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Priscum

NEWSLETTER OF THE PALEONTOLOGICAL SOCIETY

INSIDE THIS ISSUE

Support the advancement of paleontology and the understanding of the history of life on Earth through membership in the Paleontological Society.

Renew Online

https://rock.geosociety.org/membership/paleo/renew/renew1.asp

President's Statement

By Steven Holland

2015 was an important year for the Paleontological Society, and 2016 will be too. Our biggest news is that we began the first year of our five-year contract with Cambridge University Press, who will publish our journals, Journal of Paleontology and Paleobiology. The search for a new publisher began in 2013, when Council confronted the long-term financial implications of staying with Allen Press. Through the Publications Committee, chaired by Roy Plotnick, the Society called for proposals and considered the bids of eight publishers. Three of these were selected for in-person interviews with the Publications Committee, Editors, and other officers in the Spring of 2014. Cambridge University Press was the unanimous choice.

I'm pleased to be working with Cambridge. The print quality is outstanding. Submitting papers is a great improvement over what we had before. Past issues have been rescanned and are now available as fully searchable pdfs with superb image quality. Cambridge also brings a wealth of marketing experience from their other journals, experience that will help us extend the reach of our journals around the world. The editors of both journals plus several Council officers will meet with Cambridge in New York this month to develop a road map for the future of our journals.

Society unveils new logo

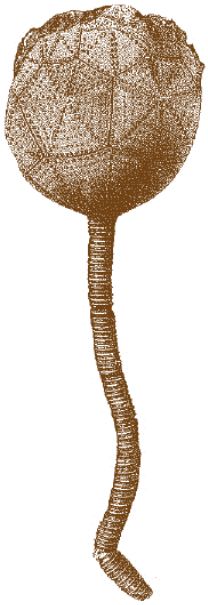
Changing publishers is a challenging task, one that falls hardest on the editors. They had to continue to process manuscripts that originated in the AllenTrack system, while also learning the modern publishing practices of Cambridge. The editors of both of our journals have done heroic service this past year to make the transition as smooth as possible. Delays have developed at the Journal of Paleontology, but the editors and Cambridge have a solid plan for eliminating those this year.

President's Statement, cont.

We are working to build our relationship with Cambridge, and we will extend our contract with them to include our Special Publications. Once we have secured all the copyrights to the various series of our special publications, they will be available for the first time as searchable high-quality pdfs. Beginning this year, Cambridge will publish our Short Course notes.

In 2015, we launched a beautiful new website. This project, spearheaded by our Communications Officer Leif Tapanila, included not only a complete audit of all of our web content, but also a redesign of the navigation, and hands-on work with Rave Communications to develop the look and feel of the site.

We see the website as an important part of the future of the Paleontological Society, and Council will consider a search this year for a half-time person to update its content on a daily basis. The site will include links to news stories, job announcements, and grant listings. We want it to become your first stop for up-to-date news on paleontology. In this same way, we plan to increase our presence on Facebook and Twitter to take advantage of all of the ways of reaching our members and attracting new members.



In 2015, we introduced a bold new logo in conjunction with the launch of our website. You can see it in this issue, and you'll see it in other places through the coming year. This logo was selected by Council from almost two dozen designs developed by Rave Communications and Cambridge University Press. The logo is highly recognizable, and it is a strong symbol of the changes being made in our Society.

In 2015, Council voted to approve a nondiscrimination policy and statement of expectations. You will find it in this issue, along with a perspective from Phoebe Cohen, who developed this policy with Margaret Fraiser. This policy is an important statement of our values as a Society and the standards that we uphold.

More changes are coming this year. In March, you will vote on a sweeping update of our governing documents, which are now available on our website and in this issue. We currently have an Articles of Incorporation, a Constitution, and a Bylaws, and this structure was a perennial source of confusion among the officers on Council because it was unclear why any given policy was in any particular document. In some cases, these documents were in conflict. In other cases, they no longer reflected how Council actually operated. In some ways, the documents did not reflect the legal requirements of a 501(c)(3) non-profit organization. In many places, the bylaws were far too specific about procedures, and this specificity either hamstrung Council or forced it to emend the Bylaws too frequently.

I began a complete rewrite of our governing documents in 2014, and the Executive Committee (Sandy Carlson, Arnie Miller, Peter Harries, Mark Wilson, and myself) met in February 2015 to complete these drafts. These were submitted for legal review, which resulted in more changes, compliance with 501(c)(3) regulations and standards, and a simplification to an Articles of Incorporation and a Bylaws. Council voted to approve these at our annual meeting in November, and they await ratification by the members of the Society.

The revised Articles and Bylaws were not written to upend the Society, but to reflect better how the Society operates now and to streamline how it will operate in the future. Much of the specificity of the previous Bylaws has been removed and placed in an Operations Manual for Council, one that can be easily updated as our needs change.

Three changes in the new Bylaws are particularly worth noting. First, they offer greater clarity on our ability to engage in lobbying within the limits of a 501(c)(3) organization. We need to be able to lobby legislators on paleontologically important issues, and these Bylaws make that ability clear. Second, we have made it easier to form sections of the Paleontological Society, and these can now be of any size or any region; they needn't follow the historical outlines of the GSA sections. We want to foster paleontological communities of any size, and these Bylaws will help us do that. Third, the new Bylaws change the requirements for the Schuchert Award from being granted "normally to someone under the age of 40" to someone within 15 years of their Ph.D. This is an important change recommended to us by several of our members, one that will make the Schuchert Award possible for a greater range of early-career paleontologists.

In 2016, we will also begin to find new and meaningful ways to reach out to the large community of avocational paleontologists. Ours is one of the few sciences where amateurs can make important contributions, and many of us have experienced these first-hand. We currently recognize exceptional avocational paleontologists through our Strimple Award, and we want to find more ways to engage a broader set of this community. President-Elect Arnie Miller has championed these efforts, and he writes about it in this issue. Reaching out to avocational paleontologists will

President's Statement, cont.

benefit all paleontologists, and this is an important initiative for the Paleontological Society.

I want to thank everyone who has served the Paleontological Society through Council or committees, including those who have recently stepped down. All of them are volunteers who have given generously of their time, and all the progress we have made reflects their efforts. If you're interested in serving on Council or working for the Society through a committee, let me know; we'd be glad to have you. Last, if you have any questions or concerns, please don't hesitate to email me at stratum@uga.edu. Your thoughts and ideas are important to us, and we are here to serve you.

Paleontological Society Adopts Code of Conduct

By Phoebe Cohen

At the spring 2015 meeting of the Paleontological Society Council, Council adopted a society-wide Nondiscrimination Policy and Conduct Expectations that applies to all members. The policy states that members of the society will not discriminate on the basis of any reason not related to scientific merit (including sex, gender, age, nationality, religion, and disability). This policy also outlines what is considered to be unacceptable behavior for all society members. Examples of these behaviors include plagiarism, and harassment in any form.

Why has this policy been enacted now, and what does it mean for our Society? I encouraged the society to adopt a policy because discrimination and harassment are common in scientific fields, and the Society is in a position to take a clear stance against such behavior. Adopting a policy helps to raise awareness amongst members about discrimination and harassment in scientific disciplines.

http://paleosoc.org/about/policy/nondiscrimination-policy-of-the-paleontological-society-and-paleontological-society-conduct-expectations/

http://www.buzzfeed.com/azeenghorayshi/famous-astronomer-allegedly-sexually-harassed-students

https://www.documentcloud.org/documents/2456336-ucb-astro-faculty-statement-1.html

http://www.nature.com/news/scientist-disinvited-from-speaking-at-conference-because-of-her-pregnancy-1.18946

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0102172

Several recent high-profile cases have brought these issues to light. The most striking may be the case of Geoffrey Marcy, a prominent UC Berkeley astronomer. Several women have accused Marcy of inappropriate behavior and sexual harassment over many years, and at multiple institutions. For years, little formal action was taken, yet informally female students warned each other about Marcy's behavior. Formal complaints were brought forward at Berkeley, and Marcy was sanctioned, but he did not step down from his position until media attention spread the story widely and his department took a strong stance against his actions.

Another less high profile case occurred when a research scientist was disinvited from speaking at a scientific conference because she was 7 months pregnant and the organizing committee felt it was too great of a risk for her to travel to the meeting. Instead of allowing her to make that decision on her own and in consultation with her medical care providers, the committee made it for her, thus discriminating against her based on a factor wholly unrelated to her scientific merit.

Issues of sexual harassment in field-related disciplines have also been brought to light, most notably in a study by Kate Clancy and co-authors, who showed that many students, both male and female, experience some sort of harassment during field work. While the study represents a relatively small sample size, it underscores that these incidents occur too frequently, and that we as a community need to raise our own, and other's awareness about what unwanted behaviors are, how to prevent them, and how to help the victims of such incidents when they do occur.

While the Society has limited reach and power in such matters, it is important for us to send a clear message that such behavior is unacceptable and to also send the message to those who may have experienced discrimination or harassment that the Society takes such incidents seriously. As we strive to make our field and our Society more diverse and inclusive, we must all help to prevent discrimination and harassment in all of their forms, by remaining vigilant of our own behaviors, and by speaking out when someone has been wronged. Let us all work together to ensure that the only biases we must deal with as paleontologists are those we may encounter in the fossil record.

31st Annual Meeting of SPNHC

Berlin, Germany

June 20-25, 2016

www.spnhc2016.berlin

SPNHC

ADVANCING COLLECTIONS CARE

www.spnhc.org

SPECIAL SECTION: REVISED ARTICLES AND BYLAWS

IN THIS SECTION

Bylaws: Questions and Answers

By Steven Holland

Q: In the Articles, Article X.4 states "Except as otherwise permitted by Code section 501(h), no substantial part of the activities of the Society shall be or consist of carrying on propaganda, or otherwise attempting, to influence legislation." How would this influence our participation in things like Congressional visit days or comments on issues like fossils on public lands or federal funding for paleontology? Can we still issue position statements and recommendations on science- management policy and science-based government policy?

A: It will have no effect on what we currently do. The requirement about lobbying is a condition for being a 501(c)(3). It doesn't prevent lobbying, but it means that it can't be a significant portion of our activities. A few policy statements and a couple of congressional visits won't rise to being a significant portion of what we do.

Q: In the Bylaws, under 2.2.c - Retired Members, what are the rights and responsibilities of retired members versus regular members? What about avocational retirees - do they merit a "senior discount"? As written, only professional paleontologists merit Retired status.

A: The rights and responsibilities are no different than a regular member, although Council may vote to grant additional benefits. These benefits might well change over time and would be spelled out in the Operations Manual. They could include things like reduced dues (as is currently true), or perhaps discounts on publications, etc. We haven't proposed a senior discount to avocational members, only a retired status for professional members.

Q: Under Bylaws 2.4 and 2.5, what is the difference between the Annual Meeting and a Regular Meeting? Has the PS had a Regular Meeting in recent history that is not the Annual Meeting? Does including a category for Regular Meeting provide a means of expanding our programs?

A: These two paragraphs are also the standard language for 501(c)(3) organizations, supplied by the legal team. For us, the Annual Meeting is our meeting at GSA; the point is that we are required to have an annual meeting. We may also hold additional regular meetings (like midyear). We could hold additional regular meetings, and 2.5 gives Council that permission to do that without requiring a modification of the Bylaws.

Q: The last paragraph of Bylaw 2.7 states "Except as provided by statute, if an annual, a regular, or a special meeting of the Members is adjourned to a different date, time, or place, it is not required that notice be given of the new date, time, or place if the new date, time, or place is announced at the meeting before adjournment." Does this mean that the time and place of a meeting can be changed without notice? I'm not sure what this phrase allows, disallows, or is intended to allow or disallow.

A: This is more of the required 501(c)(3) language. It means that if we don't finish a meeting and choose to resume it (i.e., adjourn it), we do not have to deliver a special notification of where and when we will resume, provided it's announced before we adjourned.

The idea is that the time/place of the original meeting was announced and everyone is there, so provided we announce there where/when we will resume, we don't have to publicly announce the where/when, as is required when we first hold the meeting. The point is to not have secret meetings, and telling everyone before we adjourn where/when we will continue is sufficient for not having the meeting be secret.

Q&A on Bylaws, cont.

Q: Under Bylaw 7.2, the new window for a Schuchert Awardee is 15 years after finishing their degree. This seems like a long time -- for example, I myself completed my degree in 2000 (15 years ago) and I am a full professor — in theory, someone at my stage would be in the running and I am hardly an early career scientist. I think a 10-year window might be more appropriate. That said, making this award independent of an individual's age is appropriate in my opinion.

A: This is based on a proposal I received from several members. The idea was to open it up a little to make it more feasible for those having families, particularly women, as well as people that earn their Ph.D. later in life. It keeps it an early career award, but allows a little more time for things to develop and disconnects it from one's age.

Q: In Article 5 (Committees), some of the committees have language specifying who appoints committee members (e.g., 5.2 Financial Management, 5.3 Nominations), but most (5.4-5.8) do not specify this. Article 5.9 implies that committee members are appointed either by Council or by the committee chair, but it's otherwise vague. Should this be more consistent? Perhaps adding a few words to each committee description would work, e.g., "The Past-President shall be chair of this committee, and appoint its members." Or is the appointment process to be addressed in the operations manuals?

A: The appointment process will be handled in the operations manual. This is an example of something that Council should be free to change as appropriate, without need of a vote by the membership on the Bylaws. In general, if something is not stated explicitly in the Bylaws, it will be handled in the operations manual.

Amended and Restated Articles of Incorporation

AMENDED AND RESTATED

ARTICLES OF INCORPORATION

OF

The Paleontological Society

The undersigned officer of The Paleontological Society (the "Society"), pursuant to the provisions of the District of Columbia NonProfit Corporation Act, as amended (the "Act"), hereby executes the following Amended and Restated Articles of Incorporation (the "Articles"), which supersede and take the place of the previously existing articles of the Society and all previous amendments thereto:

ARTICLE I

Name

The name of the Society is The Paleontological Society.

ARTICLE II

Purposes

The Society is organized and operated exclusively to conduct, support, encourage, and assist such scientific, educational, charitable, and other programs and projects as are described in Sections 170(c)(2)(B), 501(c)(3), 2055(a)(2), and 2522(a)(2) of the Internal Revenue Code of 1986, as amended (the "Code"), or corresponding provisions of any subsequent federal tax laws. In furtherance of such purposes, the Society's specific purposes shall include:

- furthering in the broadest and most liberal manner the advancement of paleontology in all its aspects;
- promoting paleontological research in government and industry;
- providing communication among paleontologists, thereby improving their qualifications and usefulness;
- promoting and recognizing educational development and attainments of paleontologists;

Amended Articles, cont.

- increasing and diffusing paleontological knowledge;
- cooperating and engaging in communications with other organizations and persons in the solid earth and biological sciences; and
- promoting scientific interest and inquiry through meetings, professional contacts, reports, papers, discussions and publications, thereby fostering the public welfare and education.

ARTICLE III

Powers

Notwithstanding any other provision of these Articles, neither the Board of Directors nor the Society shall have the power or authority to do any act that will prevent the Society from being an organization described in Code sections 170(c)(2)(B), 501 (c)(3), 2055(a)(2), and 2522(a)(2). Subject to the foregoing statement, and subject to and in furtherance of the purposes for which it is organized, the Society shall possess all of the rights, privileges, and powers conferred by the Act or by other law and, in addition, the following rights, privileges, and powers:

Section 1. To indemnify any person against liability and expenses, and to advance the expenses incurred by such person, in connection with the defense of any threatened, pending, or completed action, suit, or proceeding, whether civil, criminal, administrative, investigative, or otherwise, and whether formal or informal, to the fullest extent permitted by applicable law, or, if not permitted, then to any extent not prohibited by such law.

Section 2. To cease its activities and to dissolve and surrender its corporate franchise.

ARTICLE IV

Period of Existence

The period during which the Society shall continue is perpetual.

ARTICLE V

Registered Agent and Registered Office

Section 1. The name of the registered agent in charge of the Society's registered office at the time of the adoption of these Articles is [*see website*], and the address of such registered agent is [*see website*].

Section 2. The street address of the registered office of the Society at the time of the adoption of these Articles is [*see website*].

ARTICLE VI

Members

The Society shall have members. The characteristics, qualifications, rights, limitations, and obligations of the members shall be set forth in the Society's Bylaws.

ARTICLE VII

Board of Directors

The Society's Board of Directors shall be referred to as the "Council." The exact number of councilors of the Society shall be specified in or fixed in accordance with the Bylaws of the Society (the "Bylaws") at a number no smaller than three (3). At the time of adoption of these Articles, the names of the councilors of the Society are as follows:

NAMES: [*see website*]

ARTICLE VIII

Election of Councilors

The councilors of the Society shall be elected in the manner and for terms as specified in or fixed in accordance with

Amended Articles, cont.

the Bylaws.

ARTICLE IX

No Private Inurement

None of the Society's net earnings shall inure to the benefit of any private individual.

ARTICLE X

Regulation of Corporate Affairs

The affairs of the Society shall be subject to the following provisions:

Section 1. Notwithstanding any other provision of these Articles, if for any taxable year the Society is deemed a "private foundation" described in Code section 509(a), the Society shall make distributions at such time and in such manner as not to subject the Society to the tax imposed by Code section 4942.

Section 2. Notwithstanding any other provision of these Articles, at any time the Society is deemed a "private foundation" described in Code section 509(a), the Society shall not:

(a) Engage in any act of self-dealing as defined in Code section 4941(d);

(b) Retain any excess business holdings as defined in Code section 4943(c);

(c) Make any investment in such manner as to subject the Society to tax under Code section 4944; or

(d) Make any taxable expenditure as defined in Code section 4945(d).

Section 3. Neither the Council nor the Society shall have the power or authority to do any act that will prevent the Society from being an organization described in Code section 501(c)(3).

Section 4. Except as otherwise permitted by Code section 501(h), no substantial part of the activities of the Society shall be or consist of carrying on propaganda, or otherwise attempting to influence legislation.

Section 5. The Society shall not participate or intervene in (including the publishing or distributing of statements) any political campaign on behalf of or in opposition to any candidate for public office.

Section 6. Subject to the provisions of these Articles and applicable law, the Council shall have complete and plenary power to manage, control, and conduct all the affairs of the Society.

Section 7. The power to make, alter, amend, and repeal the Society's Bylaws shall be vested in the Council, subject to approval by the members.

Section 8. No councilor of the Society shall be liable for any of its obligations.

Section 9. Meetings of the Council may be held at any location, either inside the District of Columbia or elsewhere.

Section 10. All parties dealing with the Society shall have the right to rely upon any action taken by the Society pursuant to authorization by the Council by resolution duly adopted in accordance with the Society's Articles, Bylaws, and applicable law.

Section 11. The Council may from time to time, in the Bylaws of the Society or by resolution, designate such committees as the Council may deem desirable for the furtherance of the purposes of the Society.

ARTICLE XI

Dissolution of the Society

Upon dissolution of the Society, its assets remaining after the payment of all its obligations shall be transferred and conveyed, subject to any contractual or legal requirement, to one or more other organizations that have been selected by the Council and the members, and that are organized and operated for purposes substantially the same as those of the Society, and that are described in Code sections 170(c)(2)(B), 501(c)(3), 2055(a)(2), and 2522(a)(2).

Amended Articles, cont.

The undersigned officer hereby presents these Amended and Restated Articles of Incorporation to the Secretary of DC Department of Consumer and Regulatory Affairs for filing, representing beforehand to the Secretary and all persons whom it may concern that the manner of their adoption and the vote by which they were adopted constitute full compliance with the provisions of applicable law, the previously existing articles of the Society, and the Society's Bylaws.

IN WITNESS WHEREOF, the undersigned officer hereby verifies and affirms, subject to penalties of perjury, that the representations contained herein are true, this _____ day of _____, 2015.

_____

NAME, President

Amended and Restated Bylaws

Article 1. General Provisions

1.1 Name

The name of the corporation is The Paleontological Society (the "Society").

Article 2. Membership

2.1 General

Membership in the Society shall be governed by the provisions of the Amended and Restated Articles of Incorporation (the "Articles") and these Bylaws.

2.2. Classes of Members

The Society shall have three classes of Members: (i) the Regular Members; (ii) the Student Members; and (iii) the Retired Members (collectively, the "Members"):

Regular Member. Status as a Regular Member may be conferred upon any individual interested in paleontology, including professional and avocational paleontologists. The class of Regular Members may consist of individuals that meet these conditions of membership and such other conditions as may be prescribed by the Council, and that otherwise are approved for Regular Membership by the Council or by an authorized designee of the Council.

Student Member. Status as a Student Member may be conferred upon any individual interested in paleontology who is currently enrolled in a primary or secondary school, a college or university, or a graduate program. The class of Student Members may consist of individuals that meet these conditions of membership and such other conditions as may be prescribed by the Council, and that otherwise are approved for Student Membership by the Council or an authorized designee of the Council.

Retired Member. Status as a Retired Member may be conferred upon any individual interested in paleontology who has retired from employment as a professional paleontologist. The class of Retired Members may consist of individuals that meet these conditions of membership and such other conditions as may be prescribed by the Council, and that otherwise are approved for Retired Membership by the Council or an authorized designee of the Council.

2.3 Application, Dues, Requirements, and Benefits of Membership

Application requirements, dues requirements, and other requirements for membership and benefits of membership shall be prescribed from time to time by the Council. Dues shall generally be payable by January 1 of each year, and Members must have dues paid in full in order to be in good standing.

2.4 Annual Meeting

There shall be an annual meeting of the Members, which shall be held at a time and place fixed by these Bylaws or by resolution of the Members, for the purpose of transacting such business as may come before the meeting. At the annual meeting,

Amended Bylaws, cont.

the President and Treasurer of the Society, or their respective designees, shall report on the activities and financial condition of the Society. In addition, the Members shall consider and act upon such other matters as may be raised consistent with the notice requirements of Section 2.7.

2.5 Regular Meetings

The Society may hold regular meetings of the Members, at intervals, times, and places to be fixed by these Bylaws or by resolution of the Members, for the purpose of considering and acting upon such matters as may be raised consistent with the notice requirements of Section 2.7.

2.6 Special Meetings

Special meetings of the Members may be called at any time by the President or Executive Committee of the Society or by the Members upon written petition describing the purpose of the special meeting that is dated and signed by at least ten percent (10%) of the Members and delivered to the Secretary of the Society. A special meeting shall be held at a time and place specified by the caller or callers of the special meeting. Notice of such special meeting and the purposes of such special meeting shall be given in accordance with the requirements of Section 2.7. No business other than that specified in the notice shall be transacted at the special meeting.

2.7 Notice of Meetings

The Society shall give oral, written, electronic, or facsimile notice of meetings of the Members in a fair and reasonable manner. Notice is fair and reasonable if the following occur:

The Society notifies the individual Member, of the place, date, and time of each annual, regular, and special membership meeting not less than ten (10) days and not more than sixty (60) days before the meeting date;

Notice of an annual or regular meeting includes a description of any matter or matters to be considered at the meeting that must be approved by the Members; and

Notice of a special meeting includes a description of the purpose for which the meeting is called.

Oral notice shall be effective when communicated. Written, electronic, or facsimile notice shall be effective at the earliest of the following:

(i) When received;

(ii) Five (5) days after the notice is mailed, as evidenced by the postmark or private carrier receipt, if mailed correctly addressed to the address of the Member listed in the most current records of the Society;

(iii) On the date shown on the return receipt, if sent by registered or certified United States mail, return receipt requested, and the receipt is signed by or on behalf of the addressee; or

(iv) Thirty (30) days after the notice is deposited with a method of the United States Postal Service other than first class, registered, or certified postage affixed, as evidenced by the postmark, if mailed correctly addressed to the address of the Member listed in the most current records of the Society.

(v) With respect to electronic communications, notice is received when it enters the information processing system that the recipient has designated for receipt of notices and it is in a form capable of being processed.

Except as provided by statute, if an annual, a regular, or a special meeting of the Members is adjourned to a different date, time, or place, it is not required that notice be given of the new date, time, or place if the new date, time, or place is announced at the meeting before adjournment.

2.8 Waiver of Notice

Notice may be waived by a Member in a writing signed by the Member entitled to notice, and filed with the minutes or the Society's records. Attendance at or participation in any meeting by a Member (a) waives the member's objection to lack of

Amended Bylaws, cont.

notice or defective notice unless the Member, at the beginning of the meeting, objects to holding the meeting or transacting business at the meeting and (b) waives the Member's objection to consideration of a particular matter at the meeting that is not within the purposes described in the meeting notice unless the Member objects to considering the matter when the matter is presented.

2.9 Voting List

After fixing a record date for a notice of a meeting of the Members, the Secretary of the Society shall prepare a list of the names of each Member entitled to notice of a meeting of the Members; the address of each Member; and confirmation that each Member is entitled to one (1) vote at the meeting. The Secretary shall prepare on a current basis through the time of the meeting of the Members a list of Members, if any, who are entitled to vote at the meeting, but not entitled to notice of the meeting.

2.10 Quorum

At all meetings of the Members, the presence of ten percent (10%) of the Members shall constitute a quorum. After a vote is represented for any purpose at a meeting of the Members, the vote is considered present for quorum purposes for the remainder of the meeting and for any adjournment of that meeting. Any meeting of the Members, including annual and special meetings or any adjournments thereof, may be adjourned to a later date although less than a quorum is present.

2.11 Voting by Members

Each Member of the Society shall be entitled to cast one (1) vote on each matter to come before the Members. Except as otherwise provided in these Bylaws, each question shall be determined by majority vote of the Members represented at a meeting at which a quorum exists.

2.12 Action by Written Consent

Any action required or permitted to be taken at any meeting of the Members may be taken without a meeting of the Members if a written consent, setting forth the action so taken, (1) is signed by each Member entitled to vote with respect to the subject matter thereof and (2) such written consent is filed with the minutes of the proceedings of the Members or in the Society's records. Such written consent shall have the same effect as a unanimous vote of the Members at a duly held meeting of the Members.

2.13 Action by Written Ballot

Any action that may be taken at an annual, a regular, or a special meeting of the Members may be taken without a meeting if the Society delivers a written ballot to every Member. A written ballot must set forth each proposed action and provide an opportunity to vote for or against each proposed action. Approval by written ballot is valid only when the number of votes cast by ballot equals or exceeds the quorum required to be present at a meeting authorizing the action and the number of approvals equals or exceeds the number of votes that would be required to approve the matter at a meeting at which the total number of votes cast was the same as the number of votes cast by ballot. A solicitation for votes by written ballot must (a) indicate the number of responses needed to meet the quorum requirements, (b) state the percentages of approvals necessary to approve each matter other than the election of Councilors, and (c) specify the time by which a ballot must be received by the Society to be counted. A written ballot may not be revoked.

2.14 Powers Reserved to the Members

Notwithstanding any contrary provision of the Articles and these Bylaws, the affirmative vote of a majority of the Members present at a meeting at which a quorum is present shall be required for approval of the following corporate actions:

To amend, alter, change, or repeal the Articles;

To amend, alter, change, or repeal the Bylaws;

To merge or consolidate the Society with another entity or entities;

To sell, lease, or exchange more than fifty percent (50%) of the property or assets of the Society, where such sale, lease, or exchange occurs other than in the regular course of business;

Amended Bylaws, cont.

To elect the Councilors of the Society; or

To dissolve the Society.

2.15 Means of Communication

Any or all of the Members may participate in an annual, a regular, or a special meeting of the Members by or through the use of any means of communication by which all Members participating may simultaneously hear each other during the meeting. A Member participating in a meeting by such means shall be considered present in person at the meeting.

2.16 Voting by Proxy

A Member may vote by proxy executed in writing by the Member or by his or her duly authorized attorney-in-fact. No proxy shall be valid after eleven (11) months from the date of its execution, unless otherwise provided in the proxy. An appointment of a proxy is revocable by the Member.

Article 3. Council

3.1 General

The affairs of the Society shall be managed, controlled, and conducted by, and under the supervision of, the Board of Directors, subject to the provisions of the Articles and these Bylaws. The Board of Directors shall be referred to as "the Council." The membership of the Council shall comprise Councilors, each of whom are simultaneously elected as Officers of the Society. Councilors must be Members in good standing.

3.2 Election or Appointment and Terms

The process of electing the Councilors shall be the same as (and concurrent with) the process for electing Officers that is set forth in Section 4.2. A Councilor's term shall be commensurate with his or her respective term as an Officer, and shall be subject to the terms and term limits of the Officers set forth in Sections 4.3 and 4.4 of these Bylaws.

Notwithstanding the foregoing, in addition to the Councilors who shall be elected by the Members as described in Section 4.2, the President shall appoint two (2) Student Representatives to the Council (such appointments shall be subject to approval of the Council).

3.3 Quorum and Voting

A majority of Councilors in office immediately before a meeting begins shall constitute a quorum for the transaction of any business properly to come before the Council. Unless otherwise provided in the Articles or these Bylaws, the act of a majority of the Councilors present at a meeting at which a quorum is present shall be the act of the Council. Each Councilor shall be entitled to one (1) vote on all matters coming before the Council, with the exception of the two (2) Student Representatives who shall share one (1) vote. Moreover, in the event that there are Co-Editors who share the duties of Journal Editorship or of Special Publications, such Co-Editors shall share a single vote on matters to come before the Council.

3.4 Regular Meetings

The Council may hold regular meetings, as fixed by these Bylaws or by resolution of the Council, for the purpose of transacting such business as properly may come before the Council. Council will generally hold two (2) regular meetings during each calendar year to conduct the business and affairs of the Society. The Annual Meeting will typically be held in October or November, and the Midyear Meeting will typically be held in April or May. Notice of Regular Meetings shall generally be given no less than thirty (30) days prior to the date of the meeting, and may be given through a single notice of all regularly scheduled meetings for the year.

3.5 Special Meetings

Notwithstanding the preceding section and except as otherwise provided in these Bylaws, the Council may hold special meetings for any lawful purpose upon not fewer than two (2) days' notice, as described in Section 3.6, upon call by the President of the Society or by not fewer than two (2) members of the Council. A special meeting shall be held at such date, time, and place as is specified in the call of the meeting. The purpose of any such meeting need not be specified.

Amended Bylaws, cont.

3.6 Notice of Special Meetings

Oral or written notice of the date, time, and place of each special meeting of the Council shall be communicated, delivered, or mailed by the Secretary of the Society, or by the person or persons calling the meeting, to each member of the Council so that such notice is effective at least two (2) days before the date of the meeting. The notice need not describe the purpose of the special meeting. Oral notice shall be effective when communicated. Written notice, including notice by facsimile or electronic mail, shall be effective at the earliest of the following:

(a) When received;

(b) Five (5) days after the notice is mailed, as evidenced by the postmark or private carrier receipt, if mailed correctly addressed to the address listed in the most current records of the Society;

(c) On the date shown on the return receipt, if sent by registered or certified United States mail, return receipt requested, and the receipt is signed by or on behalf of the addressee; or

(d) Thirty (30) days after the notice is deposited with a method of the United States Postal Service other than first class, registered, or certified postage affixed, as evidenced by the postmark, if mailed correctly addressed to the address listed in the most current records of the Society.

3.7 Waiver of Notice

Notice may be waived in a writing, signed by the Councilor entitled to notice, and filed with the minutes or the corporate records. Attendance at or participation in any meeting (a) waives objection to lack of notice or defective notice, unless the Councilor at the beginning of the meeting objects to holding the meeting or transacting business at the meeting, and (b) waives objection to consideration of a particular matter at the meeting that is not within the purposes described in the meeting notice, unless the Councilor objects to considering the matter when the matter is presented.

3.8 Means of Communication

The Council, or a committee thereof, may permit a Councilor or a committee member to participate in a meeting by, or conduct a meeting through the use of, any means of communication by which all Councilors or committee members participating simultaneously may hear each other during the meeting. A Councilor or committee member participating in a meeting by such means shall be considered present in person at the meeting.

3.9 Action by Written Consent

Any action required or permitted to be taken at any meeting of the Councilors, or any committee thereof, may be taken without a meeting if a written consent describing such action is signed by each Councilor or committee member and such written consent is included in the minutes or filed with the Society's records reflecting the action taken. Action taken by written consent shall be effective when the last Councilor or committee member signs the consent, unless the consent specifies a prior or subsequent effective date. A consent signed as described in this section shall have the effect of a unanimous vote at a meeting of the Councilors and may be described as such in any document.

3.10 Resignation, Removal, and Vacancies

Any Councilor may resign or be removed as described in Section 4.5 of these Bylaws. If a Councilor resigns or is removed, such resignation or removal shall simultaneously terminate his or her service as an Officer. Any vacancy in the position of a Councilor caused by resignation or removal shall be filled as described in Section 4.5(c).

3.11 Standard of Conduct

Councilors and Officers must act in good faith, with care, and in the best interests of the Society. A Councilor must disclose to other Councilors all material information regarding the Society not already known to him or her, absent a legal responsibility of confidentiality.

Article 4. Officers

4.1 Officers Generally

Amended Bylaws, cont.

Each Officer of the Society shall also be a Councilor. The Officers of the Society shall consist of the President, Past-President, President-Elect, Secretary, Treasurer, two (2) Representatives At Large, Editor(s) of *Paleobiology*, Editor(s) of the *Journal of Paleontology*, Editor(s) of Special Publications, Communications Officer, Program Coordinator, and Education/Outreach Coordinator, Student Representatives, and such other officers as the Council may, by resolution, designate from time to time. Officers must be Members in good standing, and an Officer may not simultaneously hold more than one (1) office.

4.2 Nominations and elections

When an individual is elected or appointed to an Officer position, such election or appointment shall simultaneously serve as the election or appointment to serve as a Councilor.

a. For the positions of President-Elect and Representative At Large, the Nominations Committee (see Section 5.3) will submit to the Council nominations for each office to be filled. For one (1) Representative At Large, all nominees will be at least fifteen (15) years past receipt of his or her highest degree at the time of the election. For the other Representative At Large, all nominees will be within fifteen (15) years of his or her highest degree at the time of election.

b. For the positions of Secretary, Treasurer, Editor(s) of *Paleobiology*, Editor(s) of the *Journal of Paleontology*, Communications Officer, Editor(s) of Special Publications, Program Coordinator, and Education/Outreach Coordinator, the Nominations Committee will submit to Council nominations for each office to be filled. For the editorships, a nomination may consist of two (2) or more Co-Editors.

c. The Council will prepare a ballot based on the nominees from the Nominations Committee. For President-Elect and each Representative At Large, the Council will select two (2) nominees to be placed on the ballot for each office to be filled. For all other offices, the Council will select one nominee from the list of nominations to be placed on the ballot for each office to be filled. If Co-Editors are selected for a journal, they will be listed on the ballot as a slate.

d. The final ballot shall be approved by the Council.

e. Ballots shall be provided to all Members at least sixty (60) days prior to the Annual Meeting. Councilors shall be elected by a plurality of votes cast by Members.

f. Results of the vote will be disseminated to all Members and announced at the Annual Meeting.

4.3 Term lengths

a. The President-Elect shall serve two (2) years as President-Elect, followed immediately by two (2) years as President, followed immediately by two (2) years as Past-President, for a total term of six (6) consecutive years.

b. The terms of the Secretary, Treasurer, Editor(s) of *Paleobiology*, Editor(s) of the *Journal of Paleontology*, Editor(s) of Special Publications, Communications Officer, Program Coordinator, and Education and Outreach Coordinator shall be three (3) years.

c. The terms of the Representatives At Large and Student Representatives shall be two (2) years.

d. The two (2) Student Representatives shall serve offset two-year terms, with one (1) new Student Representative appointed each year.

4.4 Re-election

a. The President-Elect, Representatives At Large, and Student Representatives are not eligible for re-election or reappointment to such offices.

b. The Secretary, Treasurer, Editor(s) of *Paleobiology*, Editor(s) of the *Journal of Paleontology*, Editor(s) of Special Publications, Communications Officer, Program Coordinator, and Education and Outreach Coordinator may be elected to a second term, but may not serve more than two (2) consecutive terms in such office.

4.5 Resignation, removal, and replacement

a. **Resignation**. An Officer may resign at any time by providing written notice to the President or Secretary, who will convey such resignation to the Council. Resignation as an Officer also shall serve as resignation from the Council.

Amended Bylaws, cont.

b. **Removal**. Any Officer elected may be removed with or without cause by the affirmative vote of two-thirds of the Councilors then in office. Removal as an Officer also shall serve as removal from the Council.

c. **Replacement**. The Council shall fill Officer positions vacated by resignation, removal, or death. Any such Interim Officer will serve until the next Annual Member Meeting, when an elected successor will assume office, or in the case of a Student Representative, when an appointed successor will assume office. Such interim appointments as Officers shall also serve as interim appointments to the Council.

If the President-Elect is unable to become President at the prescribed time, the current President will remain in that office until a special election is held. If the current President is unable to become Past-President at the prescribed time, the current Past-President will remain in that office until a special election can be held. If the current Past-President is unable to complete the term, the office of Past-President will be vacated until the current President rotates into office of Past-President.

In the event an elected Officer is unable to serve, the Council will arrange a Special Election, with a slate of candidates proposed by the Nominations Committee.

4.6 Officer Duties

a. The **President** will preside over all meetings of the Society, the Council, and the Executive Committee. The President manages the affairs and property of the Society, and will insure that the policies and decisions instituted by Council are implemented. The President or an Officer designated by the President will represent the Society as appropriate.

b. The **Past-Presiden**t will serve as chair of the Paleontological Society Medal Committee, the Charles Schuchert Award Committee, and will take responsibility for any external awards for which the Society is requested to submit nominees.

c. The **President-Elect** will serve as chair of the Strimple Award Committee and of the Pojeta Award Committee.

d. The **Secretary** will keep records of Society proceedings and a complete list of Members. The Secretary will notify the membership of elections and meetings, and will provide other communications as requested by the President and Council. Except as otherwise provided, the Secretary will have custody of Society property. Society records may be kept in digital form. Requests for reproduction of information from the Society's publications and waiver of copyright for publications of the Society will be sent to the Secretary, who will accept or reject such requests.

e. The **Treasurer** will collect and disburse all funds of the Society, except where noted otherwise in the Bylaws. The Treasurer will have custody of all Society funds and will keep detailed accounts of receipts and disbursements; the accounts will be audited as provided in the Bylaws. The Treasurer will submit an annual report to Council at the Annual Meeting and provide an update on the financial status of the Society at the Midyear Meeting.

f. The **Representatives At Large** will have duties assigned by the President.

g. The **Editor(s) of *Paleobiology*** and the **Editor(s) of the *Journal of Paleontology*** will supervise all matters connected with publication of their respective journals, under the general direction of the Council.

h. The **Editor(s) of Special Publications** will supervise all matters connected with publication of the Special Publications series, under the general direction of the Council.

i. The **Communications Officer** will supervise all matters connected with publication of Society news, social media, and the website under the general direction of the Council.

j. The **Program Coordinator** will supervise the technical programs of all meetings sponsored or co-sponsored by the Society.

k. The **Education/Outreach Coordinator** will supervise the Society's education and outreach programs and related educational activities sponsored or co-sponsored by the Society.

l. The **Student Representatives** will serve as a liaison between Student Members and the Council. The Student Representatives will submit reports on their concerns and recommendations on issues that may affect the Society, including the recruitment of Student Members and retention of those Members when they complete their degrees.

Amended Bylaws, cont.

m. Each Officer will advise and assist in the activities of the Society, and shall perform the duties incident to his or her respective Office and such other duties as the Council may prescribe.

Article 5. Committees

5.1 Executive Committee

a. The Executive Committee shall consist of the President, Past-President, President-Elect, Secretary, and Treasurer.

b. The Executive Committee shall be chaired by the President.

c. To the extent consistent with applicable law, the Executive Committee shall be empowered to act on behalf of Council between its regular meetings. Actions of the Executive Committee shall be reported to and are subject to ratification by Council, with the exception of those specifically authorized by Council.

5.2 Financial Management Committee

a. The Financial Management Committee shall consist of the Treasurer and no more than five (5) former Executive Committee members, appointed by the President. The Treasurer shall serve as chair.

b. The Financial Management Committee advises the Executive Committee and the Council on matters related to the financial health and investment strategies of the Society.

5.3 Nominations Committee

The Nominations Committee shall be responsible for providing a slate of candidates for election to Society Offices and the Council. Nominations Committee members will be jointly appointed by the Council and the President.

5.4 Paleontological Society Medal Committee

The Paleontological Society Medal Committee shall be responsible for making recommendations to the Council for the recipient of the Paleontological Society Medal. The Past-President shall be chair of this committee.

5.5 Schuchert Award Committee

The Schuchert Award Committee shall be responsible for making recommendations to the Council for the recipient of the Schuchert Award. The Past-President shall be chair of this committee.

5.6 Strimple Award Committee

The Strimple Award Committee shall be responsible for making recommendations to Council for the recipient(s) of the Strimple Award. The President-Elect shall be chair of this committee.

5.7 Pojeta Award Committee

The Pojeta Award Committee shall be responsible for making recommendations to Council for the recipient(s) of the Pojeta Award. The President-Elect shall be chair of this committee.

5.8 Fellows Committee

The Fellows Committee shall be responsible for selecting names of Fellows for election by the Council. Members of the Fellows Committee must be Fellows. The Fellows Committee shall choose their chair.

5.9 Committee Composition

With the exception of the Executive Committee, members of committees may, but need not, be members of the Council (i.e., Officers). A committee member appointed by the Council or the chair of a committee may be removed by the Council with or without cause. At least one Council member must be a member of the Financial Management and Nominations Committees. The Council shall approve, by majority of Councilors in office, appointments of Council members to Committees.

5.10 Ad hoc Committees

At the direction of the Council and individual Officers, ad hoc committees may be appointed. All such Committees are adviso-

Amended Bylaws, cont.

ry and will report to the Council.

Article 6. Regional Sections

The Society may establish regional sections to promote paleontology on a regional basis. The process for establishing such sections, and the terms of how such sections must relate to the Society shall be established by the Council from time to time.

Article 7. Awards

The Society annually awards numerous medals, awards, and fellowships. The criteria for such awards and medals is determined by the Council and/or the respective award committee (if any), from time to time. At the time of the adoption of these Bylaws, the awards given annually by the Society include the following:

7.1 Paleontological Society Medal

The Paleontological Society Medal is awarded to a recipient who has a distinguished career in the advancement of knowledge in paleontology.

7.2 Charles Schuchert Award

The Charles Schuchert Award is made to a Member early in his or her career whose paleontological work reflects excellence and quality. Ordinarily, the recipient of the Charles Schuchert Award will be no more than fifteen (15) years past completion of his or her Ph.D.

7.3 Strimple Award

The Strimple Award is given to recognize outstanding achievement by avocational paleontologists. For purposes of this award, an avocational paleontologist is defined as someone who does not make his or her living full-time from paleontology.

7.4 Pojeta Award

The Pojeta Award is given to recognize exceptional professional or public service by individuals or groups of individuals that significantly advances the field of paleontology. This service should be above and beyond that expected in the recipient's formal professional role.

7.5 Fellows

A Fellow is a Member of the Society recognized by Council for significant contributions to the advancement of paleontology through research, teaching, or service to the profession. Recipients of the Charles Schuchert Award and the Paleontological Society Medal automatically become Fellows.

Article 8. Finances

8.1 Fiscal year

The fiscal year of the Society begins January 1 of each year and ends December 31 of that year.

8.2 Annual Budget

At each Annual Council Meeting, the Treasurer will review expenditures for the preceding year, assess the financial status of the Society, and present a budget for the forthcoming year.

8.3 Bequests

The Society may accept gifts and bequests at the discretion of Council.

8.4 Endowment funds

Endowment funds shall consist of gifts or grants to the Society, along with any additional monies that Council adds from operating or other funds. Assets received for an endowment fund shall be kept by the Treasurer as a separate account or accounts. The principal of a given fund may not be expended except by the affirmative vote of two-thirds of the Councilors then in office unless terms of the donations involved specifically stipulate otherwise.

Amended Bylaws, cont.

8.5 Disbursements

a. All checks or demands for money from the Society will be signed by the Treasurer, the President, or such other person(s) as the Council may designate.

b. No pecuniary obligation in excess of two thousand dollars ($2000 U.S.) shall be contracted in the name of the Society by any Officer of the Society without approval by Council.

8.6 Audit

At the Annual Council Meeting, a firm of certified public accountants shall be appointed by Council to conduct a financial review or audit the financial affairs of the Society. At the close of the fiscal year, the auditors will audit and examine records, accounts, vouchers, and financial transactions of the Society. The auditors will prepare a balance sheet and a statement of revenues, expenses, and changes in fund balances, prepared in accordance with generally accepted accounting principles. This report will be presented to Council, filed with the Secretary, and open to inspection by Members.

Article 9. Indemnification

9.1 Indemnification by the Society

To the extent not inconsistent with applicable law, every person (and the heirs and personal representatives of such person) who is or was a Councilor, Officer, employee, or agent of the Society shall be indemnified by the Society against all liability and reasonable expense that may be incurred by him or her in connection with or resulting from any claim, action, suit, or proceeding (a) if such person is wholly successful with respect thereto, or (b) if not wholly successful, then if such person is determined as provided in Section 9.3 to have acted in good faith, in what he or she reasonably believed to be the best interests of the Society (or, in any case not involving the person's official capacity with the Society, in what he or she reasonably believed to be not opposed to the best interests of the Society), and, in addition, with respect to any criminal action or proceeding, is determined to have had reasonable cause to believe that his or her conduct was lawful (or no reasonable cause to believe that the conduct was unlawful). The termination of any claim, action, suit, or proceeding, civil or criminal, by judgment, order, settlement (whether with or without court approval), or conviction, or upon a plea of guilty or of nolo contendere or its equivalent, shall not create a presumption that a person did not meet the standards of conduct set forth in this Article.

9.2 Definitions

(a) As used in this Article, the terms "claim, action, suit, or proceeding" shall include any threatened, pending, or completed claim, action, suit, or proceeding and all appeals thereof (whether brought by or in the right of the Society, any other corporation, or otherwise), civil, criminal, administrative, or investigative, whether formal or informal, in which a person (or his or her heirs or personal representatives) may become involved, as a party or otherwise:

(i) By reason of his or her being or having been a Councilor, Officer, employee, or agent of the Society, or of any corporation, where he or she served as such at the request of the Society;

(ii) By reason of his or her acting or having acted in any capacity in a corporation, partnership, joint venture, association, trust, or other organization or entity where he or she served as such at the request of the Socie ty; or

(iii) By reason of any action taken or not taken by him or her in any such capacity, whether or not he or she con tinues in such capacity at the time such liability or expense shall have been incurred.

(b) As used in this Article, the terms "liability" and "expense" shall include, but shall not be limited to, counsel fees and disbursements and amounts of judgments, fines, or penalties against, and amounts paid in settlement by or on behalf of, a person.

(c) As used in this Article, the term "wholly successful" shall mean:

(i) Termination of any action, suit, or proceeding against the person in question without any finding of liability or guilt against him or her;

Amended Bylaws, cont.

(ii) Approval by a court, with knowledge of the indemnity herein provided, of a settlement of any action, suit, or proceeding; or

(iii) The expiration of a reasonable period of time after the making of any claim or threat of any action, suit, or proceeding without the institution of the same, without any payment or promise made to induce a settle ment.

9.3 Entitlement to Indemnification

Every person claiming indemnification hereunder (other than one who has been wholly successful with respect to any claim, action, suit, or proceeding) shall be entitled to indemnification (a) if special independent legal counsel, which may be regular counsel of the Society or other disinterested person or persons, in either case selected by the Council, whether or not a disinterested quorum exists (such counsel, person, or persons being hereinafter called the "referee"), shall deliver to the Society a written finding that such person has met the standards of conduct set forth in Section 9.1 and (b) if the Council, acting upon such written finding, so determines. The person claiming indemnification shall, if requested, appear before the referee and answer questions that the referee deems relevant and shall be given ample opportunity to present to the referee evidence upon which he or she relies for indemnification. The Society shall, at the request of the referee, make available facts, opinions, or other evidence in any way relevant to the referee's findings that are within the possession or control of the Society.

9.4 Relationship to Other Rights

The right of indemnification provided in this Article shall be in addition to any rights to which any person may otherwise be entitled.

9.5 Extent of Indemnification

Irrespective of the provisions of this Article, the Council may, at any time and from time to time, approve indemnification of Councilors, Officers, employees, agents, or other persons to the fullest extent permitted by applicable law, or, if not permitted, then to any extent not prohibited by such law, whether on account of past or future transactions.

9.6 Advancement of Expenses

Expenses incurred with respect to any claim, action, suit, or proceeding may be advanced by the Society (by action of the Council, whether or not a disinterested quorum exists) prior to the final disposition thereof upon receipt of an undertaking by or on behalf of the recipient to repay such amount unless he or she is entitled to indemnification.

9.7 Purchase of Insurance

The Council is empowered to purchase insurance covering the Society's liabilities and obligations under this Article and insurance protecting the Society's Councilors, Officers, employees, agents, or other persons.

Article 10. Conflicts of Interest

10.1 General Statement and Procedures

It is the policy of the Society and the Council that the Society's Members, Councilors, Officers, and employees carry out their respective duties in a fashion that avoids actual, potential, or perceived conflicts of interest. The Society's Members, Councilors, Officers, and employees shall have the continuing, affirmative duty to report any personal ownership, interest, or other relationship that might affect their ability to exercise impartial, ethical, and business-based judgments in fulfilling their responsibilities to the Society. This policy shall be further subject to the following principles:

(a) Members, Councilors, Officers, and employees of the Society shall conduct their duties with respect to potential and actual grantees, contractors, suppliers, agencies, and other persons transacting or seeking to transact business with the Society in a completely impartial manner, without favor or preference based upon any consideration other than the best interests of the Society.

(b) Members, Councilors, Officers, and employees of the Society shall not seek or accept for themselves or anyone else, from any person or business entity that transacts or seeks to transact business with the Society, any gifts,

Amended Bylaws, cont.

entertainment, or other favors relating to their positions with the Society that exceed common courtesies consistent with ethical and accepted business practices.

(c) If a Member or Councilor, or a Member's or Councilor's relative (the term "relative" includes spouses, ancestors, and descendants, whether by whole or half blood), directly or indirectly owns a significant financial interest in, or is employed by, any business entity that transacts or seeks to transact business with the Society, the Member or Councilor shall disclose that interest or position and shall refrain from voting on any issue pertaining to the transaction.

(d) Officers and employees of the Society shall not conduct business on behalf of the Society with a relative or a business entity in which the Officer, employee, or his or her relative owns a significant financial interest or by which such Officer, employee, or relative is employed, except where such dealings have been disclosed to, and specifically approved and authorized by, the Council.

(e) The Council may require the Society's Members, Councilors, Officers, or employees to complete annually (or as otherwise scheduled by the Council) a disclosure statement regarding any actual or potential conflict of interest described in these Bylaws. The disclosure statement shall be in such form as may be prescribed by the Council and may include information regarding a person's participation as a Member, Councilor, Officer, or employee of any other nonprofit organization. The Council shall be responsible for oversight of all disclosures or failures to disclose and for taking appropriate action in the case of any actual or potential conflict of interest transaction.

10.2 Validity of Actions

The failure of the Society, its Council, or any or all of its Members, Councilors, Officers, or employees to comply with the conflict of interest provisions of these Bylaws shall not invalidate, cancel, void, or make voidable any contract, relationship, action, transaction, debt, commitment, or obligation of the Society that otherwise is valid and enforceable under applicable law.

Article 11. Amendments to the Bylaws

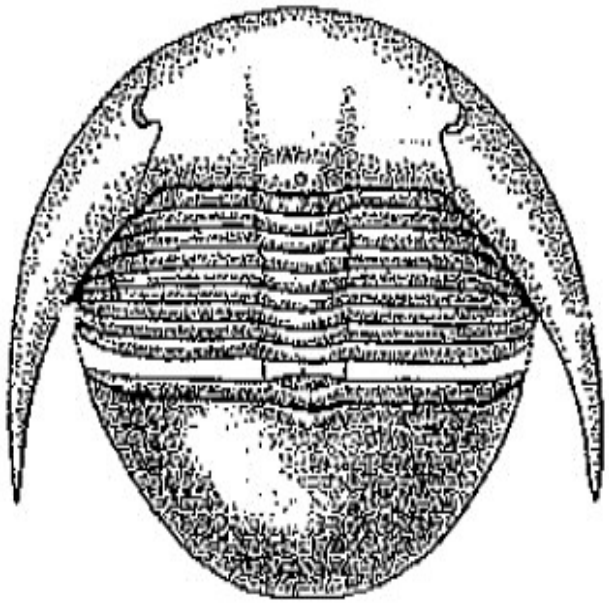
11.1 Procedure

a. Any member in good standing may propose an amendment to the Bylaws.

b. Proposed amendments to the Bylaws must be approved by the Council.

c. Following approval by Council, a proposed amendment to the Bylaws must be approved by the Members.

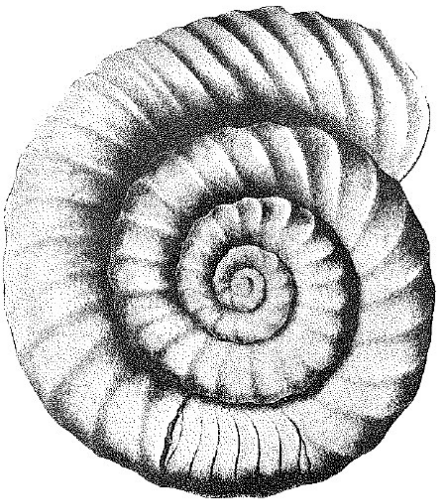
d. A ballot with the proposed amendment(s) to the Bylaws, and an appropriate explanation, must be distributed to the Members, with a minimum 60-day period for voting.



Reaching Out to Avocational Paleontologists

By Arnie Miller, President-Elect

Most members of the Paleontological Society would probably agree that, from a scientific and societal perspective, paleontology has never been more vital than at present. Collectively, paleontologists use an ever-expanding toolkit to collect and analyze data relevant to a spectrum of questions spanning the history of life. When coupled with the continued discovery and documentation of fossil taxa that are new to science, paleontologists routinely capture the imaginations not only of our scientific colleagues, but also broad segments of society. Paleontologists contribute to contemporary discussions about matters as far flung as the possible existence of life elsewhere in the solar system and beyond, and the assessment of anthropogenic alterations to environments and ecosystems.



Yet there is a sense that paleontology is also vulnerable at present, be it at the hands of school boards who seek to undermine the teaching of evolution in public schools, politicians looking to micromanage federal research funding to suit their own beliefs and needs, or federal offices enacting new restrictions on the collection of fossils on public lands.

Against this backdrop, I believe it is important for the Society to undertake a robust effort to recruit avocational paleontologists as members of the Society. The metaphorical firewall between "amateur" and "professional" paleontologists has long struck me as artificial, and the interests of the Society would be well served by a larger contingent of avocational paleontologists among its members, particularly given the efforts of avocational groups to counteract, through positive actions, issues that threaten our science.

The principal avocational group in my region, the Cincinnati Dry Dredgers, has demonstrated copiously over the years that there is nothing amateurish about its paleontological pursuits. Members of The Dry Dredgers have long partnered with students and faculty at the University of Cincinnati in scientific studies, graciously sharing their encyclopedic knowledge of the classic fossils and strata in the Cincinnati region. They have co-authored numerous scientific publications with their colleagues at the university, have financially underwritten the research of generations of graduate students at Cincinnati and elsewhere, and participate extensively in education-and-public outreach activities.

The activities of avocational organizations nationwide are summarized at the website of *The Fossil Project*, a very successful NSF-funded initiative to provide avocational paleontologists with enhanced networking opportunities, educational activities, and contact with professionals. I encourage readers to have a look at the map available at *The Fossil Project* website showing the locations of avocational paleontological organizations, and to peruse the websites of organizations linked electronically to the site. A quick look at this extensive network of organizations provides convincing evidence that avocational paleontologists throughout North America are actively serving the interests of our science, sometimes with only the limited awareness of professionals and students.

There is nothing at present to preclude anyone from becoming a member, but the Society has never *actively* reached out to avocational paleontologists. With this in mind, I pose the following questions:

- Should the Paleontological Society undertake an active effort to recruit avocational paleontologists as members?
- Should avocational paleontologists be given the option of a reduced rate for membership and/or reduced rates for attendance at our meetings?
- Should the Society establish a position on Council for a representative from the avocational community?
- Beyond providing opportunities to participate in the Society's meetings, symposia, workshops, and other regular activities, should the Society undertake special programming aimed at the avocational community?
- Should the Society establish special sections at its website to highlight the accomplishments and contributions of the avocational community, and to provide educational information of practical use to avocational paleontologists in their own research and outreach efforts?
- As part of its recruiting efforts, should the Society also reach out to K-12 science teachers?

I would greatly appreciate hearing from you on this important topic. Please feel free respond to any or all of the questions, or provide additional thoughts, by emailing me at:

arnold.miller@uc.edu. Many thanks!

Amery Green, Honorary Junior Paleontologist

By Cynthia Crane

In October, the Aurora Fossil Museum partnered with the National Park Service and held a National Fossil Day Celebration at the museum. The day involved a cookout, speaking engagements, a scavenger hunt, and special displays by members of both the Special Friends of the Aurora Fossil Museum and the North Carolina Fossil Club. The highlight of the day was fulfilling the dream of a terminally ill child.

Almost exactly a month after I became Director of the Aurora Fossil Museum in 2014, I had the rare opportunity to cross paths with an extraordinary human being, Miss Amery Green. The day that she walked into the Aurora Fossil Museum, my world (and the museum) flipped upside down. Now granted, I have been around children and raised two rambunctious sons, but the energy and excitement of this child just flabbergasted me. For here was this six year old child who was determined to live her life to the fullest even though she was afflicted with an incurable, terminal illness, Mitochondrial Disease. This disease basically inhibits the body's ability to turn nutrients into energy and there is currently no cure for this degenerative ailment. Miss Amery was diagnosed as an infant and was not supposed to live past her second birthday, she is currently 7 years old.

Since Amery's birthday was in August, her mother, Delaney, decided that they were going to celebrate Amery's birthday not just on one day, but the entire month of August. Amery has a "bucket list" and on that list was to meet someone in the career field that she inspires to be in when she grows up, a paleontologist. Amery's mother arranged to bring her, her siblings, and grandmother to the Aurora Fossil Museum so Amery could hunt for fossils and enjoy being a paleontologist for the day. Little did Amery know that I, a paleontologist, had become the Director of the museum! The moment when Amery met me, her mouth dropped and her eyes became so huge! To have a child full of energy, running around the museum, laughing, giggling, and exploring, to just stop in their tracks and look at me in disbelief was an incredible feeling. From that moment on, Amery and I formed a strong bond and since, her mother would send me updates on her condition and progress throughout the year.

During the first year of our friendship, Amery was in and out of the hospital, receiving various treatments, and at times, those treatments were painful. Her mother and I would talk and she would tell me that I was all that Amery would talk about, she told all of her doctors and medical personnel about meeting me and that she wanted to be just like me when she grew up. Delaney also told me that when some treatments became very difficult for Amery to endure, she would distract Amery's attention by talking about me, the next time she was going to visit me at the museum, or being a paleontologist. I would hear from Delaney often with her telling that I would never know how much she and Amery used our interaction to help her cope with her illness.

Fast forward to August 2015: Amery's mother and I were making arrangements for Amery's annual visit to the Aurora Fossil Museum to celebrate her 7th birthday. As August ensued, Amery's condition deteriorated and she was hospitalized. Delaney and I tried to adapt by arranging for me to "bring the Aurora Fossil Museum to her" and spend a long weekend submersed in paleontology and geology, but Amery's condition turned critical and there was no prediction of whether or not she was going to pull through. During this time, I realized the possibility of honoring her with a "degree in paleontology". This idea caused me to make a proposal to the Paleontological Society to give Amery an "Honorary Junior Paleontologist" title. For this would make her dream of becoming a paleontologist come true and if in the event she were to transpire, Amery would have known

Amery Green, cont.

the feeling of being a paleontologist. I have been a member of the Paleontological Society since 2009 when I met John and Mary Lou Pojeta in Cincinnati during the North American Paleontological Convention (NAPC), and since 2010 I have been regularly submitting book reviews for the Paleontological Society *Priscum* Newsletter. I contacted a new friend, Philip Novack-Gottshall, and he immediately forwarded my request and Amery's story to the Paleontological Society Executive Board. Within 3 days, the Executive Board decided to bestow upon Miss Amery Green the title of "Honorary Junior Paleontologist" and a beautiful certificate was sent to me at the Aurora Fossil Museum.

After many failed attempts of scheduling my visit to Amery, Delaney and I decided to arrange for Amery to visit the museum in October during the Aurora Fossil Museum's National Fossil Day Celebration. Also, during September, a dedicated museum volunteer, who also happened to be an accomplished woodworker, began working on a hand carved *C. megalodon* tooth that the museum would give to Miss Amery. We called it the "2015 Aurora Fossil Museum Meg Award" and it could hang on her bedroom wall next to her Honorary Junior Paleontologist Award from the Paleontological Society. As the days became closer to the October 10th National Fossil Day event and Miss Amery and her mother were confirmed that they were going to visit, Delaney informed me that she and Amery would be spending the evening and following day at Atlantic Beach, for Amery wanted to visit the beach. As a result of hearing their beach schedule, I contacted the North Carolina Aquarium at Pine Knoll Shores and shared a brief history of Amery's journey and asked the aquarium if they would be able to apply my reciprocity of free admission to Amery and her mother. The Aquarium officials went above and beyond that and the Aurora Fossil Museum was able to present Miss Amery with a certificate from the NC Aquarium for a day of being the Aquarium VIP. Miss Amery was treated with a special behind-the-scenes tour of the aquarium as well as the various perks that go with being a VIP visitor.

All three of these awards were given to Miss Amery Saturday afternoon during the National Fossil Day Celebration. Neither she nor her mother knew about the awards from the Paleontological Society or the Aurora Fossil Museum. Needless to say there was not a dry eye in the room, especially during the moment when I told Miss Amery that she was now an Honorary Junior Paleontologist and welcomed her into the group.

In closing, I am honored to be a member of such a respectable and compassionate organization. This instance of rallying for a cause and working together quickly to fulfill the dream of a terminal child is something that few organizations can boast about. Members of the Paleontological Society should be extra proud of their organization as a result of this kind act. Thank you for honoring Miss Amery Green with Honorary Junior Paleontologist.

Updates on Amery Green's progress and condition are regularly posted on her Facebook Page, Amery's Army at https://www.facebook.com/amerysarmy/

Cynthia Crane, Director

Aurora Fossil Museum Foundation, Inc.
400 Main Street / PO Box 352
Aurora, NC 27806-0352

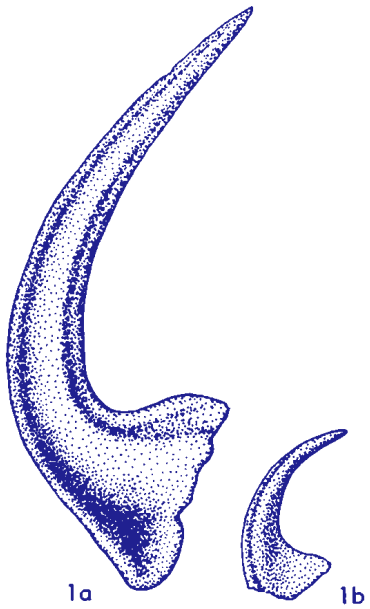
aurfosmus@yahoo.com
252-322-4238

Interview with Paleontological Society Medalist Derek Briggs

Derek Briggs is the most recent (2015) recipient of the Paleontological Society Medal, which is awarded for a distinguished career in the advancement of knowledge in paleontology. Dr. Briggs is the G. Evelyn Hutchinson Professor of Geology and Geophysics at Yale University and a former Director of the Yale Peabody Museum of Natural History. I spoke with him in January, via e-mail.

Q: You were born in Dublin and attended Trinity College. At what point did you become interested in paleontology? Were there experiences specific to Ireland that drew you to paleontology as a career?

A: As a boy growing up in Ireland I was fascinated by the natural world – I used to roam the countryside near home and explore the shore line during annual holidays on the coast. But our house was built on the Leinster granite (indeed it was built *of* Leinster granite!) and fossils were not a part of my childhood. I was drawn to science at high school and the degree program at Trinity allowed a wide choice of subjects in different science departments as a freshman followed by specialization in the third and fourth years. My geology professors awoke my interest in rocks and fossils, and I owe much to Charles Holland and George Sevastopulo for steering me toward paleontology. So in short it was the faculty at Trinity College Dublin who set me on the path I followed.



Drepanodus

Q: You are, of course, best known for your work on exceptionally preserved fossils, and particularly the Burgess Shale. How did you originally become involved in that work? And, what about it has kept your attention throughout your career?

A: That was serendipitous. I was keen to expand my horizons beyond Ireland so I applied to the only three universities in the UK with independent funding for graduate students (as an Irishman I was not eligible for UK research council funding for a PhD, and the Irish equivalent could not be taken outside Ireland). Professor Harry Whittington organized a scholarship at Cambridge University through his own college, Sidney Sussex, and offered me the opportunity to work on the Burgess Shale. He had moved to Cambridge from Harvard some years previously, shortly after the Geological Survey of Canada invited him to lead a reassessment of the fauna. The timing was fortunate: Harry had decided that he needed to add graduate students to his team in order to make more rapid progress on the project. But I had no knowledge of the Burgess Shale back then – I had to borrow the *Smithsonian Miscellaneous Collections* volumes with Walcott's descriptions of the fossils from the Royal Dublin Society, which held the only set in Ireland as far as I am aware. Simon Conway Morris was allocated the 'worms' and I the bivalved arthropods. But *Anomalocaris* was on my list because its spiny head appendages, which were then known only as disarticulated limbs, were interpreted as the body of a shrimp-like animal with an unknown bivalved carapace! My field site was the drawers of Walcott's fossils in the National Museum of Natural History in Washington – indeed I didn't visit Walcott's Quarry in British Columbia until I joined an exploration team led by Des Collins of the Royal Ontario Museum in 1981 and 1982. In those two seasons we discovered many new localities yielding Burgess Shale fossils and showed that they are not confined to the famous quarries on Fossil Ridge. Royal Ontario Museum parties continue to find new Burgess Shale sites today under the leadership of Jean-Bernard Caron.

New discoveries, most recently in the Ordovician of Morocco, have kept Burgess Shale-type fossils at center stage ever since so it's not surprising that my fascination with these animals has persisted. But I soon realized that to understand and interpret soft-bodied fossils we need to investigate the processes involved in their preservation. This led to other field work, analyses of specimens, and laboratory experiments which revealed the pattern and rate of decay, the role of authigenic minerals in preserving soft tissues, and the chemical changes that explain the survival of more decay-resistant organic features such as cuticles. So while I started with the Cambrian I've worked on exceptional preservations through the fossil record right up to phosphatized seeds in a 10th Century cess pit!

Q: In 1983, you described the conodont animal from a specimen that had lain unrecognized in a museum collection since the 1920s. Similarly, John Ostrom discovered in 1970 a specimen of *Archaeopteryx* which had been mistakenly described as a

Briggs Interview, cont.

pterosaur more than one hundred years earlier. I think the general public sees museums as repositories of known information, but these examples show that they are also repositories of information waiting to be discovered. As the former director of the Peabody Museum of Natural History, what is your view on the purpose of museums? In what ways will museums of the future be different from the way they are now?

A: Natural history collections, and not just those of fossils, have immense potential for answering new research questions. The conodont animal is a good example of something that was waiting to be discovered (in the British Geological Survey's collections in Edinburgh), but there are many others: think of the impact of Walcott's Burgess Shale collections at the Smithsonian. The best natural history museums are multipurpose – their collections capture the nature and history of life on our planet, their exhibits excite and engage the public and, directly or indirectly, they educate both young and old in the conservation challenges that face us today. The museums of the future will embrace digitization and computer technology. More and more collection data are already on line, with images, and are accessible not just to researchers but also to the general public, and internationally. This development will ensure that collections enjoy many more visitors even though the majority of those visits will be virtual. The data can be used to answer a variety of questions, about distribution in time and space, for example, and shifts in response to environmental change.

Exhibits are also being transformed by technology. Given the public's fascination with real artefacts (something we know from our experience with Marsh's dinosaurs at the Peabody Museum) museums must continue to display original specimens – the genuine objects. But computer screens can add a new dimension by conveying interpretations in a way that allows them to be interrogated by the public and, equally importantly, they make it easier to update information as new discoveries are made. Temporary exhibits, which involve a major investment of time and money, can live on in virtual versions. In my experience curators and collections managers, educators and designers, have any number of innovative ideas about using specimens to inform the public – we just have to find those generous donors who can make it possible.

Q: Many of your published works are taxonomic. Recently, the decline in the number of taxonomists (and of resources devoted to taxonomy) has received a lot of attention. Despite this, I think it's fair to say that we have not yet witnessed the rebirth of taxonomy. In your view, what are the causes of this decline, and what are the best ways to reverse it?

A: I described systematics as 'the *sine qua non* of paleontology' at a symposium on *Paleontology in the 21st century* in Frankfurt nearly twenty years ago and my view has not changed since. But the days when major museums could employ specialists to cover all the major taxonomic groups have largely gone. Now that we measure research in terms of numbers of publications and impact factors, taxonomy has become a brave route to a career in paleontology (a large monograph on a fossil group takes a great deal of time to prepare and, even though its shelf life may be long, it will attract relatively few citations). The decline in taxonomy (or taxonomists) has coincided, ironically, with increasing interest in phylogenetic analysis, driven by molecular methods, and with the rush to document biodiversity before organisms are driven to extinction. The way to maintain taxonomic research in paleontology, and this is increasingly happening, is to frame projects with a substantial element of systematics in the context of a wider question - such as extinction, climate change, or the evolutionary history and phylogeny of major groups. And the digital age helps taxonomists in a number of ways. It allows easier access to literature and to information about museum collections. On-line publishing makes it possible to publish long densely illustrated manuscripts without the prohibitive costs of printing. And monographic treatments can be published incrementally, group by group, as is now the practice for the *Treatise on Invertebrate Paleontology*.

Q: You were an editor of both *Palaeobiology: A Synthesis* in 1990 and of *Palaeobiology II* in 2001. If there were a *Palaeobiology III*, what new chapters might it contain? In other words, what have been the most exciting developments in paleobiology over the past ten or so years?

A: The aim of those two books was to provide compilations of short articles, written by leading specialists, for students. The first one sold more than 5000 copies, but sales of the second were less than half that, largely because the internet had changed how we use libraries during the intervening ten years. The plethora of on-line resources - reviews and commentaries in journals, blogs, and museum websites, not to mention *Wikipedia* – has made big reference books largely obsolete, so there won't be a *Paleobiology III*! As to identifying the most exciting developments over the last ten years – that would depend on who is making the list. But here are just a few of the topics that were not in *Palaeobiology II* but would definitely be in my (imaginary) *Palaeobiology III*: The chemistry of the Precambrian atmosphere and oceans, and its impact on the evolution of life; Biomarkers and the

Briggs Interview, cont.

timing of metazoan origins; Fossil evidence for the early evolution of the brain; Anomalocaridids; Fire in the fossil record; Early tetrapods; Sequencing the Pleistocene (the impact of ancient DNA); Developmental biology and paleontology; Ecological Niche Modeling; The Great Ordovician Biodiversification Event; Silurian soft-bodied fossils from Herefordshire; Ecosystem engineering; Reconstructing color in fossils (feathers and insects); Dinosaur biomechanics; Isotope proxies in paleontology; Conservation paleobiology; Stemward slippage – the impact of missing data on phylogenies.

Q: Are there areas of paleontology that in your opinion we, as a field, have not paid close enough attention to? Another way to put this is, if you were the King of Paleontology, to what areas would you direct resources?

A: The hope would be that the King could find more funding for paleontology! We need to continue exploring. New fossil discoveries are the lifeblood of our discipline; without them we can come up with new questions, but we are dependent on existing specimens to answer them. And we need to capitalize on new methods of analysis and imaging. But in what area should we direct resources - that's a question you should ask my postdocs and graduate students – and be prepared for many different answers!

2015 Paleontological Society Award Recipients

Jack M. Wittry
The Field Museum
Strimple Award

Jonathan Payne
Stanford University
Schuchert Award

Derek Briggs
Yale University
Paleontological Society Medal

The Paleontological Research Institute
Ithaca, NY, USA
Pojeta Award

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Book Reviews

Emsian Ammonoidea and the age of the Hunsrück Slate (Rhenish Mountains, Western Germany)

De Baets, K., C. Klug, D. Korn, C. Bartels, and M. Poschman. 2013. *Palaeontographica Abteilung A* 299: 1-113.

Reviewed by Joshua Slattery (Univ. of South Florida)

The Hunsrück Slate of Germany preserves one of the most extraordinary early Devonian marine faunas in the world, renowned for its excellent soft-tissue preservation of fossil invertebrates and vertebrates. Extensive focus has been given to this Lagerstätte's more extraordinarily preserved fossil groups such as the echinoderms, annelids, and arthropods, while relatively little attention has been dedicated to its less prominent, but equally important faunal components such as the mollusks. De Baets et al. (2013) fills in part of this knowledge gap by describing the ammonoids of the Hunsrück Slate. These specimens are among the oldest known members of this important group and reveal new information about their biostratigraphy, biogeography, taphonomy, and evolution during the Devonian nekton revolution. In addition to systematically describing this early ammonoid fauna and its paleobiology, the authors also provide a critical discussion on the age and global correlation of the Hunsrück Slate and its fauna.

In this seminal monograph, De Baets et al. (2013) begin by introducing the reader to the importance of the Devonian Hunsrück Slate and to the ammonoid fauna's early evolution and diversification. This proceeds into a detailed description of the materials and methodology used by the authors to describe the shell morphology of these ammonoids. In this section, the authors introduce several new parameters that can be utilized to quantify changes in coiling and rib spacing in both well-preserved as well as deformed ammonoid specimens. If nothing else, these new techniques are among the most important parts of this contribution, making this a necessary read for any one working with fossils with different levels of deformation as is common in many assemblages.

This is followed by a well-referenced and detailed description of the geological and depositional settings, lithostratigraphy, as well as biostratigraphy of the Hunrück Slate and its ammonoid fauna. By itself, the biostratigraphy section is one of the most significant parts of this volume (as also exemplified by the title), since it discusses the stratigraphic distribution of the ammonoids and other groups at different Hunsrück Slate localities. Even more importantly, De Baets et al. (2013) ties the Hunsrück Slate into a regional and global temporal framework making this work indispensable for anyone working specifically on this Lagerstätte, the Devonian in general, or the evolution of the earliest ammonoids.

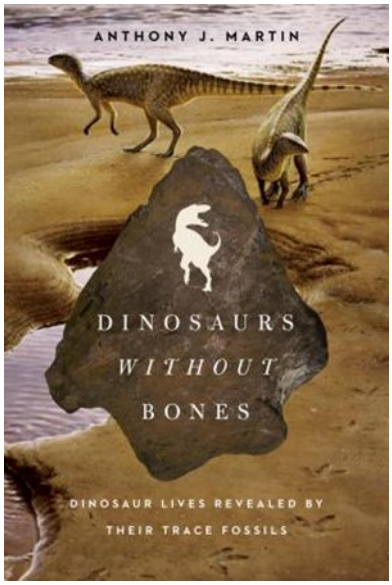
Unlike many monographs, De Baets et al. (2013) also provides a detailed description of the preservation and taphonomy of the Hunsrück Slate ammonoids, which, as with the rest of the fauna, is usually exceptionally well-preserved, especially in comparison to other early Devonian ammonoid assemblages. Here, the authors discuss different taphonomic grades (i.e., different styles of preservation) as well as the evidence for shell dissolution and compaction from the various localities. They also examine previous reports of soft-tissue preservation of ammonoids in this fauna, a critical question that has been raised in several different recent studies. This part of the paper should be of interest to anyone looking at any taphonomic aspect related to ammonoids, Lagerstätten, or just taphonomy in general. In addition to taphonomy, the authors provide an interesting examination on peculiar pitting marks on the internal molds of ammonoids, which they attribute to parasitic infestations. These sections are then followed by an important but brief discussion of the evolution of the Hunsrück ammonoid fauna as well as their phylogenetic relationships, which sets the context for the systematic descriptions found in the proceeding section. This monograph is then rounded off by an extremely detailed conclusion section, list of references, and various appendices about the Hunsrück Slate localities, their ammonoid faunas, as well as data about the specimens described in the monograph.

One of the best parts of this monograph is the numerous well-constructed figures, tables, and plates that are intended to help the reader conceptualize the various topics referred to in the text. Both the full-color and gray-scale figures are of high-quality and concisely convey the information described in the text. The high-resolution plates at the back of the

Book Reviews, cont.

monograph show examples of the ammonoids described in the text and clearly show the morphology of the Hunsrück Slate ammonoids. Furthermore, the authors also include a full-color artistic reconstruction of the various Hunsrück ammonoids and a restoration of the Hunsrück Basin paleoenvironment during the Early Devonian, which instantly grabs the attention of any reader.

In general, De Baets et al. (2013) is an extremely well-written, well-researched, and significant contribution to the paleobiology and geology of the Hunsrück Slate as well as to the understanding of the evolution of one of the earliest ammonoid faunas. The high-quality figures, tables, plates, and ammonoid reconstructions make this monograph an admirable piece of work that other workers should use as a model in their own endeavours. De Baets et al. (2013) is recommended to anyone fascinated in early ammonoids, their evolutionary transition from nautiloids, Devonian biostratigraphy, the Hunsrück Slate, Lagerstätten, and the Devonian.



Dinosaurs Without Bones: Dinosaur Lives Revealed by Their Trace Fossils

Martin, A. J. 2014. Pegasus Books, New York, 460 pp. ($25.12 cloth, $15.22 paper, $9.99 e-book).

Reviewed by James O. Farlow (Indiana-Purdue University Fort Wayne)

The average non-professional dinosaur enthusiast undoubtedly understands the importance of dinosaur skeletons for reconstructing dinosaurs as living animals. Martin's breezy little book should persuade such dinofans that there is also information that can be learned about the "fearfully great" reptiles from the more indirect traces they left in impressionable substrates. The book is partly a review of the literature, and partly a memoir of Martin's own experiences in researching dinosaur traces.

Martin begins by describing the most obvious kinds of dinosaurian trace fossils, their fossilized footprints and trackways. He presents a nice introduction to how dinosaur tracks are made and preserved, how their makers are identified, and what tracks reveal about how dinosaurs walked, ran, swam, and rested, and the extent to which different kinds of dinosaurs were solitary as opposed to gregarious animals. Martin then presents a case study of the interpretation of a controversial dinosaur tracksite, the famous Lark Quarry of Queensland, Australia. This remarkable locality preserves a huge number of footprints, mostly of small dinosaurs, as well as the trackway of a much larger bipedal dinosaur. The site was originally interpreted as recording a stampede of the smaller dinosaurs that fled in panic from a big meat-eater. More recently, the big meat-eater has been reinterpreted as a big plant-eater, and the many small footprints as having been made by swimming as opposed to running animals. Martin does not reach a final verdict over any of these matters, but fairly describes the evidence adduced by each camp. In a later chapter, Martin returns to dinosaur tracks as he describes his field experiences during discovery of the best set of dinosaur footprints presently known from another part of Australia, the Victoria coast.

Footprints are just the beginning, however. Martin also describes dinosaur nests and eggs; burrows; bite marks, poke marks, and other kinds of injuries (with bones being the substrate in which the traces are preserved); gastroliths; bromalites, enterolites, cololites, regurgitates, and coprolites. He considers several interesting questions that have been, or potentially could be, investigated using such traces. Did pachycephalosaurs butt heads? Did ceratopsians fight conspecifics or predators with their horns? Did tyrannosaurs hunt live prey, or merely scavenge? What kinds of foods are herbivorous and carnivorous dinosaurs known to have eaten? How did dinosaurs digest their food?

One of the more interesting features of the book is that Martin predicts what traces made by dinosaurs in the very acts of mating, egg-laying, hatching, and puking would be like: "I am encouraging everyone interested in dinosaurs to speculate about behaviors dinosaurs may have done and the traces that resulted from these behaviors. In the spirit of leading by example, I've done a few flights of reasonable fancy in this respect throughout the book, with the hope that more people will do the same" (p. 370). Initially I found this speculation off-putting, because the odds that such behaviors would result in preservable traces seem pretty remote—something that Martin duly concedes. By the end of the book, however, I had changed my mind. Maybe the chances of finding such

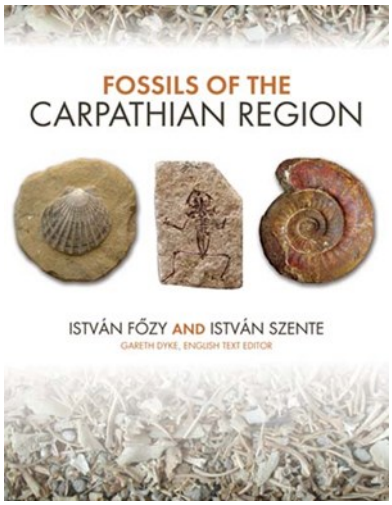
Book Reviews, cont.

distinctive traces are indeed low, but if we don't know what to look for, we will definitely not recognize them if we ever do encounter them.

In the final chapter, Martin shifts hermeneutic gears. Instead of considering how traces help us interpret dinosaur biology, he speculates about the traces the very existence of dinosaurs may have imposed on their environment and even the course of evolution. Might the huge size of sauropods, and their presumed numbers, have created game trails on the landscape that altered the topography and shapes of lagoons and rivers? Did eruptions from dinosaur guts modify the composition of the atmosphere enough to affect the climate? To what extent did the presence of herbivorous, and even carnivorous, dinosaurs affect the evolution of floras?

There are several features of Martin's book that I very much liked. I enjoyed his accounts of the way invertebrate body and trace fossils corroborate interpretations about dinosaur nesting sites and coprolites. I appreciated the fact that Martin described traces made by Mesozoic and Cenozoic birds as one more category of dinosaur trace fossils; many authors strike me as lacking the courage of their cladistic convictions by failing to include birds—especially Cenozoic birds—in their treatment of dinosaurs. A color insert illustrates many distinctive kinds of dinosaur traces in an attractive manner. Martin is generous in giving credit where it is due to the research of other paleontologists, and his endnotes cite many useful references.

There is, however, one feature about which some readers may be ambivalent. Martin frequently makes jokes, and some of his quips are LOL funny, but many are just plain groaners: "In all of Australia, not one study has been done on dinosaur toothmarks. Not a single dinosaur coprolite has been interpreted. It's almost as if the dinosaurs in Australia didn't give a crap" (p. 270). Or: "the editor then told us the paper was 'rejected,' but encouraged us to resubmit a revised article. It was like being told by a date that he or she thinks you're ugly, smelly, and stupid, but would like to go out with you again, just as long as you lose some weight, take a shower, and start playing Sudoku" (p. 148). Or: "Paleontologists [who try to do research on what a sediment trace made by a urinating dinosaur would be like] could be assured of making a big splash with it, while going against the flow of others' prejudices. Afterwards, they will be flushed with success, and their colleagues pissed off" (p. 247). There are cracks of this caliber throughout the book; readers in touch with their inner middle-schooler will love them; others may think that a little bit of that kind of humor goes a long way.



Fossils of the Carpathian Region

Főzy, I. and I. Szente. 2014. Indiana University Press, Bloomington, IN, 508 pp. ($77.00 cloth, $62.99 e-book with 30% PS discount.)

Reviewed by József Pálfy (Eötvös University, Budapest)

How to turn the inventory of the fossils of a country into a heavy volume with a wealth of information, illustrated by zillions of beautiful pictures, while recounting mosaics from the history of life as well as the history of its students? This recently published volume tries just that, and takes the reader of the IU Press "Life of the Past" series to the heart of Europe. Hungary is a small country now (nearly the same size as Indiana), nested in the Carpathian Basin, surrounded by mountain ranges shaped by the Alpine orogeny. The country was part of the Austro-Hungarian Monarchy at the golden era of paleontological exploration before World War I, but 20th century European history spilled some of the fossil localities to five of its neighbors today.

The rich fossil heritage of the region is neatly organized in this book by chronology and systematic groups, trying to treat even-handedly the microfossils, marine invertebrates (and the occasional marine vertebrate), land plants and terrestrial vertebrates. Fossiliferous localities, big and small, are presented with enough geological context to understand the broader significance of the finds. Weaved in are portrait gallery boxes which introduce the paleontologists responsible for gathering the subject of the book, and colorful anecdotes add a human touch here. The misbalance of the regional stratigraphic record is mirrored in the book where a mere 22 pages are devoted to the Paleozoic, far outweighed by nearly 200 pages each for the Mesozoic and Cenozoic.

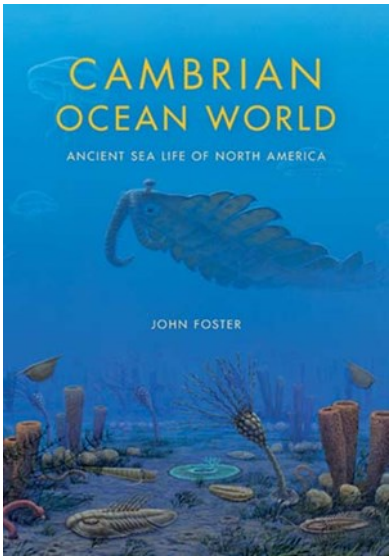
To single out highlights is no easy task but you would certainly wish to learn about the "pebble-toothed pseudoturtle" (*Placochelys placodonta*) for both its funny name and

Book Reviews, cont.

scientific significance. Or admire the diversity of Mesozoic ammonoids. Or at the young side, meet Rudi and Gabi, 10-million-year old primates from Rudabánya, who may have strolled along the shore of Lake Pannon, a large, long-lived lake that harbored endemic mollusk faunas providing textbook examples for evolutionary studies.

Well received in its two earlier Hungarian editions at home, this book was definitely worth taking to the American and international readership. The authors are genuine fossil enthusiasts, knowledgeable researchers, and entertaining storytellers. Thanks to editing by Gareth Dyke, the English text flows so well that it's hard to notice that it is a translation.

Perhaps the only thing I find it difficult is to identify a genre for this volume. A multifunctional encyclopedia for connoisseurs of fossils, it has something for many tastes, serving as a reference, an educational resource, or a pretty picture book. This book will look smart either on your coffee table or on your bookshelf, both at home and in the office. Browse it long enough and you will inevitably develop an itch to go and explore for yourself this small pocket of Central Europe, so full of fossil treasures and a rich history of their research.



Cambrian Ocean World

Foster, J. 2014. Indiana University Press, Bloomington, IN, 432 pp. ($45.50 cloth, $38.49 e-book with 30% PS discount.)

Reviewed by Claire H. Milne (Stockton, CA)

Every so often a book comes along that neither talks down to the reader nor presents material in words essentially meaningless to a reader whose interests and pursuits have been in other areas. *Cambrian Ocean World* is such a book.

The complexity of all the factors that made up the Cambrian Period, and particularly the "Cambrian Explosion" of animal life, is logically and sequentially organized so that each chapter is built on the contents of preceding chapters. What makes for exceptional clarity and all-around understanding is the inclusion in a chapter of three elements: the work of researchers who laid the foundations of geology and paleontology, the use of a particular site as exemplary of aspects of geology, and an in depth description of the biota. Dr. Foster, however, has brilliantly succeeded in including the reader as well through vivid descriptions of the rocks that once were the sandy or muddy sea floors of Laurentia, the continent we now call North America.

Each chapter includes such an extraordinary abundance of interesting information, that the references included here can only be regarded as very small samples, chosen out of a very large body of information contained in each chapter.

In his preface Dr. Foster writes that he does not assume all his readers will have had a background in geology and biology, and so begins by introducing a concept put forth 300 years ago by the Danish physician Steno, on which all subsequent work in sedimentary geology rests: sedimentary rocks are made up of particles deposited in flat, horizontal layers, and the lowest layer of a vertical sequence is the oldest. Like the stacking of the beds themselves, understanding of what they represented emerged gradually, each early stratigrapher building on what his predecessors had contributed.

In the 18th century, James Hutton established a further landmark concept, Uniformitarianism, based on his belief that geologic processes have operated in the same way throughout Earth's history. The sequence of the particles eroded from a rock being deposited and solidified as part of yet another sedimentary rock is a cycle that once realized, greatly helped understanding of the beds that make up formations.

Building on these concepts, William Smith, a 195h century English surveyor, observed in the course of his work, that if a certain fossil were found, for example, in the lowest bed of a formation, if present in another formation, it would be found in that formation's lowest bed. This is the principle of faunal succession. By enabling geologists to correlate rock layers at distances from each other, it provided the means for geologists to divide past time into eras and periods.

Moving through this chapter, we read of the methods and tools geologists use in their research: the geologic time scale, radiometric dating, and paleogeography, which is accompanied by fine clear illustrations of the Cambrian world and of the Cambrian in North America.

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In the section headed "It's a Trap," Dr. Foster effectively demolishes the belief of some that the extinction of an animal is brought about by some deficiency in the animal itself. This is not true. Extinction follows if the environment to which a species is adapted changes at a pace too rapid for adaption to occur. The causes of change in the environment could range from the food source the animal depended on disappearing, the loss of fresh water sources in the area, or drastic changes in temperature, and changes such as these can happen relatively quickly even in the context of geologic time.

If one has learned to read the rocks of the strata that layer upon layer form the Grand Canyon, it is possible to put together what Laurentia looked like at the beginning of the Cambrian period, 542 million years ago. In Chapter 2 ("Into the heart: Cambrian geology"), we accompany the author on a hike down into the depths of the canyon, a hike so vividly described that we seem to be hiking right along with Dr. Foster.

Our descent ends when we have reached the level of three formations that came into being at the very beginning of the Cambrian period, known as the Tapeat Sandstone, the Bright Angel Formation and the Muav Limestone. Together they form the Tonto Group. The sandstones, shales and carbonate rocks that make up the formations have helped greatly in establishing a geological picture of Laurentia during the Cambrian as during this period the sea water flooded the continent in successive episodes, until toward to end of the period Laurentia was almost entirely under the sea.

When sandstones and shales are formed on the seabed from particles eroded from land, the heavier ones will settle first in areas of high-energy, such as wave action along beaches, and add to the formation of sandstone, while the lighter particles are carried farther out to sea into deeper water becoming part of a bed of shale. The formations of the Tonto Group are stacked one on top of another. The Tappets Formation, the one at the bottom of the pile is the oldest. It is made up of sandstone, which indicates to the geologist that it was formed in the shallow water of a nearshore site The next layer up, the Bright Angel Formation, is composed of mud and sand characteristic of deeper water, while the uppermost bed is made of carbonates from yet deeper water.

The location of the formation had not moved, but the rock types in the formations did, and they reflected successive depths of sea water. A German geologist, Johannes Walther had an answer for all this. His observation, known as Walther's Law explains that if the site of a sandy beach is covered with the water of an ever more encroaching sea, it will eventually be under the depth of water that holds particles of silt. Dropped on the sand layer which solidifies as sandstone, the silt particles which formed the shale beds were brought by the ever deepening water of the sea as it covered more and more of Laurentia

Four billion years ago Earth coalesced from matter existing at the site of our solar system. The Cambrian Period began 520 million years ago. Considering that 80% of Earth's history occurred before the beginning of the Cambrian Period, the author invites us in Chapter 3 ("A long strange time") to explore this vast stretch of time, and we begin with a drive from Grand Canyon to Glacier National Park in Montana.

At the park, on our hike along the Highline Trail, we notice round forms bearing concentric wavy lines in the limestone along the way. These forms are stromatolites, fossils of matlike colonies of cyanobacteria, photosynthesizing bacteria whose mats, alternating with layers of sediment, had fossilized. These organisms lived in the Precambrian of 1.1 billion years ago, and remarkably enough, are with us still.

However, to understand the Cambrian Period, we must take another journey, and travel into deep time to the Hadean Eon, the first of four eons into which time is divided. Earth's surface provided no shelter from volcanism and the constant bombardment of solar debris 4.6 billion years ago. The atmosphere was composed of carbon dioxide, water and dust with a generous admixure of methane, hydrogen sulfide and ammonia. Life would have to wait.

The next eon, the Archean, began about 4.0 billion years ago, and it was not much more hospitable to life. The oceans were as acidic as lemon juice, and in some places extremely hot. However, structures that have been interpreted as bacteria have been found, although this identification is still disputed.

The Proterozoic eon began 2.5 billion years ago and about 2.2 billion years ago oxygen began to be produced by bacteria. The evolution of photosynthesis, called the oxygen revolution, probably increased the rate at which organisms grow and reproduce a least 100 times,

The history of Earth's continents themselves is one of the joining together of continents into one supercontinent, which ultimately breaks up into smaller continents. They exist separately for a time, but then regroup to form yet an-

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other supercontinent. During the Proterozoic the supercontinent Rodinia broke apart, followed by the pieces joining up again to form a continent called Pannotia. During the Cambrian Period Pannotia, following what seems to be a habitat with continents, broke apart into a new constellation of continents, among them Laurentia. Our North American continent finally settled straddling the equator.

From 850 million to 635 million years ago Earth was one big snowball. This was the Cryogenic period, and our planet was covered with miles of ice over continents and sheets of ice over the oceans. Tillites, the rocks and stones dropped by glaciers as they melt, are found all over the planet, even at the equator. Microbial life survived, perhaps in the warmth of such places as deep water vents. It is astonishing to learn that the drastic drop in temperature occurred within a 2,000 year period. As yet, there is no answer.

Just before the start of the Cambrian period, the Proterozoic produced fossils of leaf-shaped, disc-shaped, and air-mattress-shaped life forms. the Ediacarans. First found in Newfoundland in 1872, the fossils are found in sites scattered all over the world, and there are over 200 named species. The researcher Dolf Seilacher had proposed the name Vendobionts for these organisms, and believed they are organisms entirely apart from animals and plants. The question of what these organisms were is still open. Some believe that they never made it past the Precambrian-Cambrian boundary, and thus left no descendants. On the other hand, the possibility that Ediacarans may be early members of animals still here has been offered. Other suggestions include Ediacarans as relatives of fungi, or even giant amoebae.

In chapter 4 (“Welcome to the boomtown”) We are now at the threshold of the Cambrian period, and we have been well -prepared to fully appreciate the extraordinary explosion of life during that unique period, and the phyla that came into being during the Cambrian that are with us still.

Ediacaran fauna overlapped with the animals of the earliest Cambrian for quite a while. There was no sudden disappearance at the Precambrian-Cambrian boundary. However, when the Ediacarans finally did vanish from the record, we find that they had been replaced by a miscellaneous collage of bits and pieces of shells and fragments of plates and skeletal remains, all of which are included under the umbrella term “small shelly fossils”. Some of them are identifiable, such as pieces of mollusc shells and others are fragments of unknown animals. Their presence however is important, as animal groups already so diversified in early Cambrian times must have had roots in the Proterozoic and were not newly evolved.

Trilobites from their first appearance in the fossil record were fully evolved and had begun to diversify. There are no fossils of half-way stages, of forms-in-progress, for which there is no definite answer but several hypotheses: the earlier trilobites might have been too small and too few, and as such, they just haven’t been found yet. During their long tenure on Earth, which ended with the Permian extinction, trilobites evolved seemingly endless variations of the trilobite ground plan. Dr. Foster has provided excellent illustrations and descriptions of trilobite biological systems, of their remarkable eyes, seemingly adapted to very special niches and their efficient suit of armor, their exoskeleton.

This chapter belongs to the trilobites, which are intriguing in so many ways. Yet they shared the Cambrian oceans with an ever increasing diversity of fauna. There were species of hyoliths, brachiopods, mollusks, sponges and many species of arthropods. However, it is the “bugs” that have captured the interest of many in much the same way as have dinosaurs.

Chapter 5 (“On top of the world”) starts with the nineteenth century, in Pioche, Nevada, which was a rip-roaring mining town, for the Cambrian formations in the area were rich with intrusions of silver. But there is more, for these formations, particularly the Pioche Formation, have produced exceptionally fine and abundant fossils of the Middle Cambrian on the continent.

We take a trip into the Chief Range, southwest of Pioche, to an extraordinarily rich site called Ruin Wash. Here can be found eight species of trilobites, and as the site contains the worm *Ottoia*, a soft-bodied animal, it is also counted as one of the Burgess Shale-type sites. The bivalved arthropod *Tuzoia* is found here, a fossil that seems to be quite a globe-trotter, as it has turned up in the Burgess Shale of British Columbia, Australia and China.

However, in order to visit formations of the Spence Shale, another rich Middle Cambrian site we must travel to is in the Bear River Range of Idaho where the Langston Formation has provided abundant trilobites, hyoliths and brachiopods. This shale was probably from a relatively deep, farther offshore site where the conditions provided rapid burial and a low oxygen level for good preservation. The Spence Shale is found in many places in Idaho and also in Utah. It also was

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an excellent preserver of a wide range of fossils, among them algae, cyanobacteria and annelid worms.

The end of the chapter discusses trace fossils, the trails, footprints and burrows that animals made in mud flats and beach sand, fossils made not by the bodies of animals but instead by what they might have been doing.

Chapter 6 ("Magical mystery tour) focuses on the Middle Cambrian, where a steep slope on the shallow water shelf along Laurentia's coast existed. The base of this escarpment provided a habitat but had the downside being subject to the mudslides coming down from the slope. The quick burials and the physical conditions at the site produced excellent preservation not only of animals with hard exoskeletons but also of the very rarely preserved animals with soft bodies. And so it happened that the wonder-world of Cambrian ocean fauna , the Burgess Shale Fossils, was left for us on the slopes of Mount Stephen, in Yolo National Park in British Columbia

Charles D. Walcott had taken over as Secretary of the Smithsonian Institution. He had for many years been an indefatigable collector of fossils all over the West, indeed many of the sites visited in this book had been discovered by him. In 1909, he and his family (a remarkable one) while doing field work on Mount Stephen discovered what has become known as the Walcott Quarry. A fossil found along the trial on Fossil Ridge open the flood-gates for the tens of thousands of fossils collected from the Walcott Quarry in the years following.

The abundance of the fossils, however, is overshadowed by their new, strange and just plain weird appearance and the stories of paleontologists trying to make some reasonable sense out of them. Consider the tale of *Anomalocaris*. This animal was finally assembled from parts of it, scattered throughout the Burgess Shale. One part, identified as a shrimp turned out to have been the animal's feeding appendage. Another part, thought to be a jelly fish, was identified finally as the animal's mouth. Eventually all the parts were sorted out and assembled into one fantastic-looking animal and named *Anomalocaris*.

Then there is *Hallucigenia*, a caterpillar-shaped animal which had achieved stardom in Stephen J. Gould's *Wonderful Life*. It was first reconstructed with its rows of spikes placed on its underside which were used as stilt-like legs with the lobe-like appendages on the upper side. The appearance was indeed bizarre and a bad dream-like quality However, when subsequently the animal was turned upside down, the former stilts became spikes bristling from the upper side and the lobes became proper legs.

When the paleontologist Harry Whittington presented *Opabinia* in a talk to the Paleontological Association in 1972, he was greeted with laughter. At this point, I must refer you to the drawings of two *Opabinia* on page 226, as it is difficult to do justice to the appearance of an animal with five eyes, and with a proboscis emerging from its head with a grasping capability. There is still a great deal of debate about this animal's morphology, which is quite understandable.

Dr. Foster has provided in his first two chapters, excellent, comprehensive introductions to both biology and geology, Well prepared, the reader can onward with confidence. Figure 6.34 on page 241, however, shows several cladograms. and a discussion of arthropod systematics follows. However, some readers without familiarity with cladistics and cladograms might find the discussion difficult to understand. The glossary does give a good definition for "stem group" and for "crown group", but an explanation of cladistics and its terminology included in one of the first chapters would be of great help.

Toward the end of the Middle Cambrian, probably by tectonic faulting ,a bay-like area of water deeper than that of the surrounding continental shelf formed. Mud slides down the sloping sides of this embayment provided quick burial of the animals living at the bottom, echoing the preservation of the fauna of the Burgess Shale. This area is now the site of the House Range of Utah and of the Wheeler, Marjum and Weeks formation, the focus of chapter 7 ("Glory Days").

The shales of the Wheeler Formation have provided intact trilobites in super abundance, and the trilobite *Elrathia kingii*, writes Dr. Foster, enjoys the distinction of being the most widely sold trilobite on the planet. The conditions surrounding the quick burials also permitted the Burgess Shale: preservation of soft-bodied fauna and animals with unmineralized exoskeletons, an occurrence of immense importance to paleontology because it happened so rarely. However, the House Range has been generous indeed to paleontologists, for overlying the Wheeler Formation in the same embayment, the Marjum Formation's quarries have provided not only trilobites, but the Burgess Shale-type preservation of soft-bodied fauna.

During the last millions of years of the Cambrian, ever-rising sea-water flooded Laurentia so far into the interior of the continent that sandstone formations of Wisconsin and Min-

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nesota contain jellyfish fossils, and other Late Cambrian fossils are found in every part of North America.

Returning with Dr. Foster to the House Range of Utah in chapter 8 ("Taking off"), we find that during the Late Cambrian a formation known as the Weeks Formation was deposited over the Wheeler and Marjum Formations, which we visited in the prior chapter. Trilobites are present in this formation, but the small, black shells of brachiopods are present in extraordinary abundance in the Weeks Formation. Brachiopods look superficially like clams, but have a phylum of their own. Known as lamp shells, they are still around today, living on our sea floors. It is regretted by many that trilobites became extinct at the end of the Paleozoic Era

We have reached the boundary between the Cambrian Period, when nearly every phylum that was to call Earth home for the next 482 million years had evolved in the Cambrian ocean world and the Ordovician Period, when the phyla gained ecological complexity and diversity.

The previous chapters have dealt with the 58 million years fossil record of the Cambrian period. In chapter 9 ("Home by the sea"), Dr. Foster looks a bit farther into the record, considering not only the animals and their environment, but what their presence or absence can tell us about evolution itself.

Taxonomic diversity is discussed, with special emphasis on the importance of the Burgess Shale-type deposits, including as they do soft-bodied animals as well as trilobites and animals with shells, and taphonomy, the study of what happens to a dead animal's body until its fossilization.

Throughout the book Dr. Foster has included references to how geologists and paleontologists approach their work. However, this quote is included here because it seems to be the very basis of all good science:

> 'There are many things that we do not know, and that we cannot know, but the way to deal with that is to be rather explicit about what we don't know, what we are assuming, and to quantify things as much as possible in our work. This is yet another example of how science works—the more open we are about what we don't know, the more likely we are to ask the right questions that eventually lead us closer to an answer."

Most of the animal phyla still with us appeared within 10 to 15 million years during the early Cambrian (and latest Ediacaran). Although life in the form of cyanobacteria has been traced to the Proterozoic of 1.9 billion years ago, there was little change during that long period. Many explanations of the Cambrian explosion have been proposed and debated, but Dr. Foster suggests as most likely candidates the acquisition of genetic capabilities by organisms in the form of increased numbers of genes, which necessarily evolved before the diversification could occur, and an increase in the number of binding sites since an organism's ability to develop directly correlates with these sites. Dr. Foster offers a second possibility, and a very interesting one, suggesting that the eating of large food (macrophagy) seems to have played an important role. The first macro-predators dined off zoo-and phytoplankton, but as they became larger with time, other metazoans were forced to find defenses against predation with the armor of hard exoskeletons, ways of being able to burrow deeply and the acquisition of eyes and other sense organs. Indeed, Dr. Foster writes that appearance of macrophagy was a key event in metazoan history.

Dr. Foster in the preceding chapters has given us an extraordinary view of the Cambrian Ocean World. We have been introduced to aspects of biology and geology and have joined him in trips through the West and British Columbia to the sites of particular significance. We have gained a deeper understanding of the Cambrian explosion, which was not a one-time event within a time-frame of 10–15 million years, but an extraordinarily complex aggregation of causes, which sometimes acted in concurrence with others and sometimes alone. It is a tangled web to unweave, but what a challenge for geology and paleontology!

Chapter 10 ("On and on") is Dr. Foster's "Where are they now?" chapter, as he traces the further history of all the phyla we have come to know. In the 488 million years since the end of the Cambrian, the phyla have adapted to drastic changes in climate, have survived massive extinctions, have adapted to ever-changing environments and still remained faithful to their body plans. The survival of any species depends on how quickly it can adapt to a changing environment. In these times, this is something to remember.

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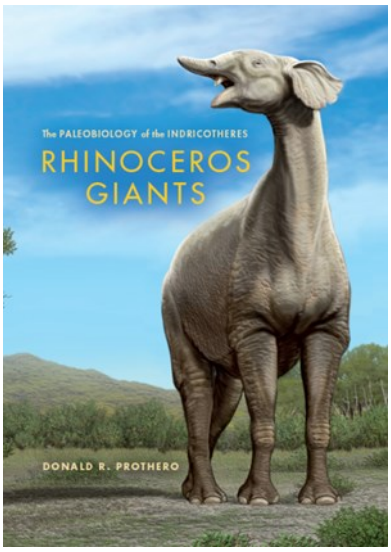

Rhinoceros Giants: The Paleobiology of Indricotheres

Prothero, D. R. 2013. Indiana University Press, Bloomington, IN, 160 pp. ($29.40 cloth, $24.49 e-book with 30% PS discount.)

Reviewed by Ephraim Nissan (London, England)

This is a very readable, and yet rigorous book about the giant hornless rhinoceros-relative *Indricotherium,* the largest land animal that ever lived, which it did in Eurasia about 37 to 23 million years ago. They stood 22 feet high at the shoulder, their skulls were 6 feet long, but as Prothero shows, their weight may have been overestimated.

Prothero is a prolific author. Mention of rhinos in the title will remind many readers that Prothero is an authority about Cenozoic rhinos. Cf. his book *The Evolution of North American Rhinoceroses* (Prothero, D.R. 2005. Cambridge University Press, Cambridge, UK), which I reviewed (Nissan, E. 2006. The rise and fall of the American rhinos. *Acta Paleontologica Polonica* 51: 350). In the preface, he tells us that his book about indricotheres "is the culmination of over thirty-five years' worth of research on fossil rhinoceroses." Chapters comprise catchily entitled sections. Among the other things we are treated to are informal, telling biographies of several paleontologists from past generations. For example, of Henry Fairfield Osborne, an effective administrator and fund-raiser, but now widely regarded "as a less-than-stellar scientist" (p. 8), we are told that his "huge scientific monographs on rhinos (1900), horses (1918), brontotheres (2 volumes of over 1,000 pages published in 1919), and the proboscideans (1936) were so full of errors and ideas that are unacceptable by modern standards that they have hindered research progress by decades" (p. 8), he "mistook a worn peccary tooth from Nebraska for an anthropoid primate" (p. 9), and yet, "[f]or better or for worse, every vertebrate paleontologist owes some of the prominence of our field to his work, and most of us have to deal with his published ideas many times in our own careers" (p. 9).

Chapter 1 ("Quicksand!") begins facing a photograph of a caravan. It is the American Museum Mongolian expedition from the 1920s, "with its Dodge cars and hundreds of camels". It resulted in a 1932 book by "the legendary explorer Roy Chapman Andrews (1884–1960)" (p. 1)—"The Real 'Indiana Jones'?" (p. 4)—a "massive volume with a very unpolitically correct imperialist title, *The New Conquest of Central Asia*" (p. 1). One of the discoveries was "Four indricothere limbs, standing vertically just as they were buried in quicksand" (p. 3). At the time, it was still known as *Baluchitherium*. "Although Andrews' storytelling skills are vivid, his account of the quicksand is a bit too much like the Hollywood film version, rather than one based on reality" (p. 2). Prothero explains how quicksand actually works. "In the case of this trapped indricothere rhino, it probably was mired down to its legs (as they found it), but the rest of the body would not have sank much deeper", and "the quicksand was thick and stiff enough to trap its legs in an upright pose" (p. 4).

Chapter 2, "Giant Hunters", "discuss[es] the places where [indricotheres] have been found and the nature of the fossils discovered thus far" (p. 17). The first section, "Pilgrim's Progress", discusses the Barbados-born British paleontologist Guy Pilgrim, whose work contributed also to oil geology. "Pilgrim is important to our story because he was the first to discover and name indricothere specimens, even though he did not realize it at the time" (p. 20). This was in what is now Pakistan. He ascribed his relevant finds as a new species of "a 'wastebasket' genus *Acerathrium* that was then used for nearly every hornless rhinoceros fossil of the Oligocene and Miocene in Eurasia and North America" (p. 20). The London-born Clive Forster Cooper—where *Forster Cooper* "is a typical double-barreled surname" (p. 21)—collected fossil mammals in Egypt, and later, in Baluchistan, he "collected a large series of skulls and partial skeletons of the gigantic rhinoceros for the first time" (p. 22); "he was the first to recognize that indricotheres were strange and very unusual rhinos that did not belong in the family Rhinocerotidae, even though he had only partial skulls and skeletons on which to base his research" (p. 24). Then Prothero explains the contribution of Russian scientists and the political constraints under which they had to work. The most complete indricothere skeleton known is displayed in Moscow (p. 27). It was Aleksei Alekseeivich Borissiak (1872–1944) who in 1916 introduced the genus name *Indricotherium,* "after the Indrik beast, a mon-

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ster in central Asian mythology that could fly over the clouds and caused the earth to tremble when it walked" (p. 26). Next, in a section entitled "Monsters of the Middle Kingdom", Prothero deals with fossils from China, and the emergence of a vivid community of local paleontologists, who, importantly, have a different understanding of what a genus and a species are, and therefore to this day are "oversplitters" in Western perceptions (cf. pp. 75, 83). "The Polish-Mongolian expeditions of the 1960s were famous for their dinosaur discoveries in Mongolia, but they found indricotheres too" (p. 34).

Chapter 3, "Lands of the giants", begins by relating how in Baluchistan, in what was then British India and is now southwestern Pakistan, a "soldier named Vickary brought back the first specimens in 1846, but they were so fragmentary that no one knew what they were" (p. 35). "What ancient environments were represented in the Bugti beds where these creatures lived? What other fossil mammals were found with the indricotheres, and what do they tell us about the ancient environments? How old were the deposits?" (p. 35). In the mid 1990s, a team led by Jean-Loup Welcomme, and later research in the Bugti beds of Baluchistan resulted in "new specimens, better stratigraphical control of the fossils, and a much clearer idea of their age" (p. 35).Between the middle Oligocene through early Miocene, "the climate supported a dense but dry subtropical to temperate forest" (p. 38). Prothero turns to Mongolia, and to the unlearning of old tenets such as "Chadronian equals early Oligocene" (p. 42), whereas by now the Chadronian of North America and the Ergilian land mammal age in Asia are understood to be late Eocene (p. 42). "One of the most striking results of this change in the time scales is that all the huge brontotheres of both North America and Asia, the largest land mammals that had ever lived before the Oligocene, have been re-correlated with the late Eocene, so there are no longer any Oligocene brontotheres (including the Asian embolotheres)" (p. 43); "only *Megacerops coloradense* remains as a valid name for Chadronian brontotheres" (p. 43). Such revisions affect the time scales of Mongolia as well (p. 44), and in China, too (p. 46). Then Prothero turns to Kazakhstan, and next, to Turkey: discoveries just southwest of Ankara "provide not only the furthest extension of the geographic range of indricotheres to the southwest, but also corroborate earlier reports of indricotheres from eastern Europe to the west of Turkey" (p. 51): there are reports from the former Yugoslavia, Bulgaria, Romania, as well as Georgia in the Caucasus.

Chapter 4 ("Rhino roots") is concerned with the broader taxonomic context of indricotheres. "Where did indricotheres come from? What features allow us to call these huge creatures without horns rhinoceroses?" (p. 53). "There are many distinctive features of the skull and skeleton that allow a paleontologist to recognize a rhino, but the easiest and most distinctive features to recognize are its teeth" (p. 54). Prothero discusses rhino radiation. It was from the hyracodonts that the indricotheres arose (p. 60). In the hyracodontine lineage, there was a specialization for running across plains. In a different lineage however, members became larger and larger. Earlier taxa such as *Forstercooperia* species (which vanished from Asia by the end of the middle Eocene) "still have primitive skulls without the high degree of nasal retraction (and therefore proboscis) that later indricotheres developed" (p. 61). In the late middle Eocene of Asia, a larger, cow-sized genus, *Juxia,* is found (in India and China). "Juxia already had evidence of the beginning of retracted nasals for a proboscis (Fig. 4.10), although it did not yet have the downturned snout seen in later indricotheres" (p. 61).

Chapter 5 ("What's in a name?") "lay[s] down the foundation of how we name animals and clear[s] up confusion in the names of these beasts" (p. 66). Along with the rules, interesting and often funny examples and anecdotes are given. Some of these are about awkward effects related to the abandonment of Latin or Greek etymology. Sometimes, scholars settled scores with rivals or a boss by means of names they gave some taxon.

Because of the rule of precedence and of overcoming the tendency to oversplit, the indricotheres of Baluchistan have to be formally called *Paraceratherium* (a name introduced in 1911), whereas *Baluchitherium,* introduced in 1913, has been considered invalid since the early and mid-1930s, and is only found now in popularizations, "even though no paleontologist has used it for almost eighty years and it has no validity in the scientific community" (p. 75). Some argue that *Indricotherium,* as described from north of the Aral Sea of Kazakhstan, is different from the Pakistani and Mongolian *Paraceratherium,* "and deserves to be recognized as a second valid genus" (p. 77). Others argue that there only is one valid genus of indricotheres, and that is *Paraceratherium*. Prothero sides with these, both on anatomical grounds, and because "each species of indricothere must have had a home range that was larger than that of any living mammal" (p. 84), owing to the size of the home range of a mammal being directly related to its body size. "Thus, indricotheres would

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have had home ranges of at least 1000 square km and maybe much more if their desert scrub habitats (see Chapter 7) had only limited trees and other resources. There would not have been enough room in Asia in the Oligocene to support more than a few populations of them, let alone many species and genera" (p. 84). Prothero rejects the counter-arguments that in the Miocene of Europe, several large genera of proboscideans, differing from each other in their anatomy, lived side by side: Prothero remarks that "these animals were all specialized in very different ways for different diets", and Europe in the Miocene had a "rich forest/parkland habitat" (p. 85), unlike "the desert scrublands of central Asia in the Oligocene" (p. 85) where indricotheres lived. Prothero concedes (p. 85) that apart from the species of the only genus *Paraceratherium,* maybe, just maybe, also *Dzungaritherium orgosensis* is also a valid genus and species alongside it. (On p. 86 however he spells *Dzungariotherium*.)

Chapter 6 ("Building a giant"), examines the anatomy of indricotheres closely. For example: "The hyracodonts, or running rhinos, are characterized by their unusually long metapodials compared to other rhinos. The indricotheres, even though they were far too large to be good runners (and probably had no real predators that they needed to run from [but elsewhere, Prothero mentions evidence of wounds from giant crocodiles, and that land predators were a danger for calves]), still retain this hallmark of their running ancestry, in spite of all the evolutionary forces that were molding their limbs to the elephantine 'graviportal' type" (p. 97). One of the sections is "Constraints on giants", and factors enumerated and discussed include thermoregulation, digestion, locomotion and home range, and predators and life habits, e.g., "in the Bugti beds there are gigantic crocodiles (*Crocodylus bugtiensis*) that are 10–11 m (33–36 feet) long! These would have been large enough to attack almost any indricothere that might be at the edge of the river to drink. Indeed, many of the specimens from the Bugti beds have crocodile tooth marks on them" (p. 103), as Prothero learned from Pierre-Olivier Antoine. In the next section, "Weight problems", Prothero first introduces constraints, and then sides with an estimate of 11–15 tonnes with indricotheres, rather than a higher estimate of 20 tons, which is an upper limit for land mammals (p. 106).

Chapter 7 ("Paradise lost"), discusses climatic change from the very warm earliest Eocene, to "The big chill" (as per a section title) in "the early Oligocene (about 33 Ma), the world of the indricotheres in Asia" (p. 109). The next section discusses differences with respect to Europe, and *La Grande Coupure* between the Eocene and Oligocene faunas. This is now understood to have occurred in relation to the global cooling even of the early Oligocene. "When the Oligocene glaciers advanced, they caused a global drop in sea level as they locked up a huge amount of water. This sea level drop probably opened land bridges between the European archipelago and Asia, allowing new animal groups to immigrate in huge numbers" (p. 115). Prothero then turns to how the fauna changed in the Asian Oligocene. And finally, in a section entitled "Where have all the giants gone?", Prothero dismisses some hypotheses for the causes of the disappearance of the indricotheres as found in the literature, and tentatively sides with the hypothesis—made by Putshkov and Kulczicki (Putshkov, P.V. and A.H. Kulczicki. 1995. The early Miocene drama: mastodonts against indricotheres. Vestink Zoologii 1995: 54–62) and Putshkov (Putshkov, P.V. 2001. "Proboscidean agent" of some Tertiary megafaunal extinctions. Pp. 133–136 in The World of Elephants. International congress, Rome)—of "competition from gomphothere mastodonts and their effects on the environment" (p. 119), in the early Miocene beds of Asia. Proboscideans are "capable of tremendous modification of the landscape" (p. 120), and "would have dramatically reduced the tree canopy on which indricotheres presumably fed" (p. 121). "Indricotheres are last known from the latest Oligocene Tabenbulukian stage in Asia, and so far as I know, there is only one place where mastodonts and indricotheres co-occur: the Bugti beds" (pp. 119–120). Reduced opportunity to feed would have reduced populations of indricotheres, making them "more vulnerable to other stresses, such as diseases, droughts, and especially new predators" (p. 121), large predators newly arrived into Asia that could take juvenile indricotheres. Prothero warns that such causal ascriptions are speculative.

There is a long bibliography (pp. 123–135), as well five pages of index. There are very few glitches I noticed. Lin Biao, unlike the "Gang of the Four", was not arrested (*pace* p. 32), but perished during an attempt to escape capture. Add the bracketed words in "when the closure and uplift [of the] Arabian Peninsula finally closed the opening to the eastern Mediterranean" (p. 119). On p. 50, "Borissak" should be "Borissiak". Fig. 6.3. on p. 91 shows a tooth, but the text on p. 104 refers to a "partial skeleton (Fig. 6.3)"; I reckon it should be Fig. 6.4 on p. 92. On p. 110, delete the comma from "Baja, California". Contrary to the reference in "giant deinotheres (Fig. 6.10)" (p. 120), that figure on p. 99 shows something else; rather, Fig. 6.11 on p. 104 was intended; its

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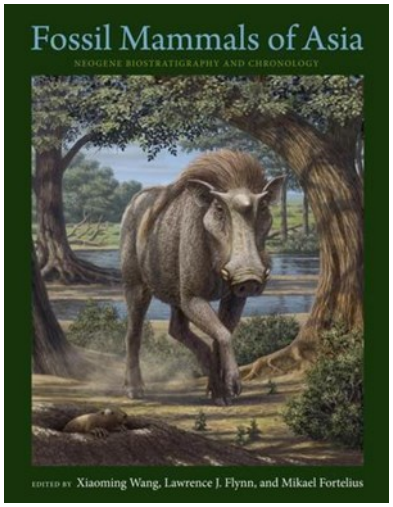
caption is "The giant deinotheres were primitive proboscideans with downturned lower tusks and were the largest land mammals in most of Eurasia and Africa during the Miocene, replacing the indricotheres".

The art on the jacket is by Carl Buell. I regret that important details in the lower part of the back cover were made semi-transparent and covered with information from the publisher. That same detail is repeated under the author's biosketch inside the jacket, but this does not make up for the waste of part of the cover art, which actually is especially remarkable as it reflects Buell's good understanding of anatomy, and offers an interesting interpretation of how this animal may have looked like and moved. On the jacket, it sports a short proboscis, and the ears are small versions of elephant ears, whereas traditionally they were drawn to resemble rhinoceros ears. Clearly, this book is a milestone on the subject, one of those books that are a classic already at their first appearance.



Fossil Mammals of Asia: Neogene Biostratigraphy and Chronology

Wang, X., L. J. Flynn, and M. Fortelius, eds. 2013. Columbia University Press, New York, 752 pp. ($52.80 cloth, $79.99 e-book with 20% PS discount.)

Reviewed by Ephraim Nissan (London, England)

This book is very demanding of readers, but its availability makes it indispensable for its subject: the biostratigraphy and geochronology of most of Eurasia, especially Asia, but also parts of Eastern Europe, in the late Cenozoic (Neogene). In fact, of the 31 chapters that follow the editors' introduction in the book under review, there is one (chapter 28, by George D. Koufos) specifically concerned with Greece. This makes sense, because of its contiguity to Anatolia.

On the front cover (there is no jacket), the Miocenic three-horned large boar *Kubanochoerus* looms large in a scene set about 15 Ma, drawn by Mauricio Antón, with a river in the background. The boar is charging up a trail, past the fossorial muroid rodent *Tachyoryctoides,* which is unrelated to modern burrowing rodents. "Both mammals are iconic for a large part of Asia, from Mongolia and China, westward to the Aral Sea" (quoted from the back of the cover).

Whereas there are greyscale photographs of bones, the occasional proboscidea footprints, and of course lots of greyscale and colour maps and charts, do not expect artists' reconstructions of fossils other than on the front cover, and this because of the very theme of the book, which "employs cutting-edge biostratigraphic and geochemical dating" and "uses data from many basins with spectacular fossil records to establish a groundbreaking geochronological framework for the evolution of land mammals" (from the blurb on the back cover). "The temporal and spatial distributions of these mammals in Asia thus provides a vital link to related clades in surrounding continents" (p. 1), "Such a strategic role is particularly apparent during the Neogene (~23–2.6 Ma) when Asia was intermittently connected to Africa and North America, and widely connected to Europe. Asia also occupies the greatest range of climates and habitats, from tropic to arctic and from rainforests to desert zones, often boasting of the most fossiliferous regions with fantastic exposures and producing some of the richest fossil mammal localities in the world. It is therefore no exaggeration that Asia is central to a global understanding of mammalian history" (p. 1).

With some exceptions, "(such as northern Pakistan), Asian mammalian biostratigraphy lags behind that science in Europe and North America for historical reasons, and many unresolved issues become bottlenecks for a detailed understanding of mammalian evolution elsewhere" (p. 1). "This book is thus a coming-of-age attempt to synthesize the state of the art" (p. 3). It grew out of workshops held in Beijing.

Figure I.1 (p. 2) shows on a map of Asia the "[m]ain Neogene vertebrate fossil-producing regions or localities in Asia discussed in this volume" (p. 2): two basins in eastern Afghanistan, many sites in China, Himalayan sites in India, Tibet, and Nepal, three areas of Pakistan, two in Tajikistan, one in Uzbekistan, two in Kyrgyzstan, five in Kazakhstan, four in Mongolia. Moreover, six around Lake Baikal and/or near Mongolia and one near Kazakhstan, totalling seven in Asiatic Russia; one in northwest Iran and two in Georgia, two sites and one region in Turkey; five sites near the Gulf coast of the Arabian peninsula; three sites in Myanmar (i.e. Burma); three basins plus a sand pit site in Thailand; and eight sites or areas in Japan.

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The editors state (as early as p. 5) that instead of sticking to the traditional chronological European Neogene Mammals units reference (this being the MN system)—unfortunate as "many Asian faunas are derived from basins with long and continuous sections, which, with careful magnetic calibrations, can offer chronological control superior to the long-distance correlations that the MN system ever can achieve" (p. 3)—the book under review tries to relate the MN and North America's NALMA systems to an emerging Chinese system, and several charts in the editors' introduction position strata, mammalian faunas, and faunistic complexes or fossil-producing horizons in various countries or (within these) areas of Asia in terms of their chronological relationships. The editors' "intention of this exercise is to put together, for the first time, all major fossil-mammal-producing regions in a series of charts, to draw attention to the different conceptual frameworks and different constructions of fauna relationships. We hope this will serve as a starting point to integrate various stratigraphic schemes. It is also immediately clear that there is much unevenness in concepts and in practices" (p. 16).

Inside the introduction, the next section is "Zoogeographic Complexity": at the workshops, questions arose "as to the feasibility of devising an Asia-wide land mammal age system that can work across major zoogeographic boundaries. If Europe and East Asia within the Palearctic Province are to have a separate chronologic system, shouldn't South Asia in the Oriental Province have its own?" (p. 17). "Faunal distinction through much of the Neogene (few species in common) is the strongest rationale for an Asian land mammal age system independent of the European MN units. This is in contrast to North America, which has a much narrower longitudinal span, and its paleofaunas have even narrower distributions within the western half of North America (eastern North America is poorly fossiliferous, pp. 17–18), so "faunal differences between pacific coastal states and the Great Plains are small enough to be subsumed within a single NALMA system" (p. 18). "[I]n contrast to increasing faunal homogeneity between east and west Eurasia during the Neogene, the north–south faunal division became progressively more clearly delineated through time as Tibet was being uplifted and its climatic effects became more pronounced" (p. 19), and this process "presents the biggest obstacle in the establishment of a truly Asia-wide land mammal age system" (p. 19). "Being in similar latitudes and warm climates, the main control of Africa–South Asia dispersal was by intermittent land corridors. It is thus not surprising that South Asia often has the largest number of African elements outside of Africa, and an Ethiopian-Oriental connection seems to be recognizable" (p. 19; cf. Ch. 18 in the volume under review).

Another subsection in the introduction deals with the connection of North America and Asia (p. 19). After the editors' introduction, the book is subdivided into five parts. These are entitled "East Asia" (13 chapters), "South and Southeast Asia" (chapters 14 to 19), "North and Central Asia" (chapters 20 to 22), and "West Asia and adjacent regions" (chapters 23 to 28), followed by Part V, "Zoogeography and paleoecology", comprising chapters 29 to 31, which respectively deal with continental-scale patterns combining Europe and Asia, intercontinental dispersals of some groups of rodents between Eurasia and North America, and paleodietary comparisons of ungulates between the late Miocene of China and two sites in Greece.

Within Part I, Chapter 2, for example, is "North China Neogene biochronology: A Chinese standard". Chapter 7 is "Stratigraphy and paleoecology of the classical Dragon Bone localities of Baode County, Shanxi Privince" of China. Chapters 12 and 13 are concerned with Japan; Chapter 10, with the Tibetan plateau, Chapter 19, with Myanmar (thus representing Southeast Asia. The Malay Archipelago and the Philippines are not dealt with in this book). As for Part IV, i.e., "West Asia and Adjacent Regions", its chapters deal with places including the United Arab Emirates, northwest Iran, Anatolia, Greece, southeast Europe, and southern European Russia.

Clearly, this book is not entirely about geology and mammals; for example, Chapter 22 is concerned with Olkhon Island in lake Baikal, in east Siberia, and the fossil content includes "rare finds of squamate reptiles" (p. 512)—a snake and a new species of skink—as well as frogs, fish, gastropods, insects, and of the mammals, just rodents.

Chapter 23, "Late Miocene mammal localities of Eastern Europe and Western Asia", giving "a synthesis of magnetostratigraphy-based correlations of large mammal localities from southern east Europe and the Transcaucasus with MN zones of central and western Europe" (p. 521), was co-authored by Eleonora Vangengeim, who did not live to see the printed book, and is commemorated in an "Addendum" to the editors' introduction.

I have already mentioned Chapter 28, about Greece. "The oldest known Miocene mammal locality of Greece is Ga-

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vathas" on the island of Lesbos (p. 596), but 48 localities in the Aegean Sea islands, Crete, or eastern or northeastern or northern central parts of mainland Greece are listed in the map of Fig. 28.1 (p. 596), while none appears in the western or central mainland or in the Peloponnese. "One of the first discovered Greek Neogene mammal locality is Pikermi (Attica, near Athens) found in 1835; its fauna is very rich and includes several new taxa, found subsequently in Eurasia and Africa (p. 595).

Take the Arabian Peninsula, which only contributes to paleomammalogy sites near the Gulf coast. The Baynunah Formation (in the Abu Dhabi Emirate west of the city of Abu Dhabi) "bears the only known late Miocene terrestrial biota from the entire Arabian Peninsula" (p. 583): "the Baynunah fossil fauna is estimated to be between 8 Ma and 6 Ma" (p. 583). Chapter 27 reports about Baynunah fossils, and lists plants (algae, Leguminosae), Foraminifera, molluscs, a crustacean, fishes belonging to four families, crocodiles and turtles, snakes from Colubridae, two flightless bird taxa from Ratitae (*Diamantornis laini,* and an *Aepyornihis*-type, i.e., elephant-bird like, eggshell)m, other birds —the extant genus *Anhinga* (i.e., the Darter) and the Ardeidae (egrets)— and then mammals: Hippopotamidae, Bovidae (such as the extant genus *Gazella*), Giraffidae, two taxa of swine, carnivorans (including a very large and medium-sized hyena-relatives, a sabretooth large cat, and a mustelid), *Hipparion* species (the only equids found there), an indeterminate rhinocerotid, as well as several rodents, an indeterminate insectivoran, an indeterminate primate, and finally, proboscideans belonging to three families (Table 27.1 on pp. 587–588).

Let us turn to Japan. For example, a subsection from Chapter 12 reports about a find in Hiroshima prefecture: an early middle Miocene amphicyonid, *Ysengrinia*. We know about its presence from just one tooth: "It is represented by a single isolated right M1, but it is the first record of the genus in Asia" (p. 327), being "known from the Late Oligocene to early Miocene of Europe and from Early Miocene of North America; the Japanese record is the youngest" (p. 327).

May I add that the genus, a giant wolf or rather beardog, was named *Ysengrinia,* given the French context of when it was defined. Ysengrin is the wolf character who is the enemy of Reynard the fox, who regularly defeats him, in medieval fiction. Reynard used to be so popular, in medieval France, that the noun *renard* replaced *goupil* (which only survived in the dialects), as the name for 'fox' in French: it is as though we ceased to call a mouse *mouse* and took to calling it *mickey* because of Mickey Mouse. In Western Christendom, the literary formation of the cycle of *Reynard the Fox* (*Roman de Renard, Fuchs Reinhart*) began in the tenth and eleventh centuries, becoming widespread by the thirteenth and fourteenth. The cunning fox has many enemies, who are his victims (he is not above attacking Ysengrin's wife), and who complain about him to the King of Animals. This is an example of how the cultural legacy of given countries or areas may affect the naming of paleotaxa, and given the find in Japan and those in North America, how far from the type specimen one may eventually find members of a genus.

Fossil mammals from Japan have been described for nearly a century, but Chapter 12 "is probably the first attempt to compile all the Miocene terrestrial mammals in Japan biostratigraphically and biochronologically with correlations to European and Chinese land mammal zonations" (p. 314). It reports on small mammals, as well as cervoids, rhinocerotids, equids, tapirids, and proboscideans. The latter include the genera *Gomphotherium* and *Stegolophodon,* which each get a subsection. Another proboscidean genus, *Sinomastodon,* is discussed in yet other two subsections in Chapter 12.

After the "List of Contributors" at the end of the book under review, there is a long "Taxonomic Index" (pp. 701–722) and a "General Index" (pp. 723–732) that perhaps could have been longer, but then it would have been an ingrate task. The general index comprises such descriptors that are not the name of a taxon. As for the taxonomic index, you would find there the genus name *Diamantornis* but not Ratitae, which is the superordinate taxonomic group that is explicitly mentioned for it in Chapter 27 about the Baynunah Formation of the Emirate of Abu Dhabi: *Diamantornis* is *incertae sedis* within Ratitae. In the general index, there is no entry for "Abu Dhabi", but you do find an entry "Baynunah Formation" with six subentries ("chronology of", "maintenance of", "paleoenvironments of", "paleogeography of", "salvage in", and "site documentation"), as well as, right after that, an entry "Baynunah Formation, fauna of" (why isn't it a seventh subentry of "Baynunah Formation"?). You can look up "United Arab Emirates" in the general index: there is an entry for that, with two subentries: "strata in", and "vertebrate fossil-producing regions in". For "Thailand", you get three subentries. For "Paratethys", an ancient sea, you are just referred at that entry to pp. 522–534, which is a lot of pages. The Paratethys was "a large shallow sea that stretched from the region north of the Alps over Central Europe to the Aral

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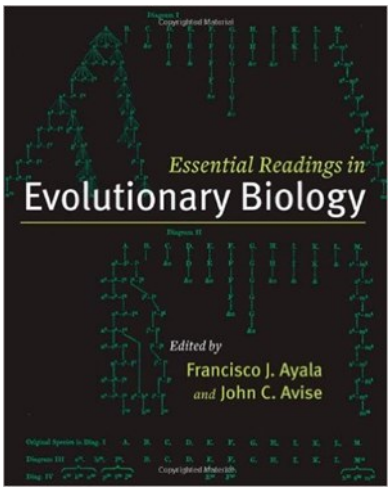
Sea in Central Asia. [...] It was separated from the Tethys Ocean to the south by the formation of the Alps, Carpathians, Dinarides, Taurus and Elburz mountains. During its long existence the Paratethys was at times reconnected with the Tethys or its successors, the Mediterranean Sea or Indian Ocean. From the Pliocene epoch onward (after 5 million years ago), the Paratethys became progressively shallower. Today's Black Sea, Caspian Sea, and Aral Sea are remnants of the Paratethys Sea" (http://en.wikipedia.org/wiki/Paratethys).

In the general index, you get no entry for "Crete", even though a map on p. 596 shows three sites on the island of Crete: Melambes, Plakia, and Kastelios (with their respective identifying labels), but none of those three gets an entry in the index. In contrast, for "Pikermi" (the name of an important site near Athens), you get an entry with three subentries. (I once prepared a very detailed index for a bulky book, a two-volume set I authored, only to see the publisher, which will remain unnamed, refuse my quite comprehensive index and retain a short index ineptly though kindly done by its own staff. And that was how the book was printed. At least the index in the book under review is done quite competently. You cannot ask for the moon.)

A page of "Errata" is attached to the book. Among the other things, it states: "The center section of certain tables may be difficult to read. For PDF versions of [some figures] please go to http://cup.columbia.edu/static/fmoa", which is where the colour plates (these in the book appear between pp. 556 and 557) can also be found.

This is a very dense, often quite technical book (sometimes even maddeningly so). But it could not afford to be more reader-friendly (vast expanses of it are indeed), as its ground-breaking aims require extreme rigour. After all, its subdiscipline within paleontology is the equivalent of advanced calculus for engineering. It is the foundation upon which the broader picture stands up or falls. The book's editors and contributors are to be congratulated. We must be grateful that this volume has come into being. It is a book into which specialists as well as other interested readers will have to delve again, and again, and again.



ESSENTIAL READINGS IN EVOLUTIONARY BIOLOGY

Ayala, F. J. and J. C. Avise, eds. 2014. Johns Hopkins University Press, Baltimore, MD, 576 pp. ($37.46 cloth with 25% PS discount.)

Reviewed by Trisha L. Spanbauer (University of Nebraska - Lincoln)

Perusing the *Essential Readings in Evolutionary Biology,* I was both eager to see what Ayala and Avise had selected for inclusion in this volume and surprised to have not previously encountered such a collection on evolutionary biology. In fact, no such compilation had been created in the field prior to this work. The authors referenced this absence in their introduction, and then set out to rectify this deficiency by sequentially leading the reader through the history of evolutionary theory through a selection of crucial manuscripts on the topic. The authors argue that their text also fulfills the purpose of redressing any public misunderstandings of evolution through exposure to foundational research manuscripts.

The authors largely succeed in their efforts, and they are a well-qualified duo to do so. Between them, Drs. Ayala and Avise have published hundreds of research articles and dozens of books in the field. Francisco J. Ayala's work focuses on evolutionary theory, but he is also known for his publications in the realms of philosophy and ethics, which is apparent in *Essential Readings in Evolutionary Biology's* epilogue. John C. Avise has spent his career dedicated to evolutionary biology, making his mark in the discipline of phylogeography – a term he coined to describe the combination of historical biogeography with population genetics to trace the natural history of populations.

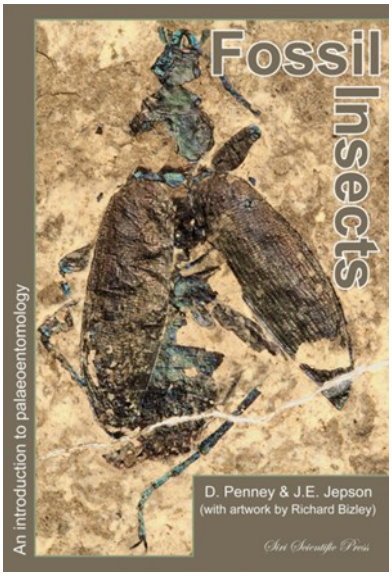
Ayala and Avise describe the chronological history of the discipline of evolutionary biology, treating readers to a well laid out road map of research that spurred new discoveries like the ability to quantify genetic variation in natural populations, or the theory on the origination of eukaryotic organisms. Readers also gain contextual insight into controversies

Book Reviews, cont.

in evolutionary biology like the debate over phyletic gradualism versus punctuated equilibrium. Above all, the text provides readers with a clear picture of an entire field told through well-annotated original research.

Indeed, it is the annotation that makes this volume compelling and immensely readable. Ayala and Avise's commentary that introduces each article provides a historical context to the research, often including background about the scientist that adds a human layer to the scientific discovery. This aspect of the work is the book's greatest strength. In fact, the only weakness of the text is that I was occasionally left wanting lengthier annotations for some of the papers. However, the authors do include further readings for each of the essential papers for readers wanting to delve further into the research presented in this volume.

The authors began this book with the classic Dobzhansky quote "Nothing in Biology makes sense except in the light of evolution," and I would like to build upon that notion after reading these essential papers and say that nothing in the study of evolution makes sense except in the light of the history of the discipline. Moreover, Ayala and Avise do a splendid job pulling together that history in this collection of thoroughly annotated research papers.



Fossil Insects: An Introduction to Paleoentomology

Penney, D. and J.E. Jepson. 2014. Siri Scientific Press, Manchester, UK, 224 pp. (£24.99 paper from Siri Scientific Press

Reviewed by Julien Kimmig (University of Saskatchewan)

As the title so aptly states, *Fossil Insects: An Introduction to Paleoentomology* written by David Penney and James E. Jepson is an interesting read on insects through the fossil record. As this is a very extensive topic to cover in a 224-page book, the authors did a great job in accomplishing this task. Not only do they cover the most important localities, they also provide a nice introduction of the preservation of insect fossils in time and space, as well as a short systematic overview on the most common insects in the fossil record.

The introduction starts with an overview on modern insects and their diversity, giving an explanation on the difficulties associated with diversity and extinction rate estimations. It is followed by a short summary of insect evolution through time and space and then fluidly moves on into the mechanisms leading to preservation of insects. This part concentrates mostly on the preservation of insects in amber, and it also includes a nicely written introduction into why fossil insects should be studied, serving as a nice segue into the following chapters.

Chapter 4 informs the reader about how differently preserved fossil insects are studied, identified, and formally described. This chapter is a great inclusion as it gives the general public an insight in the work of paleontologists and the challenges that are related to fossil identification.

Chapter 5 provides an overview of fossil deposits and Lagerstätten preserving insects. As stated by the authors, they concentrated on the most important and recently discovered deposits. The descriptions are relatively short and concentrate on the most important fossil groups of the deposits and their preservation state. The references that accompany the descriptions make up for the lack of detail and allow the interested reader to satisfy their curiosity. The deposits are arranged by continent, non-amber and amber preservation, and finally by age, making it fairly easy to find deposits of interest to the reader, especially those looking for references.

Chapter 6 provides an introduction to the taxonomy and diversity of 48 insect orders (including 18 extinct) in the fossil record. Several excellent photographs, especially of the amber specimens, accompany the short identifications for each of the orders. Additionally, the authors provide a geologic range as well as the extant biodiversity of the orders. The chapter serves as a useful and convenient reference base that guides you toward more detailed descriptions.

Insect behaviour and ecology in the fossil record are covered in chapter 7. The chapter contains excellent photographs of mating insects, parasitism, feeding-insect preservation, and death assemblages, as well as easily understandable examples and descriptions of these different behaviours. The chapter also covers possible taphonomic influences that might lead to misinterpretations of the ecology and behaviour, and offers great examples to cover this important issue.

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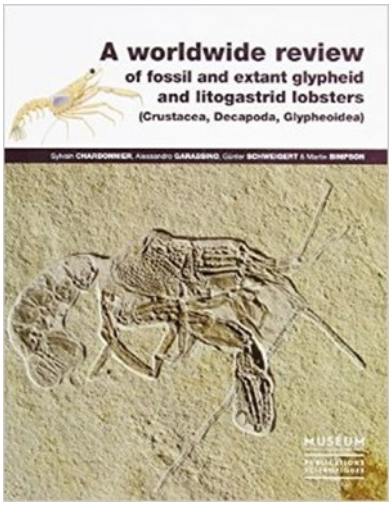
Chapter 8 covers the sub-fossil insect record. This chapter is interesting as the authors discuss the importance of sub-fossils in the light of animal dietary habits, human lifestyles over time, as well as climate change. The discussion on copal and its differentiation from amber is also very informative.

The chapter on trace fossils gives a short, but nice, overview on the ichnological structures related to insects that can be found throughout the geologic record. Unfortunately, this chapter is not as well illustrated as some of the others, but it does provide a significant amount of references allowing interested readers a tool by which they can use to further investigate the topic of ichnology on their own accord. The following chapter is a short narrative on how long a fossil species exists; this section could have been more informative.

The final chapter called 'how to become a paleoentomologist' is aimed at the younger amateur considering a career in the field, and is great summary of the academic pathway and challenges that this career choice faces.

In summary, *Fossil Insects: An Introduction to Paleoentomology* is illustrated with 240 high-quality figures; most of them color photographs and found only published in this book. Overall this book is a great addition for everyone with an interest in entomology/paleoentomology. For amateurs, it gives a nice introduction to the fossil record of insects. For professionals, it offers fantastic images of fossil insects from the most important deposits known to date, as well as a quick reference to the most important insect groups and their basic identification, including an extensive reference list.



A Worldwide Review of Fossil and Extant Glypheid and Litogastrid Lobsters (Crustacea, Decapoda, Glypheoidea)

Charbonnier, S., A. Garassino, G. Schweigert, & M. Simpson. 2013. *Memoires du Muséum National d'Histoire Naturelle* 28. Publications Scientifique du Muséum, Paris, (distributed by the University of Chicago Press, Chicago, IL), 304 pp. ($52.50 cloth with 30% PS discount.)

Reviewed by Thomas A. Hegna (Western Illinois University)

Glypheoidean lobsters are one of the great, unsung examples of so-called living fossils. While the coelacanth or *Lingula* may get all of the attention, the glypheoideans have a much more recent history of discover and recognition. Glypheoideans are a group of decapod crustaceans that could easily be mistaken for one of the common, culinary varieties of lobsters or shrimp by the uninitiated. In fact, if one were brought out to you in a restaurant, the most distinctive thing you would notice would be the odd-looking subchelate claws that are so different from the strong, chelate claws we all know and fear (if a restaurant does serve you a glypheid, please preserve it and let your local carcinologist know). They were thought to be extinct until 1975, when a modern species, *Neoglyphea inopinata*, was recognized by Forest and Saint Laurent (Forest, J., and M. de Saint Laurent.1975. Présence dans la faune actuelle d'un repésentant du groupe mésozoïque des Glyphéides: *Neoglyphea inopinata* gen. nov., sp. nov. (Crustacea Decapoda Glypheidae). *Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie D: Sciences Naturelles* 281: 155-158)—although the specimens were collected long beforehand and languished unrecognized for over 65 years.

Charbonnier and colleagues do what has always been a taxonomic dream of mine—they have taken an entire group of animals and exhaustively refigure, redescribe, and review the members of the group. For the glypheoideans, this means reviewing specimens from as far back as the Triassic, covering published literature that spans almost 200 years, and in some cases reconciling species whose specimens have been dispersed or destroyed by time and two world wars. The thoroughness of the volume extends beyond taxonomy; it begins with a short history of the study of fossil glypheoideans and those who have studied them. I am truly in awe of the detail of this work. As has been observed by Schram (Schram, F.R. 2014. Book Review [Charbonnier, S., A. Garassino, G. Schweigert, and M. Simpson. 2013. A Worldwide Review of Fossil and Extant Glypheid and Litogastrid Lobsters (Crustacea, Decapoda, Glypheoidea)]. Journal of Crustacean Biology 34:399–401), the book lacks a firm phyloge-

Book Reviews, cont.

netic footing for the taxa—especially when the classifications used by Charbonnier and colleagues are compared with other published schemes. The recently published paper by Charbonnier et al. (Charbonnier, S., Audo, D., Barriel, V., Garassino, A., Schweigert, G., Simpson, M. 2015. Phylogeny of fossil and extant glypheid and litogastrid lobsters (Crustacea, Decapoda) as revealed by morphological characters. Cladistics 31:231–249) on the phylogeny of fossil and extant glypheid and litogastrid lobsters should really be considered 'Volume 2' for the present work.

The book itself is gorgeous. It is filled with full-color illustrations of specimens, and reproductions of original illustrations. It lives up to the high standard set by Charbonnier himself with his previous book on the La Voulte Lagerstätte (Charbonnier, S. 2009. *Le Lagerstätte de la Voulte: un Environment Bathyal au Jurassique*. Publications Scientifiques du Muséum, Paris). Both volumes were published by the Muséum National d'Histoire Naturelle in Paris. The glypheoidean volume is distributed by the University of Chicago Press, which makes it much easier to get a hold of in the United States. Included with the book is a CD with pdf files for all of the chapters—even though I love the feeling of book in my hands, with pdfs comes the much appreciated capability of running a full-text search for that reference you *know* is in the book, but just cannot find. For anyone who appreciates a good fossil crustacean or living fossils in general, this volume is a must-have.

Late Ordovician Ostracods of the Girvan District, South-West Scotland

Mohibullah, M., M. Williams, and J.A. Zalasiewicz. 2014. *Monograph of the Paleontographical Society*, London 167 (640), 40 pp. (£12.50 paper with 50% PS discount.)

Reviewed by Thomas A. Hegna (Western Illinois University)

The ostracods of the Girvan District were first noted over 150 years ago by M'Coy (1851). Unlike the trilobites from the same area (which have received quite a bit of published attention over the same time period), the ostracods were largely ignored. Why? The ostracods are rare, often poorly-preserved, and difficult to extract (Mark Williams, pers. comm.), making them less tempting 'paleontological fruit' to pursue. Mohibullah et al. draw together all of the known material from Girvan and put it into its proper systematic context. The monograph integrates new collections with historic ones, and incorporates the lead authors' own recent revisions (Mohibullah, M., J. Afzal, M. Williams, T. Meidla, D. J. Siveter, and J. A. Zalasiewicz. 2010. Ostracods from Upper Ordovician (Katian) carbonate lithofacies in southwest Scotland. *Geology Magazine* 147:919–939; Mohibullah, M., T. R. A. Vandenbroucke, M. Williams, J. D. Floyd, T. Meidla, J. A. Zalasiewicz, and D. J. Siveter. 2011. Late Ordovician (Sandbian) ostracods from the Ardwell Farm Formation, SW Scotland. *Scottish Journal of Geology* 47: 57–66; Mohibullah, M., M. Williams, T. R. Vandenbroucke, K. Sabbe, and J. A. Zalasiewicz. 2012. Marine ostracod provinciality in the Late Ordovician of paleocontinental Laurentia and its environmental and geographical expression. *PLoS One* 7:e41682), including republishing previously figured images, all in one place. In a sense, this is an up-to-date regional field guide to a locally-rare group of fossil crustaceans.

The rare nature of the fossil ostracods from Girvan has some unfortunate side-effects. Chief among them is the fact that we have little information about the range of intraspecific variation. There is a high ratio of previously figured specimens to unfigured specimens—but this is to be expected of the only comprehensive revision of the Girvan ostracods.

The rarity of the specimens means that careful attention should be given to the imagery. The figured specimens are a mix of SEM and light photographs. Many of them should have had their contrast increased in Photoshop before publication to increase the visibility of subtle surface features. A 'digitally-enhanced photograph' raises fears of forgery, but in this case, all I suggest is to increase the tonal range of the image based on the grayscale tones captured by the image (see figure). It is the digital equivalent of adjusting a light.

The appearance of many of the fossil ostracods suggests that they were digitally extracted from the matrix. This practice has a long history in paleontology, dating back to the days of light photographs and Exacto knives. Though it does make for clean, aesthetically appealing images, it potentially hides

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data about the lithology and taphonomy. Furthermore, it runs the risk of masking the true shape of the fossil. In what I am sure is a rare example, images of trilobite tails belonging to *Maconoda prima* Lochman, 1964, illustrated by the original author, were trimmed for their photographic plates. However, *M. prima* has a bizarre pygidial border that was unrecognized by Lochman (Lochman, C. 1964. Upper Cambrian faunas from the subsurface Deadwood Formation, Williston Basin, Montana. *Journal of Paleontology* 38: 33–60), with the subtle evidence for its presence trimmed off in the photograph. The unique pygidial border was not recognized until Adrain and Westrop (Adrain, J. M. and S. R. Westrop. 2005. Late Cambrian ptychaspidid trilobites from western Utah: implications for trilobite systematics and biostratigraphy. *Geological Magazine* 142: 377–398) reinvestigated the type material along with newly recovered silicified material. This is not an indictment of the authors, as the practice they employ is completely conventional, but rather an excuse for this reviewer to ride his own hobby-horse under the guise of giving cautionary advice . . .

Overall, this is a great work, and one that I recommend for Paleozoic ostracod workers (despite my minor quibble about imagery).

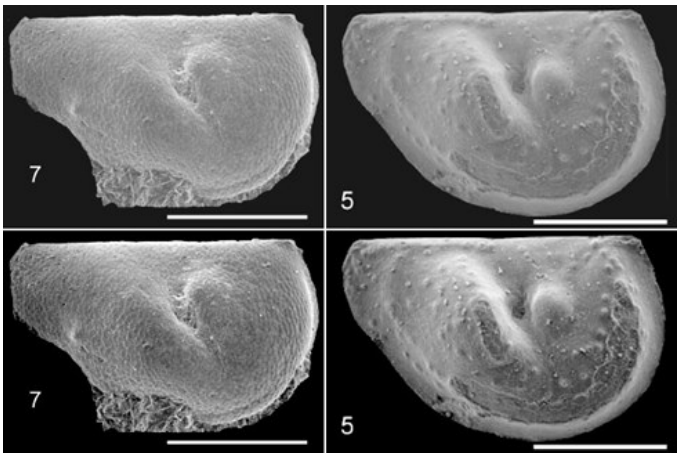
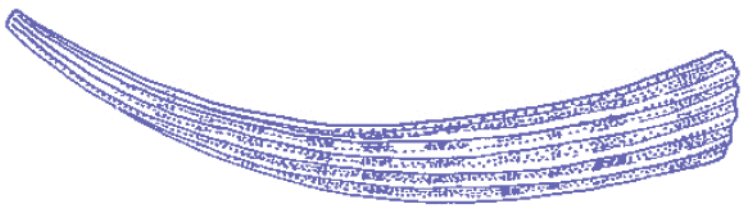


Image: Figures from Mohibullah et al., 2014 as originally presented (top) and enhanced using the Photoshop 'levels' command (bottom). The image on the left is from plate 1, and the image on the right is from plate 2



Lower Jurassic Foraminifera From The Llanbedr (Mochras Farm) Borehole, North Wales, UK

Copestake, P. and B. Johnson. 2014. *Monograph of the Paleontographical Society*, London 167 (641), 403 pp. (£107.50 paper with 50% PS discount.)

Reviewed by Michael Hesemann, (Foraminifera.eu Project, Hamburg Germany, www.foraminifera.eu)

The monograph presents a detailed biostratigraphy for the Lower Jurassic based on the most comprehensive treatment of Lower Jurassic foraminifera published so far. It is based on the doctoral theses of both authors and their continuous work on numerous Lower Jurassic materials from industrial and academic sources in their long-lasting careers within the oil industry. The authors share their comprehensive knowledge in three major parts: on biozonation, taxonomy of foraminifera, and the specifics of the section at Mochras.

The biostratigraphical part (39 pages) presents a detailed and worldwide applicable biozonation of the Lower Jurassic based on first and last occurrence dates of 55 foraminiferal index species. The authors have successfully worked with their biozonation scheme for decades in the oil industry and have now found the time to publish it in detail. The outline of this zonation has been published earlier (Copestake, P. And B. Johnson. 1989. The Hettangian to Toarcian. Pp. 129–188 *in* D. G. Jenkins and J. W. Murray, eds. *A Stratigraphical Atlas of Fossil Foraminifera*, second edition. Ellis Horwood, Chichester, UK). They compare and discuss their scheme with other relevant publications on foraminiferal biozonations, with zonations based on ostracods, dinoflagellates, miospores, nannofossils and with ammonite chronozones and subchronozones. As well as the text, the comparison is presented in easy-to-follow tables

Book Reviews, cont.

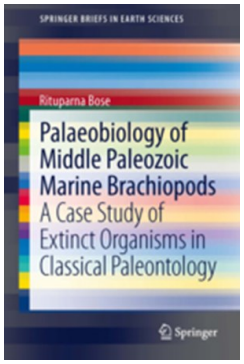
covering different regions. Two tables show first and last occurrence dates of the index foraminifera and their time range. Additionally, an excellent eight-page overview is given on the history of research on Jurassic foraminifera and their biostratigraphical interpretation.

The taxonomic part of the monograph is an outstanding atlas. On 266 pages plus 21 SEM plates, the authors describe and illustrate 270 species/subspecies in a very detailed and useful way. It is mainly based on the foraminifera found in the Mochras core material. At Mochras (Wales), an exceptionally thick Lower Jurassic section of 1304.95 m was cored and the foraminifera proved to be exceptionally well preserved. The authors have enlarged the coverage of the taxonomic part by including the results from many other studied sections, type-specimen collections and a large range of publications about assemblages from the northern hemisphere (Europe, Siberia, North Africa and North America). The very few studies of assemblages from the Southern hemisphere indicate their similarity to those of Europe. As a result, the taxonomic part is very useful for the study of Lower Jurassic foraminifera worldwide.

Each species description contains a well-focused diagnosis of its characteristics, a discussion of variations, its known distribution and a list of synonyms. Most noteworthy are the remarks which discuss the varying interpretation of the species from its first description through to recent publications. The species descriptions are homogeneously structured by relevance with the headline diagnosis, dimensions, material and horizons, variations (if relevant), remarks and distribution. This thoughtful arrangement allows a reader to easily choose the degree of detail and information wanted. Genera are described likewise. The combination of the comprehensive coverage of genera and species, their very detailed descriptions and the references make the monograph a very useful and indispensable tool for the study of foraminifera of the Lower Jurassic and beyond.

The specifics of the Mochras section are presented in the initial part and data on the core covering the whole Lower Jurassic are given in the appendices. Supplementary data comprising two large foraminiferal distribution charts (Hettangian–Sinemurian and Pliensbachian–Toarcian) are contained in an online record. The publication is completed with a very comprehensive reference list containing more than 600 entries.

The monograph should be seen as a hidden treasure for everyone studying the Lower Jurassic worldwide. Its usefulness for biostratigraphical studies and the interpretation of Lower Jurassic material cannot be underestimated. The authors share their life-long theoretical and practical experience in a most detailed though well-structured and easy-to-follow way. It is unfortunate that the cumbersome title and the high price may hinder the recognition and usage of this monograph as an indispensable publication on biostratigraphy and foraminifera of the Lower Jurassic worldwide.



Paleobiology of Middle Paleozoic Marine Brachiopods: A Case Study of Extinct Organisms in Classical Paleontology

Bose, R. 2013. Springer Briefs in Earth Sciences, Springer, Heidelberg, Germany ($49.99 paper, $29.99 e-book.)

Reviewed by Mike Meyer (Carnegie Institution for Science)

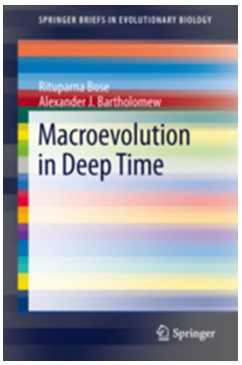
Brachiopods are a classic group used in paleontological studies and this work is a great case study in their analysis. However, I need to quickly mention its format, as this work is published in the "Springer Briefs in Earth Sciences" series. Generally I am not a fan of the format used in the Springer Briefs. They are very short works (Springer states they are "concise summaries of cutting-edge research" and this publication totals just 53 pages) with similarly short chapters: really they are very thesis/dissertation-like. Additionally, because these are stand-alone works in a non-journal, non-open access setting, they can be hard to find.

In the "Paleobiology of Middle Paleozoic marine brachiopods," the author uses geometric morphometrics to assess the temporal spatial variation in specimens of the brachiopod Order Atrypida from the late Silurian through the late Devonian (Ecological Evolutionary Unit P3) while also examining the degree of encrustation on specimens. In the "Preface" there is some mention of what is now known as the '6th Mass Extinction' and how this research ties into better understanding of modern taxonomic trends; but there isn't any follow-through on that subject; this work only discusses fossil brachiopod diversity from 444–359 mya from eastern North America. The studied specimens where scanned with a microCT and analyzed using geometric morphometrics. This is a great combination, as 3D data is often needed to

Book Reviews, cont.

properly examine landmark-poor fossils (of which most bivalved organisms are, especially in 2D photographs). However, the authors are unclear about how the 3D data was used, other than to sort taxa into subfamilies within the Order Atrypida; the geometric morphometric analyses seem to have been gathered off of 2D specimen photographs. Still, the amount of specimens examined is amazing with well over 1,500 individuals studied, a truly stunning dataset.

The conclusions found in the study represented by this work are interesting. There is some landmark deflection seen, but given the type of landmarks used and the relatively few numbers of them used, means that these are minor factors. Of seemingly more importance is the parallel shifts seen in brachiopod morphological change and encrusting rates over long time scales. This is a great example of the evolutionary arms race that can occur with one's parasites and those organisms on the host body (dead or alive in this case). Additionally, the author's findings of serious morphological stasis within taxa are further evidence of the relative stability of the examined environments. Overall, this is a well put-together study, easy to read, and the findings add to our understanding of biodiversity trends through time.



Macroevolution in Deep Time

Bose, R. and A. Bartholomew. 2013. Springer Briefs in Evolutionary Biology, Springer, Heidelberg, Germany ($49.99 paper, $29.99 e-book.)

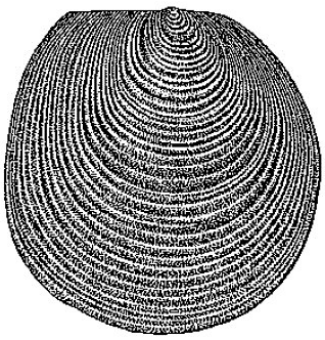
Reviewed by Mike Meyer (Carnegie Institution for Science)

This work covers parts of another study done by the same author in a different review in this same issue of Priscum (see my prior review). In that review I discuss my thoughts on the 'Springer Briefs' format (not terribly positive), so here I will stick with the content of the work.

Brachiopods, as a classic, popular, and highly abundant fossil group, are commonly utilized in paleontological studies. The research covered in this work (mainly in Chapter 2) is one of the first to try to assess the patterns and tempo of evolutionary change in the brachiopod Order Atrypida. That research is well done and applied, but I thought that Chapter 1 was the highlight of the publication. Chapter 1 covers "Advancement(s) in evolutionary theories", which include topics such as: punctuated equilibrium, proponents and opponents of punc. eq., processes behind evolution, and tempo and mode of evolution, to name a few of the sub-chapters. Chapter 1 is a great resource for a concise history and summary of some of the major evolutionary ideas and concepts within paleobiology that have developed over the last thirty years or so. The included graphics are small and simple, but get the points across easily, and you can see the enthusiasm for the topics from the authors. This is a great bit of science communication that is starkly contrasted next to the following chapters of the usual stiff academic writing format that most scientific journal articles contain.

Chapter 2 is the main focus of scientific thought in this publication and it examines whether the brachiopod Order Atrypida, within the middle Paleozoic of the Cincinnatian Arch region, including the Michigan and Illinois Basins, show evidence for evolutionary trends that follow punctuated equilibrium or phyletic gradualism. They use geometric morphometrics to analyze their large dataset of fossils and show a variety of Principle Component-based figures and MANOVA results. I don't want to give anything away, but the findings are not clear cut.

Chapter 3 is a short comparison of two middle Devonian brachiopod fauna localities; one from the New York state Hamilton Group and the other from the Michigan Traverse Group. This is a small biostratigraphic study and a little oddly placed after the first two chapters, as it is really just a "Supplemental geographical/paleontological data" complement to Chapter 2. Comparison of two sections with contemporary fossil assemblages from the Appalachian Basin suggests that the morphological trends observed by the authors are local in scope and not indicative of large-scale variations. Chapter 4 ("Evolution in the fossil record") is less than a page long and should have been incorporated into Chapter 1. Overall this is a good read, but mostly for Chapter 1 (and Chapter 4).



Books available for review

The following volumes are available to Paleontological Society members in exchange for writing a review for *Priscum*. Reviews should be informative, engaging, and 400–800 words long. The tone can be informal and casual, appropriate to recommending or critiquing a book to friendly colleagues. (Longer reviews are allowed, but please request ahead of time.) Reviews should be submitted by May 1 for inclusion in the Spring/Summer issue or Dec. 1 for inclusion in the Winter issue. Reviewers must be a current member of the Paleontological Society before beginning review. If interested in reviewing one of these volumes, please contact Phil Novack-Gottshall (pnovack-gottshall@ben.edu). Reviews will be assigned on a first-claimed basis to individuals with appropriate knowledge and experience with book content.

Benton, R.C., D.O. Terry, Jr, E. Evanoff, and H.G. McDonald. 2015. *The White River Badlands: Geology and Paleontology*. Indiana University Press.

Blows, W.T. 2015. *British Polacanthid Dinosaurs*. Siri Scientific Press.

Dial, K.P., N. Shubin, and E.L. Brainerd. 2015. *Great Transformations in Vertebrate Evolution*. University of Chicago Press.

Erwin, D.H. 2015 (2006). *Extinction: How Life on Earth Nearly Ended 250 Million Years Ago*. 2nd ed with new preface. Princeton Univ. Press.

Fariña, R. A., S. F. Vizcaíno, and G. De Iuliis. 2013. *Megafauna: Giant Beasts of Pleistocene South America*. Indiana University Press.

Fortey, R. 2015 (1982). *Fossils: The Key to the Past*. 5th ed. Cornell Univ. Press.

Gangloff, R.A. 2012. *Dinosaurs under the Aurora*. Indiana University Press.

Gass, K. 2015. *Solving the Mystery of the First Animals on Land*. Siri Scientific Press.

Gerlach, J., ed. 2014. *Western Indian Ocean Tortoises: Ecology, Diversity, Evolution, Conservation, Paleontology*. Siri Scientific Press.

Isotalo, P.A. 2015. *Ordovician Trilobites of Southern Ontario, Canada and the Surrounding Region*. Siri Scientific Press.

Kemp, T.S. 2016. *The Origin of Higher Taxa: Paleobiological, Developmental, and Ecological Perspectives.* Oxford Univ. Press and Univ. of Chicago Press.

Klug, C., D. Korn, K. de Baets, I. Kruta, and R.H. Mapes, eds. 2015. *Ammonoid Paleobiology: From Anatomy to Ecology and From Macroevolution to Paleogeography*. (2 volumes) Topics in Geobiology 44. Springer.

Lomax, D.R. and N. Tamura. 2014. *Dinosaurs of the British Isles*. Siri Scientific Press, Manchester. (See David Penney e-mail on 4/23/13 for details.)

Penney, D. 2016. So You Want to be a Palaeontologist? Practical Advice for Fossil Enthusiasts of All Ages. Siri Scientific Press, Manchester.

Pérez-Lorente, F. 2015. Dinosaur Footprints and Trackways of La Rioja. Indiana University Press.

Prothero, D.R. 2015. *The Story of Life in 25 Fossils*. Columbia Univ. Press.

Sánchez-Villagra, M.R. and N. MacLeod, eds. 2014. *Issues in Paleaeobiology: A Global View. Interviews and Essays*. Scidinge Hall, Zürich, Germany.

Webby, B.D., et al. 2015. *Part E, Porifera (revised), vol. 4–5*. (2 volumes) P. A. Selden, ed. *Treatise on Invertebrate Paleontology*. Geological Society of America and University of Kansas, New York and Lawrence, KS.

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NEWSLETTER OF THE PALEONTOLOGICAL SOCIETY

Mailing address:
Matthew Powell, Editor
Department of Geology
Juniata College
1700 Moore St.
Huntingdon, PA 16652, USA

powell@juniata.edu
Phone: 814-641-3602
Fax: 814-641-3687

Communications Officer of the Society
Leif Tapanila, tapaleif@isu.edu

http://paleosoc.org/

Ideas for *Priscum* content?

Do you have any ideas for content for the *Priscum* newsletter? If so, please contact Matthew Powell (powell@juniata.edu). We are interested in including a wide range of content of possible interest to members of our Society. Consider anything from a short description of a future GSA symposium or field trip you are planning to an op-ed sharing a cantankerous viewpoint on a topical issue, an idea for a regular *Priscum* feature, or memorable photos of fossils or fieldwork.