

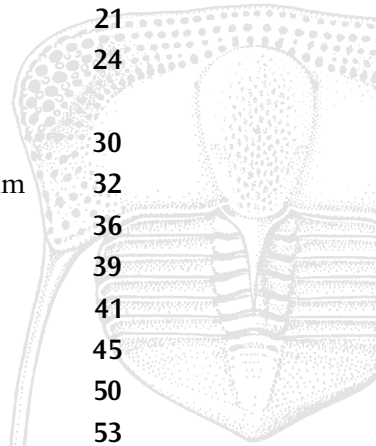
# 117

## The Palaeontology Newsletter

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Annual Meeting supplement: yellow pages



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Reminder: The deadline for copy for Issue no. 118 is 3rd February 2025.

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## Editorial

To our northern hemisphere members, welcome to winter, and to those from the southern hemisphere, welcome to summer! This is the final *Newsletter* before the exciting Annual Meeting 2024, held at the Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany. I hope you're all looking forward to a fantastic conference, organized by the hardworking FAU team led by **Emma Dunne, Thomas Clements** and **Rachel Warnock**. This year's Annual General Meeting will take place during the Annual Meeting, on 11th December – please attend if you can. We have several unfilled Council spots, so please consider joining us if you are interested!

Look inside this issue for some more details about the Meeting. Hope to see you there!

In addition to the usual segments on grant and awards information, news bites and meeting and grant reports, this issue contains details of new courses by Transmitting Science, which Association members get a 20% discount on. We take a look behind the sciences at the **Lapworth Museum of Geology, Birmingham, UK**, focusing not just on their extensive physical collections but highlighting their Virtual Museum project. **Kat Jordan-Burmeister** discusses the importance of Lam *et al.*'s 2018 palaeobiogeography study reconstructing Ordovician global dispersal patterns; this is an area of research key to Kat's research and my own. Excitingly, we also have the beginning of a new limited series, Software for palaeontologists, by the extremely knowledgeable **Peter Falkingham**! This issue, Peter takes us through some considerations and examples of CT software. The inimitable **Jan Zalasiewicz** takes us on a journey of teeth through time, and our Careers Q&A features **Sophie Kendall** discussing her career in marine management and planning after her studies in micropalaeontology.

We also have a number of contributions focusing on the social and personal aspects of academia. Please take a look at the article by **Meg Anne Veitch** on living with ADHD and coping in an academic setting. Our Palaeontologist Abroad is **Brennan O'Connell**, who studies Ediacaran palaeoenvironments around the world. And just to bring it back to the Association's logo, and my own usual study organism, we have four wonderful book reviews, including on the surefire-classic *Trilobites of the British Isles*.

I hope you enjoy issue 117, and I look forward to catching up with many of you in Germany in December!

**Harriet B. Drage**

*Newsletter Editor*

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## Postcards from the President

Rachel Wood continues her series highlighting issues of particular topical relevance.



As I am sure many of you know, it is with great sadness that we have heard of the passing of Euan Clarkson. Euan was a lifelong member of the Association, and served as a PalAss Council member, Editor and President. Euan was instrumental in encouraging us to expand our horizons, and thus played an instrumental role in creating an Association that is now the leading organization of its kind in Europe

and beyond. Euan was awarded our Lapworth Medal in 2012 for his outstanding scholarship, and left an extraordinary legacy too, in his textbook *Invertebrate Palaeontology and Evolution*, which remains widely read by students worldwide. For all this, we owe him a huge debt and much gratitude. You can read his obituary on page 94 of this *Newsletter*.

**Rachel Wood**  
President

### #1: Silurian

Wenlock Formation, Welsh Borders 430 myr ago

Foreground: *Syringopora* (centre) and *Favosites* corals (bottom) jawless fishes *Birkenia* (left) and *Hemicyclaspis* (right), trilobites *Dalmanites* (large) and *Calymene* (small)

Background: Crinoids (stalked plant-like animals) and orthocones (squid-like animals)

Image by James McKay, © The Palaeontological Association

## Association Business

### Annual Meeting

#### Notification of the 68th Annual Meeting

The 2024 Annual Meeting of the Palaeontological Association will be held at the Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg, Germany, on 9th – 13th December as an in-person meeting, organized by Dr Emma Dunne, Dr Thomas Clements, Prof. Rachel Warnock and colleagues.

### Annual General Meeting (AGM) 2024

#### Information on the 2024 AGM

The Annual General Meeting will be held on 11th December 2024 during the Annual Meeting in Germany, before the Annual Address. All members at the Meeting are strongly encouraged to attend.

#### Voting at the AGM

Voting on the Trustees Annual Report for 2023, Accounts and Balance Sheet 2023, and reappointment of our financial examiner will take place via an online vote of the membership in



November 2024, prior to the AGM. This is to allow all members to be involved in the formal running of the Association. Details of the voting procedure will be sent to members via e-mail, with results being announced at the in-person meeting and reported to the membership via the *Newsletter* in due course.

### AGENDA

1. Apologies for absence
2. Minutes of the 67th AGM\*
3. Trustees Annual Report for 2023\*
4. Accounts and Balance Sheet for 2023 and reappointment of financial examiner
5. Election of Council and vote of thanks to retiring members
6. Report on Council Awards
7. Annual Address

\* Papers pertaining to these agenda items were published in the previous *Newsletter* (116), available online at <<https://www.palass.org/publications/newsletter/archive?number=116>>.

## Council Election 2024

At the AGM in December 2024, the following vacancies will occur on Council:

- Vice-President (two-year term)
- Editor-in-Chief (three-year term)
- Publicity Officer (three-year term)
- Ordinary Member (three-year term) \*

Nominations received by the 1st September 2024 deadline are as follows:

- Vice-President: no nominations received from the membership.
- Editor-in-Chief: **Michael Benton** (Council nominee).
- Publicity Officer: no nominations received from the membership.

As no nominations have been received from the membership for two of the positions no voting will be conducted prior to or at the AGM.

\* In addition, and since the deadline for nominations closed on 1st September, our Deputy Internet Officer informed Council that they will be standing down this year. Council has determined that the Deputy Internet Officer position is no longer required going forward and as such will revert to an Ordinary Member position.

We would ask the membership to consider if they are available to fill any of the vacancies as a Trustee and, if so, to please contact the Secretary or President before the AGM.



## Upcoming Awards and Prizes in 2024/2025

The Palaeontological Association recognizes excellence in our profession by the award of medals and other prizes. The Association sees its lists of medals and award winners as a record of the very best palaeontologists worldwide, at different career stages, and offering different kinds of contributions to the field. The Association stresses the importance of nominations and encourages all members to make nominations. Members considering making nominations should first read the Palaeontological Association 'Statement of Diversity':

### Statement of Diversity

The Palaeontological Association has an *Unconscious Bias* document, the recommendations of which will be adhered to at all times. All decision-making for Palaeontological Association awards and prizes will be carried out objectively and professionally. The Association is committed to making award and prize decisions purely on the basis of the merit of the individual(s). No nominee for awards or prizes will receive less favourable treatment on the grounds of: gender, marital status, sexual orientation, gender re-assignment, race, colour, nationality, ethnicity or national origins, religion or similar philosophical belief, spent criminal conviction, age or disability. Equally, all nominations will be assessed on equal terms, regardless of the gender, age and/or ethnicity of the nominee. Nominations will therefore be assessed and graded on their merits, in accordance with the criteria and the aims and objectives set for each award or medal. Due consideration will be given to any period away from science due to parental leave, illness and any other such career break. Nominators are reminded that neutral language (e.g. gender neutral) should be used in all nominations.

The Palaeontological Association acknowledges the existence of various academic career paths and recognizes the challenges associated with balancing an academic career alongside personal commitments. When assessing applicants' eligibility and experience, the Association will take into account periods spent outside the academic environment. These periods may be the result of ill health, parental and/or adoptive leave, caring responsibilities, career breaks, *etc.* (note that this list is not exhaustive). Applicants who have taken periods outside the academic environment are strongly encouraged to include this information in any grant/award application. Furthermore, individuals with any disabilities are strongly encouraged to highlight these aspects in their applications. In the event that these factors apply to an applicant, even if no work leave was taken, we strongly advise that applicants make these factors known during the application process as we are aware that such factors can significantly slow down past and ongoing academic careers.

In the case of awards granted through the nomination schemes, we ask that nominators bring attention to these aspects if they are aware of them. In the event that the nominators are unsure, they are strongly advised to contact the Diversity Officer (e-mail <[diversity@palass.org](mailto:diversity@palass.org)>), who can approach the nominee directly and enquire whether they would like to disclose any career breaks or other relevant factors that should be taken into consideration during the evaluation of the award. The Diversity Officer can be contacted at any time for advice and assistance.



## Lapworth Medal

The Lapworth Medal is the most prestigious honour bestowed by the Association to a palaeontologist who has made a highly significant contribution to the science of palaeontology by means of a substantial body of research and service to the scientific community. It is not normally awarded on the basis of a few good papers, but Council will look for breadth as well as depth in the contributions in choosing suitable candidates.



The candidate must be nominated by two members of the Association (proposer and seconder; names and contacts details required). The nomination must consist of: (i) a two-page career summary (font-size 12); (ii) a list of ten papers that demonstrate significance and breadth of research; (iii) Professional Standards and Behaviour declarations by the nominators in relation to the nominee (see website for details). The two-page career summary should outline the significant contribution to the science in terms of research and also other activities such as outreach, teaching, mentoring and administration (including that relevant to palaeontology at their home institutions, scientific societies and at higher levels, such as funding bodies and government advisory panels). We are looking for evidence of both depth and breadth in research with clearly identified achievements and breakthroughs. Relevant honours and awards may be mentioned. If a candidate has taken time out from their professional career for family or other purposes this should be highlighted. Nominations must be compiled into a PDF file of less than 10 MB and uploaded via the webpage by the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or emailed separately to the Secretary and/or Executive Officer.

The award will be considered by Council at its May meeting and awardees will be invited to a ceremony at the Annual Meeting and/or the AGM. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right not to make an award in any particular year.

Nominations are invited by **31st March** each year.

## President's Medal



The President's Medal is a mid-career award given by Council to a palaeontologist who has had between 15 and 25 years of full-time experience after their PhD (excluding periods of parental or other leave, but not excluding periods spent working in industry) in recognition of outstanding contributions to his/her earlier career, coupled with an expectation that they will continue to contribute significantly to the subject in their further work. Please note that, in recognition of the disruption caused by the COVID-19 pandemic, Council has decided that 2020 should be discounted when calculating the years of full-time experience.

The candidate must be nominated by two members of the Association (proposer and seconder; names and contact details required). The nomination must consist of: (i) a two-page career summary (font-size 12); (ii) a list of ten papers that demonstrate significance and breadth of research; (iii) Professional Standards and Behaviour declarations by the nominators in relation to



the nominee (see website for details). The two-page career summary should outline the significant contribution to the science in terms of research and also other activities such as outreach, teaching, mentoring and administration (including that relevant to palaeontology at their home institutions, scientific societies and at higher levels, such as funding bodies and government advisory panels). We are looking for evidence of both depth and breadth in research with clearly identified achievements and breakthroughs. Relevant honours and awards may be mentioned. If a candidate has taken time out from their professional career for family or other purposes this should be highlighted. Nominations must be compiled into a PDF file of less than 10 MB and uploaded via the webpage by the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or emailed separately to the Secretary and/or Executive Officer.

The award will be considered by Council at its May meeting and awardees will be invited to a ceremony at the Annual Meeting and/or the AGM. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right not to make an award in any particular year.

Nominations are invited by **31st March** each year.

## *Hodson Award*

The Hodson Award is conferred on a palaeontologist who has had no more than ten years of full-time experience after their PhD (excluding periods of parental or other leave, but not excluding periods spent working in industry) and who has made a notable contribution to the science. Please note that, in recognition of the disruption caused by the COVID-19 pandemic, Council has decided that 2020 should be discounted when calculating the years of full-time experience.

The candidate must be nominated by two members of the Association (proposer and seconder; names and contact details required). The nomination must consist of: (i) a statement of when the PhD was awarded; (ii) a two-page career summary (font-size 12); (iii) a list of ten papers that demonstrate significance and breadth of research; (iv) Professional Standards and Behaviour declarations by the nominators in relation to the nominee (see website for details). The two-page career summary should provide evidence of outstanding contribution in career so far. If a candidate has taken time out from their professional career for family or other purposes this should be highlighted. Nominations must be compiled into a PDF file of less than 10 MB and uploaded via the webpage by the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or emailed separately to the Secretary and/or Executive Officer.

Nominations will be considered by Council at its May meeting and awardees will be invited to a ceremony at the Annual Meeting and/or the AGM. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right not to make an award in any particular year.

Nominations are invited by **31st March** each year.



## ***Mary Anning Award***

The Mary Anning award is open to all those who are not professionally employed in palaeontology but who have made an outstanding contribution to the subject. Such contributions may range from the compilation of fossil collections and their care and conservation, to published studies in recognized journals. The candidate must be nominated by two members of the Association (proposer and seconder; names and contact details required). The nomination must consist of: (i) a statement confirming that the nominee is NOT professionally employed in palaeontology; (ii) a one-page career summary (font-size 12); (iii) Professional Standards and Behaviour declarations by the nominators in relation to the nominee (see website for details). The one-page career summary should outline the nominee's contribution to palaeontology. This should include details of the sorts of activities pertaining to development of fossil collections, curation, care and maintenance of fossil collections, publications relating to these fossil collections, evidence for outreach activities associated with these fossil collections. Nominations must be compiled into a PDF file of less than 10 MB and uploaded via the webpage by the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or emailed separately to the Secretary and/or Executive Officer.

Nominations will be considered by Council at its May meeting. Awardees will be invited to a ceremony at the Annual Meeting and/or AGM, although the award may be presented at another time and place on request of the awardee. Awards will be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right not to make an award in any particular year.

Nominations are invited by **31st March** each year.

## ***Gertrude Elles Award***

The Gertrude Elles Award is to promote high-quality public engagement in the field of palaeontology. The award is made by Council for high-quality, amateur or institutional, public engagement projects that promote the discipline. Nominated projects can include museum displays and exhibitions, outreach programmes to schools and/or communities, art/science collaborations, digital initiatives, or any other programme that falls broadly under the heading of public engagement with palaeontology.

Nominations must consist of a one-page supporting case (font-size 12) and a portfolio of up to four images. The supporting case must outline:

- the aims of the project
- the nature of the target audience
- the available budget and funding sources
- visitor/audience numbers
- the results of project evaluation to demonstrate the quality and effectiveness of the project
- links to any digital components
- mechanisms for obtaining feedback





Self-nominations are permitted, and the nominators (names and contact details required) and proposed recipients do not need to be members of the Association. Nominations will be considered relative to the scale of the institution and the available project budget. The supporting case and the portfolio of images must be compiled into a PDF file of less than 10 MB and uploaded via the webpage by the deadline.

In addition, we ask that nominations are accompanied by Professional Standards and Behaviour declarations (see website for details).

The award will be considered by Council at its May meeting and winners will be invited to the award ceremony at the Annual Meeting and/or the AGM. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right not to make an award in any particular year.

Nominations are invited by **31st March** each year.

## ***Honorary Life Membership***

Honorary Life Membership recognizes individuals whom Council deems to have been significant benefactors and/or supporters of the Association. Recipients will receive free membership for life.

The candidate must be nominated by two members of the Association (proposer and seconder; names and contact details required). The nomination must consist of a one-page statement (font-size 12) outlining the nature of their support for the Palaeontological Association. In addition, Professional Standards and Behaviour declarations by the nominators in relation to the nominee are required to be completed (see website for details).

This should be uploaded via the webpage by the deadline.

The award will be considered by Council at its May meeting and announced at the AGM. The award will also be announced in the *Newsletter*, on the Association website and through social media.

Nominations are invited by **31st March** each year.

## ***Annual Meeting President's Prize and Council Poster Prize***

The President's Prize is awarded for the best talks and the Council Poster Prize is awarded for the best posters at the Annual Meeting. All student members of the Palaeontological Association, and all members of the Association who are early-career researchers within one year of the award of a higher degree (PhD or MSc), excluding periods of parental or other leave, are eligible for consideration for these awards. Individuals may nominate themselves for consideration when submitting abstracts for the Meeting. The prizes are announced immediately after the oral sessions at the end of the Annual Meeting. Winners will receive an official certificate and free membership of the Association for one year.



## ***Best Paper Awards***

The aim of these awards is to recognize papers published in *Palaeontology* or *Papers in Palaeontology* and reward excellence in our field of science. The selection criteria are as follows: scientific breadth and impact; novelty of approach; and quality of writing and illustration. The awards are open to all authors irrespective of age and nationality; membership of the Association is not required. Frontiers reviews, rapid communications and regular research articles are all eligible. The selection procedure is that a list of all papers published in the year is drawn up (when papers for the final part are allocated) and circulated around the science editors. The science editors are asked to nominate any papers that stand out, providing two to three sentences explaining why they are deserving. The Editor-in-Chief then draws up a shortlist of no more than five papers with supporting statements to circulate to the Editorial Board. The Editorial Board then selects winners by vote. Corresponding authors of winning papers will be offered 'Gold open access' paid for by the Association for one nominated paper submitted to *Palaeontology* or *Papers in Palaeontology* within the following 18 months (and subsequently accepted). In the case of joint authorship papers, the corresponding author can, by agreement, transfer the prize to one of the co-authors. The Editor-in-Chief will contact the winning authors and write a short synopsis for the *Newsletter*. An announcement of the awards will normally be made at the AGM.

## ***Undergraduate Prize Scheme***

The Undergraduate Prize Scheme annually invites all university departments where a palaeontology course or module is taught after the first year as part of a degree programme to recommend one of their undergraduate students to receive this award. The award consists of a certificate and free membership of the Association for the rest of the year in question, plus the following calendar year. It provides electronic access to both of our journals, postal copies of the *Newsletter*, and all the other advantages of membership. Receipt of the award also looks good on a recipient's CV.

Departments may use any criterion for selection, though most prefer to use the scheme as an acknowledgement of best performance in a relevant exam or project. Only one nomination will be accepted from any one institution in each calendar year. The nominee must be an undergraduate student, not a postgraduate, when they are selected. Normally the award is made to a student in their penultimate year of study, but a final-year candidate may be chosen if this is deemed more appropriate for the department in question.

Contact <[executive@palass.org](mailto:executive@palass.org)> with the nomination (name and e-mail address) and we will arrange to sign up the student as a member and send them a certificate. There is no deadline for this award and it is open to universities anywhere in the world.

## ***Innovations in Palaeontology Lecture Series and the PalAss Exceptional Lecturer***

The Innovations in Palaeontology Lecture Series, to be given by the PalAss Exceptional Lecturer, aims to promote palaeontology to the wider academic community and to recognize excellence in research among palaeontologists. The PalAss Exceptional Lecturer is selected in a competitive process. This scheme aims to:



- improve the dissemination of cutting-edge palaeontological research to the broader academic community;
- raise the profile of palaeontology within the Earth sciences and related fields;
- recognize outstanding research and science communication in palaeontology among members of the Association.

**Format of the scheme:**

- One PalAss Exceptional Lecturer will be selected each year in a competitive process.
- The PalAss Exceptional Lecturer will be expected to give five lectures at five different institutions over a nine-month period, both in person and online/virtual.
- In addition, the Exceptional Lecturer will deliver the Innovations in Palaeontology lecture at the Annual Meeting (or a similar event), which may be live-streamed on the Association's YouTube channel or similar.
- The successful applicant will receive the Innovations in Palaeontology Lecture Series Grant, which will be administered by the home institution of the PalAss Exceptional Lecturer.
- The Grant may only be used to pay the reasonable travel costs incurred by the PalAss Exceptional Lecturer to visit each of the host institutions (up to £2,000 for the total Innovations in Palaeontology Lecture Series with a maximum of £500 for any individual lecture). The host institutions will cover costs for accommodation (where necessary) and hospitality.
- Any academic institution (universities and/or museums) from any country can apply to participate in the Innovations in Palaeontology Lecture Series as a host institution.
- Any unused funds must be returned to PalAss after delivery of the final lecture. Should the PalAss Exceptional Lecturer move institutions within the timeframe of the lecture series, any unspent funds must remain available to the PalAss Exceptional Lecturer.
- Host institutions will be selected by the Exceptional Lecturer and the Association with the goal of maximizing the scheme's impact.

**Eligibility and selection process of the PalAss Exceptional Lecturer:**

- Eligible candidates will have a PhD in palaeontology or a related field.
- Eligible candidates can demonstrate (for example through their publication record) significant innovative scientific work in palaeontology.
- Applicants can reside in any country, but must be members of the Association.
- Candidates must self-nominate.
- To self-nominate, a two-page CV, full list of publications, and statement of motivation (max. 300 words) must be submitted via the Association's webpage as a single PDF file (max. 8 MB). In addition, a 60 second video summary (in MP4 format; max. size 30 MB) of a proposed seminar topic must be submitted via the Association's webpage.
- To self-nominate, candidates must provide via our online submission form a brief abstract (max. 300 words) and title for their proposed lecture which outline the subject matter of the proposed lecture and how it communicates innovation in palaeontology as a science that is of interest to related academic disciplines; a brief summary of their educational history; and a list of up to five of their publications that are relevant to the proposed lecture.
- After review of the submissions, short-listed applicants will be invited to present a five-minute lightning talk to the Association's Exceptional Lecturer committee to demonstrate their ability to communicate their chosen topic in an engaging manner and to clearly articulate how this topic is innovative and of broad interest to one or more related discipline(s).



### **Selection of host institutions:**

- Institutions interested in participating in the Innovations in Palaeontology Lecture Series should apply via the PalAss webpage and suggest a timeframe within which the lecture should be given.
- The PalAss Exceptional Lecturer will receive the list of potential host institutions after the 1st May deadline, and will choose their preferred hosts and liaise directly with them. Applications after 1st May will be considered depending on the remaining availability.

### **Expectations for host institutions:**

- Each lecture must be widely advertised across the host institution. We particularly encourage advertisement of the Innovations in Palaeontology Lecture Series on social media.
- Host institutions are expected to pay for hospitality and offer a meal in a social environment to the PalAss Exceptional Lecturer.
- If the PalAss Exceptional Lecturer has to travel more than three hours to the host institution or cannot return home at a reasonable time, the host institution must offer at least one night of accommodation.

### **Deadlines each year:**

- 15th November 23:59 GMT: Deadline for nominations for the PalAss Exceptional Lecturer.
- December: The PalAss Exceptional Lecturer will be announced at the Annual General Meeting.
- March: The call for host institutions to participate in the Innovations in Palaeontology Lecture Series will be published in the *Newsletter*.
- 1st May 23:59 GMT: Deadline for applications from host institutions.
- September – May: Delivery of lectures.

### **Application:**

Applications are via online forms. See <<https://www.palass.org/awards-grants/awards/innovations-palaeontology-lecture-series-and-palass-exceptional-lecturer>>.

## **Upcoming Grants in 2024/2025**

Palaeontological Association grants are offered to encourage research, education and outreach through different means. Undergraduates, early-stage researchers, and otherwise unfunded persons are given special encouragement to apply. All of these awards and grants are core to the charitable aims of the Palaeontological Association. A full list of the Association's grants may be found on the Association's website (<<https://www.palass.org/awards-grants>>). Those with deadlines in the next six months or run throughout the year are detailed below.

### ***Grants-in-aid: meetings, workshops and short courses***

The Association is happy to receive applications for grants from the organizers of scientific meetings, workshops and short courses that lie conformably with its charitable purpose, which is to promote research in palaeontology and its allied sciences.



The Association will, via the Grants-in-Aid programme, consider applications to financially support workshops to be held as part of the Annual Meeting and Progressive Palaeontology. There are further details on the next page.

### **General Regulations for all applications**

The Association will consider applications up to £2,000 GBP.

- Applications must be received by the deadline of either 1st March or 1st September each year.
- Application must be made in good time. The proposed event must commence no earlier than six months after the application round deadline applied to.
- All applications are to be made by the scientific organizer(s) of the meeting using the online application form at <<https://palass.org/awards-grants/grants/grant-aid-application-form>>.
- Applications will be considered by Council at either the May or the October Council Meeting each year.
- Applicants will normally be informed of the application outcome by the end of May or October (*i.e.* 2-3 weeks after the May or October Council meeting).
- If the application is successful, we require that the support of the Association is acknowledged, preferably including reproduction of the Association's logo, in the meeting/workshop/short course literature and other media.
- Any monies granted must only be used for the specified purposes stated in the original grant application. Should circumstances change and the monies cannot be used then it is expected that all unspent amount is returned to the Association.
- Retrospective changes to grant applications, *i.e.* after the proposed event, are not allowed.
- In the event of unforeseen changes in circumstances prior to the start of the proposed event (*e.g.* due to the current COVID pandemic, illness of keynote speakers, *etc.*) advice should be sought from the Association's Executive Officer and/or the Secretary.

Please see also the Palaeontological Association Grant Ethics and Conditions:

<<https://www.palass.org/awards-grants/grants/grant-ethics-and-conditions>>.

Pre-submission enquiries may be made to the Secretary (e-mail <[secretary@palass.org](mailto:secretary@palass.org)>).

### **Financial support via the Grants-in-Aid programme for workshops at the Annual Meeting and Progressive Palaeontology**

Workshops have been an important part of both the Annual Meeting and Progressive Palaeontology in recent years. These have typically been held the day before each meeting. The workshops are arranged in consultation with the local meeting organizer; the local organizer has the final decision as to how many and which events to select for inclusion in any workshop programme. It may (subject to the local organizer being able to facilitate it) be possible to arrange a hybrid event. Our preference, however, is to run the workshop as either an in-person or a virtual event. We especially welcome suggestions for workshops that help the Association advance its commitments to EDI-related issues.

We invite those organizing workshops at either the Annual Meeting or Progressive Palaeontology to apply for competitive funding via the Grants-in-Aid programme to help offset costs (*e.g.* travel, accommodation) incurred by those delivering the workshop, and/or to provide an honorarium (to a maximum of £250 GBP) for contributors. An honorarium may be appropriate to support ECRs/ precariously-employed workers, others not in full-time, permanent employment, or where the



contributions are by subject specialists on topics that do not necessarily form part of their core research activities. These examples are not exhaustive.

Before applying for funding, please liaise with the local meeting organizer and secure their support for the proposed activities. You should confirm in your application that this support is in place. This is to avoid potential issues such as there not being the infrastructure available locally (rooms, etc.), or time in the schedule, to accommodate the workshop.

The Association may support a maximum of two workshops at each of the Annual Meeting and Progressive Palaeontology.

### **Making an application for meeting or workshop/short course support**

Applications must be made through online submission, for which you will need the following information:

- Title of meeting / workshop / short course
- Date and Place of proposed event
- Name, position and affiliation of the organizer(s)
- Brief description (not more than ten lines) of the rationale behind the meeting / workshop / short course
- Anticipated number of attendees
- Amount requested
- Other sources of funding applied for
- Specific use to which requested funds will be put

**Note 1:** If funds are requested to support one or more keynote speakers, then full details of their names, affiliations and titles of presentations must be included.

**Note 2:** The application will be strengthened if the keynote speaker(s) agrees to submit their paper as a review article for possible publication in *Palaeontology* or *Papers in Palaeontology*.

Deadlines are **1st March** (for events commencing on or after 1st September in the same year) and **1st September** (for events commencing on or after 1st March the following year).

## **Research Grants**

Awards are made to assist palaeontological research up to a maximum value of £10,000 per award. Normally, grants must support a single research project, or a 'proof of concept' proposal with an aim of supporting future applications to national research-funding bodies. Field-based projects are also eligible, but the scientific objectives and outcomes of the research must be made clear.

Applications for investigator's salary costs will only be considered in exceptional circumstances and if awarded all legal and financial liability will lie with the applicant.

### **Other conditions**

Preference is given to applications for a single purpose (rather than top-ups of other grant applications). Applicants must be members of the Association and will normally have a PhD and a successful track record as an independent scientific investigator. Current PhD students (*i.e.* those who have not yet been awarded a PhD by the application deadline) are not eligible for this scheme and instead should consider the Small Grants Scheme.



Preference will normally be given to candidates who have not previously won an award. Proposals must fit with the charitable aims of the Association. We expect applicants to work in meaningful and mutually beneficial ways with local collaborators as appropriate to the project, and to consider relevant ethical aspects.

Proposals will be ranked on the following criteria:

- Scientific quality of research, novelty and timeliness, likely outputs
- Feasibility
- Value for money and cost effectiveness
- The scientific track record of the investigator

At the end of the award period a final report (including receipted accounts) will be submitted for review by the Trustees or, where appropriate, external referees. This final report will also be printed in the *Newsletter*. Awardees are asked to prioritize the Association's meetings and publications as media for conveying the research results.

Applications must be submitted electronically through the PalAss website, with a deadline of **1st March**. Enquiries may be made to the Secretary (e-mail <[secretary@palass.org](mailto:secretary@palass.org)>).

Successful applications will be reported at the May Council meeting, and funds will normally be available from 1st June. The awards will be announced at the AGM. Feedback on unsuccessful applications will be provided upon request by the Secretary.

## ***Undergraduate Research Bursaries***

The Palaeontological Association Undergraduate Research Bursaries are aimed at giving undergraduate students the opportunity to acquire research skills and experience that will significantly transform their academic career. The bursaries will support projects co-designed by students and their supervisor(s) that give students registered for an undergraduate degree their first experience of undertaking a palaeontological research project; students and supervisors from all countries are encouraged to apply. The bursaries provide a stipend for the student for up to eight weeks. The scheme is not intended to fund students to undertake routine work for the supervisor(s) and the Association expects the supervisor(s) to provide significant personal mentoring of successful student applicants. Proposals will be assessed as to whether they meet expected standards, and then awarded via an anonymised lottery system, with students from under-represented groups given priority

- Applications from any country and applicants of any nationality are encouraged to apply.
- The principal supervisor must be an academic member of staff in the same institution as the student, or in a closely-related institution such as a museum, as they can give significant career advice and take ultimate responsibility for the student researcher. It is permissible for the student to opt to work in an institution more convenient for their home town in order to remove any cost barriers, but in this case the academic member of staff must be clear in the application that the insurance implications have been considered and agreed by the host institution where the student will actually do the work. The supervisor is also responsible for verifying that the student is registered at the institution stated on the application form.



- The principal supervisor must be a member of the Association at the time the application is received. Supervisors and students applying for the first time who are not members of the Association (and have not been members in the past) can receive free membership for one year and must apply for membership before the application has been submitted. Supervisors and students are requested to contact the Executive Officer for information regarding this.
- If the principal supervisor is on a fixed term contract, then this contract must extend beyond the proposed end-date of the project.
- PhD students and postdoctoral researchers in the same, or a closely related, research institution may be named as additional supervisors and share in the training and supervision of the student, thus enhancing the quality of the research experience for the student.

Further information, including eligibility criteria for supervisors and students, details of prioritization scheme and lottery system, and a full list of terms and conditions for the Undergraduate Research Bursaries scheme can be found on the appropriate page of the Association's website. Enquiries may be made to the Secretary (e-mail <[secretary@palass.org](mailto:secretary@palass.org)>).

The deadline for applications is **1st February** each year. Successful applicants will be notified by the end of March and funds will normally be available from 1st June. A full list of awards will be announced at the AGM.

## ***Postgraduate Travel Fund***

Financial assistance is offered to postgraduate students who are members of the Association to attend international meetings that are not directly supported by the Association through the Grants-in-Aid scheme. A list of directly-sponsored meetings is given below. The funding is only intended for conferences that are explicitly scientific in nature.

### **Terms and Conditions**

Please read the following notes before applying:

1. The award is specifically for travel.
2. Applicants must be delivering a presentation (poster or oral) that falls within the scope of the Association's charitable aims.
3. The maximum amount awarded will be £200 GBP.
4. Successful awards will be paid retrospectively on the submission of receipts for reasonable travel costs.
5. Applications must be made online no later than two months prior to the beginning of the conference.
6. The total fund and number of awards will be at the discretion of Council.
7. Only one travel grant will be awarded per applicant per year, but subsequent applications can be made.
8. Applications are to be made through the Association website, and should include the personal details of the applicant and their career stage, the title of the accepted abstract, and details of other funding obtained towards the cost of the meeting. Two letters must also be attached, in a PDF document: a letter of confirmation from the meeting convenor which





states the acceptance of the applicant's abstract, and a short status-confirming letter from the applicant's supervisor.

9. Funding from the Association must be acknowledged on your poster or in your presentation.

**Directly-sponsored meetings (NOT eligible for the Postgraduate Travel Fund):**

- The Palaeontological Association's Annual Meetings.
- Progressive Palaeontology.
- Lyell Meetings.
- Any other meetings that have been awarded funds to support student attendance from the Association's Grants-in-Aid scheme.

There is **no deadline** for this fund. Enquiries should be made to the Meetings Coordinator (e-mail <[meetings@palass.org](mailto:meetings@palass.org)>).

## *Palaeontological Association Carer's Bursary*

Bursaries are made to support attendance at Association meetings by researchers with caring responsibilities. Normally the budget for an individual bursary will be a maximum of £250 GBP. Applications must include a supporting statement and a breakdown of anticipated expenses, supported by quotes where possible. Appropriate costs include attendance of a carer or use of local childcare facilities (for care of accompanying young children), or other caring costs at home.

Bursaries will be awarded to applications received prior to the application deadline. Applications will be assessed by the PalAss Diversity Group; if there are several eligible applicants, awards will be made on a first-come first-served basis. No subsequent report on expenditure is required.

Successful applicants will be invited to submit a brief statement (<60 words) describing the impact of the bursary on their career. This statement may be used in publicity for the bursary scheme and thus should not contain any confidential or sensitive information.

The principal applicant must be a member of the Association. Applications must be submitted electronically via the Association website. Any associated publicity must mention the support of the Association.

Successful awards will be paid retrospectively on the submission of receipts for reasonable costs (e.g. economy air fares or train tickets, accommodation, subsistence, care costs).

Required supporting information:

- A cover letter detailing the case for support (no more than one A4 page)
- Receipts or quotations for expenses
- Details of any pending or previous applications for funds

These documents must be submitted in a single PDF file.

The deadline for the Annual Meeting 2024 is **8th November**.



## Engagement Grants

Awards are made to encourage educational outreach, public engagement, and related initiatives in palaeontological themes. Normally, the budget for an individual grant would be less than £5,000 GBP (or equivalent currency in the applicant's country at the time the funds are disbursed). In exceptional circumstances, a budget of up to £8,000 GBP for an individual application will be considered. Grants can support either stand-alone complete projects, or they can be 'proof of concept' case studies that have their own outcomes but that form the groundwork for a larger bid elsewhere. Applications from any country and applicants of any nationality are welcomed.

Applications for salary costs are permitted, providing a full justification is given, but if awarded all legal and financial liability will lie with the applicant (see: Categories of expenditure for which the Palaeontological Association does not provide support, below).

### Other conditions:

- Proposals must fit with the charitable aims of the Association.
- Preference is given to applications for a single purpose (rather than top-ups of grants for existing projects). We particularly encourage applications with an innovative aspect, such as engaging with new media, and especially cases that will disseminate good practice. We also encourage applications aimed at supporting under-represented groups in palaeontology (see the Diversity Study for more details).
- If the principal applicant is a member of the Association they should be signed into the website when submitting the form. Applicants can contact the Executive Officer Dr Jo Hellawell (e-mail <[executive@palass.org](mailto:executive@palass.org)>) for further information regarding membership.
- Preference will normally be given to candidates who have not previously won an award. The application deadline is **1st September** and funds will normally be available from 1st November each year. The awards will be announced at the Annual General Meeting.

Proposals will be ranked on the following criteria:

- Fit to the charitable aims of the Association
- Imaginative quality, innovation, and likely spread and impact of the proposal
- Feasibility, value for money and cost effectiveness
- Track record of the investigator in engagement and education initiatives

At the end of the award period a final report (including receipted accounts) will be submitted for review by the Trustees or, where appropriate, external referees. Appropriate parts of the final report will be published in the Association *Newsletter*. Any publicity associated with the activity must mention the support of the Association.

Applications must be submitted electronically via the webpage. Feedback on unsuccessful applications will be provided upon request to the Secretary.

### Categories of expenditure for which the Palaeontological Association does not provide support:

Applicants are advised that the Association does not offer funding for the following costs, and hence none of these items may be included in any budget proposal submitted to the Association.



- Core funding or overheads for institutions. The Association will fund the directly-incurred costs of the engagement/educational initiative but, as a charity, we expect the general running costs (e.g. indirect costs, estate costs, support services, directly allocated staff costs) to be otherwise covered. We will therefore not fund on a proportion of full economic costs (FEC) basis. Attention is drawn to paragraphs 3.31 to 3.37 of the Science and Innovation Investment Framework 2004–2014, HM Treasury (July 2004), which explains arrangements for the provision of overheads linked to charity funding to academic institutions.
- Individual items of equipment over £1,000 GBP, sites, buildings or other capital expenditure. Artwork and similar specially-commissioned outreach tools are not considered to be equipment, and will be considered for funding.
- A shortfall resulting from a withdrawal of or deficiency in public finance.
- Student tuition fees and summer research bursaries. If you would like to support a summer research project see the Undergraduate Research Bursaries for more detail.

The application deadline is **1st September** and funds will normally be available from 1st November each year. The awards will be announced at the Annual General Meeting. For more information please contact the Association's Outreach Officer (e-mail <[outreach@palass.org](mailto:outreach@palass.org)>).

## *Small Grants Scheme*

The Association offers multiple awards each year, in honour of four donors, to fund palaeontological research, travel and fieldwork; these are integrated together under the Small Grants Scheme. These grants are open to any member of the Association, although preference is given to students, early-career researchers, and members of the Association who are retired.

- Sylvester-Bradley Awards: Multiple awards of up to £1,500 each, for palaeontological research.
- Whittington Award: An award of up to £1,500 for a project which is normally based on museum collections.
- Stan Wood Award: An award of up to £1,500 for projects in vertebrate palaeontology, and ideally involving fieldwork and fossil collecting.

There is one online application form with a deadline of **1st November**. The successful applications will be reported at the December Council meeting, and at this meeting Council will decide on the allocation of the awards based upon the nature of the project made in the application. The awards will be announced at the AGM, and funds will normally be available from 1st January.

Successful applicants will be required to produce a final project report that will be published in the Palaeontological Association *Newsletter*, and are asked to consider the Association's meetings and publications as media for conveying the research results.

Further information, including eligibility criteria, and a full list of terms and conditions for the Small Grants Scheme can be found on the appropriate page of the Association's website. Enquiries may be made to the Secretary (e-mail <[secretary@palass.org](mailto:secretary@palass.org)>).

The deadline is **1st November** each year.



## *Career Development Grant*

The Career Development Grant is to assist talented early-career researchers who have recently completed their PhD to strengthen their CVs to help them achieve a career in palaeontology (research or curation). The grant provides funding of up to £2,500, to be paid after submission of thesis and cessation of funding, for any purpose that would lead to the strengthening of the CV via completion of a measurable activity or output. Successful applicants will be notified in the December following the application deadline, with funding available for use from January of the calendar year following the deadline. Under normal circumstances, applicants must be able to take up the funding by April of the calendar year following the deadline.

The grantee is also automatically enrolled in the PalAss mentoring scheme and will be assigned a mentor by agreement.

Some examples of things that the grant could be used for include (but are not limited to):

- Help with living costs while turning a PhD chapter into a publication;
- Help with living costs while writing a fellowship or grant application;
- Further data collection that would allow a chapter to become publishable;
- A training course that would lead to skills enhancement;
- A training or research internship in another research group.

The grant cannot be used to pay overheads, open access or page charges, and cannot be used to support employment of another *e.g.* a student research assistant. Applicants must be members of the Association, should be submitting their PhD in the near future or have recently submitted their PhD (within one year), and should have no other form of substantial financial support on cessation of PhD funding. Applicants who have been awarded a postdoc or fellowship after their PhD, or who have already held a postdoc or fellowship, are not eligible to apply. Upon completion of the activity, applicants are asked to write a short report, which may be published in the Association's *Newsletter*. Proposals to make up a funding shortfall from other sources are not eligible. Proposals must fit within the charitable aims of the Association and will be subject to appropriate research ethics considerations.

Proposals will be ranked on the following criteria:

- Demonstrable need for funding;
- A clear and well-explained future career plan;
- How the funding will help the candidate to strengthen their CV to achieve their future career plan;
- Feasibility;
- Value for money and cost effectiveness.

The deadline is **7th October** each year. Successful applicants will be notified in December and funds will normally be available in January. A full list of awards will be announced at the AGM.



# ASSOCIATION MEETINGS



## 68th Annual Meeting of the Palaeontological Association

Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg, Germany

9 – 13 December 2024

The 68th Annual Meeting of the Palaeontological Association will be held at the University of Erlangen–Nuremberg. The organizing committee is chaired by Emma Dunne, Thomas Clements and Rachel Warnock with support from colleagues in the Paleobiology Research Group, student volunteers and colleagues at FAU's GeoZentrum Nordbayern. The e-mail address for all meeting-related matters is <[annualmeeting2024@palass.org](mailto:annualmeeting2024@palass.org)>.

Information about the meeting is provided in the coloured supplement at the back of this *Newsletter* and on the PalAss website at <<https://www.palass.org/meetings-events/annual-meeting/2024/annual-meeting-2024-erlangen-germany-overview>>.

The final deadline for registration is Friday 15th November, unless capacity is reached before that date. The abstracts for the talks and posters will be available on the Association's website and will be included in the conference pack at the Meeting. We look forward to seeing you in Erlangen in December!

## Abstract of Annual Address

The Annual Address will be given on Wednesday 11th December.

### **Fossils of the future: how palaeontological thinking can help predict humanity's legacy on Earth**

**Prof. Sarah E. Gabbott**

*University of Leicester, UK*

As palaeontologists we aim to understand past life through investigation of the fossil record. To do so we must read it correctly, taking into account a myriad of processes that have affected the make-up of the fossil archive. For example, we consider how depositional environment, sediment composition and taphonomy interact to determine what taxa are preserved, and how they are expressed as fossilized remains. In this talk I will argue that palaeontological thinking has a critical role to play in predicting the nature of the future fossil legacy that humanity will leave on Earth, and how that might help us to mitigate this legacy now. To demonstrate this new conceptual approach I will show that taphonomy can be applied to modern materials, and in particular to plastics, to predict their preservation potential. Controlled laboratory experiments, using similar research design principles to those in 'decay experiments', have provided us with data to predict the near-future fate of plastics. And to extend our understanding over millions of years, we have drawn on the fossil record of algae and macroplankton that are composed of polymer-like biomolecules. That such fossils survive in rocks 400 million years old should be a call to action for us – and for policy-makers. Humanity is producing and discarding plastics, and other materials



destined to be technofossils, in ever increasing amounts. The occurrence and abundance of plastics in the environment are now recorded across many thousands of research papers: we know where plastics end up (everywhere) and in what quantities (a lot). But it is the application of the science of palaeontology that can provide us with the long view, offering robust evidence that helps reveal the ultimate fate of plastics, and of the other materials that our global industrial society makes and discards so freely.

## Meeting support

The organizers of the Annual Meeting gratefully acknowledge the support of the following sponsors and exhibitors:

- *Nature Ecology and Evolution*
- The Palaeontographical Society
- *Fossil Studies*
- Royal Society Publishing
- Transmitting Science





# The Palaeontological Association

Reg. Charity No. 1168330

## Code of Conduct for Palaeontological Association Events

The Palaeontological Association holds regular meetings and events throughout the year. The Association's Events Code of Conduct relates to the behaviour of all participants and attendees at all events run by the Association, and acts alongside the Code of Conduct for Members.

**Behavioural expectations:** It is the expectation of the Palaeontological Association that meeting attendees behave in a courteous, collegial and respectful fashion to each other, volunteers, exhibitors and meeting facility staff.

Attendees should respect common sense rules for professional and personal interactions, public behaviour (including behaviour in public electronic communications), common courtesy, and respect for private property.

Demaneing, abusive, harassing or threatening behaviour, discrimination on the basis of race, ethnic origins, immigration status, religion, age, marital status, parental status, sex, sexual orientation, gender identity or expression, socioeconomic background, educational background, or disability will not be tolerated. Inappropriate physical contact, unwelcome sexual attention, including verbal or physical actions of a sexual nature towards other attendees or towards meeting volunteers, exhibitors or facilities staff and security will not be tolerated, either in personal or in electronic interactions.

**Digital images and social media:** Respect for the intellectual property of presenters should be maintained at all times. Photographing or recording a talk without the author's express permission is forbidden. While the default assumption is to allow open discussion of presentations on social media, attendees are expected to respect any request by an author to not disseminate the contents of their talk or poster. Questions and discussion should be constructive, respectful, and focus on data and ideas rather than individuals.

**Reporting unacceptable behaviour:** If you are the subject of unacceptable behaviour or have witnessed any such behaviour, you can report it (anonymously if you choose to) via the Report code of conduct violation form<sup>1</sup>. Alternatively you can notify a designated member of the Palaeontological Association Council on site: President Prof. Rachel Wood ; Vice-President Dr Uwe Balthasar; Vice-President Prof. Susannah Maidment; Diversity Officer Dr Nidia Alvarez Armada; or Executive Officer Dr Jo Hellawell.

Anyone experiencing or witnessing behaviour that constitutes an immediate or serious threat to public safety, or a criminal act, is expected to contact the appropriate law enforcement agency (in Germany for the police call 110, or for fire or medical emergencies call 112). Those witnessing a potential criminal act should also take actions necessary to maintain their own personal safety.

<sup>1</sup> <<https://www.palass.org/meetings-events/report-code-conduct-violation>>.



## News bites

### Use your head! The importance of trilobites' cephalic appendages in understanding euarthropod evolution

Tell me how many appendages you have and I'll tell you who you are... Trilobite head structure is a key feature for reconstructing the evolution of the euarthropod head, since trilobites, a well-known group of arthropods, represent an intermediate model to bridge the stem- and crown-group euarthropods. In their study, Hou and Hopkins analyse the Upper Ordovician olenid *Triarthrus eatoni* and middle Cambrian corynexochid *Olenoides serratus* species and correct the four pairs of cephalic appendages recognized in the traditional analysis as five pairs of cephalic appendages. Mismatch between the cephalic appendages and dorsal furrows in the head is also solved by the position and morphology of the hypostome.

HOU, J.-B. and HOPKINS, M. J. 2024. New evidence for five cephalic appendages in trilobites and implications for segmentation of the trilobite head. *Palaeontology*, **67**, 6.



### Growing up in a Miocene lake: the larvae from McGraths Flat

The Miocene Lagerstätte of McGraths Flat in central New South Wales, Australia, seemed to be the place to be, if you were an aquatic insect fossil. In their study, Baranov *et al.* describe a diverse aquatic insect assemblage, consisting predominantly of larvae. These include a new species of phantom midge (*Chaoborus abundans* Baranov, Frese and McCurry sp. nov.). Thanks to the large number of fossil specimens, Baranov *et al.* could study the development of this midge species from larvae to adults, estimating growth rates using measurements from all four larval stages of *Chaoborus*.

BARANOV, V., FRESE, M., BEATTIE, R., DJOKIC, T. and MCCURRY, M. R. 2024. New aquatic insects from the Miocene of Australia with notes on the ecology and ontogeny of a new species of *Chaoborus* (Diptera, Chaoboridae). *Papers in Palaeontology*, **10**, 4.



### Billfishes deal: take six, pay four

Four new fossil billfish species plus two previously described: this is the result of the De Gracia *et al.* study on the 10.5- to 8.3-million-year-old sediments from La Cisterna Quarry in Apulia, Italy. The Apulia region was a marlin hotspot during the late Miocene and the presence of large billfish suggests a functional connectivity between the Atlantic Ocean and Mediterranean Sea in the past, and a surface water temperature around 23-24°C, much warmer than today. De Gracia *et al.* were able to reconstruct the phylogenetic relationships between fossil and living species with more stable results than other works.

DE GRACIA, C. F., VILLALOBOS-SEGURA, E., BALLEEN, G. A., CARNEVALE, G. and KRIWET, J. 2024. Phylogenetic patterns among fossil and living billfishes (Istiophoriformes, Istiophoridae): evidence from the Central Mediterranean. *Papers in Palaeontology*, **10**, 4.







## Palaeontology in the news

### Porcupines at the crossroad: what happened roughly 8 million years ago?

Evolution is full of ambiguous twists, weird paths and confusing convergences. In their recent study published in *Current Biology*, researchers from the Florida Museum of Natural History studied the nearly complete skeleton of a porcupine found in 2005 in Florida, gathering clues to solve a decade-long mystery: why all North American porcupine's fossils are younger than 1.8 million years old. While related to the Neotropical porcupine, the North American one has distinctive features. Particularly a short tail, a thick jaw to scrape bark from trees, and weight between 4.5. and 11.3 kg. So far, so good. However, DNA analysis of living species estimates that the two groups separated around 10 million years ago. Therefore, the question is, why no traces of North American species in the fossil record for almost 8 million years?

Before the finding of the almost complete 2005 specimen, scientists had two theories. One is that the early ancestors of North American porcupines looked so similar to today's Neotropical ones that it is not possible to discriminate them within the fossil record. On the other hand, the other theory suggests that North American porcupines were already differentiated in some features from the Neotropical ones, however, the fossil record is incomplete. The problem was that the debate is impossible to solve with the available fossil data ... until now. The research at the Florida Museum of Natural History identified nearly 150 informative details about the 2-million-year-old porcupine skeleton, pointing at this specimen as a closer relative of North American porcupines. Who was right then? Well, the skeleton shows that the older relatives of the North American porcupine were missing the distinctive traits of their modern descendants, particularly the reinforced jaw and shorter tail.

VITEK, N. S. 2024. Rare Florida fossil finally ends debate about how porcupine jaws and tails evolved. *The Conversation*. <<https://theconversation.com/rare-florida-fossil-finally-ends-debate-about-how-porcupine-jaws-and-tails-evolved-234976>>.

VITEK, N. S., HOEFELICH, J. C., MAGALLANES, I., MORAN, S. M., NARDUCCI, R. E., PEREZ, V. J. *et al.* 2024. An extinct north American porcupine with a South American tail. *Current Biology*, **12**, 2712–2718.e3

### Coelacanths under the spotlight, again

Coelacanths are among the most well-known 'living fossils'. These deep-sea fish were long considered extinct, until a specimen caught off the southeast coast of Africa in 1938 was scientifically recognized. While nowadays there are two known extant species of coelacanth, *Latimeria chalumnae* (the West Indian Ocean coelacanth or gombessa) and *Latimeria menadoensis* (the Indonesian coelacanth), during their more than 410-million-year-long evolutionary history several species have arisen and gone extinct. Now, a team from Flinders University in South Australia, together with researchers from Africa, North America and Europe, have discovered a new fossil species of coelacanth from the Gogo Formation on Gooniyandi country in northern Western Australia. *Ngamugawi wirngarri*, recognized as the best 3D preserved coelacanth from the Palaeozoic, was among 50 species of fish found at this fossil site.

Well-preserved species allow researchers to advance our knowledge of the early anatomy of these fish, adding new pieces to the puzzle of coelacanth evolution. The oldest known fossil of a



coelacanth is more than 410 million years old, but it is mostly fragments. Then, around 250 million years ago, the fossil record shows an increased diversity with more than 175 species all over the world. The end of the Cretaceous period is when coelacanths disappeared from the fossil record, only to reappear as a living creature in 1938.

In the frame of their long and mysterious existence, the evolutionary rate of coelacanths is something that is worth exploring. According to the results from the Flinders University team, while coelacanths have generally evolved slowly, there are exceptions. Trying to find a reason behind the sudden increase in the evolutionary rate of these fish, the researchers found that increases seem to be linked to a specific phenomenon: tectonic activity. In periods of high tectonic activity, where seismic movements were transforming habitats, the coelacanth diversity boomed, producing new species.

Other than the fossil record, researchers are also looking into the two living species of coelacanth. For these species, it seems that the evolutionary clock stopped long ago, but is that true? Despite their features not having changed much from their ancestors, it seems that some details in *Latimeria's* DNA are still changing. Hopefully we will hear about this living not-so-fossil fish again soon.

CLEMENT A. M. and LONG, J. A. 2024. Exceptional new fish fossil sparks rethink of how Earth's geology drives evolution. *The Conversation*. <<https://theconversation.com/exceptional-new-fish-fossil-sparks-rethink-of-how-earths-geology-drives-evolution-236693>>.

CLEMENT, A. M., CLOUTIER, R., LEE, M. S. Y., KING, B., VANHAESBROUCKE, O., BRADSHAW, C. J. A. *et al.* 2024. A Late Devonian coelacanth reconfigures actinistian phylogeny, disparity, and evolutionary dynamics. *Nature Communications*, **15**, 7529.

### **Painting fossils: the lost knowledge of the San from South Africa's Karoo region**

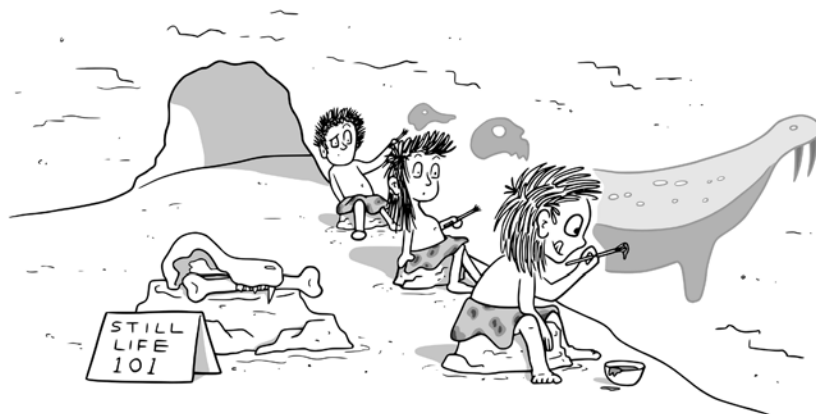
Cave paintings are one of the most ancient forms of human art. Subjects may vary but, usually, they are inspired by the surrounding environment, featuring local flora and fauna, such as the walrus painted on a cave wall in South Africa's Free State Province. Wait, walrus? The mysterious animal painted by the San, indigenous hunter-gatherers of South Africa's Karoo region, has been debated by scientists for a long time. It looks like a walrus, but there are no such animals in Africa. Is it a sabre-toothed cat? A Legendary animal? Or was it inspired by the rich fossil remains found in the region? The San had a deep knowledge of their environment, proven by the detailed depictions of it in the San's cave art. Fossils are part of this environment too. Not only did the San discover dinosaur bones in Lesotho, but they also painted dinosaur footprints on cave walls, as discovered by Benoit *et al.* (2023). So why not explore the idea that the 'walrus' on the cave wall is not a walrus but a dicynodont, an ancestor of mammals described in the literature in 1845 by the British palaeontologist Sir Richard Owen? Dicynodont fossil remains are common in the African Karoo area, and they may be part of the San's mythology in which they recall that "enormous brutes" used to roam southern Africa a long time ago. Therefore, it would not be strange to find these creatures painted on their cave walls. Furthermore, even though the exact date of the painting is unknown, it was made at the latest in 1835 when the San left the area, if not much earlier as the San inhabited the area for thousands of years. Therefore, the San depicted this dicynodont a minimum of ten years before Sir Richard Owens described it. Indigenous knowledge of palaeontology is often overlooked, but if indigenous people have a deep knowledge of their territories including the local flora, fauna, geography and geology, why should fossils be excluded?



- BENOIT J. 2024. Mysterious South African cave painting may have been inspired by fossils. *The Conversation*. <<https://theconversation.com/mysterious-south-african-cave-painting-may-have-been-inspired-by-fossils-237875>>.
- BENOIT J., PENN-CLARKE C. R. and HELM C. W. 2023. Africans discovered dinosaur fossils long before the term 'palaeontology' existed. *The Conversation*. <<https://theconversation.com/africans-discovered-dinosaur-fossils-long-before-the-term-palaeontology-existed-218833>>.
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**Nicola Vuolo**

*Publicity Officer*



KEY MOMENTS IN THE HISTORY OF ART: THE INVENTION OF ARTISTIC LICENSE

DR JONES

<<http://www.ratbotcomics.com/>>

## *Medals and awards from other bodies*

### **Geological Association of Canada medal**

The Geological Association of Canada's Middleton Medal for Sedimentology is awarded biennially to recognize outstanding contributions to any aspect of sedimentology by a Canadian, or by a sedimentology researcher working in Canada. The Middleton Medal for 2022 was awarded in 2023 to Palaeontological Association member **Prof. Brian R. Pratt** (University of Saskatchewan, Canada) in recognition of his sedimentological work over many decades. The illustrious, sadly late, Gerry Middleton, after whom the medal is named, was an enormously achieved and versatile scientist, who in fact cut his teeth on Devonian corals from Devon in the UK. As one of Brian's undergraduate professors at McMaster University in Hamilton, Ontario, Brian was in awe of his intellect, yet enjoyed



Photo courtesy of Brian Pratt.

his down-to-earth, good-natured personality. Brian's own palaeontological specialization has mainly been in Cambrian trilobites, and he has been a member of the Palaeontological Association for some three decades, although he is also well known as a sedimentologist. Brian is an expert on lower Palaeozoic microbial carbonates and reef palaeoecology, as well as a pioneer in the recognition of ancient tsunami deposits and synsedimentary deformation structures due to earthquakes. A lot of his work has also been on Proterozoic strata, from well before the advent of animal life on Earth. Brian reminds us that sedimentology and palaeontology are closely linked disciplines and that palaeontological research should be done in the geological context of the rocks. This is where creativity and imagination can really blossom, he says.

### Royal Society medal

The Gabor Medal of the Royal Society is given for acknowledged distinction of interdisciplinary work between the life sciences and other disciplines. The medal is awarded annually and was created in memory of the engineer Dennis Gabor FRS, Nobel Prize winner and inventor of holography. The first award was made in 1989. The Gabor Medal 2024 is awarded to **Prof. Emily Rayfield** (University of Bristol, UK) for pioneering a new, cross-disciplinary era of engineering-informed computational palaeobiology. Emily's research focuses on how skeletal mechanics influence morphological evolution, and the relationship between form and function in biology. Her key contribution has been to develop the technique of finite element modelling to understand the mechanics of animal skeletons, both living and extinct. The significance of this research lies not only in its methodological advancements but also in Emily's pioneering role in revolutionizing palaeobiology, by leveraging computational analysis, enhanced computer power, software and X-ray imaging tools to enable hypothesis-based testing of historical datasets, merging computational and experimental approaches. Emily is honoured to receive such a prestigious medal but also reflects that it represents a team effort, recognizing that her research has been supported by many talented students and postdocs over the years, as well as inspiring colleagues. Emily says her research builds on the foundations laid by former insightful thinkers and talented scientists who forged research at the intersection of physics, biology and palaeontology to understand the function and evolution of organisms past and present.



Photo by George Felix.

### Jo Hellawell

*Executive Officer*



## *Transmitting Science courses*

The Transmitting Science team is excited to share some upcoming courses that might interest members of the Association. As part of the Transmitting Science Ambassador Institutions programme, all members of the Association can benefit from a 20 % discount on the registration fees for these or any of our other courses.

Here is a selection of current open courses:

- Bayesian phylogenetic inference with BEAST2, 18–29 November 2024 (online).  
This course will explore how to set up and troubleshoot phylogenetic analyses using BEAST2.
- Environmental variables: how to download and process them with R, 11–13 December 2024 (online)  
During this course, we will discover practical tools to obtain and process environmental data.
- Geometric Morphometrics for Beginners, 27–31 January 2025 (online)  
In this course, we will provide a comprehensive introduction to geometric morphometrics techniques.
- Introduction to Bayesian Inference in Practice, 17–21 February 2025 (online)  
In this course, we will master Bayesian inference techniques and apply them to real-world problems.

You can check for more information about these and other upcoming courses at [www.transmitting-science.com/courses](http://www.transmitting-science.com/courses) and follow us on social media: @TransmitScience and @TransmittingScience.

If you have any questions or need further information, feel free to contact us.

**Ana Rosa Gómez Cano**

*Transmitting Science*

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*Is there news that you'd like to see included in the **Newsletter**? Let us know by e-mailing Nick at [publicity@palass.org](mailto:publicity@palass.org), sending a link to the news and explaining its significance.*

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# A Sedimentologist Abroad

Highlighting early career researchers who have taken posts outside their home country and the opportunities they used. This issue's palaeontologist/sedimentologist is Brennan O'Connell.

Brennan O'Connell is a postdoctoral research associate from the USA based in the UK.



Photo courtesy of Ash Hood.

**Q1: How did you end up in the UK?**

Someone gave me a job! Incredible.

**Q2: How is your position funded?**

I was hired as part of a Leverhulme Trust Research Project Grant.

**Q3: What is your project about?**

Establishing the paleoenvironmental context for the Ediacaran Biota using sedimentology-stratigraphy, and testing if there was a late Ediacaran mass extinction event. I am looking at Ediacaran localities in Namibia, China and Newfoundland.

**Q4: What has been the biggest challenge for you living in the UK?**

The lack of salt and spice in food has been very challenging. I also miss peanut butter-based candy.

**Q5: What is the best thing for you about living in the UK?**

One of the best things about living in the UK is its proximity to mainland Europe, which has allowed me to travel and explore quite a bit. I also enjoy the natural beauty, especially the Scottish Highlands, Wales and the salt marshes around Norfolk. I've recently taken up packrafting to explore the nice waterways. Additionally, I've found that the work-life balance is much better compared to what I experienced in the USA.

**Q6: Apart from friends and family, what do you miss most about the USA?**

The snacks.

**Q7: What forms of support for an expat in your position have been the most helpful for you? What form of support do you miss most?**

Having a strong support network has been incredibly helpful – I've been fortunate to have many people to read over my fellowship and lectureship applications, offering valuable feedback. However, one of the key challenges I've faced is the lack of smaller funding opportunities specifically for postdocs. There aren't enough accessible pots of money for things like attending conferences or launching small projects. I find myself in an awkward middle ground: I'm no longer eligible for the numerous student grants, but I'm also not yet able to apply for the larger, more advanced funding opportunities.

**Q8: What role does the language of the UK play in your academic and private life? Has the language been a challenge and how did you go about tackling this?**

Luckily, I have not had to learn a new language to be here. It has been a smooth transition.

**Q9: What was the biggest benefit of your move abroad? What was the biggest sacrifice?**

Moving abroad has opened up a world of research opportunities and collaborations that wouldn't have been possible had I stayed in the USA, or Australia where I did my PhD. The connections I've made here have greatly enriched my work, and the sedimentological community in the UK (especially the BSRG) is very strong. However, the biggest sacrifice has been the salary – working in the UK means earning roughly the same as I did during my PhD. I've had to adjust my very reasonable expectation of earning billions post-PhD to maintaining a similar quality of life to when I was a graduate student.

**Q10: What are your experiences with DEI (diversity, equality, inclusion) aspects in the UK? We are curious about your personal experiences as well as observations on policies and attitudes.**

From my perspective, DEI efforts in the UK seem typical – neither exceptional nor severely lacking, but generally moving in the right direction. One challenge I've faced is navigating when or whether to highlight DEI-related specifics in job or grant applications. I've received conflicting advice on this, and it often feels like a delicate balance. Sometimes I mention my DEI experiences or contributions, while other times I choose not to, depending on the culture of the department or the nature of the funding I'm pursuing. I wish it was clearer how to navigate DEI when applying for jobs!

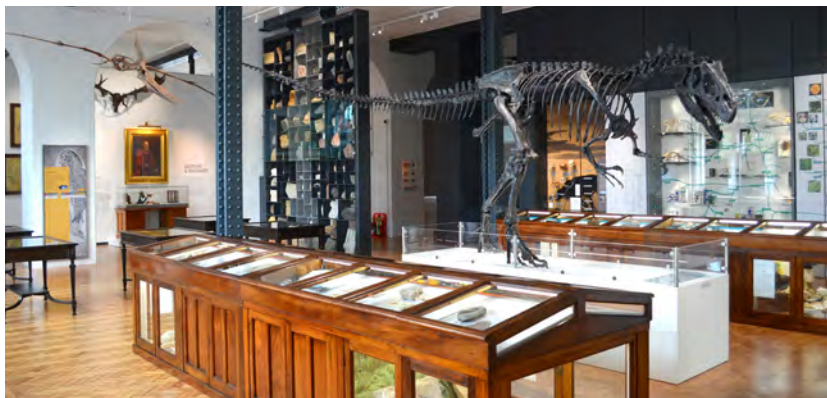
Brennan is on X at @sedsnstroms

and on the Web at <<https://brennanoconnell2.wixsite.com/sedsnstroms>>.



## Behind the Scenes at the Museum

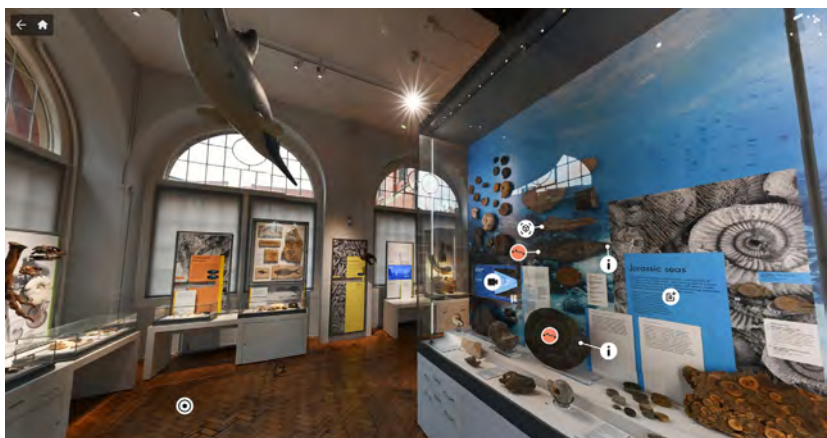
### *Lapworth Museum of Geology, Birmingham, UK*



*Evolution of Life Gallery at the Lapworth Museum of Geology. Photo courtesy of Richard Butler/ Wikimedia Commons.*

The Lapworth Museum of Geology at the University of Birmingham holds one of the largest geological and palaeontological collections in the Midlands. The Museum's origins, strengths and collections have been detailed previously by Jon Clatworthy in *Palaeontology Newsletter 91*, but here I would like to highlight two ongoing digital projects happening behind the scenes at the Lapworth Museum.

Since securing Arts Council England funding in 2018, the Lapworth Museum has embarked on a programme of collections digitization, focused on increasing accessibility for a wider audience. The latest step of this process saw the Museum launch a 'Virtual Museum' earlier this year (accessible now online at <<https://www.birmingham.ac.uk/facilities/lapworth-museum>>)!



*Inside the Virtual Lapworth Museum, complete with spotlight objects, videos and 3D models.*





When designing the Virtual Museum, facilitating online ‘pre-visits’ was noted as particularly important for visitors with accessibility concerns. However, alongside its utility, the Virtual Museum needed to be engaging in its own right, providing a valuable experience for anyone unable to visit the physical Museum.

After experimenting with gigapixel panoramas we instead settled on a standard resolution Virtual Museum, but with particular areas highlighted. To this end, the Museum team compiled more than 60 ‘spotlight objects’ from those on display in the Museum galleries. Objects were chosen as particularly striking, unusual or linked to the history of the Museum and the West Midlands, including original photographs from Charles Lapworth’s public field-trips to sites such as Comley Quarry in Shropshire; and a ‘holotype’ toilet seat linked to research carried out by P. J. Osborne and Prof. Russell Coope, labelled, *‘This is the actual toilet seat carried by P. J. Osborne in the boot of his car while solving man’s oldest question – “Is it possible that beetles can be eaten and emerge from the human alimentary tract in identifiable condition?” Unfortunately the remainder of the apparatus, a cut down Methylated Spirits tin, has been lost’*.



*Photograph of Charles Lapworth (centre, wearing a bush hat) leading a field-trip in search of Cambrian trilobites in Comley Quarry, Shropshire (1890s). Image from the Lapworth Museum Lantern Slide Collection.*

Each object was professionally photographed, many were 3D scanned, and for each was written a piece of text to add more information. These objects were dropped into the Virtual Museum as interactive ‘hotspots’, to be encountered throughout the Museum. Although more than 60 spotlight objects were now highlighted, we realized that more content would be needed to deliver the Museum’s goal to tell the story of life on Earth through the lens of the West Midlands, its geology and its people. In response, the Museum team transcribed countless text descriptions and specimen labels and photographed cases, displays and specimens until most displays featured some interactive element, accessible text, video or 3D model. The Virtual Museum was finally ‘populated’.



The Lapworth Museum is usually a peaceful space; however, its soundscapes, *e.g.* a thundery Carboniferous rainforest buzzing with insects, can pose an accessibility concern relating to auditory sensitivities. To ensure audio information is also available to preview, gallery sounds were recorded in 16 locations around the galleries, corresponding approximately with the Virtual Museum locations.

The Virtual Lapworth Museum is now 'complete', but development continues. New features are being regularly added, most recently including specimen-inspired music compositions, created in collaboration with Birmingham Contemporary Music Group (BCMG) Young Composers and the virtual Temporary Exhibition Space – preserving past temporary exhibitions. Please do drop in to the Lapworth Museum, wherever you are!

Pivoting now from our latest online offering to the Museum's origins. The Lapworth has been supporting PhD researcher Jingting Yao with her research into reconstructing 3D scenarios and affective computing – specifically, digitally reconstructing Josiah Mason's Science College and the origins of the Lapworth Museum. As the forerunner to the University of Birmingham, the original home of the Lapworth Museum and the setting in which Professor Charles Lapworth conducted his research and teaching, the Mason Science College was an important location for both Midlands geology and the history of the University. Opening in October 1880, the roughly acre-sized site, with its thirteenth-century-styled neogothic edifice, provided state of the art laboratories, lecture theatres and research offices over four floors.

The departmental geology museum occupied the attic space of the central block. It was a "large and lofty room, with open timber roof, and partially lighted from the top" with "mahogany cases, with glazed tops, for the display of specimens" (the architect, 1881) and was "presided over by a fine skeleton of an Irish Elk" (written recollection of Prof. L. J. Wills). The mahogany cases remain in the Lapworth Museum to this day, while the Irish Elk skeleton is now housed at Thinktank Birmingham Science Museum. Aside from these details however, little is known about the original geology museum. Only 15 images of the College interior seem to exist, taken from a set of photographs by Bedford, Lemere & Co. in 1897 – none of which show either the geology museum or department. The Mason College was finally demolished in 1964, having been labelled a "neo-gothic monstrosity" by Paul Cadbury.



*Neo-gothic frontage of the Mason Science College. The original departmental geology museum occupied the very top floor, lit by two large skylights flanking the steep central peak. Image courtesy of Cadbury Research Library.*



*Photograph of the zoology museum within Mason College, one of only a few images showing the interior. No photos are known of the geology museum. Image Courtesy of the Cadbury Research Library.*

Despite the lack of photos, Jingting and the Lapworth Museum have collated architectural floorplans, sketches and articles including furniture, equipment, specimen inventories and written staff recollections held by the Lapworth Museum Archive and the Cadbury Research Library, to expand our knowledge of the original geology museum and department. Sixty years after its demolition, the 3D reconstruction of the basic building structure is complete,



as per the 1881 floorplans. Next begins the exciting stage of gathering audience insight, expectations and feedback. Watch this (digital) space!

A final request: if any reader knows of a relative who may have studied in the Mason College building before its closure and may have any interior photographs, I would be delighted to be contacted! My e-mail address is <a.s.jones@bham.ac.uk>.

### **Andy Jones**

*Digital Technologies Officer*

*Lapworth Museum of Geology, University of Birmingham, UK*

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The Lapworth Virtual Museum is now live and accessible to everyone.  
To visit the Virtual Museum or to plan your in-person visit see the website:  
<<https://www.birmingham.ac.uk/lapworth>>.

Follow the Lapworth Museum on social media:

X: @lapworthmuseum

Facebook: @LapworthMuseumofGeology/

Instagram: @lapworthmuseum

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# Palaeontology's greatest ever graphs

## ***Reflection on Lam et al. (2018) 'Dispersal in the Ordovician: Speciation patterns and paleobiogeographic analyses of brachiopods and trilobites'***

One thing we understand as palaeontologists is that life (origination, speciation, *etc.*) and death (extinction, extirpation, *etc.*) are complicated. Understanding, quantifying and describing the processes and patterns that underwrite these phenomena are the basis of many of our studies. This is especially true for grander-scale phenomena throughout the Phanerozoic; teasing apart the mechanism of a mass extinction event or a major diversification event, for example, is no easy task. There are many biotic and abiotic factors at play, some of which we will never know because of the nature of the fossil record. With the advent of more (and faster) computing power, one would think this task is becoming easier. It is not, at least in this author's opinion, though I am sure many others would agree. So, in moving forward into the 2020s and beyond, what can we do with computing power to examine large phenomena with the data available?

Lam *et al.* (2018) provides an excellent example of a way in which we can examine a major diversification event (in this case the Great Ordovician Biodiversification Event (GOBE)) with more computing power. This analysis combines two types of data: phylogenetic information (brachiopods and trilobites) and geographic information to assess biogeographic patterns of these taxa across the Middle to Late Ordovician. This study was one of the first to implement the R package BioGeoBEARS (Matzke 2018a) for palaeontological data, a package that has now become more widespread. Additionally, ten species-level data matrices of brachiopods and trilobites were re-run in a Bayesian framework to produce time-calibrated phylogenies. This is not to imply better trees were produced from the Bayesian phylogenetic analyses. Rather, the authors tried a different computing method of phylogenetic analysis to produce trees for their biogeographic analyses.

This study, and its figures, speak to me for many reasons, although I will detail two main ones for brevity. First, the study itself is approachable and this comes down to the authors' methods. The authors' questions seem big from the forefront: examine biogeographic patterns of two different taxa across a period of diversification in the Palaeozoic. To do this, the authors applied quantitative methods. As anyone who has worked with quantitative methods can tell you, some methods have a steeper learning curve than others. This is especially true when coding. BioGeoBEARS is well-documented (Matzke 2018a,b) and relatively straightforward to run in R even with basic understanding of the language and software. Additionally, both types of data used for this study (phylogenetic matrices and biogeography) are relatively easy to obtain. This, of course, depends on the data publication and documentation, though in modern times most of this material is digitized and available online (*e.g.* Dryad, the Paleobiology Database, with accompanying papers, *etc.*). Second, this study incorporates not one but two types of data, one arguably more biotic and the other abiotic, to assess the diversification event. Once phylogenetic trees have been proposed from their respective analyses, *six* different probabilistic biogeographic



models are tested for each (a total of 60 analyses!). These models include differing parameters (e.g. vicariance, dispersal, and the long-distance founder-event speciation) for the evolution of geographic ranges across branches. When biogeographic models are statistically tested against one another, a clear pattern emerges: models which incorporate long-distance founder-event speciation (also known as ‘jump dispersal’) win out for most clades. More computing power means it is possible to explore this probability space for these different groups and compare their results to one another statistically. This study provides a simple and elegant way in which to do this. Admittedly, some of these methods can take a while to run on a computer, but the end results are interpretable and mean we are that much closer to teasing apart macroevolutionary patterns.

I am torn between naming Figure 6 or Figure 7 as the best in this paper. On one hand, Figure 6 tells a story: across four time stages, we can see hypothetical dispersal and vicariance events of trilobites and brachiopods across Ordovician basins. The image begs one to lean in and compare time stage by time stage.

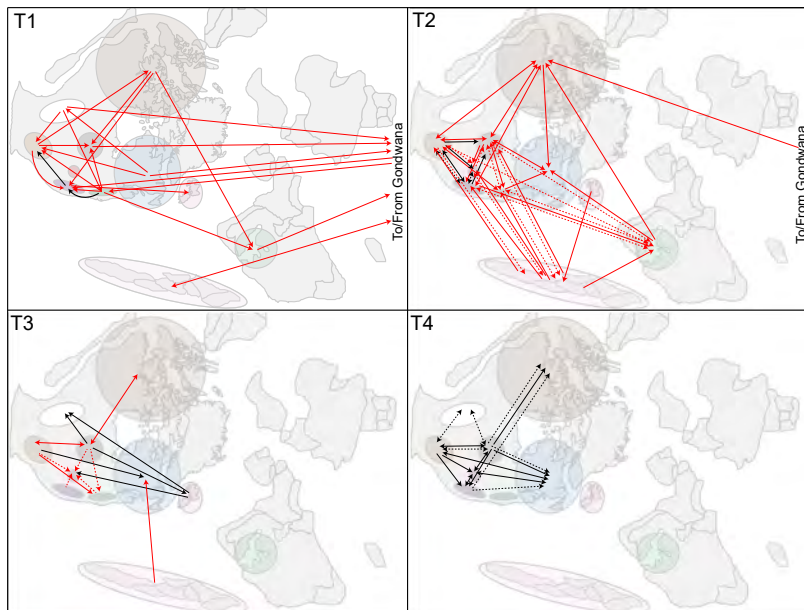


Figure 6 is a story across time stages, showing hypothetical dispersal and vicariance events of trilobites and brachiopods across Ordovician basins, reconstructed from maximum-likelihood analyses. It is a great figure for making comparisons time stage by time stage. This is a pre-print version of the figure, reproduced here with the kind permission of the author. Please see the final version in Lam et al. (2018) for the full caption and description.

The drama of diversification in time stage 1 (with lots of dispersal events) and time stage 2 (with dispersal and vicariance events) seems to calm as the Late Ordovician approaches in time stage 3. Admittedly, as a young biogeographer, I also enjoy a good palaeo-map image in any study (without getting into which is the best projection, of course!).



On the other hand, Figure 7 helps one compare a lot of data, mostly abiotic, across the four time stages of the study. The biologist in me loves to see abiotic patterns such as global sea level held up next to speciation events (via dispersal or vicariance) for the two groups. This ‘summation’ figure helps tie a lot of moving pieces together to complete the story: climate changes during the middle Ordovician may have contributed to speciation by dispersal.

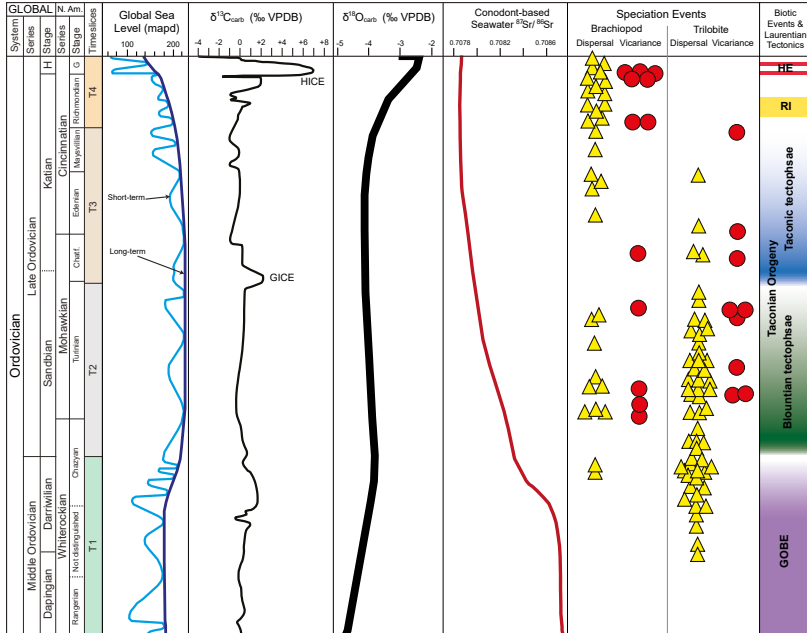


Figure 7 has the means to help the reader visually compare a lot of data across the four time stages studied in Lam et al. (2018). It contains chronostratigraphy, the time slices studied, sea-level data, geochemical proxies, biotic events and tectophases graphed with brachiopod and trilobite speciation events. This is a pre-print version of the figure, reproduced here with the kind permission of the author. Please see the final version in Lam et al. (2018) for the full caption and description.

So, if I were to decide which figure is more significant, I simply cannot. Both scratch an itch in my biogeography brain.

I implore those who have not yet read this paper to give it a read and even try the authors’ methods for themselves. More computing power and advances in quantitative methods mean we will develop new ways to examine macroevolutionary patterns across time and space. My one hope is that we keep in a similar vein to this study: keep it approachable, try to combine more data, and try to tell a story as best we can.

**Kat Jordan-Burmeister**

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## Spotlight on Diversity

### Accepting ADHD

I was 26 years old when I was diagnosed with attention deficit hyperactivity disorder (ADHD) and just beginning the third year of my PhD programme. I had sought testing for my oral language impairment, likely related to dyslexia, which affected my phonological memory and retrieval. I often struggled to find the right words, misspelled them, and had poor grammar despite excellent reading comprehension. Because my grades were good, I had never been thoroughly tested until the stress of graduate school magnified my difficulties. A professor's remark – that “no one would take me seriously as a scientist” if I couldn't pronounce unfamiliar words correctly – was the final push I needed. Many faculty members had suggested speech therapy, which I couldn't afford without an official diagnosis.

The tests confirmed my oral language impairment but couldn't determine if it was dyslexia-related as my ADHD symptoms masked the underlying cause. Unlike many adults diagnosed with ADHD, I never felt my brain worked all that differently or that I suffered from ADHD symptoms. I did not feel the diagnosis validated my challenges or gave relief at having a reason behind my struggles. I didn't believe the diagnosis at first, and when I did, I felt as if someone had cursed me. Now, of all times. I would have to learn a whole new set of management skills and behaviours if I wanted to succeed. Who had the time to do all that on top of research, teaching and keeping up with programme milestones? At the time I did not know a single person with ADHD who had completed a PhD, and the task felt daunting, if not outright impossible.

ADHD symptoms vary widely but often include dysfunctional executive functioning – difficulty focusing, distractibility, lack of organization, forgetfulness, time blindness, impulsive behaviour and constant fidgeting. However, we also experience hyperfocus, where we become so engrossed in an interesting project that we neglect basic needs, including hunger and thirst. This makes us look like we *should* be able to get past all the negative symptoms. But the hyperfocus behaviour stems from the same source as the issues with executive functions (and contributes to the forgetfulness and time blindness). Both the lack of attention and the hyperfocus come from the dopamine deficit in ADHD brains, causing a dysregulated attention system due to the ADHD brain being wired differently.

In academia, where motivation, task prioritization, time management and attention to detail are crucial, ADHD symptoms can clash with meeting these requirements consistently and to



a high standard. When an ADHD brain says “no”, pushing through isn’t simply a matter of willpower; the necessary neurotransmitters in the brain aren’t available or aren’t receiving the messages properly to regulate the switch to suppress distractions, sudden impulses and to maintain motivation. Symptoms are often misattributed to laziness or procrastination, with phrases like “try harder,” “have you used/tried XXX,” and “just do it” frequently heard by those in academia, from both supervisors and peers. Even when the other person knows you have ADHD, understanding what that means is a different beast. Without that understanding, those with ADHD will continue to struggle and feel alienated and ‘lesser’ than their peers.

Despite my initial panic at my diagnosis, I have come to realize that I was lucky. I grapple with focusing daily (squirrel!), finding motivation to do basic tasks (don’t ask about my dishes), waiting my turn to speak (many apologies to those who know), remembering details (I always know what a paper is about, but can never remember who wrote it), and not rambling (in talking or writing). Starting things becomes a massive hurdle. My brain only wants to do the ‘next’ urgent thing, which makes getting ahead hard. Yet I thrive in collaborative environments, generating new solutions and bringing enthusiasm to the work. My energy has had me described as passionate and entertaining by my students, who often feel as if I’m there with them, not just filling a role. However, I can dominate conversations in smaller groups if I don’t constantly focus on not speaking. I can change topics on a dime and flip between two tasks without getting stressed, which helps in fieldwork where multiple balls are in the air at any given time. However, focusing on single goals like writing or proofreading can take me much longer than it should. Ultimately, ADHD has both hindered and enhanced my productivity. Critically, though, I received support and understanding that many of my peers did not, giving me the time and space to work out how to utilize my strengths and tackle my weaknesses.

In the USA, accommodations for children with ADHD are widespread, ranging from structural support to individualized assignments. However, this support often diminishes in college, with only testing accommodations commonly available – sort of an institutional sense that you should be ‘over it’ by now. Multiple studies show that students with ADHD commonly graduate at a lower rate, have lower grades, and take longer than average to complete a degree. The numbers are worse in graduate school, likely reflecting the lack of formal support in graduate settings. When compared to control groups where 5–8 % of young adults (aged 23–32) hold advanced degrees, those with ADHD sit at only 0.06 % or none at all (Kuriyan *et al.* 2013). Further, these studies focused on adults diagnosed as children; none have been conducted on those diagnosed as adults. Strategies, skills and habits to manage ADHD symptoms take time to develop and refine. For those diagnosed later, the need to rapidly acquire coping strategies while meeting rigorous academic demands can feel overwhelming.

While my professors didn’t fully grasp my ADHD, most respected that my brain functioned differently. My drive and skills in interpersonal communication had both hidden the disability and gave me the ‘in’ to explain it, once I recognized that the self-reveal and request for help would be essential to move forward. My advisor and I navigated frustrations while I worked out what exactly I needed. The learning process was not always smooth, but my advisor worked at providing feedback in areas we identified I could control, and not criticizing what I couldn’t. But this level of understanding can be rare. Over my graduate career I have met others with ADHD, several of whom were told they weren’t a fit for their programmes – they were too ‘lazy’,





not making enough progress, and struggling to stay organized. Others faced constant criticism for challenges rooted in their condition, whether or not they revealed their ADHD. Those who graduated often left academia, feeling ashamed of their perceived lack of willpower while struggling unseen to regulate their focus and concentration, often at the cost of their personal lives. Often people with ADHD can't see a way forward that doesn't leave them burnt out.

Every person with ADHD must discover their own management strategies. Some find success through self-directed methods like management systems, medication, or hyperfocusing. 'Body doubling' – working alongside a colleague or friend – was transformative for me. Others require a supportive framework from both supervisors and peers: structured plans with mini-deadlines, leeway when the person is trying something new either behaviourally or medically, help in breaking down tasks, and written rather than verbal information. Above all, understanding, both from others and from yourself, is crucial.

### **Margaret (Meg) Anne Veitch**

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## Software for palaeontologists

### *CT software*

There's a decent contingent of people in palaeo who have found their calling combining fossils with computers on a day-to-day basis. There's an even larger group of people who would like nothing more than to close their laptop lid and go look at rocks but must begrudgingly wrangle their data on a computer anyway. I absolutely fall into the first category, and for some time have been writing about useful software and methods on my website (<[peterfalkingham.com](http://peterfalkingham.com)>). As such, I was asked by Harriet, the Newsletter Editor, to put together a series on useful software for palaeontologists/palaeo-methods. So, that's what I'm doing. This series is going to highlight some of the options available for doing the kinds of computational work lots of palaeo people do. I'll try and avoid the kind of hyper-specialized software that only two people in the world are using, and stick to more broadly used things. I'll also be heavily biased towards free or low-cost software; partly, this is because I'm cheap (a born and bred working class Yorkshireman), but mainly, this is because there's a practical side to that too – if you're training students on a piece of software with a £10,000 a year licence they may very well not be learning transferrable skills. Or maybe you're using it yourself then move institutions, or simply don't have the funds to renew the licence when it expires.

Anyway, let's get into this first article in the series, where I'm going to highlight a couple of options for CT segmentation and analysis. This is actually an area where there's a heck of a lot of options out there, both free and paid-for, but there's two I want to highlight here, 3D Slicer and



ORS Dragonfly. This may be familiar ground for those already well-versed in CT software, but for anyone just getting started, or looking to add a little excitement to their lives (I mean, from a CT-segmentation perspective anyway), I hope this proves helpful.

### 3D Slicer <<https://www.slicer.org/>>

3D Slicer is one of those applications that feels like it's been around forever – Wikipedia tells me the original version harks back to 1998, so 3D Slicer may well be older than some PhD students today. It has seen significant upgrades over that time, and version 5 (latest version is 5.6.2) was released a little over two years ago. It's very powerful, although not particularly user friendly compared to lots of commercial options. Key to its success is that it is free and open source. It also doesn't have any particularly restrictive hardware requirements – it's available on Windows, Linux and MacOS, although the larger your dataset the bigger computer you'll want – graphics (GPU) and RAM being among the more important factors. I and others I know have had some issues with particularly heavy micro-CT data causing it to crash, but then I know other people who've had no problems, so just be aware of that. Next time, we'll take a look at some free, multi-purpose options for viewing and analysing 3D models (such as those exported from your CT software).

Loading data is as simple as clicking the Load Data button and selecting either a directory, or a set of files (usually tif or dicom stacks) and loading them as a volume. This will present the data in the three cross-section views. To see it in 3D, you need to go to the volume rendering drop-down menu, and click the little eye icon. You can then play with the visibility/density curves to get the view you want (Figure 1).

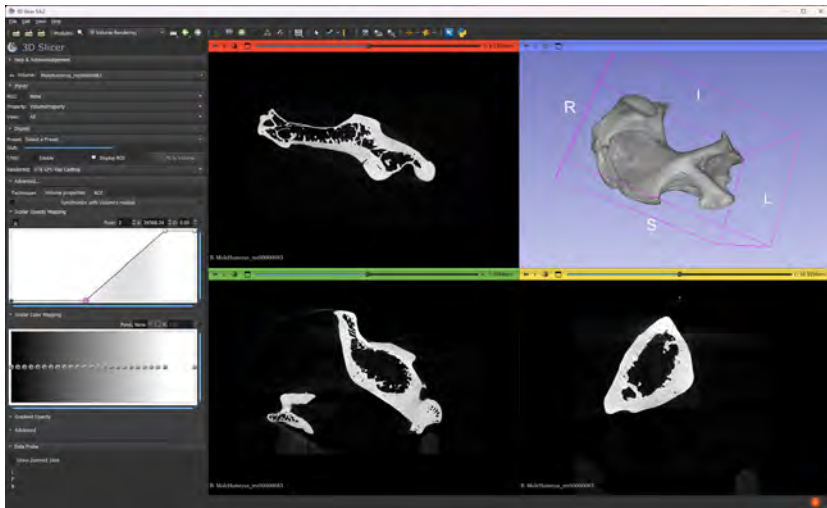


Figure 1. A mole humerus, scanned with micro-CT, and showing in 3D and three cross-sections (XY, YZ, and XZ, or sagittal, coronal and axial) with 3D Slicer. The opacity mapping curve on the left, under 'volume rendering', lets you pick the greyscale values you wish to see.

To turn your CT scan data into 3D models for further work (FEA, 3D printing, etc.), you need to segment them out. This can be as simple as applying a threshold in five minutes (if you just want a bone, for instance), or it can be an involved process taking weeks, using seed points, watershed marching algorithms and what have you. If you want a place to start with a simple test case, a



few years ago I put a YouTube video out on thresholding and segmenting some bones in ~ten minutes: <<https://youtu.be/dnwfKBj4WTS>>. There's lots of documentation out there, including the slicer forums, for learning the more advanced features for segmentation and analysis.

One of 3D Slicer's real strengths is in its extensibility – you can download extensions and variations that might help with specific tasks. For instance, SlicerMorph (<<https://slicermorph.github.io/>>) is an extension for 3D Slicer that provides a set of tools for morphologists, particularly around landmarking and geometric morphometrics but also with some handy tools for import/export and visualization.

### Dragonfly <<https://dragonfly.comet.tech/>>

Dragonfly World (the 'world' part of the name is new this year), is a commercial software package, but it offers a free academic licence. It's a fantastic piece of software, as I'll show you but, at the risk of looking a gift horse in the mouth, I do find the academic licence a bit of a faff, and a bit restrictive. To get it, you need to download the trial version then request a non-commercial licence; that entails filling out your details and uploading an image of your staff/student card to prove you're an academic. The licence works on a single computer, so there's no installing at work and at home/on a personal laptop (perhaps not a bad thing for work–life balance, but annoying if you work in two locations or at two computers regularly). The other restriction to bear in mind is that until recently Dragonfly required an Nvidia GPU (this is something we'll see commonly in this series). They actually removed this requirement for version 2024.1, and Dragonfly will now run on any GPU. However, Dragonfly also requires an AVX compliant CPU, which is niche, but means that neither Windows on Arm, nor any of the new M-series Macs (using parallels/VMware) can install and run Dragonfly. However, if you can run it, and can be bothered with the non-commercial licence application, what you'll get is a very powerful, albeit complex-looking, application (Figure 2).

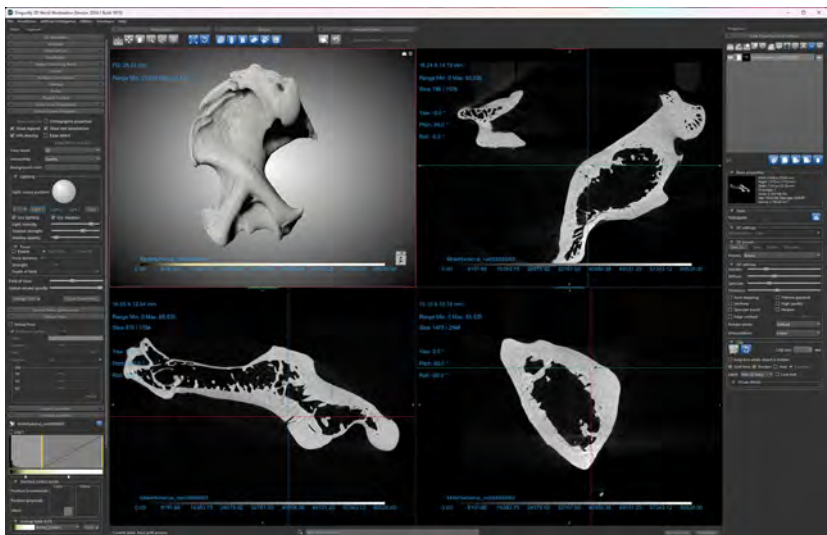


Figure 2. There's a lot going on with the Dragonfly interface, but personally I like what it has on offer and, with many of the menus collapsed, it can be quite a streamlined workflow.



I particularly like the visualization options in Dragonfly – the lighting and 3D rendering tend to highlight details in a way that 3D Slicer doesn't (although that's a personal preference). Similar to Slicer, you can very quickly output 3D models with a simple threshold algorithm, and the complexity increases rapidly from there. One of Dragonfly's biggest selling points is its deep-learning capability, which can be applied to segmentation (finding edges of similarly contrasted objects, for instance) but also general image manipulation, *e.g.* enhancing contrast and detail of your image slices. I've struggled to find the time and headspace to really get into the deep-learning tools but they are tantalizingly present in the menus! It's also worth noting that 3D Slicer has several extensions available for AI-assisted annotation and deep-learning segmentation, which again, I've not had the chance to really get to grips with.

In terms of getting into using Dragonfly, I'd say it's probably a bit easier than starting with Slicer, and Dragonfly has a whole bunch of video tutorials available (<<https://dragonfly.comet.tech/en/tutorials>>). My complaint there is that they are all video format, which I'm too middle-aged to appreciate (I like my tutorials in writing!), and that they've been uploaded over the past few years, so often don't perfectly reflect what you see in the software today.

### Summary

3D Slicer and Dragonfly are the two main CT-processing/segmenting programs I use, because they are powerful, have a gentle learning curve (at least at first), and are freely available for academics. Slicer offers the best guarantee for longevity and transferrable skills: being open source it'll never be taken away, while Dragonfly's academic licence is generous, but carries the risk of one day not being there. That said, I find Dragonfly to be a little more intuitive, and potentially a little more powerful out of the box.

As I mentioned at the start of this piece, there are a lot of options out there. A few years ago I wrote a blog post about many of those free options (<<https://peterfalkingham.com/2019/02/18/free-software-for-ct-segmentation-2019/>>) and you can take a look there, but I generally found most of them lacking compared to 3D Slicer and Dragonfly. Conversely, you may be using some of the super-expensive and high-end software like Avizo/Amira or mimics. While it's good to have a workflow you know well, I would recommend students, postdocs *etc.* at least have a play with something like 3D Slicer or Dragonfly, so that when you move on to your next position you have a skillset to continue working with CT data, even if your new employer doesn't have the software you're used to.

**Peter Falkingham**

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## Sweet tooth

"My, what big teeth you've got". Little Red Riding Hood's observation on wolf dentition was well placed, as these – the canine teeth, at least – are impressive enough, reaching two and a half inches long. Teeth have always made an impression, and not least on palaeontological sensibilities, pretty much from the earliest days. The 'tongue-stones' or 'glossopetridae' that Nicolaus Steno famously illustrated as fossil teeth in 1667 to, arguably, kickstart our science, did not come with a scale on them. But, as he said they were much larger than those of the modern white shark carcass he was describing, we might assume them to be from something like the Miocene 'megalodon' which, reaching six inches or more, might have provoked yet more pointed comment from our fairytale heroine.

Almost exactly a century later, Georges-Louis Leclerc, the comte de Buffon, set out to generate yet more public amazement, dentally speaking, as he put whole-Earth stratigraphy on the map with his *Les Époques de la Nature*. A generous part of the *Notes Justificatives* in this book is taken up with listing the dimensions of fossil teeth pulled out of peat bogs and permafrost by various of his many illustrious correspondents. One M. le comte de Vergennes, 'minister and secretary of state', for instance gave him a tooth 'found in Little Tartary in making a ditch', that weighed 'eleven pounds and four ounces'. An M. Collinson sent him teeth from the Ohio River of North America that each weighed 'ten or eleven pounds'. Buffon provided examples of impressive tusks, too – these, of course, being nothing more than overgrown teeth. A fine example was found in the countryside near Rome by M. le duc de la Rochefoucauld, the preserved fragments 'other than one purloined by the scoundrel who had charge of it' measuring seven feet, and the whole thing in life he estimated at ten feet long.

Buffon was out to show that giants lived long ago. And so they did, but this treasure-chest of highly durable dentine and enamel likely had a giant-scale impact in more ways than one – and in ways that he would no doubt have appreciated, as in places his *Époques* seems as much a herald of Earth System science as it is of stratigraphical geology, in his efforts to construct a fully working and evolving model of a planet, even on the scant basis of the few scraps of evidence he had available to him then. Teeth are a fine store of phosphate, among the most vital elements for life. The profligacy with which animals have accumulated it in crystalline mineral form to build themselves skeletons, that then become locked away in the fossil record (a gain for palaeontologists, of course, but a loss for their fellow organisms), is a big part of the Earth's phosphorus cycle. The sharks that provided the 'glossopetridae' for Steno to muse on are superb examples, as their teeth are among the most Fort-Knox-like of biological phosphate stores, while the phosphorus in their other tissues including their cartilaginous skeletons are soon recycled back into the biosphere *post-mortem*.

It is a part of what Petr Kraft and Michal Mergl (2022) call a 'struggle for phosphorus'. Animals strive here because they need phosphorus – even the animals that have no skeleton at all, because this element is needed for each of their molecules of DNA and RNA, each molecule of energy-modulating ATP, each phospholipid membrane ... and more besides. Looking at the composition of the Earth's crust, one might assume it as one of life's easier struggles, for it is the



11th most common element in our planet's carapace, making up a tenth of a percent of it. But, in seawater, the home of most life for most time, its abundance is about five orders of magnitude less. One therefore does have to fight for one's share of that thin gruel.

And in that struggle, Kraft and Mergl see among the victims a swathe of early Palaeozoic animals that, particularly amid the tumult of the 'Cambrian explosion' of life, had made use of the oceans' phosphorus supplies in what in hindsight would turn out to be a scandalously – and fatally – profligate manner. These were animals of the sea floor that secreted chunky shells of phosphate rather than of calcium carbonate: the phosphatic brachiopods come to mind, not least the iconic *Lingula*, and there were also tommotids, sphenophallids, hydrozoans and others. Kraft and Mergl describe this dawn of animal life as a time of 'almost unconstrained accessibility and use of phosphorus in the global ecosystem', a sort of Wild West of the biological phosphorus cycle.

The good times were to end, though, when better designs arrived in the seas. The particular transformation that is singled out is the 'Devonian nekton revolution' (Klug *et al.* 2010), a time when important groups of animals took to life in the open seas, notably the ammonites, with their calcium carbonate skeletons – and the fish, with their phosphatic teeth and bones, and so extending the biological need for that meagre oceanic phosphorus supply through the whole water column of the seas, and not just its floor. And here the animals used that phosphorus more sparingly and efficiently. The conodont animals were singled out by Kraft and Mergl as they 'prospered and used phosphorus only for reinforcing important elements of their digestive tract used to efficiently gain and process food'. But the sharks, too, focus their phosphate intake into their spectacular teeth – a little more extravagantly, perhaps, given their constant production and shedding: scattered into future strata generously enough to catch Steno's eye, and to start a new science. As the 'nektonic phosphate pool' grew to build the burgeoning shoals of fish, so the 'benthic phosphate pool' shrank, and the particular ecosystem that it had formed declined, from then on playing only a bit part in marine ecosystems.

The resulting array of fossil teeth, of course, provide riches for palaeontologists as they try to reconstruct the lives of their long-dead users. Teeth provide all kinds of clues; their shape, from razor-sharp predatory fangs, as in sharks – and wolves – to the flat crushing surfaces of the teeth of elephants on land and rays in the sea; their surfaces, with tell-tale scratches that can betray the kind of food that they ate; their chemistry, with isotopes of oxygen, carbon, neodymium telling various stories of climate, of biosphere function, of ocean currents. But there's another source of stories among the teeth – in the part of them that is generally seen as the very opposite of impressive and fearsome. In fact, it is a feature of teeth that is usually not mentioned in polite company. There are riches in calculus, of the dental kind.

It's otherwise known as tartar, or dental plaque, the latter being not so much a synonym as the not-quite-yet-mineralized precursor that your dentist admonishes you for neglecting. It is a lovely<sup>1</sup> example of biomineralization, a combination of oral chemistry and microbiology that can give rise to at least four minerals, all of them variously hydrated calcium phosphates:

<sup>1</sup> Or unlovely, depending on perspective.



hydroxyapatite, octacalcium phosphate, the magnesium-bearing whitelockite (also found in granite pegmatites and meteorites) and the serendipitously named brushite (nothing to do with the advice that inevitably follows admonishment, alas, but simply named after the mineralogist George Brush). It's incremental, forming successive layers, and so has a stratigraphy. And, because the mineralization is quick, taking just a few days, it preserves, exquisitely, whatever might have been in the mouth at the time<sup>2</sup>.

What's in there? Preserved remains of the oral microbiome, for a start, that is the bacteria, archaea and fungi for which a mouth is home; food particles such as starch granules; and windblown dust and pollen that finds its way into saliva. Most of its study so far is from human teeth reaching back through history, and so within the realms of archaeology, where it has become a minor though very specific industry (Radini and Nikita 2023). Dental calculus has, for instance, been found to be good at preserving DNA and proteins, so the changing patterns of these could be analysed, that belonged to both the humans and the microbiomes (Warriner *et al.* 2015).

But the teeth of other animals have also attracted a little attention. The Pleistocene deposits of South America include a gomphothere proboscidean – the kind of thing that used to be called a mastodon – which has had as tortuous a nomenclatural history as, well, as pretty much any fossil, taxonomists being what they are. Originally a couple of teeth (bulky enough to have attracted admiration from Buffon, had he seen the specimens) were called separately “*mastodonte des cordillères*” and “*mastodonte humboldien*” by the Baron Cuvier. The typically labyrinthine Wikipedia entry then takes one, a little dazed, through quite an array of names both specific and generic before landing on *Notiodon platensis*, a hefty animal reaching six tons as adult; calculus-rich tooth specimens of these were the focus of inquiries by Lidiane Asevedo and colleagues (2020). A particular question they had was how this creature might have adapted its diet to times of global cold – the Last Glacial Maximum, about 20,000 years ago – versus times of warmth, as represented by fossils from the Last Interglacial, at some 120,000 years.

A few grams of calculus extracted from a handful of these fossil teeth gave some clues. Some yielded a variety of pollen of forest trees (rather beautifully preserved, to judge from the images). Others had little pollen, but contained silica phytoliths from grasses. This mastodon was a generalist species, the authors concluded, living among the extensive forests in relatively warm and wet times, but also that could manage to subsist among grasslands that spread as the forests shrank back in cooler, drier times. More quirkily, the calculus also showed up the kind of stray material these beasts picked up while munching: fungi, bits of sponge spicule. Fussy eaters, they weren't.

How far might this very particular corner of palaeontology reach? Into the dinosaurs, perhaps? Well, here one runs into the barrier that, like sharks, dinosaurs replaced their teeth more or less frequently throughout their lives. So, while this is a mechanism for producing a lot of teeth for palaeontologists to (much later) hunt for, most of those teeth would not presumably have

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<sup>2</sup> Graham Lawton, that notable feature-writer of New Scientist and a considerable snapper-up of normally inconsidered trifles, picked up on it, and his 2022 article on it provides a very nice introduction: <<https://www.newscientist.com/article/mg25133524-400-the-microbial-gunk-that-hardens-on-teeth-is-revealing-our-deep-past/>>.



been in active service for long enough to accumulate nicely substantial and richly fossiliferous calculus layers.

Remarkably, one can estimate how frequently different kinds of dinosaurs replaced their teeth because of a different kind of stratigraphy – this time of fine growth lines (their formal name – ‘incremental lines of von Ebner’ – being, perhaps appropriately, a bit of a mouthful) within the dentine itself. Crocodiles have these, which are daily growth increments, so the same logic has been applied to dinosaurs.

Some dinosaurs kept their teeth only a short while, with the sauropods especially profligate: *Diplodocus*, for instance, had an average tooth replacement rate of 35 days, and in *Nigersaurus* a tooth might last only 14 days before being shed (D’Emic *et al.* 2013). Why the rush for replacement – especially in such prodigious eaters of vegetation as sauropods? One might think that they would follow the elephant, mammoth and mastodon example of growing some impressively massive, armoured, long-lasting molars. But, there’s more than one way to eat your greens. Here, a quite separate pathway was proposed for a herbivore to process plant material in industrial quantities: grow lots of small teeth, and replace them quickly before they had a chance to become blunt. Clearly, this worked for the sauropods, for about a hundred million years.

But to find longer-lasting teeth that might have a chance to acquire a plaque layer, one has to look elsewhere, and here it is those predators, the theropods, that might provide material: an *Albertosaurus*, for instance, checked in at 454 days replacement rate, and the yet larger and scarier *Tyrannosaurus* at 777 days. So, might we have any possibilities here? Perhaps, as some of those well-meaning lists of what foods one shouldn’t eat to keep our teeth healthy include red meat, as these can encourage some of the kinds of bacteria that cause plaque to build up.

The number one promoter of plaque build-up and enemy of good dental health, though, is, of course, sugar. Less omnipresent in the past than today, of course, but honey has been around for quite a while, as temptation and (presumably) tooth-spoiler for more species than our own. Alas, honey dissolves all too easily so is hard to fossilize. The oldest preserved honey used to be that discovered in sealed jars in Tutankhamun’s tomb in 1922 – and reportedly tasted by the explorers (it was still sweet, and the tomb raiders survived, seemingly uncursed<sup>3</sup>) – until jars in a burial mound nearly 5,000 years old were found in Georgia – of the Caucasus, not North America (Kvavadze *et al.* 2007). Here, the authors are silent as to the taste, but speak rather of boiling the samples in potassium hydroxide, seasoning with cadmium, and applying acetolysis. Unappetizing, perhaps, but this procedure yielded fine sets of fossil pollen (far more than in the soils from that age) – which indicated that each jar contained a different kind of honey. The skeleton by which the jars were arranged, were of a woman who, it seems, was a beekeeper, and a skilled one, too, with a range of products.

Beyond the record of honey, there is that of the honeybee, which is much longer, thanks to the remarkable qualities of amber. There are quite a few bees in Baltic amber from the Late Eocene, some 40 million years old, but one turned up too in Cretaceous amber perhaps 80 million years old from New Jersey (Michener and Grimaldi 1988), being assigned to the genus *Trigona* and said to be ‘closely similar’ to modern *Trigona* honeybees of neotropical regions. The most typical honeybee genus, though, *Apis*, is said to date from Miocene times. That seems to fit with the

<sup>3</sup> <<https://www.tastingtable.com/1216602/the-worlds-oldest-jar-of-honey-is-from-3500-bc/>>.





origins of some of the most notorious mellivorous, or honey-eating, animals such as bears, and indeed honey badgers (the aptly named *Mellivora*) which do eat honey, though they also, their ferocity belying their name, prey on animals including pythons and black mambas.

So perhaps among such animals there might be a small but fascinating target for palaeontologists wishing to investigate the many-sided legacy to be found in a sweet tooth, as one more obscure of the myriad pathways through this science. That's as may be. But, what is certain is that your dentist, on setting to work for that next six-monthly de-scale and polish, is unconsciously deleting some most eloquent history. Now that's food for thought.

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## Careers Q & A

### *Professional palaeontologists in the wider world: Sophie Kendall*

Sophie Kendall comes from a background in palaeontology, with undergraduate and postgraduate degrees from the universities of Portsmouth and Bristol, specializing in microfossils. She has since diversified into marine management, strategic planning and consenting. Sophie enjoys discussing different career pathways that palaeontological skills can help to set people up for, as well as teaching people beyond the palaeontological field the importance of understanding the past.



*Sophie out and about on the beach by Charmouth. Photo courtesy of S. Kendall.*

#### **When you were a child, what did you want to become when you grew up?**

I jumped around a lot with what I wanted to be – from equine vet, to zookeeper, to scientist. The common denominator was that it had to be something related to animals, in various capacities.

#### **How did you first get interested in palaeontology?**

I'm told I could say the names of 'all' of the dinosaurs as soon as I could talk! I've always had an interest in palaeontology, watching all the documentaries and films I could find, reading books, plus desires to visit museums on family holidays, but for most of my younger life

this was just a passing interest. It wasn't until I attended a university open day and thought I'd investigate what a palaeontology degree would be like that my interest really piqued. I was easily, and willingly, enraptured by the passion provided from the professor leading the open day talks!

#### **What is the biggest highlight of your work as a palaeontologist so far?**

Probably completing my master's research and continuing to develop it into a publication! I wouldn't have been able to do this without the support and motivation I was lucky to have.



**How did you make the transition from academia to your career outside academia?**

I've always been interested in the marine environment and climate change, whether in the palaeontological record or current day. A lot of the skills I learned through academia have been incredibly valuable in my career outside the university environment. My first role was in stakeholder engagement, and my experience through conferences really helped me. My current role has a large research component, which obviously translates well from academia.

**What does your job involve on a daily basis?**

It depends on the day! Some days are quite varied, with different requests coming through to be completed. In general, though, it involves lots of meetings with various governmental and non-governmental departments to discuss past, present and future policy options. There's also a lot of reports to read and write, such as developing management methods and maintaining an oversight of underwater noise contributions from offshore wind developments. To maintain my position as a subject matter expert, I spend time researching different technologies to ensure my awareness is relevant and accurate, too. I also work on maintaining an oversight of the potential opportunities and impacts of floating offshore wind, which is a novel technology globally so has less evidence than fixed (traditional) offshore wind.

**Can you tell me more about your current role, and what its significance is?**

I strategically manage offshore windfarms as an Offshore Wind Advisor in the Strategic Renewables Unit in the Marine Management Organisation (MMO). The MMO manages the seas and coasts around England, and my team ensures the MMO's vision of a prosperous future for our seas, coasts and communities is supported through the deployment of sustainable offshore marine renewable energy. We work to support regulatory and system improvements for offshore renewables to enable development, whilst managing and mitigating detrimental impacts on the

marine environment, in line with government ambitions.

**What gives you the most satisfaction in your current work, and what do you not enjoy so much?**

I get the most satisfaction from seeing ideas for new approaches come to fruition successfully! We often need to consider whether there are any different approaches which haven't been previously considered to solve problems, and seeing one of these 'outside the box' ideas work and be supported by all involved is very rewarding. I least enjoy managing conflict. Unfortunately, this role isn't unique to being able to avoid differences of opinion, and these can be quite significant in relation to this area, particularly when the scale of offshore wind projects is considered.

**Do you have any opportunity to still work in research areas of interest to you, or if not, do you miss the 'hands on' aspect of being a palaeontologist?**

I definitely miss the 'hands on' aspect! I go out fossil hunting as much as I can, but unfortunately that isn't as often as I'd like. I try to keep up with new palaeontological research relating to my interests, and this is helped by the amazing network I've been able to build with other palaeontologists over the years. As much as I love what I do now, it's not a subject I've fully closed the door on returning to yet, which my colleagues could attest to with my taking any opportunity to discuss fossils.

**Do you have any tips for anyone wishing to transition into a role like yours?**

Be open to new experiences! Five years ago, I wouldn't have guessed that I'd have the opportunity to work in offshore wind; however, it has been an amazing role and has allowed me to maintain the research aspects which I loved in academia, whilst also developing new skills and knowledge in marine consenting and conservation.



**If you could take a workplace habit from one field to the other, what would it be?**

I would probably take my organizational skills from academia. My current role can be quite research-intensive, and getting back into the correct practices from writing essays and papers was challenging after taking a few years out in different roles. Academic-me would be appalled by my referencing!

**Is there a skill you wish you had been taught at university that would be useful in industry? What turned out to not be useful at all?**

This is difficult. I had no experience in offshore wind, bar speaking to a few offshore wind developers in a previous role and interest in the topic, before I started my current role. Palaeontology is an amazing subject for learning and developing transferrable skills, and these should not be underestimated – developing the ability to understand complex scientific processes, for example. As I'm

developing myself to be a subject matter expert, it's the ability to absorb, understand and find links in the science that's helping me out a lot, which I learned from studying palaeontology. Palaeontology is also a great subject for developing 'humble confidence'; that is, being confident in the conclusions you've drawn, whilst being open to discussion around them from others. Conversely, I don't use any applied palaeontology skills in my industry, although I would not call anything I learned 'useless' as I highly valued my time in palaeontology and wouldn't have changed it.

**What are your future ambitions?**

I'm currently seeing where the wind takes me... I would still like to return to academia in the future, ideally to complete a PhD. A recent training course on acoustics I participated in reminded me that I love to learn, so I try to keep my eyes open for the right opportunity but absolutely loving my career as it is!



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



**5th Palaeontological Virtual Congress**  
Online meeting 10 – 24 March 2025

The increasing use of virtual platforms to communicate science inspired the creation of the 1st Palaeontological Virtual Congress in December 2018, the first exclusively virtual conference in our field, followed by three further editions. Following this success the fifth Virtual Congress will be held in early 2025. The purpose is to spread, worldwide, the most recent scientific advances in palaeontology in a fast, easy and economical way. In these challenging times, online platforms have gained greater relevance and are key to keeping up the drive for science communication among both academics and enthusiasts. Delegates can share their research with the world, via either oral communications or slide presentations. The organizers welcome proposals for thematic sessions until 1st December 2024 and proposals for virtual field-trips until 13th February 2025. Abstracts can be submitted until 20th December 2024.

For more details see <<https://www.palaeovc.org/>>.



**3rd Geobiology Society Conference (Geobiology 2025)**  
Banff Park Lodge, Canada 20 – 24 May 2025

Following the success of the conferences held in Banff in 2017 and 2019, the Geobiology Society has announced its 3rd international conference on geobiology, also to be held in Banff, Alberta, within the Banff National Park in Canada's Rocky Mountains. With around 300 delegates anticipated to attend from around the world, Geobiology 2025 will provide an opportunity to explore the latest advances in the field in a relaxed but engaging setting. A key focus of this conference will be fostering connections across the diverse disciplines within geobiology, particularly bridging the gaps between geological and biological perspectives. The main conference theme is 'Tracing the biosphere through time', and this will guide discussions over the course of the three-day meeting, with the three days focusing on the Archean, Proterozoic and Phanerozoic eons respectively. The meeting will showcase the work of early-career scientists and will include professional development talks on topics such as giving effective interview presentations, writing successful grant applications and overcoming career challenges. Early bird registration is open until 31st December 2024, and all attendees are encouraged to submit an abstract for a lightning talk by 30th April 2025.

See the website: <<https://cms.eas.ualberta.ca/geobiology2025/>>.



**9th Symposium on Fossil Decapod Crustaceans**  
Faxe, Denmark 9 – 13 June 2025

This conference in Faxe is co-organized by the Geomuseum Faxe and the University of Alabama (Department of Museum Research and Collections and Alabama Museum of Natural History).



Although the conference is focused on decapod crustaceans, research on other crustaceans is also welcome. The conference consists of an icebreaker followed by two conference days full of talks and posters, followed by two field-trip days. The conference venue is very close to the Faxe Limestone quarry, which is the type locality for the Danian age, and has preserved the remains of a 63-million-year-old fossil cold-water coral reef. The quarry is famous for its high number of well-preserved fossils, including abundant decapod fossils that have been formally reported from Faxe since 1820. Geomuseum Faxe has an extensive collection of Maastrichtian and particularly Danian crustaceans from Denmark. The collection will be available for participants to study during the conference. The abstract submission and registration deadline is 15th February 2025.

For more information see <<https://collections.museums.ua.edu/9th-fossil-decapod-symposium/>>.



### **10th International Meeting on Taphonomy and Fossilization (TAPHOS 2025)**

Ferrara, Italy 17 – 19 June 2025

Taphos 2025 will be the 10th International Meeting on Taphonomy and Fossilization, and continues the tradition of taphonomic meetings that have been held regularly in Spain since 1990, with more recent meetings in Tübingen (2011), Ferrara (2014), Vienna (2017) and Madrid (2022). The aims of the Taphos meetings have been to integrate all aspects of current taphonomic research from both palaeontological and archaeological contexts: biostratigraphy, taphonomy in archaeology and anthropology, taphonomy in the analysis of patterns of evolution and extinction, taphonomy in biostratigraphy, theory of taphonomy, taphonomy in palaeoecology and sedimentology, Lagerstätten and exceptional preservation, taphosystems, historical ecology, conservation palaeobiology and mudlarking taphonomy. Taphos 2025 will be held in Ferrara in June with two days dedicated to scientific sessions and a one day field-trip. Delegates will be able to sample the best of Ferrarese cuisine and Italian wines in the centre of the European Renaissance. Early bird registration is available until 31st March and the abstract deadline is 25th April 2025.

Details will become available on the website: <<https://sites.google.com/unife.it/taphos-2025-ferrara/home-page>>.



### **4th Crossing the Palaeontological–Ecological Gap (CPEG) and 3rd Conservation Paleobiology Symposium**

Zurich, Switzerland 27 July – 1 August 2025

The CPEG meeting aims to bring together palaeontologists and ecologists to share ideas, data and methods in research areas that are studied by both, but typically independently, for example community and population ecology, food web dynamics, extinction mechanisms and conservation. In 2025 the meeting will be merged with the 3rd Conservation Paleobiology Symposium to promote the application of palaeobiological and ecological records to the conservation, management and restoration of biodiversity. The meeting will be held at the University of Zurich, but will be hybrid with the option for virtual participants to deliver pre-recorded talks with questions from the audience, and all talks will be streamed to accommodate participants who cannot attend in-person



due to geo-political, financial or other logistical constraints. This will be a six-day meeting with no parallel sessions, two in-person workshops and a field-trip. Two additional virtual workshops will be offered prior to the meeting. The main conference will include keynote addresses, full oral presentations and lightning talks, plus posters. A welcome reception and poster session will take place at the Natural History Museum of the University of Zurich. Awards will be given for the best student presentations, and for delegates who have travelled with the lowest carbon footprint (corrected for distance). Early bird registration and abstract submission is expected to open in December 2024 and to close on 1st March 2025.

For more details see: <<https://www.cpeg-cpb25.uzh.ch/en.html>>.

**International Congress on Palaeontological Heritage IX (ICHP-9)**

Settat, Morocco 24 – 28 September 2025

The International Congress on Palaeontological Heritage is dedicated to both palaeontological and palaeoarchaeological heritage, communicating and exchanging research on topics linked with the preservation and enhancement of this heritage. It will be a meeting place for international researchers, socio-economic operators and activists, as well as activists in the legislation of palaeontological heritage, and will offer the opportunity for early-career researchers to forge links with these various stakeholders. It will also be a meeting place for the different generations of Moroccan palaeontologists to discuss the creation of an association of Moroccan palaeontologists. The Higher School of Education and Training of Berrechid and Hassan First University will organize this scientific and cultural event during late September 2025 in the Reception and Conference Centre in Settat, an attractive and easily accessible city in central western Morocco. The Congress aims to promote cooperation and collaboration between international researchers and socio-economic operators, with a programme encompassing new research, new methods and techniques, geoconservation strategies, and raising awareness of geoheritage protection with local communities and authorities through the creation of reserves, museums and geoparks.

See the website: <<https://sites.google.com/view/icph-9/home>>.

**85th Annual Meeting of the Society of Vertebrate Paleontology (SVP)**

Birmingham, UK 12 – 15 November 2025

The 2025 Annual Meeting of the Society of Vertebrate Paleontology will be held in Birmingham, UK, hosted by researchers from the University of Birmingham. This is only the fourth time that the meeting has been hosted outside of North America, and the second time in the UK. Birmingham is located centrally in England with an international airport and direct train connections to London and all other major UK cities. The meeting will take place at the International Convention Centre (ICC) in the heart of the city, conveniently surrounded by hotels, restaurants, bars and cafes, and a short walk from the central train station. SVP will run an open call for symposia proposals. Field-trips are being planned and will include options to classic palaeontological hotspots such as the Isle of Wight or the Jurassic Coast. Birmingham itself is surrounded by significant heritage attractions



and natural landscapes, including Shakespeare's birthplace at Stratford-upon-Avon, Ironbridge Gorge World Heritage Site, and the Peak District National Park.

More information will be on the website in due course: <<https://vertpaleo.org/svp-annual-meeting-2/>>.



### 7th International Palaeontological Congress (IPC7)

Cape Town, South Africa 30 November – 3 December 2026

The 7th International Palaeontological Congress will be held in South Africa in 2026, only the second time that this meeting will be held in the global South and the first time in Africa. The meeting will be held during the height of the very pleasant summer season at the Cape Town International Convention Centre (CTICC), which has the capacity to host hundreds of delegates, both in large rooms and in smaller breakaway rooms. The CTICC is situated close to the vibrant heart of Cape Town's city centre and a short walk to the Victoria and Alfred Waterfront which hosts numerous restaurants and hotels to suit all pockets. The fossil heritage of

South Africa is renowned globally for its importance in understanding the history of life on Earth and extends from the very beginnings of life to the world-famous hominin relatives that have been recovered there. Submissions for symposia topics will soon be invited, and the organizers expect to offer a wide range of symposia, as well as space for general talks. A series of field-trips will give delegates a feel for the rich fossiliferous rocks in South Africa that span significant periods of time. Furthermore, delegates attending IPC7 will have the opportunity to visit some of the most important museum collections of South Africa, including the Albany Museum featured in *Newsletter 115*. Circulars are available online as well as preliminary registration.

Congress website: <<https://ipc7.site/>>.



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*Please help us to help you! Add your own meeting using the link on the Association's web page:*

<<https://www.palass.org/meetingsevents/future-meetings/add-future-meeting>>.

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# Meeting REPORTS



**Redcar Rocks! Yorkshire Fossil Festival 2024**

Redcar, UK 25 – 27 May 2024

The Late May Bank Holiday weekend saw the Yorkshire Fossil Festival wash onto the sandy shores of Redcar in North Yorkshire, UK for the very first time. Just a short walk from the panoramic views of the helter-skelter-shaped Redcar Beacon was the TunedIn Centre, the venue for this year's Festival. Housed within and around the centre, the Yorkshire Fossil Festival celebrated its tenth birthday with two fun-filled festival days on the weekend and a fossil finding field-trip on the Bank Holiday Monday. Hosted by **Liam Herringshaw**, the Director of the Festival, and **Steve Cousins**, the 'Rock Showman' and Ringmaster of Let's Circus, the weekend consisted of fossils, friends and fun for the families of Redcar and beyond.



*The iconic Redcar Beacon and the Fossil Festival's equally iconic ringmaster, Steve Cousins. Photos by Nicola Vuolo.*

Outside the TunedIn Centre, the various tents housed rock polishing workshops, stations to create your very own 'Trilokite' as well as showcase lectures in the Rock Showman's booth just to name a few. There was even a performance amphitheatre where families could embark on a Wild West adventure to revisit the great American Dinosaur Discoveries as well as listen to authentic 'rock' music from the geology-inspired singer songwriter **Olivia Rafferty**.

Inside the first part of the centre there was a suite of fossil shops, beverage and accessory stalls and even fossil tours by the Yorkshire Fossil Hunter to take in before going into the main hall that housed the rest of the exhibitors. Setting up in a prime spot near the door for oncoming visitors, the Palaeontological Association stall had something for everyone including fossils, games, books and renowned palaeoartist, **James McKay**. Drawn in by the colourful and aptly named Wheel of Misfortune, players were tasked with creating a creature that's built to last using the various body parts available before spinning the wheel to decide its fate. After each successful spin of the wheel, one million years had passed with the most successful (or lucky) creatures surpassing ten million years. Regardless of those that were built to last or perished within the blink of an eye, the creators were rewarded with a sticker of their choice. Following on from this were the fossil displays of Eury the eurypterid and friends that included locally found *Gryphaea*, ammonites, trilobites and,



*The Wheel of Misfortune was popular with children of all ages, as was our mascot Eury. Photos by Nicola Vuolo.*

of course, a eurypterid or sea scorpion. This was popular with all demographics, and it even had visitors bringing in their fossils for identification. The Fossilization Frenzy taphonomy game provided a creative way of exploring the fossilization process, and the player's choice of a jellyfish crinoid, ammonite or ichthyosaur would prove vital in their chances of fossilizing if they could avoid being destroyed by heat and pressure. The most popular station across the weekend was that run by James McKay, whose free postcards and affordable book of the flora and fauna of fossil localities across the UK were also available at the Festival. At the creature creation station, the children could assemble parts or draw their imaginary animal and give it to James where he would then bring it to life with paints for free.



*Creating creatures from heads, bodies and tails; palaeoartist James McKay bringing the creature creations to life. Photos by Nicola Vuolo.*

The two days proved to be a roaring success and the partnership with Redcar Kite Festival meant that there were a lot of 'blow ins' that resulted in a diverse attendance. With around 500 interactions that were at least five minutes long over the two days, the success of the Association at the Yorkshire Fossil Festival is clear and provides a benchmark for future outreach projects.

**Luke A. Barlow**  
*Kings College London, UK*

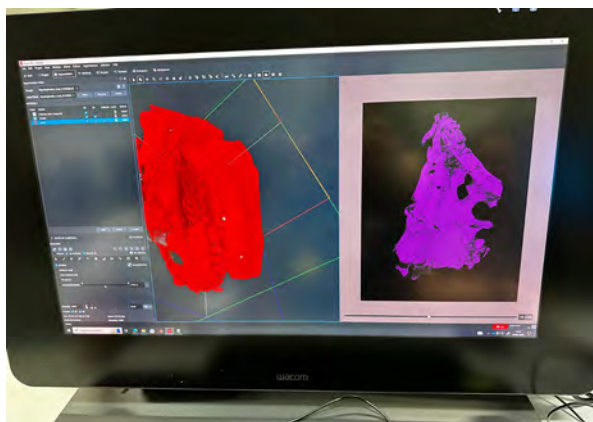
**Progressive Palaeontology**

University of Bristol, UK 17 – 20 June 2024

Progressive Palaeontology, better known as 'ProgPal', is the Palaeontological Association's conference for postgraduate research students, hosted each year solely by postgraduate students with the aim of fostering an inclusive environment of peer-to-peer support. The 41st Progressive Palaeontology meeting was hosted by students at the University of Bristol and was run by an amazing committee with a wide range of research interests. The quality of the research presented by all postgraduate students was phenomenal, utilizing a wide range of techniques and highlighting the bright future of palaeontology both in the UK and beyond. The strong attendance of international students emphasizes the excellent work and phenomenal events undertaken by the host committees past and present. A special thanks must be given to the Association for continually supporting this event for postgraduate students, providing a warm, friendly and encouraging environment to allow them to develop. This is in addition to the generous sponsors who this year were the University of Bristol, Thermo Fischer Scientific, *PeerJ*, and The Company of Biologists who supported the event and enabled attendance through a number of travel grants.

This year the pre-conference event on Monday 17th June gave an electrifying start with a panel discussions event on 'An insight into Palaeomeida'. Insightful and advice-filled keynote talks were given by **Tom Fletcher**, Senior Scientific Researcher at Silverback Films, and freelance researcher and film-maker **Zoe Cousins**, allowing all attendees to gain a rare glimpse into the scientific decisions and compromises in the television and film industry. One of the biggest lessons, contradictory to a belief held by some, is that a great level of scientific accuracy, research and discussion goes into making scientific documentaries. Yet, especially in our field, there are often legitimate differences of opinion when interpreting the fossil record, behaviours of extinct animals and their palaeoenvironments. The panel discussion that followed was made up of great contributors including **Emily Rayfield**, **Andre Rowe** and **Tahlia Pollock**, in addition to the keynote speakers, and was filled with funny, priceless and relatable moments especially when meeting one's heroes in natural history and palaeontology, such as Sir David Attenborough.

The workshops held the following day were well attended with some being overly-subscribed. In line with the University of Bristol being one of the key hubs for palaeontological research in the UK, **Hady George** gave an incredibly well-received and appreciated workshop using the cutting-edge software Avizo.



*Segmentation of a dinosaur skull performed at the Avizo workshop.  
Photo by Hady George.*



Even though Avizo and micro-CT segmentation have been used in palaeontology for some time, many attendees had never had the opportunity to use or learn about this pivotal software that has helped to revolutionize our field. Many were filled with wonder and inspiration for potential projects and uses in their future research careers. A special thanks must be given to **Deborah Hutchinson** for running the behind-the-scenes tour of Bristol Museum & Art Gallery where an exceptional collection of both invertebrate and vertebrate marine fossils is housed, so something for everyone, and a rare opportunity for attendees to have such a prestigious tour. The day ended with an icebreaker event and poster session in the foyer of the Life Sciences Building that were very well attended and had a cheerful, friendly and encouraging atmosphere, resulting in networking and scientific discussions going on long into the night.



*Attendees breaking the ice at the poster session at ProgPal. Photo by Hady George.*



The research presented at ProgPal during both the poster session and the conference talks was absolutely phenomenal, spanning a wide range of topics, techniques and questions, giving a true testimony of the outstanding early-career researchers currently in palaeontology. The quality of research was so high that the committee had a very difficult time determining the winners of the awards for the best presentations and, as such, due to such stiff competition, had numerous runners-up. The winning talk was about the enigmatic *Prototaxites* from the Devonian of Scotland by **Laura Cooper** (University of Edinburgh) and the winning poster was on an ancient arthropod relative by **Campbell Marsden Hendrick** (University of Bristol); both awards were very well deserved. I especially enjoyed speaking to **Sophie Brown** (University of Bristol) about her poster entitled 'The Bull of the Recent' on new techniques being applied to ungulate palaeoecology. ProgPal is the perfect place to practise presenting in a warm, friendly and supportive environment, which can be an elusive beast within academic circles. Such practical examples from organizations such as the Palaeontological Association must be credited for supporting students and upcoming researchers in palaeontology.

The closing of the conference was just as grand and exciting as its beginning. The auction had many great laughs, fierce but friendly competition for many items including, believe it or not, a weighty textbook on statistics in palaeontology. You will be glad to know that all items found loving new homes and hopefully will be useful for many years to come. Surprisingly, no clade or time was particularly more popular than any others, but if I may say so, dinosaur items did do better than whales. The conference dinner at The Mall in Clifton was very well attended, and many great conversations and academic discussions happened over great food, with laughter and joy, and was an excellent closing for the majority of the attendees.

The swansong of the conference was the field-trip to Penarth in South Wales, where we made the most of the beautiful summer sunshine of mid-June in Britain; a phrase I appreciate that is not seldom strung together unless being compared to a unicorn or a completely preserved fossil specimen. We wandered along the coastline in the warm afternoon sun, observing the Mesozoic sediments and walking in the literal footsteps of the dinosaurs millions of years before us, being both a humbling and beautiful experience. While some had a break and dozed off in the afternoon sun during our lunchtime picnic, others found vertebrate and invertebrate fossils from the Triassic Rhaetian beds, with a fortunate few even finding the vertebrae of ichthyosaurs. The day ended with more ice cream and snacks for the coach journey back to Bristol, as we rode off into the afternoon sunshine and sunset.

I would like to end with a very special thanks to the host committee comprising **Kirsten Flett**, **Thomas Farrell**, **James Rawson**, **Hady George**, **Isaura Aguilar Pedrayes** and **Benton Walters**, who genuinely put on a phenomenal and enjoyable conference for all. The atmosphere was filled with warmth and encouragement, and is further testimony of the Association's objectives to make palaeontology an inclusive and diverse field. My final words of reflection are to encourage all postgraduate research students to attend in future years, as it really is a special and delightful event to attend.

**Cassius Morrison**

*University College London, UK*

**19th International Nannoplankton Association Meeting (INA 19)**

Llandudno, Wales 7 – 15 September 2024

The 19th INA Meeting was held in North Wales at the St. George's Hotel, located on the seafront of Llandudno. Despite the intermittent rain, the location was very much appreciated by the participants. This year's congress attracted more than 100 participants from 27 countries, representing universities, research institutions and industrial companies from all around the world. The event opened with a pre-conference field-trip to Ynys Môn (Anglesey), allowing attendees to explore some of the region's geological highlights, including Menai Bridge Viewpoint, Parys Mountain and Llanddwyn Island. Early registration began at St. George's Hotel, followed by the icebreaker party at the stunning Conwy Castle, which set the tone for a productive and engaging meeting.



*Opening announcement by INA19 Convenors, Tamsin Lawrence (left) and Simon Cole (right). Photo by Micaela Chaumeil Rodríguez.*

Throughout the meeting 110 abstracts were presented, including 62 oral presentations and 48 posters. These were organized into thirteen sessions that covered a wide array of topics, focusing on biostratigraphy, methods and taxonomy, oceanic anoxic events, hyperthermals, palaeoecology, evolutionary history from the Jurassic to Recent, and emerging technologies such as artificial intelligence for nannofossil identification. Highlights were the keynote talks, including a discussion by **Mike Simmons** (Halliburton) on biostratigraphy and the energy transition; an exploration by **Tamsin Lawrence** (PetroStrat) and **Emma Sheldon** (GEUS) of the role of female pioneers in nannopaleontology and their work on oil rigs; and a presentation by **Paul Bown** (University College London) on the nannoplankton evolution and community dynamics through the Palaeogene. The poster sessions also provided a vibrant forum for discussion, with topics ranging from the response of coccolithophores to environmental changes to new biostratigraphic insights across different geologic periods.

In addition to the oral and poster presentations, a total of eight workshops (four per day) and a masterclass were organized. Each participant could choose two workshops. Topics and organizers



included: Biostratigraphy Software – StrataBugs (**Paul Britton**, StrataData Ltd; Jurassic Nannofossils (**Fabienne Giraud**, Université Grenoble Alpes; **Jason Jeremiah**, Viridien; and **Emanuela Mattioli**, Université Claude Bernard Lyon 1); Cretaceous Nannofossils (**Paul Bown**, University College London; **Matthew Hampton**, Network Stratigraphic; and **Richard Howe**, Ellington Geological Services); Extant Coccolithophore Biogeography (**Jeremy Young**, University College London); Geochemical Proxies from Coccoliths (**Tom Dunkley Jones**, University of Birmingham); Public Outreach (**Mario Cachão**, Universidade de Lisboa; **Micaela Chaumeil Rodriguez**, Instituto de Investigación en Paleobiología y Geología (CONICET); **Mariem Saavedra-Pellitero**, University of Portsmouth and **Deborah Tangunan**, University College London); and AI and Automated Coccolith Identification (**Luc Beaufort**, CEREGE). We also welcomed sixth-form students from several local schools in Conwy County Borough, who were introduced to the microscopic world of nannoplankton.



*The INA 19 delegates group photo was taken outside the St. George's Hotel in Llandudno. Photo by Micaela Chaumeil Rodriguez.*

Networking opportunities were abundant throughout the event. Social gatherings like the conference dinner at Dylan's Llandudno, followed by dancing to a twmpath (ceilidh) band, offered a relaxed setting for attendees to connect. The mid-conference field-trip to the Great Orme further promoted engagement, while also allowing participants to enjoy the region's rich geological heritage. After the conference a post-conference field-trip took place, offering participants the chance to explore Snowdonia (Eryri). This two-night residential trip included highlights such as the Slate Museum in Llanberis, the Zip World Deep Mine Tour in Llechwedd, and the Mawddach Estuary. Participants were able to visit sites rich in both geology and history, further enhancing the conference's educational and networking experience.

The meeting was organized by **Simon Cole** and **Tamsin Lawrence** of PetroStrat, with PetroStrat serving as the primary host of the event, marking the first time the conference has been hosted by an applied science company. Special thanks also go to **Emanuela Mattioli** (INA President) and **Paul Cornick** and **David Rutledge** (PetroStrat Directors) for their contributions. We would also like to thank **Rob Crossley** (GeoMôn/Viridien); **Peter Lucas**, **Dylan Roberts**, **Hannah Torrance**,



**Gareth Smith** and **Jack Walker** (PetroStrat); and **Jonathan Wilkins** (X-ray Mineral Services) for contributions to the field-trip. The event's sponsors and contributors made it possible to deliver such a successful meeting.



*Delegates enjoying the field-trip and hunting for fossils. Photo by Micaela Chaumeil Rodríguez.*





Alongside the scientific presentations and workshops, we took the opportunity to celebrate several award winners. The Shirley van Heck Prize went to **Micaela Chaumeil Rodríguez** (CONICET), **Odysseus Archontikis** (University of Oxford), and **Diego Felipe Vallejo Hincapié** (Universidad de Caldas). **Laura Bronzo** (University of Florence) and **Sara Marconato** (Ben-Gurion University of the Negev) were recognized with the Best Student Talk Award, while **Nikoleta Vitsou** (University of Kiel) and **Joseph Asanbe** (Uppsala University) claimed the Best Student Poster Award. The Student Marathon Award was presented to **Joeven Austine S. Calvelo** and **Justin Jorge Padre** (both University of the Philippines Diliman), and the Katharina von Salis Graduate Research Fellowship was awarded to **Edna de Jesús Francisco Tungo** (UNISINOS; joined online) and **Paula Granero Ordóñez** (University of Vienna).

Overall, the 19th INA Meeting was a resounding success, blending high-quality scientific content with ample networking and professional development opportunities. We extend our gratitude to the Palaeontological Association for their Grant-in-Aid (PA-GA202402), which enabled the authors, two early-career researchers, to attend the event. We look forward to seeing everyone at INA 20 in 2026 in Argentina, which promises to be another milestone event!

#### **Paula Granero Ordóñez**

*University of Vienna, Austria*

#### **Yi Zhang**

*China University of Geosciences, China*



*Argentina for INA 20 in 2026. Photo by Paula Granero Ordóñez.*

**Digital methods in palaeobiology**

Lapworth Museum, Birmingham, UK 14 – 16 October 2024

Digital methods for the visualization and analysis of fossils have become ubiquitous tools for palaeontologists in the last decade. However, the steep learning curve of many techniques, a variety of software and different standards (or lack thereof) make it far from straightforward to apply these methods. This problem was the motivation for our three-day workshop, led by Stephan Lautenschlager to present a practical approach to a variety of topics and methods. Day 1 started with training in different approaches for the digitization of fossils using photogrammetry and computed tomography (CT). Participants were encouraged to test their newly acquired skills by digitizing specimens on display at the Museum. Day 2 was dedicated to the digital restoration of fossils, soft-tissue reconstruction (*e.g.* musculature), and visualization and animation of virtual models using Blender, taught by Luke Meade and Stephan Lautenschlager. Day 3 focused on using geometric morphometric analysis to quantify fossil morphology in 2D and 3D, ending with an exploration of machine learning taught by Angela George. For all applications, we were able to use freely available software so that participants can use the methods learned for their own research.

We welcomed 16 early-career researchers to the workshop from the UK, Belgium, Brazil, China and Germany. Thanks to the generous support of the Palaeontological Association (grant number PA-GA202401), we were able to provide travel support to participants without access to other funding. Demand for the workshop was very high (*c.* 40 applications) but we limited the workshop to 16 participants to make it logistically feasible. However, due to the high interest, we hope to make this workshop an annual event. Feedback from participants was overwhelmingly positive and we thank everyone for attending (and for patiently bearing with us when things didn't go as planned).



*Group photo of the participants at the first Digital Methods in Palaeobiology workshop. Photo by S. Lautenschlager.*

**Stephan Lautenschlager**

University of Birmingham, UK



# Research Grant REPORT

## *The flora, fauna and depositional setting of the Upper Jurassic Sundance Formation, Wyoming, USA*

**Susannah C. R. Maidment**

*Fossil Reptiles, Amphibians and Birds Section, Natural History Museum, London, UK*

During the Middle and early Late Jurassic, the Western Interior of the USA was flooded by a large epicontinental seaway, the Sundance Sea, which was home to a diversity of marine reptiles, fishes and invertebrates. The deposits of this seaway are known as the Sundance Formation, and they are usually characterized by dark grey mudstones deposited under deep marine conditions (McMullen *et al.* 2014). However, Sundance deposits that crop out on the Wyoming–Montana border indicate a different environment (Dejarnette and Utgaard 1986). In this area, deep-water mudstones give way upwards to coarse, cross-bedded sandstones, followed by finely laminated micritic limestones which have been interpreted as being deposited in a hypersaline lagoon (Dejarnette and Utgaard 1986; McMullen *et al.* 2014). This shallowing event has been attributed to a tectonic upwarp in the area, known as the Sheridan arch (Kilibarda and Loope 1997).

During exploratory fieldwork in 2019 a team from the Natural History Museum, London (NHM), the Children’s Museum of Indianapolis, USA and The University of Manchester, UK discovered that splitting the micritic limestones along laminations reveals relatively common exceptionally-preserved insect fossils. The insects have never before been studied and, indeed, well-preserved insect fossils are unknown from this time in the Western Interior. In 2019, I logged a section through the lagoonal deposits and discovered that they displayed cyclicity on the cm and dm scale. Cyclicity in such deposits is often attributed to fluctuating environmental conditions, and has sometimes been related to Milankovich cycles (Abels *et al.* 2013). I brought a small sample back to the NHM for palynological analysis by Steve Stukins, and from it we recovered a suite of palynomorphs including spores and pollen, fresh-water Chlorophyceae algae, and dinocysts, demonstrating the utility of the sample for environmental interpretation and calling into question the hypersaline interpretation for the deposits. Palynomorphs have never previously been described in any detail from the Sundance Formation. This unique and exciting site on the Wyoming–Montana border offers an unprecedented opportunity to investigate environmental conditions and how they varied over time during the earliest stages of the Late Jurassic in the northern USA, something which has hitherto been difficult because of a lack of terrestrial deposits from this time period.

The aims of this research were therefore to i) log the sediments in several localities to capture lateral variation in facies architecture; ii) collect samples for palynological analysis at mm resolution to investigate environmental conditions during deposition and causes for cyclicity; iii) collect, study and describe the insect fauna. Funded by a Palaeontological Association Research Grant (grant number PA-RG202201 to S. Maidment), Lil Stevens (NHM) and I carried out two weeks of fieldwork on these rocks in July 2023. Six sections were measured along a 2 km escarpment, and multiple



samples from each section were collected for palynological analysis. Rocks were split to search for insects in these locations (Figure 1) and at six further locations along the escarpment as well.



*Figure 1. Lil Stevens splits a layer of laminated limestone while searching for insect fossils. Photo by Susannah Maidment.*

Logging demonstrated that the fine-grained limestones were divided into three cyclical packages, each one composed of multiple 4 mm thick packages, themselves composed of laminations <1 mm thick. Laminations were frequently wavy, perhaps indicating the presence of algal mats. The packages were separated from each other by brown, silty mudstones. We discovered over 200 insect fossils from splitting the limestones along laminations (Figure 2), and numerous fish were also found. Insects were most concentrated in the lowermost package, while fish appear to be absent, but were common in the uppermost package.



*Figure 2. Insect fossils are extremely abundant: these were found in one day before lunch. Photo by Susannah Maidment.*

Back in the UK, Open University PhD student Emily Swaby, an expert in Jurassic insects, joined the project to help us identify the insects (Figure 3).



Figure 3. Some specimens found in the field. The insects are each about 1.5 cm long. Photos by Susannah Maidment.

This work is still ongoing, but Emily has discovered that most of the identifiable insects are larvae of diving beetles. Today, such larvae are found in freshwater environments, rather than hypersaline lagoons. The palynological samples are still being analysed, but preliminary results on a couple of samples indicate no evidence for marine conditions, with relatively generic freshwater algae being the most common palynomorph recovered. Although we still have much work to do to determine the causes of cyclicity within the sediments, our results so far seem to indicate the intriguing possibility that these unique deposits are actually lacustrine. To date, we have not recovered marine palynomorphs from the sediments in between the limestone packages either, perhaps indicating that the limestone packages record times of little detrital input, due to local climatic or tectonic variations. If these preliminary finds are correct, they require a re-think of Middle Jurassic palaeogeography in the region. We hope that our ongoing work will lead to the first description of these insects, renewed work on the fish fauna, and new insights into climate and environment of the Middle Jurassic in the western USA.

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# Small Grant REPORTS

## *Hinge inversion study in Cenozoic Bivalvia of West Pacific*

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### **Introduction**

In Bivalvia, the hinge represents a system of protrusions on the dorsal edge of one valve that fit into corresponding sockets of the opposite valve. The arrangement, number, size and shape of hinge teeth are determined early in ontogeny and are hereditarily fixed. The evolutionary tree of Bivalvia groups, based on hinge morphology and topography, is well-established and widely accepted, making these features taxonomically valuable. Inversion, a phenomenon where the hinge teeth normally found in the right valve appear in the left valve and *vice versa*, has been observed in various bivalve families (Popenoe and Findley 1933; Anistratenko 1987; Matsukuma 1996). While there is substantial documentation of hinge inversion in recent species (Matsukuma 1996), data on its occurrence in fossil species are sparse, with only a few reports covering the Palaeozoic era (Saul 1986). Despite the rich marine biodiversity in the West Pacific region since the Neogene, no fossil records of hinge inversion have been previously published. This study aims to investigate this abnormality from two distinct localities in Taiwan, along with existing collections of bivalves from Taiwanese sediments.

### **Materials and methods**

The study targeted two Pleistocene strata known for their bivalve fossils. Site 1, located in Miaoli County, northern Taiwan (Figure 1), features outcrops belonging to the middle Pleistocene Toukoshan Formation (~1.70 – 0.774 Ma). This site is characterized by tidal and intertidal facies and is rich in mollusc fossils. Site 2 is in Hengchun Township, Pingtung County, southern Taiwan (Figure 1), focusing on the Szekou Formation (90 – 140 kyr), and is known for abundant marine fossils of excellent preservation. Multiple field-trips were conducted during the dry winter–spring period of 2023–2024 to avoid the intense summer floods and rains. We collected over 300 kg of bulk sediments from both sites (for smaller and juvenile shells), along with handpicked bigger bivalve shells representing heterodont families. Overall, more than 600 specimens were collected and examined for inversion abnormalities in hinges. To maximize our efforts, we additionally examined museum collections, as it was shown previously that inversions only rarely occur. Comprehensive collections were available at the Department of Geoscience, National Taiwan University ( $n=510$ ), and represented by species and genera with previously reported hinge inversions. Most of the material was collected in 1957 from the Toukoshan Formation.

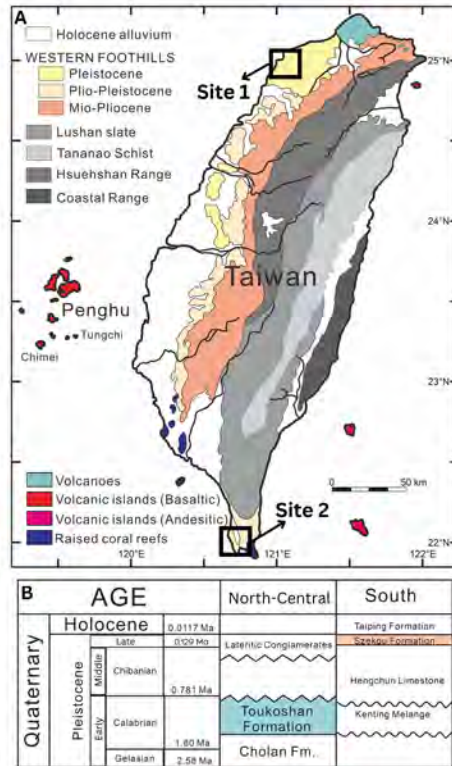


Figure 1. Summary of the sampling sites. A) General geological map of Taiwan (after Lin et al. 2022); B) stratigraphic correlation (after Chen 2016). Studied locations indicated in colour.

**Preliminary results and discussion**

During the initial stages of this study, I identified heterodont families potentially exhibiting hinge inversions based on previous research and personal observations. Target families included Carditidae, Crassatellidae, Tellinidae and Veneridae. The Szekou locality was noted for its abundance and diversity of the Veneridae family. A forthcoming publication will detail their taxonomic status. We examined five of the most abundant species of Veneridae and Crassatellidae families for hinge inversions, as this could provide statistically reliable data of inversion occurrence. Although large sediment samples were examined, no hinge inversions were found in these specimens. At the Miaoli site, the targeted Carditidae family was well-represented by *Venericardia granulicosta*, although showing no hinge inversion.

Among bivalve collections in the National Taiwan University, *Venericardia granulicosta* revealed one specimen with a full hinge inversion (Figure 2). In this case, lateral and cardinal teeth that should be in the right valve appeared in the left without any visible deformation. This is the first reported case of hinge inversion in Cenozoic bivalves from the West Pacific, previously documented only in Oligocene *Venericardia* species from France (Matsukuma 1996). Hinge transposition



appears to be closely related to systematic position, being typical of specific taxa, particularly for families of subclass Heterodonta. It was noted before, that inversions occur more often in basal families compared to more derived ones (Matsukuma 1996). For instance, the Veneridae species studied here, considered evolutionarily young, showed no inversions, supporting this hypothesis. Despite uncertainties about the importance and not widely accepted application of the inversion phenomenon, I assume that a comprehensive study of such changes in normal position of hinge teeth will facilitate our understanding of evolutionary pathways for Bivalvia, and that tooth inversions may be markers that record single events in the evolution of the hinge.



*Figure 2. Inverted left valve of the Venericardia granulicosta from the National Taiwan University collection, compared to valves with normal hinge.*

### **Future directions**

Continued sampling is planned, as some families are difficult to collect and current sample sizes are not statistically sufficient. Each discovery of this phenomenon enhances our understanding of the types of inversions possible within different bivalve groups. Outdated taxonomy and overlooked mollusc groups underscore the need for an ongoing revision of Taiwan's mollusc fossils. Given Taiwan's rich biodiversity since the Neogene period and its potential contribution to the Indo-Australian Archipelago biodiversity hotspot, clarifying Taiwan's role in this context remains a critical goal. Two papers are being prepared for publication, focusing on revised and newly discovered fossil mollusc groups of Taiwan.

### **Acknowledgements**

I would like to thank the members of the Marine Paleontology laboratory, Academia Sinica, for assistance in the field. Additional thanks to V. V. Anistratenko (I. I. Schmalhausen Institute of Zoology, Ukraine) for consultation and J. P. Lin (National Taiwan University, Taiwan) for assistance with collections examination. This work was supported by the Palaeontological Association's Small Grant Scheme, Callomon Award number PA-CA202201.





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## ***Cranial anatomy and phylogenetic relationships of the mekosuchine crocodylian *Quinkana timara****

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Mekosuchinae is an extinct clade of crocodylians that thrived on mainland Australia since at least the early Eocene until the Late Pleistocene (see Ristevski *et al.* 2023a). Some mekosuchines also inhabited several islands in the South Pacific where they went extinct in the Late Pleistocene or Holocene (Balouet and Buffetaut 1987; Mead *et al.* 2002; Molnar *et al.* 2002). Throughout their long evolutionary history, mekosuchines evolved various cranial morphotypes (*e.g.* brevirostrine platyrostral, mesorostrine platyrostral as well as altirostral/oreinirostral) and body sizes (*e.g.* small-bodied taxa of less than 2 m in total length as well as large-bodied taxa of at least 4 m in total length; Ristevski *et al.* 2023b; Yates *et al.*, 2023). This diversity in cranial morphologies and body sizes allowed mekosuchines to occupy distinct ecological and trophic niches that ranged from semi-aquatic macropredators to medium and small-sized terrestrial carnivores. The latter group includes taxa that possessed ziphodont dentition – teeth characterized by labiolingually compressed crowns and serrated mesial and distal carinae. There are no extant crocodylians with ziphodont dentition as the last known ziphodont crocodylians were mekosuchines that went extinct on mainland Australia during the Late Pleistocene (Molnar 1982).

At present, *Quinkana* is the only formally named and described genus of ziphodont mekosuchine. The genus *Quinkana* has four recognized species that are known from the late Oligocene until the Middle Pleistocene of Australia (Molnar 1982; Megirian 1994; Willis and Mackness 1996; Willis 1997). However, all four species of *Quinkana* are known from fragmentary material. The scarcity of material that is referable to *Quinkana* has imposed significant limitations on our understanding of the anatomy, palaeobiology and phylogeny of its species. This ongoing project promises to significantly expand our knowledge on the genus *Quinkana* thanks to numerous undescribed



specimens referable to the species *Quinkana timara*. *Q. timara* is known from the Middle Miocene deposits of Bullock Creek in the Northern Territory (Figure 1). The original and thus far only published study dedicated to *Q. timara* was that by Megirian (1994), who named and described the species based on fragmentary rostromandibular elements and ziphodont teeth.

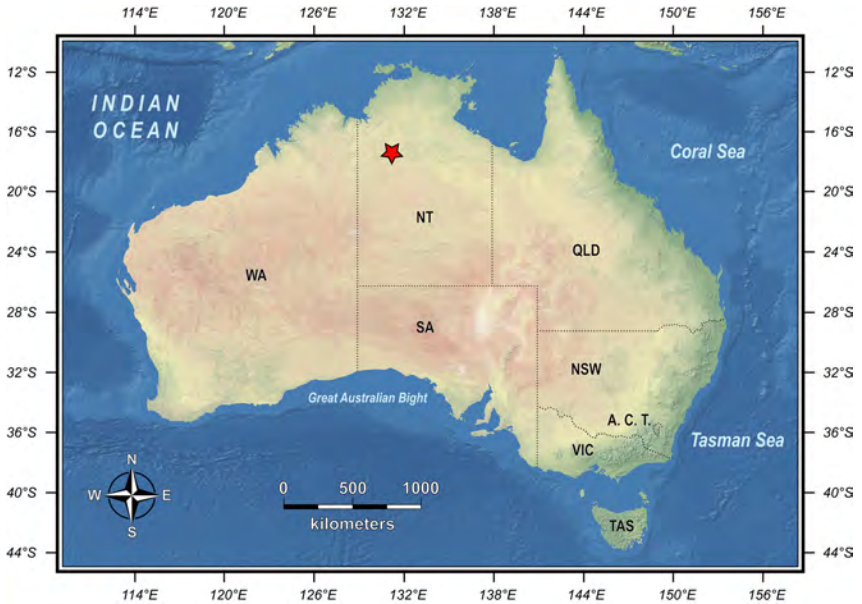


Figure 1. Map of Australia. The red star indicates the location of Bullock Creek in the Northern Territory. Basemap modified from Natural Earth (<[www.naturalearthdata.com](http://www.naturalearthdata.com)>).

The new material includes, but is not limited to, additional maxillae, premaxillae, partial dentaries and other craniomandibular elements, multiple isolated ziphodont teeth (Figure 2), as well as a near complete braincase.

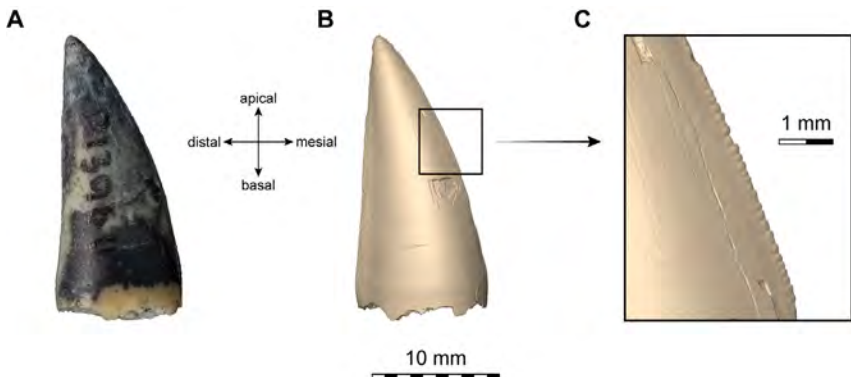


Figure 2. *Quinkana timara* Megirian, 1994, NTM P13960, isolated tooth crown in labial view. A) Photograph of the specimen. B) Image of a digital model rendered from the micro-CT scan. The black square in B) indicates the area zoomed in C) showing the denticles along the mesial carina.



The new material that is currently under study for this project will allow for a near complete reconstruction of the skull and mandibles of *Q. timara*. Much of the new material referable to *Q. timara* has been micro-CT scanned thanks to the funding that was kindly provided to me by the Palaeontological Association, thus allowing study of its anatomy to an unprecedented degree. The high-resolution micro-CT scans are expected to unravel numerous anatomical aspects of interest that cannot be observed through traditional assessments of the physical specimens. One of these anatomical aspects includes the palaeoneurology of *Q. timara*. This project is expected to be the first time that the palaeoneurology is described for any species of *Quinkana* and the third such instance for Mekosuchinae overall (Ristevski 2020; Ristevski *et al.* 2022). At the time of writing, the osteology and palaeoneurology of *Q. timara* are in the early phases of research, and I cannot provide meaningful descriptions until the project progresses further.

The new material of *Q. timara* is phylogenetically informative, which currently allowed for a preliminary phylogenetic assessment. The phylogenetic matrix of Ristevski *et al.* (2023a) was expanded with the addition of new characters and taxa, resulting in a total of 285 morphological characters and 154 operational taxonomic units (OTUs). Among these OTUs was *Q. timara*, which had its scores revised and updated in light of the new material. The analysis was conducted in TNT v1.6 using the Traditional Search option, no implied weighting, and 24 out of the 285 characters were treated as ordered. The preliminary phylogenetic results recovered ten most parsimonious cladograms with 2,095 steps. The strict consensus topology was well resolved, with a monophyletic Mekosuchinae recovered as the sister clade to Longirostres (Crocodyloidea + Gavialoidea). The genus *Quinkana* was recovered near the base of Mekosuchinae, and *Q. timara* was found as the sister taxon to *Q. fortirostrum*. Intriguingly, these preliminary results also recovered the species of the clade Orientalosuchina nested deeply within Mekosuchinae. Orientalosuchina is a clade of crocodylians that are known from the Late Cretaceous to Eocene of continental Asia that were originally referred to Alligatoroidea (Massonne *et al.* 2019). Recent studies have proposed alternative phylogenetic placements for Orientalosuchina (Chabrol *et al.* 2024), including as part of Mekosuchinae (Ristevski *et al.* 2023a). The phylogenetic position of Orientalosuchina is currently unstable and confirming whether or not they are indeed mekosuchines requires additional assessment of orientalosuchin material. It must be noted that this project is currently in its early stages of research. Hence, all phylogenetic inferences reported herein are subject to changes and updates as the project continues to progress.

### Acknowledgements

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# Undergraduate Bursary REPORTS

## *The impact of fitness landscape roughness on morphological disparity*

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### **Introduction**

There is now convincing evidence that at least some animal phyla have a Precambrian origin (*e.g.* Dunn *et al.* 2022). Nevertheless, the majority of animal body plans became fixed during the Cambrian explosion, in which animals began exploring the world in three dimensions, burrowing into the sediment and colonizing the water column. Numerous hypotheses to explain the rapid diversification observed during the Cambrian explosion have been suggested, variably invoking environmental (*e.g.* increased atmospheric oxygen), developmental (*e.g.* increased plasticity) and ecological explanations (*e.g.* the advent of predation; see Smith and Harper 2013 for an overview). Applied in isolation, none of these hypothesized drivers can fully explain both how the Cambrian explosion transpired and why it happened when it did. Marshall (2008) utilizes the concept of fitness landscapes as a framework to unite other hypotheses, arguing that a complex array of environmental and biological changes led to an increase in the number of needs an organism was required to meet. A consequence of this was the formation of more complex landscapes replete with numerous local fitness optima, or peaks. Evolution across the more complex fitness landscapes could have resulted in the evolution of greater diversity and disparity than might be expected in the simpler, Precambrian fitness landscapes (Figure 1). The aim of this project was to evaluate the Marshall hypothesis (herein fitness landscape hypothesis) using a simulation framework, by quantifying disparity in evolutionary outcomes under fitness landscapes of varying complexity. We tested the hypothesis that disparity will be higher for fitness landscapes with more optima than for landscapes with less optima.

### **Methods**

#### *Overview*

TREvoSim (<<https://github.com/palaeoware/trevosim>>; see Keating 2020; Mongiardino Koch *et al.* 2021) is an individual-based eco-evolutionary model. When a simulation runs, digital binary organisms composed of binary strings inhabit a list (the 'playing field'), and each has a fitness which is defined by an algorithm based on one or several environments (also binary strings). Fitness dictates the likelihood of duplication, and when this occurs there is the possibility of a mutation, allowing organisms to evolve. The model employs a lineage-based species concept.

#### *Software development*

As part of this research, we developed new features in TREvoSim that allow the user control over the nature of the fitness landscapes. At the start of the project we added a functionality that allowed us to match fitness peaks across multiple environments, thus providing us with the opportunity to start simulations with a known number of fitness peaks (one per environment).

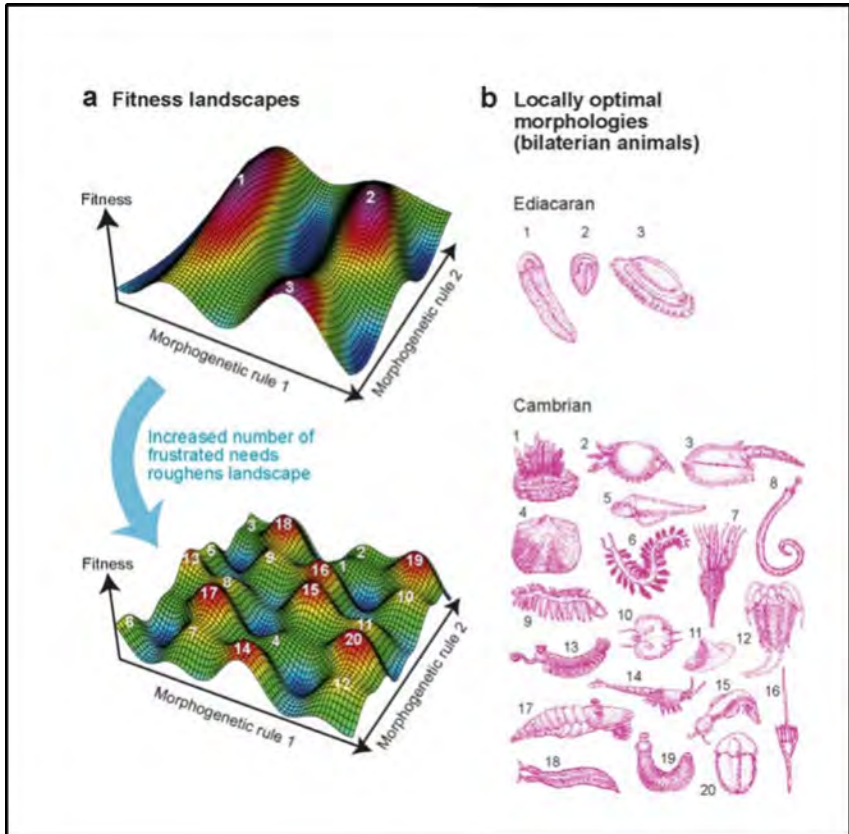


Figure 1. A) Example fitness landscapes that may have existed in the Ediacaran (top) and the Cambrian (bottom) alongside B) representative morphologies from each period. Adapted from Marshall (2008).

## Results

To test this addition to the software, we ran simulations with 1–20 environments. When there are multiple environments in a simulation, TREvoSim calculates the fitness of each individual in each environment and assigns each the highest fitness from any environment. By doing an exhaustive search across all possible organisms and keeping all other settings the same, and then ordinating the genomes of the fittest organisms using non-metric multidimensional scaling (NMDS), we were able to visualize the distribution of organisms in a two-dimensional space where relative distances reflect relative differences in genome. Subsequently mapping of the relative fitness of these organisms on to the points in this space demonstrates that adding an environment adds an additional fitness peak (Figure 2).

Following this we ran full evolutionary simulations for each of these setups, conducting 50 replicates for each environment number. We then graphed the disparity at the end of our run against environment number, measuring it using the mean pairwise distance between the genomes of the species that evolved during the simulations. Figure 3 shows that with an increased number of fitness peaks, the distance between genomes decreases, thus rejecting our hypothesis.

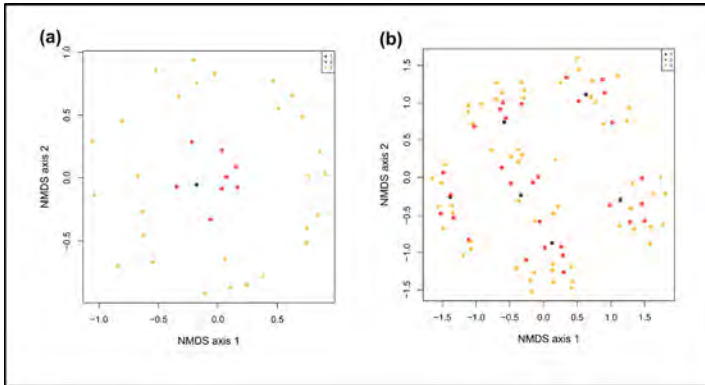


Figure 2. NMSD plots showing the best three possible fitness scores for simulations with A) one environment and B) six environments. In each plot, the best possible fitness is a black point, the next best is red and third best is yellow. Our new setting therefore dictates the number of fitness peaks in our environment.

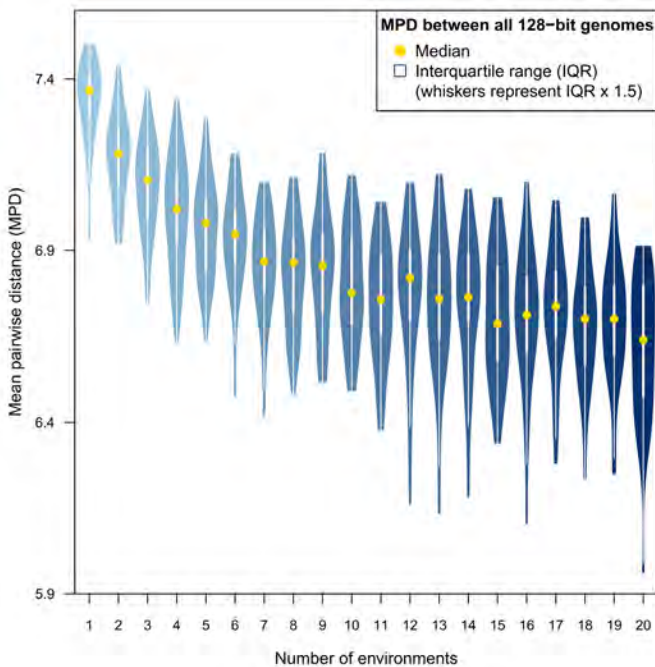


Figure 3. Violin plots showing the relationship between disparity and the number of environments (and thus fitness peaks).

**Discussion**

In this work, we have used TREvoSim to simulate the evolution of digital populations in environments with a known number of fitness peaks, and then studied the disparity of the outcomes of this evolution. Our findings do not directly support the fitness landscape hypothesis;



considered in isolation, more fitness peaks alone reduced, rather than increased, the disparity in the digital populations that evolved during our simulation. There are potentially confounding variables: for example, within the simulation, environments change as a simulation progresses and, thus, whilst simulations begin with fitness peaks of equal height, we expect that the height of peaks will change during a simulation. Especially late in our simulations, in some replicates, we expect our community might be evolving under the influence of a more limited number of fitness peaks than the initial maximum. Such confounding variables provide no obvious theoretical explanation for the result we recover, however. In contrast, the nature of the TREvoSim fitness algorithm provides possible explanations: whilst introducing more environments increases the number of peaks in our fitness landscape, it also reduces the depth of the valleys between these peaks. As such, in future work, we intend to quantify the flatness of our fitness landscape, and assess the relationship between this and organismal disparity.

### Acknowledgements

I am grateful to my supervisor Russell Garwood (The University of Manchester), as well as Luke Parry, Thomas Smith and Frankie Dunn (University of Oxford, UK) for their help, collaboration and guidance. I am also grateful for the Palaeontological Association Undergraduate Research Bursary (PA-UB202203) that enabled this project to happen.

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## *Lilliput sharks and marine apex predators of the Permo–Triassic*

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### Introduction

The Permo–Triassic mass extinction (PTME) was the most severe biotic crisis of the Phanerozoic that, via a volcanically triggered cascade of environmental shocks (*i.e.* extreme warming, widespread ocean anoxia and acidification; Dal Corso *et al.* 2022), culminated in the extinction of up to 96% of marine animal species (Benton and Twitchett 2003) and ~70% of terrestrial animal species (Sidor *et al.*, 2013). Marine invertebrate recovery following the PTME has been studied extensively in benthic environments, but less is known about the nature of this process in pelagic ecosystems. Fish are extremely sensitive to environmental change, yet the fish record across the PTME is comparatively





understudied (Mutter and Neuman 2009). Sharks filled the roles of apex marine predators throughout the Permian but chondrichthyan diversity drastically reduced across the PTME and marine reptiles radiated to fill trophic levels that had not been widely exploited during the Permian. Marine reptiles soon became the new apex predators at the top of Mesozoic marine food webs.

The ‘Lilliput Effect’ describes a temporary change in body size in a lineage across a major extinction event (Twitchett 2007). The phenomenon describes how fossil organisms are typically much smaller during the immediate aftermath of the event than in pre-extinction times due to environmental stress (Twitchett 2007). Although there is a lack of substantial evidence to support the Lilliput Effect in sharks, Mutter and Neuman (2009) determined that the Lilliput Effect can be observed in the genus *Listracanthus* over the Permian–Triassic boundary. Mutter and Neuman (2009) hypothesized that this trend may also be present in other chondrichthyans across the PTME. My project tested two hypotheses: that the PTME drove a Lilliput Effect in hybodontiforme sharks; and that sharks did not resume their previous role of apex marine predators in the Triassic, due to competition with newly originated marine reptile clades (e.g. ichthyosaurs), by using tooth size as a proxy for trophic level.

**Methods**

Occurrences of hybodontiformes from the Lopingian to Late Triassic were downloaded from the Paleobiology Database (<<https://paleobiodb.org/#/>>). Data were binned at epoch level – Lopingian, Early Triassic, Middle Triassic and Late Triassic – and all specimens were traced to the primary literature where tooth-size measurements were obtained. Labial measurements of the second upper anterior tooth (A2) were taken, as this measurement has yielded the most accurate estimates of total body length in other orders of shark, such as the lamniformes.

**Results**

One-way ANOVA with Tukey’s post-hoc test for significance revealed a significant decrease ( $p < 0.05$ ) in tooth size between the Early Triassic and Late Triassic. However, when the same test was run using mean data from the Lopingian and Early Triassic the decrease was not significant. Although statistically there is a lack of significance in changes in tooth size across the PTME, there is a decline in mean tooth size between the Lopingian and Early Triassic followed by a further decrease through the Triassic period (Figure 1). In addition, a smaller range of tooth sizes can be observed during the Middle and Late Triassic period, potentially indicating a shift towards smaller body sizes.

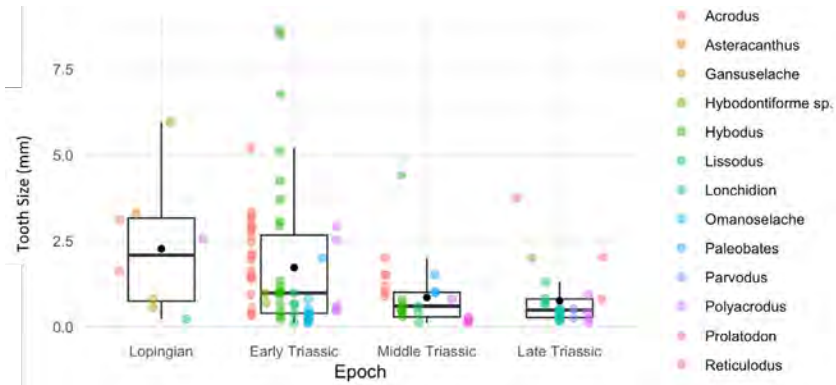


Figure 1. Comparison of tooth size (mm) across epochs: displaying range of values, mean, median, interquartile range and 95 % confidence intervals. Outliers are included in the data.



## Discussion

Despite being at low diversity during the Early Triassic, the Permian–Triassic boundary marks a major taxonomic turnover in chondrichthyan groups, with Palaeozoic stem chondrichthyans including the eugeneodontiformes getting replaced by hybodontiformes and modern elasmobranchs (Guinot *et al.* 2013). Parameters such as marine anoxia over the PTME coupled with high sea surface temperatures and nutrient limitation were most likely the proximal causes for the Early Triassic Lilliput effect in marine species (Twitchett 2007). The Lilliput Effect is most notable in Early Triassic molluscs, which demonstrate a rapid reduction in size post-extinction, with most taxa not regaining pre-extinction size until the Middle Triassic and body size changes in some taxa continuing to persist (Twitchett 2007). Unlike the patterns seen in molluscan taxa, our findings only offer weak support for the notion of a Lilliput Effect in hybodontiforme sharks following the PTME, with more significant declines in tooth size occurring later in the Triassic. While we have a lack of tooth size data from the Lopingian limiting a comprehensive understanding of size dynamics across the extinction boundary, the observed trend towards smaller tooth sizes later in the Triassic provides some evidence of evolutionary responses to ecological upheaval which may be indicative of a shift in trophic dynamics in Triassic marine ecosystems. Smaller tooth size may suggest a transition towards sharks occupying meso-predator roles in the Middle and Late Triassic in response to increased competition from new marine reptiles that were able to radiate and fill the apex predator roles that had not been widely exploited previously during the Permian.

## Conclusion

By using hybodontiforme tooth size as a proxy for body size our results indicate a shift to smaller body sizes in the Triassic. However, there is a lack of compelling evidence for a Lilliput Effect in hybodontiforme sharks despite a reduction in mean tooth size across the PTME. Our results indicate that reduction in shark body size continued to persist throughout the Triassic, suggesting that sharks did not resume their previous role of apex marine predators due to competition with newly originated marine reptile clades such as the ichthyosaurs. Whilst our findings support the reduction in body size of hybodontiforme sharks following the PTME, it is crucial to acknowledge that this apparent reduction in tooth size could be influenced by the inherent diversity in body size of different genera in the hybodontiforme order.

## Acknowledgements

I thank the Palaeontological Association for the award of an Undergraduate Research Bursary (PA-UB202301) which funded this project. I also thank Dr Alex Dunhill for this opportunity and for his support during this project, as well as Amy Shipley and Lydia Woods for their continuous help. Finally, I thank Sebastian Hatt for guidance with my R queries.

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## ***Understanding the evolution of pharyngeal structures in fossil echinoderms***

**Lucy Jackson**

*Department of Earth Sciences, University of Oxford, UK*

### **Introduction**

The fossil record of echinoderms reveals numerous morphologically disparate extinct classes, dating back to the Cambrian. Several of these lack diagnostic features of extant echinoderms. Stylophorans are one such class and one of the most iconic cornute stylophorans is the ‘boot-shaped’ *Cothurnocystis elizae* Bather, 1913 (Figure 1A), which is known from the Upper Ordovician (~440 Ma) Lady Burn Starfish Beds in Ayrshire, Scotland (Jefferies 1986). *C. elizae* is characterized by a set of serially aligned openings on the dorsal surface of the theca called ‘cothurnopores’, which are also present in some other cornute stylophorans. These have been interpreted as pharyngeal gill slits homologous to those of extant chordates and hemichordates (Jefferies 1986; Smith 2005) or as respiratory structures that are similar to features seen in other extinct echinoderm groups (Lefebvre 2003). Recent work by Álvarez-Armada *et al.* (2022) suggested homology of internal bar-like structures in mitrate stylophorans with deuterostome gill bars based on morphometric analyses, but this quantitative approach has yet to be applied to cothurnopores. The goal of this project was to test between competing interpretations of the cothurnopores, taking *Cothurnocystis* as an exemplar for cornute stylophorans more widely.

### **Methods**

#### *Micro-CT*

Three specimens of *C. elizae*, preserved three-dimensionally as moulds comprising part and counterpart, were imaged using micro-CT. Two specimens (NHMUKE23148 and NHMUKE23704ab) were scanned using the Nikon XT H 225 ST X-Ray CT scanner at the University of Bristol, UK while a previous scan of NHME28645 (scanned with a similar micro-CT scanner at the Natural History Museum, London, UK) was also studied. Scans were segmented using Thermo Scientific Amira software.

#### *Photography*

Fifty-eight specimens of *C. elizae* with preserved cothurnopores from the Natural History Museum, London’s collection were photographed using a Canon EOS 5D Mark IV camera. Photomicrographs of NHMUKE23173 were taken using a Zeiss SterEO Discovery V12 microscope and a camera-lucida drawing was made of NHMUKE23172 (Figure 1A).



### Morphometric analysis

The length, width and spacing of the cothurnopores were measured from photographs in ImageJ, following the methods of Álvarez-Armada *et al.* (2022). A Principal Component Analysis (PCA) of these measurements was undertaken in R using a modified version of the script used by Álvarez-Armada *et al.* (2022). Two analyses were conducted, one with each individual pore or gill bar included, and another with measurements averaged across the specimen (Figure 2).

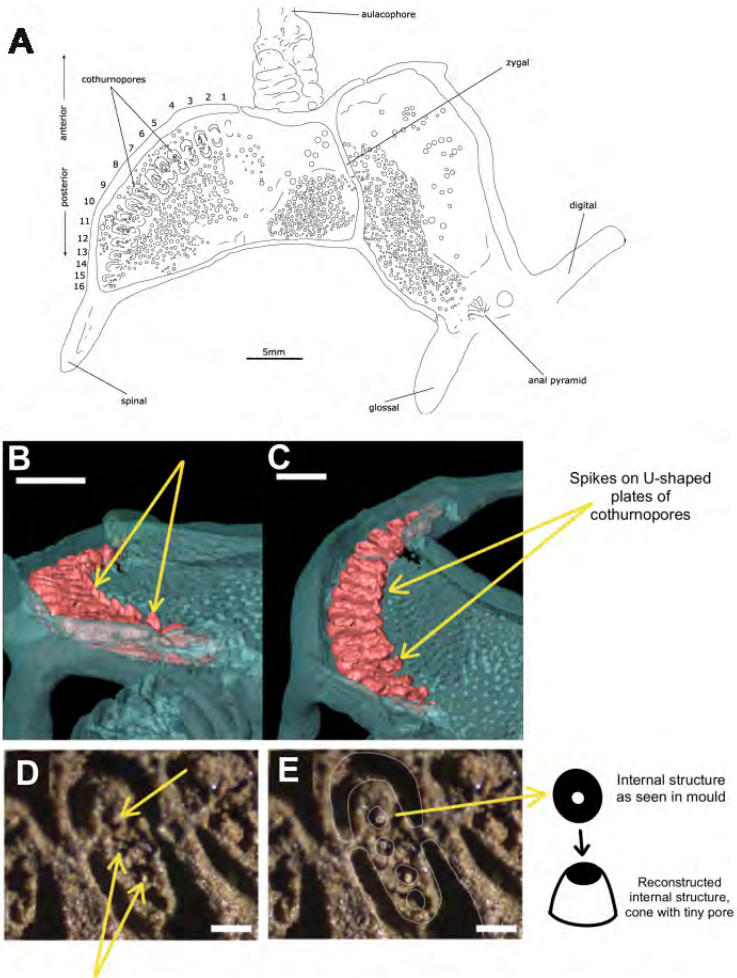


Figure 1. A) Camera-lucida drawing of specimen NHMUKE23172 showing the morphology of *C. elizae*. B and C) 3D reconstruction based on micro-CT scan of NHMUKE23148, showing spikes (marked with yellow arrows) on cothurnopores (in red in A,B). Scale bars are 2 mm. D and E) Photomicrographs of NHMUKE23172, showing putative pores in cothurnopores (left and middle; marked with yellow arrows) and reconstruction (right). Scale bars are 0.5 mm.

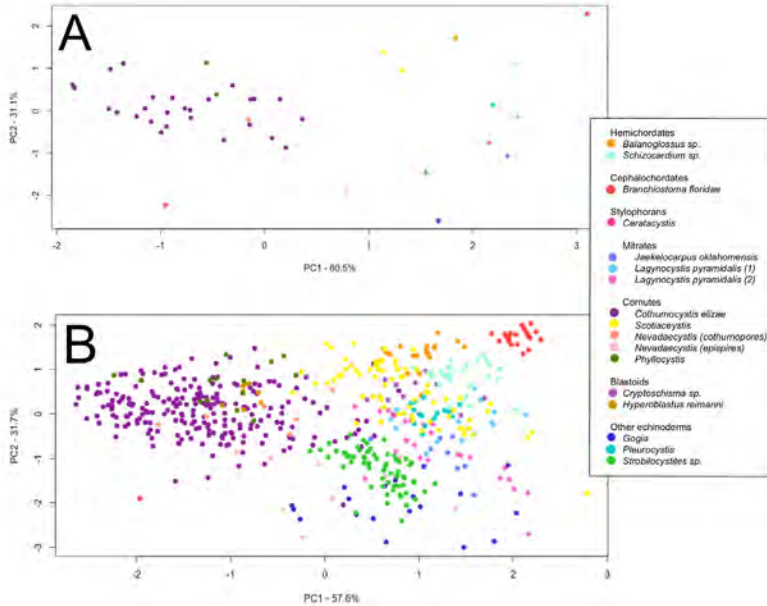


Figure 2. Principal component analyses of respiratory structures, internal gill bars and cothurnopores in extant and extinct deuterostomes. A) PCA of structures averaged across each specimen, one point represents one specimen (except Nevadaecystis for which both cothurnopores and sutural pores are plotted). B) PCA of the dimensions of each individual structure measured.

## Results and discussion

Jefferies (1986) suggested cornutes had a ‘flap’ of small plates that rested on top of each of their cothurnopores, which may have opened under internal pressure and functioned as outlet valves (Smith 2005). However, detailed observations of fossil specimens and micro-CT scans revealed no evidence of flaps covering the cothurnopores in *C. elizae*. Nevertheless, the presence of covering flaps cannot be definitively ruled out; if these were made of soft tissue, they may not have preserved in any fossil specimens.

The scans facilitated the description of novel anatomical features, in particular a ‘spike’ protruding from the top of the central U-shaped plate, which had not been described previously (Figure 1B,C). Specimen E23172 had exceptionally good preservation of the internal structure of the cothurnopores (Figure 1D,E), and photomicrographs revealed the presence of internal cone-like structures with possible pores (inconsistent with their interpretation as pharyngeal gill slits), similar to those reported by Lefebvre and Vizcaino (1999) for the cornute *Phyllocystis*. However, these putative pores could alternatively be artefacts of the relatively coarse siltstone in which the fossils are preserved. These observations are most consistent with the interpretation of cothurnopores as echinoderm-type respiratory structures (e.g. Lefebvre and Vizcaino 1999). Cothurnopores are morphologically more similar to blastozoan respiratory structures such as epispires and pectinirrhombs, which are also serially repeated openings in the theca.



In both PCAs, cornute cothurnopores consistently plotted in the same region of morphospace, separated from the regions occupied by the gill slits of cephalochordates and hemichordates and the respiratory structures of other echinoderms (Figure 2). These differences suggest that cothurnopores evolved independently to deuterostome gill slits and other echinoderm respiratory structures (e.g. epispires).

### Conclusions

Investigation of the morphology of *Cothurnocystis elizae* raises significant doubts about the presence of pharyngeal gill slits in cornute stylophorans, as previously hypothesized (Jefferies 1986; Smith 2005). The absence of a ‘flap’ covering the cothurnopores, the possible presence of tiny pores within cothurnopores, and the clear separation between cothurnopores and deuterostome pharyngeal structures all argue against their homology with pharyngeal gill slits, and they are instead more likely to represent respiratory structures similar to those seen in other extinct echinoderm groups.

### Acknowledgments

Thank you to the Palaeontological Association for the Undergraduate Research Bursary (PA-UB202302) that made this project possible. I would like to thank my supervisors Frankie Dunn and Imran Rahman (Oxford University Museum of Natural History, UK) and Ross Anderson (University of Oxford, UK) for all of their support during the project. Another thank you to Tim Ewin for providing access to and loans of specimens from the Natural History Museum, London and to Liz Martin-Silverstone at the University of Bristol, UK for carrying out micro-CT scanning.

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# Reviews



## Basin and Range

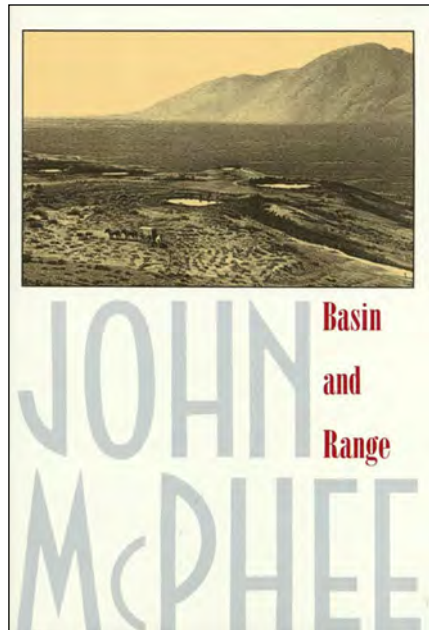
John McPhee, 1981, 224 pp., Farrar, Straus and Giroux, ISBN: 9780374516901.

This is a review of an old book, first published in 1981. *Basin and Range* brings together essays which were originally published in *The New Yorker*, so the writing is even older than that. I'm not sure when I first became aware of this book, but I kept brushing up against references to it when reading Martin J. S. Rudwick's books about the history of Earth history. When I deliberately and whole-heartedly adopted the phrase 'deep time' for talking to almost any non-academic audience, I wondered where it had come from, and learnt that *Basin and Range* was credited as the first published use. So I felt that the book deserved a read.

The essays in this book are about conversations with geologists, the practice of field geology, and road-trips, and are written for non-geologists. They are also about how you can be an outsider to a field but fall in love with its language and its conceptual frameworks. There's a little palaeontology in it – mostly evocations of Pennsylvanian swamp forests and a really good explanation of biostratigraphy – but it's not the focus of the book, so any readers who like their reading firmly focused on fossils should stop now.

I'm not very knowledgeable about North American geology. I know just enough to get me through teaching about the Burgess Shale and the End-Cretaceous mass extinction event. So I learnt a great deal from reading this book, including what the basin and range of the title referred to. Interstate 80 is a freeway which crosses North America from San Francisco to New Jersey, and this road and its rock-cuttings give McPhee a hook to talk about journeying through stratigraphy and through time. There are also plenty of digressions, including an adventure in silver prospecting and a summary of the (then) recent adoption of plate tectonic theory.

There is a lot to enjoy about this book. The writing is lyrical and expansive, and fun to read. I don't think there are many books which explain in matter-of-fact terms the things which geologists actually do in the field. His utter delight in the jargon of geoscience is infectious. There were occasionally US-specific and/or dated pop culture references that I had to look up (they quite often ended up being sporting references so that might just be me!). I also hadn't really taken in the





difference in how geology is taught in US versus UK universities. We don't have the 'rocks for jocks' thing in the UK. The decades that have passed since these essays were written can definitely be felt throughout, and not just in the language or the sense that plate tectonics was still bedding in as an overarching concept. The book is largely focused on the geology of exploitation of resources (as you would expect in the 1970s) and while there is awe and wonder in the descriptions of deep time and the continental scales on which geological processes play out, the thing that feels particularly dated to a twenty-first century reader is the absence of any environmental angle to the narrative. If someone were writing a similar book now, there would undoubtedly be a strong climate change thread, or at least more nods towards the links between geological time and environmental change. The description of geologist Karen Kleinspehn collecting rock samples in a road-cutting while passing truckers 'flirt by air-horn' felt timeless, unfortunately.

John McPhee is celebrated as a creative non-fiction writer on diverse topics, and he won the Pulitzer Prize in 1999 for a compilation which included this book alongside other geology writing. I will be seeking out more of his books.

### **Susie Lydon**

Susie Lydon is Associate Professor of Plant Science at the University of Nottingham, where she teaches about plants, rocks and science communication. Her research background was in Mesozoic palaeobotany before she became immersed in all things teaching and outreach-focused. You can find her on Bluesky at [@susieoftraken.bsky.social](https://bsky.app/profile/susieoftraken.bsky.social).

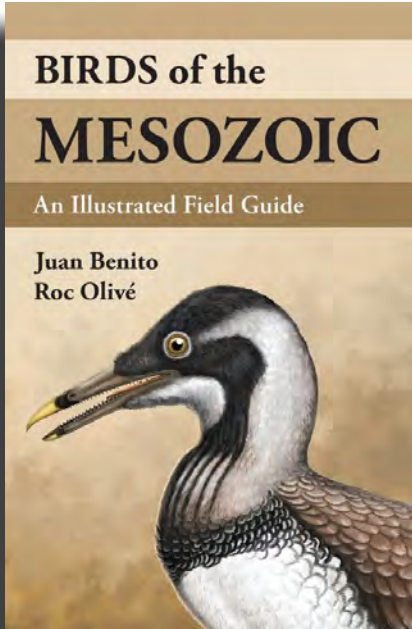
## **Birds of the Mesozoic, An Illustrated Field Guide**

Juan Benito and Roc Olivé, 2022, 272 pp., Lynx Edicions, ISBN: 9788416728527.

*Birds of the Mesozoic* by Juan Benito and Roc Olivé is a fascinating and informative book about the evolution and diversity of birds that lived from around 251 to 66 million years ago. This field guide begins with an introduction to avian evolution and the fossil record, followed by detailed profiles of a variety of avian species from around the world which make up around 80 % of the book. These accounts include the species' location, known material, morphology, plumage, biology and geological setting, and are jam-packed with beautiful illustrations. The book is well-written and well-researched, with detailed descriptions of the various extinct bird species that existed during the Mesozoic era, as well as the environments and ecological niches they inhabited. The illustrations are stunning and painstakingly accurate which helps bring to life the various bird species from the glossy photos of their fossils. For instance, the tiny teeth of *Yi qi* are accurately illustrated as only being at the tip of the jaw and the front teeth are larger with the front lower teeth angled forwards.

One of the strengths of this book is the way it situates the evolution of birds within the larger context of the Mesozoic era. The introduction and detailed glossary make the book accessible to anyone interested in palaeontology. The introduction familiarizes the reader with the bird skeleton through clear descriptions and labelled diagrams which will enable anyone to fully understand the species accounts. The authors summarize the major patterns of evolutionary relationships and provide overviews of the key bird-bearing geological formations to vividly set the scene of the environments the birds inhabited. Throughout the book, there is a buzz of excitement over new





fossil discoveries. The book emphasizes the evolving nature of the field, for example by using a CT (computed tomographic) scan of *Asteriornis maastrichtensis* to explain the importance of modern imaging techniques to study a specimen otherwise hidden within a rock.

Another strength of the book is the way it draws on the latest scientific research to challenge and update previous understandings of Mesozoic birds while also acknowledging uncertainties. For example, the authors present evidence that suggests that some birds were capable of powered flight much earlier than previously thought, and that some bird species were much more diverse and widespread than previously believed. The greatest strength may be the ability to dip in and out of the book, especially the species accounts, to take away as much or as little information as you would like in a sitting. The book is a similar size to popular bird field guides, approximately 20 x 12 x 2 cm, which makes it wonderfully

portable and perfect to slip in a bag while travelling<sup>1</sup>. This book has sparked many conversations with fellow passengers on the Tube, which is a testament to its captivating nature and ability to engage Londoners even in the hustle and bustle of commuting!

Above all, *Birds of the Mesozoic* is an engaging and informative book that will be of interest to anyone interested in the evolution and diversity of birds. The book’s detailed descriptions, stunning illustrations, and scientific rigour make it an essential addition to any bird enthusiast’s library.

**Eloise Hunt**

Eloise Hunt (she/her) is a PhD student at the NHM London and has a passion for antiquities from vintage frocks to fossils. She can be found on X: @Pa1aeoHunt.

**Born of Ice and Fire: How Glaciers and Volcanoes (with a Pinch of Salt) Drove Animal Evolution**

Graham Shields, 2024, 352 pp., Yale University Press, ISBN: 9780300242591.

Popular science books are incredibly useful things: not-only do they allow a non-specialist to access an area of science which otherwise requires multiple degrees and thousands of pounds of student debt, but they can also offer specialists in adjacent fields a way of engaging with a topic they are interested in from a slightly different perspective. The last thing I want to do is to trivialize the work by people like Nick Lane and Mike Benton who deal with the origin and extinction of life on Earth, but both of them possess the sizable advantage of having inherently charismatic subject matters. So, when I was asked to review a book about geochemistry I was, as I am sure you can imagine,

<sup>1</sup> And handy if you spot an *Anchiornis* in the park! Ed.



slightly pessimistic<sup>1</sup>. Even if its namesake is the incredibly popular and much lamented series of books which *Game of Thrones* is based upon (as an aside, the new show, *House of the Dragon*, is absolutely worth checking out).

The Cambrian explosion has been a long-standing area of research in our field and one fraught with controversy. Was the sudden onset of fossilized animal remains the benign or inevitable result of a taphonomic, fossil, or survivorship bias? Does it represent a genuine burst of evolutionary radiation unlike anything ever seen before, giving rise to all modern animal phyla in less than 100 million years? Did the Cambrian explosion even happen at all? Professor Graham Shields, prolific geochemist at University College London and presenter of an exceptional invited talk at the PalAss Annual Meeting last year in Cambridge, aims to achieve two major goals with this book. One, and perhaps what the audience may assume to be the main aim given the subtitle of the work, is explaining his theory behind the explosion of animal radiation

540(ish) million years ago, and how geochemistry has played a huge role in shaping the evolution of early animal life. However, to assume that Shields is merely trying to explain and justify his theories behind the Cambrian explosion would be a disservice as he also provides the, perhaps uninitiated, Earth scientist reader an introduction and overview of the different avenues of evidence supporting and opposing this theory at a level useful for those with even just a passing interest in the Earth's history.

It is really quite impressive just how much science Professor Shields manages to cram into the book's 288 pages of text. Shields guides the reader through space and time, navigating an array of biological, geological and chemical evidence, with chapters generally being introduced through Shields' own travels; from the 'thinking path' at Down House to the Neoproterozoic of Mongolia, these adventures involve far more bribery (mainly cigarettes and alcohol) than I expected for a Precambrian geochemist<sup>2</sup>, and possibly more than a hint of danger, with military coups, infectious diseases or deadly animals not quite managing to dissuade the professor from his fieldwork. Shields takes us through the evidence for Precambrian glaciation through tillites, striae, dropstones and the like, dolostones from meltwater plumes, divergence time estimation through molecular and radiometric clocks, fossil evidence, temperature proxies, geochemical isotopes, positive and negative feedback loops, and the effect that chemicals have had on the history of animal life on Earth.

Although the focus of the book is on how environmental conditions resulting from the thawing Snowball Earth towards the end of the Proterozoic helped kickstart early animal evolution, Shields



<sup>1</sup> Edmund graciously omitted this when I asked him if he'd do the review. Ed.

<sup>2</sup> Something to consider including in your next '*Methods in Palaeobiology*' undergraduate course? Ed.



occasionally veers off track to provide insightful context into earlier sections of Earth history, like the origin of photosynthesis and subsequent Great Oxidation Event, or the forces behind some of the more recent changes in the modern climate of our planet. For those like me who are 'geochemistry adjacent', this book offers a friendly, well-explained and unbiased introduction of many of the important sources of evidence for understanding the geological history of Earth through the much neglected (at least from a popular science point of view) lens of geochemistry, and is well worth the read.

### **Edmund R. R. Moody**

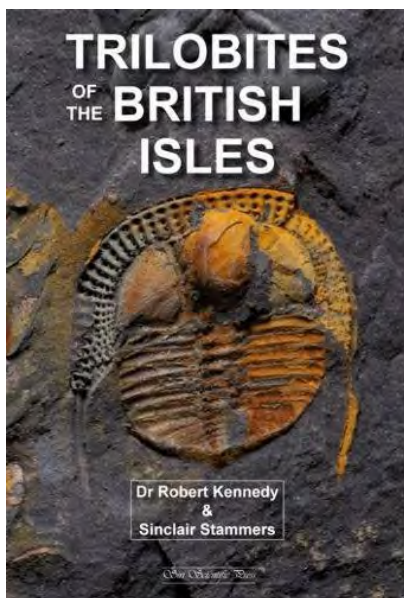
Ed is an evolutionary biologist currently working as a postdoc in the School of Chemistry at the University of Bristol. His main focus of work is the use of phylogenomics to understand important events throughout Earth's history: from our earliest ancestors like LUCA, to the evolution of complex biological machinery. Ed can be found on X: @ERR\_Moody and thoroughly enjoys collaborating with palaeontologists.

### **Trilobites of the British Isles**

Robert Kennedy and Sinclair Stammers, 2018, 384 pp., Siri Scientific Press, ISBN: 9780995749610.

To talk about the geology of the British Isles is to talk about the history of geology itself. Some of the 'big names' in British geology, such as Sedgwick, Murchison or Lapworth, dedicated their lives to unravelling the history of the great variety of rocks that cover these islands and, in turn, named the vast majority of the well-known geological periods of the Palaeozoic Era, from Cambrian to Devonian.

Also, talking about the Palaeozoic necessarily implies talking about trilobites, probably the best-known fossils of this vast era, and some of the most 'successful' (evolutionarily speaking) organisms in Earth's history. In this sense, the British Isles are probably one of the best destinations worldwide for those lovers of these bizarre critters. Some British localities, such as Comley, Tremadoc or Llandovery, resonate in the minds of anyone who has worked in Palaeozoic rocks anywhere in the world. Of course, all of these sites are known, among other things, for their spectacular fossils, including trilobites.



*Trilobites of the British Isles*, by Kennedy and Stammers, is a delightful journey through the Palaeozoic record of the United Kingdom and the Republic of Ireland, providing readers with a comprehensive, illustrated guide of the main trilobite genera and species, fossil sites and references



of this territory, spanning from Cambrian to Carboniferous. The book contains several hundreds of high-quality photographs of the vast majority of trilobite species that once inhabited the seabeds that today constitute the rocks of the British Isles, accompanied by carefully drawn illustrations of the distribution of the main Palaeozoic outcrops and simplified biostratigraphic tables, providing an enjoyable read not only for those educated in geology or palaeontology, but for all those interested in the marvellous world of trilobites. In addition, the photographed specimens are exquisitely prepared and present their detailed biostratigraphic information. Furthermore, the illustrated specimens come from a considerable number of different collections, both from private individuals and official institutions (e.g. Natural History Museum, London, British Geological Survey, Lapworth Museum, Sedgwick Museum, among others), which denotes the authors' attentiveness in order to achieve a complete, high-quality work.

One aspect I particularly enjoyed about the book was that it provides a brief historical introduction to each period, stage or substage established in the British Isles and their respective type localities, which I think is fundamental in order to understand how the chronostratigraphic table, as we know it today, has been gradually built up based on fossils. Also, it narrates some historical singularities about some of its most representative trilobites: one of the curiosities that caught my eye was all the history surrounding the so-called 'Dudley bug' (i.e. *Calymene blumenbachii*), with the buying-and-selling business around it, the Victorian 'quarrymen's forgeries', and finally becoming such a historical symbol of the town of Dudley, being included in the town's coat of arms.

Concluding this brief review, this book stands as the result of a profound, enduring passion for fossils and a lifetime devoted to palaeontology, and it will eventually become an essential reference for any palaeontologist, collector or anyone captivated by the fascinating world of trilobites.

Needless to say, I have an urge to visit the Kennedy collection!

### **Luis Collantes**

Luis is a Spanish geologist and palaeontologist from Huelva (Andalusia). His research is focused on the taxonomy, biostratigraphy and palaeobiogeography of the Cambrian trilobites from the southwestern Iberian Peninsula, with special attention to the so-called Marianian Stage. He also works on sequence stratigraphy, geological mapping and regional geology.



# Books available to review

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Here are some suggestions for books we'd like to commission reviews for. This is just a sample, please e-mail Richard if you'd like more suggestions.

- *Dinosaurs at the dinner party: how an Eccentric Group of Victorians Discovered Prehistoric Creatures and Accidentally Upended the World*, by Edward Dolnick.  
*A 'historical adventure' about the discovery of extinct animals in the 19th century and those that discovered them.*
- *Past Environments of Mexico: Unveiling the Past Environments of a Megadiverse Country Through its Fossil Record*, edited by Rosalía Guerrero-Arenas and Eduardo Jiménez-Hidalgo.  
*An academic book piecing together the palaeoenvironments of Mexico with chapters on a diverse range of methods and taxa.*
- *Beast Companions: The Unsung Animals of the Dinosaurs' World*, by John Foster.  
*Sick of dinosaurs? A book exploring the other denizens – fish, insects, amphibians and more – of the Mesozoic.*
- *The Fossil Hunter: How Mary Anning unearthed the truth about the dinosaurs*, by Kate Winter.  
*A beautifully illustrated children's book (~7yo upwards) about Mary Anning's fossil discoveries. Co-reviews with young palaeontologists welcome.*

We don't just publish book reviews! If there is something else that you think would be of interest to PalAss members and that you would like to review we would love to include it in the *Newsletter*. This could be a film, a podcast, a video game, an exhibition, or something else that Richard is insufficiently imaginative to think of. As above, please just get in touch at <[bookreview@palass.org](mailto:bookreview@palass.org)> where he is very happy to discuss ideas.

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## — OBITUARY —

### **Euan N. K. Clarkson** **1937 – 2024**

Palaeontology has lost one of its most well-known figures of the past half century. Euan Clarkson's international reputation transcended the excellence of his diverse palaeontological research and his acclaimed textbook; his infectious enthusiasm and genuine interest provided tremendous encouragement to undergraduates, postgraduates, professional and amateur palaeontologists alike.

Euan's contributions to the Palaeontological Association included his organization of the Annual Meeting (twice) and four stints on Council (spanning four decades), including his role as President (1998–2000). He was awarded the Association's Lapworth Medal in 2012, and also the Clough Medal of the Edinburgh Geological Society (1993), the Keith Medal of the Royal Society of Edinburgh (1997), the T. Neville George Medal of the Geological Society of Glasgow (1999) and the Coke Medal of The Geological Society (2010).

Euan was born in Newcastle-upon-Tyne. Following National Service, he studied Botany, Zoology and Geology at the University of Cambridge, where he obtained his BA (1960) and PhD (1964). He was appointed Assistant Lecturer at the University of Edinburgh in 1963 and remained there for his entire career, rising through the hierarchy to become Professor in 1998 and Professor Emeritus on his retirement in 2002. He was awarded a DSc at Edinburgh in 1983 and elected a Fellow of the Royal Society of Edinburgh the following year.

Euan played an active part in his science as Council member, editor and conference organizer for several societies, as a trustee of the Natural History Museum, London (1987–1992), as a very popular invited speaker and field excursion leader, and as a widely used external examiner for undergraduate and higher degrees. Many people owe their appointments after graduating or the subsequent advancement in their careers to his eloquent, enthusiastic and supportive testimonials. He was an excellent teacher who stimulated both Earth Science and final year Zoology students to undertake palaeobiological PhDs. His stated belief was that “you have to put your students first, and research is what you do in your spare time”. And how productive that ‘spare time’ was.



*Euan Clarkson in Lund in 2008. Photo by Per Ahlberg.*



Euan's PhD research on the functional morphology of trilobites, especially their visual system, was a theme he followed throughout his career. The scope of his work on trilobite eyes with their calcite lenses expanded as the technology developed from the optical microscope, through the SEM, to CT scanning. Likewise, his collaborations on trilobite eyes became increasingly broad, involving, to name but a few: early work on eye reduction with Raimund Feist, the famous study in 1975 with the physicist Ricardo Levi-Setti linking the structure of schizochroal eyes to the optics of Descartes and Huygens; and the more recent, highly productive work with the biophysicist Brigitte Schoenemann and others, also including the visual systems of other fossil invertebrates.

In collaboration with many workers from Europe, South America and China, Euan published systematic works on trilobite faunas from the Cambrian to the Carboniferous, studies on the structure and function of the exoskeleton, and descriptions of ontogenies. Euan's gift for foreign languages often facilitated such collaborations. His ontogenetic studies included work with Zhang Xi-Guang, Franco Tortello and researchers in Sweden. In the early 1990s, Euan became interested in olenid trilobites from the Cambrian Alum Shales of Scandinavia. Following his three-month sabbatical at Lund University in 1993, he became a frequent guest at the Department of Geology there, doing extensive field work and studying the ontogenetic stages and evolution of successive olenid species. This research project was largely carried out in collaboration with Per Ahlberg, Kristina Månsson, John Ahlgren and Cecilia Taylor. During his visits to Lund, Euan was an inspiration and mentor for numerous PhD students and younger researchers and he considered Lund University his 'second academic home'.

Euan's arthropod work was not limited to trilobites. Crustaceans formed a major focus of a highly productive investigation with Derek Briggs of exceptionally preserved faunas in the Carboniferous of Scotland and northern England (1980–1990). The work also resulted in the discovery of the first known conodont animal, described with Dick Aldridge; descriptions of subsequently found specimens also involved Paul Smith. Much more recently, Euan worked with Polish colleagues on the geochemistry and enigmatic fossils of the Scottish deposits containing the exceptional faunas.

Regional-scale studies involved extensive fieldwork on Ordovician macro- and microfossils in Southern Scotland with Alan Owen, David Harper, Howard Armstrong, Colin Scrutton, Cecilia Taylor, Taniel Danelian, Yves Candela and Thijs Vandenbroucke. Euan's extensive work on the Silurian rocks of the Pentland Hills combined his love of hill walking and nature with geology and palaeontology. Many of the results of this career-long passion involved collaboration with specialists in a wide range of taxonomic groups and were summarized in the Association's beautifully-illustrated, 2007, *Field Guide to the Silurian Fossils of the Pentland Hills, Scotland*, edited by Euan with David Harper, Cecilia Taylor and Lyall Anderson. Euan, in his own engaging style, documented his personal journey in the article 'Pentlands Odyssey' in the *Scottish Journal of Geology* in 2000.

Euan also spent nearly three years writing *Invertebrate Palaeontology and Evolution*; this work evolved through four editions between 1979 and 1998 and was the standard palaeontological textbook in many parts of the world. Its clear, lucid style and highly informative illustrations (most drawn by Euan, a talented artist) made it the 'go-to' volume for students and academics alike. The textbook and Pentlands fossil guide are among about 180 publications produced by Euan between 1966 and 2023. These also include two books on Scottish geology written with his Edinburgh colleague Brian Upton, four co-edited conference volumes and two co-edited geological field excursion guides.



In 1962 Euan married another Cambridge graduate, Cynthia Cowie, who survives him along with their four sons, John, Peter, Tom and Matt, and six grandchildren. Their loss as a family is immense. Euan was genuinely interested in almost everyone he met, palaeontologist or otherwise. His legacy will thrive, not only through his exceptional scientific achievements, but in the many lives he inspired and enriched. Our science has lost a true giant and a much-valued colleague.

**Alan W. Owen**

*University of Glasgow, UK*

**David A. T. Harper**

*Durham University, UK*

**Per Ahlberg**

*Lund University, Sweden*

**Peter R. Sheldon**

*The Open University, UK*



*Euan Clarkson in the field in his beloved Pentland Hills, Scotland, in 1993. Photo by Per Ahlberg.*

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[Editor's note: you can read more about Euan's career in his own words on this webpage:

<<https://www.palass.org/careers/series-careering-course/careering-course-euan-clarkson-academic-professor>>, and his reminisces on the Association here: <<https://www.palass.org/association/palass-60>>.]





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Cover: *Aldanella attleborensis* (Shaler & Foerste), lower Cambrian, Terreneuvian, Emyaksin Fm; Bol'shaya Kuonamka River, eastern Anabar Uplift, Siberian Platform, Republic of Sakha (Yakutia); inner mould with imprints of the platy shell layer on the surface, adapical side, diameter 15 mm. (Photo by kind permission of Artem Kouchinsky; see Kouchinsky *et al.* 2017, fig. 20A, doi: <[10.4202/app.00289.2016](https://doi.org/10.4202/app.00289.2016)>; CC BY 4.0).



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Cover: The echinoderm *Cambroblastus guolensis* from the Cambrian Sandu Formation of Guangxi, South China. Specimen is housed at the Nanjing Institute of Geology and Palaeontology (NIGPAS 156159). Theca approximately 10 mm wide.



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### Rudy Lerosey Aubril



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 Research/job focus: Cambrian exceptionally preserved biotas

## TAXONOMY/NOMENCLATURE UPDATE

This publication is now registered on ZooBank and is thus deemed to be valid for taxonomic/nomenclatural purposes. However we request contributors (especially those contributing grant reports) not to include names of new taxa in their reports.

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