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FOSSIL SECTION

The FOSSILETTER

VOL. 38 Number 6 April 2021

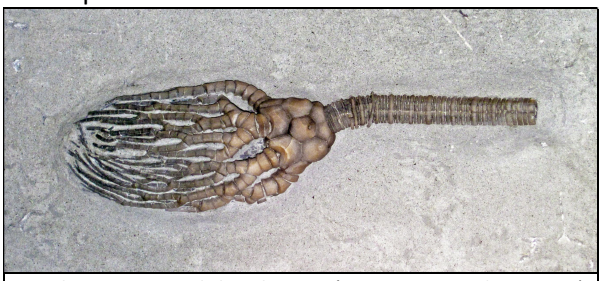
April Meeting

The April section meeting is on Tuesday, April 6, 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.

Prof. William Ausich

Our April speaker is Dr. William Ausich, Professor Emeritus of Earth Sciences at The Ohio State University on the topic of "Extreme Crinoids."

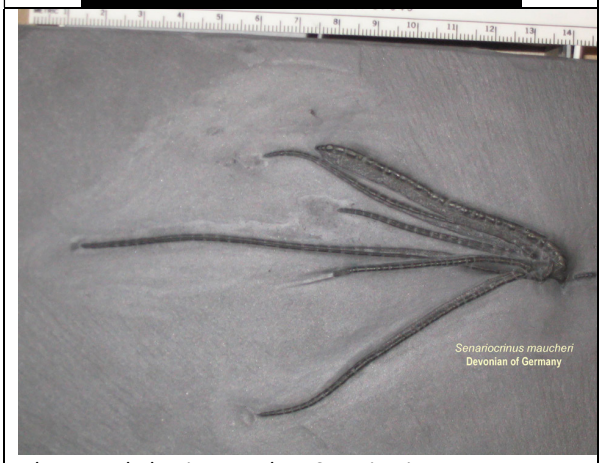
If one accepts that there are "typical crinoids," then there must be atypical ones as well, and likely some really bizarre ones. (Though they may appear unusual to me, they were well-adapted for their environment, of course.) By typical, I don't mean the handfuls of stem pieces I usually wind up with, but rather one of the rarer well-preserved complete specimens that show all the features one expects in a crinoid.



Cyathocrinites multibrachiatus *(Lyon & Casseday, 1859) Mississippian of Indiana*

Dr. Ausich provided the following summary of his talk, "*The quintessential crinoid is an erect echinoderm with a holdfast attached to the sea floor and a column (typically less than 1 m in height) that elevates the calyx above the seafloor for feeding. Through time most crinoids have maintained this idealized morphology. However, as early as the Ordovician, radical experiments in alternative morphologies have characterized a few crinoid clades. Examples include the calceocrinids that laid their column along the seafloor, crinoids that attached to logs, crinoids with planispirally coiled columns, and others with helically twisted column. Size has also varied considerably from crinoids with an adult cup height < 2mm to crinoid columns > 20 meter in height. Extreme morphologies of these and other crinoids highlights the role of paleoecology in shaping the evolution of form and function*."

A couple of examples provided by Dr. Ausich follow, which will be discussed in his talk.



Above, Eucladocrinus. *Below,* Senariocrinus.

About our speaker: Dr. Ausich received his Ph.D. in geology from Indiana University and was a Research Fellow at Trinity College, Dublin, with a Fulbright Fellowship. Dr. Ausich researches the dynamics of Paleozoic crinoid faunas through climate and biosphere change, phylogeny and classification of Paleozoic crinoids, and paleo-community dynamics through the Phanerozoic. He is a prolific author and holds many awards and fellowships.

President's Report **by Dan Krisher**

The Section's March meeting was held via ZOOM on 3/2. The meeting opened with a brief business portion after which we moved into the second portion of the meeting that featured a talk by Dr. Dale Hess from the University of Buffalo. His talk dealt with drumlins, a famous glacial feature of western New York as well as a few other regions of the northern hemisphere. Dr. Hess went into considerable detail on the overall features of drumlins as well as their mode of creation and their age. The talk pulled in the largest crowd to date (>80) and the possibility of a summer field trip to the NY drumlin fields was briefly discussed, possibly in conjunction with the Mineral Section.

March Meeting **by Michael Grenier**

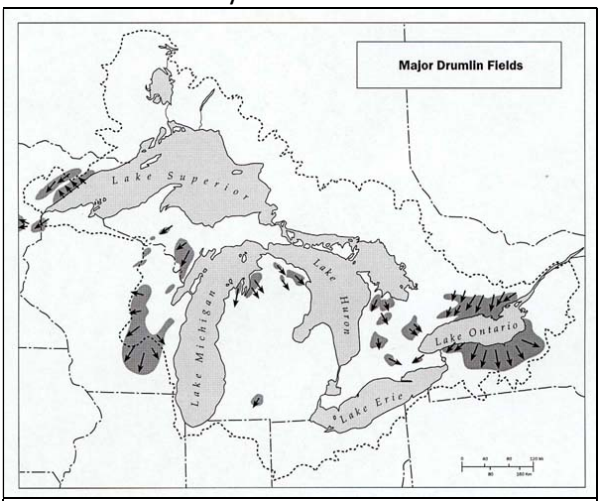
"At the end of the Last Glacial Maximum, roughly 20,000 years ago, much of Earth in the northern hemisphere was covered in vast ice sheets. The largest of these ice sheets was the Laurentide Ice Sheet, covering much of Canada and the northern United States with a mass of ice that was nearly 4 km thick in some places. After 20,000 years ago, Earth started to warm, and the ice sheet began to disappear. By 8,000 years ago, the ice sheet was a fraction of its original size, confined mostly to modern day Quebec and Labrador, a size and latitude broadly similar to that of the modern Greenland Ice Sheet." (from https://www.serc.carleton.edu)

The Laurentide ice sheet had an enormous effect on the topography we see today. It extended from the Atlantic Ocean to the Continental divide. (Its counterpart in the far west to the Pacific was the Cordilleran ice sheet.)

By cosmographicresearch.org. NY Outline added by editor

On March 2nd we met virtually on Zoom and after brief remarks by President Dan, including on the upcoming Field Trip season (see below), we were treated to a fascinating talk on drumlins and other glacial landscape forms by University of Rochester Professor, Dr. Dale Hess.

Dr. Hess noted that there are lots of drumlins in central NY and Minnesota, and in Ireland, among other places. By his count, there are 6,566 drumlins in NY drumlin field, which has been a major focus of his studies on glacial topography. Some of these drumlins can be several miles long and highly attenuated. Understanding the variability can help determine by direction of ice flow and its velocity.



credit https://project.geo.msu.edu

Several past theories for drumlin formation and elongation have been tested by Dr. Hess. Ice

velocity seems to be the most determinate factor. Models developed to explain the dynamics of the Laurentide ice sheet can now be applied to the Greenland and Antarctic ice sheets to better understand them. Dr. Hess showed a video of a dynamic numerical modeling of the Laurentide ice sheet showing ebb and flow.

Over 25 Fossil Section members attended, some doubled up on screens. We also had at least 50 guests at this talk, including members of the Wayne County Gem and Mineral Club, the Buffalo Geological Society, the Cincinnati-based "Dry Dredgers" fossil club, the Geological Society of Minnesota, and others. The talk was recorded and can be seen at:
https://www.youtube.com/watch?v=wbsURVgoRD0

Fossil Section Summer Field Trips

by Dan Krisher

Editor: We can't wait to get out again! So "Summer" officially begins in April for us.

Welcome to the 2021 field trip season for the FOSSIL Section. As you are all aware, the field trip schedule for 2020 was extremely abbreviated due to the rapidly evolving COVID-19 pandemic. The entire schedule for last year consisted of two trips scheduled for late August and September. This year will be considerably different.

The virus is still with us but with our greater understanding of how to manage exposure and the increasing presence of vaccinated individuals we can now have confidence in posting a rather busy schedule for this season. In past years carpooling has been utilized for our more distant trips but, at this time, the virus still precludes us from that option. All individuals or family groups wishing to participate in a trip will be required to provide their own transportation to the site however, in the case of longer trips, caravanning is certainly an option. When on-site all individuals will be required to have a mask available however wearing it will only be required when we cannot maintain reasonable social distancing. Hand sanitizer and a few "emergency" masks will be available if they are needed.

The process for signing up for a trip is largely unchanged from years past. About a week or so before a trip I will send an email out to all Section members concerning the upcoming trip. All interested members should get back to me via email at least 2 days before the trip and I'll respond with additional information for that trip as soon as I receive your email. I will send out a final email to all attendees the night before the trip. If you have any questions or otherwise need to get a hold of me, you can contact me at 585.698.3147 or DLKFossil@gmail.com. At this time the following field trips are or are in the process of being scheduled:

4/24/21 The Gulf at Lockport: This trip will visit two sites. The first is located on the west side of the town of Lockport. The site is a railroad cut a few yards off the road and it exposes the Silurian Rochester Shale Formation. This is a family-friendly site with no hazards, plenty of room to spread out, and many fossils. The fossils are relatively small but can be found lying loose on the hillside. The material consists primarily of brachiopods and bryozoan with some trilobites, corals, and cystoids as well as other rarer material. The second stop is optional and consists of a road cut nearby at Hickory Corners. This site exposes the Silurian Reynales Formation and the fauna consists of bryozoa, brachiopods, and the occasional gastropod.

5/08/21 - Rickard Hill and Others: This family-friendly site is a large road cut near Schoharie, New York southwest of Albany. This is a long day trip to collect in the Lower Devonian Helderberg Group. Once again brachiopods, corals, snails, sponges, and trilobites can be found but will be different genera and species from what was found earlier in the season. I'll also be lining up at least one additional site to visit on the way back.

5/22/21 Road Cuts Near Tioga, PA. A series of large road cuts near Tioga PA exposes Upper Devonian strata. The rock is primarily siltstone and sandstone and contains a fauna of brachiopods and bivalves. These sites were visited during the 2017 New York State Geological Association annual meeting in 2017

JUNE 2021 Portland Point: (Date TBD pending Permission) A new site for the Section. Exposes Middle Devonian siltstones, and shales. A wide variety of Hamilton Group fauna is available for

collecting however organisms that favored sandier environments are typical at this site.

JUNE 2021 Little Beard's Creek: (Date TBD Pending Permission) This is large shale exposure along Little Beard's Creek in a stream near Geneseo. The site exposes the Windom Member of the Moscow Formation and aside from many brachiopods and a few trilobites, the site is most well-known for the size and quantities of horn corals it produces. This trip is still in the process of being set up with the landowner so there is a small chance this date could change.

The highly productive Little Beard's Creek trip in June 2019.

7/10/21 Swamp Road: This family-friendly site is a large road cut north of Morrisville in central New York. The shales are primarily the Solsville Member of the Oatka Creek Formation however a small portion of the Bridgewater Member is exposed at the base of the section. The fauna is primarily bivalves and gastropods with a small variety of brachiopods, bryozoa, and cephalopods. The occasional trilobite can also turn up.

Jaycox Run trip in July 2019. (photo by Fred Haynes)

7/21 Jaycox Run: (Date TBD pending Permission) The trip will visit the Jaycox Run site between Avon and Geneseo and the collecting will be in the Middle Devonian Ludlowville and Moscow Formations. This is a Genesee Valley Nature Conservancy site that requires permission to visit. Heavy rains over the past few years have seriously eroded the Green's Landing bed so collecting in that area of the outcrop will be limited. No large-scale removal of bedrock will be allowed. Collecting will be limited to surface collecting, only the removal of exposed fossils. Aside from the above trips, additional trips for August are being planned. Possible or likely trips may include:

Bethany Center southeast of Batavia (Middle Devonian)

Penn Dixie Fossil Park south of Buffalo (Middle Devonian)

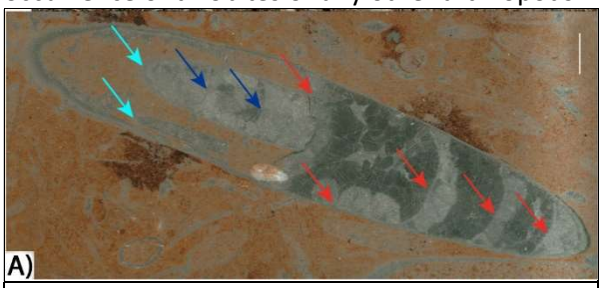
Rodman/Watertown Area (Ordovician)

Fossil News **by Michael Grenier**

A potential cephalopod from the early Cambrian of eastern Newfoundland, Canada

Although an early Cambrian origin of cephalopods has been suggested by molecular studies, until now there has been no fossil evidence. In this study, the authors examined septate shells collected from shallow marine limestone of the Avalon Peninsula's lower Cambrian Bonavista Formation (southeastern Newfoundland, Canada). They interpret these to be straight, elongate conical, chambered shells of cephalopods (called *phragmocones*).

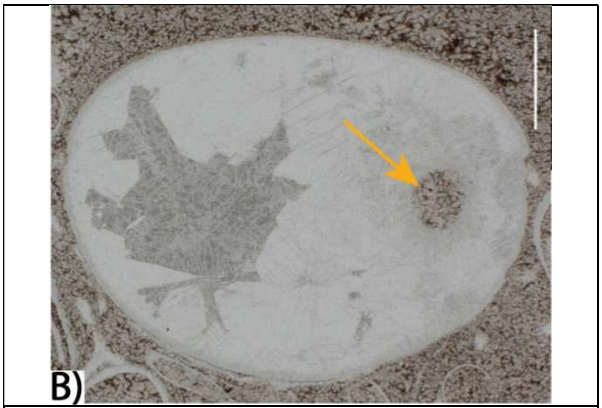
These shells push the origin of cephalopods back to a very early stage of the Cambrian radiation of metazoans, even before the first occurrence of trilobites or any other arthropods.



Hildenbrand et al Fig. 1a Thin section image of specimen NFM F-2774 with front light. Arrows: Green = Canals; Red =Septa; Blue = Septa in a possible other smaller specimen. Scale bar (upper right) is 1 mm, total length of specimen is less than 1.4 cm.

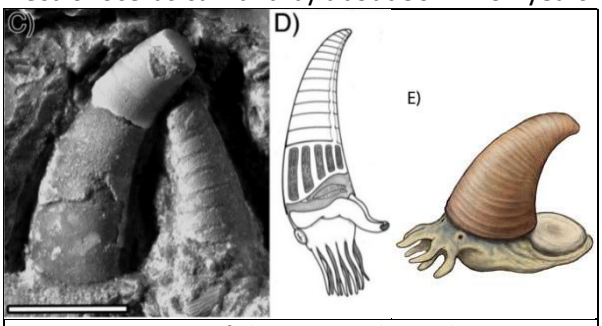
Specimen NFM F-2774 is the sagittal section of a longiconic shell. The presence of a phragmocone

in this specimen and in NFM F-2775, and the pierced chambers in specimens NFM F-2776 and NFM F-2777 support their interpretation of a cephalopod origin of our material. There is other evidence as well.



Hildenbrand et al Fig. 2a. Thin section and SEM-EDS images of specimen no. NFM F-2776. a Cross section of phragmocone showing the position of the siphuncle (orange arrow). Note that calcite spar cement filled the shell interior indicating that it formed a closed system during the earliest diagenetic stage. Only the siphuncle was filled with mud, thus providing strong evidence for its connection with the body chamber. Scale bar is 1 mm.

Dated to 522 Ma during the upper Terreneuvian, which is the Cambrian's oldest stage, it predates the undoubted mid late Cambrian cephalopod *Plectronoceras cambria* by about 30 million years.



C. Two specimens of the Late Cambrian Plectronoceras *(USNM 57819), the oldest known bona fide fossil cephalopod. Scale bars: 3 mm. D. Reconstruction of* Plectronoceras *as a swimming mollusc (Drawing by Brian Roach). E. More recent reconstruction of* Plectronoceras *as a benthic monoplacophoran-like mollusk with semi-bouyant shell. Figures C & D from Kröger et al, 2011,* Cephalopod origin and evolution: A congruent picture emerging from fossils, development and molecules*, figure 3; Figure E from palaeopedia.tumblr.com, artist unknown.*

The original paper (Hildenbrand, A., Austermann, G., Fuchs, D., Bengtson, P. and Stinnesbeck, W., 2021. ***A potential cephalopod from the early Cambrian of eastern Newfoundland, Canada***. Communications Biology, 4(1), pp.1-11.) is available at: https://www.nature.com/articles/s42003-021-01885-w

For material reported in the popular press, see the University of Heidelberg's press release at: https://www.uni-heidelberg.de/en/newsroom/cephalopods-older-than-was-thought

Million-year-old DNA sheds light on the genomic history of mammoths

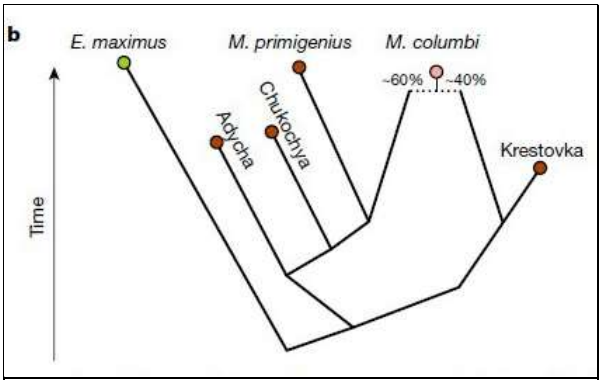
Mammoth DNA was all over the popular press last month when this paper was released.

Prior to this study, the oldest genomic data recovered had been from a horse specimen dated between 780,000 to 560,000 years ago. The authors of this paper reported the results of DNA analysis of three mammoth specimens dating to the Early and Middle Pleistocene sub-epochs. Two of these are over one million years old.

1.2 million year old mammoth tooth from the Krestovka mammoth. Credit: Pavel Nikolskiy

The three specimens used were molars from three different eastern Siberian sites ('Krestovka', 'Adycha', and 'Chukochya') with three different age ranges (1.2–1.1 Ma, 1.2–1.0 Ma, and 0.8-0.5 Ma, respectively). These were found to be from two distinct mammoth lineages in the Early Pleistocene. One lineage (including 'Adycha' and 'Chukochya') gave rise to the woolly mammoth (*Mammuthus primigenius*) and the other (including the 'Krestovka' specimen) was an unknown lineage ancestral to the mammoths that colonized North America. The Krestovka mammoth diverged from other Siberian mammoths more than two million years ago.

The authors also demonstrated that the North American Columbian mammoth (*Mammuthus columbi*) was a Middle Pleistocene hybrid of these two lineages.



van der Valk, et al. Fig. 2b, Inferred genomic history of mammoths. Cladogram showing relationships, including one admixture event, suggesting a hybrid origin for the Columbian mammoth. Elephas maximus *is commonly known as the Indian elephant.*

With the oldest known permafrost being 2.6 million years old, the authors note that it is theoretically possible fossil specimens yielding DNA over 2 million years old might still be found.

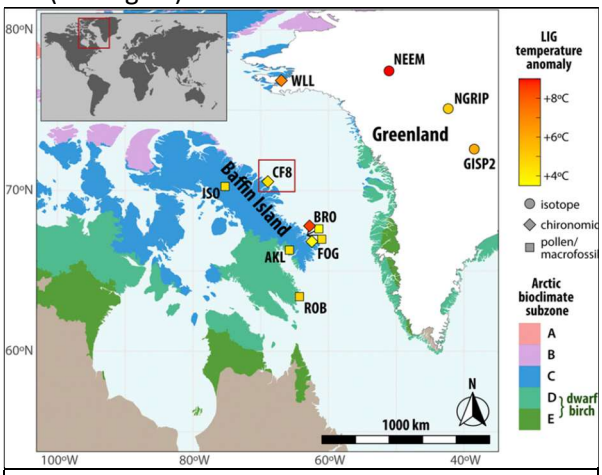
This paper (van der Valk, T., Pečnerová, P., Díez-del-Molino, D., Bergström, A., Oppenheimer, J., Hartmann, S., Xenikoudakis, G., Thomas, J.A., Dehasque, M., Sağlıcan, E. and Fidan, F.R., 2021. ***Million-year-old DNA sheds light on the genomic history of mammoths***. *Nature*, *591*(7849), pp.265-269) can be purchased from Nature or you can contact the editor for a copy.

For material reported in the popular press, see the Stockholm University's press release and the National Geographic report at:

https://www.su.se/english/news/world-s-oldest-dna-reveals-how-mammoths-evolved-1.541211 and https://www.nationalgeographic.com/science/article/million-year-old-mammoth-teeth-yield-worlds-oldest-dna respectively.

Ancient plant DNA reveals High Arctic greening during the Last Interglacial

Past warm periods help us understand the extent of past Arctic warming evidenced by greenery. This study shows that Canada all the way to the Arctic Ocean was green with shrubs, not white with snow and ice, during the Last Interglacial (LIG) warming period from 129,000 to 116,000 years before present. Earth average temperature at that time was globally about 1° to 2°C warmer than in the preindustrial period, but the Arctic experienced amplified warming. These levels are comparable to predicted 21st-century climate change. The Eastern Canadian Arctic and Greenland, in particular, were likely from 4° to 8°C warmer in summer than present. Lake sediments from this region provide a record of the vegetation response during the LIG Arctic warming. Previous work from Lake CF8 on northeastern Baffin Island demonstrates that its sediment record spans at least three interglacials (~200,000 years ago), including the substantially warmer-than-present LIG (see Fig. 1)



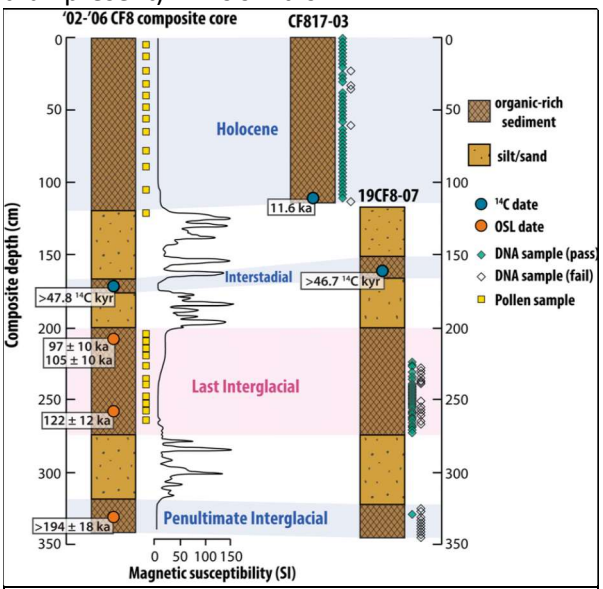
Crump, et al. Fig. 1. Map of Baffin Island and Lake CF8 study area. Symbols show maximum LIG temperature based on terrestrial proxies from Baffin Island and Greenland. Shaded regions indicate Arctic bioclimate subzones, including modern Betula *range in subzones D and E.*

The team collected cores from Lake CF8. DNA from plant material was used to identify the vegetation present during the pronounced warmth during the LIG and moderate warmth during the Holocene. Taken together, DNA-inferred plant communities and pollen-inferred July air temperatures provide insight into Arctic plant range shifts under strong summer warming.

Dwarf Arctic Birch - Betula nana

Plant material DNA was used instead of pollen to identify LIG plant communities because pollen can blow long distances and give a false reading.

Dwarf birch (*Betula nana*) is a relatively cold-intolerant woody shrub that typifies the Low Arctic tundra. The northern limit of *B. nana* is currently ~400 km south in the Eastern Canadian Arctic (Fig. 1). The DNA results show compelling evidence that *B. nana* was present at Lake CF8 during the LIG. *B. nana* DNA was identified in five levels within the middle LIG unit, and it was not present in any of the 46 Holocene samples. *B. nana* co-occurs with two other taxa, Veronica and Rhododendron, that also have not been present at CF8 during the Holocene. Veronica is currently found only at warmer, more southerly sites in the Eastern Canadian Arctic, while Rhododendron has been observed in Bioclimate Subzone C. The interval with these three taxa defines the peak vegetation community at CF8 and is characteristic of Bioclimate Subzone D, which has a mean July temperature range of 7 to 9 °C (2 to 4 °C warmer than present). This shift is consistent with peak LIG warmth of ~3 °C above the late 20th century inferred from pollen (Fig. 3) and 4 to 5 °C above the late 20th century.



Crump, et al. Fig. 2. Lake CF8 core lithostratigraphy and sampling summary. Core diagrams show simplified sediment character and interglacial/interstadial assignments for previously published CF8 cores (2002 to 2006) and new (2017 and 2019) CF8 cores. Magnetic susceptibility for 2002 to 2006 cores shows contrast between organic-rich (interglacial) units and minerogenic (deglacial) units. The key age control points and pollen and DNA sample depths are shown with symbols defined in the legend.

Paleoclimate models have underestimated the magnitude of Arctic warming during the LIG. The amount of summer solar radiation (*insolation*) at high northern latitudes during the early LIG was exceptionally high, with peak insolation at 127,000 years ago occurring after sea level reached modern levels. This suggests that unlike during the Holocene, the penultimate continental ice sheets had largely disappeared prior to the insolation maximum of the LIG, enabling solar radiation to drive strong terrestrial warming.

Thus, high-latitude landscapes were ice-free in time for more significant vegetation shifts compared to the present day. "We have this really rare view into a particular warm period in the past that was arguably the most recent time that it was warmer than present in the Arctic. That makes it a really useful analogue for what we might expect in the future," said lead author Sarah Crump, who conducted the work as a PhD student in geological sciences and then a postdoctoral researcher with the Institute of Arctic and Alpine Research (quote from press release provided by University of Colorado at Boulder.)
https://www.colorado.edu/today/2021/03/17/arctic-was-once-lush-and-green-could-be-again-new-research-shows

This paper (Crump, S.E., Fréchette, B., Power, M., Cutler, S., de Wet, G., Raynolds, M.K., Raberg, J.H., Briner, J.P., Thomas, E.K., Sepúlveda, J. and Shapiro, B., 2021. ***Ancient plant DNA reveals High Arctic greening during the Last Interglacial***. Proceedings of the National Academy of Sciences, 118(13)) can be purchased from PNAS or you can contact the editor for a copy.

CALENDAR OF EVENTS

April
Tuesday April 6, FOSSIL MEETING 7:30 PM **Virtual Meeting on Zoom** Speaker is Dr. William Ausich, "Extreme Crinoids." Visitors welcome.

Saturday, April 24, The Gulf at Lockport Field Trip.

May Tuesday May 4, FOSSIL MEETING 7:30 PM **Virtual Meeting on Zoom.** Speaker is Dr. Ben Dattilo on the life habits of *Rafinesquina* brachiopods. Visitors welcome.
Saturday, May 8, Rickard Hill and Others Field Trip.

Saturday, May 22, Road Cuts Near Tioga, PA Field Trip.

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 February 2021. Meetings are held the first Tuesday of each month from October to December and from March 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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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.