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The Palaeontology Newsletter

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Reminder: The deadline for copy for Issue no. 109 is 7th February 2022.

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

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Editorial

This issue finds many Association members on tenterhooks, anxiously following the numbers of infections and changing regulations that may decide on their in-person attendance at the much-anticipated PalAss Annual Meeting. For many palaeontologists daily life and professional prospects continue to be uncertain and there is much in this issue to testify that the Association acknowledges this and is seeking ways to support the field. *We stand in solidarity with our members residing in zones of social, economic, and political instabilities, as well as those in the geosciences and the wider scientific community* – says a statement of support for palaeontologists around the world. But how exactly are we doing this? I would like to draw your attention to the recently introduced Career Development Grant and the changes to the Undergraduate Research Bursary Scheme introduced in this issue, aimed at removing barriers to inclusion and retention. The issue also includes a statement by the Editorial Board of *Palaeontology* and *Papers in Palaeontology*, addressing the changing landscape of scientific publications and ethical aspects specific to our field. We continue with reports by two more beneficiaries of the PalAss Mentoring Scheme, **Liz Martin-Silverstone** and **Camilla Souto**, and I very much hope that their positive experiences will encourage further early-career palaeontologists to participate in this individually-tailored support. As a palaeontologist who transitioned from academia to policy, **Morgane Brosse** shares the following advice: *Allow yourself to doubt and to change your mind*.

Many of our correspondents report the prolonged impact the pandemic has had on their careers, with occasional comical twists such as **Aaron O'Dea** – writing in the second part of our *Spotlight on Diversity* series on caring responsibilities – being forced to make Zoom calls from a locked bathroom. However, it is reassuring to see initiatives strengthening the palaeontological community: **Cassius Morrison**'s call for celebrating Black History Month among palaeontologists, and the enormous success of the Progressive Palaeontology 2021 meeting in a report by **Najat Al Fudhaili**. We also feature a virtual visit to Orkney Fossil and Heritage Centre, a *Legends of Rock* piece on renowned Lithuanian micropalaeontologist Valentina Karatajūtė-Talimaa by **Andrej Spiridonov**, while **Jan Zalasiewicz** encourages us to turn our backs on the doom and gloom on this planet to take a glimpse of the sky as exopalaeontologists. Should this armchair prospecting turn out to be successful, we will be well equipped to interpret (exo)fossil accumulations thanks to **Fernando Erthal**'s enthusiastic explanation of Susan Kidwell's *Model for fossil concentrations*.

For many, the last years have meant unpredictable commitments and I am very sad to announce that our phylogenetics correspondent **April Wright** has had to step down from her role. Let me use this opportunity to encourage you to contact me with suggestions on what new columns you would like to see in future issues – or perhaps with criticism on what you find an absolute waste of space! The *Newsletter* is a special format – it offers the opportunity to present views, ask questions, or write about science in a somewhat less dry way than a peer-reviewed publication. Our *Careers Q&A*, A *Palaeontologist Abroad*, *Reviews*, *Spotlight on Diversity*, *Legends of Rock* and other columns are waiting for you or your recommendations. If you know, mentor or supervise someone with an interesting career path, a passion for the history of our field or for science communication – or perhaps you are this person? – please get in touch. This is your space.

Emilia Jarochowska
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Association Business

Annual Meeting 2021

Notification is given of the 65th Annual General Meeting

The Annual General Meeting (AGM) will be held at 14.45 on Sunday 19th December 2021 at the University of Manchester, UK.

AGENDA

1. Apologies for absence
2. Minutes of the 64th AGM
3. Trustees Annual Report for 2020 *
4. Accounts and Balance Sheet for 2020 and election of financial examiner *
5. Election of Council and vote of thanks to retiring members
6. Report on Council Awards
7. Annual address

* Papers pertaining to these agenda items were published in the previous *Newsletter*, available online at <**www.palass.org**>, and will be included in full in the Programme and Abstracts of the Annual Meeting.

Nominations for Council

At the AGM in December 2021, the following vacancies will occur on Council:

- Vice President
- Secretary
- Publicity Officer

Nominations received thus far are as follows:

- Vice-President: Prof. P. M. Barrett
- Secretary: Dr A. R. T. Spencer
- Publicity Officer: Dr N. Vuolo

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' over the page.

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/Medals selection procedures

The Palaeontological Association Council discusses Awards and Medals at the May Council meeting and votes to select awardees. 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 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 considered except those that clearly fall outside of the remit. Each Council Member will vote by listing their three preferred candidates in rank order. The candidate 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 and there is a tie the vote will be recounted including the second ranked candidate for all of the votes. If the vote remains a draw after second and third ranked candidates are considered the President will cast the deciding vote.

Lapworth Medal

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

The candidate must be nominated by two members of the Association (proposer and seconder; names and contacts details required). The nomination must consist of: (i) a two-page career summary (font-size 12); (ii) a list of ten papers that demonstrate significance and breadth of research. 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 of other purposes this should be highlighted. Nominations must be compiled into a PDF file of less than 10 MB and uploaded to the Association website by the deadline.

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

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

President's Medal

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

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. 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. We are looking for evidence of significance of research with clearly identified achievements and breakthroughs. 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 to the Association website by the deadline.

The award will be considered by Council at its May meeting and awardees will be invited to a ceremony at the Annual Meeting in December. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right to decide 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.

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. 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 to the Association website by the deadline.

Nominations will be considered by Council at its May meeting and awardees will be invited to a ceremony at the Annual Meeting in December. Awards will also be announced in the *Newsletter*, on the Association website and through social media. Council reserves the right to decide 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). 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 to the Association website by the deadline.

Nominations will be considered by Council at its May meeting. Awardees will be invited to a ceremony at the Annual Meeting in December, 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 decide 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 contacts 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 to the Association website by the deadline.

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

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

Honorary Life Membership

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

The candidate must be nominated by two members of the Association (proposer and seconder; names and contact details required). The nomination must consist of a one-page statement (font-size 12) outlining the nature of support for the Palaeontological Association. This should be uploaded to the Association website by the deadline.

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

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

Annual Meeting President's Prize and Council Poster Prize

These prizes are awarded for the best talk and best poster 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. Winners receive an official certificate and free membership to the Association for one year. The winners are announced immediately after the oral sessions at the end of the Annual Meeting.

Best Paper Awards

The aim of this award is to recognize papers published in either *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 will be drawn up in October (when papers for final part are allocated) and circulated around the science editors. The science editors are asked to nominate any papers that stand out, providing 2–3 sentences explaining why each is deserving. The Chair of the Editorial Board will draw up a shortlist of no more than five papers with supporting statements to circulate to the Editorial Board. The Editorial Board will then select 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/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 Chair of the Editorial Board will contact the winning authors and write short synopses for the *Newsletter*. An announcement of the awards will also 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**> 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.

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.
- 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 Innovations in Palaeontology Lecture Series 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.

Applications to be a PalAss Exceptional Lecturer will be strengthened if the applicant agrees to submit a paper as a review article for possible publication in *Palaeontology*.

Eligibility and selection process of the PalAss Exceptional Lecturer:

- Eligible candidates will have a PhD in palaeontology or a related field.
- 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 format 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.

The PalAss Exceptional Lecturer will be chosen based on the career track record, including research impact (relative to their career stage) and oratorical skills.

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:

1st November: Deadline for nominations for the PalAss Exceptional Lecturer.

December: The PalAss Exceptional Lecturer will be announced at the Annual Meeting.

February: The call for host institutions to participate in the Innovations in Palaeontology Lecture Series will be published in the *Newsletter*.

1st May: Deadline for applications from host institutions.

September – May: delivery of lectures.

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 (<**www.palass.org**>). Those with deadlines in the next six months are detailed below.

Career Development Grant

The Career Development Grant is to assist talented early-career researchers who have recently completed their PhD to strengthen their CVs to help them achieve a career in palaeontology (research or curation). The grant provides funding of up to £2,500, to be paid after submission of thesis and cessation of funding, for any purpose that would lead to the strengthening of the CV via completion of a measurable activity or output. The grantee is also automatically enrolled in the Association's mentoring scheme, and will be assigned a mentor by agreement.

Examples of how the grant could be used include (but are not limited to):

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

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

Proposals will be ranked on the following criteria:

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

Further details, including eligibility criteria for supervisors and students, and a full list of terms and conditions for the Career Development Grant 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**>).

The deadline is **1st November** each year. Successful applicants will be notified by the end of December and funds will normally be available soon after. A full list of awards will be announced at the AGM.

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. Students from under-represented groups will be given priority.

Applications should be made by the principal supervisor through online submission via the appropriate page on the Association's website, and will include:

- Details of the principal supervisor making the application, and other members of the supervisory team
- Details of the named student
- An account of the project aims, methods and expected outcomes
- A project plan including details of supervision
- Ethics statement

After completion of the work, successful **students** are required to produce a short report of the findings suitable for publication in the *Newsletter*. This report should be submitted by e-mail to <**palass@palass.org**> within eight weeks of the stated end date of the project. Successful candidates are requested to prioritize the Association's meetings and publications as media for conveying the research results.

Further details, including eligibility criteria for supervisors and students, 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**>).

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.

Research Grants

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

Applications for investigator's salary costs will only be considered in exceptional circumstances and if awarded all legal and financial liability will lie with the applicant (see 'Categories of expenditure for which the Palaeontological Association does not provide support', below).

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.

Proposals will be ranked on the following criteria:

- Scientific quality of research, novelty and timeliness, likely outputs
- Feasibility, value for money and cost effectiveness
- Investigator's ability to deliver the research project

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

Applications must be submitted electronically through the PalAss website (see below for details of the Required Supporting Information), with a deadline of **1st March**. 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.

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

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

- Core funding or overheads for institutions. The Association will fund the directly incurred costs of research on awards but, as a charity, we expect the general running costs (*e.g.* indirect costs, estate costs, support services, directly allocated staff costs) to be provided by the host research institute. We will therefore not fund on a proportion of full economic costs (fEC) basis. Attention is drawn to paragraphs 3.31 to 3.37 of the Science and Innovation Investment Framework 2004-2014, HM Treasury (July 2004), which explains arrangements for the provision of overheads linked to charity funding to academic institutions.
- Individual items of equipment over £1,000 GBP, sites, buildings or other capital expenditure.
- Support for attendance at, or organization of, conferences, workshops or exhibitions.
- A shortfall resulting from a withdrawal of or deficiency in public finance.
- Student tuition fees and summer research bursaries.

Further details and a full list of terms and conditions for the Research Grant 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**>).

The deadline is **1st March** each year. Successful applicants will be notified by mid-May. A full list of awards will be announced at the AGM.

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 consider applications up to £2,000. Application must be made in good time (at least nine months before the start of the event) by the scientific organizer(s) of the meeting using the online application form. Such requests will be considered by Council at the May and October Council Meetings each year. If the application is successful, we will require that the support of the Association is acknowledged, preferably with reproduction of the Association's logo, in the meeting/workshop/short course literature and other media. Enquiries may be made to the Secretary (e-mail <**secretary@palass.org**>).

Applications should be made through online submission via the appropriate page on the Association's website, for which you will need the following information:

- Title of meeting / workshop / short course
- Date and Place proposed
- 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 (also whether request is for a loan or a grant)
- Other sources of funding applied for
- Specific use to which requested funds will be put

Note: If funds are requested to support one or more keynote speakers, then full details of their names, affiliations and titles of presentations should be included. The application will be strengthened if the keynote speaker agrees to submit their paper as a review article for possible publication in *Palaeontology*.

The deadlines are **1st March** and **1st September** each year.

ASSOCIATION MEETINGS

65th Annual Meeting of the Palaeontological Association
University of Manchester, UK *18 – 20 December 2021*

We are aiming to welcome delegates to an in-person meeting at the University of Manchester, with enhanced online access to allow remote participation where possible. The current global situation is highly changeable, but we aim to keep members up to date through the Association website (<**palass.org**>) as soon as we are able to share more details. The organizing committee is chaired by Robert Sansom, with Russell Garwood and other members of Manchester's Interdisciplinary Centre for Ancient Life (ICAL) and the Department of Earth and Environmental Sciences.

The hosting committee are keen to welcome delegates to an in-person meeting with its concomitant benefits, whilst maintaining and enhancing the internationalism and diversity of the Annual Meeting during pandemic times. We will be holding in-person scientific sessions at the Oxford Road campus of the University of Manchester and stream/share oral and poster presentations for virtual delegates who are unable to attend in person. Oral sessions will be a mix of predominantly live, in-person presentations and some pre-recorded presentations from remote delegates, both presented to the in-person and virtual audience.

Programme at a glance

Friday 17th December

14.00–17.00 Pre-conference workshop (virtual): *"Social justice in palaeontology: case studies and future actions"*, Emma Dunne and Nussaïbah Raja (details below).

Saturday 18th December

10.00 – 12.30 Pre-conference workshop (in-person): *"Science communication for palaeontologists"*, Elspeth Sinclair and the public engagement group (details below).

13.30 – 17.30 Special Symposium: *"The Problem with Problematica: pushing the limits of the fossil record"* (details below).

17.30 – 19.00 Welcome Reception, University Place.

Sunday 19th December

09.00 – 12.15 Oral presentations.

12.15 – 13.30 Lunch and posters.

13.30 – 14.45 Oral presentations.

14.45 – 15.30 Annual General Meeting.

16.00 – 17.00 Annual Address: *"Decoding the evolution of form and function in the fossil record: why are animals shaped the way they are?"* by Emily Rayfield.

17.00 – 18.30 Poster reception.

20.00 – 11.30 Annual Dinner.

Monday 20th December

09.00 – 12.15 Oral presentations.

12.15 – 13.30 Lunch and posters.

13.30 – 17.00 Oral presentations.

COVID-19 and public health

The meeting will follow all University of Manchester and national UK COVID-19 guidelines. The former currently includes wearing a face covering in all indoor areas. Beyond these guidelines, we note that the Palaeontological Association is a scientific organization and we will follow the best available evidence-based policy to ensure the welfare of all those sharing space during the meeting and associated activities. As such, we expect all in-person attendees and exhibitors to be fully vaccinated unless medically exempt. Delegates who are unvaccinated or at high risk for COVID should register as virtual delegates. We also expect in-person delegates to complete lateral flow tests before attending the meeting. In the event of a positive test, or if a delegate is required to self-isolate whilst the meeting takes place, registrations can be transferred to virtual attendance. If in-person attendance is no longer possible for an individual due to travel restrictions or to allow them to isolate, then virtual attendance will be made available to that delegate. If the meeting cannot go ahead in person due to UK government guidelines/restrictions, then all registrations will become virtual. Should such a situation occur, then all presenters will be invited to submit a pre-recorded talk and attend a live virtual Q&A session. Unfortunately no refunds will be given in these instances. These measures are in place for the safety of conference delegates, but all delegates attend at their own risk.

Workshops

We are pleased to offer two workshops as part of the Annual Meeting. The first will run before the meeting as a virtual event on Friday 17th December: *'Social justice in palaeontology: case studies and future actions'* will be coordinated by Emma Dunne and Nussaïbah Raja. This virtual "workshop" will focus on a diverse range of topics relating to current ethical and legal issues in the field of palaeontology. Participants will be able to get involved in one of two ways: 1) by listening in to a series of talks and a Q&A session on 17th December (14.00 GMT); or 2) by signing up to join a focus group (max. 30 participants). This workshop is open to all, you do not need to be registered for the Annual Meeting to join the presentation session on 17th December or to participate in a focus group. Instructions for how to register for workshop participation will be circulated shortly.

The second workshop will run as an in-person event on the morning of Saturday 18th December: *'Science communication for palaeontologists'*, coordinated and delivered by Elspeth Sinclair, Liz Hide, Susannah Lydon and Zoë Hughes from the Association's public engagement group. The workshop aims to answer your questions and help to grow your knowledge about the aspects of public engagement that are important to you. The format of the workshop is flexible and will allow you to design an experience around the topics you want to learn about. Whether you are completely new to science communication or have experience and want to learn more, there is something for everyone. Places are limited, so sign up to reserve your spot (instructions for doing this will be e-mailed to registered delegates). When you have signed up, keep an eye on your e-mail for a link to the survey which will enable us to tailor the workshop to your requirements.

Symposium

Before the main meeting, we will begin on Saturday 18th December with a special thematic symposium *'The Problem of Problematica: pushing the limits of the fossil record'*. There will be talks from six international invited speakers addressing a broad range of topics, including geological, biological, ecological and taphonomic approaches to resolving the affinity and evolution of problematic fossil taxa, with important case studies from geological history. The speakers are Heda Agić (University of California, Santa Barbara), Derek Briggs (Yale University), Abder El Albani (Université de Poitiers), Xiaoya Ma (University of Exeter), Emily Mitchell (University of Cambridge) and Max Telford (University College London).

Registration and booking

Abstract submission has closed, but in-person and virtual delegates are welcome to continue to register at <**www.palass.org**> until 10th December.

Getting to Manchester

Manchester has excellent travel connections to the rest of the UK and Europe. The venue on the Oxford Road campus is a short walk (just over 1km) from the city centre and Manchester Piccadilly railway station, which has direct services to most UK cities (the 147 bus connects campus and Piccadilly). Manchester Airport is the UK's third busiest with frequent connections to a broad range of European and North American destinations; it is a short train journey (*c.* £4), tram journey (*c.* £4), or taxi ride (*c.* £20) from the university campus. Please note that the international travel requirements are frequently changing. We ask all delegates to keep an eye on the changing situation and to consult government information.

Accommodation

Manchester is a large city with a broad range of accommodation options. We ask delegates to book their own accommodation independently to match their own requirements. Hyatt House/Regency Hotel is on the university campus (Booth Street West) whilst Holiday Inn Express (Oxford Road) and the Ibis Hotel (Princess Street) are a short walk from the conference venues. Many other options are available for a range of budgets.

Travel grants to student members

The Palaeontological Association runs a programme of travel grants to assist student members (doctoral and earlier) to attend the Annual Meeting, in order to present a talk or poster. For the Manchester 2021 meeting, grants of up to £100 will be available to student presenters who are travelling from outside Manchester. The actual amount available will depend on the number of applicants and the distance travelled. Payment of these awards is given as a disbursement at the Meeting, not as an advance payment. Students interested in applying for a travel grant should contact the Executive Officer, Jo Hellawell (e-mail <**executive@palass.org**>) once the organizers have confirmed that their presentation is accepted and before 1st December 2021. Entitle the e-mail "Travel Grant Request". No awards can be made to those who have not followed this procedure.

The city of Manchester

Manchester is a large city with a historic industrial past, currently undergoing an energetic period of growth and regeneration. This includes a long history of engineering and science innovation at the University, from Ernest Rutherford's work in physics, Alan Turing's pioneering approaches in computing and Kathleen Drew-Baker's work on botany and marine aquaculture. Evidence of Manchester's industrial, political, cultural and sporting heritage can be found all over the city centre and its museums, alongside modern architecture and vibrant nightlife. Close to the University campus is Manchester's famous gay village, historic music venues, the 'curry mile', and a wide range of pubs and restaurants.

During December, Manchester city centre is usually taken over by the massive Christmas market with 300 stalls centred on Albert Square. Your local hosts can frequently be found there in December, and we encourage in-person attendees of the Annual Meeting to make a visit and enjoy some mulled wine with colleagues.

news

Ubirajara – *the Brazilian dinosaur lost to science, but raising the awareness of palaeoethics*

A paper describing *Ubirajara jubatus* from the Lower Cretaceous (Aptian) Crato Formation of Northeast Brazil was published online in the journal *Cretaceous Research* on 13th December 2020.

A compsognathid theropod, *Ubirajara* initially hit the headlines for being the first Gondwanan non-avian dinosaur with a filamentous coat, resembling fur, and for its stiff, blade-like shoulder accoutrements which superficially resemble display feathers seen on a male standardwing bird-of-paradise. However, within just a few days the focus of news coverage had moved from the undeniably exciting features of the fossil to questions regarding the legality of its export from Brazil. The hashtag `#UbirajarabelongstoBR` became the rallying cry across social media, and Aline Ghilardi, a palaeontologist at the Universidade Federal do Rio Grande do Norte in Natal, has been at the forefront of the campaign to get *Ubirajara* returned to Brazil.

On 21st December 2020 (although the letter online gives the year as 2021 in error), the Sociedade Brasileira de Paleontologia produced a statement announcing that they would be investigating the export of the specimen. *Cretaceous Research* temporarily withdrew the paper a few days later while investigations were undertaken.

Since 1942, Brazil has had a law which states that fossil deposits are the property of the nation and that any extraction requires state approval. The Federal Constitution of 1988 also considered sites of palaeontological value as Brazilian cultural heritage, to be protected by the public authorities. In addition, a number of laws starting with ratification of the UNESCO Convention of 1970 – which deals with the prohibition and prevention of illicit import, export and transfer of ownership of cultural goods – serve to regulate the movement of fossils out of Brazil.

In the original paper, the authors Robert Smyth, David Martill, Eberhard Frey, Héctor Rivera-Sylva and Norbert Lenz stated that the specimen was exported legally to Germany in 1995. The fossil currently resides in Staatliches Museum für Naturkunde Karlsruhe, Baden-Württemberg, Germany, where one of the co-authors, Eberhard Frey, is Head of the Palaeontology and Evolution section. In an investigative article for *National Geographic* by Michael Greshko published online in January 2021, Frey was reported to be in discussions with colleagues in Brazil and was hopeful of a successful resolution to the situation. But by September 2021 the Museum had put a statement on its Facebook page claiming that "the fossil of the Brazilian theropod dinosaur *Ubirajara* is the property of the German state of Baden-Württemberg".

Another of the co-authors, David Martill (University of Portsmouth), was already well-known for his work on fossils from the Crato Formation. Controversy had arisen when with co-authors in 2015 he described *Tetrapodophis amplectus*, a 'four-legged snake' (subsequently thought to actually be a lizard), based on a privately-owned specimen housed at Bürgermeister-Müller-Museum in Solnhofen, Germany. In the same *National Geographic* article by Greshko in 2021, Martill was

quoted as blaming corruption in the past in Brazil for the illicit trade in fossils and described the current strict laws as counterproductive.

In the latest twist in the tale of *Ubirajara*, the journal *Cretaceous Research* retracted the paper in September 2021 over the unresolved conditions of its export. In an article published on the *Science* website Ghilardi is reported to be happy with this outcome and thinks it will lead to more transparent and ethical research. *Cretaceous Research* has updated its policy on provenance of fossil specimens, and the Baden-Württemberg ministry was also reported to be reconsidering its position.

This case highlights the problems of parachute science, where researchers from Western Europe and North America have historically failed to include local palaeontologists in their research, as well as the broader ethical issues of fossil provenance (see *Palaeontology Newsletter* **106** for a write-up of the Palaeoethics Workshop at the PalAss Annual Meeting in 2020 and for Chris Manias's thoughtful article about palaeontology and colonialism). In the meantime, *Ubirajara* is a dinosaur in limbo, unavailable to science…

Susannah Lydon
Publicity Officer

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Changes to the Undergraduate Research Bursary Scheme

In line with our commitment to increase diversity within the Association (and palaeontology more generally) and remove barriers to inclusion and retention, we have recently made changes to the way that the Undergraduate Research Bursaries (URBs) are awarded. We have also simplified the application process in line with past feedback.

In 2017 the Palaeontological Association commissioned the Diversity Study to obtain an independent and professional assessment of diversity within the Palaeontological Association membership and palaeontology more broadly (<**https://www.palass.org/association/diversity-study**>). The study highlighted key issues and barriers to inclusion in our discipline and made recommendations for overcoming these. Among the recommendations are suggestions to utilize available funds to support individuals from under-represented groups. Paid undergraduate internships can be a very effective way of encouraging students to develop careers in science. The Undergraduate Research Bursaries offered by the Palaeontological Association are therefore one of the ways in which we can have the most positive influence over an individual's career. Under UK law this approach is referred to as "positive action" (defined in Section 159 of the UK Equality Act 2010), where the goal is to minimize disadvantages and encourage participation for groups that are disproportionately under-represented. This gives us the ability to prioritize applicants for awards based on self-declared protected characteristics that are under-represented in palaeontology. As a UK-based charity we operate under the UK Equality Act; however, we welcome applications from anywhere. In line with this, and using data from the 2017 Diversity Study and UK undergraduate statistics, the following categories are currently used to prioritize students for the Undergraduate Research Bursary:

1. Black applicants
2. Applicants from another racial or ethnic minority group
3. Women applicants
4. Disabled applicants

Once an application is determined to be competitive and feasible, the prioritization scheme is applied to determine awardees. Applicants who belong to the most under-represented group (Black applicants) are given the highest weighting under this scheme. To recognize the additional challenges associated with intersectionality, applicants who belong to more than one under-represented group will be weighted accordingly. Applicants are not obliged to provide any information on protected characteristics. Providing these data will remain an optional component of the application process, and students will be given the option to select "prefer not to answer" for any given question. Only information disclosed during the application process will be considered.

We have also made changes to simplify the application process to reduce the administrative burden for applicants and supervisors/institutions. This includes introducing a web form to remove the possibility of rejection on the basis of missing documents; streamlining the application to remove redundant or repeated sections and reduce word limits; and removing the need for a supporting statement from a second member of staff. The wording in the rubric has also been revised to make the scoring process fairer to applicants from non-research-intensive universities.

We receive more fundable applications than it is possible to fund, and recognize that the existing scoring and ranking process in grant funding allocation introduces a number of biases and inconsistencies that are difficult to account for. For the 2022 Undergraduate Bursary round, we are trialling an alternative process for the awarding of URBs. Projects will initially be assessed using existing criteria to ensure that they meet a high threshold for each of scientific quality, professional development opportunities, feasibility and supervisor availability. Funding will be allocated only to projects that meet all these high thresholds via a stratified ballot: an initial allocation on the basis of the prioritization scheme weighting (up to 50 % of bursaries awarded this way); followed by a general ballot to select remaining awards from all remaining eligible applications. This approach is in line with other funding bodies such as the Swiss National Science Foundation and the Health Research Council of New Zealand (see references below). Full details of this process will be made available on the Undergraduate Research Bursary page of the website prior to the opening of the 2022 round. This approach will be reviewed periodically, and we welcome feedback.

Sam Giles
Ordinary Member of Council
On behalf of the PalAss Council

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Palaeontology *and* Papers in Palaeontology – *policies, ethics and the way we operate*

As members, the Association's journals are important to us all for a range of reasons, not least as flagship outlets for some of the best research our field has to offer and as a source of income that we reinvest in accordance with our charitable aims. But the landscape of scientific publication is changing and the Editorial Board has been considering how we operate in this sometimes challenging environment. Much is still uncertain – what, for example, are the full implications of Plan S for journals, like ours, owned by small societies but published by big publishers? We have made progress on a number of matters, particularly around publication ethics, and issues of diversity and inclusivity, and the Editorial Board felt that an update for members would be timely.

Like many journals, *Palaeontology* and *Papers in Palaeontology* are members of the Committee on Publication Ethics (COPE) and adhere to their guidelines. This is in line with other professional societies with a similar publishing model. We have updated our publications webpages at <**palass.org/publications/**> to make this clearer. Our policies and guidance cover allegations of misconduct, authorship and contributorship, complaints and appeals, conflicts of interest, data and

reproducibility, ethical oversight, intellectual property, journal management, peer review processes, and post-publication discussions and corrections. The updated pages should ensure that members and our authors have access to the information they need about our publications and understand how to raise any concerns they may have.

Much of this policy and ethics guidance deals with events that the Editorial Board encounter very rarely, but other aspects will have a direct positive impact on many members. For example, we have adopted the CASRAI CRediT – Contributor Roles Taxonomy (<**https://casrai.org/credit/**>) for Contributions Statements. This allows authors to attribute credit explicitly for a range of contributions, including to individuals who are not authors. This approach is outlined on the Publication Policies and Ethics area of the Association's website, and as part of this we provide guidance to authors on our expectations regarding the unethical practice known widely as "parachute science":

> *In planning research and recognizing contribution and authorship, we strongly encourage investigators to recruit, and involve at all stages of the research and publication process, suitably qualified/experienced local researchers, especially where specimens, materials and/or data are from low-income or middle-income countries.*

Other areas of concern that have come to the fore in the last year or two include fossil export, fossils from conflict zones, and fossils held in private collections. We have taken action to address this in the Association's journals and the Editorial Board initiated a revision of our journals' policy on Reporting and Materials Availability. This was agreed by Council in early 2020 and has been implemented since then. Our policy states:

> *Details of palaeontological samples and specimens should include clear provenance information to ensure full transparency of the research methods. Samples should always be collected and exported in accordance with relevant permits and local laws, and in a responsible manner. Any submission detailing new material from protected sites should include information regarding the requisite permission obtained. Palaeontological and type specimens should be deposited in a recognized museum or collection to permit free access by other researchers in perpetuity.*

As a consequence, the Editorial Board has declined to handle a number of submitted manuscripts.

One of the reasons we looked again at our policy on reporting and materials availability was the attention drawn to the issues by research on fossils contained in amber from Myanmar. This is a complex area and in order to encourage open debate the Editorial Board (led at the time by Barry Lomax) convened a workshop on "Palaeoethics" at the 2020 Annual Meeting. The workshop and additional discussion with several of the speakers has informed the approach we now take to deal with submissions that may not meet appropriate standards. As a first step, the Editorial Board reviews new submissions for evidence of compliance with our Reporting and Materials Availability Requirements and, where we find shortcomings, we communicate directly with authors to make our expectations clear. We apply our policy to ***any*** fossil material, but, taking fossils from Myanmar as an example, a typical request to an author would be as follows (this is based on actual correspondence):

> *Having checked your submission we were unable to find enough detail to determine whether your research complies with our policy on reporting and materials availability. Before we can consider your manuscript please include in the materials section details of the permissions and permits to collect and export (if relevant) the material reported in your manuscript (our policy and requirements are reproduced at the end of this message).*

This is particularly important given your manuscript deals with fossils from Myanmar. The Association's position is that it is not legal to export fossils without specific permits for fossil export. Can you please clarify whether your material is deposited in Myanmar; if not, do you have plans for repatriation of specimens? If your answer to these questions is no, we are unable to consider your manuscript for publication in our journals.

Application of this policy has so far produced a range of outcomes – some authors are able to meet these requirements, while others are not. The position of the Editorial Board, approved by Council, is that this approach is more effective than singling out a particular country and imposing a moratorium; it achieves the same objectives and allows scrutiny of broader issues around the legitimacy of research on exported fossils — wherever they are from.

More generally in the context of our publications, in recent years we have taken steps to actively promote gender balance, diversity and inclusion in the composition of the Editorial Board, our team of handling editors, and in advising handling editors to seek at least one review from a woman. These actions align with recommendations in a recent analysis of gender bias in scholarly publishing (Squazzoni *et al*. 2021; *Science Advances*, 7) and, while success will require sustained activity over the years, the steps we have taken are already having an impact. Half of our Editorial Board are women. Our manuscript tracking system does not collect diversity data, but analysis that assigns gender on the basis of reviewers' first names (which we acknowledge is an imperfect approach) indicates year-on-year increases in requests to review addressed to women for the last three years (both number and percentage), despite the greater impact of the pandemic on women in academia.

Finally, a note on DORA (the San Francisco Declaration on Research Assessment). Many of you will be familiar with DORA and related guidance encouraging research evaluations to draw on a wider evidence base and, in particular, to avoid using journal-based metrics (such as the widely used and abused journal impact factor) as a proxy for the quality of an individual published article. Many of the recommendations in these documents focus on the use of bibliometrics in hiring and promotion and consequently do not apply to the Association, but there are elements that together represent best practice that would benefit the Association and its members. For example, we need to make sure we are explicit about the criteria used in evaluating the track record of grant applicants and clearly highlight, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published. A preliminary check suggests there are no major problems with our awards rubrics and criteria but we will be reviewing these to make sure we are as clear and transparent as we can be.

Nick Butterfield
Evelyn Kustatscher
Susannah Maidment
Mark Purnell (Chair)
Sally Thomas
The Editorial Board, Palaeontology *and* Papers in Palaeontology

Statement of support for palaeontologists around the world

With an ongoing pandemic and issues in numerous regions of the globe, including but not limited to social and political conflicts, economic crisis, police brutality and even wars, 2021 could be considered even worse than 2020. Within the Palaeontological Association, we acknowledge that many members are struggling to live in a safe environment, a basic human right. We understand that many members have not been able to resume their professional activity in 2021 on the basis of their geographical location.

We stand in solidarity with our members residing in zones of social, economic and political instabilities, as well as those in the geosciences and the wider scientific community.

Last year, the Palaeontological Association decided to exclude the year 2020 from the eligibility period for all grants and awards, due to the global impact of the COVID-19 pandemic. This year, in a similar fashion, the Association will exclude 2021 from the eligibility period of all grants and awards for those residing in zones of social, economic and political instabilities. We would like to highlight as well that 2021 will not be considered for early-career researchers and people with caring responsibilities.

We acknowledge that this action on its own is not enough and that we must do much more to support palaeontologists not only in the short term but in the longer term as well. For this reason, we will work on creating an active circle of local correspondents covering the entire globe who are able to provide insights on certain problems faced by local communities. This will help us acquire fast, independent information that will certainly aid in implementing effective solutions.

As a scientific organization with a global membership, it is our duty to show support for those among us who are facing challenges. In this way, we can achieve our aim of a healthy and fully functioning community.

If you have any suggestions or feedback for us please get in touch with the Diversity Officer or Executive Officer via e-mail (<**diversity@palass.org**>; <**executive@palass.org**>) or contact us on Twitter `@ThePalAss`.

The Palaeontological Association Council

Mentor Scheme experience

Photo: Benjamin Moon.

When the PalAss Mentor Scheme was first announced, I was about a year out of my PhD and looking for post docs and the future. I wasn't sure that I fitted into the category they were looking for for mentees, but was assured that it would work. Although I've had lots of help within my own supervisory committee and university, I was looking for an external or independent person who was less familiar with my work to give me some unbiased suggestions about applying for jobs and general mentorship in CVs, fellowship applications, *etc*.

I was first given a list of potential mentors to select from and see if they were interested. When I saw Susie Maidment's name on the list, I immediately thought she would be a great mentor. I knew Susie a bit, and thought she would give me honest advice, which is something I really wanted. I was also keen to talk to a fellow woman in palaeo who would understand some of the other issues we face. Happily, Susie agreed and we went from there.

We met first in person at SVPCA in 2018 and established what we wanted to do. We decided to do things on a kind of ad hoc/informal basis rather than scheduled meetings. I would send her an e-mail when I wanted to chat about something specific, and then we'd have a phone call or video call. Initially it was to get her advice on approaching people for writing grants or fellowships. It was great to be able to talk to someone that I wasn't applying to work with for suggestions on anything and everything. After the temporary position I was in as Palaeobiology Lab Manager at the University of Bristol was advertised as a permanent position, Susie was great at advising me. She looked over my CV, talked through interview questions and strategies with me, and even gave some pointers on negotiation tactics. Since I already knew the group, this was great because I didn't feel I could ask staff their for help. I was also a bit unsure initially as I wanted to have an academic position rather than be a technician, but Susie helped me see the benefits of a technical job and how I could use my skills to my advantage while still getting involved in research. And I got the job and am loving it!

Being part of the PalAss Mentoring Scheme helped me gain the confidence I needed to approach academics about applications, and to apply for things that I wasn't sure I qualified for. I think what I found the most difficult as a mentee was where to draw the line of what was too much or not

enough help. I didn't want to inundate Susie with requests and questions, but also wanted to make sure that I was getting what I wanted out of it. It was a fine line sometimes, but I don't think I was too annoying! The best piece of advice that I received was probably as simple as "You must apply for this job". Even though I tell that to people often, hearing it myself from someone who was so positive about the opportunity made me have confidence in myself. If she thought I could do it, maybe I should too!

I would definitely recommend other early-career researchers to join this scheme in the future, but do so having a clear idea of what you want beforehand. It's easy to just have general advice, but I think you get more out of it if you have a specific idea in mind. Don't be afraid to ask your mentor for help and advice when you need it – if they didn't want to help you, they wouldn't have offered to do it!

Liz Martin-Silverstone
Palaeobiology Lab Manager
University of Bristol, UK

Photo: Camilla Souto.

I joined the Palaeontological Association Mentor Scheme because I needed advice to advance my career, especially getting feedback on job application materials and on career planning. Basically, all the additional things that we need for success, but that are not generally taught in graduate school! Also, "the rules of the trade" vary from region to region. As an international scholar, I needed specific advice regarding applications for the US and Europe. Finally, it is not easy to approach mentors and the Mentor Scheme bridged this gap. My main expectation was to have someone to fill a void that existing mentors and knowledge could not fill. I was specifically looking for a female mentor whose unique experience I could draw on and learn from; I am surrounded by exceptional male mentors on the research side. I was looking for a mentor I could relate to on a more personal level and who could provide objective feedback. It is great that the Scheme provides a list of mentors and we get to suggest who we think are the best fit for us.

My mentor and I meet approximately once a month via Zoom. While it would be great to meet in person at a coffee shop, for example, virtual meetings increase the opportunity to be mentored by someone in a distant location and provide the flexibility to meet when convenient.

My expectations have been met in that it has been great to receive expert guidance and feedback on job application strategy and materials. My mentor has provided thoughts on specific areas of

my CV to be further developed and has been candid about the application process and associated challenges, and has helped me feel confident that I can submit a strong application. I feel we have developed a relationship where she feels comfortable pointing out hard truths and harsh realities about my chosen career path and what I still may need to do to be successful in my pursuit of this career.

I think it is important to come to a mentor with specific questions and to already have developed some materials which can be critiqued. One should truly listen as the nuances and golden nuggets are often embedded in the fabric of the mentor's personal experience. While no mentor can tell you exactly what to do to be successful, wise use of a mentor's time provides the most value.

For me, it is difficult to use up someone's time for my benefit and it takes an effort for me to ask for help. Based on my personal experience as a mentor though, I know that mentors benefit from these interactions as well. Additionally, it takes some time to develop a relationship with a stranger and to allow yourself to be vulnerable enough to ask for and take criticism. I have a different appreciation for this particular mentor/mentee relationship, as I have not personally worked with this mentor in a professional setting, so she does not know me well, yet she has been invaluable in providing her perspective and insight.

The greatest impact of this relationship is that I feel supported and nurtured. I know that there is someone out there who I can turn to when I need a boost of confidence and encouragement. I have had many burning questions answered, especially those which I could not ask other mentors! At the end of our conversations, I feel like a weight is lifted from my shoulders and I am grateful for the exchange.

It is hard to distill down a single piece of advice which might be considered the best I have received. My mentor has provided feedback in many different areas, has shared her experiences and has been candid with her advice.

I would definitely advise others to join the Mentor Scheme. Our career path does not need to be a lonely road – it is certainly difficult to pursue what we do in isolation. I am thankful for diverse mentors and mentees who have gifted me with their perspectives.

I plan to join the Scheme as a mentor in the future. Knowing that academics go through emotionally draining moments and that it is imperative that we support each other, it is only natural for me to want to serve future generations of early-career researchers.

Camilla Souto
Peter Buck Deep Time Fellow
Smithsonian National Museum of Natural History (NMNH), USA

For more information on the Association's Mentor Scheme see the website

<**https://www.palass.org/careers**>

From our Correspondents

A Palaeontologist Abroad

Highlighting early-career researchers who have taken posts outside their home country and the opportunities they used. This issue's palaeontologists are Mónica Carvalho, William Harrison and Sergi López-Torres.

Mónica Carvalho is a Colombian in Panama, employed as a postdoctoral fellow at the Smithsonian Tropical Research Institute on an Earl S. Tupper Fellowship.

Photo: Peter Wilf.

Q1: How did you end up in Panama?
I was drawn to Panama by the Smithsonian Tropical Research Institute. This division of the Smithsonian Institution is one of the largest centres for tropical ecology (and palaeoecology) in the world. I spent some time in Panama as an undergraduate student, while working on my senior thesis at STRI. Such was my delight working in this place, that I managed to come back as a postdoctoral fellow thanks to being awarded a postdoctoral fellowship.

Q2: How is your position funded?
My position is funded by the Earl S. Tupper Postdoctoral Fellowship, granted annually through the Smithsonian Tropical Research Institute. This is a three-year fellowship endowed by the Tupper family, that allows for independent and innovative research in any area related to tropical ecology, extant or past. The fellowship includes a monthly stipend and some extra funds for research purposes.

Q3: What is your project about?
During the Palaeocene, northern South America was covered by modern-like tropical rainforests: multistratal communities of angiosperm trees that assembled after the end-Cretaceous extinction. My project aims to understand the response of these early, modern-like tropical rainforests to the early Eocene warming events. I explore Palaeocene and Eocene deposits in northern South America in search of fossil plants aiming to answer: How did tropical rainforest plant community composition change during the early Eocene hyperthermals? How were plant–insect interactions, as seen through leaf damage, affected? How did forest evapotranspiration change in tropical America as CO_2 and temperatures rose?

Q4: What surprised you most about living in Panama?
I was most surprised by the cultural diversity you can find. This Latin American country has a long history of immigration, as reflected in the many cultural and ethnic groups who live here.

Aside from the large numbers of Caribbean and South Americans, you will see the local Kunas, an indigenous group who live near the Colombian–Panamanian border, wearing their traditional outfits. There is a large Chinese community, most of whom are descendants of people who came into the country during the construction of the Panama Canal, and the Jewish, Muslim and Buddhist communities are very notable – something that is not too common in Latin American countries.

Q5: Apart from friends and family what do you miss most about Colombia?
Aside from friends and family, I would have to say the weather and the food. Panama has a toasty, tropical weather with frequent rainstorms, similar to that experienced in many places in Colombia. Yet, I come from a city situated in the mountains where cooler, spring-like weather prevails all year round.

Q6: How has the pandemic affected your situation as a palaeontologist abroad?
The pandemic hit Latin America particularly hard. I was only able to return to my lab 18 months after the pandemic began. The final fieldwork efforts related to my project had to be cancelled, I had no access to my fossil collections and had to search for extra funding in order to continue my research. Fortunately, I was able to work on data analysis while struggling with strict quarantine, family obligations and the emotional toll that the pandemic had on most of us. On the personal side, I had to return to Colombia in order to take care of an elder family member who did not have anybody else to rely on.

Mónica Carvalho tweets at `@moccada`. You can find her in Instagram at `@moccada` and on the Web at <**https://moccada.wixsite.com/paleobiology**>.

G. William M. Harrison IV is a Jewish American in the Netherlands, employed as a PhD candidate at Naturalis Biodiversity Center on a Marie Skłodowska-Curie Innovative Training Network (ITN).

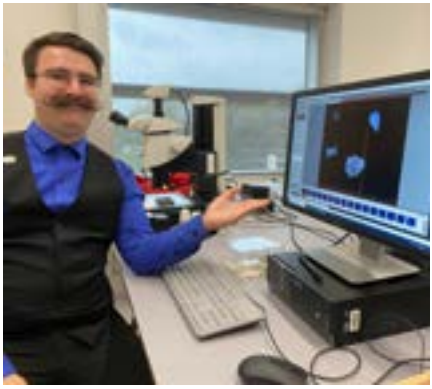

Photo: Leo Bertini.

Q1: How did you end up in the Netherlands?
I was drawn in by my project. When I was finishing my master's degree in Germany, I applied to projects throughout the world. However, the concept of an international training network really fascinated me. The rule requiring every PhD student based in the European branch of the programme to move to a new country was especially exciting as it guaranteed a diverse group. Combined with the interesting PhD topic outlined below, it was too good to pass up.

Q2: How is your position funded?
My position is funded by the European Union under the Horizon 2020 programme through the 4D-REEF project, which is a Marie Skłodowska-Curie Innovative Training Network. This funding not only covers my salary but also affords me €58,320 over four years for analyses, training, conferences, temporary research assignments and such.

Q3: What is your project about?
The 4D-REEF project is a large consortium of European and Indonesian scientists that formed to study the past, present and future of turbid coral reefs in Indonesia (<**https://www.4d-reef.eu/**>). In short, the goal is to combine palaeontological studies on the order of tens of thousands to tens of millions of years, decade-scale survey data, modern data, and models of both past and future climate conditions in order to assess the fate of individual coral species and coral reefs as structures in Indonesia over the next 100 years. This requires interdisciplinary and international collaboration to succeed, leading 40+ researchers from 14 institutions to write a grant together and hire 18 Early Stage Researchers (*i.e.* PhD candidates).

My chunk of the project is supervised by Willem Renema and Ken Johnson and has two parts: making AI tools to assist researchers in analysing samples, and using those tools to answer questions. Many questions in palaeontology require a researcher to sort sand-sized samples under the microscope and identify all taxa on a crude level. This task is often offloaded onto bachelor's and master's students; Vanessa Roden, at that time a PhD student at Friedrich-Alexander-Universität, paid me to sort sieved Triassic sediments in this manner during my master's thesis. However, a computer can perform repetitive tasks like this far faster than a human. Therefore, I am seeking to train computers to locate sediment grains on a sample tray and identify them on the taxonomic level one could expect from a bachelor's student, allowing other researchers in 4D-REEF to process samples more efficiently than ever before.

Additionally, I am building an AI to trace the borders of components in thin sections, count the pixels within those borders, and identify them to a crude level, allowing researchers to quickly determine the proportion of a thin section that is occupied by specific taxa. This will allow me to quantitatively compare the contribution of different carbonate-producing taxa to rocks in Indonesia from the Miocene through the Pleistocene, highlighting shifts. These data will be combined with palaeoclimate models developed by Xin Ren, who is studying palaeoclimate modelling at Bristol, to establish links between environmental conditions and reef-building taxa in the Pliocene, which will be combined with models for future climates to predict where reefs will survive in 2100 and what those reefs will look like.

Q4: What surprised you most about living in the Netherlands?
The people for sure. In my experience, the Dutch are the most tolerant people. The directness for which the Dutch are famous is refreshing, especially to a foreigner. I find teasing out the cultural norms to be one of the hardest parts of moving to a new cultural region, so direct communication is a welcome change in both professional and social situations.

Q5: Apart from friends and family, what do you miss most about the USA?
Difficult to say; I was living in Germany for two-and-a-half years before coming to the Netherlands and before that I lived in so many radically different regions of the USA. But if I had to pick one constant that I miss, it is walking in old growth forests. From Ohio to Colorado to Bavaria, I always enjoyed walking among massive trees on a moment's notice; now I have to plan a vacation when I want a walk in a large woodland.

Q6: How has the pandemic affected your situation as a palaeontologist abroad?
Quite a few of my training courses moved online and some of the lab work I needed had to be postponed. Otherwise, I was very lucky: my project is mostly programming based and suffered relatively few setbacks. Furthermore, my apartment building is full of friendly neighbours (and their pets), making for a lovely work environment.

William tweets at `@GWMHarrison4`.

Sergi López-Torres is a Spaniard in Poland, employed as an assistant professor at the University of Warsaw.

Photo: Wioletta Kamieńska.

Q1: How did you end up in Poland?
During the last year (2016–2017) of my PhD at the University of Toronto I was trying to get myself into the job market and applied for several positions. Eventually, I was offered a two-year (2017–2019) postdoctoral position at the Institute of Paleobiology at the Polish Academy of Sciences in Warsaw, to work under a grant of the National Science Centre (NCN) that was awarded to my postdoctoral supervisor. There I worked on the taxonomy of fossil mammals and brain evolution of lagomorphs. After this postdoctoral stay, I won a Kalbfleisch Postdoctoral Research Fellowship to do a second postdoc at the American Museum of Natural History in New York (2019–2020) to work on the description of a beautifully preserved Eocene mammalian specimen from Asia. After my second postdoc, I returned to Poland, where I was temporarily hired as an assistant professor at the same Institute of Paleobiology. After that, I was offered an assistant professorship at the Institute of Evolutionary Biology at the University of Warsaw, which I have just started this October.

Q2: How is your position funded?
I have just recently landed in my current position as an assistant professor at the University of Warsaw. My plan is to apply for funding to the Polish science funding agency NCN (under funding schemes like the OPUS grants), as well as international grants (like NSF) together with colleagues from foreign institutions.

Q3: What is your project about?
My research focuses on several aspects of the taxonomy, phylogenetic relationships and functional morphology of early members of Euarchontoglires (the group that includes modern primates, treeshrews, colugos, rodents, and rabbits). I am particularly interested in primate origins and the study of a group of fossil mammals called plesiadapiforms, as well as other early groups, like anagalids or stem lagomorphs, and how they can inform us about the evolution of major modern mammalian lineages, like Primates or Glires.

Q4: What surprised you most about living in Poland?
Probably the first shock came with the language. It is quite a challenge to learn! The grammar is incredibly complex and I still struggle to construct simple sentences. But everyone seems very pleased that I am trying, so that is uplifting!

As for the weirdnesses, one that does not cease to amaze me is that when you turn the TV on in Poland and there is a foreign movie on, you will notice that it is dubbed. This sounds completely normal, except for the fact that all characters are dubbed by one single man, the lektor, who is making an extremely neutral voice. I find it so distracting and weird that I have to stop watching!

Also, I have had the chance to see a lot of Poland, from the sea at the Hel Peninsula in the North to the Tatra Mountains in the South, and this country has breathtaking places all over.

Q5: Apart from friends and family what do you miss most about Spain?
Although I am a big fan of Polish cuisine, the flavours are very different from the food at home. I try to make up for it by cooking home recipes, but it is sometimes hard to find certain ingredients. The weather is also dearly missed; not so much in the summer (Polish summers are great), but definitely during the winter. I also miss the patronal feasts of my hometown, a type of town festivals that do not really happen here.

Q6: How has the pandemic affected your situation as a palaeontologist abroad?
The breakout of the pandemic caught me in the middle of my postdoctoral stay in New York, which got hit pretty bad at the time. I spent half of my one-year-long postdoc not being able to go to the Museum, as the rest of my colleagues, so that particularly limited data collection for my projects. I also missed some very promising in-person meetings, and I have not seen many colleagues in a very long time. Upon my return to Poland, work-from-home policies were still in place, so that still slowed down some of the research that needed access to certain resources. But things are looking up now. All in all, I still consider myself fortunate in the context of how devastating the pandemic has been for some, especially because I have had good support from colleagues, friends, and family.

Sergi tweets at `@S_LopezTorres`.

Legends of Rock

Valentina Karatajūtė-Talimaa: a giant in the field of vertebrate microfossils

I first heard about Valentina (1930.12.07 –) when I was ten years old when I read a Russian popular palaeontology book "По следам минувшего" ("In the footsteps of the past"). The authors – palaeontologists and storytellers Irina and Vladimir Yakovlevs – mentioned that in Vilnius you can find the greatest researcher in the world on matters of the earliest teeth and scales – Valentina Nikolaevna (her patronym – father Nikolai) Karatajūtė-Talimaa. I was deeply impressed that in my small country of Lithuania you can find such a great scientist, who moreover is a palaeontologist!

V. Karatajūtė-Talimaa (in 2020) with the Golden Hammer. Photo courtesy of V. Breivienė.

The first time I met her I was in high school. She was not only as smart as everybody wrote and said, but also she was immensely funny and entertaining, ferociously seeking adventures and pursuing her goals, as well as being very

V. Karatajūtė-Talimaa in the Lithuanian Geological Society meeting. Photo courtesy of M. Kaminskas.

helpful and good-hearted. Through six decades of her active career she travelled through the whole former USSR and, after independence came in the nineties, she travelled through the rest of the world. She gathered an immense number of fossils, which are now stored at the Institute of Geology and Geography, Nature Research Centre. Thousands of macroscopic specimens with fossilized fish remains were collected from the Ukraine, northern Urals, Novaya Zemlya Arctic archipelago, south-eastern Siberia (Tuva) and Mongolia, but also Estonia, Latvia and Lithuania. These – literally – tons of material were transported to the Institute on her petite shoulders. This material is also accompanied by an immense number of microfossil slides – her primary target of research. She held the view that a palaeontologist who only theorized and did not know fieldwork was worth very little. She is a woman of strong opinions. I tend to (quite romantically) think that this character is inherited from her ancestors. Her genealogy, as she told me, is quite diverse, with Russian, Lithuanian, German, Polish ancestors … and also the Tatars. Her family name Karatay in Turkic languages means "black horse". The grand duke of Lithuania Vytautas the Great gave the rights of settlement and privileges to a rebellious faction of noblemen from the then competing empire – the Golden Horde – during the High Middle Ages. They – native Muslims of Central Europe – settled around Vilnius in the territory of modern Lithuania, Belarus and Poland and served as a class of warriors and later also as craftsmen and statesmen. They always had great respect for skill. Think as you may, but this spirit shines in Valentina's character – she even won a student fencing championship in the early 1950s!

She began her scientific career under the supervision of Juozas Dalinkevičius, who is regarded as the father of modern geology and palaeontology in Lithuania. As a student, she volunteered in the joint expedition of Dalinkevičius and the famous palaeoichthyologist Dmitry Obruchev, which excavated some of the best material of the early tetrapodomorph *Panderichthys* in the Devonian sands of central Lithuania. From this point she started her career in the Institute of Palaeontology in Moscow, where she built her network of collaborators. Her work can be understood as a synthesis of Russian and German traditions of palaeoichthyology, since she knows these languages (as well as English, Polish and her native Lithuanian) and communicated a lot between scientists from different institutions.

Her lasting scientific legacy is the development of a classification approach for Palaeozoic fish scales based on the joint analysis of morphology and histology. Her work revealed that morphology can be highly convergent between very different clades, and the internal structure of scales is a much better guide for their phylogeny. Nonetheless, morphology could be used

in forming so-called chains of intergrading scale types from different parts of the body of a species, which can be joined in a morphological assemblage. Using this refined classificatory approach, she completely revised the classification of the whole class Thelodonta, analysed many other jawless fishes and also took part in the debate on the biological affinity of conodonts, as well as possibly the oldest skeletal remains of vertebrates. Her magnum opus published in 1972 "Thelodonts from the Silurian and Devonian of the USSR and Spitsbergen" is a must-have classic of the field and historically served as the reference for classification and biostratigraphic correlation of Devonian and Silurian strata using thelodonts as an index taxon.

Her work was recognized by the Society of Vertebrate Paleontology, where she was awarded honorary membership in 2002 for a distinguished contribution to the field of vertebrate palaeontology. She is also an honorary member of the Lithuanian Geological Society and a recent recipient of The Golden Hammer – a prize for outstanding life-long achievements in the field of geology. She is an excellent example of a model scientist for all palaeontologists.

Andrej Spiridonov
Vilnius University, Lithuania

Behind the Scenes at the Museum

Orkney Fossil and Heritage Centre

The Orkney Fossil and Heritage Centre set up in the farm buildings at Viewfirth first opened its doors in 1990 to display the private collection of antiques and fossils belonging to the Firth family, local builders, and owners of the quarry at Cruaday, the type locality of the Sandwick Fish Bed. Due to ill health Leslie Firth transferred operation and ownership to a board of local trustees in 2020. The Fossil Centre Trustees have successfully run the museum café and gift shop for the past 20 years through two major refurbishments. The Centre remained closed throughout the 2020 season due to COVID-19 and opened again this year. The gift shop carries a wide variety of books, local crafts (knitwear and jewellery), worldwide fossils, and local fossil fish (provided by local collectors) for sale.

The Orkney islands lie on a broad ridge of metamorphic basement which extends northwards from Caithness towards Shetland. This basement high is bracketed by the deep fault-bounded

Orkney Fossil and Heritage Centre facilities at Burray, Orkney. Photo: John Flett Brown.

Examples of fossils exchanged by Leslie Firth for specimens of fish gathered from Cruaday Quarry. Photo: John Flett Brown.

half grabens of the West and East Orkney Basins. On top of this basement lies about 1,500 m of gently folded and faulted middle Devonian sedimentary rock consisting equally of sandstone and flagstone. The lower beds of Eifelian and early Givetian lacustrine sedimentary cycles are 730 m thick and made up of 94 individual cycles (Milankovitch, 100,000 year cycles) each starting with 1 m to 3 m thick deep lake laminite with fish remains. The approximately 385 million year old Sandwick fish bed is 20 m thick, containing about 16 species of fish preserved as articulated specimens, most of which are represented in the Museum's collection.

Education of local schoolchildren is a high priority for the trustees and is accomplished with the use of high-quality professional bespoke graphics. Because the Firth family owned the type locality of the Sandwick Fish Bed, many museums and individual collectors wanted to acquire specimens, for which they exchanged many of their own prize specimens. This gave rise to our second 'Earth Gallery' of world fossils.

The Orkney Fossil and Heritage Centre has two fossil galleries, along with a top floor of local heritage exhibits, a lower gallery depicting the construction during World War II of the Churchill Barriers, and a café serving food from local sources.

The website at <**https://www.orkneyfossilcentre.co.uk/visit-info/**> gives much more detail on our project.

John Flett Brown
Stromness, UK

Lithostratigraphic column of the succession in Orkney with hand samples of each unit. Photo: John Flett Brown.

Rock samples on display in the Centre. Large slab: Cheiracanthus *sp.*, Osteolepis macrolepidotus, Gyroptichius agassizi, Coccosteus cuspidatus, Mesacanthus *sp.*, Diplacanthus striatus. *Small slab:* Osteolepis macrolepidotus *with a coprolite. Photo: John Flett Brown.*

Articulated specimen of Dipterus valenciennesi *from the Middle Devonian Sandwick Fish Bed at Cruaday. Photo: John Flett Brown.*

Mystery Fossil 28

The new Mystery Fossil has been submitted by Paul Blake. The fossils are flat and sheet-like but so far only impressions have been found. They are from the Cretaceous (Albian) Allaru Mudstone in southwestern Queensland, Australia, and were found with typical marine fossils such as ammonites and bivalves. No edges of these fossils have been found. So far the two found seem to occupy the entire bedding plane of the specimens collected. The Allaru Mudstone is interpreted as having been deposited in a quiet-water, shallow marine environment in Draper (2002, p. 53). However, terrestrial fossils have been found in it too so it is possible that the mystery fossils could be part of a drift flora.

If you have any suggestions for what these fossils could be, please contact Paul by e-mail to <**p.blake@bigpond.net.au**> or the Newsletter Editor at <**newsletter@palass.org**>

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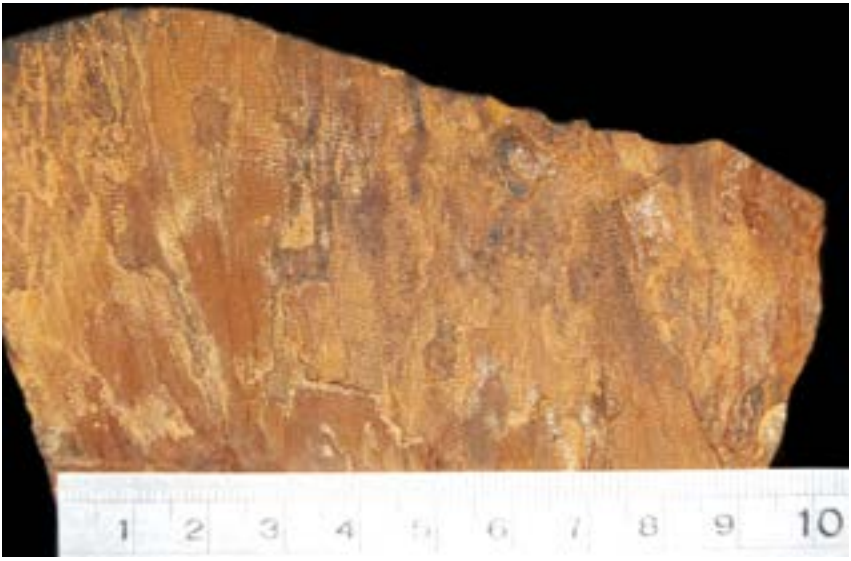
All photos by Paul Blake. Rulers are in cm and the scale bar on photo (c) is 3 mm.



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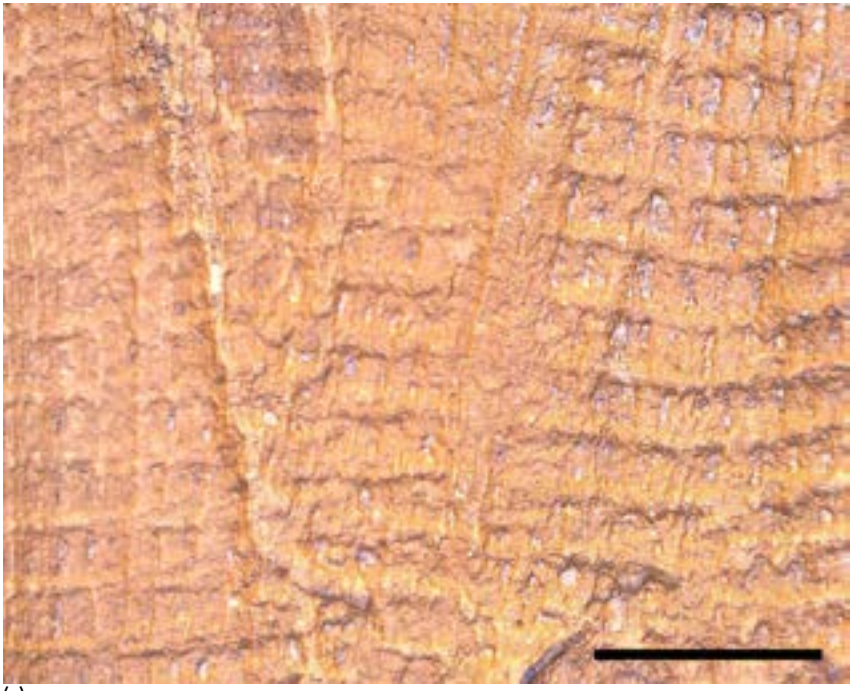

(c)

Scanning the heavens

Palaeontology is a science – whether profession, pastime or passion, depending on personal taste and circumstances – that is most decidedly down to Earth. This, for most of us, is its precise and central charm. From excavating those recalcitrant rock slabs from a bramble-choked stream, to excavating some fossil marvel from the clinging matrix with a stout mounted needle, then faithfully reproducing its outlines with a pencil sketch, and gluing on its label before finding space for it in the museum drawer, it is an agreeably tactile and practical occupation and a constant reminder of its local landscape. It takes one through almost unimaginably long vistas of time, certainly, but there is less tradition of stretching across miles of endless space. One can go to exotic lands, from Patagonia to Spitsbergen and the like to hunt for fossils, of course – but what is exotic to a Lancashire palaeontologist is really just visiting someone else's home space. To really stretch palaeontology into a cosmic discipline, one has to leave our homely planet and go into the cosmos. But just how far can one go?

It is a question that, for most of the history of our discipline, has probably narrowed, with each new discovery discouraging further enquiry. From Democritus in classical times to Buffon and colleagues in the Enlightenment, there was a strand of thought (often heretical, if not downright dangerous to hold, true) that assumed the Earth to be just one of many planets out there, with no particular distinguishing features except that we just happened to live on it. On those other planets, life of some sort would generally arise, just as it did on Earth – and if life arose, then death and fossilization must follow, just as certainly as that oft-quoted pairing of death and taxes, though less expensively. For the eighteenth and nineteenth century savants, biology, it was thought, must be a universal constant, so logically[1] it must bring along its more cadaverous relation, palaeontology.

Alas! – that fine optimism was to be dashed, step by step, as the biology part of the equation proved more and more elusive. The Moon in bygone days was the first port of call, with that pillar of the astronomical establishment, William Herschel, proclaiming that he had seen towns on the Moon through his telescope in 1778. But the urban sprawls of the Selenites faded away, rather than coming into sharper focus, as the ever-more-powerful telescopes of the 19th century were trained on them. That did not stop the speculation, of course, though a little ingenuity was needed to keep optimism alive. That scientifically literate writer H.G. Wells, in *The First Man on the Moon* of 1901, put his advanced Selenite civilization[2] underground, away from the prying eyes of the Earthlings. By the time of the first Moon landings, the only kind of Selenite life to be expected was that of microbes or organic molecules, and even those proved elusive on what turned out to be a barren lunar wasteland.

With Mars, the optimism carried on for longer – and is still there, indeed, though with a growing recognition that this is going to be a long haul. In the glory days of the late nineteenth century, the straining eyes of Percival Lowell notoriously went into cahoots with an optimistic imagination, to see – and draw, in considerable detail – those notorious canals, together with oases, the constructions – it was averred – of a Martian civilization. Well, that idea lasted long

[1] A mostly unspoken logic, admittedly – the explorers of a new planet would mostly have more cheerful things to do than search for the nearest crypt.

[2] Advanced enough to be properly horrified at the way the brutish Earthlings organized their lives.

enough to prompt H.G. Wells to write *The War of the Worlds*, but with Lowell's fellow astronomers, it was a concept pretty well dead in the water[3] from the beginning.

Still, Mars has stayed in the hunt for extraterrestrial life, dead or alive, as successive orbiters and landers from NASA & co. have shown pretty conclusively that while it may now be a freeze-dried planet, water once flowed across its surface, and perhaps even formed oceans. As those balmy conditions were in place something like four billion years ago, in the Noachian era of the Mars chronostratigraphic table, it is palaeontology that is in pole position to find the first evidence of life beyond Earth. Not that the NASA scientists have given up on finding contemporary life on Mars, of course – there are those periodic exhalations of methane from some underground source into the Martian atmosphere still to explain. But if it is Martian microbes producing these methane burps, and not some purely inorganic reaction, then they live far too deep below ground to be reached in any conceivable near future. Meanwhile, beautifully-preserved strata from Noachian times are right at the surface and available for close examination by those trundling rovers. A fossil – any fossil – is top of the wish list.

Many close-up pictures have now been taken of Mars strata in those sites, such as Gale Crater, carefully chosen as the best candidates to show ancient lake beds. And those pictures have then been pored over by the exopalaeontologists back on Earth, who have, sure enough, found some decidedly intriguing sedimentary structures. Vincenzo Rizzo (2020) for instance, has worked through thousands of images taken by the Spirit, Opportunity and Curiosity rovers, all freely available on NASA's capacious website. He picked out rounded structures resembling microbialites, curved fine laminae that look quite stromatolite-like, more irregular masses that he compared with microbial thrombolites, cylindrical structures that might be biogenic, and masses of curved linear structures. Find these on Earth, he said, and you would say that these were probably fossils. True enough, but even on Earth they would not certainly be fossils, as terrestrial rocks contain a fine array of most intriguingly shaped pseudofossils too. And on Earth one can collect such objects, dissect them, put them under a microscope, X-ray them … and even then it can be hard to say what is definitely biogenic and what is not. On Mars, all we have is an image, captured by a passing machine. We will have many more such tantalizing hints on Mars, one suspects, before that first exofossil is definitely nailed. Nevertheless, the surface evidence is out there, and more is being gathered all the time. The hunt is on, it is a big and exceedingly well-funded operation, and we can simply sit back and wait for the next news – without, though, holding our breath. While we wait, let us venture a little farther afield, in our mind's eye, at least.

Our other next-door neighbour is Venus and here the rollercoaster study of potential life has swooped along highs and lows that have been truly precipitous. That thick cloud cover kept its dreadful secret for long after the Mars canals were debunked. Even Svante Arrhenius, who worked out the truth of Mars's frigid climate (and of Earth's climate too, once humans began to get their paws on the controls) considered that, beneath that unbroken cloud cover, Venus would have an ever-wet climate and lush Carboniferous-like forests. Others went further, to suggest that it would have a planet-wide ocean, a Panthalassa because, they said, continents would cause atmospheric updrafts that would make breaks in those clouds. Those sober scientific assessments helped spark the golden age of Venusian science-fiction, a riot of gaudily-covered penny dreadfuls that explored the full gamut of Earthling–Venusian relations. Some of the

[3] In the water that likely did not exist, of course.

authors had their own impeccable credentials. The highly scientifically literate Isaac Asimov, for instance, in 1954 penned *Lucky Starr and the Oceans of Venus* using, as the title suggests, the Panthalassa-like model as general setting for the derring-do. For the endless Venus-ocean, Asimov created an ecosystem that Wikipedia describes as Cambrian-like, though that is something of a chronostratigraphic generalization, given that it includes telepathic amphibians, while the murderous deep-sea orange patch that adds to the Venusian suite of perils is more phylogenetically ambivalent. Asimov's creation was part of yet another phylogeny, a literary one, in being overtly inspired by the Venusian ecosystems earlier invented for the *Astounding Stories* series by Stanley G. Weinbaum, notably in *Parasite Planet* of 1935. Here the "thousand different species" of Venus had many legs, many mouths, and were always hungry – a blunt and basic interpretation of the tree of life, but one that was certainly effective at shivering the spines of his army of readers.

These phantasmogoric visions came, as we know, to a definitive end, as allowable possibilities, on the 18th of October, 1967, when the Venera 4 spacecraft penetrated the thick clouds and worked for just long enough to signal surface temperatures of some 450 degrees Centigrade maintained by 90 Earth atmospheres-worth of carbon dioxide, laced with sulphuric acid for good measure and vanishingly small amounts of water. A hyper-arid and toxic planetary oven, it was an instant cold shower for ideas of Venusian life, and (among many other things) forever changed the course of Venusian science fiction. It did not quite put to rest ideas of some form of microbial life drifting in the higher, cooler parts of the Venusian cloud system. That seems a long shot. But in looking for signs of life, today's Venus is not yesterday's Venus. There may be fossils on Venus. But where – and in what shape?

The window into that past came, serendipitously, from an instrumental glitch, brought on by the extreme conditions in the Venusian atmosphere. When the NASA Pioneer spacecraft parachuted down through those thick clouds in 1978, it had a mass spectroscope on board to measure what the Venus atmosphere was made of. As it was switched on, a drop of sulphuric acid condensed within the instrument, and upset those atmospheric measurements. However, the instrument then analysed the chemistry of the acid drop, and the tiny amount of water within it. That water was found to contain values of the heavy hydrogen isotope deuterium within it that were much higher than those on Earth. And hence, the logic went, Venus once must have substantial amounts of water, and then lost almost all of it to outer space from the atmosphere, fractionating it along the way until only deuterium-rich remnants were left.

So, how much water was there and when was it lost? A few years ago, a NASA team crunched some numbers to shed some light on the "when" question (Way *et al.* 2016) and, usefully, they referred to various previous estimates of the "how much" question too. Estimates of early Venus oceans, it turns out, have ranged from an average thickness of some four metres of water across the planet, to a little over half a kilometre's depth. That latter figure, while not approaching the Earth's ocean volume (that would be a little more than two and a half kilometres deep across our planet, if the continents did not exist) is eminently respectable, and would be enough for a hydrological cycle of rain, rivers, lakes and seas. Ample, one would have thought, for giving rise to both an incubator of life – the NASA team in their title suggest that Venus might have been "the first habitable world of the solar system" – and then preserving the remains of that mysterious maybe-life within strata.

How long might these balmy conditions have lasted? Well … pronounced that team of modern-day savants: that depends. Among other things, it depends on how fast Venus rotated around its axis, as that factor helps control heat balance. Assuming a rotation speed like today's, allowing for that "faint young" Sun being less bright than today, and plugging in a range of other factors, they calculated that habitable conditions might have lasted up to 715 million years ago, before a runaway greenhouse set in to sterilize the planet. That is quite a stretch and means that Earth might have had a true planetary twin through the Hadean, Archean and Proterozoic eons. By an eerie coincidence, that calculated 715 million years ago for one planet to go into broil mode is almost exactly equivalent to the time when its neighbour froze at the beginning of Snowball Earth conditions of Cryogenian times. If the Solar System has a guiding spirit, it must have a very dark sense of humour.

Sense of humour or no, that near-four billion years of potential life, sedimentation and fossilization on Venus should have given rise to a stratigraphic record which is nearer that of Earth in duration than that of Mars. That's quite a target and – setting aside for now the small problem of the challenging working conditions – we might speculate where those strata might be and what form they might take.

There is, firstly, a physical barrier to overcome. Since its climate catastrophe and the end of water and water-based sedimentation, volcanism has ruled the roost on Venus. Those thick clouds are impenetrable to light, but not to radar, and the resulting volcanic landscapes thus revealed are spectacular. And telling too: the age of that planetary surface of Venus, as worked out by the chronology of meteorite impact craters, is surprisingly uniform, at about half a billion years. Whether that is due to an awesome "resurfacing" process, where subterranean heat builds up to unleash magma in a single, planet-wide burst of volcanism, or to more gradual volcanism, mosaic-style, seems still unclear. No matter. There is a geologically recent – that is, roughly equivalent to the Phanerozoic Eon of Earth – carapace of volcanic rocks that needs to be got through to get at those tantalizingly perhaps-fossiliferous rocks of the Venusian equivalents of the Precambrian.

That's quite a barrier. On Earth, of course, the inexorable pressures of plate tectonics would have, in many places, pushed ancient rocks towards the surface. Venus does not have plate tectonics, but it must have tectonics of some sort, if only to reflect the deep movement of magma. And because of this, here and there older terrain does poke out from beneath the omnipresent volcanic rocks. This is the kind of landscape termed "tesserae", where the radar picks out complex patterns of lines. One recent study suggests that these lines represent eroded ancient strata (Byrne *et al.* 2020). Another suggests that tesserae may include patterns of river erosion from the time when Venus had surface water (Khawja *et al.* 2020). This is clearly the kind of landscape to send the next generation of spacecraft to, in search of the Venus of old, that might have been a living Venus and that might, just perhaps, still retain the fossils to show this.

Having found target strata, would they be in good enough shape to preserve fossils? Venusian taphonomy now includes an overprint, everywhere, of heating up to that 450 degrees C. It must be a bit like thermal metamorphism, but pervasive and constantly maintained – and of course added to by true contact metamorphism when that later generation of "resurfacing" lavas came near. If carbonate skeletons formed in that long Venusian Precambrian, what would happen to them? Put them in a limekiln on Earth, and they start to break down into lime and carbon

dioxide at nearing 900 degrees Centigrade. So has anything like that survived? There is that Venusian atmosphere to think of here, though, crammed with carbon dioxide – containing more of the stuff, indeed than the equivalent of all of Earth's buried carbonate stores. So is that a factor to add to Venus's taphonomic equation? Any organic carbon fossils should be, literally, toast, as wood on Earth catches fire below 300 degrees centigrade and (in the absence of oxygen) begins to decompose below 500 degrees C (there may have been time for photosynthesis to develop on Venus, of course, so there is another potential addition to the Venusian fossil-hunter's manual).

This kind of armchair prospecting is great fun, and – who knows? – might be a way of, one day, preparing for the real thing. One can, of course, go much further, to muse upon the taphonomic potential of the ice strata of Callisto and Europa and of the sediments that may lie at the bottom of their hidden oceans, deep below the ice – but that farther journey is a story for another day and another column. Meanwhile, we can wait for the rebirth of Asimov's Lucky Starr to continue adventures on distant lands – only this time s/he would thank their lucky stars, for sure, to be reincarnated as an exopalaeontologist.

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Black History Month: A proposed article and event to celebrate Black Palaeontologists and Earth Scientists

As palaeontologists we are aware of the vast diversity of Prehistoric Life, yet diversity within the field of Palaeontology is not always as visible or known. With October being Black History Month, this is the perfect time to celebrate the contribution of Black palaeontologists to the field and to continue the discussion for greater diversity in Palaeontology for all protected characteristics.

My name is Cassius Morrison and I am a PhD student in Vertebrate Palaeontology at University College London (UCL) and the Natural History Museum in London, in addition to being a member of the UCL Earth Sciences Minority Ethnic Network. As part of Black History Month, we are planning two main activities. Firstly, we are preparing to write a multi-part article about historical, current, influential and pioneering Black figures in the Earth sciences; with the final part focusing specifically on Black palaeontologists. Additionally, we would like to explore the impact colonialism has had on Palaeontology, as well as looking at issues such as the north-south hemisphere divide related to research and funding.

We hope this will be the start of further discussions and dialogues for better equality, diversity and inclusion in Palaeontology and the Earth sciences for minority ethnic and other protected characteristics. We will be continuing the dialogue after Black History Month and would like to bring as many as possible of our colleagues along on this collective journey, as well as being the foundation of future intersectionality events with other networks and protected characteristics.

The second activity is a series of online events, the first of which already took place during Black History Month on 19th October. The aim of this initial online event was to have a panel discussion about the challenges and blockers for Black and minority ethnic Earth scientists, as well as potential solutions for overcoming these. It was followed by a discussion on the following point:

> Do we as a community expect minorities (in this case Black scientists) to behave more ethically than others, and is that fair/reasonable? (*i.e.*, are they held to higher and different standards?)

The recording of this event is now available at <**https://www.youtube.com/watch?v=h1k_MfzVhR8**>. Another event focusing on Diversity in Geoscience is planned for 9th February 2022 where panellists from all protected characteristics are welcome. Furthermore, an event on the topic of Decolonising Palaeontology is planned for March 2022. Hopefully, these events will further the discussion for better equality, diversity and inclusion while providing potential solutions. If you would like to take part or have any queries, please do not hesitate to contact me.

This message is to reach out to any palaeontologists or those who may know other palaeontologists who would like to be featured in the articles or potentially take part in the upcoming online events. With the permission of any potential speakers/panellists, we would like to include some of their work and achievements in the article. Before the full article is published it will be available for recommendations and amendments or even the complete omission of

an author's name or work if they are not happy or satisfied with the article. Furthermore, if anyone would like to attend the upcoming online events but is unable to, a written or recorded message or video to share at the event would be very much appreciated. In addition, if any palaeontologist would like to add any comments or feature in the panel discussion as an ally of Black scientists, this too would be welcome.

The aim is a celebration of Black palaeontologists, then to continue the discussion on equality, diversity and inclusion. We plan to celebrate other minorities and characteristics at appropriate times throughout the year and would be happy to collaborate on additional activities. I am more than happy to answer any questions or concerns you may have; my contact details are below. For all enquiries relating to attending the events or distribution of the published articles, please use the contact details below as well.

I look forward to hearing from you.

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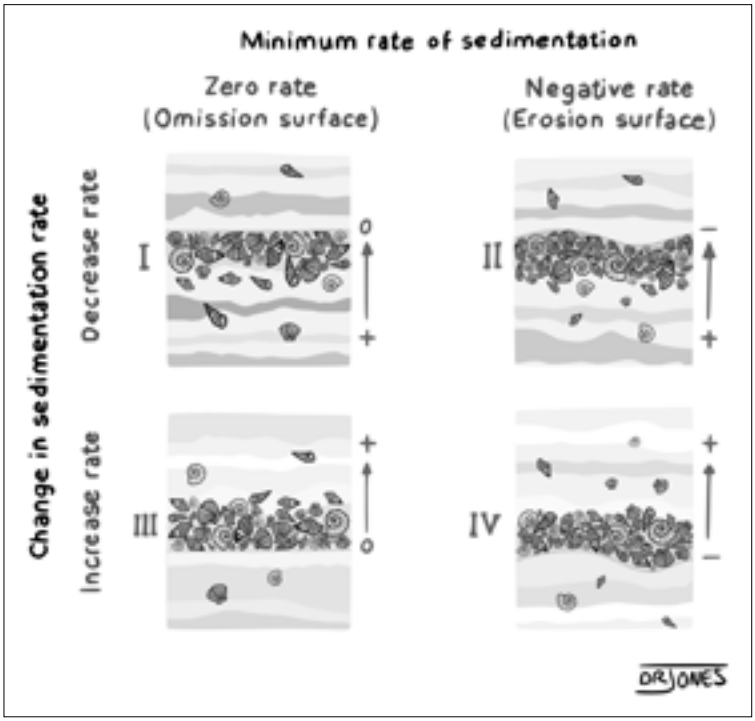
Palaeontology's greatest ever graphs

Model for fossil concentrations
by Susan Kidwell



Field classification of shell beds on the basis of stratigraphicalc ontacts. Based on Fig. 1 in Kidwell (1985).

To understand how fundamental Figure 1 in Kidwell (1985; for short, I will call it K1985F1) is, in my view, for quantitative taphonomy, I need some geographical context. In Southern Brazil, near the Atlantic side of Mangueira Lagoon, the third largest lagoon of the Rio Grande do Sul State, there is a beach called *Praia dos Concheiros* (literally "made of shells" beach). There, Pleistocene–Holocene mollusk (and other skeleton-bearing organisms) shells are exposed at the shore. This beach is an exposed, unconsolidated coquina, deposited in an ancient nearshore setting when the sea level was several metres above its present-day position. This place has twice figured on the cover of the journal *PALAIOS* (SEPM).

Despite the age of this short-lived sea-level highstand deposit being well known (some 6 kyr BP, with some controversies), the shells in *Concheiros* may be significantly older. During the last 20,000 years, the sea level there rose from *c.*160 metres below to c.4 metres above its present

position. Little siliciclastics were fed to this temperate basin at the time (the climate was cold and dry, with little weathering), but high benthic productivity induced by the discharge of the nutrient-rich La Plata River (do not mistake it with the River Plate soccer team) allowed much bioclast input.

This shell bed extends offshore. Several elongated, shell-rich banks are known up to depths of 50 metres in the underwater region known as *Albardão Platform*. They result from time intervals when the sea level stabilized, forming beaches, but the shells were being carried onshore during the last 20 kyrs. To me, this is a perfect scenario to explore the implications of K1985F1. It is easy to grasp how the product of sedimentation rates × omission/winnowing × shell production behaves in the sense of K1985F1's paradigm, especially when one lives close to a (presently) sediment-starved passive continental margin, such as 30º3'56"S, 51º14'09"W (just a reference).

When I first really studied K1985F1, during my PhD, I did not fully realize I was going to be permanently tied to it. The material I used, shells from the topmost sediments of the Southern Brazil Continental Shelf, are still material for ideas I have put in the oven of my mind. My addiction to this figure has also a historical reason. It was published the year before the first issue of *PALAIOS* was released, inaugurating what I like to think of as "modern" Taphonomy.

The figure shows a conceptual framework to predict the occurrence of fossil concentrations: It allows interpreting variations in sedimentation rate based mostly on the density of bioclasts and the sharpness of top and base contacts. The dilution by clastic sediment also allows estimating the relative degree of time-averaging. This graph may not reveal a universal pattern explaining from where we have come and where we are going, but it reveals a simple truth (and its deep roots) about the formation of the fossil record, especially in ordinary concentrations: biological remains stay despite sediment removal. It also somehow distorts an important rule of taphonomy, that biological remains behave as sedimentary particles.

As Kidwell stated in 1985, the dynamics of sedimentation shown in this graph have immediate implications for assemblages collected from both fossil-rich and fossil-poor strata. Erosive base and/or top indicate severe time-averaging, and this probably occurred in the shelly deposits from *Praia dos Concheiros* and *Albardão*. The graph (and its expanded guide, Kidwell 1986) allowed a chain of events: namely, successive publications that showed an inexorable change in knowledge, which is on the way to becoming a scientific commonsense! Net sedimentation rate is the kernel control of hardpart concentration, preservation state and the degree of ecological resolution interpretable from fossil accumulations.

At least two perspectives may have led Kidwell to the concept of this figure. First, the "simple" realization that "the less sediment, the more fossils". High sedimentation rates equal low palaeontological interest, or at least this is true for non-taphonomists. The other perspective derives from ecological modification of benthic habitats induced by removal of fine sediment and enrichment in large bioclasts, further allowing hard-bottom taxa to establish and develop. The palaeoecologist's dream of finding a fossilized ecological succession.

Naturally, K1985F1 is more frequently used to examine fossils from marine or coastal accumulations. Fine. But fossiliferous freshwater deposits, including those not mollusk- or other invertebrate-based, can also be (better) explained under this paradigm. I used the word

"paradigm", because the equation sedimentation rate × hardpart production × omission/winnowing is still under construction. The taphonomic revolution will be complete when all fossil deposits are proven predicted or predictable by K1985F1.

But taphonomists also fear (and expect) dense fossil layers with contrasting patterns in their preservation states or taxonomic composition, because there lie high quantities of interpretable information. This is my reason to practise taphonomy: to suffer when extracting data and then struggle to ordinate it intelligibly, but never departing from the gem of achieving a comprehensive theory, useful for a broader readership.

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Spotlight on Diversity

Juggling palaeontology and caring responsibilities (continued)

Photo courtesy of Morten Lunde Nielsen.

Morten Lunde Nielsen is a Danish PhD student at the University of Bristol, UK, who studies the impact of taphonomy on anatomical and palaeoecological reconstructions in Cambrian Lagerstätten, with a focus on the Sirius Passet Lagerstätte, North Greenland.

1. What role does care play in how you conduct your work as a palaeontologist, *e.g.* in the ability to attend conferences, join work calls across time zones, plan your schedule?

I have two kids with a partner who is also doing a PhD in palaeontology but at the University of Copenhagen in Denmark. Our son has grown with my PhD; he is four years old now but was only six months old when we first moved from Denmark to Bristol back in 2017. We used to have two apartments, one in Bristol and one in Copenhagen, and we would travel back and forth between them every second or third month. That required a lot of detailed scheduling when booking equipment and conferences. Since PhDs are often expected to travel a lot to collaborators (I have spent almost six months at a research institute in South Korea), both of us have had extended periods where we would take care of our kid(s) alone which in turn would restrict our ability to do our work. It is definitely easier for us to attend conferences and meetings now that everything has moved online. However, with two kids, I feel it is nearly impossible to catch up on lost or unexpected work as I cannot work evenings after their bedtime without losing precious sleep myself. And kids have a lot of sick days (especially around deadlines for some reason), so we have to plan for that too. That is the main reason I am a part-time student (80% of the contract).

2, How has the coronavirus pandemic affected your ability to work?

I have been in Denmark since the first lockdown as our daughter was born in early March 2020. During the lockdown, we stayed at our small apartment with a newly-born infant and a very energetic three-year-old. It was pretty chaotic and I could not work for three months until the oldest was back in daycare. Since then the daycare in Denmark has stayed open, so my work-life balance has been fine considering everything. However, due to Covid-19 I have missed the two field seasons in North Greenland which my PhD project was built around so that was pretty sad. It has required quite a lot of re-planning, but I am fortunate that there is a lot of good stuff to work on in the collections already so I will be alright. Weirdly, the pandemic has offered my family stability since we have to stay at one place (Denmark) where I also have a collaborator and an office at the University of Copenhagen.

3. What recommendations do you have for colleagues and institutions to make your work more family-friendly, *e.g.* what can PIs, HoDs, conference organizers do to make it possible for palaeontologists with care responsibilities to have equal opportunities at work?
My main concern with academia is the expectation that researchers will move around the globe for jobs. This will be nearly impossible for me in a few years when my kids start school, especially as they speak a 'small' language (Danish). I sincerely hope that PIs will be open to post-docs who can do some, or even most, of their work remotely. I think the pandemic has shown that this is possible in research where a lot of the work is centralised around writing, which should be possible to do anywhere. Furthermore, there is very little active palaeontological research in Denmark or even open grants to apply for, so there is a creeping fear that my lack of mobility means that my career will be over before it even got a chance to take off.

Otherwise, supervisors or PIs should understand that researchers with caring responsibilities may only be able to work 30-40 hours a week and then expect accordingly. Also, it is important to accommodate for flexibility. My partner and I were offered our PhD studentships within three days and we told our supervisors about our forthcoming 'two-home' situation before they hired us. They have both been very supportive and understanding of our situation which we are very grateful for.

Hybrid conferences with physical meetings being broadcast online are a good opportunity for researchers who are unable to travel to follow the latest research. I was very happy to attend (without presenting) two online conferences while I was on paternity leave. Some conferences, like North American Paleontological Convention in 2019, have been very good at planning activities that allowed researchers' families to attend too. That is especially beneficial for parents who want to attend the same conferences.

4. Do you have any tips to share with fellow or beginner palaeontologists in a similar situation, or palaeontologists who are worrying whether they will be able to reconcile work and care responsibilities?
I think this question is very dependent on the specific host country's social security system. For example, Denmark offers much more help to parents than *e.g.* England.

However, I can think of three main tips on top of my head:

1) Find a PI who might understand your situation. I have been very fortunate to have a supervisor who reminds me not to try to get work done when I spend time with my family (*e.g.* holidays).

2) Go part-time if you can afford it. Kids get sick all the time and you will need flexibility in your schedule. My oldest used to have one sick day every week during the winter on average. Not being able to work as much as I wanted to began to stress me until I got down on 80% of my contract which instantly lifted a huge burden from my shoulders. However, I am privileged that my partner's PhD salary is so high that we can afford it.

3) Try not to compare yourself to others. People do their research under different circumstances and success can be measured by more than one parameter. Focus on what you wish to achieve in the tempo that suits your circumstances.

Photo courtesy of Aaron O'Dea.

Aaron O'Dea is a staff scientist at the Smithsonian Tropical Research Institute Panama and currently on sabbatical at the University of Bologna, Italy. His group studies tropical ecosystems over deep and shallow time. They work on many groups including molluscs, sharks, humans, bryozoans and corals, as well as ancient DNA and stable isotopes. Their work covers large-scale events in the history of life (*e.g.* the formation of the Isthmus of Panama) and ecosystem changes in the absence and presence of humans (*e.g.* baseline coral reef ecology and function).

1. What role does care play in how you conduct your work as a palaeontologist, *e.g.* in the ability to attend conferences, join work calls across time zones, plan your schedule?
Before the pandemic I would always try to find someone who could help look after at least one of our two kids while I was away on fieldwork or conferences to relieve the burden on my partner who is a medic. That has obviously not been a problem this last year, but as people have quickly become comfortable with online meetings, it is necessary to carefully control the ever-growing Zoom/Teams invites while ensuring that projects advance and new opportunities are not lost. I try to schedule all online meetings so that I can care for my two kids while I am solo-parenting. This is certainly challenging with time zones stretching from Taiwan to California. But I am very lucky to be able to work with a team of people who are flexible in scheduling meetings and my colleagues are all understanding. Having a supportive community, no matter how small, has been important.

Most people accept (and even enjoy) interruptions from the kids in online meetings, but sometimes, if the meeting is serious, or with people you do not really know, it can be awkward. The locked bathroom with a Zoom background of a coral reef has been an occasional saviour!

2. How has the coronavirus pandemic affected your ability to work?
It was enormously challenging when schools were closed in Italy. The kids could not leave the apartment for three months. Now that they are back to school, work has become easier.

The experience really shaped everyone in our scientific community but not all negatively. Luckily my position is permanent which was obviously an enormous relief. My younger scientist colleagues and group members did not have that security and they were very nervous initially as the uncertainties about the future grew. I wanted to divert my energy towards supporting them as best as possible and being able to do so has been rewarding.

I miss fieldwork immensely. My dreams turn to coral reefs frequently! The uncertainty has made it hard to plan, but on the positive side I have been surprised at how fulfilling relationships can develop online now we have learned how to do it. I now have colleagues I know best through the camera, which is surprising. It means we can travel less and connect more broadly. I do, however, worry that we may all be working even more than before and taking less time to escape, because it's "easy" to just hop online.

3. What recommendations do you have for colleagues and institutions to make your work more family-friendly, *e.g.* what can PIs, HoDs, conference organizers do to make it possible for palaeontologists with care responsibilities to have equal opportunities at work?
This is a serious problem because caring is one of the reasons why great scientists, especially women, leave brilliant science careers and/or cannot accomplish greatness. Institutions must take a hard look at the structural limits and biases that exist and cultural stagnations that persist that cause these losses, and then strive for change. There are many easily-available resources that have effective ideas and programmes and which are appropriate at all levels in science; group leaders, PIs, heads of departments, deans and heads of institutions.

I would say that it is not always immediately obvious that someone is caring for someone else and therefore being accommodating and patient to everyone is just good practice.

4. Do you have any tips to share with fellow or beginner palaeontologists in a similar situation, or palaeontologists who are worrying whether they will be able to reconcile work and care responsibilities?
It was terrifying to think about having a family when I already felt like my time was short and pressure to achieve so high. Yes, it was challenging at first, but it is amazing how quickly you can adapt. There are even unexpected benefits aside from the intrinsic value of a loving family. I had a deep change in perspective which was positive, and of course my multitasking skills became honed! And now, half an hour of fooling around with my nine-year-old son blasts any stress away.

Of course, you need to find an institution and community that will support you, and that is the fundamental issue.

Leigh Anne Riedman studies Precambrian palaeobiology, specifically focused on organic-walled microfossils of the end Palaeoproterozoic through the Tonian period, and vase-shaped microfossils of the Tonian period. She is from the rural south of the United States and is now at the University of California, Santa Barbara, having recently started a two-year postdoctoral fellowship in early eukaryotic evolution.

Photo courtesy of Leigh Anne Riedman.

1. What role does care play in how you conduct your work as a palaeontologist, *e.g.* in the ability to attend conferences, join work calls across time zones, plan your schedule?
I care for four children, ages 7 to 15, who have been in remote schooling since March 2020. They each have several Zoom classes per day and asynchronous work to complete. To varying degrees they all require regular reminders to log in to class and to complete their work materials. The seven-year-old in particular needs a lot of guidance. This means that my workday cannot really begin until their school days end at about 2 to 3 pm. My spouse also works from home but has a more rigid schedule, so the bulk of the responsibilities fall to me.

I have attended one online conference but felt I could not get much out of it because I could watch only a few talks per day. I am very selective about which meetings or colloquia I attend

simply because I can expect only a few hours of work time per day and I need to prioritize my research as I am on a short, fixed-term fellowship.

2. How has the coronavirus pandemic affected your ability to work? For example by how much has your weekly work time been affected, on average? Did you miss important opportunities, *e.g.* to submit a grant application, get a promotion, apply for a job? Has it negatively impacted your work-life balance or stress resilience? What will be the long-term impact on your career?
My work time has taken a major hit. Now, I typically can expect only two to three hours of work time per day.

I am very fortunate that I was selected for a fellowship that I applied for before this pandemic began. This has given me a bit of breathing room but I am concerned about my ability to stay in this field. There have not been many jobs to apply for, so having no time to apply seems moot.

3. What recommendations do you have for colleagues and institutions to make your work more family-friendly, *e.g.* what can PIs, HoDs, conference organizers do to make it possible for palaeontologists with care responsibilities to have equal opportunities at work?
I am afraid I do not know how to fix this. I know my colleagues without children must be struggling in their own ways, but I also see some of them getting more work than usual done so I just feel that I am falling behind with regards to my competitiveness for jobs. I would not want those colleagues to be constrained from being able to get that extra work done – that would not make anything more fair. It is just a really crap situation.

4. Do you have any tips to share with fellow or beginner palaeontologists in a similar situation, or palaeontologists who are worrying whether they will be able to reconcile work and care responsibilities?
I do not really. I try to not stress about what I cannot control and to just try to do the best job I can do (I will admit that this is definitely a struggle sometimes). In practical terms – I try to prioritize and have a list of specific small tasks that will move me forward on projects – this way even when I have only 30 minutes I can still get something done, which helps the project and my mental health. I am also making time for exercise and this helps burn off stress and helps my work time to be more efficient when I do get to sit and work.

Pedro Dante Ruizis is a 27-year-old Geology student at the National University of Salta in northern Argentina and a palaeontology enthusiast. Even though still a student he has been working on a few palaeontology topics. For example, in 2017 he presented to a congress the first record of the genus *Panochthus* for his province; in 2020 the first record of the genus *Succinea*, also to a congress, and in the same year a palaeoecological study using GIS related to Palaeogene turtles. His final degree thesis will be on a sedimentological and taphonomical study of a Palaeogene turtle bone bed.

Photo courtesy of Pedro Dante Ruizis.

1. What role does care play in how you conduct your work as a palaeontologist, *e.g.* in the ability to attend conferences, join work calls across time zones, plan your schedule?
I have an almost three-year-old daughter. She was born in March 2018. My life partner had postpartum depression after she gave birth, so everything in my life for the past three years spun around my daughter and my partner's wellbeing. I had to quit university for two years in a row. I can say I am a full-time father or at least I try to be always there for them. Always. Answering your question, care duties are the most important thing in my life. There were times I could not attend classes or study for an exam, I even had to study with my little daughter sleeping in my lap.

2. How has the coronavirus pandemic affected your ability to work?
Surprisingly, the coronavirus pandemic affected me both negatively and positively. Both at the same time. The negative part was the uncertainty of not knowing what to do with classes. We had no classes for almost eight months. I had to suspend my final degree thesis because of the impossibility of travelling, so that delayed a lot of work. But, on the other hand, and thankfully, the university did not ignore people who were in this situation. When classes resumed, many of them were online and I did not have to worry about things that worried me before, for example daily meals (eating in university can be very expensive), bus travel and all the time it takes me. I was blessed I could attend classes and do my work and my side projects with my little girl playing around me. In perspective, it went from really bad to really good.

3. What recommendations do you have for colleagues and institutions to make your work more family-friendly, *e.g.* what can PIs, HoDs, conference organizers do to make it possible for palaeontologists with care responsibilities to have equal opportunities at work?
A very good friend once told me that family is the most important thing in your life. That I should always take care of them, of myself and take rests. At the time when we worked together he forbade me to work at weekends. That is the best advice I can give.

4. Do you have any tips to share with fellow or beginner palaeontologists in a similar situation, or palaeontologists who are worrying whether they will be able to reconcile work and care responsibilities?
Never ever give up. Life sometimes can be rough but in the end if you never chase your dreams you will never catch them. It is my dream to become a palaeontologist and I will never give up on that. So, never give up.

Dr Barbara Seuß did her diploma thesis working on the Mesozoic deposits and mollusc fauna of Hochfelln Mountain, Northern Calcareous Alps, before she dug deeper in time with her PhD on the Pennsylvanian Buckhorn Asphalt Quarry Lagerstätte (OK, USA). After a research grant (Bioerosion in *Nautilus*) she started a postdoc at Friedrich-Alexander Universität Erlangen-Nürnberg, working on the Late Palaeozoic Ice Age and the Pennsylvanian Finis Shale (TX, USA). Now she is the administrative project manager of PaleoSynthesis (<https://www.paleosynthesis.nat.fau.de>).

Photo courtesy of Barbara Seuß.

1. What role does care play in how you conduct your work as a palaeontologist, *e.g.* in the ability to attend conferences, join work calls across time zones, plan your schedule?
With a six-year-old son and a self-employed partner, caring duties are largely on me. Planning, in general, has worked rather well, but joining conferences and calls across time zones or doing fieldwork, has been a challenge, being both a mum and a researcher.

2. How has the coronavirus pandemic affected your ability to work?
During the first lockdown, I split my work into time segments interrupted by child care, preschooling, chores, *etc.* To fulfill my work time, I even worked at weekends, so there was not much time to relax; as a result, my stress level was pretty high and my work-life balance was impacted negatively. In the second lockdown, it was easier, as kindergarten was still open, and my son could attend a few days per week, so I could work with no interruption on these days. I have no idea about the future … this is largely depending on the pandemic, I suppose.

3. What recommendations do you have for colleagues and institutions to make your work more family-friendly, *e.g.* what can PIs, HoDs, conference organizers do to make it possible for palaeontologists with care responsibilities to have equal opportunities at work?
I largely gave up thinking about this issue as my level of frustration is too high. It has not worked out even at my own institute – despite mentioning issues more than once – that, for example, invited speakers don't give talks before noon, so when the kid is in kindergarten. Usually talks were, and are, in the afternoon or evenings. It seems that science is not a "morning-job".

4. Do you have any tips to share with fellow or beginner palaeontologists in a similar situation, or palaeontologists who are worrying whether they will be able to reconcile work and care responsibilities?
Find a partner who is flexible with their work and is willing to share care duties.

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

XII Congress of the Asociación Paleontológica Argentina (CAPA 2020)
Virtual conference *23 – 26 November 2021*

This meeting is postponed from September 2020. The 12th congress of the Argentine Paleontological Association (APA) will commemorate the 65th anniversary of the Association, featuring recent advances in the field of palaeontology in Argentina. This meeting aims to promote a favourable environment to exchange knowledge and coordinate joint actions between palaeontologists, museum workers, biologists, related Earth scientists, teachers, students and institutions linked to the areas of education, protection and tourism, strengthening links between palaeontologists and the broader community. Advances in the field and outreach communication are fundamental for the conservation of Argentinean palaeontological heritage.

For more information please visit the website: <**https://www.congresoapa.org.ar/**>.

Fossil Crustaceans: Conference to celebrate the life and work of Joe Collins
Virtual meeting organized by the Geologists' Association *25 November 2021*

The Geologists' Association is hosting an online, posthumous, meeting in honour of Joe S. H. Collins, who was one of Britain's greatest advocates for fossil decapods and had a formidable publication record, particularly on Brachyura, but also other groups of Crustacea, particularly cirripedes. His interests were not limited geographically and included published works on crustaceans from around the globe. Joe was an extraordinary man; he had no formal training in palaeontology, but he achieved more research, fieldwork and awards than most professionals, even before he retired. A familiar sight at UK fossil festivals, Joe was as keen to impart knowledge to non-specialists as to his research collaborators. Kindly and modest, he was a real inspiration to many generations of palaeontologists.

Joe's family will also be attending and the organizers are hoping to have an introductory talk about Joe's life. Everyone is very welcome, anyone who knew or worked with Joe, or has an interest in his collections and research on decapods. To register your interest and get online access details, or if you have other queries, please e-mail <**crustaceans@geologistsassociation.org.uk**>.

Meeting website: <**https://geologistsassociation.org.uk/conferences/joecollins/**>.

3rd Paleontological Virtual Congress
Virtual meeting *1 – 15 December 2021*

The increasing use of virtual platforms to communicate science encouraged the creation of the first Palaeontological Virtual Congress in December 2018, followed by the second edition in May 2020. The first two editions were a success, so the organizers are pleased to present the third edition of the Congress. The purpose is to spread, worldwide, the most recent scientific advances in palaeontology in a fast, easy and economical way.

This initiative was pioneering in palaeontology, being the first exclusively virtually developed conference in our field. In these challenging times, online platforms have gained great relevance and are key to keeping up the drive for science communication among peers and enthusiasts. This

year the organizers did not want to miss the opportunity of offering this platform so palaeontologists can share their research with the world, either by oral communication or by slide presentations.

Even when online meetings are the norm, the main aim is still the same: to give international projection to the palaeontological research carried out by groups with limited economic resources, as well as to promote the participation of palaeontologists from developing countries around the world. This is reflected in low-cost registration fees.

Please see the meeting website for more information: <**http://palaeovc.org/**>.

XVII Somexpal Paleontological National Congress
Hermosillo, Sonora, Mexico *14 – 18 March 2022*

Founded by Prof. Ismael Ferrusquia, the Sociedad Mexicana de Paleontología (SOMEXPAL) is the most important professional palaeontological association in Mexico. Since 1986 the SOMEXPAL Congress has brought together a diverse community of students and investigators who are making cutting-edge advances in palaeontology and related areas of the Earth sciences. This congress promotes discussion among all participants, creating a continuous dialogue between students and specialists that crosses career boundaries, and allows for networking opportunities for the next generation of palaeontologists.

Please visit the meeting website: <**https://somexpal.wixsite.com/inicio/xvii-congreso**>.

5th International Congress on Ichnology (ICHNIA 2022)
Florianópolis Island, Brazil *4 – 8 April 2022*

Every four years ichnologists from around the world join to discuss the progress of the science and share experiences and ideas. Previous congresses have been held in Argentina, Poland, Canada and Portugal, and Brazil is the next hub of ichnology to share some of the vast heritage of ancient and modern biogenic structures. The 5th edition of ICHNIA was planned for 2020 but, due to the pandemic, was postponed to April 2022. Several keynote speakers are already confirmed, including Karen Chin (University of Colorado Boulder), Koji Seike (Geological Survey of Japan) and Anthony J. Martin (Emory University).

Please see the website for further information and updates: <**https://www.ichnia2020.com/**>.

Marine Reptiles Conference 2022
The Etches Collection, Kimmeridge, UK *3 – 5 May 2022*

This conference has been rescheduled from May 2020 due to the coronavirus pandemic. The Marine Reptile Conference organizers are committed to bringing delegates the best possible version of the event, whilst ensuring all reasonable precautions with regard to COVID-19. As such, the decision to hold a physical or hybrid event will be announced in January 2022. All professionals, amateurs and enthusiasts of marine reptiles are invited to attend. The primary focus will be on the fossil record, covering not only the marine reptiles but also the other organisms that formed part of their ecosystems. A session will also take place on modern reptiles, and we welcome abstracts from researchers studying all aspects of this field.

For more information please visit the website: <**http://www.marinereptiles.org/**>.

9th International Meeting on Taphonomy and Fossilization (TAPHOS) and 6th ICAZ Taphonomy Working Group Meeting (ICAZ-TWG)
Museo Arqueológico Regional de Madrid, Spain *late May – early June 2022*
DATES TBC

This meeting has been postponed from September 2020. The 9th edition of TAPHOS and the International Council for Archaeozoology will bring together palaeontologists and archaeologists and also calls on other researchers to participate, such as forensic scholars, molecular biologists, histologists and anthropologists. A special tribute will be paid to Sixto Fernández-López, founder of the TAPHOS meetings, and to Peter Andrews for his innovative work on small mammal taphonomic methodology and palaeoenvironmental interpretations.

For more information please visit the website: <**https://taphostwg.es/**>.

11th European Palaeobotany and Palynology Conference (EPPC)
Stockholm, Sweden *19 – 22 June 2022*

The organizing committee invite you to the 11th European Palaeobotany and Palynology Conference to be held in Stockholm as a physical (on site) meeting jointly at the Swedish Museum of Natural History and at the adjacent Stockholm University. The scientific programme will cover all aspects of palaeobotany and palynology. The meeting will provide palaeobotanists and palynologists with an opportunity to present and discuss their research and meet one another four years after the previous conference in the series in Dublin. The meeting will include three full days of scientific sessions, with some additional options for pre-conference workshops and short pre- and post-conference excursions. The organizing team of Swedish palaeobotanists and palynologists invites you to spend midsummer week in Stockholm, present your latest results, and enjoy the sights, sounds and flavours of Sweden.

For updates see the Facebook page: <**https://www.facebook.com/11thEPPC**>.

International Conference on Modern and Fossil Dinoflagellates (DINO 12)
Palacio Congresos De Canarias, Gran Canaria, Spain *4 – 8 July 2022*

This conference has been postponed from July 2020. The aim is to hold the event in a safe environment, attracting the participation of scientists from all over the world, so is postponed until July 2022. The International Conference on Modern and Fossil Dinoflagellates (DINO) has been held on a continuous basis in different parts of the world since 1978. For this edition, DINO12 will be framed within the common topic of global warming, but preserving the essence of the meeting, in which the dinoflagellates and their cysts are the major protagonists. As is usual, the conference will gather biologists working with modern dinoflagellates and geologists working with fossil dinoflagellates. For more information please see: <**https://dino12conference.com/**>.

Palaeo Down Under 3 (PDU3)
Perth, Western Australia and online *11 – 15 July 2022*

Australasian Palaeontologists (AAP) cordially invites all palaeontologists from Australia, New Zealand and around the world to participate in Palaeo Down Under 3 (PDU3) in Perth (Australia) in July 2022. A full conference programme is proposed, covering all aspects of palaeontology and associated disciplines. PDU3 will include guest keynote lectures, general and thematic sessions, symposia and posters. Due to the global pandemic, the AAP will be broadcasting its first virtual conference, providing an opportunity for members to participate from all over the world.

For more information, please e-mail <**PalaeoDownUnder3@gmail.com**>.

Meeting website: <**https://www.australasianpalaeontologists.org/pdu3**>.

World Congress of Malacology 2022 (WCM 2022)
LMU Biocenter, Munich Germany *1 – 5 August 2022*

The World Congress of Malacology (WCM) will be hosted by the Staatliche Naturwissenschaftliche Sammlungen Bayerns (SNSB) and the Biological and Medical Faculty of the Ludwig-Maximilians-Universität (LMU) Munich during the first week of August 2022. The theme of WCM 2022 will be all aspects of diversity, function, ecology, evolution and conservation of extant and fossil Mollusca. Special topics of the Congress will include evolutionary and developmental aspects, taxonomy, phylogeny, palaeontology, genomics and functional morphology, as well as all methodological innovations concerning malacological aspects. The organizers wish to explicitly welcome the next generation of malacologists from across the globe, including those at bachelor level to those in the postdoctoral phase of their career. The organizers will encourage their contact and the exchange of ideas and experiences with the – no less welcome – already established scientists from the various fields of malacology from all countries and continents. Registration will open in November 2021.

For more information see <**https://www.wcm2022.bio.lmu.de**>.

18th International Nannoplankton Association Meeting (INA 18)
Avignon, France *28 August – 3 September 2022* *NEW DATES*

The INA brings together the world's approximately 200 nannofossil and nannoplankton (coccolithophore) scientists, and this biennial meeting is their main venue for the exchange of information. The meeting rotates amongst different continents and is back in Europe for the first time since Athens in 2017. Early bird registration will open in early 2022.

For more details please see the website: <**https://ina18.sciencesconf.org/**>.

11th International Symposium on Cephalopods Present and Past
London, UK *September 2022* *DATES TBC*

This is an early call for anyone interested in joining the 11th International Symposium on Cephalopods Present and Past to sign up for our mailing list by registering using the online form at <**https://forms.office.com/r/jSQDae7tWM**>.

For more information please e-mail <**ISCPP11@nhm.ac.uk**>.

6th International Palaeontological Congress (IPC6)
Khon Kaen, Thailand *7 – 11 November 2022*

The International Palaeontological Congress convenes every four years. The 6th International Palaeontological Congress will be held in Thailand in November 2022 and the organizers are assembling an exciting and informative programme. There will be symposia on one or more days covering all aspects of our science and its connections to biology and Earth and planetary science, from the Archean to the Holocene, and from all continents. Sessions of IGCP 700 Carbonate Build-ups in South East Asia and other IGCP projects will be in the programme as well as several field-trips.

For more information, visit our website at <**https://ipc6.msu.ac.th/scientific-sessions/**>.

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

The Congress celebrating 200 years of modern palaeobotany, postponed from September 2020, was due to take place in May 2021. Following a review of the various levels of coronavirus infections and the processes implemented by various countries, the organizers postponed the meeting further, 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 will take place in 2022. These conferences are held biannually and usually alternate between European and world events.

For more details please see the website: <**https://www.prague2020.cz/**>.

14th Conference on Mesozoic Terrestrial Ecosystems
Salt Lake City, Utah, USA *June 2023* *NEW DATES TBC*

Postponed from June 2022, this conference will feature all aspects of Mesozoic terrestrial palaeontology, palaeoecology, palaeoclimatology and palaeogeography. Generally held every four years, the pandemic has caused the meeting to be delayed. First time in the United States, Utah has been a major centre for new discoveries in its nearly complete Mesozoic terrestrial section over the past 25 years. MTE14 includes pre-meeting field-trips to local museums, a four-day trip up and down through Mesozoic areas of Utah and a post meeting trip to the region around Dinosaur National Monument.

Meeting website: <**https://utahpaleo.org/mte14/**>.

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>.

Meeting REPORT

Progressive Palaeontology 2021
Virtual meeting hosted by
University College London (UCL) *17 – 19 June 2021*

Like every conference during the pandemic era, ProgPal was shifted to a virtual meeting, keeping its inclusive, friendly and welcoming atmosphere. Conference co-chairs **Miranta Kouvari** and **Cecily Nicholl** alongside their great team (**Alice Leavey**, **Bethany Pittard**, **Eryka Kritikos**, **Grace Varnham**, **Lou Andrews** and **Sam Bright**) ensured that the 89 participants were able to present their work remotely and facilitated efficient interaction among the participants from all over the world. The conference included **51 full talks** of 10–12 minutes, **20 lighting talks** of five minutes and **18 posters** which revealed a wide range of topics and scientific approaches. All contributions were available via the Palaeontological Association website during the conference. Daily interaction was hosted via **Discord**, which allowed for engaging discussions and smooth communication between the participants.

Day one started with three interesting workshops; the first one, led by **Phil Mannion** (UCL), was on the Paleobiology Database (PBDB). According to **Jenna Davenport**, one of the workshop delegates, the workshop provided a good understanding of the database and how it works: "it made what appeared to be a quite daunting, complicated process relatively easy to understand". Synchronously, a workshop on Stepping Out of Academia was held by **Soledad De Esteban-Trivigno** (Català Miguel Crusafon Institute). This revolved around reasons behind quitting academia at different scientific stages, and gave participants the chance to talk about their own career paths.

After the lunch break the last workshop, on phylogenetics, was led by **Sebastian Groh** (UCL) on Reconstructing the Evolutionary History of Organisms. It started with an introduction on different dating methods and biogeography. Participants were provided with codes and a set of data, and were given the chance to ask questions and discuss problems with Dr Groh. **Nicole Barnes**, a participant in the workshop, thought that it was accessible for people with varying levels of knowledge and experience in programming: "I have not had that much experience with R, and I found it really easy to follow and engage with."

On Thursday, after the stimulating workshops, the icebreaker event took place via Discord, including a number of themed channels where delegates enjoyed talking about what kind of films, TV series and hobbies they picked up during the lockdown. Some artsy palaeontologists shared their work in the palaeoart channel. There were also the memes and games channels where participants enjoyed themselves.

The first three Q&A sessions started on the second day of the conference, where a Discord channel was assigned to each participant to answer the questions related to their work. The first session finished up with a tea break, which was followed by an informal LGBTQ meeting. After the second and third Q&A sessions, the day wrapped up with a quiz night in place of the dinner that used to take place pre-corona. During the quiz the participants were divided into teams to answer a series of simple but fundamental questions on palaeontology.

The last day of the conference started with the fourth and fifth Q&A sessions, with a tea break in between. This year the meeting concluded with the presentation of awards:

Best Full Talk: **Matthew Dempsey** (University of Liverpool, UK); his presentation focused on the investigation of "The evolution of forelimb anatomy and function in ornithischian dinosaurs". **Struan Henderson**'s talk on "Biases in the early actinopterygian fossil record obscure underlying patterns of diversity" was also highly praised.

Best Lightning Talk: **Amber Wagstaffe** (University of Hull, UK), on her informative and interesting work on "The evolution of functional disparity in the avian skull". **Aqqid Saparin**'s lightning talk was very much commended too. He presented his "Preliminary study on the organic petrology of graptolites fragments from the Ordovician–Silurian black shale of Tanjung Dendang Formation, Langkawi, Northwest Peninsular Malaysia".

Best poster: **Najat Al Fudhaili**; I was privileged to win this for my work on the "Silica replacement of rudist shells". I received many positive comments on the poster design and the content, which was a big confidence boost for me. **Grace Varnham**'s poster on "Spatiotemporal variation in completeness of the early cynodont fossil record and its implications for mammalian evolutionary history" was highly complimented by the delegates.

The talk awards were sponsored by the *PeerJ Life & Environment* journal, and the poster award by *Transmitting Science*.

ProgPal2021 was exceptionally successful and an outstanding virtual online meeting, with diverse research topics and great quality in the field of palaeontology. Many thanks to the organizers for creating such an interactive and enlightening environment.

Najat Al Fudhaili
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany, and
Utrecht University, The Netherlands

——OBITUARY——

Angela C. Milner 1947 – 2021

Photo © The Palaeontological Association.

Angela C. Milner, who died on 13th August 2021, was the doyenne of fossil vertebrates at the Natural History Museum, London (NHM) for over three decades (Milner and Barrett 2011). She joined the Museum's curatorial ranks in 1976, with the specific remit of improving the storage and documentation of the fossil amphibian, bird and reptile collections, and ended her career as Assistant Keeper of Palaeontology, the only woman to hold this position to date. Angela was noted for her consummate professionalism and pragmatism – qualities that enabled her to negotiate the tangled webs of Museum bureaucracy and to deal expertly with some of the more difficult visitors (and staff) she encountered. During her time at the NHM, Angela pursued a career that incorporated research, curation, administration and public outreach. The latter was exemplified by her role in developing the Museum's current Dinosaur Gallery, which is the Museum's most popular exhibit and attracts millions of visitors per year.

Angela was born in Gosforth and grew up in Whitley Bay, spending all of her childhood in the northeast of England. Her early interests in biology led to a degree in Zoology at her local university, the University of Newcastle upon Tyne. Originally, she had intended to become a microbiologist but was inspired to switch fields by one of her lecturers, Alec Panchen. A successful undergraduate project on the microsaur *Microbrachis* formed a natural progression into a PhD on Permo–Carboniferous tetrapods, under Alec's supervision. Angela's dissertation focused on diplocaulid nectrideans, a group of small, largely aquatic tetrapod taxa, on which she became a world-leading authority (Milner 1980; Carroll *et al*. 1998). Early tetrapods remained one of Angela's major research foci and she continued to publish on these taxa throughout her career. Some of these studies were conducted in collaboration with her husband, Andrew Milner (*e.g.* Milner *et al*. 2009), whom she met while they were still PhD students in Newcastle, marrying in 1972.

Serendipity often plays a key role in palaeontology, and the discovery of an enormous claw in a Surrey clay pit in 1983 led Angela into a new area – dinosaurs. Working alongside Alan Charig, she excavated and described what remains one of the most complete theropod dinosaur skeletons found in Europe, and their new taxon – *Baryonyx walkeri* – was an instant media sensation (Charig and Milner 1986; 1997). *Baryonyx* turned out to be the first confirmed fish-eating dinosaur and its relatively complete remains, including an elongate, crocodile-like snout, shed new light on

the mysterious spinosaurs that were otherwise known only from fragments. Building on this work, Angela reinvented herself as a leading dinosaur specialist and went on to lead many other dinosaur-related projects. Alongside taxonomic and biomechanical work, these included molecular preservation in dinosaur bones and, most prominently, a CT-study of the endocast and inner ear of the 'urvogel' *Archaeopteryx* (Domínguez Alonso *et al*. 2004) in which her team demonstrated the mosaic nature of this early bird brain. To some extent this success compensated for the grief caused by Fred Hoyle and Chandra Wickramasinge's outlandish claim that this iconic specimen was a fake, a charge refuted robustly by a team including Angela and other NHM colleagues (Charig *et al*. 1986). Birds also became integral to Angela's research programme with several studies on inner ears and Eocene bird endocasts (*e.g.* Walsh *et al*. 2009; Walsh and Milner 2011). Indeed, Angela's interests encompassed numerous groups of Mesozoic–Palaeogene tetrapods, including plesiosaurs, ichthyosaurs, turtles, lizards and lissamphibians, as well as projects on footprints and eggs.

Although most often associated with the Museum's collections, Angela was an experienced fieldworker who participated in major excavations in the UK and overseas. The most notable of these were expeditions to Sichuan, China in 1982, the first dig to include western participation after the Cultural Revolution, and to the Sahara of Niger in 1988. However, the majority of students and researchers who met Angela did so thanks to her encyclopaedic knowledge of the NHM collections: the time that she spent moving and rehousing those specimens in the current Palaeontology Building gave unparalleled familiarity with a wide range of taxa. Her patience with visitors was legendary, and her opinions of more diva-ish colleagues were usually kept private but were sometimes acknowledged with her wry sense of humour. Many researchers around the world owe considerable debts to Angela for locating key specimens, facilitating loans or preparation, and for the insights she gave over lunch or while rummaging through Museum cabinets. In addition, Angela was the driving force behind the NHM's acquisition of its CT-scanner, having seen the potential of the technology at an early stage. Her advocacy provided us with a powerful tool now used routinely on a daily basis, enabling us to peer into our fossils in greater detail than ever before.

Although the Dinosaur Gallery remains Angela's most visible outreach achievement, she was also in considerable demand by the media as an expert pundit on dinosaurs and other extinct animals. The Sahara trip was covered by none other than Sir David Attenborough in his TV series *Lost Worlds, Vanished Lives*, and Angela was on the red carpet at the London premier of *Jurassic Park*, quite undaunted by working alongside 'A'-list talent. Her NHM dinosaur book inspired many younger colleagues to enter the subject and she consulted on numerous other TV programmes, books and articles.

Outside of the Museum, Angela's interests revolved around the natural world. She and Andrew travelled extensively to see the flora and fauna of places as far flung as Spitzbergen, the Galapagos, southern Africa and the Indian Ocean, as well as frequenting many UK nature reserves, with birding and wild flowers particular favourites. Closer to home, classical music, opera and gardening were frequent topics of conversation and Angela was still strongly engaged with research until her final illness interposed. An inspiration to many, her wisdom, knowledge and wit are missed greatly and she will be remembered fondly by all who worked with her.

Paul M. Barrett
Natural History Museum, London, UK

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Small Grant REPORT

Merging genomics and phenomics to understand macroevolution: a case study using echinoid body size

Nicolas Mongiardino Koch
Department of Earth and Planetary Sciences, Yale University

Invertebrates constitute 95 % of extant animal biodiversity (Bisby *et al*. 2010), but only about 40 % of macroevolutionary research has focused on them (bibliographic search on Google Scholar). This paucity of studies on invertebrates means that we know relatively little about the deep-time evolutionary dynamics of most of life on Earth. Echinoidea is a clade of echinoderms including sea urchins, heart urchins and sand dollars. Several of their characteristics make them ideal for tackling macroevolutionary questions. Echinoids have an impressive fossil record (Smith *et al*. 2006) and a complex morphology that can be coded into morphological matrices encompassing extinct and extant taxa (Kroh and Smith 2010). Recent advances in phylogenomics have resolved much of the deep structure of their phylogeny (Mongiardino Koch *et al*. 2018; 2021). Therefore, they provide unparalleled opportunities to combine neontological and palaeontological information in a phylogenetically explicit framework, an approach that dramatically improves macroevolutionary inferences (Slater and Harmon 2013).

Over the past few years I have gathered a large-scale echinoid morphometric dataset, including linear estimates of the length, width and height of their tests. This phenomic resource (termed EchinoMetrix after the echinoid genera *Echinometra*) was built through a combination of direct measurements of museum specimens and systematic mining of the published literature, and currently encompasses 25,744 observations spanning 3,572 species across the living and extinct biodiversity of the clade. A small fraction of this dataset has already been used to explore the macroevolutionary history of echinoid body size (Mongiardino Koch 2021), employing a comprehensive total-evidence dated phylogeny (Mongiardino Koch and Thompson 2021). This project resulted in a revised understanding of the drivers of phenotypic change at deep timescales, their interactions with ecological novelty and mass extinction events, as well as a novel approach to parameterize multi-Ornstein Uhlenbeck models that depict evolution across adaptive landscapes (<**https://github.com/mongiardino/extendedSurface**>). I have also CT-scanned a diverse set of fossil and living echinoid species representing all major body shapes found in the clade, including representatives of hemispherical, coniform, cordiform and scutelliform bodies (Figure 1). Several specimens of different sizes were chosen for each species, in order to estimate the degree with which linear measurements are able to approximate the (bio)volume contained in the organisms' skeletons, by comparing morphometric estimates with precise volumetric data retrieved from three-dimensional scans. This will provide a necessary corroboration that this relatively simple method of

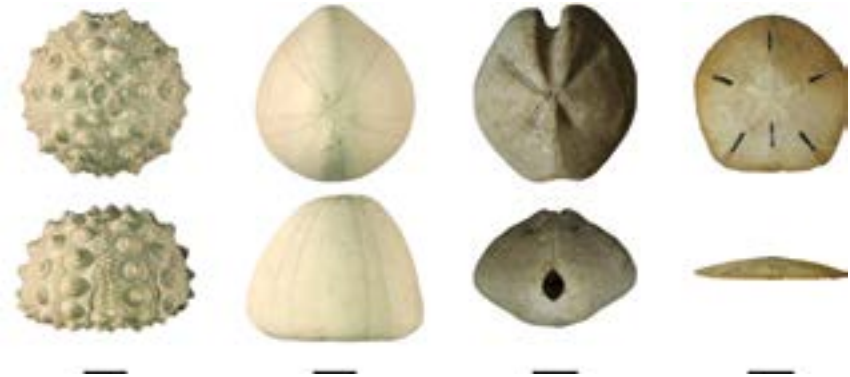

Figure 1. Aboral (top) and lateral (bottom) views of scanned species. From left to right: Hemicidaris intermedia *(Fleming, 1828) IP 531876,* Conulus albogalerus *(Leske, 1778) IP 531890,* Brisaster fragilis *(Düben and Koren, 1844) IZ 18296 and* Leodia sexiesperforata *(Leske, 1778) IZ 4561. Scale bars are 1 mm, 1 mm, 1 cm and 2 cm, respectively.*

body size estimation remains accurate across different echinoid lineages that have evolved derived body shapes. Preliminary results show a very good fit between the two estimates (Figure 2), opening up a door for a large-scale, systematic exploration of evolutionary trends in the disparity of echinoid body sizes across the last 270 million years.

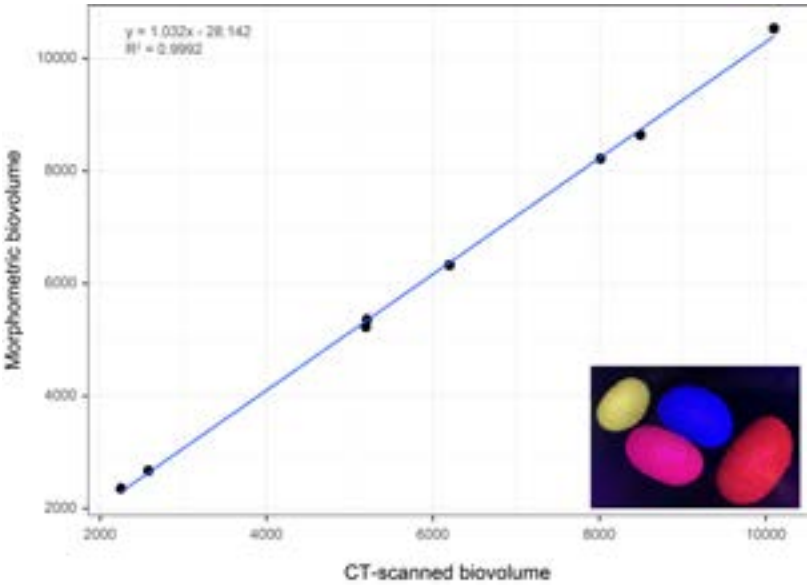

Figure 2. Estimation of echinoid biovolumes using linear morphometrics constitutes an accurate approach. Linear regression shows not only a remarkably good fit (high R2) between morphometric and CT-scanned estimates, but also a high precision with a slope ~ 1. Data correspond to all scanned specimens of Hemicidaris intermedia *(see Figure 1). Inset figure on the bottom right shows multiple specimens scanned together and digitally separated, providing a method of cost-efficient scanning.*

The results of this project will increase our understanding of the evolution of body size in a major invertebrate clade, and will be an important step towards developing a big data approach to the study of evolution that synthesizes palaeontological and neontological information, and relies on both phenomic and genomic data sources.

Acknowledgements

I would like to thank Dr Elizabeth G. Clark for help scanning and processing CT data, as well as the staff at the Center for Nanoscale Systems, Harvard University. I am grateful to the Palaeontological Association for grant number PA-SB201801.

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Undergraduate Bursary REPORTS

Palaeobiodiversity analyses of late Palaeozoic and early Mesozoic echinoids

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Introduction

Echinoids, commonly known as sea urchins, originated in the late Ordovician period and are a diverse clade occupying a range of marine habitats (Thompson and Bottjer 2019). The reconstruction of diversity patterns of echinoids is vital for the understanding of their macroevolutionary history. In order to better understand patterns of echinoid diversification, I compiled genus-level diversity curves for the Palaeozoic and early Mesozoic. The dataset analysed was modified from Thompson and Bottjer (2019) and consists of echinoid occurrence data from over 2,500 fossils compiled from visits to institutional collections across the United States and Europe. To assess potential drivers of echinoid diversity patterns in the rock record, I used generalized least squares regression models to determine how well temperature or sedimentary rock packages predict changes in echinoid diversity.

Diversity Curves

Diversity curves have been used for decades to investigate the macroevolutionary history of taxa in deep time (Alroy *et al.* 2008). I assessed the raw generic richness as well as carrying out two types of subsampling, classical rarefaction (CR) and shareholder quorum subsampling (SQS), which were used to minimize sampling intensity biases. In all three cases, the range-through sampling technique was used due to the gappy nature of our dataset. Genus richness (raw, CR and SQS) was computed using the R package 'divDyn' (Kocsis *et al.* 2019). As is evident in Figure 1, genus richness appears to be highest in the Carboniferous period, specifically during the Mississippian, even after subsampling. This supports previous evidence that echinoids diversified during the carboniferous (Kier 1965;

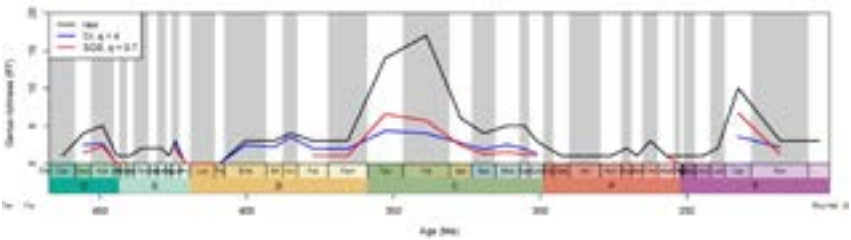

Figure 1. Marine echinoid genus richness, computed using the 'divDyn' package in R. A subsampling quota of 4 was used for the CR due to the small sample sizes in some stages, whilst a quorum of 0.7

was used for the SQS.

Thompson and Bottjer 2019). In particular, diversity during the Tournaisian and Visean is notably higher than during the Ordovician and Devonian. However, due to low numbers of fossil occurrences, we prefer not to make such comparisons for the Silurian, Permian or Triassic.

Generalized least squares

Generalized least squares (GLS) was used to estimate the parameters of multiple regression models using the R package 'nlme' (Petsios *et al.* 2019). Abiotic predictors were compared to our patterns of raw and subsampled (CR and SQS) echinoid genus diversity. Marine carbonate units from Macrostrat were used as a proxy for available carbonate rock area (Peters *et al.* 2018). Similarly marine siliciclastic units were also used in the models as an alternative. We included mean sea surface temperature from Song *et al*. (2021) and the corresponding variance in the regression models to determine if temperature played a role in echinoid diversity patterns. Finally, all models included time bin duration because diversity and rock area can accumulate over larger time intervals. All variables were $\log_{10}$ transformed, apart from time bin duration, to reduce heteroscedasticity and ensure normality in the model residuals. The restricted maximum likelihood (REML) model fitting method was used, and the error covariance matrix was estimated using autoregressive models of order 1. The models were compared using Akaike information criterion corrected for small sample sizes (AICc) and weighted such that the model with the highest Akaike weight best explained echinoid diversity patterns. It is important to note that the echinoid fossil record is relatively poor for some time intervals, resulting in interval exclusions in our GLS.

Whilst the raw data indicate that carbonate rock area best predicts genus richness, this pattern disappears when the data are subsampled (Table 1). This implies that the patterns of raw diversity are the results of sampling biases brought about by the geological record. Both CR and SQS subsampling show that our echinoid diversity is actually best explained by time bin duration. As a result, the Tournaisian and Visean stages did not necessarily possess the highest biodiversity, they purely accumulated a higher richness due to their long interval lengths. Interestingly though, after subsampling, mean sea surface temperature did receive a higher AIC weight. This could therefore indicate that echinoid diversity is correlated with temperature change, in line with existing evidence for marine animals (Song *et al.* 2021). Lower temperatures in the carboniferous may hence be a factor in the high echinoid diversity observed during this interval. However, this pattern is overshadowed by the importance of time bin duration.

Model	log-likelihood	r2	AICc	AIC Weights
Raw_richness ~ duration	-4.032	0.294	17.263	0.162
Raw_richness ~ duration + carbonate_rock	-1.387	0.622	15.441	0.402
Raw_richness ~ duration + mean_temp	-2.711	0.268	18.09	0.107
Raw_richness ~ duration + mean_temp + carbonate_rock	-0.315	0.646	17.63	0.134
SQS_richness ~ duration	-3.326	0.197	15.853	0.452
SQS_richness ~ duration + mean_temp	-2.152	0.182	16.97	0.258
CR_richness ~ duration	-0.868	0.296	10.937	0.493
CR_richness ~ duration + mean_temp	0.449	0.311	11.709	0.325

Table 1. GLS model comparisons using AIC weights. Highlighted weights are the highest for each dependent variable. Only models with AIC weights > 0.1 have been included.

Conclusion

We can conclude that any patterns of echinoid genus richness are not predicted by rock area or temperature. Analysis using 10 Ma time bins would improve our method rather as it would negate the influence of time bin duration in our models. The estimation of fossil age in our database was not refined enough to be able to separate out the data into 10 Ma bins so future studies should consider this during data collection where possible. The dataset used in this analysis is not complete, and the results may change as more data are added into the dataset.

Acknowledgements

I would like to thank the Palaeontological Association for awarding me the Undergraduate Research Bursary (PA-UB202104) and my supervisor Dr Jeffrey Thompson from the Natural History Museum, London.

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Systematic and biogeographic affinities of the early titanosaur sauropod dinosaurs from the Early Cretaceous of the UK

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Introduction

Titanosauriformes is the most diverse and cosmopolitan clade of sauropods, represented by more than one hundred distinct species (Mannion *et al*. 2013). Within Titanosauriformes, titanosaurs represent one-third of all sauropod diversity, extending from the Early Cretaceous to the Cretaceous/Palaeogene mass extinction (Wilson and Upchurch 2003; Upchurch *et al*. 2004). Several caudal vertebrae from the Barremian (Early Cretaceous) Wessex Formation of the UK (Figure 1) represent some of the earliest putative titanosaurs discovered globally. Here these specimens are compared to other titanosaurs and, using an expanded version of criteria proposed by Mannion *et al*. (2013), their approximate positions in the caudal sequence have been estimated.

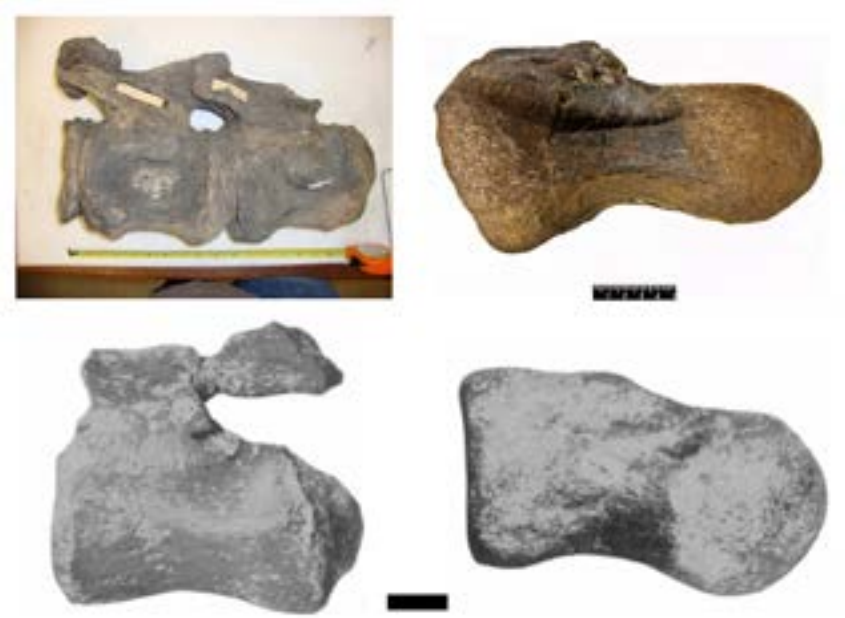

Figure 1. Left lateral views of the four specimens described in this project. Upper left: NHMUK R5333. Upper right: NHMUK R16483. Lower left: NHMUK R1886. Lower right: NHMUK R151. Scale bar for the lower specimens is 2cm.

Placement of vertebrae in the caudal sequence

Initial estimations of serial placement were based on the scheme presented by Mannion *et al*.

(2013): 1) anterior caudal vertebrae possess ribs, even as reduced ridges; 2) middle caudal vertebrae lack ribs but possess distinct neural spines and postzygapophyses; 3) posterior caudal vertebrae lack ribs and distinct neural spines and postzygapophyses; 4) distal caudal vertebrae lack ribs and the entire neural arch. Based on measurements of caudal vertebral columns of several titanosauriforms, the width:height ratios, and elongation and condylar convexity, indices of their centra were calculated and plotted for each species, to develop a scheme to assign the serial position of the UK specimens (Figure 2) more accurately.

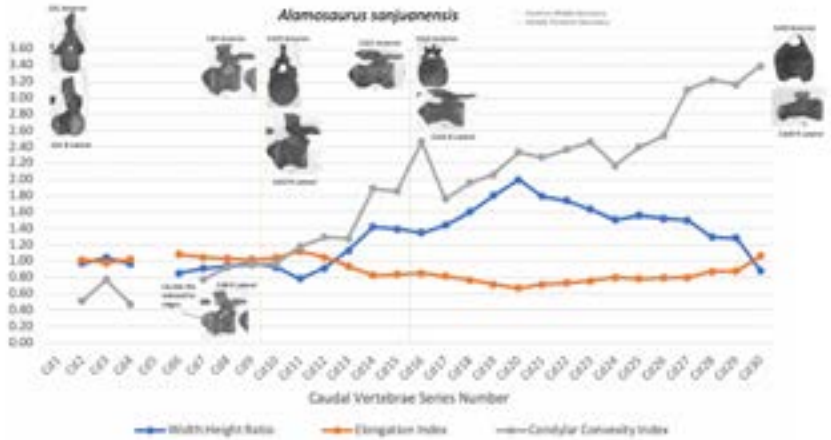

Figure 2. Width:height ratio (blue), elongation index (orange) and condylar convexity index (grey) for the titanosaur Alamosaurus sanjuanensis. *Images of exemplar caudal vertebrae (after Gilmore 1946) are shown on either side of the estimated boundaries (anterior/middle: yellow, middle/posterior: green).*

Based on all criteria above, NHMUK R5333 is likely an articulated set of three distal-anterior caudal vertebrae (around Cd10–15), possessing reduced ribs. NHMUK R16483, retaining its posterior chevron facets but lacking anterior ones, is likely a distal-middle caudal vertebra, from around Cd19–23. Presence of a distinct neural spine and postzygapophyses but absence of caudal ribs designates NHMUK R1886 as a middle caudal vertebra, between ~Cd18–23. For NHMUK R151, absence of both anterior and posterior chevron facets suggests a proximal–posterior position along the caudal sequence, likely between Cd25–30. The following section will briefly outline some key anatomical features which allowed interesting comparison with other taxa.

Key anatomical comparisons with other taxa

Proceolous centra, seen in all the NHMUK specimens, is typical of most titanosaurians, present in all caudal vertebrae except Cd1 of most derived titanosaurs. NHMUK R151, R5333, and R1886 have mediolaterally compressed centra, also seen in Cd2–12 of the saltasaurid *Alamosaurus* (Gilmore 1946), in *Baurutitan* up to Cd8 (Kellner *et al*. 2005), and in only three anterior caudal vertebrae in the Early Cretaceous titanosaur *Volgatitan* (Averianov and Efimov 2018). NHMUK R16483 has a centrum mediolaterally broader than dorsoventrally tall, commonly seen in the saltasaurid family, such as that of posterior caudal centra of the Late Cretaceous *Rapetosaurus* (Curry Rogers 2009), and in *Alamosaurus* posterior to Cd12 (Gilmore 1946). Subequal centrum height and width generally characterizes derived titanosaurs (Curry Rogers 2009).

Presence of posterior and anterior chevron facets, as in NHMUK R5333, is commonly seen at the anterior end of the tail (Upchurch *et al*. 2004). Both sets of chevron facets are present in anterior caudal vertebrae of *Malawisaurus*, *Baurutitan*, *Rapetosaurus* and *Alamosaurus*, amongst many other lithostrotians; however, the caudal number at which these begin to disappear in subsequent caudal vertebrae varies between taxa (Gilmore 1946; Gomani 1999; Kellner *et al*. 2005; Curry Rogers 2009). Presence of posterior chevron facets, but the absence of anterior ones, as seen in NHMUK R16483, is often seen in more middle–posterior regions, prominent in *Malawisaurus*, whose anterior chevron facets are indistinguishable posterior to Cd18 (Gomani 1999). Nearing the more posterior end of the tail sequence, absence of both anterior and posterior chevron facets as seen in NHMUK R151 and R1886 is common in this section of the caudal vertebrae of sauropods in general, for example with complete loss of both sets of chevron facets in both *Baurutitan* and *Alamosaurus* by Cd15-18 (Gilmore, 1946; Kellner *et al*. 2005).

Caudal ribs, present on the centra of NHMUK R5333, is a common feature within the first fifteen caudal vertebrae of most eusauropods (Upchurch 1998). The tubercle present on the dorsal surface of the posteriormost vertebrae is a common feature amongst the anterior caudal vertebrae of many titanosaurs (Kellner *et al*. 2005). Similar lateral extension of the anterior caudal ribs can be seen in the basal lithostrotian *Malawisaurus* (Gomani 1999); however, more derived lithostrotians display stout, posteriorly curving ribs (Kellner *et al*. 2005).

Neural spines of both NHMUK R5333 and R1886 have bases directed posterodorsally, with R1886 (middle) directed slightly more posteriorly than R5333 (anterior). This aligns with the pattern in anterior caudal vertebrae of titanosaurs such as *Malawisaurus*, *Baurutitan* and *Tengrisaurus*, in all of which the anteriormost neural spines are inclined posterodorsally, progressively becoming more horizontal posteriorly (Gomani 1999; Kellner *et al*. 2005; Averianov and Skutschas 2017).

Future work

As the vast proportion of early evidence is from southern continents, Titanosauria is traditionally regarded as a Gondwanan radiation (Wilson and Upchurch 2003; Mannion *et al*. 2019). However, recent discoveries of Early Cretaceous titanosaurs in the Northern Hemisphere challenge the traditional biogeographic model. We therefore plan to expand this research with a phylogenetic analysis of these early titanosaur UK specimens, placing them in their broader biogeographic context.

Acknowledgements

I would like to thank Dr Phil Mannion for his help in supervising this project, Dr Susannah Maidment for facilitating access to the specimens, and the Palaeontological Association for providing funding (PA-UB202004).

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Reviews

Hello PalAss members!

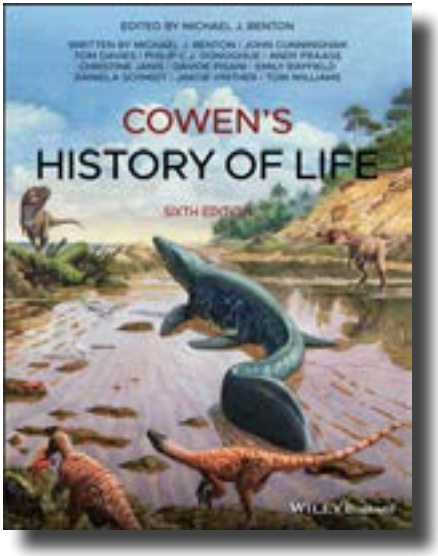
The reviews in this edition are slightly different from our normal content. We have our first review (during my tenure) of a video game, *Horizon Zero Dawn*, and we have a double review about the same book, *Beasts Before Us*!

Regular readers will know that we are pushing to diversify the type of material we review in the Newsletter, whether the content is a film, TV programme, online blog, YouTube series, podcast, computer game, educational resource, or even a software package. If something pertains to palaeontology and has piqued your interest, we would love to hear from you. We are also very happy to consider self-promotion if you have created something that you think the rest of the membership should know about. Please feel free to pitch an idea to us by e-mailing <**bookreview@palass.org**>.

Thomas Clements
Reviews Editor

Cowen's History of Life

Michael J. Benton (Editor), Publisher: ↑ Wiley-Blackwell; 6th edition (2019)ISBN-10: ↑ 1119482216, £45.



If you are looking for an introductory text to Palaeontology / Earth History, then this is the book for you! The book contains an easy flowing narrative that covers major events in the Earth's biological past, from evolution of first life to humans and the ice ages. It would be a great companion to other introductory palaeontology texts which deal with the palaeontological detail of individual animal and plant groups.

At first glance *Cowen's History of Life* is your typical undergraduate textbook; packed with diagrams, images and text covering the basics of everything you would need to know for a first-year undergraduate Palaeontology/Earth History module. Closer inspection, however, reveals it to be much more accessible than a first year degree textbook. Written in an easy-to-read manner, anyone with a GCSE in Biology or Geology would be able to follow the narrative throughout most of this text. This makes this book of interest to

amateur palaeontology enthusiasts as well as undergraduates. The companion website is a nice addition, providing students and educators with high-quality digital figures used in the text itself.

This is the most recent edition of a textbook that has adorned our bookshelves for the past 30+ years. Many people will be familiar with the previous editions and use them frequently. In this latest edition the words of Cowen can still be found on the pages, but significant rewrites and the addition of new chapters have brought this tome up to date with current theory and recent finds.

With 23 chapters in total, you can expect to find information on everything from the origin of life to human evolution, changing environments to evolution of flight, and of course the obligatory chapters on dinosaurs. The text sets out to explore the major events in the Earth's biological past. By covering these events in chronological order, it allows the reader to follow each evolutionary and environmental change as it happened on the planet.

Each chapter has a clear and easy-to-use layout with a short summary at the start and references, further reading suggestions and thought-provoking questions at the end. The text itself has an easy flow that guides the reader through some challenging concepts and is littered with figures and diagrams to help explain some of the trickier points. Whether you want to dip in and out or read a section extensively, this book covers both bases.

The book uses the expertise of multiple authors well to cover some of the most challenging and controversial events in the past. Where multiple theories are proposed for an event, for example the Cambrian explosion, all lines of evidence are discussed, allowing readers to reach their own conclusions. Importantly the book does not shy away from highlighting where there are gaps in our understanding that still need to be investigated.

At £45, this is not the cheapest textbook, however, the breadth of information covered in a style that is easy to comprehend makes this an excellent buy. As an academic, I would happily recommend this text to my undergraduate students and place it on their reading lists. At the very least, it is worth the effort of academics to chase their library contacts to get copies of this latest edition on to the shelves for student use.

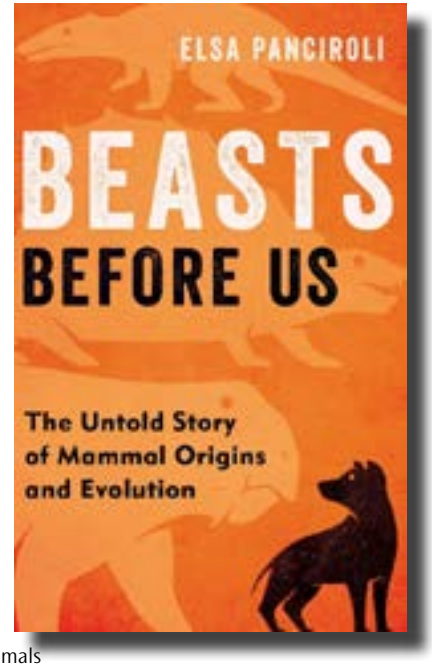
Laura McLennan

Laura is a lecturer in palaeobiology at the University of Derby, UK. In her spare time she can usually be found lying in a muddy field taking part in competitive shooting matches.

Beasts Before Us: The Untold Story of Mammal Origins and Evolution

Elsa Panciroli, Publisher: Bloomsbury Sigma, ISBN-10: 1472983823, Hardback, £20.

In so many popular science books, and even textbooks, the story of mammals begins following the bolide impact at the end of the Cretaceous. The diverse array of Mesozoic mammals, and their precursors from the non-mammalian synapsids, are treated merely as the warmup for the astonishing diversity of the Cenozoic mammalian crown. Dr Elsa Panciroli, in her new book *Beasts Before Us: The Untold Story of Mammal Origins and Evolution*, to a certain extent seeks to redress the balance: the demise of the dinosaurs is not the start of the story, but the end.



Beasts Before Us charts the evolution of the mammalian lineage right from the very beginning: their split in the Carboniferous from the reptile lineage. The pelycosaurs and therapsids that dominated terrestrial ecosystems during the Permian are not dismissed as primitive precursors, but are discussed in detail as an interesting and diverse array of species, each with a dedicated chapter. The end-Permian mass extinction, and its impact on the synapsid line, is discussed, followed by the Triassic rise of the cynodonts and the origin of the Mammalia. Finally, over the last few chapters, the incredible diversity of Mesozoic mammals is highlighted, from docodonts to haramyids, from gobiconodonts to multituberculates. And, of course, the origins of the placentals and marsupials that make up the majority of the mammals today are highlighted. The end Cretaceous mass extinction and rise of the Cenozoic mammals make up the penultimate chapter. Panciroli finishes on a sober note, discussing the challenges faced by the modern mammals during the sixth mass extinction and the many ways in which human activity is impacting on them.

What really impressed me about this book is the incredible diversity of topics touched upon. I do not mean this solely in terms of the diverse array of animals and evolutionary events that are reviewed, although this is considerable. Rather it is the insight into the varied approaches to palaeontology that caught my attention. This discipline has been undergoing a revolution in the past few decades. The evolutionary history of mammals is illustrated not only by discussions of fossil anatomy, but also of phylogenetics, isotope analysis, tooth wear, CT and synchrotron scanning and evolutionary modelling. What is even more impressive is that all these concepts, and their uses in palaeontology, are explained in terms that may be understood by any layperson, while still conveying the required scientific nuance; it is a very difficult line to walk, but I think it has been walked successfully here. A lot of popular misconceptions about evolution and palaeontology are put to rest, patiently and with clarity. Panciroli does not, however, neglect the aspects of research that might be more in keeping with the public view of the palaeontologist. Her accounts of her fieldwork in Skye and South Africa and her journeys to the museum collections around the world produce a highly personal style to the book, creating a vivid impression of the life of a scientist at work.

The history of science is a major feature of the book, with the lives of key scientists in the search for mammal origins dissected alongside their discoveries. Panciroli does not shy away from the unpalatable aspects of palaeontology's history. The colonial plunder that has filled our museums, the practices of scientists, their treatment of indigenous people and the lack of acknowledgement of their contributions to the work are not ignored or simply mentioned in passing, but are highlighted as illustrations of how science today is built on an imperialist framework that has not yet been eliminated. The stereotype of the palaeontologist as the manly adventurer is also challenged,

with the lives and contributions of women such as Zofia Kielan-Jaworowska given the prominence they deserve.

This book is really a *tour de force* of popular science. It is written with humour, lucidity, and an eye for interesting anecdotes. I found it a pleasure to read the account of the earliest members of the mammal line, giving this neglected interval in our evolution the attention it deserves.

Neil Brocklehurst
Neil is a postdoctoral researcher at the University of Cambridge, UK. He is also a gardener, model railway enthusiast, and father to a human and a dog. He can be found on twitter at `@palaeo_neil`.

Beasts Before Us: The Untold Story of Mammal Origins and Evolution

Elsa Panciroli, Publisher: Bloomsbury Sigma, ISBN-10: 1472983823, Hardback, £20.

I opened *Beasts Before Us* with high hopes to discover the untold evolutionary origins of mammals, and I was not disappointed. Elsa Panciroli writes eloquently about our mammal ancestors, guiding us to a better understanding of our own evolutionary lineage and the world around us – a refreshing change from the dinosaurs that monopolize popular science books (apologies dinosaur workers!).

Panciroli's evocative storytelling transports the reader from the wilds of the Inner Hebrides, across Europe, through to East Asia and beyond. The globe-trotting adventure also whisks the reader through time, beginning with the Synapsid-Reptile split in the Carboniferous, whirling through the birth of modern palaeontology in the Victorian era, through to the cutting-edge research being conducted around the world today to understand our furry friends better.

But let us talk about mammals. In Panciroli's own words, "if you've always repeated the tale that mammals came from reptile stock, wash your mouth out!". The narrative leads the reader through the development of mammalian characteristics; including possessing hair, producing milk and having unique jaw and ear anatomy, through to niche specialization, such as that seen in the skulls of the platypus and echidna. For 350 million years and far into the future, "the cogs of biology endlessly turn", a point Panciroli is keen to highlight – the organisms around us are ever-changing.

This engaging romp through geological history also highlights the shifting configuration of our planet and the impacts that these geological upheavals had upon the organisms present at that time (cue dinosaurs). Besides blockbuster-worthy meteorite impacts, the transition from water to land was a significant way-marker in mammalian evolution history, when mammalian ancestors took advantage of more suitable oxygen levels, changing their breathing styles, developing larger mouths, choosing different diets, growing larger body sizes … you will have to read the book to find out more.

Research is brought right up to date too, with new virtual reconstruction techniques described in easy-to-follow details. Panciroli describes how these digital methods are allowing palaeontologists to peer inside fossils to uncover the stories of their development, without the need for previously destructive methods, saving fossils for future generations to enjoy. Importantly, the book highlights the diversity of research pathways within palaeontology – something particularly inspiring for the next generation of palaeontologists.

Beyond research, Panciroli addresses issues in the field that are beginning to come to the fore. The contribution of female palaeontologists is admirably celebrated, as is the importance of both acknowledging fossil provenance and the incredible value of indigenous knowledge, promoting working with local researchers to advance palaeontology for the better. Also highlighted is the bias in palaeontological research, the tendency of researchers to cherry-pick what's popular and in so doing, missing some of the juiciest details of evolution – understated and overlooked research topics can often be the most important.

From a personal perspective, I wholeheartedly agree that there is so much more to discover about mammalian evolution. My PhD uses digital reconstruction methods to investigate mammalian brain evolution, a feat that would not have been possible without the palaeontological advances described throughout *Beasts Before Us*. The narrative was invaluable for highlighting the key developmental stages of our ancestors (which may be reflected in brain development), the characteristics of the Permian extinction event that led to so much diversification, and the fact that mammals, and their ancestors, deserve the spotlight that Panciroli has now given them. Hopefully the book will encourage more researchers to join `#TeamMammal`!

Panciroli's fabulous sense of humour will keep you chuckling throughout and her love for her homeland, Scotland, alongside its importance in the mammalian evolutionary story, is clear to see. If you are looking to learn about the mammalian evolutionary story, the history and future of palaeontology (its good, bad and ugly sides), the fantastic research going on around the world and the exciting discoveries just around the corner, then this book is a must read!

Charlotte Bird
Charlotte is a Doctoral Researcher at the University of Birmingham, UK researching cynodont brain evolution towards modern mammals. She is a keen science writer, illustrator and animator who can be found on Twitter `@CharlotteMBird`.

Horizon Zero Dawn

Director: Mathijs de Jonge, Released: 2017, Developer: Guerrilla Games, Publisher: Sony Interactive Entertainment, Available on Microsoft Windows and PlayStation 4.

Horizon Zero Dawn presents some fun questions that palaeontologists should find interesting: What *would* happen if a robot was released into the wild that was capable of rapid evolution? How quickly would it adapt to different environments? Would it converge on existing morphologies? Would it become an apex predator and outcompete its living counterparts? Would it diverge into multiple species and take on a range of niches? Would it form unique ecosystems and robotic predator/prey relationships? And, finally, what would human civilization look like after hundreds of years of living alongside this?

Horizon Zero Dawn is a post-post-apocalyptic role-playing game, first released in 2017 for the Sony PlayStation 4 by *Guerrilla Games* and then remastered for the PC in 2019. You play as Aloy, a young outcast on a quest to explore her crazy-robot-dinosaur-infested-world and uncover how it came to be. The gameplay comprises long hikes through the western United States (which is fun!) and completing quests for various factions (which is mostly less fun). It is, however, incredibly refreshing

to explore a fictional distant future where instead of wandering a barren, desolate wasteland, the environment is rich and lush. Rarely, you come across the last, crumbling vestiges of recognizable human infrastructure, now being slowly reclaimed by nature. There is also real effort taken in modelling this future environment: for instance, the only *real* living animals still around are limited to generalists like wild boars, turkeys, and foxes, and the game models how the geology (such as the very well recreated Monument Valley) would influence future architecture and culture of the surviving humans.

But of course, what makes *Horizon Zero Dawn* of interest to us is the mechanical megafauna that inhabit this virtual wilderness. There are over 30 unique designs of machine, many of which are clearly inspired by extinct, ancient animals. There are the "Longlegs" that are basically robot terror birds, the "Snapmaw" that continues evolution's habit of making animals in the shape of giant crocodiles, the "Tallnecks" that look like a sauropod got its head stuck in the tailpipe of the *USS Enterprise-D*, and the "Thunderjaw", a mechanical *T. rex* with railguns instead of dentaries. What is more, these machines even have their own functioning ecosystem! The *Megaloceros*-like "Grazers" look like what would happen if a lawnmower convergently evolved into a cervid – industriously grazing on the grass and converting it into fuel. Meanwhile, you can watch the hyena-like "Scrappers" and vulture-esque "Glinthawks" scavenge the wires and metal plating of other fallen machines to survive. It is one of the most realistic fictional ecosystems I have ever seen, despite being made up of fake animals in more ways than one.

Unfortunately, I found the gameplay itself often tiring and frustrating. Despite being someone for whom video games have abruptly become quite a large part of my career as a science communicator, I admit I am especially hopeless with them. And though *Horizon Zero Dawn* is very accessible for the new or casual gamer, even featuring an easier Story Only mode, there is a complete lack of freedom. It is as if the game punishes you for not behaving or not playing exactly as intended. Look, I would say herding a giant robot crab with tasers for claws into an enemy camp as a diversion is a very solid tactic, but apparently it was not fair, so the game forcibly teleported me back to the camp and into said robot crab's face until I did it properly!

These issues however are nothing compared to the game's most insidious and under-reported problems which completely put me

off the story once I caught on. *Horizon Zero Dawn* has been rightly praised for its relative progressiveness – especially in regard to its positive representation of gender and sexuality. With the majority of modern video game protagonists being what they are (an unfettered sea of grizzled white dudes in power armour with guns the size of small locomotives), Aloy is a wonderful and refreshing protagonist. However, *Horizon Zero Dawn* is laden with anti-native tropes, stereotypes and cultural appropriation. Almost every aspect of the game's narrative, character design, clothing and language are lifted directly from real indigenous and first nation cultures. Regardless of their intentions, the developers of *Horizon Zero Dawn* (composed primarily of a majority culture based in Europe) have directly incorporated aspects of multiple minority cultures into their game purely for aesthetics without any consultation. Combined with the flagrant misuse of words historically tied directly to anti-native racism such as "braves" and even "savage" to describe the game's characters and culture, it makes for a pretty uncomfortable experience.

When the entire premise of your game's setting is that thanks to a catastrophe, humanity has '*reverted*' back to the-so-called-dawn-of-time and therefore '*returned*' to living in tribes, you instantly present existing, modern native communities and cultures as defunct and primitive. The game's director was called out on this by writer Dia Lacina[1], but his response was a textbook example of a non-apology. Luckily for him, he was backed up by hundreds of furious fans who drove Lacina away from social media. So that's fun.

Why is this important? Well, I find it deeply worrying that the developers saw the fossil record and Native American culture as equally valid sources of inspiration for designing their game, and whilst the former made headlines, the latter was quietly kicked under the rug. Furthermore, given their response last time, I highly doubt that the incumbent sequel will reconcile these issues. With that in mind, I really cannot in good conscience recommend *Horizon Zero Dawn*. Though it is very ambitious and explores a lot of palaeontological themes, which I would like to see more of in entertainment generally, unfortunately the game's over-reliance on tiring, racist tropes is just inexcusable.

Jake Atterby
Jake (he/they) is a PhD student at the University of Birmingham, UK. He co-hosts an educational YouTube channel (Palaeocast Gaming Network) that uses video games as a platform for teaching palaeontology and geology. Jake can be found on twitter: `@Jake_Atterby`.

[1] Dia Lacina, 2017. "What We Talk About, When We Don't Talk About Natives". *Medium. (No longer available).*

Books available to review

The following books are available to review. Please contact the Reviews Editor Thomas Clements (e-mail <**bookreview@palass.org**>) if you are interested in reviewing any of them.

- *Fossils of the Milwaukee Formation: A Diverse Middle Devonian Biota from Wisconsin, USA*, by Kenneth C. Gass, Joanne Kluessendorf, Donald G. Mikulic and Carlton E. Brett.
- *Fossilization: Understanding the Material Nature of Ancient Plants and Animals*, edited by Carole T. Gee, Victoria E. McCoy, and P. Martin Sander.
- *Across the Bridge*, by Henry Gee.
- *Trilobites of the British Isles*, by Robert Kennedy and Sinclair Stammers.
- *William Smith's Fossils Reunited*, by Peter Wigley (editor) with Jill Darrell, Diana Clements and Hugh Torrens.

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Careers Q & A

Professional palaeontologists in the wider world

Morgane Brosse completed her PhD (2011–2016) on conodonts and the biotic recovery of the basal Triassic at the Palaeontological Institute and Museum of Zürich University and postdocs at Eawag (ETH Zürich) and Zürich University (2017–2020), switching to the impact of climate change on the current biodiversity crisis in freshwater systems. She started to link science and policy as a scientific collaborator at the Swiss Federal Office for the Environment (2019–2020) and, since 2021, is the scientific coordinator of the Blue-Green-Biodiversity initiative led by Eawag and WSL (ETH Zürich).

Photo: Aurore Brosse.

How did you first get interested in palaeontology?
I was so young I hardly remember any more. My oldest memory is of a pocket-book about dinosaurs I was given as I was learning to read. I carried this book everywhere with me. I will always be interested in palaeontology.

What was the biggest highlight of your work as a palaeontologist?
In general, I am proud of my PhD work. A more concentrated highlight was to successfully lead a field expedition in difficult conditions with a student, which then generated several good publications.

What made you pursue your current job?
I felt that research, rewarding though it is, needs a hand to translate findings and discoveries into policy, outreach and practices.

What are the main responsibilities of your job?
I am working for a programme that aims at preserving biodiversity. I am assisting the coordination and organization of research projects, scientific events, stimulating exchanges between scientists and policy-makers and the production of outreach and teaching material.

What gives you the most satisfaction in your job?
The feeling that I help my fellow researchers and contribute to the preservation of our biodiversity and environment.

What was the process of making a decision to leave academia like?
It took me about two years to understand the niggling feeling that my work did not reach far enough, did not have a big enough impact on our world and society.

Do you have any tips for students who might consider taking a similar career path?
Be patient, every transition takes time. Do not be afraid to question your motivations and yourself, and allow yourself to doubt and to change your mind (in one direction or another).

Do you miss anything from your time in academia?
I miss the thrill of asking my own questions and making my own discoveries. Also the fieldwork a little bit.

You can find out about Eawag and its aquatic research at <**https://www.eawag.ch/en/**>.

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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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