The Palaeontology Newsletter

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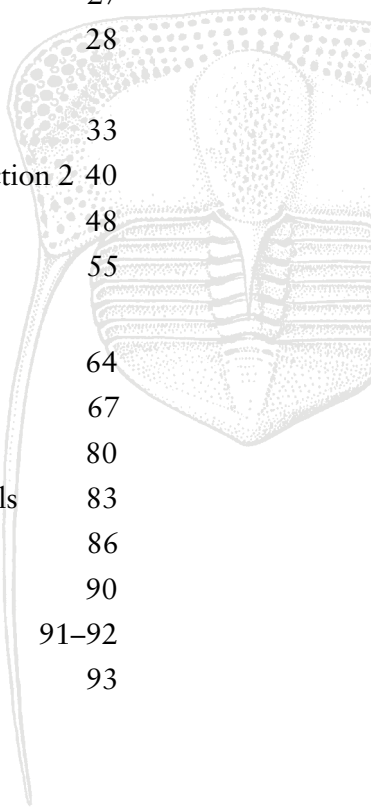

Reminder: The deadline for copy for Issue no 87 is 13th October 2014.

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Editorial

You know you are getting pedantic when you find yourself reading the Constitution of the Palaeontological Association, but the third article does serve as a significant guide to the programme of activities the Association undertakes.

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.

Council has taken a significant step under categories (b) and (c) above, by committing significant funds, relative to spending on research and travel, to Outreach and Education projects (see p. 27 for more details).

This is a chance for the membership of the Association to explore a range of ways of widening public awareness and participation in palaeontology that is led by palaeontologists. Not by universities, not by research councils or other funding bodies with broader portfolios. Some of the projects may feed in to future Impact Statements or form part of Impact Cases for the offspring of the REF. However, these projects also offer a significant chance to consider the impact of projects done for the joy, enthusiasm and excitement generated by a local site visited by generations of avocational palaeontologists, or to prepare works on the relationships between the built-heritage and palaeontology. Palaeontology, and geology, are part of natural history and can be enjoyed in this way. We should not be afraid to promote palaeontology by these means, and the Association has a fine tradition of producing excellent field guides. However, these can contain a great deal more information than most people want. The Lyme Regis area is well served by a range of inexpensive guides that list the common fossils and give short explanations of the relevant geology. Often such projects require only a few hundred pounds to run and can provide a local resource that can be used by a range of community groups. Getting such groups involved in projects offers a way to make projects sustainable and multiply their effectiveness.

The Association's aim to support allied sciences should also be considered. Where are the links with the other areas of geosciences, evolutionary biology, archaeology and ecology that can help us raise the visibility of the distinctive contribution palaeontology and palaeontologists make to these sciences? At a time when Earth Sciences and Geology, despite the tremendous range of scientific and technical skills they call upon, are not subjects that school pupils have much contact with, perhaps we do need to consider how to work with colleagues in allied subjects that have a higher public profile to deliver joint events and packages that benefit all concerned. In an environment in which the school curriculum apparently has a growing influence over the sort of events that are run on schools days at science fairs, we have a situation where those areas of science that lie outside the curriculum are airbrushed out. To this end, it may be the community groups, the local geological societies and other elements of civic society that we need to turn to as a means of building a resilient network of organisations that can allow people to engage with palaeontology on their terms. To borrow from the title of the Geologists' Association 2014 Annual Meeting: 'Palaeo to the People!'

Al McGowan
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Newsletter Editor
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Association Business

Annual Meeting 2014

Notification is given of the 58th Annual General Meeting

This will be held at the University of Leeds, UK, 17th December 2014, following the scientific sessions of the Annual Meeting.

AGENDA

1. Apologies for absence
2. Minutes of the 57th AGM, University of Zurich
3. Trustees Annual Report for 2013
4. Accounts and Balance Sheet for 2013
5. Election of Council and vote of thanks to retiring members
6. Report on Council Awards
7. Annual address

DRAFT AGM MINUTES 2013

Minutes of the Annual General Meeting held on Saturday 14th December 2013 at the University of Zurich, Switzerland.

1. Apologies for absence: Prof. D. Donovan, Prof. J. Kennedy, Ms J. Lawrence, Dr A. McGowan, Dr P. Orr, Dr M. Sutton, Dr T. Vandenbroucke.

2. Minutes: Proposed by Mr D. J. Ward and seconded by Mr A. Spencer, the minutes were agreed a correct record by unanimous vote of the meeting.

3. Trustees Annual Report for 2012: Proposed by Prof. G. Sevastopulo and seconded by Dr H. A. Armstrong, the report was agreed by unanimous vote of the meeting.

4. Accounts and Balance Sheet for 2012: Proposed by Dr C. T. S. Little and seconded by Prof. D. A. Harper, the accounts were agreed by unanimous vote of the meeting.

5. Proposed changes to the Constitution: As proposed by Prof. M. P. Smith and seconded by Dr M. Munt, the members agreed by a unanimous vote to accept the following changes to the Constitution (new text in bold):

a. Paragraph 6: The business of the Association shall be undertaken by a Council and by committees of the Council. The Council shall consist of a maximum of twenty members. The Officers shall consist of a President, and, at least, two Vice-Presidents, a Treasurer, a Secretary, **an Editor-in-Chief**, and such other Officers as the Council may from time to time determine. At any meetings

of the Council six members shall form a quorum which shall always include the President, or a Vice-President or the Secretary. The committees of the Council may co-opt members of the Association as non-voting committee members. Committees of Council shall be open to all members of Council.

b. Paragraph 7: Periods of service for Officers shall be flexible but should normally not exceed two years for President and Vice-Presidents, and five years for Secretary, Editors, and Treasurer. Total consecutive service as an Officer (excluding service as President) should **normally** not exceed ten years. Other members of the Council shall be elected for a period of three years. All members of Council are Trustees of the Association in accordance with charity law.

6. Subscriptions: Following discussion, members agreed to Council's proposed changes to subscriptions. From 2015, the rates for retired and student members will be £15 (for online access to the journal only) or £36 (including a paper copy of the journal); the rates for ordinary members will be £30 (for online access only) or £45 (including a paper copy of the journal).

7. Election of Council and vote of thanks to retiring members

Prof. M. J. Benton extended a vote of thanks to the following members of Council who were retiring from their positions this year: Dr H. A. Armstrong, Dr C. Klug, Dr P. Upchurch. The following members were elected to serve on Council. *President:* Prof M. J. Benton; *Vice Presidents:* Dr M. Sutton and Dr A. B. Smith; *Treasurer:* Mr P. Winrow; *Secretary:* Prof R. J. Twitchett; *Editor-in-Chief:* Dr A. B. Smith; *Editor Trustees:* Prof C. H. Wellman, Dr M. Ruta; *Newsletter Editor:* Dr A. McGowan; *Book Review Editor:* Dr C. Jeffrey-Abt; *Publicity Officer:* Dr L. Herringshaw; *Education Officer:* Dr C. Buttler; *Outreach Officer:* Dr F. Gill; *Internet Officer:* Mr A. Spencer; *Meetings Coordinator:* Dr T. Vandenbroucke; *Ordinary Members:* Dr R. J. Butler, Dr C. T. S Little, Dr M. Munt, Dr R. Owens and Mr D. Ward. Dr C. T. S. Little will organise the annual meeting in 2014 at the University of Leeds, UK.

8. Association Awards: The following awards were made: Lapworth Medal to Prof. D. Edwards (University of Cardiff); President's Medal to Prof. C. H. Wellman (University of Sheffield); Hodson Award to Dr M. Friedman (University of Oxford); and the Mary Anning award to Dr Hans Hess (Basel, Switzerland). Under the Small Grants Scheme, the following awards were announced: Sylvester-Bradley Awards to Dr M. Barham, N. Barling, L. Hauser, L. McLennan, and M. O'Sullivan; Callomon Award to E. Pape; and Whittington Award to Dr C. Apaldetti. Research Grants were awarded to Dr A. McGowan (University of Glasgow), Dr T. Challands (University of Edinburgh) and Dr S. Danise (Plymouth University). The President's Award was made to J. Clarke (University of Oxford) and the Council Poster Prize was presented to D. Button (University of Bristol).

9. Annual Address: The Annual Address entitled "Sharks and the deep origin of modern jawed vertebrates" was given by Prof. M. Coates (University of Chicago).

Trustees Annual Report 2013

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 18th December 2012: *President*: Prof. M.J. Benton; *Vice Presidents*: Dr A.B. Smith and Dr H.A. Armstrong; *Treasurer*: Mr P. Winrow; *Secretary*: Prof. R.J. Twitchett; *Chair of Publications Board*: Dr P.J. Orr; *Editor Trustees*: Dr P.C.J. Donoghue and Dr H.A. Armstrong; *Book Review Editor*: Dr C. Jeffrey-Abt; *Newsletter Reporter*: Dr L. Herringshaw; *Newsletter Editor*: Dr A. McGowan; *Web Officer*: Dr M. Sutton; *Meetings Coordinator*: Dr T. Vandenbroucke*; Ordinary Members*: Dr C. Klug, Dr R. Owens, Dr W. Renema, Dr P. Upchurch, Mr D. Ward. *The Executive Officer*: Dr T.J. Palmer and *Editor-in-Chief*: Dr S. Stouge continued to serve Council but are not Trustees. Dr C. Buttler, Dr F. Gill and Prof M.A. Purnell were co-opted onto Council but are not Trustees.

Membership. Membership on 31st December 2013 totalled 1,163 (1,182 at end 2012). Of these 660 were Ordinary Members, 147 Retired Members, 19 Honorary Members, 285 Student Members and 52 Institutional Members. There were 80 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, St Helen's, 1 Undershaft, London EC3A 8BB.

Reserves. The Association holds reserves of £790,665 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 £64,246 in Designated Funds which contribute interest towards the funding of the Sylvester-Bradley, Hodson, Callomon, and Whittington Funds and towards the Jones-Fenleigh awards. Total funds carried forward to 2014 totalled £854,911.

Finance. Total charitable expenditure, through grants to support research, scientific meetings and workshops in 2013, was £295,456. Governance costs were £16,158. Total resources expended were £341,665. 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*.

Risk. The Association is in a sound financial position. Succession planning for the Executive Officer remains a concern and will be considered as part of the Annual Review of Officers in 2014.

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.

Research Grants. Palaeontological Association Research Grants were awarded to Dr A. McGowan (University of Glasgow) for a project entitled 'Determining whether damming of the River Kerry (NW Scotland) produced a deleterious growth spurt in a threatened *Margaritifera margaritifera* population with high-precision dating methods'; to Dr T. Challands (University of Edinburgh) for 'Palaeoneurology and sensory systems in Devonian lungfish: morphological diversity or conservatism in the neurological system?'; and Dr S. Danise (Plymouth University) for 'Mesozoic marine reptile dead-falls: analogues of whale fall communities?'.

Grants–in-aid. The Association provided funds to support the following meetings and workshops: 'Biological and Environmental Feedbacks in the Colonization of the Water Column' (GSA Annual Meeting 2013, Session T236, Denver, CO, USA); 'Konservat-Lagerstätten: Morphology, Ecology, and Taphonomy of Exceptionally Preserved Fossils' (GSA Annual Meeting 2013, Session T243); Stan Wood's Palaeontological Legacy meeting (National Museum of Scotland); 'Prehistoric colours in fossil insects and feathers' (Royal Society Summer Science Exhibition); a workshop entitled 'Introduction to Research Methods in Quantitative Palaeobiology' (University of Bristol); the 9th European Palaeobotany and Palynology Conference (Padova, Italy); the Arthur Smith Woodward 150th Anniversary Symposium (NHM, London); a workshop entitled 'Challenges in Macroecology – scaling the time barrier' (NHM, London); 'Dead organisms as data archives: Conservation and global change palaeobiology' (EGU session SSP4); the 2014 Society of Vertebrate Palaeontology and Comparative Anatomy meeting (York, UK); the 9th International Congress on Cephalopods Past and Present (Zurich, Switzerland); and a meeting entitled 'The Old Red Sandstone of the South-Western Province' (South Wales). In addition, funds were provided to support the following sessions at IPC4, to be held in Mendoza, Argentina: 'Cretaceous marine biotas and seaways in Gondwana'; 'Research and Management of Palaeontological UNESCO World Heritage Sites'; 'Rotten fossils? Experimental and analytical approaches to decay and exceptional preservation of soft tissues'; and 'Evolution of photosynthesizing organisms – from microbiota to plants'.

Small Grants Scheme. The scheme received eleven applications. Seven were recommended for funding in 2014, totalling £9,183.50. Sylvester-Bradley Awards were made to Dr Milo Barham, Nathan Barling, Luke Hauser, Laura McLennan, and Michael O'Sullivan. The Callomon Award was awarded to Edine Pape, and the Whittington Award to Dr Cecilia Apaldetti.

Online activities. The online activities of the Association continue to expand with investment in a larger, faster, and more secure server. The Association is now the sole host for the online-only journal *Palaeontologia Electronica*. The Association also continues to host websites for other societies (The Palaeontographical Society; International Organisation of Palaeobotany), palaeontological online resources (EDNA fossil insect database; the Kent Fossil Database), and online outreach projects (*Palaeontology* [Online]). The Association launched a Twitter account, @ThePalAss, which had *c.*500 followers by the end of the year.

Public meetings. Four public meetings were held in 2013, and the Association extends its thanks to the organisers and host institutions of these meetings.

57th Annual Meeting. This was held on 13th – 16th December at University of Zurich, Switzerland. Dr Klug with local support from colleagues and PhD students organised the meeting which included a symposium on "Fossilised ontogenies and evolution" and comprised a programme of internationally recognised speakers. There were 268 attendees. The Annual Address entitled "Sharks and the deep origin of modern jawed vertebrates" was given by Prof. Michael Coates (University of Chicago). The President's Prize for best oral presentation from an early career researcher was made to John Clarke (University of Oxford). The Council Poster Prize was presented to David Button (University of Bristol). A choice of two post-conference field trips was offered: to the dinosaur museum at Aathal or to Monte San Giorgio.

British Science Festival, Palaeontological Association Symposium. This is an annual forum for presentations to the public and general scientists. The Symposium "Bodies of Evidence" was organised by Dr Liam Herringshaw at the Great North Museum, Newcastle. Funds were provided to support presentations by Prof. Mark Purnell and colleagues (University of Leicester), Dr Howard Armstrong, Prof. Dave Harper and Ms Katie Strang (Durham University), Dr Martin Ruecklin (Bristol/ Leiden) and Mr Esben Horn (10 Tons, Copenhagen).

Progressive Palaeontology. The annual open meeting for presentations by research students was organised by T. Fletcher and a team of other colleagues, and was held at the University of Leeds.

Lyell Meeting. The Lyell Meeting in 2013 was held in London on the topic of "The Cambrian Explosion – understanding Earth systems at the origin of modern ecosystems", organised by Prof. M.P. Smith (Oxford University Museum of Natural History) and Prof. D.A.T. Harper (Durham University).

Publications. Publication of *Palaeontology* and *Special Papers in Palaeontology* is managed by Wiley Blackwell. Volume 56 of *Palaeontology*, comprising six issues, was published. *Special Papers in Palaeontology* **89**, "Devonian spore assemblages from northwestern Gondwana: taxonomy and biostratigraphy", by P. Breuer and P. Steemans; and *Special Papers in Palaeontology* **90**, "Latest Ordovician and earliest Silurian brachiopods succeeding the Hirnantia fauna in south-east China", by Rong Jiayu *et al.*, were also published during the year. 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. The Association had a stand at the Lyme Regis Fossil Festival, which was staffed by members of Council, the Executive Officer and volunteers.

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 Prof. D. Edwards (University of Cardiff). 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 Prof. C.H. Wellman (University of Sheffield). 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 M. Friedman (University of Oxford). The Mary Anning award, for an outstanding contribution by an amateur palaeontologist, was made to Dr Hans Hess (Basel, Switzerland). Council also awards an undergraduate prize to each UK and Irish university department in which palaeontology is taught beyond Level 1.

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. M.J. Benton and Prof. R.J. Twitchett represented the Association. During the year, substantial changes were made to the post of Editor-in-Chief following the retirement of Dr Stouge, and a new post of Publications Officer was created. The post of Chair of the Publications Board ceased to exist and the duties were transferred to the new post of Editor-in-Chief. These changes required a minor change to the wording of the Constitution, which was approved by members at the AGM.

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. In 2014, a similar programme of public meetings and publications will be carried out. Funds will be made available to develop the website further, with the aim of encouraging outreach and to support other outreach, education and publicity initiatives. The Association will launch a new undergraduate research bursary scheme and a new fund to support outreach activities in 2014. The 58th Annual Meeting will be held at the University of Leeds. Progressive Palaeontology will be held at the University of Southampton. The Association will sponsor a symposium at the British Science Festival and will provide travel grants and symposium sponsorship for the Congress of the European Geosciences Union and the 4th International Palaeontological Congress.

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369
STATEMENT OF FINANCIAL ACTIVITIES for the YEAR ENDED 31st DECEMBER 2013

			General Funds	Designated Funds	TOTAL 2013	TOTAL 2012
Incoming Resources						
Generated Funds						
Voluntary income	Subscriptions	55,744			55,744	58,627
	Donations	3,221		1,340	4,561	2,741
			58,965	1,340	60,305	61,368
Charitable activities						
Sales	*Palaeontology*	257,385				
	Special Papers	13,677				
	Offprints	110				
	Newsletter	0				
	Field Guides	7,230				
	Distribution	426				
			278,828		278,828	230,050
Investment income			13,932	75	14,007	15,050
TOTAL INCOMING RESOURCES			351,725	1,415	353,140	306,468
Resources expended						
Costs of generating funds						
…for voluntary income	Admin.	26,514				27,805
Investment management	S'broker fees	3,537				3,186
			30,051	0	30,051	30,991
Charitable activities						
Publications	*Palaeontology*	113,470				
	Special Papers	6,485				
	Offprints	1,128				
	Field Guides	0				
	Newsletters	18,035				
	Distribution	752				
	Marketing	1,102				
	Editorial costs	65,135				
	Total Publications	206,107			206,107	158,458
Scientific Meetings & Costs			26,591		26,591	6,946
Grants and Awards			5,903	9,506	15,409	32,060
Research Grants			5,685		5,685	16,197
Administration of charitable activities			41,664		41,664	34,756
			206,107		295,456	248,417
Governance costs	Examiner's fee	500				
	Trustee expenses	8,083				
	Administration	7,575				
			16,158	0	16,158	15,555
TOTAL RESOURCES EXPENDED			332,159	9,506	341,665	294,963
NET INCOMING RESOURCES			19,566	-8,091	11,475	11,505
INVESTMENT GAINS/LOSSES						
Realised gain		1,993				
Unrealised gain		59,222				
			61,215		61,215	27,625
DEFICIT/(SURPLUS) FOR THE YEAR			80,781	-8,091	72,690	39,130
FUNDS BROUGHT FORWARD			709,884	72,337	782,221	743,091
FUNDS CARRIED FORWARD			790,665	64,246	854,911	782,221

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

BALANCE SHEET as at 31st DECEMBER 2013

2012 £			Note			2013 £
		INVESTMENTS				
	546,214	At market value	**1.6**			594,639
		CURRENT ASSETS				
166,901		Cash at Banks		162,483		
119,767		Sundry Debtors	**6**	128,438		
286,668		Total Current Assets			290,921	
		CURRENT LIABILITIES				
19,681		Subscriptions in Advance		21,010		
30,980		Sundry Creditors	**7**	9,639		
50,661		Total Current Liabilities			30,649	
	236,007	NET CURRENT ASSETS				260,272
	782,221	TOTAL ASSETS				854,911
		Represented by:				
	709,884	GENERAL FUNDS				790,665
		DESIGNATED FUNDS	**8**			
11,230		Sylvester-Bradley Fund			5,052	
23,286		Jones-Fenleigh Fund			23,720	
10,386		Hodson Fund			9,152	
8,599		Callomon Fund			7,573	
18,836		Whittington Fund			18,749	
72,337						64,246
782,221						854,911

Approved by the Board of Trustees 7th May 2014

THE PALAEONTOLOGICAL ASSOCIATION Registered Charity No. 276369

DESIGNATED FUNDS, Year ended 31st December 2013. Note 8 to the Accounts

	Sylvester-Bradley	Jones-Fenleigh	Hodson	Callomon	Whittington	TOTAL 2013	TOTAL 2012
Donations	270	410	0	207	453	1,340	2,566
Interest Received	12	24	11	9	19	75	80
TOTAL INCOMING RESOURCES	282	434	11	216	472	1,415	2,646
Grants made	6,460	0	1,245	1,242	559	9,506	11,299
NET SURPLUS/(DEFICIT)	-6,178	434	-1,234	-1,026	-87	-8,091	-8,653
TRANSFERS BETWEEN FUNDS	0	0	0	0	0	0	0
SURPLUS/(DEFICIT) FOR THE YEAR	-6,178	434	-1,234	-1,026	-87	-8,091	-8,653
FUNDS BROUGHT FORWARD	11,230	23,286	10,386	8,599	18,836	72,337	80,990
FUNDS CARRIED FORWARD	5,052	23,720	9,152	7,573	18,749	64,246	72,337

Notes to the Financial Statements for the year ended 31st December 2013

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 2011 and cover all the charity's operations, all of which are continuing.

The effect of events relating to the year ended 2013 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 2013 and the results for the year ended on that date.

1.2 Fund Accounting

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

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

- Sylvester-Bradley Fund: Grants made to permit palaeontological research.
- Jones Fenleigh Fund: Grants to permit one or more students annually to attend the meeting of the Society of Vertebrate Palaeontology and Comparative Anatomy (SVPCA).
- Hodson Fund: Awards made in recognition of the palaeontological achievements of a worker under the age of 35.
- 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.

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 of both investments and foreign cash balances.

1.6 SCHEDULE OF INVESTMENTS (per analysis sheet)

2. Analysis of Financial Resources Expended

	Staff costs £	Other costs £	Total 2013 £	Total 2012 £
Generating Funds	17,635	12,416	30,051	30,991
Charitable activities	61,865	233,591	295,456	248,417
Governance	5,039	11,119	16,158	15,555
	84,539	257,126	341,665	294,963

3. Staff Costs

	Salary £	National Insurance £	Pension Contributions £	Total 2013 £	Total 2012 £
Publications: 1 employee (2012 - 1)	29,323	1,539	3,290	34,152	38,987
Administration: 1 employee (2012 - 1)	32,167	3,384	14,836	50,387	46,300
	61,490	4,923	18,126	84,539	85,287

4. Trustees Remuneration and Expenses

Members of Council neither received nor waived any emoluments during the year (2012 – nil).

The total travelling expenses reimbursed to 17 Members of Council was £8,083 (2012 – £8,154).

5. Costs of Independent Examiner

	2013 (£)	2012 (£)
Examination of the accounts	500	450
Accountancy and payroll services	1,500	1,450
	2,000	1,900

6. Debtors

	2013 (£)	2012 (£)
Accrued income – receivable within one year	128,438	119,767

7. Creditors – falling due within one year

	2013 (£)	2012 (£)
Social Services costs	1,796	3,196
Accrued expenditure	7,843	27,784
	9,639	30,980

8. Designated Funds (per analysis sheet)

Nominal	Holding	Cost (bought pre 2013)	Value end 2012
£18,000	UK 4.75% Stock 07/03/20 GBP 100	£ 18,145.87	£ 22,498.00
£20,000	UK 4.5% Gilt 07/03/19 GBP 0.01	£ 20,092.99	£ 24,352.00
£64,176.46	COIF Charities Fixed Interest Fund	£ 85,000.00	£ 86,477.78
804	Royal Dutch Shell B shares	£ 12,432.00	£ 17,487.00
1,425	BP Ord 25c shares	£ 5,047.35	£ 6,053.00
600	BHP Billiton $0.5 shares	£ 4,341.48	£ 12,777.00
500	BG Group Ordinary 10p shares	£ 3,977.95	£ 5,063.00
1,465	HSBC Holdings Ordinary 0.5 US Dollar shares	£ 4,425.44	£ 9,477.00
1,800	Barclays 25p Ord shares	£ 4,034.84	£ 4,723.00
450	Barclays 25p Ord shares rights issue		
105	Next Ord 10p shares		
230	Weir Group 12.5p shares	£ 5,064.75	£ 4,322.00
1,000	3I Group Ordinary £0.738636 shares	£ 3,058.76	£ 2,172.00
1,150	Tesco Ord GBP 0.05	£ 4,583.22	£ 3,864.00
1,550	Kingfisher Ord GBP 0.157142857	£ 3,554.45	£ 4,404.00
500	IMI Ord 25p shares	£ 4,905.57	£ 5,485.00
175	Carnival Plc Ord USD 1.66	£ 3,996.49	£ 4,127.00
650	Glaxo Smithkline Ordinary 25p shares	£ 10,232.42	£ 8,678.00
220	Shire Ord 5p shares	£ 4,986.29	£ 4,151.00
2,499	Bluecrest Allblue Ord Npv GBP shares	£ 3,020.28	£ 4,251.00
550	Amec ord 50P	£ 6,133.62	£ 5,517.00
2,200	Melrose Indust Ord 0.1p		
4,175	Vodaphone Group Ord USD 0.11428571	£ 6,034.20	£ 6,448.00
2,150	BT Group Ordinary 5p shares	£ 7,787.53	£ 4,969.00
225	Brit Amer Tobacco Ord GBP 0.25	£ 4,991.81	£ 7,022.00
300	Unilever PLC Ord GBP 0.031111	£ 4,326.21	£ 7,098.00
460	Pearson Ordinary 25p shares	£ 8,069.00	£ 5,465.00
490	Serco Group Ord 2P	£ 3,005.01	£ 2,622.00
700	National Grid Ord GBP 0.113953	£ 3,648.26	£ 4,921.00
420	Experian Ord 10C	£ 3,444.95	£ 4,116.00
670	Blackrock World Mining Ord 5P	£ 4,019.09	£ 3,930.00
400	Persimmon Ord 10p		
650	RIT Capital Partners Ordinary £1 shares	£ 4,903.90	£ 7,352.00
4,400	TR Property Ord 25p shares	£ 7,560.85	£ 7,612.00
1,000	Balfour Beatty 50P	£ 2,913.17	£ 2,737.00
1,225	Brown Advisory US Equity Value £B	£ 14,789.62	£ 14,945.00
1,500	British Empire Sec & Gen Trust Ordinary 10p shares	£ 5,005.61	£ 7,110.00
425	Findlay Park Partners US Smaller Companies	£ 6,158.47	£ 14,336.00
2,825	Ishares S&P 500 GBP	£ 20,319.63	£ 24,263.00
900	JPMorgan Am UK Ltd Emerging Markets I Instl	£ 5,043.10	£ 5,257.00
8,000	Bny Mellon Glb Fds Erg Mkts Debt Loc Crr C	£ 10,776.59	£ 10,434.00
425	Fidelity EUR Value Ordinary 25P shares	£ 4,059.07	£ 5,470.00
3,900	Edinburgh Dragon Trust Ordinary £0.20 shares	£ 4,478.10	£ 10,452.00
160	GLG Japan Corealpha Equity IT Acc	£ 11,330.79	£ 10,629.00
5,194	Scottish Widows Property Trust B	£ 4,669.49	£ 4,451.00
26	Veritas Asset Mgmt Veritas Asian A GBP	£ 8,182.27	£ 7,671.00
65	Roche Hldgs Ag Genusscheine Nvp	£ 7,226.55	£ 8,040.00
6,600	Henderson Gbl Invs European Special Sits I Inc	£ 7,037.91	£ 8,210.00
1,283.80	COIF Charities Investment Fund Acc Units	£ 75,000.00	£ 114,775.57
	Total	£ 451,814.95	£ 546,214.35

Proceeds (sold in 2013)	Cost (bought in 2013)	Gain realised during 2013	Value end 2013	Gain unrealised during 2013
			£ 20,813.00	-£ 1,685.00
			£ 22,688.00	-£ 1,664.00
			£ 80,836.67	-£ 5,641.11
			£ 18,331.00	£ 844.00
			£ 6,955.00	£ 902.00
			£ 11,214.00	-£ 1,563.00
			£ 6,488.00	£ 1,425.00
			£ 9,704.00	£ 227.00
			£ 4,895.00	£ 172.00
	£ 832.50		£ 1,224.00	£ 391.50
	£ 4,648.88		£ 5,723.00	£ 1,074.12
£ 4,838.85		£ 516.85		
£ 3,124.67		£ 952.67		
			£ 3,845.00	-£ 19.00
£ 4,687.62		£ 283.62		
			£ 7,625.00	£ 2,140.00
			£ 4,377.00	£ 250.00
			£ 10,475.00	£ 1,797.00
			£ 6,274.00	£ 2,123.00
			£ 4,378.00	£ 127.00
			£ 5,984.00	£ 467.00
	£ 7,039.88		£ 6,725.00	-£ 314.88
			£ 9,895.00	£ 3,447.00
			£ 8,157.00	£ 3,188.00
£ 8,317.58		£ 1,295.58		
			£ 7,446.00	£ 348.00
			£ 6,169.00	£ 704.00
			£ 2,446.00	-£ 176.00
			£ 5,516.00	£ 595.00
			£ 4,679.00	£ 563.00
			£ 3,116.00	-£ 814.00
	£ 5,035.71		£ 4,956.00	-£ 79.71
			£ 8,190.00	£ 838.00
			£ 9,966.00	£ 2,354.00
			£ 2,869.00	£ 132.00
			£ 19,931.00	£ 4,986.00
			£ 7,275.00	£ 165.00
			£ 18,322.00	£ 3,986.00
			£ 31,358.00	£ 7,095.00
			£ 4,946.00	-£ 311.00
£ 9,816.77		-£ 617.23		
			£ 6,481.00	£ 1,011.00
			£ 9,543.00	-£ 909.00
			£ 17,104.00	£ 6,475.00
			£ 4,780.00	£ 329.00
			£ 8,192.00	£ 521.00
			£ 10,994.00	£ 2,954.00
			£ 10,006.00	£ 1,796.00
			£ 133,747.44	£ 18,971.87
£ 30,785.49	£ 17,556.97	£ 2,431.49	£ 594,639.11	£ 59,221.79

Independent Examiner's Report

on the Accounts of The Palaeontological Association

for the year ended 31st December 2013

Respective responsibilities of trustees and examiner

The charity's trustees are responsible for the preparation of the accounts. The charity's trustees consider that an audit is not required for this year under section 144 of the Charities Act 2011 (the Charities Act) and that an independent examination is needed.

It is my responsibility to:

- examine the accounts under section 145 of the Charities Act,
- follow the procedures laid down in the general Directions given by the Charity Commissioners (under section 145(5)(b) of the Charities Act), and
- to 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 no opinion is given as to whether the accounts present a "true and fair" view and the report is limited to those matters set out in the statement below.

Independent examiner's statement

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

(1) which gives me reasonable cause to believe that in any material respect the requirements:

to keep accounting records in accordance with section 130 of the Charities Act;

to prepare accounts which accord with the accounting records and comply with the accounting requirements of the Charities Act

have not been met; or

(2) to which, in my opinion, attention should be drawn in order to enable a proper understanding of the accounts to be reached.

Dated: 2nd May 2014

G R Powell F.C.A.

Nether House, Nether Green,
Great Bowden,
Market Harborough
Leicestershire
LE16 7HF

Nominations for Council

At the AGM in December 2014, the following vacancies will occur on Council:

- Vice-President
- Newsletter Editor
- Book Review 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. Nomination 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 from <**secretary@palass.org**>.

The closing date for nominations is **8th October 2014**. They should be sent to the Secretary: Prof. Richard J. Twitchett, Department of Earth Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, UK; e-mail:<**secretary@palass.org**>.

Council's nominations are as follows:

Newsletter Editor:	Dr Jo Hellawell
Meetings Coordinator:	Dr Thijs Vandenbroucke (2nd term)
Ordinary Members:	Dr Imran Rahman

(See over the page for 'job descriptions' for these roles…)

Vice-President (Five-year term)

The Vice-President is one of the more loosely defined Council offices. Vice-Presidents are normally long-serving Council members who have previously held one of the other offices. They have no formal portfolio or duties other than to deputize for the President if and when required, but are present on Council to provide independent input on all matters, backed up by experience arising from their long service. They are also expected to lead or at least participate in important sub-committees, particularly those tasked with making recommendations for the awards of grants.

Newsletter Editor (Three-year term)

The main task of the Newsletter Editor is to produce the three editions of The Palaeontology Newsletter that come out each year. This involves interaction with many other members of Council and the membership. The post does involve a fair time commitment and the need to meet some deadlines, especially in relation to the Autumn Newsletter that carries the information for the Annual Meeting, but in return the Editor gets a wide overview of the broad sweep of activities related to palaeontology across the world.

Book Review Editor (Three-year term)

The Book Review Editor is responsible for co-ordinating the review of books of interest to the readership of the Newsletter. This involves the receipt of review copies of books from publishers, producing a list of books available for review, sending the books to reviewers and then editing the reviews for publication in the Newsletter. The Book Review Editor is a full member of Council and is able to take on additional duties within Council if they wish.

Ordinary Members (Three-year term)

Although Ordinary members of Council do not have particular tasks attached to their posts, they provide an important pool of experience that Council can draw upon to complete various projects and tasks that fall to Council every year, such as reviewing grant applications, and often contribute to sub-committees where they can provide particular expertise or enthusiasm.

Meetings Coordinator (Three-year term)

The Meetings Coordinator ensures that PalAss has a presence at most of the major international meetings across the wider Earth Sciences domain, mainly by soliciting and/or organizing symposia that are hosted or sponsored by the Association or through other initiatives. The Meetings Coordinator liaises with the Annual Meeting organizers about the topic of the symposium at the Annual Meeting, and with other conveners of other PalAss-sponsored symposia to avoid overlaps and enhance the visibility of a wide range of palaeontological topics. The Meetings Coordinator is also responsible for the evaluation and administration of the Association's Postgraduate Travel Grants.

Awards and Prizes

Nominations are now being sought for the Hodson Fund, Mary Anning Award and to 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. Nominations must be 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 **25th 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 **25th September**. The award comprises a cash prize plus a framed scroll, and is usually presented at the Annual meeting.

Golden Trilobite Award

Nominations are sought for the "Golden Trilobite Award" 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 should be sent to the Secretary at <**secretary@palass.org**> by **25th September**. The websites will be judged by Council members.

Grants

Palaeontological Association Small Grants Scheme

The Association now offers three small grant awards to fund palaeontological research, travel and fieldwork:

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

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

Whittington Award. An award 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 first read the *Terms and Conditions* at <**http://www.palass.org/modules.php?name=palaeo&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 are to be submitted electronically through the website, and will comprise a CV, an account of project aims, 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.

Grants-in-aid: meeting support

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. Such requests will be considered by Council at its March and October meetings each year. Completed requests should be made at least six months in advance of the event in question. The next two deadlines are **1st October 2014** and **1st March 2015**. Inquiries may be made to <**secretary@palass.org**>.

Grants-in-aid: workshops and short courses

The Palaeontological Association is happy to receive applications from the organisers of workshops and short courses 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 organiser(s) using the online application form (see 'Awards and Grants' > 'Grant-in-aid schemes' at <**www.palass.org**>). Such requests will be considered by Council at its March and October meetings each year. Completed requests should be made at least six months in advance of the event in question. The next two deadlines are **1st October 2014** and **1st March 2015**. Inquiries may be made to <**secretary@palass.org**>.

Palaeontology: the next step

When I last wrote in the Newsletter, shortly after taking up the post as Editor-in-Chief, there was still some uncertainty about how the Association would develop its publications over the coming years. Since then discussions with our publishers have progressed and I am pleased to be able to announce that, starting from 2015, the Association will be publishing two sister journals, *Palaeontology* and *Papers in Palaeontology*. These journals will have different remits:

- *Palaeontology* will focus on shorter higher-impact papers devoted to the publication of innovative and timely hypothesis-driven research or the reporting of important new fossil discoveries that significantly advance understanding of the history of life on Earth. It will also publish topical reviews, papers describing new approaches and methods, and synthetic papers that are cross-disciplinary in nature.
- *Papers in Palaeontology* will be a successor to *Special Papers in Palaeontology* and is devoted to the publication of papers that document the diversity of past life and its distribution in time and space. As a sister publication to *Palaeontology* its focus is on descriptive research, including the descriptions of new taxa, systematic revisions of higher taxa, detailed biostratigraphical and biogeographical documentation, and descriptions of floras and faunas from specific localities or regions. Most contributions are expected to be less than 30 pp long but longer contributions will be considered if the material merits it, including single topic parts. A website for submitting your work to *Papers in Palaeontology* will be available soon but until then authors can submit their work through the *Palaeontology* portal.

Both journals will have the same publication model, with an initial assessment of submitted manuscripts being undertaken by the five members of the Editorial Board. Papers that lack novelty or are too restricted in their scope will be rejected without review, and papers dealing with one or a few new taxa belonging to well-documented groups are unlikely to succeed unless their wider significance is made clear. Manuscripts that are deemed suitable will be passed to a Scientific Editor who will manage the peer-review process. In the light of the comments of at least two referees and the opinions of the Scientific Editor and Editor-in-Chief, a decision on whether to publish the manuscript will be made. Accepted typescripts will be published electronically shortly after final author corrections are received, currently 40–50 days after acceptance.

Initially both journals will be available to all subscribing members of the Association electronically but there will be differential subscriptions for those who wish, in addition, to continue to receive paper copies of one or both of these publications. Moving to electronic delivery for *Palaeontology* provides for faster, more efficient publication and the use of colour in illustrations as standard.

Having two journals with clearly differentiated remits seems the best way to develop *Palaeontology* as a world-class journal that reflects the changing nature of palaeontological research while maintaining the Association's founding principle of publishing high-quality, purely taxonomic work that forms the bedrock of our science.

I hope you agree and I look forward to receiving your contributions over the coming months.

Andrew Smith

>>From the PalAss Publications Officer

Publishing in *Palaeontology*: open access

Publishers, funding bodies, researchers and other interested parties have for some time been locked in debate on the sticky issue of open access and the future of journal publishing. There is a lot of confusion and new terminology surrounding this issue, and the following short article is intended to clarify the most important points and make clear how they affect the authors of PalAss journals.

What is open access?

Open access (OA) is often referred to as either green or gold. *Green* OA allows authors to self-archive a version of their manuscript (not usually the final published article) in an institutional or subject repository from which it is freely available for anyone to download. Green OA usually comes with an embargo period, often six or twelve months from publication of the article version of record. The version of record is available immediately under licence from the publisher; either as part of a subscription arrangement, or on payment of an individual download fee. *Gold* OA makes the final published article, or version of record, freely available through the publisher's website immediately on publication, usually for a fee known as an article processing charge (APC). Gold OA may be available in a fully OA journal which has no subscription charge for readers, or in a hybrid journal which has a subscription charge that may be modified to reflect the number of freely available OA articles that are also published in it. Hybrid journals allow the author the option of OA at the article level.

When talking about green OA, it is important to make the distinction between the *accepted author manuscript* (AAM) and the final *version of record*. Publishers have different guidelines surrounding self-archiving of manuscripts, but they are generally converging on the AAM, or post-print, as the most acceptable version. This is the manuscript as it was accepted by the journal, after peer review corrections have been made by the author, but before any copy editing, style adjustments or typesetting. The alternative is the submitted version, or pre-print, which is the author's original version of the article that has not been peer-reviewed. The version of record is therefore the final article as it appears on the publisher's website on publication, with all the journal formatting and added value in the form of copy editorial checking, cross referencing, multiple online formats (pdf or html) *etc*.

Other OA terms that you may come across are gratis and libre, which refer to the rights or freedoms that the reader has rather than the venue (*i.e.* repository or journal). *Gratis* OA means that the article is freely available to read but normal copyright permission is required for re-use; *libre* that at least some of the permission barriers have also been removed.

Many authors are now affected by OA mandates imposed by their funding body which may conflict with the requirements of their institution or publisher. For example, any author based at a UK higher education institution is governed by HEFCE policy as well as that of their local institution, but may also have relevant research funding from the RCUK, Wellcome, ERC or the US Government for example, all of whom have separate OA policies which will affect publications arising from that research. Many academic institutions will now offer advice on funder mandates and individual institution OA policy. More information on funder mandates, publisher policies and OA in general is available through SHERPA at <**sherpa.ac.uk**>.

Licensing

Open access publication requires a copyright licence that stipulates what rights and freedoms the reader has. Usually this is in the form of a Creative Commons agreement. These come in a number of flavours, but the most common are:

CC-BY **Attribution.** This licence lets others distribute, remix, tweak and build upon your work, even commercially, as long as they credit you for the original creation. This is the most flexible Creative Commons licence offered by journal publishers, and is mandated by all research councils in the UK (RCUK) and the Wellcome Trust.

CC-BY-NC **Attribution Non-Commercial**. This licence lets others remix, tweak and build upon your work non-commercially.

CC-BY-ND **Attribution Non-Derivative**. This licence allows for redistribution, commercial and non-commercial, as long as it is passed along unchanged and in whole, with credit to you.

CC-BY-NC-ND **Attribution Non-Commercial Non-Derivative**. This licence allows others to download your works and share them with others as long as they credit you, but they can't change them in any way or use them commercially.

For more information on Creative Commons see <**creativecommons.org**>.

Open access in *Palaeontology* and *Papers in Palaeontology*

Both *Palaeontology* and the re-launched *Papers in Palaeontology* are hybrid journals, so authors are offered the option of gold OA publication for a fee of $3,000. This fee may be paid by the author, institution or funding body. Green OA is also available for both journals: authors may upload the accepted manuscript (after peer review corrections, but before copy editing) to an institutional or subject repository, subject to a 12 month embargo. A form of the article is therefore freely available to any reader 12 months after publication of the version of record. Authors are not permitted to replace this document with the final pdf (version of record) that they receive from the publisher, at any time. This is compliant with HEFCE and RCUK research funding mandates which state that a 12 month embargo on green OA is acceptable if the journal offers a gold OA option but funding for the fee is not available to the author.

To prevent 'double dipping' or charging twice for the same content, Wiley-Blackwell monitor the number of gold OA articles published in each hybrid journal. A reduction in subscription cost is factored in, based on the previous 12 months' output, when subscriptions are revised each year. In common with many other hybrid journals, take-up of gold OA in *Palaeontology* is currently extremely low.

When an article is accepted, the corresponding author will receive an invitation to log in to Wiley-Blackwell's Author Services site at <**authorservices.wiley.com/bauthor/default.asp**> and select a licence agreement on behalf of all authors. The options will be gold OA or the standard copyright agreement (green OA is automatically available to authors who sign this). This will replace the current copyright form that is issued at proof stage. Authors who select gold OA will also need to select a Creative Commons licence. If you indicate that you are funded by a UK Research Council (RCUK) or the Wellcome Trust, the only option will be CC-BY as this is mandatory. All other authors

will be offered a choice of: CC-BY, CC-BY-NC or CC-BY-NC-ND (see above for details). You should check to see if there are any restrictions on licence imposed by your funder or institution.

The sands will no doubt continue to shift for some time as the debate goes on, but I hope that this article provides a slightly clearer view of the path to OA publication as it currently lies.

Sally Thomas
Publications Officer
<editor@palass.org>

Advance Notice about Journal and Subscription Changes in 2015

These are some of the changes that will be taking place with the subscription starting on 1st January 2015, for *Palaeontology* Vol. **58** and following. Details about new subscription rates are given below and will be available to those subscribing through the WorldPay™ website, accessible through New Memberships or Membership Renewal at <**www.palass.org**>. All the changes have been agreed by Council or by the Membership at the AGM, as appropriate.

All members will receive *Palaeontology* as an online copy through the Wiley website (as they do in the present arrangement – accessed through the <**www.palass.org**> website as a logged-in member); for a higher subscription they will receive the hard copy as well. All subscribers will also have online access to *Papers in Palaeontology* through the Wiley website. *Papers in Palaeontology* is the replacement journal to *Special Papers in Palaeontology,* and it will contain short and long papers (including papers as long as many past *Special Papers*), often with a traditional systematic content. It will be produced in several parts per year. For the current cost of a *Special Papers* subscription, members can also choose to receive the hard copy of *Papers in Palaeontology*. The ISSNs for *Papers in Palaeontology* are: print copy ISSN 2056-2799; electronic copy ISSN 2056-2802. The *Newsletter* will be produced as at present.

There are a number of reasons behind these decisions, but they include a wish to reduce the membership subscription for those who elect to receive *Palaeontology* in the electronic version only (currently there is no subscription reduction for the 200 or so members who already do this), and to increase the subscription to members who want both electronic and paper copies to better reflect the high additional costs of printing and (particularly) mailing. The new membership subscription prices will be as follows:

Ordinary Member online only	30.00 GBP
Ordinary Member online + print	45.00 GBP
Retired Member online only	15.00 GBP
Retired Member online + print	36.00 GBP
Student Member online only	15.00 GBP
Student Member online + print	36.00 GBP
Papers in Palaeontology online	free as part of membership subscription
Papers in Palaeontology print	30.00 GBP supplement to the subscription

Final arrangements are still being discussed, and more details will be given in due course. The subscription forms that we use will obviously reflect the changed rates. **However, if you are an Ordinary or a Retired member (not a Student member) who currently pays your subscription by Standing Order with your U.K. bank, then you will need to change the details of this arrangement with them (we are not able to do this for your Standing Order; it is not the same as a Direct Debit). Please contact your bank to make the changes (you can do this easily if you use online banking); subscriptions are due on 1st January of the year in question. You may even prefer to cancel your Standing Order and renew online through the renewals pages at <www.palass.org>, using your username and password to pay through Worldpay™. This is the most popular way of renewing at present. It is also by far the easiest method for us, and will allow your access to the online *Palaeontology* and *Papers in Palaeontology* automatically, without your needing to contact us.**

History shows that getting the last 10% of the membership to update their Standing Order details every time we make a subscription change is a thankless task, and that there is a rump of recalcitrant members who never get round to doing this, even having received many reminders and much pleading. You may be one of them. We will eventually stop providing their (your?) full requirements, so if you do not want to be treated in this cavalier manner, please update now, ready for the new arrangements at the year's end (the mailing list for *Palaeontology* **58-1** will go to the printers in November). It will be clear from our bank statements and records what you have done, so you don't need to tell us as well.

If you wish to continue to receive the printed copy of *Palaeontology*, but your Standing Order is not updated to the new rate, then you will be underpaying. You will in effect have chosen to be an online-only subscriber, or even a Newsletter-only subscriber. The print-runs of each part will be determined by the number of subscribers to that part when the members' addresses are sent to the printers. Because we will no longer be producing additional copies of printed parts, you will not subsequently be able to obtain missing parts if you are late in renewing your subscription or in updating your Standing Order.

We exhort you to act accordingly and in good time to avoid probable disappointment and certain indignation!

Tim Palmer
Executive Officer
<palass@palass.org>

Announcement: New Outreach and Education Grants

The Palaeontological Association is pleased to announce the first call for our new Outreach & Education Grants scheme. The awards will be made to encourage educational outreach, public engagement and related initiatives in palaeontological themes. We particularly encourage applications with innovative aspects, such as engaging with new media.

Preference will be given to applications for a single purpose. They may be stand-alone projects, or 'proof of concept' studies for a larger bid elsewhere. The awards are open to amateur and professional palaeontologists. However, the principal applicant must be a member of the Association.

Grant applications will normally be for up to £5,000, but under exceptional circumstances a budget of up to £15,000 will be considered. The deadline for submissions is **1st September 2014**. Funds will normally be available from 1st January each year.

For more detailed information on submissions and eligibility, please visit the Awards and Grants section of the Association website:

<**http://www.palass.org/modules.php?name=palaeo&sec=awards**>

Fiona Gill
PalAss Outreach Officer

Caroline Buttler
PalAss Education Officer

ASSOCIATION MEETINGS

58th Annual Meeting of the Palaeontological Association
University of Leeds, UK *16 – 19 December 2014*

The 58th Annual Meeting of the Palaeontological Association will be held at the University of Leeds, UK, organized by Crispin Little (<**earctsl@leeds.ac.uk**>), Fiona Gill (<**f.gill@leeds.ac.uk**>), and colleagues from the School of Earth and Environment.

Tuesday 16th: Symposium and icebreaker reception

The meeting will begin on Tuesday at noon with the Symposium in **Conference Auditorium 2**, followed by the icebreaker reception in the **Parkinson Building**. Registration and tea/coffee will be available in **Sports Hall 2**.

The Symposium title is 'The photosynthesis revolution: how plants and photosynthetic micro-organisms have bioengineered the planet'.

12:00–12:15 Welcome

12:15–12:45 Professor Simon Poulton (University of Leeds): 'Environmental instability following the rise of oxygenic photosynthesis'.

12:45–13:15 Dr Bettina Schirrmeister (University of Bristol): 'Cyanobacteria and the Great Oxidation Event: Evidence from genes and fossils'.

13:15–13:45 Professor Charles Wellman (University of Sheffield): 'Evidence for terrestrial photosynthetic organisms in the Proterozoic: the land becomes vegetated'.

13:45–14:15 Dr Nick Butterfield (University of Cambridge): 'Photosynthesis in Proterozoic oceans: evolutionary and ecological innovations'.

14:15–14:45 Professor Dianne Edwards (Cardiff University): 'Cryptogamic covers and Lilliputian plants in the mid Palaeozoic: aspects of early photosynthesising ecosystems on land'.

14:45–15:15 Tea/coffee break; **Sports Hall 2**

15:15–15:45 Professor David Beerling (University of Sheffield): 'Trees and forests as geo-engineers of past and future global climates'.

15:45–16:15 Professor Else Marie Friis (Swedish Museum of Natural History): 'Emergence of angiosperms and fossil evidence for pollination in Cretaceous flowers'.

16:15–16:45 Dr James Riding (British Geological Survey): 'The evolutionary history of marine phytoplankton'.

16:45–17:45 Annual Address: Professor Alan Haywood (School of Earth and Environment, University of Leeds): 'Understanding ancient Earth climates and environments using models and data'.

18:00–20:00: Icebreaker reception in the **Parkinson Building** of the University of Leeds, with drinks and regional food canapés.

Wednesday 17th to Thursday 18th: Conference and Association AGM

The conference will commence on Wednesday 17th December with a full day of talks in **Conference Auditorium 2**. The Association AGM will take place in the afternoon. In the evening there will be the Annual Dinner at the **Leeds City Museum**. Thursday 18th December will be a full day of posters and talks in parallel sessions in **Roger Stevens Lecture Theatres 22 and 25**. Posters will be displayed throughout the meeting in **Sports Hall 2**, the same place as registration, refreshments, buffet lunch and advertisers' stands.

Friday 19th: Tropical Yorkshire: field-trip to the Wolds

Price: **£30**, including transport and barbeque lunch. Starts at 08:00 from the **Parkinson Building** steps; returns 18:00 to Leeds Train Station and then *ca*. 18:20 at the Parkinson Building. The number of participants is limited to 45.

The field-trip will visit three inactive quarries in the Yorkshire Wolds, to the East of Leeds, to look at various facies of the Oxfordian (Upper Jurassic) Corallian sediments in the area. We will start at Betton Farm Quarry, a Site of Special Scientific Interest that has recently been cleared. Here there are metre-scale reef structures formed by the corals *Isastraea* and *Thamnasteria*, together with very fossiliferous inter-reef facies containing molluscs, echinoids and other fauna. Also in the quarry are examples of the surrounding oolitic facies of the Malton Oolite Member (Coralline Oolite Formation). After a BBQ lunch at the quarry we will move to Ravenswyke Quarry to look at tall quarry faces displaying weathered surfaces of the Malton Oolite, some beds of which are packed by gastropods, and the overlying Coral Rag Member, which contains in-situ *Rhabdophyllia phillipsi* corals and the characteristic echinoid spines of *Paracidaris florigemma*. We will then walk and/or drive a short way to Spaunton Quarry to look again at the Coral Rag, which here contains patch reefs and various inter-reef facies, and is overlain by the sandy sediments of the Newbridge and Spaunton Sandstone Members of the Upper Calcareous Grit Formation, from which ammonites can sometimes be collected. We will then return to Leeds. Please dress warmly as we will be exposed to the elements during the day. Stout footwear will be useful, although there will not be a lot of walking on the day. Hard hats will be provided.

Registration and booking

Registration, abstract submission and booking (including payment by credit card) commences on **Monday 14th July 2014**. Abstract submission closes at midnight on **Friday 19th September 2014**; abstracts submitted after this date will not be considered. Registration after **Friday 3rd October 2014** will incur an additional administration charge of £25.00. The final deadline for registration is **Friday 14th November 2014**. 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 through online forms available on the Palaeontological Association website (<**http://www.palass.org/**>). Please note that all these transactions will be in sterling (£:GBP). Accommodation must be booked separately (see below). The cost of registration is the same as last year. Early registration is **£90.00** for ordinary and retired members; **£60.00** for students; and **£120.00** for non-members. Registration costs include sandwich lunches on Wednesday and Thursday, the icebreaker reception on Wednesday evening, full registration package and tea/coffee from Tuesday through to Thursday.

The Annual Dinner event costs **£45.00**. It will be held at the **Leeds City Museum**, which is five minutes' walk downtown from the University. The evening's festivities will include a drinks reception followed by a three-course meal including carvery and vegetarian option. Due to the size of the venue numbers are limited to 250.

Oral presentations

All speakers (apart from the symposium speakers) will be allocated 15 minutes. You should therefore prepare a 12 minute talk to allow time for questions and switching between presenters. On the second day of the meeting we are using a number of parallel sessions in adjacent theatres so timing will be especially important. All the lecture theatres will have a single A/V projector linked to a large screen (*e.g.* <**http://www.teachingspace.leeds.ac.uk/room_details.asp?ID=1-01-086-2486-GM-GM01**>, and <**http://www.teachingspace.leeds.ac.uk/room_details.asp?ID=1-01-086-2810-10M-22**>). All presentations should be submitted and checked the day before they are scheduled. The University of Leeds is PC-based, so Mac-based presentations may cause problems, particularly if animations are included. If you are using a Mac please make sure your presentation is PC compatible before you leave your institution.

Poster presentations

Poster boards will accommodate an A0-sized poster presented in **portrait** format. The boards will not be suitable for posters of this size in landscape format. Materials to fix the poster to the boards will be available at the meeting.

Venue and travel

The conference will take place in the campus of the University of Leeds, which is located just to the North of Leeds city centre. The venues for talks, posters, icebreaker reception, and Annual Dinner are all very close together. Campus maps are available online at <**www.leeds.ac.uk/info/20014/about/157/how_to_find_us**>; hard copies will also be included in the welcome pack.

Getting to Leeds

Car

There is limited parking around the University, and almost none on campus, so driving is not the best option. The closest large car park (which is expensive) is Woodhouse Lane Car Park (LS2 3AX).

Bus

Intercity buses arrive at the main bus station at the South side of Leeds city centre, about 30 minutes' walk from the University. Buses are usually cheaper than trains. See National Express Coaches (<**www.nationalexpress.com**>) and Megabus (<**www.uk.megabus.com**>). There are a number of buses that go from the bus station past the University (see <**www.wymetro.com**>).

Train

Leeds is on the main inter-city train network, so is easily accessible from anywhere in the UK and this is probably the best travel option. Booking early will get the best ticket prices, particularly if travelling from London on East Coast Trains (<**www.eastcoast.co.uk**>). From Leeds train station the University is 20 minute walk uphill to the North (see link above).

Plane

Leeds is served by Leeds-Bradford Airport (LBA), which has connections to many other European cities

(<**www.leedsbradfordairport.co.uk**>). The airport is about 30 minutes' drive to the North of the city, depending on traffic. There are buses into Leeds bus station, or a taxi booking service. Alternatively, the much bigger Manchester Airport (MAN – <**www.manchesterairport.co.uk**>) is 1.5 hours away by train (<**www.tpexpress.co.uk**>) from Leeds. Another option is to fly into London airports and get the intercity trains to Leeds from London Kings Cross station (<**www.eastcoast.co.uk**>). These run every 30 minutes or so, and the journey takes about 2.5 hours.

Taxis

Leeds city taxis are black and white, and there a good number of designated stops around the city, including outside the train station and at the Parkinson Building of the University. There also lots of local hire taxis that have to be booked. One is Amber Cabs (0113 231 1366).

Accommodation

This needs to be booked separately. Leeds has a wide variety of hotels, hostels and guest-houses at a range of prices that can be booked through the usual online resources. The following list of hotels (that is by no means exhaustive) are all within 20 minutes' walking distance of the University. Booking in plenty of time will ensure the best prices.

Budget (around £50/night):	Ibis.
Mid range (£50–£100/night):	Radison Blu, Park Plaza, The Met, Premier Inn Leeds City Centre (Leeds Arena).
Expensive (£100 plus):	Leeds Marriott, Hilton Leeds City, Queens Hotel.

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 Leeds 2014 meeting, grants of less than £100 (or the € equivalent) will be available to student presenters who are travelling from outside the British Isles (UK and Ireland). The actual amount available will depend 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 (e-mail <**palass@palass.org**>) once the organisers have confirmed that their presentation is accepted, and before 1st December 2014. Entitle the e-mail "Travel Grant Request". No awards can be made to those who have not followed this procedure.

Leeds and Yorkshire

Leeds and the famous Yorkshire Dales to the North featured internationally in July when the Tour de France started off in the city (<**letour.yorkshire.com**>). Why not visit some of the areas the tour visited? The Dales in particular are fantastic for walking, and have many picturesque towns and villages, many of them accessible from Leeds by train and bus (<**www.yorkshire.com**>). Alternatively, spend time exploring the Victorian industrial heritage of Leeds (<**www.leeds.gov.uk/museumsandgalleries/Pages/Visit.aspx**>), or go by train to nearby York, to see its medieval architecture (<**www.visityork.org**>).

We look forward to seeing you in Leeds in December.

Annual Address:

Understanding Ancient Earth Climates and Environments using Models and Data

Professor Alan M. Haywood

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Geology and palaeontology have demonstrated that climate is not stable. We know that climate change occurs over a variety of timescales (*e.g.* tectonic, orbital, millennial, centennial, decadal, sub-decadal). The fossil record and advanced numerical models of climate, and increasingly the Earth system, are gradually lifting the veil on the mysteries of Earth's climatic and environmental evolution and variability. Studies have focused on understanding the drivers for changes in mean climate state as well as the causes and consequences of climatic transitions and rapid climate change. In this talk we will explore how models and data have been used successfully together to better understand three distinctly different intervals in Earth history, each presenting its own unique challenges, scientific questions and benefits.

The first case study is focused on the relative role of climate and environmental change versus human influence on the extinction of Late Quaternary megafauna. Despite decades of research, the roles of climate and humans in driving the dramatic extinctions of large-bodied mammals during the Late Quaternary period remain contentious. Models and data have shown that climate has been a major driver of population change over the past 50,000 years. However, species respond differently to the effects of climatic shifts, habitat redistribution and human encroachment. Although climate change alone can explain the extinction of some species, such as Eurasian musk ox and woolly rhinoceros, a combination of climatic and anthropogenic effects appears to be responsible for the extinction of others.

The second case study focuses on quantifying the equilibrium response of global temperatures to an increase in atmospheric carbon dioxide concentrations, which is one of the cornerstones of climate research. Components of the Earth's climate system that vary over long timescales, such as ice sheets and vegetation, have an important effect on this temperature sensitivity, but are normally neglected. Climate models, using geological derived boundary conditions (vegetation and ice cover), have been used to simulate the climate of the mid-Pliocene warm period, and to analyse the forcing and feedbacks that contributed to the relatively warm temperatures. Estimates suggest that the response of the Earth system to elevated atmospheric carbon dioxide concentrations is 30% to 50% greater than the response based on those fast-adjusting components of the climate system that are used traditionally to estimate climate sensitivity. This suggests that targets for the long-term stabilization of atmospheric greenhouse-gas concentrations aimed at preventing a dangerous human interference with the climate system should take into account this higher sensitivity of the Earth system.

The final case study focuses on the Eocene to Oligocene transition and the shift between a greenhouse and ice house state ~33 million years ago. The development of the Antarctic Circumpolar Current (ACC) has been linked to the thermal isolation and growth of the Antarctic Ice Sheet at the time, yet the development of the ACC during the Cenozoic is controversial in terms of timing and its role in major climate transitions. Climate model results show that a coherent ACC was not possible during the Oligocene due to Australasian palaeogeography, despite deep water connections through the Drake Passage and Tasman Gateway and the initiation of Antarctic glaciation. These simulations of ocean currents compare well to marine proxy records relating to the physical oceanography of the Oligocene, and provide a framework for understanding apparently contradictory dating of the initiation of the ACC.

From our Correspondents

Darwin's diffidence

It's nice to have a few of the classics around, to help one through the rigours of the day. A few of Shakespeare's plays, individually wrapped in those cheap and cheerful Wordsworth Classic editions, of generous print size and not too much preliminary blathering. Better these, than one of those posh and daunting volumes of collected works bound in luxurious Skivertex. In my small collection it's the comedies that tend to be better-thumbed, clearly revealing a character defect. The Sherlock Holmes stories – ah, that *is* a collected edition, battered, umpteenth-hand and more than a touch foxed[1], bought for the princely sum of 3d. – yes, three of the old pre-decimal pence – off a stall in Bury market, Lancashire, and then swiftly devoured, for Conan Doyle is *that* kind of writer. The Steinbeck oeuvre, now – and the fact that the dark and depressing *Of Mice and Men* is so often on the school syllabus rather than the carefree and anarchic *Cannery Row* speaks volumes about the earnestly *improving* spirit of British education[2]. But it's the spirit of Doc and the gang that I would have around me, every time.

Then there's the *Origin of Species*. Not as much fun as the *Voyage of the Beagle*, but definitely something that the average palaeontologist should have close to hand. In some ways this particular book is the most quirky of them all. The one I currently possess is not a first edition, or anything remotely close, or, the heavens forbid, a shiny new paperback. The old version I had once having walked off somewhere a little while back, as books do, I picked up another old edition recently in a local Oxfam shop. It's a hardback nondescript enough to challenge the most taxonomically-minded of antiquarians, with a fading kind-of-blue dust jacket adorned by a pained-looking *Archaeopteryx*. The publisher was that worthiest-spirited institution of all, the Everyman's Library, for which I do have a soft spot.

The creation of Joseph Malaby Dent in 1904, he promised – and Everyman's went a long way towards providing – 'infinite riches in a little room'. This was obtained via fine writing at a shilling a book. That, then a low price for a reasonably-produced book, was maintained by some spectacularly histrionic haggling with prospective authors: it was Dent's scream, recalled Hugh Kenner, that broke their spirits and resistance. Extreme, one might say, but it did help Everyman's came up with the goods. Even now, they have a lovely website, where they feature, say, recordings of original readings by the likes of Anna Akhmatova recalling the victims of Stalin, and Camus reading from *The Outsider*, and P.G Wodehouse simply being P.G. Wodehouse. There's even a crackly Tolstoy, reading improving literature for the masses in old age after he had decided that his epic novels were simply a diversion for the idle rich, and therefore a waste of time. All in all, the outfit was and still is a class act.

So what they did with Darwin is quite mysterious. The first time they published the *Origin of Species*, in 1928, they asked Sir Arthur Keith to write the introduction. These days, Keith mainly comes to mind via his enthusiastic involvement in the Piltdown Man affair. As an anthropologist

[1] More like cheetah'd.

[2] Yes, I know that *Of Mice and Men* has just been removed by ministerial *fiat*. But it has not been replaced with *Cannery Row*. I rest my case, and consider it strengthened.

who firmly believed that humans arose in Europe, he helped push the Piltdown story merrily along, while pouring scorn on, say, Raymond Dart's discovery of *Australopithecus africanus*, saying that the Taung skull that was 'Dart's child' was nothing more than a juvenile ape. Indeed, he is still among those suspected of being the brains behind the whole scam – partly out of ambition for an FRS and all that kind of thing, and partly because the Piltdown skull as manufactured (human-size braincase and ape-like teeth) was the exact opposite of the characters shown by the Taung skull. The case against him as regards Piltdown, needless to say, rests resolutely non-proven, as it does for the 20-odd other suspects in the case. Keith held other views on human evolution and development, too, that ranged from the bizarre (Britain's cold and wet climate was a driver of the capitalist instinct) to the dubious (on human race in general, the Jewish people in particular, and Hitler).

So – Arthur Keith was an interesting character, to be sure. A man of his time, one might say. In any event, at that time he was a pillar of the anthropological establishment, and so a prime target for the Everyman's editors to approach and presumably haggle with. For whatever pittance he finally received, he did what was expected vis-à-vis Darwin, praised him as an immortal on a par with Shakespeare, and waxed eloquent on natural selection. Keith was a genuine Darwin enthusiast, who went on to live for a while in retirement in Darwin's own Down House (as it had been donated to the Royal College of Surgeons).

Came 1958 and another edition, the one I had stumbled upon. Indeed, it is a centenary edition, or near as dammit. Arthur Keith was no longer alive and the Piltdown fossils that he expended so much eloquence on had been recently revealed as a hoax. The editors needed somebody else to write the introductory words. What then possessed them is quite as mysterious as the Piltdown case itself. They went from a celebrated British anatomist and anthropologist to a moderately obscure Canadian entomologist, William Robin Thompson, head of the Commonwealth Institute of Biological Control in Ottawa.

Thompson went about his work with gusto. There was a nod to politeness in the opening paragraph. Darwin, he said, had been admirable through his immense scientific labours. But then, he rolled up his sleeves and went on to the heart of things. Like the Assyrian (as P. G. Wodehouse put it on more than one occasion) he came down like a wolf on the fold. Thompson was not satisfied that Darwin had proved his point – or that his influence on scientific or public thinking had been beneficial. The success of the *Origin* was all very regrettable, and had been accompanied by a decline in scientific integrity, not least in the 'shifting devious and histrionic argumentation' of that 'propagandist', one certain T. H. Huxley. The whole concept was built on 'fragile towers of hypotheses, where fact and fiction mingle in inextricable confusion'.

Heavens! – it was as though one had asked a Fox News shock jock to comment on a new edition of *Das Kapital*. After that first hint of faint praise, it was full frontal attack through and through. Wherefrom this tirade? Ah. Thompson notes with clear disapproval Arthur Keith's comment that Darwin had done much to lift 'the pall of superstition' from mankind. He goes on to say that the *Origin*, while containing no direct attack on the Christian concept of the Universe is, 'on a number of points, opposed to the concept'. It 'dissipated the evidence of providential control'. There we have it. I am now the proud possessor of a creationist edition of the *Origin*.

So who, quite, was W.R. Thompson? There's not much to go on. He was a professional entomologist, for sure, though with few signs of being a giant within that science. A good organizer, it seems – the only academic reference I can easily find on the web is a thank-you from the *Canadian Entomologist* for his sterling editorial work. Michael Ruse, who has delved into sundry introductions written for the *Origin*, has got a bit farther[3]. W.R. was deeply religious, with a PhD in Catholic philosophy, and he was also an Aristotelian (and a Thomist – that is, a follower of the writings of St. Thomas Aquinas). He therefore believed in Aristotelian 'types', and did not accept that there could be transition from one to another of such 'types'.

Worse, Darwin's ideas suggested that the biological world might be run on random principles, and therefore humanity (and every other species) is some kind of accident, mediated through the operation of natural selection. Darwin's ideas thus put science, not so much against religion *per se* and *sensu lato*, as Ruse underlined – they put science against a highly conservative reading of religion. Therefore, an even more diabolical figure to Thompson than Darwin was Teilhard de Chardin[4], for attempting to find working ground between evolution and Catholicism. One guesses he would have thought much the same about William Buckland's and Charles Kingsley's operations between those two magisteria.

It is fascinating to look at the way Thompson deals with the array of evidence for 'descent with modification' that Darwin assembled for the *Origin*. The evidence of substantial and geologically ultra-rapid morphological change in domesticated animals and plants? Of no value, said Thompson, because most domesticated forms would not survive left to their own devices in nature (though he somewhat grudgingly admitted that Darwin had noted the same point). The evidence that living organisms possess common morphological features and can be classified taxonomically? Irrelevant, snorts Thompson – different atoms of the Periodic Table have common structures too. Relict structures in animals, such as small bones representing the pelvis, femur and tibia in whales? They probably, said Thompson, calling on the authority of 'some anatomists', have some important role in development. He vigorously carried out the strategy that P. G. Wodehouse so often had the hapless Bertie Wooster bring into play: stout denial, in all circumstances.

But it is the way that Thompson deals with the geological evidence that most takes the breath away. He notes how Darwin emphasized the imperfectness of the geological record, the unsatisfactory condition of fossil material, the paucity of intermediate forms. The position, said Thompson – presumably keeping a straight face while writing the words – 'is not notably different today'.

Extraordinary. Now here he has been either so engrossed in his entomological responsibilities as to be unaware of a century's worth of palaeontological study, or, in doing battle with the Ungodly, he is simply taking every opportunity to take disingenuousness into new dimensions. This, remember, is 1958 and not 1858. It is a few years away from the plate tectonics revolution. This is now a scientific world with a mature palaeontology – and a settled stratigraphy, too. Even here, Thompson misses no opportunity to launch a delicately-sculpted insinuation. Strata, he says, do not always occur in the accepted order. In some areas, Cambrian strata – that are

[3] Ruse, M. 2013. How texts are read: looking at introductions to the *Origin of Species*. *American Philosophical Society*.

[4] Another one of the people caught up in the Piltdown debacle.

regarded as the oldest – rest upon Cretaceous rocks. Elsewhere, he notes, Cretaceous or Tertiary rocks do not rest upon Cambrian rocks but on granite. This is clearly, he opines, all very puzzling. Various hypotheses, he went on to say, have been put forward to explain these 'departures from accepted theory' but although they are often 'the subject of controversy among geologists', he himself does not 'suggest that the problems to which they relate are insoluble'.

The weaselieness with words is … well, it is what one has come to expect in this particular debate, if debate is the right word to use. It is as though the Alpine geologists had never ventured into the field, and Peach & Horne had spent their lives in a Glasgow pub instead of anatomizing the north-west Scottish mountains, and as if Arthur Holmes had never started to extract radiometric ages from rocks. Thompson may be hard to track down scientifically, but he is very prominent in creationist websites, where he is still regarded as something of a superstar. This was clearly the stuff to give to the troops.

Things geological were not quite so settled, or so anatomized, in Darwin's day, and hence that famous diffidence about geological uncertainties. WR leapt on to these and in effect fossilized them, bringing them forward in their original state almost exactly a century. It's as though Thompson was releasing, into a transformed new world, some bewitched princess from a hundred years sleep, to call for her horse-drawn carriage as the lorries thunder past on the highway.

The diffidence is there, of course, in the very title the *Origin*'s tenth chapter: *On the Imperfections of the Geological Record*. Darwin certainly went out of his way to point out the problems. Why was every geological formation and every stratum, he said, not full of intermediate links? Geology, he went on, assuredly does not reveal any such finely graduated organic chain, as he went on to speak of the 'extreme imperfection' of the geological record. Within that chapter there is that section entitled '*On the Poorness of our Palaeontological Collections*', where he begins by turning to 'our richest geological museums' where 'what a paltry display we behold!'. Right at the end of the book, this kind of thing continues. The 'noble science of Geology' he says 'loses glory from the extreme imperfection of the record'. He saw 'open fields for far more important researches', including psychology via 'the necessary acquirement of each mental power and capacity by gradation'. With this final dismissal of the rock record, it was on to the closing paragraphs, completed with that tangled bank and those endless forms most beautiful.

Where from this pessimism? Perhaps it was his sense of the immensity of geological time that the poor rocks had to represent. In the *Origin*, he repeated James Croll's lovely illustration of what a million years really means. Take a narrow strip of paper, he wrote, 83 feet and four inches in length (for those too young to think Imperial, that is 25.4 m) and stretch it along a wall. This will work well if you have a sufficiently magnificent ballroom handy. Mark off at one end a tenth of an inch (2.5 mm). That will represent one century. In a century, Darwin then reminded us, an animal breeder can significantly modify the form of any beast they were working on.

His fears, though, as regards the evidence that may be extracted from the rocks, turned out to be unfounded. One might say that he was wrong, but then this was caution at work, understandable given the time and the circumstances. We now know that some rock sequences are stuffed full of petrifactions that fairly demonstrate descent with modification. But, you have to look at the right kind of rocks in the right way. The evidence is often microscopic[5] and even when dealing

[5] For example, the 20-odd studies listed in Pearson and Ezard (2014).

with larger, easily visible and measureable fossils, it takes a lot of time and a clear focus to extract the information. It is not the geological record, then, that had been so imperfect, but rather the palaeontologists' study of it. Darwin, one must recall, was gathering data only decades after Cuvier had finally established, to general scientific acceptance, the reality of extinctions in the geological past. From that realization to working out the outlines of the successive appearances and extinctions of many thousands of species took a little more time, and a lot of work at the rockface.

Skim the papers in the *Quarterly Journal of the Geological Society of London* in its first decade, from the mid-1840s to the mid-1850s, for example. One can perhaps glimpse one reason for Darwin's frustration over whether geology could provide him with the kind of answers that he wanted. There's a lot of palaeontology in them, but these are accounts of explorers going through the newly discovered, trackless jungle of time and space and bringing back specimens almost at random. Peruse those pages and you get a very good idea of the palaeontological bazaar then out there.

The first volume, in 1845, awash with palaeontology, has already been considered in these pages[6]. It included such as Egerton on the mouth of a fossilized *Hybodus* shark, Richard Owen on whale earbones and one J. Middleton committing indignities upon the (purposefully) mummified remains of some poor Egyptian cat. In 1846 there is another potpourri, with Mantell and his nemesis Owen crossing swords, with the utmost politesse, over whether or not fossil birds could be found in the Wealden. There is John Dawes, with observations of Sternbergiae, Samuel Stutchbury on a new plesiosaur, and J. Black on footsteps in slabs of New Red Sandstone from Runcorn, Cheshire. In 1847, the litany continues. There's J. W. Salter on fossilized Chiton in the Silurian, James Smith on a Maltese elephant, and the Reverend P. D. Brodie on fossil insects from Swindon. And so it goes on, year after year. It's a kind of lucky dip of the fossil world, and goodness alone knows how anyone – even such a formidable processor of data as was Darwin – could make sense of any of that lot.

En masse, of course, this work did produce the clear picture that times past had been crowded with highly distinctive animals and plants that were no longer alive, and it pretty soon established a fair succession of order in which they appeared and disappeared. The question, though, was exactly how.

Where could Darwin have gone to, then, to overcome the imperfection of the fossil record? Well, throughout the last forty years of his life – and before Sir Arthur Keith got hold of the house keys – he lived in Down House, by Downe, on the North Downs and therefore, at the risk of labouring the point, upon part of the Chalk downlands. Darwin was quite aware of the Chalk as a geological phenomenon and even – a century before Derek Ager made the point – noted in the *Origin* that it was a global stratigraphic phenomenon.

This singular Chalk deposit is remarkable because – unlike most of the earlier deposits that it rests on and those that overlie it, it captures most of the geological time that it represents. That geologically high sea level to spread pelagic deposits over the continental surfaces, and all that. Darwin wasn't to know this, of course, but it is just one of those nice coincidences that litter this science of ours. The Chalk also includes some successions of fossils that are amongst the most classic of evolutionary lineages, not least the humble heart urchin, *Micraster*, a fossil that he must have been aware of, given how common it is in that part of the world.

[6] 'Halfway there' – *Newsletter* **68**.

By Darwin's time, there were already quite a few *Micraster* species, thanks to the energetic collecting and taxonomising of Edward Forbes and others. But to unveil the broader pattern took a little more work. Had Darwin had a go at this set of fossils himself, instead of becoming involved in (for instance) orchid pollination, earthworms and the like, then he might have had quite a different view on the fossil record and on the regrettable absence of missing links in the geological record. A bit of energetic field work – it's hard work hammering fossils out of the Chalk – might also have done his delicate health the world of good. Whatever, the heart urchins of the Chalk needed a patient and determined person to get to know them properly. And since Darwin was otherwise engaged, one Arthur Walton Rowe came in on the scene.

Rowe was a professional man – a doctor – and a busy one, so the amateur palaeontology got fitted in on his few holidays and late in the evenings. Nevertheless, he showed 'perticinacity and scrupulous care' as a collector, as his obituary in the *Geological Magazine* observed approvingly. He extracted 2,000 specimens of *Micraster* from the Chalk – from Beachy Head, Dover and suchlike places – measured them exhaustively, and set out his results in the *Quarterly Journal* in 1899. This is now quite a different concoction from the kind of palaeontological magpie-collections of earlier accounts. It was a single focused study that took one narrow fossil group systematically through one set of strata. And the problem was not so much the absence of links between forms, but their multiplicity.

Rowe expressed this with splendid pithiness. Yes, species had been defined. Indeed 'of the making of species there had been no end'. He wrote of d'Orbigny 'plaintively' bemoaning the 15 named by 1850, and determining to reduce them to six. He noted the 'utter lack of unanimity' of 'well-known English palaeontologists and field workers' about what was a definite species of zonal importance and what simply was a 'meaningless variety'. He would have wished to start '*de novo*' and work out a rational, zoologically-founded classification scheme, but alas the 'iron law of priority' did not allow one to abolish 'such barbarisms as *cor-anguinum*[7] and *cor-testudinarium*'.

The problem was, Rowe said, that it is hard to make 'abrupt specific distinctions' where 'gentle transition from one form to another is the invariable rule'. One can lay a series of this 'Protean genus' on a table, and they would show 'an imperceptible transition from one form to another'. And yet, one could also, from that same series, 'pick out distinct museum-types of several well-known species'. Rather than add to the 'burdensome' number of named species, Rowe worked out patterns through time, that is through the 10 million years or so represented by a couple of hundred metres or so of Upper Chalk. *De novo* it pretty well was, although he did have to work – clearly reluctantly – with the nomenclatural barbarisms that he had been bequeathed.

The patterns he established have pretty well stood the test of time. They were nicely summed up in '*The Science of Life*', a book that H. G. Wells marshalled in the 1920s, acting as taskmaster for his zoologist son G. P. ('Gip') Wells and Julian Huxley (grandson of T. H. Huxley, but a formidable figure in evolutionary science in his own right). As one tiny part of this three-volume exposition of biology as it stood in the 1920s, they took Rowe's formidably detailed paper and neatly boiled down the results into 'absolutely continuous' changes from a flattened to an arched shape, a general broadening, and a mouth 'creeping steadily forward' as stratigraphic time passes, and so on. So, with these fossils, not an absence of links but an embarrassment of them. Indeed,

[7] This also described by Rowe, warming to his task, as 'a polysyllabic enormity'.

the story seems to be one of all link. It's the kind of pattern that seems all too familiar to me in considering some of the equally temporally Protean graptolite taxa that turn up all too frequently, in the depths of the Early Palaeozoic.

It wasn't the last word, of course. Some decades on, Kenneth Kermack applied further number-crunching, and David Nichols reworked the patterns in terms of functional biology of modern relatives, and then Robert Stokes reworked those barbarous names a little, and there's been more besides. Nevertheless, it remains a nice example that fossils can, indeed nicely, show descent with modification – even on (or more precisely beneath) Darwin's own doorstep. If only he had known. Geology, he would then have realized, really can petrify a finely divided organic chain.

Rowe's work was one of the first really detailed studies of this kind. And by 1958, enough classic microevolutionary studies of fossil lineages had piled up to show whole cavalcades of intermediate forms. There are the likes of the late Cambrian olenid trilobites of the Alum Shales of Sweden, anatomized by Westergård as far back as 1922, and peered at in yet greater detail by Kaufmann in 1933, to pick out four successive trends of lengthening and narrowing in the pygidium. Brinkmann's studies of the ammonites of the Oxford Clay, too, showed the pattern of change in close-up. If one looks beyond the small fry, the tree of the American horses was growing respectably.

Now, one can nitpick about how many of these can be shown to be convincing examples of gradation between specific taxa, in the way that, for example, Peter Sheldon later showed for a cluster of Mid-Ordovician trilobites from the Welsh Borders, and how many might represent successive, or closely temporally overlapping closely related forms. In whichever interpretation, the picture of descent with modification is quite clear.

Darwin's working life didn't overlap with these classic small-scale analyses. That of W. R. Thompson did, and he should have known all about them, though whether he did or not is a moot point. If he did know of them, would he have worried over the subtleties of whether a particular succession of fossils reflects truly gradual change or finely-spaced punctuations? Such distinctions must be entirely nugatory for someone who is still questioning, in 1958, which of the Cretaceous or Cambrian came first. A century's worth of busy palaeontology might have piled up an impressive amount of stilled life, in increasingly precisely delineated patterns. No matter. WR had, all too clearly, an agenda too elevated to worry about such details. Things haven't changed so much since his time. In creationist circles, stout denial is still the order of the day.

Things have moved on in the publishing world. There is still an Everyman's library version of the *Origin of Species*, and the editors have made up for their earlier eccentricity as regards the selection of Introduction-ists. Currently its *Origin* is graced by Richard Dawkins, who would certainly have a better grasp of how the Cambrian relates to the Cretaceous. It's all to the good, of course: Darwin really does deserve better than W. R. Thompson in bilious mode as a champion. But, there's a tiny part of me that regrets this sensible and admirable choice. It will make the future exploration of charity bookshops just a tiny fraction less of an adventure.

Jan Zalasiewicz

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R for palaeontologists

2. Introduction part 2: Loops, logical statements and writing functions

Introduction

The first article in this series focused on introducing the very basic elements of the R language: types of data, vector calculations, statistics and plotting your data. I also mentioned that one of the most important benefits of statistical platforms such as R is that they allow for researchers to have direct control over their analyses by either adapting pre-existing software or writing bespoke code to execute a particular task in exactly the way they want it to be done.

This article is a direct continuation of the previous article, to introduce you to more basic techniques that are common in all programming languages – including loops and logical statements. Finally, with an understanding of these methods I will conclude by showing you how to turn your existing code into functions so they can be easily applied to multiple datasets and shared with other researchers.

Loops

Loops are one of the more useful tools available to programmers, although they can be troublesome as I will discuss briefly later. Simply put, a loop contains a series of commands (contained within curly braces) that you wish to be performed a certain number of times. There are two kinds of loops that are commonly used: **for** and **while** loops. The first, **for**, is used when you have a *vector* or *list* of values you wish to loop through and has the following general format, sometimes called *pseudocode* by programmers:

```
for(counter in vector){

  command(s)

}
```

For example if you had a *scalar* called **x** that has a value of 1 and you wanted to add 2 to **x** 10 times you could use the following code:

```
x <- 1
for(i in 1:10){
  x <- x + 2
}
```

If you were now to call for the resulting value by typing **x** R will print the value:

```
[1]  21
```

You may have noticed that in the first line of the loop after the command **for** is the letter **i**. This is referred to as the *counter* and represents each iteration of the loop changing each time to the next value in the list that you have defined – in this case the values from one to ten. To see this in action you can print the value of **i** at each iteration using the following code:

```
for(i in 1:10){
  x <- x + 1
  print(i)
}
```

The value of the counter can also be included within each loop and used in calculations. For example if we were to create the *scalar* **y** that is also set to 1 and we wanted to add the value of the counter (**i**) each time – *i.e.* adding one in the first loop, two in the second and so on up to 10 – we could use the following code:

```
y <- 1
for(i in 1:10){
  y <- y + i
}
```

If you then call for **y**, by typing the letter y at the prompt '>', R will return the following:

```
[1]  56
```

The second main type of loop is called a **while** loop and you can think of it in these terms. Here a loop continues while a certain condition remains true and the loop will cease when the condition is no longer met. Using an example similar to the previous one, say we had a value, **z**, and we wished to add a random number to it until it reached another value, say 100; we can use a while loop for this. In order to add a random value to **z** we can use the function **runif** (for more information type **help(runif)**) which requires three values: the number of values you want and a minimum and maximum number to select these numbers from.

```
z <- 1
while(z < 100){
  z <- z + runif(1,0,10)
}
```

If now you were to call for **z**, you'll find a value greater than 100. Because you are adding a random value to **z** the final value will be different every time you run this code. This occurs because in order for the loop to stop the condition must become FALSE. If you now type **z < 100** at the prompt, R will tell you that it is FALSE.

Common issues with loops

Although very useful in programming there are number of quirks about loops that I should briefly mention. Firstly, they can take a long time to run, especially if you have nested loops (for example if you have a loop of ten containing a second of ten it means the commands are being run 100 times in total). Now, this may be unavoidable but one tip is: leave outside the loop anything you only need to do once so it keeps run-time shorter. Secondly, be careful not to have a conditional statement that will result in the loop running forever; an extreme example of this would be to use the following:

```
value <- 1
while(value > 0){
 value <- value  + 1
}
# Press ESC to stop the program otherwise it will keep running
```

Here, the condition of running the loop is if the *scalar* called **value** is greater than zero, and this is always the case as you are continually adding one to the original value of one. To see this in action include the line **print(value)** in the loop. This will also give you some idea of how quickly your computer does calculations!

On another note, one of the most common, but easily fixed, errors in programming is making sure that every statement you write is properly closed. By this I mean every time you open a bracket '(' or curly-brace '{' you have to end with the opposing closed bracket ')' or brace '}'. If you don't do this R will consider that line or function incomplete and will not provide you with the command prompt '>' but instead you will get a '+'. In order to demonstrate this take any of the previous examples and run all the lines except for the final one, leaving out the last curly brace. You will see that until you type in and run the last curly brace the code will not run until completion.

Logical statements

Another important component in programming is the use of logical statements; these are questions about your data that result in an answer that is TRUE or FALSE which in turn can dictate what methods are applied to the data. This was mentioned briefly in the previous article but will now be discussed in greater detail. The syntax for the different logical arguments used in R is provided in Table 1.

Table 1. Logical commands in R.

Syntax	Explanation
!	Logical NOT
&	Logical AND
|	Logical OR
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
&&	AND when used with **if**
||	OR when used with **if**

A simple example of a logical question would be to ask whether one value – *e.g.* 5 – is greater than another, *e.g.* 3, using the greater than symbol (**>**), by typing:

```
5 > 3
```

This will return the following:

```
[1]     TRUE
```

Two or more statements can be joined together using either AND (**&**) which will return TRUE if *all* individual statements are true, or OR (**|**) which will return TRUE if *any* of the statements are true. Below are two examples using both the AND and OR statements, which in English can be read as "Is 5 greater than 3 AND is 10 less than 9?" and "Is 5 greater than 3 OR is 10 less than 9?" respectively. As only the first statement in each case is true the first example returns FALSE but the second example returns TRUE.

```
5 > 3 & 10 < 9
[1]     FALSE
5>3 | 10 <9
[1]     TRUE
```

If we wanted to ask a logical question of a dataset containing multiple values, in the form of either an *array* or a *matrix*, each element is treated separately. So if we create a scalar called **x** with five values and want to know which values are greater than or equal to four we could use the following:

```
x <- c(1,2,3,4,5)
x >= 4
```

R will return:

```
[1]     FALSE   FALSE   FALSE   TRUE    TRUE
```

Making things more complicated, say we wish to know which value is greater than two AND less than four:

```
x > 2 & x < 4
```

```
[1]     FALSE   FALSE   TRUE    FALSE   FALSE
```

It is important to note that the syntax for 'greater than or equal to' and 'less than or equal to' must be '>=' and '<=' respectively as this command varies across programming languages (for example .GE. and .LE. in Fortran). If you were to type '=>' R would return an error saying that it did not expect the '>' symbol.

The use of logical statements becomes clear not just when you want to identify elements of your datasets that match certain parameters but when you want to select, ignore or only perform calculations of selected elements. If any of the previous logical statements are used to select elements, only those in which the result is TRUE will be returned. So creating a new *array* called **y**:

```
y <- c(1,10,12,3,90,8)
```

If we then wanted to return all the values greater than 10 we could use:

```
y[y>10]
[1]  12  90
```

Rather than using specific values, say we wanted to know which values were greater than the mean value for **y**:

```
y[y > mean(y)]
[1]  90
```

As the mean value for **y** is 20.6667 only the last element (90) is greater than the mean value.

If and else statements

There are times when you will want your code to perform a particular task but only when a specific condition is TRUE, or if that condition is not TRUE to run a secondary function. For this you will use what are known as **if** and **else** statements. In simple terms you can think of these as the following:

```
if(conditional statement){
  command(s) to perform if conditional statement is TRUE
} else{
  command(s) to perform if conditional statement is FALSE
}
```

Conditional statements are commonly either in the form of a logical statement such as in the previous examples or can be associated with one of the arguments of a function. When using comparative statements with an **if** command – such as "is x equal to y?" – you must include two equals signs (==) (Table 1) otherwise in this case R will want to assign the value of y to the variable y.

In order to demonstrate this we will use the dataset I provided in the previous article, called **asaphidae** that contains a series of measurements recorded for twenty-one trilobite genera in a matrix format, in which each column represents an individual genus. Details of where to find and how to set a working directory and load in this file are available in the previous article.

```
asaphidae<-read.table("asaphidae.txt",header=T)
```

If we wanted to separate the genera here into two categories according to their mean size, large and small genera, using an arbitrary value of 30mm to differentiate them, one way to do this would be to use **if** and **else** statements. In English we would want to ask the following: "IF the mean size of a genus is greater than OR equal to 30mm save the genus name in an *array* ELSE save the genus name in a second array". So for this we first need to set up two empty arrays with which we will save the genus names that match our criteria:

```
large.species <- array(dim=0)
small.species <- array(dim=0)
```

Second we will use a **for** loop, using the counter **t** to represent each column of data, to examine each genus in turn:

```
for(t in 1:length(asaphidae[1,])){
 if(mean(asaphidae[,t],na.rm=TRUE) >= 30){
  large.species <- c(large.species,colnames(asaphidae)[t])
 } else {
  small.species <- c(small.species,colnames(asaphidae)[t])
 }
}
```

If you now run both **large.species** and **small.species** R will provide lists of the genera that have a mean size greater and smaller than 30mm respectively.

Taking this further, you are not limited to using **if** and **else** once but can use them together to ask a second (or more) conditional statement(s). Using the previous example, if we wanted to add in a third category to represent the medium sized species that ranged in size between 10mm and 30mm we could amend our code in the following way:

```
large.species <- array(dim=0)
medium.species <- array(dim=0)
small.species <- array(dim=0)

for(t in 1:length(asaphidae[1,])){
 if(mean(asaphidae[,t],na.rm=TRUE) >= 30){
  large.species <- c(large.species,colnames(asaphidae)[t])
 } else if(mean(asaphidae[,t],na.rm=TRUE) >= 10 && mean(asaphidae[,t],na.
rm=TRUE) <= 30){
  medium.species <- c(medium.species,colnames(asaphidae)[t])
 } else {
  small.species <- c(small.species,colnames(asaphidae)[t])
 }
}
```

Writing your own functions

Once you understand how to implement the basic programming techniques discussed here and in the previous article you will be ready to input your own data and write functions to analyse these datasets. Writing your own functions has several advantages in that it provides you with the ability to run identical analyses on multiple datasets without having to change any variable names, and second it provides a much easier way for other researchers to use your code.

Using the same data as before let's say that we are interested in knowing what the mean value of each genus is and want to store the resulting values as an *array*. A simple way to do this would be to create an *array*, here called **asaphidae.means**, with a length equal to the number of genera in the matrix, using **length(asaphidae[1,]** (*i.e.* the number of columns in the matrix).

```
asaphidae.means <- array(dim=length(asaphidae[1,]))
names(asaphidae.means) <- colnames(asaphidae)
```

Next we could systematically calculate the mean for each of the 21 genera, assigning the value to **asaphidae.means** individually as in the following:

```
asaphidae.means[1] <- mean(asaphidae[,1],na.rm=TRUE)
asaphidae.means[2] <- mean(asaphidae[,2],na.rm=TRUE)
asaphidae.means[3] <- mean(asaphidae[,3],na.rm=TRUE)
# etc…
```

As you can see, for 21 genera this would be an extremely cumbersome approach to solve this issue. However, we now know that if we wish to perform the same operation (*e.g.* calculating the mean) multiple times we can simply loop through each column in turn by using a *counter* (here called **m**) instead of a specific column number:

```
asaphidae.means <- array(dim=length(asaphidae[1,]))
names(asaphidae.means) <- colnames(asaphidae)

for(m in 1:length(asaphidae[1,])){
 asaphidae.means[m] <- mean(asaphidae[,m],na.rm=TRUE)
}
```

Another approach to this is to use the names of the genera to loop through rather than a list of values. So, in the first instance, rather than R seeing the number 1 as the first column it is looking for a column called "Isotelus":

```
for(m in colnames(asaphidae)){
 asaphidae.means[m] <- mean(asaphidae[,m],na.rm=TRUE)
}
```

You may have noticed that in all the previous uses of the **mean** function the argument **na.rm=TRUE** is included; this is used to tell R to exclude any cells containing the value NA (which stands for not applicable) when calculating the mean. With this argument set to FALSE (the default) R cannot calculate the mean value; try running **mean(asaphidae[,1])** and you will see that R returns:

```
[1]    NA
```

So now you have a piece of code that works well in calculating the mean species values for one particular dataset. What if we wanted to use this regularly on a wide range of taxonomic groups? There are several options; we could assign any dataset we wished to use to **asaphidae**, or change any mentions of **asaphidae** in the code to the name of the other dataset. However, the best option is to create a function using this code. In order to do this, all the code is assigned a name using **function**. The rest of the code follows the same layout as for all other functions in R. Firstly, any arguments (or options) you wish to have within the function are included in the brackets after **function**. Secondly, the function **return** is used at the end of the code to include the dataset you want to be returned to the user once the program is completed. Note that **return** can only be used once and with one variable; if you want to return multiple variables they must be combined together as one object such as a list using **list(variable1,variable2)**. Using the previous code for calculating mean species size as the basis of the new function **genus.means**, the *array* containing the resultant mean values, called **means**, is returned to the user.

```
genus.means <- function(dataset){
 means <- array(dim=length(dataset[1,]))
 names(means) <- colnames(dataset)

 for(m in 1:length(dataset[1,])){
  means[m] <- mean(dataset[,m],na.rm=TRUE)
 }
return(means)
}
```

This can now be used in the same way as any other function in R. The dataset we wish to analyse, **asaphidae**, is assigned using the argument **dataset**:

```
asaphidae.means.new <- genus.means(dataset = asaphidae)
```

The results of this function can now be viewed by typing:

```
asaphidae.means.new
```

As it happens there is a similar function for calculating the mean values for all columns of a matrix, called **colMeans** (the alternative for calculating row means is called **rowMeans**). You can compare the results of your new function with **colMeans** by using the following code:

```
colMeans(data=asaphidae,na.rm=TRUE)
```

All the example code used here, which has been commented in detail, is available to download from the PalAss website (<**http://www.palass.org/**>). In addition I have provided another version of the **genus.means** function (called **genus.stats**) that calculates several additional statistics on each genus (minimum, maximum and median values).

Summary

While all programmers have their own coding philosophy and will find different and unique ways to solve problems, it is important to state that there is no single correct approach to statistical programming and the examples here are just one solution of those possible. However, the basic techniques introduced here are universally applied amongst programming languages, and with these you will be well on your way to understanding what pre-existing functions are doing as well as developing code for your own specific needs.

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FURTHER READING

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PARADIS, E., 2002. *R for Beginners*.
<**http://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf**>

You can find the support material for this column, such as the data files *extrinsic.txt* and *asaphidae.txt*, in the Newsletter section of the PalAss website, at <**www.palass.org**>.

>>***Future*** Meetings of Other Bodies

9th European Palaeobotany-Palynology Conference
Padua, Italy *26 – 31 August 2014*

The Italian group of palaeobotanists and palynologists is very glad to be able to invite all of you to Padova in 2014 for the next EPPC.

Padua (Padova in Italian) is a picturesque, historic city in Northern Italy (about 40 km west of Venice), with a dense network of arcaded streets, large communal "piazza" (squares) and many bridges crossing the various branches of the Bacchiglione.

All scientific sessions will be held at the new Department of Geoscience, and the famous Botanical Garden and Museum of Geology and Palaeontology will be involved in this conference. Field-trips are planned in the fascinating landscapes of the Dolomites, Sardinia, Emilia-Romagna, Latium and Tuscany.

For further information contact the conference secretary (e-mail <**Evelyn.Kustatscher@naturmuseum.it**> or look for updates on the conference website at <**http://www.geoscienze.unipd.it/9th-european-palaeobotany-palynology-conference/**>.

9th International Congress "Cephalopods – Present and Past" (ISCPP 9) and the 5th International Coleoid Symposium
University of Zurich, Switzerland *4 – 14 September 2014*

This series of cephalopod meetings was launched in the 1970s in York. Thereafter, they were held every three or four years in various cities including Tübingen, Granada, Vienna, Fayetteville, Sapporo and Dijon. It is the only occasion in which cephalopod workers meet from around the world. There are normally three to four days of scientific presentations. The interesting and important aspect of this meeting is that both biologists and palaeontologists meet, although there traditionally have been slightly more palaeontologists. This might change at the 2014 meeting, however, since it will host the International Coleoid Symposium for the first time.

Traditionally, two field-trips are associated with the meeting. For this meeting, trips are planned to the Fossillagerstätten of southern Germany and fossil localities yielding cephalopod fossils in Switzerland, each of which will last a couple of days. Details of these field-trips will be announced in due course.

For further information visit the conference website at <**http://www.pim.uzh.ch/symposia/ISCPP9/index.php**>.

GA Annual Meeting sponsored by Elsevier:
Palaeo' to the People! Fossils in the service of Man
University of Leicester, Leicester, UK *6 – 7 September 2014*

This year's conference will explore the following themes:

- Applied stratigraphy;
- Archaeology;
- Engineering projects;
- Forensic micropalaeontology;
- Hydrocarbon exploration and production;
- Museum collections

Conference booking is now open, at <**http://www.geologistsassociation.org.uk/conferences.html**>

Organisers: Haydon Bailey and Mark Williams.

7th International Meeting on Taphonomy and Fossilization
Ferrara, Italy *10 – 13 September 2014*

Taphos 2014 represents the 7th International Meeting on Taphonomy and continues the tradition of taphonomic meetings that have been regularly held in Spain since 1990 and then in Tübingen (2011). This is the first time that the Taphos meeting is held in Italy, so I have great pleasure in inviting you, on behalf of the University of Ferrara and the City of Ferrara, to Italy in 2014.

Please visit the conference website for updates, at <**http://web.fe.infn.it/taphos2014/**>.

6th International Symposium on Lithographic Limestone and Plattenkalk
Museo del Desierto, Saltillo, Mexico *15 – 19 September 2014*

The Museo del Desierto invites you to the 6th International Symposium on Lithographic Limestones and Plattenkalk. This multidisciplinary meeting is planned to address aspects of the study of lithographic limestones and plattenkalk deposits across all disciplines, from palaeontology (taxonomy, palaeoecology, taphonomy), to geology (stratigraphy, sedimentology, palaeoenvironments), and also mineralogy and petrology of Plattenkalk deposits and related Fossil-Lagerstätten. The meeting is organized in collaboration with the Institute of Earth Sciences of the University of Heidelberg, Germany. We plan field-trips to the famous plattenkalk deposits of Vallecillo, Cuatro Cienegas and possibly Muzquiz.

Please visit the conference website at <**http://isllpsaltillo.uni-hd.de/**> for updates.

Are there limits to evolution?
St. John's College, Cambridge *25 – 26 September 2014*

What will evolutionary biology look like in 50 years? More of the same or will there be new paradigms, new syntheses? What lies on the horizon?

The impact of evolution is undeniable, but it can be viewed through different lenses. For the scientist it is the investigative discipline, mapping out the history of life, uncovering its intricacies and revealing its mechanisms. For others it might be the grand narrative, and across society it brings different meanings – sometimes to the point of polarization.

This conference is an opportunity to focus on the important research objectives, discuss the best ways to achieve them, and use these to set a considered agenda for the continued study of evolution. This event is part of a larger programme on evolution funded by the Templeton World Charity Foundation. Keynote speakers include Margaret McFall-Ngai (University of Wisconsin), Eors Szathmary (The Parmenides Foundation, Munich), Geerat J. Vermeij (University of California at Davis) and Gunter Wagner (Yale University).

Accommodation will be available in College, and the Conference package will include all meals, a wine reception, and a Conference Dinner in John's medieval Dining Hall. Further information is available by contacting Dr Victoria Ling (e-mail <**vl237@cam.ac.uk**>). *Registration is now open, please visit the Department of Earth Sciences website.*

Regional Committee on Mediterranean Neogene Stratigraphy Interim Colloquium: The Mediterranean Messinian Salinity Crisis (MSC): from geology to geobiology
Torino, Italy *25 – 28 September 2014*

This interim colloquium will focus on the MSC sedimentary record with emphasis on climate–microbes feedback during evaporite deposition. Contributions from scientists interested in climate, biologic and geologic evolution of terrestrial and marine environments of the Mediterranean and Paratethys during the late Neogene are welcome.

A two-day post-congress field-trip, focused on the Messinian succession of the Piedmont Basin, is planned.

A dedicated workshop entitled "Morphology and taxonomy of Lago-Mare dinocysts" will be held in Torino before the colloquium, on 24th September. To register for the workshop please e-mail <**adele.bertini@unifi.it**>.

Please check the colloquium website for further information: <**http://www.rcmns-turin2014.unito.it**>.

4th International Palaeontological Congress (IPC 2014) to include the 47th AASP-TPS (AASP – The Palynological Society) Annual Meeting
Científico Tecnológico, Mendoza, Argentina *28 September – 3 October 2014*

Local organizers are planning a comprehensive congress with an intellectually motivating scientific programme. The Congress will create opportunities for participants to present and share experiences, explore new directions, and debate topics among specialists from across the globe. The meeting will include the 47th AASP-TPS Annual Meeting.

A varied array of meeting styles with a combination of keynote lectures, special symposia on leading issues, interactive workshops, technical sessions, and short courses promises to hold sessions of interest to all palaeontologists.

Delegates will have the opportunity to enjoy a wide range of conference excursions to rich and well-known Argentinean palaeontological sites involving a combination of scientific and touristic attractions. The schedule of field-trips covers superbly exposed sedimentary successions, representing a great diversity of marine and continental palaeoenvironments, and encompasses nearly the whole stratigraphic record.

Organisers for the 47th AASP-TPS Annual Meeting are now calling for Symposium topics. If you have any great ideas for palynology-related symposia, please feel free to contact Thomas Demchuk (e-mail <**tdemchuk@swbell.net**>).

Please see the conference website (<**http://www.ipc4mendoza2014.org.ar/**>) for further conference details.

International Nannoplankton Association Extant Coccolithophores Workshop
Crete *October 2014*

Further information is available by contacting Maria Trianthaphylou at the University of Athens (e-mail <**mtriant@geol.uoa.gr**>).

Co-evolution of Life and the Planet 2014 Conference: Future perspectives in Earth System Science
The Geological Society of London, Burlington House *4 – 6 November 2014*

The Earth that sustains us today has arisen out of planetary scale co-evolution of the physical and biological worlds. The complexity of these interactions necessitates a multidisciplinary 'Earth System Science' approach. Two years on from 'Life and the Planet 2011', this two-day meeting will explore advances in our understanding of the coupled evolution of life and the planet.

The four main themes of this meeting are: 1) Precambrian origins of the modern Earth System; 2) Key events in the evolution of marine ecosystems; 3) Geological constraints on biological evolution in the polar regions; 4) Descent into the Icehouse during the Cenozoic Era.

Please check the conference website at <**http://www.lifeandplanet.net/2014-life-and-planet.html**> for updates. *Abstract deadline: 30th June 2014*.

Radiation and Extinction – Investigating Clade Dynamics in Deep Time
Linnean Society of London, Burlington House, London *10 – 11 November 2014*

[Sponsored by the Linnean Society of London, the Palaeontological Association and University College London's Environment Institute]

Determining the causes and drivers of evolutionary dynamics is central to our understanding of life on Earth. What factors shaped the modern biota? Why did some groups go extinct, whilst others survived and radiated? Why are some groups so much more diverse than others? What will happen to organisms as the Earth continues to warm up?

These issues cannot be addressed solely by studying the present day: only by examining evolution on longer, deep-time scales can we hope to understand what controls and drives these processes. Increasingly sophisticated quantitative methods are becoming ever more available to try and answer such questions, allowing us to explore rates and patterns of evolution, test evolutionary models, and examine the effects of intrinsic and extrinsic drivers on biodiversity, using entirely palaeontological, and mixed palaeontological, neontological, and genomic data sets.

This two-day meeting will bring together a diverse array of researchers developing and applying methods for reconstructing deep-time macroevolutionary patterns in biodiversity, with a particular focus on analytical approaches that take advantage of the wealth of data available in the fossil record. Dan Rabosky (University of Michigan) will deliver the plenary talk, with additional confirmed presentations from Tracey Aze (University of Oxford), Natalie Cooper (Trinity College Dublin), Mario dos Reis (University College London), John Finarelli (University College Dublin), Matt Friedman (University of Oxford), Melanie Hopkins (American Museum of Natural History), Graeme Lloyd (University of Oxford), Emily Rayfield (University of Bristol), Marcello Ruta (University of Lincoln), Graham Slater (Smithsonian National Museum of Natural History), Jeroen Smaers (Stony Brook University), Tanja Stadler (ETH Zürich), Gavin Thomas (University of Sheffield), and Chris Venditti (University of Reading). Additional speakers will be added as confirmed. Speakers will detail both methodology and application for a range of taxonomic groups, time intervals, and macroevolutionary themes corresponding to radiation, extinction and clade dynamics in deep time.

Further information can be obtained and bookings made via the meeting website at <**http://www.linnean.org/Meetings-and-Events/Events/**>.

12th International Symposium on Fossil Cnidaria and Porifera
Muscat, Oman *8 – 12 February 2015*

Planned symposium topics are based on: Biology and Paleontology, Cnidaria and Porifera through time, Cnidaria and Porifera through space, and Phanerozoic bioconstructions.

Please check the conference website for updates, at <**http://www.12sfcp2015.gutech.edu.om/**>.

15th International Nannoplankton Association Meeting
Bohol Island, Philippines *7 – 16 March 2015*

Pre-conference field-trip: 7–8 March, Bohol Island.
Post-conference field-trip, 14–16 March, Palawan Island.

Further information is available by e-mailing the organisers, to <**ina15philippines@gmail.com**>.

Palaeozoic Echinoderm Conference
Zaragoza, Spain *14 – 21 June 2015*

This conference will celebrate the career of Dr Andrew Smith, a world-renowned specialist in echinoderms who retired in late 2012.

The conference will be focused on Palaeozoic echinoderm communities; presentations will review the current state of knowledge for a range of groups, highlighting recent advances and identifying topics of uncertainty and possible future research paths. There will be short workshops on Spanish fossil material and new analytical techniques, and a field trip will take place close to Zaragoza (Iberian Chains) and in the north-western part of Spain, between the cities of León and Oviedo (Cantabrian Mountains).

For further details and to be added to the conference mailing list, please contact Samuel Zamora (e-mail <**s.zamora@igme.es**>).

Systematics Association Biennial Meeting
University of Oxford, UK *26 – 28 August 2015*

This three-day meeting will take place in The University Museum of Natural History and the Department of Zoology, with accommodation available in historic Christ Church College. Sessions will include: Systematics & Ecology, Systematics & Evolution, Systematics & Taxonomy and Systematics & Fossils.

Please check the Systematics Association website at <**www.systass.org**> for updates.

Flugsaurier 2015, The International Meeting of Pterosaurology
University of Portsmouth, UK *26 – 30 August 2015*

In 2015, Flugsaurier, the International Meeting of Pterosaurology, will be held in the United Kingdom for the very first time. Flugsaurier 2015 will be held at the University of Portsmouth in conjunction with the Symposium of Vertebrate Palaeontology and Comparative Anatomy which will be held afterwards in Southampton.

Anyone who would like to be included on the mailing list so that they receive the first circular should contact Dr Dave Martill (e-mail <**david.martill@port.ac.uk**>).

The Annual Symposium of Vertebrate Palaeontology and Comparative Anatomy
National Oceanography Centre, Southampton *29 August – 4 September 2015*

The meeting will be preceeded by Flugsaurier 2015 (to be held in Portsmouth). Pre-conference field-trips are planned, in conjunction with Flugsaurier, to visit the famous Jurassic coast in Dorset on 29–30 August. A post-conference field-trip on 4th September will follow the formal SVPCA sessions.

Please check the website for updates, at <**http://svpca.org/years/2015_southampton/index.php**>.

5th Polar Marine Diatom Workshop
Salamanca, Spain *2015*

Further details will follow in due course, meanwhile please check the website for updates, at <**https://sites.google.com/site/polarmarinediatomworkshop/**>.

14th International Palynological Congress and the 10th International Organization of Palaeobotanists Congress (IPC XIV/ IOPC X 2016)
Salvador, Brazil *late September – early October 2016*

Local organizers are planning the Congress to occur after the Olympics in Brazil. Further details to come.

DINO11
EPOC Laboratory, Bordeaux University, Bordeaux, France *2017*

Further details to come.

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

Meeting REPORTS

Lyell Meeting 2014: Deep-sea chemosynthetic ecosystems: where they are found, how they work and what they looked like in the geological past
The Geological Society, Burlington House, London *12 March 2014*

The discovery of hydrothermal vents astounded scientists during the late 1970s, who, as well as finding an entirely new type of ecosystem with a vast richness and abundance of novel organisms, uncovered another chapter in the story of life on our planet: life through chemosynthesis. This revelation sparked a massive research effort to explore, catalogue, and understand the chemosynthetic organisms dependant on hydrothermal vents, as well as those of the more recently discovered methane seeps and organic falls. This one-day meeting was held in the majestic surrounds of Burlington House in London, and featured a multi-disciplinary array of speakers covering the realms of deep-sea biology, ecology, biogeochemistry, ore mineralogy, palaeontology and astrobiology, to look into what we currently know about deep-sea chemosynthetic ecosystems.

Proceedings began with a talk by **Jonathan Copley** (University of Southampton, UK) outlining why we need to go beyond the notion of biogeography in order to understand the ecology of hydrothermal vent ecosystems. Vent faunas are globally partitioned into distinct biogeographical provinces, however these patterns are frequently disrupted by sites where the expected is not observed. Because of this, Jon suggested that perhaps we need to move towards a new system to characterise the distinctiveness of vents, one that takes into account functional zonation of organisms relating to their different trophic approaches. Following this, **Nadine Le Bris** (Université Pierre et Marie Curie, France) provided a perspective on hydrothermal vents as a mosaic of microhabitats shaped by chemistry, whereby vent habitat is essentially a mixing zone with steep gradients that structure vent communities in both space and time. Successional patterns have also been characterised by the study of seafloor eruptions, showing that over time, a species can outcompete another for optimal access to resources. She also touched on the technological challenges of recording observations at depth. **Richard Herrington** (Natural History Museum, UK) then drew attention to the economic importance of hydrothermal vent deposits and the recent interest in mining these in the deep-sea, which led to a discussion into why we would want to mine the deep-sea when plenty on-land analogues of these systems remain.

Marina Cunha's (Universidade de Aveiro, Portugal) talk on the biogeography of cold seep faunas outlined that seeps also exist in a heterogeneous geochemical environment and can therefore exhibit great variability, even on small spatial scales. As with hydrothermal vents, this renders seep biogeography difficult to systematize. Marina advocated considering all chemosynthetic habitat types together, as the same factors shape their ecology. **Jörn Peckmann** (University of Vienna, Austria) then described how the biogeochemistry of ancient seeps could be resolved, through the use of isotopes and molecular fossils such as lipid biomarkers. These studies have revealed that the anaerobic oxidation of methane, a major process occurring within modern seeps which results in carbonate deposition, is at least 300 million years old.

One very exciting recent discovery is the finding by **Jillan Petersen** (Max Plank Institute for Marine Biology, Germany) and others that as well as hydrogen sulphide and methane, the symbionts of vent animals can also use hydrogen to fuel chemosynthesis. Jillian informed delegates that hydrogen use for energy is emerging to be widespread among vent animals, and that even asphalt may be being employed as an energy source. Following this, **John Taylor**'s (Natural History Museum, UK) overview of chemosynthesis in bivalves revealed that chemosynthetic bivalve groups have evolved on at least eight separate occasions and bear a great diversity of symbionts, owing to the incredible plasticity of their gill tissues.

Whether whale-falls act as ecological and/or evolutionary stepping stones for the dispersal of deep-sea fauna was discussed by **Adrian Glover** (Natural History Museum, UK), who revealed that the use of organic falls for this purpose varies between different chemosynthetic animal groups, and within different polychaete lineages too. **Steffen Kiel** (Universität Göttingen, Germany) then offered a window into the deep-sea chemosynthetic communities of the past: when catshark eggs were laid at the base of tubeworm thickets 120 million years ago, and giant brachiopods occurred in vast numbers but mysteriously disappeared during the Cretaceous.

The final talk of the meeting expanded the search for chemosynthetic ecosystems to outer space, with **Monica Grady**'s (The Open University, UK) review of the best celestial candidates for housing chemosynthetic life. Jupiter's moon Europa shows evidence of convection in the liquid layer below its surface, however any mission to investigate whether this convection could be fuelling chemosynthetic life would first need to overcome the obstacle of breaking through Europa's thick icy surface.

This meeting was an exciting and inspiring venture through the outstanding scientific achievements of deep-sea chemosynthetic ecosystems research to date, with plenty of time for networking and socialising between friends and collaborators united in the study of these remarkable habitats. With the first major project to mine seafloor massive sulphide deposits now moving towards production phase, and the beginnings of gas extraction from methane hydrates, furthering understanding

of how these ecosystems may respond to change, as well as how extraction operations should be managed to minimise negative effects, are vital research directions for the future.

Magdalena Georgieva
University of Leeds

'Challenges in Macroecology: Scaling the Time Barrier'
Natural History Museum, London *1 April 2014*

Palaeoecologists work on ecology in the past, and neo-ecologists are getting increasingly interested in longer timescales. But how often do they actually collaborate, or even meet each other? On 1st April 2014 67 ecologists and palaeoecologists met at the Natural History Museum in London for 'Challenges in Macroecology: Scaling the Time Barrier'. The meeting, which was co-funded by the British Ecological Society (through the Macroecology Special Interest Group) and the Palaeontological Association, aimed to bring together neo- and palaeoecologists for talks, discussion and networking. The day was co-organised by Phil Jardine (Open University), Victoria Herridge (Natural History Museum), Isabel Fenton and Adriana de Palma (both Imperial College London and Natural History Museum). It was built around four talks by invited speakers, sessions of five-minute 'lightning talks' that were open to delegates, and two networking exercises: a speed dating session and breakout discussion groups.

Registration was accompanied by a challenge: self-identification of the time period worked on, via the medium of coloured stickers (blue for deep time, green for shallow time, red for modern day,

and yellow for other) that were attached to name badges. Some people went ahead and identified themselves with more than one time period, which was very much in keeping with the cross-timescale, multidisciplinary nature of the day.

Neo-and palaeoecologists get to know each other across the time barrier during the speed dating session.

After an introduction and welcome by meeting co-organiser **Victoria Herridge**, **Andy Purvis** gave the first talk on 'What is Macroecology'. At about 25 years old it's still a relatively young field, and Andy took us through the development of macroecology in that time, from descriptions of large-scale patterns of abundance, diversity and body size (often with birds) to more process-orientated studies that seek to explain these and other patterns, with an ever-increasingly complex set of analytical tools.

Our next invited speaker was **David Jablonski**, who focused on spatial patterns of diversity in bivalves through time, and especially the latitudinal diversity gradient (LDG). David showed how the temporal processes of speciation, extinction and dispersal have underpinned the LDG from throughout the Cenozoic, and explored the interplay between climate, range size and extinction.

The next session was chaired by Isabel Fenton. Our third invited speaker, **Lee Hsiang Liow**, opened the session with a talk entitled 'Inferring paleoecological and evolutionary dynamics by separating process and observation'. Lee Hsiang showed how ecological modelling approaches (capture–recapture and occupancy modelling), that model detection and ecological processes separately, can be applied to the fossil record to reconstruct patterns of turnover and occupancy in the face of incomplete and variable sampling.

We then moved into our first set of lightning talks. **David Nicholson** spoke about macroecological responses of turtles to environmental change in the Mesozoic and Cenozoic, and **David Hawksworth** reminded us that the big obvious organisms aren't always the most ecologically interesting by exploring the macroecological aspects of fungi. **Andrés Baselga** showed that biotic spatial ranges

are fractally structured. **Anne Magurran** demonstrated that while alpha diversity in ecological assemblages has remained stable through the 20th century, the composition of those assemblages has changed dramatically. Both **Ellinor Michel** and **Viv Jones** spoke about palaeolimnological datasets, for studying community change and carbon cycling respectively.

The morning ended with academic speed dating, with delegates targeting people working in different time intervals using the coloured stickers on their name badges, and Victoria marking the changeovers with her trusty tin whistle. This got everyone mixed and mingling in time for lunch, and a bit more networking.

Adriana De Palma chaired the third session, which was opened by **Kathy Willis** with a talk on 'Earth's testimonies: how the past can inform the future in biodiversity conservation'. This talk made a strong case for using palaeoecological data to set baselines for conservation and to test forecasting methods such as species distribution models.

The next set of lightning talks was kicked off by **Graeme Lloyd**, who showed the impact of incorporating fossils into Evolutionary Distinctiveness metrics. **Paul Barrett** invited the ecologists in the audience to offer ideas for deciphering diffuse co-evolutionary patterns in the fossil record, and **Carola Gómez-Rodríguez** explored the relationship between climatic niche width and diversification rate. **Bill Austin** spoke about morphological variability and functional morphology in foraminifera, and was followed by **Andrew Johnson** who, complete with scallop shells as props, discussed productivity and extinction in Plio-Pleistocene bivalves. **Amy Waterson** closed the session with a return to turtles, and the spatial dimension of macroecological change.

It was then time for the breakout discussion session. We had already split the delegates into eight discussion groups to ensure thorough mixing across time intervals and career stages, and approached a number of delegates to act as chairs. We asked each group to produce lists of the five main challenges and solutions to integrating questions and data across timescales, and the five key research questions that we as a community should be addressing. These lists were handed in at the end of the session, to be brought together for further discussion at the end of the meeting.

Phil Jardine chaired the final session of the day. **Stewart Edie** opened the third set of lightning talks, with his research on the effect of taxonomy on large-scale biodiversity patterns. The next three talks took us back to the latitudinal diversity gradient. **Philip Mannion** showed that pronounced gradients may only be present in ice-house climatic phases, and **Mark Bell** explored tetrapod latitudinal diversity in the Cretaceous. Meeting co-organiser **Isabel Fenton** spoke about her research on modern and past latitudinal gradients in planktonic foraminifera. **Richard Field** then presented research on elevation and isolation as important factors in enhancing plant speciation, and **Thomas Guillerme** ended the session with a talk on missing data in phylogenies that include both extant and fossil taxa.

In breakout discussion groups the delegates identify the challenges and potentials of cross-timescale macroecological research.

During this session of talks Victoria had been busily compiling the lists from the discussion groups, which formed the framework for a final open discussion. Major points to come out of the discussion groups were the importance of data sharing and access, and more communication across disciplines and timescales, especially in terms of integrating terminology and the analytical tools used. The meeting closed with a wine reception, sponsored by BMC Ecology.

Thanks to all those who attended the meeting and contributed with ideas and talks, and thanks to the British Ecological Society, the Macroecology SIG, the Palaeontological Association, and BMC Ecology for providing funding.

Phil Jardine
The Open University

Victoria Herridge
The Natural History Museum

Isabel Fenton, Adriana De Palma
Imperial College London and The Natural History Museum

Progressive Palaeontology 2014
University of Southampton, UK *21 – 23 May 2014*

Delegates outside the National Oceanography Centre on 22nd May; it was a nice sunny day that we all spent indoors.

Day 1 – Icebreaker

The first day was check-in and an evening icebreaker that consisted of drinks, nibbles and a pub quiz. There was a huge selection of nibbles thanks to James Hansford and his mother doing some cooking/prep work. The pub quiz was put together by **Dave Carpenter** and included a picture round of famous palaeontologists! The first two groups of the pub quiz received prizes; the first being prints of Mark Witton's artwork and the second a box of celebration chocolates. Afterwards, many of us headed to the local Wetherspoon's (The Standing Order) for some more drinks and food and great conversations.

T-shirts were given out that day, and turned out well. We had a problem with the company that did the front, they told us at the last minute that they were unable to do the back of the shirt as promised. Our T-shirt design winner, **Rebecca Groom**, made a last-minute change to the design to make it more T-shirt friendly. James then got a second company to do the back and it turned out fantastically! We did not make as large a profit as we had originally hoped for, but we still came in under budget. We had planned on getting more wine for the dinner with any excess, but as we were unsure that we would meet our budget we did not risk it. This picture shows the back of the T-shirt.

Day 2 – Talks, Posters and Annual Dinner

The second day started off early, but well. As you can see from the attached agenda, made by **Liz Martin**, and the packet that was given to each attendee, it was a busy day. There were very minor hiccoughs, like a test going on next

door to the Charnock in the morning. This was alleviated by putting up signs and moving people into the poster area for the breaks, wonderfully organized by Dave Carpenter again. The sound was not the best for the Palaeocast videos, as the room was not set up well for it, but Dave Marshal did an excellent job getting something to work.

The T-shirt design winner, Rebecca Groom, had a stand to sell her Palaeoplushies and our extra T-shirts. These went over really well and she was very happy with the amount she sold. She has a Facebook page and Etsy store (<**https://www.etsy.com/uk/shop/Palaeoplushies**>). Her next event with be TetZooCon that is being held in London the second weekend in July.

Talks and even Lightning Talks went well with no problems. Only two people went really far over the time limit for the lightning talks and were therefore eliminated from the possibility of winning an award. We allowed eight minutes for each Lightning Talk to allow for transition time, but they went much faster than that so we were done early. This gave more time for posters at the end which was needed.

The Annual Dinner was at Kuti's Royal Thai Pier, which is the big white building right by the Isle of Wight Ferry Terminal. The buffet was amazing and we even seemed to have a small upgrade on the wine available at each table. James Hansford did an amazing job organizing and getting us a great price. So much so that we feel we will use them for SVPCA 2015 when it is in Southampton. We did quick announcements for awards which were as follows:

Best Talk: Our Choice, **Sam Giles** (Oxford); Crowd Favourite, **Tom Fletcher** (Bristol).

Best Lightning Talk: Our Choice, **Nicholas Wiggan** (Cambridge); Crowd Favourite, **Luke Parry** (Bristol).

Best Poster: Our Choice, **Max Stockdale** (Bristol); Crowd Favourite, **Nidia Armada Alvarez** (3D Gill poster, Bristol).

This was followed by more dinner, then we all moved to the local Weatherspoon's again to finish out the evening.

Day 3 – Field Trip, Isle of Wight

The next morning started relatively early again, but the weather looked promising. We were a few people short, but could not wait as the next ferry would not be leaving for another hour (the delegates were warned!). A field guide was given to the people who attended, compiled and written mostly by **Jon Lakin**, who did a great job organizing the trip. The weather was fine for the ferry ride over to the Isle of Wight. On getting to the Isle of Wight, we met up with Gange's coaches, who were ready and waiting for us. The weather held out for us until half way through the first stop, when it became apparent that not everyone had come prepared for typical English weather. To be honest, the rain was so bad that even those of us prepared were somewhat waterlogged. The students were finding some decent fossils and seemed to be having a grand time in spite of the weather. Then, some of the slopes started falling down in front of our eyes and people were shivering a bit, so for health and safety reasons we made our way back to the bus quickly. The photo below was taken in the midst of the rainy weather (I also mentioned in a small H&S speech, that this is a learning point for anyone who will be doing field work: always have your rain gear, and make sure it is *good* rain gear!).

Iguanodon foot cast from Hanover Point area; notice how wet and muddy everyone is.

Our second stop was at The Needles where we got some warm food and drink and warmed up. Unfortunately due to the weather, the chair-lift was closed, so no trips down were really made. Jon Lakin took a group on a walk up to The Battery viewing point after lunch. When looking back down to the coloured sand beach, we saw that almost all of the cliffs were taped off as there had been multiple landslides. So, had the chair-lift been open, going down to the beach would not have been as exciting. The view from The Battery was breathtaking though, and everyone really seemed to enjoy that.

We then took the bus ride back and hopped on the ferry back to Southampton. This ferry ride was incredibly sunny and nice, just our luck. Everyone seemed in good spirits and had warmed up and dried up by the time we arrived back in Southampton. I made sure everyone was headed off and in the right direction, and it was all done.

Jessica Lawrence Wujeck
University of Southampton

——OBITUARY——

A. Seilacher
1925 – 2014

With the death of Dolf Seilacher on 26th April 2014, the palaeontological community lost one of its most prominent members who, gifted with an extraordinary imagination, stimulated research and opened up new avenues of palaeontological thinking, more so than many others in the second half of the last century.

He was born on 24th February 1925 in Gaildorf, a small town in south-western Germany (Swabia), an area where palaeontology is better known to the public than in other parts of Germany owing to the highly fossiliferous Triassic strata of the region. He published his first paper while still at school, describing some vertebrate remains from the Muschelkalk and Keuper. He spent the years 1943–1945 in the German Navy, and immediately after WW II he started studying palaeontology at the University of Tübingen under the guidance of O. H. Schindewolf, the leading European palaeontologist of the mid-20th century. Like most of Schindewolf´s students, Dolf started out by studying the taxonomy of a particular group of fossils, in his case trace fossils. Trace fossils and their Recent counterparts had for several decades been the domain of German palaeontologists. Unlike ammonites, the subject of most of Schindewolf´s students, however, the taxonomy of trace fossils did not lead to new biostratigraphic or evolutionary insights. Instead Dolf, while describing trace fossils, realised the fundamental difference between trace fossils and body fossils, and recognised the need for a classification scheme different from that of body fossils. This required an understanding of the morphology of trace fossils as fossilized expressions of behaviour.

We still use Dolf's behavioural classification today, enlarged by several new categories. In 1951 he received his doctorate, as usual at that time without having first to undertake a bachelor or master's programme. The following six years he spent as an Assistant (equivalent to a Junior Lecturer) at the Institute in Tübingen, still concentrating on trace fossils. Widening his Swabian experience, he made an expedition with Schindewolf to India and the Salt Range (Pakistan), then undertook field work in Central America (El Salvador) and the western United States, the latter in conjunction with a scholarship at Stanford University (1955). The field studies involved trace fossils from Precambrian and Cambrian strata – a part of the geological record in which he became increasingly interested in later years, particularly in the Ediacaran biota. His habilitation thesis, a must for those pursuing a university career in Germany, submitted in 1957, was on sphinctozoan sponges. This was his only major taxonomic study of an invertebrate group, demonstrating his ability to do taxonomic work, but he was clearly not particularly interested in this aspect of palaeontology.

After two years at the University of Frankfurt, Dolf spent two years as Assistant Professor at the University of Baghdad, which gave him an opportunity to investigate the Palaeozoic rocks of northern Iraq. From Baghdad he returned to Göttingen, where he held the equivalent of an Associate Professorship before succeeding his former teacher Schindewolf in the Chair of Palaeontology in Tübingen in 1964. He held this position until his retirement in 1990. In addition, he was Adjunct Professor at Yale University from 1987 until 2010, and used to spend the autumn terms there. This seemingly ordered career was, however, diversified by 22 stays as Visiting Professor at foreign institutions, from Moscow to Christchurch and from Buenos Aires to Beijing. Most of these visits lasted from one to three months and gave him the opportunity to teach (mainly trace fossils, but also morphodynamics and molluscan constructional morphology) and to interact with colleagues. Convinced that geology has to be learned in the field and by meticulous observation of features, be they sedimentary structures, trace fossils or body fossils, he travelled extensively to look at rocks on all continents and from all geological time intervals. This gave him enormous experience and enabled him to recognise links between seemingly unrelated features.

In the early 1970s, his main interests shifted from trace fossils (which he never abandoned completely and from which he developed important concepts such as the depth-related ichnofacies and the behavioural interpretation of graphoglyptids and trilobite traces) to fossil lagerstätten and constructional morphology. These concepts, which he developed, formed the core of the large Special Research Programme 'Palaeoecology' of the German Science Foundation which he initiated and led for 15 years (1970–1984). This highly successful programme – linking, in an exemplary way, palaeontology with sedimentology on the one hand and biology on the other – greatly influenced palaeontological research in Germany and beyond. In particular, the introduction of the concept of constructional morphology – stressing the importance of phylogeny and architecture as additional factors, apart from function, for understanding the morphology of organisms – was novel. Subsequently, he enlarged the concept by including environmental influences on the form of organisms, and called the enlarged concept 'morphodynamics'. He applied it to a variety of organisms such as molluscs, brachiopods and echinoderms. Fortunately, he was able to complete a book project that he had been working on for many years in which he summed up his ideas on the morphodynamics of invertebrate skeletons, illustrated by numerous 'Seilacherian' line drawings. A related aspect that caught his interest was self-organisational processes and their influence on the morphology of organisms.

His interest in Precambrian life forms was a continuous thread running through all his scientific work. Initially dealing with Precambrian trace fossils, he became interested in biomats and, in particular, in the late Proterozoic megafossils. Focusing on the latter group, he interpreted them not in the conventional way as precursors of present-day metazoans, but as different life forms which he called Vendobionta. His analysis of these structures illustrates well the way in which he worked, combining detailed observation with highly imaginative thinking.

Dolf was not a great administrator. He acted as head of the Tübingen Institute for several years and also as Dean of the Earth Science Faculty for a couple of years – tasks that were expected of him, but that he did not particularly love. For nearly 30 years he was one of the editors of the *Neues Jahrbuch für Geologie und Paläontologie* and for 37 years editor of the *Zentralblatt für Geologie und Paläontologie* (Abt. II Paläontologie).

Dolf Seilacher's publication record is long, but not extraordinarily so. Except for the last 20 years, when an increasing number of articles were co-authored with one or several colleagues, he

published on his own. He is, however, a prime example of the superiority of quality over quantity, something that is apparently often forgotten these days. His publications are usually written in a very lucid way, with excellent diagrams that often look like posters; in fact that is how he advertised his work. He did all the line drawings himself; indeed they are his trademark. He rightly said that by drawing a fossil rather than just photographing it, he was forced to observe morphological features in great detail and was thereby helped to understand what he saw.

Apart from his academic research, which he published invariably in international journals, Dolf was aware of the importance of sharing his knowledge with the interested public. This is documented by numerous articles in German in which he popularized his research and which he published in popular magazines. In the same way, he often presented his new research at the "Steigenklub", a small amateur society in Stuttgart. In a way, his travelling exhibition "Fossil Art", which he designed in 1992 and has been shown in several European countries, North and South America and Japan, also reaches out to general audiences. The large-scale bedding plane replicas are not only beautiful from an artistic point of view, but each of them tells a story – a successful attempt to bridge the gap between the arts and sciences.

For a scientist of his reputation, Dolf had relatively few graduate students and only very few of them studied trace fossils. Some were a bit afraid of him – he could be very stern in regard to the quality of the work of his PhD students, but he also provided plenty of stimulus. He was an excellent teacher in the lecture hall and even more so in the field. I remember short informal field-trips organised spontaneously on Wednesday afternoons to outcrops in the vicinity of Tübingen, where he taught us how to deduce the maximum information from a particular fossil or shell concentration and to reconstruct its taphonomic fate, autecology, and environmental setting.

During his long academic career Dolf Seilacher received numerous awards, starting as far back as 1980 when he was elected Fellow of AAAS. They include the Membership or Honorary Membership of several Academic Institutions (*e.g.*, Akademie der Wissenschaften Heidelberg und Göttingen, Geological Society of London, European Palaeontological Union), several medals (*e.g.*, the R.C. Moore Medal from SEPM in 1983, the Paleontological Society Medal, the Steinmann Medal in 1993, the Medal of the Geologische Vereinigung in 1994, and the Lapworth Medal of the Palaeontological Association in 2006). The Paläontologische Gesellschaft, in contrast, was a bit late in honouring its former President (1977–1979) (Honorary Membership in 1994, Otto-Jaeckel Medal in 2013). By far the most prominent of these awards was the Crafoord Prize of the Royal Swedish Academy of Sciences, given to him in 1992 for his innovative research concerning the evolution of life and interaction with the environment, as documented in the geological record.

Dolf Seilacher abhorred the thought of being the founder of a particular school of research, the term 'school' for him implying fixed thinking, and he encouraged his students to question established concepts and to come up with original ideas. Nevertheless, he influenced numerous students and colleagues with his way of thinking and enticed them to work along similar lines. With his death we lost a highly original palaeontologist who changed our ways of thinking in the fields of ichnology, taphonomy, functional morphology, and of our understanding of the evolution of life. It is good to know that what he initiated has been taken up and is continued by palaeontologists of the next generation.

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Sylvester-Bradley REPORTS

Lagerstätten and Mesozoic fish diversification

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Teleost fish are the dominant group of vertebrates today; they comprise 29,000 species, assume a bewildering array of morphologies, and have come to occupy nearly every environment imaginable.

The success of teleosts has provoked workers to suggest key innovations to explain their prolific diversification. The most fashionable hypothesis is that genome duplication on the teleost stem is the sole cause of their diversity today; an appealing idea given that the sister group of teleosts – the holostean fish – lack duplicated genomes and consist of just eight species today. However, to meaningfully test the notion that genome duplication drives diversification, I must reconstruct the taxonomic, morphological and functional diversity of holosteans and teleosts at the time of the duplication (the Mesozoic) and determine whether the pattern we see in the fossils is consistent with this claim.

To reconstruct the history of diversification in holosteans and teleosts (together forming the neopterygian crown-group), I have been constructing a large dataset of morphological traits from the appearance of neopterygians in the Lower Triassic until the end of the Lower Cretaceous, a point at least 50 million years after genome duplication had occurred. Across this 150 million year time period, I gathered morphological information from over 400 taxa, principally from images. Many of these images were derived from photographs of museum specimens, yet prior to the Whittington Award, there were two diverse faunas I had been unable to sample fully: the Upper Jurassic (Kimmeridigian–Tithonian) Solnhofen and Lower Jurassic (Toarcian) Holzmaden in Germany.

It was important to sample these faunas completely for three reasons. First, it has been highlighted that diverse sites such as *Lagerstätten* have the ability to alter richness trajectories, a point made with specific reference to Solnhofen (Raup 1972). A relationship between *Lagerstätten* and peaks in marine tetrapod richness has also been demonstrated throughout my desired study period (Benson *et al.* 2010). Given the importance of *Lagerstätten* to species diversity, I wanted to quantify their impact on a different measure of diversity – morphological diversity – as the relationship between the rock record and morphology has received little attention to date. Second, the Upper Jurassic Solnhofen limestones contain the first appearances of crown-group teleosts (Arratia 2000). Since many of my analyses try to quantify and test for differences between crown teleosts (with duplicate genomes) and all other neopterygian fishes, it was important that I sample as many crown teleosts as possible. Finally, the project involved a suite of phylogenetic comparative methods. These methods are considered to give more reliable and robust answers with better sampling. Given that Holzmaden and Solnhofen in particular contain a wealth of species that would otherwise not have been sampled, it was important to incorporate their full richness in order to strengthen the results of comparative analyses.

Sampling Fossil Fishes

Thanks to the Whittington award, I was able to travel to museum collections in southern Germany. I was especially keen to target Holzmaden since its full diversity is poorly represented in other collections. The best collection for this material resides in Holzmaden itself, at Urweltmuseum Hauff. The diversity, preservation and preparation of specimens were perfect for measurement collection, and there appeared to be more distinct species than anticipated, with over twenty represented, many by multiple specimens. See Figure 1 for a selection of species sampled.

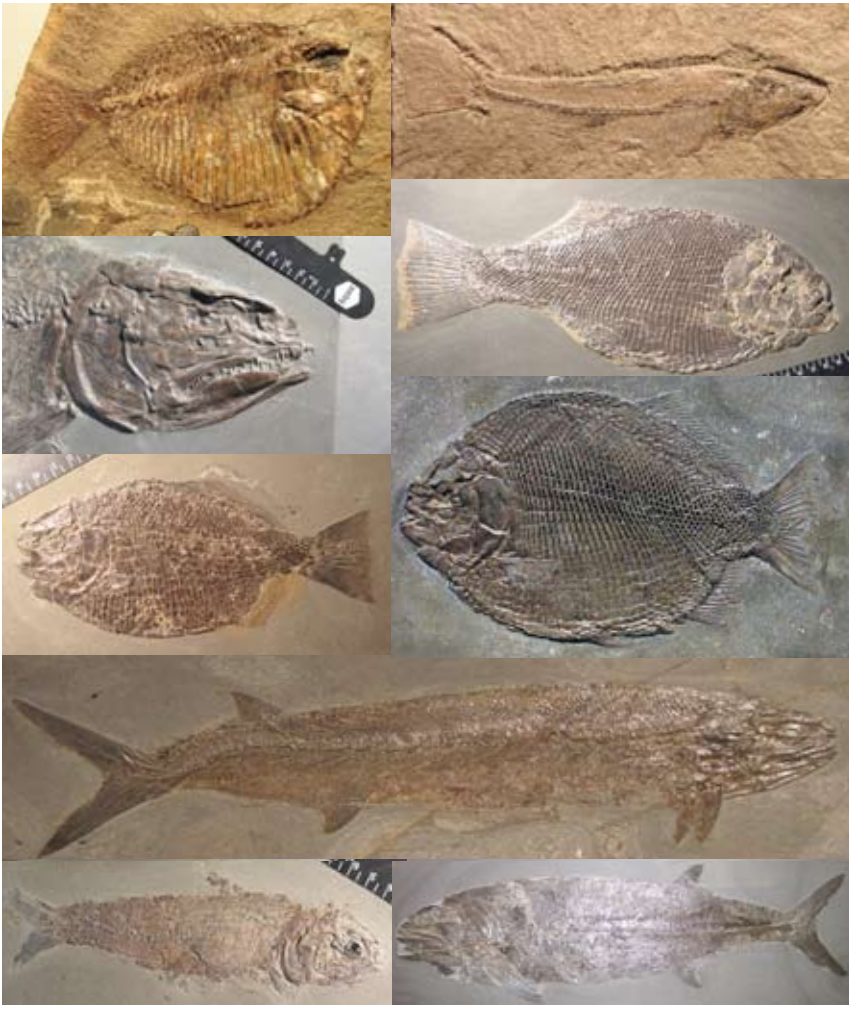

Figure 1. *Holzmaden fishes. a)* Tetragonolepis semicinctus, *b)* Leptolepis coryphaenoides, *c)* Caturus smithwoodwardi, *d)* Dapedium caelatum, *e)* Dapedium pholidotum, *f)* Dapedium stollorum, *g)* Euthynotus incognitus, *h)* Pholidophoroides limbata, *i)* Sauropsis veruinalis.

It was also important for me to visit the State Museum of Natural History in Stuttgart. This museum has a good collection of Holzmaden material complemented by representatives from over 15 other sites of interest across the Mesozoic. Amongst these was a collection from the Nusplinger Plattenkalk, an Upper Jurassic deposit that would otherwise never have been sampled, particularly good in revealing anatomical details for the collection of functional measurements.

To improve my sampling of Solnhofen, I was able to meet with Martin Ebert (Jura-Museum, Eichstätt) who enabled me to sample essentially all known neopterygian species from Solnhofen, of which there are around 100. Examples of some species sampled are shown in Figure 2, and many species have now been sampled from multiple specimens. Solhofen also contains some 14 species of crown group teleosts, an impressive diversity given that these layers represent the first appearance of the group in the fossil record (although some are Kimmeridgian and others are Tithonian).

Figure 2. Solnhofen fishes. a) Eurypoma grande, *b)* Furo latimanus, *c)* Proscinetes elegans, *d)* Macrosemimimus fegerti, *e)* Ophiopsis attenuata, *f)* Bavarichthys incognitus, *g)* Pleuropholis laevissima, *h)* Belonostomus kochi.

In summary, the aim to incorporate the full diversity of Holzmaden and Solnhofen was a complete success, and there was also opportunity to improve sampling of numerous other sites across the Mesozoic. In total, I estimate that 50+ species from 200+ individuals were added to our database as a direct result of this work, and given that numerous images were collected from each individual, thousands of images have been added to my collection.

Morphological pattern of evolution

One aim of my PhD research, still ongoing, is to document the pattern of morphological diversification in holosteans and teleosts across the Mesozoic. Teleost fish are clearly morphologically dominant today, but how teleosts came to accumulate this spectacular variety is unknown. Despite ample fossil material for fishes, few studies have quantified their morphological diversification (*but see* Friedman 2010).

Through the application of landmarks to all species sampled across the Triassic and Jurassic and subjecting these to a relative warp analysis, I obtained the main axes of shape variation between taxa. I then assigned taxa to a series of time slices across the Mesozoic and calculated the sum of variances across the four main axes of shape variation for all the holostean and teleost taxa present in each bin. This metric gives me a measure of how spread/varied the morphologies are for a particular group – precisely what I need in order to compare holosteans and teleosts. With this metric, I can examine morphological variety through time, and prior to the Whittington Award, the pattern was as seen in Figure 3a.

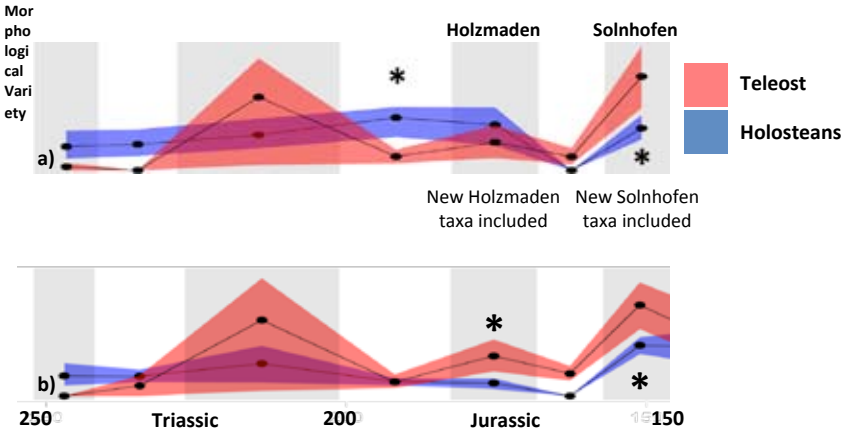

Figure 3. Morphological diversity through a series of Mesozoic time slices derived from the sum of variances for relative warp axes 1-4. Black dots represent the mean variance from 1000 bootstrap replicates, and colour shading represents the associated 95% CIs. a) Species occurrence pattern prior to detailed sampling from Holzmaden and Solnhofen. Time bins containing Holzmaden and Solnhofen are labelled. b) Species occurrence pattern after inclusion of detailed Holzmaden and Solnhofen sampling. Both plots have the same vertical axis, and so can be directly compared.

If we focus directly on the time bins affected by sampling, we should look for changes in the second time slice of the Jurassic (in grey) and the final Jurassic time slice (also in grey) (Figure 3a). Prior to detailed sampling, the time slice containing Holzmaden suggested that although holosteans

and teleosts displayed a broadly similar amount of morphological variety, yet holosteans had the edge, appearing on average to be slightly more diverse than teleosts. When we examine the same time slice after detailed sampling of Holzmaden we see quite a dramatic change – teleosts appear significantly more morphologically diverse than holosteans (Figure 3b). The pattern differs for two reasons. The first stems from doubts over whether some fossils previously interpreted as holosteans actually demonstrate any clear holosteans characters. In the absence of this evidence, they have been removed from the analysis altogether. The second explanation, which accounts for an increase in teleost diversity, is the result of more thorough sampling. Therefore the inclusion of Holzmaden has influenced pattern in this case. Turning our focus to the last time slice of the Jurassic, prior to detailed sampling, teleosts were significantly more diverse than holosteans (Figure 3a). Improved sampling of Solnhofen alters the picture slightly, narrowing the error bars of holosteans and teleost diversity, and increasing holostean diversity. However, the overall pattern is robust; teleosts remain significantly more diverse in the Upper Jurassic.

Clearly, thorough sampling of *Lagerstätten* can affect the results of morphological diversity trajectories, yet not necessarily in a predictable fashion. Work in progress will assess the full extent of the relationship between *Lagerstätten* and morphological diversity, by examining all of the exceptional sites in my dataset (>8) at differing sampling thresholds. These results will contribute to debates on the role of the rock record in determining patterns of biodiversity, and ultimately define the limits beyond which direct biological interpretations are unreliable.

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Geochemical investigation of Mazon Creek concretions

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Introduction

Carbonate concretions are a source of exceptional fossils from the Cambrian (Maeda *et al*. 2011) to the Recent (Waagé 2000). Such carbonate concretionary Lagerstätten are united by a common mechanism of concretion growth – carbonate precipitation from supersaturated porewater around a nucleus – but there is variation in depositional environment, concretionary cement composition, and soft tissue preservation (Raiswell *et al*. 2000). From the Pennsylvanian to Early Triassic, the coal

swamps across the US and Europe gave rise to siderite concretions containing exceptional soft-tissue floras and faunas preserved primarily as void-fills and carbon imprints, with a small amount of authigenic mineral replacement (Baird *et al*. 1985b; Baird *et al*. 1986; Legg *et al*. 2012). The Mazon Creek fossil site (Illinois, USA) exemplifies the typical features of these Lagerstätten – near-shore coal swamp depositional environment, siderite concretions, and organic carbon/void-fill fossil preservation – lending it's name to the class of sites that are sometimes called "Mazon Creek-type fossil assemblages" (Baird *et al*. 1986).

The goal of this project was to use freshly collected specimens from the Mazon Creek fossil site as a test case to understand some aspects of concretion formation and fossilization at such concretionary Lagerstätten. The conclusions may prove to be applicable to a wider range of fossiliferous concretions.

Three factors, each known to impact fossilization within concretions, were considered:

1) *Ion source.* Siderite concretion formation requires sources of iron (Fe^{2+}) and carbon (the latter being incorporated into CO_3^{2-}). Identifying the source of concretion ions is necessary to determine which ions must be present in the environment and which must be released from the organism in order for the concretion to form and initiate fossilization. Furthermore, understanding the ion source may reveal which environmental factors are necessary to promote or inhibit concretion growth. At Mazon Creek exceptional fossils occur inside concretions, but some concretions are barren, and poorly preserved fossils occasionally occur outside concretions (Baird *et al*. 1986), suggesting that concretion formation is a key part of the exceptional fossilization process. Thus, the controls on concretion formation may also be controls on exceptional fossilization.

2) *Rate of concretion nucleation and growth.* The rate of concretion growth may indicate how the concretion affects fossilization. If the concretion grows quickly it may inhibit decay; if the concretion takes longer to grow than would be expected for the organism to decay, the effect must be more complex.

3) *Porewater source.* The most abundant and best preserved fossils (Baird 1997) are near the open water salinity transition from fresh to brackish water, as indicated by the shift from a terrestrial (Braidwood) fauna to a marine/brackish (Essex) fauna. This suggests that a salinity transition may affect exceptional fossilization within concretions, most likely through pore fluid flux (Baird *et al*. 1986).

Methods

Carbon, oxygen and strontium isotope analysis and trace element analysis were performed on fossiliferous and non-fossiliferous concretions from the Braidwood (freshwater) and Essex (brackish water) assemblages as follows:

(i) *Ion source*: the sources of carbon and iron ions were investigated through carbon isotope analysis and trace element analysis, respectively;

(ii) *Rate of concretion nucleation and growth:* marine strontium isotope variation through time is relatively well-constrained on about a million-year timescale (Burke *et al*. 1982); thus, strontium isotope analysis of samples of Essex (marine) concretions were performed in an effort to ascertain the time scale of the formation of such concretions.

(iii) Porewater source: oxygen (Mozley *et al.* 1993) isotope analyses were carried out in an effort to understand the composition of the porewater from which the siderite precipitated.

For all analyses, concretions were designated Braidwood or Essex on the basis of collection locality. Determination of fossil content (or lack thereof) was based on either cracking open the concretion along a fossil, CT scanning the concretion, or cutting it open along two perpendicular planes. Welch's two sample *t*-tests and ANOVA were used to compare the oxygen isotope values of different groups.

Results and discussion

As a preliminary step, optimal approaches to the proposed geochemical analyses were determined by powder x-ray diffraction analysis of samples from both the Braidwood and Essex concretions. The results show evidence of siderite and quartz (Figure 1a, c); the smaller, unlabelled peaks most likely correspond to clay minerals. Concretions form through the deposition of carbonate cement in the pore spaces (Pye 1984; Raiswell *et al*. 2000); the XRD signals correspond to the authigenic siderite cement phase and the detrital quartz and clay minerals present in the sediment. Notably absent in these samples were significant amounts of calcite and pyrite (Figure 1b, d), the presence of which would have necessitated extra steps in the sample preparation for geochemical analyses, but which were not detected, and thus not present.

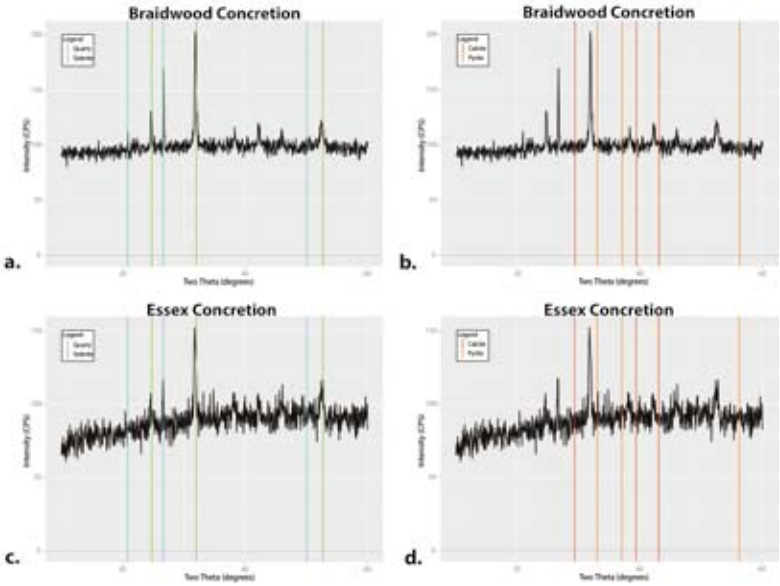

Figure 1: Results from the XRD analyses: a) siderite and quartz present in the Braidwood concretion; b) calcite and pyrite absent in the Braidwood concretion; c) siderite and quartz present in the Essex concretion; d) calcite and pyrite absent in the Essex concretion.

Ion Source: Carbon. The results of the $\delta^{13}C$ analysis (horizontal axis, Figure 2) indicate that the source for the carbon in the carbonate ions is primarily oxidation of organic matter in the zones of iron, sulphate and manganese reduction; carbonate precipitated in these zones in organic rich sediment has small negative to small positive $\delta^{13}C$ values (Mozley *et al*. 1993), a pattern that is reflected in the

Figure 2 data. The $\delta^{13}C$ values do not differ significantly between fossiliferous and non-fossiliferous concretions ($p = 0.599$), indicating a similar source of carbon for fossiliferous and non-fossiliferous concretions.

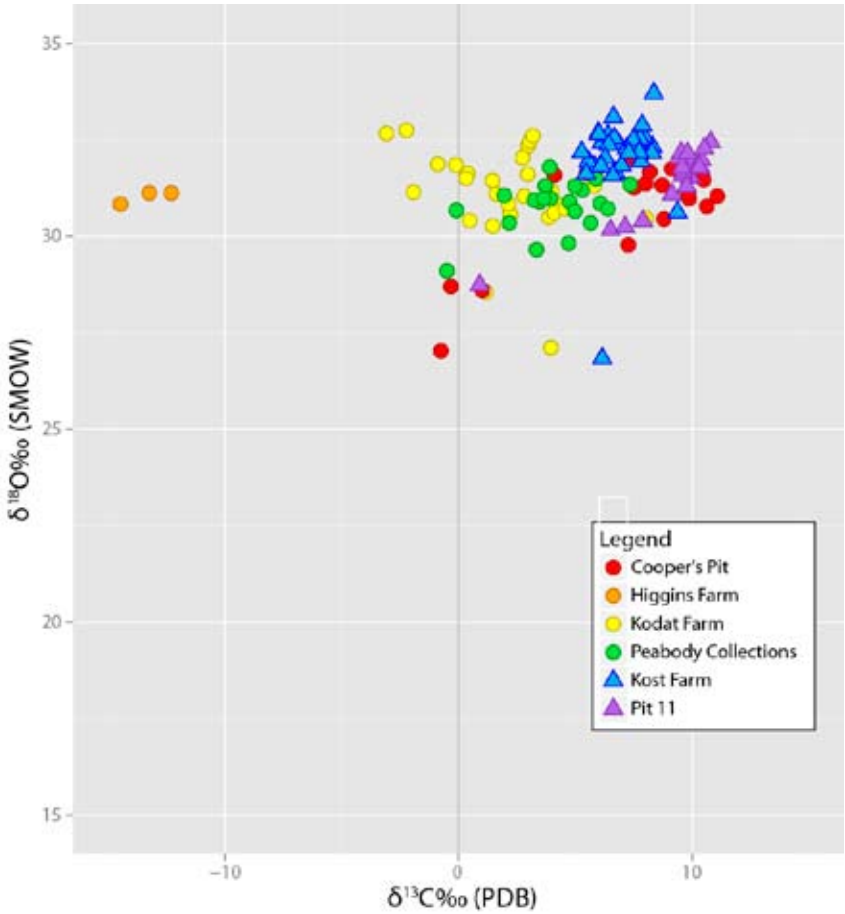

Figure 2: Plot of carbon and oxygen isotope results, colour-coded by locality. Circles correspond to Braidwood concretions, triangles correspond to Essex concretions.

A sedimentation hiatus mechanism has previously been proposed to explain how the entire mass of carbonate in a concretion can be deposited in the same metabolic zone within sediment (Raiswell *et al.* 2004). Some of the concretions with slightly higher $\delta^{13}C$ values may have been precipitated at least partially in the zone of methanogenesis (Mozley *et al.* 1993). Only one site, Higgins' Farm, has concretions that approach the range of high negative $\delta^{13}C$ values (Mozley *et al.* 1993) that might indicate oxidation of methane (Figure 2); these concretions are also notable for containing only occasional, poorly preserved fossils and for being highly weathered.

The organism is unlikely to be a primary source of carbon for the concretion. The concretion typically is too large for the organism to contribute a significant proportion of the carbon present,

and in many cases at least some small part of the organic carbon remains as an organic carbon film preserving the fossil (Baird *et al.* 1986; Legg *et al.* 2012).

There is a significant difference in carbon isotope composition between the Braidwood and Essex concretions ($p = 0.0001$), with the Essex concretions having higher $\delta^{13}C$ values than the Braidwood concretions (Figure 2). However, this trend is the opposite to that typically expected when transitioning from freshwater to marine conditions; $\delta^{13}C$ values are usually lighter towards the marine side, due to the increased availability of sulphate (Mozley *et al*. 1992). The presence of siderite suggests that sulphate was not abundant (Berner 1981) even where Essex concretions formed, so other factors may be important. Bacterial faunas change over short geographic scales along estuaries, and this may explain the distribution of different metabolic pathways that are responsible for the differential fractionation of carbon (Bouvier *et al*. 2002).

Ion Source: Iron (trace elements). The measured levels of the trace elements Mg, Mn, Ca, Ba and Sr were compared to the measured levels of iron to provide a measure of how much siderite was actually dissolved. Strontium, barium, calcium and magnesium are not easily incorporated into siderite (Rimstidt *et al*. 1998; Wang *et al*. 2001) and, as siderite forms, they become proportionally more abundant in the pore fluid compared to iron. Thus it would be expected that the relative concentrations of these elements in the siderite would increase with growth. In contrast, Mn is more easily incorporated into siderite, and thus the relative concentration of Mn in the siderite should decrease with growth. The results are a mixture of expected and unexpected patterns: Sr, Ba and Ca are constant, and Mg and Mn increase in proportion to iron during concretion growth. On balance, these results suggest that the supply of iron is augmented in some fashion during the process of concretion formation. Additional analyses should allow models of the underlying process to be refined.

Rate of concretion nucleation and growth. Marine $^{87}Sr/^{86}Sr$ values for the Late Pennsylvanian fluctuate around 0.709 (Veizer 1989); the measured values of the analyzed Essex concretions are around 0.712. These values are too high to be controlled entirely by marine processes and thus cannot be used to assess the length of time involved in concretion nucleation and growth.

Porewater source. The depositional environment of the Mazon Creek Lagerstätte has been interpreted as a tidally influenced estuary based on sedimentological studies (Kuecher *et al.* 1990), and analyses of the fossil assemblages (Baird *et al.* 1985a; Baird *et al.* 1985b). The fossils include terrestrial organisms characteristic of a coastal swamp, and aquatic organisms from freshwater and brackish marine settings (Baird *et al*. 1985a). The marine organisms are rarely ever found in the freshwater localities, but the freshwater and terrestrial organisms are often found in the marine localities, indicating transport from freshwater to marine settings (Schellenberg 2002). The Mazon Creek environment is consistent with a hypothesis of complicated salinity fluxes; however, other lines of evidence are necessary to ascertain the microenvironment where individual concretions precipitated. Oxygen isotope values of carbonates can be used to distinguish carbonates precipitated from marine or freshwater conditions, and such data can be used to address the predictions of the salinity flux hypothesis.

Porewater Source – Oxygen isotopes. The $\delta^{18}O$ values at Mazon Creek range from 25‰ to 35‰ (wrt SMOW) (vertical axis, Figure 2). Braidwood and Essex concretions differ significantly in their $\delta^{18}O$ values (Figure 2), with a complex underlying pattern. Non-fossiliferous concretions show a significant difference in mean $\delta^{18}O$ values between Braidwood and Essex, while fossiliferous

concretions from the two assemblages show very similar means, closer to the Braidwood non-fossiliferous value than the Essex non-fossiliferous value, without a significant difference.

The $\delta^{18}O$ values of the Braidwood and Essex concretions, although significantly different ($p = 0.003$), do not confirm the assignment of Braidwood concretions to a freshwater setting and Essex concretions to a more marine influenced brackish setting. Instead, the values for all the concretions correspond to those expected for siderite precipitated from seawater (~31 ‰ wrt SMOW, Figure 2) (Carothers *et al*. 1988; Mozley *et al*. 1993).

Thus, at first glance, the oxygen isotope values do not support a first prediction of the salinity flux hypothesis: as they do not clearly reflect the occurrence of separate freshwater and marine/brackish environments at Mazon Creek. However, the significantly different $\delta^{18}O$ values between the Braidwood and Essex concretions, in conjunction with the fossil evidence, suggest that there were two regions with different salinity. Moreover, low oxygen isotope values of meteoric water are due primarily to evaporation and re-precipitation, and thus a freshwater area close to the shore might not clearly show this oxygen isotope signature.

The observed oxygen isotope values appear to support a second prediction of the salinity flux hypothesis: non-fossiliferous Braidwood and Essex concretions have significantly different $\delta^{18}O$ values ($p = 0.004$), representing precipitation from different initial environments, one primarily marine, and one with a stronger meteoric influence; and fossiliferous Braidwood and Essex concretions do not have significantly different $\delta^{18}O$ values ($p = 0.06$). According to the hypothesis fossilization in the marine Essex region requires a flux of meteoric water, which shifts the oxygen isotope composition of that concretion towards the Braidwood values. Note that one macroscopic indicator of such a “sudden flux” effect would be the occurrence of concretions in distinct, well-populated sedimentary layers, as frequently observed in concretion sites (see Figure 3 for an example from Mazon Creek).

Some caution must be used when interpreting the $\delta^{18}O$ values. Carbonate oxygen isotopes are sensitive to many environmental variables, in particular temperature (Carothers *et al.* 1988). The differences in $\delta^{18}O$ values between all groups tested (divisions based on fossil content, site, and environment) in this analysis may be too small to interpret as an effect of a specific environmental variation such as changing salinity. The strontium isotopic system offers an alternative to the oxygen isotopic system. Strontium isotopic ratios also vary between marine and freshwater sources (Capo *et al.* 1998) but are less susceptible to other environmental factors.

Figure 3: Mazon Creek concretions in a distinct sedimentary layer.

Conclusions

Decaying macro-organisms are not an important source of carbon for concretion formation, since the fossil is often preserved in organic carbon, despite acting as a nucleus for concretion precipitation. Rather, organism decay must promote concretion formation by affecting environmental factors other than carbonate saturation, such as pH and alkalinity.

The carbonate ions for concretion formation come primarily from the sediment pore fluid, in the zones of iron, sulphate and manganese reduction, which most likely requires a sedimentation hiatus. This suggests that fossils within concretions will only be found in areas with specific sedimentation patterns.

The iron for siderite precipitation must be augmented as concretion formation proceeds, suggesting a source with a constant flux or coeval dissolution of iron containing minerals, such as coal, clay minerals, or iron oxides in the sediment.

Preservation at these near-shore, coal swamp concretionary Lagerstätten is enhanced by the increased preservation potential of fluid fluxes across the salinity boundary. These fluid fluxes inhibit decay in the sediment in general, thus promoting fossilization.

Acknowledgements

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Outside The Box

An 'independent' approach to palaeontological research

I have written this article at the invitation of Alistair McGowan, who rightly noted that "you seem to have constructed a very successful path to doing the things you enjoy and being able to carry on primary systematic work." In the current global economic climate, competition for jobs that include an element of palaeontological research is probably greater than it ever has been. One aim of this article is to demonstrate that a formal position is not a prerequisite to conducting cutting-edge palaeontological research using the latest techniques.

First, a little background about myself is in order. I have had a life-long interest in natural history, especially entomology and arachnology. After completing a B.Sc. in Zoology I gained a Ph.D. in fossils preserved in amber. I did a one-and-a-half year stint in a curatorial role at a university museum, followed by four-and-a-half years of funded post-doc research. Following a short period of unemployment I was offered another post-doc in the USA of one or two years' duration. However, prior to taking up this position it became very apparent to me that there was much more to life than worrying about impact factors and where my next grant or funded position would come from. I also found some of the politics of academia particularly disagreeable, so I decided to 'give up' science – but this was easier said than done.

I disposed of all my worldly possessions, apart from (strangely enough) my amber books, research papers and my laptop, then moved to West Africa, where I found myself with a lot of free time. I kept myself busy wandering around the forests, photographing animals (mainly spiders and insects) and plants, in addition to recording field observations and collecting ecological data (I found it difficult not to do science!). I also wrote a book on the topic I had been researching for more than a decade: fossil spiders in Dominican amber (Penney, 2008). I prepared the book as a print-ready PDF and when it was finished I contacted a number of literary agents to try and get it published. They all found it too specific, so I tried a number of academic presses directly. One major university press sent it out to reviewers and it got two excellent reviews recommending publication. Nonetheless, they decided it would not make enough profit for them so they rejected it. That left two options: vanity publishing, or setting myself up as a publisher. I opted for the latter and named it after my daughter Siri, who had been born several months earlier.

At that point I did not have significant publishing aspirations. The books were stored at my mother's house and I sent instructions for distribution from Africa, which she very kindly did for me. Things changed in February 2009. I found myself back in the UK and unable to return to the African country in which I had been living for the past few years. Literally, I had the shirt on my back, my 13-month-old daughter and my laptop, on which I had a couple of field guides to West African fauna and flora in preparation.

When time allowed, I completed these works and initiated several more, including an edited volume on the biodiversity of fossils in amber from the major world deposits. I was very lucky in that

leading researchers around the globe agreed to contribute to this project, despite it being published by a new and independent publisher. I also conceived a number of ideas for several other volumes that required contributions from colleagues I knew personally. I had to do a bit of arm-twisting to get what I needed, but eventually all these projects came together nicely and resulted in published volumes. Through word of mouth I also had a number of additional offers to publish the work of other researchers. I am extremely grateful for this early cooperation as it helped me build up a critical mass/presence, which I needed in order to attract other authors who I did not know personally. Now, I no longer need to contact researchers offering to publish their work (though I still do this occasionally). Rather, I get contacted by authors asking me if I would be interested in publishing their work.

I have now published more than 20 volumes, with an emphasis mainly on palaeontology and entomology, and I have enough works in the pipeline to keep a steady output for the next few years. I have no doubt that I will receive more offers of work to keep up this momentum. Most of the authors are well-respected academics at high-profile institutions. This has not been an easy field in which to generate a presence. There is a considerable amount of what I call publishing snobbery. Some academics turn up their noses at the idea of publishing with a small independent, rather than a mainstream academic publisher. However, in my opinion there is no real justification for this. The prime concern of mainstream publishers is making profit. Unfortunately, this often results in lower-quality production, for example, as a result of using print-on-demand publishing. In addition, a high-profile name does not always equate to accurate or up-to-date content, or even good editing for consistency and style (I have reviewed many academic works from such publishers over the last few years). In some cases, it can take several years from submission of files to publication of the final work. I pride myself on a quick turnaround and in maintaining a high quality, in terms of both content and production. That my authors are happy with progress and the final product is very important to me. Also, it is just as easy to purchase one of my books from anywhere in the world, with the click of a single button, as it is a book from a more established publisher.

As an active, multidisciplinary researcher I am well placed to consider the academic content of the volumes I produce; I believe that my experience in publishing has now reached a point where my current works are of a consistently high standard, and this is reflected in their academic reviews. My publishing ethos also differs. I am happy to produce titles that I think are interesting, even if they are unlikely to make a profit. I rely on titles that do well to offset the losses from those that do not do so well, and apart from taking a meagre living allowance, all profits are channelled back into producing new titles. Of particular significance is that Siri Scientific Press provides the means by which early-stage researchers can publish a monograph in their area of expertise. This can look very good on a CV when applying for a research or teaching position in this highly competitive age. You can see more information about titles, authors and publishing ethos at <**http:www.siriscientificpress.co.uk/**>

Whilst developing Siri Scientific Press, I have maintained an academic presence as an Honorary Lecturer in the Faculty of Life Sciences at the University of Manchester. Although I do not get a salary, I have enjoyed total academic freedom as a result of not being tied to specific grants. In addition to my more general research output I have been able to collaborate in multidisciplinary cutting-edge research using the latest techniques such as X-ray computed tomography (Penney *et al.*, 2012) and next generation DNA sequencing (Penney *et al.*, 2013). My academic presence is

significant enough that I get invited to give keynote lectures at conferences, so I must be doing something right. My complete research profile can be seen at <**http://www.siriscientificpress.co.uk/Pages/DavidPenneyresearch.aspx**>.

All in all, I am very happy with my current arrangement, but given that I do absolutely everything with regard to the publishing business (other than running the printing presses), as this continues to grow my time available for my own research activities is dwindling. Nonetheless, I thoroughly enjoy what I do and if I were offered a permanent palaeontological research or teaching position tomorrow I would not take it.

When I look back at the time I was in academia and my grant was coming to an end, I recall wondering to myself what else it might be possible for me to do in order to make a living. I was convinced that all I knew about was fossil spiders and that I would not be able to do anything else. I did have transferable skills that I had picked up along the way, even if I was unaware of this. I have been able to put these to good use, but it has been a steep learning curve that has occupied a great deal of my time. There is something to be said for the security of a salary at the end of each month, but there is also a great deal of satisfaction in building up something from scratch. The take-home message here is: if you are unable to (or do not want to) take up a formal academic teaching or research position, there are still possibilities available for remaining in the field. The above is my experience of doing this. I am sure there are others with similar stories they may like to share in the *Newsletter.*

It would be remiss of me not to mention that I would be happy to hear from any potential new authors who may be looking for a specialist palaeontological publisher (e-mail: <**books@siriscientificpress.co.uk**>).

David Penney

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Jurassic Seas and Yorkshire Fossils

Two events to report, and two requests to make. The events will hopefully be simultaneous: the inaugural Yorkshire Fossil Festival (hereafter to be known as YFF), and the launch of 'Fossil Worlds Online', a new web-based teaching resource. 'Fossil Worlds Online' will be unveiled at the YFF.

The YFF will take place at William Smith's wonderful Rotunda Museum in Scarborough, from Friday 12th to Sunday 14th of September. The success of the Lyme Regis Fossil Festival (about which more elsewhere) led a group of us to propose a sister project at the other Jurassic end of England. Will Watts of Hidden Horizons (<**http://hiddenhorizonsblog.wordpress.com/about/**>) is the Festival's organizer, on behalf of (and working together with) the Scarborough Museums Trust, whilst Fiona Gill, Caroline Buttler and I represent the Association.

Our first request is for your assistance. The YFF needs volunteers and contributors. We have a marvellous line-up of participants, but we're always on the look-out for enthusiastic and entertaining palaeontologists. If you can extol the virtues of Mesozoic microfossils through the medium of interpretive dance that would be terrific. If you can help put up the stall that hosts the exhibition in the first place, that would be just as terrific. Whatever your age, specialism or locality, the YFF has a role for you. Contact myself or Will Watts (<**will.watts@hiddenhorizons.co.uk**>); drop us a line and we'll be happy to chat with you about what that role might be.

Built of local Jurassic sandstone in 1829 under William Smith's instructions, the Rotunda Museum in Scarborough will be the focal point of the Yorkshire Fossil Festival, on 12–14 September 2014.

The second request, and perhaps lasting rather longer than a weekend, is for your input. The Association is also funding the 'Fossil Worlds Online' initiative, which we are developing in conjunction with the Earth Science Teachers' Association (ESTA) and Palaeocast, with the aim of launching at the YFF.

The project will develop an online educational resource. ESTA are extremely keen to provide such information for teachers and pupils at primary and secondary school level, Palaeocast have been looking to develop a set of "Palaeo-101" teaching resources, and PalAss have the expertise and funding to facilitate such a project.

So, aimed primarily at schoolteachers and pupils, but hopefully of use to lots of other people, Fossil Worlds Online will provide high-quality images, reconstructions and descriptions of major groups of fossils, their likely behaviour and interactions, and their value in reconstructing ancient environments. Ultimately, the site will feature a series of different time slices, but to get the ball rolling, we are beginning with the Jurassic Seas.

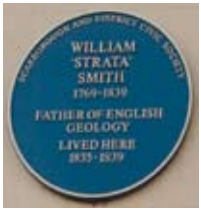
This is where you come in. We are working with a company called Triple Geek to build the website, and for a website you need content. Triple Geek are brilliant at the visuals and innovation – they work with the BBC, Aardman Animations, and marvellous musical outfits such as *Pulp*, *Queen* and the *Pet Shop Boys* – but they are not palaeontologists. They will be building an animated Jurassic sea for the website, a sea through which you'll be able to swim (virtually), and one in which the Jurassic creatures interact with each other realistically.

To do this, they need accurate information on what the organisms looked like, how they moved, where they lived, what they ate. From ichthyosaurs to bivalves to brittle stars and teleost fish, the creatures' features must be as up-to-date as we can make them.

The website will not just be an animated fishbowl, though. To provide the best educational resources on Jurassic marine palaeoenvironments, we need the best people. We need good photographs of fossils. We need stories from the palaeontologists who work on those fossils, inspiring the next generation to take up the science. We need pithy summaries of how we know what Jurassic sea life looked like, and how it behaved. Whether you work on invertebrates or vertebrates, ecology or ontogeny, if you are interested in giving up a little (or a lot) of your time to help the project succeed, we'd be delighted to hear from you.

The Jurassic Seas project is beginning in July, and I'm sure it will be a steep learning curve. In order to have a prototype ready for the YFF, it will also have to be fast-moving, so the steepness must be at least partly downhill. If you fancy a challenge, it'll probably be like the Tour de France (which is coming to Yorkshire too). Now's the chance to jump on your rock cycle!

In the meantime, to whet your appetite for the YFF more generally, here are a few of the highlights. After a Friday schools' day full of palaeontological goodness, Hugh Torrens will kick things off with a Friday evening talk about the amazing life of William Smith. On Saturday, amidst all the fabulous stalls and exhibitions (musical fossils, interactive artworks, guided tours), Mike Romano will take us walking with Yorkshire dinosaurs, and in the evening there will be the world's first 'Stand Up For Fossils' comedy event.



This shop in central Scarborough – formerly William Smith's home – is now one of various stopping points on a new William Smith Trail, special tours of which will be a key part of the Yorkshire Fossil Festival.

And on the Sunday afternoon, an intrepid team of palaeontological cricketers (currently known as Piltdown CC) will take on the Authors XI, founded by Sir Arthur Conan Doyle and currently starring such names as Sebastian Faulks, Tom Holland and Dan Stevens (of *Downton Abbey* fame).

If you're not tempted to sign up after all that, I have to ask Y the FF[1] not, but if all this demand for volunteers doesn't appeal, you can always look to develop something yourself. As you will see elsewhere in the Newsletter, the Association has just launched the first call for Outreach & Education grants. Members of the Association are encouraged to bid for financial support to bring palaeontology to new audiences, in whatever novel manner you think might work. So if you have a burning desire to do something yourself, rather than simply be asked to do it by us, we'd love to receive your submissions.

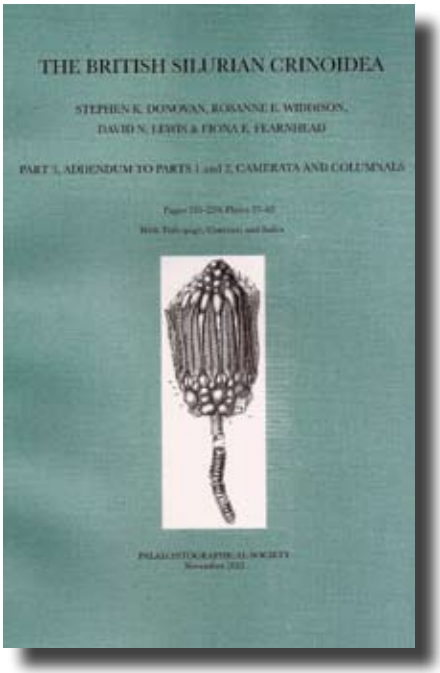
Liam Herringshaw
PalAss Publicity Officer
<publicity@palass.org>

[1] Fossil Friday, of course.

Book Reviews

The British Silurian Crinoidea – Part 3, Addendum to parts 1 and 2, Camerata and Columnals

Steven K. Donovan, Rosanne E. Widdison, David N. Lewis and Fiona E. Fearnhead. 2012. Monograph of the Palaeontographical Society London, Issue 638 (part of Volume 166), pp. 135–259, pls 37–62. £115 (£57.50 for members of the Palaeontographical Society).



This work concludes the first monographic study of British Silurian crinoids since Philips, 1839. Reviewing only the last section, without reference to the previously published parts, has been a difficult exercise. It is very clear, however, that this is a work of impressive scholarship and the authors must be commended. The fifteen pages of references highlight the scope of their undertaking.

In part 3, 120 taxa are discussed, with seven new species formally described, and a new genus, *Pleuroptyx,* erected. The taxonomy is brought into the twenty-first century, with particular emphasis on the complex phylogenetic relationships that have become increasingly tangled over the last century. This volume improves known taxonomy and re-assigns several taxa previously left in open nomenclature and columnal morphotaxa. There is a particularly useful discussion on the state of crinoid palaeontology from 1839 to 2009/2012 (pp. 232–239), with a comparison between Silurian crinoids in the 1839 monograph and their modern systematic positions. Another relevant discussion presents the problems of access to Webster's 2003 *Bibliography and index of Paleozoic crinoids, coronates and hemistreptocrinoids 1758–1999*. Only available online, this key research tool was shut down by the Geological Society of America in 2010 and, at the time of publication, still remains closed.

By its very nature, Donovan *et al.*'s British Silurian Crinoidea part 3 will only be of interest to crinoid specialists and advanced level postgraduate students currently engaged in research. It is certainly not intended for interested amateurs or palaeontologists working on other fossil groups; they would probably not benefit from the detailed, taxonomic treatment.

The work has all the production quality and attention to detail one has come to expect from Palaeontographical Society Monographs. The text is well laid out and easy to read, with scrupulous editing by B. M. Cox and M. Williams; the taxonomic sections are detailed but concise, and the font is carefully chosen to ensure readability.

Black and white plates complement line drawings, and schematic plating diagrams make it easy to see even trivial details that may be crucial for identification or comparative purposes. All have been prepared to a very high standard.

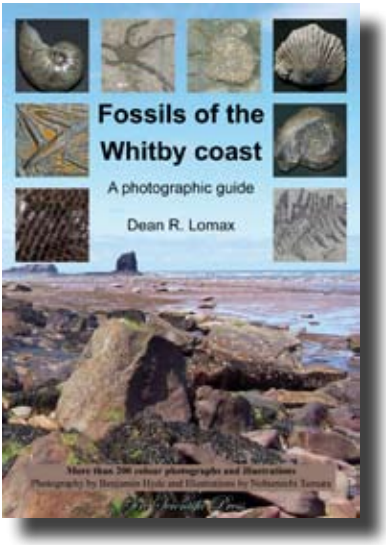
The work follows the typical monograph format with a very detailed taxonomy, type locality, other material and remarks, with well laid-out plates and detailed plate descriptions. The specimens illustrated are not all perfect – they reflect the range of typical forms seen in museum collections and, although many are extremely attractive, the less impressive columns and detached ossicles are also featured to reflect the variety of this extremely diverse fossil group. The index is also well laid out, comprehensive and easy to use.

Since this is only part three in the series, the overall price (£115 but £57.50 for members) and its specialist, taxonomically-focused nature puts this well beyond the reach of amateur palaeontologists. Part 2 comes in at £105 (£52.50 for members) and part 1 £70 (£35 for members). Crinoid specialists with an extensive budget or a very accommodating departmental librarian, however, will not be disappointed!

R. S. Pyne
Ceredigion, Wales, UK

Fossils of the Whitby Coast: A Photographic Guide

Dean R. Lomax, 2011. Siri Scientific Press, Manchester. 132 pp. £15 (available directly from the publisher). ISBN: 978-0956779502.



Every year thousands of fossil collectors descend upon the coastline around Whitby, which includes some of the top fossil-bearing sites in the country, in hope of finding some of the diverse fossils which weather out of the rocks on to the beaches. A short walk along some of the more fossiliferous sites, such as Saltwick Bay, can rapidly result in a rucksack crammed full of rocky relics. Exciting new discoveries of international significance are still being made and experts continue to advance their research by journeying to this fascinating coast for fossil collection and analysis. Despite this broad appeal there had not been a thorough fossil identification guide for the Whitby coast, until Doncaster-based palaeontologist Dean Lomax felt the need to step up and fill the gap (for someone born in Doncaster the coastline around Whitby is the best place for a day or two hunting fossils).

The book follows a simple structure, ideal for quick reference whilst trundling along the beach, or when studying the day's finds in more detail after the trip. It begins with the requisite advice on safety and equipment, ensuring that excitable amateurs don't commit a fossicking *faux-pas*, followed by a brief description of the geological context. The major locations from Staithes down to Ravenscar are described, with useful information on accessibility and the fossils found there and the preceding sections. The subtitle of the book is "A photographic guide" so it is no surprise that this section, and even the sections before it, are supplemented by some stunning photographs of the locations in question, enough to make a visit seem worthwhile even if fossil collecting is not on the agenda.

It is as a photographic guide that this book really excels. The descriptions are succinct, allowing focus on Ben Hyde's photographs of some of the finer examples of each fossil. Descriptions and photographs are supplemented by information on the stratigraphic context of the fossil in question, and information on its occurrence. Tireless palaeoartist Nobumichi Tamura has provided reconstructions of many of the taxa, helping bring the Jurassic of Whitby to life. The fossils are grouped in a logical order, starting with some of the most common fossils found – the ammonites – and continuing through molluscs, echinoderms, arthropods, and on to some of the spectacular vertebrate finds. Plants are not left out, and are followed by some very useful information on trace fossils, pseudo-fossils, and the glacial erratics that can often confuse even experienced fossil collectors. The book is rounded off with some useful information, particularly for newcomers to the world of fossil hunting, such as the image showing likely finds on a first foray and tips on what to do with fossils once found.

The book is clearly pitched at first-time fossil collectors and newcomers to the Whitby coast, but they are by no means the only audience for this guide. It should appeal to the whole spectrum of fossil collectors, from beginner to experienced palaeontologist. As palaeontology is a very visual field, an illustrated guide is indispensible, especially when no Palaeontological Association Field Guide is yet available. The book covers the whole gamut of Whitby fossils and so should become heavily thumbed by the frequent collector. It should even appeal to those who rarely, if ever, manage to make the trip to the Yorkshire coast, as it is brimming with beautiful images of both the fossils and Tamura's imaginings of the beasts in life. The asking price of £15.00 from the publisher's website means that this book is worth investing in; readers will get their money's worth.

There are no real weaknesses with this book, just areas for which personal preference might leave readers wanting more information. More detail on stratigraphic context could be supplied, such as labelled images of the rock exposures at each location; though as collecting from the rock faces is prohibited, something made clear in the book, this information could be considered unnecessary. Also, those on the expert end of the spectrum may desire more information on defining characters of the taxa featured, although that could be seen as excessive in a book with a broad target audience.

Overall, Dean Lomax has provided an excellent book that does exactly what it says on the tin: it is a photographic guide to the fossils found along the Whitby coast and it does not disappoint. It should appeal to fossil lovers of all stripes, even those who cannot get to Yorkshire to collect, and has the ability to inspire readers to want to get out and explore the lost Jurassic world. I know that simply writing this review has whetted my appetite to get out there yet again and find some ammonites and other fantastic fossils.

Jason Sherburn
Doncaster, UK

Overview and Descriptions of Trichoptera in Baltic Amber: Spicipalpia and Integripalpia

Wilfried Wichard, 2013. Verlag Dr. Kessel, Remagen-Oberwinter. 230 pp. €32.00 (softback). ISBN: 978-3-941300-84-2

Trichoptera is an order of insects commonly referred to as caddisflies. They have winged adults and aquatic larvae, the latter often with strict habitat requirements. Hence, they are often used as biological indicator species for habitat quality, and their fossils also have similar potential for understanding the palaeoecology of fossil environments. These insects are common as fossils in Baltic amber. It has been 200 years since the first Baltic amber species was described, with the first major taxonomic monograph appearing one hundred years later. Now, a century on, a much-needed revision has just been published, written by Wilfried Wichard who is undoubtedly the leading authority on these fossils.

This volume covers the suborders Spicipalpia and Integripalpia (a second volume on Annulipalpia, which account for approximately 90% of Baltic amber caddisflies, is in preparation). In total, 99 species in 19 families are revised, including the description of 31 new species, eight new genera and one new family. This work is based on the examination of 15,000 specimens between 1970 and 2010, with 1,500 of the taxonomically most informative fossils chosen for detailed examination. These include, where available, some of the historic type specimens described 100 years ago. Fossilized aquatic larvae are also included.

Following a short (three-and-a-half pages) introduction and acknowledgements, there are three short tables as follows: List of acronyms of depositories; Systematic[s] and classification; Genus key to Spicipalpia and Integripalpia in Baltic amber. The remainder of the book, apart from five pages of references at the end, is essentially a taxonomic monograph. Taxonomic keys are presented where necessary; these are all based on taxa preserved in Baltic amber and use characters that are likely to be observed in the fossils. The keys to genera also list the number of relevant species in parentheses.

For the various species the following headings are used: Type; Etymology; Diagnosis; Description; Remarks. However, for some species there is no description, but rather a lengthy, descriptive diagnosis. Maintaining a succinct and specific diagnosis, followed by a separate description, would have been a better approach. The descriptions are supported by line drawings and colour photographs. The illustrations are excellent, but the photographs have not been reproduced at the highest possible quality. This was no doubt a production decision and is reflected in the relatively low price for such a specialist volume. Nonetheless, they are perfectly fit for purpose. Unusual

specimens are also described and illustrate parasitism by nematodes, teratological deformities and a pair preserved *in copula*. The figures are numbered up to 145. However, each of these often has several parts (a, b, c, *etc*.), so in reality there are considerably more than this.

Throughout, only very brief references are made to other fossil localities, biogeography and recent systematic studies. This is very much a taxonomic monograph of Baltic amber Trichoptera and I feel that the opportunity to provide a more informative summary of data has been missed, particularly given the large number of fossils that formed the basis of this study. Maybe this is something that will be incorporated into the Annulipalpia volume that is currently in preparation.

In terms of physical production, the paper quality and binding are excellent. The illustrations are all of a good size. Unfortunately, typographical errors and inconsistencies abound throughout; the former in many cases are clearly due to a lack of familiarity with English spellings. The latter would have been picked up with better proofing. However, on the whole the English is very good and these minor errors do not detract from the functionality of the volume.

Despite these few quibbles, this is an impressive volume representing, in part, the culmination of several decades of study by the leading expert in the field. It forms a reliable reference work for these suborders of Trichoptera in Baltic amber and will be of interest to anybody with an interest in Baltic amber inclusions or fossil caddisflies, whether amateur or professional.

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Books available to review

The following books are available to review. Please contact the Book Review Editor, Charlotte Jeffery Abt (e-mail <**bookreview@palass.org**>), if you are interested in reviewing any of these.

- *Trilobites of the World*, by P. Lawrance and S. Stammers.
- *The Great Fossil Enigma: The Search for the Conodont Animal*, by S.J. Knell.
- *Anatomy, Phylogeny and Palaeobiology of Early Archosaurs and their Kin*, by S.J. Nesbitt, J.B. Desojo and R.B. Irmis (eds).
- *Mammoths and the Environment*, by V.V. Ukraintseva.

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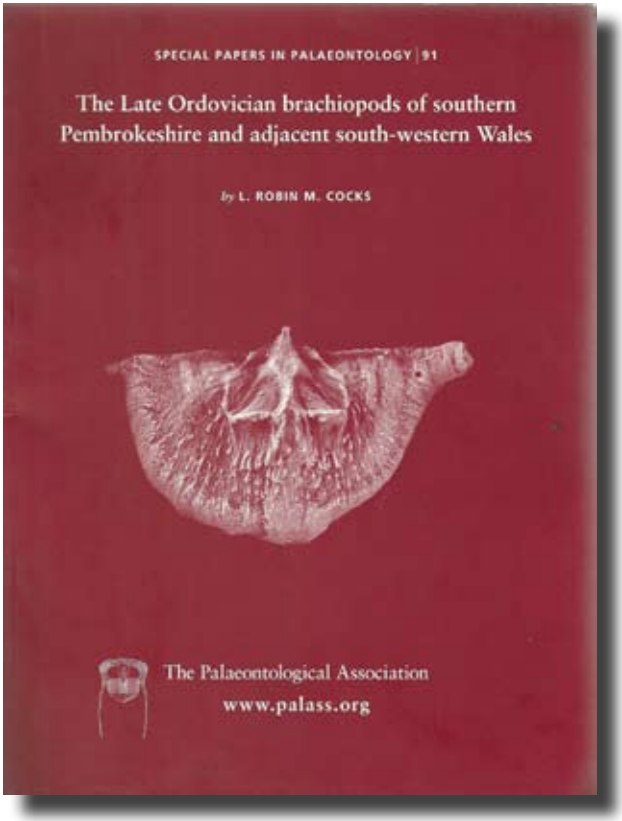
Frontiers in Palaeontology

Special Papers in Palaeontology No. 91

The Late Ordovician brachiopods of southern Pembrokeshire and adjacent south-western Wales

L. Robin M. Cocks



Abstract: Diverse Late Ordovician (late Katian and Hirnantian) shelly faunas have been known for over 150 years from southern Pembrokeshire and adjacent south-western Carmarthenshire, Wales, which formed part of the continent of Avalonia in the Ordovician. The rocks concerned are the Sholeshook Limestone Formation (and the equivalent Robeston Wathen Limestone Formation), the Slade and Redhill Mudstone Formation and the lower part of the Haverford Mudstone Formation. The Portfield Formation (between the Slade and Redhill Mudstone Formation and the Haverford Mudstone Formation) is largely without macrofossils, and the Ordovician–Silurian boundary lies within the Haverford Mudstone Formation. However, the brachiopods have never been properly monographed, and apart from a short paper by Reed (1905), the only systematic descriptions have been as a few isolated species in papers covering wider topics. Thus, the 61 brachiopods from

the Sholeshook Limestone and Slade and Redhill Mudstone formations and the 16 from the lower Haverford Mudstone Formation are reviewed here and described where necessary. Many specimens are poorly preserved and so some taxa are left in open nomenclature. There is systematic revision of much of the fauna, including the transfer of the few older-named species to more modern genera and the erection of 16 new species: *Acanthocrania elusa*, *Gunnarella mcdermotti*, *Mackerrovia? jinei*, *Eostropheodonta portfieldensis*, *Sampo transversa*, *Fardenia gwaliae*, *Triplesia hintsae*, *Kullervo grandis*, *Nicolella crabbi*, *Glyptorthis splendens*, *Boreadorthis sheehani*, *Neoplatystrophia deani*, *Cryptothyris magnifica*, *Dedzetina major*, *Harknessella stevensorum* and *Salopia posterior*, as well as the new subspecies *Christiania nilssoni sholeshookensis*. No new genera are erected, but the widely quoted dalmanelloid *Laticrura* is placed within the synonymy of *Salopia*. The only pentamerides are sparse material of *Porambonites?* sp. and a camerelloid in open nomenclature. Rhynchonellides are also extremely rare, and the order is represented by a meagre three specimens, two of which are *Thebesia* sp; atrypoids are only known from two specimens of *Eospirigerina*? The late Katian faunas of the Sholeshook Limestone and Slade and Redhill Mudstone formations are largely similar, and both were deposited on the middle and deeper-water parts of the shelf, chiefly preserved in shell bands with the brachiopods broken and not in life position. Most of the assemblages consist of a variable *Onniella–Sowerbyella* Association in both formations, which are combined at some localities with a fauna comparable with a *Foliomena* Fauna Association in part of the Sholeshook Limestone Formation and near the base of the Slade and Redhill Mudstone Formation, but the latter association is only represented as part of a more diverse assemblage than is usual for that well-known fauna. Two faunal turnovers can be recognized within the Haverford Mudstone Formation: the first at its base, at which a *Hirnantia* Fauna is developed in the St Martin's Cemetery horizon, which is followed higher in the formation by sporadic but much less diverse Hirnantian assemblages; however, only the species of the *Hirnantia* Fauna originally described from south-western Wales are reviewed here. The second turnover is at about 250 m above the base of the Haverford Mudstone Formation, where the sparse Hirnantian age faunas (dated by the trilobite *Mucronaspis*) are succeeded by the rich Rhuddanian faunas of the Early Silurian within the top 100 m; however, the latter are not discussed in detail. The faunas of south-western Wales are compared with those from other parts of Avalonia and also with other Late Katian and Hirnantian brachiopods from the adjacent continents of Laurussia, Baltica and north-western Gondwana, and their palaeogeography discussed: Avalonia had many genera, but few species in common with the others.

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