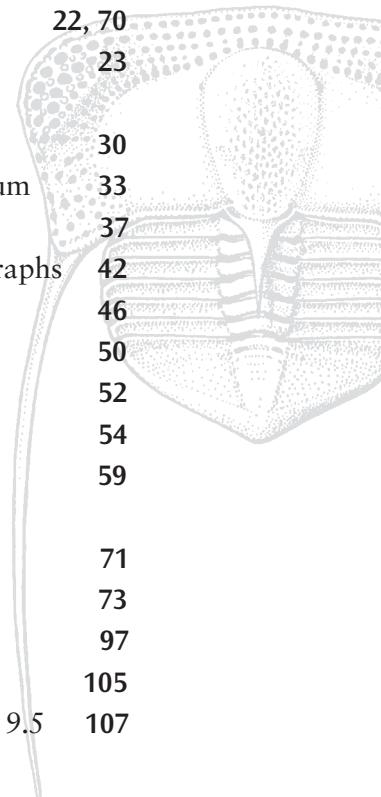


# The Palaeontology Newsletter

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Reminder: The deadline for copy for Issue no. 115 is 1st February 2024.

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

ISSN: 0954-9900



## Editorial

This issue of the *Newsletter* follows 2023's fantastic Annual Meeting, which took place in Cambridge, UK, organized by a dedicated team spearheaded by **Alex Liu**. The whole Association I'm sure would agree that the Cambridge team did a brilliant job – the Meeting was exceptionally well organized, with many wonderful additional events. I was personally present at the early-career researcher and pop-up museum events; during the latter we learnt about how to target different museum audiences, and made a new display in about two hours! (See the photos on page 59) I found both these events to be insightful, educational, and highly enjoyable, and excellently run by the inimitable **Liz Hide, Rob Theodore** and **Steve Pates**. The talks and posters at the Meeting were also of such high quality that the Council had a very hard time deciding prizes, and awarded many – see details inside, and a full meeting report by **Philip Vixseboxse**. I know we're all greatly looking forward to next year's meeting, which will take place in Erlangen, Germany. I'm expecting much consumption of glühwein!

Also in this issue, the host *Progressive Palaeontology* committee, **Amber Wood Bailey, Matthew Dempsey** and **Samuel Cross**, at the University of Liverpool, UK, provide us with insights into research student activity in this year's meeting report. We also have meeting reports from the Yorkshire Fossil Festival and the Asian Palaeontological Congress for those of us not lucky enough to attend, and grant reports ranging from herbivore palaeocommunity reconstruction, to burrowing decapods, to microinvertebrates. As we draw to the end of his tenure as Council Diversity Officer, we hear from **Farid Saleh** on EDI initiatives that have taken place over the last three years, and we have a fascinating article on spatial sampling bias by **Lewis Jones**. Our 'Behind the Scenes at the Museum' this issue takes us to the Staatliches Museum für Naturkunde Stuttgart, Germany, and **Hester Hanegraef** tells us about the trailblazing life and discoveries of the palaeoanthropologist Mary Leakey. Lastly, **Richie Howard** discusses the joys and despairs of handling problematic mystery fossils as a curator – hit up Richie if you can demystify his not-a-horseshoe crab fossil!

Finally, we have several contested open positions on Council. All Association members will receive voting instructions by e-mail or post before the AGM on 20th December – please do exercise your democratic rights and vote! Members of Council work to ensure your voice is heard and to improve things for everyone, so it's vital that you vote on your representatives. The candidates for the open positions are given herein. I look forward to working with the newly elected Council members!

### **Harriet B. Drage**

*Acting Newsletter Editor*

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<<https://www.facebook.com/ThePalAss/>>



## Postcards from the President

Rachel Wood continues her new series to highlights issues of particular topical relevance.



### Donations and fundraising proposals

We face a challenging financial climate, so Council has recently explored how we might increase and grow support from charitable donations. Council now proposes two straightforward routes to increase our visibility and aid charitable donations to the Association. First, by creating two new honorific membership titles which have a donation component, 'Patron' – £80 (£40 donation) and 'Benefactor' – £120 (£80 donation). These membership tiers will retain the same benefits and voting rights

as Ordinary Members of the Association. Second, we will create a new Donations page, to be folded into our forthcoming website re-build. These changes will be announced to the membership via e-mail once they are confirmed.

**Rachel Wood**  
President

#6: Pleistocene  
Kirkdale Cave, North Yorkshire 125,000 years ago  
Foreground: *Crocuta crocuta spelaea* (cave hyena)

Image by James McKay, © The Palaeontological Association

## Association Business

### Annual General Meeting 2023

#### Notification is given of the 67th Annual General Meeting

The Annual General Meeting (AGM) will be held at 16:00 GMT on Wednesday 20th December 2023 as a virtual meeting. Joining details will be sent to all Members by e-mail or post (as applicable).

#### AGENDA

1. Apologies for absence
2. Minutes of the 66th AGM\*
3. Trustees Annual Report for 2022\*
4. Accounts and Balance Sheet for 2022 and reappointment of financial examiner\*
5. Overview of the Association's activities 2023
6. Results of Council Election 2023 and vote of thanks to retiring members
7. Announcement of Council Awards: Lapworth Medal, President's Medal, Hodson Award



The meeting will close with an address by the PalAss Exceptional Lecturer for 2023/24, Dr Donald R. Prothero, entitled: "How do animals respond to climate change? Lessons from the prehistoric birds and mammals of La Brea Tar Pits".

\* Papers pertaining to these agenda items are available at the back of this *Newsletter* and were previously published in *Newsletter* 113. They are also available online at <<https://www.palass.org/publications/newsletter/archive>>.

## Council Election 2023

At the AGM in December 2023 the following vacancies will occur on Council:

- President-elect (one-year term, co-opted)
- Vice-President (two-year term)
- Diversity Officer (three-year term)
- Education Officer (three-year term)
- Newsletter Editor (three-year term)\*
- Reviews Editor (three-year term)
- 2x Ordinary Member (three-year term)\*

Nominations received by the 15th September 2023 deadline are as follows:

- President-elect: **Philip Donoghue**.
- Vice-President: **Alex Dunhill, Susannah Maidment and Daniela Schmidt**.
- Diversity Officer: **Nidia Álvarez-Armada, Kirsten Flett, Omar Rafael Regalado Fernández and Romy Rayner**.
- Education Officer: **Nidia Álvarez-Armada and Joseph Keating**.
- Newsletter Editor: – no nominations received –\*
- Reviews Editor: **Richard Dearden**.
- 2x Ordinary Member\*: **Nidia Álvarez-Armada, Chris Mays, Laura Porro, Amalia Robertson and Daniela Schmidt**.

\* As no nominations were received for the position of Newsletter Editor, Council has invited **Harriet Drage**, who since joining Council as an Ordinary Member in 2022 has become part of the Newsletter team, to move into the role. Harriet has accepted, resulting in an extra Ordinary Member role opening up. As such there will now be two Ordinary Member positions available in this election.

### *Voting process:*

As there are multiple nominations for all except the President-elect, Newsletter Editor and Reviews Editor positions, an election will be conducted prior to the Annual General Meeting. This will take place electronically (or by post for those without electronic access) as per section 11.7 of the Association's Constitution. Voting instructions will be sent via e-mail (or post where necessary) to all voting members in early November, to allow for all votes to be cast by early December and



subsequently counted in time for election results to be announced at the AGM. As no candidate may hold more than one position on Council, if a candidate has already been declared the winner of a vote they will be discounted from all subsequent results. The order of vote results has been determined to give each candidate the best chance of attaining their preferred position as indicated on their nomination. The statements of interest for the positions by the candidates are as follows.

### *Personal Statements of Candidates:*

**Nidia Álvarez-Armada:** I am volunteering for election to become a Council member of the Palaeontological Association. I have been a member of PalAss for over ten years; during this time I have received unconditional support, not only financially but also with the tricky conciliation of research and family life. I have recently started a Marie Curie Individual Fellowship at The University of Manchester, UK, moving from my native Spain with my partner and three-year-old child and I finally find myself in a comfortable position to reimburse the Association with my time and enthusiasm as a member of Council. I am passionate for the fair and equal treatment of all individuals regardless of their cultural, socioeconomic or personal background and my moral obligation as a scientist to transfer my knowledge to the upcoming generations and the general public. It is my wish to work with other Council members towards the creation of a 'safe space' network for all researchers in need of assistance and, more particularly, the establishment of an independent working group that will seek a sustainable response from institutions worldwide for the creation and application of a code of conduct regarding the fair treatment of researchers.

**Richard Dearden:** I am a postdoc at Naturalis Biodiversity Center in the Netherlands. I am interested in the evolution of vertebrates, especially cartilaginous fishes (sharks and rays) and the earliest jawless vertebrates, with a focus on trying to understand their anatomy and phylogenetic relationships with modern imaging methods. I have been a member of the Palaeontological Association since I was a PhD student and have attended most of the Annual Meetings since then. After having gotten a lot from PalAss over my early career I would like to contribute back to the Association in a way that aligns with my skills and interests. I am a keen consumer of books, games and podcasts and have a wide-ranging curiosity about palaeontology and evolutionary biology. I am experienced in editing my own and my students' scientific writing, and have in the past done freelance editorial work checking English in scientific publications. I also have some idea of how the role works, having written a review for the *Newsletter* earlier this year. I am well-organized and personable, both important skills for dealing with publishers and reviewers. If elected to this position I would enthusiastically pursue palaeontological media and reviewers to feature in the *Newsletter*.

**Alex Dunhill:** Having been an active member of PalAss since 2009 and having served on Council as an Ordinary Member from 2016 to 2019, I am now delighted to stand for Vice President. My experience together with my passion for palaeontology and fondness for the Association make me a great candidate. If elected, I would vocally champion the early-career section of our membership by supporting more ECR-facing events, awards and funding, together with increased inclusion of our rising stars as Annual Meeting invited speakers. ECRs are the beating heart behind the most cutting-edge research and they deserve much more recognition for these critical contributions that are so vital to the advancement of palaeontology. In recent years, I have been delighted to both witness and contribute to the progressive steps the Association has undertaken, both scientifically and in equality, diversity and inclusivity. I am keen to build upon this progress by continuing to



strive to improve EDI within the Association and by harnessing my experience of cross-disciplinary research to endeavour to broaden the activities of the Association beyond pure palaeontological science. This is an essential step to ensure that palaeontology remains relevant in tackling some of the biggest scientific challenges currently facing our planet.

**Kirsten Flett:** As someone who has been a student at two different universities and had the opportunity to attend conferences it has given me the insight into what I believe is still missing in academia in the terms of diversity and inclusion. Being a woman in science always feels like an uphill battle, trying to break into the world of academia that has for so long been dominated by men. Luckily for me I have had some greatly inspirational female lecturers and have read the research of great female leaders in academia, but I still feel we can do more to make geology and palaeontology an attractive research area for young women to go into. My research consists of using fossils from the Ediacaran such as the Weng'an biota of the Doushantuo Formation to assist in understanding the evolution of animal body plans to help us further understand how early animals evolved. I hope to produce some revolutionary findings whilst completing my PhD at Bristol so that I can help to inspire and show other young girls who are at the stage in life of deciding where to go with their education that geology and palaeontology are not only disciplines with great educational value but also disciplines where you feel no prejudice because of your gender.

**Joseph Keating:** I am a Senior Research Associate at the University of Bristol, UK, with more than seven years of postdoctoral experience. My affiliation with the Palaeontological Association spans 13 years, during which I have greatly benefited from the opportunities it provides. I am eager to contribute to the Association's important work; hence I am applying for the position of Education Officer. I am an active participant in the palaeontological community. My involvement has encompassed serving on various conference organizing committees (e.g. ProgPal, SVPICA). Furthermore, I have mentored students at the University of Bristol and the University of Manchester, and coordinated the Bristol Palaeobiology seminar series in 2022–2023. My dedication to outreach aligns with the Association's charitable objectives. I've hosted Palaeocast, contributed to Palaeontology[online] and presented at national science festivals. In addition to my academic credentials, I have valuable experience working as a commercial palaeontologist and stratigrapher. Palaeontology is of unique interest to non-specialist audiences and features prominently in secondary education curricula. I hope to draw on my broad experience to support students and educators in their exploration of palaeontology. This will involve creating digital educational materials and resources that complement learning objectives.

**Susannah Maidment:** I have sat on Council for the last three years as a member of the Editorial Board for the PalAss journals *Palaeontology* and *Papers in Palaeontology*. In this role I have sat on the publications sub-committee, which has been navigating the Association's journals through renegotiation of the contract with our publisher, Wiley, at a time of upheaval in the academic publishing landscape. I've also chaired the Small Grants committee and was instrumental in the development of the new Career Development Grant. I will rotate off the Editorial Board of the journals at the end of 2023, but have very much enjoyed being actively involved in the many and varied tasks required of a member of Council. I would relish the opportunity to be able to continue to contribute to this effort as Vice-President. Palaeontologists at all career levels face a range of challenges in the current academic landscape, from access to funding and job security, to maintaining a healthy work-life balance, to making sure our work is relevant in the modern world.



As Vice-President, I will support the President and other members of Council to ensure that PalAss continues to advocate for and support all palaeontologists.

**Chris Mays:** My goals are to cultivate a palaeontological community that inspires the next generation of naturalists, while highlighting to the public the increasing relevance of the fossil record in our rapidly changing world. To this end, my recent research interests have been drawn to mass extinctions. My contributions to the community have been largely conducted in Australasia. For instance, I founded the largest palaeontology undergraduate volunteer programme in the Southern Hemisphere while lecturing at Monash University, Melbourne, and I serve as Associate Editor for *Alcheringa, An Australasian Journal of Palaeontology*. When I joined the University College Cork team in Ireland in early 2022, a major part of my decision was because of the upcoming (at that stage) Palaeontological Association's Annual Meeting in Cork, for which I became a member of the conference organizing committee. The Meeting (literally) gave me a front-row seat to the Association's progressive goals, sense of community and global perspective, and I liked what I saw. Ever since, I have looked forward to contributing further to the Association's goals; I see this nomination as the ideal path to do so. It would be an absolute privilege to help guide the future of palaeontology through membership of the Palaeontological Association Council.

**Laura Porro:** I would like to be considered for the position of Ordinary Member of the Palaeontological Association Council. I am an Associate Professor at University College London, UK, investigating the relationship between animal form, function and large-scale evolutionary events, using various experimental, imaging and biomechanical modelling techniques. I work across a range of vertebrate taxa and organismal systems but I am especially interested in the evolution of feeding in living and fossil reptiles, and during the water–land transition. My work is highly interdisciplinary and bridges palaeontology, biology and engineering, and I have active collaborations with colleagues around the world. I have been an editor for *Palaeontology* since 2016, attended several past Palaeontological Association Annual Meetings, and I am now looking for an opportunity for greater involvement with the Association. If elected to Council I pledge to contribute my time and energy to diverse discussions, with a particular interest in helping early-career researchers (having myself been a postdoc for ten years!) and assisting with education, public engagement and outreach.

**Omar Rafael Regalado Fernández:** I think I am a good fit for the position of Diversity Officer, due to both my professional and my personal development. Professionally, I have been involved in scholarly discourse on decolonization and ethics in science. Personally, I have experienced first-hand some of the challenges that people of colour and citizens from the Global South experience in a Global North-dominated academia. Historically under-represented groups in academia are not excluded from academia due to a lack of awareness or interest in the field, but due to socioeconomic barriers. For instance, racialized students and postdoctoral researchers tend to lack a safety net and an economic network to sustain transitions, and the people who are in positions to mentor these groups tend to lack awareness or lack institutional knowledge on how to overcome these obstacles. Furthermore, intersectionality has a role that makes situations more complicated, for instance, LGBTQ+ members tend to be isolated from the racialized communities they come from. Scientific societies like the Palaeontological Association are key in providing a space where institutional knowledge can be shared, discussed or developed, and I think my personal experience as an LGBTQ+ Mexican expat coming from a low-income family can provide a helpful insight.



**Romy Rayner:** As a member of several under-represented minorities, including my gender and mixed ethnicity parentage, I have a keen interest in how diversity and inclusion are supported in the field of palaeontology. There has been some recent friction and disenfranchisement between independent movements seeking to increase ethnic representation and I'm passionate about facilitating and focusing on ways in which channels of communication can be opened and maintained between the Palaeontological Association and under-represented members of the wider palaeontological community. The recent Palaeontological Association Diversity Study demonstrated that we still have an issue with male dominance despite increasing gender equality in comparative fields, and I think this is an area that still warrants specific focus. I would also hope to spotlight some often overlooked areas, such as the inaccessibility of higher education to those from a socio-economically deprived background and how more could be done at large conference events to cater to those with sensory, mobility and caring constraints. I hope to have the opportunity to work on ways to increase accessibility to a broad range of individuals in terms of both conference access and education.

**Amalia Robertson:** I am just finishing my Museum Studies master's programme at the University of Leicester, UK, after completing a BSc (Hons) Palaeontology degree at the University of Portsmouth. As an Ordinary Member of Council I will be able to support and represent the Association and its members when sharing my passion for engagement, palaeontology and museums with the wider community – particularly young people who represent the future of palaeontology. As a young (23 year old) palaeontologist seeking a career in the palaeontological sector, supporting young people is a passion that I have applied in the Scout Movement for many years. I have considerable voluntary experience at my local museum, organizing family-friendly fossil activities and transferring the collections to a new building. More recently I secured an eight-week placement at the Lapworth Museum of Geology in Birmingham, working on the amazing collections and helping with their Family Fun Days. I am an active member of the Association, attending this year's Yorkshire Fossil Festival to assist with running activities, and staffing the stand to promote the fantastic work of the Association to the wider public. I would relish the opportunity to share my passion at more public engagement events like this and enable people to develop a similar love for fossils. I would be delighted to help support the Association and promote palaeontology amongst young people and the wider community.

**Daniela Schmidt:** I am a Professor in the School of Earth Science at the University of Bristol, UK. My research focuses on understanding the causes and effects of climate change on marine systems today and in the geological record. Marine organisms are ideal high-resolution archives for climate change but also provide a wide range of ecosystem services. I have transferred tools from a wide range of fields and am combining large morphometric datasets, CT scanning and high-resolution geochemical and material properties. One of my research highlights was the characterization of the unprecedented rate of change of past intervals of rapid environmental change and the biotic response to these changes. My highest research achievement has been my appointment as the coordinating lead author for the IPCC WGII impact assessment for Europe. Coordinating the negotiations with the governments, ensuring our messages were heard loud and clear, is something I am very proud of. I am proud of the diversity of professions in which my former students apply their skills. I have supported and mentored PDRAs and fellows to successful careers in academia or in industry.



## Awards and Prizes

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' below.

### ***Statement of Diversity***

The Palaeontological Association has an Unconscious Bias document (available on the Association website), 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 sex, 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.

### ***Palaeontological Association awards and medals selection procedures***

Council discusses the Association awards and medals at the May Council meeting. Voting to select awardees occurs at the meeting or soon after the meeting by electronic means. The benefit of using Council to select awardees, rather than a dedicated awards committee, is that it draws on the wider experience of the entire Council. Voting is preceded by an introduction from the President and/or Secretary, either verbally or in a written format, that: (i) includes a diversity statement to remind Council of their responsibility in terms of fairness and diversity issues (including impact of non-standard careers etc.); (ii) outlines the remit and selection criteria for each award; (iii) considers the impact of awardees in terms of increasing the diversity of recipients. Each award is considered in turn with every application being considered except those that clearly fall outside of the remit. Normally only one candidate will be awarded in each category per year. However, at Council's discretion and in exceptional circumstances more than one award in any one category may be bestowed if this is deemed appropriate.

In normal circumstances, selection of awardees is conducted by a modified form of supplemental voting, where each Council Member votes by listing their three preferred candidates in rank order (first to third). The candidate(s) with the most votes as preferred candidate will be awarded the



award/medal. If there are only two candidates and they are tied, the President shall have the casting vote. If there are three or more candidates tied, the second ranked candidates will be added to the tally. If the result remains tied, then the third ranked votes are incorporated. If the vote still remains tied the President will cast the deciding vote or (in exceptional circumstances) will ask Council to consider awarding multiple awards/medals.

Nominations that are unsuccessful will be rolled over for a further two years, unless this takes them outside of the award's remit. The nominees will have the opportunity to revise the nomination each year by contacting the Secretary. After the three-year period elapses re-nomination is possible providing that the application continues to fall within the award/medal remit.

## 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 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 appropriate page on the Association's website before the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or e-mailed 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 to choose 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 in 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 appropriate webpage on the Association's website before the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or e-mailed 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 be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right to choose 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 relevant webpage on the Association's website before the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or e-mailed 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 to choose 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 relevant page on the Association's website before the deadline. The completed Professional Standards and Behaviour forms should be either combined with the aforementioned PDF or e-mailed 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 the 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 to choose 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 on the Association's website before the deadline.

In addition, we ask that nominations are accompanied by Professional Standards and Behaviour declarations (see Association website for forms). The completed forms should either be combined with the aforementioned PDF or e-mailed separately to the Secretary and/or Executive Officer.

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 to choose 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 contacts 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 [from April 1st 2023 onwards], Professional Standards and Behaviour declarations by the nominators in relation to the nominee (see PalAss website for form) are required to be completed. The outline should be uploaded via the webpage on the Association's website before the deadline. The completed Professional Standards and Behaviour form should either be combined with the aforementioned PDF or e-mailed separately to the Secretary and/or Executive Officer.

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>>.



# GRANTS

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 GBP 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 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 prioritise 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 to 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.

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 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)>).



Join us in Germany for the 68<sup>th</sup> Annual Meeting!

Symposium on “Extinction” | 2 days of talks & posters | Annual dinner in the ‘Altstadt’ | Fieldtrips to Bamberg museum, Solnhofen & Messel Pits | many Christmas markets!



10–13th  
DECEMBER

2024  
**ERLANGEN**



news



## ***Palaeontology in the news***

Like Alice in Wonderland, who could change her size by drinking different potions, palaeontological discoveries show that many creatures other than Alice have changed their size. Only, they probably didn't have any potions to do the dirty work for them. New insights have recently been shed on the evolution of whales and pterosaurs via the discovery of two of the smallest species of these groups. At the same time, new research suggests how sauropod dinosaurs become bigger and bigger.

### **The story of the young pharaoh of the seas told by a group of palaeontologists**

*Tutcetus* is a specimen of basilosaurid whale that died young, 41 million years ago. It was discovered by an international team of scientists, led by Egyptian researchers (Antar *et al.* 2023). Its name is inspired by Egyptian history, combining 'Tut' – the first part of the name of famous Pharaoh Tutankhamun – with the Greek word for whale, Cetus. *Tutcetus rayanensis* is the name of the species, is the smallest basilosaurid whale known so far, and this is one of the oldest records of its family in Africa. This discovery shed light on early whales' life, phylogeny and paleobiogeography. *Tutcetus*, and all basilosauridae, represent a crucial moment in whales' evolution in which this group transitioned back from the land to the sea. Adapting to the new environment, they developed a streamlined body, flippers, and a tail fin. However, *Tutcetus* still show hind limbs even though they couldn't be used to walk anymore. The holotype of *Tutcetus rayanensis* consists of a skull, jaws, hyoid bone and the atlas vertebra. The estimated length is 2.5 metres, and the body mass may have been around 187 kilos. It may not sound that small, but it is when compared to the other members of its family.

### **A tiny creature challenges our understanding of early Triassic reptile evolution**

*Venatoraptor gassena* may be smaller than its descendants, but its importance for the understanding of pterosaur evolution is huge. Found in Brazil and described by Müller *et al.* (2023), *Venatoraptor gassena* was a lagerpetid, a pterosaur precursor that lived around 230 million years ago. Its name derives from the district where it was found, Vale Vêneto, and 'raptor' because of its potential hunting behaviour. This small creature had unique features such as a toothless, raptorial beak and scimitar-like claws. This toothless beak likely had multiple functions, and its long fingers with sharp claws suggest it may have been capable of grasping prey or even climbing trees. Its discovery expands our understanding of early Triassic life and challenges previous notions about the diversity and morphology of early reptile lineages.

In fact, before the *Venatoraptor gassena* finding, the lagerpetids were considered closely related to dinosaurs, while now their taxonomical position seems to be closer to pterosaurs. On top of that, *Venatoraptor gassena* shows a bipedal locomotion, challenging the idea that early reptile precursors were exclusively quadrupedal. This finding reinforces the importance of fossils from South America in understanding the early Triassic tree of life. We are reminded by Marina Soares, co-author of the paper describing *Venatoraptor gassena* and associate professor at the Federal University of Rio de Janeiro, that "Over the past two decades, about 30 new species have been described from Triassic beds of Brazil, including forerunners to mammals and representatives of distinct lineages of archosaurs".



## Oops, sauropods did it again!

Sauropods are quite iconic. Their long heads and tails are part of the common imagination when we think about dinosaurs, but what is stunning is their size. They were huge, and bigger than any other terrestrial creature before or since. But how did they get so big? And why does no other terrestrial animal reach even a third of the sauropod's weight? Answering this question is a big challenge – almost as big as sauropods themselves – and was recently tackled by Michael D'Emic in *Scientific American* (2023). One of the major challenges in reconstructing the sauropods' story is that their fossil record is rather incomplete. In fact, like other terrestrial animals, they lived – and died – in an environment that does not foster fossilization. Over the years, however, more and more fossils have been found, offering a clearer vision of the evolution of this group. Even though the iconic sauropod is a big, chunky animal, the truth unveiled by the fossil record is that this group of dinosaurs was quite variable in shape. Some of them were more slender, while others corpulent. They even had different ways to walk, according to their fossil footprints. Many different body shapes coexisted in the same ecosystems, so they were likely adapted to exploit different resources.



Being so different from the other animals makes it difficult for palaeontologists and other researchers to estimate and compare their body size. Considering their length or height may be tricky and, for this reason, instead of the size, their body mass is used for comparison. The most popular way to estimate the body mass of an extinct animal is through the size of its limb bones. As in columns, the amount of weight that can be supported by a limb increases with thickness. This is why it is possible to estimate the mass of a sauropod based on a cross-section of its limb bones. A study of sauropods' body mass highlighted that not all sauropods were giants. On the contrary, most of them were smaller than many terrestrial mammals. On the other hand, many clades of sauropods had delusions of grandeur; in each new sauropod family to evolve, one or more lineage independently evolved to achieve the status of 'giant'.

**Nicola Vuolo**  
Publicity Officer

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MÜLLER, R. T., EZCURRA, M. D., GARCIA, M. S., AGNOLÍN, F. L., STOCKER, M. R., NOVAS, F. E. *et al.* 2023. New reptile shows dinosaurs and pterosaurs evolved among diverse precursors. *Nature*, **620**, 589–594.

## News bites

Will a flawless smile help to achieve success in life? For sure it helped rhynchosaurians to gain an ecologically significant role in the Middle and early Late Triassic. According to Sethapanichsakul *et al.*, during their evolution rhynchosaurians moved from an irregular tooth insertion to a much more regular one, with deep-rooted teeth. In their paper, Sethapanichsakul *et al.* demonstrate that the teeth of rhynchosaurians, unlike in other reptiles, show a unique implantation with deep roots fused in the bone, and do not replace from below, but are inserted posteriorly with addition of new bone, and worn and lost in a forwards direction. Rhynchosaurians' new smiles helped them through tough conditions, even though they eventually had to leave the scene to other herbivores.

SETHAPANICHSAKUL, T., CORAM, R. A. and BENTON, M. J. 2023. Unique dentition of rhynchosaurians and their two-phase success as herbivores in the Triassic. *Palaeontology*, **66**, e12654.



One skeleton to rule them all ... more or less. A new species of reptile from Mallorca (Balearic Islands, western Mediterranean) has been described by Matamales-Andreu *et al.* The reptile lived about 285 million years ago and its skeleton is almost complete. In fact, Matamales-Andreu *et al.* were able to correlate the new-found specimen to one form of some co-occurring tracks, providing important information to interpret other fossil deposits in which bones are absent.

MATAMALES-ANDREUL, R., MUJAL, E., GALOBART, À. and FORTUNY, J. 2023. A new medium-sized moradisaurine captorhinid eureptile from the Permian of Mallorca (Balearic Islands, western Mediterranean) and correlation with the co-occurring ichnogenus *Hyloidichnus*. *Papers in Palaeontology*, **9**, e1498.



When being clever isn't enough, will cleavers help? Apparently not that much... In their paper Yates *et al.* describe a new species of 'cleaver-headed crocodile' from central Australia. This lineage of crocodile was specially adapted for preying upon megafauna, and they were common in northern Australian waterways from about 25 million years ago through to about eight million years ago. The new species is about eight million years old, therefore it is among the last of its lineage. The extinction of cleaver-headed crocodiles appears to be part of a turnover in crocodylian species that happened in Australia between eight and five million years ago, and may be the result of an extreme pulse of aridity during that period.

YATES, A. M., RISTEVSKI, J. and SALISBURY, S. 2023. The last Baru (Crocodylia, Mekosuchinae): a new species of 'cleaver-headed crocodile' from central Australia and a turnover of crocodylians during the late Miocene in Australia. *Papers in Palaeontology*, **9**, e1523.



**Nicola Vuolo**  
Publicity Officer



## *PalAss members win awards*

### **Jean Baptiste Lamarck Medal**

The 2023 Jean Baptiste Lamarck Medal of the European Geosciences Union (EGU) has been awarded to **Prof. David A.T. Harper** in recognition of his outstanding work on the biostratigraphy and evolution of Lower Palaeozoic invertebrate faunas, as well as his important contributions to quantitative palaeontology education. Prof. Harper was President of the Association in 2015 and 2016 and has made major impacts with his studies of Early Palaeozoic brachiopods, stratigraphy, palaeogeography and major events in the Ordovician. During his career he has worked at different institutions in several European countries and is now Emeritus Professor of Palaeontology at Durham University in the UK. He is an outstanding taxonomist and systematist of the Brachiopoda and has published numerous papers on their evolutionary history and taxonomic relationships. He was a major contributor to the 'Treatise on Invertebrate Paleontology', generating new and cladistically-based classifications of four major groups and revising all their known genera. This monumental work is now the standard work of reference and has made him the world authority on these groups. With 350 refereed articles in scientific journals to date, Prof. Harper continues to actively (co-) publish his research findings, including those resulting from field campaigns in remote areas of China and Greenland. Prof. Harper has also made a very significant contribution to the education of palaeontologists. He has co-authored a number of widely-used textbooks and he pioneered computer packages for statistical analysis in palaeontology. He led the Subcommission on Ordovician Stratigraphy and is currently Chair of the International Commission on Stratigraphy. We extend our congratulations to Prof. Harper, a very worthy winner of the Jean Baptiste Lamarck Medal.



Photo courtesy of Lucia Angiolini.

### **Darwin-Wallace Medal**

**Prof. David Jablonski** of the University of Chicago, USA has been awarded the Darwin-Wallace Medal of the Linnean Society of London. He is only the fourth palaeontologist to be awarded the Medal since its inception. Prof. Jablonski is one of the most influential and innovative palaeobiologists in our field; he is a leader in the use of large-scale datasets to investigate macroevolutionary patterns over diverse temporal scales and levels in taxonomic hierarchy. His contributions cover topics as diverse as the effect of larval ecology on evolution, causes and dynamics of the latitudinal diversity gradient, determinants and consequences of geographic range size, the origin and fate of evolutionary novelties, species selection and the biology and evolutionary impact of mass extinctions.



Photo courtesy of Susan M. Kidwell.



Working with organisms from molluscs to mammals, he has demonstrated that morphologically-defined genera are largely concordant with clades present in molecular phylogenies, with coherent macroecological properties (like geographic range and body size), and therefore are valid and meaningful evolutionary units for analyses of both fossil and living organisms. He is a tireless advocate for palaeobiology and, more broadly, evolutionary biology. We extend warm congratulations to Prof. Jablonski, a very worthy recipient of the Darwin-Wallace Medal.

## Milne Edwards Medal

At the 14th quadrennial symposium of the International Fossil Coral and Reef Society (IFCRS), recently held in Chęciny, Poland, **Dr Brian Roy Rosen** was awarded the Society's Milne Edwards Medal for his outstanding contribution to research on fossil cnidarians and ancient reefs. As an Associate Scientist in the Department of Earth Sciences at the Natural History Museum, London, UK, Dr Rosen is a specialist researcher in corals and reefs past and present, in both their biological and geological aspects. Dr Rosen joined the Natural History Museum as a researcher in 1972 and worked there until his statutory retirement some 30 years later; however, retirement has not stopped his tireless research and he has continued there as an Associate, working with a large number of collaborators on everything from coral evolution and palaeoecology to taxonomy and morphology, as well as conservation of living coral reefs. His diverse background in science, across physics, geology and geography, has facilitated his research on plate tectonics and fossil reefs, including a retrospective re-interpretation of Charles Darwin's subsidence theory of coral atolls in relation to plate tectonics. Dr Rosen has also served our community extensively as the founding editor of both the *Reef Encounter* newsletter and the journal *Systematics and Biodiversity*, and as the organizer of various review seminars and workshops for the Association. The IFCRS medal is named for Henri Milne Edwards who was an outstanding pioneer of coral systematics. In the mid-nineteenth century, together with Jules Haime, he monographed corals from the Silurian through to Recent and their Palaeontographical Society monograph of British fossil corals is still a key major reference. As another outstanding coral researcher, Dr Rosen is a very worthy awardee of the Milne Edwards Medal and we extend our warmest congratulations to him.

**Jo Hellawell**  
Executive Officer



Photo © George Darvell.



## *Annual Meeting awards*

At the Annual Meeting in Cambridge several awards were given for the best posters and talks by early-career presenters. All student members of the Association, and all members within one year of the award of a higher degree, are eligible for consideration for these awards. There was a very high standard for presentations given at the Annual Meeting this year, meaning that our committees had a difficult job to select the winners. The Council Poster Prize was awarded to four recipients this year: **Neil Adams** (Natural History Museum, London) for his poster on the dental microwear of 'condylarths' and their apparent dietary diversity; **Daniel Cirtina** (University College Cork) for his poster on melanosome distribution and geometry in fish; **Zishan Fu** (University of Edinburgh) for her poster on the diversity and evolution of phloem in ferns; and **Luke Meade** (University of Birmingham) for his poster on small-bodied pterosaurs from Skye. Five presenters were awarded the President's Prize for 2023: **Mickaël Lheritier** (Université Claude Bernard Lyon 1) for his talk on juvenile arthropleurids from the Montceau-les-Mines Lagerstätte; **Anna McGairy** (University of Leicester) for her talk on an early ostracod radiation into cold, deeper-water environments in the Upper Ordovician; **Aaron Quigley** (University College Cork) for his talk on melanosome geometry and how it informs us on the functional evolution of melanin in Reptilia and Amphibia; **Amy Shipley** (University of Leeds) for her talk on ecosystem structural changes following the extinction of *Otodus megalodon*; and **Philip Vixseboxe** (University of Cambridge) for his talk on microbial collagenase as a constraint on soft tissue preservation. Regrettably, the Council's recently-developed protocol for these awards was not followed correctly during the conferral of the President's Prize in Cambridge, with only one winner being announced and four presenters recognized for their 'highly commended' presentations. We have since corrected this error and all five will now receive their prize of a certificate and free membership of the Association for one year. We apologize unreservedly to the four who missed the opportunity to be recognized fully during the announcement in front of peers and colleagues.

**Rachel Wood**

*President*

## *New PalAss Webinar series: ECR funding*

PalAss has launched a new webinar series aimed at helping early-career researchers to apply for funding. The first event was held on 1st November, led by panellists who had made successful grant applications to the Leverhulme Trust Early Career Fellowship.

The next event in this series is about the 1851 Royal Commission Research Fellowship, on 22nd November, followed by Royal Society Fellowships and NERC grants on dates in January to be announced in due course (see next page).

The webinars begin with a brief overview, followed by a discussion led by a panel of successful applicants, and finish with an open Q&A session with attendees. The webinars are free to join but we ask that you register in advance to receive information on how to participate.

**Orla Bath Enright**

*ECR Officer*

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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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Thinking about applying for funding?  
Need help finding someone to exchange  
experiences?



17:30 (GMT) ON ZOOM

We invite you to join our **ONLINE** winter 2023 series.

## POSTDOC FUNDING CHATS

**1<sup>st</sup> November:** Leverhulme Trust, Early Career Fellowship

**22<sup>nd</sup> November:** 1851 Royal Commission, Research Fellowship

Coming soon in January:  
Royal Society, Newton International Fellowship  
NERC, ERC Starting Grant

Registration info via our X account (Twitter)  
and email list!



Meet postdocs who successfully obtained  
funding and ask all your burning  
questions!



## Legends of Rock

### *The life and legacy of Mary Douglas Leakey*

In the field of palaeontology, a handful of individuals stand out for their trailblazing work in understanding our species' origins. One such notable figure is Mary Douglas Leakey. A pioneering fossil hunter, Mary's discoveries in East Africa helped unravel the mysteries of our ancestral past. As we dig into her remarkable life and work, you will discover a woman whose passion for archaeology knew no bounds, whose discoveries rewrote the story of human evolution, and whose legacy continues to inspire generations of scientists.



Mary Leakey examines a fossil find, 1972. Science History Images / Alamy Stock Photo.

Born in London on 6th February 1913 and the only child of Cecilia Frere and Erskine Nicol, Mary spent much of her early years travelling abroad with her parents. It was during their summer visits to France that Mary's fascination with prehistoric sites was first kindled. Amidst the picturesque landscapes, she keenly observed the excavations conducted by Elie Peyrony at Laugerie Haute in Les Eyzies, where she salvaged countless Upper Palaeolithic artefacts that had been carelessly discarded amidst the spoil heaps – a consequence of the less-than-scientific excavation methods of that era. Mary also explored the enigmatic cave paintings of bison and horses at Pêch Merle in Dordogne, guided by the local village priest and amateur archaeologist Abbé Lemozi. Undoubtedly, these formative experiences ignited her passion for geology and archaeology, becoming the bedrock upon which Mary's illustrious career was built.

Aged thirteen, she faced a pivotal moment when her father's death led Mary and her mother to return to London. Set on making a new life for themselves, Mary finally began her formal education in a local Catholic convent, although this endeavour did not go as planned. Expelled for refusing to recite poetry and later for an intentional explosion in the chemistry laboratory, Mary's mother hired multiple tutors without success. Mary's dream of becoming an archaeologist seemed unattainable with her academic record, yet at the age of seventeen she informally attended lectures in geology and archaeology at University College London and the London Museum. Mary also joined several summer excavations, including the Hembury Dig in Devon under the supervision of Dorothy Liddell, who trained Mary for four seasons until 1934. Mary's



artistic talent for illustrating the tools found at this Neolithic site, a gift perhaps inherited from her father and grandfather who were both accomplished painters, caught the eye of Gertrude Caton-Thompson. As a result, Mary was commissioned to provide illustrations for her book *The Desert Fayoum*. Pleased with her work, Caton-Thompson introduced Mary to Louis Leakey who was seeking an illustrator for his book *Adam's Ancestor*. While doing the work, Mary and Louis became romantically involved and eventually got married on 24th December 1936, marking the beginning of a partnership that changed the course of human evolutionary studies.

Over the following years, Mary and Louis embarked on several expeditions to East Africa, an area that became the focal point of their research on human origins. Mary's sharp eye and meticulous excavation techniques unearthed a treasure trove of ancient fossils, including hominins and tools, spanning millions of years of human evolution. On 2nd October 1948, Mary found her first fossil of great importance on Rusinga Island in Kenya, the *Proconsul africanus* skull. This early Miocene specimen represents an ancestor of apes and early humans, highlighting the evolutionary connection between the two groups.

About a decade later, on 17th July 1959, while Louis was in bed with influenza, Mary made yet another significant discovery as she unearthed the fossilized skull of a 1.75-million-year-old early hominin man at Olduvai Gorge in Tanzania. The specimen had to be reconstructed from many fragments and was named *Zinjanthropus boisei* (later reclassified as *Paranthropus boisei*). Its robust jaws and teeth, hence the 'nutcracker man' nickname, challenged the prevailing notions about dietary adaptations and for the first time shed light on early human diversity, sparking intense debate within the scientific community. A year later at the same site, a team led by Mary and Louis started to uncover remains of larger-brained hominins. Although contemporary with *Australopithecus*, the unique combinations of characteristics in these specimens led to the naming of a new species, *Homo habilis*, meaning 'handy man' as this early human was suspected to have been responsible for crafting the numerous stone tools also found at Olduvai Gorge. As was custom at that time, these early findings were interpreted and published by Mary's husband. Later though, Mary and Louis collaborated on many research publications until he suffered a heart attack and died on 1st October 1972.

Mary continued her archaeological endeavours after this ill-fated event, becoming an authority in the field of palaeoanthropology in her own right. She spent substantial time travelling to deliver lectures and raise funds, but her true passion remained excavating in the field. Her attention to detail was legendary, and she could spend countless hours meticulously sifting through sediment and cataloguing each find. Between 1976 and 1978, Mary and her staff uncovered amazingly



Mary Leakey and her husband Louis Leakey in 1962.  
Smithsonian Institution Archives; image #SIA2008-5177.



well-preserved fossilized footprints at Laetoli in Tanzania, arguably the most exciting discovery in her career. It is believed that 3.6 million years ago three individuals, likely belonging to the species *Australopithecus afarensis*, left these footprints as they walked in a layer of volcanic ash, offering compelling evidence that our ancestors had evolved to walk upright long before the development of advanced tools and the enlargement of the human brain. Mary's groundbreaking discovery redefined our understanding of human evolution and forced a re-evaluation of the timeline for significant developments in our lineage. During her career, Mary received numerous awards from institutions around the world in recognition of her contributions to the field of palaeoanthropology. Even in her retirement, she continued many research projects. Sadly, on 9th December 1996, Mary Leakey passed away at the age of 83, marking the end of a remarkable career dedicated to the study of human evolution.

Mary's contributions to palaeontology were not just scientific, they were also a testament to the power of determination, resilience and passion for knowledge, as she shattered gender barriers in a male-dominated field. Mary paved the way for future generations of researchers who continue to explore the intricate tapestry of human evolution, including her son and daughter-in-law, Richard and Meave Leakey. The Leakey Foundation, established by Mary and Louis in 1968, continues to this day to support scientific research and exploration related to human origins and evolution. Mary Leakey, the fossil hunter and trailblazer, will forever be an icon in our field, and her legacy will continue to shape the future of palaeontology.

**Hester Hanegraaf**

Natural History Museum, London, UK



The 3.6 million-year-old footprints formed in wet volcanic ash found by Mary Leakey at the Laetoli site, Tanzania.  
Kenneth Garrett / Alamy Stock Photo.



# Behind the Scenes at the Museum

## *Staatliches Museum für Naturkunde Stuttgart, Germany*

The Staatliches Museum für Naturkunde Stuttgart (SMNS), in Baden-Württemberg, Germany, contains some of Europe's most extensive and scientifically valuable palaeontological and zoological collections. Founded on 21st May 1791 by Duke Carl Eugen (1728–1793), it was to be an institute dedicated to showcasing and preserving the rich natural history heritage (both fossil and modern) of Würtemberg. However, it was quickly closed down following the duke's death, with the collection suffering extensively from various relocations (five times in 55 years, between 1746 and 1801), thefts, damage, wars and dermestid beetle infestations. During this time, a large number of valuable specimens were lost. The institution was finally consolidated in 1826 following the construction of a new museum building in Neckarstrasse. It underwent several major extensions as the collection rapidly grew, including an entire annexe built to solely accommodate a giant Steppe mammoth discovered nearby in 1910, and by the late 1920s a century of stability had facilitated a strong reputation for scientific research.

Plans were made to build a new museum in 1939, but they were to fall through. At the outbreak of World War II, the Museum began to evacuate as much of the collection as possible into the surrounding countryside, with old mine shafts, castles and wine cellars used for safe storage should Stuttgart be bombed. This precaution was justified, as the museum on Neckarstrasse was almost completely destroyed by the bombings, reducing the building to smouldering rubble. Many of the larger specimens in the exhibit could not be moved in time and were destroyed, including several near-complete skeletons of *Plateosaurus*. Desperate curators combed over the rubble to salvage what they could of the burnt specimens. Some survive today as charred fragments. Exhibited today is a large plesiosaur (*Meyerasaurus victor*) that was saved from the rubble and reconstructed; the severely burnt bones are a grim testament to the scientific cost of war.

Today the collection is permanently housed in the current SMNS, split across two sites in Rosenstein Park: the Museum am Löwentor (1985) showcasing palaeontology and anthropology, and the Schloss Rosenstein (1956) dedicated to zoology and taxidermy collections.

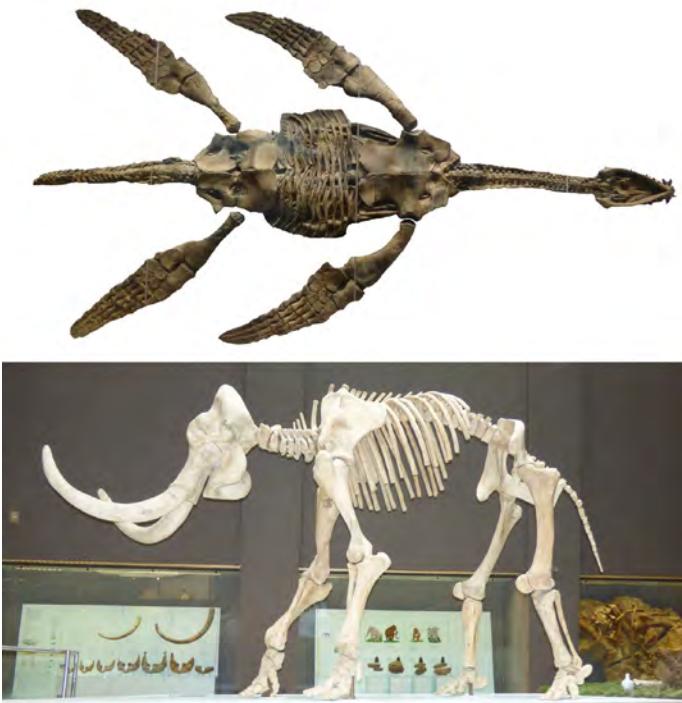
The collection holds well over a million items, with the oldest specimens coming from the former sixteenth century cabinet of Ludwig V, Duke of Würtemberg. These include the lower jaw of a boar which the duke allegedly slew with his rapier (the broken blade still impaled in the bone) and a large antler from a Pleistocene giant deer (*Megaloceras giganteus*) dated to 1600, which is the oldest collected fossil in the Museum.

From the Triassic, which is well represented in the geology of Baden-Württemberg, the SMNS stores an impressive collection of vertebrate remains from the Buntsandstein, Muschelkalk and Keuper. Dedicated research at the SMNS on the Lower Keuper swamps has uncovered an impressive assemblage of Triassic tetrapods, including several large temnospondyl amphibians, like the enormous 'crocodile like' *Mastodonsaurus*, and various archosauriformes. The most significant find came in 2015 with the discovery of the oldest stem turtle *Pappochelys rosinae*, providing ground-breaking new data on the evolutionary origins of turtles (Schoch and Sues



2015). The SMNS is perhaps best known for its collection of skeletons of the sauropodomorph *Plateosaurus* from the Upper Triassic (Upper Keuper) of Trossingen. The legend goes that a schoolboy ripped his trousers on a dinosaur bone weathering out of the hillside. Early excavations uncovered over 70 skeletons from the site and more than a dozen were near enough complete. *Plateosaurus* has since become an icon of the Triassic, the state dinosaur of Baden-Württemberg and the heraldic animal of the SMNS. The mystery of why so many individuals died in the ‘*Plateosaurus* graveyard’ continues to baffle researchers. New excavations in Trossingen began in the early 2010s, led by Prof. Rainer Schoch, with the aim of better understanding how *Plateosaurus* lived, what their environment was like, and why so many all seemingly died in one place.

The Lower Jurassic (Toarcian) Posidonienschiefer Formation – a marine Konservat-Lagerstätte – is very well represented in the Museum, predominately collected from the nearby Holzmaden area. The Museum boasts the largest collection of Toarcian ichthyosaurs, including some of the largest



*Top: restored skeleton of the Early Jurassic plesiosaur Meyerasaurus victor, salvaged from the bombed museum rubble in 1944. Bottom: cast of the now heavily damaged Steinheim steppe mammoth, originally found complete in 1910. Photos by Samuel Cooper.*

specimens of *Temnodontosaurus*, a hyodont shark (*Hyodus hauffianus*) with almost 200 belemnite guards preserved inside the gut, numerous marine crocodilians, plesiosaurs, pterosaurs, a huge diversity of actinopterygian fishes, as well as various articulated crustaceans, soft-bodied teuthids, pseudoplanktonic crinoids, ammonites and complete belemnites with articulated tentacles. Some of the ichthyosaur carcasses hosted rare dead fall benthic



communities, providing islands of habitation and nutrition within an oxygen-depleted sea floor (Maxwell *et al.* 2022). A large number of ichthyosaurs represent gravid females with fossilized foetuses preserved either inside the mother or expelled from the womb by an implosion of decay gases. These rare finds provide the best source of evidence for ichthyosaur early development and ontogeny. Preserved soft tissues first found in the formation prove that ichthyosaurs were dolphin-like with a fleshy dorsal fin and fluked tail.

The SMNS also holds the world's largest collection of fossils from the Nusplingen Plattenkalk – another Baden-Württemberg Konservat-Lagerstätte (Kimmeridgian), equivalent to the more well-known Solnhofen deposits in Bavaria. Extensive collecting from the site since the 1990s, predominately led by Dr Günter Schweigert, has amassed an enormous abundance and diversity of fossils. Notable inclusions are complete and fully articulated angel sharks (*Squatina acanthoderma*), which, despite their rarity in the fossil record, are unusually abundant at Nusplingen. Invertebrates are particularly well represented and diverse, and include various echinoderms, crustaceans, limulids, insects, teuthids, sponges and ammonites. There are numerous examples of coelacanths (*Coccoderma*, *Undina*), actinopterygians, sharks, pterodactyloid and ctenochasmatid pterosaurs, and two large marine crocodilians (*Geosaurus suevicus*, *Dacosaurus maximus*).



*Top left: the famed Steinheim skull in front view. Top right: an articulated decapod crustacean, *Cycleryon spinimanus* from the Nusplingen plattenkalk. Bottom: skull of the holotype of *Plateosaurus trossingensis*, from the Upper Triassic of Trossingen. Photos by Samuel Cooper.*



The crown jewel of the palaeontological collection is a 400,000-year-old hominid skull, the holotype of *Homo steinheimensis* (likely synonymous with *H. erectus*), discovered in a gravel pit from Steinheim/Murr in 1923. The palaeomammology unit curates a variety of the fauna that the Steinheim person lived alongside and also preceded. The gravels and travertines around the north of Stuttgart have yielded bones of rhinoceros, deer and mammoths, the oldest found by farmers as early as 1700.

The SMNS remains one of the leading institutes for palaeontological research in Germany, with researchers visiting the collections from all over the world. The SMNS continuously expands its research laboratories, collections, fieldwork campaigns, international collaborations, outreach and education programmes, and these are all helping the institution to thrive as it slowly approaches its quarter-millennium birthday in 2041. The Museum is approximately three hours by train to Erlangen, where the Palaeontological Association's next Annual Meeting will be held in December 2024. Please get in touch with us if you are thinking of visiting our collections!

### **Samuel Cooper**

*Staatliches Museum für Naturkunde Stuttgart, Germany*

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For further information:

<<https://www.naturkundemuseum-bw.de/>>.

X (formerly Twitter): @SMNStuttgart.

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## Air on a sauropod

It was a most atypical subject for a painting, at least for Scotsman William Dyce, devout Anglican, well-known religious artist and a pillar of society (invited to decorate the Queen's Robing Room in the Palace of Westminster with frescoes of the Arthurian legends, no less). It's a memory of a summer day in 1857, when he and his family visited Pegwell Bay, Sussex, in the southeast of England. They're there in the foreground, grubbing around on the muddy shore for shells and fossils. Half the picture is taken up with the sky: nothing of Turner's pyrotechnics here, just a pale wash with a few clouds and, most delicately outlined – at a casual glance, you'd miss it – there's a comet. That's Donati's comet, which appeared in 1858, and to include it in the picture, Dyce had to cheat<sup>1</sup> and put the date of the painting forward a year. No matter: it's all a frame for the central protagonist, the chalk cliffs of Pegwell Bay, which hold the viewer's gaze with a presence that mere rock, one would think, just should not have.

This oddity, *Pegwell Bay*, is now Dyce's most celebrated painting, and much has been written<sup>2</sup> about how it symbolizes the dawning comprehension of the depth of geological time and the vastness of space in mid-Victorian times, and how it intersects with the detonation of Darwin's unsettling ideas. Dyce's picture, though, was well on its way to completion when the *Origin of Species* was published, late in 1859, following which the kerfuffle duly started. I wonder, rather, whether Dyce might have had a copy of Gideon Mantell's *Thoughts on a Pebble* on his bookshelf. Published in 1849, this charming and non-socially-threatening example of early popular geology not only described typical fossils (including microfossils) of the Chalk in considerable detail, but did this so lyrically that it doubtless propelled many families to have a go at fossil hunting themselves. And for good measure among the illustrations is one of the Brighton chalk cliffs, in composition not unlike *Pegwell Bay* in mirror-image<sup>3</sup>.

In composition, perhaps, but not in execution. Dyce was allied to the pre-Raphaelites, who took naturalistic detail seriously, and he captured the rock texture so faithfully that he was accused of painting from another of the Devil's new inventions, the photograph. The strata in *Pegwell Bay* are recognizably the rhythmic ones of the Chalk, the preserved signal of multi-millennial astronomical cycles. *That* he would not have known, as this interpretation did not emerge until much later. But if he had read his Mantell, he would have learned that these Chalk layers were laid down on a very deep, very ancient sea floor inhabited by many kinds of animals that no longer existed – though with some resembling animals living today in hot tropical seas. It's easy to forget just how much those early nineteenth century savants had worked out – and made public – just by puzzling through the fossils. Dyce may have dreamed of Cretaceous greenhouse seas, as he so painstakingly immortalized their solid remains.

What kept those ancient seas so warm? One customary answer these days is that the Cretaceous was a time when ocean crust formed more rapidly, and so volcanoes belched carbon dioxide into the air more vigorously. But there's been another suggestion that might have made the straight-laced Dyce blush delicately, for it features the kind of outgassing of which mention would surely have been frowned on in polite Victorian company: methane emission via the flatulence

<sup>1</sup> Artistic licence, in its purest form.

<sup>2</sup> For example, <<https://greatscottishart.wordpress.com/2014/02/15/2-william-dyce-peggewell-bay/>>.

<sup>3</sup> One chalk cliff seascape, of course, can't really fail to resemble another.



of dinosaurs<sup>4</sup>. An April Fool's joke of the coarser kind? Not a bit of it. It was an ingenious and serious suggestion (Wilkinson *et al.* 2012), though naturally did not fail to excite some rather less serious comment from the more excitable sections of the press. The idea is simple enough: that the sauropods, rather like ruminants today, would have emitted enough methane into the air through their enormous digestive tracts to significantly warm the climate. So far, so good – but the devil lies in the detail, which provided the additional bonus of emphasizing just how alien the world of the dinosaurs<sup>5</sup> was.

For, in most humans of a fossilish inclination, these beasts go through a kind of evolution of the mind. As a child, we think of them as monstrous, and that's just that. Growing up, we get more sophisticated, and learn that there were small dinosaurs as well as big dinosaurs, and that some were feathered and likely warm-blooded and active; it's knowledge that paints a picture closer to the familiar pattern of today's land animals. Then ... from a study which has to do sums on the digestive capabilities of dinosaurs, the picture changes again: back, strangely, towards the juvenile version.

The sums used by Wilkinson *et al.* (2012) are built on the kind of comparisons of dinosaurs and mammals made by Jerzy Trammer (2011). Based on their fossilized remains, the median body mass of a dinosaur genus, Trammer noted, was over one and a half tonnes; the same measure for a mammal genus alive today is a third of a kilogram. Even allowing for the thinning out of large mammals over the past fifty millennia (eaten by our ancestors, mostly), that is a whopping difference. The dinosaurs, therefore, put their body mass into a few very large bodies, while the mammals – elephant and blue whale notwithstanding – tend to divide theirs among very many small ones. So those sauropods were not in reality the dramatic and endlessly publicized end members of a wide spectrum of dinosaur body sizes: they were merely the biggest of generally very big animals. Before that Mexican meteorite demolished the global ecosystem, the Cretaceous really was a time of giants.

Now, if the average dinosaur was several thousand times bigger than the average mammal, they must have been less numerous too than in a mammal-based ecosystem, as regards both individuals and species. But there's more to the equation. It takes a lot less energy, and therefore food, to maintain body mass that is packed into a few huge animals rather than divided among many small ones, and Trammer uses the analogy that driving 400 motorcycles along a road uses 22 times as much fuel as packing them all into a truck and driving that instead. It may not be a *perfectly* exact analogy – but nonetheless it follows that the same amount of vegetation can support substantially more dinosaur than mammal biomass. Dinosaurs, therefore, were not only big but there were relatively rather more of them than one might expect from simple considerations of size distribution.

Among these, the sauropods are given centre stage in this story of climate. In Dyce's day, they were simply not in the public consciousness; a few bones of *Cetiosaurus* had been described and named by Richard Owen in 1842, though he thought they were of some kind of marine crocodile. It wasn't until magnificent, near-complete skeletons of such as *Brontosaurus* and *Diplodocus* were unearthed from the late 1870s, amid the ferocious USA 'bone wars' waged between Edward

<sup>4</sup> Though perhaps not impolite Victorian company: one can imagine the delighted reaction of, say, the rumbustuous Rev. William Buckland – he who coined the term 'coprolite' – to such a hypothesis.

<sup>5</sup> Non-avian dinosaurs, one stresses. The fat pigeons in my back garden are decidedly not role models for this kind of story.



Drinker Cope and Othniel Charles Marsh, that this extraordinary body plan came to light. And as more bones were dug out it became clear that the sauropods were not spectacular rarities, but common and indeed keystone species throughout pretty much all of the Jurassic and Cretaceous periods. Walk across the average square kilometre of suitably productive landscape of that time, it has been calculated (by Farlow *et al.* 2010), and you might rub shoulders – so to speak – with anything from a few to a few *tens* of these beasts, with a collective *avordupois* of a few hundred tonnes.

Wilkinson and colleagues took these monstrous numbers and converted them into methane production. The equation they used (one established for ‘modern non-ruminant herbivores’) was of a simplicity sufficient to beguile even the maths-phobic among us, where methane output in litres per day is equivalent to 0.18 times body weight in kilograms to the exponent of 0.97. As this exponent is as near as dammit 1.0, then one can safely toss it overboard and just use the 0.18 and the body weight, since the relation will be much the same whether the animal is big or small. But as these animals *were* big, then one can pick, as they did, a run-of-the-mill 20-tonne *Apatosaurus*<sup>6</sup>, and compute its daily output as 2,675 litres of methane. Domestically viewed, that’s quite modest. It’s a little under a therm of natural gas: to heat your house comfortably you would need to have it plumbed into a couple of *Apatosauri*, and give them free rein among the begonias.

Multiply these beasts by the inferred amount of sauropod-friendly landscape reconstructed for those times, though, and the numbers climb, to something over half a billion tons of methane emitted a year. That’s comparable to modern-day methane emissions (which, lest we forget, are more than double what they were in pre-industrial times, and which are fanning the flames of climate heating, in recent years ever more fiercely; see Nisbet *et al.* 2023<sup>7</sup>). It’s an estimate, of course, scribbled on the back of a beermat with the bluntest of 2B pencils; but even half the methane output would give the sauropods agency, to use the modern turn of phrase, in climate control. Not them *personally*, of course. *Apatosaurus* and its ilk were just large mobile reaction chambers, with the real work being done by the battalions of methanogenic bacteria in their capacious guts. Wilkinson & co noted that the late Lynn Margulis, that great illuminator of the microbial universe, would surely have been entranced by that spectacular demonstration of the methanogens’ alchemical powers.

There’s a hinterland, of course, behind such studies. Euan Nisbet, one of the authors, recalled methane’s reality as emphasized by misadventure: a vet in Africa treating a bloated cow in a barn, releasing the pressure by simple puncture, and inadvertently showing the farmer it was methane by striking a light; the ensuing conflagration destroyed both barn and reputation. And recalled too, those moments in discussion that kick over the traces of sober calculation, conjuring up imaginary sauropods with enough gas to become buoyant, rising like zeppelins to graze the treetops...

But back down on Earth: if the sauropods did help keep the climate of their days warm, then they were part of the planetary machinery for an unconscionably long time, from the late Triassic onwards, and through most of that time they dominated many land-based ecosystems right to

<sup>6</sup> Which is perhaps the same as *Brontosaurus*. Or perhaps not. Taxonomy can be hell at times.

<sup>7</sup> It’s an illuminating and thought-provoking paper, though for readers in a hurry there’s an abbreviated version: <<https://theconversation.com/rising-methane-could-be-a-sign-that-earths-climate-is-part-way-through-a-termination-level-transition-211211>>.



the ‘very end’ (Sander *et al.* 2011) – the bitter end, as it transpired – of the Cretaceous. Switch that warmth-generating machinery off, then, *very* suddenly, and what might happen?

This question, mind, is not one that can receive a sensible answer, and certainly not in a hastily penned entertainment of this kind, because of the complexity of the rest of the planetary machinery that controls the surface temperature of the Earth, and because of the mayhem – including climate mayhem – that one would reasonably expect to have followed that most singular and transformational meteorite impact on Mexico’s Yucatán peninsula. The kind of things that have been invoked are both dramatic cooling from the ‘nuclear winter’-like effects of suddenly injecting so much soot and dust and sulphate aerosols into the atmosphere, and a fierce pulse of global warming from the carbon dioxide released from instantly vaporized limestones in the target area, following the heat instantly generated by the impact itself – not to mention the effect of changes in albedo from devastated vegetation. And lest we forget, the Deccan Traps volcanoes were rumbling away mightily if unsteadily in the background too, to add into the mix.

But it’s precisely *because* of this gigantic tangle that a coolly distanced look at the passage of climate across the Cretaceous–Paleogene boundary becomes so desirable. And this is something that Lauren O’Connor and her colleagues have recently (2023) provided, from a couple of fossilized peat bogs, now compressed into coals, in Saskatchewan, Canada. At the time of the impact these would have been at a *moderately* safe distance – well, a thousand or so kilometres away – from Mexico, and the plants that made them clearly survived to carry on laying down carbon for another day, and indeed long after the disaster.

Quite how does one reconstruct climate from a coal? That is, reconstruct it *precisely*? – and go beyond the general linking of coal with warm and wet climates that geologists have made ever since the Comte de Buffon made the connection, in typically evocative style, in his 1778 *Les Époques de la Nature*, that first *properly* science-based history of our planet. The answer revolves around a kind of palaeothermometer based on a couple of formidable acronyms: the brGDGTs, which at least technically are short for branched glycerol dialkyl glycerol tetraethers, from which MBT’5ME – the unpronounceable thermometer itself – was derived. The brGDGTs don’t come from the plants themselves, but are lipids in the membranes of bog-dwelling bacteria, lipids which systematically changed their chemical structure as the outside temperature changed. Even more amazingly, the structure of these complex organic chemicals survived well enough over millions of years of burial to preserve a precise record of temperature, once interrogated by a mass spectrometer.

The coal preserved, too, the iridium layer, and so *almost*<sup>8</sup> the precise position of the Cretaceous–Paleogene boundary, and radiometric dating of similar coals suggest that a metre’s thickness most likely represents about 40,000 years. Sampling through about 70 centimetres’-worth, from just below the boundary to somewhat above, O’Connor *et al.* took palaeotemperature readings that represented, roughly, successive individual millennia, and then sat back and looked at the pattern.

One surprise: an observed lack of climate drama, even at that most percussive of geological boundaries. If there was a nuclear winter, or a pronounced hyperthermal event, it lasted

<sup>8</sup> The precise boundary position has been placed, ingeniously, at the very instant of impact (Molina *et al.* 2006), so the iridium layer everywhere must be slightly later, if only by a few hours or days in the case of Canada.



considerably less than a millennium. And, over the whole ~40,000 year record, the reconstructed temperatures bobbed a little, but the main pattern shown was of some progressive cooling over those first thirty or so post-impact millennia. As one seeks kill mechanisms in this most iconic of all mass extinctions, long-lasting dislocations of climate have dropped a little down the list of candidate assassins. Any post-sauropod effect remains *wholly unproven*, of course, though at least it is consistent with that 30,000 year cooling so neatly established via those mightily acronymic – and mightily enduring – organic molecules. Dragon's breath, indeed.

At least, then, the sauropod hypothesis has not been slain quite as mercilessly as was the dragon of legend by St. George, one of the recurring themes among the pre-Raphaelite painters. Not by William Dyce, as far as I am aware, but Edward Burne-Jones, Dante Gabriel Rossetti and Sidney Harold Metayard all had a go at re-telling this epic in glowing oilwork. Look, though, at these paintings, and all the drama is focused on the gallant knight and distressed damsel. The poor dragon portrayed is a feeble beast, a bit player to be sacrificed on the altar of high-minded chivalry. Let's even the odds a little, though: translate the scene back, far back, into the time of real dragons, and have the bumptious knight approach, with malice intended, a sauropod. Why, the next gale of post-lunch methane would simply sweep him away. That, for sure, would be a demonstration of ancient powers.

### Acknowledgements

I'm grateful to Karla Nielsen and Kristen Anthony of the Huntington Library, Art Museum and Botanical Gardens, California, for directing me towards William Dyce's most singular *Pegwell Bay*, and for Euan Nisbet's peerless guidance through the highways and byways of methane science.

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# Palaeontology's greatest ever graphs

## *The absence of evidence: spatial sampling bias in the fossil record*

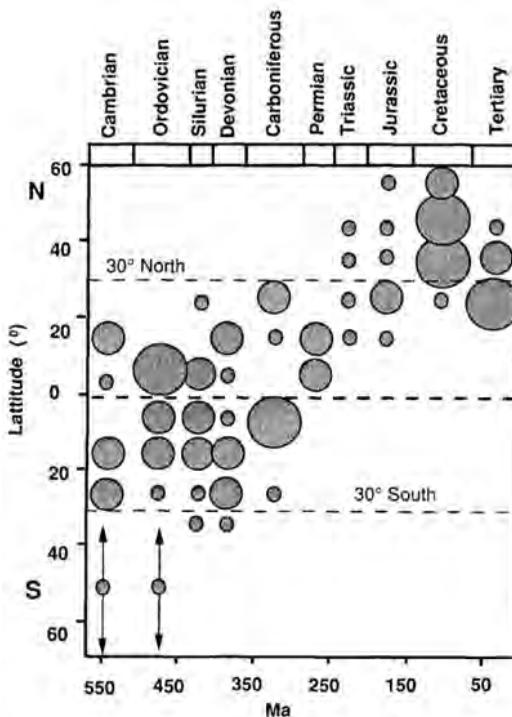
Sampling attempts to estimate the patterns and processes of a whole population based on a subset of individuals. To remain representative, a sample should meet a predetermined number of observations and not be subject to a biased sampling methodology. For centuries, palaeontologists have used the known fossil record – a sample of life in the geological past – to gain understanding of macroevolutionary patterns and processes. However, the quality and quantity of these data are influenced by geological and anthropogenic factors that generate an uneven temporal and spatial structure in the fossil record. Failure to correct for this structure results in a biased sampling of life in the past, and fundamentally contradicts the characterization of a sample.

The spatiotemporal variability of Earth System processes results in a heterogeneous distribution of rock volume, and a non-uniform sampling window of geographic regions, time periods and environments. Early work by Raup (1972) was amongst the first to identify the potential impacts of sampling biases on estimates of diversity, in which he outlined seven “sources of error”. One of these sources of error – sampling biases – came from the strong relationship between sedimentary rock volume and species richness (Raup 1972). Raup suggested that the number of taxa within a given time bin must be a function of the volume of sedimentary rock available for sampling. Since this early work, a suite of studies has demonstrated the impacts of variable sedimentary rock volume and surface exposure on estimates of taxonomic richness (Wall *et al.* 2009; Smith and McGowan 2011; Upchurch *et al.* 2011; Vilhena and Smith 2013; Dunhill *et al.* 2014). Unsurprisingly, these studies unequivocally confirm that a greater surface area of exposed sedimentary rock leads to a greater volume in collected species. At temporal scales, this relationship has the potential to drive observed trends in biodiversity patterns, including extinction and speciation events (Signor and Lipps 1982; Miller and Foote 1996; Sepkoski 1998; Alroy *et al.* 2001). However, this relationship also has the potential to influence our understanding of past macroecological patterns, such as the latitudinal biodiversity gradient, in which species richness decreases with increasing latitude.

A key example of this is how the palaeolatitudinal distribution of sedimentary rock volume has shifted throughout the Phanerozoic, tracked by palaeolatitudinal biodiversity estimates (Allison and Briggs 1993; Vilhena and Smith 2013). Such changes in the spatiotemporal distribution of sampling could lead to erroneous conclusions about ‘global’ diversity curves (Close *et al.* 2020a) and the shape of the latitudinal biodiversity gradient in deep time (Jones *et al.* 2021). In recent years, there has been growing interest and concern about the spatial structure of the fossil record, and how this might influence our understanding of past diversity and its distribution in the geological past (*e.g.* Vilhena and Smith 2013; Close *et al.* 2017, 2020b; Jones *et al.* 2021). Several articles have concentrated on documenting the potential impacts (Vilhena and Smith 2013; Jones *et al.* 2021), while others have focused on attempting to correct for it through implementing various subsampling algorithms (*e.g.* Close *et al.* 2017; Antell *et al.* 2020; Flannery-Sutherland *et al.* 2022). However, decades prior to this work, efforts to quantify and correct for heterogenous spatial sampling were already being made.



This leads us on to this issue's featured graphic which I believe to be without a doubt one of palaeontology's greatest ever graphs (Figures 1 and 2). In 1993 Peter Allison and Derek Briggs published an article in *Geology* in which they set out to quantify the palaeolatitudinal distribution of Phanerozoic marine sedimentary rock outcrop and generate a new 'global' diversity curve by accounting for differences in palaeolatitudinal sampling. They did so by factoring in the variation of species richness with latitude into data on the palaeolatitude of the geological outcrop sampled. This work represents one of the earliest efforts to quantify and correct for heterogenous spatial sampling bias in the fossil record, 30 years prior to today's efforts! The graphic demonstrates – with great simplicity – how the palaeolatitudinal distribution of Phanerozoic non-metamorphosed marine sedimentary rock outcrop in Europe and North America changes through time (Figures 1 and 2). In particular, it shows how almost all of this sediment was deposited in tropical latitudes during the Palaeozoic, shifting to temperate latitudes during the Mesozoic and Cenozoic. Why is this important? There is a whole suite of answers to this question, but if we imagine a simple scenario, where the steepness of the latitudinal biodiversity gradient has remained constant through time, sampling of the European and North American rock record would suggest a decline in diversity through time.



*Figure 1. Palaeolatitudinal distribution of Phanerozoic marine sedimentary rock outcrop in Europe and North America. Circles indicate the areas of outcrop: small < 100,000 km<sup>2</sup>; medium 100,000 to 500,000 km<sup>2</sup>; large > 500,000 km<sup>2</sup>. Arrows indicate potential variation in depositional latitude for areas of rapidly drifting continental masses. Figure from Allison and Briggs (1993), reproduced with permission (© Geological Society of America).*

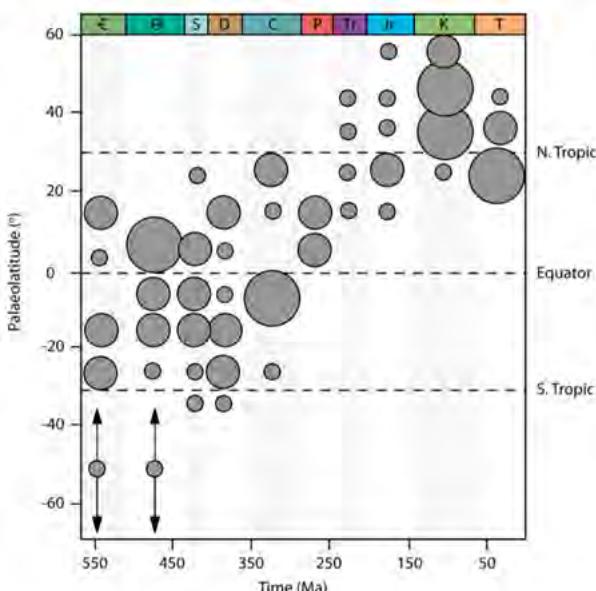


Figure 2. Palaeolatitudinal distribution of Phanerozoic marine sedimentary rock outcrop in Europe and North America. Circles indicate the areas of outcrop: small < 100,000 km<sup>2</sup>; medium 100,000 km<sup>2</sup>; large > 500,000 km<sup>2</sup>. Arrows indicate potential variation in depositional latitude for areas of rapidly drifting continental masses. Figure redrawn from Allison and Briggs (1993) by Dean (2018), and further modified by Jones (2020).

Today, the data to generate such a graphic could be pulled directly from online services such as Macrostrat ([<https://macrostrat.org>](https://macrostrat.org)) with outcrop area easily calculated from shapefiles in geographic information system applications such as QGIS or geospatial packages in R. However, in the 1990s access to such resources was not readily available. A couple of years ago, I was fortunate enough to hear directly from Peter how he pulled together the data to produce the featured graphic: it involved many evenings sitting in front of the television overlaying graph paper on geological maps, shading in squares, and a hell of a lot of counting. Essentially, a manual rasterize operation!

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# A new model for publishing

## The academic publishing ecosystem: a monoculture?

Academic publishing has been in the news this year, and not for the right reasons (e.g. Fazackerley 2023; Sample *et al.* 2023). In April 2023, the editorial boards of *NeuroImage* and *NeuroImage: Reports* resigned *en masse* over the imposition by their publisher of what they considered to be unacceptably high article processing charges (APCs)<sup>1</sup>. The following four months saw four more mass editorial board resignations, including one particularly relevant to our own discipline at the *Journal of Biogeography*. There, the Editor-in-Chief and two thirds of the editorial board had resigned by the end of August 2023 citing the publisher's imposition of "exorbitant" APCs, the automatic rerouting of rejected manuscripts to other journals, and a massive increase in workload for editors (Upton 2023). The wave of mass editorial board resignations over the last few months is a symptom of the domination of the academic publishing landscape by a few very large publishing houses with similar publishing models, who have become the gatekeepers of academic literature and a constraint on the agency of editorial boards.

Most editorial boards are snowed-under with work that is not properly recognized (e.g. de Knecht 2019) and have limited time and agency (e.g. Upton 2023) to innovate with new models for improved transparency, accountability, accessibility, article formats, or peer review in the publishing process. One outcome of this is increasingly pressured and stressed academics. Another outcome is an increasingly uniform publishing landscape; a monoculture with little room for community-driven innovation and development of healthier working practices. Generally speaking, diversity in a system is good for the health of both the system and those within it. Diversifying the options for publishing academic work may help foster a healthier and more robust publishing ecosystem.

## A new wave in academic publishing

There has been a boom in digital-only community-driven diamond open access (DOA) journals across the geosciences in the last few years, with the establishment of *Volcanica*, *Tektonika*, *Seismica*, *Sedimentologika* and *Geomorphica* (Farquharson and Wadsworth 2018; Rowe *et al.* 2022; Thomas *et al.* 2023). DOA means papers are free-to-publish and free-to-access, and authors retain full copyright of their work. There is no such thing as a free lunch, or indeed a free journal – DOA journals still require peoples' time, as well as money for one-off and recurring expenses like web-hosting, server space, digital object identifier (DOI) registration, and secure archiving services (e.g. Farquharson and Wadsworth 2018). *Volcanica*'s initial costs were estimated at £480 (about £580 today; Farquharson and Wadsworth 2018). So, whilst DOA publishing requires funding to run, the monetary cost is considerably lower than institutional journal subscription fees or APCs, for most journals (Khoob 2019).

As well as these recently-developed community-driven journals, there are several long-standing DOA geoscience journals, including *Palaeontologia Electronica*, *Acta Palaeontologica Polonica* and *Rivista Italiana di Palaeontologia e Stratigrafia*. *Lethaia* has also recently converted to this model. However, the majority of palaeontology-specific journals remain paywalled in some way (Tennant and Lomax 2019). DOA is a more equitable financial model from the perspective of authors

<sup>1</sup> <<https://imaging-neuroscience.org/Announcement.pdf>>.



and readers but, on its own, DOA only addresses financial accessibility and ownership aspects of publishing, leaving the rest of the traditional publishing model untouched.

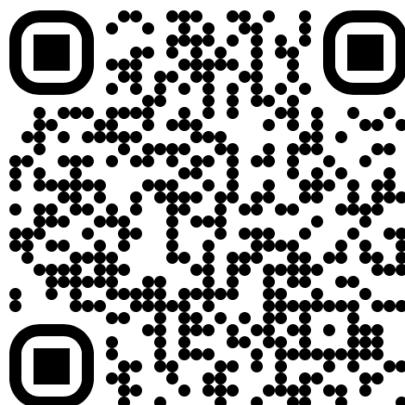
There have been recent significant innovations in other aspects of academic publishing, however, some of which have gained traction in other disciplines. Peer review is integral to academic publishing, and beyond the academy it is generally interpreted as ensuring the veracity of published work. Traditional single-blind peer review has well-understood problems (e.g. Smith 2006; Kern-Goldberger *et al.* 2022; Liu *et al.* 2023) and is typically opaque in both process and decision-making. Other review models tackle some of these bias and opacity issues. Notably, double-blind peer review has been shown to mitigate many issues of personal bias, when the double-blinding is done properly (Kern-Goldberger *et al.* 2022). Open interactive peer review can encourage more transparent, collegiate, and discursive review exchanges, and this model has been developed and used by Copernicus journals for over 20 years (Töpfer, accessed 29th September 2023). Neither of these models has been broadly applied, although double-blind reviewing is gaining popularity, and it is increasingly common for review exchanges, either signed or single-blind, to be published alongside an accepted manuscript. More transparency in the review process may go some way to tackling the caricatured but recognizable bigotry of ‘Reviewer 2’ and may lead to more constructive, professional, dialogues between authors and reviewers. Additionally, author contribution statements and the CRediT (Contributor Roles Taxonomy) system have been increasingly used to make clear ‘who did what’ and are a big step forward in accountability and attribution in the research process (Allen *et al.* 2014; 2019). However, author contribution statements are usually written after-the-fact and are susceptible to gaming and power dynamics in the academic system. More flexibility than is allowed under current publishing models could allow greater accountability regarding ‘who was involved and when’ in the research process.

Finally, most research papers follow the formal ‘introduction–methods–results–discussion’ layout and make it easy to (inadvertently) muddle the order in which ideas were developed or hypotheses and tests devised. This is important for readers to properly understand the intellectual progression of hypothesis generation, data collection, data analysis and hypothesis testing to differentiate between prediction and postdiction (Nosek *et al.* 2018), and this is especially crucial when interpretations hinge on the results of formal statistical tests (Head *et al.* 2015). Research pre-registration is a well-established means of tackling these problems in clinical psychological disciplines and is now available in some journals with a broader scope, like *PLOS One* (Heber 2020). Research preregistration means that research aims, objectives and methods can be presented and peer reviewed before data collection and analysis is conducted, with publication of the results guaranteed as long as the reviewed method is correctly applied.

Diversifying the academic publishing ecosystem involves tackling all of these and other aspects of the publishing process. Academic journals should aim to support good practice throughout the whole research process, from design, to data collection, to analysis, and dissemination. We think a new approach is needed in the academic publishing ecosystem; an approach which builds in good ethical practice, transparency and accountability, flexibility, and equitable access at the foundations. In our recent preprint, we outline a new model for publishing in palaeontology that includes a flexible structure that allows work to be shared at different stages of its development, research pre-registration, and peer review incorporating community discussion (Drage and Wong



Hearing 2023). We are not the first to propose most of these ideas, but we think that it is worth considering these problems and potential holistic solutions, and that a new journal with these principles at its heart would be the cleanest way to put some of these ideas into practice. We warmly welcome interest in helping with this work, and encourage people who may wish to contribute to the development of a new journal in this spirit to get in touch.



*Follow the QR code if you're interested in getting involved or hearing more!*

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# Spotlight on Diversity

## *Palaeontological Association initiatives promoting diversity and inclusion*

In recent years, diversity and inclusion have legitimately emerged as fundamental principles in academic and professional communities worldwide. The Palaeontological Association has taken significant steps to champion diversity, equity and inclusion. Through the implementation of a comprehensive Code of Conduct, the establishment of Career Development Grants, the introduction of equitable membership fee structures, the enhancement of accessibility to its Annual Meetings, and a revisited ranking scheme for its Undergraduate Research Bursaries, the Association has made commendable strides towards achieving its mission of promoting diversity and inclusion in the field of palaeontology.

**The Code of Conduct: cultivating a respectful environment.** The Palaeontological Association's commitment to diversity and inclusion is most evident in its new Code of Conduct. This code applies to all members, irrespective of their professional status, including students and retired members. By establishing clear guidelines on behaviour and professional conduct, the Association seeks to create an environment that is free from harassment and discrimination. The Code of Conduct serves as a foundational document that not only defines unacceptable behaviour but also delineates the consequences for violations. It sends a powerful message that the Association values the well-being and dignity of all its members, regardless of their background or status.

**Career Development Grants: empowering early-career researchers.** One of the Association's proactive steps in promoting diversity and inclusion is the introduction of Career Development Grants. These grants aim to support talented early-career researchers who have recently completed their PhDs and are pursuing a career in palaeontology. By providing financial assistance of up to £2,500 the Association empowers these individuals to undertake activities that enhance their CVs and increase their competitiveness in the field. This initiative recognizes the barriers faced by emerging palaeontologists and provides a valuable resource for those who are under-represented in the discipline.

**Membership fee structure: ensuring accessibility.** Acknowledging global disparities in income and resources, the Palaeontological Association Council has agreed to implement a fair and equitable membership fee structure. The Association will offer a 60 % reduction in membership fees for individuals from low-income countries, as defined by the World Bank. This move acknowledges the financial challenges faced by researchers from regions with limited resources and will enable their active participation in the Association's activities, fostering a more inclusive and globally representative membership base.

**Annual Meeting accessibility: bridging geographical boundaries.** To increase accessibility to its Annual Meetings, the Palaeontological Association has taken a significant step by reserving presentation slots for delegates from low- to lower-middle-income countries who cannot attend in person but wish to participate virtually. These delegates can register for



free and present their research remotely, breaking down geographical barriers and allowing scholars from disadvantaged regions to share their findings and engage with the global palaeontological community.

**Undergraduate Research Bursaries: a data-driven approach.** The Association has also made efforts to address historical under-representation by collecting protected characteristic data of applicants considered for Undergraduate Research Bursaries. These data inform decision-making in the review process: students from under-represented groups are given priority, ensuring that those from historically marginalized groups receive support and opportunities within the field.

The Palaeontological Association has demonstrated a commitment to promoting diversity and inclusion in the field of palaeontology. While commendable progress has been made, it is important to recognize that achieving a fully diverse and inclusive palaeontological community is an ongoing endeavour. Continued efforts and dedication are required to reach this goal. The Association's initiatives not only benefit its members but also contribute to the broader mission of creating a more equitable and inclusive scientific community.

**Farid Saleh**

*Diversity Officer*



# Mystery Fossil 30

## *The joy and despair of ‘mystery fossils’*

‘Mystery fossils’ in museum collections are a frequent phenomenon. It’s not unusual in a national collection, which is enormous and has grown constantly for over 150 years, for things to just pop up, seemingly out of nowhere, that fall under your jurisdiction as curator. You may have no idea what it is and/or where it came from. It slipped through the cracks at some point and now you’ve found it and need to sort it out. These are mystery fossils. Gifts from the past that can bring intrigue, discovery and wonder, but can also bring panic, boredom and stress in some cases. Every mystery fossil is unique, and they all require unique solutions because they can range from relatively simple cases, like a fossil that has already been properly curated but was misidentified and needs to move home to another drawer, to extreme cases of finding an un-labelled cardboard box containing a trilobite wrapped in newspaper written in a language you can’t read from a decade you weren’t even alive in (probably won’t be the last time that happens either).

Misidentification is common. I’m sure most readers involved in field- or collection-based work are guilty of abusing the poor old ‘wastebasket’ taxon. Plus, our understanding of taxonomy, systematics and stratigraphy are always evolving. Taxa are transferred between genera or even higher groups routinely with every new volume, and today’s *Agnostus pisiformis* Zone inhabitant may be much happier in tomorrow’s *Olenus cataractes* Zone given some new stratigraphical correlation. Occasionally something less mundane happens (if you find the scenarios above mundane of course). Recently a visiting researcher perusing *Mesolimulus* from the Solnhofen Plattenkalk noticed one specimen wasn’t a horseshoe crab at all – but it was a *thing* in the vague *shape* of a horseshoe crab. It is most certainly a fossil, but I have no idea what it is or where it should go (see photo accompanying this article). Do you recognize this fossil? Some kind of mollusc perhaps? Help!

The more extreme mystery fossils can cause endless headaches however, regardless of how fascinating or dull they appear. It’s very difficult to deal with a specimen that seemingly has no associated information regarding where it came from, how it got here, who collected it and when – this can cause panic. We must think about museum collections under responsible ethical frameworks. If there is no information accompanying this fossil, how can I even confirm its legality? Let alone its taxonomy or stratigraphy. Your best hope in a situation like that is that you know someone with the appropriate expertise who knows instinctively what you are dealing with and can help piece the puzzle together. Fortunately, it’s very rare to find something with a literal absence of data. Most of the time you have enough scraps to play a bit of ‘Scooby Doo’ and eventually, perhaps after many long, frustrating hours of digging, reach that satisfactory conclusion of unmasking the mystery of that fossil and sending it straight to jail (*i.e.* cabinet 9D, drawer 38). And it would have gotten away with it too if not for that meddling palaeontologist.

**Richie Howard**

*Natural History Museum, London, UK*



Mystery fossil from the Solnhofen Plattenkalk, Germany; the fossil is 28 mm in length and 14 mm wide. Photo courtesy of Richie Howard.



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



### The Micropalaeontological Society Annual Conference 2023

University of Southampton, UK and online 15 – 17 November 2023

This annual meeting brings together micropalaeontological workers to present on their latest research. Early-career researcher participation is strongly encouraged. The keynote theme is 'Bridging the gap: connecting microfossil groups, environmental systems and people' and keynote speakers include Flavia Boscolo-Galazzo, Mariem Saavedra-Pellitero, Peter Bijl, Elizabeth Sibert and Sandra Nogué Bosch. Four pre-conference workshops are planned followed by an icebreaker and then two full days of scientific sessions all at the National Oceanography Centre in Southampton. The conference will conclude with the TMS General Meeting. For information see: <<https://generic.wordpress.soton.ac.uk/tms2023/>>.



### Linnean Society Palaeobotany Specialist Group meeting

London, UK 22 November 2023

This year's meeting is being held to celebrate the contributions made to the field of palaeobotany by Professor Barry Thomas. For well over 50 years, Barry has been one of Britain's leading palaeobotanists, and has published numerous books and over 100 papers on the subject (this is not counting his many books and papers on living plants and geoconservation). His main specialism is the Palaeozoic lycopsids, especially their taxonomy, floristics and taphonomy, and he was a pioneer in the use of cuticles to study these fossils. He has also been active in promoting a wider public understanding of palaeobotany, especially during his time as Keeper of Botany at Amgueddfa Cymru – National Museum Wales in Cardiff. For more information contact Peta Hayes at the Natural History Museum, London.



### 8th International Meeting on the Valorization and Preservation of Palaeontological heritage (RIV3P8)

El Jadida, Morocco 23 – 25 November 2023

The RIV3P meeting (Rencontre Internationale sur la Valorisation et la Préservation du Patrimoine Paléontologique) takes place every two years, hosted by a Moroccan university. Chouaib Doukkali University will host this 8th edition, previously scheduled for 2020 but postponed due to the pandemic, and international researchers are welcomed. The objectives of the meeting are: reinforcement of cooperation between researchers and socio-economic actors; raising awareness and involvement of local communities in protecting and valourizing geoheritage through the creation of museums and geoparks; and approaching the pedagogical problem of palaeontology teaching which is about to disappear from Moroccan universities, becoming 'extinct' like the fossils. The main topic of the meeting is therefore 'Geoheritage and sustainable development'. A post-meeting excursion is planned. The meeting website is: <<https://sites.google.com/view/riv3p8>>.

**18th Conference on Australasian Vertebrate Evolution, Palaeontology & Systematics****(CAVEPS 2023)**

Melbourne, Australia    27 – 30 November 2023

CAVEPS is the biennial conference for vertebrate palaeontologists, Earth scientists, evolutionary biologists and fossil enthusiasts from Australasia and around the world. The conference will be co-hosted by Monash University and Museums Victoria, and held at Melbourne Museum, Victoria. CAVEPS 2023 will be a multidisciplinary forum that showcases the latest research on vertebrate morphology, phylogeny, systematics, evolution, development, zooarchaeology and palaeoecology. The meeting will begin with workshops covering the topics of: synchrotron, neutron and X-ray 3D imaging; and biomolecular analysis. The remaining three days will consist of general sessions, including plenary presentations, papers on all aspects of vertebrate palaeontology and a themed symposium.

The meeting website is: <<https://www.caveps.org/>>.

**200 Years of Dinosaurs: New Perspectives on an Ancient World**

London, UK    11 – 12 January 2024

To celebrate the 200th anniversary of the naming of the first dinosaur, the Natural History Museum, London will host an international conference showcasing the state-of-the-art in dinosaur palaeobiology. The event will include two days of talks, with eight invited keynote speakers whose work sits at the cutting-edge of the discipline and who also represent the breadth and depth of work done internationally and at a variety of career stages. The remainder of the talks will be chosen through application via abstract submission. The conference will also include an evening talk for the general public, and a conference dinner in the marine reptile gallery of the Museum. The aim of the meeting is to attract a diverse and international audience of vertebrate palaeontologists from around the world and from all career stages to network and share their work. A conference volume is planned.

For information see:

<<https://www.nhm.ac.uk/our-science/science-events/dinosaur-conference-2024.html>>.

**XXII EJIP (Encuentro de Jóvenes Investigadores en Paleontología)**

Igea, Spain and online    1 – 5 April 2024

Early-career researchers are invited to join this next edition of the EJIP (meeting of young researchers in palaeontology) in Spain. This meeting has traditionally been held in various locations on the Iberian Peninsula; last year it was held in Lourinhã, Portugal but now it returns to Spain, to Igea in La Rioja. Igea is known for its valuable palaeontological heritage, which includes outstanding dinosaur track sites, considered among the best in Europe. In addition, the Centro de Interpretación Paleontológico de La Rioja, the main venue of the meeting, houses some of the



most important fossils from the region such as Mesozoic reptiles, remains of fish and many other organisms from the past. Talks may be delivered in English, Spanish or Portuguese, but slides must be in English; posters can be presented in English or Spanish. Online participants will be able to follow the presentations electronically via broadcast using the Discord platform and virtual presentations are welcomed. A special volume of the *Spanish Journal of Palaeontology* is planned for after the meeting.

See the circulars online at: <<https://xxiiejip2024.com/>>.



**XV International Palynological Congress and XI International Organization of Palaeobotany Congress (XV IPC-XI IOP)**  
Prague, Czech Republic    25 – 31 May 2024

This congress celebrating 200 years of modern palaeobotany, originally scheduled for September 2020, was postponed until May 2021; however, due to the ongoing pandemic the organizers made the decision to move the event to 2024. This date has also been chosen to reflect the decisions of the parent organizations (IFPS and IOP), and the fact that the online European Palaeobotany and Palynology Conference in Stockholm took place in 2022. These conferences are held biannually and usually alternate between European and world events. More information is available via the website; abstract submission and early bird registration end on **1st December 2023**.

Meeting website: <<https://www.prague2020.cz/>>.



**3rd World Biodiversity Forum special session: Insights from the past for a better future**  
Davos Congress Centre, Switzerland    16 – 21 June 2024

More than 60 thematic sessions will bring together international researchers, practitioners and policy makers of a variety of disciplines. During this edition of the forum there will be a special session on palaeontology: BEF\_1.5 'Insights from the past for a better future'. Species are going extinct at an accelerated rate and despite some success stories, current conservation efforts have not been sufficient to halt extinctions, with more species threatened every year. However, these extinctions do not occur randomly in the tree of life, with some species being more vulnerable than others. What determines this extinction selectivity can provide key clues to target conservation actions. Given that 99 % of species that have ever lived are already extinct, the fossil record can offer unique insights to better understand extinction mechanisms. This session focuses on the use of the fossil record to better understand extinction mechanisms and its potential applicability to inform conservation today. Contributions from early-career researchers are encouraged, as well as both near-time and deep-time perspectives on ecological and evolutionary processes. Abstract deadline is **19 November 2023**.

Meeting website: <<https://worldbiodiversityforum2024.org/>>.



### 12th North American Paleontological Convention (NAPC)

University of Michigan, USA    17 – 21 June 2024

The 12th NAPC will bring together professionals, graduate and undergraduate students, amateur palaeontologists and interested members of the public from all over the world. The meeting covers all branches of palaeontology, including vertebrate, invertebrate, palaeobotany, micropalaeontology, palaeo-related organic and inorganic geochemistry, palaeoecology, palaeoclimatology and astrobiology. The meeting provides a forum for exchanging research findings, defining future directions and fostering relaxed interactions in the palaeontological community at large. A wide variety of symposia and topical sessions are planned, along with associated workshops and other forums, varied field-trips, and technical workshops.

Meeting website: <<https://sites.lsa.umich.edu/napc2024/>>.



### Turtle Evolution Symposium (TES 2024)

Fribourg, Switzerland    26 – 29 June 2024

The goal of the Turtle Evolution Symposium is to present, promote, communicate and discuss the latest advances and original results on the evolutionary history of turtles, from their origin and early evolution until the present. This is an international meeting that brings together turtle researchers and students from around the world working on specific topics such as anatomy, evolution, nomenclature, taxonomy, phylogenetic relationships, the fossil record of extinct turtles, conservation and more. The symposium will feature a one-day field-trip to the Jura Mountains led by Jérémie Anquetin, and keynotes will be given by Juliana Sterli, Adán Pérez García and Tyler Lyson. Contact Serjoscha Evers at the University of Fribourg for more information.

First circular is available here: <[shorturl.at/uALT8](https://shorturl.at/uALT8)>.



### Ecological uniformitarianism – help or hindrance to palaeoecology, palaeoclimatology and conservation biology?

Virtual (hosted by the Palaeontological Association)    2 – 3 July 2024

Following the success of a pump-priming event in 2022 (<<https://youtu.be/kYEP1-aF4sQ>>), this online meeting will reunite a diverse community of Earth and life scientists to discuss the stability of ecological niches. Earth scientists have long taken the (pseudo-)uniformitarian view that niches are stable and hence that the environments of fossil organisms can be interpreted from the ecology of modern counterparts. Niche change is, however, demonstrated by many invasive species. Whether niches are stable or labile has major implications not only for interpreting past environments but also for predicting future communities in the face of ongoing climate and other environmental change. The organizers now invite offers of talks (deadline 12th February 2024) concerning niche stability/lability over various taxa and timescales to complement invited lectures from a set of prestigious speakers. Online publication of the proceedings is planned under one of the Association's titles.

Meeting website: <<https://www.palass.org/meetings-events/ecological-uniformitarianism>>.

**The 175th anniversary of the Maastrichtian Stage – a celebratory conference**

Maastricht, the Netherlands 8 – 11 September 2024

In the summer of 1849, Professor André Hubert Dumont of Liège, Belgium first used the phrase ‘système maastrichtien’, while doing geological mapping in the Belgium/Netherlands border area near Maastricht. In the three decades that followed, a wealth of stratigraphical and palaeontological data were published. In fact, the same may be said about recent progress in these fields. New information on the type Maastrichtian, including a chemostratigraphical analysis, clearly shows that interest in this latest Cretaceous time slice is still very much alive and kicking. Therefore, this celebratory conference has been organized, commemorating the 175th anniversary of the stage, for participants to discuss recent progress and outline future research in an informal setting. A special issue of the periodical *Netherlands Journal of Geosciences*, covering various aspects of the Maastrichtian, will be produced. Two days of oral and poster presentations, an icebreaker party and dinner, plus a full day of fieldwork at two localities in the area are scheduled.

For more information see: <<https://www.nhmmaastricht.nl/maastrichtian-anniversary/>>.

**7th Triennial Mosasaur Meeting – a global perspective on Mesozoic marine amniotes**

Maastricht, the Netherlands 12 – 15 September 2024

Early in May 2004, some 25 scholars of mosasaurid reptiles assembled for the first edition of what was then referred to as the ‘Mosasaur Meeting’ at the Natural History Museum of Maastricht. An aptly chosen venue – after all, the first fossils of ‘Meuse lizards’ were unearthed there in the latter half of the eighteenth century. The 2004 meeting was the first in a series of triennial workshops, in Europe and North America, for which it was later decided to include also talks on non-mosasaurid marine amniotes of Mesozoic age. The last meeting prior to the pandemic took place in Drumheller, Canada in May 2019, and although not conforming to the three-year turnaround schedule, the next meeting in September 2024 is a special one in that it coincides with the 175th anniversary of the Maastrichtian Stage. During the 7th Triennial Mosasaur Meeting, all aspects of taxonomy, systematics, phylogeny, palaeobiology and palaeobiogeography of mosasaurs (and other Mesozoic marine amniotes) will be considered. Two full days of oral and poster presentations, an icebreaker reception and conference dinner, plus a full day of fieldwork at two localities in the Maastricht area are scheduled.

For information see the website: <<https://www.nhmmaastricht.nl/mosasaur-meeting/>>.

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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



## 67th Annual Meeting of the Palaeontological Association

University of Cambridge, UK 11 – 15 September 2023

Returning to Cambridge after more than two decades, the 67th PalAss Annual Meeting, hosted in September, was a wonderful start to the new academic year. Lasting a full five days, the meeting was attended by over 300 conference-goers, with over 90 talks and 140 posters presented! The conference began on Monday 11th September with the Early-Career Researcher Event, hosted by **Liz Hide**, and focused on how the next generation of palaeontologists can navigate the changing academic landscape. Topics included a workshop on how best to pitch your research to contemporaries and senior academics alike, discussions on how to consciously address biases and barriers for access in research, the impact of climate change on future research, and a presentation by Elsevier on publishing. The session was well attended and thought-provoking for all.



*Liz Hide leading the ECR event 'Palaeontologists for the Future'. Photo by Nicola Vuolo.*



*Exhibitions on display at the Sedgwick Museum, Cambridge, created in just a couple of hours at the Annual Meeting's pop-up museum workshop. Participants were really proud of what they achieved! Photo credits: Harriet B. Drage.*



On the Tuesday, the wide variety of museums available in Cambridge permitted several concurrent tours to the collections of the Sedgwick Museum (and Research Centre), Zoology Museum, CASP and the British Antarctic Survey, often examining specimens generally not visible to the public. Workshops on Photogrammetry, Best Practices in Taxonomic Research, Palaeoart, and Palaeontological Communication were fully booked, and enjoyed by all who attended. Many thanks to those who hosted for providing a thoroughly enjoyable suite of pre-symposium events. The Symposium took a new format this year; chaired by **Nick Butterfield**; the topic 'Ecosystem Engineering through Deep Time' was discussed by four invited speakers and in six additional volunteered talks. This change in format was a marked success, kick-starting new projects on ecosystem engineering for several of the presenting attendees. Following this, the icebreaker drinks reception was held in the Sedgwick Museum and the Department of Earth Sciences – an ideal venue to hide from the rain and meet old and new friends alike!



*Discussions at the icebreaker in the Sedgwick Museum of Earth Sciences. Photo by Rocky Yu.*

Wednesday began with a session chaired by **Orla Bath-Enright**; we heard of exciting new work on the last universal common ancestor by **Edmund Moody**, the role of Ediacaran organisms on deep-sea ventilation by **Imran Rahman**, and the winning description of never-before-seen aspects of arthropleurid morphology by **Mickaël Lheritier**. **Ruolin Wu** presented novel molecular clock analyses with important implications for angiosperm evolution, **Tahlia Pollock** presented a fascinating adaptive landscape approach to understanding the evolution of sabre teeth, and the session concluded with a thought-provoking talk by **Eileen Straube** on the relationship between extinction risk and range.

After the obligatory consumption of coffee, the parallel sessions began and I attended Session 2C, hosted by **Fred Bowyer**. **Frances Dunn** provided an important new update to the Rangeomorph tree of life, and **Nile Stephenson** gave an enthusiastic talk on Ediacaran community succession. **Heda Agic** presented exciting evidence of a true diversity crisis in the terminal Ediacaran, and



remarkable specimens of *Namacalathus* were interpreted and presented by **Ruaridh Alexander**. The session was wrapped up by **Mariana Yilales**, who presented analyses that suggested there may not have been a terminal Ediacaran mass extinction event. After lunch, attendees of Session 3C, chaired by **Karma Nanglu**, heard about the convergent evolution of arthropod sensillae and vertebrate odontodes from **Yara Hardiy**, and the exciting discovery of preservation mechanisms for organic carbon from the Chengjiang Biota by **Xiangtong Lei**. **Joseph Moysiuk** presented evidence of substantially enhanced arthropod appendage integration in the Cambrian, an exciting possible driver for rapid arthropod evolution, and **Martin Smith** provided interpretation of putative early arthropod embryonic development. **Javier Ortega-Hernández** presented remarkable specimens from the Marjum Konservat-Lagerstätte, resulting from new investigations by the research group. The session concluded with a thought-provoking proposal by **Alavya Dhungana** on how to read the fossil record.

The Annual Address, this year given by **Gregory Edgecombe**, was entitled “Fossils, molecules and arthropods”, and highlighted the critical role fossils have in providing key morphological insights near the root of the arthropod tree. After this, most conference-goers quickly suited up before travelling to Girton College by coach for the Annual Dinner. The reception was held in the verdant Fellow’s Garden, before migrating to the Great Hall for the three-course dinner and President **Rachel Wood**’s speech. After-dinner activities included a palaeontological quiz (rapidly becoming an Annual Dinner staple after Cork 2022!), karaoke (hosted by **Catherine Boddy**) and attending the college bar before shuttling back to Cambridge centre. I would like to extend my gratitude to the catering team at Girton College for such an enjoyable evening.



Picturesque view of punting on the way to the conference venue. Photo by Jo Hellawell.

On Thursday morning, those attending Session 4B, hosted by **Valentina Rossi**, were treated to a whole session of taphonomy! First, **Alison Daley** gave a synopsis of taphonomic work conducted at the University of Lausanne, followed by **Rob Sansom**’s exciting talk on DNA barcoding as a powerful tool in understanding taphonomic processes. After this, I gave my presentation on how the proliferation of collagenases may explain the disappearance of exceptionally-preserved soft tissues from the rock record. Then, **Nora Corthésy** presented exciting evidence of rapid kaolin precipitation on carcasses at fast timescales, followed by **Daniel Falk**’s fascinating presentation explaining the taphonomic processes at Geiseltal. The session concluded with **Laura Devine**’s illuminating presentation on the role of continuous environmental disturbance on arthropod taphonomy.

Switching to Session 5C, chaired by **William McMahon, Sarah Jamison-Todd** provided a fascinating talk on the origin



and evolution of *Osedax* in marine reptile-falls, followed by a riveting window into ecosystem engineering in the Mesozoic by **Anthony Shillito**. **Xiaoting Xu** provided an exciting presentation into the cryptic insect diversity of the Tibetan Plateau in the Eocene, followed by **Romain Gougeon**'s comprehensive description of Ediacaran–Cambrian turnover in the ichnofossil record of Newfoundland. The session drew to a close with **Yorick Veenma**'s exciting talk linking ichnofossil motifs with sedimentary stasis – or lack thereof.

Returning from lunch to Session 6, chaired by **Erin Saupe**, **Andrej Spiridonov** provided an illuminating overview of Bretskyan hierarchical approaches to understand the spatiotemporal aspects of evolution. Following this, **Sihang Zhang** gave an exciting reinterpretation of the neural anatomy of myllokunmingids from the Changjiang Biota, **Pierre Cockx** presented an enlightening foray into the sensitivity of ancestral state estimation approaches, and **Bethany Allen**'s talk on the impact of fossil tips in phylogenies highlighted the importance of including palaeontological data in trait evolutionary analyses. **Amy Shipley** provided an exciting model for how ecosystems restructured in the wake of *Otodus megalodon* extinction, and **Fernando Blanco** concluded the session by highlighting the explanatory power of network analysis for explaining the functional aggradation of mammals in the Cenozoic.

The final (single) session, chaired by **Javier Ortega-Hernández**, started with **Paul Pearson**'s talk illuminating the impact of temperature as a key constraint on the efficiency of the biological pump. **Zekun Wang** provided an exciting numerical approach to quantifying a wide array of ichnogenera, linking modern-day signatures of known producers to fossils in deep time. This was followed by **Corentin Loron**'s ground-breaking approach to molecular fingerprinting of organic matter, here shown for the Rhynie Chert. Virtually, **Vera Korasidis** provided an exciting overview of the palynological signatures of the PETM, and the session concluded with **Laura Porro**'s illuminating presentation on mandibular functional performance across the water–land transition. The main conference concluded with the reveal of Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany, as the host of the 68th Palaeontological Association Annual Meeting in December 2024, to many cheers. An exciting time is sure to be had there – particularly with the abundance of Christmas Markets! The conference proper closed with the awarding of student prizes and concluding remarks from the President.

The post-conference field-trip to Sutton Hoo and Bawdsey, led by **Neil Davies** and **Simon Schneider**, was a substantial change in pace! Visiting the Red Crag, we observed large iron-cemented *Polykladichnus* and *Skolithos linearis* burrows, alongside numerous shell fragments, including recognizable fragments of *Neptunea contraria*, and reworked Eocene shark teeth. A quick visit to Sutton Hoo then for some archaeological interest – and stalling for the tide – before we visited Bawdsey. The cliffs had substantially retreated by the sea defences, but the section was still visible. Scouring the foreshore turned up pyritized wood and *Striatolamia macrota* teeth derived from the Eocene London Clay, with whale bone fragments and teeth from *Otodus megalodon* and *Isurus* from reworked lag beds at the base of the Neogene Red Crag. Overall it was a really enjoyable day and a great end to an interesting and stimulating week.

Enormous congratulations to **Alex Liu**, the student volunteers and the entire organizational team for putting on such a fantastic event. See you all at #PalAss24!

**Philip Vixseboxse (he/they)**  
University of Cambridge, UK



Delegates fossil hunting on the field-trip to Red Crag. Photo by Nicola Vuolo.



### Progressive Palaeontology

University of Liverpool, UK 1 – 3 June 2023

This year commemorated a significant occasion as the 40th anniversary of *Progressive Palaeontology* (ProgPal), and 22 years since the meeting was last hosted in Liverpool. ProgPal is the Palaeontological Association's annual conference for postgraduate research students who wish to present their results at any stage of their research. The conference is run by postgraduate students, and staff members are not welcome to attend, in order to foster an inclusive and welcoming environment and to allow students to present exclusively to their peers.

This year ProgPal was preceded by 'An Evening with Palaeontologists', a seminar that was open to the public for a small fee but free to attend for delegates; four esteemed speakers from notable universities in the northwest region of England took part.

**Alana Sharp** (University of Liverpool) opened the event by exploring the utilization of micro CT scanning in palaeontology, emphasizing Australian taxa. Subsequently, **Charlotte Brassey** (Manchester Metropolitan University) investigated the evolution and morphology of the baculum, followed by **Peter Falkingham** (Liverpool John Moores University) who provided



From left to right: Charlotte Brassey (MMU), Alana Sharp (UoL), Peter Falkingham (LJMU) and Katrina Jones (UoM). Photo by Amber Wood-Bailey.



guidance through the methodology of interpreting dinosaur locomotory patterns via footprints. Lastly, **Katrina Jones** (University of Manchester) presented insights concerning the role of anatomy in modern science and its capacity to solve enigmas pertaining to extant animals.

The first full conference day began with two workshops and a poster session, concluding with an icebreaker event. One workshop acquainted attendees with the technique of estimating body mass in extinct animals, while committee member **Matt Dempsey** conducted a session discussing the history of palaeoart and its utility for scientists. The icebreaker in the evening facilitated connections and social interactions among attendees over drinks.

Subsequent excitement unfolded the following day, initiated by a keynote address from **Sophia Anderson**, who introduced an innovative technique for grouping ecological factors, such as diet and locomotion, through cluster analysis. The day continued with a multitude of stimulating talks from attendees, which were streamed live to online delegates thanks to Palaeocast, who provided both equipment and technical expertise. As the day culminated, an annual dinner was held and we were able to recognize the commendable efforts of student presenters.



Committee member Matthew Dempsey provided the official welcome. Photo by Samuel Cross.



**Jake Atterby** was acknowledged with the Best Talk award, **Megan Jones** with Best Poster Award and **Laura Devine** with Best Lightning Talk. Their diligent efforts were rewarded with a complimentary *Peer J* publication.

*Jake Atterby (University of Birmingham), Megan Jones (University of Manchester), and Laura Devine (University of Portsmouth) were the recipients of the Best Talk, Best Poster, and Best Lightning Talk awards, respectively. Photo by Matthew Dempsey.*

The conference concluded the next day with an excursion to Llandudno in Wales, where delegates participated in a hike to explore for Carboniferous fossils and sampled the town's famous fish and chips.

Gratitude is extended to all speakers, attendees and sponsors who made the 40th anniversary of ProgPal a resounding success. Specific appreciation is directed towards the Company of Biologists,



the University of Liverpool's Alumni & Friends Fund, the Palaeontographical Society, *Peer J* and Palaeocast. Here's to another 40 years of progress and discovery in palaeontology!

**Amber Wood Bailey, Matthew Dempsey, Samuel Cross**

*ProgPal 2023 Organizing Committee*

*University of Liverpool, UK*



*Attendees prepare to ascend to the summit of the Great Orme complex in pursuit of Carboniferous fossils. Photo courtesy of Nathan Jeffery.*



**The Yorkshire Fossil Festival**

**Whitby, UK    10 – 11 June 2023**

On 10th and 11th June representatives of the Palaeontological Association attended the Yorkshire Fossil Festival held at Whitby Museum, Dock End and Pannett Park in Whitby, UK. This year the Festival was co-directed by Steve Cousins (The Rock Showman) and Liam Herringshaw, working together with Let's Circus, Whitby Museum (led by Roger Osbourne and Rebecca Bennion) and Scarborough Museums & Galleries. The free festival, open to the public, was a dynamic event combining science (in the form of national and local exhibitors such as the Geological Society and various museums), with the performing arts (including performances by Let's Circus and geological singer-songwriter Olivia Rafferty). The PalAss brought an array of activities aimed at visitors of all ages, including a game to design an extinction-proof arthropod, a handling collection of trilobites, and the chance to design a creature for our resident palaeoartist, James McKay, to illustrate. Three volunteers recall the Festival here and look back on moments that had an impact on them.

**Amalia Robertson – MSc Museum Studies student, University of Leicester, UK**

I have wanted to attend a fossil festival for a while now, but various factors (including distance and funds) meant I wasn't able to. I was thrilled at the opportunity to not only attend but to be part of such an event. I am passionate about outreach and science communication, and I felt honoured to be a part of such an event; I loved every moment. I helped lead the 'Fossilization Frenzy' board game about how to become a fossil. This is where children pick a creature and take turns rolling some dice to work their way along the board. The aim is to become a fossil and make it into a museum collection; however, there are several obstacles that may stop you, including being eaten, being crushed, or becoming a fossil and not being collected or recorded properly. This aimed to teach children and adults how hard it is to become a fossil and make it into a museum. I enjoyed running this event as it attracted people of all ages, and it helped visitors realize that even if a creature makes it to become a fossil and get discovered it still might not end up in a museum. I can't wait to be a part of similar events in the future, it was very rewarding to interact with other like-minded people and inspire the next generation.



*Amalia Robertson interacting with children playing the 'Fossilization Frenzy' board game. Photo courtesy of Nicola Vuolo.*

**Annabel Hunt – vertebrate palaeontology PhD student, University of Cambridge, UK**

*Annabel Hunt volunteering on the 'Wheel of Misfortune' activity stand. Photo courtesy of Nicola Vuolo.*

choosing their creature's habitat and then finally spinning the wheel of misfortune to determine the fate of their creature. The purpose of the activity was to demonstrate how various environmental changes (such as sea level rise) will impact organisms disproportionately according to their environmental niche. For me, the most rewarding part of public outreach is being able to inspire young people to pursue a career in palaeontology. I was thrilled to speak to several young visitors who were passionate about becoming a palaeontologist and were eager to ask me questions about my own academic pathway. I am really looking forward to volunteering at future outreach events!

I was eager to volunteer at the Yorkshire Fossil Festival so that I could share my passion for palaeontology with children and adults alike. I have volunteered at a similar science festival previously, but this was my first-time volunteering at a festival where I was representing the Palaeontological Association. I supervised the 'Wheel of Misfortune' activity on the PalAss stand. This activity involved visitors building an arthropod (a mix and match activity consisting of various body parts),

**Leo Le Good – Library and Archive Assistant, Natural History Museum, London, UK**

I have a background in Natural Sciences and especially enjoy fossils and geology. The chance to share this with other people, especially young people who might want to follow a similar career path, was very exciting. I learned a lot from my new colleagues, who all came to the Festival with their own particular areas of interest and expertise. My favourite part of the stall quickly became our little handling collection of trilobites:



*Leo Le Good volunteering at the Festival in Whitby Museum.  
Photo courtesy of Nicola Vuolo.*

unsurprisingly, many of the young soon-to-be-palaeontologists knew exactly what they were, but the various uncertain responses from others ("is it a prehistoric woodlouse?") led to some fantastic discussions, comparisons and questions. I can honestly say I learned as much from the visitors as they did from me. From meeting and working with other volunteers, to visiting a new place, to (the best part) interacting with and encouraging people of all ages to pursue their interests, working with PalAss for this event was extremely rewarding. I am keen to do more outreach in future, and if you are considering volunteering for PalAss, I would urge you to do so!

The Association usually has a presence at major fossil festivals and advertises for volunteers via the *Newsletter* and e-mails to student members. If you are a postgraduate student member and are interested in volunteering keep an eye out for future announcements!

You can download your own copy of the Fossilization Frenzy board game from Amgueddfa Cymru – National Museum Wales here:

<<https://museum.wales/learning/activity/349/Fossilization-Frenzy-Board-Game/>>.

**The 2nd Asian Palaeontological Congress (APC2)**

Tokyo, Japan 3 – 7 August 2023

The 2nd Asian Palaeontological Congress, held in Tokyo, Japan, centred around the theme of 'Science in Deep Time in a New Epoch'. The venue for the on-site sessions was the Hongo Campus of the University of Tokyo, which is the oldest national university in Japan. Spearheaded by the Palaeontological Society of Japan and the Asian Palaeontological Association, and with the backing of various Japanese institutions, the congress aimed to facilitate the exchange of recent advances in palaeontological studies across Asian regions. Moreover, it provided a platform for collaboration and communication among palaeontological societies in Asian countries, encompassing scientific research, education, fossil preservation and curation. Due to occur every four years, this congress marked only the second iteration following its inaugural success in Beijing, China, in 2019. The four-day event comprised parallel sessions encompassing talks and poster presentations across 22 distinct palaeontological topics. Additionally, participants were offered pre- and post-conference



excursions to explore Japan's captivating geological and palaeontological marvels in the Chubu, Hokuriku or Hokkaido areas. I had the privilege of attending alongside my supervisor **Mohd Suhaili Ismail** and presenting my doctoral research during one of the sessions.

On 3rd August the participants were welcomed for a reception and ice-breaking sessions in the Otemachi Bankei Plaza. The meet and greet session went smoothly, facilitated with a fine buffet meal and drink. On 4th August, when the meeting proper began, participants gathered at the Ito International Research Center, University of Tokyo, for the opening ceremony. The inaugural plenary session, led by **Xijun Ni**, explored 'Major Events of Human Evolution from Early Primates'. Following a brief intermission, attendees engaged in poster sessions that showcased a diverse array of captivating subjects. I was particularly intrigued by the array of graptolites and palaeoenvironmental studies, engaging in fruitful discussions with the presenters. The day progressed with oral sessions where I attended captivating talks on the geochemical proxies discovering palaeoecology, palaeoenvironment and their interactions.

There was another engaging day on 5th August, commencing with two plenary talks at the Ito Hall. **Maoyan Zhu** delved into 'Early Life and the Cambrian Explosion', followed by **Dong-Chan Lee's** presentation on the 'Palaeozoic Palaeogeography of the Korean Peninsula'. For the oral session, I had the privilege to present a talk on 'Basin History and Associated Macroevolutionary Events during the Ordovician–Silurian Transition in the Northwestern Domain of Peninsular Malaysia' during the session 'Palaeozoic macroevolutionary events' (IGCP653 Joint sessions). I was elated that the participants who joined my talk found my topic to be very insightful. Similarly, I also found many other talks during the sessions to be very interesting, such as the talk on a 'Comparative study of the Palaeozoic extinctions in view of non-bolide extraterrestrial cause' by **Yukio Isozaki**.

On 6th August we departed from the usual routine, with the first half of events conducted entirely online, including plenary talks, oral sessions and poster presentations. The plenary talk was held by **Ryusuke Motani** on 'Functional adaptations during the marine colonization and oceanic dispersal by Mesozoic marine reptiles'. The latter half resumed the standard format, featuring oral sessions on non-tetrapod vertebrate diversity, vascular plant evolution and open sessions. Afterwards, the participants were welcomed to an evening buffet-style banquet at the Otemachi Sankei Plaza. The banquet was complemented by an ensemble of small string and wind instruments by palaeo-musicologists and they gave a very entertaining performance.

On 7th August, which was the last day of the congress, participants were able to listen to two plenary talks, on 'Time machine biology: paleobiology, biodiversity and climate change' by **Moriaki Yasuhara** and 'Phylogeography of sand dollars from Taiwan' by **Jih-Pai Lin**. I also managed to attend several oral sessions afterwards, including on the topic of diversity change and evolutionary history of radiolarians, Mesozoic and Palaeozoic oceanic anoxic events and the open session. After the lunch



The author with his supervisor, Dr Mohd Suhaili Ismail, during the conference.

Photo © Muhammad Aqqid Saparin.



break, participants were invited to the Ito Hall for the general assembly and closing ceremony. During the closing ceremony, the host and venue for the third Asian Palaeontological Congress was announced, which will be Thailand. The organizers extended their gratitude to all the committees and participants for a successful congress before finally concluding the meeting.



*Group photo taken during the 2nd Asian Palaeontological Congress on 4th August 2023.*

*Photo © Palaeontological Society of Japan.*

My heartfelt appreciation goes to the Palaeontological Association for the Postgraduate Travel Fund, which partially supported my trip, and to my supervisor for his invaluable guidance throughout my studies. Equally, I am grateful to the APC2 organizers and committees for orchestrating a profoundly enriching and impactful congress experience.

**Muhammad Aqqid Saparin**

*Universiti Teknologi PETRONAS, Malaysia*



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The logo features a stylized red and white spiral shell on the left and a detailed illustration of a fossilized skull on the right. Below the illustrations, the words "Palaeobiology" and "University of Bristol" are written in a serif font.





## —OBITUARY—

### Simon Richard Appleton Kelly 1949 – 2023

On 19th May 2023, Simon R. A. Kelly passed away peacefully, surrounded by his family. He will be remembered for his significant contributions to Mesozoic biostratigraphy, as well as to the taxonomy and nomenclature of Jurassic and Cretaceous bivalves. Those who had the privilege to accompany Simon on fieldwork will have seen him in his element; he was an excellent field geologist and tireless collector of data and fossils. Simon's enthusiasm for his research, his cheerful and affable personality, and his consideration towards people of all kinds made him a wonderful presence. Simon is survived by his wife, Christina, and their three sons Thomas, Edward and Patrick.

Born in Chester in the UK on 16th October 1949, Simon was educated at schools in Arnside and Marlborough. In 1968, Simon began reading geology at the University of Oxford, St Edmund Hall, graduating in 1971. He undertook a PhD at Queen Mary College, University of London, under the supervision of Peter F. Rawson, who remained a life-long friend. His PhD thesis was titled 'The bivalves of the Spilsby Sandstone and contiguous deposits in eastern England', and was completed in 1977. Following two years working as a demonstrator at the Department of Geology, Goldsmiths College, University of London, he took up a position as Assistant in Research to the Woodwardian Professor, Harry Whittington, at the Sedgwick Museum, University of Cambridge. Simon held this position for five years before enlisting at W. Brian Harland's Cambridge Arctic Shelf Programme (CASP) in 1984 as a research palaeontologist and curator of the rock collections. Between 1988 and 1994, Simon switched Poles, joining a research project at the British Antarctic Survey (BAS) as a palaeontologist, which involved fieldwork on Alexander Island, Antarctic Peninsula. Following his time at BAS, Simon rejoined CASP in much the same capacity as before. During the latter stages of his CASP career, Simon played a pivotal role in planning and overseeing the completion of a new rock store to house the CASP collections; a building which today bears his name. Having seen the rock store finished and his treasured rock collections safely moved, Simon officially retired in 2020. In early 2022, Simon was diagnosed with cancer, and his presence in his CASP office became more sporadic. Nonetheless, he continued working on scientific publications.

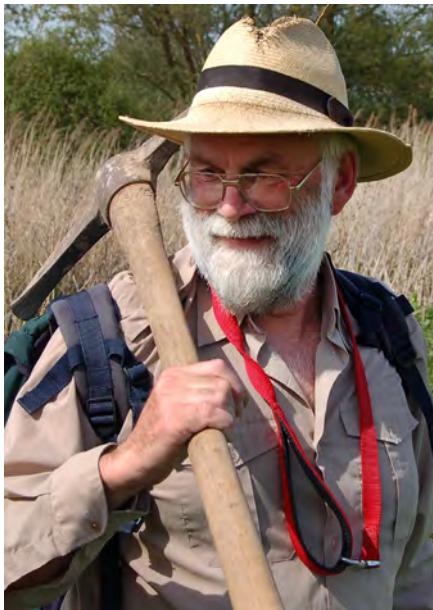


Photo courtesy of Manja Hethke.



From his early days as a scientist, Simon had a passion for fossil bivalves and recognized these humble and ubiquitous invertebrates as excellent palaeoenvironmental indicators and useful biostratigraphic tools in Mesozoic sedimentary successions. During the course of his stratigraphic studies, he developed an interest in ammonites and belemnites, and these three molluscan groups became the focus of his research. With a keen eye for detail, he published on their taxonomy, nomenclature, biostratigraphy, biogeography and palaeoecology, and on bivalve trace fossils. Many of the bivalves he studied for his PhD had close ties to the Arctic realm – and so had Simon. During his years with CASP, he joined field parties to Svalbard, Arctic Canada and to his ‘second home’, East Greenland. As an avid mountaineer, he greatly enjoyed all aspects of life in the field, including the deep snows of spring in Greenland, the perpetual daylight of Arctic summers and even the dehydrated food rations. Arguably, Simon’s most prestigious discovery is the Early Cretaceous cold seep carbonates of Wollaston Forland, Northeast Greenland, and their biota, including his most treasured bivalve, *Caspiconcha whithami* Kelly, 2000.

Aside from more than 60 journal articles and book sections, Simon contributed to nearly 100 scientific reports for CASP, BAS and other organizations. More than 11,000 fossil and rock samples in the CASP collection alone are testimony to his remarkable efforts. For his achievements in Arctic and Antarctic palaeontology, Simon was awarded a Polar Medal in 2000, and a second clasp to his medal in 2022.

Simon loved to entertain his listeners at conferences, on field-trips and in the pub with scientific discoveries on fossil walking sticks (heteromorph ammonites) and ‘Big Mac’ (the bivalve *Mclearnia*), richly garnished with anecdotes from history and fieldwork, and a number of good jokes. His expert knowledge and jovial personality will be missed in equal measure.

#### **Simon Schneider and Michael A. Pointon**

CASP, UK

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Simon in the field. Photo courtesy of Andrew G. Whitham.



# Research Grant REPORTS

## *Changes in functional morphology during ontogeny – a case study in ornithischian dinosaurs*

**Stephan Lautenschlager**

*School of Geography, Earth and Environmental Sciences, University of Birmingham, UK*

Ornithopoda is a clade of herbivorous dinosaurs with a fossil record that extends from the Early Jurassic to the latest Cretaceous and a near-cosmopolitan distribution. Although early members are characterized by small bipedal taxa, ornithopod dinosaurs became one of the dominant groups of terrestrial herbivores during the Cretaceous (Norman 2004; Norman *et al.* 2004). Ornithopod dinosaurs have been known for nearly two centuries now, but our knowledge of the anatomy, evolution and phylogeny of this group has notably increased in the last decades. In particular, for derived ornithopods the Hadrosauridae, “more is known ... than about virtually any other group of dinosaurs” (Horner *et al.* 2004). However, early evolutionary stages and ontogeny of more basal ornithopod dinosaurs, such as Iguanodontia, are still not completely understood, not least due to the fragmentary fossil record.

Dryosauridae are a group of basal iguanodontians, that have been discovered in deposits of Africa, North America and Europe dated to the Middle Jurassic through to the Early Cretaceous (Janensch 1955; Norman 2004; Ruiz-Omeñaca *et al.* 2006; Barrett *et al.* 2011; Escaso *et al.* 2014). Currently, there are only six recognized genera that belong to Dryosauridae (*Callovosaurus*, *Dryosaurus*, *Dysalotosaurus*, *Elrhazosaurus*, *Kangnasaurus*, and *Valdosaurus*), many of which are represented by isolated and fragmentary material only, offering little insight into their ontogeny, functional morphology and evolution. In contrast, *Dysalotosaurus lettowvorbecki* from the Upper Jurassic Tendaguru Formation of Tanzania is documented by thousands of bones belonging to over 100 individuals collected during the German Tendaguru Expeditions of 1909–1913 (Janensch 1955). Despite this wealth of information, existing studies mostly consist of histological and descriptive works (e.g. Hübner and Rauhut 2010; Hübner 2012), whereas only a few studies have addressed the functional morphology and its changes throughout ontogeny.

For this ongoing project, an articulated skull of a juvenile individual of *Dysalotosaurus* (Figure 1A) has been reconstructed using digital methods (Lautenschlager 2016). For this purpose, the individual skull bones were segmented from computed tomography (CT) data. In a second step, the bones were re-articulated, cracks and breaks removed, missing elements duplicated and elements retrodeformed. The fully restored skull and jaw of the juvenile individual (Figure 1B) were then used to reconstruct the jaw adductor musculature. Jaw muscles were reconstructed by identifying corresponding muscle attachment sites on the skull and jaw (Figure 1C). These attachments were



then connected using digital tools and fleshed out to create three-dimensional muscle bodies (Lautenschlager 2013). Based on these reconstructions the muscle forces of the jaw adductors could be obtained (which were subsequently used for finite element analyses) and the maximum jaw gape calculated. Using the restored skull model and the reconstructed soft tissues, a biomechanical model was constructed and virtual stress tests conducted to evaluate the functional performance of the skull during feeding simulations.

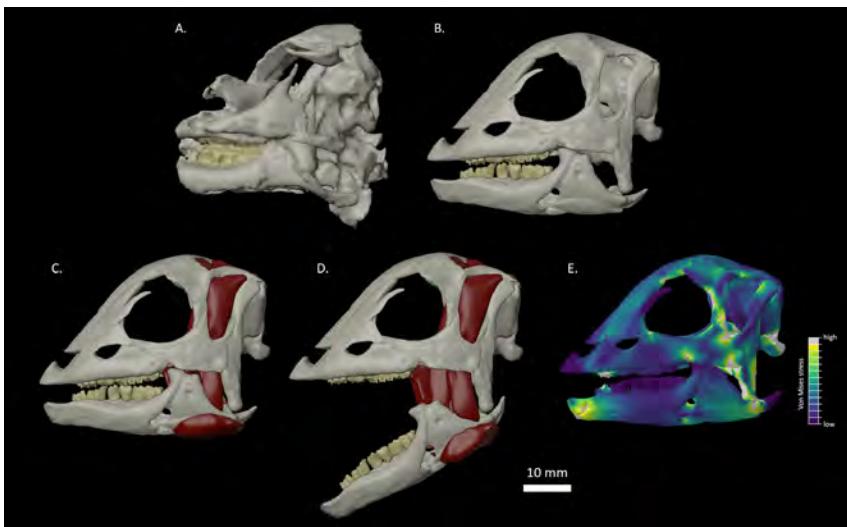


Figure 1. Digitally reconstructed skull of a juvenile *Dysalotosaurus lettowvorbecki*. A. Specimen as preserved. B. Digitally restored model. C. Specimen with reconstructed jaw musculature. D. Estimated maximum gape angle based on muscle tension. E. Finite element model showing stress distribution for a simulated feeding scenario.

Results of the different analyses show that the juvenile *Dysalotosaurus* with a skull length of c. 50 mm had a relatively high bite force of c. 70–165 N and a maximum jaw gape of 50–60 degrees (Figure 1D). The biomechanical analysis revealed that the skull was well equipped to deal with these relatively high loads during biting (Figure 1E). These first results indicate that juvenile *Dysalotosaurus* was likely capable of feeding on a variety of vegetation and plant matter. Future ongoing work to complement the findings includes the digital reconstruction of an adult individual to evaluate the changes of the functional properties with ontogeny.

It should be noted and acknowledged that the material is of Tanzanian origin and, in a colonial context in the early twentieth century, was brought to Germany where it is now housed in different museums including the Museum für Naturkunde in Berlin. The Museum is working with a team from the National Museum of Tanzania regarding the future of the Tendaguru specimens. In addition, this study and any publications resulting from it will include researchers from the National Museum of Tanzania and I am developing concepts to share material and data with the local community.



## Acknowledgements

I would like to thank the Palaeontological Association for supporting this research (grant number PA-RG202103).

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## *Characterizing the diagenesis of sex hormones*

### **Evan T. Saitta**

*Department of Organismal Biology & Anatomy, University of Chicago, USA*

### **Introduction**

Palaeontology is understandably weighted towards descriptive and observational studies of the fossil record. With sophisticated statistics and computation, new analytical equipment from engineering and chemistry, and controlled taphonomic experiments, rigorous hypothesis testing



was introduced to a field often disparagingly stamped as a collection of curiosities, rather than a rigorous science. However, one characteristic of science is still difficult to come by – the ability to readily make and test predictions about the precise contents of the fossil record. One might look at fossil biogeography/biostratigraphy, note a gap, and then prospect candidate geologic formations in the hopes of filling that gap, but this is extremely dependent upon luck. Entire research topics even focus on fossil record uncertainty, such as sampling biases present in extinct biodiversity. But what about observing the known fossil record, curated in vast global collections, and predicting what specimens (taxa, formations, age, taphonomic mode) will contain specific fossil biomolecules – a process likely less dependent upon the luck required for prospecting fossils in the field?

While studying under Jakob Vinther (University of Bristol, UK), the thermal stability of biomolecules through diagenesis as first approximation of fossilization potential was impressed upon me (Saitta *et al.* 2017). Biominerals apatite and carbonate are clearly capable of entering the geologic record, while RNA is the first organismal component to degrade. But there are organic molecules that are stable over millions of years and through deep burial diagenesis, such as melanin, informing us about palaeobiology. Steroid lipids are a prime example. Ancient sterols have been found (Melendez *et al.* 2013), and their diagenetically altered cholestanes persist from the Precambrian (Bobrovskiy *et al.* 2018). Considering this, my PhD thesis predicted that sex hormones, such as masculinizing androgens and feminizing oestrogens biosynthesized from cholesterol precursors (Payne and Hales 2004), would be stable through diagenesis and distinguishable from other steroid classes (cholesteroids, progestogens, corticosteroids), even after full alteration into hypothetical fossil steranes due to their unique carbon skeletons (Figure 1).

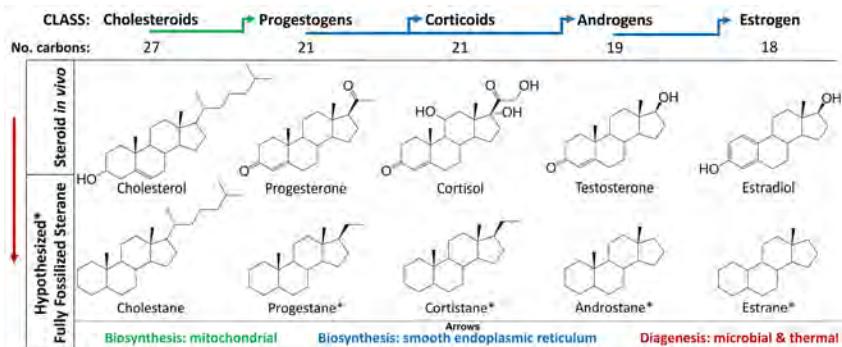


Figure 1. In vivo steroidogenesis (Payne and Hales 2004) and steroid fossilization through diagenesis (Melendez *et al.* 2013). Fossilized cholestanе has been observed deep into the fossil record. \*Otherwise, fossil steranes can be hypothesized after predictable saturation of double bonds and loss of reactive functional groups. Even fully altered sex hormones would still be identifiable.

## Methods

Powdered oestrogen standard (Sigma-Aldrich) underwent high-temperature, high-pressure maturation in sealed Au-Pd capsules with Richard Brooker (University of Bristol) to simulate diagenesis. Modern bird bones from Thomas Gnoske (Field Museum, Chicago, USA) underwent both sealed-capsule and bentonite clay-encased maturation, a method Thomas Kaye (Foundation for Scientific Advancement, USA) and I developed to simulate diagenesis in realistic open systems (Saitta *et al.* 2019). Finally, nine Oligocene–Jurassic fossil crocodilian, fish, ichthyosaur, non-avian dinosaur



and mammal bones were obtained for testing. These fossils, the untreated and matured oestrogen standard, and fresh and matured modern bird bone (with surrounding clay as applicable) were taken to the University of Bristol's Organic Geochemistry Unit and specifically Ian Bull's lab, abraded to remove surface contamination, powdered, Soxhlet extracted to obtain their lipid content, and separated by column chromatography to yield an alcohol-dominated fraction. This fraction was later TMS-derivatized and analysed with gas chromatography-mass spectrometry by MSc student Holly Latta.

## Results and discussion

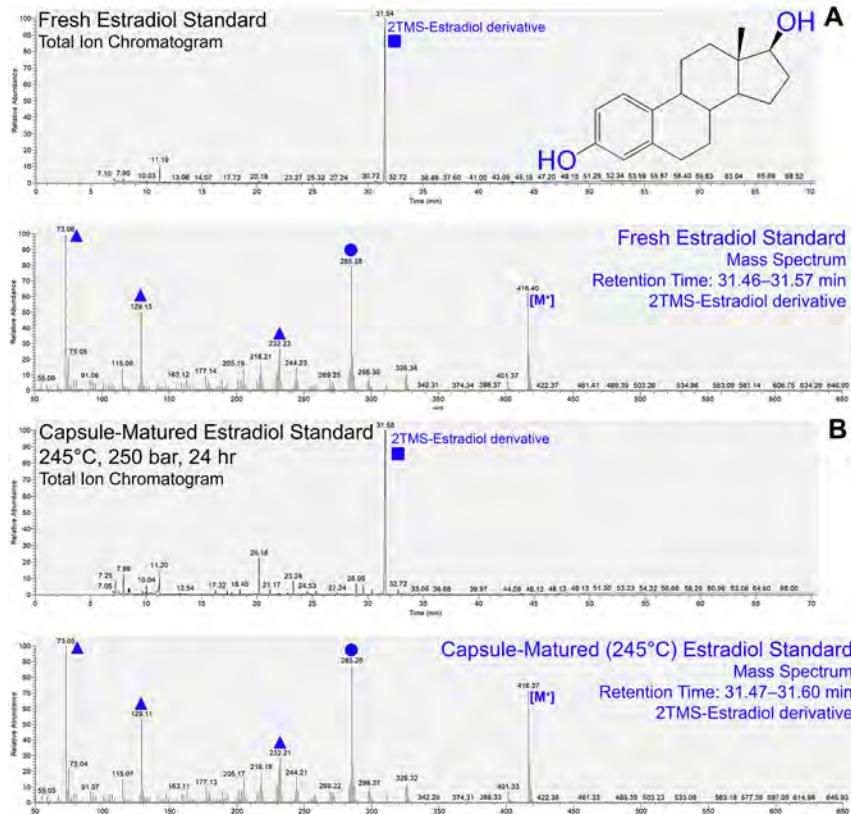


Figure 2. Fresh (A) and capsule-matured (B) estradiol standard powder yield GC-MS results that match the estradiol (2TMS derivative) spectrum in the NIST database. Averaged mass spectrum of major peak (retention time: ~31.5 min) shown below each total ion chromatogram. TMS groups replace hydroxyl groups (-OH, blue). [M<sup>+</sup>]: molecular ion peak.

Preliminary results were very promising. Oestradiol is extremely thermally stable (Figure 2), with little alteration up to 245°C, 250 bar and 24 hr, consistent with its predictable stability conferred by aromatic ring resonance. Key oestradiol ions are possibly more easily observed above instrument baseline in sediment-matured bird bone than in surrounding clay matrix, but further experiments



could better quantify this. Trace oestradiol was possibly detected in about half of the fossils (Oligocene Chadron Fm. mammal, Late Cretaceous Hell Creek Fm. *Triceratops*, Early Cretaceous Wessex Fm. dinosaur, Early Jurassic Blue Lias Fm. ichthyosaur) alongside cholesterol, indicating taphonomic environments conducive to steroid preservation.

With trace oestrogen preserving from possibly as old as the Jurassic, our results raise the possibility of using hormones to sex fossils biochemically, since males and females in vertebrates often have drastically skewed hormone ratios and absolute concentrations (e.g. Tanabe *et al.* 1981). Such an ability would have tremendous impact on palaeobiology because, even though an individual's sex is crucial primary information for ethology, ecology, etc., without dramatic sexual dimorphism, close modern relatives/analogues, or preserved anatomical markers of sex (e.g. claspers, *in situ* eggs, reproductive medullary bone), it is nearly impossible to sex most fossils. Doing so would allow for better estimates of sexual dimorphism magnitude in extinct taxa and for studying reproductive biology and sexual selection across macroevolution (Saitta *et al.* 2020).

I am excited to pursue further research, particularly characterizing degradation of the likely less stable testosterone, whose ketone group suggests it is more prone to convert toward its sterane form rather than remain unaltered like oestradiol. Additionally, I hope to increase sample size, lower detection limit for these compounds, and add further quantitative controls/internal standards.

### Acknowledgements

I am grateful to the Palaeontological Association for Research Grant PA-RG202202 that funded this work.

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# Small Grant REPORTS

## *Palaeoecological reconstruction of Quaternary herbivore communities in Siwalik Hills using ecomorphological approaches*

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Siwalik Hills (18.3–0.22 Ma) are one of the most comprehensively studied fluvial deposits globally and are well known for their rich fossilized vertebrate remains. Since the early nineteenth century scholars have been involved in extensive palaeontological surveys of the region, making comprehensive collections and detailed descriptions of the Siwalik fauna. Pilgrim (1910), for the first time, classified the entire Siwalik group into three stratigraphic units (faunal zones), which were further classified into various formations. These are, from oldest to youngest, Kamli and Chinji (Lower Siwalik), Nagri and Dhok Pathan (Middle Siwalik), Tatrot, Pinjor and Boulder Conglomerate (Upper Siwalik). Over the decades, Pilgrim's classification has been supplemented by magnetostratigraphic datasets, thereby enabling scholars to precisely identify the first and last appearance datums for various taxa and also use them for correlations between these formations (Keller *et al.* 1977; Opdyke *et al.* 1979; Barry *et al.* 1982).

This project aimed at understanding the palaeoecological implications for hominin dispersal(s) in the Pinjor Formation (2.58–0.63 Ma) of northern India. The Pinjor Formation comprises the only known record of Quaternary mammalian fauna from the Siwalik Hills. It was initially identified in the region north of Chandigarh in northern India. Since then, Pinjor fauna has been reported from near Jammu in India (Nanda 2002), Pakistan (Dennell *et al.* 2004), Nepal (Corvinus and Rimal 2001) and the Irrawaddy Valley in Myanmar (Colbert 1943). However, as it is most well-developed near the town of Chandigarh, this region was identified as the primary study area (Figure 1).

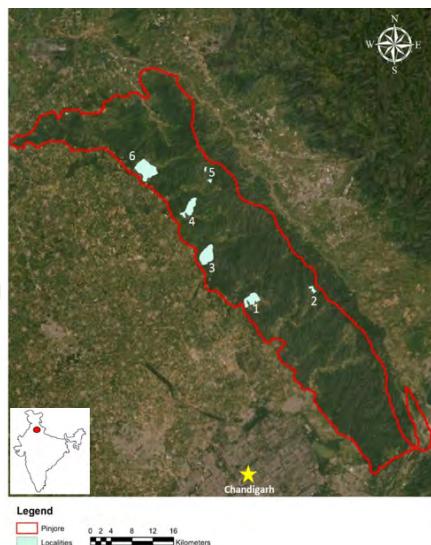


Figure 1. Map of the study area.



Field surveys were resumed in this region with a primary objective to better understand the taxonomic diversity, biochronology and palaeoecology of the Pinjor Fauna, thereby improving our knowledge regarding local terrestrial events and their implications for hominin dispersal(s) through the region. As a part of the field surveys, previously known fossil localities in the study area were revisited, and six new localities were identified. A total of >1,000 fossil specimens were collected in association with a secure and traceable stratigraphic context. These include cranial, post-cranial and dental remains of hippopotamids, bovids, cervids, equids, giraffids, rodents, proboscideans, ratite eggshells and molluscs.



Figure 2. A bovid skull from the Upper Siwalik Hills north of Chandigarh, curated at the American Museum of Natural History.

However, about 60 % of the new assemblage (mostly post-cranial remains) is highly fragmented and undiagnostic in nature. In order to make the palaeoecological dataset more robust and interpretations accurate, I analysed Upper Siwalik collections from the study area with a well-defined context, curated at the American Museum of Natural History, USA, Yale Peabody Museum, USA and Panjab University, India. A total of 602 dental and 94 post-cranial specimens were analysed from these museums. Dental specimens were analysed for palaeoecological reconstruction using the hypsodonty index, mesowear and eometrics. Specific dental specimens from the Yale Peabody Museum were also sampled for stable isotope analysis. Results for these are still awaited. However, preliminary ecomorphological analysis in conjunction with previous isotopic studies from the study area (Patnaik *et al.* 2019) indicate that the Pinjor Formation supported a wooded grassland type of biome with a subtropical to tropical climate and high monsoonal variability. Even though the landscape was dominated by grasslands, these were interspersed with gallery forests. Furthermore, there is a close affinity between the palaeobiome of Early Pleistocene hominin-



bearing sites of Africa (Koobi Fora, Natoo Formation and Swatkrans Cave) and that of the Pinjor Formation, indicating presence of a suitable landscape without any ecological/terrestrial barriers for hominins to disperse through, further strengthening the possibility for finding evidence of early hominin presence in the region.

This research is ongoing, with preliminary results being presented at various conferences such as the Society of Vertebrate Paleontology Annual Meeting 2022, the EAAPP (Eastern Africa Association for Palaeoanthropology and Palaeontology) meeting 2022 and the INQUA (International Union for Quaternary Research) meeting 2023.

### Acknowledgements

I would like to acknowledge the support of curatorial staff at the American Museum of Natural History (AMNH), Yale Peabody Museum (YPM) and Panjab University. I am greatly thankful to Judy Galkin at the AMNH and Daniel Brinkman and Vanessa Rhue at the YPM for their support and assistance during my visit to the collections. I am also grateful for the Sylvester-Bradley Award number PA-SB202102 that enabled this work.

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# Taxonomy and phylogeny of enigmatic taxa from the late Miocene of Tuscany

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## Introduction

Since the description of the *Oreopithecus* dental material (Gervais 1872), numerous studies have aimed to investigate the evolution of fossil endemic mammals from the Late Neogene of the so called Tusco–Sardinian archipelago, in the western Mediterranean Basin (Weithofer 1888; Rook *et al.* 2000; Abbazzi *et al.* 2008; Rook 2016). Despite these efforts, no conclusive evidence has yet been provided that confidently addresses the debate about the origin of some of the species characterizing the *Oreopithecus*-faunal assemblages, such as the enigmatic giraffid-like *Umbrotherium azzarolii*. Archival research at the Naturhistorisches Museum Basel, Switzerland has enabled the rediscovery of an unpublished fauna from the latest Miocene lignite levels (V1) of Botro della Canonica, 60 km south of Pisa, Italy that contains the cranial remains of a giraffid and several other species. The new giraffid specimens were described and compared with the type material from Casteani and the material collected from Fiume Santo to provide new considerations on the taxonomy and affinities of this endemic mammal, and the relative palaeobiogeographic implications (Pandolfi and Rook 2023a). Other taxa will be the focus of several publications in the future as well as the revision of the biochronology of the mammal assemblages from the endemic Miocene palaeobioprovince (see Pandolfi and Rook 2022a; 2022b; 2023b).

## Materials and methods

The studied material is stored in the Naturhistorisches Museum Basel and at the Department of Earth Sciences in the University of Florence, Italy. Comparisons were made with type material from Casteani, stored at the Natural History Museum, Geology and Palaeontology section, University of Florence; the specimens described by Abbazzi *et al.* (2008) and stored at Soprintendenza Archeologia Belle Arti e Paesaggio per le Province di Sassari e Nuoro (SABAP Sassari), Sardinia and Late Miocene representatives of fossil Giraffidae from both published papers as well as personal observations. Several of the studied specimens were acquired using the structured blue LED light 3D scanners Artec Eva and Artec Space Spider. A selection of downloadable 3D models is available online (see Pandolfi and Rook, 2023a).

## Results, implications and perspectives

The abundant material from Botro della Canonica (Figure 1) allowed an extensive comparison with both Casteani and Fiume Santo specimens, as well as a better comparison with other Late Miocene European giraffids. At first, an origin from the continental genus *Decennatherium* was proposed, considering the plesiomorphic features of deciduous and permanent dentitions. Further, the upper permanent dentition from Botro della Canonica resembles the type material from Casteani both in proportion and morphology. The material from Fiume Santo instead displays some differences in size (in particular in the length of the tooth row), and a few differences in morphology, such as the absence of ectostylids. These characters can be related to a more advanced stage of endemism in the species from Fiume Santo and justified the erection of a new species, *Umbrotherium engesseri* Pandolfi and Rook 2023a. The new results derived from the study of the Botro della Canonica giraffid would open up a new hypothesis regarding the colonization route of the Tusco–Sardinian



Figure 1. Late Miocene *Umbrotherium azzarolii* specimens from Botro della Canonica. Right mandible with  $i1-m3$ , NMB BdC.1, in lingual (upper), labial (middle) and occlusal (lower) views. Scale bar equals 20 mm.

archipelago and its palaeogeographic structure (Pandolfi and Rook 2022a; 2022b; 2023b). New fieldwork activities at Botro della Canonica and the revision of the material from the other Tuscan localities, such as Serrazzano and Montebamboli, are planned for better investigation of the palaeogeographic assessment of the area and the origin of other endemic mammals, such as the genera *Maremmia* and *Etruria*.

#### Acknowledgments

I am very grateful to the Palaeontological Association for the Sylvester-Bradley Award (number PA-SB202103).

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## ***Body size change in burrowing decapods through the Cenomanian–Turonian boundary event***

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### **Introduction**

Burrowing decapods promote important physical and chemical changes to the marine environment (Laverock *et al.* 2010). Those from the infraorders Axiiidea and Gebiidea, commonly known as ‘mud shrimp’, produce some of the deepest and most complex burrow systems in the bottom sediments. Burrows can increase the surface area of the metabolically active sediment surface by up to 400 %, introducing oxygenated conditions into an otherwise anoxic environment (Ziebis *et al.* 1996). Important implications for nutrient cycling have been identified, including increased rates of nitrification and denitrification, biodiversity and primary productivity (Erwin 2008).

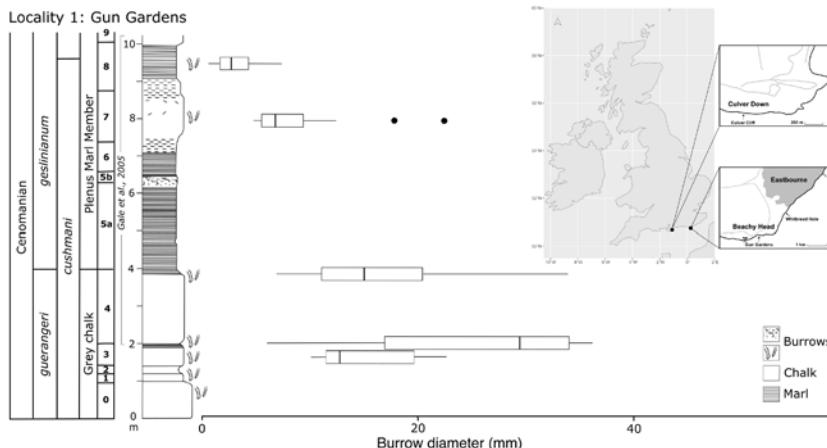
Complex interactions between warming climate and changing environment result in significant effects on the physiology of marine animals, including increased developmental rates and metabolism, with predictions that extant animals will subsequently shrink in size (Calosi *et al.* 2019). A reduction in body size could have significant effects on their role as ecosystem engineers. Smaller animals will produce proportionately smaller burrows and subsequently reduce the oxic–anoxic interface, consequently limiting nutrient cycling and productivity (Calosi *et al.* 2019). Organisms can only be as big as the burrows they produce, making the diameter of burrows a useful proxy for body size (Twitchett 2007). Decapod crustacean burrows are well preserved in the fossil record (*Thalassinoides*) and can provide a unique insight into the response of these important animals during past warming events. The aim of this project was to explore size changes in burrowing decapods through the Cenomanian–Turonian boundary event (CTBE; ~93.5 Ma) in the Late Cretaceous to improve our understanding of the present and future impacts of climate change on modern marine invertebrates.

### **Methods and materials**

The exposed chalk between Eastbourne and Beachy Head (Gale *et al.* 2005) and on the Isle of Wight, UK (Jarvis *et al.* 2006) in the Anglo–Paris Basin presents a record of the Upper Cenomanian–Lower Turonian boundary. This project focused on three localities: Gun Gardens, Whitbread Hole near



Eastbourne, and Culver Cliff on the Isle of Wight (Figure 1). *Thalassinoides* trace fossils are easily visible in the chalk beds (Figure 2), allowing for data collection through the warming event, as well as before and after. The diameters of accessible *Thalassinoides* burrows in the outcrop were recorded to the nearest millimetre using digital callipers and the three localities were logged in detail.



*Figure 1. Log of the Gun Gardens locality, part taken from Gale et al. (2005) as specified. Box plots of the burrow diameter measurements taken relative to their position in the outcrop. Map included to demonstrate the locations of all three localities.*

Although oxygen isotope data from Voigt *et al.* (2006) are available for Gun Gardens and Whitbread Hole, it is not possible to correlate the data points precisely with the sampled beds. To analyse more accurately the relationship between temperature and size, brachiopod and bivalve shells were collected contemporaneously to burrow data for oxygen isotope analyses. Two samples were collected from each horizon to allow for any potential variation or a failed sample.

### Preliminary results and discussion

A total of 131 burrow measurements were collected at Gun Gardens across ten horizons, 151 at Whitbread Hole across 12 horizons and 312 at Culver Cliff across 24 horizons. A minimum sample size of 20 measurements per bed was decided as the cut-off for performing any statistical analyses. Significant changes in the burrow diameter of trace fossils measured in the exposed chalk at all three localities were apparent through the CTBE. A reduction in body size of historic burrowing decapods is therefore inferred. However, palaeotemperature estimates acquired from the geochemical analysis are needed to determine whether these fluctuations in size are really linked to temperature change. Preliminary analyses also show a significant increase in mean burrow diameter following the event, indicating signs of recovery as conditions began to improve again.

A reduction in body size fits the hypothesis of the Lilliput effect and supports studies from other events that record similar reductions in the burrow diameter of *Thalassinoides*, e.g. during the Triassic–Jurassic extinction event (Twitchett and Barras 2004). Furthermore, trace fossil burrow diameters are known to have become smaller through the end-Permian mass extinction event in response to the environmental stress experienced by infaunal animals during this time.

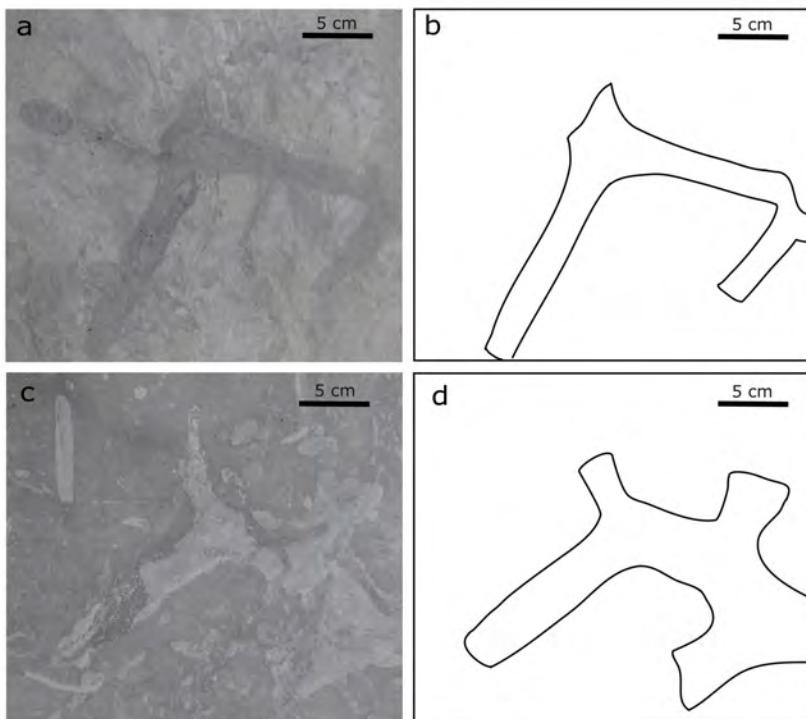


Figure 2. Field photographs (a and c) of *Thalassinoides* trace fossils at Gun Gardens near Beachy Head, Eastbourne, UK, with corresponding outlines (b and d) demonstrating their respective Y-shaped, branching morphology.

(Twitchett 1999). These results may help to predict the response of modern animals to anthropogenic warming, and the potential consequences the shrinking of these animals will have on marine ecosystems should be considered.

#### Upcoming analysis

Oxygen isotope analysis is ongoing. Once the data are available, temperature estimates will be correlated with individual beds and used to assess the relationship more accurately between temperature change and body size fluctuations through the CTBE.

#### Acknowledgements

I thank Richard Twitchett (Natural History Museum, London) for accompanying me in the field and for helpful discussions. I would also like to thank Thomas Fogerty (Natural History Museum, London) for his assistance on field-trips. This project was made possible by the Palaeontological Association's Small Grants Scheme (Callomon Award PA-CA202101).



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## **Petrography, mineralogy and geochemistry of fossil mammal bones from Mio-Pliocene marine depositional settings**

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### **Introduction**

Mammalian bone, such as that of cetaceans and sirenians, is a surprisingly interesting material, made of both organic and mineral constituents, and is highly sensitive to the surrounding environment – both pre- and post-mortem. After death and deposition at the seafloor, bones from marine mammals undergo a complex series of processes that usually lead to complete degradation. In some fortunate cases, fossilization processes occur, resulting in the preservation of bony remains. The final fate of bones from dead marine mammals depends on a plethora of biostratinomic and diagenetic processes that are extremely difficult to disentangle.



The Neogene marine deposits of Tuscany in central Italy are rich in fossils of mysticetes, odontocetes and sirenians (Dominici *et al.* 2018; Bianucci *et al.* 2019), and on the whole represent a crucial reference for those interested in the Late Miocene and Pliocene marine mammal record. The high diversity of palaeoenvironments (from deltaic and shoreface to slope) of the Tuscan Neogene make it an ideal scenario for investigating the manifold taphonomic processes that affect marine mammal skeletons in different depositional settings and host sediments, where the biostratinomic and diagenetic processes at play are similarly various (Gioncada *et al.* 2018; Bosio *et al.* 2021a).

### Materials and methods

Small fragments of bone (mostly ribs) and the host sediment were collected from cetacean (both mysticete and odontocete) and sirenian skeletons from marine deposits exposed at the Tuscan sites of Ponsano (Tortonian shelf sandstones), Arcille (Zanclean deltaic/shoreface sandstones), Lucciolabella (Zanclean slope clays), Monterotondo (Pliocene mudstones), Riparbella (Pliocene calcarenites), Asciano Senese (Pliocene mudstones), Castelfiorentino (Pliocene mudstones), Empoli (Pliocene mudstones), Spicchio (Pliocene sandstones) and Certaldo (mid-Pliocene shelf mudstones). These fossil remains, for which detailed geographic and stratigraphic whereabouts are known, were studied at the Museo di Storia Naturale of Università di Pisa and the Museo Geopaleontologico GAMPs in Scandicci. Fieldwork was also carried out at the localities of Empoli, Certaldo, Spicchio and Arcille to investigate the sediments associated to the fossil vertebrate specimens.

Following Bosio *et al.* (2021b), first-order taphonomic observations were carried out under a stereomicroscope, looking for shark bite marks, *Osedax* borings and other invertebrate traces. Seventeen thin sections were prepared from bones at the TS Lab & Geoservices in Pisa. Microscopic features were investigated under transmitted- and reflected-light through a Nikon Eclipse LV 100N POL optical microscope at the Università degli Studi di Milano-Bicocca. Scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM-EDS) were carried out through a Zeiss FEG Gemini 500 at the Università degli Studi di Milano-Bicocca for studying the bone structure and composition. Electron probe microanalyses (EPMA) were also employed for a quantitative compositional characterization through a JEOL Superprobe JXA-8230 at the CNR (Consiglio Nazionale delle Ricerche) in Florence. Finally, laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) was performed using an Analyte Excite 193 nm ArF excimer laser microprobe system equipped with an HelEx II volume sample chamber (Teledyne Photon Machines), coupled to a single-collector quadrupole ICP-MS (iCAP RQ; Thermo-Fisher Scientific) at the LASA laboratories of the Università di Milano for measuring element (including REE) abundances as proxies for diagenetic processes.

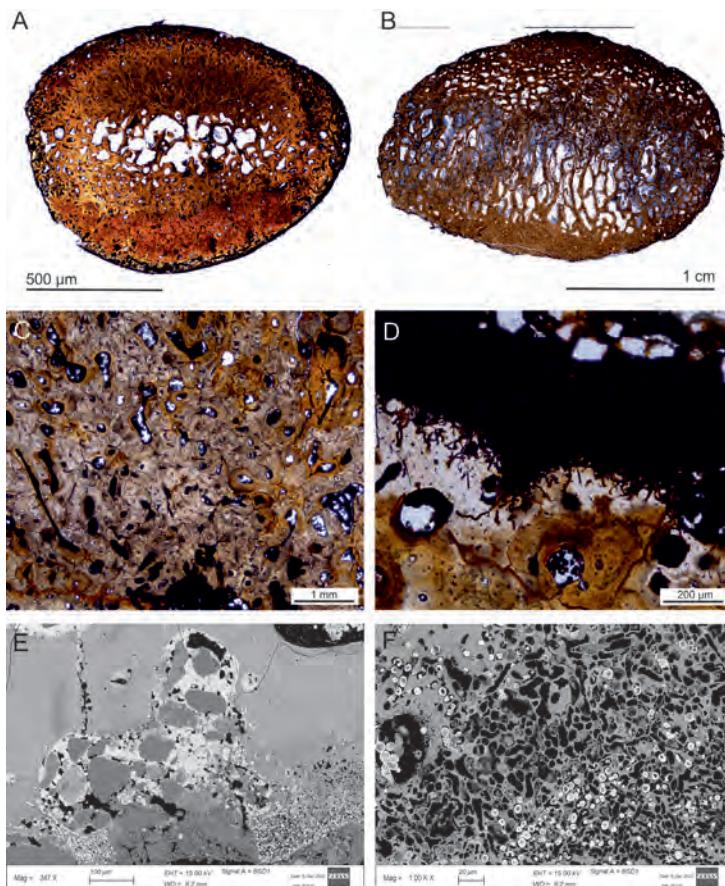
### Results and discussion

The fossil cetacean and sirenian bones studied in the Tuscan region exhibit a great plethora of different preservation stages. However, they have several common features, such as the poor preservation of the cortical tissue pointing to abrasion processes. The colour of bones varies from grey to brown, dark amber to red (or black and red), showing similarities with bone type 2 and 3 of Bosio *et al.* (2021b) (Figures 1A, B, C). The red colour is related to the presence of Fe-oxides and Fe-sulphides found associated with the bone (Figures 1F, 2E, F). In most cases, Fe-oxides substitute the bone tissue and fill the cavities and microborings during both early and late diagenesis. The presence of microborings of type B and associated pyrite frambooids (Figure 1F) suggest bacterial activity related to sulphate reduction processes during organic decay (Bosio *et al.* 2021a).

Histological features such as osteocytes and lamellae are well preserved, except for the specimens



from Empoli. The chemical composition of the bone is fluorapatite, with variable Fe, F, Sr, Cl, Na, Ba, Mg and  $\text{SO}_3$  content. The minor element and REE uptake is high, with peaks in Be, Sr, Ba, Gd and a very high content of U. The chemical composition is still to be compared and discussed. Secondary cements such as calcite and barite are also present in the Ponsano and Monterotondo specimens (Figure 2A-D), suggesting that in some cases late diagenetic processes also intervened in the preservation path. Microcracks and fractures are common in all the bones, and pervasive in most cases. Together with dissolution, algal perforations and frequent microborings at the sediment–bone interface (Figure 1D-F), these features indicate a long exposure of the carcasses at the seafloor before being buried. Following our studies, a rapid burial may not be the only factor leading to good fossil preservation. The results of this study will be discussed and published soon in peer-reviewed journals and presented in future national and international congresses.



**Figure 1.** A, B. Compact and cancellous bone tissue of two sectioned ribs from Asciano and Ponsano under transmitted plane-polarized light. C. Red-coloured compact bone tissue under transmitted plane-polarized light. D. Bone–sediment interface showing destruction of the bone surface by bacterial activity under transmitted plane-polarized light. E. BSE image of an algal perforation. F. BSE image of microborings of type B, in some cases infilled by pyrite frambooids.

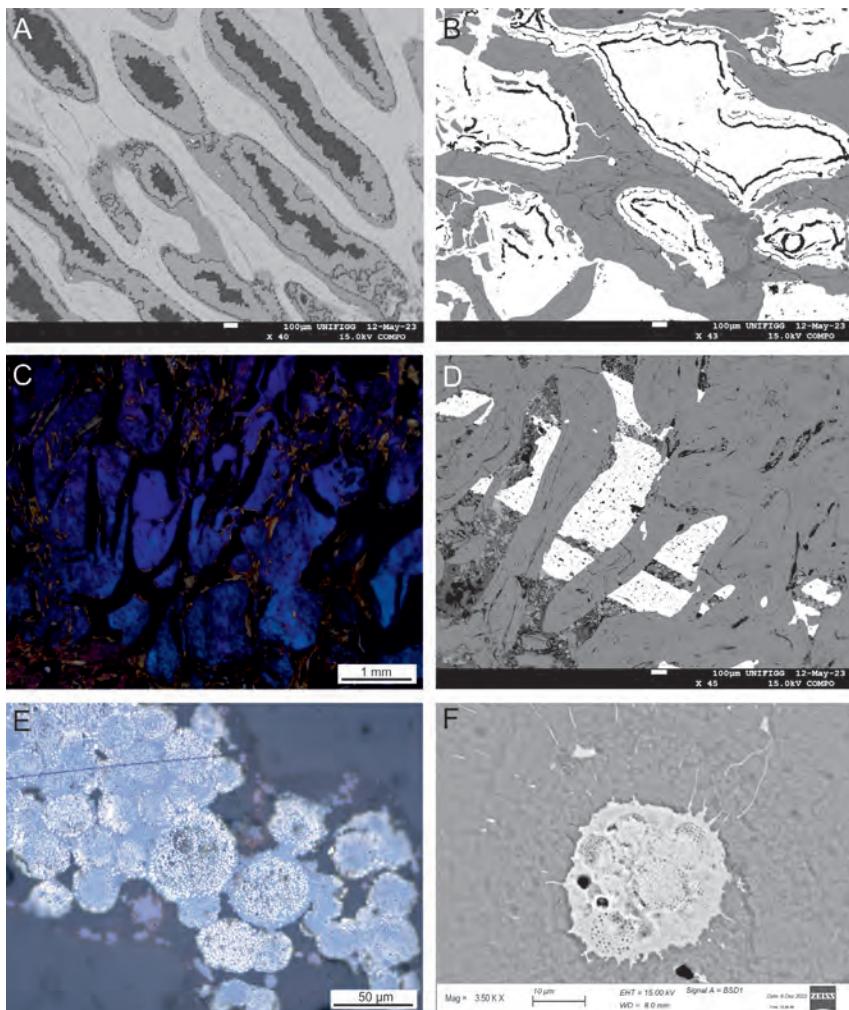


Figure 2. A. BSE image of cancellous bone tissue showing secondary calcite cements filling the medullary cavities. B. BSE image of medullary cavities filled by barite cement. C. Medullary cavities filled by a late diagenetic barite cement under transmitted cross-polarized light. D. BSE image of medullary cavities filled by barite crystals. E. Pyrite framboids under reflected light. F. BSE image of pyrite framboids filling a Haversian canal.

#### Acknowledgements

Thanks to Giovanni Bianucci, Alberto Collareta, Simone Casati, Andrea Di Cencio, Chiara Sorbini, Anna Gioncada, Eleonora Braschi, Andrea Orlando and Gianluca Sessa. This study was supported by the Palaeontological Association's Small Grants Scheme (Stan Wood Award PA-SW202101).



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# *Undergraduate Bursary* **REPORT**

# *Microvertebrates from the Middle Jurassic of Hornsleasow, Gloucestershire*

Maximilien Derème

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## Introduction

Vertebrate remains in Hornsleasow Quarry in Gloucestershire, UK were first found by amateur geologist Kevin Gardner in 1987 when he noticed large sauropod bones belonging to *Cetiosaurus* and a *Megalosaurus* tooth in a clay lens. Having alerted David Dartnall, Deputy Curator of Natural History at Gloucester City Museum, Gardner worked with Huntsman Quarries Ltd (the quarry owners) to expose the rest of the clay lens by blasting away the overlying limestone. A team of palaeontologists and archaeologists dug up the bones and the rest of the clay lens, which delivered more *Cetiosaurus* bones as well as a tonne of fossiliferous sediment that they bagged up. After excavation, a project was started to wash the clay in search of microfossils, led by Roger Vaughan (Bristol City Museum) and Kevin Gardner, which provided an impressive abundance and diversity of well-preserved microvertebrate remains (Vaughan 1989).

The clay lens sits within the limestones of the Chipping Norton Formation (Bathonian, Middle Jurassic; Figure 1), a time from which relatively few terrestrial locations are known worldwide.

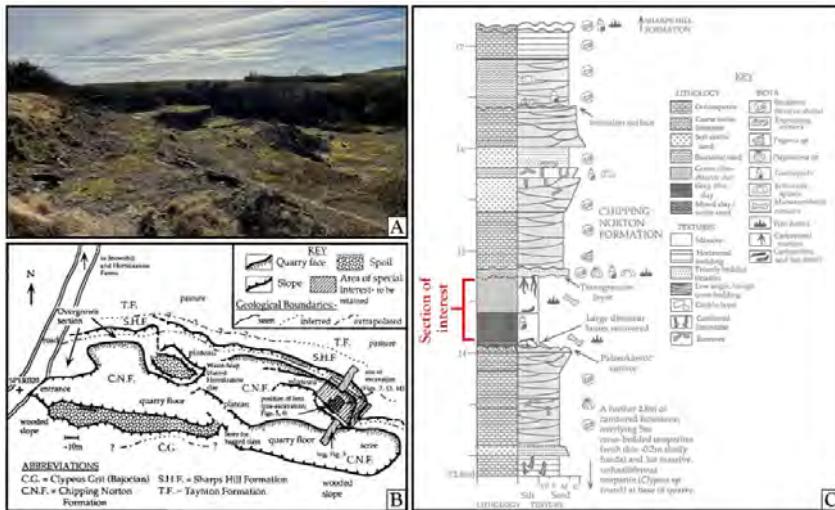


Figure 1. A) Photo of the quarry currently (taken Feb 2021). B) Plan of the quarry layout and main geological formations. C) Cross-section produced by Metcalf (1993) of the Chipping Norton Formation at Hornsleasow Quarry, with the section of interest highlighted in red.



The clay lens can be divided into two units, the grey illite clay below and the green illite-chlorite clay above. Both are believed to be palaeosols formed in an ancient lacustrine environment, with the Grey Clay being more boggy and acidic (Metcalf *et al.* 1994). Washing the clay yielded an extraordinary amount of well-preserved microvertebrate remains from crocodiles, dinosaurs, fish, tritylodonts and even mammals. Sara Metcalf was the main researcher for the Hornsleasow project and worked on it during her PhD at the University of Bristol (Metcalf *et al.* 1992; 1994); my research is a continuation of her work from 30 years ago, analysing to a greater depth the faunal assemblage of Hornsleasow Quarry, and identifying and imaging all important taxa from the site.

### Methods and materials

My plan for the project involved field work and museum visits, but these were curtailed by COVID-19 and a number of other factors. Once the pandemic restrictions eased up, we first went to Hornsleasow Quarry to collect some material, but we found that most of the fossiliferous clay lens (Figure 1C) had been excavated, with only a small portion of the Green Clay left behind. We collected some of this, broke it up, washed it and sought fossils, but we found very little. We found that the remaining unprocessed material from the Gardner–Vaughan excavations at the Museum of Gloucester had had to be disposed of because of asbestos contamination in their basement.

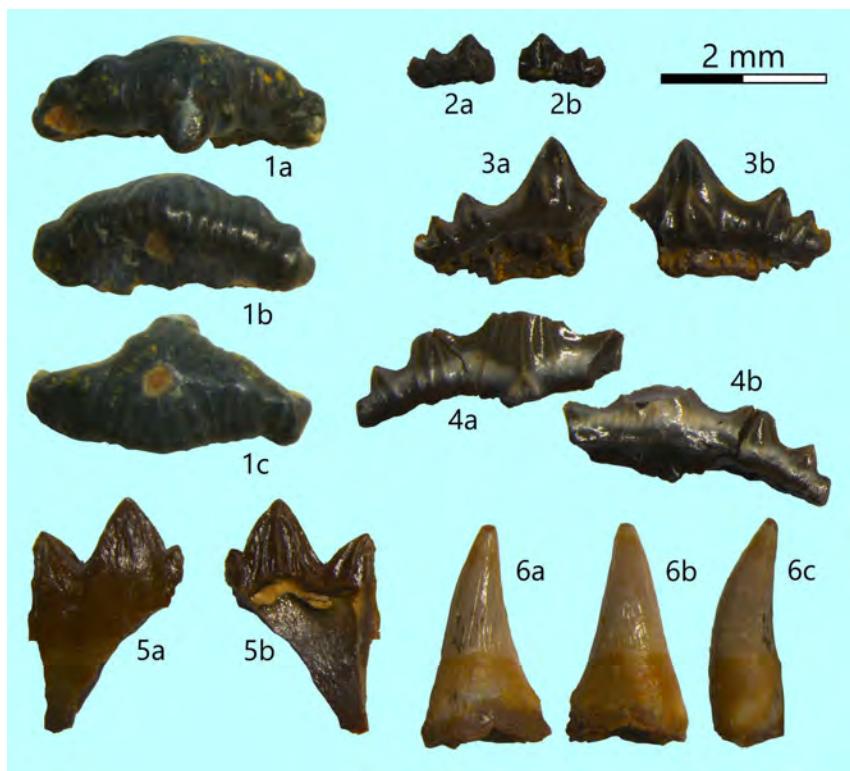


Figure 2. Chondrichthyan teeth from clay lens in Chipping Norton Formation of Hornsleasow Quarry. 1. *Lissodus leiodus*; 2-4. *Parvodus pattersoni*; 5. unidentified hybodontiform; 6. cf. *Ischyrhiza* sp. All specimens in Museum of Gloucester.



Thankfully, we could study the extensive washed and processed collections in the city museums in Gloucester and Bristol, as well as processing some unwashed matrix from the Natural History Museum, London.

### Results and discussion

The microfossils from Hornsleasow Quarry are plentiful, diverse, and are often well-preserved. We identified examples of hyodontiform sharks, including *Lissodus leiodus* and *Parvodus pattersoni* and abundant bony fish scales. Some scarce amphibian remains are known from the site, for example jaw fragments, possibly from the salamander-like *Albanerpeton* and potentially the frog *Eodiscoglossus*. A number of unidentified turtle carapace fragments as well as some rare postcranial bones were identified, together with the most abundant fossils, crocodilian teeth belonging to multiple taxa, but it was hard to identify whether they are teleosaurids, goniopholidids or something else. We identified some rare postcranial remains of pterosaurs, but perhaps some supposed pterosaurian teeth might belong to other taxa such as theropods, crocodiles or fish. Ornithischian dinosaur teeth are known, including several examples of a ‘fabrosaur’-type taxon and an early thyreophoran. The only sauropod confirmed so far is *Cetiosaurus* sp., known from several large bones and teeth. Among the theropods, we identified teeth of *Megalosaurus*, as well as Dromaeosauridae, Troodontidae and Therizinosauridae, very early records of these clades identified using morphometric methods (Wills *et al.* 2023). Most important are the relatively abundant teeth of the tritylodont *Stereognathus ooliticus*, as well as rare mammaliaforms of various kinds.

The study is still under way, as many taxa remain unidentified, and I hope my final publication will present a thorough overview of the taxa present in terrestrial England during the until now poorly known Middle Jurassic, an important time for the evolution of dinosaurs and mammals.

### Acknowledgements

I thank Deborah Hutchinson (Bristol City Museum), Nigel Taylor-Jones (Museum of Gloucester), Mike Day and Chris Duffin (Natural History Museum, London) and Mike Benton (University of Bristol). This work was supported by the greatly appreciated Undergraduate Research Bursary of the Palaeontological Association (grant PA-UB202105).

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# *Career Development Grant REPORTS*

In 2021 the Association's Council instigated a new Career Development Grant to assist talented early-career researchers who have recently completed their PhD during the difficult transition period as they navigate into postdoctoral or curation positions. The grant of up to £2,500 can allow them to strengthen their CVs, via completion of a measurable activity or output, helping them move on to the next step in achieving a career in palaeontology. The grantee is also automatically enrolled in the Association's mentoring scheme (see <<https://palass.org/careers>>) and is 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; or a training or research internship in another research group. The following two accounts are from early-career researchers who were awarded the first of these grants.

*Nidia Álvarez-Armada writes:* The Palaeontological Association has proven to be an unconditional support in the development of my career as a palaeontologist for over a decade. I have been a member of the Association since I received the Undergraduate Prize in 2012 as a student at the University of Galway, Ireland. A few years later, my PhD experience was far from easy and enjoyable, and as a result I was considering abandoning academia until I learned of the PalAss Mentor Scheme featured in *Newsletter 104*. I was delighted when Russell Garwood at The University of Manchester, UK agreed to be my mentor. I owe him great respect as a scientist and a mentor, and I believe some of the success that followed would not have been possible without that first mentoring meeting in September 2020. In December 2021, in its inaugural year, I received a PalAss Career Development Grant (CDG). I had just passed my PhD viva and was in a complicated financial situation with a young daughter to care for and only one of the parents providing an income. The CDG covered my daughter's nursery fees and sustenance for a five-month period, during which I submitted three peer-reviewed articles, all of which have now been published; and I also learnt the ill-fated result of my already submitted Marie Curie Individual Fellowship proposal. It was very disheartening but thanks to the CDG I had the time and resources to work on my proposal and resubmit it; the second time around I was successful in securing funding for a 2023 start. Currently, I am getting used to and enjoying my new position at The University of Manchester as a Marie Curie Fellow. I will be investigating the effects that pigments have on the potential for fossilization of insect cuticle, particularly from a biomechanical perspective.



*Nidia's daughter reading the PalAss Newsletter.*  
Photo © Nidia Álvarez-Armada.



I only took up my post a little over a month ago, but I am confident the palaeontological community will be hearing some exciting science from me soon. I would have not been able to achieve any of this without the unconditional help and support from the Palaeontological Association, their mentoring scheme and the CDG funding.

*Arindam Roy writes:* After completing my MSc at the University of Bristol, UK, I was fortunate to receive the Hong Kong PhD Fellowship at the University of Hong Kong. However, being a first-generation doctoral candidate from a lower-middle class family in the Global South, I found myself in a challenging situation during the COVID-19 pandemic with dwindling job opportunities. I had to leave Hong Kong with my limited savings, which would only cover a few months of expenses at best. I urgently needed both financial support and guidance to navigate the highly competitive international academic job market. It was at this juncture that I discovered the PalAss Career Development Grant (CDG) and promptly submitted an application. I was fortunate to be matched with Prof. Richard Butler (University of Birmingham, UK) as my mentor, who not only helped me establish a consistent work schedule for publishing my thesis chapters and maintaining my mental well-being, but also assisted me in preparing applications for various fellowships. Under his expert mentorship, I achieved placement on the reserve list for the Royal Society Newton International Fellowship in 2022 and successfully published one of my thesis chapters in May 2023. Although my proposal to the Royal Society didn't secure funding, I am currently in the process of preparing manuscripts for publication during 2023–2024. From a financial perspective, the CDG enabled me to cover my living expenses throughout 2022 while continuing to publish papers and seek funding for my postdoctoral research. I am still actively applying for fellowships, eagerly awaiting an opportunity to materialize. I greatly applaud the Association for initiating such a novel funding scheme for job transitioning early-career researchers; without this I would not have been able to continue in academia. Without any concrete offers, the journey remains challenging, but I am committed to making the best of all the uncertainty that lies ahead.



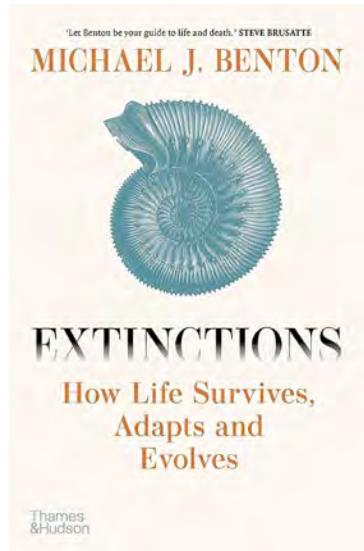
# Reviews



## Extinctions: How Life Survives, Adapts and Evolves

Michael J. Benton, 2023, Thames and Hudson Ltd, ISBN: 0500025460.

Among the most captivating yet dreadful revelations ever made is that the several-billion-year-long story of life on Earth is characterized by death<sup>1</sup>. More than 99.99 % of all organisms that have ever lived on our planet have been wiped out, countless lineages snuffed from existence, an inevitable finale awaiting all living things. Palaeontologists have long been fascinated by the incredible amount of bizarre and awesome organisms lost to deep time. Prof. Mike Benton, a prolific palaeontologist based at the University of Bristol in the UK, has made tremendous contributions to the study of major extinction events, especially related to the Triassic. Benton also sets the highest standard for popular science writing with his extensive bibliography consisting of numerous books aimed at communicating palaeontology to a general audience. In his new book, *Extinctions: How Life Survives, Adapts and Evolves*, Benton masterfully walks readers through the causes and consequences of many notable extinction events.



The chapters of the book successively discuss extinction events in order of when they occurred. They begin with the controversial end-Ediacaran extinction event and continue all the way up until the modern Industrial Age. Benton clearly explains how each extinction event might have originated, affected life on our planet, and set the stage for new life forms to emerge. Arguably the most interesting extinction events are those close to and during the Triassic as well as the many hyperthermal events our planet has seen. The interplay between geological, chemical and biological factors might seem intimidating, but Benton's ability to break down complex processes and scientific terms into digestible words allows for all readers, regardless of educational background, to understand how one bad incident can cause a domino effect resulting in a global catastrophe. On top of this, the writing also clearly explains how scientists can determine what climates were like through geological signals and the fossil record. I especially enjoyed the section on the Carnian–Pluvial event. Benton and his colleagues have made massive contributions to understanding this event, and his enthusiasm and knowledge on the subject shine through the pages. This book excellently accomplishes its objective: to walk readers through how we have discovered so many extinction events.

<sup>1</sup> Editor's note. The bleakest start to a book review I've had so far. The Association accepts no responsibility for existential crises caused by reading this review...



Throughout the book there are numerous sections that immerse the reader in a long-lost environment, familiarizing the reader with wonderful and terrifying extinct animals by describing what you might have seen if you were transported back in time. My favourite is the section that paints a picture of what the Devonian seas were like. Benton's description of *Dunkleosteus* and the many other strange fishes of the time is enthralling. These sections are a much-needed change of pace from the more chemistry- and geology-heavy sections. Additionally, there are many brilliant and creative illustrations by a variety of talented artists. These further add to the immersion and kept me wanting to flip through the book to see what wondrous extinct animals were going to jump off the coming pages.

By far the most important part of the book is how it links so many past extinctions to current climate change. The resemblance between the many devastating hyperthermal events of the past and what we're experiencing now is uncanny. Palaeontology is often thought of as a science that does not have any relevance for the advancement of society, but as this book points out, if we don't learn from the cataclysmic events of the past, society won't be advancing anywhere. The similarities with the end-Permian mass extinction event, the deadliest mass extinction of all time, are especially mortifying. I sincerely hope people who pick up this book will better appreciate the importance of taking care of our planet.

My only issue with this book is the repetition. While many extinction events might have different origins, they are characterized by similar environmentally-destructive cascades. Re-reading how hyperthermal events alter ecosystems several times throughout the book did feel like a bit of a chore. This is less a fault of the writer, and more a result of the similarity between so many extinction events though. The repetition did help drive home the science however, and I believe will help me better remember how one harmful factor can spiral out of control and ravage environments.

While I think anyone can pick this book up and learn a great deal about the many extinction events of Earth's tumultuous past and how life recovered each time, I think prospective and new palaeontology students will especially find this book helpful. Many are drawn to the field by the incredible dinosaurs and other extinct alien-like animals. This book can introduce to those eager to learn more how knowledge of the history of life is essential for piecing together what extinct environments were like, and why they are no longer with us. Additionally, the many connections between extinctions of the past and our unfortunate present can clarify to new and prospective students why palaeontology is immensely important and very relevant to the modern day, encouraging them to pursue their dream of making discoveries about Earth's spectacular past.

### **Hady George**

*Hady is a Lebanese and British palaeontologist about to begin his PhD at the University of Bristol, UK. You can find him on X (formerly Twitter) @HoudzGeorge, and he always enjoys chatting about good books, movies, and exciting adventures in the wilderness.*



## Vertebrate Skeletal Histology and Paleohistology

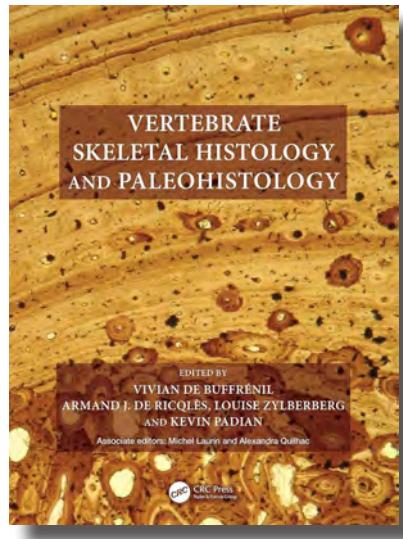
Edited By Vivian de Buffrénil, Armand J. de Ricqlès, Louise Zylberberg, Kevin Padian, 2021, CRC Press, 838 PP, ISBN 9780367700867.

Ever wondered about the skeletons of fishes, reptiles, dinosaurs, or even your own? <sup>2</sup> This book is a deep dive into skeletal biology through the intimate lens of histology. As someone who found palaeontology later in life, I quickly began drowning in a sea of complex literature, written by specialists for specialists. When completely exhausted by the strong undercurrent of terminology, debates and the sheer volume of information, I found refuge in rafts of review papers that reined in the chaos. If a good review paper is a raft, this book is the long-awaited shore.

*Vertebrate Skeletal Histology and Paleohistology* is a richly illustrated and hefty tome that summarizes decades of research into a one-stop shop reference. My first impression was awe at the effort this opus must have taken. At over 800 pages and 40 chapters this is not a cute coffee-table book and nor is it a light read, but it is worth every page it is printed

on. The editors have collected and orchestrated a monument to the histology of both the extinct and the extant. *Vertebrate Skeletal Histology and Paleohistology* is a large body of work that is richly illustrated with illustrative diagrams, thin-section images of tissues, photographs of fossils, and 3D models, all in full colour. That alone is difficult to find in any special topic textbook. Those who are new to histology soon discover the heavy emphasis on visualization in this field; indeed, at its core, it is the study of microanatomy with the aid of light, X-ray tomography, and other ever-evolving visualization tools. Interpretation and methods in histology often go hand in hand, with some histologists becoming specialists in digital CT imagery, while others prefer the physical thin sectioning of specimens and light microscopy. This book not only delves into the theory and interpretations of histology but also reviews the classic and cutting-edge methods by which the information was gained in the first place. This is done through inter-chapter 'box' explanations, and throughout the chapters there is a heavy emphasis on methodology as well as the taxa and evolutionary story.

What did I like about this book? Histology and palaeohistology can be overwhelming for both beginners and specialists. The sheer amount of information available for both extant and extinct taxa is vast and expanding at an ever-increasing rate, paced by both conceptual and technological advancements. This book is written by 47 scientists who are at the top of their respective specialties, giving the reader a personal tour of sorts of the authors' respective subfields. I particularly enjoyed the contextualization of every new topic that is covered. It is very easy to get lost in the expansive wilderness of histological literature, but the authors make every effort here to ground each topic in its larger phylogenetic and evolutionary context, which makes further interpretations of histological convergence and homology more meaningful.



<sup>2</sup> Editor's note: alarmingly, more than I probably should. I think about skeletons more than I think about, say, the Roman Empire, for instance.



This is the kind of book I will personally be referencing for years to come, naturally as an essential part of my research toolkit but perhaps more importantly as an indispensable teaching tool. The breadth and depth of the topics are indispensably informative both across and within chapters. For example, one chapter describes the ‘modern bone tissue types and categories’ and while the list alone is a great visual resource, the in-depth explanation and provided references are equally indispensable. Then there are chapters for specific taxonomic groups such as finned vertebrates, turtles and modern mammals to name a few. These chapters felt like listening to a colleague at a conference as they guide you from the humble beginnings through the progression to the current challenges and state-of-the-art of the histology of each taxonomic grouping. Even as someone who has been a dedicated naturalist, I found myself amazed at how little I knew about certain groups, for example often catching myself saying “I didn’t know turtles did that too!” while reading the chapters dedicated to the shelled oddities. This was a recurring theme; as I jumped around the book in no particular order, I always found something I didn’t know. The well-curated references in each chapter allowed for never-ending rabbit holes of in-depth reading and references that I have since relied on heavily.

But who is this book for? Content-wise, I say this book is for everyone in that it is an easy read for specialists and lay-people alike, the language is not unnecessarily technical, and the chapters as well as the sections within the chapters build on one another in a logical manner. However, first and foremost, this is a book for histologists by histologists. By that, this is not a one-time read on a plane to a conference but rather an ongoing reference due to its depth and breadth of topics. Much like other sub-fields, histologists often specialize in a particular sub-field or taxonomic group. Therefore, a book like this makes it possible to have a much-needed visual comparative guide across taxa and time.

Graduate students who are beginning their research journey, or researchers looking to add a new skill set to their repertoire, are the two main groups that I see benefiting most from this book. Histology and palaeohistology are just that – a skill set of interpretation and varied methodology. Much like anatomy, we learn a certain set of ‘rules’, then promptly learn of the variety of instances when those rules are broken and what we can learn from these aberrations. I would strongly recommend this book to those looking to cross one of the great barriers to studying evolution, integrating both palaeontological and neonatal data, in this case on a tissue and cellular level. So earlier when I said that this is a book for histologists by histologists, I say that not to exclude non-experts but rather to invite them to read and learn about this niche field.

The price point on this book is steep, but not unwarrantedly so considering its intellectual and physical heft. That being said, this may present a barrier to many early scholars and independent researchers, and therefore I strongly encourage all principal investigators and libraries to have copies available. This book and the references within will continue to be a great resource for years to come, and by having a physical copy accessible for your students, you are doing them a great service.

### **Yara Haridy**

*Yara Haridy is a palaeontologist and science communicator focusing on how our skeletons evolved through deep time. Yara can be found holding a skull and talking to the public at the Field Museum of Natural History, looking through a microscope at the University of Chicago, or on X (ex-Twitter) or Instagram @yara\_haridy.*



## Otherlands: A World in the Making

Thomas Halliday, 2022, 416 PP, Allen Lane, ISBN-10: 0241405742.

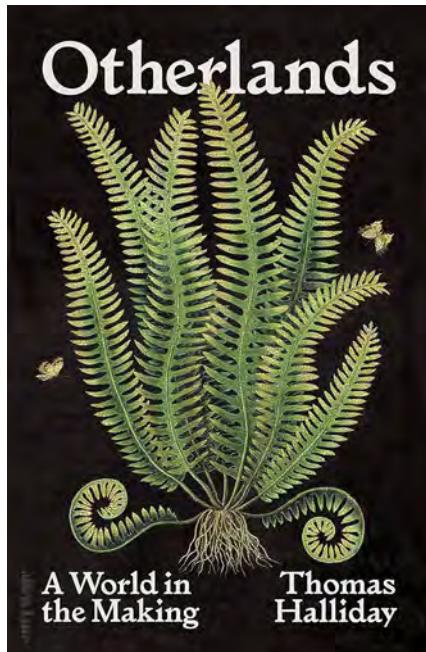
In full disclosure, I have known Thomas Halliday since we were both PhD students, and have eagerly followed the journey of *Otherlands* on social media. I even answered a few questions about pterosaurs for him and was pleasantly surprised to be acknowledged in the book. Having heard so much about this book over many years, I was excited to see that it was up for review and that I could have this opportunity to review it.

*Otherlands* is an excellent non-specialist summary of the history of Earth (or at least the history of life on Earth, as we don't learn anything before there was definitely life). My first impression was that of surprise and excitement that unlike most other books of similar types it starts out more recently in the Pleistocene and then goes back through time, finally ending in the Ediacaran. This means that we go from relatively easier-to-picture, more recognizable environments and animals down to the wacky completely different Earth of the past

550 million years. But to do this Halliday doesn't just do a brief history of each time period and try to cram half a billion years of history into 300 pages – instead he picks a single important place and time within a time period and describes it in great detail. This means the reader is introduced to a specific significant scene that explains everything from the geological background to the plants and animals found there.

Each chapter is titled with a single word that explains the time or place discussed, such as "Origins" for the chapter including the first humans in the Pliocene of Kenya, or "Collaboration" for some of the earliest examples of land plants and animals in the Rhynie Chert. The reader is provided with a world map showing where the site was located and what the world looked like at the time, the name of the locality and age the chapter is based on, and a few quotes to set the scene. There is one other image of one of the organisms discussed in the chapter, usually just a lone animal or plant, but sometimes including a bit more of the environment.

Halliday does a very good job of painting a picture of these snapshots in history rather than just discussing many facts, in a way that feels like he is telling a story though still complete with references and scientific information which reminds the reader it is not fiction. Each picture is painted layer by layer, starting with a bit about the land and geology, then some info on the plants, then some animals, with each new bit continually building on previous ones and making an entire scene that is easy to visualize.





I really enjoyed how many different aspects *Otherlands* covers. It's not just palaeontology, but also brings in anthropology, geophysics, environmental sciences and more. In every chapter I learned something new, not just about the plants and animals but little tidbits about Norse mythology, geology or geophysics. And importantly we learn about the effects of climate change, both on a small local scale looking at water level changes in the Miocene of Italy, and also a global sense introduced in the Eocene of Antarctica.

The book ends with a stark reminder about how climate change affects us as a species, pulling together examples discussed in previous chapters, and how those same things are happening or could happen around the world. It shows how something like disappearing glaciers can have such an effect on 700 million people living off the water coming from Himalayan ice, as well as the ecosystems changing worldwide. I felt that this was one of the best ways I've seen of the marrying of the geological record and past climate change with what is happening today and may happen in the future. Although the final chapter makes everything sound quite dire, Halliday ends with an all-important message of hope.

If I could pick one thing that I would have liked to see in *Otherlands* it would have been quite literally to have more pictures. Although the animals and scenes are described very well, some of them are so downright weird and wonderful that to have just one example shown in each chapter left me doing some Internet searches trying to figure out what other things looked like. However I did really enjoy the book and do recommend it to anyone who wants to learn a bit about many interesting snapshots through Earth's history.

#### **Liz Martin-Silverstone**

*Liz is the Palaeobiology Lab Manager at the University of Bristol, UK. She can be found on X (formerly Twitter) @gimpasaura where she sometimes posts about palaeontology but more often her corgi Merlin.*

### **The Cosmic Oasis**

Mark Williams and Jan Zalasiewicz, 2022, 288 PP, ISBN: 9780198845874.

Mark Williams and Jan Zalasiewicz, in their newest book *The Cosmic Oasis* explore a series of themes for which they have become influential advocates over the last couple of decades. These include the place of mankind in the grand scheme of the evolution of the biosphere, our impact on that biosphere as we became the dominant species on the planet, and the legacy we will leave behind as a species.

In *The Cosmic Oasis* the authors sketch Earth's unique position of hosting life and succinctly explain how life arose and evolved through time and space in the first chapters of the book. Much of the narrative is presented via the ideas and discoveries of great thinkers (Humboldt, Wallace, Sepkoski, etc.) so the reader is introduced to the evolution of palaeontological and scientific thinking in parallel with the story of our biosphere. This section of the book is targeted to a general audience, while readers with a firm palaeontological background will still enjoy getting the background story on some of the discoveries behind the insights we learned or teach about in class. As the story develops, other general principles of palaeontology are not only introduced but increasingly linked to and compared with the effects humans have on the biosphere, as agents of biogeographic



homogenisation (the infestation of San Francisco Bay), extinction (megafauna and the current sixth mass-extinction), morphological change (the chicken of tomorrow), and how we eventually gave rise to the Technosphere. It is the back-and-forth between palaeontologic insights and the big issues we are facing in the Anthropocene that makes up the backbone of the book, and it is this juxtaposition that makes this a must-read text for palaeontologists.

Although the book does not shy away from showing the dire state of the planet as it is, using the baffling numbers and statistics that underlie such statements, the book certainly is not all doom and gloom. Williams and Zalasiewicz also discuss, with a certain degree of optimism, how we can deal with some of the huge challenges we face, and, in a final chapter, explore how humans and the Technosphere can learn to coexist. Despite the gravity of the subject, the text skips across the chapters surprisingly gracefully and light-footedly,

riddled with eloquent references to pop-culture (Dr. Who! Terry Pratchett! And even *The Blob*<sup>3</sup>), philosophy and scientific giants alike, illustrated with anecdotes and local tales, a style I have learned to expect and very much appreciate from these authors.

I have had the privilege of following the evolution of Mark and Jan's thinking and interests, sometimes from close by, at times from a distance, from palaeobiologists/stratigraphers to their current involvement in all things Anthropocene, so this review is not entirely without bias. Having said this, it is this combination of a deep-time palaeontological perspective with an insightful analysis of today's problems, crystallised together in this thoroughly enjoyable book, that makes *The Cosmic Oasis*, in my opinion, a highly recommendable read.

#### Thijs Vandenbroucke

*Thijs is an associate professor of palaeontology and stratigraphy at the University of Ghent in Belgium with a keen interest in middle Palaeozoic climate and extinctions. Many of his students currently work on the teratological misfits in the fossil record. Follow the group on Instagram @palaeo\_Ugent.*

<sup>3</sup> Editors note: a fantastic horror 'B movie' from 1958 and starring Steve McQueen. Would recommend and be willing to accept reviews on this classic.



# Books available to review

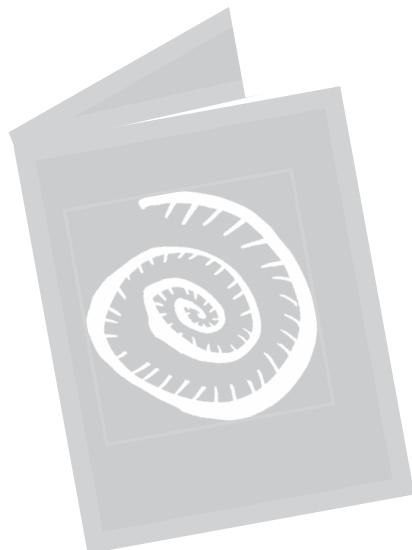
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Here are the items we currently have awaiting reviewers, all books:

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- *The Origin and Early Evolutionary History of Snakes*, edited by David J. Gowe and Hussam Zaher.
- *Life Sculpted: Tales of the animals, plants, and fungi that drill, break, and scrape to shape the Earth*, by Anthony J. Martin.
- *The Old Red Sandstone*, by Hugh Miller.
- *The Next Supercontinent: Solving the Puzzle of a Future Pangea*, by Ross Mitchell.

## Dr Thomas Clements

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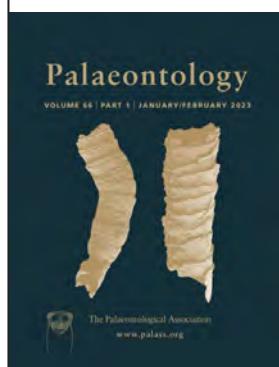
# Palaeontology

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Cover illustration: *Cloudina* from the upper Ediacaran of Lijiagou in Shaanxi Province, China (image courtesy of Prof. Shuhai Xiao). Specimen height approx. 2–3 mm.



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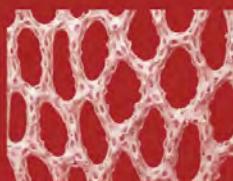
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This publication is now registered on ZooBank and is thus deemed to be valid for taxonomic/nomenclatural purposes. However we request contributors (especially those contributing grant reports) not to include names of new taxa in their reports.

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