Newsletter of the Conservation Paleobiology Network

Issue #22
March 2024

CPN Newsletter

Conservation Paleobiology Network

INSIDE THIS ISSUE:

Diversity, Equity, and Inclusion Statement:

The CPN upholds a commitment to diversity, equity, and inclusion as a core value. We seek to build on this commitment by striving to create an inclusive community whose members represent diverse cultures, backgrounds, career stages, and life experiences. This commitment is critical to strengthening our relevance, credibility, and effectiveness within the field of conservation paleobiology and broader STEM community. Through these efforts, we strive to transform the field in practice, while diversifying the face of conservation paleobiology for the future.

Supported by RCN-NSF Award: EAR-1922562

Introducing Working Group: Conservation Paleobiology in Cities, Integrating Geohistorical Data into Urban Greening

In a rapidly changing world, scientists and conservationists are increasingly leveraging fossils and other geohistorical records to inform restoration and management of global ecosystems, but these tools are rarely if ever applied in significantly human-modified landscapes. While often thought of as embodying the erasure of natural baselines, cities can possess rich records of pre-Anthropocene ecosystem states, including historic specimens and documents collected during the development of the city, and fossils and geological data unearthed during the construction of buildings, transportation corridors, and hydrologic conduits.

Our working group goals are 1) to create a generalized framework for approaching urban (re-)greening projects using long-term data, and, 2) to apply this framework using paleobiological information to inform choices about revegetation at specific locations, answering questions like: what vegetation types characterized these areas prior to significant human modification and in past millennia? What was the past variability of these communities over centuries and millennia? Which species and communities have been resilient to climate change in the past? Using the Greater Los Angeles (LA) Area as a case study, we are assembling and analyzing data on vegetational history to support applied work by land managers focused on greening and enhancing biodiversity and abundance of native biota in urban spaces, information which will be used to generate specific recommendations for urban greening projects across LA.

For more information about this working group, please see their webpage: https://conservationpaleorcn.org/conservation-paleo-in-cities-working-group/

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Conservation Paleobiology Research Highlight

By Dr. Michelle LeFebvre, Florida Museum, University of Florida

Historical DNA from a rediscovered nineteenth-century paratype reveals genetic continuity of a Bahamian hutia (*Geocapromys ingrahami*) population

"Dark' museum specimens inform new conservation-relevant understandings of diversity"

Past and ongoing human activities have shaped the geographical ranges and diversity of species. New genomic techniques applied to degraded samples, such as those from natural history collections, can uncover the complex evolutionary consequences of human pressures and generate baselines for interpreting magnitudes of species loss or persistence relevant to conservation. Here we integrate mitogenomic data with historical records from a recently rediscovered Bahamian hutia (*Geocapromys ingrahami*) specimen at the Fairbanks Museum & Planetarium (Vermont, USA) to determine when and where the specimen was collected and to place it in a phylogenetic context with specimens that both predate (palaeontological) and postdate (archaeological) human arrival in The Bahamas. We determined that this specimen was part of the same population as the named holotype specimen in 1891 on East Plana Cay. Bahamian hutia populations were widely extirpated following European colonization. Today, East Plana Cay hosts the last remaining natural Bahamian hutia population.

Mitogenomic data places the focal specimen within the southern Bahamian hutia population, which is now largely restricted to East Plana Cay. The results reveal previously undocumented genetic continuity among the East Plana Cay population for at least the past 500 years, highlighting how 'dark' museum specimens inform new conservation-relevant understandings of diversity.

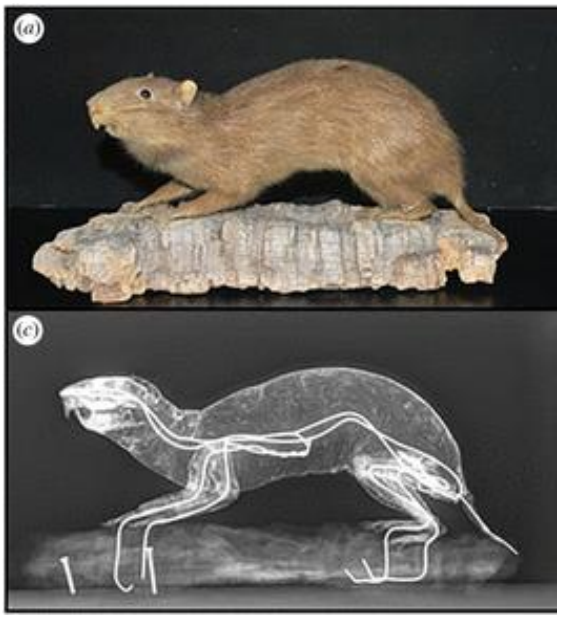

***Image caption**: (top) Photograph of the individual Bahamian hutia (Geocapromys ingrahami), and (bottom) X-ray revealing the internal structure of the specimen, including the presence of some original skeletal material and wiring used to support the taxidermy mount.*

For more information see the article by LeFebvre 2023 in Biology Letters: https://doi.org/10.1098/rsbl.2022.0566

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Practitioner Perspective *By Olivia Olson*

Ben Siggery - PhD student working on palaeoecology at the Centre for Environment & Sustainability, Surrey, and a Research & Monitoring Manager at Surrey Wildlife Trust

***Image caption**: Ben Siggery with a sediment core.*

1. Would you introduce yourself to our readers?

I have a slightly weird background, but a useful one in this context. I did my undergrad in geography, and my masters in freshwater conservation but I spent time doing paleo work during both degrees. I knew that I wanted to work in conservation, and later worked for The Wildlife Trusts (https://www.wildlifetrusts.org/). The Wildlife Trusts are a national federation of non-profit organizations in the UK with 46 regional bodies and I have been at Surrey Wildlife Trust for seven years. I've done a lot of different stuff under the conservation banner. Funding for a PhD student came around for someone working at my organization and was offered to me, so I went back to study what I was really interested in which was paleo work. The PhD is unique in that it is a practitioner doctorate in sustainability. While completing the degree, students work for their host organization one day a week.

2. What did you find in your experience in the conservation realm and its connection to paleo research? Where are the gaps?

One of the things I wanted to do was to make paleo more user friendly. The research wasn't being used and people didn't know what it was. There were three things that contributed to this disconnect: lack of communication, resources, and understanding. Paleo research is published in academic journals with a lot of jargon which excludes people who would find it interesting and useful, but don't have the time to read all of the new research. Conservation in the UK is poorly funded, and NGOs especially have many resource constraints. Paleo research is generally thought to be inaccessible.

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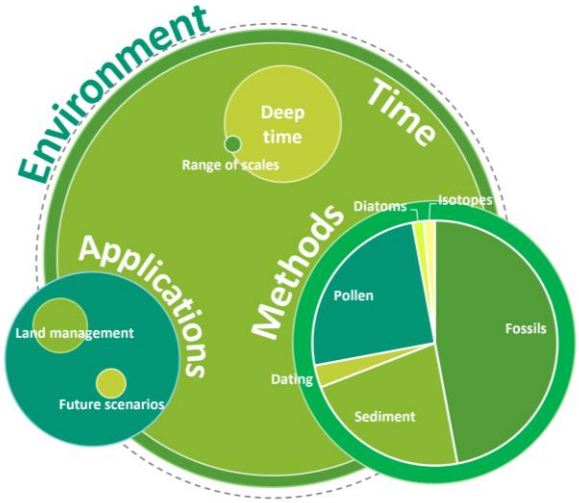
Practitioner Perspective continued

3. What can paleobiologists do to make their work more accessible to conservationists?

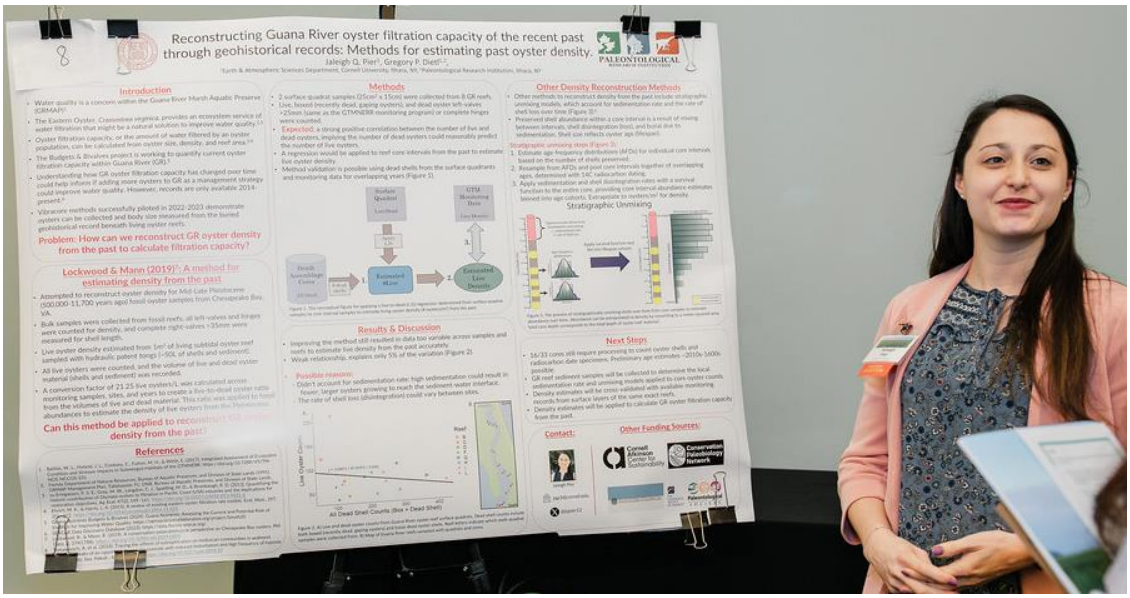
As our paper showed, conservationists had several practical requests for paleobiologists (link to paper: https://www.frontiersin.org/articles/10.3389/fevo.2023.1304510/full). Applied case studies, better access to data (which could include a website with data where you could zoom into a local patch), or publishing work in magazines or periodicals that are already read by conservationists like those sent out by conservation organizations. It's challenging for conservationists who have a lot on their plate to add another journal to read or join a new working group. They only have so much time and mental bandwidth. For conservationists, who have concrete conservation goals in mind, the why of the research and the applicability to their work has to be made clear.

4. What would you say to students who are interested in the work you do?

It's really important to get experience working in the field that you want to influence with your research. The conservation sector is such a different world to academia that you would have no clue about it unless you work in it. There is a very different set of pressures and constraints and priorities, and understanding this will help you co-design, co-facilitate, and ultimately produce better research. Universities and conservation groups work on different timescales with different sets of resources. You can help conservationists by improving your communication and not assuming that everyone knows about paleo already and are available to help with your research. I really appreciate that I had a background in conservation before starting my PhD as I feel like I can see both sides of these issues.



Student Section (Jaleigh Pier)



Thanks to the CPN Student Travel Grant, I was able to attend the Guana Tolomato Matanzas National Estuarine Research Reserve's (GTM) State of the Reserve meeting on February 15th, 2024. This annual meeting, hosted at the GTM visitor center in Ponte Vedra, Florida, brings together GTM staff, volunteers, academic researchers, local community leaders, governmental and non-governmental agencies, and community members for updates on research taking place across the reserve. The GTM invited four project leads to give a talk and provide updates on current ongoing projects within the reserve. Afterward, two poster sessions highlighted research by students, researchers, and GTM staff. Presenting a poster at the meeting was a great opportunity to network with other researchers and share my work with interested community members and local agency representatives.

I have been conducting my PhD dissertation research on oyster reefs in Guana River within the GTM which aims to reconstruct oyster ecosystem services (benefits to humans), like quantifying filtration capacity, by extending the baseline of information into the past from coring oyster reefs. An extensive oyster monitoring program was established in 2014, but little information about oysters and the ecosystem is known prior to the last decade. At the meeting, I presented a poster on methods for reconstructing oyster density from the past, a necessary metric for estimating ecosystem services. Being able to engage with individuals across various interests, expertise, and relationships with GTM allowed me to practice my science communication skills for engaging with diverse audiences. It also served as an opportunity to introduce attendees to the field of conservation paleobiology and how geohistorical approaches can address questions of interest about the reserve and fill information gaps. Based on my experiences so far, I greatly recommend other students to get involved with local research reserves close to where they conduct their research! It serves as a great opportunity to network, build partnerships, communicate to a broad audience, and appreciate the potential impact your research can have on local communities.

Paleo Proxy Spotlight – Dinoflagellate cysts *by Darja Dankina*

Dinoflagellate cysts (or dinocysts) are produced by single-celled algae classified as Pyrrhophyta. Dinoflagellates form a significant part of the microphytoplankton of marine and nonmarine waters. According to the research in ScienceDirect, living forms anatomically and physiologically demonstrate primitive eukaryotic characteristics, suggesting that dinoflagellates, probably non-cyst-forming species, could have developed in the Precambrian. Recent molecular “biomarker” studies biochemically indicate the Precambrian presence of at least dinoflagellate precursors. Possible but controversial pre-Triassic fossil links to older dinoflagellates include the Upper Silurian *Arpylorus antiquus* and Devonian *Palaeodinophysis altaica*.

In the geologic record, dinoflagellate cysts are significant because they are the most abundant and widespread marine palynomorphs preserved in Upper Triassic to Recent marine rocks. They are also found in rocks recording estuarine and not as frequently in freshwater paleoenvironments. Only a relatively small proportion of living dinoflagellates (estimated at 10%) produce cysts, however, and it is reasonable to assume that the more than 2500 fossil species assigned to almost 500 genera represent only a tiny part of a vast and highly diverse dinoflagellate history. Here, a few instances of these markers and their application will be discussed in more detail.

Mudie et al. (2001) described in detail the importance of dinoflagellate cysts as a proxy of nutrient levels and pollution, salinity measurements, and temperature analyzing the Holocene environmental aspects. This conclusion came from the fact that dinoflagellate cysts have been used to reconstruct variations in sea ice cover, industrial pollution, and coastal proximity over time. They have also frequently produced excellent records of changes in salinity, temperature, and nutrients over time. Due to their roles as primary producers and predators of bacteria and microeukaryotes, dinoflagellates are significant members of the marine plankton community.

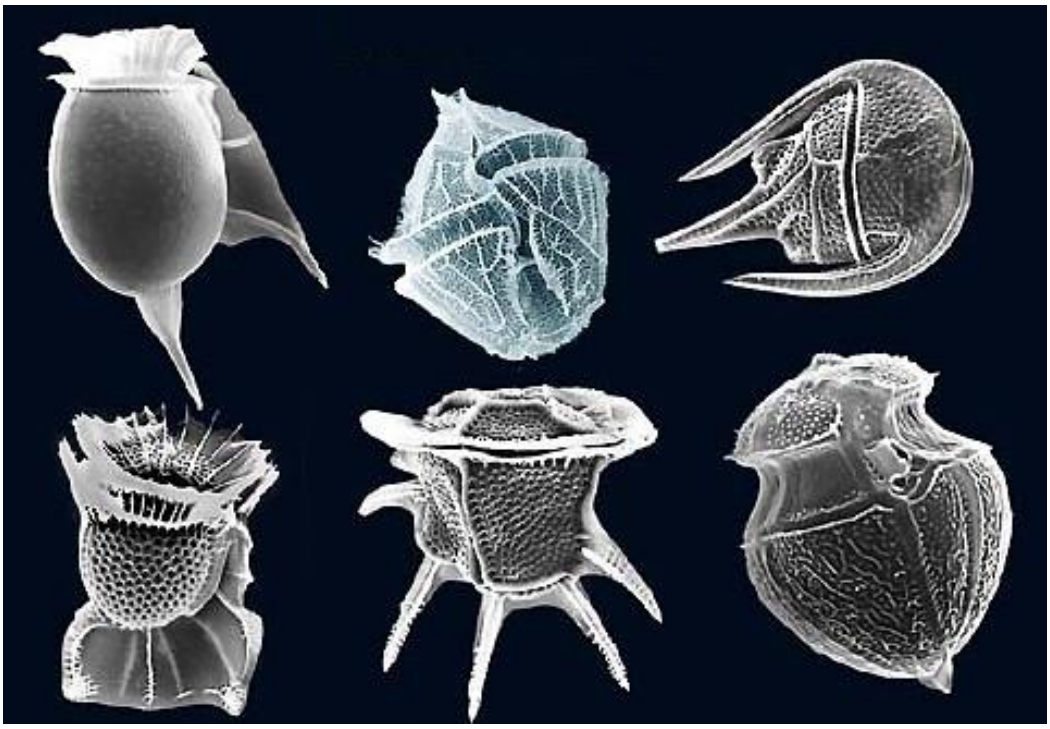


***Image caption**: Scanning Electron Microscope images of dinoflaggellates. Image credit: fickleandfreckled.*

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Paleo Proxy Spotlight continued

As part of their life cycle, over 200 species—most of which are estuarine—form a resting stage known as a cyst. Dinoflagellate cysts are primarily organic, consisting of a highly durable substance called dinosporin, and are usually discovered in exceptionally well-preserved sediments. Reconstructing these environmental alterations can be done using three different methods: (1) altering dinoflagellate cyst groups; (2) altering numbers of cyst units; and (3) altering individual species' morphology. The two primary techniques for concentrating dinoflagellate cysts from sediment samples are density separation and palynological processing using HCl and HF. Because dinoflagellate cysts are primarily organic, they may persist in areas where silica or calcium carbonate microfossils have dissolved.

Moreover, the dinoflagellate cysts data may be used as a proxy for paleoenvironment reconstruction of Mesozoic time based on the Mantle et al. (2020) studies. In this publication, Mantle and the team were analyzing the Late Triassic radiation of cyst-forming dinoflagellates in the Northern Carnarvon Basin of Western Australia. At this time, this large depocenter on the southern edge of the Tethys Ocean accumulated enormous shallow marine and deltaic successions, which often house early dinoflagellate cyst assemblages. The shallow marine Brigadier Formation, of the Rhaetian and Anisian–Norian ages, and the fluvially dominated Mungaroo Formation, of the Anisian–Norian ages, have both been penetrated by several petroleum exploration wells in the basin. Thus, a vast amount of sidewall core samples and cuttings from these northwest prograding deltaic systems are available for analysis. As one of the results, the Northern Carnarvon Basin has a high taxonomic diversity, with 29 species and one subspecies, in addition to undifferentiated forms of five genera. It means that the associations reported in the above mentioned article are, by a fair amount, the richest formally described Triassic dinoflagellate cyst assemblages. It is hypothesized that the high diversity Triassic dinoflagellate cyst associations were paleoclimatically restricted and were probably limited to the temperate and cold temperate paleolatitudes. The recorded assemblages are notable biostratigraphically as well.

This short overview of a select few scientific studies highlights the significance of dinoflagellate cysts in reconstructing the paleoenvironment and environment, revealing salinity, temperature, and numerous other parameters.

References:

Mantle, D. J., Riding, J. B., & Hannaford, C. (2020). Late Triassic dinoflagellate cysts from the Northern Carnarvon Basin, Western Australia. Review of Palaeobotany and Palynology, 281, 104254.

Mudie, P. J., & Rochon, A. (2001). Distribution of dinoflagellate cysts in the Canadian Arctic marine region. Journal of Quaternary Science: Published for the Quaternary Research Association, 16(7), 603-620.

Postcards from the Field

In this feature of our newsletter, we showcase members' research in the field, lab, or other settings. Please submit your "postcards" with approximately 100 words of text to us at conservationpaleo@floridamuseum.ufl.edu.

Image caption: *'Gryphaea Graveyard' – The Maastrichtian Gryphaea Limestone Member in TANCEM Kallankurichchi Mine, India.*

Arkaprava Mukhopadhyay, PhD student, Indian Institute of Technology Kharagpur

I'm Arkaprava Mukhopadhyay, a final-year PhD student at IIT Kharagpur, India. Last December, me and my lab mates hit up the Late Cretaceous deposits in Ariyalur (Tamil Nadu, South India). It was likely my last field trip there as a PhD student, so I wanted to share the breathtaking view of the Maastrichtian *Gryphaea* Limestone unit of the Kallankurichchi Formation with the CPN members. This unit is exposed in various limestone mines near Ariyalur, and is a real visual treat! The entire formation boasts a diverse array of macrofossils, including giant valves of *Phygraea*, abundant bivalves like *Rastellum*, *Ceratostreon*, *Chlamys*, *Neithea*, large inoceramids, brachiopods, echinoids, and bryozoan colonies. It's a haven for fossil enthusiasts! Over the past five years, we've collected molluscs and brachiopods spanning the Albian to Maastrichtian from several fossiliferous outcrops in the Ariyalur Sub-basin. My focus has been on studying the bivalves, delving into their body-size evolution, community structure, predator-prey interactions, and paleobiogeography as part of my Doctoral research.

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Are you interested in:

…contributing to **Postcards from the Field**?
…sharing a recent publication as a **Research Highlight**?
…being featured in a **Practitioner's Perspective** piece?
…providing other content suggestions for this newsletter?

If yes, please email us at conservationpaleo@floridamuseum.ufl.edu

Invite Your Colleagues to Join our Network!

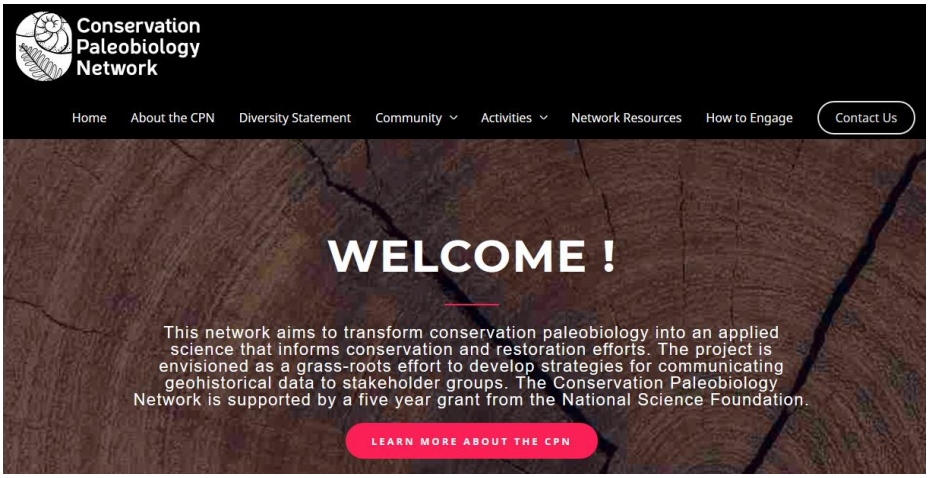
If you know people who might be interested in our network, please invite them to join. You can use the link below to extend your invitation on behalf of our network.

By joining the network, you become a member of our Community of Practice. The membership does not impose any obligations, but enables participants to engage fully in network activities. Members will be able to:

1. Participate in the CPN mailing list
2. Nominate and self-nominate for committees and panels
3. Submit announcements for publication in the CPN Newsletter
4. Apply to participate in the CPN activities
5. View CPN webinars and submit proposals for webinar modules

To join please go to our website and select "Join the Network"

Visit the website! https://conservationpaleorcn.org/



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