myFOSSIL

News from the FOSSIL Project

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FEATURED PROFESSIONAL: SALLY E. WALKER

Editor's note: This issue we feature Sally E. Walker, a Paleobiologist/Taphonomist in the Department of Geology at the University of Georgia in Athens. Eleanor Gardner, who completed her M.S. in Geology under Sally's guidance, crafted the interview questions.

How did you become interested in taphonomy and paleoecology? Were you drawn to fossils as a child?

The question for me is: When did you think you were going to be a scientist? When I was a child (~6 years old), I really liked to draw. I would draw on the walls in my bedroom. That led me to try to figure out how to remove the crayon from the walls, and therefore my first experiment! I mixed vegetable cooking oil and my mother's very expensive Chanel No. 5 perfume that she saved for many years to buy, and viola - it worked, no crayon markings. I'll spare you what my mother thought of this idea.

Sally Walker in Antarctica

So no, I was not interested in fossils as a young child, but instead very interested in forensics and criminology. This is probably because I read Nancy Drew, the Hardy Boys, and Tom Swift books as a kid. My favorite was Tom Swift because he was a scientist who not only went into space, but he also explored the ocean in a submersible. I wasn't allowed to watch much TV, but I did get to see nature and underwater programs (Jacques Cousteau) on TV. By the time I was nine, I wanted to be a marine biologist and go to the Galápagos and do research on tortoises. My family, however, had other desires for me like being a secretary and homemaker. I cannot tell you how many Betty Crocker cooking sets I got as a kid at Christmas, all the while staring enviously at the nature books that my brother received.

One Christmas stands out as the turning point: When I was 12, my grandfather gave me a microscope and I cried with joy for a very long time after opening the package. Everyone stopped - they had no idea that a microscope would mean so much to me. I have tears now just thinking about that day. I immediately took it home and started looking at my water turtle's skin under the scope, and I found a whole new world of organisms (protists)! Ever since then, I have not been without a microscope and I have remained true to my interests that I developed at a young age: combining forensics (taphonomy) and historical marine biology (paleobiology).

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I know that hermit crabs (and their traces) interest you. How did you come to be fascinated by hermit crabs and their ichnological record?

While a graduate student, I was curating fossils for my Professor at UC Berkeley, Dr. Carole Hickman, and I didn't want to remove the creatures that encrusted the shell (all curators usually remove this material to have a beautiful shell). She let me leave the encrusters on and suggested that I look into hermit crabs; she was familiar with Dr. Jim Carlton's work on hermit crabs. I had no idea what she was talking about, but I soon figured it out. Independently, I read a paper by Dr. Anna Kay Behrensmeyer on her forensic experiments that determined how long vertebrate bones last in a particular terrestrial environment, and the light bulb went off in my head: I designed field experiments like hers to test how long snail (gastropod) shells lasted in various marine environments, and along the way, examined what effect hermit crabs had on those shells. My first field experiments were destroyed by nefarious crabs, which led me to examine not only hermit crabs but mistaken predation on empty gastropod shells, and how the fossil record of gastropod shells is possibly biased by biological entities as much as by physical and chemical factors.

Sally at the Burgess Shale

Where are some of your favorite places to travel, paleontologically-speaking?

The Galápagos Islands and Antarctica are my two most favorite places for research, although I also really enjoy Bermuda and the Bahamas as well.

What research question currently excites you the most?

What are the physical, chemical, and biological factors that affect shell carbonate preservation in Antarctica and how do those factors bias the marine invertebrate/protist fossil record of Antarctica? This question further involves the following questions: how much carbonate do these organisms produce, how much is preserved, and what is their importance to the polar carbon cycle?

What is involved in preparing for and conducting a taphonomy research project in Antarctica?

One of the most amazing things about Antarctica is that it is currently protected by a multinational treaty. Antarctica is a very important part of our Earth system, meliorating our climate. It takes a lot of preparation to work there, and the National Science Foundation (for the USA) does an incredible job facilitating research there and protecting the Antarctic ecosystem.

We recently found that a single-celled creature (a foram) that lives on Antarctic scallops makes as much shell carbonate in a year as tropical lagoonal forams. That is pretty impressive considering that it is supposed to be very difficult to make carbonate shells in the coldest waters on Earth (- 2 oC). This suggests that polar organisms may contribute a lot to the Earth's carbon cycle (which affects climate), but are rarely considered. Read more about this discovery in a paper by Hancock et al. (2015).

What is a typical work day like for you? What are some of your favorite parts of your job? Your least favorite?

A typical day is about 10 to 12 hours on average, including weekends, and can be composed of the following: I read new scientific papers and incorporate them into my lectures or labs; I write and set up my labs; I mentor undergraduate and graduate students (and they mentor me!) in research and scientific writing. I also answer queries

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about identifying fossils or what it is like being a paleontologist, write letters of recommendation for students for jobs and graduate school, evaluate young professors for tenure or full professor and write letters of support. I typically also evaluate and review grants and review scientific papers; I collect and analyze data, do the illustrations and

photographs, and write scientific papers; I have committee work for the department, college and university level; I have professional service work for the Paleontological Society. In short, my day is not typical, and that is what I like (and I really like my students and research)! I least like being the token female on committees to make it more "diverse" and having to deal with gender bias.

Given that the goal of FOSSIL is to link amateur groups with professionals, what are your thoughts about the role of amateurs in the science?

Frankly, we are all amateurs before the beauty of science. I don't make a distinction between amateur and professional: regardless of what degree we have (if a degree is what "amateur" is based on), if we are trying to make science better, using the principles of science, and keeping the STEM fields alive (for instance, not denying that climate change occurs despite overwhelming evidence from the past and today), then we are all working toward the same STEM goals. We are on the same team! I know many "amateurs" that know far more than me about particular fossils. Therefore, I don't consider them amateurs, I consider them valued colleagues. Therefore, their role in science and society is just as valuable as my role.

Many of our fossil clubs and societies are very committed to education and work hard to engage youth. As a university professor who often does public outreach/education, do you have any advice to share about effective ways to get children and teens interested in paleontology?

Yes - take them on field trips, get them involved in a research project, and museums. Hands-on activities are the best.

Do you see on the horizon any new directions or opportunities in paleontology emerging as the result of technological advances or new discoveries?

Yes, many cool new topics. First, the technological revolution: the digitization of museum fossils and the gigapan images of fossils that are being produced are revolutionizing our science. This new technology allows not only scientists to use the fossils for research, but also K-12 and university students as well. The new technology that allows paleontologists to non-destructively examine samples and image them in 3-D is also amazing. We can then print 3-D copies of these fossils to use for outreach and class projects. The use of drones is changing how we do geology and paleontology (we can overview an outcrop and zoom in on the fossils, even though they could be hundreds of feet up a steep rock wall face). There are new sampling techniques for analyzing stable isotopes and chemical elements from fossils that are very exciting. Second, from a conceptional point of view, I love the Earth System Science approach to studying paleobiology: Conservation paleobiology and how the past can be used to examine how modern ecosystems have changed under the influence of humans; paleo-macroecology, or how body size and body plans have changed over time, as well as how ecosystems are structured. I also like that parasitism and mutualism are now being studied, in addition to predation and competition. And lastly, I think that paleogenomics and biomarker studies are giving us a more complete window of organism relationships, their history in deep time, and the biological aspects that we can't necessarily see from the shape (morphology) of fossils.

Do you have a favorite fossil discovery?

Yes. I really enjoyed working with my former Ph.D. student, Dr. Lisa Gardiner and my dear colleague, Dr. Steven Holland, when we discovered the first hermit crab walking trace known in the fossil record. We were scouring the sea cliffs (fossilized dunes from the Pleistocene Epoch) on San Salvador Island in the Bahamas for hurricane damage when we discovered this trace fossil. After measuring the details of the track way and casting it, Lisa and I then tried to figure out if a land hermit crab (of the genus Coenobita) made the walking trace. We found a land hermit, whom

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we named "Tulip," and had her walk on wet vs. dry sand, on flat surfaces, and on sloping surfaces. We measured her tracks and trackways on these surfaces and compared it to the fossil we'd found, and they were essentially identical. We then named the trace after Lisa's wonderful undergraduate mentor, Dr. Al Curran, who is an expert on the trace fossils of the Bahamas. That trace fossil is Coenobichnus currani, and thinking about it brings back many happy memories. Read more about this fossil in Walker et al. (2003).

To learn more:

Learn more about what a research expedition in the Antarctic entails at "Postcards from the Poles."

Read about the science behind the Antarctic project in this article from *The Antarctic Sun*.

Sally's Antarctica research is profiled in this AAAS Spotlight.

Listen to an interview with Sally on the NSF Kids' Science Challenge.

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"Frankly, we are all amateurs before the beauty of science. I don't make a distinction between amateur and professional: regardless of what degree we have (if a degree is what "amateur" is based on), if we are trying to make science better, using the principles of science, and keeping the STEM fields alive (for instance, not denying that climate change occurs despite overwhelming evidence from the past and today), then we are all working toward the same goals. We are on the same team!" Sally E. Walker

AMATEUR SPOTLIGHT: SAMUEL J. CIURCA, JR.

This issue we feature Samuel J. Ciurca, who received the 2016 Harrell L. Strimple Award from the Paleontological Society. University of Cincinnati scientists Carlton Brett and Matthew Vrazo nominated Sam for the Strimple Award. The Strimple Award recognizes outstanding achievement in paleontology by an amateur (someone who does not make a living full-time from paleontology). Now retired, Sam had a highly successful career as chemist and inventor at the Kodak Corporation in Rochester, New York. He has held the position of Yale Peabody Curatorial Affiliate for nearly ten years. We thank Derek Briggs and Susan Butts of Yale University for sharing their thoughts with us. (The quotations below are excerpts from the Yale letter of support for Sam's nomination of the Strimple Award.)

Susan Butts and Sam Ciurca. Photo credit Kimberly Lau

Sam Ciurca has been collecting fossils since the 1960s. Initially interested in minerals, petrified wood, and a variety of other types of fossils, Sam soon focused almost exclusively on eurypterids—an extinct group of sea scorpions that lived from about 465 to about 250 million years ago and were most abundant around 400 million years ago. While eurypterids have a nearly global distribution, among the few places complete eurypterid fossils can be found are the rocks of the Silurian Bertie Group in New York and southern Ontario. Over the years, Sam amassed a huge collection of eurypterids and his specimens now reside in many museums including the Buffalo Museum of Science, Paleontological Research Institute, Smithsonian Institution, and the Yale Peabody Museum.

Most of Sam's material makes up the Ciurca Collection in the Division of Invertebrate Paleontology at Yale which holds 11,045 specimens from 560 localities. As Briggs and Butts observe, the Ciurca Collection is recognized by eurypterid workers as comprising "more eurypterids than the rest of the world's eurypterid collections combined." The collection reflects the huge effort and diligence that Sam Ciurca has devoted to collecting these fossils:

> "He is diligent in cultivating relationships with property owners, obtaining their permission to collect and conduct research on-site. He has tracked-down dozens of construction projects with subsurface excavation, including major road infrastructure projects in Rochester (i.e. development of the "Can of Worms" interstate interchange), numerous industrial projects such as the prolific Wegmans supermarket chain development, and has researched and found many historical localities which had not been visited in decades."

According to Briggs and Butts, Sam's contributions to paleontology go far beyond the fossils he collected:

> "The associated taxa, minerals, and sedimentary structures that he has amassed alongside the eurypterid fossils provide invaluable information to the depositional setting and paleoecology of the Bertie Group…Mr. Ciurca's greatest achievement is the documentation and characterization (both informally and formally, in guidebooks of the New York State Geological Association) of the lithology and stratigraphy of the Bertie Group."

Sam's locality information and field notes dating back to 1966 are archived at the Yale Peabody Museum and are a valued resource for researchers studying the collection. Sam continues to send field notes to the Peabody where they are digitized to document the collection. (You can view an example here.)

Briggs and Butts note that Sam has also proved to be a valued collaborator with professional paleontologists around the world, as well as students:

> "Sam is consistently available to discuss our material with senior researchers, graduate students, and undergraduates, provide additional information about localities, depositional environments, and types of preservation…He is willing to use his vast experience and love of collecting and documentation to assist the research efforts of his academic counterparts – a collaboration which has been of enormous benefit to professional paleontologists."

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Sam was kind enough to respond to our interview questions and share his passion with the myFOSSIL community:

I read an article in a Buffalo, NY, newspaper that noted you saved/collected a lot of fossils from a landfill. Can you talk a little about how you made that happen?

That was the Tastings Site (see http://eurypterid.us/EurypteridsTastingsSite.html) – a restaurant was under construction and I knew they would encounter the famous "Pittsford Shale" there. Upon excavation, circumstances caused them to truck many tons of rock several miles to an abandoned gravel pit. There, with the help of a friend, we were able to recover several hundred fossil specimens. The rock is extremely fragile, quickly decomposing with any rain. We were actually able to collect the site for several months. All of the material from this site was donated in 2016 to the Paleontological Research Institute (PRI) in Ithaca, N.Y. While most of the specimens consisted of eurypterid material, there were also ostracods, Lingula, and other miscellaneous finds.

Do you have a favorite fossil find?

I consider my best find to be "Ezekiel's Wheel" - a strange and enigmatic Late Silurian organism currently being studied at the Peabody Museum of Natural History. A close second is the large (4 foot) Pterygotid eurypterid I uncovered in Herkimer County, N.Y. That fossil is now housed at PRI; you can view the photo online.

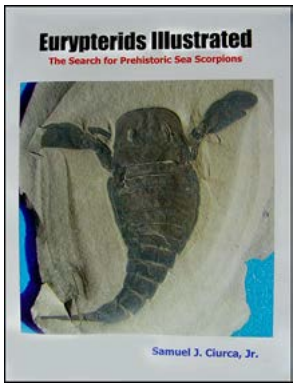
"Ezekiel's Wheel." It is Late Silurian Williamsville 'A' Waterlime, Bertie Group. It is associated with abundant eurypterid fragments mostly of Eurypterus lacustris. Photo courtesy of Sam Ciurca.

Do you belong to any fossil or related clubs or organizations? If so, what kinds of benefits might amateurs and professionals gain from involvement with these groups?

Locally, I belong to the Buffalo Geological Society and the Fossil Section of the Rochester Academy of Science. I am also a member of the Paleontological Society and I think it is important to support the PS and their endeavors. The BGS is great for the large number of field trips they provide to members, exposing us to a wide and varied choice of geological sites.

Do you have any advice to share with amateur collectors, especially those just starting out?

My best advice, which I try to follow as best I can, is to log and document your finds. Visit your local museum and try to connect with others, especially those showing an interest in the kinds of fossils you are collecting. If you are purchasing fossils, try to buy only those that have documentation of some sort. Also, information on labels may lead you to new collecting sites. When I first went to Canada, it was because of some well-labeled specimens I had purchased from a large geological supply house.



I see that you published a book in 2010 entitled 'Eurypterids Illustrated: The Search for Prehistoric Sea Scorpions.' Can you tell us about the book? Can you recommend other resources for fossil collectors?

The book was a labor of love (certainly) - I did it all in Microsoft Word and had it printed locally. The front cover was designed for framing as it pictures the New York State fossil (Eurypterus remipes), the specimen I donated to the Smithsonian Institution in the 1980s. I recommend the impressive and practical book, "Fossil Ecosystems of North America" by John R. Nudds and Paul A. Selden – I had the good fortune of taking Paul to a few eurypterid localities for inclusion in his chapter on "The Bertie Waterlime."

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Have you collected fossils at international locales other than Canada, such as Australia or Germany? Where is your favorite place to collect?

I've not been able to visit international sites. However, with the advent of the Internet, I've been able to purchase specimens from important sites I could not visit, e.g. Ukraine, Scotland, Estonia. Some of those specimens (e.g. *Baltoeurypterus*) I've added to the collections at Yale so that there is study material for comparison to New York specimens I've collected. My favorite place to collect now is an active quarry in Ontario, Canada (the management there has been generous enough to allow collectors in the quarry one day per week and many significant finds have been made there in strata difficult to get at any other place).

The newspaper article included photos of your collection that is housed in your basement! I'm sure our readers would be interested in knowing how you organize or curate your personal collection.
Early on, I used a date system, for example "122516-1A" and the locality using permanent black ink. The letters A & B were used if I had part and counterpart. When possible, I also indicated orientation with a black arrow pointing upwards on the side of each specimen. And, for the past couple of decades at least, I took orientation photos (using a compass) of the specimen in situ and typed up field notes.

I read that thousands of your fossils ended up in several museums including the Yale Peabody (where the collection bears your name), Smithsonian, Buffalo Museum of Science, and PRI. I'm curious about the process by which the fossils you find end up in museum collections. Do you contact the museums or do the scientists reach out to you or...?
Both – the museums contacted me because of the unusual nature of the fossils I was amassing and I contacted them as they were the specialists (for example the description of the early land plant Cooksonia in our NY and Ontario Silurian rocks). More importantly, however, were contacts that resulted in field cooperation in one way or another. In the case of the Peabody Museum, I was fortunate to be able to take a post-graduate researcher across New York to document all the eurypterid localities more precisely for all the specimens in the Ciurca Collection -- that was actually quite a lot of fun.

Similarly, I've seen that you have published scientific papers on eurypterids with co-authors from as far away as Europe and also that others have published papers on fossils you have collected. What are your thoughts about the contributions amateur paleontologists can make to the science of paleontology?
I think the science of paleontology has benefited greatly from association with amateurs - and this allows the science to proceed even when the general public seems to lack interest (unless it's a dinosaur). Just a couple of years ago, I happened to be at the right place at the right time when a collector from Ohio found the first Silurian fish fossil (an acanthodian) from an active quarry in Fort Erie, Ontario, Canada. A couple of us suggested to him that he donate the specimen to the Royal Ontario Museum in Toronto. He did and later a paper was published describing the new discovery. For my part, I donated the photos that documented the find.

To learn more:
You can read about the first Silurian fish fossil (an acanthodian, *Nerepisacanthus denisoni*) Sam mentioned above in this PLoS ONE article.

Were the extinct sea scorpions top predators? Read about some recent research findings here.

You can find the newspaper article that shows some of Sam's home collection here.

For many years, Sam has typed up notes and sent copies to the Yale Peabody Museum where they digitize them to document the Ciurca Collection. He graciously provided us with one example.

Learn more about the order Eurypterida here:
Sam's own website: http://Eurypterids.net/EurypteridLinkIndex.html
Written-in-Stone-Seen-through-My Lens blog
The Fossil Guy website

CLUB CORNER: DELAWARE VALLEY PALEONTOLOGICAL SOCIETY

by Jason P. Schein and William J. Shankle

Philadelphia and the surrounding tri-state region are the birthplace of paleontology (especially vertebrate paleontology) in the New World. It is here that the first complete dinosaurs were discovered, where the Bone Wars began, and where much of the last century's biggest discoveries were made. It remains an important hub of paleontology even today, due in large part of course to the region's geology, but also to the many world-class museums nearby, and to the many professional and avocational paleontologists in Philly or within just a couple hours' drive. For the last several decades, the Delaware Valley Paleontological Society (DVPS) has been a proud and significant part of this rich history.

The DVPS was founded in 1978 with 58 members, and has grown significantly to a total of more than 300 members today, all of whom enjoy a monthly newsletter. Membership - which is open to anyone - includes both professional and avocational paleontologists, young and old, representing all levels of interest, and from throughout the region. Meetings are held monthly (with a break during the summer for field work!) at the Academy of Natural Sciences of Drexel University (ANSDU) - the academic homes E. D. Cope and Joseph Leidy, and mere feet away from specimens collected by Lewis and Clark! Meetings include time for "show-and-tell" as well as a talk by a professional or an avocational paleontologist.

Paleontologist Jason Schein talking to the DVPS at a monthly meeting about the Bighorn Basin Dinosaur Project.

The original purpose for establishing the DVPS was for gathering and disseminating information relating to fossil forms, and it accomplishes this mission in many ways and for a wide variety of audiences. Members very often participate in outreach opportunities, festivals, and all manner of fossil-related events throughout the year. Members also take advantage of the region's varied geology by leading field trips to collect all ages and types of fossil flora and fauna (though collecting trips have been known to extend to such exotic locales as Florida and Kansas)!

Members of the DVPS collecting Paleozoic fossils in upstate New York.

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Some might say that the DVPS' contributions to academic paleontology is where the group has its biggest impact. The Mosasaur is the DVPS' well-respected scientific journal that publishes original, peer-reviewed articles that contribute to paleontology and are of interest to both the amateur and professional paleontology communities. Every article of The Mosasaur is available on our website. Plans are also underway for the publication of a new journal, dubbed "The Nautilus," that will publish less scientific, more anecdotal articles authored by members. Just as importantly, members regularly donate scientifically important specimens to museums throughout the region, with the primary beneficiaries being the ANSP and the New Jersey State Museum.

Delaware Valley Paleontological Society Fossil Fair

The DVPS raises funds primarily through its annual Fossil Fair and holiday party/auction. These monies, along with dues and donations, fund the annual Paul Bond Memorial Scholarship, which supports a regional student's research project with an award of $1,500. The only stipulation for receiving this award is that the winner must present their research as the featured speaker at one of the monthly meetings. These scholarships have helped to launch the careers of some of today's most successful paleontologists, including Drs. Matthew Lamanna (Assistant Curator of Vertebrate Paleontology at the Carnegie Museum of Natural History) and Tyler Lyson (Curator of Vertebrate Paleontology at the Denver Museum of Nature and Science). The DVPS also offers occasional grants to help fund other regional paleontology-related initiatives, including a crowdfunding campaign in 2015 and the creation of Rowan Fossil Park (now Jean & Ric Edelman Fossil Park at Rowan University) in 2016. To date, the DVPS has distributed a total of $17,500 to 14 scholarship awardees since 1997, and more than $11,650 to 13 paleo-related projects.

DVPS members on a collecting trip

The DVPS' members - no matter their profession or background - are simply fossil enthusiasts at heart who just want to get together and have fun talking about and sharing fossil stories. But the DVPS accomplishes so much more than that. There is a shared sense of responsibility to the science of paleontology that surely emanates, at least in part, from working and gathering in the shadow of so much history - the birthplace of our beloved science.

For more information, including details on how to join the DVPS, please visit our website.

NEWS FROM THE PALEONTOLOGICAL SOCIETY

by Bruce MacFadden

In October I became President-Elect of the Paleontological Society (PS). This includes a two-year term followed by two years as President (and then Past President for two years). During this interval, I will be reporting news from the PS that benefits amateur paleontologists and the myFOSSIL community. I have been a member of the PS for 45 years. With a membership of 1500, the PS is the largest professional society in the world devoted to advancing the science of paleontology, including invertebrates, microfossils, plants, and vertebrates.

The PS has recently partnered with us to sponsor the successful Fall 2016 myFOSSIL webinar series. Their sponsorship has included promoting these monthly events to their community. We are looking forward to continued collaboration as we continue the webinars in 2017.

Strimple Award

In my role as President-Elect, I am Chair of two PS committees that make recommendations for the Pojeta Award (for service to the PS) and Strimple Award. With regard to the latter, and of likely interest to the myFOSSIL community (from the PS website, listed below):

"*The Strimple Award recognizes outstanding achievement in paleontology by amateurs (someone who does not make a living full-time from paleontology). Contributions may be an outstanding record of research and publication, making outstanding collections, safeguarding unique paleontological materials through public service, teaching activities in the area of paleontology, and collaborations with others working in paleontology*."

Deadline: February 1, 2017

In order to nominate someone, see information at:
http://paleosoc.org/grants-and-awards/strimple-award/

With this message and as Chair of the Strimple Committee, I encourage you to nominate qualified candidates for this award.

New Amateur PS Member category

Effective as of the upcoming 2017 dues year, the PS has started a new member category geared towards the large community of amateur paleontologists. At $30 per year, this is an affordable way to become a member of the world's largest paleontological society. As can be seen from President Miller's article reprinted below, there is a sense of good will and sincere interest in reaching out and promoting amateur involvement in the PS; and one of the best steps forward is to support this society through becoming a member.

Therefore, I likewise encourage you to join the PS, and in so doing, become eligible for member benefits and support the science of paleontology. For more membership information see:
https://rock.geosociety.org/membership/paleo/

In summary for this report, I encourage you to attend the webinars, nominate someone for the Strimple Award, and join the Paleontological Society!

REACHING OUT TO AVOCATIONAL PALEONTOLOGISTS

This essay is reprinted with permission from the Winter 2016 (Volume 23, Issue 1) issue of Priscum, Newsletter of The Paleontological Society.

by Arnie Miller, President, The Paleontological Society

Most members of the Paleontological Society would probably agree that, from a scientific and societal perspective, paleontology has never been more vital than at present. Collectively, paleontologists use an ever-expanding toolkit to collect and analyze data relevant to a spectrum of questions spanning the history of life. When coupled with the continued discovery and documentation of fossil taxa that are new to science, paleontologists routinely capture the imaginations not only of our scientific colleagues, but also broad segments of society. Paleontologists contribute to contemporary discussions about matters as far flung as the possible existence of life elsewhere in the solar system and beyond, and the assessment of anthropogenic alterations to environments and ecosystems.

Yet there is a sense that paleontology is also vulnerable at present, be it at the hands of school boards who seek to undermine the teaching of evolution in public schools, politicians looking to micromanage federal research funding to suit their own beliefs and needs, or federal offices enacting new restrictions on the collection of fossils on public lands.

Against this backdrop, I believe it is important for the Society to undertake a robust effort to recruit avocational paleontologists as members of the Society. The metaphorical fire- wall between "amateur" and "professional" paleontologists has long struck me as artificial, and the interests of the Society would be well served by a larger contingent of avocational paleontologists among its members, particularly given the efforts of avocational groups to counteract, through positive actions, issues that threaten our science.

The principal avocational group in my region, the Cincinnati Dry Dredgers, has demonstrated copiously over the years that there is nothing amateurish about its paleontological pursuits. Members of The Dry Dredgers have long partnered with students and faculty at the University of Cincinnati in scientific studies, graciously sharing their encyclopedic knowledge of the classic fossils and strata in the Cincinnati region. They have co-authored numerous scientific publications with their colleagues at the university, have financially underwritten the research of generations of graduate students at Cincinnati and elsewhere, and participate extensively in education-and-public outreach activities.

The activities of avocational organizations nationwide are summarized at the website of The FOSSIL Project, a very successful NSF-funded initiative to provide avocational paleontologists with enhanced networking opportunities, educational activities, and contact with professionals. I encourage readers to have a look at the map available at The FOSSIL Project website showing the locations of avocational paleontological organizations, and to peruse the websites of organizations linked electronically to the site. A quick look at this extensive network of organizations provides convincing evidence that avocational paleontologists throughout North America are actively serving the interests of our science, sometimes with only the limited awareness of professionals and students.

There is nothing at present to preclude anyone from becoming a member, but the Society has never actively reached out to avocational paleontologists. With this in mind, I pose the following questions:

> Should the Paleontological Society undertake an active effort to recruit avocational paleontologists as members?
>
> Should avocational paleontologists be given the option of a reduced rate for membership and/or reduced rates for attendance at our meetings?
>
> Should the Society establish a position on Council for a representative from the avocational community?
>
> Beyond providing opportunities to participate in the Society's meetings, symposia, workshops, and other regular

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activities, should the Society undertake special programming aimed at the avocational community?

Should the Society establish special sections at its web- site to highlight the accomplishments and contributions of the avocational community, and to provide educational information of practical use to avocational paleontologists in their own research and outreach efforts?

As part of its recruiting efforts, should the Society also reach out to K-12 science teachers?

I would greatly appreciate hearing from you on this important topic. Please feel free respond to any or all of the questions, or provide additional thoughts, by emailing me at: arnold.miller@uc.edu. Many thanks!

ANNOUNCMENT ABOUT THE PALEONTOLOGICAL RESOURCES PROTECTION ACT (PRPA)

Dear colleagues,

In response to discussions with fellow paleontologists and officers from the Department of Interior, we have substantially revised our FAQ on the proposed rules for fossil collecting on lands managed by that agency. These rules are open for comments until 7 February 2017. As these rules will have a large impact on paleontological collecting in the United States, Paleontological Society members are encouraged to make their voices heard.

Sincerely,

Steve Holland, Past-President

FAQ on the Department of Interior's proposed rules for fossil collecting

(v. 2, revised 22 Dec 2016)

I thought the Paleontological Resources Protection Act (PRPA) is already law. What is this about?
PRPA was signed into law on 30 March 2009, and federal agencies were tasked with writing their own rules for how they would put the law into effect. The rules for the Department of Agriculture went into effect on 18 May 2015. Now, the Department of Interior has finished the draft of its rules, and it is open for comments until 6 February 2017.

Preservation of paleontological resources sounds like a great idea. Why are so many concerned?
Indeed, the rules for PRPA will be effective in protecting scientifically valuable rare fossils, such as many vertebrates. Because many non-vertebrate sites have fossils that are orders of magnitude more abundant, invertebrate paleontologists, paleobotanists, micropaleontologists, ichnologists, as well as some vertebrate paleontologists have raised several concerns about the proposed rules, including:

a process that requires obtaining permission to release or publish the coordinates on fossil localities, hindering the ability to use paleontological data collected on federal lands in databases such as the Paleobiology Database.

a permitting process that can take several months and that could delay graduate student research.

restrictive limits on the amount of material that could be collected by amateur paleontologists, who can meet the requirements needed for obtaining a permit only if they apply with a professional paleontologist.

creating storage and reporting burdens on museums, yet offering no funding to meet these burdens.

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PRPA allows for casual collecting without a permit. Can't we just collect our fossils that way? Wouldn't reconnaissance collecting be a form of casual collecting?
No. If you collect fossils for research, that is not considered casual collecting. If you are conducting research, you must obtain a permit.

The law is the law. Can anything be changed?
Federal agencies have considerable latitude in how they implement the law, because they are required to implement the law in accord with good scientific practice. The Department of Interior could readily enact several changes that would better balance the needs of invertebrate paleontologists, paleobotanists, micropaleontologists, and ichnologists, as well as those that collect common vertebrate fossils. Officials with the Department of Interior are enthusiastic about working with paleontologists, but they need specific suggestions. Several changes would substantially improve the proposed rules, including:

allow a researcher to request non-confidentiality of the location of fossil sites when they apply for a permit. This would allow local managers to aid the science and focus protection efforts on those sites that need it.

expedited permitting for surface collection of common fossils, including the ability to obtain an on-the-spot permit at regional offices. At the outside, approval of surface collection of common fossils in non-sensitive areas should take no more than 10 days.

allow flexibility in the limits for casual collecting.

How do we request changes to the Department of Interior's implementation of PRPA?
Go to the Federal Register website before 6 February 2017 to read the proposed rules and comment on them. The rules begin on page 88187, so you'll need to skip over the first several pages. Your comments will be most effective comments if they make specific changes to the wording of specific rules. Be sure to cite the rule (e.g., Subpart A, section 49.25), your proposed rewording, and a brief justification. The law is in place, and using the comments just to complain about it will not help. We have an opportunity to work with the Department of Interior to develop rules that promote paleontology for all.

My colleagues have already done this. Do I need to?
Yes. The best way to get changes that promote paleontology is to let federal agencies know how the rules should be changed to meet the needs of all paleontologists. Even if a colleague has made the same comments as you, hearing from many paleontologists helps the Department of Interior know the importance of particular rule changes.

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OP-ED: COLLECTING INVERTEBRATE FOSSILS ON PUBLILC LANDS

Editor's note: Michael Nelson is emeritus dean of science at the University of Wisconsin-LaCrosse. This column is reprinted with permission from the Rocky Mountain Federation of Mineralogical Societies newsletter.

by Mike Nelson, Colorado Springs Mineralogical Society Fossil Study Group

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On March 30, 2009, the Paleontological Resources Preservation Act (PRPA) became law on lands managed by various agencies of the federal government. The law had been through numerous drafts before approval by the US Congress and subsequent signing by President Obama. Although in 1999 the Senate Interior Appropriations Subcommittee asked federal agencies to prepare a report on fossil resource management, most rockhounds, and many professional paleontologists, believed that any new regulations would be written to protect vertebrate fossils (in my opinion). However, unbeknownst to most amateur fossil collectors, the United States Forest Service (USFS) published (May 23, 2013) draft regulations concerning the collection of invertebrate fossils and plant remains on land managed by the Agency. The comment period was 60 days and the Agency received few legitimate (non-form letters) concerns. Candidly, the proposal caught most rockhounds "off guard" and it was tough for rock and mineral clubs to organize informative responses. In my opinion, rockhounds lost many, many collecting privileges associated with invertebrate fossils as the proposed rules are now codified as 80 FR 21588. However, in defense of the USFS, the Agency was simply interpreting tenets of the PRPA, and that is the magic word, at least for me---interpretation.

In December 2016, proposed regulations for lands managed by the Department of Interior (Bureau of Land Management [BLM]; National Park Service [NPS]; Fish and Wildlife Service [FWS]; Bureau of Reclamation [BR]) were published in the Federal Register and became available for comments (received no later than February 6, 2017). The proposed rule [of Interior] would address the management, collection, and curation of paleontological resources from federal lands using scientific principles and expertise, including collection in accordance with permits; curation in an approved repository; and maintenance of confidentiality of specific locality data.

Most of the proposed regulations (formally known as A Proposed Rule by the Land Management Bureau and the Fish and Wildlife Service on 12/07/2016), but specifically subparts A through H, applies to all four bureaus---BLM, FWS, BR, NPS. Parts A through H are also very similar, perhaps mostly identical, to current USFS regulations (80 FR 21588). However, Part I of the proposed rules notes some differences between Interior (BLM and BR) and the USFS regulations regarding actual field collecting of common fossil plants and invertebrates. I should also note that PRPA does not allow casual collecting in areas administered by NPS or FWS.

So, what are some of the proposed items in Interior's new rules and regulations---hereafter known as the Rule? I will
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only hit on a few sections as the proposed Rule, as published in the Federal Register, is tens of pages long.

The Rule does not impose additional requirements regarding fossil collecting activities on permitted lands associated with general mining or mineral laws. It appears that if you have a permitted mining claim the fossil plants and invertebrates are fair game for any collecting (§ 49.15 …states that the proposed rule does not impose additional requirements on activities permitted under the general mining or mineral laws). Does this mean that if you are mining sedimentary rocks for minerals (such as barite or uranium) that any and all invertebrates may be collected? I don't know; however, that seems to be a reasonable assumption to me. But remember, my interpretation of various regulations and codifications found in the Federal Register may be subject to suspect. I do know, however, that a mining claim will not be approved by an Agency simply to allow a person/company to collect fossils. Any approved mining claim must include some sort of a commodity and fossils are not such.

The mining claim section of the Rule is an interesting one. Around this part of the country one permitted mining claim would create more surface disturbance, and could destroy more fossils, than all the Colorado rockhounds added

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together. BLM and USFS manage multi-purpose lands; however, some activities are much higher on the pecking order than rockhounding.

Fossils found in an archaeological context are archaeological resources, and are not considered paleontological resources. It is always best to not disturb archaeological resources.

An authorized federal officer at BLM or USFS (the person in charge) may decide that specific rocks/minerals, such as coal, chalk beds, diatomites, etc. are not subject to PRPA rules as paleontological resources. However, there are a myriad of other federal regulations that may protect them.

The Department of Interior has specific Agency regulations concerning the collection of petrified wood on their managed lands. *Petrified wood is managed as a paleontological resource when on or from lands administered by NPS, Reclamation, and FWS. On lands administered by BLM, petrified wood (defined by the Petrified Wood Act of 1962, Pub. L. 87-713, 76 Stat. 652, Sept. 28, 1962 as agatized, opalized, petrified, or silicified wood, or any material formed by the replacement of wood by silica or other matter, and identified as a mineral material under the Materials Act of 1947) is subject to commercial sale at 43 CFR part 3600 and free use regulations at 43 CFR part 3622. Therefore, on BLM lands, petrified wood may be managed as a paleontological resource, but the savings provisions in PRPA (16 U.S.C. 470aaa-10) prevent the imposition of additional restrictions on the sale or free use of petrified wood. When it is not subject to sale or free use, petrified wood on BLM-administered lands may be managed as a paleontological resource and/or under the authority of FLPMA.* My old and used mind fails to understand this latter statement! Why would not all petrified wood collected on BLM-managed land be free use?

PRPA rules do not apply to "Indian lands." However, lands managed by Native Americans **always** have collecting rules so avoid trespassing.

A federal authorized officer may restrict access or close a collecting area at any time. Therefore, fossil collecting on federal lands will now essentially involve a visit or call to an agency office.

Microfossils, such as foraminifera and radiolarians, are paleontological resources and are subject to collecting rules---except if you are drilling a permitted energy well. The drilling bit may then grind up as many microfossils as the driller pleases. Yes, that last sentence was cynical.

Most individual rockhound collecting of invertebrate and plant fossils (excluding petrified wood) falls under the definition of casual collecting; therefore, such individuals may collect on BLM lands that are not restricted or closed--lands such as BLM-administered national monuments would be closed. The Rule notes casual collectors may collect common invertebrate and common plant paleontological resources…casually. Common invertebrate and common

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plant paleontological resources are invertebrate or plant fossils that have been established by the bureaus, based on available scientific information and current professional standards, as having ordinary occurrence and wide-spread distribution. But, and there are many "buts" in the Rule, not all invertebrate or plant paleontological resources are common. When in doubt, collectors should err on the side of caution and collect only the resources that they know are common. In other words, pay a visit to an Agency to find out what fossils an officer has decided are "common."

So, what is a casual collector as defined by the Rule? Casual collecting means the collecting without a permit of a reasonable amount of common invertebrate or plant paleontological resources for non-commercial personal use, either by surface collection or the use of non-powered hand tools, resulting in only negligible disturbance to the Earth's surface or paleontological or other resources. Although this seems a restrictive definition, it is much better than the USFS definition: causal collecting is generally happenstance without intentional planning or preparation…, the view of casual collecting as an activity that generally occurs by chance without planning or preparation. The "good thing" about the Rule and the USFS regulations is that they clarify the allowance of collecting certain fossils from their managed lands.

But here are additional "buts" of the Rule. The casual collector may only collect 25 pounds per day, not to exceed 100 pounds per year---and this weight includes matrix. This part of the Rule was modified after the codified collecting rules long established for petrified wood; however, there is a big difference between specimens of petrified wood and invertebrate fossils. Petrified wood is usually collected without matrix while many invertebrate fossils are collected with matrix. Rockhounds do not want to take a chance of breaking the specimen by chipping away the matrix in the field. Collectors also may not pool a total weight with their buddy in order to collect larger specimens. What does this mean for the collection of larger fossils weighing over 25 pounds? I don't know. Perhaps it indicates a permit is required? However, an issued permit requires a collector give up his/her specimen to a museum or repository!

Collectors also may not disturb over 1 square yard of the landscape, and your digging buddy must be at least ten feet away from your land disturbance. I am uncertain if a collector may have several disturbances per day? At any rate, like all good rockhounds, collectors must fill in their disturbance holes.

This restrictive regulation on land disturbance continues to be a problem for me. If the BLM really wants to stop major land disturbance, then I suggest examining extensive disturbance by domestic livestock, off-trail ATV and OHV riders, and even off-trail mountain bikers and hikers (among others). I support these multi-use land activities, in moderation, but simply want to point out that land disturbance by rockhounds is minimal compared to these other large-scale activities.

Casually collected fossils may only be used in a personal collection and may not be sold, bartered, used for financial gain, or research! I presume this section also means that club members may not use the collected common plants and animals in their club silent auctions. What about gifting a common plant or invertebrate during a club gift exchange? Does bartering mean that fossil interest groups may not trade collected fossil specimens? I don't have those answers. But to me the interesting aspect of this tenet is that the casual collector may not use his/her collected fossils for research! The federal agencies want the collector to get a permit if any of the fossils are used in a research project. I presume the point behind this requirement is to make certain that fossils in the research project are documented as to provenance and placed in an accredited repository. However, I would like to suggest that any casually collected fossils could be turned voluntarily over to a repository before results of the research are reported. A case in point---our rock club-sponsored Pebble Pups and Junior Scientists collect fossils and actually write up reports (sometimes published) and present results at meetings where abstracts are refereed. How can an agency expect a group of Pebble Pubs to submit a permit application (see below)?

Another set of questions, then, involves the definition of research. If a collector completes a study on a casually collected fossils and later presents information on such organisms at a rock/mineral club meeting---is this research? What if the collector "publishes" results of their study in a club or federation newsletter, or on a Blog---is this research? Questions to be answered. I do not want some of these restrictive clauses in the Rule to stifle the interest of our

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children and young adults. As with the USFS regulations, the Rule requires that only hand tools may be used in collecting fossils. These excavation tools may not be motorized and must be light and small enough to be hand-carried by one person. Does this mean that my geological hammer may not be carried in my backpack, or must it be hand-carried? Does it mean that I cannot bring along a two-wheel cart to pack a 25-pound specimen back to the vehicle (my knees will not allow carrying 25 pounds plus equipment)? Luckily, Interior listened to criticism directed at USFS over their regulation about size of collecting tools-- but not large tools such as full-sized shovels or pick axes. I don't have any trouble carrying a full-size shovel in my hand!

Unfortunately, Interior chose not to rid the regulations of the permitting process for small groups of rockhounds. I argued against this rule implemented by the USFS without success. As I read the rules, and perhaps they are beyond my comprehension, it is my understanding that groups of rockhounds heading out to collect some invertebrate fossils must have a permit. I can understand permitting a group of professionals going out to quarry a marine limestone looking for specific ammonites. I cannot understand requiring a permit in order for a club's fossil interest group, or a group of Pebble Pups, heading out on a beautiful fall afternoon to do some prospecting for fossils! If a group of Pebble Pups, some as young as six years old, go fossil hunting at a locality where both common and uncommon invertebrate fossils may be found, then a permit is required (as I try to understand the Rule). For example, I can envision local localities, actually a number of old quarries, where there is a mixture of common and uncommon lower Paleozoic fossils represented. These quarries have been prospected for years and rockhounds have almost always submitted their interesting specimens to museums and repositories. However, the permitting process is a very onerous experience for "ordinary" rockhounds, so what happens? Collection without a permit continues, with loss of interesting specimens heading to a museum due to a fear of prosecution, or collecting stops and children and adult rockhounds simply drop out.

Assume that a permitted fossil prospecting activity could be pulled off, please note that all prospectors must deposit their fossil finds in a designated repository. Can you imagine taking kids on a fossil hunt and then taking away their finds? In addition, the rules and regulations concerning report writing are onerous (for most rockhounds) and would require additional time.

As a former classroom instructor, I could not imagine applying for a permit every time I took my students fossil hunting. Certainly, a permit was required whenever a student researcher was out collecting fossils and describing stratigraphy---these collected fossils were deposited in a repository. In fact, during my early days of writing environmental impact statements (fossils) for projects crossing federal lands I devised my own permits (with approval from the agencies) from items like logging permits. I am not against permits; however, I simply want to allow for some slack with non-professional collectors.

In addition, mandating that all permitees must deposit their fossils in an approved repository creates other concerns since the requirements for establishing a repository are pretty stiff. Most colleges and universities with a scientific staff have something, a museum or curated collection, that could qualify as a repository. But what about the poor old group of rockhounds---would nearby repositories curate their specimens without monetary assistance (Permittee is responsible for the costs, monetary and otherwise, of the permitted activity, including fieldwork, data analysis, report preparation, curation of the collection and its associated records consistent with subpart C of this part)? I don't know. Once fossils are collected under a permit they remain the property of the Agency in perpetuity. Even if a federal authorized officer removes the collected fossils from the research collection the specimens still remain in repository collection "somewhere."

My comments pertain to only a small part of the Rule but are, in my opinion, most directly related to fossil collecting by rockhounds and other amateurs. I want members of our rock and mineral clubs, including Pebble Pups and Junior Scientists, to have an opportunity to collect fossils without fear of "breaking the law." I want these members to have an opportunity to study and photograph and learn about specimens without fear their work is research and requires a permit. I want members, especially younger members, to have an opportunity to present information at professional meetings about their fossils finds without fear their study requires a permit. But, I would also expect the mentors of

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the collector to require fossil specimens be offered to a museum and/or repository along with appropriate provenance information. I believe there must be some middle ground in this entire permitting and land disturbance issue. If not, we may begin to lose generations of future STEM graduates that our nation badly needs.

With that said, please note that I have several friends and acquaintances working in the federal agencies. In fact, I take pride in the fact that some Agency paleontologists were my students and we have remained friends for decades---they do excellent work. In visiting with these paleontologists, I have found they are, in their opinion, constrained by federal law found in the PRPA. Perhaps they are; however, I still believe in compromise and middle ground and "working things out." Is this possible with the rules in the PRPA? I don't know. Could interpretation of PRPA regulations be less "strict." I don't know.

What I do know is that these new laws (USFS) and the proposed Rule (Interior) are almost impossible to enforce---I am not advocating breaking the law but simply stating my strong opinion that collecting of invertebrate fossils on federal lands will go underground. Unlike vertebrate fossils, where poachers are interested in selling their unlawfully collected specimens, rockhounds collecting invertebrate fossils are interested in building up a personal collection, trading specimens with club members, and perhaps most importantly helping young children and their schools build collections. Also unlike the somewhat easily identified vertebrate fossils (yep, that is a dinosaur skull so leave it alone), invertebrate fossils are much more difficult to identify. I am guessing that most rockhound amateurs will have great difficulty identifying uncommon fossils (need a permit) from common fossils (casual collecting).

So, what advice can I offer? Take the time to read, or attempt to read, the Federal Register: https://www.federalregister.gov/documents/2016/12/07/2016-29244/paleontological-resources-preservation. After this little chore, rockhounds should submit personal comments, or even pooled comments by several members of the club; however, it is best to not use form letters. Also, remember as you comment:

> **Provide first and last name, city, state, & country. All other fields of information are optional. Keep in mind that much of this information is publicly viewable.**
>
> **Comments may be typed in the box provided or they may be uploaded as attachments (Word docs or PDFs only).**
>
> **Comments may be brief or in-depth/well-researched. Comments with facts to support them are much more useful (e.g., examples of overlooked scenarios). Keep comments civil and straightforward. Comments using offensive terms, threats, or other inappropriate language will be disregarded.**
>
> **Comments on the proposed rule must be received by February 6, 2017.**

And finally, stop in Agency offices (especially BLM and USFS) and visit with the geologists—they are a nice group of people. The paleontologists in both the USFS and the BLM are stationed few and far between. But again, if you are in their area stop in and converse with them.

Perhaps I am just a crusty old guy remembering "the good old days" of collecting. But perhaps I am just an old guy seriously worried about the impact of the Rule (and USGS regulations) on school children, Pebble Pups, rockhounds, and interested amateurs. I want to find a common ground with the USFS and Interior in the permitting processes, the land disturbance issues and the collecting limits. Will it happen? Another question that I cannot answer.

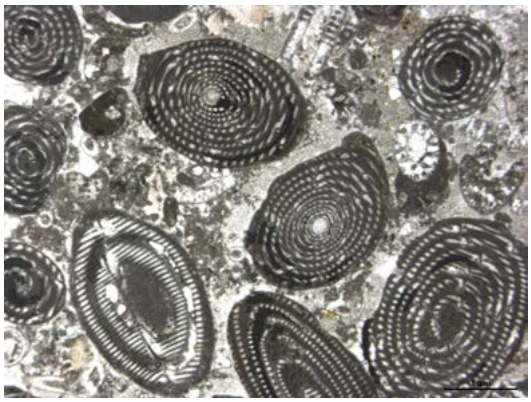
RESEARCH: LARGER BENTHIS FORAMINIFERA AND THE EOCENE-OLIGOCENE TRANSITION

by Laura Cotton

Laura Cotton

Larger benthic foraminifera are amazing but rather underappreciated fossils. They have a long geological history, ranging from the Palaeozoic to the modern day – in Okinawa, Japan, "star sand" can be bought as a souvenir, and those tiny star shaped sand grains are the larger foraminifera Calcarina and Baculogypsina. However, they are most well-known during the Eocene, where they occurred in huge, rock forming quantities and are the dominant component of many shallow water limestone deposits, including those in Florida. Large benthic foraminifera are single celled organisms with a calcareous test, or "shell," which has a complex and often very beautiful internal structure. As their name suggests, this test can get incredibly large – up to 15 cm, and is still a single cell. One of the reasons they are thought to get so big is because they have photosynthesizing symbionts, allowing them to get more energy than from just eating. This is also the reason they developed such complex test structures, to enable symbionts to be moved around the test and help regulate the light they receive. The presence of photosymbionts means that larger benthic foraminifera favor a similar environment to corals, the shallow marine photic zone (about < 100 m) in tropical regions. It also means that they are susceptible to environmental change, making them very useful for tracking the effect of climatic changes in the shallow water through geological time.

Large forams



Thin section view showing the internal structure of Alveolina forams

The Eocene (56 - 33.7 million years ago) was a dynamic interval of Earth's climatic history. After a peak in temperatures at the beginning of the Eocene there is a gradual global cooling trend, interrupted by a short warming episode in the middle Eocene, and culminating in a rapid cooling known as the Eocene-Oligocene transition. This transition event consists of an approximately 500,000 year-long cooling interval, associated with changes in ocean circulation and the first glaciation of Antarctica (see Coxall and Pearson, 2007 for detailed review). It is also associated with a large number of extinctions in both marine and terrestrial ecosystems, including within the larger benthic foraminifera. Several genera with long global fossil records appear for the last time around this transition event. For a long time, it was thought that a sea-level fall due to water becoming locked away as ice during the Eocene-Oligocene transition was responsible for the larger benthic foraminiferal extinction. However, it is often difficult to correlate the shallow water larger benthic foraminiferal record to the deep-water climate records. This is because preservation in limestones is often not good enough for geochemical analysis and the planktonic microfossils which are frequently used to date marine sediments live in the open ocean and mostly do not occur in such shallow marine sediments. Thus the exact timing of the larger benthic foraminiferal extinction with respect to the Eocene-Oligocene Transition, and therefore the extinction mechanism, remained uncertain.

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My research used material from three on-shore drill sites from the Kilwa District in southern coastal Tanzania which contain beautifully preserved small calcareous fossils, including planktonic foraminifera, molluscs, bryozoans, nannofossils, and larger benthic foraminifera. The sediments recovered in the cores continuously span the Eocene-Oligocene transition, allowing high resolution geochemical and micropalaeontological studies to be carried out across this interval. The presence of well-preserved planktonic foraminifera and nannofossils in this material, along with the larger benthic foraminifera, made it a unique site for correlating the larger benthic foraminiferal occurrences to the global climate record and therefore to gain some insight into how shallow water environments respond to major climate events. Geochemical studies using oxygen isotopes and ratios of magnesium and calcium were carried out by my colleagues on the planktonic foraminifera and small benthic foraminifera to determine the exact levels in the record that the temperature change, and sea level fall occurred (Pearson et al., 2008; Lear et al., 2008). The identification and ranges of the larger benthic foraminifera from the same samples were then determined.

Drill rig in Tanzania

The results were surprising: rather than showing an extinction level at the same as the sea-level fall, the extinction occurs 200,000 years prior to this - during a relatively stable time in the temperature record (Cotton and Pearson, 2011). It is also almost exactly the same level as an extinction in the planktonic foraminifera, despite their inhabiting different parts of the ocean. One possible mechanism for this may be that the changes taking place in ocean circulation cause the water column to be less stratified and more nutrients to occur in the surface and shallow waters. Since both the planktonic foraminifera and larger foraminifera like low nutrient clear water environments, this may have been detrimental to them.

Recently I have been looking at the molluscs from these same samples, and unlike many other organisms, the molluscs show increasing diversity and numbers from the onset of the transition. The nannofossil record also shows a change to an assemblage that likes a more nutrient-rich environment; increased nutrients could also be a reason for the increase in molluscs and lends some support to the potential high-nutrient extinction mechanism for the foraminifera. However, more sites are needed to see if there is a similar pattern elsewhere.

Collecting forams in Tanzania

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In January 2016 I will be joining the Department of Geological Sciences at the University of Florida and the Florida Museum of Natural History to continue this research. Florida is full of larger benthic foraminifera from the Eocene and Oligocene, but the assemblages and extinction pattern here are quite different from other areas of the world and not well constrained compared to the climatic events. The lepidocyclinids (another group of large forams), which are common in the Ocala and Marianna limestones, survive the Eocene-Oligocene transition, while taxa with a similar morphology in the rest of the world go extinct. So, the next step in my research is to see what is happening over this interval in the Americas, how it compares to the rest of the world, and why these differences occur. Hopefully I will be able to update the myFOSSIL community on this in the future!

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FORAMINIFERA AND THE CUSHMAN FOUNDATION

by Jere H. Lipps, President, Cushman Foundation for Foraminiferal Research, Inc.

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Microfossils have perhaps one of the best fossil records of any group of organisms. These tiny fossils include whole skeletons or parts thereof so small that they cannot be seen by the naked eye and thus a microscope of some kind is required to see them. They include representatives from most phylogenetic groups—animals, plants, protists, algae, and various microbes (Fig. 1). Many of them are particularly useful in biostratigraphic, environmental, and paleoceanographic interpretations going back about ½ billion years. Bacteria and algal eukaryotes go back even farther, some to the origin of life itself at nearly 4 billion years. Single-celled protists with skeletons, like foraminifera, radiolaria, diatoms, coccoliths, tintinnids, silicoflagellates, and others, are abundant in both marine and nonmarine Phanerozoic rocks.

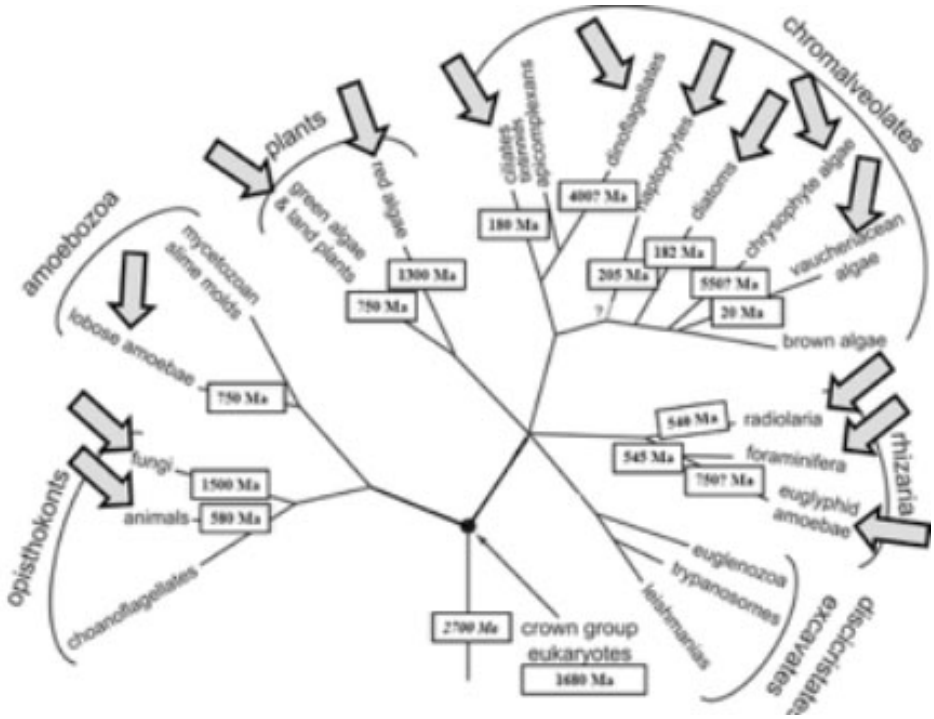

Figure 1. Distribution of microfossils (arrows) across the Eukaryote groups

Microfossils are not commonly collected by avocational paleontologists, although in the past, people with microscopes, like doctors or their spouses, collected diatoms (micro-algae with siliceous skeletons) and arranged them on glass slides into pictures formed by their unique shapes and patterns. These were traded among the advocates. Foraminifera (forams) were rarely collected by amateurs, even though they are easily retrieved from marine rocks exposed in most places in the world and have been around since the latest Precambrian. Forams also are perhaps the best known microfossils because they have been intensely studied scientifically in geology since the late 1800s for biostratigraphic and paleoenvironmental interpretations, particularly in the oil industry, and more recently in modern ecology and biology, including phylogenetics.

Forams (Fig. 2) are diverse and super-abundant compared to larger fossils, so much so that statistically-valid samples are easy to collect and prepare from small hand or core samples. They have occupied every marine habitat from the very deepest oceans to the shallowest pelagic and near-shore. They have been critical in biostratigraphy of marine strata as old as the Ordovician, and they also provide environmental inferences of wide interest, having been used to detect ancient climate change, earthquakes, tsunamis, pollution, invasions of exotic species, function, extinctions, and ocean chemistry and productivity. They have been common rock-forming organisms as exemplified by fusulinid (foram) limestones, nummulitic (foram) rocks forming the pyramids of Egypt (Fig. 3), the oozes found in the deep sea, some beach sand (star sands), and many others. Although most are smaller than a pin head, some forams are quite large, especially for single-celled organisms, ranging up to about 10 cm long. Even though they are single cells, forams have a well-documented evolutionary history that rivals any known from animals or plants, and that record matches the evolutionary events inferred for these larger organisms.

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Figure 2. A living foram, Alveolinella quoyii from the reefs at Papua New Guinea, showing the calcified test (shell), the anastomosing pseudopods with granules (characterizing the group) arrayed in the direction of movement and shorter ones at the other end and along the sides that stabilize it. Like all forams, it eats bacteria, algae and possibly some small animals. This kind also harbors dinoflagellate symbionts inside its test that photosynthesize, allowing the foram to grow larger.

Figure 3. The pyramids of Egypt are made of Eocene foram Nummulites (inset) limestone.

For many years, the oil industry employed thousands of foram workers worldwide to assist in the discovery and recovery of petroleum at depth in the earth's crust. One of the first workers to demonstrate their usefulness in finding oil was Joseph Augustine Cushman (Fig. 4), who began working with forams in 1910 and soon started with an oil company in Mexico where he demonstrated the usefulness of forams in oil exploration. He then established a laboratory of foram research in Sharon, Massachusetts, and in the next 40 years published over 700 papers on forams in a variety of journals, including his own Contributions from the Cushman Laboratory for Foraminiferal Research. He described hundreds of new genera and species, their occurrences in modern sediments, their biostratigraphy, and their classification. He established foram micropaleontology in America after it had prospered for 100 years previously in France, England, and Germany. J. A. Cushman died in 1949 bequeathing a huge collection of forams (0.5 million; 150,00 slides) from all ages and around the entire globe as well as 4000 library items among others to the Smithsonian Institution. He was deeply admired by foram workers who then wished to continue foram work, based chiefly at the Smithsonian's Natural History Museum in Washington, DC, where his collection of forams and library were deposited. His material is now curated in the Cushman Room at the Museum. See http://paleobiology.si.edu/cushman/index.html for more information about Cushman and his life.

Figure 4. Joseph Augustine Cushman in 1920. Photo courtesy of the Smithsonian NMNH Department of Paleobiology's J. A. Cushman Archive

Thus, in 1950, members of the staff of the USNHM, particularly Al Loeblich, Jr. and his wife, Helen Tappan (Fig. 5), and Ruth Todd, among others, established

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the Joseph A. Cushman Foundation for Foraminiferal Research, Inc. based at the Smithsonian. It initially published the Contributions from the Cushman Foundation for Foraminiferal Research, closely reminiscent of Cushman's own publication series. After 20 years, the Contributions were renamed and reformatted as the Journal of Foraminiferal Research, now in its 46th annual volume. The Foundation itself has existed now for 66 years under the guidance of a 15-person Board of Directors. It provides student research and travel support, awards to advanced scholars, and the Joseph A. Cushman Award for Excellence in Foraminiferal Research, as well as other services for foram and paleo workers including an informative website (http://www.cushmanfoundation.org/) on foraminifera. Membership is open to anyone interested in forams and we welcome the amateur community.

Figure 5. Joseph Augustine Cushman (center) and two of the founders in 1950 of the Cushman Foundation for Foraminiferal Research, Inc., Alfred R. Loeblich, Jr. (left), and his wife Helen Tappan (right). Photograph taken on the steps of Cushman's Foraminiferal Research Laboratory in Sharon, Massachusetts in 1946,courtesy of the Smithsonian NMNH Department of Paleobiology's J. A. Cushman Archive

FEATURED FOSSIL: COOKIE CUTTER SHARKS IN FLORIDA!

by Victor Perez, Florida Museum of Natural History

Recently, the Florida Museum of Natural History received a donation from Ken Marks. The donation included a handful of microscopic shark teeth (~5mm in vertical height), which represent the genus Isistius or more commonly known as the cookie cutter shark. These sharks are so named because of the distinct bite mark they leave behind on their prey. Cookie cutter sharks will latch onto their prey, which are often large bodied marine mammals such as whales and dolphins. The shark will then rotate its body rapidly, removing a circular (i.e., cookie-shaped) chunk of flesh from the prey that eventually heals.

This donation by Ken Marks represents the first record of this genus from Florida. If others have found representatives of this genus in Florida, we would love to hear about them! These additional occurrences will be included in a publication and aid in filling out our understanding of shark communities through time.

If you have any questions or information that you'd like to share please contact Victor Perez at victorjperez@ufl.edu.

FOSSILS: FACT OR MYTH?

by Joyce Drakeford, Friends of the Aurora Fossil Museum

We have all heard things in the fossil world about fossil collecting and wondered if it was true. Well, here are a few top questions I received answered for you!

Is there really such a thing as a honey hole?

MYTH. There are no true places where a limitless amount of fossils will be found every time. In reality when fossil hunting from in situ locations, Dr. Robert Boessenecker notes, that finding a few nice teeth in a location are more about environmental factors such like erosion rate rather than actual fossil abundance. However, some of those factors, particularly in waterways, can cause loose deposits of fossils to erode out of the formation and land in a specific location in higher volumes. Victor Perez adds that consistency of the stratigraphy is also a large factor. Stratigraphy varies everywhere.

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Hollow fossilized teeth are teeth that remained when the shark died.

FACT. It is the consensus among experts that the majority of the hollow teeth that are missing roots are those that did not fully develop during the animal's life. Victor Perez states, "In sharks, teeth are replaced in a conveyor belt fashion, and during the tooth formation the enamel is created before the dentin and root. So when the shark dies, those teeth that haven't fully formed yet can be preserved leaving behind the enamel." The enamel is the strongest part of the tooth. So there are a small percentage of teeth that have had the root broken off and the dentin has worn away.

Specimens that have a hazy, foggy, matte or silver sheen have been digested.

MYTH. It is almost impossible to tell if a tooth has been digested or not. It is more likely that a tooth with those characteristics have been subjected to a slew of environmental factors. Two of those are having been reworked and being naturally exposed to acids in the soil.

Lower fossil shark teeth are not found as often because they are swallowed/digested more than upper teeth.

FACT and MYTH. The majority thought this was a good possibility but not necessarily because of digestion. Dr. Ronny Leder feels there is truth in this statement. "It is true that lower teeth break generally more easy because they have to hold the prey whereas that upper jaw teeth saw or cut. From that perspective you should find more lower jaw teeth. But even in our collection at the FLMNH shows the same pattern, nearly half the number of lower jaw teeth."

If dirt is not collected from the layer it is not called matrix (i.e. Aurora spoil pile).

MYTH. "Matrix is very general term," advises Victor. The professionals agreed that soil, sediment, dirt and reject (spoil pile) are all interchangeable terms.

Photos taken of fossils where they are found are in situ.

MYTH. In situ refers to the fossil in the formation exactly where it was fossilized. Most shark tooth and other fossils we find on the East Coast have been moved in some way. When you photograph your fossil where you find it, it is referred to as float due to reworking.

Megalodon and pathological teeth are rare.

MYTH. "It is a common misconception that Megalodon teeth are rare when in fact they are relatively common." says Victor. Pathological teeth are also not rare. A tooth can be pathological due to damage or genetic mutation. Due to the immense number of teeth produced in a shark's lifetime and continuing to be produced in a deformed manner, this type of tooth can actually be quite common.

I would like to send a HUGE thanks to Victor Perez, Dr. Ronny Leder, Dr. Bruce MacFadden and Dr. Robert Boessenecker for taking time out of their very busy schedules to assist me with this article. If you have any other questions you would like to see answered please send an email to auroramusfriends@gmail.com.

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EDUCATION: USING myFOSSIL TO TEACH STUDENTS DATABASING

by Gabriel-Philip Santos, Raymond M. Alf Museum of Paleontology

"It was really cool to learn about the myFOSSIL data base. At first it was confusing, but after I figured it out, I could do like eight specimens in an hour. The only complicated part was the picture-taking - it took forever for bigger files to send over email from my phone to the computer!" Izzy Gerard, student

How do you teach a high school student to enter specimens into a database? That was the question that came into my mind when I was asked to help teach students about curation at my museum.

Gabriel Santos, photo credit Cal State Fullerton

Sorry. A little background first. My name is Gabriel-Philip Santos. I am a paleontologist and the collection manager for the Raymond M. Alf Museum of Paleontology, the only nationally accredited natural history museum on a high school campus–The Webb Schools, an independent school in southern California. At the Alf Museum, we offer our students many classes to learn about the science of paleontology and an after-school program where students can learn about the "behind-the-scenes" part of museums. I wanted my students in the after-school program to learn how we keep track of 170,000+ fossils and associated data and why it's important we do so (we are currently using Microsoft Access, but transitioning to Specify). This is what brought me to my question.

Now, it seems like my question has a simple answer, right? Get the students on the computer and show them step-by-step how to input specimen data into the database. That's how I teach my museum volunteers. But the more I thought about it, the less I thought how simple it was really going to be. First of all, we only have one database workstation. When I'm teaching one volunteer, this is fine, but for a class of 10 students, that probably wasn't going to work. Then there was specimen entry. Entering specimen data (specimen ID, locality information, preparation records, etc.) into our database is a very detail orientated process. There are so many data fields and thus many chances for important data to be lost during the process. I had hoped to give my students a hands-on experience in databasing, but if I had to monitor each student during a one-on-one teaching session, this idea was never going to work. What I needed was a simplified version of our database for students to practice on from multiple workstations that I could go back into and check their work. Unfortunately, I could not think of anything that fit that description. So, my question of how to teach students to database remained unanswered, and my idea of a hands-on learning experience shelved.

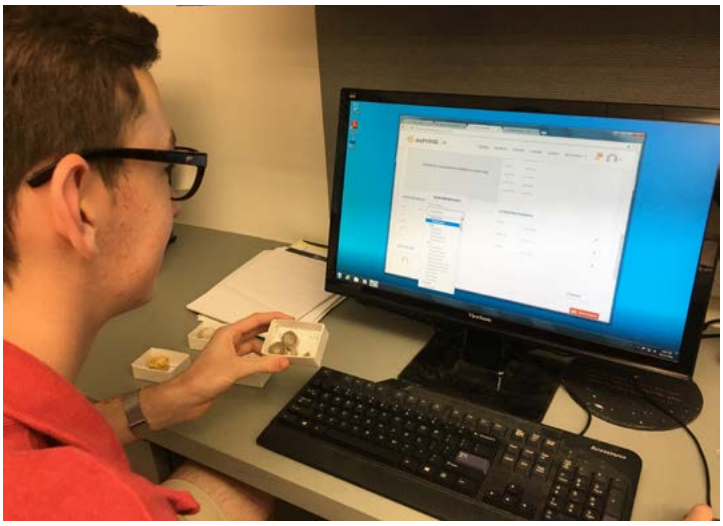

Photo courtesy of Gabriel Santos

Flash-forward to a couple months later, I was on my way to an education workshop at the 2016 Geological Society of America annual meeting in Denver put on by the FOSSIL Project. It was here that my question was finally answered through the form of the myFOSSIL community online database! Throughout the workshop, we were taught the basics of how to use the database and become contributors to the growing online collection by inputting our own fossil data. As we were taught by the amazing folks behind the myFOSSIL project, I couldn't help but imagine doing nearly the same thing with my students. The myFOSSIL online database had everything I could need to effectively teach my high school students the basics of databasing. The program interface was streamlined, with only the

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essential data fields. The data input was very easy to use. And best of all, everything was done online, so I could have my students working from classroom computers while I guided them along from mine. Once the workshop ended, I couldn't help but be excited to return to my museum and get the students started on the myFOSSIL database.

So now the question on you probably have for me is, "How did you teach high school students to catalog specimens into a database?" Well, since this was going to be kind of an experiment, I decided to start by asking only five students to give databasing a go. Once I knew who was going to be part of my trial, I then selected a group of fossils from the Alf Museum collection that had reliable locality information, identifications, and age estimates. This way the students just had to focus on data entry in the beginning and not have to worry too much about verifying the data; that came later. I gathered everything together, I had the students all sign up for a myFOSSIL account and began the experiment.

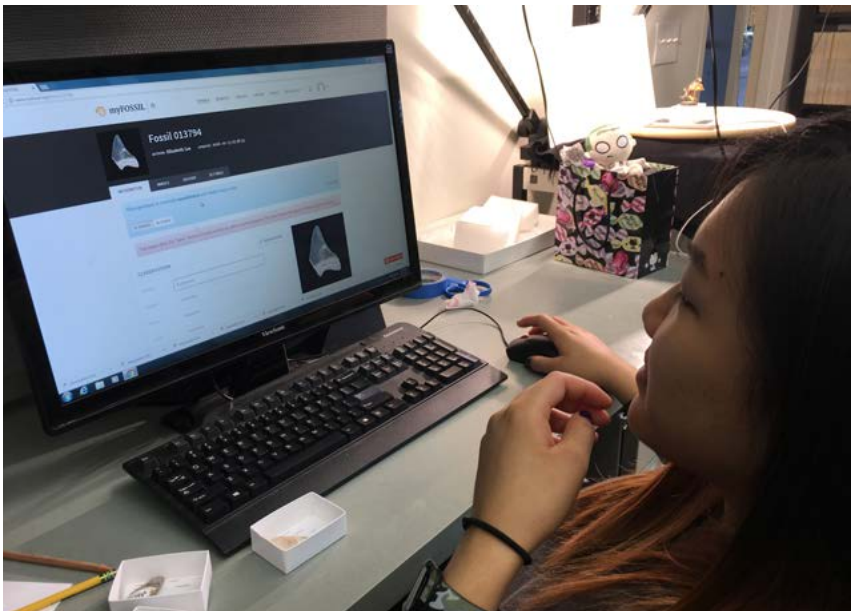


Photo courtesy of Gabriel Santos

So how did it all go? Well, not bad, actually. All of the students had a great time learning how to use the myFOSSIL database, and I like to think they got a basic idea of why databases are so important for museums. That's not to say I didn't have any bumps in the road. For one, I am definitely going to be creating a formalized document that lists the data entry procedure for students to reference. Having me guide them was a little difficult as I had to run between computer stations while still attending to the other students working on other curation projects. I also think I will do a whole class dedicated to specimen photography before having students learn to database. Some of the photographs that the students took and uploaded were admittedly not the best and a few needed some reshoots.

In the end, I am so happy and thankful that the wonderful scientists at the FOSSIL project took the time to create the online database and myFOSSIL community. Most educational resources available to "paleo-educators" (educators who teach paleontology, not people who teach the paleo-diet!) are designed to teach people about the broader scientific concepts like evolution and deep-time. Rarely are there resources for educating people on the more technical side of paleontology or even just museum science in general. As a collections manager, I think having people learn about why we preserve and catalog specimens is just as important as having them learn about the fossils themselves. Now with the myFOSSIL database, I have an amazing tool to ensure I can do just that and maybe inspire some future collection managers in the process.

To learn more:

Read about Gabriel's work at the museum here.

Learn about his graduate research in this Cal State Fullerton publication.

The GSA short course that inspired this article is described here.

PALEOART: STEVE HUTCHENS

Suzan and Steve Hutchens
photo credit FLMNH

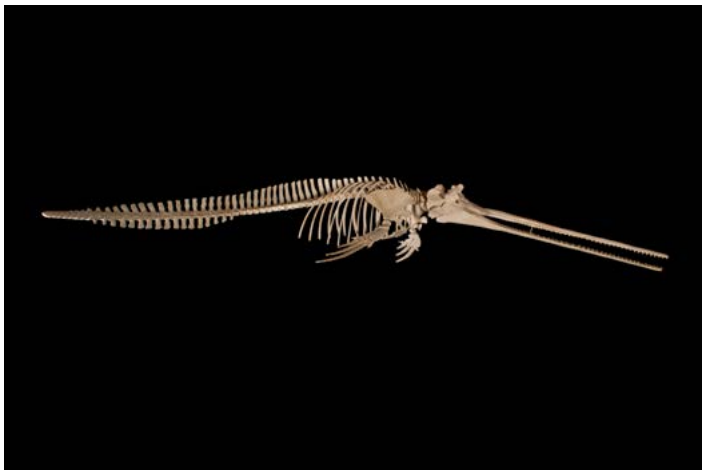
I *am delighted that we are featuring Steve Hutchens for the Paleoart article. I have known Steve for more than 25 years. Steve is an extraordinarily talented sculptor, preparator, and avid fossil collector. More than a decade ago, when we were building the Hall of Florida Fossils at the FLMNH, many of the vertebrate skeletons now on display there were fabricated by Steve, with assistance from his wife Suzan. I am also humbled by Steve's ability to find fossils in the field that professionals like me cannot see, as well as being grateful that he has donated those of scientific importance to our museum. Previously from Florida, Steve and Suzan--who is also an avid and skilled fossil collector herself--now live outside Chadron, Nebraska, where on numerous occasions they have welcomed us to their farm and shown us wonderful examples of Steve's artwork*. Bruce J. MacFadden

by Shari Ellis

Steve traces his interest in prehistoric animals back to his childhood growing up near Boca Ciega Bay outside of St. Petersburg, Florida. It was easy to find horse and shark teeth nearby, and his parents encouraged his interest. In terms of his artistic knowledge and skill, Steve learned much from his father who was a custom woodworker and sculptor in his own right. Steve spent his life doing woodworking and carving and, for many years, had a business in St. Petersburg carving wooden birds for homes and restaurants.

Steve and Suzan became involved with the Florida Museum of Natural History in the mid-1990s when they started to volunteer in the Vertebrate Paleontology prep lab—which they tried to do as much as they could, at least once a week. Around that time, the museum needed an Equus mount and—with the encouragement of Bruce MacFadden—the couple bid on the project.

Steve and Suzan were then asked to create displays for the new exhibit "Florida Fossils: Evolution of Life and Land." When asked which of the 18 or so mounts they created for the exhibit he was most proud of, Steve had a hard time picking one. When pressed, he selected the "beaked dolphin" (*Pomatodelphis inaequalis*) because that one required that he reconstruct the skull from small fragments along with casts of other pieces they had in the collections; the rest of the body, flippers and all, is a metal sculpture.



Steve's reconstruction and scupture of Pomatodelphis inaequalis

Steve had an easier time identifying which of the mounts he found most challenging—the giant armadillo! All of the osteoderms arrived in bags and boxes with no directions whatsoever. As he worked with the material, Steve came to recognize the "rhyme and reason" where each piece fit. Reflecting back on the experience, Steve chuckled and said,

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"Now I know how they go together if I ever had to do it again." Steve also reconstructed a baleen whale skull found in the Bradenton, Florida, area. He re-built the many significant parts that were missing, then made a mold and a replica now housed at the Smithsonian Institution.

Steve recently completed a Titanis walleri (terror bird) sculpture for the South Florida Museum that took him over two years to complete—longer than any other project he has undertaken. This project started without any fossil bones to work from; instead, Suzan gathered research papers from which they created drawings, then moved on to wood carvings covered with epoxy clay. As with other projects, this piece involved a good deal of metalwork as there is an internal metal armature supporting the structure and the whole thing can be disassembled—which proved to be critical when it came time to ship the seven foot tall sculpture.

Now based in Nebraska, Steve stays busy working on his ranch and sculpting. Some of his most recent projects started as large blocks of Styrofoam that were to be thrown away.

Steve in his Nebraska studio

Some of his most recent sculptures

He also spends much of his time preparing fossils for people collecting in the Badlands, including teachers who participate in a summer program run through the South Florida Museum supported by the museum's board member Jim Toomey.

We asked Steve to reflect on what is required to be a good preparator, and also for any advice he would give youth interested in a career in paleoart. He said that, while he had just a high school degree, he had been a craftsman all of his life. Also important is a willingness to learn anatomy, because an artist cannot produce realistic depictions without an understanding of form and function. In his words, "you need some sense of how a skeleton works, how teeth work, how the bones work together, so when you look at something you have some understanding of what makes it tick… and patience!"

His advice for youth was very encouraging—"Never give up! Follow your interest and if you have enough interest it will keep you going. Don't be afraid to try new things. Volunteer at your local museum; it will provide huge opportunities to learn things and people get to meet you and see what you're all about. Always do your very best no matter whether you are getting paid for it or not. That's beside the point. Always do the very best you can. And that applies to everything."

FLORIDA MUSEUM SEEKS VOLUNTEERS TO COLLECT 5-YO-6-MILLION-YEAR-OLD FOSSILS

by Rachel Narducci and Richard Hulbert, FLMNH

Each year, the Division of Vertebrate Paleontology (VP) at the Florida Museum of Natural History (FLMNH) holds at least one 'in the field' event, requiring a volunteer effort to help dig for and collect fossils in Florida. Since 2000, volunteer digs occurred at the early Miocene Thomas Farm Site, the late Miocene Tyner Farm Site, the early Pleistocene Haile 7C and 7G sites, and the late Pleistocene Millennium Park Site. Collectively, these digs have produced many thousands of scientifically valuable fossils now housed in the museum collection.

Volunteers working at the Montbrook site. Photo courtesy of Jeff Gage/FLMNH

In early November of 2015, a five-year-old girl and her grandmother were walking around the family's property near Williston looking for chert artifacts. The pair stumbled upon a pit, which had been used to excavate clay for road repairs. Shortly after entering the pit, instead of chert they discovered vertebrate fossils. Through a succession of interactions, news of this discovery reached the VP Collections Manager, Dr. Richard Hulbert. After receiving an image of the first fossils discovered, he drove out to the locality and not only found fossils at the surface but also in-situ. An excavation began the very next day.

Within the first year, 227 volunteers and VP staff dug on 150 different days (41% of the year), recovering 10,000 identifiable fossils and discovering 60 different species! During this time, the locality was named after a nearby defunct town, 'Montbrook', and the age was narrowed down to the latest Miocene to earliest Pliocene geological epochs, which occurred 5.5- to 4.5-million-years-ago.

Fossils found at Montbrook include both aquatic and terrestrial species, including pieces of the shells of two types of turtles, Trachemys (slider) and Apalone (soft-shelled turtle), gar fish scales, an alligator osteoderm, and a gomphothere (elephant-relative) metapodial. Photo courtesy of Rachel Narducci.

The Montbrook Site is very productive and almost all volunteers will find some fossil specimens on their first day. The most commonly found fossils are partial to complete freshwater turtle shells and vertebrae, spines, scales, and skull bones of fish, including gar, catfish, snook, and drum. Shark and ray teeth, and fossils of alligators, birds, and mammals are also found, but less frequently. Of the mammalian remains, the most common are from gomphotheres, which are elephant relatives. Isolated bones and teeth are typically found, with fewer articulated skeletons, strengthening an idea that a flowing river may have scattered the remains after death and decay of the soft tissues.

Montbrook is the first late Hemphillian (North America Land Mammal Age) site found in north Florida. It is located about 120 miles north of the Palmetto Fauna, the state's only other source of late Hemphillian fossils. Unlike that region, Montbrook is producing more complete specimens and contains the first significant terrestrial small vertebrate fauna of this age from Florida. The Palmetto Fauna is rich in marine species, while the aquatic species discovered at Montbrook are mostly from freshwater habitats. It appears that Montbrook is providing the first direct evidence of its age about vertebrate life in a coastal river and adjacent habitats in the Southeastern United States. This means

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we are digging into the unknown; we may have already discovered new species or species venturing further from their currently believed geographical ranges.

The fossil dig site is located on private property and the owner has been extremely generous in allowing access but endless extensions to our access cannot be expected; time is of the essence. Volunteers are needed to help with the excavation. Without the volunteer effort, 10,000 identifiable fossils and 60 different species absolutely would not have been recovered within the first year. Discovering fossils from a red panda is possible with the age and environment of this locality. It would be the southernmost occurrence and the third record of this creature in North America. The more dirt we move the closer we may come to this possibility. Volunteers are also needed to help in the lab and collection, preparing specimens out of plaster jackets, screen washing, rebuilding, and cataloging/identifying fossils from Montbrook.

Alex uncovering a gomphothere tusk. Photo courtesy of Rachel Narducci.

Making an elephant jacket. Photo courtesy of Rachel Narducci

Digging at the Montbrook fossil site will end for the Fall 2016 season on Sunday, December 18th. Almost all of the dates leading up to this are now full thanks to so many amazing volunteers. After a holiday break, we will begin digging again, 6 days per week on Saturday, January 14th, 2017 until early May 2017. There is no cost to volunteer and all digging and collecting equipment will be provided. Volunteers must be at least 15 years old, able to work outdoors for several hours, and physically fit enough to kneel/dig within a 1 meter by 1 meter square and carry buckets of dirt out of the pit. Volunteers can work just a single day, a few days, or a regular schedule one or more times per week. If you are interested in volunteering at the Montbrook Fossil Dig follow the links below or email the coordinator of the volunteer effort, Rachel Narducci: rnarducci@flmnh.ufl.edu.

For more information and the volunteer application with digging dates:

http://www.flmnh.ufl.edu/vertpaleo/volunteering/field/

http://www.flmnh.ufl.edu/museum-voices/montbrook/get-involved/

For more information about the locality and images:

http://www.flmnh.ufl.edu/florida-vertebrate-fossils/sites/mont/

Rachel Mussetter, a teacher volunteer, successfully created and removed a plaster jacket from the fossil site. The plaster jacket allows the fossil and surrounding dirt to be brought back to the lab where it will be carefully prepared. Photo courtesy of Rachel Narducci.

"FOSSIL NEWS" MAGAZINE RETURNS: EXTINCTION IS NOT ALWAYS FOREVER!

by Wendell Ricketts

The first issue of *Fossil News*, a twelve-page, black-and-white newsletter, appeared in January 1995. Since then, nearly twenty-two years have passed, but *Fossil News* has never stopped evolving.


FOSSIL NEWS
and Amateur Paleontology

$3.00

DUCKBILL DILEMMA

In This Issue

First page of the very first issue of Fossil News, January 1995. Used by permission.

The founding editor of *Fossil News*—the avocational paleontologist, science educator and, currently, editor of the online *Journal of Accessible Sciences*, Joe Small—remained at the helm of his creation for three years. The photos in those early issues were sometimes fuzzy, typos weren't uncommon, and the layout was occasionally a bit haphazard. But looking back at them today, two things shine through: First, Small's commitment to creating community among fossil "enthusiasts" and, second, the generosity of the young magazine's volunteer writers, artists, long-time avocational collectors, and friendly professionals who shared their vast information and experience with readers.

When Colorado-based author, artist, and museum specialist Lynne Clos took over the magazine in 1998, she increased the number of pages per issue, introduced color to *Fossil News*, and officially changed the publication's subtitle from *The Journal of Amateur Paleontology* to *The Journal of Avocational Paleontology*. The new name, which aligned *Fossil News* even more closely with the concept of the "citizen scientist," stuck, lasting not only through the fourteen years of Clos's editorship but on into the present.

During Clos's tenure, *Fossil News* continued to attract a stable of loyal contributors that included Marc Behrendt, Alan Debus, Steve Brusatte, Sally Day, Glenn Mattei, and many others (some of them are still writing for *Fossil News* today), and its national and international subscriber base grew steadily. The articles that appeared in *Fossil News* were lively and diverse, representing the interests of fossil collectors and aficionados with nearly every imaginable "specialty": the Ashfall Fossil Beds, Middle Silurian cystoids, Florida fossil turtles, Mesozoic plants, eurypterids, "terror" birds, Devonian brachiopods, T. rex, mastodons, Green River stingrays, lots and lots of trilobites, scores of book reviews, and countless other topics.

Flexicalymene meeki, Corryville & Foot-long Isotelus maximus: Two of the many Ordovician trilobites that Marc Behrendt described for Fossil News readers over the years; these are from his July 2000 and July 2004 articles, respectively. Used by permission.

When Clos stepped back from *Fossil News* in 2012, the magazine seemed to have reached its natural end—but extinction isn't always forever.

After a several-year hiatus, *Fossil News* returned in Spring 2016 as a 52-page, full-color quarterly. Our subscribers recently received the journal's fourth issue, Winter 2016, bringing the first year of the "new" *Fossil News* to a close.

Though the magazine's look and format have changed considerably over more than two decades, *Fossil News*' mission has not. We remain dedicated to providing interesting, good-quality information to anyone with a passion for paleontology and to connecting fossil collectors at all levels of experience - both with each other and with professional paleontologists, science writers, educators, curators, preparators, and other experts.

Fossil News has also renewed a commitment to the magazine's mission in several important areas. First, we want to make sure that whatever we publish about paleontology, fossils, and fossil collecting exists in the broader context of reliable, accessible science education and information. That's why we do our best to work with writers who are

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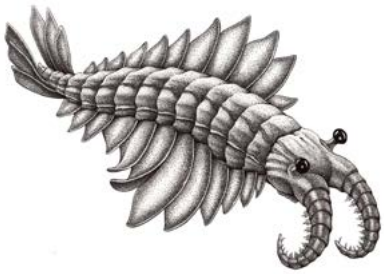
well-versed in their fields and whose perspectives are based in experience and research. As we tell potential authors: Explain it well, and readers will understand. Don't dumb it down and don't hold back!

Second, we're constantly impressed by the astonishing quality and variety of paleoart that is being produced today, both by means of traditional media, including photography, and through the use of ever more sophisticated design and drawing software. Because of that, *Fossil News* makes it a priority to showcase the work of paleoartists in every issue. We've worked with Norwegian artist Esther van Hulsen; the UK-based paleo-illustrator Gareth Monger; native Atlantan Daniel Eskridge; and Aaron John Gregory, co-owner of the T-shirt company "Cotton Crustacean" in Santa Cruz, California. Our Winter 2016 issue includes a "PaleoGifts" special section that highlights the work of toy makers, photographers, conceptual artists, clothing designers, jewelry makers and others, all of whom produce, in one medium or another, what can be called paleo-inspired art.



Anomalocaris by Aaron John Gregory

Finally, *Fossil News* is convinced that anyone involved in disseminating fossil-related information today has a responsibility to acknowledge fossils as a natural resource and to behave accordingly. As such, though some fossils are obviously more common than others, they are not infinitely exploitable. Properly protecting and safeguarding fossil resources means understanding the difference between "endangered" and common fossils and distinguishing sites that deserve to be sheltered from those that can stand unrestricted traffic. In some cases, that may include accepting sensible regulations and limitations on collecting and taking a clear-eyed look at the ethics and impact of a commercial fossil market that is all but completely unregulated.

For individual collectors, proper tutelage of fossil resources means treating their collections with care and seriousness, including maintaining complete and accurate records. This means not over-collecting just because fossils are abundant, and perhaps becoming a little more willing to share their surplus with schools, museums, and educational programs.

Above all, as fossil sites succumb to development, are "collected out," end up on private property, or are turned into pay-to-play attractions, there's a significant risk that casual, non-commercial collectors will be shut out of their "avocation." That's a big problem with no easy solution, but depending upon the diminishing ability of fossil clubs to host collecting trips for an increasing number of interested parties isn't a long-term answer either. These are all conversations we hope to deepen in the pages of Fossil News in the coming months.

As the "new" *Fossil News* officially concludes its first year, we can boast of subscribers in England, Scotland, Belgium, Australia, Canada, Switzerland, Italy, and Norway, as well as in thirty American states. We've made a special effort to ensure that our content is international in focus, with articles by British ichthyosaur expert and paleontologist, Dean Lomax, and other reports and features by Scottish, Italian, Cuban, and Norwegian scientists, artists, and collectors (though most of our writers are here in the U.S.).

In the coming months, look for us at the 22nd Street Show in Tucson—and don't forget that a subscription to Fossil News makes an exceptional holiday gift. Information about subscriptions and discounts is available from https://FourCatsPress.com/FossilNews/How-to-Subscribe.

The covers of the first four quarterly issues of the "new" Fossil News

FOSSIL PROJECT UPDATES: WINTER 2016

by Eleanor E. Gardner

The past few months have been very busy for the FOSSIL Project team!

In September, Bruce MacFadden was officially announced as President-Elect of the Paleontological Society. For more information about this, see his new column "News from the Paleontological Society" in this issue.

On October 22, Victor Perez and fellow graduate student Sean Moran helped to run the fossil shark pop-up exhibit portion of the UF Cultural Plaza Festival. At the pop-up exhibit, visitors interacted with professional and amateur paleontologists and received identification help with their own fossil collections. Later, on November 17, Victor gave a talk about the FOSSIL Project to the Fossil Club of Lee County at their monthly meeting. If you'd like to have a FOSSIL-sponsored speaker come to your club/society meeting, please contact us at fossil@flmnh.ufl.edu.

Sean Moran at the UF Cultural Plaza event

Before moving back to Germany on November 28 to start his new job as a museum director, Ronny Leder participated in his last U.S. fossil festival – at the Southwest Florida Fossil Society's Fossil Expo in Punta Gorda, FL, on November 12. At the Fossil Expo, Ronny promoted the myFOSSIL online community, distributed Florida fossil permit application forms, and shared information about volunteering on a FLMNH fossil dig.

On November 13, the FOSSIL team sent Lisa Lundgren, Michelle Barboza, and Sharon Holte to run a table at the 2016 FLMNH "She's A Scientist: A Girl Scout Exploration" event. Girls from ages 5-12 completed three activities toward earning an earth-science Girl Scout badge, including making their own trace fossils. By far the most popular activity was the makeshift photo booth where girls had fun posing as different kinds of paleontologists.

Sharon Holte and Lisa Lundgren having fun at "She's a Scientist"

On November 30, the first FOSSIL Project webinar series, which was entitled "Fundamentals of Fossils," came to a close. Rachel Narducci of FLMNH gave an excellent presentation on fossil preparation tools, methods, and practices. You can read summaries of the last three webinars in Joyce Drakeford's compilation article in this issue. If you'd like to watch recordings of any of the webinars, go to http://www.myfossil.org/video-tutorials/. And be sure to mark your calendar for January 25, when the second FOSSIL Project webinar series begins! The theme for our second series is "Women in Paleontology" and our first speaker will be California-based paleontologist and science educator, Tara Lepore. We are also happy to announce that the Paleontological Society and the iDigBio Project are once again partnering with us in presenting the new webinar series.

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In early December, Lisa Lundgren, Kent Crippen, Eleanor Gardner, Victor Perez, and Ronny Leder received the news that their paper proposal was accepted for presentation at the April 2017 National Association for Research in Science Teaching (NARST) conference. This proposal forms the basis for a larger manuscript which will be published later on in 2017. Another manuscript, co-authored by Victor, Ronny, Lisa, Kent, Betty Dunckel, and Shari Ellis, on the 2016 PaleoBlitz is in the final stages of preparation and will be submitted to a journal at the beginning of the New Year.

A new team member was officially brought onto the FOSSIL Project in December. Jeanette Pirlo splits her time between GABI-RET and FOSSIL, where she is responsible for promoting K-12 engagement, providing content knowledge, and helping with administrative tasks. Jeanette comes to Florida from the Central Coast region of California, where she earned a B.S. in marine biology and oceanography from UC-Santa Cruz. She recently applied to the Biology Ph.D. program at UF where, if accepted, she would study marine paleobiology under Bruce MacFadden starting in Fall 2017.

Jeanette Prilo

On December 7, the Department of the Interior released new proposed regulations under the Paleontological Resources Preservation Act and opened the proposal for public comment. Comments can be made through February 6, 2017. Be sure to read a thoughtful summary and critique of the new PRPA regulations, authored by Mike Nelson (current officer of the Colorado Springs Mineralogical Society and former geology professor), re-printed in this issue. Also in this issue, see our PRPA infographic for guidance on posting comments. For step-by-step video help on commenting, check out http://www.myfossil.org/video-tutorials/#tutorial 6.

Last but not least, we highly encourage members of the FOSSIL community to submit abstracts for oral or poster presentations in our special theme session at the 2017 Northeast/North-Central GSA joint section meeting. The abstract submission deadline is FAST APPROACHING – 11:59pm Pacific time on January 3, 2017! The meeting will take place March 19-21 at the Omni William Penn hotel in downtown Pittsburgh, PA, and our special theme session is entitled "FOSSIL Collaborations: Enhancing Paleontology through Professional and Amateur Partnerships." We invite abstracts from professionals, amateurs, university students, and K-12 educators. Funding is available for session presenters to help defray the cost of travel; contact Eleanor Gardner at fossil@flmnh.ufl.edu for more information. Details about attending the GSA meeting and submitting an abstract are available at: http://geosociety.org/Sections/ne/2017mtg/techprog.htm. We are also excited to announce that several session co-chairs, such as Jayson Kowinsky and Cathy Young, along with officers of the Delaware Valley Paleontological Society are arranging a fabulous field trip for Saturday, March 18, prior to the GSA meeting. The field trip plans tentatively include a tour of the Carnegie Museum of Natural History and visiting a fossil fern site. For more information, or for help crafting an abstract, please contact Eleanor Gardner at fossil@flmnh.ufl.edu.

FOSSIL SPEAKER SERIES: DR. SANDRA CARLSON VISITS SCPS

by Karol McQueary

It was a great day in Los Angeles when the Southern California Paleontological Society connected with the FOSSIL Project. Our vice president, Jennifer Kerr, was contacted by Eleanor Gardner, FOSSIL Project Coordinator. Eleanor discussed the FOSSIL speaker program and its financial support in bringing professional paleontologists to speak to amateur fossil groups. Eleanor suggested that we contact Dr. Sandy Carlson of UC Davis, a professor of Paleobiology, whose research focuses on the systematics of fossil and recent brachiopods. When asked if she would be willing to fly to Los Angeles to speak to the SCPS, Dr. Carlson agreed, despite a schedule busy with her additional duties as Director of the CalTeach Mathematics and Science Teaching Programs.

After arriving in Los Angeles, Dr. Carlson and SCPS President Karol McQueary visited the Natural History Museum Invertebrate Paleontology Research and Collections Facility in Gardena. Dr. Austin Hendy, Collections Manager, gave Dr. Carlson a tour, highlighting the excellent collection of brachiopod specimens, as well as the amazing collection of Paleogene fossil insects from Georg Statz.

Dr. Austin Hendy shares part of the Georg Statz insect collection with Dr. Sandy Carlson at the Natural History Museum Invertebrate Paleontology Research and Collections Facility.

The next day, Dr. Carlson was the featured speaker for an enthusiastic group of more than 50 members and guests at the October SCPS meeting at the La Brea Tar Pits and Museum. She spoke on "Brachiopod Biology, Paleobiology, and Evolutionary History." In her presentation, she described the evolutionary innovations in brachiopod development over time. She began with explaining what a brachiopod is – a bivalved lophophorate, which brings up the question, "What is a lophophore?" It is a ring of ciliated tentacles, beating in synchrony, and including a mouth and anus. It is, as Dr. Carlson puts it, the business part of the animal. Lophophores are found in living brachiopods, bryozoans, and phoronids, but evidence of lophophores in extinct brachiopods can be found in their brachial ridges and the mineralized structures that position and support the lophophore within the mantle cavity. Dr. Carlson's study has looked at brachiopod diversity and identified evolutionary structural innovations that were successful. And what constitutes success? Of the roughly 5000 genera in 26 orders of brachiopods, 95% are extinct, leaving 5% extant and available for study. These are clearly the successful ones!

The informative presentation was well-illustrated with beautiful images of brachiopods and other lophophorates and was followed by an opportunity for questions and discussion. Our members learned much from Dr. Carlson's presentation and were enthusiastic about a possible return visit.

Ciliated tentacles visible in a living brachiopod

The FOSSIL Project's stated purpose is to foster learning, science, and outreach through the collaboration of professional paleontologists and the amateur paleontological community. I can truthfully say that Dr. Carlson's presentation, supported so generously by the FOSSIL Project, achieved that purpose. Thank you Dr. Carlson, Eleanor Gardner, and the FOSSIL Project!

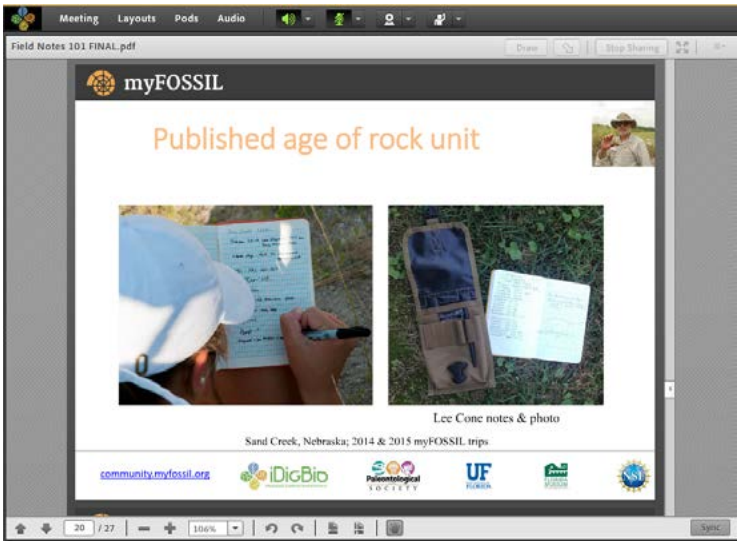
FOSSIL WEBINAR SERIES: FIELD NOTES 101, FOSSIL EXCAVATION, & BASIC FOSSIL PREP

by Joyce Drakeford, Special Friends of the Aurora Fossil Museum

On September 29, October 19, and November 30 I participated in the FOSSIL Project webinars. For each, I opted to connect on my Android phone via the AdobeConnect app. If you missed any of the webinars, please visit www.myFOSSIL.org and look for "videos" under the "resources" tab.

"Field Notes 101" with Bruce MacFadden

Dr. Bruce MacFadden, distinguished professor and curator of vertebrate paleontology at the University of Florida / Florida Museum of Natural History, presented the second webinar in the FOSSIL series. He discussed why, when, and how to take excellent paleontological field notes.



When collecting fossils, you want to have proper documentation for finds. That is where field notes come in. They help to document fossil discoveries, reflect your knowledge, and are a critical 'best practice' in paleontology. Lee Cone, amateur paleontologist and President of the Special Friends of the Aurora Fossil Museum, was quoted as saying, "Field notes are a very important part of an educational field trip, especially in regions that you may not be familiar with… In both [myFOSSIL] trips to Nebraska and Cincinnati I took a lot of pictures… When the picture is combined with field notes, all of the meaning of the picture comes to life."

First, when going to a new fossil site you want to find out as much information as possible before going. This is the first step in your documentation. Reading previous reports about the site, looking at Google Earth and geological maps, and doing internet searches are all important for figuring out when and what you are collecting. When you are ready to visit the site, Dr. MacFadden recommends taking a waterproof notebook, heavy ballpoint pen or pencil, possibly a map, Garmin GPS, camera, and even your smart phone. He recommended phone applications such as 'Mancos' or 'Where Am I' to assist with your documentation collection. The 'Mancos' application will advise you of the rock formation (rock name), where you are (latitude & longitude), the rock group, and the stratigraphic member. The Apple iPhone also has a compass application that can be useful. Google Earth can also be used for GPS coordinates.

The essential information that you want to record during your trip include the date, who was collecting with you, locality/general location, latitude, longitude, rock name, published age of rock unit, other notes and observations, photos, and photo numbers. Include the kinds of fossils and what the rocks look like as part of your observations. Make a rough map and rock column sketch. Photos can include in-situ (in matrix) or float (out of the matrix/context). The latitude and longitude in the decimal convention are the most informative data set. The altitude is not always important, but would need to be included if collecting fossils from the top or bottom of a cliff.

When making on-site notations in your field book, reference the latitude, longitude, elevation, picture number, and diagrams for each collecting spot or find. When collecting fossil teeth, it is not important to document which tooth position it is. Multiple finds of the same item (like shark teeth) can be put together. This is known as cataloging by lot. When sharing on myFOSSIL.org geochronology and location would be great information to provide.

Thorough field notes give your finds scientific value. Museums DO care about all of this information and the overall intention is to give confidence in properly documenting your discoveries.

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"Excavating Fossils" with Dava Butler

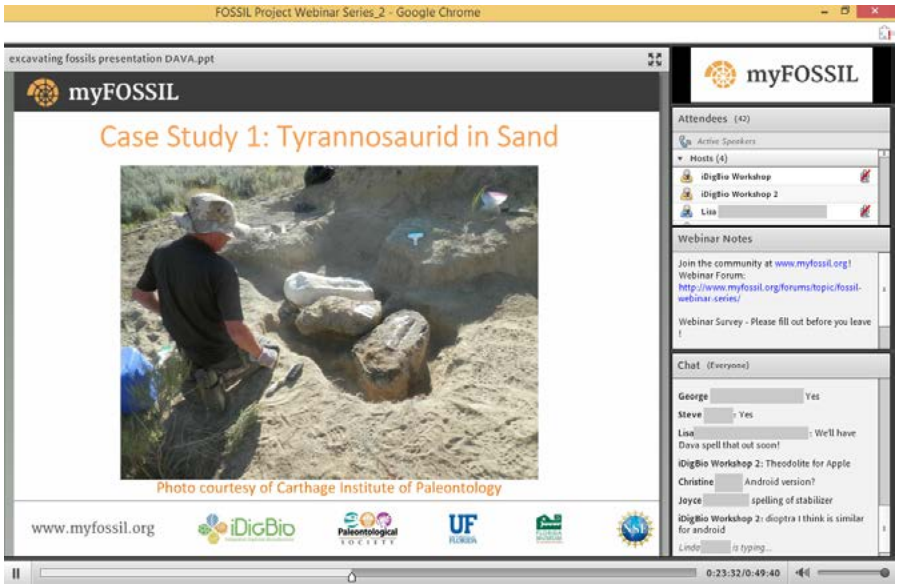
The third webinar in the FOSSIL series was presented by Dava Butler, education coordinator at the Waco Mammoth National Monument and a science education graduate student at Montana State University. She covered the basics of excavating vertebrate fossils and provided guidance regarding collection/excavation fossil laws.

Some people confuse the fields of paleontology and archaeology. Paleontology is the study of the history of life (fossils). Archaeology is the study of human history and culture (artifacts). The definition of a fossil is: evidence of life found in a geologic context. Fossils come in several forms. Body fossils refer to the physical remains of an organism whether it be plant, animal, or bacteria. Body fossils also include molds, casts, and imprints of fossil shells. Trace fossils refer to the behavior of organisms such as burrows, tracks, and coprolites (feces). Another type of fossil is a chemical fossil. Chemical fossils are organic compounds created by the breakdown of organisms. This is where phosphate and petroleum come from.

When looking for fossils, keep in mind that every country, state, and county has different laws regarding collection. For example, in China it is illegal to export any fossil. When looking at private land rules, most fossils belong to the owner of the land where they are found. In addition to these rules and guidelines, many states have specific laws regarding the collection of vertebrate fossils. You are not allowed to take any fossils from a National Park. Dava recommends a good rule to remember: "If it has a spine, there might be a fine." So please make sure you are knowledgeable about all rules and regulations in specific areas before collecting. Beyond laws, you should also incorporate ethics into your fossil collecting. The reason this is important is because every fossil is a unique piece of information and fossils cannot contribute to scientific knowledge without context.

You must protect yourself. Work with an ethical team like the Society of Vertebrate Paleontology, American Alliance of Museums, Paleontological Society, or Geoscientists in the Parks (National Park Service). To get in on excavation teams, check with museums, become an intern at a park, or join local paleontological societies or organizations looking for new team members. Dava was able to join The Mammoth Site dig through the Tate Geological Museum (Casper, WY). When looking for a team, you should examine their history of research and permits for excavation. Make sure the fossils are going to a public trust (for the benefit of science). If fossils are privately owned then the owner is the gatekeeper of who can study it. This, in turn, can cause negative effects in peer review studies. Something else to keep in mind when finding a project is that excavation can last from weeks to months.

Dava presented two "case studies" on vertebrate excavation. Case Study 1 is the excavation of a Tyrannosaurid in sand. This includes trenching, pedestaling, stabilizing, and putting on a plaster jacket. A plaster jacket will last on a fossil indefinitely if needed. Vinac is often used in the field because it is easy to remove later. Occasionally, Butvar, an acryloid stabilizer, is used.



Case Study 2 involved the excavation of a Ceratopsid in rock. The bones were covered with foil, tarp, and rocks since there were several days of wet weather. The best way to excavate from rock is with an awl or screwdriver and then lifting at the cracks in the rocks. When working on a site, Dava suggests keeping the matrix/sediment around the bones in order to collect microfossils which are then screened afterwards at the lab. If you find fragments of bone separate from the main fossil, put

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them in a ziploc bag and thoroughly document them so they can be studied at the lab. Since Casey Study 2 was on BLM (Bureau of Land Management) lands, remediation was required when the excavation was completed.

"Basic Fossil Prep" with Rachel Narducci

The final webinar in the FOSSIL series was a talk given by Rachel Narducci, who works as a fossil preparator and collections assistant at the Florida Museum of Natural History. Rachel's excellent presentation covered tons of information and resources for those interested in fossil preparation.

To start a preparation project, you must ask yourself the following questions: What is the desired outcome? Is the fossil just in need of stabilization? Is it for display only? Will it be used in research? How much time do you want to spend on the preparation? What condition is the fossil in? When considering preparation methods you will want to begin with the least invasive method and increase in strength as needed.

Scientific value of a specimen is based on a fossil having all of the associated field data. If field data is missing, most likely the fossil will not be prepared and instead will be put into a museum's donation pile. Other things to do during preparation to maintain the scientific value of the fossil include: saving all of the matrix to be searched for microfossils, saving fragments that may fall off during the preparation process, and keeping track of any other special discoveries while completing the preparation task. Make sure all items are properly labeled!

Begin with tools such as a compressed air duster, soft brush, bristled paintbrushes, stiff-bristled paintbrushes for tougher matrix, your own finger nails, dental picks, and an air abrasion unit. Next, you can obtain carbide tools. They will need to be shaped into an elongated diamond shape with a rounded tip. Pneumatic tools will be the next step. These tools will need to be connected to an air compressor of at least 100 psi. These tools can be purchased on www.paleotools.com. With the pneumatic tool, you will need oil for internal lubrication and it is best used under a microscope. You may ask which tool you should buy – it all just depends on the project, but Rachel advises that the most common one used at FLMNH is the 'Microjack 4.'

Magnification tools are the next item in the preparator's toolbox. A headband magnifier is the easiest to use and cheapest option. Some of the models also have lights in them. Magnifying lamps are used the most by Rachel when prepping invertebrate fossils. They come in floor models and clamp models. Stereo dissecting microscopes on a boom arm are used for a lot of vertebrate fossil preparation. Finally, surgical microscopes are the biggest scopes and they are used to work on large specimens or at different angles (instead of just overhead like the stereo dissecting microscope).

Water is the basic cleansing liquid. It is easy to dispose of, has multiple uses, and is great for clay preparation. For fragile fossils or reversing/diluting glue, acetone and isopropyl alcohol would be appropriate. This requires proper disposal. Lastly, formic acid works best on fossils in limestone. This option is considered hazardous waste and requires regulated handling for disposal. Formic acid baths are commonly used to disintegrate matrix from fossils. To create a bath, a solution of 7% formic acid with water and tribasic calcium phosphate are placed in a plastic container. A loose lid is placed on top. When the mixture stops bubbling, it is finished. It may need to be repeated. It will need to be handled with rubber gloves. The rinse period is double the bath time. (For example: after being treated for 2 hours, a fossil would need a 4-hour rinse.)

There are several different glues, including Elmer's wood glue (PVA), B72 paraloid, super glue, and sculpting/5 minute epoxies that have different uses in preparation. Elmer's glue is commonly used after being mixed with acetate. For clay specimens it is mixed with water. B72 mixed with acetone dries very fast, but when mixed with isopropyl alcohol it reacts better to heat and humidity in the field. With either B72 mixture it needs to be thin for absorption into the fossil or thick to put pieces together. Painting this formula on will leave streaks, so it is better to pat it on slowly. With very porous bone, an eye dropper is suggested. Sculpting and 5 minute epoxy are used to fill large gaps.

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In the field, plaster is commonly used to make casts for large fossils. For that you will need to have plaster of paris, water, and burlap strips. When prepping this in the lab, you will need sand bags to prop the jacket up, a spray bottle to apply water for softening the plaster, tin snips, and a box cutter. You will also want to cover it in plastic to trap moisture. After opening the jacket, take photos and label the pieces in Photoshop. Once the specimens have been removed, cleaned, and labeled, they should be entered into a spreadsheet. You can then label them with the matching spreadsheet entries. This way, when putting the specimen together, the spreadsheet and images can be used as a reference.

Rachel explained the process of making a mold for casting fossils. They can be used to make a full 3-D impression or can be used against a surface like external molds of invertebrates, called peels. Since FLMNH has 6.5 million invertebrate paleontology specimens, peels are used to separate them.

When labeling, pencils should be used because there are liquids in the lab that can make pens and markers bleed. Also, heavy paper like cardstock should be used for the same reason. When cataloging a fossil, it is recommended to use an archival ink. Writing should be in all capital letters. When writing on an irregular surface, a Radiograph pen should be used. For a small smooth area, a Micron pen can be used. In the case of a dark-colored fossil, a line of gesso can be applied before using the pens.

Acid-free paper labels and acid-free archival trays or boxes should be used when storing fossils. Other containers such as those comprised of cotton, bubble wrap, vials, gel caps, and ziploc bags are all acceptable. When storing in foam, ethafoam (a polyethylene foam) should be used. Fossils can be left in plaster bandages permanently if needed. Metal and glass cabinets can also be used to store fossils. Fossils are best kept in a low-humidly environment. High humidity can cause Pyrite disease. Never store fossils in wood containers. The wood, especially in combination with high humidity, can cause fossils to get Byne's disease. Both diseases will lead to rapid decomposition of fossils. Specimens should also be kept away from Styrofoam, cardboard, and direct sunlight.

Overall, preparation is a constant experiment for the best techniques and most cost-effective ways to prep and store fossils. Trial and error are used for the most part! A book Rachel recommends is entitled "Vertebrate Paleontology Techniques, Volume One." She also suggests two websites that help with amateur preparation (see slide from webinar below). Rachel answered quite a few questions during the webinar, and then researched many more and posted answers on the myFOSSIL site. If you have a question you would like answered about fossil preparation and storage, you can contact Rachel on the myFOSSIL site at @rnarducci.

UPCOMING EVENTS

January 3, 2017 @ 12:00 am – 11:55 pm
Abstract Submission Deadline for Joint Meeting of Northeast & North-Central GSA!

Don't forget! If you wish to present an oral or poster presentation in the special FOSSIL theme session at the 2017 Geological Society of America Northeast / North-Central Joint Section Regional Meeting, submit your abstract by 11:59pm PST on January 3! Need help crafting your abstract? Contact Eleanor at fossil@flmnh.ufl.edu.

January 14, 2017 @ 1:00 pm – 4:00 pm
Discovery Days at the Alf Museum: Climate Change – Claremont, CA

January 25, 2017 @ 7:00 pm – 8:00 pm
FOSSIL Webinar Series Presents: Tara Lepore (Alf Museum) Promoting Women in Paleontology

February 1, 2017 12:00 am – 11:55 pm
Deadline for Nominations for the Strimple Award

February 2, 2017 12:00 am – 11:55 pm
Deadline for Applications for Summer 2017
- National Park Service Geoscientists-In-the-Parks Opportunities
- GSA GeoCorps™ America

February 6, 2017 @ 12:00 am – 11:55 pm
Last Day to Submit Comments on 2016 Proposed Rules Under PRPA

February 11, 2017 @ 1:00 pm – 4:00 pm
Discovery Days at the Alf Museum: Women in Paleontology – Claremont, CA

February 17, 2017 @ 8:00 am – February 19, 2017 @ 8:00 pm
51st Annual Western Association of Vertebrate Paleontology Meeting – Prescott, AZ

February 18, 2017 @ 9:00 am – 5:00 pm
Fossil Club of Lee County Fossil Festival – Fort Myers, FL

February 25, 2017 @ 9:00 am – 4:30 pm
2017 Bone Valley Gem, Mineral, & Fossil Show – Lakeland, FL

March 4, 2017 @ 9:00 am – March 5, 2017 @ 5:00 pm
WIPS Symposium – "Journey to the Jurassic: Exploring the Morrison Formation" – Golden, CO

March 11, 2017 @ 1:00 pm – 4:00 pm
Discovery Days at the Alf Museum: Making Monsters – Science in Art – Claremont, CA

March 18, 2017 @ 9:00 am – 5:00 pm
Can You Dig It? Florida Museum of Natural History – Gainesville, Florida

March 19, 2017 @ 8:00 am – March 21, 2017 @ 5:00 pm
FOSSIL theme session @ 2017 Northeast / North-Central Regional GSA Meeting

March 31, 2017 @ 9:00 am – April 2, 2017 @ 5:00 pm
National Fossil Exposition – MAPS – Iowa City, IA

More events

FOSSIL is funded by a grant from the National Science Foundation (AISL Award #1322725). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. All images used with permission or are free from copyright.

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