least two members of the Association and that any individual may not propose more than two candidates. Nominations must be accompanied by the candidate's written agreement to stand for election and a single sentence describing their interests.

All potential Council Members are asked to consider that:

'Each Council Member needs to be aware that, since the Palaeontological Association is a Registered Charity, in the eyes of the law he/she becomes a Trustee of that Charity. Under the terms of the Charities Act 1992, legal responsibility for the proper management of the Palaeontological Association lies with each Member of Council'. Responsibilities of Trustees can be obtained by emailing <secretary@palass.org>.

The closing date for nominations is **1st October 2011**. They should be sent to the Secretary: Dr Howard A. Armstrong, Department of Earth Sciences, Durham University, Durham DH1 3LE; e-mail: <h.a.armstrong@durham.ac.uk> or via <secretary@palass.org>.

Council nominations are as follows:

President elect (*ex officio*): Prof. Mike Benton
Vice president: Dr Howard Armstrong
Chair of the Publications Board: Dr Paddy Orr
Secretary: Dr Richard Twitchett
Book Review Editor: Dr Charlotte Jeffrey Abt
Newsletter Editor: Dr Alistair McGowan
Meetings Coordinator: Dr Thijs Vandenbroucke
Ordinary Members: Dr Bob Owens, Prof. Paul Smith



Grants, awards and prizes

Grants in Aid

The Palaeontological Association is happy to receive applications for loans or grants from the organizers of scientific meetings that lie conformably with its charitable purpose, which is to promote research in palaeontology and its allied sciences. Application should be made in good time by the scientific organizer(s) of the meeting using the online application form (see PalAss website). Such requests will be considered by Council at the March and the October Council Meetings each year. Completed requests should be made at least six months in advance of the event in question and should be sent by **1st March** or **1st October**. Enquiries may be made by e-mail to <secretary@palass.org>.

Grants-in-aid: Meeting support, workshops and short courses

The Palaeontological Association is happy to receive applications from the organizer(s) of meetings and workshops for grants-in-aid. If the application is successful, we will require that the support of the Association is acknowledged, preferably with reproduction of the Association's logo, in the Meeting literature. Application should be made by the scientific organizer(s) on the online form (see <www.palass.org>). Such requests will be considered by Council at the March and the October Council Meetings each year. Completed requests should be made at least six months in advance of the event in question and should be sent by **1st March** or **1st October**. Enquiries may be made by e-mail to <secretary@palass.org>.

Awards and Prizes

Nominations are now being sought for the Hodson Fund and Mary Anning Award, and applications under the Small Grants Scheme.

Hodson Fund

This award 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. The closing date for nominations is **1st September**. Nominations will be considered and a decision made at the October meeting of Council. The award will comprise a fund of £1,000, presented at the Annual Meeting.

Mary Anning Award

This 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 is **1st September**. The award comprises a cash prize plus a framed scroll, and is usually presented at the Annual meeting.

Palaeontological Association Small Grants Scheme

The Association is pleased to announce the broadening of its awards, and now offers three awards to fund palaeontological research, travel and fieldwork:

Sylvester-Bradley Award. Multiple awards of up to £1,500 for palaeontological research.

Callomon Award. An award of up to £1,500 for a project which is normally field-based.

Whittington Award. An award of up to £1,500 for a project which is normally based on museum collections.

1. There will be one application form and Council will decide on the allocation of the awards based upon the nature of the project made in the application.
2. Before applying, applicants should read the *Terms and Conditions* at <http://www.palass.org/modules.php?name=palae&sec=geninfo&page=76>, which leads to the online application form.
3. Awards are open to all members of the Association and will be announced at the AGM.
4. Applications should be submitted electronically through the website, and will comprise a CV, an account of project aims and objectives and expected outcomes (5,000 characters maximum and including references where appropriate), and a breakdown of the proposed expenditure.
5. Each application should be accompanied by an e-mailed reference (to palass@palass.org), to cover the project and a personal reference for the applicant. Applicants are responsible for ensuring that this reference is sent by the deadline.
6. The application should include a summary (of up to 1,500 characters) suitable for the non-specialist which will be published in the *Palaeontology Newsletter* when the award is made.
7. The final project report will be published in the *Palaeontology Newsletter*, and successful applicants are asked to consider the Association's meetings and publications as media for conveying the research results.

The deadline for applications is **1st November**.

Nominations are sought for the "Golden Trilobite Award" for prestigious websites

This award is for the best institutional and amateur websites that promote the charitable and scientific aims of the Association. The award will take the form of a statement of recognition that can be posted on the winning sites. Nominations are sought from the membership, and should be sent to the Secretary at secretary@palass.org by **1st September**. The websites will be judged by Council members.





THE PALAEOLOGICAL ASSOCIATION Registered Charity No. 276369
STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31st DECEMBER 2010

		General Funds	Designated Funds	TOTAL 2010	TOTAL 2009
Incoming Resources					
Generated Funds					
Voluntary income	Subscriptions	66,913		66,913	68,202
	Legacies	30,000		30,000	0
	Donations	<u>0</u>	1,589	1,589	4,886
		96,913	1,589	98,502	73,088
Charitable activities					
Sales	Palaeontology	198,361			
	Special Papers	12,598			
	Offprints	1,581			
	Newsletters	0			
	Field Guides	12,671			
	Distribution	<u>1,663</u>			
		226,874		226,874	226,761
Investment income		<u>12,069</u>	94	12,163	15,230
TOTAL INCOMING RESOURCES		<u>335,856</u>	<u>1,683</u>	<u>337,539</u>	<u>315,079</u>
Resources expended					
Costs of generating funds					
for voluntary income	Administration	21,029			18,670
Investment management	Stockbroker fees	<u>2,845</u>			1,771
		23,874	0	23,874	20,441
Charitable activities					
Publications	Palaeontology	73,217			
	Special Papers	9,972			
	Offprints	1,230			
	Field Guides	20,831			
	Newsletters	13,795			
	Distribution	1,234			
	Marketing	2,974			
	Editorial costs	<u>55,150</u>			
	Total Publications	178,403		178,403	154,134
Scientific Meetings & Costs		70,931		70,931	18,939
Grants and Awards		7,525	7,260	14,785	14,877
Research Grants		5,619		5,619	6,637
Administration of charitable activities		<u>26,286</u>		26,286	23,337
		288,764		296,024	217,924
Governance costs	Examiner's fee	400			
	Trustee expenses	7,450			
	Administration	<u>5,257</u>			
		13,107	0	13,107	13,013
TOTAL RESOURCES EXPENDED		<u>325,745</u>	<u>7,260</u>	<u>333,005</u>	<u>251,378</u>
NET INCOMING RESOURCES		10,111	-5,577	4,534	63,701
INVESTMENT GAINS/LOSSES					
	Realised gain	3,122			
	Unrealised gain	<u>43,127</u>			
		46,249		46,249	44,838
NET MOVEMENT IN FUNDS		56,360	-5,577	50,783	108,539
TRANSFERS BETWEEN FUNDS		-50,000	50,000	0	0
SURPLUS/DEFICIT FOR THE YEAR		6,360	44,423	50,783	108,539
FUNDS BROUGHT FORWARD		<u>667,511</u>	<u>42,128</u>	<u>709,639</u>	<u>601,100</u>
FUNDS CARRIED FORWARD		<u>673,871</u>	<u>86,551</u>	<u>760,422</u>	<u>709,639</u>



THE PALAEOLOGICAL ASSOCIATION Registered Charity No. 276369
BALANCE SHEET as at 31st DECEMBER 2010

2009		Note	2010
£			£
	INVESTMENTS		
454,924	At market value		534,720
	CURRENT ASSETS		
171,134	Cash at Banks	138,151	
147,424	Sundry Debtors	7 <u>126,690</u>	
<u>318,558</u>	Total Current Assets		264,841
	CURRENT LIABILITIES		
24,244	Subscriptions in Advance	20,795	
39,599	Sundry Creditors	8 <u>18,344</u>	
<u>63,843</u>	Total Current Liabilities		39,139
254,715	NET CURRENT ASSETS		225,702
<u>709,639</u>	TOTAL ASSETS		<u>760,422</u>
	Represented by:		
667,511	GENERAL FUNDS		673,871
	DESIGNATED FUNDS 9		
4,656	Sylvester Bradley Fund		20,325
23,064	Jones-Fenleigh Fund		22,805
14,408	Hodson Fund		13,421
0	Callomon Fund		10,000
<u>0</u>	Whittington Fund		<u>20,000</u>
42,128			86,551
<u>709,639</u>			<u>760,422</u>



Notes to the Financial Statements for the year ended 31st December 2010

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 accounts have been prepared in accordance with the Statement of Recommended Practice issued by the Charity Commission in March 2005 and cover all the charity's operations, all of which are continuing.

The effect of events relating to the year ended 2010 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 2010 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 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.
- Callomon Fund: Grants made to permit palaeontological research with a fieldwork element.
- Whittington Fund: Grants made to permit palaeontological research with an element of study in museum collections.

1.3 Incoming Resources

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.

During the year the Association received bequests from two former members totalling £30,000.

1.4 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 have been allocated to the various cost headings based on estimates of the time and costs spent thereon.

1.5 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. In view of the low rates of interest on cash balances, Council allocated an additional sum of £50,000 to the investment portfolio.



2. Analysis of Financial Resources Expended

	Staff costs	Other costs	Total 2010	Total 2009
Generating Funds	15,652	8,222	23,874	20,441
Charitable activities	19,565	271,759	291,324	217,924
Governance	<u>3,913</u>	<u>9,194</u>	<u>13,107</u>	<u>13,013</u>
	<u>39,130</u>	<u>289,175</u>	<u>328,305</u>	<u>251,378</u>

3. Staff Costs

	Salary	National Insurance	Pension Contributions	Total 2010	Total 2009
Publications: 1 employee (2009 – 1)	29,425	0	4,687	34,112	32,795
Administration: 1 employee (2009 – 1)	<u>31,305</u>	<u>3,303</u>	<u>4,522</u>	<u>39,130</u>	<u>36,775</u>
	<u>60,730</u>	<u>3,303</u>	<u>9,209</u>	<u>73,242</u>	<u>69,570</u>

4. Trustees Remuneration and Expenses

Members of Council neither received nor waived any emoluments during the year (2009 – nil).

The total travelling expenses reimbursed to 12 Members of Council was £7,450 (2009 – £7,746).

5. Costs of Independent Examiner

	2010	2009
Examination of the accounts	400	400
Accountancy and payroll services	<u>1,400</u>	<u>1,350</u>
	<u>1,800</u>	<u>1,750</u>

6. Transfers between Funds

Council has transferred £30,000 from General Funds representing the sums received under the bequests to Callomon Fund £10,000 and Whittington Fund £20,000 (see note 1.2). In view of the cumulative deficit in the Sylvester-Bradley Fund, Council has transferred £20,000 from General Reserves into this fund in order that these grants may continue to be supported.

7. Debtors

	2010	2009
Accrued income – receivable within one year	126,690	147,424

8. Creditors – falling due within one year

	2010	2009
Social Services costs	3,182	3,172
Accrued expenditure	<u>10,462</u>	<u>36,427</u>
	<u>13,644</u>	<u>39,599</u>

9. Designated Funds

See next page.



THE PALAEOLOGICAL ASSOCIATION Registered Charity No 276369

STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31st DECEMBER 2010

DESIGNATED FUNDS

Note 9 to the Accounts:

	Sylvester- Bradley	Jones- Fenleigh	Hodson	Callomon	Whittington	TOTAL 2010	TOTAL 2009
Donations	400	1,189	0	0	0	1,589	3,886
Interest Received	<u>10</u>	<u>51</u>	<u>32</u>	0	0	<u>94</u>	<u>285</u>
TOTAL INCOMING RESOURCES:	410	1,241	32	0	0	1,683	4,171
Grants made	<u>4,742</u>	<u>1,500</u>	<u>1,019</u>	<u>0</u>	<u>0</u>	<u>7,261</u>	<u>8,154</u>
NET SURPLUS / (DEFICIT):	-4,331	-259	-987	0	0	-5,577	-3,983
Transfers in	<u>20,000</u>	0	0	<u>10,000</u>	<u>20,000</u>	<u>50,000</u>	<u>0</u>
SURPLUS / (DEFICIT) FOR THE YEAR:	15,669	-259	-987	10,000	20,000	44,423	-3,983
FUNDS BROUGHT FORWARD:	4,656	23,064	14,408	0	0	42,128	46,111
FUNDS CARRIED FORWARD:	<u>20,325</u>	<u>22,805</u>	<u>13,421</u>	<u>10,000</u>	<u>20,000</u>	<u>86,551</u>	<u>42,128</u>
	Sylvester- Bradley	Jones- Fenleigh	Hodson	Callomon	Whittington	TOTAL 2010	TOTAL 2009



Independent Examiner's Report on the Accounts of The Palaeontological Association for the year ended 31st December 2010

Respective responsibilities of trustees and examiner

The charity's trustees consider that an audit is not required for this year (under section 43(2) of the Charities Act 1993 (the Act), as amended by s.28 of the Charities Act 2006) and that an independent examination is needed.

It is my responsibility to:

- examine the accounts (under section 43 of the Act as amended)
- follow the procedures laid down in the General Directions given by the Charity Commissioners (under section 43(7) of the Act as amended), and
- state whether particular matters have come to my attention

Basis of independent examiner's statement

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 the trustees concerning 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 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 trustees have not met the requirements to ensure that:
 - proper accounting records are kept (in accordance with section 41 of the Act) and
 - accounts are prepared which agree with the accounting records and comply with the accounting requirements of the Act
- (2) to which, in my opinion, attention should be drawn in order to enable a proper understanding of the accounts to be reached.

Dated: 1st May 2011

G R Powell F.C.A.
Nether House, Great Bowden,
Market Harborough
Leicestershire LE16 7HF



The Palaeontological Association

Nominal	Holding	Cost (bought pre 2010)	Value end 2009
35,300	M & G Securities Ltd Corporate Bond I GBP Inc	£10,061.14	£11,600.00
£18,000	UK 4.75% Stock 07/03/20 GBP 100	£18,145.87	£19,218.74
£7,000	UK 4.75% Stock 07/03/20 GBP 100	£7,056.73	£7,473.26
£20,000	UK 4.5% Gilt 07/03/19 GBP 0.01	£20,092.99	£21,028.00
£64,176.46	COIF Charities Fixed Interest Fund	£85,000.00	£81,048.45
804	Royal Dutch Shell B shares	£12,432.00	£14,564.00
1,425	BP Ord 25c shares		
600	BHP Billiton \$0.5 shares	£4,341.48	£11,970.00
500	BG Group Ordinary 10p shares	£3,977.95	£5,610.00
1,825	HSBC Holdings Ordinary 0.5 US Dollar shares	£5,512.91	£12,936.00
6,800	Lloyds TSB Ordinary 25p shares	£10,169.91	£3,447.00
950	Barclays Ord 25p shares	£3,528.34	£2,622.00
875	BAE Systems Ord 2.5 P shares	£3,542.00	£3,146.00
1,000	3I Group Ordinary £0.738636 shares	£3,058.76	£2,830.00
1,150	Tesco Ord GBP 0.05		
1,550	Kingfisher Ord GBP 0.157142857		
175	Carnival Plc Ord USD 1.66		
650	Glaxo Smithkline Ordinary 25p shares	£10,232.42	£8,577.00
2,499	Bluecrest Allblue Ord Npv GBP shares	£3,020.28	£3,981.00
1,100	Wood Group (John) Ordinary 3.33p shares	£2,975.36	£3,397.00
7,000	Ing Global Real Estate Securities Ord NVP shares	£7,084.00	£4,883.00
4,175	Vodafone Group Ord USD 0.11428571		
2,150	BT Group Ordinary 5p shares	£7,787.53	£2,903.00
225	Brit Amer Tobacco Ord GBP 0.25		
300	Unilever PLC Ord GBP 0.031111	£4,326.21	£5,982.00
150	Novo-Nordisk As DKK 1 Ser B	£6,200.64	£5,944.00
460	Pearson Ordinary 25p shares	£8,069.00	£4,099.00
490	Sercos Group Ord 2P		
1,350	Prudential Ordinary 5P shares	£7,063.25	£8,640.00
700	National Grid Ord GBP 0.113953		
1,150	Misis Ord 1P		
420	Experian Ord 10C		
670	Blackrock World Mi Ord 5P		
315	Standard Chartered Ord USD 0.50		
650	RIT Capital Partners Ordinary £1 shares	£4,903.90	£6,793.00
1,000	Balfour Beatty 50P		
20	Schroder Alt Solut Agriculture C GBP Dis Hdg	£2,987.22	£2,166.00
1,500	British Empire Sec & Gen Trust Ordinary 10p shares	£5,005.61	£6,249.00
425	Findlay Park Partners US Smaller Companies	£6,158.47	£10,348.00
2,825	Ishares S&P 500 GBP		
900	JPMorgan Am UK Ltd Emerging Markets I Instl		
1,750	Cazenove Inv Fd Mt European Fund X Acc Nav	£6,107.82	£7,825.00
425	Fidelity EUR Value Ordinary 25P shares	£4,059.07	£4,892.00
3,900	Edinburgh Dragon Trust Ordinary £0.20 shares	£4,478.10	£7,547.00
3,100	Capita Morant Wright Japan B Inc Nav	£5,170.11	£5,477.00
5,200	Swip Fd Mgmt Property Trust Inc		
100	Bluebay Funds SA LI.FD-D GBP Base		
26	Veritas Asset Mgmt Veritas Asian A GBP		
13,750	Investec Fund Mgrs American I Acc		
1,320	Goldman Sachs Fund US Equity I GBP Inc Nav		
65	Roche Hldgs Ag Genusscheine Nvp		
6,600	Henderson Gbl Invs European Special Sits I Inc		
55	Fauchier Ptnrs Paragon Cap App Instl Stlg	£9,894.52	£9,906.00
1,283.80	COIF Charities Investment Fund Acc Units	£75,000.00	£91,316.44
5,270	M & G Charifund Units	£4,073.00	£56,505.00
	Total	£371,516.59	£454,923.89



Investment Portfolio 2010

Proceeds (sold in 2010)	Cost (bought in 2010)	Gain realised during 2010	Value end 2010	Gain unrealised during 2010
£11,624.30		£24.30		
£7,988.60		£515.34	£20,072.00	£853.26
			£22,030.00	£1,002.00
			£81,523.36	£474.91
			£17,005.00	£2,441.00
	£5,047.35		£6,634.00	£1,586.65
			£15,306.00	£3,336.00
			£6,480.00	£870.00
			£11,883.00	-£1,053.00
			£4,468.00	£1,021.00
£2,750.44		£128.44		
			£2,888.00	-£258.00
			£3,285.00	£455.00
	£4,583.22		£4,888.00	£304.78
	£3,554.45		£4,083.00	£528.55
	£3,996.49		£5,219.00	£1,222.51
			£8,060.00	-£517.00
			£4,248.00	£267.00
			£6,149.00	£2,752.00
			£6,003.00	£1,120.00
	£6,034.20		£6,922.00	£887.80
			£3,887.00	£984.00
	£4,991.81		£5,543.00	£551.19
			£5,889.00	-£93.00
£8,457.19		£2,513.19		
			£4,637.00	£538.00
	£3,005.01		£2,722.00	-£283.01
£7,471.32		-£1,168.68		
	£3,648.26		£3,871.00	£222.74
£3,417.67	£2,987.60	£430.07		
	£3,444.95		£3,352.00	-£92.95
	£4,019.09		£5,434.00	£1,414.91
	£5,514.48		£5,435.00	-£79.48
			£7,794.00	£1,001.00
	£2,913.17		£3,129.00	£215.83
			£2,790.00	£624.00
			£7,290.00	£1,041.00
			£13,130.00	£2,782.00
	£20,319.63		£22,819.00	£2,499.37
	£5,043.10		£5,620.00	£576.90
			£7,948.00	£123.00
			£4,730.00	-£162.00
			£9,965.00	£2,418.00
			£6,423.00	£946.00
	£4,669.49		£4,678.00	£8.51
	£11,581.33		£11,252.00	-£329.33
	£8,182.27		£8,462.00	£279.73
£14,537.31	£15,128.39	-£591.08		
	£14,640.81		£14,559.00	-£81.81
	£7,226.55		£6,104.00	-£1,122.55
	£7,037.91		£8,336.00	£1,298.09
			£9,927.00	£21.00
			£101,847.58	£10,531.14
£57,929.06		£1,424.06		
£114,175.89	£147,569.56	£3,275.64	£534,719.94	£43,126.74



ASSOCIATION MEETINGS



55th Annual Meeting of the Palaeontological Association
University of Plymouth, UK 17 – 20 December 2011

The 55th Annual Meeting of the Palaeontological Association will be held at the University of Plymouth, organised by Richard Twitchett and colleagues in the School of Geography, Earth and Environmental Sciences. As in previous years, this meeting will cover new and exciting developments in the fields of palaeontology and palaeobiology. Please check the Association's website <www.palass.org> for all details and updates.

Meeting Format

The meeting will begin with a symposium on Saturday 17th December entitled 'Ancient and Modern Biotic Crises', to be followed by a drinks reception. Sunday 18th December will include a full day of talks and posters, the Association AGM and the Association Annual Address, which this year will be given by Prof. Paul Pearson of Cardiff University and entitled 'Climate and evolution in the Cenozoic oceans'. In the evening there will be a drinks reception followed by the Annual Dinner. Monday 19th December will comprise another day of talks and a dedicated poster session. The meeting will conclude on Tuesday 20th December with a field excursion to the English Riviera Global Geopark (<<http://www.englishrivierageopark.org.uk> />), to take in local exposures of the marine Devonian and a visit to Kents Cavern.

The time allocated to each talk will be 15 minutes; if too many abstracts of sufficient quality are submitted then shorter slots are envisaged to avoid the need for parallel sessions. Please check the website for technical details on the preparation of oral and poster presentations.

The President's Prize will be awarded for the best talk at the Annual Meeting by someone under the age of 30 who is a member of the Association. This is a cash prize of £100. The Council Poster Prize will be awarded for the best poster at the Annual Meeting by someone under the age of 30 who is a member of the Association. This too is a cash prize of £100.

Symposium

Entitled 'Ancient and modern biotic crises' this symposium aims to address a number of key themes surrounding recent advances in our understanding of ancient and modern crises. These will include comparative palaeoecological and palaeoenvironmental studies of ancient and modern events, to explore similarities in the responses of the biosphere to selected major crises in the past; studies that show how the ecology and evolutionary history of key groups of organisms were shaped by environmental changes of the past; and discussion of whether understanding ancient events may be useful in predicting biosphere response to present environmental changes, and whether techniques and approaches used in studying modern crises may be employed to better understand past crises.



Confirmed speakers are:

David Bottjer (University of Southern California, USA)

Matt Friedman (Oxford, UK)

Mark Leckie (University of Massachusetts, USA)

Bas van de Schootbrugge (Frankfurt, Germany)

Martin Solan (Southampton, UK)

Peter Ward (University of Washington, USA)

Fieldtrip

The field excursion will leave from campus on the morning of Tuesday 20th December. The itinerary will include examination of some of the famous, fossiliferous marine Devonian localities of the Torquay area (the English Riviera Global Geopark) in the morning, followed by lunch and an afternoon tour of Kents Cavern. At the end of the day, delegates will have the choice of returning to Plymouth or of being dropped off at Newton Abbott train station, which is on the main line to Exeter and all stations north and east.

Venue and travel

The conference will take place on the campus of the University of Plymouth (www.plymouth.ac.uk) right in the city centre of Plymouth.

Transport into Plymouth can be achieved via a variety of means: rail, road, air and sea. Travel by train from London Paddington to Plymouth takes between three and four hours depending on the time of day and the number of stops. The cheapest fares are available by booking in advance, e.g. through the First Great Western website (www.firstgreatwestern.co.uk). There are currently direct air links into Plymouth from Aberdeen, Bristol, Cork, Dublin, Glasgow, Guernsey, Jersey, Leeds Bradford and Manchester airports (www.airsouthwest.com), but at the time of writing the future of Plymouth airport is in doubt so please check availability well in advance. In addition, many national and international airlines fly into Exeter airport or Newquay airport. Of the two, Exeter has the best public transport links to Plymouth and is one hour away from Plymouth by train. Ferries link Plymouth to France (Roscoff), Spain (Santander), and Cornwall. National Express coaches link Plymouth with all major UK cities and London airports. Plymouth University is situated a few minutes' walk from the train station, coach/bus station, and a number of hotels, guesthouses and other accommodation.

Plymouth is an historic and vibrant city that overlooks one of the world's great natural harbours. Best known for its rich maritime heritage, Plymouth is also home to the oldest gin distillery in the UK, in operation since 1793 and housed in a 15th century former monastery in the historic Barbican district. The Barbican is a short ten minute walk downhill from the University campus and is famous for its Elizabethan buildings and for being the final departure point from which the Pilgrim Fathers set sail on the Mayflower to the New World in 1620. Its cobbled streets house a number of restaurants and pubs, which are situated a stone's throw from the National Marine Aquarium. On the hill above the Barbican sits Plymouth Hoe, with its iconic lighthouse (Smeaton's Tower), the imposing Royal Citadel fort and the Sir Francis Drake bowling lawn, amongst other attractions.



Accommodation

Plymouth has a large number of hotels, guesthouses and hostels at a variety of prices, most of which are within ~1km of the University campus (hotels with PL1 or PL4 postcodes are closest). More information on these can be found through the usual channels, and a useful starting point is: <<http://www.visitplymouth.co.uk/site/where-to-stay>>.

In addition, we have organised discount rates at the Jury's Inn, Exeter Street, which is located ~500m from the conference venue. A maximum of 100 rooms have been reserved, and will be allocated on a first come first served basis. Rates per night are:

Room only rate	£52.00
Single occupancy with breakfast	£59.00
Double occupancy with breakfast	£66.00

The hotel will be able to split twin occupancy bills equally, if required, for those who take the twin option on the accommodation. Reservations can be made through the following website, quoting PALA161211: <<http://plymouthhotels.jurysinns.com> />.

Registration and booking

Registration, abstract submission and booking (including payment by credit card) will commence in July 2011. Abstract submission will close on Thursday 15th September 2011 and abstracts submitted after this date will not be considered. Registration after this date will incur an additional administration charge of approximately £20, with the final deadline of Friday 18th November 2011. Registrations and bookings will be taken on a strictly first come first served basis. No refunds will be available after the final deadline.

Registration, abstract submission, booking and payment (by credit card) will be from online forms available on the Palaeontological Association website (<<http://www.palass.org> />). Accommodation must be booked separately and details will be placed on the website.

The cost for early registration is £90 for ordinary and retired members; £60 for students; and £115 for non-members. Registration costs are the same as last year, with a small reduction for students, and include sandwich lunches on Sunday and Monday, the reception on Saturday, full registration package and tea/coffee breaks. Early registration ends on Thursday 15th September after which date all registration fees will increase by £20. Final registration is Friday 18th November. No refunds will be considered after that date. The field excursion costs £25 (this includes lunch). The cost of the Annual Dinner is £45.

Travel grants are available to help student members (doctoral and earlier) to attend the meeting in order to present a talk or poster (see below).



Outline Programme

- Saturday 17th December 2011
- Symposium
 - Reception (National Marine Aquarium).
- Sunday 18th December 2011
- Scientific sessions: talks and posters
 - AGM
 - Annual Address by Prof. Paul Pearson (Cardiff)
 - Reception and Annual Dinner
- Monday 19th December 2011
- Scientific sessions: talks and dedicated poster session
 - Presentations of awards
- Tuesday 20th December 2011
- Field excursion to the English Riviera Global Geopark.

Travel grants to student members

The Palaeontological Association runs a programme of travel grants to assist student members (doctoral and earlier) to attend the Annual Meeting in order to present a talk or poster. For the Plymouth meeting, grants of less than £100 (or the € equivalent) will be available to student presenters who are travelling from outside the UK. The actual amount that will be payable is dependent on the number of applicants and the distance travelled. Payment of these awards is given as a disbursement at the meeting, not as an advance payment. Students interested in applying for a PalAss travel grant should contact the Executive Officer, Dr Tim Palmer (by e-mail to <palass@palass.org>) once the organisers have confirmed that their presentation is accepted, and before 1st December 2011. Entitle the e-mail "Travel Grant Request". No awards can be made to those who have not followed this procedure.

Contact

To contact local organisers Richard Twitchett, Christopher Smart or Malcolm Hart please send an e-mail to <annualmeeting@palass.org>.

We look forward to welcoming you to Plymouth!



Islands: Palaeontology, Geology and Tectonics Lyell Meeting 2011



Attendance is FREE!

Geological Society, Monday 24th October 2011

9.00 a.m. – 5.00 p.m.

This free, one-day meeting aims to bring together experts on diverse aspects of the geology and palaeontology of islands. Island chains furnish key evidence for plate tectonic processes, providing subaerial expressions of suites of rocks that are otherwise limited to the marine realm. The rock records of oceanic islands are dominated by igneous rocks and limestones which together contribute to an unusual suite of natural environments. And the fossil biotas of islands provide evidence of generally widespread marine taxa contrasted with unusual terrestrial biotas brought together by chance biogeographic processes, influenced by the barriers of geology, tectonics and physiography.

Speakers include

Grenville Draper (Florida International University, Miami)

Trevor Jackson (University of the West Indies, Trinidad)

Tom Spencer (University of Cambridge)

David Harper (University of Copenhagen)

Peter Skelton (The Open University)

Hanneke Meijer (Smithsonian Institution, Washington, D.C.)

Daniela Winkler (University of Hamburg)

Don McFarlane (W.M. Keck Science Center, Los Angeles)

Attendance is FREE, but you must pre-register your interest in attending this conference.

Please e-mail Georgina Worrall – <georgina.worrall@geolsoc.org.uk>

For more information contact, the convenor, Steve Donovan,
at <Steve.Donovan@ncbnaturalis.nl> or (0031)-71-568-7642

**A joint meeting of the Palaeontological Association, the Geological Society, the
Palaeontographical Society and the Micropalaeontological Society**



Late Cretaceous nautiloids and heteromorph ammonites transferred from Aachen to Maastricht

A selection of early Campanian and early Maastrichtian nautiloids and scaphitid, baculitid and diplomoceratid ammonites from the Vaals–Aachen area (southeast Netherlands and adjacent German territory) has recently been transferred from the collections of the former Technische Hochschule Aachen (currently RWTH, Rheinisch-Westfälisch Technische Hochschule) to the Natuurhistorisch Museum Maastricht (access numbers: NHMM 2006 105–2006 108, 2006 112–2006 121 and 2007 057–2007 092).

This material includes specimens, often silicified, from several key localities of the Vaals Formation (lower Campanian), now mostly overgrown or built over, in the Aachen city area (Lousberg, Melatenerstraße, Linzeshäuschen). In addition, it comprises specimens from Raren (northeast Belgium), collected by Dr Hans-Joachim Albers during mapping in the 1970s, as well as silicified material (ex M. H. Debey Collection) from the Vaals area, which was the source of numerous specimens illustrated by Müller (1847–1851, 1859) and Holzapfel (1887–1889).

Taxa represented are the nautiloids *Cimomia* sp. and *Eutrephoceras*? sp. and the heteromorph ammonites *Glyptoxoceras aquisgranense* (Schlüter, 1872), *G. roemeri* (Geinitz, 1850), *G. vaalsiensis* (Holzapfel, 1887)?, *Baculites vaalsensis* Kennedy & Jagt, 1995, *Scaphites* (*Scaphites*) *hippocrepis* (DeKay, 1828) II-III *sensu* Cobban, 1969 and *Acanthoscaphites* (*Acanthoscaphites*) *tridens* (Kner, 1848). The last-named species originates from the Vijlen Member of the Gulpen Formation.

A handful of the taxa listed have been illustrated previously (Kennedy & Jagt 1995; Jagt *et al.* 1999). In view of the general lack of outcrops of Vaals Formation strata in the type area of that unit (Felder & Bosch 2000), the present material is of considerable importance. It has now been made available again for scientific research.

John W. M. Jagt & Elena A. Jagt-Yazykova

REFERENCES

- FELDER, W. M. and BOSCH, P. W. 2000. *Geologie van Nederland, deel 5. Krijt van Zuid-Limburg*. Delft/Utrecht, NITG-TNO, 192 pp.
- HOLZAPFEL, E. 1887–1889. Die Mollusken der Aachener Kreide, I. Abtheilung. Cephalopoda und Glossophora; II. Lamellibranchiata. *Palaeontographica*, **34**, 29–180 (1887); **35**, 139–268 (1889).
- JAGT, J. W. M., KENNEDY, W. J. and MACHALSKI, M. 1999. Giant scaphitid ammonites from the Maastrichtian of Europe. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, **69**, 133–154.



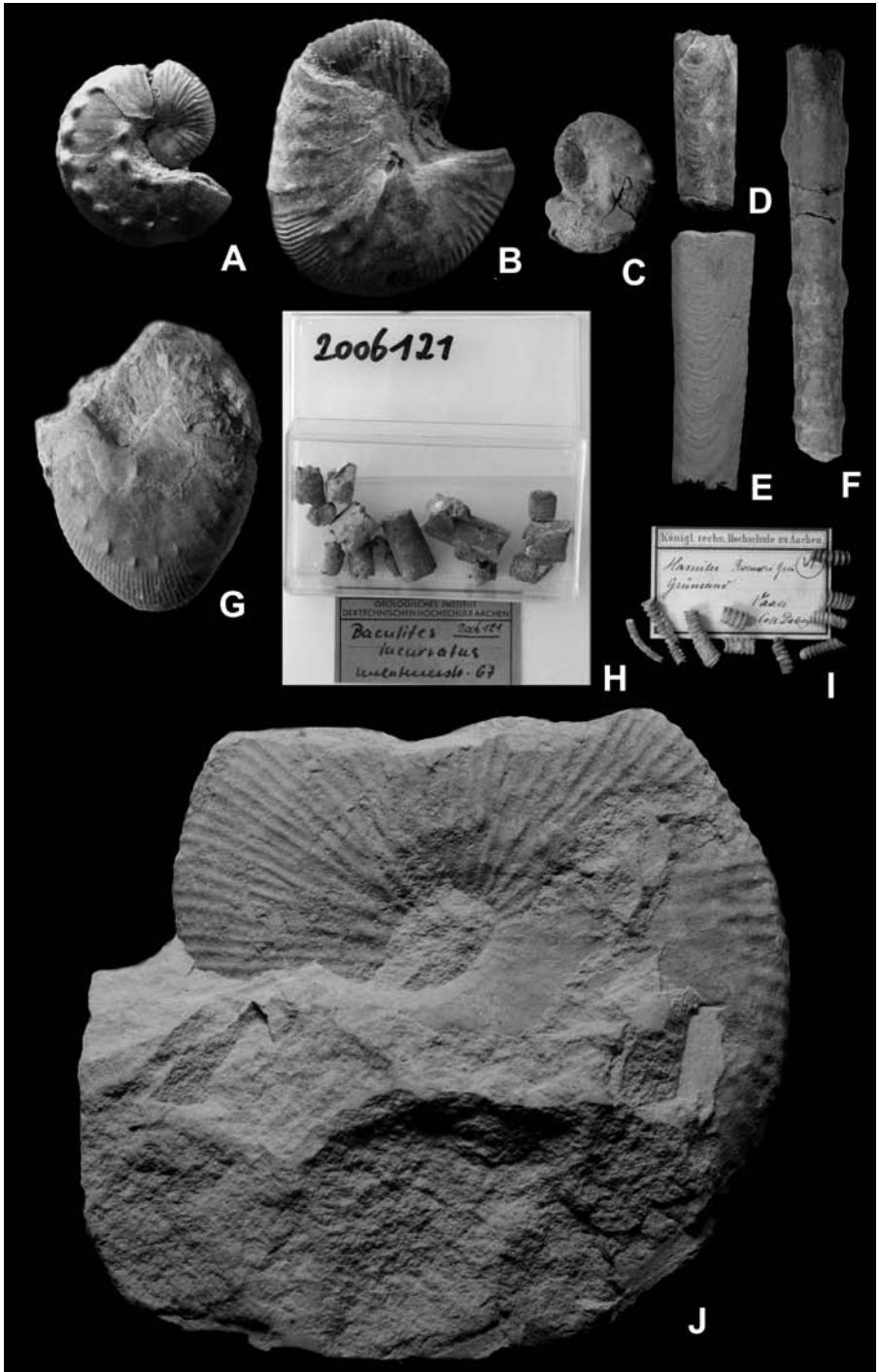
KENNEDY, W. J. and JAGT, J. W. M. 1995. Lower Campanian heteromorph ammonites from the Vaals Formation around Aachen, Germany, and adjacent parts of Belgium and The Netherlands. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 197, 275–294.

MÜLLER, J. 1847–1851. *Monographie der Petrefacten der Aachener Kreideformation*, 1 [Erste Abtheilung], 2 [Zweite Abtheilung]. Bonn, Henry & Cohen, 1–48 (1847); 1–88 (1851).

MÜLLER, J. 1859. *Monographie der Petrefacten der Aachener Kreideformation [Supplementheft zur ersten und zweiten Abtheilung, mit zwei in Stein radirten Tafeln]*. Aachen, J.A. Mayer, 32 pp.; Aachen.

- A – *Scaphites (Scaphites) hippocrepis* (DeKay, 1828) II-III *sensu* Cobban, 1969, NHMM VG 3048, microconch (silicified), Vaals-Eschberg, Vaals Formation, Gemmenich Member, Vaalsbroek Horizon;
- B – same species, NHMM VG 3049, macroconch (silicified), Vaals-Eschberg, Vaals Formation, Gemmenich Member, Vaalsbroek Horizon;
- C – same species NHMM 2006 113a, microconch (silicified), Vaals (possibly Eschberg), Vaals Formation, Gemmenich Member, Vaalsbroek Horizon. Previously illustrated by Kennedy & Jagt (1995: fig. 7/19);
- D – *Baculites vaalsensis* Kennedy & Jagt, 1995, NHMM 2007 076, with remains of iridescent shell, probably from Terstraten, lower part of Vaals Formation;
- E – same species, NHMM 2007 081a, internal mould of posterior portion of phragmocone, Vaals Formation. Previously illustrated by Kennedy & Jagt (1995: fig. 5/11–13);
- F – same species, NHMM 2007 059, internal mould of body chamber; definitely from Vaals-Aachen area, lower part of Vaals Formation. Previously illustrated by Kennedy & Jagt (1995: fig. 4/8–10);
- G – *Scaphites (Scaphites) hippocrepis* (DeKay, 1828) II-III *sensu* Cobban, 1969, NHMM JJ 10396 (leg. G. Busch), macroconch in internal mould preservation, CPL SA-Haccourt (Liège, northeast Belgium), Vaals Formation, upper 3 metres of ‘smectite de Herve’ facies;
- H – *Baculites vaalsensis* Kennedy & Jagt, 1995, NHMM 2006 121, Aachen-Melatenerstraße 67, lower part of Vaals Formation;
- I – *Glyptoxoceras roemeri* (Geinitz, 1850) and *G. aquisgranense* (Schlüter, 1872), NHMM 2007 079 (ex M.H. Debey Collection), small lot of silicified, fragmentary portions of phragmocone, probably from Vaals-Eschberg, Vaals Formation, Gemmenich Member, Vaalsbroek Horizon;
- J – *Acanthoscaphites (Acanthoscaphites) tridens* (Kner, 1848), NHMM 2007 089, macroconch, Aachen-Schneeberg, Gulpen Formation, Vijlen Member, interval 3. Previously illustrated by Jagt *et al.* (1999: pl. 1, fig. 1).

(All specimens are approximately 75% of natural size.)





Books for Hugh Miller Museum

Do you have any spare copies of the works of Hugh Miller, or works related to Hugh Miller? His best-known geological book is 'The Old Red Sandstone' (1841), but there are several others on geology, religion and folklore. Would you like to donate books to the Hugh Miller Museum in Cromarty? The 'Friends of Hugh Miller' aims to improve the Museum library by building up a collection of the various editions of Hugh Miller's publications. These would be available for research into the literary legacy of Hugh Miller.

Donated copies that duplicate editions already held in the collection would be sold to Museum visitors to assist The Friends in supporting displays and events at the Museum, and in the purchase of editions of Miller's work not in the library.

Donated books for this good cause can be sent to Martin Gostwick, Russell House, 55 Shore Street, Cromarty IV11 8XL, or to Prof N. H. Trewin, Dept of Geology and Petroleum Geology, Meston Building, University of Aberdeen, Aberdeen AB24 3UE.

The 'Friends of Hugh Miller' (Charity No. SC037351) supports the National Trust for Scotland properties of Hugh Miller's Birthplace Cottage and Museum at Cromarty. A recent generous donation to NTS has funded the appointment of a new Manager/Curator, Dr Alix Powers-Jones, who took up her post on 1st June. The Museum is now open daily from 12 to 5 until 30th September, and then on Tuesdays, Thursdays and Fridays in October. Other times can be arranged for group visits.

Why not sign up and join 'The Friends'? For a mere £10 (or more!) you will receive details of meetings, publications, and a newsletter with reports of events. For further information visit the website at <<http://www.hughmiller.org> />.

Prof. Nigel H Trewin

Chairman 'The Friends of Hugh Miller'

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Paul Selden

NATIONAL FOSSIL DAY



EXPLORE • LEARN • PROTECT
OCTOBER 12, 2011

<http://nature.nps.gov/geology/nationalfossilday/>



Invasion of the dinosaur

Gideon Mantell's tooth lies in New Zealand. Well, not *his* tooth, as such – presumably his – all of them indeed, or as many as survived the depredations of mid-nineteenth century dentists – are with the rest of him¹ in grave 273, plot 99, West Norwood Cemetery². Rather this is *the* tooth, the first of the relics of the *Iguanodon* that was to propel him into the ranks of the immortals, as being almost³ the first scientific discoverer of the mighty clan of the dinosaurs. I would not have known this, but for a coincidence of pebbles, brought to my attention by Garry Tee. Garry is a mathematician by profession, but he has spent much time rescuing (I think that is the right word) the scientific heritage of New Zealand. Did I know, he asked, that my musings on what a pebble⁴ might contain had been preceded by Mantell's own, very successful *Thoughts on a Pebble* – and that the original pebble in question also resided in that country, in the Alexander Turnbull library in Wellington?

Mantell's *Pebble* I did know (and it gets pride of place in the 'Further Reading', not least because of the inimitable verse of such as Mrs. Howitt on the pearly *Nautilus* – that help leaven the primeval fare of sundry Cretaceous happenings). The antipodean connection, though, came as a surprise. The details of the story are recounted in Tee (1992) and Yaldwyn *et al.* (1997). Walter Mantell, Gideon's elder son, having trained as a surgeon in Chichester, had left, apparently without warning, for New Zealand in 1839. This was something that might have been connected with the turmoil then taking place in Gideon's life, for it was more or less when his wife, Mary Anne, departed the family home for good – the family home by then being pretty well entirely converted into a museum. There may have been a little more to it than that, as we shall see, but contact with Walter was lost for some years – then resumed via letters. And then – by exchanges of specimens, as Walter himself began to explore his adopted country, and sent his father bones of the mighty Moa. Gideon may have sent the tooth then – or more likely Walter brought it back with him, when he took part of his father's collections back to New Zealand some years after Gideon's death in 1852.

The tooth was unearthed, it seems, in 1820 (Dean 1993). Gideon Mantell was then newly established in his practice in Lewes, Sussex, but as his Journal (Curwen 1940; Cooper 2010) shows, his interests were, even then, more aimed at the distant past than at the medical present. It was a year, by the bye, that should have started with a great sense of national loss, but somehow ... didn't. The king died at the end of the January, but as the king was George III, who had been in a world of his own for some years, the event, according to Mantell, 'excited but little sensation'. Mantell himself was busy digging, for things quite old ('a silver coin of Eadred') and also much

¹ With most of the rest of him: his spine, as we shall see, went elsewhere.

² It's a rather sad story. A son of Lewes, he asked to be buried in West Norwood, next to the grave of his beloved daughter Hannah Matilda, who had died, aged seventeen and a half, of tuberculosis. The service was attended by his cook, his solicitor and a local head teacher, among others – but not, it seems, by his widow. It's all in Newsletter No. 46 of the Friends of West Norwood Cemetery.

³ Almost, but not quite. William Buckland and the *Megalosaurus* beat him to it by a short whisker, as Delair and Sarjeant (1975) make clear. Therein, of course, lies another story – but not for today.

⁴ *The Planet in a Pebble* – Oxford University Press 2010.



older ('specimens of Echinites, fish, Encrinites *etc* from the Chalk Quarries'). The storms of future years were still beyond the horizon – he was then four years married and noted that 'my domestic happiness is greater than ever'. His interest in things ancient was more than a hobby – he was scientifically ambitious, having completed a geological map of the district, and preparing to publish it at his own expense.

His journal mentions the likely location of the first *Iguanodon* tooth, but only in a general sense: on 16th June of that year, he received 'a packet of bones from Cuckfield, among them was a fine fragment of an enormous bone; several vertebrae and some teeth of the Proteo-saurus'. This is about the time that Dean (1993) suggests that an *Iguanodon* tooth was first sent to him, so something of that ilk may well have been hidden amongst the Proteo-sauri. On 15th August he visited Cuckfield, he on horseback and his brother driving the 'ladies in his chaise'. He records that they found 'nothing of consequence' (Cooper 2010). Nevertheless, this is when his wife likely found several more of the mystery teeth in rock broken up for roadstone, and these (assigned to 'unknown animals' in Mantell's *Fossils of the South Downs*, published two years later) became something of an itch that he continued, in the best ur-scientific tradition, to scratch.

Mantell sent casts of one of the teeth – that is, the one that is protagonist here – to Baron Cuvier (among others) via one of his new-found acquaintances, Charles Lyell. Famously, Cuvier first dismissed the specimen as a worn example of a hippopotamus tooth, before retracting, to consider (and to publish, in his *Recherches sur les Ossemens Fossiles*) that it belonged to some unknown kind of herbivorous reptile. Even more famously, Mantell in 1824 identified the teeth as resembling those of an iguana, albeit being enormously larger, by making comparisons with a newly-prepared iguana specimen in the Hunterian Museum.

For this, it is usually thought that one Samuel Stutchbury should get at least part of the credit: a young assistant conservator there, he had prepared the specimen, and likely first noticed the resemblance between the modern, modestly-proportioned reptile and the giant of the past⁵. Stutchbury, by the bye, was also to take an Antipodean direction. His first foray, in 1826, seems like something out of a storybook. He was naturalist on a pearling expedition to the Tuamotu islands, a string of Pacific coral atolls – the largest chain of atolls, indeed, in the world. The voyage took him to New Zealand, where his collections included what became known as 'Stutchbury's cockle' – *Chione stutchburyi*.

Stutchbury was a more than competent geologist as well as zoologist. He drew the first geological cross-section made in New Zealand, and eventually went to work on the New South Wales goldfields of Australia. In better circumstances, he might have joined the ranks of the early graptolite workers, for the precious metal is hosted in black Ordovician shales that abound in these wonderful plankton. However, his employers kept his nose pressed firmly to the grindstone. In just five years, he mapped the geology of some 32,000 square miles of difficult and dangerous terrain, for which his main reward seems to have been illness, poverty and an early grave. One hopes that the adventure proved some reward in itself.

⁵ Mantell's connection with Stutchbury seems to have started yet earlier – he was exchanging specimens with a Mr Stutchbury (presumably one and the same) as early as 1819: on 30th March of that year receiving from him 'a Hamper ... containing ... some curious Antiquities and Fossils', including 'fine glass Roman tesserae inlaid with gold' and 'fossils ... from the Kentish Rag' (Cooper 2010).



Mantell, meanwhile, published his new findings at the Geological Society in 1824. He made a splash, for sure, with his new behemoth, but his diaries record little elation. He simply noted that he had received ‘numerous applications from different persons respecting the new animal whose teeth I have discovered in the sandstone of Tilgate Forest’. This might seem strange. He craved scientific recognition – fame, even – and this was recognised even in those early years as just that (his diaries later record, more in the spirit of consolation than triumph, his friend Robert Bakewell telling him that he would ‘ride on the back of (his) *Iguanodon* into the temple of Immortality!’).

Yet, the year that the *Iguanodon* found its name was also the one when domestic discord surfaced. Mary Anne Mantell, it seems was no longer happy with sharing attention with the Gideon’s expanding, time-devouring museum of antiquities. The unhappiness spread through the household, as such things do. The diaries begin to show glimpses of genuine misery, even when viewed through the emotional restraint exercised by a nineteenth century English gentleman of the old school (and that even when alone with his diary). In early 1824 he writes that ‘so unhappily have my days been spent: that I had not the resolution to record mementoes of wretchedness’ – and such sentiments are repeated with depressing regularity for the next decade and more.

Part of the despair is of a feeling of ambition thwarted. This, mark, when Mantell is in regular correspondence with – and has the respect of – the likes of Adam Sedgwick (‘famous chairman rather too lengthy in his speeches’), Lyell, Buckland and others, and is encouraged in his work on fossils by more than words (‘Received a very handsome letter from Sir James Langham presenting me with £100’). His public lectures are clearly hugely successful. And yet, there is bitter disappointment expressed in verse (‘And anxious vigils I’ve kept – In a fruitless search for fame’) and in prose (‘the disappointment of every long cherished hope’).

To what extent this disappointment was caused by the yawning gap between (merely!) solid achievement and vaulting ambition, and to what extent growing domestic unhappiness became a dark prism through which everything else was viewed, is uncertain. The journals do include some telling asides (‘Marriage, marriage, spoils them all’). And, the sharp intuition of the Friends of West Norwood Cemetery offers another, more prosaic interpretation of the lute of domestic harmony rifted by a houseful of divers petrifications. For Gideon had an eye, as these custodians remark, for the tender gender (to clothe the allusion in the spirit of the age): comparing the teeming crowds at the Crystal Palace exhibition with the ‘lovely female figures of the sculptor. Oh! – how I wished I had the power to petrify the living and animate the marble...’. In the journal too, he sees the wife of the composer Thomas Bayley as ‘a very tempting syren by the bye’, and composed an ode to a visiting actress, Kate O’Brien, in which he expressed his feelings quite explicitly:

But alas! Since I’ve married as many as now
Our unfeeling laws to *one* man will allow
Ere
Though I cannot but envy the times of the flood
When a fellow might *Hymenize* just as he would



Mary Anne, therefore, might have had rivals – at least in imagination – more animated than fossils. If so, this couldn't help but concatenate the usual domestic misunderstandings – though, perhaps the situation had already gone past the reach of diplomacy. In another age, Gideon might have lived a happy life as advisor to Hollywood dinosaur extravaganzas (he was a genuinely inspired popularizer of the prehistoric) – and Mary Anne could at least have had a mogul's ransom as alimony.

The year 1840 seems to have been the nadir. That was when his wife (and, in effect, Ellen, his eldest daughter) finally left him, after Walter had abruptly departed to seek his fortune – or at least a solid future – in New Zealand. A few months later, his favourite daughter, Hannah, of 'sweetness of disposition, and affectionate heart,' finally succumbed to tuberculosis, leaving him only in close and non-conflictual contact with Reginald, his younger son. A little while later, he had a coach accident that caused, or exacerbated, scoliosis of the spine⁶, and this gave him more or less acute physical pain for the rest of his life. He dulled the pain with massive doses of opium – one of which was ultimately to kill him.

Curiously, the tone of the diaries picks up from then on. The pain and discomfort are there, for sure, with better days and worse days. But the existential angst, the frustrated ambition, seem much more muted. Instead, he seems to take genuine pleasure and satisfaction with the various scientific meetings, not just with Lyell, Murchison & co, but with the likes of Faraday and Herschel. Even the sharp disagreements with that sharp-elbowed aristocrat of Victorian palaeontology, Richard Owen ("the picture of malevolence") are written more in justified anger than in despair. There is genuine pleasure in the work that he does with Reginald, who inherited his father's interest in science – and in the renewed contact with Walter, as the crates of giant bird-bones arrived at his door.

The 'Cuvier tooth' – and perhaps the pebble⁷ – might have been sent then by Mantell, *en revanche* as it were. Or, Walter might have taken them, on a visit to England after Gideon's death. No matter: part of Mantell's legacy has crossed the Earth: fossils, as spectacularly derived as any, translocated in both time and space, to confuse the palaeontologists of the far future. His name has made it there, too, in the form of a mountain named Mantell.

In this he is, at least, among friends (though none maybe so close as his favourite, Hannah, a few footsteps away from his mortal remains in Norwood). For New Zealand – again, thanks to the indefatigable researches of Garry Tee (2006–7) – is seen as a place which, in its geography, he suggests, may have honoured more scientists than the rest of the world put together.

There are the usual immortals (Einstein, Davy, Faraday and so on). But, also a fine roll-call of geologists and palaeontologists. There are Murchison and Ramsay, Forbes and Jukes. Lyell has a mountain, a range, a creek, a chasm – and then snaffled a settlement. It's a good job the country has so many ups and downs – on an ancient peneplain it would have been much harder to fit such a collection of the great and the good.

⁶ Mantell's spine, apparently on the order of Owen, was placed in the Museum of the Royal College of Surgeons in London and then – in 1969 – destroyed for lack of space, as Fairbank (2004) recounts. Philistinism in museums clearly has deep roots.

⁷ Carefully chosen, it was – if you look at the frontispiece of Mantell's most popular work, then you will see a flint pebble with imprints of both a shell and a fine sea urchin.



So – there is the memory of Mantell, in his remains and in his own words. The country doctor, though, wrote not so much of the doctoring, though there are a few accounts, a little grim, of the early equivalent of industrial accidents and the subsequent (usually unsuccessful) amputations⁸. His interest, though, was aroused by the cholera outbreak in London (that, at its height, was ‘carrying off from 200 to 400 daily’) and – shades of Conan Doyle – by the dodgy forensic evidence that – without his intervention – would have hanged a young woman, Hannah Russell, accused of poisoning her husband. And then, there are the leeches, which turn up regularly – not in any special way, but simply as a matter-of-fact part of doctoring, sufficiently trustworthy to apply to his own children. Indeed, when Walter, as a small child, was ‘attacked ... with an inflammation of the lungs’, his father applied two leeches to his chest, which ‘greatly relieved him’. Self-medication was in order, too: when afflicted with ‘giddiness of the head’, he applied fifteen leeches to his forehead; relief came again, in this case.

The leech – *Hirudo medicinalis* – was simply, then, a normal part of the medical cabinet. But how, in those days, did one get a leech? Supplying a leech was then a trade – and leeches were not farmed, but hunted. Or – as William Wordsworth more politely put it – gathered. The leeches lived – or rather, used to live – in shallow muddy ponds and ditches. The leech gatherers would walk in (or sometimes, send a horse in, for this was the prey of choice of *Hirudo medicinalis*). When the leeches stuck, the gatherers struck, and it was one more for the basket.

Wordsworth’s description was based on a real encounter. It has a good deal that is very Wordsworthian⁹. Thus the birds sing in the distant woods, the sky rejoices in the morning’s birth, the hare races in her mirth upon the plashy earth, and suchlike: the kind of stanzas, in fact, that P.G. Wodehouse pounced upon with glee, to give to Bertie Wooster to mangle and the omniscient Jeeves to disentangle.

The entrance of old man that gathered leeches, though, cuts through the pastoral mist. He was old, and poor, engaged in ‘employment both hazardous and wearisome’, specifically:

*‘From pond to pond he roamed, from moor to moor
..... stirring thus about his feet
The waters of the Pools where they abide’*

In that single lifetime, the old man saw the death of the trade

*‘Once I could meet with them on every side
But they have dwindled long by slow decay
Yet still I persevere, and find them where I may’*

Wordsworth saw this as spiritual nobility, and later renamed the poem *Resolution and Independence*. Wordsworth’s sister Dorothy, in her *Grasmere Journal*, remembered the encounter a little differently – though the resolution grows, if anything, in her even bleaker take on the encounter. The old man could no longer make his money from leeches, because they had grown too scarce (a practical woman, she noted that the price had risen from two shillings and sixpence, to thirty shillings a hundred). He had been injured in driving a cart (‘his leg broke his body driven

⁸ He wrote more of this, though, in his *Memoirs of the Life of a Country Surgeon*. And he was skilled; the success rate he seems to have had as an obstetrician – less than one maternal death per thousand cases – he attributed to ‘a very light hand, and delicacy of touch’ (Morris 1971).

⁹ ‘Convincing all, by demonstration plain – Poetic souls delight in prose insane’, as Byron put it.



over, his skull fractured”) and was now a beggar. This was in 1800, a couple of decades before Mantell’s journal entries on medical bloodletting.

All of that led, in Britain, to the death – almost – of the species. By the early 20th century it was thought extinct on this island – gathered out from every pond and ditch in the country, its cause not helped by the widespread draining of wetlands: a testament, nevertheless – in a sense – to the skill and fortitude of the leech-gatherers.

The leeches didn’t quite disappear, but were reduced to what one might term ‘critically endangered’. They survived – it seems – in a few pools in the more lonesome parts of Romney Marsh (not too far from Mantell’s stamping ground). One of these turned up in 1978 – to no little surprise and even a little fanfare – attached to a dog that had been swimming in an old gravel pit in Dungeness. What is left of the species is now protected in the wild. It is bred, though, in captivity, for medically the leech has made a bit of a comeback: good if one needs to re-attach a finger or toe, it seems – a nice clean bite. Nevertheless, the fact that a large and complicated island, which remains full of ponds and ditches, can be almost scoured clean of a common invertebrate – *by hand*¹⁰ – seems an almost shocking reminder of our ability to re-organise (or perhaps de-organise) the biology of the Earth.

Almost shocking. For Britain is an island where humans, of various species, have trod for over half a million years. The really shocking stuff is on islands that have remained human-free until much more recently. Like New Zealand, for instance. The moa bones that Walter Mantell so enthusiastically collected were of creatures that, we now know, were not just one extraordinary race but encompassed 11 or so species. The largest of these, *Dinornis robustus*, was truly monstrous, twice the height of an adult human, as when seen as in the well-known illustration of its skeleton towering over Richard Owen – who places a paternal hand on its shoulder. Owen looks to be standing against a heavy-beaked, two-legged feathered giraffe, if one can image such a chimera¹¹. The image may be a touch misleading, as modern work suggests that the moa held its neck more horizontally than vertically, so the creature would have looked one in the eye¹².

K-selective to a fault, the moas laid few eggs, and grew slowly. When the ancestors of the Maori people arrived on New Zealand a little before 1300 AD, the giant, but strictly vegetarian and entirely flightless birds – no wings, not even vestigial ones – stood little chance. A century later, they were pretty well all gone – despite claims, which persist to the present, that a few elusive individuals still survive in remote mountainous parts¹³. The only pre-human predator of the moas, Haast’s eagle – that had been the largest of all the eagles – disappeared at the same time.

The Maoris did not only take away. They brought dogs with them, and the Polynesian rat, and these settled, too. They were modest additions, though, by comparison with the transplanted menagerie of the Europeans: pigs, goats, mice, yet more rats, cats, rabbits, stoats, ferrets, weasels – the list has grown ever longer, and when one adds plants and looks at this phenomenon in relative rather than absolute terms, then one gets a sense of its scale. Jeff McNeely (2001) attempted to assess the number of invasive versus native species across the world, and for New Zealand suggested that, just as regards plants, there were 1,570 invasive species compared

¹⁰ Well, by bare leg.

¹¹ Dr Who scriptwriters, please note.

¹² Which has its own dramatic possibilities, of course.

¹³ But, unlike the Romney leeches, it is virtually certain that none have clung on.



with 1,790 native species. That is almost one-to-one. For terrestrial mammals, of course, it is now many-to-one, for prior to human arrival there were only three mammals – all bats – on this land¹⁴. The invaders are bad news for the natives. The iconic brown kiwi, *Apteryx mantelli* (named after Walter), for instance, is hit hard by the stoats and dogs, and is down to a few tens of thousands.

The world has changed, for sure, and there has been a merry-go-round of species, going by boat, and now by plane, to re-populate the Earth. They have not, of course, taken the direct route of going *through* the Earth, Jules Verne-style, though a recent discovery means that an animal can go farther than one might think along such a route. This is Borgonie *et al.*'s recent demonstration (moderately convincing, I thought) that nematode worms might penetrate down to as far as three kilometres below the Earth's surface. There, they graze, ever so slowly – for metabolic rates are *low* down there – on deep-living microbial colonies that inhabit rock fracture surfaces. That kind of discovery, they say quite reasonably, might colour one's perspective of looking for life – or fossils, of course – on other planets.

On this planet, though, to continue along the thread of a global biology transformed, the thing that has most struck me this past quarter, is to look at life not simply as regards extinctions and critical endangerment (that fine recent review of Barnosky *et al.* 2011), or even invasions – as in McNeeley's paper, or a near-equivalent for the sea, by Molnar *et al.* (2008). It is simply our weight. Not individually (perish the thought) or intellectually (it's the lowbrow that attracts me, personally) – but collectively. Vaclav Smil has been trying to work out this kind of thing – again in relative terms (rather more difficult, that, than simply multiplying average body mass – wet or dry – by seven billion). The results (Smil 2003), to me, are in some realm beyond shock.

Of all terrestrial vertebrates, counted by relative mass, we, *Homo sapiens*, make up about a third. The creatures we keep to consume – cows, pigs, sheep and so on – make up most of the other two-thirds. Wild animals – all the elephants, gazelles, cheetahs, platypi and such of the nature documentaries – make up something of the order of five per cent. Forget the alien worlds – this is now the science fiction planet, and the future palaeontology it generates will be remarkable.

This is all a long way from Mantell's tooth? Perhaps so. The journey it took was just a part of the human transmigration that, true enough, did not start then. Nevertheless it was a tiny – but quite representative – part of the acceleration in this trend, that went on to create our world. Heaven knows what will stay untouched as this history continues. Hopefully the pebbles, at least, will keep rolling along the beach.

Jan Zalasiewicz

Acknowledgements

I'm indebted to Garry Tee for sparking off the original idea behind this column, for sending much literature on the early scientific history of New Zealand (only a fraction of which I've used), and for suggestions and corrections to the draft manuscript.

¹⁴ And, yes, there are invasive leeches as well: *Helobdella triserialis* – it took DNA bar-coding to establish that, but it's from South America: the evidence is in Siddall and Budinoff (2005). Prospective holidaymakers shouldn't worry – it doesn't feed on human blood, but if you have a pet worm on you, it may well go for that.



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PalaeoMath 101

Centroids, Complex Outlines and Shape Functions

In the last column we learned how to use a powerful mathematical technique—the Fourier series—to characterize the shape of any single-valued outline no matter how complex by breaking it down into a set of consistently defined geometric descriptors (= shape variables) that we could then use to both analyze and model patterns of shape variation within any sample. However, as powerful as Fourier analysis is, the classic or ‘radial’ approach has several built-in disadvantages. Chief among these is the requirement that all outlines included in the sample be ‘single-valued’ (Fig. 1).

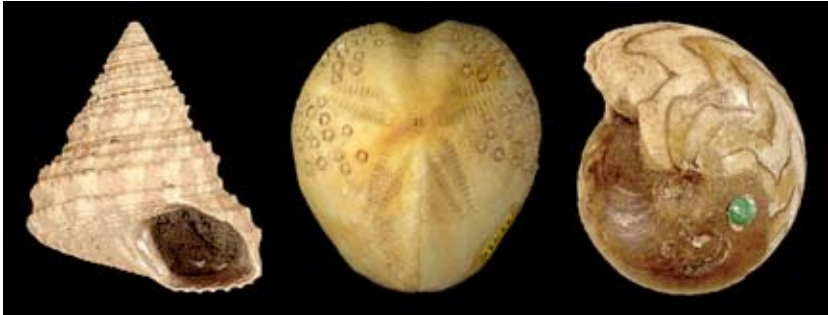


Figure 1. Fossil specimens exhibiting single-valued outlines.

Geometers call a closed curve ‘single-valued’ when any radius vector drawn from the outline’s centre crosses the outline in one and only one location. For this class of outlines the radius-vector sampling scheme we discussed and illustrated last time effectively transforms the outline into an empirically defined mathematical function.¹ Once a set of outlines has been re-described in terms of their function-equivalent geometries, it’s possible to use the Fourier series to tease apart their forms/shapes and assess the sample for patterns of form/shape similarity and difference. However, many biological forms are characterized by multi-valued outlines, in which at least some radius vectors cross the boundary at more than one location, or in which the very idea of an outline centre is problematic for one reason or another (*e.g.*, the mean x,y coordinate location falls outside the object’s boundary, see Fig. 2).

¹ In mathematics, a function is a relation in which any input value (x) has exactly one output value (y). Hence the expression $x + 2 = y$ is a function whereas the expression $x + 2 = 3$ is not.



Figure 2. Fossil specimens exhibiting multi-valued outlines.

These curves cannot be analysed using a standard radial Fourier sampling scheme because they cannot be transformed into valid mathematical functions. In these cases the trick is to find a way of converting the complex outline into a configuration that (1) preserves as much of the geometric information of relevance to the scientific question at hand as possible and (2) has the form of a mathematical function. Before we begin our discussion of non-radius vector-based shape functions though, we need to take care of an ugly little detail left over from our previous discussion of radial Fourier analysis.

This detail focuses on calculation of the centroid of the outline. Radial Fourier analysis requires location of the centre, or centroid, because it is from that point that the set of radius vectors used to describe the outline emanate. As you may recall, a basic assumption of radial Fourier analysis is that the set of adjacent radius vectors subtend equal angles as they move around the outline. This ensures that the form or shape has been sampled evenly and—more importantly—that the mathematical representation of the form/shape has not been biased by inconsistencies in the placement of the radius vectors relative to each specimen's geometry.

In the simplest of situations some sort of landmark point that lies relatively close to the form's centre can be found on all of the specimens in the sample. In this case the data analyst is perfectly justified in using this landmark point as the shape's 'centre' from which a set of coordinate points can be located such that the angles between adjacent radius vectors are equal (Fig. 3). Since this landmark point is defined by a consistently and universally relocatable point defined and accepted *a priori* as the reference point for the geometric description of each shape, the equi-angular sampling criterion will always be true.

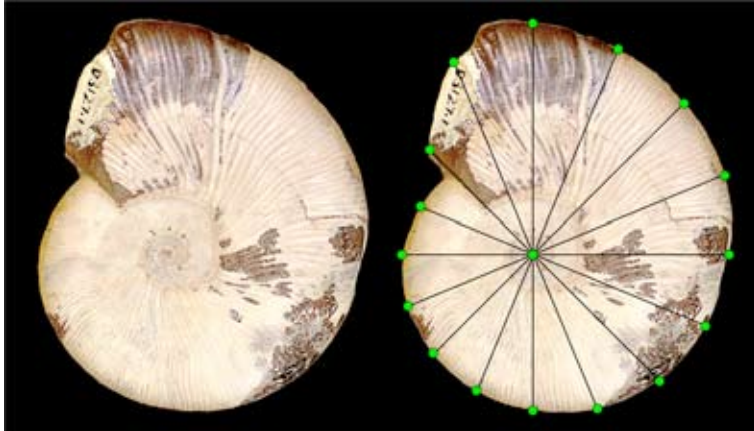


Figure 3. Fossil maoritid ammonite sampled using an equi-angular radius vector sampling scheme with the scheme's centroid being placed at the position of the specimen's proloculus. Note this centroid location is not synonymous with the outline's geometric centroid. Nevertheless, this location has the advantage of being able to be located on (virtually) every maoritid specimen and represents a point of unquestionable biological and geometric significance.

But what happens if we don't have an objectively locatable landmark point in this region of the shape that can be used as the reference? The fallback convention is to calculate the geometric centroid of the outline as the mean of all x -coordinate values and the mean of all y -coordinate values.

$$\bar{x} = \sum_{i=1}^n x_i / n \tag{23.1}$$

$$\bar{y} = \sum_{i=1}^n y_i / n \tag{23.2}$$

Where:

x_i = i^{th} x -value

y_i = i^{th} y -value

n = total number of specimens in sample

Once this centroid has been obtained it can be used first to mean-centre the outline and then to calculate an initial estimate of the raw set of radius vectors by converting the x_i, y_i coordinate values into their r_i, θ_i polar coordinate equivalents.

$$c_i = \sqrt{(x_i^2 + y_i^2)} \tag{23.3}$$

$$\theta_i = \tan^{-1}(y_i / x_i) \tag{23.4}$$



Next, a set of new radius vectors is calculated such that the angles subtended between adjacent vectors are equal. The maximum number of Fourier amplitude and phase angle coefficients (= harmonics) that can be calculated from any given collection of boundary outline coordinates is set by the following relation.

$$\begin{aligned} k &= (n - 1) / 2 && \text{if } n \text{ is odd} \\ k &= n / 2 && \text{if } n \text{ is even} \end{aligned} \quad (23.5)$$

In these equations k is the number of Fourier harmonics and n the number of x,y points used to describe the outline. This relation is often referred to as the Nyquist frequency. If the Fourier series is expanded beyond the limit set by the Nyquist frequency, errors will result due to aliasing of the spatial signal.

From a practical point of view the problem which the Nyquist frequency limit imposes on Fourier calculations is one of interpolation. These days it's almost always the case that digitizers collect boundary outline coordinates that are not arranged in an equiangular series with respect to any central point. Conversion of a sequence of outline coordinates to an equiangular series usually amounts to working through the following procedure.

1. Deciding how many harmonics are necessary to describe the form(s) under consideration adequately
2. Calculating the angle between successive radius vectors as $\theta = 360 / 2k$
3. Determining the lengths of the $2k$ equiangular radius vectors by searching the original data that have been converted to polar coordinate form, locating empirical radius vectors that lie on either side of the desired radius vector, and estimating the length of the desired radius vector via linear interpolation

The radius vectors calculated as a result will be equiangular relative to the initial outline centroid, the position of which was estimated using all the coordinate points in the digitized outline (equations 23.1 and 23.2). Unfortunately, this does not mean these $2k$ radius vectors will be equiangular with respect to their own centroid. As the Fourier series equations we used in the last essay assume strict equi-angularity among the radius vectors, any deviation from this condition will introduce error into the calculation of the harmonic amplitudes and phase angles.

Schwarz and Shane (1969), Full and Ehrlich (1982) and Boon *et al.* (1982) were the first to bring this problem to the attention of the geological community, originally in the context of the analysis of sedimentary particle shape. To resolve this problem they recommended comparing the centroid of the set of radius vectors that will be used to calculate the Fourier harmonics (= harmonic spectrum centroid) to the initial centroid used to calculate the total set of radius vectors. If the harmonic spectrum centroid lies within a tolerance envelope about the initial centroid, no adjustment need take place. Full and Ehrlich (1982) recommend this tolerance envelope have a value of '0.007 pixel values', which seems to be an empirically determined limit based on their experience with sand grain shape analyses. My own experiments with radial Fourier centroid estimation suggest that a tolerance envelope about the initial centroid of 1.0 percent of the outline's maximum x , or maximum y dimension (whichever is longest) delivers approximately the same level of consistency.

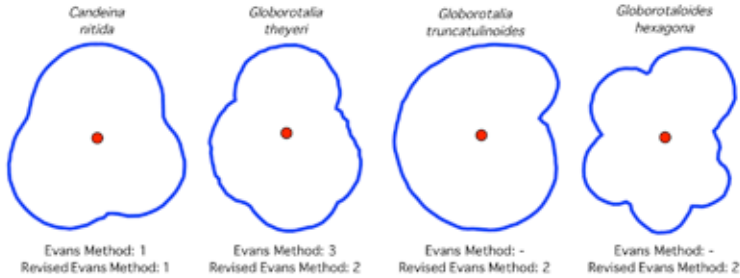


Figure 4. Outlines of four planktonic foraminifer species with statistics on how many adjustment iterations were required to find a stable centroid location using both the Evans and Revised Evans methods. Note that the centroids of *Globorotalia truncatulinoides* and *Globorotaloides hexagona* did not converge even after 40 iterations under the Evans Method.

Obviously, if there is no need for adjustment of the initial centroid, radial Fourier analysis can proceed as outlined in the previous column (see also Fig. 4). In some instances though, the positions of the initial and harmonic spectrum centroids will differ by a value greater than this tolerance envelope. For these cases Full and Ehrlich (1982) offer two iterative estimation procedures.

The first is termed the ‘Evans Method’ after David Evans who devised the solution originally (see also Boon *et al.* 1982). This method involves drawing a chord from the harmonic spectrum centroid back to the initial centroid and locating a new centroid at a position equal to twice the deviation between these two centroids but in the opposite direction. Algorithmically, this new centroid value can be found as follows.

$$\hat{x}_h = \bar{x}_h - 2\bar{x}_i \tag{23.6}$$

$$\hat{y}_h = \bar{y}_h - 2\bar{y}_i \tag{23.7}$$

Where:

\bar{x}_i, \bar{y}_i = coordinates of the initial centroid

\bar{x}_h, \bar{y}_h = coordinates of the (old) harmonic spectrum centroid

\hat{x}_h, \hat{y}_h = coordinates of the (new) harmonic spectrum centroid

Once calculated the new estimate of the harmonic spectrum centroid can be used to recalculate the polar coordinate transformation of the original *x,y* outline data and the harmonic spectrum radius vectors. The tolerance envelope test is then repeated. If the new initial and harmonic spectrum centroids fall within the tolerance envelope, the estimation procedure is terminated and the radial Fourier spectrum calculated. If not, the centroid is re-estimated again using equations 23.6 and 23.7, after which all calculations are repeated.

A number of empirical studies have reported that this procedure is usually sufficient to stabilize the centroid locations for the majority of single-valued, closed-curve outlines, usually within ten centroid-estimation iterations or less (Full and Ehrlich, 1982, Healy-Williams 1983, Pharr and Williams 1987, Healy-Williams *et al.* 1997). For those outlines whose centroid does not converge using the Evans Method, Full and Ehrlich offered a ‘Revised Evans Method’ which locates the new estimate of the harmonic spectrum centroid as the point mid-way between initial and (old) harmonic spectrum centroids. In terms of calculations, the Revised Evans Method can be implemented as follows.



$$\hat{x}_h = \bar{x}_h - 0.5\bar{x}_i \tag{23.8}$$

$$\hat{y}_h = \bar{y}_h - 0.5\bar{y}_i \tag{23.9}$$

These authors claim that the Revised Evans Method can find stable centroids for approximately half of the single-valued outlines whose centroids failed to converge under the Evans Method (see Fig. 4). Still, a rump of outlines is left whose centroids fail to converge under either method.

Inspection of Figure 4 also suggests some rough guidelines that could be useful for determining whether an outline is likely to run afoul of the centroid-estimation problem. Based on this analysis, as well as my own experience, outlines composed of two or more unequal lobes (e.g., *Globorotalia truncatulinoides*, *Globorotaloides hexagona*) are often problematic. This is because the number of radius vectors falling into each of the two lobes can differ, with the local size differential between the lobes often accentuating the effect of that difference. In these cases the centroid estimate often settles into a quasi-stable oscillatory pattern outside the tolerance envelope. Somewhat counter-intuitively three-lobed (e.g., *Candeina nitida*) or four-lobed (e.g., *Globorotalia theyeri*) outlines don't seem to suffer from centroid instability problems to anywhere near as great an extent as two-lobed and some multi-lobed forms. Also, based on my experience, the Revised Evans Method does indeed turn in a better performance in finding a stable centroid than the standard Evans Method, especially if relatively small numbers of harmonic amplitudes are being used to characterize the shape.

What difference does it make to a radial Fourier analysis if you don't get the centroid right? Figure 5 shows the result of using the initial and tolerance envelope-adjusted centroid for *Globorotalia truncatulinoides* to calculate the harmonic amplitude spectrum.

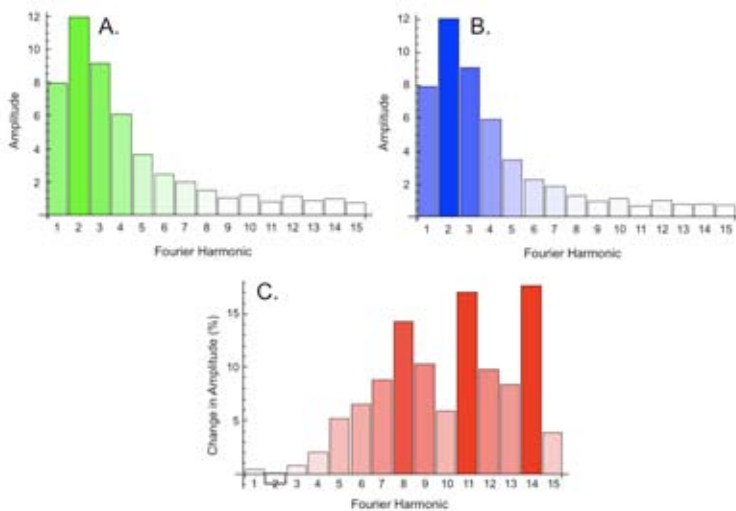


Figure 5. Harmonic amplitude spectra for *Globorotalia truncatulinoides* using the raw outline centroid (A) and the Revised Evans Method adjusted outline centroid. Although the spectra for these two analyses may appear superficially similar, calculation of the percentage difference of the harmonic amplitude values (C) shows that the shift in centroid location had both a significant and a highly unpredictable effect on the Fourier amplitude values, with three harmonics exhibiting a greater than 10% change.



Full and Ehrlich (1982) provide a theoretical discussion of the effect that centroid repositioning has on calculation of the radial Fourier harmonic spectrum. For the purpose of this discussion it is sufficient to point out the magnitude and non-linearity of the deviations in the harmonic amplitude spectrum. Since these amplitudes represent the independent ‘characters’ used by Fourier analysis to summarize and model shape variation, instabilities on the order of 10% in the values of these parameters—due entirely to geometric inconsistencies in centroid placement—should be avoided wherever possible.

In addition to this issue of instability of the harmonic spectrum, one must also consider the fact that it is impossible to obtain centroid convergence for some outlines. When this occurs two options present themselves. Either the unstable outline must be eliminated from the dataset, or some manner of representing the geometry of the objects’ outlines that does not require location of each outline’s centre must be employed. Fortunately, a number of strategies have been developed to describe outline shape variation without having to find the outline’s centre, not only for cases of pathological single-valued outlines, but additionally for the far more common situation in which the objects under consideration (or some subset thereof) are characterized by multi-valued outlines. It is to these more generalized shape-characterization approaches that we will now turn our attention.

Oddly enough, the oldest of these procedures involves a form of image processing that strikes many data-analysts as rather extreme. For those objects or images in which one axis is markedly longer than the other, giving rise to multiple-value outline issues as a result of pathological variation in the outline in regions of the form remote from the centre, it is often possible to resolve the problem by slicing the image into two halves along the long axis and pivoting or reflecting one of the halves so that its *x*-pixel/coordinate values are reversed (Fig. 6). This has the effect of ‘unfolding’ the outline along the specimen’s long axis, and in so doing transforming the closed outline curve into a periodic waveform. Such periodic data are exactly the sort that Fourier analysis was developed to analyse originally. Accordingly, analysis of these wave-form data proceeds in a straightforward manner. The curve is digitized at equally-spaced intervals at a resolution that corresponds to twice the number of Fourier terms desired in the harmonic spectrum, and the locations of these points along the *y*-axis (= equivalent to the lengths of the radius vectors) recorded.

Revising the notation we developed for the radial Fourier series calculations, we can analyse the curve presented in the lower portion of Figure 6 using the following (standard-form) Fourier series equations.

$$y_j = \bar{r} + \sum_{j=1}^k [a_j \cos(j \cdot \beta) + b_j \sin(j \cdot \beta)] \quad (23.10)$$

Where:

r = length of a sampled (radius) vector along the *y*-axis

β = angle of sampled vector in radians

\bar{r} = average of all sampled (radius) vectors

j = Fourier harmonic number

k = total number of harmonics in Fourier series

a_j = amplitude of the cosine term for the *j*th harmonic

b_j = amplitude of the sine term for the *j*th harmonic

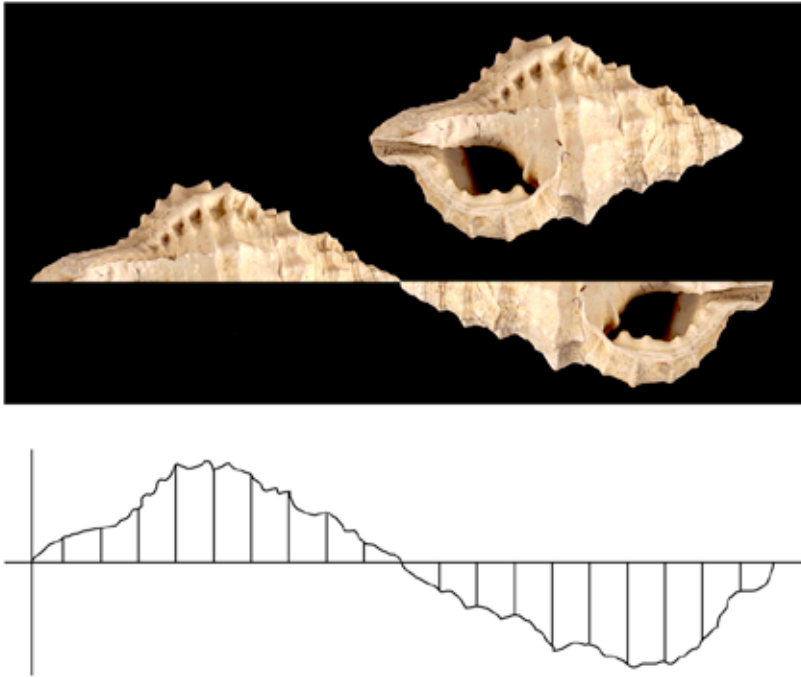


Figure 6. Transformation of the boundary outline curve characterizing the fossil gastropod *Sassia* to a periodic waveform by slicing the image in half along the specimen's long axis and pivoting or reflecting the lower (=left) half at the position of the proloculus such that the outline forms a continuous, single-valued curve. See text for discussion.

The amplitudes of the sine and cosine terms for equation 23.10 can be calculated using the following expressions.

$$a_j = \frac{2}{n} \sum_{i=1}^n r_i \cos(j \cdot \beta_i) \tag{23.11}$$

$$b_j = \frac{2}{n} \sum_{i=1}^n r_i \sin(j \cdot \beta_i)$$

Where:

- n = total number of sampled points along empirical curve
- r_i = distance between i^{th} point and y-axis
- j = Fourier harmonic number
- β_i = angle of the i^{th} radius vector in radians

Finally, the values of the amplitude and phase angles for each term in the harmonic spectrum can be calculated using these standard expressions (equations 23.3 and 23.4).



The harmonic spectrum for the first 15 terms of the *Sassia* Fourier series calculated on the basis of the waveform curve shown in Figure 6, and a comparison of original and reconstructed outlines based on these 15 harmonics, are shown as figures 7 and 8.

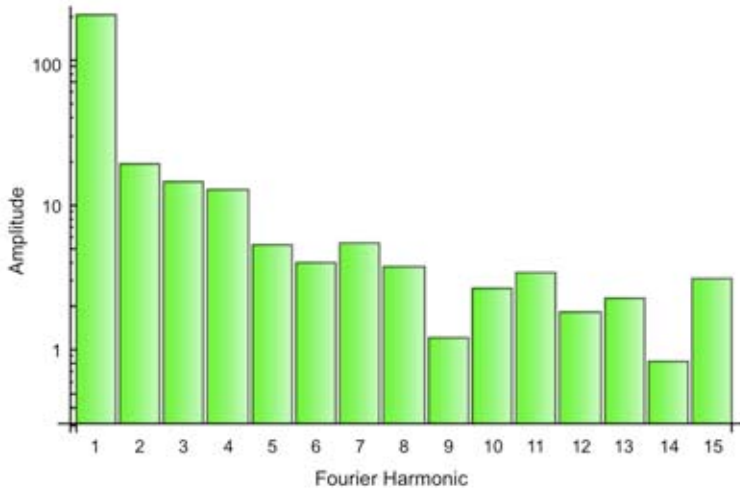


Figure 7. First 15 amplitude (c_j) values in the harmonic spectrum of the *Sassia* processed outline. Note logarithmic scale indicating that the overwhelmingly predominant shape component is that of a single sinusoidal waveform of length 1.0. See text for discussion.

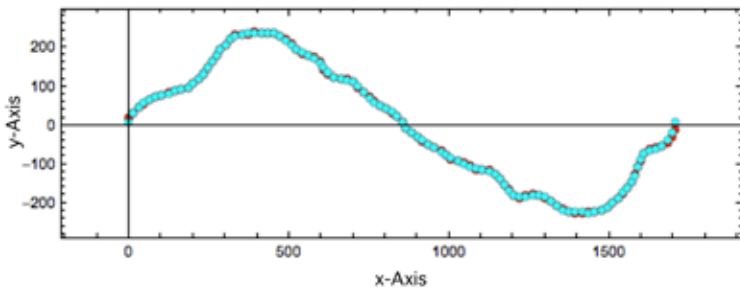


Figure 8. Original (red) and reconstructed (cyan) *Sassia* outline curves calculated based on a 15 harmonic Fourier amplitude and phase angle spectrum.

Although we're still at the beginning of our discussion of outline-based data analysis methods, I hope you can already appreciate the power of techniques such as Fourier analysis for describing, quantifying, and modelling organic forms in a way that has meaning in a wide range of biological and systematic contexts. Use of these methods has been somewhat eclipsed by the understandable enthusiasm with which landmark-based approaches to shape analysis were embraced by the morphometric community, aided and abetted by an inflexible—almost ideological—stance on Fourier analysis taken by several early proponents of geometric morphometrics. Over the next several essays we'll work our way through a set of increasingly



more sophisticated and generalized approaches to outline analysis until finally arriving at a true synthesis between these two (supposedly) separate approaches to form/shape characterization.

In terms of software, virtually all higher-level statistical data analysis packages for personal computers implement one or more Fourier analysis routine. While discrete-form, radial Fourier analysis is rarely included in these packages, a little work understanding what their Fourier routines are designed to do usually results in the identification of a procedure or modification of the data format that should allow you to implement Fourier analysis yourself. Unfortunately, the problems inherent in the centroid stabilisation issue are unique to radial Fourier analysis and so are not covered by any pre-programmed package with which I am familiar. Regardless, it's an easy matter to program a simple Excel spreadsheet routine that will allow you to check radius vector datasets to determine whether any of your specimens have a problem with unstable centroid locations (see the *PalaeoMath 101* spreadsheet). This having been said, the fact that so few data analysts make use of landmark points that lie at or close to the form's central region has always struck me as odd. If such a landmark is available, not only is the centroid stability issue easily and elegantly avoided, the biological interpretability of the shape analysis as a whole is often improved dramatically.

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Don't forget the *PalaeoMath 101-2* web page, at:

<http://www.palass.org/modules.php?name=palaeo_math&page=1>



>> **Future** Meetings of Other Bodies



6th Symposium of IGCP 507

China University of Geosciences, Beijing, China 15 – 20 August 2011

We are pleased to announce that the China University of Geosciences will organise the 6th Symposium of the International Geoscience Program IGCP 507, which will be held on 15–20 August 2011, in Beijing, China. The symposium aims to create an opportunity to discuss the Cretaceous biodiversity, faunal change, environments and climate in Asia based upon the studies of palaeontology, palaeoecology, stratigraphy and sedimentology.

The symposium will include two days of oral and poster presentations including a half-day main workshop on “the Early Cretaceous Jehol Biota of China”. It is followed by regular sessions on palaeoenvironments, stratigraphy, palaeontology and tectonics. In regular sessions there will be a variety of talks and posters on regional geology, stratigraphy, vertebrate and invertebrate fossil faunas and environments in the eastern part of the Asian continent during the Cretaceous.

A post-symposium field excursion will be organized to observe the non-marine Cretaceous deposits in Western Liaoning, which contain abundant mega- and micro-fossils. In a four-day long post-symposium field excursion, we will visit some important sites for the Cretaceous Jehol Biota, stratigraphy, and depositional environments in Western Liaoning.

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21st Canadian Paleontology Conference

Vancouver, British Columbia, Canada 19 – 22 August 2011

The 21st Canadian Paleontology Conference will be held in Vancouver in August 2011. The website for this meeting is at <<http://132.156.108.208/cpc/>>. The meeting will end with Field Trips to the Coast Mountains and Gulf Islands.

Specific Dates and Venues:

19th August 2011: Registration, Reception, Meetings

20th August 2011: Conference and Banquet

21st August 2011: Field trip 1: Harrison Lake

22nd August 2011: Field trip 2: Saltspring Island



The CPC will be held at the University of British Columbia with accommodation available on campus. The Reception will be held in the Pacific Museum of the Earth, part of UBC's brand new Earth Sciences Complex. The intention is that the Conference will be held in the Irving K. Barber Learning Centre, and the Banquet (and optional music jam session) in the magnificent Beaty Biodiversity Museum and Research Centre. The anticipated Registration Fee (including the banquet) will be approximately \$200 (student and public rate will be less than half this amount); firm rates will be posted in March 2011.



The 15th International Symposium on Dental Morphology

Northumbria University in Newcastle upon Tyne, UK 24 – 27 August 2011

The 15th ISDM will be held on 24–27 August 2011 at Northumbria University in Newcastle upon Tyne, sponsored by the Newcastle University School of Dental Sciences. This symposium will bring together scholars from around the world to present research in all aspects of dental morphology. The range of presentations will be broad and include topics such as dental anthropology, dental evolution, dental function, growth and development, dental tissues, and the genetics and clinical aspects of dental morphology. For information, registration, and accommodation bookings, please visit our website at <<http://www.ncl.ac.uk/dental/ISDM/index.htm>> or for other queries, e-mail <Wendy.Dirks@ncl.ac.uk>.



9th International Conference on Modern and Fossil Dinoflagellates (DINO9)

University of Liverpool, UK 28 August – 2 September 2011

The international conference on modern and fossil dinoflagellates is a longstanding conference series that began in 1978 in Colorado Springs, Colorado with a Penrose Conference organised by Bill Evitt. The overarching aim of the series is to bring together researchers working on present day dinoflagellates with those working on dinoflagellates in the fossil record to foster interdisciplinary understanding and collaboration. Over the years the conference has attracted dinoflagellate workers from across the world who have come together to deepen their understanding of this fascinating group of organisms and gone away with new perspectives and new research avenues to explore.

Further details can be found on the conference website at <<http://pcwww.liv.ac.uk/~dino9/>>.



**44th Annual Meeting of the American Association of Stratigraphic Palynologists
(The Palynology Society)**

University of Southampton, UK 4 – 7 September 2011

This year's AASP Annual Meeting will be held at the National Oceanography Centre, University of Southampton, England, and will be a joint meeting with The Palynology Group of The Micropalaeontological Society. The National Oceanography Centre, a collaboration between the



Natural Environment Research Council and the University of Southampton, is the largest institution of its kind in Europe, a £50m purpose-built centre which opened in 1995.

The AASP meeting will run consecutively after Dino9 (see above) at the University of Liverpool. The two-day technical sessions will be accompanied by two one-day pre- and post-conference fieldtrips to the Dorset coast and the Isle of Wight respectively, and there will be a conference dinner aboard HMS Warrior in Portsmouth Harbour.

The conference website at <<http://www.southampton.ac.uk/aasp2011>> is now open for registrations, abstract submission, *etc.* Delegates will be responsible for booking their own accommodation for the conference from the selection listed on the conference website. The deadline for pre-registration, abstract submission and field trip bookings is 31st July 2011.



8th International Triassic Field Workshop 2011

Toulon area, Southern France 4 – 8 September 2011

During the highly successful 2010 Triassic Workshop in the Dolomites it was suggested to hold the 2011 workshop in Southern France. The Triassic of the Toulon area provides a unique opportunity to study the transition between the Germanic and the Tethyan facies. Our colleagues Marc Durand (Nancy-Laxou), the co-organiser of the 3rd Workshop, Jean-Paul Caron (Marseille) and Hans Hagdorn (Ingelfingen) will organise and guide the workshop between 4th and 8th September 2011.

You are kindly requested to pre-register as soon as possible.

So far we had the following field workshops with mostly 20–30, and up to 70, international participants: 2004 England, 2005 Central Germany, 2006 Eastern France, 2007 Western Poland, 2008 Hungary, 2009 Southern Germany, 2009 Central Germany, 2010 Dolomites.

The 2012 Field Workshop is planned in the Lombardian Alps (Andrea Tintori, Milano).

The aim of the field workshops is to demonstrate stratigraphy and facies of the Triassic in the respective area. Participants pay for their own travel, accommodation and food. Transport is normally by private or department cars.

For further information please visit <<http://paleo.cortland.edu/sts/>> (Meetings) and <<http://www.stratigraphie.de/perm-trias/>> (Triassic Field Workshops, and contains guidebooks from earlier workshops, too).



10th Annual Workshop for the Antarctic Funding Initiative

Murray Edwards College, Cambridge, UK 12 – 13 September 2011

The aim of the meeting is to strengthen links amongst those funded by NERC to engage in field-based research in Antarctica. It is also intended that the meeting will convey something of the challenges and special considerations associated with undertaking Antarctic fieldwork, or marine science cruises in the Southern Ocean.



NERC has recently changed the way that it funds Antarctic Research. Since 1999 the NERC Antarctic Funding Initiative (AFI) was set up as a separate ring-fenced scheme. Now proposals requesting to use BAS infrastructure can be submitted through any of the NERC funding schemes. The Collaborative Gearing Scheme still operates.

Those who are currently in receipt of AFI funding, have received funding through one of NERC's other schemes or have been involved in a Collaborative Gearing Scheme project for which fieldwork was conducted during the 2010/11 Antarctic field season, may be eligible for financial support to attend the workshop. Anyone who has an interest in field-based Antarctic research funded by NERC is welcome to attend.

Attendance is FREE, but you must pre-register your interest in attending. Places are offered on a 'first come, first served' basis. Attendance numbers are restricted to no more than 120, by the capacity of the conference centre at Murray Edwards College.

To register, or to obtain further information, please email Nicola Munro (<nalm@bas.ac.uk>) at the Programme Office of the British Antarctic Survey, no later than 26th August.



2nd UK Arctic Science Conference 2011

University of Leeds, UK 14 – 16 September 2011

The aim of this meeting is to bring together UK researchers who work on all aspects of Arctic research, to share their results and adventures in the Arctic – from deep ocean to atmosphere, marine and terrestrial, deep time past, to future predictions. This meeting follows the 10th Annual Workshop for the Antarctic Funding Initiative at Murray Edwards College, Cambridge (see above).

Attendance is FREE, but you must pre-register your interest in attending through the conference website <<http://www.ukarcticscience.org/>> by 1st August 2011.



8th International Meeting on Phytolith Research

Rocky Mountain Park Inn Resort, Colorado, USA 14 – 18 September 2011

This is the first time that an IMPR meeting will be held in the USA. This meeting will provide an excellent opportunity for researchers from around the globe to meet formally and informally, to discuss the many aspects of phytolith research, including methodology, taxonomy, taphonomy, and interpretation. Because of the broad application of phytolith analysis, this meeting also provides an opportunity for professionals in diverse fields such as archaeology, palaeoecology, geography, botany and geology to meet face-to-face for intellectual exchange.

Further details can be found on the conference website at <<http://www.8impr.paleoresearch.com/index.php>>.



**The Geological Society of America (GSA) Annual Meeting –
Archean to Anthropocene: The Past is the Key to the Future**
Minneapolis, Minnesota, USA 9 – 12 October 2011

The GSA annual meeting programme offers attendees a rich array of activities, including technical sessions, field trips, short courses, award ceremonies, business and social events, and special lectures. Further details can be found on the conference website at <<http://www.geosociety.org/meetings/2011/>>.



Warm climates of the past – a lesson for the future?
The Royal Society, London 10 – 11 October 2011

In several periods in Earth's history, climate has been significantly warmer than at present. What lessons about the future can be learnt from past warm periods? The answer depends on the quality of reconstructions of past climates, our understanding of their causes, and the validity of climate models that aim to reproduce them. This meeting will address these exciting and challenging issues.

There are further details on the Royal Society website. The meeting is free, but please pre-register on the website, which is at <<http://royalsociety.org/warm-climates-of-the-past/>>.



Linnean Society Palaeobotany Specialist Group meeting
Burlington House, London 2 November 2011

For details please email Lil Stevens (<l.stevens@nhm.ac.uk>) at the Natural History Museum. For more information on The Linnean Society of London, please visit <<http://www.linnean.org/>>.



Society of Vertebrate Paleontology 71st Annual Meeting
Las Vegas, Nevada, USA 2 – 5 November 2011

During the course of the meeting, there will be field trips to Palaeozoic and early Mesozoic marine units, terrestrial Mesozoic units in southern Nevada and Utah, and famous Cenozoic deposits in and around the Las Vegas Valley. In addition to the offered field trips, we have made arrangements with several known regional institutions for comparative collections visits.

Early bird registration is until 9th August 2011. Further details can be found on the conference website at <<http://www.vertpaleo.org/meetings/index.cfm>>.



Linnean Society Palynology Specialist Group meeting

Burlington House, London 3 November 2011

The meeting theme will be "Pollen and spore research: morphology, ecology and phylogeny". For details please email Carol Furness (<c.furness@kew.org>) at Kew Gardens. For more information on The Linnean Society of London, please visit their website at <<http://www.linnean.org/>>.



World Conference on Paleontology and Stratigraphy

Nakhon Ratchasima, Thailand 28 November – 2 December 2011

The World Conference on Paleontology and Stratigraphy (WCPS 2011) is an international conference to be held in order to celebrate His Majesty the King's 84th Anniversary on 5th December 2011. The conference will be hosted by the Northeastern Research Institute of Petrified Wood and Mineral Resources (NRIP) and Nakhon Ratchasima Rajabhat University, with cooperation from international and domestic museums, universities, government agencies and private sectors.

Presentations on all aspects of palaeontology, ranging from tiny extinct creatures to large marine and terrestrial animals are welcome. The themes include vertebrates, invertebrates, microfossils, plant fossils and associated subjects, such as biostratigraphy, lithostratigraphy and chronostratigraphy. Contributions related to technological samples as well as fossil-site and museum management and fossil energy are also welcome.

Further details can be found on the conference website at <<http://www.wcps2011.com/wcps/>>.



Workshop on Palaeozoic Limestones of South-East Asia and South China

Petronas University of Technology, Malaysia 5 – 8 December 2011

Spectacular and picturesque Palaeozoic Limestone outcrops are scattered around South East Asia and southern China, in places such as Guilin (China), Halong Bay (Vietnam), Vang Vien (Loas), Kampot (Cambodia) and Phuket (Thailand), as well as the Kinta Valley (Malaysia). This workshop intends to try and understand the interrelation of these carbonate systems in a regional context.

This is the first of several workshops organised by the European Association of Geoscientists and Engineers (EAGE) on the regional geology of South East Asia. The workshop will cover all aspects of Upper Palaeozoic carbonate geology of the region, from sedimentology and hydrocarbon plays to tectonics and geohazards. The organisers intend to have a session devoted to palaeontology, stratigraphy and palaeogeography. Palaeontologists of all disciplines are very much encouraged to participate in this workshop.

The meeting will take place on the campus of the Petronas University of Technology (UTP), surrounded by tropical rainforest, while the delegates will be accommodated in the nearby city of Ipoh in the heart of the Kinta Valley. The workshop will comprise three days of presentations and discussions followed by a one-day optional field-trip to the limestone hills and cave temples of the



Kinta Valley. The deadline for abstracts is 1st August 2011, and they can be submitted through the website at <<http://www.eage.org/>>. For further information please e-mail <asiapacific@eage.org> or <aaron_hunter@petronas.com.my>.



34th International Geological Congress
Brisbane, Australia 5 – 10 August 2012

The IGC was first held in 1878, and the Oceania region has only hosted the event once in its prestigious history. High-level political and scientific support secured in Australia and New Zealand for the Congress will underpin this outstanding event.

Under the theme “Unearthing our Past and Future” the IGC will showcase the Oceania region’s geoscience strengths, innovations and natural wonders, through an exciting range of pre- and post-Congress field trips.

AUSTRALIA 2012 will include a GeoExpo, an education outreach programme, and a support programme to encourage young delegates to attend. The IGC will demonstrate the crucial role that geoscience plays in the quest for sustainable development and show how geoscience contributes directly to the future of its resource-based industries, land and water management and mitigation of geohazards.

Early bird registration is open until 30th April 2012. The submission deadline for abstracts is 17th February 2012. Further details are on the conference website at <<http://www.34igc.org/index.php>>.



13th International Palynological Congress
9th International Organisation of Palaeobotany Conference
Chuo University, Tokyo, Japan 23 – 30 August 2012

Our world is changing dramatically. There are many urgent environmental issues, such as pollution, climate change, landscape and land-use changes, that have affected the ecosystem, biological diversity and human life. Palynology and Palaeobotany have provided baseline information on the past biological and environmental changes, which have in turn become critical for sustainable environmental management and nature conservation.

In Japan and elsewhere medical doctors are actively involved in Aerobiology and Palynology to prevent further spread of pollen-related allergies influenced by human-induced environmental changes. Our disciplines now have wider implications and applications relevant to the modern society than ever. The main theme “Palynology and Palaeobotany in the Century of the Environment” is thus timely for the IPC/IOPC 2012 meeting in Tokyo, Japan.

Further details can be found on the conference website at <<http://wwwsoc.nii.ac.jp/psj3/jp/>>.



29th International Association of Sedimentologists (IAS) Meeting of Sedimentology
Schladming, Austria 10 – 13 September 2012

The International Association of Sedimentologists and the Department of Applied Geosciences and Geophysics, Montanuniversitaet Leoben (Austria) invite you to the 29th IAS Meeting of Sedimentology.

The Meeting will bring together all facets of sedimentology under the theme of Sedimentology in the Heart of the Alps. It will feature a wide-ranging interdisciplinary scientific programme, and an exciting range of Pre- and Post-Meeting Field Trips which are being organised with important contributions from our Austrian partners and inputs from our Slovenian, Croatian, Hungarian and Slovakian neighbours. Expert training Pre- and Post-Meeting Short Courses, an exhibition and leisure options will be other features.

The deadline for early bird registration and abstract submission is 30th April 2012. Further details can be found on the conference website at <<http://www.sedimentologists.org/ims-2012>>.



10th North American Paleontological Convention
Venue TBA Summer 2013

Check the Paleontological Society website at <<http://www.paleosoc.org/>> for updates.



9th European Palaeobotany-Palynology Conference
Padua, Italy end August – early September 2014

The Italian group of Palaeobotany and Palynology is very glad to be able to invite all of you to Padova in 2014 for the next EPPC. All scientific sessions will be held at the new Department of Geoscience, and the famous Botanical Garden and the Museum of Palaeontology will also be involved during this conference. Field trips are planned in the fascinating landscapes of the Dolomites, Sardinia, Emilia-Romagna, Latium and Tuscany.

More details to follow.

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



Meeting REPORT



Progressive Palaeontology 2011

University of Leicester, UK 4 – 6 May 2011

As a preliminary note, we would like to extend our apologies to the delegates who came to the icebreaker: we should have mentioned that the dress code included sunglasses. Indeed, 4th May had been one of the sunniest days in Leicester this year, and yet no astral light could outshine the company of the 37 delegates who gathered in the beer garden of the 'Old Horse' pub for the 2011 edition of Progressive Palaeontology in the Department of Geology at the University of Leicester. New and old friends alike could discover and enjoy "Real Leicester Ale" (Tennant, 2011), while checking in the programme book (which should be available for download on the PalAss website by the time you read this) the abstracts for the 16 talks and ten posters, as well as whose company was expected.

As time went on, more of that company (and one late organiser) joined the assembled punctual fellows, gathering in Leicester from exotic places such as Edinburgh, Bath or Crayssac. The delight of beholding the acrobatic skills of some delegates at glass-handling went on for a few hours until the sun took refuge beyond the horizon and the fellowship inside the pub. There they enjoyed, along with a few latecomers, the more than unique hat and tea-pot heavy decoration of the walls and ceiling, or the subtleties of the double meaning of the titles of talks once translated into French. Discussions went on, fuelled by Leicestershire brews and pub food, with topics ranging from the nomenclatural oddities of Leicester restaurants, colour patterns in politics, and a bit about palaeontology also. Sadly, the last present organiser had to bring the registration material to the Department and thus could not report on the quality of the icebreaker evening as a whole this year.

Rumour has it that there was more "local brews tasting" involved, though the majority of the 37 delegates were present the next morning to listen to the introductory note by Professor Richard Aldridge mentioning aspects of doctoral phylogeny. So as to provide a nice transition between the yester evening and the following talks, **Alex Dunhill** presented works about the completeness of the fossil record of the Dorset coast and the correlation between sampling bias and pub



The early stages of tea-break: poster viewing, science discussing, dextrous biscuit-handling

proximity. Then **Javier Ortega-Hernandez** discussed aspects of trunk segmentation in trilobites based on developmental patterns in modern creepy crawlies and the phylogenetic implications which were well discussed in the following questions. **Nicola Clark** guided us through a delve into the frozen (or not) Antarctic marine shelf environments using bivalve growth and chemistry as proxies, miles away from the works of **Ross Mounce** who explained the influence of missing



Our delegates after the talks, along with Jane, hungrily staring at Luis-Felipe

entries in character matrices via the example of separating them between cranial and post-cranial partitions in vertebrate palaeontology.

Speaking of vertebrates, as a reward for their efforts, the first presenters and their keen audience had the opportunity to walk past Jane (our very own T-rex replica) on their way to the abundant biscuits, tea and coffee made available by our dear colleague **Alison Tasker** (whose wise choices were praised many times in the next hours), strategically positioned next to the posters on display. Variety was the keyword for this year's posters: **Caroline Sogot** was tracking variations in marine palaeocommunities through the K–T boundary by looking at often neglected sclerobionts. The outlines of very promising studies were drawn by **Marianne Pearson**, who will shed some light on the past distribution of salamanders. **Emiliano Peralta-Medina** analyzed the distribution of Cretaceous forests and used tree-ring width to assess productivity. On a completely different topic, genome duplication events were at the heart of **Fanny Pouyet's** work on early vertebrate evolution. Such molecular data was also mentioned along with developmental and phylogenetic evidence to support **Duncan Murdock's** conclusions on the origin of biomineralization in Cambrian animals. **Alex Dunhill** compared tridactyl dinosaur footprints using landmark analysis, a non-subjective approach which could be a stepping stone for future developments in ichnology. Many biases were mentioned in **Anne O'Connor's** study of stratigraphic congruence metrics, which earned her the prize for best poster presentation. **Silvia Danise** made a very efficient use of a combination of extant and fossil data together with ecological information and tools to discover the conditions favouring the development of cetacean populations. Ecological tools were equally used by **Luis-Felipe Opazo** to look at changes in the marine environments associated with the late Triassic extinction event. Arthropods were at the heart of **David Legg's** studies, as exemplified by his work on the phylogeny of the marrellomorphs.

David gave the second series of talks a vigorous start with another investigation of arthropod phylogeny, demonstrating the importance of fossil specimens when looking at their modern diversity. On to palaeobotany then, with a thorough examination by **Emiliano Peralta-Medina**



of exquisitely preserved leaves from the Miocene of Mexico, followed by an excursion through a dense 16 million year old tropical forest shattered and entrapped by a pyroclastic flow. Last in that session was a phylogenetically-driven biomechanical investigation of tail stiffness in thyreophoran dinosaurs by **Michael Pittman**, whose illustrations and enthusiastic introduction were so appreciated by the jury, he was rewarded with the prize for the best talk.

After being set loose for lunch break within the campus (for those who had not yet filled themselves with biscuits), delegates could enjoy some more investigation into arthropod anatomy, with **David Marshall** losing himself into the (putative) eyes of *Limuloides limuloides*. **Nikita Jacobsen** explored the complex biological response of bivalves to the Triassic–Jurassic high-CO₂ interval with an interesting in-the-field non-destructive measurement methodology. In the field as well, **Emily Mitchell** used differentiated GPS to map the spatial distribution of species on the Ediacaran bedding planes from Mistaken Point and draw inferences of ecological networks. Finally, **Rachel Warnock** explained the importance of using detailed palaeontological data along with other techniques when calibrating molecular clocks and estimating divergence times.

After another biscuit degustation paired with a poster session, the last series of talks started as **Florian Schroth** detailed a combined study of isotopic and morphologic data in the different morphotypes of the foraminifer *Neogloboquadrina pachyderma* sinistral, highlighting issues of randomly picking specimens for investigation. We returned then to Mistaken Point, Newfoundland, where a cast of the surface allowed **Anthony Hancy** to make thorough observations of stages of decay in the community. Back to more recent times, we followed **Pete Heintzman** as he molecularly tracked the recolonisation of Canada by the coleoptera *Amara alpina*. As a conclusion to the talks, **Holly Barden** detailed the many ways to demonstrate the presence of original eumelanin pigmentation in fossil feathers, explaining techniques with promising applications in taphonomic studies.

It was then time to close the conference with a few words but most importantly, a picture of our assembled delegates in front of Jane. Most delegates then headed to the Marquis Wellington, lubricating themselves in preparation for the annual dinner in the Taj Mahal. It is worth mentioning that the dinner was of great taste and of more than epic abundance, physically impossible to finish, though we battled hard and showed valiant effort. The rest of the evening evolved in an unordered way: overseas beers, the surprising association of Nepetoideae and Rhinocerotidae, a picturesque celebration of sports, displays of prowess around the pool table and heartbreaking goodbye hugs.

As fresh as expected, 19 delegates gathered at the gathering point in front of the Charles Wilson building before heading to the Jurassic limestone of Ketton quarry. Led by **Dennis Gamble** and **Carys Bennett**, our crew was joined by the deputy quarry manager Pete Bell and went on to explore the Blisworth Clay Formation first. What we discovered was a real hoard of fossils, rich with



Inside the Taj Mahal, before the gargantuan feast.
(Photo... Entschuldigung. Foto: Florian Schroth)



brachiopods and bivalves, some of them as big as a fist, hosting even a few echinoderms and a dinosaur vertebra! After lunch in the field under the sun and a quick exploration of the base of the Rutland Formation, we set sail (aboard the quarry's rovers) to the conquest of mighty limestone, there again a treasure chest of fossil brachiopods, bivalves, echinoids, and the occasional shark tooth or toothplate. This was indeed a place we left with regret, though not before taking a few group pictures and thanking the staff of the quarry who helped us finish the conference in a memorable way on a wonderful day.



Gimme ma fossil back!

Whoever would like to get more information about the presentations can find some in the abstracts book, available for download from the PalAss website. Each and every minute of those three days has been filled with enjoyable moments of a social or scientific nature. Every presentation was a display of mixed cutting-edge technology, keen mind sharpness, critical thinking and precise observation, generating new ideas, potential collaborations, and holding the promise of a great future for palaeontology. Thanks go to all the delegates, thumbs up to the presenters, the organising committee, the generous sponsors and everybody at the University of Leicester who provided help of any kind. The last thing we have left to do is to wish the team of organisers at Cambridge the best of luck for next year.

Laurent Darras

University of Leicester

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The end of the trip and of the conference. A few delegates show how much they dig the place.



MYSTERY FOSSIL 21: update

No new mystery fossils were sent in for scrutiny this time, but we have had a couple of suggestions for **Ed Jarzembowski's** pretty little 'unidentified problematicum' from the last *Newsletter* (Fig. 1). MF21 is of Early Barremian age and occurs in sideritic ironstone concretions from Smokejack's Brickworks, Surrey, UK, and as he couldn't identify it Ed favoured a vertebrate origin...



Figure 1.

Bo Wang (Palaeobiology & Stratigraphy Lab., Nanjing) responded to Ed's plight by showing that he's not alone, and sent in an image of a comparable but flatter fossil from the Middle Jurassic (Bathonian) of Daohugou accompanied by conchostracans (spinicaudates) (Fig. 2). So, whatever MF21 is, it must have been widespread and must have spanned at least 35 million years or so.

Dima Shcherbakov (Palaeoarthropodology Lab., Moscow), suggested that it might be a pronotum (*i.e.* the specialised dorsal plate between the head and wings) of a palaeontinid – an extinct cicada-like insect (Fig. 3). So, unless anyone has any alternative ideas, a palaeontinid pronotum it is!

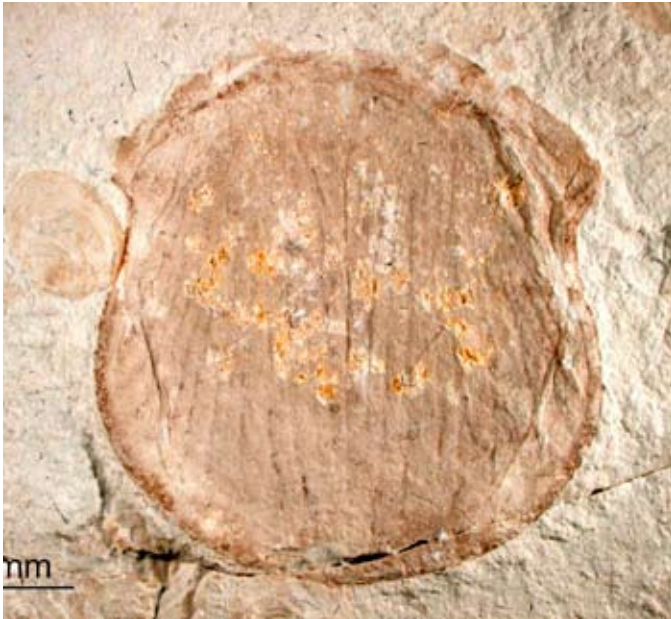


Figure 2.



Figure 3.

As the season of (northern hemisphere) Summer fieldwork is by now well and truly upon us, do keep your eyes peeled if you're out and about, and if any problematica turn up you know what to do!

Richard Twitchett



— OBITUARY —

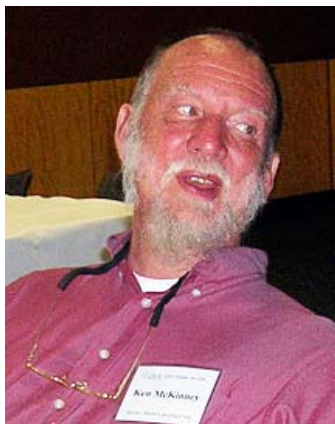
Frank K. McKinney 1943 – 2011

With the passing of Ken McKinney in April, four days before his 68th birthday, we lost a leader in the study of fossil and living bryozoans. It was a privilege to work with a man who achieved so much academically, and always a pleasure to be in the company of such a kind, amiable and liberal colleague. Whether they came recently as PDFs, or in the past when reprints were sent through the post, my reaction on receiving a McKinney paper was usually to wish that I had written it myself. His publications on bryozoans never failed to be both original and significant.

Ken was born in Birmingham, Alabama on 13th April 1943, the son of a steel worker. Graduating with a BSc in Geology from Old Dominion College in 1964, he received his MSc in 1967, for research on the non-fenestrate bryozoans of the mid Carboniferous Bangor Limestone of Alabama. His PhD followed in 1970, for work on the trepostome bryozoan fauna of the Ordovician Chickamauga Group of the same state, both from the University of North Carolina, Chapel Hill. He was appointed to a teaching post in the newly founded Department of Geology at Appalachian State University (ASU) in Boone while working on his PhD. The town of Boone, nestling in the Blue Ridge Mountains of western North Carolina, was to be his home and academic base until his death. Numerous visitors were welcomed to his small farm with its sheep and goats and magnificent views across wooded hillside towards Grandfather Mountain. He shared with these visitors his enthusiasm for choral music, as well as the fine wine and food (especially Italian) which he loved.

Despite a heavy teaching load at ASU, Ken maintained an impressive output of papers and books. His first paper, on borings in a bryozoan from the Carboniferous of Tennessee, published in 1968, began a series of more than 120 peer-reviewed papers produced at a rate averaging three per year. Aside from some substantial taxonomic works, Ken was responsible for several seminal contributions on bryozoan functional morphology and evolution. The first of these came in 1974 when he published a paper in *Science*, co-authored with Bill Banta and Russ Zimmer, providing the first convincing explanation of the regularly spaced pimples called monticules that cover the surfaces of many bryozoan colonies. The *Science* paper showed how monticules functioned as sites where exhalant feeding currents were vented on the colony surface.

Ken appreciated fully the importance of studying living bryozoans in order to interpret the palaeobiology of fossil species. This led him to spend several Summers based at a marine station in Rovinj, Croatia. There he was able to observe feeding and other aspects of bryozoan behaviour such as larval settlement preferences and competition for living space. Ken noticed similarities between the bryozoan-rich, epibenthic communities on the muddy seabed of the eastern Adriatic Sea and





the Palaeozoic communities of epifaunal suspension feeders he was familiar with from the eastern USA. His final book, *The Northern Adriatic Ecosystem: Deep Time in a Shallow Sea* (2007), explained this resemblance in terms of the relatively low nutrient level of the eastern Adriatic compared to the higher level pertaining in the western Adriatic where a benthic biota of more modern aspect is found. Ken's first book, *Bryozoan Evolution* (1989), written jointly with Jeremy Jackson, provides by far and away the best introduction to anyone interested in the functional morphology of bryozoan colonies, even though more than 20 years have elapsed since its publication.

Research undertaken during sabbaticals at the universities of Durham (1978) and Cambridge (1992) provided the foundation for pivotal papers respectively on the functional morphology of erect bryozoan colonies and the evolutionary dynamics between bryozoans from competing bryozoan clades. Ken showed how maintaining efficient colonial feeding currents has been a key factor controlling optimal colony forms in non-encrusting bryozoans. Bryozoans with mesh-like colonies indicative of a one-way flow of feeding currents through the gaps (fenestrules) were shown by Ken to have replaced those possessing a hydrodynamically less efficient, monticule-based system involving filtered water exiting the colony surface at 180° relative to in-currents. Evolutionary displacement of monticule- by fenestrule-bearing colonies occurred twice, once during the Palaeozoic and a second time during the post-Palaeozoic when the dial was reset to zero following removal of the dominant Order Fenestrata at the end of the Permian. Based on this and other observations of evolutionary patterns in bryozoans, Ken challenged Steve Gould's notion of lack of progress in evolution in a letter published in *Science*.

Perhaps Ken's single most important contribution concerned the long-term effects of competition among clades. Seldom is it possible to demonstrate competition in the fossil record unequivocally. However, by studying overgrowths between Cenomanian–Holocene cyclostome and cheilostome bryozoans – spatial competition frozen in the fossil record – Ken succeeded in showing that cheilostomes have been victorious in two-thirds to three-quarters of competitive encounters with cyclostomes throughout the last 100 million years, and yet the long supremacy of cheilostomes has not resulted in them driving cyclostomes to extinction.

Ken McKinney fuelled the enthusiasm of generations of undergraduate students at ASU. His ingenuity in teaching palaeontology is evident from his 1991 book *Exercises in Invertebrate Paleontology*. The University recognized Ken's excellence as a teacher by creating a small geological museum in his honour when the progressive debilitating muscular condition that had cast a shadow over his career and his life in general finally forced him into an early retirement from teaching. In hindsight, it is a great pity that there was no graduate school in geology at ASU – Ken would surely have inspired many masters and doctoral students too.

At the time of his death Ken was close to finishing the genus descriptions for the volume of the *Treatise on Invertebrate Paleontology* on the Fenestrata, work which will be completed by co-author Patrick Wyse Jackson. Together with his indispensable palaeobiological papers this will provide a lasting testament to the work of a palaeontologist who contributed so much to the study of bryozoans, and whose friendship and support inspired so many of his colleagues.

Paul D. Taylor



A fossiliferous Countdown

In my last newsletter article, I asked members of the Association to submit their best efforts at geopoetry, which I would then publish here. Unfortunately, I only received two submissions, so either everyone thought I was joking, or there are no potential palaeontological poets out there. I can't believe that's the case, and as I'm entirely serious about the project, I shall solicit offerings again. I think it would be a fantastic way to try and bring fossils to a new audience.

So if you are in any way inclined to verse, please do ping a poem my way. It could be a halkieriid haiku, a limulid limerick, or an epibenthic epic. Funny or serious, long or short, I would be delighted to put them together and show that earth scientists are perfectly capable of engaging in literary pursuits.

In the mean time, I will have to offer you something else: Alistair McGowan reading poems on Channel 4. No, I'm not referring to a dramatic change of career for my predecessor in this role, but to a curious encounter I had with the British comedian and impressionist. It was all thanks to *Countdown*.

For those of you not familiar with the programme, *Countdown* is a UK television quiz show that has been screened for almost thirty years, since being the first thing broadcast on Channel 4 the day it was launched in 1982. Modified from a French gameshow, *Des Chiffres et des Lettres*, *Countdown* features two contestants competing against each other to make the longest words out of nine-letter mixtures, to solve number puzzles, and to unravel a conundrum.

On a whim of early Spring enthusiasm, I applied to be on the show, and after a short interview in Leeds, was told I'd been selected. I didn't think I'd done very well at the audition, but the associate producer had said to me, "Ah, you're the palaeontologist," in an intrigued, we-don't-get-many-of-your-type-applying voice when I arrived. I wondered, therefore, if simply having an unusual career was good enough.

Thus, on a Monday in early May, off to Manchester I pootled. *Countdown* is filmed in the Granada Studios, which was where the Association took on the Eden Project in *University Challenge: The Professionals* in 2004. That familiarity certainly helped settle the nerves, as did the friendliness of my fellow contestants, and of the show's producers.

Five episodes of *Countdown* are filmed in one day, so that a full Monday–Friday schedule, featuring the same special guest, can be recorded in a single batch. I'd been told that my show would be the 'Friday' episode, so I didn't need to come in to the studios too early. However, the special guest was none other than Delia Smith, making her debut in 'Dictionary Corner', so there was an extra frisson of excitement. There was also a capacity crowd for the filming.

The reigning champion was a very talented man called Tom Barnes, so I feared I might have to play him, but I was rather lucky. If you win eight episodes of the show, you have to stop, and retire as an 'octo-champ'. The game before mine (the 'Thursday' episode of filming) was Tom's eighth, and he defeated a lady called Liz. So when it came to my match, I was up against another new contestant (although, slightly confusingly, he was also called Tom).



Before filming, however, there was time for some dinner in the Granada canteen (where the serving staff were clearly distressed to be offering their wares to Delia) and then a trip to make-up, to be rendered presentable for public consumption.

Dined and dusted, we were ushered onto set and to our seats, followed shortly afterwards by presenter Jeff Stelling, numbers whiz Rachel Riley, lexicographer Susie Dent, and of course, Delia. Filming began, and Jeff started off by chatting with Tom about his fascinating double-life as a charity worker and fine-art printmaker. And then he moved on to me.

“What the heck’s a palaeontologist?” asked Jeff, and I tried my best to explain. I attempted, briefly, to describe my own research interests, before going down a more predictable route and commenting that most people think I study dinosaurs, or that I am in some way like the character Ross from *Friends*. I tried to debunk this by pointing out I had never lived in a New York penthouse apartment or dated Jennifer Aniston.

And then the game began, and in the first round I only got a five-letter word, failing to spot ‘goofus’, which Ross certainly would have seen, according to Mr Stelling. In a round shortly afterwards, I thought I had a six-letter word, and submitted ‘venoms’. Unfortunately, Susie in Dictionary Corner rejected the pluralization, and I scored no points.

It didn’t matter much, though, as my soft-rock background came in useful a couple of rounds later and I identified a nine-letter word: ‘laminated’. Suddenly I was well in the lead, and though there was a bit of give-and-take (I was particularly annoyed at failing to recall my Problematica and spot ‘weirdos’), I managed to hang on for the rest of the show.

Thus, to my very pleasant surprise, I became the new champion, and got to come back the next morning to film my first defence. This was against a bookmaker called Jamie, who didn’t fancy his chances. He thought palaeontologists were too clever, and told Jeff that his odds of winning were about 6-1.

Jeff asked me about the areas I’d done fieldwork in, and we had quite a long chat, but in the broadcast version it got edited down to him saying, “Did you once drive from Birmingham to the Sahara Desert?” and me replying, “Yes, sort of,” which wasn’t much of an explanation, or indeed a story.

But not to worry, the game began, and I did quite well on the letters, and by the first advert break I was a short nose in front. Jamie said his odds had now lengthened to 8-1 and then we moved over to Dictionary Corner, where the new guest was Alistair McGowan. He made no mention of ammonoid evolution or biases in the palaeontological record, and instead read a poem on becoming more and more like his father.





When the filming re-started, I failed to spot 'glaciers' and only saved my bacon with a speculative offering of 'girasole', which I thought I might just have invented. Thankfully, I hadn't, and I was told it was a sunflower, as well as a fiery form of opal. I was winging it, but winning it too, so I couldn't complain. I pulled away with a couple of other decent words, and at the end, Jamie told Jeff that he thought his odds of 6-1 were about right.

At the start of my next game, Jeff asked me what the most exciting find I'd ever made was, and I was rather stumped. I don't tend to find exciting fossils, and most of the discoveries I'm proud of are in rather obscure corners of the Palaeozoic invertebrate world, so I racked my brain. Confessing that I was quite disappointing, I declared that the most publicly interesting specimens I'd found were probably dinosaur footprints.

"And where did you find these footprints?" asked Jeff, expecting me to name-drop a glamorous locality. "Scarborough," I told him, to general bemusement.

The match, against Gary from Macclesfield, was fairly bemusing too, as we had a battle of who could score less. In one round, my offering of 'beration' turned out to be an imaginary word, rather like the 'beneficent' I once used in an A-Level maths test, whilst in another, Gary confused an M for an N, submitting an impossible 'fallen'.

In the next round, I thought 'butanes' would be acceptable, but it wasn't, and now I was behind by a few points. Extraordinarily, Gary then repeated his earlier mistake, and saw an N when it was an M, declaring 'deacon' for another no score. He still got more than me in the final letters round, when I could only spot 'granite' to his 'tapering', and then we both cocked up the last numbers round.

So it came to the final round, the conundrum, and it was crucial, as I had 60 points and Gary 65, and very flukily, I saw almost immediately that 'edged late' could become 'delegated', and I had won by the skin of my teeth.

As some sort of consolation prize, the show's producers took the first of the letter Ns from the COUNTDOWN display board and gave it to Gary. This was a nice gesture, but looking at the new name of the show, I did think to myself that it was lucky Gary hadn't had a problem with Os.

It was still Tuesday, but now 'Wednesday', and the third match of the day. I knew that, whatever happened, I would have no more games to play once this one was done, as the series' quarter-finals were starting immediately afterwards. This was actually rather convenient, as there was an Association Council meeting in London the next morning, and I needed to get down to the Smoke that evening.

I was up against another Tom, who was from Chesterfield, and very nervous. Jeff attempted to break the tension with a terrible gag, noting that my partner Helen is an archaeologist, "so you clearly dig each other." He then tried to put Tom at ease with some football banter, before getting the game started. In the first letters round, Tom and I offered up between us, 'silver pelvis', which is a very rare form of vertebrate fossilization, but we missed 'gerontic' and 'peatier' in the next two rounds.

It was neck-and-neck for much of the game, till the nerves got the better of Tom, and he began to struggle. Showing my invertebrate bias, 'amniote' was an option in two successive rounds, but



I didn't spot it either time, and neither did I see 'taconite' in the last letters round. Indeed, since I didn't know what taconite was, I couldn't have spotted it, and had to rely on Susie in Dictionary Corner for an explanation. "A low grade iron ore consisting largely of chert," she told us.

It didn't matter, though, as I had enough points to win the match. There was a somewhat surreal ending, though, as (apparently unaware of his esteemed namesake) Alistair McGowan wondered aloud who the most famous palaeontologist was. Jeff claimed it was now me, probably as he'd never met another one, but the line was really a set-up for Alistair to impersonate David Schwimmer. "Will we ever lose the 'Ross from Friends' tag?" bemoaned a fossiliferous friend of mine when she watched the show.

Probably not, I suspect, but far more worrying was the warm-up man. Yes, even a sedate show such as Countdown has a comedian charged with getting the crowd excited, and Granada Studios' resident called himself Dudley Doolittle. At more than one point during filming, desperate for something to talk to the crowd about, he made mildly disparaging comments about the practical value of my chosen profession.

I didn't really argue with him, knowing that I'm extremely lucky compared to my factory-working grandparents. I did think it was a bit rich, however, for a man with a made-up name, working as a low-grade comedian on a very niche television show, to be casting aspersions on the validity of other's career choices.

There wasn't time to debate it for long, though, as I had to dash off for my train to the Council meeting. Delays outside Euston ensured I arrived late that evening, and when I explained why I'd had to come from Manchester, and told them I'd be going back to film again the following week, my colleagues were quick to see the publicity potential.

The first idea was sensible enough: could I wear a t-shirt with an Association logo, perhaps? Unfortunately, I said I couldn't, as the rules wouldn't allow it. The logo would have probably been acceptable, but the sound technicians demanded that men wear shirts or v-neck sweaters so that they can attach the microphone a proper distance away from your stubbly chin.

The next idea was more controversial: how about getting a tattoo of a trilobite on my face? Whilst appreciating that this would have undoubtedly been a high-impact means of promoting palaeontology, I am fairly squeamish, and enduring a series of ink-filled needles to fossilize my face didn't fill me with joy. Having declined, I said the best I could do would be to take a couple of fossils onto the show and see if I could get them on screen.

My return to filming was early the following week, and I am pleased to say that the fossils went down very well. I can't say I ever imagined myself trying to explain the origins of marine



invertebrates to Jeff Stelling, but he seemed genuinely interested, as did many other members of the Countdown team.

For ease of transport, and explanation, I just took a couple of specimens I'd picked up recently on the Yorkshire coast. "To the uninitiated," said Jeff, "we would say they are stones in front of you, but what are they?"



Well, one was a gryphaeid, the other a glacially erratic Carboniferous coral, and I gave a simple explanation of each. Watching the show now, it's a bit hard to see what the gryphaeid really is, but the coral looks fairly distinctive, so I think viewers could get a reasonable idea of what they might be looking for.



Jeff was very keen to talk about fossil-hunting, so perhaps we can look forward to seeing him going out beach-combing with his kids. Though it didn't make the final cut, he asked about what he might find around his home area of Hartlepool, having heard there was a fossil forest, but, having never been there, I had to say I wasn't certain. If anyone out there does have information on the palaeontology of the 'pool, do feel free to email Jeff at <countdown@channel4.com>.

Back in the game itself, I won one more, and then lost to Graeme, a very sharp computer engineer from Reading. Failing to spot 'nodular', 'loricate' and 'patina' didn't help, but I was simply beaten by the better player. And, anyway, I'd exceeded my expectations by a mile, having thought I might win one or two games if I was lucky. I never thought I'd end up winning five, and have a chance of coming back for the quarter-finals in the Autumn.

It was great fun filming the show, and if you've ever contemplated trying it, I thoroughly recommend it. It was a very relaxed atmosphere, the crew were all very welcoming, and if you win, you get a Countdown teapot! As for the fossils, they're still going strong: the last conundrum in the series final was 'argue toss', and the answer was palaeontological. I didn't get it, and neither did the contestants. If you know the answer, perhaps you should drop Countdown an email and give the show a try. Or just send me a poem about it.

Liam Herringshaw

<lgh865@hotmail.com>



A palaeontological impersonator meets Alistair McGowan

Graduate Opportunities in Palaeontology!

Students: Do you want to study for a postgraduate qualification (MSc, MRes, PhD etc.) in palaeontology or a related discipline in the UK or abroad?

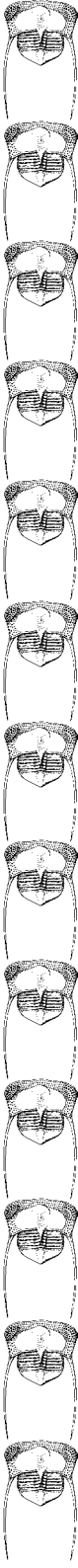
If the answer is YES then please check out the home page of the Palaeontological Association (<<http://www.palass.org/>>) and follow the link to “Careers & Postgrad Research”.

These pages will be updated regularly over the coming months, so don't forget to check back at regular intervals!

Researchers: Do you want to advertise your palaeo-related MSc course or PhD to as many students as possible?

If the answer is YES then please send details of your courses/projects to the Newsletter Editor. These details will then be posted on the Association website and will be published in a forthcoming edition of the *Newsletter*.

For available PhD titles please include the title, the names of all academic advisors and a contact email address. For MSc and other graduate courses please include a brief descriptive paragraph, a link giving details of admission procedures and a contact email address or telephone number.



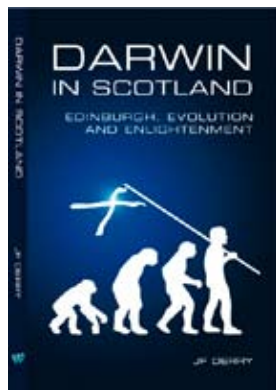


Book Reviews

Darwin in Scotland: Edinburgh, Evolution and Enlightenment

J. F. Derry (2010), ISBN: 978-1904445579, Whittle Publishing, 186pp, £18.99.

It is a matter of fact that the bicentenary of Charles R. Darwin's birth produced a surge in related books, historical research, museum exhibitions and Darwinalia during 2009. Indeed, publishing 'Origin of Species' in his fiftieth year also provides us an additional excuse every fifty years to celebrate Darwin's life, works and contribution to scientific thought. With this currently considered title, J. F. Derry has added a useful contribution, setting the scene as he does for the understanding of just how influential the city of Edinburgh was to the Pre-Cantabridgian student. Derry's book examines in close detail the contribution that the Scottish physical and intellectual landscape made to Darwin's development as a theoriser grounded in the collection and compilation of facts.



In preparation for writing this review, I revisited *Origin of Species* to refresh my own memory as to just what Darwin actually said, and not what he was reported to, or has since been interpreted to have said. This proved to be a valuable reminder, made more accessible by the use of electronic book formats and 'text to speech' software (*Origin* and many of Darwin's other works are now freely downloadable as 'Classics'). I happily discovered that Derry remained true to the original source.

Darwin in Scotland does not follow a strict chronological order of the man's life. This is a refreshing change to how 'things Darwin' normally appear – usually inspired by his own voluminous archive of dated letters, notebooks, collection catalogues and published works.

The first eight chapters relate to Darwin, Edinburgh and his subsequent travels and researches until his death in 1882. The next four examine various evolutionary processes, some of which don't appear to fit comfortably within Darwin's original outline of *Descent with Modification*. Chapters 13 to 17 are concerned very much with the Religion and Science debate which for some demands conflict, others acceptance and still others partition and isolation. With titles such as 'Creationism', 'The Dissent of Man' and 'Intelligent Design', the reader is left in no doubt as to what content is discussed therein.

Each of the 17 chapters is preceded by a choice quotation from the Scots poet Robert ('Rabbie') Burns (1759–1796) – 'choice' in that they demonstrate that something can always be found to quote in support of one's arguments, a theme exhaustively explored later in the thirteenth chapter.

Darwin in Scotland begins with an initial examination of the cultural and intellectual climate that had developed in Scotland during a period referred to as the 'Scottish Enlightenment' (which took place in the latter half of the 18th Century). Firmly grounded in concerns of moral philosophy and coupled with a national programme of public education, the country was developing on the



international stage. Moral philosophers such as David Hume (1711–1766) traced their lineages of thought back to the empiricism of the Ancient Greek practitioners. This proved key to the methodology that Darwin subsequently put into practice in his scientific life.

Derry makes the interesting point that Edinburgh had become an important focus for medical training at the time, as it was a city that possessed both a teaching university for theoretical concerns and an adjacent hospital for more practical learning. This explains the family tradition of the Darwin males attending medical school there, starting with Charles' grandfather Erasmus and followed by his father and contemporaneously his elder brother. The family's non-conformist Unitarian faith provided another reason why Edinburgh with its more 'free-thinking' environment was favoured over the Anglican Church's stranglehold of the English universities of the time.

In Chapter 2 (Darwin's Scottish Enlightenment), two full plates of black and white images illustrate some key architectural scenes and figures from Edinburgh. Surprisingly though, there is little illustrating the striking Carboniferous volcanic topography which shaped the layout and constraints of the city. What influence did the vistas of the Firth of Forth have on Darwin's later 'Volcanic Islands'?

Chapter 3 (Mendelian Ratios) initiates the format adopted throughout the rest of the book. Namely, Derry introduces a topic, then quotes verbatim interviews he held with academics associated with the University of Edinburgh or other leading figures in the topical debates. In this instance, the broadcaster and animal behaviourist Prof. Aubrey Manning provides a personal account of how Darwin has influenced his research and work.

The Burns quotation 'Lord grant that thou may ay inherit' opens the fourth chapter concerned with the modern evolutionary synthesis. Here Derry interviews Nick Barton who emphasises Darwin's importance to evolutionary biology more so perhaps than Mendel and the DNA duo of Watson and Crick.

Chapter 5 (Scottish Geology) explores how Darwin's comprehension of 'Deep Time' arose entirely from his Edinburgh experiences. James Hutton and his school of plutonic rock formation thought had influenced Hope, Darwin's lecturer in Chemistry. Countering this was Darwin's interaction with Robert Jameson's Wernerian-flavoured lectures and field classes undertaken during his second year in the city. Much later and after the publication of *Origin*, when Lord Kelvin argued for a younger age of the Earth based on cooling rates, it was another Scot, James Croll (1821–1890), who defended Darwin.

The sixth chapter is an examination of Darwin's return to Scotland to decipher the parallel roads of Glen Roy, influenced by his having encountered similar phenomena on the hills above the coastline of Chile. In South America, Darwin had interpreted the presence of 'upraised shells' (mainly marine mollusc fossils) as evidence of land uplift relative to a static global sea level. Try as he might he could find no such fossil evidence in Glen Roy. Here, is introduced the Swiss Louis Agassiz (1807–1873) who proved former ice action in Scotland with a tour in 1840, only two years after Darwin's Scottish Highlands tour and subsequent fruitless theorising. Darwin's last visit to Scotland was in 1855, to Glasgow and the Annual Meeting of the British Association for the Advancement of Science.

The book then moves on to be concerned with the voyage of HMS Beagle and Joseph Dalton Hooker. This man, later to become Darwin's botanical confidante regarding the species question, was born in Suffolk, but grew up, was educated and later worked in Glasgow, Scotland.



Explanation and interviews dealing with the concept of Punctuated Equilibrium and Stephen J. Gould follow on. A useful quote from Richard Dawkins reminds us that Darwin required a gradual speed for modification through descent, not a constant speed, hence allowing for leaps and bounds over time. Other quotations are provided by a parasitologist who discusses Chagas disease which Darwin is thought to have picked up in South America and suffered the effects of for the rest of his life.

The relatively short chapter 11 ties together the seemingly disparate topics of the etymology of Darwin's family name, the uses of oak trees in England at the time of the second (and Darwin-carrying) voyage of HMS Beagle, and Darwin's imagination of the inter-linked life of a kelp forest – derived from a rotten pile of seaweed on the seashore. In a similarly visionary vein, Astronomer Royal Martin Rees reminds us that there is more time ahead for evolutionary change than has gone before and thus Man is not the pinnacle of the process.

The chapter headed Creationism is notable in terms of its lengthiness (15 pages) in comparison to preceding chapters. The reason for this seems to be that the interviewee, Ken Ham (Answers in Genesis) has a lot to say and is given an impartial platform to say it on. Carefully questioned by Derry, Ham attempts to explain the difference between observational and operational science and why that is important to his World View. Here it is interesting to read of at least three 'Kirks' of thought under the banner of Creationism: Young Earth Creationists, Old Earth Creationists and adherents of Intelligent Design, all of whom object to Darwin's theory of evolution, some of them accepting the reality of Natural Selection, others not. Ham states that he is not blaming evolution for the World's ills, but that through the implications of the theory, it indirectly contributes to the erosion of Christian morality.

In the fourteenth chapter, the viewpoint is expressed that Darwin's lack of prejudice gave him clarity of vision, which was unavailable to others. A discussion of Darwin and the Animal Kingdom is then presented via Rheinhold's bronze *Affe mit Schädel* (Ape with Skull). Helpfully, the reader is also directed to an advert on the last page of the book where they can order a custom hand-made bronze replica for their own desk. This chapter ends with a useful listing (running to 14 pages) of Darwin (DAR) Archival sources held by the University Library of Cambridge.

A chapter discussing teaching Darwinism honestly in schools follows, and once more the reader is reminded of the fact that it involves a simple idea with grand repercussions. In the Epilogue, Derry discusses how although remaining impartial in the interviews, it was inevitable that he be drawn into the Religion vs. Science debate. But in a personal note, he reveals that he considers the evidence for evolution as incontrovertible. Following on is a useful Appendix, one portion of which consists of a 'Clarification of Terms' followed by a 'Glossary of Scientific Terms'. This ties in nicely with the final chapters of the book which relate to the religion and science debates which invariably surface when Darwinism is mentioned, and the teaching of science in schools, particularly in the US and Scotland. Derry provides a useful resource that those science teachers who would present evolution in the classroom would do well to read, digest and transmit on to their charges. A list of contributors is given which provides a strong indication of what to expect in terms of the direction and content of the interviews.

Finally, there are nine pages of Endnotes which enrich and advise the reader on background which would otherwise have disrupted the narrative flow. This book is a welcome addition to the body of interpretive material relating to Charles Darwin. At £18.99 it is reasonable value, providing as it



does a slightly different angle on a much-studied historical figure. Lastly, had the front cover been rendered in a yellow and black rather than a blue and white colour scheme, one wonders what the First Minister of the newly devolved Scottish Parliament would have made of the procession from knuckling chimp to Saltire-hoisting *Homo sapiens*!

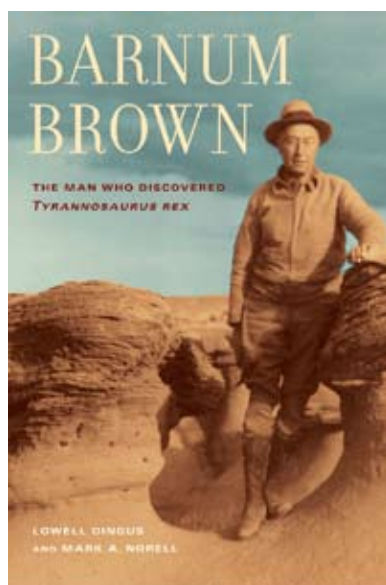
Dr Lyall I. Anderson

The Sedgwick Museum of Earth Sciences, University of Cambridge

Barnum Brown – the man who discovered *Tyrannosaurus rex*

Lowell Dingus & Mark A Norrell, University of California Press, 2010, ISBN 978-0-520-25264, hardback, 368pp. £20.95.

For someone known as the greatest dinosaur hunter of all time, it is surprising this is the first real biography of Barnum Brown (1873–1963). Previous books have concentrated on field activities, leaving the man himself a shadowy figure. The authors make this point: “Given all that he accomplished, the fact that no full biography has ever been written is a mystery to us.” A mystery no longer, this book examines his personal life as well as his scientific career and offers a vivid, highly readable account. On essentially the centenary of his *T. rex* discovery, Dingus and Norell produce an outstanding tribute to “Mr Bones”. The competitively-priced book draws on correspondence, notes and expedition reports in American Museum of Natural History archives as well as writing by his wives and daughter. It is all the better for that. Favourable reviews from dinosaur specialists appear on the cover but this book is of interest to non-specialists as well as vertebrate palaeontologists. The text is lavishly supported



by eight maps and 43 figures, and uses a clear font. Production standards are extremely high, from type-setting to the illustrations. A well-formatted bibliography and notes allow the reader to explore further, and find Brown’s original publications. Three appendices include a list of 57 major specimens displayed in the AMNH, a fascinating memoir on the discovery, excavation and preparation of the type specimen of *T. rex*, and a summary of collections made from 1896 to 1941.

We begin with an old man, reflecting on a “life filled with adventure and intrigue,” preparing an autobiography that never materialised. It covers the period 1873–89 and explains why his parents moved from the settled East to the Midwest frontier, nearly two decades before his birth on 12th February 1873; an interesting diversion, but we do not stay long. The unusual Christian name reflects the popularity of P. T. Barnum’s “Great Traveling World’s Fair” during the 1870s and an inability to decide what to call a new baby. A six-year-old brother solved the problem and the name stuck. William Cody founded Buffalo Bill’s Wild West in 1883 – an attraction that toured annually.



If Mr Bones had been born later, this book might have been about Buffalo Brown! Raised on a farm, the five-year-old Barnum collected Pennsylvanian invertebrates in overburden excavated from coal seams. The first chapter closes with a four-month trip into the remnants of the Wild West with his father which reinforced an instinct for taking reasonable risks.

Chapter 2: 1889–96 covers high school and undergraduate studies at Kansas University, and the introduction to Samuel Wendell Williston that crystallised Brown's palaeontological ambition. Inevitably in any book on this period, two great American fossil hunters must be mentioned: Marsh and Cope, and their well-known rivalry. Although interesting and well written, the three-page amble across well trodden ground could perhaps have been shortened. The authors redeem themselves by justifying its inclusion since Williston was the head of Marsh's field operations before he tired of the turmoil. Brown talked himself onto the 1894 expedition into South Dakota's White River Badlands to collect Tertiary mammals and learned excavation skills.

Chapter 3: 1896–98 details fieldwork and the beginnings of a relationship with the AMNH and its head of vertebrate palaeontology, Henry Osborn. One of the book's strengths is that it introduces many great American palaeontologists with interesting brief sections before steering the reader back to how they furthered Barnum Brown's career. A major discovery from this period was the skull and other skeletal elements of *Coryphodon*, one of the first mammals to attain large size after the Cretaceous dinosaur extinction. After all his fieldwork, it is hardly surprising that Brown did not complete his degree for another decade. It is a wonder he found time at all. The fourth chapter 1898–1900 details an 1899 South American expedition but begins with two more American greats – the mammal specialist William Diller Matthew and John Bell Hatcher. Patagonia became a focus for research into mammal evolution in the early 1890s when an Argentine palaeontologist proposed Argentina as “the cradle for mammalian origins and the focal point for vertebrate evolution and distribution” [p. 63].

Chapter 5: 1900–1903 documents Brown's interest shifting to Cretaceous dinosaurs, after discovering “a large carnivorous dinosaur not described by Marsh.” Although he immediately recognised its significance, he did not realize that this would be his greatest legacy. Chapter 6: 1903–06 deals with marriage to his first wife, Marion, who accompanied him on a scientific expedition and extended honeymoon. Dingus and Norell draw on unpublished accounts by Mrs Brown (*Log book of the Bug Hunters*) which must be a fascinating read, with notes on flora and fauna, weather, temperamental mules and the Crow Fourth of July dance. This is a particularly engaging chapter since it balances scientific discovery (most importantly the type of *Kritosaurus navajovius*) with landscape, natural history and Native American culture.

It closes with Osborn beginning a formal description of the prepared tyrannosaur. Although Brown is acknowledged, he is not a co-author in the 1906 paper proposing the new genus and species *Tyrannosaurus rex*.

Chapter 7: 1906–10. Brown's “Hell Creek Beds” coin a new name for the latest Cretaceous dinosaur-bearing sediments and set a foundation for understanding the Mesozoic–Cenozoic transition, *i.e.* the end of the dinosaur age and the beginning of that of mammals. The section ends poignantly with Marion's death. Both mother and her baby daughter contracted scarlet fever; the infant recovered, but Barnum lost the love of his life.



Canada's 1910 Dinosaur Bone Rush is skilfully described in chapter 8 (1910–16) – where dinosaur fossils were discovered in a remote region of Alberta. The Red River, Belly River Series and Edmonton Formations were slightly older than the Hell Creek Formation and the AMNH had geographical and chronological gaps to fill. Off Brown went to make numerous discoveries, including a new ceratopsian and other treasures. Dingus and Norell usefully correct nomenclature, noting that “*Ornithomimus*, which if truly an ornithomimid, would now probably be called *Struthiomimus*” [p. 134]. They also note that the specimen may be a juvenile *Albertosaurus*. The fact that both authors are dinosaur specialists is apparent in their attention to detail, and they increase the value of their work to those in their field as well as to non-specialists. Brown collected mammoths in Texas and Mexico, primitive whales in Mississippi and then on to Cuba. By July 1911, he returned to Alberta and almost drowned in an accident. If that had happened, the book would be much shorter.

Chapter 9 documents the three years Brown spent in Montana, US treasury consultancy and Cuba. Mr Bones published a *National Geographic* article in May 1919 entitled “Hunting big game of other days” and this is a good way to summarise his entire career. Correspondence from this period reveals his womanizing and a blackmail attempt. Oil prospecting in SW Ethiopia proved impossible to resist. Lilian McLaughlin, soon to be his second wife, waited in Cairo and accompanied him to India and Pakistan (Chapter 10: 1921–23). The narrative discusses hominid evolution before returning to Brown's expedition. The next two chapters (1923–25) cover Burma and Greece. Chapter 13 (1925–31) includes the only time, 1925–6, in 45 years that Brown “abandoned the field during consecutive years” [p.227]. He visited Nebraska in 1925 in search of ‘*Hesperopithecus*’ but doubted they were primate.

A paper published the next year confirmed this; despite resembling anthropoid molars the teeth probably belonged to an extinct peccary *Prosthennops*. The chapter returns to dinosaur hunting and valuable discoveries including ‘*Daptosaurus*’. This languished in collections until the 1960s when this lightly built theropod was renamed ‘terrible claw’: *Dienonychus* Ostrom 1969. The description of robot dinosaurs at Chicago's 1933 Worlds Fair in Chapter 14 is engaging. Sponsored by a US oil company, they gave Brown the idea to request expedition funding. Budgets became increasingly tight, mirroring problems of research today. The oil company funded a 20,000 mile aerial survey – a “paleontological extravaganza” [p. 251]. Hampered by lack of funds, Brown was busy in the field from 1935 to 1941 and this is documented in the penultimate section.

After battling museum cuts, he retired in July 1942, aged 69. The last chapter deals with Brown's role in war planning from late 1942–43, consulting (1943–45), oil prospecting on the Duke of Windsor's Alberta ranch and Guatemala (1947–52). His last field season in 1955 aged 83 almost killed him. After recovering from Rocky Mountain spotted fever, he then proposed being lowered down sea cliffs on the Isle of Wight by helicopter to dig for dinosaurs! Barnum Brown died a week before his ninetieth birthday. The epilogue summarises his career and personal life and character, while hinting at amorous adventures and clandestine government work: a balanced view of this larger than life character.

In summary, “The man who discovered *Tyrannosaurus rex*” is a work of great scholarship, nearly a decade in development and production. It is also a fascinating read.

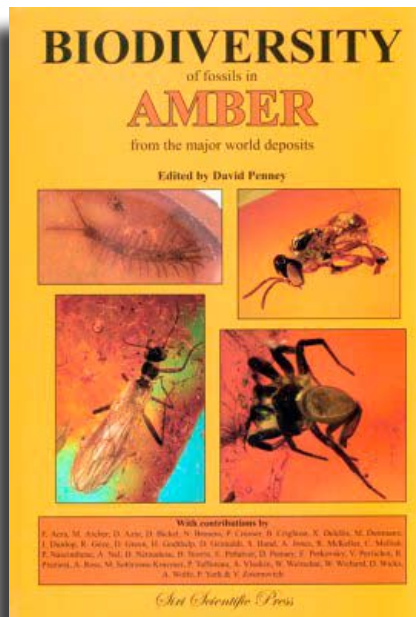
Rebecca Pyne
Ceredigion, Wales



Biodiversity of fossils in Amber from the major world deposits

Edited by David Penney. Published by Siri Scientific Press. Hardback.

ISBN 978-0-9558636-4-6. 303 pp. £90.50 including postage to United Kingdom addresses.



This is a collection of fifteen essays on amber and the variety of life which is contained therein. The book begins with a general introduction to amber and its fossil inclusions and concludes with a short look at recent copal inclusions. The meat of the book is a series of thirteen chapters, each of which is devoted to a separate amber deposit or amber-bearing region. Each such chapter is written by one or more specialists who has worked on the bioinclusions of the amber in question.

The deposits covered are those of the Baltic, Bitterfield, Burma, Canada, Cape York in Australia, Charente, Dominica, Lebanon, Mexico, New Jersey, Oise, Rovno, and Spain. Each chapter follows the same general pattern. After an introduction there is a section dealing with the geological setting of the amber, its age, its physical properties and its botanical source. An attempt is made for each deposit to say something about the palaeohabitat

which is represented. There then follows a discussion of the inclusions which have been found in the relevant deposit. These vary in length depending upon the amount of work which has been undertaken. It is no surprise that the longest section is in the Baltic chapter, given the long history of research there.

Each chapter concludes with a thorough bibliography. These are all absolutely up to date, and appear to be fully comprehensive. Anyone who wishes to delve deeper into the fauna of any particular amber deposit is given all that they will need to enable further reading. It is difficult to think of any improvement which could have been made to this aspect of the book. Perhaps a little space could have been saved by running all of the bibliographic information into a single unit, as there is some duplication from chapter to chapter, but the convenience of each chapter having its own reading list would then be lost.

Most of the chapters have an appendix listing the arthropods which have been identified from that deposit. A comprehensive species list is given for the ambers of Oise, New Jersey (Raritan), Burma, and Lebanon. For most other deposits all that is listed are the families which have been identified. Space would have precluded a full listing of species of many of the long-studied ambers, such as the Baltic and Dominica.



The book is very comprehensively illustrated, and many of the pictures of inclusions are of a very high standard. Unfortunately, many of these seem to be reproduced a little too yellow and a little less sharp than they might be. Some of the photographs have appeared elsewhere, such as many of the depictions of inclusions in the chapter on Baltic amber by Weitschat and Wichard which first appeared in the same authors' "Atlas of Plants and Animals in Baltic Amber" in 1998 – where they look less yellow, are reproduced at a larger size and appear somewhat sharper. Only a small minority of the illustrations are given a scale or details of institution and specimen numbers for the figured pieces.

Use is made of modern technology to provide several computerised reconstructions of inclusions in opaque amber. The illustration on page 77 of a scolytid beetle is exquisite and shows the level of detail which future researchers will be able to extract from difficult specimens as a matter of routine. Routine, that is, if they have access to a synchrotron. There is much scope in coming years for refiguring much of the type material from the Baltic, where there is often partial obstruction in visible wavelengths as a result of a milky emulsion having been formed by the reaction of the water in the inclusion with the amber-forming tree resin.

It is inevitable in a multi-author work that some chapters will be better than others. Those on the ambers of Burma, the Baltic, Bitterfield and Dominica are the best. Others can decide upon their personal 'least favourite' chapters.

There are commendably few typographical errors. A little tighter editing could have been deployed in places. For example, on page 49, when speaking of Arachnida in Mexican amber it is stated that these include "32 species in 33 genera". This is either wrong (a species cannot be in more than one genus) or it is an obscure way of saying that 32 have been identified to species, and that 33 genera have been identified. The reader cannot tell which. Similarly, the word 'table' is used as a transliteration from German, where 'plate' would be much more appropriate.

The editor tried to solicit chapters on the amber faunas of Russia, China and Japan, but unfortunately he could not find anyone who possessed both a willingness to write about, and the requisite specialist knowledge of, the fauna.

There is no discernible logic to the order in which the chapters appear. One would have thought that stratigraphic order would have been the most obvious to follow, or perhaps the chapters could have been grouped geographically. They simply seem to have been added at random – perhaps in the order in which the editor received the manuscripts.

The book lacks an index. No doubt the justification for this is that each chapter follows the same format, so that it is relatively easy to navigate the whole work. However, at the very least, a taxonomic index would be very useful.

Each chapter has a diversity table, presented as a bar chart on a fetching amber background. These would be easier to look at if printed as black on white.

Overall there is much to like about this book. It is right up to date. The bibliographies could not be bettered. It provides a good overview of what is currently known of the composition of the fauna (and to a lesser extent the flora) of the amber deposits covered. By implication, it shows the ample areas where further research is needed.



This book is aimed at amber specialists and also at the extensive number of amateur collectors of amber inclusions. Given its price, sadly it will be beyond the means of many of the latter. For those who can justify the price to their significant other or their library purchasing committee, they will know much more when they finish reading this title than when they start.

Peter M. Macdonald

Berwickshire, Scotland

New Perspectives on Horned Dinosaurs

(Review 1)

Edited by Michael J. Ryan, Brenda J. Chinnery-Allgeier and David. A. Eberth.
2010. Indiana University Press. 624 pp. US\$110.00. ISBN 0-253-35358-0.



Among all the known groups of dinosaurs, the ceratopsians – or horned dinosaurs – of which the iconic *Triceratops* is a member, has seen the most explosive growth of new material in recent years, with an astonishing 14 new species named since 2007. As a result, keeping track of the plethora of new ceratopsian genera and research has become increasingly difficult. *New Perspectives on Horned Dinosaurs* addresses this problem by containing a host of articles revealing new theories and findings and descriptions of new (and in some cases bizarre) species.

An examination of the list of contributors reveals a veritable ‘who’s who’ of ceratopsian and dinosaur researchers from around the world, which is indicative of the depth and quality of the work contained in this book.

The book is divided into five sections, each pertaining to different aspects of recent ceratopsian research, making for a structured and coherent volume. Within these five parts there are 36 articles presented in the same format as those within a scientific journal, beginning with an abstract and an introduction, then broken down into appropriate headings and ending with a list of references.

The first part only contains one item, an introductory overview written by Peter Dodson, whose expertise on ceratopsians is matched only by his enthusiasm. Here he details the journey that he undertook to become a major influence and contributor in the sphere of ceratopsian palaeontology. His story, like so many others in the science, is firmly rooted in his childhood, and you cannot help but be infused with what Dodson has quite appropriately coined “ceratophilia”, a love of horns. The existence of *New Perspectives on Horned Dinosaurs* is a clear indication that this is a condition afflicting an ever-increasing number of people.



Following this introductory overview, the second section opens with a paper by Paul Sereno regarding *Psittacosaurus*. An extensive re-evaluation of the relationships of the numerous species assigned to the genus (more species than any other dinosaur taxon) is presented, as well as a detailed account of cranial morphological development from juvenile to adult. This article is set to be the cornerstone of *Psittacosaurus* systematics for many years. The remainder of the second part of the volume consists of twelve chapters that contain descriptions of new taxa or the re-evaluation or examination of pre-existing species in light of new material.

As well as descriptions of new genera, functional, morphological and behavioural studies are also presented in the third section. Some of these articles explore new areas not previously worked on with regards to ceratopsians, such as the possibility of nocturnal behaviour in *Protoceratops*, a theory that – while it may challenge popular preconceptions – is well presented with a strong argument. Others, such as thermoregulation (a function which has been attributed to ceratopsian cranial ornamentation before) and the forelimb stance of ceratopsids (an issue that has caused significant debate) are re-examined in light of new material or computing and analytical techniques.

The fourth section contains studies regarding palaeobiogeography, taphonomy and palaeoecology, areas of research that can be extremely informative, but that have until now received relatively little study with regards to ceratopsians. This section contains some interesting results, such as evidence for multiple dispersal events both to and from Asia to North America, as well as indications that some ceratopsian species may have, on occasion, gathered into large groups.

The final section, History of Horned Dinosaur Collection, is the shortest of the five, containing only two articles. The first of these delves into the mystery of William E. Cutler's missing *Eoceratops* – a mystery that I shall not divulge the conclusion of here. While this tale doesn't contain any ground-breaking revolution in the study of ceratopsians it is still a fascinating read and adds a more human element to ceratopsian palaeontology. The final article suggests that the rarity of juvenile *Triceratops* finds compared to adult material, as well as being the result of taphonomic factors, may be attributed to collecting bias in the Hell Creek Formation. While it is regrettable that the mudstone beds where juvenile material is concentrated were overlooked, such a revelation will hopefully lead to the discovery of greater quantities of subadult material, invaluable in furthering our understanding of *Triceratops*.

The book includes a supplemental CD-ROM containing a further two articles in .pdf format. These should not be overlooked, as each one is an extremely detailed and in-depth resource. The first, *A Ceratopsian Compendium*, contains a list of all known ceratopsian specimens as of 30th May 2008. Listed in geochronological order, the entry for each specimen contains the following information: taxonomic designation and author(s), specimen number, the location from which the specimen was collected, stratigraphy, and the current taxonomic status. As well as this wealth of information, full references are provided, should you wish to read up on a specific specimen, making this article a truly valuable resource. The second article, *Ceratopsian Discoveries and Work in Alberta, Canada: Historical Review and Census*, contains an incredibly detailed history of ceratopsian discoveries in Alberta. For each year discoveries are listed as well as other events, such as expeditions, personal details of palaeontologists and collectors, formations of institutions and other useful pieces of information. Included are a significant number of figures, such as maps, photographs and illustrations of ceratopsian specimens, and photographs of dig sites. The sheer scope of information on the history of Alberta's ceratopsian finds in this article is staggering.



As is to be expected with a book produced by so many contributors, there are subtle variations in writing style throughout the book, mostly in the more general areas such as the introductions to the articles. In such areas the writing is both engaging and succinct.

The illustrations and figures in *New Perspectives on Horned Dinosaurs* are typical of most palaeontological articles, including site maps, cladograms, photographs and renderings of specimens, and life reconstructions of new taxa, all of which are of an excellent quality and serve a definite purpose in the article. The book also contains eight high-quality plates which are full colour versions (barring one in greyscale) of figures featured throughout the book, mostly pertaining to Sereno's article regarding *Psittacosaurus*. One minor criticism is the curious location of the plates in the book, nestled within an unrelated article towards the start, somewhat breaking the flow of the text. A more logical position would be at the end of a chapter or before the index.

The intended audience of this book is academics who have a firm understanding of palaeontological methods and terminology, so it is not well suited as an introductory source to ceratopsians or palaeontological techniques for the casual reader.

Not since *Review of the Ceratopsia* by Hatcher, Marsh and Lull in 1907 has such a comprehensive and significant single publication focusing on the ceratopsians been released, and *New Perspectives on Horned Dinosaurs* serves as an essential resource in the understanding of this popular and dynamic group of dinosaurs.

Richard Bailey

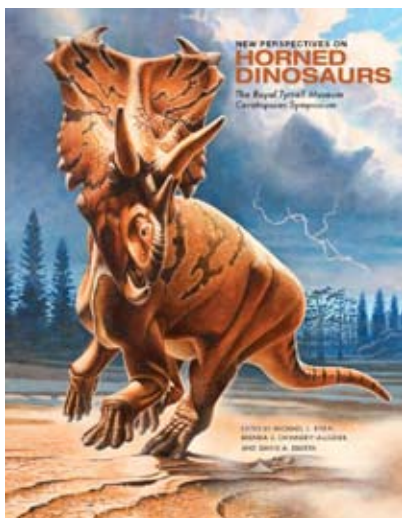
Lincoln

New Perspectives on Horned Dinosaurs

(Review 2)

Edited by Michael J. Ryan, Brenda J. Chinnery-Allgeier and David. A. Eberth.
2010. Indiana University Press. 624 pp. US\$110.00. ISBN 0-253-35358-0.

Of all extinct organisms, the end-Cretaceous horned dinosaur *Triceratops* is surely one of the most iconic, doomed to be eternally reconstructed in a heroic faceoff with its equally iconic contemporary, *Tyrannosaurus*. *Triceratops* is the best known member, and one of the latest-surviving representatives, of the Ceratopsia, a group of herbivorous ornithischian dinosaurs characterised by the presence of facial horns and a frill extending from the posterior margin of the skull (the horns and frill are rudimentary or absent in basal members of the clade such as psittacosaurus). Ceratopsians appear in the fossil record during the early Late Jurassic, and their fossil record suggests high taxonomic and morphological diversity during the Cretaceous, particularly during the latest Cretaceous (Campanian and Maastrichtian).





Geographically, they appear to have been a Laurasian diversification: almost all ceratopsian diversity is known from North America and Asia, with only fragmentary material from Europe (*Ajkaceratops*). The most derived group of ceratopsians, the large, superficially rhino-like ceratopsids, were long thought to be entirely restricted to the Western Interior of latest Cretaceous North America, but have recently been documented from Asia (*Turanoceratops*, *Sinoceratops*).

Like many other groups of non-avian dinosaurs, ceratopsians have seen a staggering increase in their documented diversity in recent years, reflecting a massive increase in field- and specimen-based research (as well as, probably, a recent shift towards 'splitting' rather than 'lumping'). Whereas no new ceratopsid genera were named between 1950 and 1986, at least 17 have been named since 1990. The most recent comprehensive reviews of ceratopsian systematics in 2004 recognised around 40 valid species; as of early 2011, that figure is probably closer to 80. In 2010 alone, 15 new genera or species of ceratopsian were erected. The sheer volume of research being conducted on the group is reflected by the publication of the monumental new volume *New Perspectives on Horned Dinosaurs*. This multi-authored volume of new research papers is the result of a symposium held at the Royal Tyrell Museum, Canada, in 2007, and includes 36 chapters by 66 contributors, including nearly every major researcher currently working on ceratopsians (at least within North America: there are few to no contributions by Chinese, Russian or European workers). The volume is accompanied by a CD that contains two useful resources: a 153 page document by Tracy Ford detailing ceratopsian distribution (including localities, specimen numbers, stratigraphic units and ages), and a 488 page monster of a document by Darren Tanke reviewing the discoveries of ceratopsians from Alberta over the last 110 years. The sheer size of *New Perspectives...* makes it undoubtedly the most important volume on ceratopsians to appear since a monographical overview of the group published by Richard Lull more than 75 years ago, and perhaps the most significant multi-authored volume on dinosaurs to appear since the second edition of *The Dinosauria* in 2004.

The book is divided into four sections. The first (Chapter 1) consists of an autobiographical sketch by the American palaeontologist Peter Dodson of his career. Dodson is well known for his lifelong work on ceratopsians (and is a self-confessed 'ceratophile'), he wrote the only serious popular overview of the group currently available (*The Horned Dinosaurs*) as well as contributing to the last major reviews of the group's systematics, and might perhaps be considered the elder statesman of ceratopsian research. The second section (chapters 2–14) focuses on ceratopsian systematics, including the description of six new species and one new genus, as well as less diagnostic new material. This section contains one of the most useful and important contributions to the entire volume: Paul Sereno's beautifully illustrated review of the species-level taxonomy, cranial anatomy and ontogeny, and phylogeny of the basal ceratopsian *Psittacosaurus* (Chapter 2). Moreover, the new ceratopsian material described includes important new taxa from Mexico (Chapter 7: Loewen *et al.*) and Utah (Chapter 8: Kirkland & DeBlieux) that expand the stratigraphic and biogeographical range of ceratopsids. At least some of the new taxa described here are likely to prove controversial: for example, *Ojoceratops* (Chapter 11: Sullivan & Lucas) and *Tatankaceratops* (Chapter 14: Ott & Larson) have already been argued to be junior synonyms of *Triceratops* (Longrich, N. R. in press. *Cretaceous Research*).

Section 3 (chapters 15–25) focuses on anatomy and functional morphology, and opens with two chapters that focus on the comparative anatomy of the palate, basicranium and mandible of basal



ceratopsians (chapters 15 and 16: Dodson *et al.*; Tanoue *et al.*) and one chapter on the histology of the frill of *Centrosaurus* (Chapter 17: Tumarkin-Deratzian). The following four chapters focus on a topic of perennial interest, the function of the horns and frills of ceratopsids (generally thought to have been used in defence or to have been secondary sexual characteristics used in displays or for intraspecific combat), and apply approaches such as finite element modelling (Chapter 18: Farke *et al.*) and beam theory (Chapter 21: Henderson). Particularly interesting is the chapter by Happ (Chapter 19), which makes a strong case for a thermoregulatory role for the horns of *Triceratops* on the basis of a new, exceptionally preserved specimen. Two provocative chapters focus on the behavioural adaptations of basal ceratopsians: Longrich (Chapter 22) argues that the proportionally large eyes of *Protoceratops* are consistent with nocturnal behaviour in this desert-dwelling taxon, whereas Ford & Martin (Chapter 23) argue for a semi-aquatic lifestyle in *Psittacosaurus*. Unfortunately, the arguments of the latter chapter are rather poorly supported and unconvincing. The final two chapters of this section address ceratopsid forelimb stance and kinematics (Chapter 24: Rega *et al.*) and ceratopsid palaeopathologies (Chapter 25: Tanke & Rothschild), the latter making the interesting proposal that the high proportion of fractured ribs seen in ceratopsid specimens is potentially evidence for nonlethal flank-butting behaviour.

Section 4 (chapters 26–34) is a mixed bag of research topics, opening with an interesting and useful, although qualitative, overview of ceratopsian palaeobiogeography (Chapter 24: Chinnery-Allgeier & Kirkland); recent discoveries from Europe and Asia will mean however that many of the conclusions of this chapter already require reassessment. Sampson & Loewan (Chapter 27) provide an excellent overview of the evolution of ceratopsids within the Western Interior of North America during the Campanian and Maastrichtian: they make a compelling case that the abundant and well-studied material, well-documented stratigraphy, high species diversity, and low temporal duration and geographical range of ceratopsids makes them an excellent case study for understanding a vertebrate evolutionary radiation. Ceratopsids appear to have had surprisingly rapid species turnover and small biogeographical ranges, with strong evidence for latitude-related endemism. Eberth (Chapter 28) provides an important and data-rich review of ceratopsian palaeoenvironmental associations and taphonomy. Chapters 29–34 focus primarily on taphonomy, particularly on the formation and implications of the ceratopsid bonebeds that are known from many locations in latest Cretaceous North America.

The final section of the volume (chapters 35 and 36) addresses historical aspects of the collection of ceratopsians: particularly interesting is the discussion by Goodwin & Horner (Chapter 36) of the possible effects of historical collecting biases on our understanding of the ontogeny of *Triceratops*.

As a multi-authored conference proceedings, the quality and interest of the individual chapters is naturally variable, although the great majority of chapters are of a good-to-high scientific standard. The volume suffers somewhat from the scarcity of synthetic overviews: examinations of broad-scale phylogeny, patterns of diversity and disparity, or evolutionary trends across all ceratopsians would have been particularly welcome. Minor gripes aside, this is a visually attractive, well-edited, well laid out, and important volume. Its list price is not cheap, but at 624 pages it represents reasonable value for money, and is an essential purchase for anyone with a serious interest in horned dinosaurs.

Richard J. Butler

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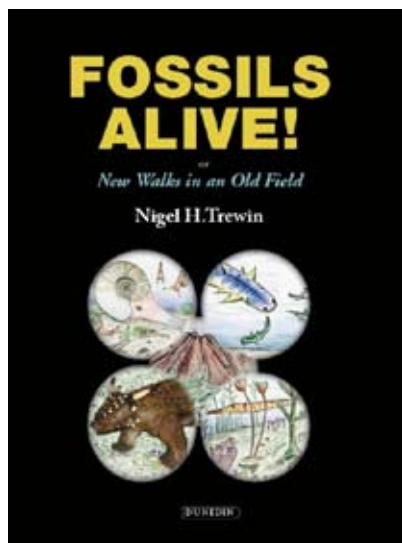


Fossils Alive! or New Walks in an Old Field

Trewin, Nigel H. 2008. Dunedin Academic Press, Edinburgh, 211 pp.
ISBN 978-1903675883. £19.95.

Britain is a fortunate place: it provides us with some of the most complex and varied geology of any area of comparable size in the world. The north-east corner of Scotland, home for the past 40 years or so of Nigel Trewin – the Indiana Jones of British (Palaeozoic) Palaeontology – is no exception, though it is perhaps relatively unknown to many geologists simply because it is remote.

The ten 'wildlife excursions or safaris travelling back through time' presented in this volume give the reader (general or professional alike) a chance to experience almost first hand the intellectual fun of fossil hunting along unknown paths. The book also provides an almost Larsen-like 'far side' exploration of past faunas, floras and environment. Nigel's fascinating and rather quirky book will guide any geologically-minded visitors or young students to explore this splendid isle, and to learn more about its unique rock successions.



Just a little disappointing to me in his chronological tour were only brief mentions of the Silurian; at Lesmahagow and Hagshaw, and even Pentland where the UK's oldest fish was found over 150 years ago in little-acknowledged Lagerstätten (Turner 2009). Nevertheless, Nigel gives chapter and verse through the Devonian sites of importance, such as the Lower Devonian of the Midland Valley and the mid-Devonian of Rhynie where the Trewin 'team' have done such good work on fish, invertebrates, plants and traces. His work in my own adopted country on giant arthropod track-makers is also a highlight.

The nice illustrations show active palaeontologists, both amateur and professional, including 'mates' and students, e.g. Bob Davison and Lyall Anderson, from his coterie of collaborators.

Dunedin Press has done a good job in production, with a gazetteer but sadly no index, which would have been useful. This little gem of a book should be on every palaeontologically-minded bookshelf.

Nigel has created a narrative that reveals not only his accumulated years of knowledge and a little of his own history, but allows us to be vicarious travelers, sometimes in a dangerous land. The text is well written and easy to digest for the educated reader; it probably best suits advanced undergraduates and postgraduate students. The story unfolds with lively anecdotes that will entertain and inform readers and hopefully inspire both this and future generations.

Susan Turner
Brisbane, Australia

REFERENCE

TURNER, S. 2009. Fossil Lagerstätten in Australia: discovery and politics. *INHIGEO 34 Fossils & Fuels*, University of Calgary Aug 10–14 2009. Abstracts, p. 73-74.



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- *Biology of the Sauropod Dinosaurs*, edited by Klein, Remes, Gee & Sander
- *Fossils in Amber: remarkable snapshots of prehistoric forest life* by Penney & Green
- *Eurypterids Illustrated – The Search for Prehistoric Sea Scorpions* by Samuel J. Ciarra Jr
- *Cold-Water Corals* by Roberts, Wheeler, Friewald & Cairns
- *Frasnian (Upper Devonian) Colonial Disphyllid Corals from Western Canada* by McLean
- *Late Ordovician and Early Silurian Stromatoporoid Sponges from Anticosti Island, Eastern Canada* by Nestor, Copper & Stock
- *Scotland's Beginnings* by Taylor & Kitchener
- *Death of an Ocean: A Geological Borders Ballad* by Euan Clarkson and Brian Upton
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The phylogeny of post-Palaeozoic Asteroidea (Neoasteroidea, Echinodermata)

Andrew Scott Gale

Abstract: The skeletal morphology and homologies of 24 extant asteroid taxa and one Palaeozoic outgroup (*Calliasterella mira*; Upper Carboniferous, Moscow area, Russia) are described in detail. This information is used to construct a character matrix to identify deep relationships within the Neoasteroidea. Particular attention is paid to the morphology and homologies of the character-rich ossicles of the mouth frame (orals, circumorals, odontophore) and of the ambulacral groove (adambulacrals, ambulacrals). In addition, new homologies between alveolar and forcipulate pedicellariae are identified. Soft-tissue characters are reviewed from the literature.

Simultaneous unconstrained cladistic analysis of 128 characters yielded six equally parsimonious trees, and a consensus tree of these is presented. This places the Paxillosoidea as the most basal neoasteroid group, sister taxon to the Surculifera, which include all other neoasteroids. The Spinulosida (used here in its original sense) are a well-supported monophyletic group, and a newly identified clade here named the Tripedicellaria, unified by characters of the pedicellariae, includes both the Valvatida and Forcipulatida. 'Valvatids' are a paraphyletic group of taxa that are sister group to the Forcipulatida. The fossil record of the asteroid families to which the 24 investigated species belong is reviewed, and the stratigraphical information is used to constrain the positions of the nodes on the consensus tree.

The enigmatic asteroid fossil record from the Triassic is reviewed, and it is concluded that the order Trichasteropsida is a poorly understood assemblage of diverse morphologies of which the relationships with other taxa are uncertain. Middle Triassic (Muschelkalk) asteroids are identified as neoasteroids *incertae sedis* and assigned to two families: Trichasteropsidae and Migmasteridae fam. nov. Well-preserved asteroid ossicles from the Carnian of the Italian Dolomites are described and demonstrate that much of the neoasteroid radiation had taken place by the early Carnian (Late Triassic) because ossicles of taxa close to ophiasterids and asterinids are present. It is concluded that the sudden appearance of diverse taxa with close affinities to modern families in the Early and Mid-Jurassic is an artefact of the extensive record of marine sediments of these ages and not of contemporaneous radiation of the neoasteroids. Detailed ossicular morphology is extremely useful and underused, both in the identification of asteroid relationships and for the assignation of fossil neoasteroids to extant families.

The adaptive evolution of the neoasteroid skeleton is reviewed, and the neoasteroids are considered to be primitively infaunal and only secondarily adapted to epifaunal modes of life, the opposite of the case of post-Palaeozoic echinoids. It is concluded that *Xyloplax* is a true neoasteroid and most closely related to the Caymanostellidae. A new genus of Xyloplacidae, *Ankyloplax*, is erected. *Calliasterella mira*, from the Upper Carboniferous of Moscow, is redescribed. The first Jurassic goniopectinid (*Chrispaulia jurassica* sp. nov.), a benthoplectinid (*Jurapecten hessi* gen. et sp. nov.) and two pterasterids (*Savignaster wardi* gen. et sp. nov., *Savignaster trimbachensis* gen. et sp. nov.) are described from the upper Oxfordian (Upper Jurassic) of the French Jura. *Terminaster cancriformis* is redescribed on the basis of new material and assigned to a new family, the Terminasteridae.

Key words: Asteroidea, neoasteroids, phylogeny, classification.





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