The Paleo Times

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Rick Poropat, Editor

Rick's Ramblings

For a change, I have some good news to pass along. Unless pandemic conditions in our area worsen, we will be allowed to return to in-person meetings at Washington University beginning in September. Right now, the university requires all students, faculty and employees to be fully vaccinated before start of school and it is suggested that visitors be vaccinated or wear masks while on campus if they are not vaccinated. Our officers will meet in August to iron out our own conditions for getting together again. Stay tuned for an update in the next newsletter.

Our annual summer picnic is still on track for Sunday August 8, 2021, beginning at 12:00 noon at the Lions Pavilion in Kirkwood Park. Plenty of parking is available next to the tennis courts at the corner of Geyer Road and Adams. Another option is to park in the community center lot and walk up the hill (across the bridge) to the pavilion. The pavilion is located at the end of the sidewalk leading into the park from the parking lot. There are actually two pavilions. Our picnic is in the one next to the rest rooms.

This picnic is a ***members-only*** potluck event. The club will provide burgers, brats, hotdogs, buns and condiments, plates, cups, plastic utensils, napkins, soda and ice. Participants are asked to bring food dishes to share with others. Please bring table covers if you have them.

BYOB. (beer & wine only please as we don't have a permit for the stronger stuff.)

We will begin to arrive around noon for appetizers, socializing and to begin cooking. The main meal will begin around 12:30-1:00pm. Rumor has it there will be fossils for sale. Masks suggested for the unvaccinated.

In order to prepare for this event, we will need to determine how many club members and their families will be coming**. If you plan to attend, please RSVP no**

One of the special activities everyone looks forward to at our monthly meetings is searching through the freebee fossils members bring to share with others. Over the past year or so, because of Covid, these items have accumulated to the point that there is now too much of a load to bring to meetings.

So, announcing the *EMSP Great Fossil Giveaway* which will be held at the home of Rick & Kay, on Saturday August 14, 2021. Rain date will be Sunday the 15th. This event is for ***EMSP members only*.**

Offered free to good homes will be more than one hundred boxes of fossils, mineral and rocks from around the U.S. The assortment represents the last remaining specimens donated to the club by Addie Bolser from the *Joe & Addie Bolser Collection*, specimens donated by the Helen Porter Family from the *Henry Porter Collection*, plus a variety of specimens down-sized from the *Poropat Family Collection* and others. Included are insects and leaves from the Green River formation, trilobites from Utah and Illinois, brachiopods, crinoids, corals, geode pairs, sponges, graptolites and many other specimens from Texas, Oklahoma, Indiana, Tennessee, Missouri, Kansas and Mississippi, etc. There will probably be a few books and magazines as well.

Many specimens have been identified, labeled and boxed and are ready for your collection. Many others are as they were found and will need to be cleaned, trimmed, prepared and identified.

We will have a few empty boxes for you to fill, but better bring your own just in case. Everything must Go! Children very welcome here!

Members are welcome to bring their own surplus material to add to the treasure pile.

A mask is not required for those who are fully vaccinated.

The gate opens at 10 am. **NO Early Birds Please.**

Fossil of the Month

The summer "fossil of the month" is an unidentified specimen from Missouri. It resembles the Upper Neoproterozoic Ediacaran ball algae, *Nemiana simplex*, from the Ukraine and also the domal stromatolite, *Kussiella* sp. from the Newland Limestone of Montana. Is this an undescribed species from our state? For scale, each "dome" is about one inch wide.

A few of our club members have collected slabs of these from Missouri. Does anyone know what they are? What is their age and geologic formation? Are they even organic in origin? This Missouri specimen isn't featured in Dr. Stinchcomb's book, *World's Oldest Fossils*.

GSLAESC Show

We are back on track to participate in the 2021 Greater St. Louis Association of Earth Science Clubs (GSLAESC) Rock, Mineral & Fossil show to be held at the Machinist Hall, 12365 St. Charles Rock Road, Bridgeton, MO. on Aug. 20-22. We will NOT be selling, however, as association members we are asked to provide volunteers to help set up (Friday) and take down the show (Sunday), staff the admissions table on Friday night and provide displays for five cases. (provided) The displays can be fossil or mineral. Work usually involves setting up and taking down the display cases.

Our club is paid from show receipts, based on the number of volunteers and the time worked. Volunteers will receive free admission to the show.

We evidently will not be doing fossil preparation demonstrations this year.

On Friday, we need two volunteers for each of two

Volunteers will NOT be responsible for enforcing any Covid mask restrictions that might be in place at show time. The Association and Machinist Hall officials will be responsible for rule enforcement.

If you are interested in volunteering to help with the show or would like to display your collection, please contact Faye at Fayewhobrey@gmail.com for more information.

2021 Show Hours

Friday August 20: 3:00pm-8:00pm
Saturday August 21: 10:00 am-6:00pm
Sunday August 22: 11:00 am-5:00pm
Machinists Hall Auditorium
12365 St. Charles Rock (Bridgeton)
St. Louis County, MO.

Did You Know?

Graptolites are colonial marine organisms known mainly as fossils from the Middle Cambrian through the Lower Carboniferous (Mississippian). The name comes from the Greek *graptos*, meaning written and *lithos*, meaning rock as many specimens resemble hieroglyphs written on the rock.

The name "graptolite" originates from the genus *Graptolithus*, which was used by Linnaeus in 1735 for inorganic mineralizations and incrustations which resembled actual fossils. In 1768, in the 12th volume of *Systema Naturae*, he included *G. sagittarius* and *G. scalaris*, respectively a possible plant fossil and a possible graptolite. In his 1751 *Skånska Resa*, he included a figure of a "fossil or graptolite of a strange kind" currently thought to be a type of *Climacograptus* (a genus of biserial graptolites). The term *Graptolithina* was established by Bronn in 1849 and later, *Graptolithus* was officially abandoned in 1954 by the ICZN.

Since the 1970s, as a result of advances in electron microscopy, graptolites have generally been thought to be most closely allied to the pterobranchs, a rare group of modern marine animals belonging to the phylum Hemichordata.

Graptolithina includes two main orders, Dendroidea (benthic graptolites) and Graptoloidea (planktic graptolites). Graptoloidea is the most diverse, including 5 suborders where the most assorted is Axonophora. This group includes Diplograptids and Neograptids, groups that had great development during the Ordovician.

Graptolites are common fossils and have a worldwide distribution. They can be found in Missouri.

The preservation, quantity and gradual change over the geologic time scale of graptolites allow the fossils to be used as important index fossils for dating rock strata throughout the world. Graptolites are especially useful for dating Paleozoic rocks as they evolved rapidly with time and formed many different species. Geologists can divide the Ordovician and Silurian rocks into graptolite biozones, generally less than one million years in duration. A worldwide ice age at the end of the Ordovician eliminated most graptolites except the *neograptines* that diversified about two million years later.

Graptolites were a major component of the early Paleozoic ecosystems, especially for the zooplankton because the most abundant and diverse were the planktonic forms. They were most likely suspension feeds and strained water for food such as plankton.

Graptolite fossils are often found in shales and mudrocks where sea-bed fossils are rare, this type of rock having formed from sediment deposited in relatively deep water that had poor bottom circulation, was deficient in oxygen, and had no scavengers. The dead planktic graptolites, having sunk to the sea floor, would eventually become entombed in the sediment and were thus well preserved.

These colonial animals are also found in limestones and cherts, but generally these rocks were deposited in conditions which were more favorable for bottom-dwelling life, including scavengers, and undoubtedly most graptolite remains deposited here were generally eaten by other animals.

Fossils are often found flattened along the bedding plane of the rocks in which they occur, though may be found in three dimensions when they are infilled by iron pyrite or some other minerals. They vary in shape, but are most commonly dendritic or branching (such as Dictyonema), sawblade-like, or "tuning fork"-shaped (such as Didymograptus murchisoni). Their remains may be mistaken for fossil plants by the casual observer, as it has been the case for the first graptolite descriptions.

Graptolites are normally preserved as a black carbon film on the rock's surface or as light grey clay films in tectonically distorted rocks. The fossil can also appear stretched or distorted. This is due to the strata that the graptolite is within, being folded and compacted. They may be sometimes difficult to see, but by slanting the specimen to the light they reveal themselves as a shiny marking. Pyritized graptolite fossils are also found.

2021 Calendar

Aug. 08	EMSP Picnic Kirkwood City Park
Aug 14 (15)	EMSP Great Fossil Giveaway Home of Rick & Kay Poropat, Kirkwood
Aug 20-22	GSLAESC Show Machinists Hall Auditorium Bridgeton, Missouri
Sept. 10	EMSP 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

Longest Known Continuous Record of the Paleozoic Discovered in the Yukon

Expeditions to a remote area of Yukon, Canada, have uncovered a 120-million-year-long geological record of a time when land plants and complex animals first evolved and ocean oxygen levels began to approach those in the modern world.

Hundreds of millions of years ago, in the middle of what would eventually become Canada's Yukon Territory, an ocean swirled with armored trilobites, clam-like brachiopods and soft, squishy creatures akin to slugs and squid.

A trove of fossils and rock layers formed on that ancient ocean floor have now been unearthed by an international team of scientists along the banks of the Peel River a few hundred miles south of the Arctic's Beaufort Sea. The discovery reveals oxygen changes at the seafloor across nearly 120 million years of the early Paleozoic era, a time that fostered the most rapid development and diversification of complex, multi-cellular life in Earth's history.

"It's unheard of to have that much of Earth's history in one place," said Stanford University geological scientist Erik Sperling, lead author of a July 7 study detailing the team's findings in *Science Advances*. Most rock formations from the Paleozoic Era have been broken up by tectonic forces or eroded over time. "There's nowhere else in the world that I know of where you can study that long a record of Earth history, where there's basically no change in things like water depth or basin type."

Oxygen was scarce in the deep water of this and other oceans at the dawn of the Paleozoic, roughly 541 million years ago. It stayed scarce until the Devonian, roughly 405 million years ago, when, in a geological blink -- no more than a few million years -- oxygen likely rocketed to levels close to those in modern oceans and the diversity of life on Earth exploded. Big, predatory fish appeared. Primitive ferns and conifers marched across continents previously ruled by bacteria and algae. Dragonflies took flight. And all of this after nearly four billion years of Earth's landscapes being virtually barren.

Scientists have long debated what might have caused the dramatic shift from a low oxygen world to a more oxygenated one that could support a diverse web of animal life. But until now, it has been difficult to pin down the timing of global oxygenation or the long-term, background state of the world's oceans and atmosphere during the era that witnessed both the so-called Cambrian explosion of life and the first of Earth's "Big Five" mass extinctions, about 445 million years ago at the end of the Ordovician.

"In order to make comparisons throughout these huge swaths of our history and understand long-term trends, you need a continuous record," said Sperling, an assistant professor of geological sciences at Stanford's School of Earth, Energy & Environmental Sciences (Stanford Earth).

With permission from the Na Cho Nyak Dun and Tetlit Gwitch'in communities in Yukon, Sperling's team, which included researchers from Dartmouth College and the Yukon Geological Survey, spent three summers at the Peel River site. Arriving by helicopter, the research team hacked through brush with machetes beside Class VI rapids to collect hundreds of fist-sized samples of rock from more than a mile of interbedded layers of shale, chert and lime mudstone.

Back at Sperling's lab at Stanford, a small army of summer undergraduates and graduate students worked over five summers to help analyze the fossils and chemicals entombed in the rocks. "We spent a lot of time splitting open rocks and looking at graptolite fossils," Sperling said. Because graptolites evolved a vast array of recognizable body shapes relatively quickly, the pencil-like markings left by the fossils of these colony-dwelling sea creatures give geologists a way to date the rocks in which they're found.

Once the researchers had finished identifying and dating graptolite fossils, they ground the rocks in a mill, then measured iron, carbon, phosphorus and other elements in the resulting powder to assess the ocean conditions at the time and place where the layers as well as 106 new samples from other parts of Canada and 178 samples from around the world for comparison.

The data show low oxygen levels, or anoxia, likely persisted in the world's oceans for millions of years longer than previously thought -- well into the Phanerozoic, when land plants and early animals began to diversify. "The early animals were still living in a low oxygen world," Sperling said. Contrary to long-held assumptions, the scientists found Paleozoic oceans were also surprisingly free of hydrogen sulfide, a respiratory toxin often found in the anoxic regions of modern oceans.

When oxygen eventually did tick upward in marine environments, it came about just as larger, more complex plant life took off. "There's a ton of debate about how plants impacted the Earth system," Sperling said. "Our results are consistent with a hypothesis that as plants evolved and covered the Earth, they increased nutrients to the ocean, driving oxygenation." In this hypothesis, the influx of nutrients to the sea would have given a boost to primary productivity, a measure of how quickly plants and algae take carbon dioxide and sunlight, turn them into new biomass -- and release oxygen in the process.

The change probably killed off graptolites. "Although more oxygen is really good for a lot of organisms, graptolites lost the low oxygen habitat that was their refuge," Sperling said. "Any environmental change is going to have winners and losers. Graptolites might have been the losers."

Source: Stanford University. "Longest known continuous record of the Paleozoic discovered in Yukon wilderness." ScienceDaily. ScienceDaily, 8 July 2021. <www.sciencedaily.com/releases/2021/07/210708185945.htm>.

Do Animals Control Earth's Oxygen Level?

For the first time, researchers have measured how the production of algae and the Earth's oxygen level affect each other -- what you might call 'Earth's heartbeat'. Studies of 540 million-year-old limestone indicate that it is not just the oxygen level that affects animals, but that animals can indeed regulate the oxygen level.

No more than 540 million years ago there was a huge boom in the diversity of animals on Earth. The first larger animals evolved in what is today known as the Cambrian explosion. In the time that followed, with the evolution of the animals, the oxygen level in the atmosphere dropped and this temporarily slowed the radiation. However, subsequent oxygenation and growth of algae added energy to the food chain and got the explosion of life going.

In a new scientific study, researchers from the GLOBE Institute at the Faculty of Health and Medical Sciences, University of Copenhagen, have now found that the animals themselves probably contributed to an adjustment of the oxygen level and thus indirectly controlled their own development.

"For the first time, we have succeeded in measuring 'Earth's heartbeat'- understood as the dynamics between the oxygen level and the productivity on Earth. We have found that it is not just the environment and the oxygen level that affect the animals, but that, most likely, the animals affect the oxygen level", says Associate Professor Tais Wittchen Dahl from the GLOBE Institute.

To understand what controls the oxygen level on Earth, the researchers have looked at limestone deposited on the ocean floor during the Cambrian explosion 540-520 million years ago. The ratio of uranium-238 to uranium-235 in the old lime has revealed how much oxygen there was in the oceans at that time. The researchers have thus been able to see some massive fluctuations between two extreme conditions, where the ocean floor was covered by oxygenated or oxygen-depleted bodies of water, respectively. It is these global-scale fluctuations that they believe the animals themselves have contributed to.

During the Cambrian explosion, the marine animals evolved. They became larger, began to move on the ocean floor, ate each other and developed skeletons and shells. In particular, the new ability to move is interesting because the animals ploughed through the mud on the ocean floor, and -- as a result -- much of the phosphate contained in the water was instead bound in the ocean floor. Phosphate is a nutrient for algae in the oceans, and algae make photosynthesis, which produces oxygen.

"Less phosphate produced fewer algae, which over geological time led to less oxygen on Earth, and due to the oxygen-poor conditions, the larger animals moved away. Once the animals were gone, the oxygen level could go up again and create favorable living conditions, and then the process repeated itself", explains Tais Wittchen Dahl.

"'In this way, the mud burrowing animals themselves helped control the oxygen level and slow down the otherwise explosive evolution of life. It is entirely new that we can render it probable that such dynamics exist mechanisms that control the oxygen level on Earth".

Understanding the mechanisms that control the oxygen level on our planet is not just important for life on Earth. A better understanding of the dynamics between oxygen and life ¬- Earth's heartbeat -- will also bring us closer to an understanding of possible life on other planets.

"'Oxygen is a biomarker -- some of what you look for when you look for life elsewhere in the universe. And if life in itself helps control the oxygen level, it is much more likely that there will also be life in places where oxygen is present", says Tais Wittchen Dahl.

Interpreting the million-year-old dynamics is the closest we can come to making a global experiment. As it is not possible to test how you might influence the global oxygen level today, scientists must instead resort to the past to gain an understanding of the dynamics that make up Earth's heartbeat -- and in this way perhaps make it a little easier to understand life on our own and on other planets.

University of Copenhagen The Faculty of Health and Medical Sciences. "Do animals control earth's oxygen level?." ScienceDaily. ScienceDaily, 10 September,2019. <www.sciencedaily.com/releases/2019/09/190910105401.htm>.

The Evolutionary History of Museum Specimens

Museum specimens held in natural history collections around the world represent a wealth of underutilized genetic information due to the poor state of preservation of the DNA, which often makes it difficult to sequence. An international team, led by researchers from the University of Geneva (UNIGE) and the Museum of Natural History of the City of Geneva (MHN), has optimized a method developed for analyzing ancient DNA to identify the relationships between species on a deep evolutionary scale. This work is published in the journal *Genome Biology and Evolution*.

In this work, the scientists used HyRAD-X RNA probes instead of DNA probes to find fragments of interest in the genome. RNAs, copies of DNA molecules in charge of transferring the information encoded by the genome, have a very strong affinity for DNA and RNA-DNA pairings occur more easily than DNA-DNA pairings.

Source: Université de Genève. "DNA reveals the evolutionary history of museum specimens." ScienceDaily. ScienceDaily, 13 July 2021. <www.sciencedaily.com/releases/2021/07/210713093705.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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