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### Featured Professional: Alycia Stigall

*Editor's Note: Our featured professional this issue is [Alycia Stigall](#), Professor in the Department of Geological Sciences at Ohio University. Alycia is the North American leader of the UNESCO-funded International Geoscience Programme Project 653: The Onset of the Great Ordovician Biodiversification Event. Alycia was awarded the Association for Women Geoscientists (AWG) Professional Excellence Award in academia and research in 2017. She was also selected as the 2016 recipient of the Charles Schuchert Award from the Paleontological Society. Colloquially known as the "Best paleontologist under 40 years of age" award, it is presented annually "to a person under 40 whose work early in his or her career reflects excellence and promise in the science of paleontology, and thus reflects the objectives and standards of the Paleontological Society."*

**Can you describe your path to becoming a PhD paleontologist and university professor? Did you begin college thinking you would become a paleontologist? What led you to choose an academic career?**

I have been excited about fossils and geology ever since I was a small child. I grew up in Cincinnati, Ohio, home to amazing Ordovician fossils. As a child, I would run off and explore the nearby creek for hours at a time collecting brachiopods and bryozoans, then identifying them with a 1964 "Golden Guide to Fossils" that had been deaccessioned from the library at the elementary school where my mother taught. Both of my parents were teachers, so we had a lot of time in the summer, but not a lot of money. So most years, my parents would take my sister and me camping in various National Parks all around the country. It was a great way to experience a lot of geology, biology, and paleontology as a kid. I was fascinated by all of this and wanted to become a high school science teacher.

I entered my undergraduate program at Ohio State as a dual major in Geology and Biology--because OSU's teacher education program at the time required students to earn undergrads in their disciplines, then do a 4 quarter MS program to gain the pedagogical training. Along the way, I started to get really interested in the big questions, particularly the differences in the way that paleontologists and biologists classified arthropods and the amazing way that Earth and life evolve together. I also



*Alycia with Ordovician trilobites in the field on a recent trip to Morocco*

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became involved in undergraduate research with a series of really fantastic mentors. I realized that I still wanted to teach, but I wanted to teach about all the cool stuff I was learning now, which was too advanced for high school. I also really wanted to explore and answer really burning questions about the history of life on Earth. So I realized I would have to become a professor. So I did :)

***You have an active research lab that includes graduate students, undergraduates, and volunteers. Do you think the skills students need to be successful in the field now are any different that when you were an undergraduate? Do they face any new or different challenges?***

Definitely! One of the great challenges for each new generation of students is that they need to learn everything that the last generation did in school PLUS everything we've discovered since. The accessibility of information via the internet has hugely changed the way that students learn. I sat down with piles of books in the library, now they can search rapidly from anywhere with Google Scholar. This increased information really creates a challenge for an early career scientist to learn to differentiate core information from accessory information. Students also need to master more sophisticated analytical techniques, be able to synthesize more data streams, program in R, and develop proficiency in scientific communication.



*Alycia and graduate students at an Ordovician (Cincinnatian) outcrop in Ohio*

It's a really exciting time in paleontology because we have so much more data available and powerful tools to analyze these data, but it does create organizational challenges. I work to help my students focus in the face of this information overload, which can be really overwhelming for students. I describe research as similar to bowling. You throw the ball down the lane, and if you are novice, you are likely to get a lot of gutter balls. My job as an advisor is to act like the inflatable bumper guards and help my students reach the pins at the end with a minimal amount of meandering in the wrong directions.

***I read that one of your current research passions is “the interaction between paleobiogeography, paleoecology, and macroevolution during episodes of biotic overturn.” Can you explain what that all means for us novices?***

My primary research focuses on understanding how and why new species form and conversely why speciation declines at certain times in Earth history. The development of new species is similar to the birth of an organism (like you!)—speciation happens at a particular place, at a particular time, and within a particular evolutionary lineage (just like you were born at a specific place, on your birthday, with your mom). So we need to understand the geography and the environment to understand speciation. New species only form when there is a change in one or both of these parameters, so my work focuses on identifying these linkages. I have a particular emphasis on instances when a species migrates into new regions, as these immigration events can serve as long term analogs for modern invasive species. The Ordovician record of brachiopods provides great data for this work, and my current projects look at both global impacts of invasions and environmental change during the Great Ordovician Biodiversification Event and regional impacts of the Richmondian Invasion (and its precursors) in the Cincinnati, Ohio region.

***I understand that you work with the Dry Dredgers. Prior to moving to Ohio University, did you have experience working with amateurs? What are your thoughts about the role of amateurs in science?***

As a grad student at Kansas, I was aware that many of their most significant specimens from the Cambrian Lagerstätten collections were collected by a family of amateurs, the Gunthers, but I did not have the opportunity to work with those collections.

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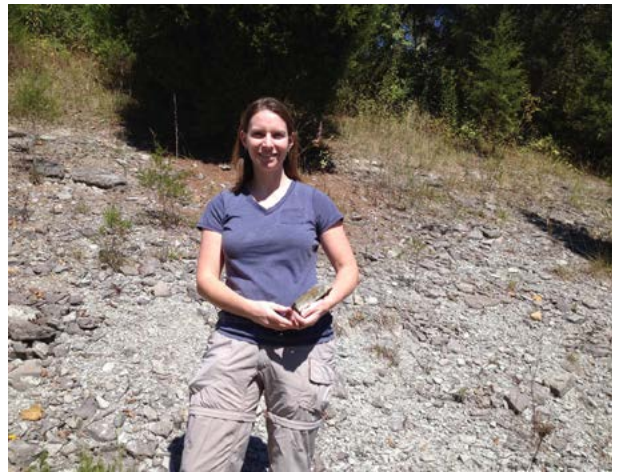
I did know about the Dredgers a little bit before starting my faculty position at Ohio University. When I was a girl, I would drag my parents (and reluctant younger sister) to the [Dry Dredger's GeoFair](#) each year and spend hours learning about—and telling my family about—the specimens on display and for sale. So I knew about the Dredgers a little bit before starting my faculty position at Ohio. However, it's been a true pleasure to get to know many of them in a professional context.

I really can't overstate the importance of amateurs to the field of paleontology. The amazing men and women of the Dredgers spend so much time and energy scouring the outcrops of Cincinnati. They are experts in knowing which fossils "ought" to be where and spotting the rare fossil or the inconsistent fossils. I always learn so much each time I am fortunate to interact with them. Without their efforts, we wouldn't have nearly the high-quality information we do, particularly about the rare taxa. In addition to that, the Dredgers leadership and University of Cincinnati faculty have cultivated a truly collaborative environment, and the depth of knowledge and detail of records that are maintained by members also really add tremendous scientific value to the specimens that they collect.

For example, about 9 years ago Jack Kallmeyer gifted a portion of his collection of beautifully curated specimens of relatively common species to Ohio University and recently Ron Fine donated a set of equally well curated, somewhat unusual specimens. Ron and I recently submitted a manuscript together, and more than 15 students have now been able to work with these collections to learn curation, photography, and analytical skills. The Kallmeyer collection is available via iDigBio and formed a core component of the Ordovician Atlas project.

***What is one of your most memorable field experiences? Do you have a favorite locality or site?***

I am very fortunate to have worked in a variety of really interesting places including field work on all seven continents. Antarctica wins the award for most spectacular field area. The night my students and I spent in a tornado shelter while studying Middle Ordovician fossils in Oklahoma also really stands out. I loved the field work my husband and I conducted in Namibia when our son was 14 months old and "helping" while I carried him around in a frame backpack. My favorite localities, though, are always Cincinnati sites! I particularly love the Richmondian outcrops such as Southgate Hill in Indiana.



***Social equity and diversity in science is another of your passions. How did you become interested in those issues?***

*Alicia at an Ordovician (Cincinnati) outcrop in Ohio*

I am really passionate about broadening participation in science. I distinctly recall an instance when I was nine or ten when my physician said to me "it's great that you like science and math because most girls don't." I assume that the comment was meant to be complimentary, but what I internalized was "oh, I'm different and that makes me strange." I never had female mentors because there were no female paleontologists --and barely any female geologists--where I studied. So I understood that I needed to work harder to earn similar respect, but I suppose I didn't really appreciate the structural barriers present until I was serving the Paleontological Society as the Councilor-under-40, which is the membership chair position. It was then that I first saw the data that showed just how underrepresented women and people of color are in within paleontology and began to seriously begin to study and learn more about structural barriers to full participation in science.

Since that time, I have been vocal about these issues on a variety of fronts from local to international. I am really pleased to be able to participate in leadership roles in the IGCP 653 Project and the Paleontological Society that provide a platform from which to support and foster initiatives. Some of these are as simple as reaching out to female students that I meet at conferences and providing encouragement. This can be surprisingly impactful for students who



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are not used to receiving affirmation, such as some women I recently got to know in China. But we also need to work to change the culture and the conversation broadly. We need to make science inclusive and welcoming for all. The GSA RISE program, which works to eliminate harassment at scientific meetings, and new PaleoSociety initiatives to provide travel funds for diverse students who otherwise couldn't attend scientific meetings are both helpful steps in the right direction. We can and will do more, but these examples are positive steps.

Think about any elementary school classroom that you might visit to do a paleontology outreach program. Every one of those kids is excited about paleontology. Many of them love—and can name—many dinosaurs and other fossil organisms. My vision for the future of paleontology is that every one of those kids would have the equitable opportunities to pursue paleontology. I want none of them to be told they are not the type of person that should pursue such a dream, but that all of them be told they are exactly the type of person to pursue this dream because this dream is accessible to everyone. We have a long way to go to make this vision a reality, but I am very encouraged by how pervasive such conversations are becoming, how much progress we have made so far, and the tremendous dedication of many members of our field to keep progressing and broadening participation in science.

*You have been involved in developing a number of educational resources including lesson plans and the Digital Atlas of Ancient Life. Why do you think it is important that paleontology is included in the K12 curriculum? Can you share any advice or lessons learned in developing accessible science content that will be used by teachers in formal K12 settings?*

Fossils can be the gateway to getting kids hooked on science. Extinct organisms and ancient worlds are inherently fascinating and can be used to teach concepts from classification to ecosystems to climate change to chemistry. The key to making lesson plans that work well in a K12 setting is to develop them in concert with science educators, either in-service teachers or education faculty. It is critical to find out what learning objectives and standards teachers need to cover and then design lesson plans to meet their needs. In paleontology, there are so many great example and stories we can tell, but if the lesson plans don't match state standards, they are unlikely to be adopted by teachers who are already strapped for time in the year. So be sure to find out need first, then develop lessons to meet those needs, and include a list of which standards lessons meet to help teachers understand how to use the lessons. Also, give teachers boxes of fossils—they all need more fossils!

#### **To learn more:**

Lam, A. R., Stigall, A. L., & Matzke, N. J. (2018). Dispersal in the Ordovician: Speciation patterns and paleobiogeographic analyses of brachiopods and trilobites. [Palaeogeography, Palaeoclimatology, Palaeoecology, 489, 147-165.](#)

Stigall, A. L., Bauer, J. E., Lam, A. R., & Wright, D. F. (2017). Biotic immigration events, speciation, and the accumulation of biodiversity in the fossil record. [Global and Planetary Change, 148, 242-257.](#)

Stigall, A. L. (2017). Ordovician oxygen and biodiversity. [Nature Geoscience, 10\(12\), 887.](#)

Trubovitz, S., & Stigall, A. L. (2016). Synchronous diversification of Laurentian and Baltic rhynchonelliform brachiopods: Implications for regional versus global triggers of the Great Ordovician Biodiversification Event. [Geology, 44\(9\), 743-746.](#)

Stigall, A. L. (2012). Speciation collapse and invasive species dynamics during the Late Devonian “Mass Extinction”. [GSA Today, 22\(1\), 4-9.](#)

Digital Atlas of Ancient Life [website](#); Article about the Digital Atlas of Ancient Life in [Palaeontologica Electronica](#)

Previous newsletter articles about the Digital Atlas of Ancient Life [website](#) and [app](#)

## AMATEUR SPOTLIGHT: JOHN CATALANI

*Editor's Note: This issue we feature former high school teacher John Catalani. John is a member of several fossil and mineral clubs including Mid-America Paleontology Society (MAPS), Earth Science Club of Northern Illinois (ESCONI), Dry Dredgers, and Cedar Valley Rocks and Minerals Society (CVRMS).*

### ***How did you first discover your passion for fossil collecting?***

Seventh grade and a book on fossils caught my eye. Fortunately, the bedrock of my hometown (Rockford, Illinois) is Ordovician with many fossils available.

### ***How long have you been collecting fossils (when did you begin)?***

Since age 12 when I had my father take me, begrudgingly, to area quarries.

### ***I understand that you are an expert on nautiloids. How did you come to be especially interested in this particular type of fossil?***

The Ordovician rocks (Platteville Formation) are chockablock with molluscs and I noticed that certain forms, the nautiloids, were more complex morphologically than the others and so I began to study those. Serious collecting and study began in college.



*John Catalani*

### ***In one of your articles, I read that you collected from quarries. Can you talk a little about how you made that happen? Do you continue to collect and, if so, do you travel to collect or return to the same locality?***

When I first began to collect heavily back in the day, access to quarries was much easier. I often began a relationship with the owners by taking the time to talk to them and explain what my purpose was. Most of the time they appreciated my taking the time to do this and provided me with access and in several instances, I was the only one able to gain access. Living in Woodridge, Illinois, now, I need to travel to central Illinois or to south-central Wisconsin to collect and, yes, I have collected the same quarries for some 30-40 years. Problem now is that most are flooded, not actively working, or unavailable but I still collect those still available. Fortunately, I was able to amass a large collection of Ordovician nautiloids and associated fossils early in my career.

### ***To what do you attribute your considerable success as an amateur paleontologist?***

As with most amateur (avocational) paleontologists, I have an intense desire to get outside and collect. Fortunately, I had a knack for Ordovician nautiloids in Platteville rocks of IL and WI. Hard to describe but you either have the desire or you don't. When I got interested in fossils I knew I wanted to be in the field COLLECTING the fossils first hand.

### ***Based on articles you and others have written, I know that you have a respected private collection. How do you identify/organize/store your fossils? Have you donated any of your fossils to museums?***

I do have a substantial collection of fossils, and not just nautiloids. To identify the fossils collected you need the primary literature either by purchase or library. Again, I was lucky that, back in the day, those publications were often available from the source or in used bookstores. I pretty much have all primary papers and books dealing with Ordovician nautiloids, but it took time. I usually organize non-nautiloids in labelled boxes by site. Nautiloids are grouped by taxa and mostly individually marked by locality. I have donated to Rock Valley Community College and

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Burpee Museum in Rockford and PRI/Museum of the Earth in Ithaca and to several individual professionals.

***In one article, you emphasized the importance of documenting your finds in order that they can be of greatest value to science. How did you come to appreciate the value of documentation? What advice can you give other fossil collectors, especially those just starting out?***

For me, documentation was logical and practiced right from the beginning. The topographic maps I often used to find sites allowed me to designate township & range coordinates. I had a book (now expanded to two volumes) in which I listed each productive site by time period and state with directions, township-range, and dates visited. As I have said before, without locality documentation, fossils are nothing more than curious artifacts and this is the advice I would give.

***You have allowed scientists to study specimens in your collection and collaborated with others on papers. How did your relationships with scientists develop? Do you have any recommendations or tips for others who are trying to improve their level of collaboration with professionals?***

I was very fortunate. When I first started seriously identifying published forms and discovering that some were not identifiable, I wrote to the Illinois State Geological Survey. The person that was given my letter was new to the Survey and had just finished his PhD--Dr. Dennis Kolata, now emeritus at the Survey. As I explained in the essay I sent, he patiently allowed me to explain the nautiloid specimens even though his dissertation was on echinoderms and his first love is trilobites. That began a 40-year friendship during which Dennis always encouraged me to continue collecting. Rousseau Flower, top nautiloid specialist, also welcomed me and we were planning a paper when he passed away. Other encouraging professionals I have encountered: Robert Sloan, the late John Pojeta, Warren Allmon, and Bob Frey, whom I am now working with on publishing. As I said, I was lucky and the only advice I have is to seek out professionals that are willing to work with you. But you need to show them that you are serious about paleontology.

***You have been a long-standing member of the Mid-America Paleontology Society (MAPS) and have played a number of different roles (e.g., newsletter editor, officer) over the years. Do you belong to any other fossil-related organizations? What do you see as the benefits of belonging to an organization such as MAPS?***

You hear about these clubs from other collectors and you need to check them out to see what they are about. Other clubs I belong to: Earth Science Club of Northern Illinois (ESCONI), Dry Dredgers, Cedar Valley Rocks and Minerals Society (CVRMS). Obviously, the camaraderie but also Clubs can often get insurance that quarry or site owners want before they allow you to collect.

***Do you have a favorite fossil?***

This is hard to answer. I have a favorite in each taxonomic group. Probably my true favorites are the unpublished nautiloids that I have discovered.



*John with with Plectoceras occidentale*

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*Goniceras occidentale*



*Actinoceras beloitense*



*Endoceras annulatum*

*I believe your annual Fossil Expo is coming up! What should folks be looking forward to this year?*

This year our theme is the Permian/Triassic and our keynote speaker is Dr. Margaret Fraiser of the University of Wisconsin, Milwaukee.

**To learn more:**

Catalani, J. A. (2014). Contributions by amateur paleontologists in 21st century paleontology. [Palaeontologia Electronica, 17, 1-4.](#)

John's May, 2000 column "An Amateur's Perspective" published in American Paleontologist provides more detail on John's personal history: [AP May, 2000](#). His Summer 2008 column describes three "explosions of biodiversity," including the Great Ordovician Biodiversification Event: [AP 2008 Summer](#). The Fall 2008 column explores cephalopod intelligence: [AP 2008 Fall](#). Many thanks to the [Paleontological Research Institute \(PRI\)](#) for allowing us to share these articles!

Find the details about the Mid-America Paleontology Society's 40th National Fossil Exhibition to be held April 6 - 8 on the MAPS [website](#) or the FOSSIL [event calendar](#).

Read John's article about the Mid-America Paleontology Society in our [2015 spring issue](#).



## CLUB CORNER: ALBERTA PALAEOLOGICAL SOCIETY (APS)

By Mona Marsovsky and Georgia Hoffman

The Alberta Palaeontological Society (APS) demonstrates the role that an amateur society can play in outreach and education. APS was incorporated in 1986 as a non-profit organization to promote the science of palaeontology through study and education, and to make contributions to the science by

- the discovery and responsible collection of fossils;
- the curation and display of fossils; and
- the preservation of fossils for study and for future generations.

APS works with the professional and academic communities to aid in preserving and understanding Alberta's heritage, and hosts a variety of public educational and outreach events.

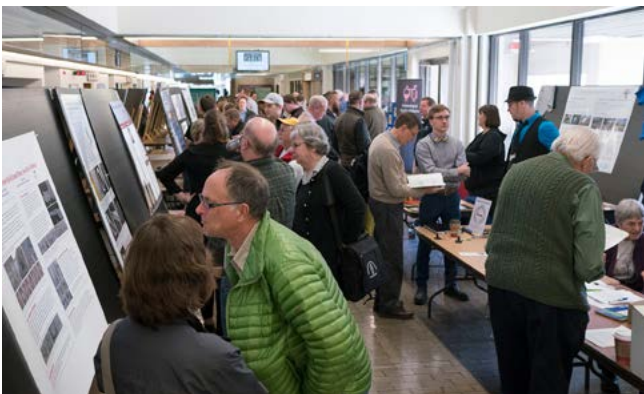
APS maintains a fossil collection that includes fossil vertebrates, invertebrates, and plants, as well as microfossils and ichnofossils (fossil tracks), primarily from Alberta, but also from other areas of North America. All fossils were obtained and are maintained in accordance with applicable laws.

APS holds monthly lectures on a broad range of palaeontological topics at Mount Royal University in Calgary. These allow students, professionals and amateurs to present their research to the public, and practice their presentation skills to a varied audience including children, amateurs and professionals. All meetings are free to the public. Field trips for APS members are held in the summer.

APS holds an annual symposium in March that allows amateurs, students and professionals to share their work. The symposium, now in its 22nd year (March 17, 2018), features a full day of talks, posters, networking and a printed abstracts volume. Sponsored by Mount Royal University, the Canadian Society of Petroleum Geologists and APS, this event is free to the public. Hands-on workshops are held on the second day. This year's workshop (March 18, 2018) focused on brachiopod basics.



*Searching for microfossils during the APS Field trip to Eastend, Saskatchewan to aid the research of Dr. Emily Frampton.*



*Poster session and presentations at the annual APS Symposium*





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APS has been aiding scientific research by extracting microfossils from matrix for over 14 years. Up to 20 APS members and volunteers from the public gather for nine 2.5 hour long Saturday afternoon sessions from November to March. APS has sorted microfossils for scientists from the Royal Tyrrell Museum of Palaeontology since 2003 and for the University of Calgary since 2013. These researcher-supervised sessions are held at no cost (thanks to Mount Royal University providing the room and microscopes without charge) and are open to the public (no experience required).



*APS members search for microfossils to aid in research for the Royal Tyrrell Museum of Palaeontology*

Other APS outreach activities include annual participation in a Rock and Fossil Clinic, the Calgary Gem and Mineral Show, and the Earth Science for Society event. APS members also present talks for schools, youth groups and Historic Calgary week.

If you are interested in presenting a talk, workshop or poster at an APS event, contact the APS program coordinator at [programs1@albertapaleo.org](mailto:programs1@albertapaleo.org).

**To learn more:**

APS [website](#)

Follow APS on [Facebook](#)



*APS display at the Earth Sciences for Society annual event*

## FEATURED FOSSIL : *Candelarhynchus padillai*\*

By Oksana Vernygora & Javier Luque, University of Alberta

\*How a 10-year old boy discovered a 90-million year old fish at a Colombian monastery

The tropics are regarded as hot spot of biodiversity on land and in the water; yet the past of the tropical diversity has remained largely unexplored. During the last few decades our knowledge of the fossil record in tropical regions has increased considerably, thanks to a growing number of professionals and amateurs engaged in a collective effort of discovering its fossil record. However, we are just starting to unveil the richness of the fossil record in equatorial latitudes, and every new fossil finding adds to the pieces of the puzzle of the tropical diversity through time. Some of these discoveries occur while doing field work or visiting museum collections, but from time to time the discoveries occur in unexpected ways and places, as it was the case with a new fossil fish from the Cretaceous of Colombia.



*Photo credit Oksana Vernygora*

About three years ago, a family of tourists with their 10-year-old son was on a tour in a region of Colombia famous for its colonial architecture. While visiting a local monastery known as La Candelaria, the boy noticed an unusual shape in one of the flagstones at the entrance of the monastery that reminded him of some extinct marine animals he knew existed a long time ago, so he decided to take a photo and share with the staff at the local Paleontological Research Center in Villa de Leyva: one of the most fossil-rich areas in northern South America. During a follow-up visit to the monastery they not only re-discovered the flagstone that captured the boy's eye, but also found its counterpart in a separate slab eight meter apart. The slabs were removed and brought to the research center for preparation and study, but as the fossil started to reveal clues of its identity, the provenance of the flagstones and the quarry from where they were originally extracted remained unknown. In the winter of 2016 Mary Luz Parra, from the Paleontological Research Center, and Javier Luque, a PhD candidate at the University of Alberta, were able to contact



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the people who built the pathway in the monastery 15 years earlier and who also extracted the slabs from a nearby quarry. They helped the researchers track down the original quarry and discovered that the rocks in the quarry were identical in lithology and fossil content to the slabs preserving the fossil fish from La Candelaria. The fossil invertebrates include abundant crabs and ammonites that lived in the region during the lower Turonian (lowermost Upper Cretaceous, ~ 90 Mya), providing a geological context to the new fish. Later that year, Javier, my supervisor, Dr. Alison Murray, and myself joined forces and collaborated on the study of this new fossil discovery.

After a thorough examination of the specimen, we were able to establish that the fossil represented a new species and genus of the Aulopiformes distinct from all other members of the group known before. The fish species, named *Candelarhynchus padillai*, using a combination of words “Candelaria”

(region where the fossil was found) and “rhynchus” – from the Greek word “rhynchos” which means “nose” or “snout.” *C. padillai* was a slim, long-jawed, fine-toothed fish measuring 16 inches long. Superficially it resembled a modern-day needlefish, but, in fact, its closest living relatives are barracudas, grinders, and lizardfishes.



Photo credit Javier Luque



Photo credit Oksana Vernygora

This is the first fossil of its kind discovered so far in northern South America, and despite being exposed in the pathway for over 15 years, the fossil shows a remarkable preservation of anatomical details. Since it's two-dimensional, the fossil stayed preserved for years while dozens of visitors stepped on the walkway it was a part of.

This new find could provide some clues for how fish of this group adjusted to a changing environment, which could be useful to predict how today's marine life will adapt to the changing climate.

So, our advice to everyone interested and fascinated by fossils, is to keep your eyes open and your mind ready for unexpected discoveries. Sometimes finding fossils is just a matter of looking at things with an inquiring mind.

The research team  
Photo credit CIP, University of Alberta





## RESEARCH: ARE BISON NATIVE TO THE GRAND CANYON REGION?

By Jeff M. Martin, Rachel A. Short, and Jim I. Mead

*Editor's Note: Jeff is a PhD candidate in Wildlife and Fisheries Sciences at Texas A&M University. He earned his BS in Geology and MS in Geosciences from East Tennessee State University and was an PCP-PIRE intern in 2012. Rachel is a PhD student in Ecosystem Science and Management at Texas A&M University. She earned her BA in Biology from Illinois Wesleyan University, and MS degrees from East Tennessee State University (Geosciences) and University of Maine (Teaching). Jim earned his MS and PhD in paleoenvironmental studies (Geosciences) from the University of Arizona. He is now the chief scientist and site director at The Mammoth Site, Hot Springs, SD, having retired from 33 years in academia.*



*Jeff and Rachel*



*Jeff and Jim*

Few animals in North America possess the cultural, spiritual, ecological, economic, political, and natural history attributes of the North American bison. Certainly, no other North American animal has gone to the brink of extinction twice—during the megafaunal extinction at the end of the Pleistocene and then during the late 1800s when Euro-Americans hunted nearly all that existed at that time.

Today, nearly 400 bison live in and around Grand Canyon National Park. Management of the herd is complex because the animals are property of the State of Arizona (Arizona Game and Fish Department, AZGFD), but the herd meanders onto the North Rim of the Grand Canyon and uses the natural resources of the Kaibab Plateau (Martin, 2014). Moreover, while the State of Arizona has designated bison a native species, the Grand Canyon National Park regards them as nonnative and human (re)-introduced. Wildlife, including bison, do not adhere to arbitrary boundaries. As such, wildlife biologists must use science-based precedence, including wildlife nativity, to determine management strategies and protocols (Martin and Mead, 2014). In this case, nativity means naturally occupying an area through time. However, managing transient wildlife across Federal and State lands is not simple because of differing goals of agencies that, in this case, include the U.S. Forest Service, the National Park Service, and the AZGFD. For instance, according to the State of Arizona, bison are a native species; yet, Grand Canyon National Park does not have the same designation. Conflict between agencies can have cascading effects on management decisions and, in an effort to resolve this, we examined the nativity of bison on the Colorado Plateau (Martin et al., 2017).

Although there are fossil records of *Bison* in many areas of the western United States, few *Bison* fossils have been found in the arid Southwest—especially in and around the Greater Grand Canyon Region. Today, there are fenced areas near the Grand Canyon, but the Grand Canyon ecosystem extends beyond the property boundaries and is referred to by us as the Greater Grand Canyon area. We looked at the Greater Grand Canyon area ecosystem and the Colorado Plateau physiographic region as potential areas where *Bison* could have lived prior to the fencing of the West. We reviewed undocumented and misidentified specimens from archaeological and paleontological localities archived in collections at the Museum of Northern Arizona, at the Grand Canyon National Park, and at the East Tennessee State University Vertebrate Paleontology lab. The previously undescribed specimens consist predominately

of dung and skeletal remains from cave, rock shelter, and packrat midden localities. We also located occurrences of *Bison* from the following online data sets: Neotoma Paleocology Database (NeotomaDB, [www.neotomadb.org](http://www.neotomadb.org)); Arizona’s Cultural Resource Inventory (AZSite, <http://azsite3.asurite.ad.asu.edu/Azsite/>) and Neogene Mammal Mapping Portal (NeoMap, [www.ucmp.berkeley.edu/neomap/](http://www.ucmp.berkeley.edu/neomap/)).

Poor fossil preservation introduced a collection bias that caused previous researchers studying faunal distributions to assume that bison were not native, even with evidence from paleontological, archaeological, and historical sites. A seemingly unintended outcome of this assumption was the erroneous taxonomic identification of some specimens. For example, 13 localities were found to have *Bison* fossils that were previously mislabeled as Pleistocene horse (*Equus*) and Anthropocene cattle (*Bos taurus*; Balkwill and Cumbaa, 1992). In total, we located 74 *Bison*-bearing fossil, subfossil, and historical localities (for a complete listing of localities, see Martin et al., 2017) since the latest Pleistocene (~160,000 years ago).

In conclusion, our findings indicate that *Bison bison* should be considered a native species on the Colorado Plateau because they have a nearly continuous record of nativity in the region (see Table 1). This information is valuable for public natural resource managers at GCNP and beyond.

Years BP	Pecos Classification	Geologic Time	Bison Localities
160,000 - 14,300	Preanthropogenic	Late Pleistocene	14
14,300 - 10,000	PaleoIndian	Latest Pleistocene	8
10,000 - 1,300	Archaic	Early to Late Holocene	15
1,300-850	Pueblo I-II	Latest Holocene	14
850 - 650	Pueblo III	Latest Holocene	8
650 - 400	Pueblo IV	Latest Holocene	12
400 - Present	Pueblo V	Latest Holocene	3

Table 1. Temporal summary of *Bison* localities on the Colorado Plateau using the Pecos Classification system of the American Southwest. Abbreviations: “BP”, calendars years before present.

**References:**

Balkwill, D. M., and S. L. Cumbaa. 1992. A guide to the identification of postcranial bones of *Bos taurus* and *Bison bison*. *Syllogeus* 71:277.

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Martin, J. M., R. A. Martin, and J. I. Mead. 2017. Late Pleistocene and Holocene *Bison* of the Colorado Plateau. *Southwestern Naturalist* 62(1):14–28. Available from: <http://www.bioone.org/doi/abs/10.1894%2F0038-4909-62.1.14>

## FAUNAL INTERCHANGES, HIGH SCHOOL STUDENTS AND THE PALEOBIOLOGY DATABASE

By Andrew Farke, Director of Research & Collections, Raymond M. Alf Museum of Paleontology; Science Faculty, The Webb Schools

I teach an introductory paleontology research class for high school students (grades 10 and 11), which I have refined over three years of teaching. Of course, we read and talk about plenty of journal articles. Because we have access to the paleontology museum on our high school campus, we also have a heavy emphasis on specimen-based research projects. For instance, earlier this semester we finished a project where students wrote and illustrated a detailed description of a fossil they collected on a field trip in the fall. To follow that, I wanted to give the students a taste of another face of paleontology--that of databases. I felt it would be a great way to help them develop their analytical skills and see how hypotheses can be tested with big fossil datasets. What better way to do so than with [Paleobiology Database](#)? This site hosts thousands of records of fossils from the scientific literature, allowing an interested user to track changes in distribution and abundance for organisms through time.



*Andy Farke*

Thankfully, there is a [nice roster of lesson plans using PBDB](#) already available. As I scrolled through them, though, I realized that many were probably a bit beyond what we had time or skills to discuss in class. For instance, most of the students haven't done a lot of programming or even heavy spreadsheet use yet. After a bit of looking, I found the perfect introductory lesson--[one examining the development of the Isthmus of Panama and the resulting faunal exchange between North America and South America](#).

Two things particularly made this lesson appealing--it dealt with easily relatable animals (large mammals), some of which the students already had encountered in labs and fieldwork. Second, it had easily testable hypotheses, requiring only the plotting of data on a map (which PBDB does automatically via its [Navigator](#)). The students didn't have to load any special software, which was an added bonus. The goal, of course, is not to turn all of the students into paleontologists. Instead, I want them to see how the process of science works, explore tools used by scientists, and feel empowered to ask their own questions about the world around them.

To start, we practiced searching for and plotting data by taxon and time period. I had given them a brief homework assignment where they followed a [video tutorial](#) on PBDB, and generated a few quick plots (e.g., plot all birds from the Cretaceous). A minute of brief review was all that was needed to make sure the students were on track at the start of class.

As a final bit of preparation for the activity itself, I gave the students our research question—using data from fossil mammals, when were North America and South America physically linked up? Rather than giving them a “cookbook” with step-by-step directions, I had them group up into pairs and trios to talk about what kind of evidence they would need and why. I was happy to see that they were able to link the importance of age data and fossil geographic occurrence. The students decided that making a table with organism, location of fossil sites by continent, and age would be the best way to collect data.

In the interest of time, I trimmed the suggested organism list from the original activity down to six taxa--Equidae, Glyptodontidae, Felidae, Sparassodonta, Canidae, and Chiroptera. We reviewed their names (many of which the students already knew, such as equids; we did have to talk about sparassodonts, though!), as well as the names of the major time periods relevant to this work.

The students then worked in their small groups on tracking the distribution of known sites for each group of mammals



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over time, in the Miocene, Pliocene, and Pleistocene. Rather than drawing them onto a map, I had them make a table of presence/absence for the two continents at each time interval (see photo). They had around 20 minutes to track everything down, while I circulated and answered any questions.

	Miocene	Pliocene	Pleistocene
- Equidae	✓	✓	✓
- Lepidoptera	✓	✓	✓
- Felidae	✓	✓	✓
- Sparassodonta	✓	✓	
- Canidae	✓	✓	✓
- Chiroptera	✓	✓	✓

How would you use fossils to determine when S. reconnected?

What information would you...

Miocene  
Pliocene  
Pleistocene

Photo credit Andy Farke

Finally, we reconvened to put all of our data together. We used some of the questions from the published activity, including asking the students to interpret when North and South America were reconnected (during the Pliocene was the agreed-upon scenario from the students). We also talked about why some groups might have taken longer to show up in the fossil record than others, and why bats had a pretty broad distribution throughout the studied time interval. It was neat to hear the students working through their thought processes, and asking deeper questions (such as, why were there so few sites for some time periods at certain locations?).

Informal feedback from the students shows that they found the activity enjoyable and accessible. They liked searching for and plotting data, and thought it was neat to see how animals they had collected in the field (fossil horses, for instance) changed distribution over time.

We're using the faunal interchange activity to springboard our next major project, generating diversity curves for various marine reptile groups throughout the Mesozoic and looking at them within the context of global events. We're still in the midst of that multi-class activity, but I can already say that these students are pretty comfortable with Paleobiology Database, the geological time scale, and hypothesis testing for these kinds of data sets!

## INTRODUCING THE WHITESIDE MUSEUM OF NATURAL HISTORY

The Whiteside Museum of Natural History (WMNH) was established as a 501(c)3 non-profit corporation in December of 2013 due to the herculean philanthropic efforts of the late Judge Clyde E. Whiteside. As his lifelong mission was to create a natural history museum for Seymour based on the incredible paleontological importance of Baylor County, Judge Whiteside financed the museum's incorporation and hired Christopher J. Flis as its Museum Director and Resident Paleontologist to oversee the museum's development. We interviewed Chris to learn more about the history and ongoing science at the museum.

### ***Why is Seymour, Texas, an important location for a natural history museum?***

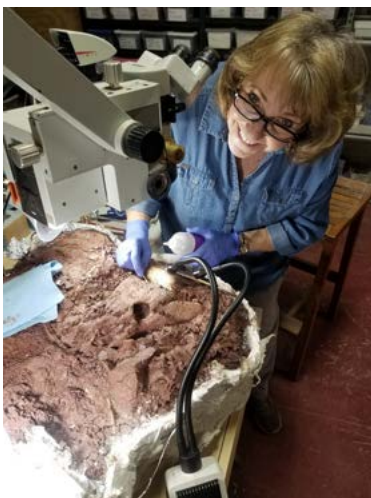
The first Lower Permian vertebrate fossils were found in Baylor County in the late 1870s, with legends of the paleontology world headlining the initial discoveries, including Edward Drinker Cope and Charles Sternberg. More recently, Dr. Robert T. Bakker and I have been engaged in Baylor County Permian research for over 10 years. More than 125 years since the first Permian fossils of Texas were discovered, Seymour and Baylor County have been described as some of the best places on Earth to study basal synapsids, reptiles, and amphibians due to the incredible abundance and exceptional preservation of Lower Permian vertebrate fossils.



*Christopher Flis and Dr. Robert Bakker at the Lower Permian "Mary" site discussing a new species of Dimetrodon*

Since the 1870s, the majority of the fossils collected from Baylor County were transported to permanent collections at Princeton, Harvard, and the Smithsonian Institution, as well as private collections around the world. As a result, no fossils remained in Texas, and the communities of Baylor and nearby counties never had a chance to learn about the paleontological importance of their own backyards. With the creation of the Whiteside Museum of Natural History, Seymour and North Texas now have a museum with a permanent collection of fossils that will remain in their community and state. WMNH to date has enjoyed approximately 21,000 visitors, including 5,000 school children engaged in no-cost, school-sponsored visits. WMNH provides all visitors with an interactive glimpse into the natural world and more specifically the ancient life that once inhabited North Texas.

### ***Can you tell us about the role of volunteers at the museum?***



*Sandy Stripling; volunteer fossil prep technician working on "Irma" the Trematops*

WMNH retains a successful volunteer program that currently holds approximately 30 active members, and we are very proud to have such active volunteers. Volunteer duties range from helping with guided tours of the museum to working in the paleo prep lab on fossils that I bring in from my research sites. I currently have 10 paleo prep technicians and field-team members that I have trained to prepare fossils. Prior to our grand opening in 2014, none of them had any experience in paleontology. And now, 4 years later, I can say that they are experts in fossil preparation and paleo fieldwork.

Ms. Sandy Stripling is a retired teacher who absolutely fell in love with fossil preparation and is my expert tech specializing in preparing *Dimetrodon* and other Lower Permian Pelycosaur, reptile, and amphibian skulls, and the delicate bones that comprise them. Needless to say, she loves teeth. Gil Allison is retired from the Hospital Administration field and comes in twice a week from an hour away to work on *Dimetrodon* fin spines and is also active on my fieldwork team. It is very rewarding to see volunteers come in and find a joyful sense of pride

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and responsibility from having the opportunity to work with 287-million-year-old fossils from incredibly important research sites located only 5 miles from Seymour. They are contributing to the preservation of the incredibly rich natural history of Seymour and its neighboring communities.

***When people visit the Whiteside Museum, what might they see or experience? What do you hope they'll take away from their visit?***

Ok, so I have to be a kid again here, and I admit that working as a paleontologist and in a museum often prevents me from growing up. WMNH is a really wonderful place with incredibly fun and interactive exhibits. It's comprised of six exhibit halls, starting with the Permian Paleontology hall where we focus on the incredible fossils found as close as 2 miles from the museum. As one of the absolute best places in the world to study Lower Permian vertebrates, the hall is filled with hundreds of fossil specimens collected by museum staff. The dinosaur section follows the Permian area and focuses on some of our Texas natives, including a complete *Tyrannosaurus* skull and a one-of-a-kind, fully fleshed out model of the king of the dinosaurs. Visitors can also experience the native animals of Texas exhibit that displays more than 20 full-body mounts of bison, coyotes, mountain lions and other critters. The African Hall is important for the community of Seymour as well, as WMNH has numerous ice-age fossil sites that include mammoths, mastodons, and other animals whose relatives thrive today on the African continent. In this exhibit, guests can see full-body mounts of the African Lion, as well as more than 25 other specimens. The WMNH Zoozeum is one of the most popular exhibits, as we display live lizards and snakes, as well as more than 20 other live amphibians and reptiles. Many of the specimens are native to the Seymour area, though we have numerous exotic animals as well which helps to show the relationships of past and present animal groups.



*Gil Allison; volunteer fossil prep technician working on "Abby" the Dimetrodon*



*The Paleo Hall at the Whiteside Museum of Natural History*

The last exhibit hall is our paleontology prep lab- it's our pride and joy. It's one of the largest public-friendly prep-labs in the U.S. This is where I bring all the fossils and skeletons from my dig-sites, so the volunteers and I can clean and prepare them for research and exhibit. We have 7 incredible microscopes we use for cleaning fossils. When the public comes in to the lab for a tour, they are given the opportunity to interact with the museum scientists and use the microscopes. There is nothing more satisfying than seeing someone, young or old, who has never looked through



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a microscope. There is a moment I think we have all experienced at least once where we have taught someone something new or given them a chance to experience something amazing for the very first time, a moment we can see on their faces the second it happens. The reward for both parties is incredible. Ultimately, we want the mission of WMNH to be providing a world-class museum and science education experience to the world, based on the rich fossil history of Seymour, Texas. We are living in a time when the school field trip is going the way of the dinosaur. Education outside of the classroom is a vital tool to expanding our youth's way of thinking and broadening their access to education. There is a huge world out there, and it's our responsibility to open as many new doors to the future of our youth as possible.

***It looks like there is a lot of ongoing science at the museum. Can you tell us about the research being done?***

Dinosaurs are so incredibly sexy- that's what people are most familiar with in pop-culture. Look at the classic 1933 film *King Kong*, where the giant ape battled a *T. rex* and a pterodactyl. And of course, *Jurassic Park*. Icons of our culture. As much as I love dinosaurs, I have an enduring fondness for the Permian. This is where we find land ecosystems that are dominated by the first large terrestrial carnivores and herbivores. *Dimetrodon* and *Edaphosaurus* are some of the planet's first large land-walking meat-eaters and plant-eaters. They thrived some 60 million years before we see creatures that we would call a dinosaur. The WMNH is fascinated by these new ecosystems and the colorful evolutionary history that is told in the rocks right here in Seymour. The best bone-beds in the world that tell the story of these first big land-dominating basal synapsids, reptiles and amphibians are only 5 miles away from our museum.

**In 2017, the WMNH Paleontology team discovered Bonnie, a near-complete skeleton of the famous finback reptile, *Dimetrodon*. Now on display, the 287-million-year-old fossil delights all guests and ranks as one of the most complete *Dimetrodon* skeletons ever found.**

The Craddock Ranch Bone Bed near Seymour, Texas; Baylor County, represents one of the most faunally diverse samples of Lower Permian terrestrial vertebrate deposits in the world and has yielded abundant fossils of numerous Sphenacodont types as well as more than 12 additional genera and 15 species of reptiles and amphibians. Currently we have over one dozen *Dimetrodon* skeletons in varying completeness being worked on in the lab and the field. One of the big mysteries dating back to the 1870s in the time of Cope and Sternberg, was how many species of *Dimetrodon* were there? How do you tell the sex? We've made a lot of headway into answering these questions in the last 4 years.

***What are your goals for the museum? Are there any research projects or education initiatives you'd like to tackle in the future?***

When the late Judge Clyde Whiteside's dream of building a museum for Seymour, Texas came to fruition, there was a lack of faith from the public that we could maintain WMNH in a town of no more than 2,500 people. The history of small town museums is one marred by short life expectancy due to lack of funding and support. Following our first 4 years of existence, we have seen an overwhelmingly positive and steady attendance of more than 20,000 guests and over 5,000 school children. Our support from the public and especially the community is truly incredible at this point. We have changed a lot of lives for the better, and we provide the community with a healthy source of interactive education that has been long needed. It is becoming progressively challenging for schools to receive funding to provide beneficial learning opportunities outside the classroom. Field Trips are a highly effective supplement to classroom education, as it exposes students to new life experiences. Consequently, their interest and engagement in science is expanded greatly. Field trip programs inspire our youth to explore outside of their normal learning environment, experiencing science first hand from a primary source rather than a textbook. Tighter budgets and standardized tests in schools have resulted in fewer field trip opportunities and often the elimination of field trips all

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together. The Whiteside Museum of Natural History is committed to expanding the availability of science education to beyond the classroom walls and reinvigorating the importance of school field trips by providing science education to schools at no cost.

On the research side of the fence, we have slowly been attracting more universities to come out to the museum for free Permian Paleontology lectures and dig-site training. This year we had Sul Ross University come out for a day of lectures focusing on paleoecology, biology, and the geosciences including stratigraphy and geology. Following the lectures we took them out to the research field sites to give the students some hands-on experience in digging and collecting, as well as the chance to experience the geology first-hand. I highly encourage students and universities to join us for these field-courses. As we are collecting vertebrate fossils all year round, our collections department has thousands of specimens that are available for students and universities to use for their studies. The nice thing about having our research sites within 5 miles of the museum, is that we can be out at a site and back to the museum on the same day. This is an incredible resource for institutions to utilize.

WMNH is first and foremost a museum of natural history dedicated to the rich paleontological history of the area. But one of the most important things about paleontology is not only what we can learn, but how much of our newfound knowledge we can pass on, and with hopes to inspire the next generation to find their passion in life. Having the opportunity to teach our community, and the world, about the fossils that are incredibly unique to Seymour is a blessing.

**To learn more:**

Read a paper based on material collected in the region: Beck, K. G., Soler-Gijón, R., Carlucci, J. R., & Willis, R. E. (2016). Morphology and histology of dorsal spines of the xenacanthid shark *Orthacanthus platypternus* from the Lower Permian of Texas, USA: Palaeobiological and palaeoenvironmental implications. [Acta Palaeontologica Polonica, 61\(1\), 97-117.](#)

Visit <http://www.whitesidemuseum.org/> to learn more about the museum.

# BIGHORN BASIN PALEONTOLOGICAL INSTITUTE CELEBRATES ITS FIRST YEAR

By Jason P. Schein, Executive Director, Bighorn Basin Paleontological Institute



You last heard from us around this same time last year, when the Bighorn Basin Paleontological Institute was a mere one month old. Now only a year old, we still feel like the new kids on the block, but at the same time, boy, have we been through and learned a lot! I couldn't possibly list all of our accomplishments, so let me describe just a few.

We hit the ground running after our launch in February, and jumped right into the deep end of spring outreach season. Within just a few weeks, after giving talks, attending great events like Paleopalooza at the Academy of Natural Sciences, and participating in several Philadelphia Science Festival events, we had already educated and reached thousands of people in the tri-state Philadelphia region. In just the ten months we operated in 2017, well over 4,500 people across the country knew more about fossils, paleontology, earth science, and their world, thanks to our education and outreach programs.

Then of course, we jumped right into the summer field season. Almost 40 people from across the U.S. and the U.K. joined our team of paleontologists and educators in the northern Bighorn Basin of Montana and Wyoming. Throughout the 2017 field season, we focused on the Jurassic Morrison Formation, and it did not disappoint. Our primary site revealed new, associated, and so far unidentified sauropod material, and a new locality close by, named "LZ Blue," is already both promising and extremely exciting. Within a moderately-sized, 250 lb jacket, we've already collected three articulated cervical and one distal caudal vertebrae and an articulated tibia & fibula, all from *Allosaurus*, as well as an *Apatosaurus* phalanx, *Camarasaurus* vertebra, and crocodile vertebrae. Even more impressive is that the remains are exceptionally well preserved. This wasn't even the big surprise of the summer, though.



Exposing an *Allosaurus* fibula at "LZ Blue"

Early in the season, one of the BBPI staff members learned that another Morrison Formation site - the Mother's Day Quarry - was on the way to our main field site. With permission from the Bureau of Land Management, we decided

to make a quick visit one morning. This site is famous because in the 14 years it was actively quarried, over 3,500 bones were collected. It's also worth noting that every single one of those 3,500 bones, minus just a handful of theropod teeth, are from juvenile *Diplodocus*. We dropped in on this site, expecting just a quick visit with little to see or do. The Mother's Day Site had other ideas, though, and within moments of arriving we were finding bone. Everywhere. Some had clearly been partially excavated by those previous crews and covered over, and others were newly exposed. All were in immediate danger of being weathered and eroded, lost forever, by the elements.



Intertwined ribs at the Mother's Day site



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Once again, with the BLM's blessing, we collected these materials at or very near the surface, and once again, Mother's Day had other ideas. Almost every single bone we uncovered led to one, two, or six other bones. It was impossible to excavate one without running into multiple others, and sometimes there were so many intertwined ribs, the site looked more like a series of giant keltic knots than a dinosaur quarry. The most difficult job of the 2017 field season was figuring out how not to collect too many bones.

The true highlight of the season, though, had little to do with fossils, though. For two weeks, we had Honorary Expedition Leaders: two boys joined us, with their families, as part of the Make-A-Wish program. It was their wish that they become paleontologists and dig up dinosaurs for a week, and that's exactly what happened. One of them even found the first and only dinosaur skin impression this seasoned paleontologist has ever seen in person! It was the thrill of a lifetime for that 11 year old boy, and the look on his face was the thrill of a lifetime for this 39 year old boy. Most important of all, I'm happy to report, is that both boys are now in remission, with clean bills of health!

We ended the season by transporting back to the Academy of Natural Sciences of Drexel University dozens of fossil jackets, containing many more individual fossils. We could not have collected any more than we did in the six-week season. However, we were also hampered by not having an excavation permit from the BLM. We won't make that mistake again - our permit applications for the 2018 season are being processed and many people have already signed up to join our field teams this summer. With permits in hand, many more team members, and perhaps as many as three proven bonebeds to attack, 2018 is shaping up to be a banner year in the field.



*Max, one of our two Honorary Expedition Leaders, helping to load up a fossil jacket.*

In truth, there is no real education and outreach "season," because both of those go hand-in hand, and are incorporated into everything we do.

Our Dinosaur Treasures In Our Backyards program brought BBPI paleontologists to the Boys and Girls Club of Carbon County (Montana) during our field season to teach rural children of that region about paleontology, earth science, and the enormous contributions their home region has made to the history of paleontology. Thanks to four separate grants, that program will return this year, and expand to additional summer programs in the region.

Fall was at least as busy as spring and summer, though from the outside it may not have appeared that way. There were fewer talks, festivals, and public events, fortunately, because this is the season of BLM annual reports, grant reports, searches and proposals, and believe it or not, preparation for the next field season already! Of course the lab at the Academy of Natural Sciences was busy preparing and curating our first specimens, with more exciting discoveries along the way.

Now, as we've entered our second year, we have come full circle. 2018 is shaping up to be a lot like 2017, just bigger, better, all the way around. It's already been an incredible adventure, and we hope you'll join along for the ride, whether that's by following us on [social media](#), joining our [email list](#), or [becoming part of our field team](#)!

## RESEARCH: WHAT MAKES A SOCIAL MEDIA MESSAGE ENGAGING?

By Lisa Lundgren

As members of the FOSSIL project team, Dr. Kent Crippen and I have been exploring ways to effectively engage the public with science using social media. In one recent project, we examined the impact of three elements of social media posts--mentions, hashtags, and URLs--on engagement. "Mentions" occur when a post includes someone's username, such as @FloridaMuseum or @AndyFarke. Hashtags involve adding a # to a term or phrase (e.g., #paleontology) used in the post. As a result, that post is pooled with all other public posts on that social media platform that include #paleontology which makes it easier for users interested in a specific topic to find relevant posts. Lastly, users can add URLs--links to websites with additional content--to their messages.

To explore the FOSSIL Project's use of these elements, we analyzed messages posted on the FOSSIL Project's Facebook and Twitter pages from May 2014 through December 2016. In total, we analyzed 1450 messages, with approximately half the messages coming from Facebook and half from Twitter. We found that there were seven combinations of messaging elements that the FOSSIL Project used in their posts as well as posts that did not include any elements. Some posts included only mentions, while others included hashtags, mentions, and URLs, while others included mentions and URLs. But which elements made posts engaging?

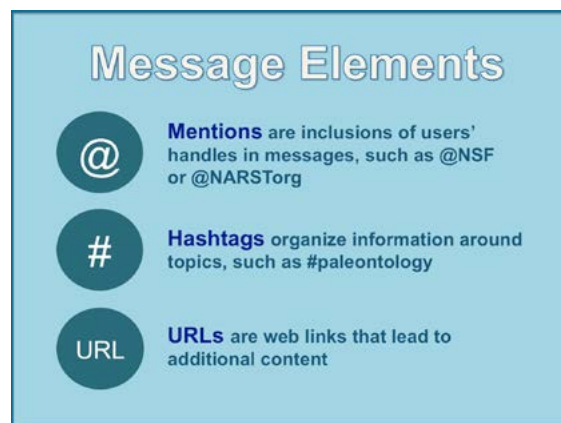
To help us determine which message elements, if any, are most likely to interest viewers, we used data analytics provided by Facebook and Twitter. Specifically, Facebook and Twitter provide what is called engagement rate. Engagement rates are calculated by determining the number of people who interacted with a message by either "liking" it, sharing it with others, or commenting on it and dividing that total by the number of people who saw a message (interactions/number of people who saw a message). The engagement rate is usually displayed as a percent, such as 3.2 percent.

To our surprise, we found that messaging elements actually tended to lower engagement rates! The posts with the highest engagement rates were those that had no messaging element, averaging an engagement rate of 4.7 percent. Posts that only included a hashtag dropped the engagement rate only slightly, to 4.3 percent. However, we found statistically significant differences in engagement rates when the other two elements, mentions and URLs, were included in the post. In posts that included only a URL, the engagement rate was 3.3 percent. Including only the mention element significantly lowered engagement rates to a rate of 2.3 percent. Interestingly, including mentions and hashtags in a post lowered the rate to 1.9 percent!

What we took away from these findings is the ways that message elements structure a social media message and therefore affect engagement. Mentions are a way to call out a specific person or organization, and therefore create barriers to community conversations; however, mentions are helpful and important to communicating with specific people. If you are interested in creating social media messaging to include communities, social media messages should include elements such as hashtags, as these do not significantly lower your engagement rates and are designed to include a community through aggregating information. We suggest that scientists, museums, and clubs can get their messages out more effectively by following these strategies.

We recently presented these findings at the largest international science education research conference, NARST. To read the full paper and view the research poster with associated figures, please visit <http://bit.ly/fossilnarst2018>.

Lundgren, L. & Crippen, K. J. (2018, March). Educative social media for informal science learning: Effective message design across two digital niches. Annual International Conference for the National Association for Research in Science Teaching (NARST), Atlanta, GA



## PROJECT UPDATES SPRING 2018

By Sadie Mills, FOSSIL Project Coordinator

### Coming Soon- myFOSSIL Mobile App

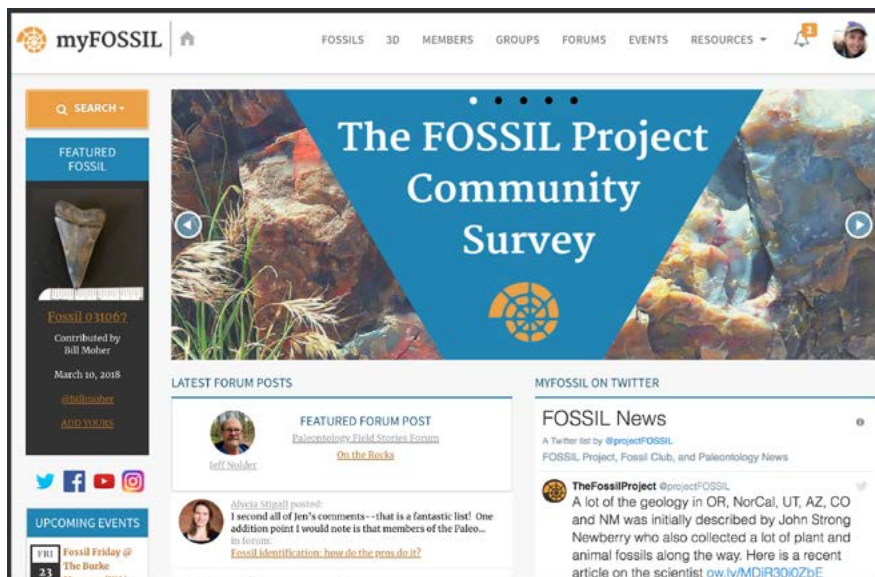
We have begun the design of the myFOSSIL mobile app in partnership with our developer, Atmosphere Apps. The myFOSSIL app will allow users to upload and share photos in the field, as well as connect with groups, research projects, and more. Be on the lookout for the mobile app's debut this summer.

### Learn your Fossil ABCs on Instagram

Check out FOSSIL's Instagram page to explore paleontology terminology from A to Z! We're introducing a new fossil-themed term each Tuesday and Friday, and are including some great fossil facts too. Follow us at <https://www.instagram.com/thefossilproject/> to join in on this geological and alphabetical social media adventure.

### Website

The myFOSSIL.org homepage has a new look! Updates to the page include a scrollable Twitter feed, a focus on new forum posts, a featured fossil, and easy links to our social media pages. Thanks to Atmosphere Apps for putting together the welcoming new design.



### Summative Evaluation

This March, we have been requesting feedback from the community as part of our summative evaluation, which we report to the National Science Foundation. Thank you to those who completed our survey, we truly appreciate your time and opinions. Our evaluator will next be contacting community members to get more in-depth feedback via telephone interviews. If you are interested in participating, please contact Kate Haley Goldman at [Kate@HaleyGoldman.com](mailto:Kate@HaleyGoldman.com).



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## **FOSSIL at NARST 2018**

This March, FOSSIL team members Kent Crippen, Lisa Lundgren, and Rich Bex attended the 2018 NARST International Conference. NARST is an international organization focused on using research to improve science education and learning. Lisa and Kent presented a poster of their research on FOSSIL's social media described on page 22.

## **FOSSIL Team Members attend NSTA**

FOSSIL team members Jeanette Pirlo and Victor Perez presented at the National Science Teachers Association 2018 National Conference in Atlanta, Georgia. Jeanette presented with iDigBio on using Natural History Collections in the classroom, and Victor gave a talk on using 3D-printed fossils to teach about Megalodon's size. Bruce MacFadden, along with Florida Museum of Natural History graduate students Claudia Grant, Sean Moran, and Michael Ziegler, presented a workshop on using 3D-printed fossils to teach about the Great American Biotic Interchange.

## **YouTube**

FOSSIL graduate student assistant, MacKenzie Smith, has started a new series on the FOSSIL YouTube channel. Called "50 States of Fossils," the series aims to help people get involved with fossil collecting around the United States.

Visit

[https://www.youtube.com/channel/UCt18MbS9hR6BjGK6yV\\_al\\_A](https://www.youtube.com/channel/UCt18MbS9hR6BjGK6yV_al_A)  
to watch the first episode!



*YouTube 50 States Series*

## **Upcoming Activities**

### ***Dry Dredgers Talk***

On April 27th, 2018, Bruce MacFadden and Jennifer Broo Sunderman will give a FOSSIL-sponsored talk to the Cincinnati Dry Dredgers entitled "Fossils horses, museum exhibits, and 3D learning in schools."

### ***Aurora Fossil Festival***

This May, FOSSIL will travel to Eastern North Carolina to participate in the 2018 Aurora Fossil Festival. We will have a display table in the community center on Saturday the 26th, and plan to have a test version of our mobile app to show to visitors. We are also looking forward to seeing the other exhibitors and activities at the festival!

### ***Research at the Belgrade Mine: Partnership between FOSSIL and SFAFM***

FOSSIL, in partnership with the Special Friends of the Aurora Fossil Museum, is planning a research trip to the Belgrade Mine in order to collect rare extinct land mammals. Many thanks to the SFAFM and Martin Marietta for making this research and citizen science opportunity possible!

## UPCOMING EVENTS

**March 30 @ 5:30 pm – 8:00 pm**

[Dino Egg Hunt - Arizona Museum of Natural History \(AZ\)](#)

**April 6 @ 8:00 am – April 8 @ 5:00 pm**

[MAPS 40th National Fossil Expo \(IA\)](#)

**April 7 @10:00 am - 1:00 pm**

[Fossils at the Fort \(TN\)](#)

**April 7 @10:00 am - 4:00 pm**

[Dino Family Day at the Morris Museum \(NJ\)](#)

**April 13 @ 4:00 pm – April 15 @ 5:00 pm**

[26th Annual Venice Shark's Tooth Festival \(FL\)](#)

**April 14 @ 1:00 - 4:00 pm**

[Discovery Day at the Alf Museum - Extinction of the Dinosaurs \(CA\)](#)

**April 21 @ 9:30 am - 12:00 pm**

[Educator Development at the Field Museum - Learning through Collections \(IL\)](#)

**April 27 @ 12:00 pm - 4:00 pm**

[Fossil Friday at the Burke Museum \(recurring event\) \(WA\)](#)

**April 29 @ 11:00 am - 2:00 pm**

[I Dig Dinos @ the Burke Museum \(recurring event\) \(WA\)](#)

**May 5 @ 10:00 am - 5:00 pm**

[PaleoAdventures: Unearthing Duck-Billed Dinosaurs \(Grades 2 & 3\) \(NYC\)](#)

**May 11 @ 5:30 pm - 9:00 pm**

[Understanding Dinosaurs in the 21st Century \(OH\)](#)

**May 24 @ 11:00 am - 11:30 am**

[Smithsonian Science How Webcast: How Bones Fossilize or Don't with Paleontologist Kay Behrensmeyer \(On-line\)](#)

[More events](#)