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The Palaeontology Newsletter

Contents

Reminder: The deadline for copy for Issue no. 107 is 1st June 2021.

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Editorial

When I was a student in Warsaw, the PalAss Newsletter was my first contact with the professional palaeontological world. This was in the pre-social media epoch, when names appearing on scientific articles seemed to belong to omniscient beings with supernatural powers of research and reflection. The Newsletter was the only manifestation of their human aspect, with cheerful photographs from ice breakers, occasionally heated debates, and accounts of career paths that were not always a straightforward ascent to academic and financial glory. Having now observed these ascents up close and attempted one myself, I learned how this human aspect determines the progress of science – behind a successful published study there is access to childcare, access to safe working conditions, a residence permit, a leave for caring duties, laws protecting fossils, effective anti-harassment and anti-discrimination policy, transparent hiring practice, a good mentor who volunteered their time and many other factors, including a supportive professional community. Behind many important discoveries that remain unpublished and lost human expertise there is a lack of this support. Following the efforts of previous Newsletter Editors and contributors, I hope the Newsletter will continue its role in supporting the Association in *promoting research* and *extending knowledge of the science* by highlighting achievements, as well as identifying and removing the barriers.

In an entirely grassroots manner, overcoming barriers features throughout this issue, particularly through making collections accessible, in contributions on the Sedgwick Museum by **Liz Hide** and on the terrifically well digitized Estonian fossils by **Ursula Toom** and **Olle Hints**, whereas **Chris Manias** writes about palaeontology's entanglement with colonialism and **Nussaïbah Raja-Schoob**, **Emma Dunne** and **Jeff Liston** offer a critical report on the Palaeoethics workshop, which took place at the PalAss Annual Meeting 2020. This issue's *Spotlight on Diversity* contains a report on membership diversity in 2020, in which the incoming Diversity Officer **Farid Saleh** and the outgoing Officer **Rachel Warnock** evaluate the progress since the 2018 report and discuss solutions which have already been implemented and those which should be the focus in the future. **Jeanette Pirlo** writes about being a first-generation scientist coming from an immigrant background and, in *Careers Q&A*, **Myria Perez** shares an open-hearted account on becoming a fossil preparator. These last two contributions made a big impression on me by illustrating the degree of job and funding uncertainty faced by early-career palaeontologists and the decisive role of mentors in their academic survival. We are reminded of happy endings in the uplifting *Legends of Rock* story of Birbal Sahni, a palaeobotanist and founder of the Institute of Palaeosciences in Lucknow, which became a hub for palaeontological research in India. A scientific success story by **Jan Zalasiewicz** recounts how the makers of *Daimonelix*, or "devils corckscrew", traces have been uncovered, but we balance one resolved mystery with a new, unresolved one by resurrecting the *Mystery Fossil* column.

The outgoing Newsletter Editor **Graeme Lloyd**, the Executive Officer **Jo Hellawell**, **Rachel Warnock** and **Farid Saleh** dedicated a lot of their time and expertise to help me in my new role. For the next Newsletter issue, with a copy deadline on 1st June, I would like to call for contributions, especially from previous or current mentees of the PalAss mentoring scheme, from palaeontologists with childcare duties, as well as from palaeontologists who are or have been unemployed. These three topics have been requested by Association members. If you have

any suggestions on what – discoveries, policies, programmes, initiatives, collections, problems, solutions – you would like to see covered, or if you would like to contribute to the Newsletter, please get in touch.

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Association Business

Annual Meeting 2021

Notification of the 2021 Annual Meeting, AGM and Annual Address

The 2021 Annual Meeting of the Palaeontological Association will be held at the University of Manchester, UK, on 18th – 20th December, organized by Dr Rob Sansom and colleagues.

Nominations for Council

AGM 2021

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

- Vice President
- Secretary
- Publicity Officer

Nominations are now invited for these posts. Please note that each candidate must be proposed by at least two members of the Association and that any individual may not propose more than two candidates. Each nomination must be accompanied by the candidate's written agreement to stand for election, and a short personal statement (less than 200 words) describing their interests.

All potential Council Members are asked to consider the following:

> 'Each Council Member needs to be aware that, since the Palaeontological Association is a Registered Charity, in the eyes of the law he/she becomes a Trustee of that Charity. Under the terms of the Charities Act 1992, legal responsibility for the proper management of the Palaeontological Association lies with each Member of Council'.

Further information on the responsibilities of Trustees can be obtained by e-mailing <**secretary@palass.org**>.

The closing date for nominations is **1st September 2021**. They should be sent in PDF form to the Secretary, by e-mail to <**secretary@palass.org**>.

Council vacancies: 'job descriptions':

Vice-President (two-year term)

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

Secretary (five-year term)

The Secretary is one of the senior members of Council and has a wide range of duties and responsibilities – never a dull moment! In addition to dealing with enquiries and other communications from members and non-members, preparing agendas and keeping the minutes of all the Association's meetings, the Secretary also has a major role in keeping written records up to date, such as the rubric for the various grants and awards, and drafting the annual Trustees Report. As a senior Council member, the Secretary usually sits on most of the grant-awarding committees – a demanding but ultimately very satisfying aspect of the position – and also acts as the Executive Officer's line manager. Whenever Council agrees to forge ahead with a major new initiative, the Secretary has a responsibility for drafting any new documentation that may be required, such as job descriptions and adverts. These duties require the Secretary to work closely with the President and Executive Officer in particular, but also with the Internet Officer and Newsletter Editor. The responsibility and breadth of the role requires that the applicant has had previous experience of being on Council (or a similar role in another related organization).

Publicity Officer (three-year term)

Together the Publicity Officer, Outreach Officer and Education Officer comprise the Public Engagement Group (PEG). These posts have responsibility for the Palaeontological Association's outreach activities. Currently they include organizing the Association's presence at Lyme Regis Fossil Festival and the Yorkshire Fossil Festival, co-ordinating the Engagement Grants, answering relevant enquiries, as well as initiating other activities that promote and develop palaeontological outreach and education for the Association. The members of PEG work closely together and their roles often overlap; responsibilities particularly associated with the Publicity Officer post include leading the Association's publicity and promotion via social media and other outlets.

Awards and Prizes

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

Statement of Diversity

The Palaeontological Association has an Unconscious Bias document (available on the Association website), the recommendations of which will be adhered to at all times. All decision-making for Palaeontological Association awards and prizes will be carried out objectively and professionally. The Association is committed to making award and prize decisions purely on the basis of the merit of the individual(s). No nominee for awards or prizes will receive less favourable treatment on the grounds of: gender, marital status, sexual orientation, gender re-assignment, race, colour,

nationality, ethnicity or national origins, religion or similar philosophical belief, spent criminal conviction, age or disability. Equally, all nominations will be assessed on equal terms, regardless of the sex, age and/or ethnicity of the nominee. Nominations will therefore be assessed and graded on their merits, in accordance with the criteria and the aims and objectives set for each award or medal. Due consideration will be given to any period away from science due to parental leave, illness and any other such career break. Nominators are reminded that neutral language (*e.g.* gender neutral) should be used in all nominations.

Palaeontological Association Awards/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 members 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, and 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 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 not to make an award in any particular year.

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

President's Medal

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

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 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 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 contacts 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 at 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 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 contacts 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, and 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 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 members
- the results of project evaluation to demonstrate the quality and effectiveness of the project
- links to any digital components
- mechanisms for obtaining feedback

Self-nominations are permitted, and the nominators (names and contact details required) and proposed recipients do not need to be members of the Association. Nominations will be considered relative to the scale of the institution and the available project budget. The supporting case and the portfolio of images must be compiled into a PDF file of less than 10 MB and uploaded 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 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 deem to have been significant benefactors and/or supporters of the Association. Recipients will receive free membership for life.

The candidate must be nominated by two members of the Association (proposer and seconder; names and contacts details required). The nomination must consist of a one-page statement (font-size 12) outlining 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 the 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. The prizes are announced immediately after the oral sessions at the end of the Annual Meeting.

Best Paper Awards

The aim of these awards 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 the final parts 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 they are deserving. The Editor-in-chief will draw up 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* or *Papers in Palaeontology* within the following 18 months (and subsequently accepted). In the case of joint-authorship papers, the corresponding author can, by agreement, transfer the prize to one of the co-authors. The Editor-in-chief will contact the winning authors and write 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 in 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, submit a two-page CV, full list of publications and statement of motivation (max. 300 words) via the Association's website as a single PDF file (max. size 8 MB), along with a 60 second video summary (in MP4 format; max. size 30 MB) of a proposed seminar topic.

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 website 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 September:	Deadline for nominations for the PalAss Exceptional Lecturer.
December:	The PalAss Exceptional Lecturer announced at the Annual Meeting.
March:	The call for host institutions to participate in the Innovations in Palaeontology Lecture Series 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.

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. 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 its May and October 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 (by e-mail to <**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 the 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.

Engagement Grants

Awards are made to encourage educational outreach, public engagement, and related initiatives in palaeontological themes. Normally, the budget for an individual grant would be less than £5,000 GBP. However, under exceptional circumstances, a budget of up to £8,000 GBP for an individual application will be considered. Grants can support either stand-alone complete projects, or they can be 'proof of concept' case studies that have their own outcomes but that form the groundwork for a larger bid elsewhere. Applications for salary costs are permitted, providing a full justification is given, but if awarded all legal and financial liability will lie with the applicant. See below for the categories of expenditure for which the Palaeontological Association does not provide support.

Other conditions:

- Proposals must fit with the charitable aims of the Association.
- Preference is given to applications for a single purpose (rather than top-ups of grants for existing projects). We particularly encourage applications with an innovative aspect, such as engaging with new media, and especially cases that will disseminate good practice.
- The principal applicant must be a member of the Association.
- Preference will normally be given to candidates who have not previously won an award.

Proposals will be ranked on the following criteria:

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

At the end of the award period a final report (including receipted accounts) will be submitted for review by the Trustees or, where appropriate, external referees. Appropriate parts of the final report will be published in the Association *Newsletter*. Any publicity associated with the activity must mention the support of the Association. Applications must be submitted electronically through the PalAss website (<**https://www.palass.org/awards-grants/grants/engagement-grants**>, which includes details of the Required Supporting Information).

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

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

- Core funding or overheads for institutions. The Association will fund the directly-incurred costs of the engagement/educational initiative but, as a charity, we expect the general running costs (*e.g.* indirect costs, estate costs, support services, directly allocated staff costs) to be otherwise covered. We will therefore not fund on a proportion of full economic costs (fEC) basis. Attention is drawn to paragraphs 3.31 to 3.37 of the Science and Innovation Investment Framework 2004–2014, HM Treasury (July 2004), which explains arrangements for the provision of overheads linked to charity funding to academic institutions.

- Individual items of equipment over £1,000 GBP, sites, buildings or other capital expenditure. Artwork and similar specially-commissioned outreach tools are not considered to be equipment, and will be considered for funding.
- A shortfall resulting from a withdrawal of or deficiency in public finance.
- Student tuition fees and summer research bursaries.

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

Carer's Bursary

Bursaries are made to support attendance at Association meetings by researchers with caring responsibilities. Normally the budget for an individual bursary will be a maximum of £250 GBP. Applications must include a supporting statement and a breakdown of anticipated expenses, supported by quotes where possible. Appropriate costs include attendance of a carer or use of local childcare facilities (for care of accompanying young children), or other caring costs at home. Bursaries will be awarded to applications received prior to the application deadline. Applications will be assessed by the PalAss Diversity Group; if there are several eligible applicants, awards will be made on a first-come first-served basis. No subsequent report on expenditure is required. Successful applicants will be invited to submit a brief statement (<60 words) describing the impact of the bursary on their career. This statement may be used in publicity for the bursary scheme and thus should not contain any confidential or sensitive information. The principal applicant must be a member of the Association. Applications must be submitted electronically through the PalAss website. Any publicity associated with the activity must mention the support of the Association. Successful awards will be paid retrospectively on the submission of receipts for reasonable costs (*e.g.* economy air fares or train tickets, accommodation, subsistence).

Deadline: 1st May (Progressive Palaeontology) and 1st October (Annual Meeting) at 23:59 GMT.

Required supporting information:

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

These documents must be submitted in a single PDF file.

Awards and Prizes AGM 2020

Lapworth Medal: Dr Andrew B. Smith

Photo: Andrew Smith.

George Sevastopulo writes: Andrew Smith is an outstanding scientist whose research and publications have had a significant influence on advances in knowledge in the fields of palaeontology, evolutionary biology and geology, and whose service to the Palaeontological Association as Editor-in-Chief of the Association's journals has been transformative. Andrew undertook undergraduate study at the University of Edinburgh, graduating in Geology in 1976. In the summer following his graduation, he was awarded a Carnegie Award to study Jurassic echinoids in Gloucestershire and this led to his first paper, published in *Lethaia* in 1978. This already showed many of the features which became his trademark: interpretation of fossils as living animals; attention to detail; and excellent illustrations. He joined the Department of Biology at the University of Exeter in 1976 to study for a PhD under the supervision of the late Professor David Nichols. In his PhD thesis, he examined the tube feet and associated coronal pores of echinoids and analysed the relationship between the architecture of stereom in ossicles, using SEM, and the nature of soft tissues connecting them, identified using histological techniques. This work, published in four significant papers including a monograph in *Special Papers in Palaeontology* (number 25), opened up the possibility of determining the functional significance of different coronal pores and of identifying the distribution of ligamentary and muscular connective tissues in fossil echinoids. He moved to the University of Liverpool in 1980 as a research assistant to Dr Chris Paul. Together they wrote a monograph on the enigmatic echinoderm clade Cyclocystoidea, which is still the standard work on this group. Whilst at Liverpool, he also wrote a book, *Echinoid Palaeobiology*, which is a model of a readable text suitable for palaeontologists of all levels and for the general public. In 1982 he took up a position as Scientific Officer at the British Museum (Natural History), now the Natural History Museum, London, where he spent the remainder of his career, retiring in 2012 from the position of Merit Researcher.

During his time at the Natural History Museum, Andrew produced over 170 papers of rigorous and significant research, which can be broadly categorized under five headings. 1. Taxonomy and phylogeny of living and fossil echinoids, typified by a 12-part monograph on British Cretaceous Echinoids and the phylogeny and classification of post-Palaeozoic echinoids. 2. A large number of papers describing examples of enigmatic clades of Palaeozoic (many of them Cambrian)

echinoderms, such as cinctans, ctenocystids, edrioasteroids, glyptocrinids, helicoplacoids, stylophorans, *etc.,* and analysing their relationships in a phylogenetic framework. 3. The application and exploration of methods of phylogenetic analysis in palaeontology and biology. One example from a large body of work is his book *Systematics and the fossil record: documenting evolutionary patterns*, which will have been a primer for many palaeontologists. 4. The integration of both morphological and molecular data and the importance of fossil data in the analysis of phylogeny. 5. Analysis of biases in the rock record covered in a number of papers examining various sources of bias and their influence on patterns in the fossil record. Andrew's research has been marked by his rigorous analysis of data, much of it specimen-based, his lucid insights and outstanding standard of illustration. During his career in the Natural History Museum, London, he mentored many younger colleagues from both the UK and elsewhere and through this he has nurtured a cadre of young outstanding palaeontologists to carry on the research he initiated. His influence is truly international and his creation of the online *Echinoid Directory* (now maintained in collaboration with Dr Andreas Kroh) has provided a powerful tool for all those involved in research on living and fossil echinoids.

In July 2013, Andrew took on the position of Editor-in-Chief of the Association's publications. He resigned from this position in 2019. During the intervening six years, he transformed the profile of *Palaeontology*, changing its focus, as he stated in *Palaeontology Newsletter* **84**, "to the publication of innovative and timely hypothesis-driven research that significantly advances understanding of the history of life on Earth". A new journal, *Papers in Palaeontology*, was launched in 2015 to cater for topics with a more systematic palaeontology content than those accepted for *Palaeontology*. The success of these innovations is evidenced by the increased impact factor of *Palaeontology*, the rise in the number of manuscripts submitted, and the efficient and timely way in which they are handled.

Andrew has received many honours for his work, including the Linnean Society Bicentennial Medal (1993), the Geological Society Bigsby Medal (1995), Fellowship of the Royal Society of Edinburgh (1996), the Geological Society Lyell Medal (2002), Fellowship of the Royal Society (2002), the Palaeontological Association Golden Trilobite Award (2004) and the Linnean Society Zoology Medal (2005). Andrew is thoroughly deserving of the Lapworth Medal for 2020.

President's Medal: Prof. Xu Xing

Paul Barrett writes: Xu Xing is an astoundingly productive researcher who has been one of the key figures revolutionizing our views on dinosaur evolution and palaeobiology. He is currently the most prolific describer of new dinosaurs ever and, unlike many of his historic rivals for this title, all of these taxa have (so far) survived the detailed scrutiny of taxonomists. He is best known for working on feathered non-avian dinosaurs and has done more than anyone else to expand our knowledge of this Mesozoic bestiary, while also making pivotal contributions to our understanding of bird origin. His work has had major impact in other areas too, such as evolutionary development, and he is a major player in discussions over the genetic mechanisms controlling feather development and digit reduction.

Xu gained his undergraduate degree in Paleontology and Stratigraphy from Peking University, then moved to the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) of the Chinese Academy of Sciences to complete his Masters and PhD. During his PhD, Xu was tasked with

Photo: Xu Xing.

describing the dromaeosaurid dinosaurs from the internationally famous Early Cretaceous Jehol Biota. Xu documented these important theropods in exquisite detail and, in addition to providing some of the first descriptions of non-avian dinosaur feathers, incorporated these animals into a major new phylogenetic analysis of theropod inter-relationships. He named many of the feathered dinosaurs that have brought the Jehol Group to international prominence, such as *Beipiaosaurus*, *Microraptor* and *Sinornithosaurus*, and has been a leading figure in cementing the dinosaurian status of birds, demonstrating how this major evolutionary transition occurred in breath-taking, unprecedented detail.

A two-year postdoc at the American Museum of Natural History gave Xu the opportunity to interact with a wide range of colleagues and, following this, he returned to the IVPP, where he is now Deputy Director and a Distinguished Research Professor. Although best-known for his anatomical descriptions and work on dinosaur phylogeny, Xu has made substantial contributions to debates over the developmental origins of feathers and the genetic basis for digital reduction in dinosaurs, helping to develop multidisciplinary projects with life scientists. All of his research is marked by exceptional attention to detail and the desire to extract the greatest possible information from the material at his disposal. Despite his success Xu has always found time to assist other researchers and to nurture a new, growing generation of postgraduate students. He has become China's main media spokesperson on dinosaurs and is in constant demand for appearances in documentaries and news bulletins. He has lent his considerable intellectual weight to help Chinese universities and museums develop their own palaeontology programmes and donates his expertise as an editor to many local and international journals.

The prominence of his research made Xu an internationally recognized figure while still completing his PhD, a reputation that has expanded ever since. He has made substantial contributions to new collections of dinosaurs and other Mesozoic vertebrates through major, often multinational, field campaigns that he has led in Xinjiang, Inner Mongolia and other areas of China. His expertise is in great demand internationally and he travels frequently to advise on excavations, descriptions and new museum displays in China and elsewhere. Xu has always had a broad international outlook and collaborates often with other specialists, inviting many colleagues to work with him on the spectacular material that he accumulates on what seems like an almost daily basis. Indeed, Xu has been instrumental in developing closer collaborations between Chinese scientists and those from other countries, with especially close collaborators in the USA and UK, and he sees science as transcending national boundaries. In spite of his truly ground-breaking work, Xu remains a modest, self-effacing individual, who has found himself dragged rather unwillingly into the limelight, although he has done much to raise the profile of palaeontology within China and been

an excellent ambassador for the subject. In summary, Xu has already had a profound impact on the development of our subject internationally. However, he has many years of excellent work ahead of him and is likely to advance to even greater heights. Our community can only benefit from his continued influence.

Hodson Award: Dr Erin E. Saupe

Alex Dunhill writes: Erin Saupe is a palaeobiologist working on the co-evolution of the Earth, life and environments over geological time scales. She tests innovative hypotheses regarding the degree to which environmental changes govern macroevolutionary and macroecological patterns and processes. Erin obtained her PhD from the Department of Geology at the University of Kansas in 2014, after which she was awarded a highly competitive fellowship by the Institute for Biospheric Studies at Yale University. In 2016 she received one of only ten National Science Foundation (NSF) Earth Science Postdoctoral Fellowships conferred across the entirety of geosciences. Erin joined the Department of Earth Sciences at the University of Oxford as an Associate Professor of Palaeobiology in September 2016.

Photo: Erin Saupe.

Erin's research has been pivotal in defining the newly emerging field of conservation palaeobiology, which applies deep-time information to current problems of species conservation. She has conducted highly cited, pioneering work in this field that provides information for assessing how current and future climate change will impact Earth's biodiversity. Much of her research focuses on the factors that govern extinction risk for species, including disentangling whether niche breadth or geographic range size is a better predictor of risk (finding the latter). To further interrogate extinction dynamics, Erin designed an innovative simulation framework using cellular automaton modelling to test the role that continental configuration plays in governing extinction during climate change. She found that palaeogeography is a key boundary condition when considering the ability of species to track suitable habitat. Erin's world-leading standing in conservation palaeobiology was showcased by her recent keynote address for the Conservation Paleobiology Symposium at the University of Bologna, and by the Royal Society meeting she co-organized, focused on how the fossil record can contribute to conservation. She co-edited the volume produced from this meeting, with two co-authored publications.

Erin's research has fundamentally altered the way that ecologists perform ecological niche modelling (ENM). Her ENM work has generated citations from researchers across the globe, who have applied her methods to the study of organisms as diverse as fish to arthropods. For example, Erin has clarified how different factors affect the success or failure of ENMs, and how the region used for model calibration can truncate niche estimates. Erin applies ecological niche modelling to

questions in palaeobiology and palaeoecology, most recently in determining the distributional and evolutionary history of ten neornithine bird clades over the Cenozoic. She examined how millions of years of climate change has affected the range and habitat of modern birds. Her research suggests that many groups of tropical birds may be relatively recent arrivals in their equatorial homes, with climatic changes over the Cenozoic having caused dramatic range shifts. Erin's research on these bird clades also illustrates her unique contribution to the study of niche evolution. Determining the rate and relative frequency of niche evolution is important for implementing conservation strategy, which relies on our ability to predict biotic responses to changing conditions, and is essential to most of our current understanding of ecology. Her study on neornithine birds showed, for the first time, remarkable conservation in clade-level tolerances, since present-day tolerances for these birds could be used to predict the location of 50-million-year-old fossils. Erin was also the first to integrate both palaeontological and neontological data to test whether species' environmental tolerances remain stable across their lifetimes (*i.e.* millions of years). Results from this ground-breaking study confirm that species' tolerances are conserved, even in the face of significant environmental perturbations. In addition to her empirical work in the fossil record, Erin has performed simulations to better understand how errors in niche characterization can bias estimates of niche evolution across phylogenetic trees. She found that incompletely characterized niches inflate niche evolution and lead to error in ancestral state reconstructions.

Erin's interests in macroecological dynamics extend not only to niche evolution but to the factors structuring biodiversity on Earth. She recently proposed a novel and synthetic explanation for the latitudinal diversity gradient, one of the largest scale and longest known patterns in ecology. Using complex cellular automata simulations, Erin found that spatio-temporal changes in precipitation can generate latitudinal diversity gradients remarkably similar to empirical diversity gradients. Essentially, spatio-temporal change in precipitation can drive higher rates of range fragmentation at low latitudes, which can then increase speciation rates and therefore diversity. Recently, Erin's work was also key in efforts to quantify how diversity has changed across space and through time. Her contribution facilitated the finding that among-region variation in diversity is comparable to variation through time.

Not only is Erin dedicated to research, she is also committed to public outreach. For example, she currently serves as PI on a grant to build capacity for biodiversity research and conservation management in sub-Saharan Africa. The grant provides in-depth training on collecting and analysing biodiversity data in a series of two-week workshops in Rwanda, Malawi and Namibia. She also organizes and co-chairs the awards committee for female excellence in palaeontology, conferred jointly by the Association for Women Geoscientists and the Paleontological Society. She volunteers frequently at outreach events at the Oxford University Museum of Natural History (*e.g.* 'The Science Behind Jurassic Park' and 'Late Night in the Museum') and has engaged the public with the Pint of Science programme. In summary, Erin is a world-leading expert on how Earth processes impact macroevolutionary patterns, and her work transcends traditional disciplinary boundaries between palaeontology, evolutionary biology and ecology. She has continually pushed the boundaries of palaeontological research to new frontiers and has contributed novel hypotheses and solutions to some age-old problems, such as those factors that generate biodiversity gradients. Erin's contributions to palaeontology have already been recognized by the Winifred Goldring Award, conferred by the Association for Women Geoscientists, and she is a deserving recipient of the Hodson Award of the Palaeontological Association.

Mary Anning Award: Maggie Wood

Photo: Maggie Wood.

Tim Smithson writes: Maggie Wood is a retired eye surgeon and former member of the General Medical Council. She is not and never has been professionally employed in palaeontology. Over the past 15 years, Maggie Wood has played a unique role in British palaeontology, firstly behind the scenes supporting the fossil collector Stan Wood and then, following Stan's death, as a generous benefactor, curator and enthusiastic museum volunteer. Before meeting Stan in 2005 Maggie had only a rudimentary knowledge of palaeontology. This quickly changed. After they married in 2007, Maggie and Stan lived in Selkirk in the Scottish Borders and Stan started fossil hunting again. Maggie developed a keen interest in the fossils Stan was finding and the palaeontologists who came to look at them. His most important discovery came in 2008 when he found a diverse vertebrate and arthropod fauna at Willie's Hole on Whiteadder Water. This included some of the earliest known tetrapods. For two years Maggie provided the support and encouragement that enabled Stan to concentrate on collecting and preparing fossils from this new site. Sadly, Stan died shortly after his discoveries were announced in 2012 and he was not able to take part in the very successful TW:eed Project that followed.

Since Stan's death, Maggie has maintained a very strong relationship with British palaeontology and made her own significant contribution to it. She began by concluding the sale of Stan's Willie's Hole collection to National Museums Scotland. From the proceeds, she made a major donation to the Palaeontological Association, used to establish the Stan Wood Award which supports vertebrate palaeontology fieldwork and fossil collecting. In the following year she donated a significant part of Stan's library of books and reprints to the Symposium of Vertebrate Palaeontology and Comparative Anatomy (SVPCA). These were auctioned in aid of the Jones-Fenleigh Fund which helps pay for delegates with no institutional funding support to attend SVPCA meetings. Following Stan's death, Maggie inherited a very large collection of fossils, some of them dating back to the 1970s. Using Stan's notes and registers, she produced a detailed catalogue to ensure that the provenance of the specimens and any other useful data were not lost. Much of the collection was subsequently donated to National Museums Scotland and the University Museum of Zoology, Cambridge, but one part, a substantial collection of bony fishes from Stan's excavation at Mumby Quarry, near Glencartholm, in the 1990s, was purchased by the Natural History Museum, London. To support the sale, Maggie prepared an account of the excavation based on Stan's notes, which included a log of the exposed section and a detailed census of the fauna. This was published in the *Earth and Environmental Science Transactions of the Royal Society of Edinburgh* in 2018. In the same year, she also enabled the 'publication' by the Biodiversity Heritage Library of Stan's 1992 privately-published memoir on Wardie to ensure it was readily available to future researchers.

In the last few years Maggie has been a regular volunteer at National Museums Scotland, initially undertaking general curatorial duties but, following intensive training at the Sedgwick Museum, quickly began to assist in the preparation of the fossils collected from Willie's Hole. With the care and patience of a former eye surgeon she has exposed a number of specimens including the first partially articulated lungfish and a small tetrapod skeleton with an intact manus. These are important specimens and would not now be available to study without Maggie's efforts. Over the past 15 years Maggie has been a big friend to palaeontologists, supporting the collection of fossils, their preparation, conservation and curation and, above all, ensuring they are accessible for research. She is a very worthy winner of the Mary Anning Award.

Gertrude Elles Award: Dr John Murray for the History of Life *film project*

Photo: © Aengus McMahon.

The primary goal of the *History of Life* film project lies deeply rooted in the area of science communication, education and public engagement. Creating greater awareness and understanding of the evolution of life is important in this respect: it illustrates just how inextricably interlinked the Earth and its inhabitants are (and have always been) and provides valuable perspective on the present. Digital storytelling has proven a powerful tool for encouraging student engagement, particularly when it allows them to present their ideas to much wider audiences. Despite this, the use of student-produced films as a pedagogical tool remains relatively underdeveloped. The *History of Life* film project was created in an attempt to bridge this experiential gap for science students, with the principal objective being the production of a free (and fun) online educational resource for the general public (the target audience). Since 2011, final-year undergraduate students taking the module 'History of Life', at the National University of Ireland Galway, have worked in small teams to research a significant theme relating to the evolution of life on Earth and then produce a

short documentary-style film on their chosen topic. The student teams storyboard, script, film and edit their films in just six weeks, before uploading them into the public domain on the *History of Life* YouTube channel. A short film compilation of highlights explaining more about the project is available on the channel at <**https://youtu.be/0Y0RmQFb628**>.

Best Paper Awards

Barry Lomax (Chair of the Editorial Board) writes: The Palaeontological Association awards annual prizes to the best papers published in *Palaeontology* and *Papers in Palaeontology*, to recognize and reward excellence in our field of science. Each year the science editors (who have the task of steering papers through the review process) are asked to nominate papers that they feel stand out as being particularly noteworthy and that have scientific breadth and impact. For articles published in *Palaeontology*, the papers should have a wide impact and shape future research directions, and for *Papers in Palaeontology* novelty, breadth, quality of the description and a clear and robust discussion of why the fauna or flora has wider significance are sought. The nominated papers are then voted on by the Editorial Board. The awards are open to all authors irrespective of age or nationality, and membership of the Association is not required.

This year has proved to be very challenging on almost all fronts with the ongoing pandemic resulting in lockdowns, remote teaching, home schooling and social isolation. But through it all the Association's journals are still attracting many high-quality papers, which meant that again the competition was keenly contested, giving the Editorial Board a difficult choice. The two papers that emerged as winners were as follows:

THOMAS, R. D. K., RUNNEGAR, B. and MATT, K. 2020. *Pelagiella exigua*, an early Cambrian stem gastropod with chaetae: lophotrochozoan heritage and conchiferan novelty. *Palaeontology*, **63**. 601–627.
<**https://doi.org/10.1111/pala.12476**>

Whilst the Editorial Board recognized that the findings of this paper might be seen as controversial, we thought that the results as reported revealed an exotic and unexpected fossil discovery that carries important implications for understanding early molluscan evolution, which was further enhanced by the comprehensive, multifaceted analysis.

THOMPSON, J. R., MIRANTSEV, G. V., PETSIOS, E. and BOTTJER, D. J. 2020. Phylogenetic analysis of the Archaeocidaridae and Palaeozoic Miocidaridae (Echinodermata, Echinoidea) and the origin of crown group echinoids. *Papers in Palaeontology*, **6**. 217–249.
<**https://doi.org/10.1002/spp2.1280**>

The Editorial Board thought that this paper was a thorough account, combining descriptive palaeontology with phylogenetic analysis to develop a broad understanding of the phylogenetic relationships. Also noteworthy are the high-quality images.

As well as announcing the winners of the Best Paper Awards for 2020 I would like to take this opportunity to offer my heartfelt and sincere thanks to all those in our community who have somehow managed to find the time, in what has been a very challenging year, to contribute to the Association's publications. I would like to particularly acknowledge the tireless work of the handling editors and the work of our Publications Officer, Sally Thomas.

Small Grant Awards AGM 2020

The small grants awarded by the Association for funding in 2021 include the Sylvester-Bradley, Whittington and Stan Wood awards. Council agreed that the following applicants should receive Sylvester-Bradley awards: Sarah Losso (£1,500), Joana Órfão (£1,498) and Valentina Rossi (£1,182). The Whittington Award was made to Jesse Hennekam (£1,500) and Stan Wood awards to Dr Lene Liebe Delsett (£1,100) and Dr Hanwen Zhang (£1,500). Details of the proposed research projects are given below.

Comparative isotopic analysis of exceptional fossils preserved through calcite from two Paleozoic Konservat-Lagerstätten

Sarah Losso
Harvard University,USA

Exceptionally-preserved fossils reveal crucial insight into the evolutionary history of extinct organisms, but most fossils are highly compressed making their interpretation challenging. Only two major Palaeozoic localities preserve non-biomineralized organisms as three-dimensional internal moulds filled with calcite crystals: the Ordovician Walcott-Rust and the Silurian Herefordshire biota. The formation of these exceptional fossils is not well understood, however, especially given the differences in geologic settings and specimen size. The aim of this project is to understand the processes leading to internal calcite mould fossils of non-biomineralized tissues through characterization of the isotopic signatures of $\delta^{13}C$ and $\delta^{18}O$ from fossils of both Lagerstätten. This work will clarify the conditions under which calcite precipitated in buried carcasses, and will determine whether the bicarbonate was sourced from seawater or decaying organic matter in an isolated environment. This work will further our understanding of fossilization and potentially help find more localities with this exquisite mode of preservation.

On captorhinids: is skull sculpturing a good criterion to distinguish taxa?

Joana Órfão
University of Aveiro, Portugal

Captorhinids are an extinct group of Palaeozoic eureptiles, being model representatives of basal Reptilia. These nonsynapsids amniotes represent the first major radiation of terrestrial vertebrates. They have a conservative skull anatomy with the presence of conspicuous skull sculpturing. Morphological skull features are extensively used in phylogenetic analysis, particularly external cranial texture. However, there is no consensus on the definition and classification of this trait, and different authors use different words to describe similar character states – not only for captorhinids but also in several clades of extant and extinct vertebrates. This precludes proper nomenclature definition and prevents robust phylogenetic trees being generated. This project aims to contribute to a better understanding of the evolutionary history of Amniota and basal Reptilia, and to assess the potential of skull sculpturing as a criterion to help distinguish between captorhinomorph species,

while shedding light on the evolutionary history of this trait. In order to do this, high-resolution images of several museum specimens will be treated digitally, and the resulting data subjected to statistical analyses. New phylogenetic trees will be generated based on a new character list including skull sculpturing traits, and the phylogenetic significance of this characteristic will also be assessed. If successful, this methodology can be applied to other groups of vertebrates in the future.

Taphonomy of the plumage of a Late Pleistocene Eurasian griffon vulture preserved in a pyroclastic flow from Central Italy

Valentina Rossi
University College Cork, Ireland

The late Pleistocene Eurasian griffon vulture *Gyps fulvus* is a historical fossil vertebrate from the Alban Hills (Rome, Italy) preserved in a pyroclastic deposit (Peperino Albano, 22.9 ± 6.7 Ka). This specimen shows evidence of the plumage from the right wing and the head, with the latter preserved as an external mould with well-defined anatomical details. Despite recent studies on the specimen, a rigorous analysis of the mode of preservation of the plumage has been so far neglected and its taphonomic history remains unclear. Critically, different types of feathers are distinguishable in the specimen (*i.e.* primaries, coverts and scapulars) and are often preserved as three-dimensional objects. The visible colour displayed by these varies between dark orange and golden beige. This project aims to investigate the mode of preservation and ultrastructures of the feathers of the wing of *G. fulvus* using scanning electron microscopy, energy dispersive spectroscopy and thin sections. Regardless of the fidelity of the preservation of feather ultrastructure, this study will shed new light on a historical fossil vertebrate and support future studies of the late Pleistocene biota that lived during one of the most recent periods of volcanic activity in Central Italy.

Morphological divergence of the island ruminant Myotragus balearicus

Jesse Hennekam
University of York, UK

Animals on islands often show drastic adaptations to their isolated habitat. Larger mammals tend to get smaller on islands, whereas smaller animals can become gigantic. The fossil record shows that insular dwarfing happened rather frequently on Mediterranean islands, including dwarfed elephants, hippopotamuses, deer and goats. However, the driving forces behind these size adaptations are not fully understood. Because of the extremely isolated nature of the Balearic islands Mallorca and Menorca, the fossil fauna on these islands provide an excellent case study for analysing this phenomenon in detail. For this project, a large quantity of osteological material will be scanned from the extinct island ruminant *Myotragus balearicus*, a dwarfed goat that roamed these islands for roughly five million years. We aim to analyse the morphological variation within this dwarfed animal during its long stay on the islands. This study will result in a better understanding of the shape changes coinciding with the process of insular dwarfing. Furthermore, the morphological features will show to what extent *Myotragus* adjusted its size and shape for adapting to specific niches on the islands, or as a response to a more generalist behaviour.

First plesiosaur from the early Cretaceous of Arctic Canada and the biogeography of marine reptiles during the Jurassic–Cretaceous transition

Dr Lene Liebe Delsett
University of Oslo, Norway

In 1952 a Danish geologist found a plesiosaur specimen on Ellesmere Island in Arctic Canada. He brought it to Copenhagen, but it was never described. Because of its age, geography and the fact that it preserves important skeletal elements, this fossil can now help us to understand the relationships and biogeographical patterns of marine reptiles across the Jurassic–Cretaceous transition. In a wider perspective, understanding marine predators enhances our understanding of marine food webs, which is also important for the future. The plesiosaur specimen is from the earliest Cretaceous and, at the time, the large Sverdrup Basin extended over large parts of Ellesmere Island, linking the European and Alaskan portions of the Arctic Sea. The plesiosaur is the only comprehensive skeleton known from this basin. Some Mesozoic marine taxa presumably had a circum-Arctic distribution, but phylogenies also suggest ties to South American and European taxa. A number of seaways through may have facilitated exchange. In this project, I will describe the plesiosaur specimen, compare occurrences of marine reptiles from Europe and the Americas, coupled with data on the condition of seaways, seawater temperature and marine ecology across the Jurassic–Cretaceous transition.

Laetoli: unchartered crossroad in elephant evolution?

Dr Hanwen Zhang
University of Bristol, UK

Laetoli is a celebrated Pliocene site in Tanzania, most renowned for skeletal remains and fossil footprints of the bipedal hominin *Australopithecus afarensis*. Of equal importance, Laetoli yields a diverse fossil fauna, a crucial window into the evolution of hominins and other mammal species in the burgeoning African savannah ecosystem. Among these are the fossilized molars of an extinct elephant, *Loxodonta exoptata*, a presumed ancestor of modern African elephants. Yet, it has been known for some time that the Laetoli elephant molars are quite variable in morphology, prompting some early experts to suggest the presence of two species at the site: a forbearer of today's African elephants and an ancestor of the extinct gigantic straight-tusked elephant *Palaeoloxodon*. This hypothesis merits reconsideration, as recent ancient DNA evidence revealed a surprising phylogenetic closeness of *Palaeoloxodon* with *Loxodonta*. I propose to undertake a re-study of *Loxodonta exoptata* dental morphology, by combining CT imaging with traditional morphological perspectives to determine the taxonomic nature of this hypodigm, housed in Berlin's Museum für Naturkunde. Should the Laetoli elephant fossil represent a single species, it would reveal a rare example in the fossil record of intrapopulational phenotypic variation prior to lineage divergence.

ASSOCIATION MEETINGS

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

We aim to hold the Annual Meeting of the Palaeontological Association at the University of Manchester, the largest single-site university in the UK. The organizing committee is chaired by Dr Robert Sansom, with help from Russell Garwood and other members of Manchester's Interdisciplinary Centre for Ancient Life (ICAL) and the Department of Earth and Environmental Sciences.

Outline conference programme

The 65th Annual Meeting will be held from 18th to 20th December 2021, potentially with a pre-conference field-trip led by Prof. Phil Manning (to be confirmed). All scientific sessions, workshops and the symposium will take place at the Oxford Road campus of the University of Manchester, at University Place, and the adjacent Department of Earth and Environmental Sciences. Our aim is to return to an in-person format in December. Whilst many of our members have an appetite for seeing each other in person after a long 2020/2021, many have also found that pandemic-related travel restrictions have seen innovations in virtual and online conferences that have increased accessibility, bringing the community within reach of people for whom attendance was not previously possible. We aim to continue this accessibility by making presentations and events available for people to watch and comment on remotely. Details are yet to be confirmed, but we look forward to providing more information in future announcements.

Registration, booking and abstract submission should commence in July 2021. Abstract submission will close in September (date to be confirmed) and abstracts submitted after the closing date will not be considered. Registration after that date will incur an additional administration charge, with the final deadline for registration in November 2021. We will circulate information to members as more details are known, both via e-mail and in the next *Newsletter*. Information will also be made available on the Association website <**www.palass.org**>.

Registration is free!

June 17–19th

Hosted by University College London

Conference run by students, for students

Talks, posters, and social events

Workshops on biomechanics, the Paleobiology Database, and palaeobiogeographical methods

Roundtable talks with palaeontologists

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The Palaeontological Association

UCL

UCL Department of Earth Sciences Vertebrate Palaeontology

news

The new PalAss President

Photo: Paddy Orr.

Our new President, Dr Patrick (Paddy) Orr, is currently Head of the School of Earth Sciences at University College Dublin where he has been a member of the faculty for 17 years.

Paddy studied for his BSc (Hons) Geology degree at Queen's University Belfast before completing a PhD at the University of Bristol. There are two main strands to his research interests. The first, on the ichnofabric record of the colonization of deeper marine environments in the early Phanerozoic, was initiated during his PhD research. During a series of postdoctoral positions he also became interested in the taphonomy of exceptional biotas and, in particular, the application of scanning electron microscopy and other methodologies to investigate this. Paddy has served for a number of years on the PalAss Council, as an Editor, Book Review Editor, Vice President, and Chair of the Publications Board. We warmly welcome him to his new position as President of the Palaeontological Association.

The PalAss Council welcomes new members Richard Butler (Vice-President), Susannah Maidment (Editor Trustee), Manabu Sakamoto (Treasurer), Emilia Jarochowska (Newsletter Editor), Farid Saleh (Diversity Officer), Elspeth Wallace (Publicity Officer) and Robert Theodore (Ordinary Member). Thomas Clements, previously an Ordinary Member of Council, steps into the role of Book Review Editor.

We are very grateful for the time and efforts of departing Council members Charles Wellman, Thijs Vandenbroucke, Barry Lomax, Paul Winrow, Graeme Lloyd, Thomas Challands, Rachel Warnock and Maria McNamara.

Jo Hellawell
Executive Officer

PalAss Exceptional Lecturer: Emily Mitchell

We are pleased to announce that Dr Emily Mitchell of the University of Cambridge has been appointed as the PalAss Exceptional Lecturer for 2021-2022. Emily will present the Innovations in Palaeontology Lecture Series on early animal evolution and we now invite interested institutions to apply to host her.

The 2021–2022 Innovations in Palaeontology Lecture will be on:

Using ecology to unlock the secrets of early animal evolution

by Dr Emily Mitchell (University of Cambridge).

Register your interest to host the Exceptional Lecturer:

If your institution would like to host Dr Mitchell to deliver her lecture, please register via the 'Awards & Grants' section of the Association's website with suggested dates for the lecture (between September 2021 and May 2022) and indicative travel costs. The Association will pay for any reasonable travel costs incurred by the Exceptional Lecturer in visiting each of the host institutions (up to a maximum of £500 per lecture), while expecting host institutions to cover accommodation and hospitality expenses (where applicable). Details of all registered institutions will be passed on to Dr Mitchell on 3rd May (applications submitted after this date may still be considered depending on the remaining time and budget) and she will put together a schedule to deliver the Innovations in Palaeontology Lecture Series. Informal inquiries can be sent to <**meetings@palass.org**>.

Please see page 11 in this *Newsletter* for further details or look in the 'Awards & Grants' section of the Association's website.

Uwe Balthasar
Meetings Coordinator

Palaeontology in the news

It was with a due sense of caution that I chose my search terms as I reviewed recent news coverage for this article. In the absence of a big theropod story to dominate the virtual newspaper columns, genitalia were the common theme of fossil news coverage in January 2021. Two stories about very different beasts were the gift that kept on giving for lovers of the puerile.

The first story featured *Aphelicophontes danjuddi*, a newly-described assassin bug from the Eocene Green River Formation, and published in our very own journal *Papers in Palaeontology*. The slab bearing the beautifully-preserved holotype of the bug had been split in 2006 and the part and counterpart sold to different collectors. Authors Daniel Swanson, Sam Heads, Steven Taylor and Yinan Wang reunited the two halves of the fossil and described the exquisite details of its coloration and its pygophore. The pygophore is the animal's genital capsule, brilliantly described as a 'chitinous codpiece' in Haaretz.com, and a 'prehistoric jock strap' in *The New York Times*.

Genitals are the key to much taxonomic work in arthropods, and the authors also describe an eye-watering method for preparing and studying modern arthropod male organs in order to make comparisons and classify the new species. Gwen Pearson, an entomologist from Purdue University not involved in the study, provided helpful comment for the lay-reader in an *Ars Technica* article: "It's not because entomologists are pervy, it's because genitals are the place where we can see evolution happening". Phew.

The second story featured the Frankfurt specimen of the dinosaur *Psittacosaurus* sp. from the famous Early Cretaceous Jehol Group of Liaoning, China. A new study by Jakob Vinther, Robert Nicholls and Diane Kelly, published in *Current Biology*, took a new look at this animal's cloaca.

The remarkable preservation of the specimen had already allowed a remarkable reconstruction, incorporating colour patterns and countershading, to be produced by Bob Nicholls, but this study allowed the team to improve the accuracy of its undercarriage.

In a veritable feast for connoisseurs of the art of clickbait headlines, we saw such delights as "A dinosaur's butthole was a Swiss Army knife of orifices" (CBC Radio), "Finally, Science Has Allowed Us to Gaze Upon a Dinosaur's Orifice" (The Cut), and – my personal favourite for low-key sarcasm – "At Long Last, Paleontologists Scrutinize a Dinosaur Cloaca" (Gizmodo). Gizmodo also quoted Jakob Vinther explaining that "All of the magic of a cloaca happens on the inside". Unfortunately, this means I am now unable to shake dubious mental images of Paul Daniels from my head.

In some sort of Rorschach Test for online news editors, SYFY Wire captioned a detailed schematic of the cloaca in question as a "Closeup of what the sexiest part of a dinosaur looked like". Metro News also provided some additional speculation on "how very long, flexible penises could explain how huge or spiky dinosaurs got up close and personal – without one of them being killed". An important take-home message from the study was that it was likely that these psittacosaurs were signalling to each other during courtship, and discussions of this possibility made it into the coverage.

Note to folks wishing to get good media coverage for their newly-described animal fossils: insert a penis early on in your press release.

Susannah Lydon
Publicity Officer

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

Anning statue campaign success!

A milestone has been reached in the campaign to erect a statue of Mary Anning in her hometown of Lyme Regis on the south coast of England. The 'Mary Anning Rocks' campaign led by 13-year-old Evie Swire and her mum Anya Pearson has recently reached the £100,000 target, meaning that the statue will be able to go ahead. A design by Denise Dutton has been commissioned (pictured) and the legal work, planning, surveys and groundwork will soon be under way. A stretch campaign has now been launched to fund the Mary Anning Rocks Learning Legacy, an educational programme of free learning materials and funded fossil walks for children from under-served backgrounds. All involved with the campaign are blown away by the generosity of everyone who donated, particularly given the current tough times during the pandemic, and we thank all who have contributed. You can read more about (and contribute to!) the Learning Legacy campaign at <**https://www.crowdfunder.co.uk/maryanningrocks**>.

A sketch of the Mary Anning statue design by the sculptor Denise Dutton. Image © Mary Anning Rocks.

Dean Lomax
University of Manchester, UK and a Patron of Mary Anning Rocks

The Etches Collection has been awarded designated museum status by Arts Council England

The Etches Collection (The Museum of Jurassic Marine Life in Kimmeridge, Dorset, UK) are very proud to announce that our amazing Museum has been officially awarded Designated Status by Arts Council England for our palaeontological collection. We are so proud of this achievement in gaining this national quality accolade in the four years since we officially opened!

Steve Etches (right) with project student Nick Horton and Kimmerosaurus. *Photo by John Marshall.*

The Designation Scheme is a mark of distinction that celebrates nationally and internationally significant collections held in England's non-national museums, libraries and archives. Our award proves that we deliver the highest standards of collection management, and that the Museum is committed to the continued recognition and promotion of our remarkable collection for the future.

Steve Etches MBE commented: "The fact we have received designated status highlights the importance of the collection not only for academic and educational purposes but also, will hopefully enable the legacy of The Etches Collection to be future-proofed for the benefit of all".

Dr Stella Butler, Chair, Designation Panel, said: "The Designation Scheme plays a critical role in raising the profile of nationally and internationally significant collections throughout England. I'm delighted that the scheme is recognizing The Etches Collection, a diverse and globally significant collection of marine fossils, and hope this spotlight safeguards it for the enjoyment and enrichment of many generations to come".

The Etches Collection Museum is located in the village of Kimmeridge near to Kimmeridge Bay from where much of the fossil material was collected. The Bay is the internationally recognized type section for both the Kimmeridge Clay Formation and the Kimmeridgian Stage of the Jurassic Period (although the base Kimmeridgian GSSP is in Skye). Many academic institutions, from both the UK and abroad, visit the cliffs in the Bay due to the international geological importance of the rocks exposed there. The Collection is set to become the reference collection for material of this time interval and has attracted considerable research interest both nationally and internationally. It is housed in a purpose-built, eco-friendly building constructed from locally-sourced Purbeck Limestone and is situated in an internationally-renowned geological area.

The Museum is an independent charitable trust and, as such, is completely dependent on visitor income and donations; it does not receive government or local council financial support. The impact of the COVID-19 pandemic has resulted in months of closure during 2020–2021 and the associated reduction in income.

Nowhere in the UK has such a comprehensive collection of fossil specimens, from such a key interval in Earth history, containing many new species assembled in such a short length of time (40 years). Steve Etches was described in *Proceedings of the Geologists' Association* (Noè *et al.* 2019, *PGA* **130**: 366–389) as one of the three most celebrated fossil collectors of the last 200 years, which further emphasizes the importance of the Museum's Collection to the nation (the others being Mary Anning and Alfred Nicholson Leeds).

The future potential for the Collection, assuming it survives the current COVID-19 crisis, is significant for several reasons. First, it contains a major, diverse collection of fossils which are of interest to a wide range of palaeontologists and palaeobiologists. Second, the fossils are exquisitely prepared so that scientists have many details to study that are often not available in less well-preserved (or well-prepared) material. Third, collecting continues and undoubtedly many new specimens and new species will continue to be uncovered. Finally, the geological interval that is the focus of the Collection has been hitherto something of a gap in terms of fossil collecting and research.

The Museum has in excess of 2,500 fossils, including 13 holotypes, the latter probably an underestimate as there are also many undescribed specimens. This includes the largest collection of Late Jurassic pterosaurs, including the bones of the largest pterosaur yet found from this time period. New specimens of ichthyosaurs and plesiosaurs are present together with a significant number of isolated bones exhibiting evidence of predation and scavenging (bitemarks) which contribute to our understanding of the ancient ecology and to recreating food webs from 157 million years ago. The shark and ray material is also of global scientific importance and includes rare partial and entire skeletons and skulls, where previously specimens were only known from scattered teeth and spines.

The marine invertebrate material includes ammonites, cuttlefish, squid, octopus, barnacles, molluscs, crabs, echinoids and lobsters amongst many others, and even contains the first insect remains from the Kimmeridge Clay. Many of these had soft bodies which are rarely preserved in the fossil record so their presence coupled with soft-tissue preservation (including muscle, skin and internal organs), in these and in some of the vertebrates, is attracting significant scientific interest. The crustacean material is exceptionally preserved and research being undertaken on this group will help us to understand the evolution of our modern crustacean fauna.

It is important to note that in a very short space of time a non-academic who was simultaneously running a plumbing business has collected, expertly prepared and then donated to the general public and scientific community, a collection of Kimmeridgian fossils unmatched in any other British museum, demonstrating that it is possible for anyone from any background to do the same.

These unprepossessing slabs of Kimmeridge Clay with only a few bones visible when first collected from the Dorset coast have been painstakingly transformed into stunning displays of exquisite preservation. No other museum has used the same preparation and preservation techniques on Kimmeridge material and no other museum has exhibits with the same level of captured detail,

Caturus *fish, Etches Collection K2059. Photo © the Etches Collection.*

particularly in terms of soft tissue preservation. The Collection, therefore, stands as a beacon for all that makes museums a vital statement of the wonderful, and very far from the cliché of the dusty and forgotten museums of old. The Collection celebrates the energy of one dedicated individual who has been determined to share his life-time commitment with the wider world so that everyone may better appreciate the mysteries of deep-time and the strange inhabitants of now vanished worlds.

Unusually for a museum, every single specimen has been photographed and catalogued with all the key details captured and stored in a well-maintained digital database which is regularly expanded when new finds or new donations of fossil material are added to the Collection. Many other museums have a large backlog of material yet to be catalogued, often going back years or even decades. The Museum therefore maintains an up-to-date 'live' database of images of all the fossils in the Collection which can be accessed by researchers across the world.

The main display gallery is unique in that, rather than using detailed scientific labels, it instead focuses on how the various creatures present in the Collection lived, died, moved around and interacted with each other, thus providing us with a snapshot of a unique, vanished world. The curved ceiling with its CGI display of Late Jurassic marine life imagery is designed to allow visitors to feel as though they are walking in a giant Jurassic aquarium. They can watch the colourless skeletal exhibits in the cabinets come to life and interact in the CGI display above them, as they would have done 157 million years ago. The display allows everyone to gain a clear insight into both the diversity and the predator–prey relationships of the specimens presented. The ethos of the Museum is to provide an experience for visitors, including digital engagement, rather than simply viewing lots of labelled fossils. Several of the more important fossil specimens have been used to create an educational augmented-reality experience where tablet devices provided by the Museum use the PalaeoGo application to direct visitors towards particular parts of the exhibition, where they read the notes in the cabinets and undertake a short quiz. If sufficient answers are answered correctly then the tablet is used to scan a bar code on the cabinet, which then unlocks a partially interactive 3D image of what the specimen in the cabinet would have looked like in life. This approach is especially important for attracting the younger generation and encouraging an interest in the Earth sciences, biosciences and ecology, whilst also revealing what past environments and climates may tell us about the future.

Specimens of important Kimmeridgian fossils in private collections and specimens found by the general public are regularly being gifted to the Museum based on the understanding that the Museum is the best place for them, as they will be prepared and stored to the highest standards.

As with all museums and galleries the Etches Collection is going through a financial crisis because of the COVID-19 pandemic. Unlike many museums it is not attached to a university or local

authority and has to survive on its own resources. We are therefore calling on the support of the palaeontological community to help the Collection through these difficult times to ensure that it remains open. There are three easy ways to support the Collection:

1. By making cash donations, however small, to <**https://www.theetchescollection.org/donate**>.
2. By signing up to our online lecture programme *The Mary Anning Symposium of Curiosities* which is a series of virtual lectures starting on 12th April this year.
3. By visiting the Collection during the upcoming *Great British Staycation Summer*, including an opportunity to spend lavishly in the gift shop. Those unable to visit in person can still purchase from the online shop at <**https://www.theetchescollectionshop.org/**>.

The Collection can be found online at <**https://www.theetchescollection.org/**>.

John Marshall
University of Southampton, UK and a Trustee of the Etches Collection

A new Field Guide

We are pleased to announce the publication of a new Field Guide to the *Fossils of the Kimmeridge Clay Formation*. The Guide, published shortly before Christmas, features the work of over 30 authors and was edited by Dave Martill and Steve Etches, with Bob Loveridge as pictures editor. The highly fossiliferous Upper Jurassic Kimmeridge Clay Formation is spectacularly exposed in the sea cliffs of south Dorset and elsewhere intermittently throughout England, with coeval deposits in Scotland. This comprehensive guide, presented in two volumes, reviews all major groups, from microfossils to gigantic dinosaurs and pliosaurs. The guide is number 16 in the *Field Guides to Fossils* series and is available for purchase from our online shop with a discount for members. We are grateful to all authors, contributors and editors, as well as Series Editor Phil Lane, for their time and dedication in bringing about the publication of this guide. Like all of the Field Guides in the series, the new guide was instigated and brought into being as a voluntary project and we thank all involved.

Sally Thomas
Publications Officer

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 Ekaterina Larina, Pilar Navas-Parejo and Zoneibe Luz.

Ekaterina Larina is a Russian/Kazakh in the USA, doing a PhD at the University of Southern California and funded by a Teaching Assistantship.

Photo © Ekaterina Larina.

How did you end up in the USA?
Initially, I came to the United States through the "Work & Travel" programme designed for foreign post-secondary students to work and travel in the United States over the summer. Afterwards, I went to English as a Second Language (ESL) school and stayed as an ESL student. After I graduated from the ESL school, I was admitted to Brooklyn College, New York, and this is where my path to a career in palaeontology started.

How is your position funded?
Over the years, my studies were funded by multiple sources. During my Master's studies, I received three-year funding from the National Science Foundation Graduate Research Fellowship (NSF GRFP). I was able to transfer one year of funding from NSF GRFP into my PhD. During my third year of PhD, I was self-funded via a USC Research Enhancement Fellowship. The rest of my PhD has been funded by a Teaching and Research Assistantship through the University of Southern California.

What is your project about?
I investigate palaeoenvironmental and palaeoecological changes leading up to the end-Triassic mass extinction event in different parts of the Panthalassic (Canada and USA) and Tethys (Austria) basins. I chose to study the end-Triassic mass extinction because this event allows us to investigate how the 'Modern Fauna' was affected by rapid rates of CO_2 injection into the atmosphere that led to warming temperatures, ocean acidification, and ocean anoxia the conditions that are analogous to daunting issues facing our world today.

To do this, I use a multi-proxy approach combining the examination of marine invertebrate assemblages through time with geochemical (Hg and C), petrographic and sedimentary data. An exciting part of this project is that it reassesses a current understanding of the pre-extinction interval. A combination of proxies reveals disruptions to shallow marine ecosystems and biogeochemical cycles prior to the onset of the end-Triassic mass extinction, at least in the Panthalassic basin. The data from the Tethys basin are currently under investigation. Stay tuned!

What surprised you most about living in the USA?
I was surprised to see how friendly and helpful people were. During my upbringing, I was brainwashed through TV and other media sources about Americans and their attitude towards Russians. This stereotype was completely broken once I was in the US. It was really heart-warming to see how random strangers on the street went out of their way to help me. Especially, when I just arrived, it meant the world to me since I barely spoke English, at the same time trying to find a job. Another thing that mesmerized and inspired me was the diversity of people, self-expression and art projects on the streets of New York.

An unpleasant surprise was food. All veggies and fruits were tasteless to me compared to the rich flavours I used to experience in Kazakhstan and Russia. I still vividly remember when I called my mom for the first time from the US and the first thing I told her was "I don't know what I am going to eat here". With time, I found where to find food to my liking.

Apart from friends and family what do you miss most about Kazakhstan?
I miss Kazakh cuisine since it is practically non-existent in the US. I miss the outdoor celebration of cultural holidays such as Maslenitsa and Nauryz.

How has the pandemic affected your situation as a palaeontologist abroad?
In terms of my career as a palaeontologist, my situation was simultaneously fortunate and unfortunate. On one side, I am fortunate because I am at the end of my PhD, so I collected all necessary data to finish my dissertation. At the beginning of the pandemic, I had to finish processing bulk samples in my garage and it was funny to observe the peculiar reaction of neighbours to my rock-breaking activities. On the other hand, job opportunities were extremely scarce since most universities put hiring on freeze. Luckily, in recent months the job market is slowly improving.

On a personal note, it is difficult not knowing when I will be able to travel to Kazakhstan to see my family. Unfortunately, this is the case for many people nowadays.

Katya tweets at @K_Larina.

Pilar Navas-Parejo is a Spaniard in Mexico, employed as a Professor at Instituto de Geología – UNAM on a tenured position.

How did you end up in Mexico?
I came here more than seven years ago on a postdoctoral fellowship that continued as an Assistant Professorship and eventually I became tenured.

How is your position funded?
Since the beginning, I have been paid by Universidad Nacional Autónoma de México to whom I am deeply grateful.

What is your project about?
My research focuses on Late Palaeozoic microvertebrate palaeontology, mainly conodonts, but also ichthyoliths, with a geological approach to better understand the timing and dynamics of the closure of the Rheic Ocean and the formation of Pangaea in its western segment.

What surprised you most about living in Mexico?
It is impossible to select only one thing that has surprised me since I came here. People are amazingly hospitable, humble and funny (they call it "albur"). And of course, the food, which is

listed as Intangible Cultural Heritage of Humanity by UNESCO. Nature and landscape are very often breathtaking also. I am not used to seeing live saguaros, every time I see one I feel respect.

Apart from friends and family what do you miss most about Spain?
Walking, because here everything is so big in the cities that you need a car or to use public transport. I also miss tapas, which I would miss no matter the country I would be in.

How has the pandemic affected your situation as a palaeontologist abroad?
As any other palaeontologist, I guess, I could not do fieldwork nor lab work since last March. Personally, I have not been able to go to Spain for more than a year.

Pilar tweets at @paleomicro and she is on Facebook (pnavasparejo).

Photo © Pilar Navas-Parejo.

Zoneibe Luz is a Brazilian PhD Assistant at the University of Lausanne (UNIL; Institute of Earth Surface Dynamics, IDYST), Switzerland.

How did you end up in Switzerland?
In 2015 for my MSc in Brazil I studied regional modern and fossil shark bioapatites, and I realized with my supervisor (Peter Toledo, Instituto Nacional de Pesquisas Espaciais/INPE) that phosphate oxygen isotope analyses were needed for my research (palaeoecology). I tried to contact a few people about this and one of them (László Kocsis, University of Brunei Darussalam) recommended the University of Lausanne (UNIL). After he invited me to visit in the summer, I travelled there and met him and his former supervisor (Dr Torsten Vennemann), who is also head of the Stable Isotope Laboratory (IDYST/UNIL). After spending three weeks there, I can say that it was an amazing professional and personal experience, and when I came back to Brazil, I decided to search for PhD opportunities at UNIL.

Photo © Zoneibe Luz.

How is your position funded?
In the first four years, I was funded by an SNF grant (Swiss National Science Foundation, division 2) awarded to Dr Hugo Bucher and Dr Torsten Vennemann for a project entitled Mid-Early Triassic Extreme Climatic Oscillation (METECO). Based upon this grant, my

research work was focused on characterizing the isotopic composition of conodont biomineral from Permian–Triassic sections as palaeoclimatic and palaeoenvironmental proxies. For the fifth year and conclusion of my PhD activities, I'm being supported by a cantonal (Vaud) and university (UNIL) funding.

What is your project about?
My PhD research is based on stable oxygen isotope analyses in phosphatic conodont dental elements, interpreted as proxies for the Early Triassic palaeoclimate. While isotopic analysis was mainly of conodonts, I used modern and fossil shark teeth as additional bio- or fluorapatites to better understand our results. Other geochemical techniques included in my research are: high-resolution imaging using a scanning electron microscopy (SEM), chemical mapping and quantitative analyses using an Electron Probe Microanalyzer (EPMA). All these analyses have widened our perspective about bioapatites in general, as well as phosphate oxygen isotope analyses in conodont bioapatite. At the moment, I'm evaluating the results from specific Lower Triassic localities and I hope to compile all this information in the coming months as publications.

What surprised you most about living in Switzerland?
It was my first time in Europe, so a lot of new things came into my perspective. I think the most classical example I use to explain my 'first view' was when cars were stopping for me at pedestrian crossings. It may seem silly, but it was a first experience of how educational and social aspects worked differently here. I was also amazed when I travelled around Europe, but missed coming back to Switzerland where (in most cases) people warmly greet you on the streets, even when they are pushing a supermarket cart uphill.

The mountains and temperate forest were also something entirely new for me. After having lived all my life in the tropics, these different landscapes still dazzle me as if it was the first time, even more with the magic of seasonality and its changes, and with the cold that comes along during winter!

Apart from friends and family what do you miss most about Brazil?
I think this is a common answer, but I definitely miss local food a lot. With time, I felt that food was not only about the taste. I think that eating something that you are used to also relates to your memories and emotions as well. Quoting Michael Pollan (writer), "we all have powerful memories of being cooked for by our moms, by our dads" *etc.* and I felt that much of the joy I had eating Brazilian food when briefly visiting home during my PhD was because I was rescuing these memories. Aside of that, in most cases there are unique tastes in products that grow only or grow better in tropical countries. For these reasons, I try to make a local dish once a month to rescue some good memories, which helps me to stay abroad.

How has the pandemic affected your situation as a palaeontologist abroad?
Working as a geochemist and more in the lab, I've seen more restrictions for lab activities. During most of this period I've avoided travelling outside Switzerland, since personal quarantine is necessary on return and losing two weeks of lab work would be expensive for me.

Zoneibe Luz is on ResearchGate (<**https://www.researchgate.net/profile/Zoneibe_Luz**>) and Facebook (<**https://www.facebook.com/zoneibe.luz**>).

Legends of Rock

Birbal Sahni FRS, the Naturalist

Birbal Sahni aged 23, studying at Cambridge. Photo © Ashok Sahni.

The turn of the 20th century in undivided India can easily be termed as the Age of Enlightenment for the Subcontinent. As the emerging Indian middle class grappled with new ideas and innovations of the western world while still trying to hold on to ancient traditions and customs, a new class of intellectuals came to the fore in all fields of endeavour: religion, philosophy, mathematics, politics, science and the newly found spirit of nationalism. Success lay in the fact that the intellectual must acquire the ways and habits of the colonial power, so that the person could be heard and understood and recognized by colonial society. A family in the Punjab epitomized this dilemma: Ruchi Ram Sahni, a self-made man, through his personal brilliance and perseverance, obtained a Masters degree in Chemistry in 1885 from Presidency College, Kolkata (then Calcutta in Bengal). It was he who laid the foundation for his children, Birbal included, to study at the best schools in England and return to India to set up the institutions, services or businesses that would help in the growth of the community.

Birbal went to the Mission and Central Model School in Lahore and excelled, there getting his matriculation degree in 1911. He mastered the classic languages of Latin and Sanskrit and excelled in the latter. He maintained a keen interest in literature, science and astronomy, but his main interests were in botany and in Himalayan plants, for the identification of which he used *Hooker's Flora of British India*. This early interest in the natural sciences was fuelled by his father's summer tours to remote and then rather inaccessible corners of the Himalaya. His younger brother mentions that Birbal was always excited about the plants that he found on his innumerable visits to the mountains, some of which he donated to Kew Gardens in England. After his matriculation, he left for England where he was admitted to the University of Cambridge at Emmanuel College. He obtained a Natural Sciences Tripos I in 1913, and the Natural Sciences Tripos Part II in 1915.

In 1914 he was in a position to welcome his father, Ruchi Ram Sahni, a chemist, who was joining the University of Manchester to work with Ernest Rutherford, the atom physicist. In fact, Birbal is believed to have played a major role in his father's choice of a research option, which was the

imaging of alpha and beta particles, as Birbal himself was an accomplished photographer. This assumption needs to be substantiated, but it is supported by archives at his residence in Lucknow. After his father left for India, Birbal moved to London and obtained his DSc from the University of London on a subject that he had been working on for some time, namely the arrangement of seeds in conifers. In 1929 he obtained a ScD from the University of Cambridge. In 1936, he was conferred the Fellowship of the Royal Society. Many awards and recognitions followed, as he moved to India to continue his research. He joined Lucknow University in 1921 as a professor in the departments of Botany and Geology and was foremost in the galaxy of scientists and academicians who were making Lucknow University a seat of great learning. That same year he got married to Savitri Suri.

Birbal and Savitri shortly after their wedding. Photo © Ashok Sahni.

His research canvas extended beyond classical botany and plant anatomy to other fields. He applied his knowledge of the ecology of plants to measure the rise in elevation of the Himalaya; his finding of an ancient coin mint dating to 100 BCE with several coins in place triggered an interest in numismatics; he also shed new light on the stratigraphic age of plant-bearing beds in the Salt Range and in the Deccan Plateau of peninsular India. Nonetheless, his greatest contribution was the study of fossil plants associated with the two major volcanic activities in peninsular India, the Rajmahal Traps and the Deccan Traps. Amongst his major findings was the discovery of *Williamsonia sewardiana*, published in 1932, belonging to the family Bennettitales in the Jurassic–Lower Cretaceous strata of the Rajmahal Hills. His genius lay in integrating records of the plant made by previous authors to reconstruct the whole plant. This is just a single example of the great body of his research, too extensive to discuss here. He was also greatly involved in the 1930s on what were new thoughts and concepts of the age, discussions and validity of the theory of "continental drift" and Haeckel's hypothesis that ontogeny recapitulates phylogeny.

Reconstruction of Williamsonia sewardiana *(Bennettitales) by Birbal Sahni (note initials) 1932, Pal. Indica, Geological Survey of India, modified from the original paper and illustration. Photo © Ashok Sahni.*

While still at Lucknow University, Birbal had the vision of building a world-class institution in the field of Palaeobotany. He worked tirelessly towards the fulfilment of this dream, which fructified when Pandit Jawaharlal Nehru, the

then Prime Minister of India and a former Cambridge colleague, laid the foundation stone on 3rd April 1949. Alas, Birbal Sahni could not reap the benefits of his efforts as he died a week later, leaving the fledgling institute rudderless. However, it is to his credit that his students rallied round after his death and, led by his wife, took the institution to great heights, which it still enjoys in the scientific world. At present the legacy lives on as the Birbal Sahni Institute of Palaeosciences, a modern institution overseeing all aspects of the fields of palaeontology, palaeobotany and geochronology.

Birbal Sahni speaking at the Foundation Day ceremony of the Institute of Palaeobotany, 1949. ***Photo © Ashok Sahni.***

Sahni was honoured internationally with many awards. He was to assume the office of one of the Honorary Presidents of the Seventh International Botanical Congress in Stockholm in 1950, which his untimely death denied him. His other awards and honours include the Presidentship of the National Academy of Sciences at Allahabad, the Barclay Medal of the Royal Asiatic Society for Biological Sciences, and the Sir C. R. Reddy Prize for Natural Sciences 1947.

Palaeobotany was a little-known subject in the early 20th century and it is because of Birbal Sahni's great efforts and those of other dedicated colleagues that the science with all its applications is now universally recognized.

Ashok Sahni
Panjab University, India

Behind the Scenes at the Museum

Geoscience collections at TalTech, Estonia – a journey from "rocks in drawers" to a well-curated and accessible natural history archive

Geoscience collections of the Department of Geology, Tallinn University of Technology (TalTech), represent the largest geological archives in Estonia, holding over 0.4 million fossil specimens, rock samples, micropalaeontological preparations, drill cores *etc*. These, and linked information, are curated with the help of a multi-institutional data management platform. The bulk of the collections was established during the last 70 years of geological research in Estonia and neighbouring regions. The materials are actively used by Estonian scientists and students, but every year we also host visitors from other countries and send out loans in physical, as well as digital, form. The most valuable part of the collections contains more than 20,000 type, figured and cited specimens, of which more than 1,200 are name-bearing taxonomic types.

The first geological studies in Estonia were carried out in the seventeenth century, but systematic research started in the nineteenth century. In 2020, Estonia celebrated the 200th anniversary of geology education. These long traditions of geological research have been promoted by excellent exposures of Lower Palaeozoic sedimentary rocks rich in well-preserved fossils, many of which have found their place in the museum collections in Estonia and abroad.

The Institute of Geology of the Estonian Academy of Sciences – which is now the Department of Geology at TalTech – was established in 1947 as the central geological research institution. The

Male reproductive organs in Devonian placoderms. ***1.*** Microbrachius*, GIT 628-24, Essi locality, Estonia (Long* et al. *2015).* ***2.*** Meeksiella*, GIT 196-50, Piskovichy locality, Russia (Trinajstic* et al. *2019).*

Institute soon developed into an important centre for palaeontological and stratigraphical studies in the Soviet Union. During the "golden period of geological research" the staff of the Institute reached nearly 200, including 18 palaeontologists covering all major lower Palaeozoic fossil groups. Fieldworks were extensive in Estonia and neighbouring areas and, as a result of these, the collections grew rapidly. From the 1960s to the 1980s the Institute's scientists participated in many expeditions all over the Soviet Union, which also contributed significantly to the growth of the collections. For instance, the large collection of Devonian fossil fish from the Soviet arctic islands, lithological and palaeontological collections from Subpolar Urals, Podolia and Siberia are held at TalTech and continuously used to date. Special expeditions for collecting meteorites from several distant regions of the Soviet Union were also organized. This period was characterized by extensive drilling programmes for geological mapping, exploration, and resource estimation in Estonia, which laid the foundations for the drill core collection. Many fossil specimens held by TalTech derive also from these drill cores.

The palaeontological collections of TalTech include research materials of many renowned Estonian palaeontologists; for instance, Dimitri Kaljo (rugose corals, graptolites), Einar Klaamann (tabulate corals), Heldur Nestor (stromatoporoids), Linda Hints and Madis Rubel (brachiopods), Ralf Männil (bryozoans, trilobites, echinoderms), Reet Männil and Helje Pärnaste (trilobites), and Elga Mark-Kurik and Tiiu Märss (vertebrates). The large vertebrate collections from Estonia and former Soviet Union areas require special highlighting as they are the foundation of some of the most spectacular collection-based discoveries to date.

Another strength of the fossil collections lies in micropalaeontology. Ostracods were intensively studied from drill cores starting in the 1950s and systematic studies of acid resistant microfossils commenced in the 1960s. At present, TalTech holds key collections of several lower Palaeozoic microfossil groups such as conodonts (by Peep Männik and Viive Viira), chitinozoans (by Ralf Männil, Jaak Nõlvak and Viiu Nestor), ostracods (by Lembit Sarv and Tõnu Meidla) and scolecodonts (by Olle Hints).

Examples of Ordovician–Silurian acid-resistant microfossils from the collections of TalTech. From left to right: a chitinozoan Belonechitina*, a conodont* Pterospathodus *and a scolecodont* Kaljoprion*. Photos by U. Toom and O. Hints (CC BY-NC). See more on the fossil catalogue* <**https://fossiilid.info**>.

In 1991 Estonia regained independence from the Soviet Union and this initiated many changes also in research institutions, their structure, funding and research focus. The Academy of Sciences was reorganized and most of its institutes were transferred to universities. The Institute of Geology joined Tallinn University of Technology in 1997, and since 2017 its official name has been the Department of Geology. While the number of geologists, and especially palaeontologists, has decreased over recent decades, the curation and accessibility of geoscience collections have improved considerably over this period.

For a long time, the collections were held in rather poor conditions: in public rooms, offices, temporary storage areas and the Institute's cellar that experienced several floods. The lack of storage space and facilities was a constant problem. So was the curation of the material, which was mostly maintained by individual researchers, and only the type- and figured material was properly catalogued. At the beginning of the twenty-first century the situation changed – a permanent position of chief curator was established in 2000, and a year later the department of collections was established.

Since 2004, all of Estonia's research collections held in universities have been funded by the Ministry of Education and Research as part of so-called "national collections". The "national geological collection" involves three institutions: TalTech, University of Tartu and the Estonian Museum of Natural History. This political decision has ensured base-level funding and the continuous maintenance of the collections to date. Since 2006, TalTech geoscience collections have been housed at the University campus, in rooms specially built for the storage of geological collections. Moreover, the Institute's field station and drill core repository, established in 1973, has been renovated and new core storage and study facilities were built in 2011–2015 as part of the national research infrastructure NATARC (<**https://natarc.ut.ee**>).

Curation and usage of collections is nowadays unimaginable without proper electronic cataloguing. Initial efforts in creating a collections database started at TalTech in 1996, and by 2000 a multi-user networked database system was in place. In 2002 we were able to provide our specimen-level data online at a dedicated web portal. Since then, the in-house developed system named SARV has evolved into a multi-institutional data management and publication platform that is far beyond a simple collection catalogue. Its relational data model hosts over 150 tables and serves a number of web-based user interfaces via APIs, including the Estonian Geoscience Collections Portal (<**https://geocollections.info**>), Baltic Fossils Portal (<**https://fossiilid.info**>), and Geoscience Research Data Repository SARV-DOI (<**https://doi.geocollections.info**>). To foster openness and knowledge-sharing, all our recent software developments are made open-source and available in GitHub (<**https://github.com/geocollections**>).

The progress in geoscience database development at TalTech has been made possible by the national research infrastructures NATARC and DiSSCo Estonia (see also <**https://dissco.eu**>). As part of the latter initiative, we are contributing to the updated version of GeoCASe, the Geoscience Collection Access Service (<**https://geocase.eu**>), which aims at creating easy e-access to all European geological collections, much like the GBIF (<**https://gbif.org**>) serves the biodiversity research community.

All researchers are welcome to study the geoscience collections held in TalTech, as well as in other Estonian institutions. We would be happy to host you, process loan requests and serve the

community by making our collection-related data easily accessible online. Check it out at <**https://geocollections.info**>!

Prof. Tony Prave (University of St Andrews, Scotland) is logging core section across the Silurian Ireviken Event to identify the background for a geochemical study. TalTech drill cores provide continuous archives across environmental perturbations, climate changes and biotic turnover episodes through the Early Palaeozoic. Photo by O. Hints.

Ursula Toom and Olle Hints
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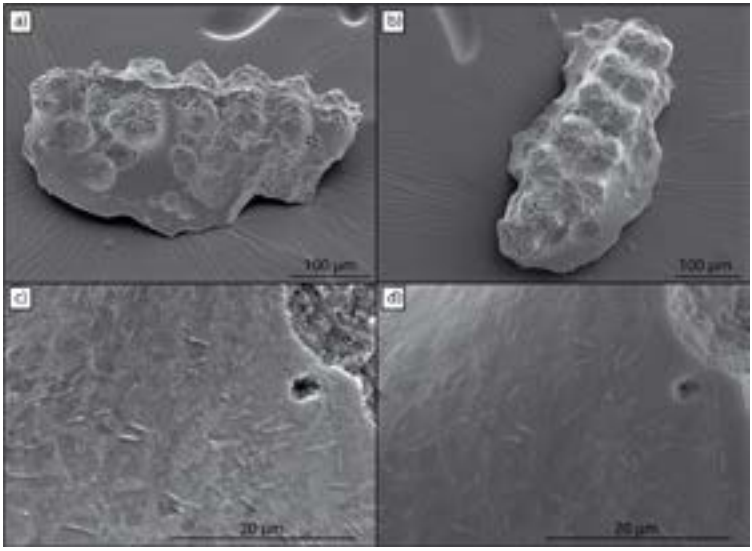
Mystery Fossil 27

A case of Permian dental decay?



These small chains of rod-like fossils (c, d) cover the surface of a 295 million-year old conodont dental element collected from the Tensleep Formation, Wyoming, USA. Conodonts are an early marine vertebrate that possessed phosphatic dental elements in a complex feeding apparatus comparable to that of modern-day lampreys. This dental element belonged to the shallow water species *Sweetognathus whitei*. Initially, when viewing the specimen, the circular borings catch a viewer's eye (a, b), but upon closer inspection numerous chains of approximately 2 µm long rods of serial circular structures cover its surface (c, d). Are these evidence of dental decay during the conodont's life, a bacterial colony decomposing the animal after its death, or contamination during processing?

The conodonts were retrieved by dissolution from calcareous rocks using a dilute solution of acetic acid. Specimens were then separated from rock residue using a heavy liquid, sodium polytungstate or tetrabromoethane. Finally, they were picked and glued to micropalaeontological slides using gum tragacanth, potentially introducing a source of bacterial contamination. Images a) and b) provide an overview of the conodont element, with the large borings. Image c) is a close-up view of the element where the rods are clearly present. Image c) was taken using backscattered electrons, while d) is the same region but using secondary electrons. An energy dispersive X-ray analysis on a transect through a rod yielded no difference in composition from the conodont element's apatite, though the instrument sensitivity may be at fault for the inconclusive results.

If you have any ideas on what these fossils could be, please contact me by e-mail at <**wyatt.petryshen@ucalgary.ca**>.

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The Building Trade

Humans do relate to the rest of living organisms – but that relation can be exceeding strange. I am not thinking so much of strict taxonomy here, where we and our fellow primates are placed in the Euarchontoglire clade these days, so I am told. Rather, one may think more of ecological relations – but, as few of us go out into primeval forest to hunt wild boar and antelope with flint-tipped spears these days, the notion of ecology needs be stretched a little. Not so much into directly confronting the agribusiness that does keep us alive, as this essay is for a family readership and so steps delicately around such sordid matters[1]. Rather, one can explore our own mental landscapes – that after all drive this newly re-engineered ecological web – to see where and how our fellow organisms fit in, where it really counts.

This came to mind when browsing through one of Wikipedia's many treasures, the List of Fictional Animals. In this, someone – or I would guess a small, if admirably eccentric, army – has been chasing down all of the animals that have ever appeared in books, films, cartoons and (as this is a contemporary list) video games. The list, as one might guess, is enormous, and – in illuminating those animals that are constantly on our minds, or at least, on the minds of those who make up stories for the rest of us – is exceedingly thought-provoking. An obvious question here is which *fossil* animals make it into this kind of common currency.

The answer is, of course, instantly found. There is a whole section of fictional dinosaurs – getting on for a hundred, at a quick scan. It starts with Crackers the Quetzelcoatlus in *Captain Underpants*, and goes on to take in the groan-inducing (Terry Pterodactyl in *Horacio's World*), the unbearably cute (Baby Bop the Triceratops in *Barney & Friends*), the bizarrely deadpan (Charlene Sinclair the Protoceratops in *Dinosaurs*) and many, many more. All human life seems to be there in the characterization – but not, by any means, all fossil life. The rest of prehistoric life barely gets a look-in. There is the odd mammoth (hiding in the List of Fictional Pachyderms) and an ammonite turns up in the List of Miscellaneous Fictional Animals – though, just to rub salt in the wound, in a manga series called *Dinosaur Hour*. But otherwise, the creative human imagination is a palaeontological desert. There are almost as many fictional arthropods as there are fictional dinosaurs – but all are modern, and among these I searched in vain for a trilobite, amid the likes of Scarrafone the cockroach[2] and Hawthorne the hermit crab.

This dearth is purely of palaeontological diversity. Come into the modern world, and the taxonomic diversity in these lists is truly impressive. There are fictional parasites, fictional worms, fictional snails (quite a few), fictional anteaters, fictional sea cucumbers, fictional parasites and even a fictional comb jelly – and of course more fictional cats, dogs and horses than you can shake a very long stick at. There is clearly a gap in the market here, that is crying out to be filled. The adventures of Annie the anomalocarid, Rudolf the rudist and Gwyneth the graptolite[3], should not, in these enterprising times, be too far away.

My browsing of this garden of delights wasn't quite idle. The human portrayal of beavers seemed at the time to be worth looking up, as their identity as icons of animal architecture takes on some

[1] But if you are feeling strong enough, Bennett *et al.* (2019) lay this out in suitable palaeontological terms.
[2] Though Don Marquis' immortal Archy the cockroach does not appear. Tsk. A major omission
[3] Always in many minds, of course, as befits a colony.

new and thought-provoking dimensions[4], once viewed through the perspective of deep time and distant ancestry. Eighteen beavers are tallied in the List of Fictional Rodents, including Doris (a talented soccer player) in *Timothy Goes to School* and Bingo "Bet It All" Beaver (an inveterate gambler, one is ashamed to say) in *The Get Along Gang*. This is maybe not as many as fictional mice or rats, but more than fictional hamsters and comfortably more than fictional gerbils. In narrative fiction, the reputation for solid industriousness has clearly trumped familiarity (beavers do not make easy pets, as they usually take a dim view of other mammals in the house, and like to eat the furniture).

The solid industriousness goes back a long way, though not always in the building of dams. A particular story about this has flared up, now and then, over more than a century, albeit starting within a very different kind of imagined terrain. From the late nineteenth century, Edwin H. Barbour headed the University of Nebraska's State Museum. Industrious, something of a polymath (a medal for the best designed home windmill is listed among his honours) and clearly a fieldwork enthusiast, he led expeditions into the surrounding badlands for some thirty years, amassing some fine collections, especially of Tertiary mammals.

One kind of fossil, in early Miocene strata of Nebraska and Wyoming, caught his eye. These would have caught anybody's eye, mind, being vertical, impressively regular spiral structures getting on for three metres high. *Daimonelix*, he termed them in 1892, the 'devil's corkscrew'. He said the strata they were in were lake deposits, and that these were hence gigantic fossilized freshwater sponges. A likely story? Ripostes came the very next year. One was from the pen of none other than Edward Drinker Cope, by then a grand old man, but not quite finished with his own adventurous fieldwork – and he was certainly not finished with academic disputatiousness. Henry Fairfield Osborn said that Cope's motto was "war whatever it cost" – and as Barbour earlier in his career had been second-in-command to Othniel Charles Marsh, Cope's formidable adversary in the notorious Bone Wars that raged for years across the dinosaur-bearing terrain of the mid-West[5], that might have added an extra frisson to Cope's combativeness.

Not sponges, said Cope, but animal burrows made by some kind of rodent, being joined simultaneously and quite independently in this judgement by an Austrian scholar, Theodore Fuchs. Barbour, who seemed a touch on the combative side himself, would have none of this. He back-pedalled from the lacustrine interpretation but announced that they were some kind of extraordinary giant plant. Others piled in to the debate, though it took eighty years to settle the argument properly.

Enter, in the 1970s, Larry Martin and Debra Bennett of Kansas's Museum of Natural History. They were just as amazed as was Edwin Barbour by these structures, but having done their homework, they could express their amazement firmly from one side of the fence, lauding them as 'perhaps the most spectacular trace fossil known'. Barbour's 'devil' tag survived their exquisite analysis, though, being if anything enhanced by a photo of the senior author, cowboy hat on head and shirtless in the fierce Nebraska sunshine, standing beside one of these structures which towers over him, a stray horn-like offshoot from its top underlining its diabolical connotations.

The evidence for their judgement was beautifully assembled, and the case they made may now be safely closed. Some of the corkscrews include skeletons of an early beaver, *Palaeocastor*

[4] Ancient dimensions, of course – just newly discovered.

[5] Osborn on Cope again: " the scowl of his foe" – Marsh, that is – "caused him to grow".

fossor. An accidental juxtaposition, perhaps, or later occupation of a pre-existing structure, as one might recall from the tale of Hawthorne the hermit crab? Martin and Bennett emphatically excluded these possibilities by carefully exposing the spiral walls to reveal scratch marks from incisor teeth on them, which exactly matched the dimensions of the teeth of this *Palaecastor* species. This animal therefore dug through three metres of hard-packed soil with its teeth, before shovelling the debris out with its paws or its (notably broad) head, to excavate its extraordinary living chambers.

Barbour was not completely wrong about the plant connection, as the plant tissues he reported from the giant corkscrews are certainly there. Indeed, many burrows are completely filled with plant roots, now impregnated with silica, and these help both preserve the burrows, and make them vividly stand out against the dull-coloured sandstone that they are encased in. Martin and Bennett made the point that, in the Miocene semiarid upland soils that these sandstones represent, roots would tend to follow any structures – like large burrows – that might be a little more humid; it was easier, too, for roots to grow through a void than through hard-packed soil. While the burrows were occupied, the industrious *Palaeocastor* would nip away the continually invading roots, and use them as an extra food source. When the spirals were abandoned, the roots would take over, and quickly produce a living cast of the structure. Game, set and match, and the restless spirit of Cope – in this case at least – can be vindicated. The structures are even more spectacular at grand scale, mind. Martin and Bennett's careful mapping showed that *Palaeocastor* was an urban-spirited beaver, building its *Daimonelix* in close-packed clusters of hundreds at least, separated by large burrow-free expanses.

So is constructional sophistication a speciality of the beaver clade, to be later redirected into the dams that we are familiar with today? It's not so simple. The marvellous *Daimonelix* structure, it turns out, is not confined to beavers, and spiral 'daimonelices' of different shapes and sizes have now turned up as far back as the late Permian, some 255 million years ago, with an admittedly rather smaller structure made by a small herbivorous mammal-like therapsid, *Dictyodon*, to the largest example yet known, discovered surprisingly recently on our own temporal doorstep: Sean Doody and colleagues in 2015 found monitor lizards in northwestern Australia that today spirally burrow down to 3.6 metres, thus, they say, pipping the Miocene beavers to the honour of making the deepest vertebrate nest.

Why do this kind of thing at all? asked Doody & co., quoting calculations that indicate that the constructing animal needs to expend half or more as much energy again to construct a spiral tunnel, as it would to go the same distance by simply building a straight one. Better protection against predators? Less chance of adjacent burrows cutting across each other? Better control of air circulation, moisture and humidity? The case here, it seems, is not closed at all. Empirically, it worked for *Palaeocastor* then as it does for the Aussie lizards now, and it's nice to have some puzzles left – especially those of a devilish kind.

So when did the beavers begin to take on streams and rivers as an engineering challenge? The story here is a little more tangled, though not for want of exquisite fossil evidence in suitably exotic settings. The Pliocene strata of Ellesmere Island off northern Canada today are the sort of thing to be studied only by palaeontologists who go there *very* warmly dressed, given a climate so bleak that only the smallest and hardiest of shrubs now survive there. About four million years ago, though, there were lush forests traversed by streams, showing what an atmosphere with

about 400 parts per million of carbon dioxide can do to Arctic Circle landscapes. That, of course, is about the level we have lately arrived at (and are quickly surpassing), so future developments are naturally being watched with much interest. Be that as it may, the peat layers that survive from Pliocene times contain a good deal of beautifully preserved fossil wood – quite a lot neatly trimmed with the unmistakable teethmarks of *Diploides*, an extinct beaver, the bones of which turn up in the strata too.

Evidence of dam-making? That conclusion came first to mind, of course, but beavers today cut and trim wood to eat and to store for eating later, as well as for building. For them the gingerbread house is not just a fairy tale, devised to stay one step ahead in the pecking order on the List of Fictional Animals, but a most sensible ecological strategy. In the latest deliberations on this puzzle, Tessa Plint and colleagues (2020) nail down this transmutation of Ellesmere wood into Pliocene beaver by showing that the patterns of carbon and nitrogen isotopes in the fossil bones of the latter must have been derived from the former. They suggest that beavers had been cutting wood for food for twenty million years previously, and that the transition to adapting this pattern for building came rather later. Had it developed in that long-lost Ellesmere Island forest? Perhaps. Plint & co. note the possible remains of a dam structure preserved in those strata, but don't seem too convinced by it. In any event, the woodworking abilities of *Diploides*, they say, were rather cruder than those of today's beavers – a put-down that one would not wish, of course, to reach the ears of the List's severely-minded editors.

So there are some things – discounting, naturally, humanity's own baroque constructions – that are more or less new under the sun. Beaver dams, among the more spectacular examples of animal architecture, thus seem to have graced terrestrial landscapes for only a few million years. That grace comes with environmental baggage of surprising reach. The dams trap water, of course, to make beaver ponds, and they trap sediment, too, just as human-built dams do. Quite how much sediment they trap is not very obvious from just looking at the surface of valleys today, so one needs to develop X-ray eyes to see below the surface, to measure out beaver-formed sediment-layers.

This is exactly what Natalie Kramer and colleagues did a few years ago, using the modern magic of ground radar, at a place called Beaver Meadows in the Rocky Mountains of Colorado. With an irony that is now habitual in such circumstances, there are no beavers at Beaver Meadow, though there used to be many decades ago, before our species evicted them. Nevertheless, their sedimentary footprint remains. It's gigantic. Ground radar may not quite be an all-seeing magic eye, and it works better in some places than others, but here buried beaver dams could be made out and, stretching upstream of them, nicely well-behaved patterns of radar reflectors marking where sediment built up evenly in the long-lived ponds behind the beaver dams. Up to half of the post-glacial sediment infilling these valleys was beaver-dam-trapped, and Kramer *et al.* suggested that such landscape construction was widespread across much of North America and Eurasia, before humans moved in and beavers were moved out.

These beaver-made strata make up one hell of an extended phenotype – which does more than just comprise multi-million ton masses of sand, mud, and carefully arranged tree branches. It *does* things – like control floods and maintain water tables (so it is good news for amphibian populations when beavers move in and bad news when they move out), make pollution loads

more diffuse and so less harmful, and store large amounts of carbon. The last two of these benefits solve problems that are mostly human-made ones, admittedly, but they add to the arguments used by those humans who would like to see beavers encouraged back into our contemporary depleted rivers.

Our perception of the enormous scale of this ripple effect in landscape engineering, and of the ecological networks that form as a by-product, relies upon the kind of clues that one can – and even then with some difficulty – only glean from the very youngest strata, those that are still perfectly preserved and intimately linked to the present landscape. How might one explore such phenomena in more ancient geological time, where such pristine evidence is largely absent?

I'm a little baffled as to how one might construct a research strategy of sufficient creativity and imagination to decipher such deeper connections in the fossil record. Until then, perhaps a manga cartoon charting the adventures of Polly the intrepid *Palaeocastor*, keeping one paw ahead of the baddies amid those endless spiral labyrinths, might be the perfect way to bring Miocene ecological dynamics to a mass audience. It could be quite devilish fun – and be one way, too, to finally bring a little palaeontological justice to that infamous List.

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Palaeontology's greatest ever graphs

Darwin's tree of life sketch

During his voyage on the Beagle, Charles Darwin recorded all his observations in field notebooks. In addition, he used red leather notebooks to write down his theoretical speculations. These notebooks reveal in detail his research and gradual illumination of the species question as well as the ideas that later led him to develop the famous theory of evolution. Twenty years ago, two of Darwin's red notebooks stored at the Cambridge University Library (B and C) were removed from the Special Collections Strong Rooms to be photographed. Since then, they have been missing, believed misplaced, until January of last year when those responsible for this material reached the conclusion that they had probably been stolen. The gravity of the matter lies not only in the theft of two original works by Darwin himself with a value of millions of pounds, but also in that one of the notebooks (B) contains one of the most precious illustrations in the history of science, *Darwin's tree of life sketch*.

It was in July 1837, when at the age of 28, Darwin had just returned from his voyage to the Galapagos Islands on HMS Beagle. At his home in London, the young naturalist speculated for the first time how species could 'transmute' from ancient forms to later forms. He wrote at the top of the page of one of his red leather notebooks, "I think", and then drew a sketch of an evolutionary tree.

Tree-shaped diagrams originated in medieval times as a representation of genealogical relationships and, since then, have harboured a wide range of interpretations (Pietsch 2013). According to Darwin, as he wrote more than twenty years later, on 24th November 1859 in his *On the Origin of Species*, the interpretation of this first sketch would be that: "At each period of growth all the twigs have tried to branch out for all sides, and overrun and kill the surrounding twigs and branches, just as species and groups of species have tried to dominate other species in the great battle for life. The limbs divided into large branches, and these into lesser and lesser branches, were themselves once, when the tree was small, budding twigs; and this connection of the previous and present buds by means of ramifying branches may well represent the classification of all extinct and living species in groups subordinate to groups. Of the many twigs that flourished when the tree was a mere bush, only two or three, now grown into large branches, survive and support all other branches; so, like species that lived during long-past geological periods, very few now have living and modified descendants". The first sketch shows how species might evolve along branches of an imaginary tree, with older speciation events being closer to the root, and the younger ones closer to the tips of the metaphorical tree. It consisted of three tree-shaped, ascending and branching genealogical diagrams to visualize various aspects of what Darwin 'baptized' as "the Tree of Life".

Darwin's Tree of Life (ToL) scheme was nothing more than a graphic representation of his ideas. What he did not know is that it would be the precedent of an entire scientific and, why not, philosophical trend, which would continue to this day. It was the symbol of the theory of evolution by natural selection. The sketch already represented evolution seen as a set of unpredictable processes framed in time, with a beginning and an end not yet determined and that would be driven by unknown changes (Atzmon 2015). What was special and what distinguished Darwin from the others, who had previously used trees to represent genealogies, is that he used a single tree for **all** of life. The ToL concept is important and central in modern evolutionary biology. It is used in systematics (for classification of organisms, ancestral reconstruction of the evolution of characters in time…), phylogeography and comparative biology (anatomy, comparative genomics…). Currently, there even exists the "Darwin Tree of Life Project", which consists of genome sequences of 66,000 British species. Similar initiatives are also being carried out in other countries to sequence the maximum number of quality genomes possible, which will allow performing exhaustive studies of present and past species with the use of genomic information. Precisely because it is essential, some researchers have proposed that the idea is not so simple, and that evolution is not just a vertical process, as the tree would indicate, but that it would have the shape of a network. The exchange of genes between species in different evolutionary lineages is evident, especially in small organisms, such as microbes and ancestral eukaryotes, but also in plants and animals. As a result, the idea of genes only transferring down individual branches of the ToL has been questioned. Another question would be whether genes are the only criterion to define an organism and its genealogy. What other factors could or should be taken into account? This is a topic of debate that would occupy

many pages. What is clear is the high value of this sketch that has opened a different vision of life and its evolution. It is important to know the direction of the change, and the shape of the branches that have resulted from it. Unfortunately, scientists do not have a time machine to know with certainty how one species has evolved into another one. Instead, what they do is to compare extant life forms and fossils to infer how closely related they are. In the past, ToL were built by comparing visible physical characteristics. Now scientists are able to go further, using comparative genomics to calculate organisms' affinities. The methods have been refined, but even the most advanced representations remain approximations of the history of life. The beginning of all these ideas is in the lost notebooks. It is certainly heart-breaking that such a precious treasure is missing. Where is one of Palaeontology's greatest ever graphs?

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An Introduction to Bayesian Phylogenetics Relaxing Assumptions of the Mk Model

[NB: This tutorial, data and other useful files are available at <**https://github.com/wrightaprilm/PA_newsletter**>.]

Recap

In the previous instalment of this Newsletter we covered using the Mk model of Paul Lewis (Lewis 2001) to estimate a phylogenetic tree. Today, we will be examining how to relax some of the assumptions of the Mk model, particularly the assumption of equal state frequencies, and by extension, equal between-state transition rates.

Relaxing Character State Symmetry

The Mk model makes a number of assumptions, but one that may strike you as particularly unrealistic is the assumption that characters are equally likely to change from any one state to any other. That means that a trait is as likely to be gained as lost. While this may hold true for some traits, we expect that it may be untrue for many others.

RevBayes has functionality to allow us to relax this assumption. We do this by specifying a beta prior on state frequencies. Stationary frequencies impact how likely we are to see changes in a

character. For example, it may be very likely, in a character, to change from 0 to 1. But if the frequency of 0 is very low, we will still seldom see this change.

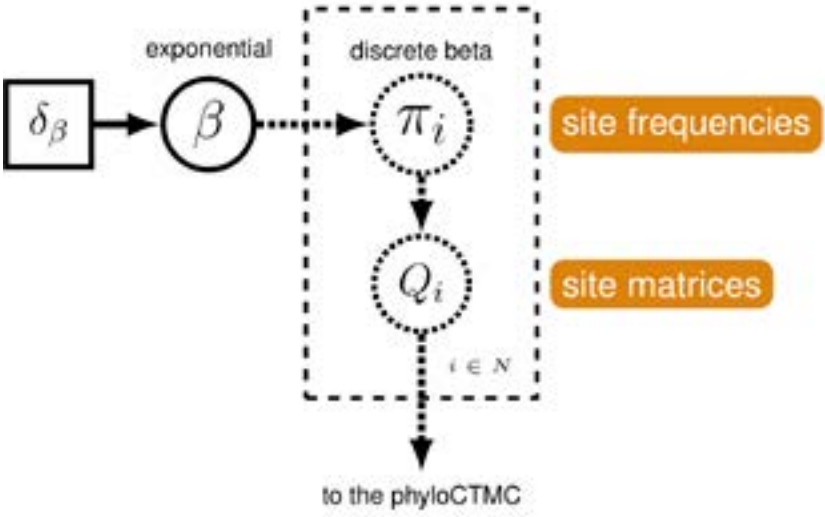
We can think of a Q matrix as looking like so:

$$Q = \begin{pmatrix} -\mu_0\pi 0 & \mu_{01}\pi 0 \\ \mu_{10}\pi 1 & -\mu_1\pi 1 \end{pmatrix},$$

In which the probability of changing states depends not solely on the transition probability, but also the frequency of the starting state. For example, if we have a rare character state, we do not expect to see many transitions from the rare state to another. π is the value chosen to represent state frequency commonly in phylogenetic models.

We can exploit the relationship between state frequencies and observed changes to allow for variable Q-matrices across characters. To do this, we generate a beta distribution on state frequencies, and use the state frequencies from that distribution to generate a series of Q-matrices used to evaluate our data (Nylander *et al.* 2004; Pagel and Meade 2004; Wright 2016).

This type of model is called a mixture model. There are assumed to be subdivisions in the data, which may require different parameters (in this case, state frequencies). These subdivisions are not defined *a priori*. This model has previously been shown to be effective for a range of empirical and simulated datasets (Wright 2016).



Graphical model demonstrating the discretized beta distribution for allowing variable state frequencies.

Modifying the Rev-script

Make a copy of the Rev script you made in the previous tutorial. This new script will contain the new model parameters and models. Call it `mcmc_mk_discretized.Rev`.

We will use the copy of the Mk model script from last Newsletter's tutorial. We will not need to modify the helper variables or MCMC setup.

We will use a discretized beta distribution to place a prior on the state frequencies. The beta distribution has two parameters, α and β. These two parameters specify the shape of the distribution. State frequencies will be evaluated according to this distribution, in the same way that rate variation is evaluated according to the gamma distribution. The discretized distribution is split into multiple classes, each with its own set of frequencies for the 0 and 1 characters. The number of classes can vary; we have chosen 4 for tractability. Note that we need to make sure that this discretization results in a symmetric model, therefore we will use only one parameter for the beta distribution: `beta_scale` such that $\alpha=\beta$.

```
num_cats = 4
beta_scale ~ dnLognormal( 0.0, sd=2*0.587405 )
moves.append( mvScale(beta_scale, lambda=1, weight=5.0 ) )
```

Above, we initialized the number of categories, the parameters of the beta distribution, and the moves on these parameters. This can be added before the definition of the Q matrix.

Next, we set the categories to each represent a quadrant of the beta distribution specified by `beta_scale`.

```
cats := fnDiscretizeBeta(beta_scale, beta_scale, num_cats)
```

If you were to print the cats variable, you would see a list of state frequencies like so:

```
[ 0.011, 0.236, 0.764, 0.989 ]
```

Using these state frequencies, we will generate a new vector of Q-matrices. Because we are varying the state frequencies, we must use a Q-matrix generation function that allows for state frequencies to vary as a parameter. We will, therefore, use the fnF81 function. This code block will replace the old Q matrix.

```
for (i in 1:cats.size())
{
    Q[i] := fnF81(simplex(abs(1-cats[i]), cats[i]))
}
```

Additionally, in RevBayes we need to specify the probabilities that a site evolves according to one of the Q-matrices. For this model the probabilities must be equal because we need to guarantee that the model is symmetric. Thus, we use a simplex function to create a vector that sums to 1.0.

```
matrix_probs <- simplex( rep(1,num_cats) )
```

This will be added to the CTMC like so:

```
phyMorpho ~ dnPhyloCTMC(tree=phylogeny, siteRates=rates_
morpho, Q=Q, siteMatrices=matrix_probs, type="Standard",
coding="variable")
```

In the above, we have modified the CTMC to accept a vector of Q-matrices, instead of one.

This script can now be executed as in Lesson Two.

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Colonialism and palaeontology: connected histories

As a historian of science working on the history of palaeontology, I am involved in two scholarly communities which are becoming more and more committed to engaging with the problematic histories of their fields, and current issues around diversity and representation within them. The relationship between science and colonialism has long been one of the most fruitful areas in the history of science, but it is only relatively recently that historians of science have turned serious attention to diversity in their own communities. Palaeontologists and connected branches of natural history have recently been engaging in highly reflective ways with the history of their fields, with an agenda towards decolonizing them. Some notable examples have been the recent edition of the podcast Palaeocast on "Decolonising Palaeontology", and the online 2020 meeting of the Natural Sciences Collections Association on the theme of "Decolonising Natural Science Collections". Both the Palaeontological Association and the History of Science Society have issued statements condemning racism and committing themselves to addressing problems of diversity and representation in their communities. This is important work, and work where thinking across disciplines becomes very useful – both for understanding long-running processes and also for sharing insights.

What follows are a few thoughts on some of the ways in which palaeontology has been historically linked with colonialism, and some of the implications of this for the present. The important thing to bear in mind is that palaeontology did not just develop in parallel with colonialism in the nineteenth- and twentieth-centuries, but was very much entangled with it. This was not just the familiar story of western scientists using colonial territories as fields of study, to "acquire" specimens of either natural or human-made objects. Colonial governments were very interested in surveying, mapping and digging. This ranged from large-scale projects like geological, geographic and mineralogical surveys, to more day-to-day activities of building infrastructure, mining and agricultural expansion. In the course of this, people frequently unearthed fossils, and these became the focus of significant study. Projects like the "Dinosaurs in Berlin" project at the Museum für Naturkunde in Berlin, looking at the history of the huge dinosaur excavations in the 1900s in Tendaguru in modern Tanzania (then the German colony

of German East Africa), and books like Pratik Chakrabarti's *Inscriptions of Nature*, have started to pay attention to the ways in which the origins of the deep-time sciences and colonialism were closely entwined.

We can tease this out more if we start thinking about different forms of colonialism. Historians of empire often talk about a variety of types of colonialism. Firstly, we have the "classic" form of colonialism, of setting up authoritarian governments over subjugated societies, as occurred in India, large parts of Africa, Oceania and Southeast Asia across the nineteenth century. Secondly, we have "settler colonialism", where land was annexed to be settled by large numbers of European colonists, while the Indigenous inhabitants were dispossessed, with classic examples being in Australia, New Zealand and the Americas. And thirdly we have a messier category of "informal empire", which refers to places which remained politically independent, but were nevertheless dominated by the economic, military and diplomatic power of imperial states. Here we can see much of South America and China in the nineteenth century, and potentially also forms of "neo-colonialism" over the twentieth. These are ideal types and some places moved in and out of different categories, or mixed features of different forms, but they are nevertheless useful to think with.

We can find instances of palaeontology being connected with each of these varied forms of colonialism. In our classic colonialism, we have particularly famous examples in the extraction of fossil mammals from the Siwalik Hills in India in the early-nineteenth century, as well as the already-mentioned excavations at Tendaguru. For settler colonialism, the classic sites of the "Bone Wars" in the United States in the latter half of the nineteenth century show these tendencies greatly, with palaeontological excavation occurring alongside the annexation of territories in the West from Native American peoples like the Cheyenne, Lakota and Arapaho. And with regards to informal empire, we see especially notable instances in South American fossil mammals brought to Britain in the mid-nineteenth century by figures like Woodbine Parish, or the huge upsurge in palaeontological expeditions in China in the 1920s.

Colonialism in palaeontology was not just connected to these big prestige projects. We see a great deal of smaller-scale activity too. Museum collections are littered with fossils that were "acquired" by geologists, missionaries, soldiers and other figures, and sent to European and North American museums as either gifts or exchanges. Whatever the scale though, these colonial histories have a strong impact on which sites are regarded as classic in the literature and the emphases in museum collections. Having done archival work in museums across Europe and North America, I am continually struck when visiting museum stores and archives by how closely the collections often map on to former colonial territories or areas of informal influence. In many respects, the colonial heritage is not in the past, but is still mirrored in many of our institutions.

The links between colonialism and palaeontology were also present in the very practical business of excavating and finding material. In older literature, it was conventional to talk of western palaeontologists "discovering" particular formations or fossils. This derives from many of the narratives around early palaeontology, where figures like Othniel Charles Marsh and Werner Janensch would present themselves as dramatic and heroic explorers or scientific prospectors (the field photograph, where paleontologists dress almost as caricatures of colonial explorers or frontiersmen, is a particular trope of the period). What Elsa Panciroli has called "the image

problem" in palaeontology, where these sorts of "rugged outdoorsy" macho tropes are presented as a norm in palaeontological work – with corresponding problems for diversity – is now quite well recognized, and is another area where the colonial history of the field has exerted a long reach. Palaeontologists are increasingly refocusing the stories and representation around the discipline, with projects like Trowelblazers having done a lot of excellent work. However, colonial imagery of pith-helmeted Victorian explorers venturing to retrieve fossils from mysterious territories or depictions of the palaeontologist as Western hero and "scientific cowboy" still crops up in palaeontological outreach and media presentations, and here it definitely pays to reflect on the histories of the field.

As well as moving away from these clichés, it is also important to recognize that many fossil localities were often well known to the people living in colonized places, who identified fossils and gave particular meanings to them (and the reports of colonial palaeontologists are littered with accounts of their discussions with local peoples telling them where to find fossils). Likewise, the actual business of digging and excavating was rarely done by western palaeontologists alone, and most of the labour was supplied by colonized people – which could involve small teams of excavators, or be on a much larger scale, such as the hundreds of African workers working at Tendaguru (and of course, this was not limited to colonial contexts – lower-class excavators doing the actual digging was fairly standard in contemporary excavations in Europe). The contributions of these excavators has been largely omitted from the record and gaining any knowledge of them often requires reading against the grain of excavation accounts, or looking deeply into archives and unpublished material. However, not doing so means that we miss a large number of people who have been involved in palaeontology, as well as failing to acknowledge people who were essential to many palaeontological projects.

This last point potentially allows one way we can move forward. Thinking about the many people who were involved in palaeontological work in history allows us to think in a broader way about how the discipline developed, and who has been involved in it – not just elite scientists, interspersed with a few notable exceptions like Mary Anning, but whole networks of people. One of the main points of the history of science is that science is a social activity. Bringing the range of people involved in the practice of palaeontology more fully into the stories we tell about the discipline can be a way of thinking in more diverse terms (just being careful to remember and acknowledge that these were unequal relationships). And by doing so, we both diversify, but also expand, our understanding of what palaeontology is, and who has done it.

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Further Reading & Resources

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Rethinking the Museum

Bringing the Sedgwick Museum to your kitchen table

Many of you will have been feeling the separation from our fossils over the last year, be they in the field, the lab or a museum collection. The Sedgwick team are feeling this too: our work is centred around connecting people with the Museum's million or so specimens, and while we have been able to keep some limited research and teaching access going throughout lockdown, with the doors closed to the public we have really had to think hard about how we can continue to demonstrate our relevance. Our remote public offer is definitely still a work-in-progress – like everyone, we've had to make a bit of it up as we go along – but we've had some real successes and innovations over the last year.

Last spring we were looking forward to opening probably our most high-profile temporary exhibition, *Dawn of the Wonderchicken: the oldest modern bird* showcasing the work of Daniel Field and his team on the late Cretaceous *Asteriornis maastrichtensis*. Our exhibitions are an important way in which we can show visitors how science happens and present inspiring role models for young people thinking about science careers. With our Easter-egg-themed launch postponed at the onset of the first lockdown, within a month our exhibitions coordinator Rob Theodore had put together an online version of the exhibition (<**https://wserv4.esc.cam.ac.uk/online-exhibitions/index.php/Shorthand/dawn-of-the-wonderchicken-2/**>) which has proved to be extremely popular in the wake of the press excitement about Daniel's work.

We're a small team without a digital specialist, so have had to learn quickly and draw on what expertise we could in creating our digital resources. We collaborated with Game Dev London on a live-streamed virtual museum tour in Animal Crossing (<**http://www.sedgwickmuseum.org/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=118&cntnt01returnid=15**>) and with the Sutton Trust on workshops for young people considering University, while our work in

partnership with colleagues in the University of Cambridge Museums meant we were able to offer virtual sessions to people with dementia and their carers in partnership with Dementia Compass (<**https://www.museums.cam.ac.uk/blog/2020/09/17/from-the-sedgwick-museum-to-my-living-room/**>)

Throughout lockdown, families have been on the lookout for fun things to do outdoors. Encouraging fossil hunting is easy when you are based in Dorset or Scarborough, but much harder when you live in the flat murk of East Anglia. Even more so if you don't have transport or walking boots or simply don't know where to go. Our Gravel Hunters project aimed to be as accessible and achievable as possible by getting people finding and identifying fossils in the everyday gravel around them. In September – in the brief moment when schools were able to visit – we hosted an outdoor physically-distanced school session where 30 nine-year-olds rummaged through a couple of sacks of finest builders' gravel, finding sponges, echinoid spines, *Gryphaea* and more. Alongside this, we were able to promote an online version of our regular identification service via e-mail and social media.

With a bit of consultation with conservation colleagues, we have been able to make our loans boxes COVID-secure, meaning that teachers can borrow material from our collections to support their classroom teaching while the Museum is closed. We have developed new loans boxes in consultation with teachers so that we can be sure that they fit with their needs. Due to popular demand we have developed new boxes and accompanying resources, and provided advice to other museums across the country as more and more of them realize the potential for working with schools in this way.

We had planned a programme of activities – with the generous support of a PalAss Engagement Grant – highlighting the Mary Anning material in our collections and how it enables us to reflect on gender and class in palaeontology. With a bit of 'pivoting' this programme is under way online: Artist and geologist Emma Jude, who had successfully led our 'Feminist Guide to Dinosaurs' drawing workshops in 2019, delivered a really successful online ammonite drawing workshop, with participants from the USA and Canada as well as the UK. We have costumed interpreters working on a film, and are collaborating with teachers to produce new downloadable resources. Throughout the year, we have contributed downloadable resources for teachers and home schoolers, from sock ammonites to Build-a-Bird worksheets. And we are delighted that the 17-year-old we hosted for virtual work experience now has an offer to study geology at university next year.

A key priority for the Museum is to address inequality, broaden access to our Museum, and address the barriers that prevent people engaging with us. This last year has highlighted how important it is to consider digital inequality when planning activities. Throughout lockdown we have worked with other University of Cambridge museums and Cambridge City Council to reach families who do not have digital access by distributing printed activity sheets and resources packs through targeted networks including the city food hubs.

As I write this in February we still do not have a clear date for reopening to the public but anticipate that, as with last summer, we will reopen with reduced hours and visitor levels to ensure physical distancing. Once of the hardest things about making the Museum COVID-safe has been to remove the interactives that go a long way to make a historic museum like ours family-

friendly: things like the giant jigsaws, the digital interactives, the book trolley and the family activity boxes. As an alternative we will be offering visitors their own family discovery packs with activities to do in the Museum and to continue at home afterwards. A real positive about the reduced visitor numbers and increased staffing levels means there has been much more opportunity for staff to chat to visitors and answer questions.

Things have been, and continue to be, hard for the Museum: we have taken a big hit in terms of shop and visitor donation income, and our year-long collections relocation has been substantially delayed. Like everyone, the Museum team have had to draw hard on their skills, creativity, resilience and partnerships, but they have also found new flexible and joined-up ways of working. It is not an overstatement to say that the pandemic will change the face of museums forever – the satisfaction of walking through a busy, buzzing museum gallery packed with people is still a long way away – but we feel confident that this change will enable us to make new and more sustainable connections between people and palaeontology.

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Spotlight on Diversity

Diversity at the Paleontological Association: 2020 membership report

Brief Introduction

The Palaeontological Association endeavours to establish a diverse, inclusive, healthy, and welcoming palaeontological community. In 2017 Council commissioned an independent assessment of diversity, aiming among other things to identify under-represented groups and barriers to inclusion. One of the immediate actions from this was to create the role of Diversity Officer and a Diversity Group on Council. Another of our first major steps has been to establish ongoing data monitoring, enabling us to benchmark progress over time. Here, we give a brief overview of where we are currently and highlight some of our particularly problematic areas, along with solutions that have already been implemented. It is worth mentioning before we present any data that not everyone fills out our diversity surveys (the response rate is around 40%, typical percentage of responses to PalAss surveys). Regardless, these data still provide valuable insights into where the PalAss membership stands today.

Diversity data 2020

2.6% of our members are non-binary, 31.7% are female, and 63.9% identify as male. 1.9% identify as trans. 79.5% are heterosexual, 17% are gay men, 10% are gay women or lesbians, 6.9% are bisexual and 1.9% are either pansexual or asexual. 17.8% have a long-term illness or health condition, including but not limited to autism, heart problems, cancer, diabetes, restricted mobility, asthma, Asperger syndrome, depression and anxiety. The vast majority of PalAss members are white (86.6%), 3.3% are Asian, 2.6% are Hispanic/Latinx, 4.3% have mixed/multiple

ethnic groups, and less than 1% are Black. 66.3% of members do not have a religion or belief, and 21.8% are Christians. 74% do not have a caring responsibility, 18.5% are taking care of at least one child or elderly relative. 13.5% consider themselves as being from a disadvantaged socio-economic group. 44% are the first person in their immediate family to go to university. 47.2% of our members come from 34 countries and together speak more than 40 languages. The remaining 52.8% are from the UK. The vast majority work in universities (71.6%). Some 16.3% of our members are PhD students and 15.5% are fixed-term contract researchers who do not have a permanent contract in palaeontology. In a separate survey, 15% of respondents noted that they have encountered discrimination, including racism, sexism and sexual harassment, at a PalAss Annual Meeting. Several respondents indicated that they did not report these behaviours for fear of retributions or consequences that would negatively impact their careers.

Problems Raised

Perhaps the first problem that can be raised is that we do not see any progress in our data since the initial assessment of diversity in 2018. When we compare our data to the UK census as a benchmark, we still observe that women are under-represented. We also acknowledge that a large number of our members do not have permanent or secure employment. We also know that women and non-binary people are generally under-represented among those who do have permanent positions (Hill *et al.* 2010; Gibney 2019; Marín-Spiotta *et al.* 2020). We are doing worse when it comes to representing race and ethnicity. We are doing particularly badly when it comes to the representation of Black palaeontologists. These problems are not only limited to membership data. For instance, to date, our awards and grants have been skewed towards UK- or USA-based white male palaeontologists. And it is only in 2021 that – to the best of our knowledge – the first Black palaeontologist was elected to Council, which means that, historically, we have not been very representative of racial diversity either on Council, or in the distribution of grants and awards. In addition to these problems, discrimination and harassment at meetings constitute a key issue that should be solved.

Solutions Implemented

In order to improve the current imbalance within palaeontology, and considering that it is the responsibility of those who do have secure employment to support members who do not, PalAss have introduced a mentoring scheme (a link to which follows this report). This scheme aims to assist palaeontologists at the start of their academic careers and focuses on those transitioning from late-stage PhD to postdoctoral positions and from postdoctoral positions to permanent jobs. Mentorship is an evidence-based approach to supporting individuals from under-represented groups to the next career stages. This scheme will hopefully increase the representation of under-represented groups over the long term.

We have reviewed our awards and grant schemes and made a number of preliminary changes. This includes publishing more detailed remits for our awards, along with the criteria used by Council to select award winners. It is important to highlight as well that the year 2020 will not count in the calculation of full-time experience after a PhD when applying for the 2021 awards and grants. Moreover, we now provide a diversity statement in all calls for nominations, encourage the use of neutral language and we have revised our voting system. Starting in 2021, all first-time applicants (both students and supervisors) for the Undergraduate Research Bursaries will receive free membership to the PalAss for one year. We have implemented a prioritization

scheme based on self-declared protected characteristics. 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. At the top of our priority list are Black students who belong to the most under-represented group in geoscience, followed by students with disabilities, women, and people from other racial and ethnic minorities. It is important to note that we cannot prioritize members of the LGBTQ+ community using positive action because available data suggest that members of this group are overall well represented in palaeontology. However, this is not to say that LGBTQ+ individuals do not encounter additional challenges pursuing a career in the geosciences and we will endeavour to identify ways in which we can better support members of this community. Similarly, we cannot include individuals from socio-economically disadvantaged backgrounds because under UK law this is not considered a protected characteristic, although we recognize this as another important area in which to improve our support.

We have been working with the Newsletter Editors to promote diverse voices in palaeontology. We have invited a broad range of palaeontologists to contribute their personal experiences in the 'Spotlight on Diversity' and 'A Palaeontologist Abroad' sections. Finally, in order to improve the inclusivity of our meetings, in 2019 we established the Carer's Bursary, and in 2020 improved reporting procedures for Code of Conduct violations – we encourage members to always report any inappropriate incidents.

These initiatives will not be enough to remarkably increase diversity and inclusion. For instance, many awards are delivered based on either self-nominations or nominations from other community members. We strongly encourage you to nominate your colleagues for awards – take a global perspective, and think beyond your immediate circle of acquaintances and collaborators. We encourage diverse individuals to stand for Council as positions become available (see page 4). Despite having implemented a considerable number of solutions, a lot of work remains to be done, as evidenced by our survey data, to achieve the ultimate goal of having a fully active and diverse palaeontological community.

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Link to the PalAss members' Mentoring Scheme
<https://www.palass.org/careers>

Spotlight on Diversity

An unconventional path to a PhD as a first-generation student

One of my earliest memories was watching Shark Week with my father. Mind you, this was way back in the early years when the Discovery Channel was still providing informative and scientifically-based content. I remember watching with awe as a Great White Shark gnashed its massive jaws at the bait hanging along the side of the research vessel. I knew that I was supposed to be scared of these ferocious beasts, but all I wanted was to touch one. When I shared my dreams of touching a shark, my dad just smiled and said, "Sure".

Flash-forward 20 plus years and a few (Leopard) shark pats later, I find myself at the precipice of accomplishing another one of my goals, receiving my PhD. With this degree in hand, I will be the very first in both my immediate and extended family, to be named Dr Pirlo. Even just writing it seems ludicrous and impossible. I will not fully believe it until I have that piece of paper in hand. Like many of my fellow graduate students in the USA, attaining a PhD is something that we have been told directly and indirectly that we could not do. The following narrative contains three lessons for how I found success as a first-generation STEM student. Although our experiences may differ, the lessons learned are applicable to many situations. I thank you for joining me on my unconventional path to a (nearly complete) PhD in vertebrate palaeontology.

I am proud to be the daughter of my immigrant parents. Both came to the USA with the hope of achieving the American Dream, a dream that was described in their respective native countries as achievable via hard work and assimilation into the culture. Growing up, my father was very much against my sister and me learning any language other than English. As an Italian immigrant, he had faced much discrimination due to his accent and lack of mastery of the English language. However, my mother, a recent immigrant from Mexico, refused to learn a new language to yell at her children in. It was through my mother's stubbornness against my father's wishes that I learned how to speak Spanish and Italian long before I learned how to speak English. Being fluent in the languages of my grandparents, I was able to communicate and interact with them, learning our customs directly from the source. I quickly understood how difficult it was to navigate the school system in any manner different than the norm, so I strove to speak English perfectly and hid my heritage. Soon enough, my homework began to surpass the schooling that either of my parents had received in their native countries and I soon found myself having to find alternative resources to keep up with my studies. Thus, I learned the **first lesson**: that which made me different from my classmates gave me the tools to seek out innovative learning tools and styles.

In high school, my academic advisors suggested I attend a four-year university right after graduation. This is the only manner in which students can have a successful future; this is the only path to success, or so we were informed. So I applied to a university and was accepted. I was the first in my family to go to college! My parents had accomplished one part of the American

Photo: Jeanette Pirlo.

Dream, they had provided a better future for their children. And then I got to my university…

I found college intellectually challenging and I was excited about the available courses. Yet, I was not finding success at this new institution. I did not know how to be successful in college and my academic advisors were not helpful. I soon learned that it is difficult to ask questions when you do not really know what it is you are even trying to accomplish or what to ask. On top of my confusion with academic success, I also felt lost when it came to financing my studies. My parents fell in that frustrating economic bracket where they made too much money to qualify for financial aid, but not enough to financially afford my studies. My only recourse was to take out bank loans to cover my fees. I did not want to burden my parents financially, so I made the decision to leave my four-year institution and enrolled in a two-year college. This was a huge source of shame for me because I had been taught that two-year or community colleges (CC) were not going to lead me to success, but I refused to give up my studies.

To cover my tuition and living expenses, I began to work full time. At times, this meant working three jobs while still taking course work. Although all of my academic advisors always claimed that community colleges would not lead to success, I found more academic support at my CC and, with time, successfully transferred to another four-year institution to receive my bachelor's degree. But I would not be doing my path through academia any justice if I skipped the important lessons I learned at my CC. I spent nine years completing my general education courses necessary to transfer to a four-year. The majority of those years were spent trying to pass pre-calculus. I had never been very good at math, but I had never failed a class, that is until I took pre-calculus. I just could not grasp the concepts. It was incredibly frustrating because pre-calculus is a requirement for any science degree in the US. My inability to pass the class led me to an ultimatum with myself, either pass pre-calculus or drop out of school. Long story short, after five attempts, I finally passed pre-calculus AND transferred to a top university to complete my degree. And so, **lesson two** presented itself: I found the confidence in myself to accomplish any goal I set my mind to. That my goals could only be accomplished through discipline, hard work and dedication. Failure teaches us to keep pushing to achieve our goals.

A couple of years later, I found myself near the end of my bachelor's degree in marine biology. I did not have a plan for what was next after undergrad. Due to my background, I did not have the extra time or financial stability to volunteer in labs to gain experience. Thus, I was not prepared, and didn't feel like I could submit a competitive application for graduate school; I didn't even have faculty I felt close enough to to ask for a genuine letter of recommendation! My only recourse would be to move back home, working a job that probably did not require a college diploma. This seemed like such a waste of a diploma and of all the time I spent attaining it. Thankfully, I had enrolled in a vertebrate palaeontology (VP) course to fulfil an elective requirement. I wll be completely honest with you, I absolutely HATED VP. I never found dinosaurs interesting (do not judge too harshly please) and I could not conceptualize the structures that were allegedly in the thin-sectioned slides. Nevertheless, this course set me along the path I walk today.

I met my current PhD advisor through this VP course. Over a student lunch, he and I discussed my career interests, as well as my current employment. At the time, I was working at a local high school as an academic advisor, as well as a Spanish geometry teacher. I loved this job because I saw the value of validating my students' thoughts. Many were like me, children of immigrants, or even, recently arrived immigrants themselves. I uniquely understood the feeling of isolation from other classmates because of a language and cultural barrier. By attending a core course in their native language, the students were able to connect their understanding of a subject and begin translating it into their new reality. My passion for increasing students' science identity must have shown through enough while talking with my future advisor that he invited me out to my first palaeontological dig. As mentioned previously, I did not really care about fossils, I was obsessed with extant sharks, but I jumped at the opportunity of a free trip. And then I found my very first fossil…I was hooked! I was blown away that I was the very first person EVER to see, hold and marvel over this five-million-year-old fossil! I had to figure out how to convince my would-be advisor to let me be his student. I had very little understanding of VP, but I had so many questions! Luckily, he agreed and I found myself moving cross-country towards my new future.

I did not make this decision lightly. By this time, my father was very ill and I was loath to move so far from home, but my parents felt it was an opportunity I could not pass up. I was accomplishing the goals they set when they moved to the US and would, hopefully, have a better and more financially secure future. With their blessing and support, I left everything that I knew and embarked on this adventurous PhD. I had found a supportive advisor, not just academically, but also financially, alleviating the stress of figuring out how to pay for my degree.

Through my advisor I have learned many things, not just the expected instruction of the field, but lessons about myself. My advisor has a unique manner in seeing the potential each one of his students has, regardless of that student seeing it themselves, and he pushes his students out of their comfort zone, not just to show that he was right, but to instil confidence in ourselves as academics, researchers and mentors. Through his and my lab's support, advice and high expectations, I applied for graduate funding through the National Science Foundation (NSF) and received it. I was able to secure my own funding and am not beholden to TA- or RA-ships to cover my tuition. He also challenged me to write a second grant application to the NSF to fund a paid internship programme for under-represented groups of undergraduate students. This grant was also funded, to my great surprise. This internship programme is dear to my heart because

we seek to provide experiential research opportunities for students like me, community college students, minority students, students who want to do research, but cannot afford to volunteer their time because of their financial obligations. By paying our programme participants to conduct research, we make it possible for them to gain critical experience necessary for graduate school applications, or, at least, deciding if they enjoy research or not, while alleviating the financial strain of volunteering their time and intellect.

And so, with this, we arrive at the **final lesson** for finding success in grad school: success is not an individual task. Success is found through support from our community, whether that is academic advisors, family or friends. With their support and belief in our abilities, the sometimes-impossible task of completing a degree is easier to manage.

In summary, I do not have the recipe for success in grad school, but I can impart some hard-earned lessons I have learned along the way:

1. That which makes you different from your colleagues, whether it is ethnic, financial or experiential diversity, has given you the tools for success. Your unique experiences provide you with a different point of view and solutions when challenged with a task or problem.

2. Attaining our goals is not easy. To achieve them, we must be dedicated, hardworking and ask for help when we do not know how to continue. Recognizing we need help and seeking it out takes maturity and humility and helps achieve our goals. Failure is not the end of a goal, but just a redirection of our efforts to approach a problem from a different angle.

3. Surround yourself with a strong and supportive community. Having someone cheer you on and remind you that you are a rock star when you do not feel like you belong in an academic space is imperative. Your community will help you build your science identity and remind you that you are NOT an imposter.

As I get closer and closer to graduation, I realize that I belong in STEM. My experiences and viewpoints enrich our field. No matter what hardship you are facing, reach out to your community, ask for help and believe that you can achieve your goal. The path you originally laid out may not be the one you eventually traverse, but through flexibility and perseverance, we can achieve our goals.

Jeanette Pirlo
Florida Museum of Natural History, University of Florida, USA

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

5th International Meeting of Early-stage Researchers in Palaeontology (IMERP)
Virtual Meeting organized by Vilnius University, Lithuania *18 – 21 May 2021*

The IMERP is aimed at early-stage palaeontologists, from undergraduate students to recent post-doctoral researchers, and hopes to bring young palaeontologists together from all over the world. The meeting's character is informal and its aim is to create a friendly environment where young researchers can present their work and meet other palaeontologists from many different fields of expertise. The meeting's sessions will include presentations (oral and poster) from different fields of palaeontology, such as: vertebrate and invertebrate palaeontology, micropalaeontology, palaeobotany, taphonomy, palaeoanthropology, palaeoenvironment, palaeoclimate studies *etc*.

For more details please see the website: <**https://imerp2021.weebly.com/**>.

35th IAS Meeting of Sedimentology
Vienna House Diplomat Prague, Czech Republic *22 – 24 June 2021*

This meeting has been postponed from June 2020. The meeting will feature several sessions with a palaeobiological theme, including 'Sedimentary environments as the theatres of life and evolution' (session T05-SS05). Researchers from a broad range of fields including ichnology, palaeoecology, sedimentary geology, geochemistry and geomorphology, in both marine and non-marine settings, have been encouraged to contribute.

For more information please visit the website: <**https://www.iasprague2021.com/**>.

18th Conference of the European Association of Vertebrate Palaeontologists (EAVP2021)
Virtual meeting co-organized by several institutions *6 – 9 July 2021* ***NEW DATES***

The in-person conference in Benevento has been postponed from July 2020 due to the coronavirus pandemic. However, the EAVP board and the organizers have decided to hold the 18th EAVP meeting online. Several European institutions (Università di Firenze, Università del Sannio, Museum für Naturkunde Berlin, Humboldt-Universität zu Berlin) are co-organizing this event with the support of many other institutions and companies. The number of participants will be restricted to 200 to avoid having parallel sessions for oral presentations. The organizers aim to make the online experience as close as possible to an in-person one and therefore the talks and related discussion time will be held live. Instead of poster sessions, the organizers aim to showcase all poster presenters and propose a 1–2-minute flash talk for each poster. Early registration is encouraged and the call is open for proposals for roundtables, workshops and symposia. For more information please visit the website: <**https://eavp.org/**>.

36th International Geological Congress
India Expo Centre, Delhi, India *16 – 21 August 2021*

The IGC was postponed from March 2020 due to COVID-19. The IGC is a non-profit scientific and educational organization whose meetings are held in collaboration with, and under sponsorship of, the International Union of Geological Sciences (IUGS). IUGS holds its General Assemblies in conjunction with Sessions of the IGC. The main purpose of the Congress is to encourage the advancement of fundamental and applied research in the Earth sciences worldwide.

For further information please visit the website: <**https://www.36igc.org/**>.

9th International Meeting on Taphonomy and Fossilization (TAPHOS) and 6th ICAZ Taphonomy Working Group Meeting (ICAZ-TWG)
Museo Arqueológico Regional de Madrid, Spain *30 August – 6 September 2021*
NEW DATES

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: <**http://taphostwg2020.es/**>.

2nd Crossing the Palaeontological–Ecological Gap (CPEG)
Museum für Naturkunde Berlin, Germany *5 – 8 September 2021*

Postponed from September 2020, this three-and-a-half-day meeting is planned with oral and poster presentations and a workshop. Besides giving a platform to scientists and work that crosses the gap between modern and ancient worlds, the aim is to cover all major organism groups, ecological levels and process focuses. Keynote speakers, round-table discussion and goals will remain the same. The Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science, Berlin is one of the most important research institutions worldwide in the areas of biological and geological evolution and biodiversity. with a collection of over 30 million items covering zoology, palaeontology, geology and mineralogy.

See the website for further details: <**https://cpegberlin.weebly.com/**>.

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

This meeting is postponed from September 2020. The 12th cCongress 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/**>.

VIII International Conference on Mammoths and their Relatives (ICMR)
Indian Institute of Science, Bangalore, India *2021* ***NEW DATES TBC***

The Conference is postponed from October 2020 and revised dates and deadlines are yet to be announced. However, participants are encouraged to submit abstracts without waiting for further announcements. The themes of the Conference will include evolution and biogeography, genetics, ecology, extinction, conservation, archaeozoology and others, with both oral and poster sessions. Field-trips include a visit to Asian elephants in Bandipur National Park and a chance to explore the famous Neogene–Quaternary vertebrate fossil site of the Siwaliks.

Please visit the website: <**https://mammothindia2020.org/**>.

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

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.

Please visit the website: <**https://www.ichnia2020.com/**>.

Marine Reptiles Conference 2020
The Etches Collection, Kimmeridge, UK *May 2022* *NEW DATES TBC*

This Conference has been rescheduled from May 2020 due to the coronavirus pandemic. Originally postponed to October 2020, this has now been postponed further as delegates were polled and preferred an in-person meeting. 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/**>.

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

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/**>.

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

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/**>.

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* NEW DATES

The Congress is postponed from September 2020 and will celebrate 200 years of modern palaeobotany. 1820 saw the first use of binomial nomenclature for fossil plants by the Czech 'Father of Palaeobotany' Caspar Maria Sternberg, who published Flora der Vorwelt in this year. Palynology and palaeobotany have a long tradition in the Czech Republic with several eminent pioneers. The scientific programme will cover all aspects of palaeo- and actuopalynology and palaeobotany. Several Congress field-trips will be on offer around parts of Bohemia and Moravia. The International Organisation of Palaeobotany will financially support several postgraduate students, allowing them to participate in the conference and present their research results.

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

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 REPORTS

64th Annual Meeting of the Palaeontological Association
Virtual meeting hosted by
Oxford University Museum of Natural History, UK *16 – 18 December 2020*

No one anticipated the disaster of a year that was 2020.

Every academic, hobbyist or curator alike had dates and locations scribbled in notebooks, plans, and Gantt charts. The Palaeontological Association Annual Meeting 2020 (herein referred to as PalAss2020) was surely one of them. I know, because PalAss2020 was too, one of the landmarks on my annual chart. Initially the meeting was scheduled to take place in Manchester, my alma mater. I was looking forward to reuniting with old colleagues and staff in the rainy metropolis of the British North. Alas – something we anticipated, but were not prepared for, swept the globe. Possibly the biggest social, financial and academic event in the past decade. Numerous conferences were either cancelled or postponed, while some – in very evolutionary fashion – tried to adapt and move into the new, uncharted online realm.

Big Thanks Jack, portrait by Rachel Erin.

Lockdown-life for many was little more than sitting from morning till night, switching from Zoom, or Teams, or Collaborate; with R Studio, TNT, or LaTEX sandwiched between, as Twitter is ominously buzzing in the background. It takes craft to make a conference feel more than "*a hectic Zoom call you have to pay for*". But the **Oxford University Natural History Museum (OUNMH)**, this year's impromptu hosts, managed to pull it off, using WebinarJam and a mixture of synchronous talks, asynchronous poster sessions and networking on the personalized Discord server. It was by far one of the better conference experiences I have had in the online world.

PalAss offered reduced prices and a fee waiver for those who needed it, which is extremely thoughtful considering museums and numerous folk in scientific employment were on thin ice this last semester. Such a gesture also removes barriers for academics around the globe, which was reflected in the cosmopolitan attendance. This opportunity was complemented by the Symposium: "New Ideas on Old Fossils: A Symposium of Early-Career Palaeontologists from Around the World", which utilized this shortcoming as an opportunity to highlight international research, such as **Sanaa El-Sayed**'s look at the wealth of material coming from Egypt.

The conference was preceded by insightful call-to-action talks on the ethics of fieldwork and specimen acquisition – a topic that was finally given enough time and was not hidden as a side note (see page 79 for the full report). These conversations have to be had, especially in the context of the aptly timed #UbirajarabelongstoBR initiative. It was also refreshing to see talks *about* science, such as **Liz Hide**'s presentation on colonial connotations to the Sedgwick Museum. Social science, indeed, has a place in palaeontology.

The talks ran professionally, with an active live community, but it being technology, of course things were bound to go slightly awry. Problematically, numerous correspondences landed in 'Promotion' or 'Spam' mail folders, sparking some initial confusion. Internet faults took their toll – notably during the award ceremony. While we are at it, congratulations to all the award recipients and leaving/joining Council members!

Despite the drawbacks, all the event hosts and session chairs dealt with inevitable glitches seamlessly. Enormous thanks to **Jack Matthews** for being an excellent host, along with the plethora of fantastic support crew.

It is an enormous shame that some talks ran simultaneously without the ability to catch up asynchronously or re-watch at one's own pace. And there was a lot to catch up on – with talks running almost non-stop from 9 am and with official events closing shop at 7 pm, if not later. Topics varied from palaeoclimate (**Monsuru Adebowale**), microbial life (**Edwin Rodriguez-Dzul**), hadrosaurids (**Alfio A. Chiarenza**), statistical models (**Manabu Sakamoto**) to organic chemistry (**Jasmina Wiemann**).

It was great to see **Albert Chen** (also presenting on phylogeny of avian girdle), as always, synchronously tweeting panel summaries! Our in-house artist, **Rachel Erin**, created portraits of every speaker with astounding speed, and *Newsletter* regular **Ellis Jones** sketched cartoons of many of the talks. Could a conference-artist be a permanent fixture? Along with conversations held on Discord, the conference did feel like a tangible event with some semblance of life-like networking and connectivity. After all, that is what *meetings* are for.

Cambrian molluscs by Rachel Erin.

The lunch breaks were nicely accompanied by virtual field-trips run by **Hilary Ketchum** exploring astounding anecdotes and fossils in the collections of the OUMNH. It was an informative, engaging way of dealing with "down time". It brought neat flashbacks to the better times, where we had the ability to visit and explore collections. This is something I am sure most academics severely miss.

The event was bookended with 'Palaeovision', which I approached cautiously with "I am going to pop in, get the gist for this report, and pop back out" attitude. But that did not happen. From the get-go I was enthralled by the creativity and wackiness of the event and its entries. The competition started with a strong contester, Herr Müller the ammonite, represented by **PalaeoFAU**, which inevitably lost to dancing *Anomalocaris* represented by the **University of Lausanne**. After all,

The Palaeovision winning entry – Anomalocaris *representing the University of Lausanne.*

Anomalocaris fought against *Tyrannosaurus* [pictured] and survived to dance along to the beat of Waterloo. I swear, it all makes sense in the context of the event!

While networking in stuffy corridors and eating university food is greatly missed, it still is astounding that conferences are running, science is being communicated, and one can still watch the talks and peel potatoes simultaneously. Enormous thanks to the Oxford University Museum of Natural History for hosting and, with incredible finesse, running the event. See you – maybe, hopefully – next year in Manchester.

Natalia Jagielska
University of Edinburgh, UK

[Editor's note: all recorded talks from PalAss20 are now available to view on the PalAss YouTube channel: <**https://www.youtube.com/c/ThePalaeontologicalAssociation/playlists**>]

One of the "field-trips" covered Mary Anning and her connections with the OUMNH.

Palaeoethics from the Field, to the Museum, and to Publication – a review
Virtual Workshop *15 December 2020*

"*Science doesn't exist in a legal and ethical vacuum*" – Prof. Paul Barrett.

The day before the official start of the Annual Meeting, the Association held a workshop on Palaeoethics, with the aim of "discussing issues in the field of palaeontology", particularly with regards to fieldwork, collections and publications.

'Palaeoethics' is a longstanding issue which has seen recent day conferences on the subject provided by both the European Association of Vertebrate Palaeontologists (in Haarlem, see Liston 2016) and the Society of Vertebrate Paleontology (in Albuquerque 2018 and Brisbane 2019), with the publication of accompanying proceedings (Parkes and Liston 2018). This PalAss workshop was apparently prompted by discussions amongst the palaeontological community surrounding recent publications on Myanmar amber, and represented the Palaeontological Association's first event in the area of ethics in palaeontology since the 1980s. As such, the first half of the workshop acted very much as an introduction, covering the topics of geoethics and geoconservation with presentations by **Jack Matthews** (Oxford University Museum of Natural History) – and chair of the Annual Meeting organizing committee – on "*Palaeontological research, the law, and education*" and **Daniel DeMiguel** (Universidad de Zaragoza and International Association for Promoting Geoethics) on "*Geoethical issues in Palaeontology at a glance*".

The second half of the workshop focused on the ethics and legalities of research on Myanmar amber, with **Donna Yates** (Maastricht University), a criminology expert with an archaeological background, examining palaeontology through the lens of criminology ("*What criminology can tell us about ethics in palaeontology*" – <**https://prezi.com/view/chNwWY9HUVMZjgkTaqlX/**>), and **Prof. Paul Barrett** (Natural History Museum, London) with a talk entitled "*Law, ethics and science: three parts of the same puzzle*".

Myanmar (Burmese) amber has over the past year sparked controversies due to its alleged links to the military, conflicts and human rights issues in Myanmar (Burma), as well as the legal grey zone in which it falls (*e.g.* Sokol 2019). A criminology framework, as presented by Dr Yates, can help us to understand the ethical boundaries within which we, as palaeontologists, operate and to understand why certain people engage in ethically questionable behaviours. For example, individuals might be in denial ("It's just one piece", "I did not excavate it, I am just studying it"), condemn their critics ("they are being overly politically correct", "they are envious of my achievements") or appeal to higher loyalties ("it is for the good of science"). Understanding these patterns from criminology may help us to develop clearer ethical codes and locate the critical points for monitoring unethical behaviour, as well as helping us develop a curriculum for teaching ethics to students.

Dr Yates also discussed the legal grey zone in which Myanmar amber falls. It is illegal to export fossils from Myanmar without a permit but since amber is classified as a gemstone, it can be exported under the gemstone law for economic purposes. While it is not illegal to export the container itself – the amber – the fossils remain the property of Myanmar under preservation laws, even if the "owner" is currently not exercising its right to enforce this.

This legal grey zone has led to a normalization of unethical behaviour in palaeontology, where the situation is allowing researchers to carry on as if nothing was wrong. Such behaviours are rarely condemned by fellow palaeontologists, professional societies or academic institutions, creating an environment where this behaviour is culturally approved and even passed on to students.

Prof. Barrett continued this discussion stating, "Science does not exist in a legal and ethical vacuum" and we, as palaeontologists, should be conscious of how our decisions of what to study affect other sectors beyond the walls of academia. Along with reiterating the legal and ethical dilemmas of Myanmar amber, he also mentioned the role of societies and journals in addressing these issues. In April 2020, the Society of Vertebrate Paleontology (SVP) published a letter calling on editors to be mindful of harmful and unethical practices and containing initial guidelines on dealing with manuscripts on Myanmar amber (Rayfield *et al.* 2020). This includes a change to editorial policies which would only approve manuscripts where the fossils had been deposited in a permanent, accessible repository to ensure long-term access for future studies as well as reproducibility of results. They also requested a moratorium on publication for any fossil amber specimens purchased after June 2017, which is when the Myanmar military began its campaign to seize control of the amber mining. In response, the *Journal of Systematic Palaeontology*, of which Prof. Barrett is the co-Editor-in-Chief, released a statement, stating that the journal would no longer consider manuscripts based on Myanmar amber (Barrett and Johanson 2020). As evidenced by this action, journal editors and scientific journals can have a significant impact on a broad set of academic stakeholders, and thus influence scholarly interests in a field where research output in terms of scientific publications is of utmost importance for academic success.

During the Q&A session that followed these presentations, a participant noted that SVP's proposed ban would greatly impact students. As guidelines are being proposed and revisited, the issue remains that there are several PhD students currently working on Myanmar amber specimens, typically acquired by their supervisors. A ban will likely damage their prospects in both finishing their doctoral studies and finding future academic opportunities, as they will not be able to publish their research and their choice of fossil specimen may portray them as a liability. Along with being vocal of ethical and legal problems that perpetuate the field, societies should also support students and early-career researchers who have often had no say in how specimens had been acquired or deposited, yet bear the brunt of policy changes.

In all, this workshop represents a step forward in creating space for critical discussions of ethical and legal concerns in the field of palaeontology. As a field, we currently lag noticeably behind other similar fields such as archaeology, which has recently been developing and applying robust ethical standards. As such, Dr Yates' perspective, as archaeologist and criminologist, was a significant contribution to this workshop.

Given the pertinence and importance of the topic, a more diverse panel would have provided a broader perspective on the issues. All the speakers were from European institutions and thus provided a very Euro-centric view of ethical issues in palaeontology. Additionally, almost all of the speakers hold permanent academic positions, which makes it less risky for them to speak on and against certain unethical behaviours in the field. This is a privilege that people in temporary positions, such as students and early-career researchers, do not have. The topic of ethics in palaeontology cannot be addressed by just a few people with specific demographics in the room making the decision, and by which the rest have to abide.

Finally, while the event was advertised as a workshop, the afternoon ended without an objective action plan for how to tackle ethical issues in palaeontology going forward. When asked about how the PalAss journals (*Palaeontology* and *Papers in Palaeontology*) plan to handle manuscripts on Myanmar amber, Barry Lomax, Editor Emeritus, referred only to the Association's policy on only accepting manuscripts where specimens were collected and exported in accordance with relevant permits and local laws, which does not yet expand to include specific examples.

Events such as the Palaeoethics workshop are immensely valuable for palaeontologists who are keen to understand more about ethical issues in their field of research, especially when they involve diverse perspectives and expertise outside of our direct field of study. However, without purposeful and targeted actions to combat unethical, illegal and deleterious practices, we are destined to continue making the same mistakes and doing the same harm. The impassioned chatter in the webinar chat function gave us hope that meaningful change is on the horizon and that the field of palaeontology will be all the stronger for it.

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1st TaphCon Meeting Report
Virtual conference *19 – 20 November 2020*

TaphCon2020 was a free, two-day virtual conference aimed at early-career taphonomists that also welcomed anyone with an interest in taphonomy. We aimed to create a diverse programme, in terms of the science presented and the people presenting it, that was especially inclusive to delegates outside of Europe. The conference was intended to be digital pre-COVID and, once the pandemic hit, we felt it was imperative to foster community and help taphonomists interact without travelling during this difficult time. Despite not having a budget, the University of Birmingham kindly provided us with a specialist Zoom licence to host the event. To ensure that TaphCon had no registration costs the freeware Discord was used to facilitate discussion.

TaphCon2020 delegates attended TaphCon from the safety of their own homes. Images used with permission from Holly Smith, Carmen Nacarino-Meneses and Farid Saleh.

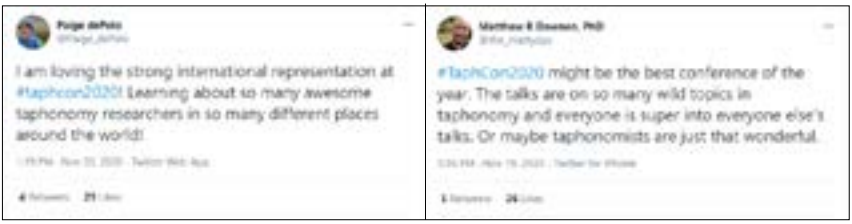
Around 400 delegates from over 25 countries enrolled for TaphCon, consisting of amateur palaeontologists, high-school students, curators, full-time lecturers and even one Fellow of the Royal Society. TaphCon kicked off with keynote talks from early-career researchers. These delegates were invited to deliver introductions to a broad range of taphonomic topics to our diverse audience: **Thomas Clements** (University of Birmingham) outlined the importance of experimental design to experimental taphonomy, which was followed by a talk elucidating the impacts of biostratinomy on exceptional preservation from **Orla Bath Enright** (University of Lausanne). **Farid Saleh** (Yunnan University) then provided an introduction on mineralization processes occurring during fossilization, whereas **Giliane Odin** (Gustave Eiffel University) focused on the chemical changes that can occur to geomaterials in collections. We were then joined by **Christopher Dean** (Natural History Museum, London) whose research aims to understand biases in the fossil record to better understand palaeoecology and **Caitlin Colleary** (Cleveland Museum of Natural History) who gave an overview of the fascinating topic of palaeoproteomics.

The remainder of the conference featured delegates giving either five- or 13-minute talks. We hosted 46 speakers from around the world, who spoke on a variety of topics. The quality of talks was very high and of course there are far too many interesting talks to mention here, but we never knew ants could be used to collect microfossils (**Clint Boyd**), nor that you could treat gastropod shells with chemicals to recover their original colour patterns (**Maura Enriqueta González Aguilar**)!

Each and every talk was incredibly well received and stimulated plenty of discussion on Discord throughout the conference.

A common complaint at virtual meetings is a lack of atmosphere, but delegate feedback indicated that TaphCon2020 fostered a strong sense of community. Discord allowed delegates to chat and ask questions in real time, as well as answer the question: 'what is taphonomy to you?'. The answers promoted a more holistic understanding of the field of taphonomy, which was well received and produced a wonderful graphic.

Word cloud using the responses from TaphCon2020 delegates to the question 'what is taphonomy to you?'.



Comments from TaphCon2020 delegates. Used with permission from Paige dePolo and Matthew Downen.

Comment from a TaphCon2020 delegate. Used with permission from Meaghan Wetherell.

We also received feedback that should be considered when planning future virtual events. Some delegates stated that attending virtual conferences can be more difficult than travelling and attending in person due to factors such as caring responsibilities. Also, one delegate noted that closed captions were not available for all talks (it was requested that pre-recorded talks contain closed captions, but this was not mandatory). Finally, several delegates expressed disappointment that they could not attend all the talks they wished to (due to inevitable time differences, teaching commitments, caring responsibilities, *etc*.), and that the lack of a digital repository for talks was disappointing. Unfortunately, TaphCon2020 could not facilitate this due to GDPR issues and the absence of funding to host a web portal.

Although there were some minor technical hiccups and some terrible (or great, depending on your affinity for puns) taphonomy jokes to fill the gaps between sessions, the conference generally ran smoothly and feedback for the event was overwhelmingly positive, with many delegates asking if TaphCon would return in future years: for now, only time will tell!

Written by the organizers of TaphCon2020.

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——OBITUARIES——

William A. Clemens, Jr. 1932 – 2020

Photo by Ed Kirwan © UC Berkeley.

Bill Clemens, palaeomammalogist and long-time professor at the University of California at Berkeley, died at home with his family on 17th November 2020 after fighting a recurring cancer. Bill was an expert on Mesozoic mammals. In 1960 when his publishing career began, very little was known about the first two-thirds of mammalian history. While the first Mesozoic mammal, *Amphitherium prevostii* from the Jurassic Stonesfield Slate in England, had been described more than 120 years before, the fossil evidence was scattered and incomplete. The picture was much more complete by his retirement in 2003, in no small part due to Bill's work, the work of his students, and the syntheses achieved through his collaborations.

Bill completed his PhD at Berkeley in 1960 under the guidance of Ruben A. Stirton, and was a contemporary of Richard Tedford, Malcolm McKenna and Michael Woodburne. He pursued fieldwork in the Cretaceous Lance Formation where he discovered the fossil mammals that were the subject of his PhD dissertation monographs, published in 1964, 1966 and 1973. His work in North America occurred while Zofia Kielan-Jaworowska and her group were making important discoveries in the Mesozoic of the Gobi Desert. In 1979 they produced the first synthesis on Mesozoic mammals since George Simpson's in the 1920s, *Mesozoic Mammals, the First Two-Thirds of Mammalian History* (Lillegraven, Kielan-Jaworowska, and Clemens, eds.).

Some of Bill's most important contributions were reinterpretations of British fossils. Among his earliest publications were Cretaceous mammals from the Wealden published in *Palaeontology* and the *Proceedings of the Geological Society of London*. He returned again and again to Britain and its Mesozoic mammals. Bill was a postdoctoral scholar at University College London with Kenneth Kermack in 1960–61, a senior postdoc at Royal Holloway, University of London with Percy Butler in 1968–69, returning to University College London as a Guggenheim Fellow in 1974–75 and spent sabbaticals at the Natural History Museum, London in 1998–99 and 2001–02. He frequently asserted that his favourite conference was the annual Symposium on Vertebrate Palaeontology and Comparative Anatomy, which he attended as often as he could.

Jerry Hooker remembers Bill as a peacemaker in the 1970s controversy between Kermack and Rex Parrington on whether the important Triassic mammaliaforms from Britain should be called *Eozostrodon* or *Morganucodon*, a debate that was heated enough to have created something of a schism between the London and Cambridge palaeontological communities. As Bill said in his 1979 paper on the subject, "My involvement in preparation of a study of Rhaetic mammals from continental Europe and a co-authored reference book on Mesozoic mammals has required decisions

on nomenclature and classification" (Clemens 1979). Perhaps because he was an outsider, perhaps because he was diplomatic, or perhaps because he was simply dispassionately detailed, Bill's conclusion that both names remained valid but that they applied to distinct taxa seemed to heal the fracture, although Andrew Milner concluded that Bill was more of an arbitrator adding that "I don't recall there ever being 'peace'".

Bill did fieldwork all over the world – South America, Australia, Africa and Asia, as well as Europe and North America – but mostly at the K–Pg boundary sequence preserved in the Hell Creek and Tullock Formations of eastern Montana. That work embroiled him in controversy over the asteroid impact hypothesis of Louis and Walter Alverez advanced in 1980. Bill (and many palaeontologists) argued that a single catastrophic event was insufficient to explain the pattern of extinction documented in the few rock sections that passed through the boundary. His work had shown that marsupials were heavily hit by the extinction, but multituberculates less so and placentals passed through nearly unscathed. Research over the next decades confirmed that the Alvarez asteroid had indeed struck the planet 65.5 million years ago with devastating effects, but the complexity of its interaction with independent extinction processes continues to be studied today. Many of the publications in Bill's final decade with Greg Wilson, Stephanie Smith, Courtney Sprain, Paul Renne, Joe Hartman and others focused on the extinction event.

In addition to his own research, Bill was mentor to nearly 30 PhD students and at least ten Masters students. They are too many to mention, but included among them are Annalisa Berta, whose work is the basis of our understanding of pinniped evolution and who in 2004 became the third female president of the Society of Vertebrate Paleontology (since then another of Bill's students Jessica Theodor has become the eighth female president of SVP). Jay Lilligraven, David Archibald, Don Lofgren and Greg Wilson expanded his work on the end-Cretaceous extinction, Nancy Simmons

Bill Clemens discusses fossils with John Ostrom at the 1980 meeting of the Society of Vertebrate Paleontology. Photo by Christine Janis.

redefined our understanding of the evolution of bats, Laurie Bryant served as a palaeontologist of the US public land system and Michael Novacek rewrote the phylogeny of placental mammals and their post-K–Pg history. Don Lofgren once described Bill's mentoring as "like a submarine: always there below the surface, keeping an eye on things, but when needed, surfacing to fire off a few torpedoes and then fade back into the depths … always watchful".

Bill lived nearly his entire life in Berkeley, California. He was born there in 1932 and married his Berkeley High School classmate Dorothy Thielen Clemens, who was herself well known in the palaeontological community. Bill received a BA from Berkeley in 1954 and a PhD in 1960. After his postdoc in London he joined the faculty at the University of Kansas from 1961–1967, before returning to Berkeley for the rest of his career. His family came to California from Indiana, and late in his life Bill donated the land where his grandparents had lived to the Sycamore Land Trust where it is known as the Clemens Place on Clifty Creek.

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Matthew Parkes
1961 – 2020

Matthew Parkes at the opening of the Archaeopteryx *exhibition 'Jurassic Skies' in 2018. © National Museum of Ireland, photo by Paul Sherwood.*

Matthew Parkes passed away suddenly on Friday 23rd October 2020, to the shock of his many colleagues and scientific collaborators. A native of Hertfordshire, he studied geology at the University of Sheffield and obtained his BSc in 1985. Working with Dave Harper at the National University of Ireland in Galway is what brought him to Ireland, where he studied the south-eastern margin of the Iapetus Ocean, from Meath to Waterford. The endemic shelly faunas are poorly exposed and it takes determination to get decent fossils out of the scrappy Lower Palaeozoic outcrops. He secured a postdoctoral post at Trinity College Dublin and commenced the first of several contracts with Geological Survey Ireland. In 1992 National Museum Wales was embarking on developing major geology galleries and he spent a year and a half in Cardiff, standing in for curators to free them up for that project. Matthew's use of geological collections in his research and the time in Cardiff drew him into the world of museums and the value of old specimens was always clear to him, as was the need to care for neglected collections. He became contract curator for Geological Survey Ireland in 1994. The project produced the first catalogue of type and GSI figured specimens (Parkes and Sleeman 1997) and he received an MSc in museum studies from the University of Leicester. At GSI he maintained his research interests, contributing to the Geological Society Ordovician correlation landmark (Fortey *et al.* 2000) and has over a hundred publications to his credit.

Ten years at GSI saw him work on the establishment of a scheme for sites of scientific interest and audits of 22 Irish counties, where he became the national expert (Parkes 2008). He took up the post of curator for the geological collections in the Natural History Division of the National Museum of Ireland (NMI) in 2005. He worked effectively on the curation of the extensive national geological collections, capably filling a post that used to be staffed by three people in the 1980s. He built up a reputation in NMI as someone who would help with anything, and who would particularly go out of his way when a young budding geologist would arrive with an enquiry.

Matthew was a key player in maintaining standards of geological curation in museums across Ireland and in the UK, where he sat on the British Geological Survey's National Geological Repository Advisory Committee, and was a long-time Editor and later Chair of the Geological Curators' Group. Among Matthew's many passions was the heritage associated with Ireland's mines, and in 1996 he helped to set up the Mining History Society of Ireland, holding office continually as Secretary, Journal Editor and finally Chair of what became the Mining Heritage Trust of Ireland (MHTI), and

was instrumental in its legacy website (<**www.mhti.org**>). As a Director of Copper Coast Geopark clg, he helped to promote the mining heritage and tourism potential of what is now recognized by UNESCO as an important Geopark on the County Waterford coast.

Matthew was keen to see things published and made publicly accessible. He acted as Editor for journals of the Geological Curators' Group, Speleological Union of Ireland and the *Irish Journal of Earth Sciences* of the Royal Irish Academy, as well as contributing regularly to the popular magazine *Earth Science Ireland*. His technical reports made their way into popular publications bringing geology to the general public across Ireland. His friends remember him as a kind, helpful and supportive person with as much time for the amateur as the professional.

Nigel T. Monaghan
National Museum of Ireland – Natural History, Ireland

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Engagement Grant REPORT

Palaeocast Gaming Network

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Context

Only 44% of the UK's population believes in evolution as a natural process (Kantar 2020). In terms of public acceptance of the sciences, this fares even worse than the recognition of anthropogenic climate change, which stands at 48% (BEIS 2019). The need to improve the public perception of evolutionary sciences is therefore self-evident. In many cases, the entertainment industry represents the first and only approximation of fossil organisms to non-specialist audiences. Within this industry, we identified computer games as an area that often utilizes palaeontological content yet offers little to no acknowledgment of the underlying science. Computer-generated imagery can be vital for helping visualize fossils as living organisms, but in isolation and without appropriate context, games can often present wildly inaccurate depictions of anatomy, behaviour and evolutionary events.

A huge audience engages with computer game-related content online around the globe. 'Gaming' accounts for 14% of videos on YouTube with six of the ten most popular channels featuring gaming content and, similarly, in 2017, Twitch (a service for watching others play live games) was viewed more times than Netflix. The average gamer in the USA is 35 and the demographic is near gender parity (Siwek 2017), indicating that a wide transect of the population is regularly engaging with computer games. There is therefore great potential for a YouTube gaming channel to reach an entirely new audience with content that promotes the science behind their favourite videogames.

The PGN logo, featuring a trilobite with a games controller for a cephalon.

The PGN

In response, we launched the Palaeocast Gaming Network (PGN) in July 2020. The PGN produces weekly 'playthroughs' and reviews of some of the huge number of palaeontological-related games available. The PGN is a collaborative project, where the burden of regular content generation is shared between our contributors. Each brings their own flair and research experience, allowing for diversity of content beyond what a single presenter could deliver. The PGN can be found at <**www.youtube.com/c/PalaeocastGamingNetwork**>, and @palaeocastGN across all social media channels. The PGN was enabled via Engagement Grant PA-OE201802 from the Palaeontological Association to purchase good-quality external microphones for contributors who did not have access to decent equipment. Since the visuals captured for the videos are pre-defined, the audio is a primary contributing factor to the final quality of PGN playthroughs so these were essential.

Impact

Since launch, 36 videos have been published to both YouTube and Facebook (including Instagram) platforms. Whilst statistics from these two differ (*e.g.* as to what defines a view), we are still able to broadly quantify engagement on each.

YouTube

PGN content on YouTube has produced a total of 18,534 views (video starts). Of the 487 subscribers to the channel, 89% identify as male and 11% identify as female, and are aged between 18–24 (45%) and 25–34 (50%). The largest audiences (when declared) are the USA (37%) and UK (16%), with all other countries representing <1%. Metrics show that 82% of our views are not from subscribers, while 54% of YouTube views result from searches or suggested videos. This indicates that the PGN channel has significant scope for growth on the platform and extrapolation of current subscription rates would see the channel reach 1,000 subscribers by mid-2021. Currently, our most popular video is "Palaeontologist plays Saurian" (a dinosaur simulator published by Urvogel Games, LLC), generating 7,886 views, 311 likes and 38 comments since the release date (8th July 2020). 17.4% of all PGN views on YouTube were generated by search terms for "Saurian", demonstrating the effect that videos focusing on relatively popular titles can have.

Facebook

PGN content on Facebook produced a total of 1,800 views (for >1 minute). Of the 215 fans of the page, 57% identify as male and 40% female, and are aged between 18–24 (15%), 25–34 (53%) and 35–44 (20%). The largest audiences (when declared) are the USA (37%), UK (16%), Australia (14%) and Canada (5%). The most popular video on this platform was "Palaeontologist plays Cambria Sword #1: *Leanchoilia superlata*" (a shoot 'em up based on animals from the Cambrian Explosion), generating 293 views, 525 clicks and 184 interactions (reactions, comments and shares) in just three days (released on 5th February 2021, report compiled 8th February 2021). This video reached 13,400 people organically so likely represents our first viral content, with Facebook users having shared this content with their friends and posted it to relevant interest groups.

Qualitative assessment

At this stage, no formal qualitative assessment has been conducted, but public feedback around the PGN content has been overwhelmingly positive including the following comments:

Evodolka: *"Finally a dinosaur play-through with a person who actually KNOWS their dinosaur info. Also neat to see such an educational angle for a gameplay, it is a neat thing that I have never actually seen anyone else do before"*;

TheAnzuGod: *"It cannot be fully described how much I appreciate a channel like this! It's amazing to finally get some truly enlightening commentary while playing games about dinosaurs or nature and evolution in general"*;

Beth Armstrong, a primary school teacher, tweeted: *"Thank you @Jake_Atterby for providing some fascinating information for my fossils lesson. My class are going to love the Animal Crossing fossils gallery. Thank you for helping me to make the learning so interactive and fun for the children!"*

This last interaction led to an invitation for Jake to give an online presentation to students based on this game, thus overlapping with more 'traditional' outreach activities.

Future directions

For a recently established channel, the PGN is growing its reach and fan base at a rate higher than anticipated. Within six months, we have accrued 20,334 views from 34 videos. This shows that the PGN is able to reach an audience significantly larger than many traditional outreach events and demonstrates a significant return on the investment made by the Association. Furthermore, as we actively build our network of contributors, we expect this engagement to continue to grow with increased output. As the PGN becomes established, our plan is to reach out to developers of games that the audience are already excited to see, to request early review embargoed copies to record and then upload our videos upon the games' release. This will increase impact and grow our audience in line with more traditional YouTube gaming channels.

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A collection of PGN video cover images for some of the most popular video titles.

Undergraduate Bursary REPORT

Deep-fried calamari? The effect of Early Triassic extreme global warming on cephalopod biogeography

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Introduction

The Permo–Triassic mass extinction (PTME; *c.* 252 Ma) was the most severe biotic crisis of the Phanerozoic, causing the extinction of up to 95% of animal life. The prolonged eruption of the Siberian Traps large igneous province meant the global environment remained hostile for millions of years (Song *et al.* 2018), with tropical sea surface temperatures (SSTs) reaching 40°C during a thermal maximum in the Smithian (Early Triassic) (Sun *et al.* 2012). Ammonoids suffered substantial losses across the PTME but their recovery in the Early Triassic was rapid, especially in comparison to many other surviving clades (Brayard *et al.* 2006). However, ammonoids are thought to have moved poleward when SSTs were high, suggesting temperature played a significant role in determining the ammonoid latitudinal diversity gradient (LDG) (Brayard *et al.* 2006). Similar patterns have been recovered for terrestrial tetrapods across the same time period (Allen *et al.* 2020). LDGs have varied throughout geological history, particularly when comparing greenhouse and icehouse climates (Mannion *et al.* 2014). Greenhouse world LDGs tend to show a bimodal or flattened pattern of diversity (Song *et al.* 2020), whereas icehouse climates usually have a unimodal pattern with the peak at the equator (Mannion *et al.* 2014). Here, analysis of ammonoid LDGs from the Middle Permian to Middle Triassic tests whether we see a transition from a normal LDG during the cooler Middle Permian to a flat or bimodal LDG in the hot Early Triassic.

Methods

Occurrences of the Ammonoidea from the Permian to Triassic were downloaded from the Paleobiology Database (<**https://paleobiodb.org/#/**>). The data were cleaned to genus-level identifications, binned to the Epoch level and subdivided into 20° latitudinal bins. In order to account for uneven sampling across latitudes, shareholder quorum subsampling (SQS) (Alroy 2010) was used at quorum levels of 0.4, 0.5, 0.6 and 0.7, using the iNEXT package (Hsieh *et al.* 2016) and following the methods of Dunne *et al.* (2019) and Allen *et al.* (2020), to reconstruct LDGs.

Results

The shape of the ammonoid LDG varies throughout the Permian–Triassic despite the broad sampling distribution of ammonoid occurrences remaining consistent (Figure 1). The Middle Permian LDG shows low diversity at the poles and high diversity in the tropics, albeit with a dip in diversity across the equator (Figure 1B). The LDG changes to a 'classic' unimodal distribution in the

Late Permian, with a peak over the equator (Figure 1D). A marked change is seen across the Permo–Triassic boundary, as the LDG in the Early Triassic is generally flat across all latitudes, apart from a strong peak in the northern tropics (Figure 1F). The LDG remains generally flat into the Middle Triassic, with hints at the recovery of diversity in equatorial regions, and higher diversity in the northern hemisphere as compared to the southern (Figure 1H).

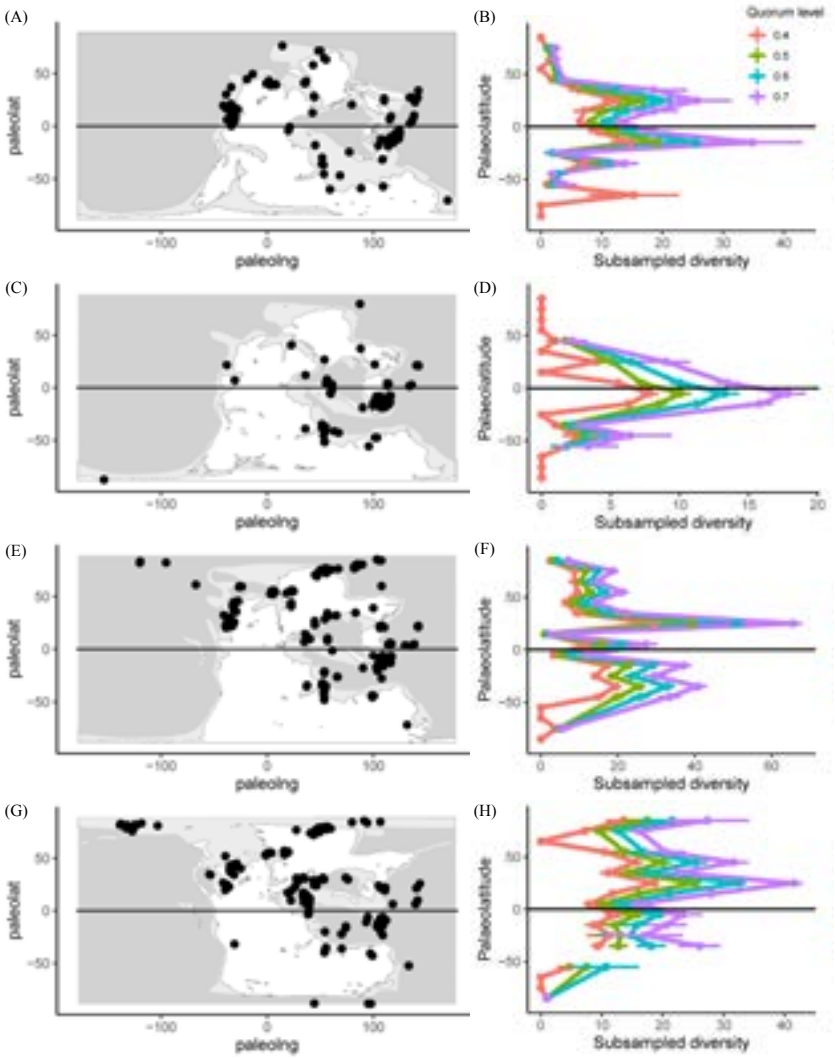

Figure 1. Ammonoid occurrences plotted on palaeogeographic reconstructions and subsampled LDGs for the (AB) middle Permian, (CD) late Permian, (EF) Early Triassic and (GH) Middle Triassic. Some higher quorum levels have been extrapolated across empty bins to produce smoothed LDGs.

Discussion

Icehouse conditions are expected to yield a unimodal LDG, with diversity peaking at the equator and gradually decreasing towards the poles (Mannion *et al.* 2014). This pattern is clearly depicted in the Late Permian and, to a certain extent, in the Middle Permian. However, greenhouse climates are hypothesized to produce bimodal or flat patterns of diversity, as taxa in the tropics either go extinct or migrate poleward to track their thermal niches (Reddin *et al.* 2018). Ammonoids show a poleward shift in diversity across the PTME, with peak ammonoid diversity at mid-latitudes. This suggests equatorial temperatures were generally too high to support diverse assemblages due to the Siberian Traps LIP eruptions (Sun *et al.* 2012), and that SST is a primary driver of the ammonoid LDG. Our results are consistent with Brayard *et al.* (2006) and Dai and Song (2020), who suggest that, in the earliest Triassic, ammonoids displayed a cosmopolitan distribution; their generally flat LDG suggests many species may have adapted to thrive across all latitudes. These results also fit with those of Song *et al.* (2020), who reconstructed a flat LDG for all marine animals in the Early Triassic. By the Middle Triassic, diversity is still low at the equator, suggesting the environment had not ameliorated and temperatures remained too high for full ecological recovery (Sun *et al*. 2012; Song *et al*. 2018). These results are also reflected in the distribution shifts observed in recent and modern pelagic organisms in response to warming oceans (Yasuhara *et al.* 2020), suggesting that extreme warming events in the deep geological past may provide a warning of the effects future warming may have on the biosphere.

Conclusions

The ammonoid LDG appears to strongly reflect SSTs throughout the Permo-Triassic and thus supports the hypothesis that broad climatic regimes (*i.e.* icehouse/greenhouse) are influential in controlling the LDG.

Acknowledgements

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Book Reviews

A message from the Book Review Editor

Hello members! As part of Council's workings over the last year, we have been looking at ways to update the role of the Book Review Editor. While book reviews are, and will continue to be, an important part of the Association's newsletters, I am actively looking at modernizing the role. This means, going forward, that we are looking to solicit write-ups of other types of media that pertain to Palaeontology – whether that is a film, TV programme, online blog, YouTube series, podcast, computer game, educational resource, or even a software package. If you want to highlight something you've created or something that you think the rest of the membership should know about, then we really want to hear from you!

Thomas Clements
Book Review Editor

Beyond Extinction: The Eternal Ocean. Climate Change & the Continuity of Life: Part 3 (The Deep Time Trilogy)

Wolfgang Grulke. 2019. At One Communications. 224 pp. £48.00.
ISBN: 1916039405

Animal life in Earth's oceans has a long and illustrious history and is likely to have a long and illustrious future – so runs the central tenet of Wolfgang Grulke's latest beautifully illustrated instalment for your coffee table. *Beyond Extinction: The Eternal Ocean* invites the reader to accompany Grulke on his personal journey of discovery of animal life in ancient and modern oceans, with a strong emphasis on continuity between ages past and the present day. *Beyond Extinction* is perhaps better characterized by its subtitle of "The Eternal Ocean" and is liberally adorned with well-chosen photographs, diagrams, and artistic impressions of the diversity of Phanerozoic sea creatures. Disappointingly, however, the substance of the text tends to detract from what could be an up-beat exploration of the resilience of marine life through the ages.

Open *Beyond Extinction* to almost any page and you will be greeted by high-quality images guaranteed to spark awe and admiration for the variety, and often sheer flamboyance, of life in the oceans, many of which were produced by the author himself. The images alone fulfil the author's

aim for this book as "an unbridled celebration of life" and firmly state its intention to take pride of place on a coffee table near you. In keeping with this intention, the curious reader will also discover countless topics for discussion, or perhaps contention, that are best exercised over a highly caffeinated drink, or maybe something a little stronger.

Appropriately for a coffee table treatise, Grulke sets the scene with a sweeping introduction that lays out his intentions for the book and moves on to a broad history of pre-Phanerozoic life. Moving towards the substance of the text, the second chapter begins with a broad take on the origins and early history of life on Earth. From here, Grulke provides a potted study of geology, palaeontology and time intended to set the scene for the discussion of continuity of life through ages past that forms the main argument of the text. Distractingly, in the chapter on *Time* Grulke introduces the conflict between the relativistic and quantum approaches to understanding time at a very fundamental level, going far beyond what is helpful to comprehend the geological past and biological present but falling short of a satisfying discussion of this intricate topic. As elsewhere in the text, a little judicious editing was perhaps required to prune the excesses here. However, the potted histories of geology and palaeontology are neatly illuminated with anecdotes of some of the key figures in the early history of these subjects, from the maps of William Smith to the discoveries of Mary Anning and Gideon Mantell, and help to bring the narrative back on track.

In prelude to the fifth chapter, *Evolution & Extinction*, is one of the more baffling sentences of the book, in which Grulke exclaims that "what has become most disturbing to me is that none of these [methods of displaying evolutionary relationships through time] highlight the powerful continuities that exist in the history of life" (p. 77). This may come as something of a surprise to anyone familiar with the construction and use of phylogenetic trees which can only be determined due to the continuity of life on Earth as members of one species evolve over generations into another. In going on to introduce the "conceptual phylogeny of the continuity of animal life", Grulke does fall somewhere short of his aim to "clarify and inspire, rather than add another level of noise to the temporal fog" (p. 77). The concept is worth entertaining – placing more emphasis on diversity and continuity of ecological niche occupancy than biological affinity – but the execution is certainly louder than it is clear. For examples, the inexplicable separation of trilobites from all other arthropods, and the seemingly closer relationships of bivalves to jellyfish than to other molluscs.

The sixth chapter, *Continuities*, opens with the rather lovely metaphor of the fossil preparator "scuba diving in rock" and the sense of true exploration of ancient seas that this brings. The chapter title rather belies the content which provides an overview of the major marine animal phyla and their fossil and recent diversities that will be familiar to many first-year students of palaeontology. Again, it is the beautiful illustrations that bring this chapter to life and invoke a real sense of scuba diving through the pages. However, this is perhaps the point to raise the unfortunate factual errors that crop up a little too often throughout the text, and from which this chapter is no exception. These errors are unfortunate because most feel like they could have been avoided with judicious consultation of everyone's favourite Internet search engine. Of minor concern in a well-illustrated volume that aims for the coffee table rather than the shelves of a reference library, these small factual errors need not unduly bother the reader, but I found them more than a little distracting. One is left with the unshakeable feeling that a little more careful research would have gone a long way. That said, the excellent illustrations soften the blow of these, in the scheme of things, minor errors that do not undermine the author's central message.

In turning the page to the final chapter, *The central message*, which was discernible in places throughout the text, is brought into sharper focus: supposedly altruistic notions of 'saving the planet' combine an anthropocentric arrogance of omnipotence with a projection of anthropocentric fear for the future of our species under the course already set for ourselves. Exactly how this conclusion is arrived at is a little woolly, but on the bright side that does leave plenty of space for discussion amongst friends over a nice hot coffee. Evoking the earlier remarks on time, sweeping general applications of complex and disparate concepts from Gaia to chaos theory and creative destruction mark out the culmination of the thesis. To take just one of these examples, the economics concept of creative destruction is brought to bear on the topic of evolution in the wake of mass extinction, summarized with the statement that "without extinction there is no white space" and that "extinction is a vital and essential part of evolution". In drawing this parallel between the business and biological spheres, there is the apparent underlying assumption that either individual animals or evolution itself are cognisant of the opportunities available to extinction survivors and that they need only **innovate** their way out of disaster. A detailed study of extinction recovery this is not.

Further drawing from his professional corporate experience, Grulke exults the "great appetite for innovation and growth" of the business world while lamenting the luddite "individuals and nations [who] seem to be hell bent on conserving what we have – to avoid change" (p. 205). The disdain for the prospects of environmental protection is further expounded on in the complaint towards the end of the chapter that "nations can't seem to agree on common agendas for the most important issues, be it the ozone layer, climate change or plastic pollution" (p. 212). Notwithstanding, one presumes, the **international legally binding** Montreal Protocol and Paris Climate Agreement, and the United Nations Environmental Assembly (UNEA) forums, at which a binding agreement to tackle marine plastic pollution has been in progress since 2014.

"*Beyond Extinction: The Eternal Ocean. Climate change & the continuity of life*" is somewhat confused about its content, origin and purpose, *i.e.* where it may comfortably nestle on your bookshelf. As suggested by the expansive subtitles, this book attempts to cover a lot of intellectual ground but does so with rather fewer words and rather less research than was necessary. For me, this left the slightly unsatisfying impression of a conclusion unrealized, and certainly one unsupported by the preceding arguments. Much of the text reads like the unfiltered monologue of an enthusiastic business executive with stridently positive views on the possibilities emergent from 'creative destruction', while the images reflect the extensive private collection of a well-travelled gentleman scholar. Ultimately, it is the voice of the business executive who forms the lasting impression of having applied corporate frameworks to environmental and ecological processes without having done the necessary homework in critically examining their own argument. Regrettably, this volume generates more heat than light, though with its liberal application of stunning photography it will certainly look pretty alongside a steaming pot of coffee.

Thomas Wong Hearing
Ghent University, Belgium

Books available to review

The following books are available to review. Please contact the Book Review 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.
- *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

Myria Perez is a Fossil Preparator at the Perot Museum of Natural Science in Dallas, Texas (USA), and an ambassador of the IF/THEN programme managed by the American Association for the Advancement of Science, or AAAS. She graduated from Southern Methodist University with a Bachelor of Science in Geology and a Bachelor of Arts in Anthropology. She just started her science communication YouTube channel called Paleontologica.

Emilia interviews Myria on her way back from physiotherapy, which she needed following an arm injury that put her out of preparation work for a couple of weeks.

Myria with one of her projects, a braincase from a dinosaur called Pachyrhinosaurus.

Is it an occupational risk for preparators to develop arm injuries?

I am afraid yes. I have switched to a new project, using different tools, and I lost track of time. I am slowly working towards being able to prep again. I have known people who have hurt their arms doing preparation. It is the same motions that you do for hours, as if you were an athlete. There are other risks too, we deal with chemicals, so there is the risk you get something in your eye, or when we make moulds and casts. For that we use silicone rubbers and resins, where we have to mix chemicals together and if you get that in your eye or under your skin, that is a sort of occupational risk. When we go out into the field to collect the fossils, there is also dehydration risk and lifting heavy things. It is a very active job physically.

With all this I am tempted to ask you if you have ever had any accident or any scary moment in your work?

I started very early as a volunteer and, on the first couple of fossil excavations, I got extremely dehydrated and ended up having to go to the hospital because I was so excited and lost track of time. You are looking for fossils, it is very therapeutic and it is very easy to lose track of what your body's telling you. I suffered from it so now I come prepared and I drink lots of water.

It did not happen to me, but on one of the trips to that area we were joined by a volunteer teacher who had a venomous centipede crawl up her leg when she was at the dig site, sitting down trying to get fossils out of the rock. The centipede bit her and she had to be hospitalized. She said the pain was worse than childbirth. So as a preparator you might be working out there with rattlesnakes and other venomous creatures. You have got to have the right gear, proper hiking boots that hold your ankle in place and that fit properly. You can injure yourself if you have shoes that do not fit right and you slip. You do have to be aware of your surroundings, especially when you are out excavating fossils.

Looking at all your achievements, it might be a bit intimidating for some students when they see that you started volunteering at a local museum at the age of 12 and you were so determined very early on to follow this career path. Did you ever have any doubts?

Did you consider any other careers?
There are palaeontologists out there that I know started very late. I know a curator who realized he wanted to do this at the age of 30, when he was already married and had his first kid, but he decided to go back to school for an undergraduate degree. And now he is a successful curator, so it is never too late.

I still have doubts sometimes. This is a very high-risk-high-reward field, because when you do get a job, it is amazing. I really enjoy working with fossils, but when COVID hit and so many people were laid off, many museums were not able to support their palaeo staff. Some people who have spent their whole lives preparing or being a curator of palaeontology have lost that. Museums sometimes do not make a whole lot of money and the jobs are pretty few and far between. That is definitely something to consider if you are interested in palaeontology. It is very hard to find a job and it was very hard for me to go through this, I really thought I was going to lose my job because of the pandemic. I was looking at other options and sometimes you have to accept that maybe at some point you might not be in a palaeontology position, because it is very hard to find them, especially preparation jobs like mine. They are temporary, so they only happen during the summer or maybe they just need a fossil preparator for a certain project, so you are on a contract for maybe a year. And it can be tricky, because you have got to plan your life around where you are going to live and because these jobs are kind of spread out. You may not be able to pick a city that you want to be in, so you have to go where the jobs are. I have definitely had doubts because it is a competitive field, but the community is very supportive.

I have been in school until two years ago and now I am seeing the real world and how jobs work and how to play the game. You have got to network and reach out to people and that is how you can get jobs. And you should be aware before a job is posted too. It is a very small community. I have had a lot of support with peers, I have had many amazing mentors. If anybody's considering palaeontology or honestly anything in the sciences, I would suggest getting a mentor, finding somebody who can guide you, see your skills and guide you in the right direction, push you to succeed.

You have done a lot of volunteering before you started an actual job so could you describe your path? You have got two degrees. How long did it take you to actually get employed in your field?
I have always loved palaeontology. As a kid I was fascinated with palaeontology, so I could never remember a particular moment where I was like: this is it, this is what I want. It has just always been that way. Back in 2008, I was about to turn 12 and I went to an event at the Houston Museum of Natural Science, which was my local museum when I was growing up.

My mom brought me to an event called Dino Days or Breakfast with Dr Bakker, a renowned palaeontologist. It was really exciting to meet somebody real. I brought a binder full of dinosaur drawings and asked the curator how I could be involved. He said: you can volunteer. Somehow they saw something in me, although I was too young to be a volunteer, as the minimum age was 14. But I think, because I genuinely wanted it, they allowed it, as long as my mom was coming with me. So I was a junior volunteer. We were an hour's drive from the museum so my mom was a real trooper, taking me in on any free time I had on the weekends.

The associate curator there, David Temple, has been a huge mentor in my life. He is the one who showed me how to prep fossils, how to excavate them and do science communication, going out there and talking to visitors in the halls about dinosaur skeletons.

I was a volunteer there until my first summer in college. When I was looking at colleges, I wanted somewhere where I could continue fossil prep. I looked for a mentor, because to

me the biggest thing is having somebody like a professor to help guide you. I emailed so many different palaeontology professors at different universities: "Hey, I am Myria, I have been volunteering at the museum in Houston. I want to do this for my career. How can I get involved? Do you have a lab I can start working in as a freshman?" To find a lab for undergraduate research is hard. Usually it is graduate students that do that. But I connected with Dr Louis Jacobs at Southern Methodist University at Dallas, Texas. I visited him at the University and saw the labs. He also came down to Houston and I gave him a tour of the Houston museum. And it was perfect. They had a lab I could work at and Dr Jacobs was an amazing mentor.

Most palaeontologists get their degrees in biology or geology, sometimes anthropology, which is what I did. Originally I wanted to do biology and geology, but I found myself really loving the geology aspects and I found courses from the anthropology majors to be really helpful, for example a lot of osteology and anatomy courses.

Through college I spent my hours in between classes prepping fossils from Angola. Those fossils eventually ended up in an exhibit at the Smithsonian National History Museum in DC. My mentor offered to me to get involved in it. If I hdd not had a mentor to do that, I would not have had all the experience building an exhibit.

I also did a separate research internship at the Smithsonian. I have not done any research prior to that and that was very eye opening. Compared to palaeontology researchers, I am in more of a tech job, I work with my hands all day. That is the difference to figuring out what in palaeontology you like: do you like the research, do you like solving puzzles and asking questions, or do you like using an art aspect to it, using your hands and getting dirty.

After college, I had a summer where I continued to prep and finish up fossils for the Smithsonian exhibit and I was applying for jobs. I probably had an eight-month gap between my graduation and the job at the museum. But I applied for different positions and got interviews on a couple, which was good practice. Now I am looking back at those interviews going "Oh man, I did not know anything". But I got the job at the Perot Museum and I have been here for over two years, working on dinosaur fossils from Alaska.

What is an interview for a preparator job like? Do you have to actually prep a fossil to demonstrate your skills?

That is actually really helpful to know. They ask you what kind of glues you use. That is a hot topic in the prep world, because there is a lot of controversy. You never want to say that you use Superglue. You should only use Superglue in very specific circumstances, but I freaked out and I said "Superglue". It has to do with how long these glues last, because the ultimate goal is for your fossil to be preserved for a long time, so generations of palaeontologists can come back to study it. If you use certain resins or certain glues that degrade, a couple of years later they become brittle, damaging the fossil. You might also get questions on the types of tools that you use. We use many different tools. There are air abrasives, which shoot a kind of grit through a little tube and it knocks away the rock around the fossils. You can use dental picks for things that have softer rock, Q-tips, acetone – which you can find in nail polish remover – that works well for stuff with soft rock. We use air scribes a lot at the Perot Museum. This looks like a fat pen with a vibrating needle at the end, powered by compressed air, which chips away rock like a mini jack hammer.

You also do a lot of science communication. What exactly is in your job title, apart from preparation?

My job title was only fossil prep, but also we have volunteers who come in every day so we have to be able to instruct those volunteers how to prep. We help them and guide them, as well as prep our own projects. They have all kinds

of backgrounds, we have an acoustic engineer, an emergency veterinarian, people who are just in all different stages of life and careers, which is really cool. A lot of artists, but my job has shifted a little bit, because the Museum hosts events such as evening events for 21 and up. We have things like Dino Fest, where we have a day where everything is dinosaur-themed and we have educational talks. Many science communication projects were my own idea, I had the freedom to do it, but it did not feel like work because I just love talking about fossils.

If you could go back, what would you do differently?

I would not be so hard on myself. When I was in school, I struggled with some courses in geology, which were math-heavy. I also struggled with chemistry and I thought: this is too hard, STEM is not for me, I am not good enough for this. I felt the pressure that palaeontology was my entire life, I had worked so hard for this career and here I was thinking I might drop out. I wished I had stressed less about it and focused on things I was good at.

What was the most memorable fossil you have worked with?

This is a hard choice, but I actually do know. I got to see the ichthyosaur collection of the famous palaeontologist Mary Anning. We went to her museum in Lyme Regis and to the Natural History Museum in London and we got to work with the ichthyosaurs she collected, touch them, this was a special moment. I have a tattoo of her plesiosaur on my arm!

You can follow Myria on Twitter at @paleontologica_

The Perot Museum of Natural Science is at <**perotmuseum.org**>.

Field Guide to Fossils: Number 16

New from the Palaeontological Association

www.palass.org

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Palaeontology and *Papers in Palaeontology*

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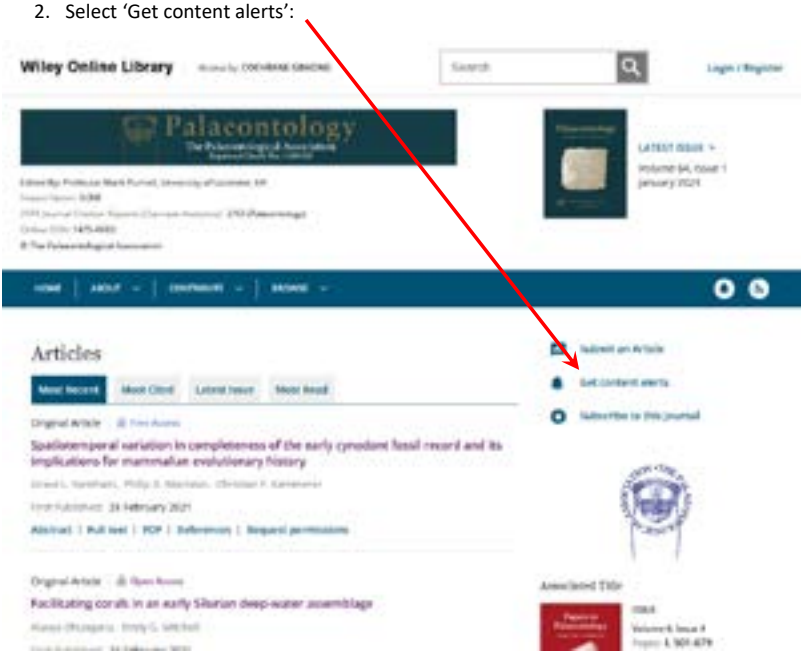

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TAXONOMY/NOMENCLATURE UPDATE

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

Newsletter copy

Information – whether copy as such or Newsletter messages, review material, news, emergencies and advertising suggestions – can be sent to Emilia Jarochowska, e-mail <**newsletter@palass.org**>). The *Newsletter* is prepared by Nick Stroud, and printed by Y Lolfa, Talybont, Ceredigion.

Deadline for copy for Issue No. 107 is 1st June 2021.

Palaeontological Association on the Internet

The Palaeontological Association has its own pages on the World Wide Web, including information about the Association, and copies of the *Newsletter*. Internet Officer Russell Garwood can be reached by e-mail at <**webmaster@palass.org**>. The locator is <**http://www.palass.org/**>.

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