A publication of the Rochester Academy of Science
FOSSIL SECTION

The FOSSILETTER

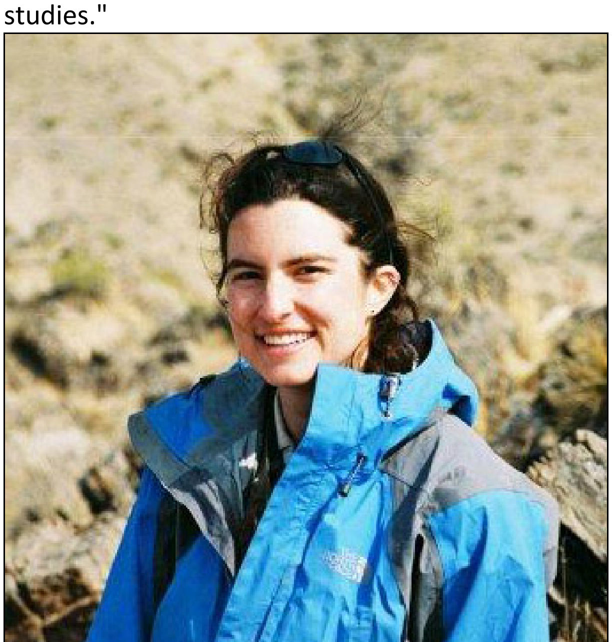
VOL. 39 Number 1 October 2021

October Meeting

The October section meeting is on Tuesday, October 5, at 7:30 PM. This meeting will be conducted as a virtual meeting on Zoom. Details on how to login in are in the accompanying email.

We apologize, but the Brighton Town Hall, where we normally have live meetings, is not ready to begin booking meetings yet. Your Board expects that we will continue with ZOOM meetings for the rest of the year.

Meanwhile, this imposition means that we can continue to bring you world class speakers not normally available to us. We have as our guest for our October meeting Dr. Melanie J. Hopkins, Chair of the Division of Paleontology and Curator in Charge of Fossil Invertebrates at the American Museum of Natural History. President Dan will conduct some business, mostly on past field trips, and then Dr. Hopkins will speak to us on, "How to Grow a Trilobite: Learning about trilobite growth and development through empirical and modeling studies."


Dr. Melanie J. Hopkins. Photo courtesy of AMNH.

As Dr. Hopkins writes, “Trilobites offer one of the best fossil records of an arthropod group. The heavily biomineralized exoskeleton was particularly suited to withstand decay and destruction during burial and fossilization. Like all arthropods, trilobites were also molting organisms, and because their exoskeleton was biomineralized from an early developmental stage, all of their shed molts also had potential to make it into the fossil record.

“This allows researchers to reconstruct the developmental changes that trilobite species underwent, and ask questions about how such change in segmentation patterns, growth rates, and morphology, might have influenced the longer term evolution of trilobites.

“In this talk, I will present recent work using both empirical and modeling approaches. In the former, recently made large collections of the well-known trilobite *Elrathia kingii* provided the basis for detailed analysis of the patterns of segmentation, growth rates, and shape change during development of this species. In the latter, information obtained from this and other empirical studies provided the basis for modeling trilobite growth, allowing us to see the impact of altering different growth parameters on trilobite size and body proportions. Although the model is relatively simple, it is possible to recover much of the tremendous diversity we see in the trilobite fossil record.”

Dr. Hopkins’ research focuses on patterns and processes of morphological evolution, including the roles of both development and ecology in directing evolution over long time scales. She works primarily on trilobites but has also worked on projects involving other marine invertebrate groups, including crinoids and fiddler crabs. She did her undergraduate training at Stanford University and her PhD at the University of Chicago.

Elrathia kingii *from Middle Cambrian House Range of Utah Wheeler Shale Formation. From www.fossilmuseum.net*

Dr. Melanie J. Hopkins with some of her trilobites. Photo courtesy of AMNH.

Samuel Ciurca, 1939-2021

We are sad to report the death of long time member Sam Ciurca on Saturday, 10/2/2021. We will have more details in the next issue.

President's Report **by Dan Krisher**

Summer has breezed past as it always seems to do and, as we move into Fall, it is time to begin our monthly Fossil meetings once again. Early in the summer the board planned on and was looking forward to resuming in person meetings in the Brighton Town Hall. The Board was busy planning the logistics of holding in person meetings while simultaneously broadcasting them via ZOOM to accommodate our remote members as well as our affiliated clubs and groups. Unfortunately, the resurgence of COVID in the form of the Delta variant has rendered in person meetings impossible. In early August the Board learned the town hall ventilation system did not meet updated New York standards and the hall would be closed for meetings for the remainder of 2021 and mostly likely most or all of 2022.

Over the last few weeks, board members have investigated numerous other venues which could accommodate us however all proved to be too expensive for our limited budget. While we have not given up finding a suitable venue the board has made the decision to hold the 2021-2022 meetings via ZOOM as we did in the Spring of this year. The process for logging into meetings will be like earlier this year and we do have the advantage of having worked out all the kinks of the process.

On a brighter note, the Section did resume fieldtrips this year with an extensive schedule although mother nature did not cooperate with us on a couple of the trips. We kicked off the season on 4/24 with a visit to the Middle Silurian Rochester Shale at the Gulf site outside of Lockport.

On 5/8 the Section had a field trip scheduled for the Lower Devonian Helderberg Group at Schoharie, but this trip was rained out. Our next trip was to a fairly new site outside of Tioga, PA. This allowed for collecting in the Upper Devonian sandstones which is uncommon for the Section. On 6/5 the Section returned to long-timefavorite Little Beard's Creek where we collected in the Fall Brook Bed of the Windon Shale. On 6/19 the Section visited the Portland Point and Salmon Creek sites near Ithaca. These are new to the Section and the Portland Point site is rarely visited as permission can be hard to obtain. The Section next visited on 7/10, the Swamp Road site near Morrisville and the Pompey Center Road cut. These are also frequent stops for the Section. The final trip for the season was a return to Jaycox Run between Avon and Geneseo. This is a Nature Conservancy site, and the Section has been fortunate to again access to this site once again. The Section did try once again to visit the Rickard Hill site but once again we were rained out. There is always next year.

Election Results of June 2020

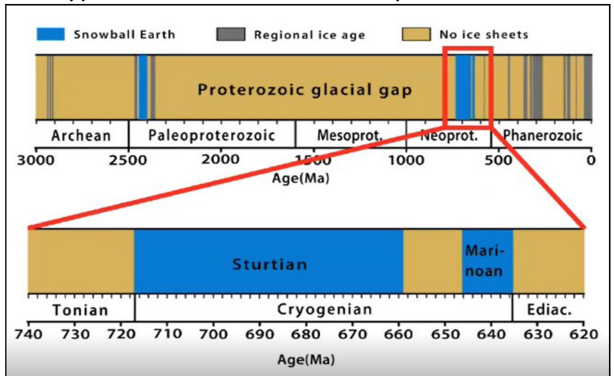
The election results were tallied with the slate of nominated candidates winning unanimously.

President: *Daniel Krisher*
Vice President: *Michael Grenier*
Secretary: *Daniel Krisher*
Treasurer: *John Handley*
Director 3 year term*: open*
Director 1 year term: *open*
Positions begin immediately.
Directors whose terms have not expired are Melanie Martin (2023) and Fred Haynes (2022)

June Meeting Recap

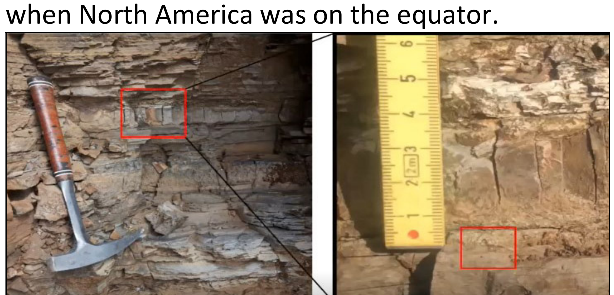
In lieu of our traditional June picnic, our June 2 meeting was held via ZOOM. After a brief business session, the remainder of the meeting consisted of a provocative presentation by Dr. Scott MacLennan on "An introduction to global glaciations, Earth's most extreme climate change events." This talk was well attended by our own members, including by members too far away to come to our usual meetings. We also had a number of guests from the Geological Society of Minnesota, Buffalo Geological Society, North Coast Fossil Club (Cleveland), Dry Dredgers (Cincinnati), and the Natural History Society of Maryland. A few key points of the talk follow.

Between 600 and 700 million years ago there were multiple global glaciations that greatly affected the development of life. Ancient climates are indicated by many evidences in the rocks. For example, high levels of calcium carbonate indicate hot conditions and various glacial deposits indicate frigid. After reviewing the profile of the Pleistocene ice ages and the various climate feedback loops, both negative (silicate weathering drawing down atmospheric CO_2) and positive (accumulated ice and snow reflecting solar energy back to space [albedo] causing further cooling), Scott reviewed the ice ages for which we have evidence. There were three major ice ages in the Paleozoic and Cenozoic, each with several pulses or cycles. These occurred regionally, at the poles and high elevations. However, two in the Proterozoic, beginning with the Huron ice age and ending with the Sturtian/Marinoan just before the Ediacaran, are hypothesized to have encompassed the Earth.

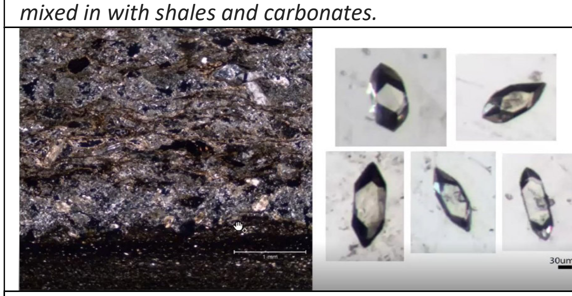


Note the 1.4 billion years of warm climate between the Paleoproterozoic and the Cryogenian and the 255 million years of warmth from the Permian to the Oligocene.

The start of the Sturtian between 717.4 and 716.9 MYA can be found in Alaska and in Ethiopia, and can be dated using ^{238}U-^{206}Pb radioactive decay in zircon crystals. Another boundary at the start of the Sturtian, studied by Scott, is found in the Konnarock Formation of Virginia, where sediments contain dropstones and laminated lake deposits, when North America was on the equator.



Here is found a volcanic tuff associated with glaciation mixed in with shales and carbonates.

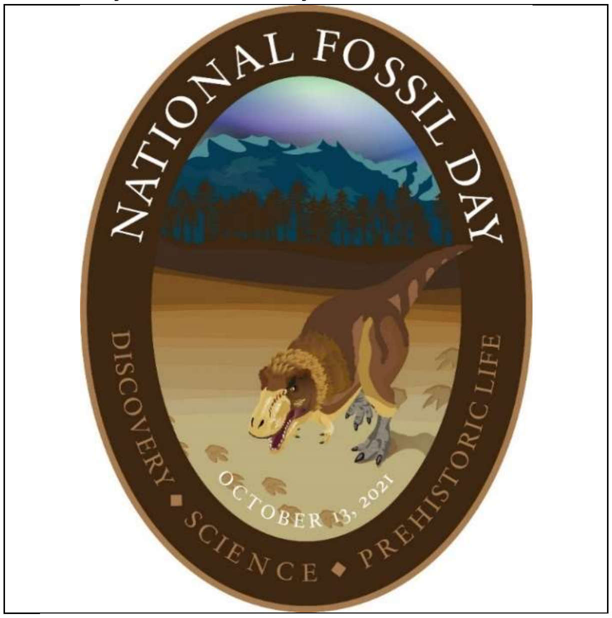


The small square in the above right photo is blown up here, showing a shale base overlain with tuff, in which one can see zircon crystals, which were used in dating.

So, was Earth a Snowball or was there open water anywhere? Watch the talk for Scott's take. The full talk can be found at https://youtu.be/oBLXqemu44g

National Fossil Day

We celebrate the eleventh annual National Fossil Day on Wednesday October 13, 2021.



The 2021 National Fossil Day Logo is inspired by the diverse record of Late Cretaceous dinosaur footprints from Denali National Park and Preserve in central Alaska. The logo features an Alaskan tyrannosaur walking under a northern polar night sky, through a mudflat, and encountering a trackway left by a hadrosaur (duck billed dinosaur). In the distance, an ancient boreal forest outlines the Cretaceous landscape. The Late Cretaceous (100 to 66 million years ago) represents the end of the Mesozoic Era and the height of dinosaur diversity. At the end of the Cretaceous a massive extinction event occurred that claimed all non-avian dinosaurs, pterosaurs, large marine reptiles, several groups of early birds, a few families of fish, and several groups of mollusks such as ammonites. The extinction event also marked the beginning of the Cenozoic Era and the great diversification of mammals. Trace fossils, or ichnofossils, are the evidence of the biological activities and behaviors of past life. These kinds of fossils include footprints, burrows, nests and scat. Trace fossils are distinct from body fossils, which are the physical remains of plants and animals (such as wood, bones or shells). Trace fossils are an important source of information on ancient environments, the distribution of where ancient life occurred, and how lifeforms changed over time. They also provide information on soft bodied animals that are rarely found as body fossils. Trace fossils have been documented in many of our national parks and monuments representing biological activity spanning back more than a billion years of geologic time. At Grand Canyon National Park (Arizona), a rich record of life has been identified from trace fossils dating back to the Precambrian (roughly 1.2 billion years ago) to the Early Permian (275 million years ago). For the Mesozoic, fossil tracks left by early dinosaurs have been identified from parks such as Glen Canyon National Recreation Area (Arizona, Utah) and Gettysburg National Military Park (Pennsylvania). At Death Valley National Park (California) thousands of mammal tracks have been identified from the Pliocene epoch approximately 6 million years ago. At White Sands National Park (New Mexico) playa lake deposits preserve tracks showing a co-occurrence of late Pleistocene megafauna (mammoths, sloths, camels, etc.) and early humans in North America.

The Cantwell Formation at Denali National Park and Preserve consists of sedimentary rocks which are interpreted as braided and sandy stream channels, overbank floodplain and lake deposits. Trace fossils are common in the Cantwell Formation. First discovered in 2005, thousands of fossil tracks representing a variety of dinosaurs and other organisms have been identified within the park. In addition to dinosaurs, traces of small invertebrates such as nematodes (roundworms), oligochaetes (segmented worms), bivalves, crayfish, beetles, and fly larvae indicate a rich diversity of invertebrates occurring in the North American arctic during the Late Cretaceous. Evidence of non-dinosaurian vertebrate traces include the presence of fish and pterosaurs. The pterosaur record includes the distinctive manus (hand) prints of both large and smaller species and is the first fossil evidence of this group of flying reptiles both for the state of Alaska and this far north during the Cretaceous.

A large number of fossil footprints associated with plant eating dinosaurs have been identified at Denali National Park and Preserve. The most common are tracks belonging to hadrosaur dinosaurs of different ages. Commonly called “duck billed” dinosaurs, hadrosaurs were very common and diverse during the Late Cretaceous in

North America. At one site within Denali National Park and Preserve, thousands of tracks of hadrosaurs were discovered, representing evidence of a multi-generational (mixed ages) herd. Body fossils found within similarly aged rocks in the Prince Creek Formation of northern Alaska suggests these tracks could have been made by a hadrosaur similar to *Edmontosaurus*, a common crestless hadrosaur also found in Montana, Wyoming, North and South Dakota, and western Canada. Other tracks of plant eating dinosaurs at Denali National Park and Preserve include tracks left by ceratopsian (horned) dinosaurs, which are known from body fossils documented in the Prince Creek Formation. Possible tracks of ankylosaurs, armored herbivore dinosaurs, have also been reported from the park.

Hadrosaur footprint in Denali Park

A variety of theropod dinosaur tracks have also been identified from Denali National Park and Preserve. Theropods are a group of largely predatory bipedal dinosaurs. Bird tracks have been found alongside other dinosaur tracks at Denali National Park and Preserve. Several different types of bird tracks have been identified within the park. Theropod and bird tracks typically are three-toed with narrow claws. However, a series of didactyl or two toed tracks were discovered within the park. These have been attributed to "raptorial" dinosaurs such as dromaeosaurs (the Velociraptor group) or a sister group to the dromaeosaurs called the troodontids. A bizarre theropod track type with four toes has also been identified within the park. These series of tracks have been attributed to either a therizinosaur or an oviraptorosaur. Therizinosaurs were sloth-like plant eating dinosaurs that had small heads with both a beak and leaf shaped teeth, and elongated arms with three fingered large claws. Oviraptorosaurs were omnivorous bird-like theropods with beaks and sometimes prominent crests. Either identification marks the first evidence of either group in Alaska as well as their northern most occurrence. Lastly, large three-toed prints attributed to large theropod dinosaurs have been identified, suggesting a type of tyrannosaur wandered in what is now the park during the Late Cretaceous.

During the Late Cretaceous a relatively small tyrannosaur roamed the Alaskan Arctic. It has been named *Nanuqsaurus hoglundi*, which translates to "Hoglund's polar bear lizard." The name derives from the Iñupiaq people's word for polar bear, *Nanuq* and the species honoring philanthropist Forrest Hoglund. This tyrannosaur was a close cousin to the larger and famous *Tyrannosaurus rex* which is known from the latest Cretaceous of western North America, but was half its size, being estimated at 16 to 20 feet in length. *Nanuqsaurus* is known from a partial skull collected from the Prince Creek Formation from BLM administered lands on the North Slope of Alaska. The largest theropod tracks found at Denali National Park and Preserve are attributed to a tyrannosaur with one footprint measuring a half meter long and representing the largest carnivore ever known to have inhabited Alaska. Our 2021 National Fossil Day logo reconstruction of the tyrannosaur track maker from Denali National Park and Preserve is based on that of the body fossils found of *Nanuqsaurus*, and feathered based on fossils of complete earlier tyrannosaurs from the Early Cretaceous of China, *Yutyrannus* and *Dilong*. Both *Dilong* and *Yutyrannus* were preserved in fine grained sediments that preserved the impressions of fine filamentous feathers covering their bodies. It is hypothesized that *Nanuqsaurus* would also have had feathers to help regulate its body temperatures in the cooler climates of the Late Cretaceous Arctic.

Nanuqsaurus hoglundi is a large meat eating dinosaur that lived during the Cretaceous. Fossil footprints of *Nanuqsaurus* (or a close cousin) have been found at Denali National Park and Preserve, Alaska.

For more information on National Fossil Day: **www.nps.gov/subjects/fossilday/index.htm**

The Last Paleontologist in Venezuela

Recommended reading includes this story at https://longreads.com/2019/02/27/the-last-paleontologist-in-venezuela/.

Ascanio Rincón with sabre-toothed cat Homotherium venezuelensis

Ascanio Rincón is a vertebrate paleontologist who has remained in Venezuela to continue his work at the Pleistocene-aged Orocual tar pit despite all his peers leaving the country and having almost no resources with which to work. The tar pit is akin to that at La Brea in Los Angeles, CA, but with South American fauna.

Fossil News **by Michael Grenier**

A 390 million-year-old hyper-compound eye in Devonian phacopid trilobites

FROM ABSTRACT: Trilobites, extinct arthropods that dominated the faunas of the Paleozoic, since appearing about 523 million years ago, were equipped with elaborate compound eyes. While most of them possessed compound eyes with adjacent lenses in direct contact with one another (in trilobites called holochroal eyes), comparable to the compound eyes of many diurnal crustaceans and insects living today, trilobites of the suborder Phacopina developed atypical large eyes with wide lenses and wide interspaces in between (schizochroal eyes). The authors show that these compound eyes were highly sophisticated systems—hyper-compound eyes hiding an individual compound eye below each of the big lenses. Thus, each of the phacopid compound eyes comprises several tens, in cases even hundreds of small compound eye systems composing a single visual surface. The authors discuss their development, phylogenetic position of this hyper-compound eye, and its neuronal infrastructure. A hyper-compound eye in this form is unique in the animal realm.

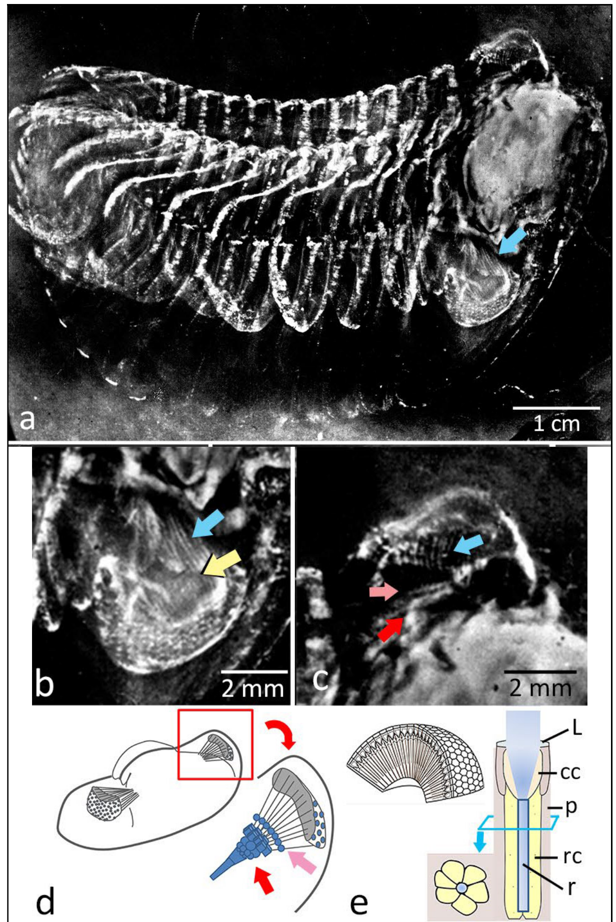


Figure 1. Filaments at the visual units of phacopid trilobites. (a) Chotecops (Phacops) ferdinandi (Kayser, 1880), [WS 2617]. (b) Right eye of a. 'fibers' originating below the facets, converging towards interior of the cephalon. (c) Left eye of a, with (indistinct) 'fibers', converging to plate of spheres and pyramidal element. (d) Schematic drawing of 'fibers'. (e) typical ommatidium (apposition eye).

The discovery was made when Dr. Brigitte Schoenemann and her colleagues examined X-ray images taken by radiologist and amateur paleontologist Wilhelm Stürmer in the 1970s. Stürmer had already believed the filaments under the trilobite eyes to be nerves, or a light guiding system. Schoenemann also found markings by Stürmer on the images designating the six subfacets. However, scientists at the time did not believe his interpretations. Now, however, the re-examination of the images and verification with modern computed tomography succeeded in confirming his conjectures.

This paper (Schoenemann, B., Clarkson, E.N.K., Bartels, C. et al. ***A 390 million-year-old hyper-compound eye in Devonian phacopid trilobites***. Sci Rep 11, 19505 (2021), is available for download at https://doi.org/10.1038/s41598-021-98740-z.

Science Daily article on the paper is at www.sciencedaily.com/releases/2021/09/210930101416.htm

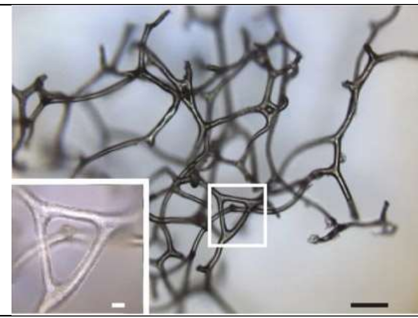
Possible poriferan (sponge) body fossils in early Neoproterozoic microbial reefs

FROM ABSTRACT: Molecular phylogeny indicates that metazoans (animals) emerged early in the Neoproterozoic era, but physical evidence is lacking. (See timeline in Scott MacLennan/June meeting article in this newsletter.) The search for animal fossils from the Proterozoic eon is hampered by uncertainty about what physical characteristics to expect. Sponges are the most basic known animal type; it is possible that body fossils of hitherto-undiscovered Proterozoic metazoans might resemble aspects of Phanerozoic (Paleozoic through Cenozoic) fossil sponges. "Vermiform micro-structures" are tiny, wormlike structures that are a complex petrographic feature in Phanerozoic reef and microbe carbonates. Dr. Elizabeth Turner has found identical microstructures in approximately 890-million-year-old reefs. These tiny millimeter-sized fossils are likely from organisms only a few millimeters to centimeter size that lived only on, in, and immediately beside reefs built by photo-synthesizing and calcifying cyanobacteria, and occupied microniches in which the cyanobacteria could not live. If vermiform microstructure is in fact the fossilized tissue of keratose sponges, the material described here would represent the oldest body-fossil evidence of animals known to date, and would provide the first physical evidence that animals emerged before the Neoproterozoic oxygenation event and survived through the glacial episodes of the Cryogenian.

Sponges are enigmatic in origin. The oldest undisputed sponge body fossils are from the Cambrian period[1], though a sponge-like micro fossil has also been found in the Ediacaran Doushantuo Formation in China[2]. Their presence has been indirectly detected in Precambrian rock by fossilized steranes (such as 24-isopropylcholestane), hydrocarbon markers characteristic of the cell membranes of sponges.

However, molecular clock data from DNA-based analysis suggest that sponges emerged in the early Neoproterozoic[3]. Seaches for diagnostic fossils in the PreCambrian (Edicaran and NeoProterozoic), such as the calcium carbonate or silica spicules of sponges, have so far found nothing.

Many modern demosponges, whether they have spicules or not, have a type of keratin called spongin as a scaffolding structure. If this is the primitive condition, then evidence for this may be what is needed in the distant past, and is what Dr. Turner believes she has found.



Turner (2021) Fig 2c, Three-dimensional fragment of spongin skeleton from a modern keratosan sponge, illus-trating its branching and anastomosing network of fibres (incident light). Scale bars, 100 µm (main panel), 20 µm (inset).

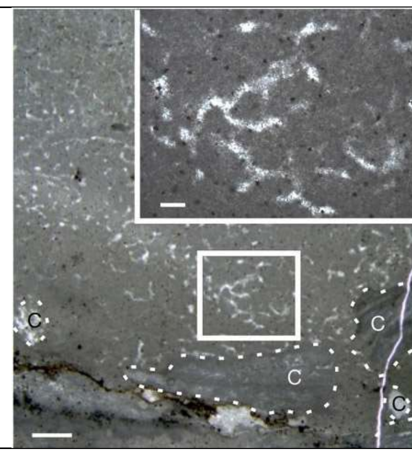


Fig 2a, Well-preserved vermiform microstructure exhibits a polygonal meshwork of anastomosing, slightly curved, approximately 30-µm-diameter tubules embedded in calcite microspar (KEC25). Scale bar, 500 µm.

This paper is available from the editor.

1. Dohrmann, M. & Wörheide, G. Dating early animal evolution using phylogenomic data. Sci. Rep. 7, 3599 (2017).
2. Antcliffe, J. B., Callow, R. H. & Brasier, M. D. Giving the early fossil record of sponges a squeeze. Biol. Rev. Camb. Philos. Soc. 89, 972–1004 (2014).
3. Yin, Zongjun, et al. "Sponge grade body fossil with cellular resolution dating 60 Myr before the Cambrian." *Proceedings of the National Academy of Sciences* 112.12 (2015): E1453-E1460.

CALENDAR OF EVENTS

October
Tuesday October 5, FOSSIL MEETING 7:30 PM. Virtual Meeting on Zoom. Speaker is Dr. Melanie J. Hopkins on "How to Grow a Trilobite: Learning about trilobite growth and development through empirical and modeling studies." Visitors are welcome.

November
Tuesday November 2, FOSSIL MEETING 7:30 PM. Virtual Meeting on Zoom. Speaker is Carl Fechko on collecting in the Eocene Period Green River Formation near Kemmerer, WY.

Visitors are welcome to all Fossil Section meetings! For more information and the latest updates check the RAS Website (**www.RASNY.org**). You can also contact Dan Krisher at DLKFossil@gmail.com or John Handley at jhandley@rochester.rr.com for further information.

ROCHESTER ACADEMY OF SCIENCE FOSSIL SECTION
Monthly meetings will be held on Zoom until at least December 2021. Meetings are held the first Tuesday of each month from October to December and from February to May at 7:30 pm. In person meetings, when they can be held again, are at the Brighton Town Hall, Community Meeting Room, 2300 Elmwood Avenue, Rochester, NY unless otherwise listed.

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Director (three year term): ***Open***		
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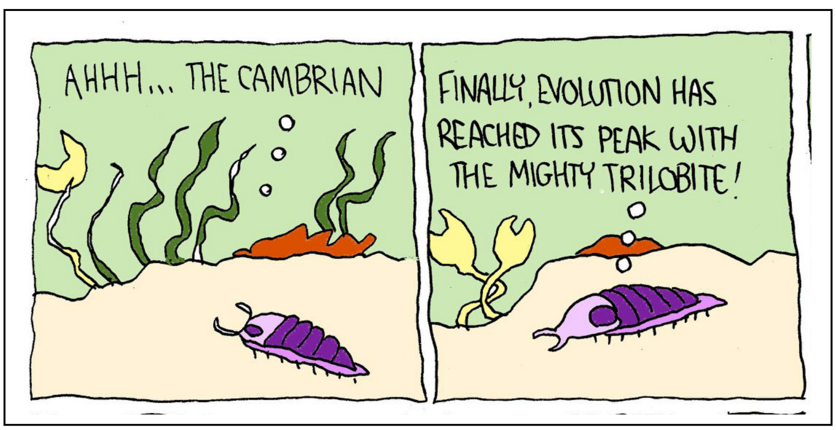
The FossiLetter is published before each meeting month of the year. Please send submissions to mgrenier@frontiernet.net or by U.S. Postal Service mail to 692 Maple Drive, Webster, NY 14580. Deadline for submissions to the Fossiletter is the 15th of the month.



For scheduling changes and the latest updates please check the RAS Website (www.rasny.org) and click on the Fossil Section link. Last minute updates can also be found on the *General Announcements* page of the Academy Website.