

The Paleo Times



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Rick Poropat, Editor

Rick's Ramblings

GOOD NEWS! Our September meeting will be held **IN- PERSON** on Friday, September 10, 2021 at 7:30 pm in Room 203 on the second floor of the Earth and Planetary Sciences building on the Washington University campus. Our program for the evening will be "What I did on my Summer Vacation" presented by several of our members. Please contact David Lukens if you want to be a part of this program.

Due to Washington University COVID policy, all who attend this in-person meeting, regardless of your vaccination status, MUST WEAR A MASK AT ALL TIMES while in the building. No exceptions! If you don't want to wear a mask, or are unable to do so because of medical or religious beliefs, please do not attend. I am sure that no one wants to jeopardize our standing with Wash. U. and our ability to meet there. This is the University's policy, not EMSP's and it will be enforced.

Masks will be available at the meeting.

The new parking garage across from the Earth & Planetary Sciences building is now OPEN. Parking is free after 5 pm but you must park in the yellow visitor area and only on the lower level.

To access this garage: from Big Bend Blvd., take Forest Park Parkway east to Hoyt Dr., turn right onto Hoyt and enter the garage. If you want to use Hoyt from the Forsyth side of campus, don't do that! Hoyt DOES NOT go all the way through to access the garage!

It appears that the Science Building door that will be unlocked is the back door that we have been using during construction. Remember that, as in the past, the building doors automatically lock at 7:30. Plan accordingly.

August was a busy month for the club with two in-person events taking place. Our first in-person event in more than a year; a larger-than-expected crowd attended the summer picnic, enjoying great food and conversation. It was gratifying to see everyone again!

A **Big Thanks** to everyone who helped make this event so successful!

A week later, a big crowd attended the fossil giveaway at the Poropat domicile. More than 100 flats representing hundreds of fossils, minerals, rocks and shells went to new homes. A **Special Thanks** to Addie Bolser, John & Dorothy Stade, Bruce Stinchcomb, Derek Belknap, Rick Poropat and the families of Bill Jeffries and Henry Porter for donating the many nice specimens that were given away!

Fossil of the Month



The September "fossil of the month" is the camarate crinoid *Agaricocrinus americanus* from the Lower Mississippian (Osagean) Keokuk Formation in Monroe County, Missouri. This species of extinct crinoid can be found in the Lower Mississippian rocks of Indiana, Tennessee, Kentucky and Missouri. In Missouri, it can be found in the Burlington Limestone as well as the Keokuk and Warsaw Formations. It dates to about 345 million years.

Agaricocrinus sp. has a small- to medium-size, low-lying cone to rounded, bowl-shaped cup (calyx) with a flat to indented (convex) base. The calyx looks like a mushroom cap. The indented side (underside of the

“mushroom cap”) is the side where the crinoid stem attached, which is called the aboral side. The rounded side of the calyx (top of the “mushroom cap”) is formed by a structure called a tegmen. The tegmen side is termed the oral side of the calyx.

Thirty-nine species of *Agaricocrinus* are known from the literature, but detailed studies of these species have resulted in many being synonymized or combined into others, such that only three remain valid today (Meyer and Ausich, 1997). Most of the variability in features that had been used to determine which species were invalid was related to ontogenetic variation. Ontogeny is the term used to describe natural changes in individuals from birth to adult (for example small versus large size). The remaining valid species are defined based on their relative cup shape, plate ornamentation (where preserved), and details of specific plates, which require some knowledge of crinoid morphology to differentiate.

Large, granular plates on the calyx are what sets this species apart from others. Most specimens found are only the calyx. A rare, complete crown would have ten arms attached in pairs around the base of the calyx. A more common species, *A. planoconvexus*, has a smaller calyx with a smooth plates rather than protruding, granular ones. For scale, the illustrated calyx of *A. americanus* is about 2.5 inches wide.



A complete *Agaricocrinus* sp. crown from the Edwardsville Formation near Crawfordsville, Indiana.

Did You Know?

The Keokuk Formation is a geologic formation found in Illinois, Iowa and Missouri. It contains marine fossils dating back to the Mississippian Sub-period of the Carboniferous era.

The Keokuk Limestone is characterized by mottled gray bioclastics and chert in the southeast, and brownish-black cherts with white spicules and by argil-

laceous dolomite in the west. The carbonate is argillaceous and the formation contains shale beds throughout the area. No sharp boundary marks the contact with the overlying Warsaw Formation. The latter consists of gray dolomite beds and much more shale than the Keokuk; chalcedonic chert and crystalline quartz are generally abundant.

Marine fossils are found in certain layers throughout the Keokuk, but the formation is more widely recognized for the tremendous variety of fabulous geodes found in an area encompassing southeastern Iowa, northeastern Missouri and west-central Illinois.

Brown County, Indiana has the largest accumulation of geodized fossils on the planet. Most come from the Mississippian Harrodsburg Formation and include crinoids (crowns and stems), blastoids, brachiopods, bivalves, horn corals, colony corals and gastropods. Look for them in creek beds or buy them cheap at the Bedford Rock Swap. The geodizing process greatly increases the size of the fossil but obscures most detail. Yes, most are hollow.

2021 Calendar

Sept. 10	EMSP ZOOM (In-Person?) Meeting Washington University
Sep. 11-20	Denver Show National Western Complex & Events Center Denver, Colorado
Oct. 22-24	MAPS Fossil Expo Orr Building, Illinois State Fairgrounds Springfield, Illinois
Nov. 19-21	Mineral & Gem Club Show Affton-Rogers Recreation Center
Dec. 11	EMSP Holiday Party Kirkwood Community Center

Give me a pick and give me a bag
And give me a summer day.
Then give me a trail where rocks abound
Profusely by the way.
Give me the time and give me the health
And give me a peaceful mind.
For as I wander along the trail
I'll leave my troubles behind.

-- W.H. Allaway (from ESCONI Newsletter, 1952)

Argillaceous The adjective “argillaceous is used to describe rocks in which clay minerals are a secondary, but significant component. For example, argillaceous limestones are limestones consisting primarily of calcium carbonate, but also contain 10-40% of clay minerals such as kaolinite, montmorillonite-smectite, illite and chlorite. Such limestones, when soft, are often referred to as marls.

890-million-year-old Sponges may be Oldest Animal Fossils

Recently discovered fossils belonging to ancient sponges might be the earliest known remnants of an animal body and pre-date other sponge fossils by 350 million years.

Elizabeth Turner, a professor of paleontology and sedimentary geology at Laurentian University in Ontario, discovered what she believes are possibly the fossilized structures of sponges that once existed in reefs millions of years ago. They were found in rock samples in northwestern Canada.

A study on Turner's findings published Wednesday in the journal *Nature*.

Little is known about the earliest days of animal life's emergence on Earth because the fossil record is sparse. While scientists have used genetic evidence to suggest that sponges first appeared between 541 million and 1,000 million years ago during the early Neoproterozoic era, the lack of fossilized sponges has created a knowledge gap. Turner's discovery may help fill that gap and provide a glimpse into the earliest marine animal life on Earth.

"I serendipitously came across a few very rare examples of the material during my unrelated PhD research, long ago, on fossil microbial reefs," Turner said. "When I became a professor and had my own grants, I was able to return to the field sites and collect more material so that I had a more robust collection to work from."

What she found in the ancient rock samples were fossilized structures that resembled the skeletons like those that exist within horny sponges -- the kind you use for a bath sponge. Horny sponges, also called modern keratose demosponges, have a skeleton with three dimensional branching made of a tough organic substance called spongin.

The branched networks of tube-shaped structures were covered by mineral calcite crystal. These also appeared similar to structures found in calcium carbonate rocks that were likely created when horny sponge bodies decayed.

"This organic skeleton is very characteristic and there are not known comparable structures," said Joachim Reitner, a professor in the University of Goettingen's department of geobiology who reviewed Turner's study

ahead of publication.

The ancient sponges lived in "shadowy nooks and crannies" on and below large reefs made from water-dwelling bacteria that were photosynthesizing, or converting light energy into chemical energy.

"They may well have hunkered down and lived a sweet life without having to evolve much for a few hundred million years," Turner said.

The "oxygen oasis" and potential food sources produced by the bacteria would have been a Goldilocks spot for the sponges.

These sponges appeared 90 million years before events thought necessary to support the appearance and diversification of animal life.

About 800 million years ago, Earth's oxygen levels increased during what scientists refer to as the Neoproterozoic oxygenation event, when there was a substantial boost in the amount of oxygen in the oceans and atmosphere.

The sponges may have been tolerant of low oxygen levels, so what was provided by the bacteria could have been enough.

Then, there were also the Cryogenian glacial episodes, during which much of Earth likely experienced severe ice ages between 635 million and 720 million years ago. The sponges weren't likely affected by this either.

The finding in Turner's paper "is a milestone in the understanding" of the animal family tree and reveals that the origin of it was much earlier than previously thought, Reitner said.

Many fossils can be dated back to the Cambrian explosion, a period 540 million years ago when diverse animal life flourished on the planet, according to David Bottjer, professor of Earth sciences, biological sciences and environmental studies at the University of Southern California. Bottjer was not involved in this study.

"The fossil record of animal life is something that many people are interested in and in particular, when animals first evolved on Earth," he said. "The big discussion has been, was there animal life in a significant way in the pre-Cambrian before the Cambrian explosion or not."

Researchers use two data sources to address these, he said. One is the fossil record. Then, there are molecular clocks, which are used to help scientists estimate how evolution has occurred in different organisms over time. The idea is that DNA evolves at a constant rate within organisms and genetic evidence can fill the gaps where the known fossil record is sparse

or entirely bare.

"This molecular clock approach says that animals were on Earth a good deal earlier than the Cambrian," Bottjer said.

Previously, many scientists believed spicules -- the mineralized skeletal structure of sponges -- were needed to show the existence of sponges. But some sponges don't have mineralized skeletons.

If complexly structured and diverse fossils are appearing in the rock record during and before the Cambrian period, it suggests that animals had to evolve ahead of that, Turner said.

This also suggests a time when animals existed, but were not well preserved or preserved at all -- prior to skeletons, shells and exoskeletons, Turner said. She understands that the earlier timeline suggested by her research "may be a little alarming for some researchers."

Bottjer thinks Turner has authored "a very well-founded paper." He also acknowledges that her findings will certainly ignite discussion among researchers.

"I tell my students that all pre-Cambrian fossils are disputed by somebody because it's very early in evolution," Bottjer said. "These animals commonly don't have all the features that they evolve later on so it can be a little tricky. I look forward to seeing what the response is, but it's I think it's a very strong case."

What isn't surprising is that the earliest evolutionary animals were probably sponge-like, Turner said. Sponges are simple, basic animals with a long history in the fossil record, and prior research suggests they likely appeared around this time.

Now, Turner wants to investigate when sponges actually emerged if they were already present 890 million years ago.

"The early evolution of animals remains murky, regardless of what I have to offer in this paper," she said. "What is needed is a lot of really focused work on very thoughtfully chosen rocks of the same age, as well as younger and older rocks, to look for other possible physical evidence of early animals -- sponge-like and possibly other more complex types of animals."

She also suggests keeping an open mind during the search. When it comes to early animal life, researchers really have no idea what they will find.

Turner also said the current academic standard and research grant system is less supportive of the type of time-consuming work, often resulting in unpublished findings, that will be required to thoroughly understand and investigate the rock record of early animal evolution.

"If we find ourselves looking for something that looks familiarly animal-ish, we will fail, because the familiar is too complex for the earliest animals," she said. "We

need to do some real soul-searching about what early animal preservation might have been like."

This research could even help in the search for life beyond our planet. While the Perseverance rover searches for evidence of ancient microbial life on Mars in an ancient lake bed, the ancient rock record on Earth could help scientists spot intriguing targets.

"If we're going to find things on other planets, it's probably going to be more like the pre-Cambrian stuff than something that is a million years old and has mammoth bones in it," Bottjer said.



Elizabeth C. Turner/Laurentian University This is a small sample of well-preserved microstructure in an ancient sponge, as shared in Turner's study.

Source: Ashley Strickland, CNN, July 28, 2021.

Fossils Seized in Police Raid Demystify a Prehistoric Flying Reptile

Limestone slabs recovered in a 2013 police raid in Brazil have revealed the most complete fossil of a species of pterosaur ever found, providing new details about how the flying reptile might have looked and behaved some 110 million years ago.

The discovery also brings attention to the issue of scientific colonialism — the removal (and sometimes outright theft) of items of scientific value from their countries of origin by fossil traders or more developed nations. According to the authors of a new report about the fossil, Brazil and other countries that have historically had their fossils smuggled or taken to other countries now have the infrastructure to responsibly handle and study them — and should accrue benefits like scientific discovery and tourism that come with a rich national cache of fossils.

The raid, at a harbor near São Paulo, led to the confiscation of about 3,000 fossils, including many fish and insects, according to Victor Beccari, a graduate student and the lead author of the study, published this week in the journal PLOS ONE. The centerpiece

was the nearly-complete skeleton from the pterosaur species, *Tupandactylus navigans*, preserved in six limestone slabs.

The oddball reptile must have been stunning to behold. With a giant, mohawk-style crest, a birdlike beak and a body covered in something resembling but not quite fur, the pterosaur probably stuck out even among the other exotic creatures of the early Cretaceous Period. Its sprawling wingspan indicated that it almost certainly flew, but probably only for short distances because of its long neck and large crest. It most likely spent a good deal of time foraging on the ground, the researchers say.

The crest, the researchers suspect, was a blessing and curse. Individuals endowed with larger-than-average headgear may have been more likely to attract a mate. The trade-off? Greater vulnerability to predators. (Die young and leave a beautiful corpse, perhaps.)

Pterosaur fossils are rare. Their bones are extremely fragile, even more so than birds, the researchers say.

A lake with fluctuating salinity that was created when Africa and Brazil separated was ideal for fossil preservation. Researchers have access to many fish preserved with their internal organs from that region. Mr. Beccari suspects their pterosaur specimen may have died by the lake, or by a river that dragged the body along into the lake.

"We think at the bottom of the lake there was no oxygen, so no animals or bacteria could decay the animal," Mr. Beccari said. "If it managed to get to this part of the lake it would be safe from decomposing."

Brazilian authorities had to sort out legal issues about exactly where the fossil should be sent. It was found in the northeastern part of Brazil but was seized in São Paulo, in the southeastern part of the country. It was eventually given to the University of São Paulo, and in 2016, Mr. Beccari, then an undergraduate, and a team of researchers began studying it.

David Hone, a paleontologist at Queen Mary University of London who was not part of the team of researchers, said there were "no big surprises" in the new paper but it provides a fuller anatomical description of the species. Whereas it was previously "known only for a skull," he said, "now we have the whole animal."

"It's a spectacular fossil," he continued. "This group is known for its giant head crest. This one is a big and ridiculous one even by those standards, which is really pretty neat."

For Dr. Hone, the most significant part of the research is that it occurred at all. "Fossil smuggling out of Brazil is a huge problem for science," he said.

Dr. Hone noted that movie stars and other rich people

pay large sums to display fossils on their walls.

Several years ago, the actor Nicolas Cage returned the skull of a *Tyrannosaurus bataar* to Mongolia after being contacted by the Department of Homeland Security.

"This (pterosaur) is a specimen that was presumably going to be smuggled or sold illegally," Dr. Hone said of the pterosaur, "and is now in a museum and available for research."

Source: Vimal Patel, The New York Times, August 27, 2021.

Fearsome Dragon

Australia's largest flying reptile has been uncovered, a pterosaur with an estimated seven-meter wingspan that soared like a dragon above the ancient, vast inland sea once covering much of outback Queensland.

University of Queensland PhD candidate Tim Richards, from the Dinosaur Lab in UQ's School of Biological Sciences, led a research team that analyzed a fossil of the creature's jaw, discovered on Wanamara Country, near Richmond in North West Queensland.

"It's the closest thing we have to a real life dragon," Mr. Richards said.

"The new pterosaur, which we named *Thapunngaka shawi*, would have been a fearsome beast, with a spear-like mouth and a wingspan around seven meters.

Mr. Richards said the skull alone would have been just over one meter long, containing around 40 teeth, perfectly suited to grasping the many fishes known to inhabit Queensland's no-longer-existent Eromanga Sea.

The new species belonged to a group of pterosaurs known as anhanguerians, which inhabited every continent during the latter part of the Age of Dinosaurs.

Being perfectly adapted to powered flight, pterosaurs had thin-walled and relatively hollow bones.

Given these adaptations their fossilized remains are rare and often poorly preserved.

Dr Steve Salisbury, co-author on the paper and Mr. Richard's PhD supervisor, said what was particularly striking about this new species of anhanguerian was the massive size of the bony crest on its lower jaw, which it presumably had on the upper jaw as well.

The fossil was found in a quarry just northwest of Richmond in June 2011 by Len Shaw, a local fossicker who has been 'scratching around' in the area for decades.

Source: University of Queensland. "Researchers find a 'fearsome dragon' that soared over outback Queensland." ScienceDaily. ScienceDaily, 9 August 2021.

<www.sciencedaily.com/releases/2021/08/210809100448.htm>.

(EMSP) is a registered Missouri not-for-profit organization dedicated to promoting the enjoyment and scientific pursuit of fossil collecting. It is open to all individuals interested in learning about the history of ancient life on earth. The club membership includes professional paleontologists as well as amateur hobbyists providing an open forum for the exchange of information as well as access to expertise on collecting, identifying, preparing and displaying fossils.

EMSP meetings are held on the second Friday of every month (except July, August and December) at 7:30pm in Room 203, on the second floor of the Earth and Planetary Sciences Building on the campus of Washington University. The building is located at the SW corner of the intersection of Forest Park Parkway and Hoyt Drive. Each meeting includes an informal exchange of information and speakers on a variety of fossil-related topics. Note: the building doors automatically lock at 7:30pm.

Club activities include occasional field trips led by experienced collectors, a great way to augment discussions at the monthly meetings. The club also participates in joint field trips with other paleo clubs, visiting fossil sites throughout the United States. EMSP is also proud to be involved in a partnership with the St. Louis Science Center as well as STEM outreach to classrooms, community events and science fairs.

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