A publication of the Rochester Academy of Science FOSSIL SECTION

The FOSSILETTER

VOL. 36 Number 4 February 2019

February Meeting

The February section meeting is on Tuesday, February 5, Brighton Town Hall Downstairs Meeting Room, 2300 Elmwood Ave. We will again be hosting a fossil review session for Middle School Science Olympiad teams. See December newsletter for details.

We will start EARLIER than usual at 7:00 PM to give the middle-schoolers an earlier time. We are expecting between 20 and 40 students there (though there may be fewer), representing perhaps 10-20 teams from all over the region.

Much help is needed. Please check your fossil collections to see what you have from the list of items needed. We need multiple examples of each item, as spares will be required for the testing table. If you do not have fossils (or pictures) to contribute, you can still assist at one of our display tables or the testing table.

All members are welcome—if you cannot help with the program, you will find it interesting to visit the tables and learn about fossils with which you may not be familiar. It will be a fascinating opportunity for you to learn more about fossils. Go to our testing table after the kids are done and see if you score well.

To help us with space and coverage planning, please let us know if you will be coming, how you would like to help, and with which fossils. Please contact Fred Haynes at 585- 203-1733, or by email at: **fredmhaynes55@gmail.com**

Bring a friend, visitors are welcome.

President's Report

by Dan Krisher

The Section's December meeting was held on December 4th and featured the annual pizza party and Show-n-Tell. A wide range of fossil were on display and the event was well attended. On December 29 and 30 the Section participated in an outreach event at the Rochester Museum and Science Center. The crowd on Saturday was steady but a bit low however our display was very busy on Sunday. Section members Fred Haynes, Michael Grenier, Sam Ciurca, and Dan Krisher staffed the tables over the 2-day span.

As is tradition, the Section did not have a January meeting. On January 13, the Section once again participated in the WinterFest at Mendon Ponds Park. John Handley, Sam Ciurca, and Dan Krisher staffed the tables and in a welcome change from the past couple of years there was snow. We had a good turnout at our tables in the Cobblestone house and, despite the very cold temperatures, we managed to stay quite warm.

Fossil Section hosts a crowd at the Mendon Park Winterfest Saturday 1/13/2019. Photo by Fred Haynes

I hope that many of you will make it to this next meeting to help out with our Science Olympiad coaching. This is such a great way to introduce youth to our passion for fossils and earth's history of life.

April Outreach Program

By Dan Krisher

Jennifer Luisi, the Vice-President, Cobbles PTA has asked us to return for Family Science Night at

Cobbles Elementary School in Penfield. I accepted and we will have our fossil display at the event. We always look forward to the enthusiasm their students show as we answer questions and provide a great hands-on educational experience. This event is scheduled for Wednesday, April 3rd from 6pm to 8pm.

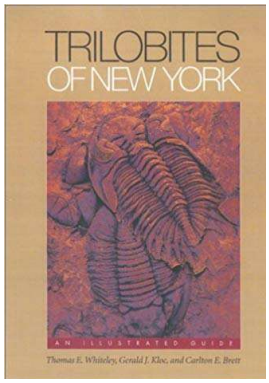
Membership Renewal Time

We are still awaiting many of our members to make their renewal of membership (which expired 12/31/2018). If you have not, please renew at your earliest convenience. A membership form was sent with the November newsletter, or you can get one at **rasny.org/mbform.pdf**.

Book Review

Not seeing any exciting new books on the market, I return to another older publication. I have hesitated to review this before, as I expect that most of our members are already familiar with it, but I have been assured that many are not, and should be. I will have my copy of this book available for loan at the February meeting, along with other recently reviewed books.

Trilobites of New York. by Thomas E. Whiteley, Gerald Kloc, and Carlton E. Brett. Ithaca, NY.: Cornell University Press, 2002. 203 pages, 67 figures, 175 plates.



People who like trilobites and collect in New York love this book. In addition to great information the photographic plates are astounding! Well written chapters give excellent background, and extensively cover trilobite biology and taphonomy, regional geology of New York, and a catalogue of the trilobites that is almost a systematic paleontology. The text figures include maps, biological illustrations, and stratigraphic drawings, as well as many photographs of specimens and outcrops. The great treasure is the 175 plates with very large (generally 6" by 8"), gorgeously detailed black and white photographs of specimens. I have reproduced a few these in small scale here, but you need to see them in the book. The photography is superb! The specimens were, of course, especially selected for their completeness and extraordinary preservation. Most were masterfully prepared or touched up by our own Gerry Kloc. I did find the section on phylogeny to be weak, but that is likely just me. Though there are only 4 reviews on Amazon and one on Barnes and Noble (after 16 years!), they are ALL 5-star reviews. However, rather than gush on my own, I will let the experts give their opinions on this book.

Plate 83 Gabiceraurus dentatus. *From the Middle Ordovician Lindsay Formation.*

First, here is an excerpt from the foreword by the late Dr. Rolf Ludvigsen, renown expert in trilobites. "Trilobites are the most lifelike of fossils—many well-preserved specimens belie their great antiquity and seem almost ready to arch their bodies, peer about with their compound eyes, and crawl forward as if to complete a journey

that was interrupted hundreds of millions of years ago. A trilobite is an ancient arthropod, but it is certainly not a lesser arthropod."

The authors provide a preface that must be read, including these excerpts. "New York State is and has long been a magnet for trilobite hunters." "New York's trilobites were among the first illustrated fossils in North America." "Many outstanding localities in New York State, from the majestic Ordovician limestone bluffs of Trenton Falls, to the Silurian beds in the great gorge of Niagara River, to the Devonian shale cliffs of Lake Erie, continue to yield abundant and spectacular trilobite fossils. New York strata have also yielded more trilobites with preserved appendages and other 'soft parts' than almost any other region of the world." "Spectacular, ornate trilobites from New York ranging from a few millimeters to nearly a half meter in length, are featured in museums all over the world."

Dr. Richard Fortey, now retired, had a long career as a paleontologist at the Natural History Museum in London and is one of the world's foremost experts in trilobites. His book, *Trilobite! Eyewitness to Evolution* was reviewed here in May 2015 and is available to be borrowed. In his review in *New Scientist* (9/14/2002), he wrote, "In *Trilobites of New York*, Whiteley, Kloc and Brett have compiled a splendid photographic tribute to the area's trilobites." "Gratifying though it is to have a coffee-table book of trilobites, *Trilobites of New York* is rather more than that. It has a good introduction to the rocks and stratigraphy of New York—an excellent way of putting the creatures into context. With this book in the car, you could tour the state and start your own collection." "You can't buy a better introduction to one of the most fascinating groups of marine animals." "A beautifully illustrated guide to some of New York State's oldest and most beautiful inhabitants - the trilobites. This book is essential reading for those who love fossils, but it will be enjoyed by anyone with an eye for nature's extravagant creations." He also wrote, "This superbly illustrated book reviews the trilobite fossils found throughout New York State, including their biology, methods of taphonomy (preservation of specimens), and the broader Paleozoic geology of the state. A general chapter on the geology of New York State places the importance of these now-extinct invertebrate marine animals into context. Sixty-seven line drawings and 175 black-and-white photographs illustrate individual species, many represented here by type specimens, and display the eerie beauty that has made New York State trilobites favorites of collectors the world over."

Another trilobite expert, Dr. Nigel Hughes of the University of California, Riverside, wrote in *Palaeontologia Electronica* (5:2,.2003), "Whiteley and his friends' book is uniquely successful in capturing the visual drama of these beasts, in plates that define the highest formal standard of taxonomic illustration. This is an extraordinary feat. . . Buy this book."

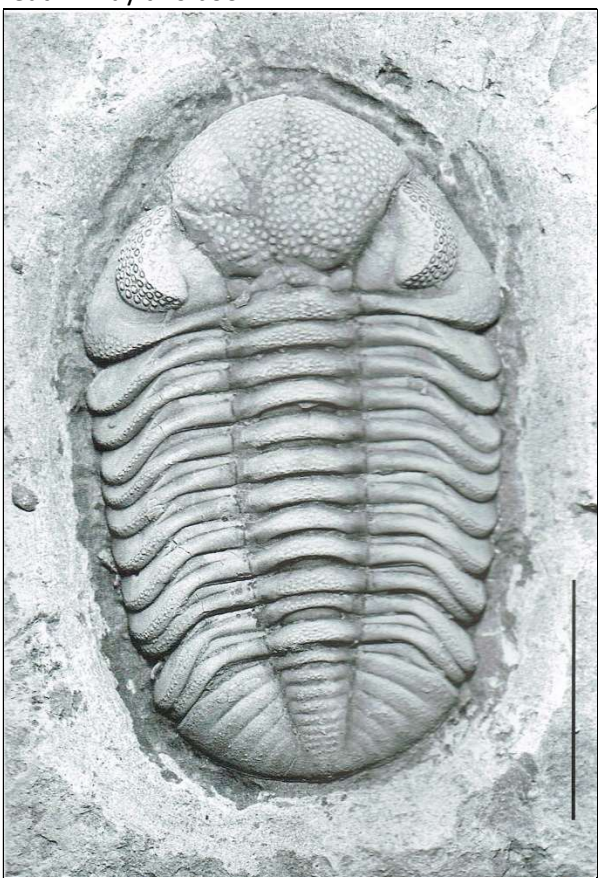


Plate 104 Eldridgeops rana*. From the Middle Devonian Wanakah Member. Who does not have some of these?*

Dr. Harry B. Whittington, another trilobite specialist famed for doing the definitive analysis of the Burgess Shale Fossils (his book, *The Burgess Shale* (1985) is also available to be borrowed), wrote in *Geological Magazine* (140:2, 2003), "Cornell University Press is to be congratulated on

this excellently-printed volume, which will be an eye-opener to the teachers and collectors to whom it is primarily aimed. To those, both inside and outside the United States, whose special interest is trilobites, the very complete documentation of known species and the selection of rare specimens illustrated provide a new and valuable guide. . . This book provides for the general reader a first-rate view of the variety of trilobites known from a long-explored region, and basic information about them. For the collector there is much vital information, and for the specialist excellent photographs of previously unknown, type or exceptional examples of particular species."

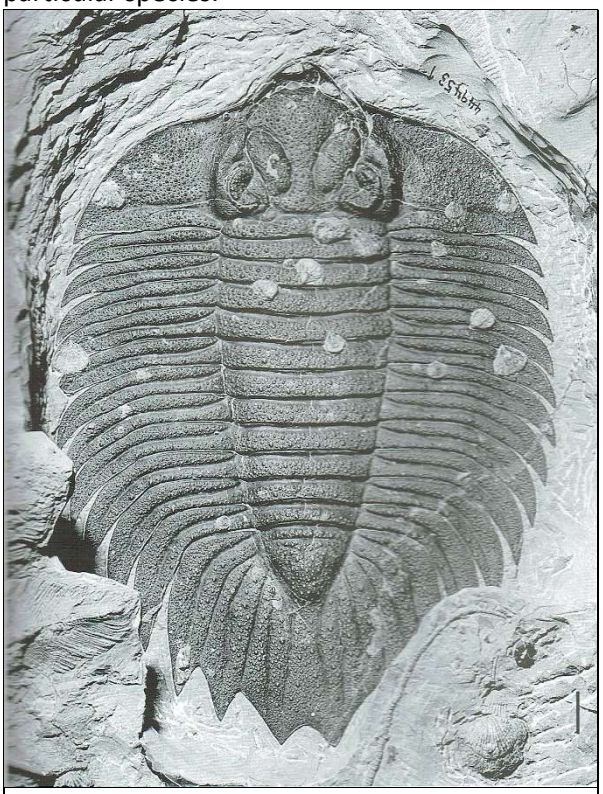


Plate 20 Arctinurus boltoni*. From the Lower Silurian Rochester Shale. I love the attached brachiopods.*

Dr. Steve Brusatte is actually a vertebrate paleontologist and well-known science writer that I frequently see at conferences. He wrote, in *Fossil News: Journal of Avocational Paleontology* (Oct. 2002). "I can't express my amazement at *Trilobites of New York*. Volumes such as this coffee table book/textbook hybrid should be published for the invertebrate fossils of every state. The three authors do an excellent job of introducing the reader to trilobite anatomy and evolution, and then continue with a nice overview of the geology of New York. What follows is a beautiful collection of photographs and descriptions of the state's most important trilobite fossils. This book is a must for anyone interested in invertebrate paleontology."

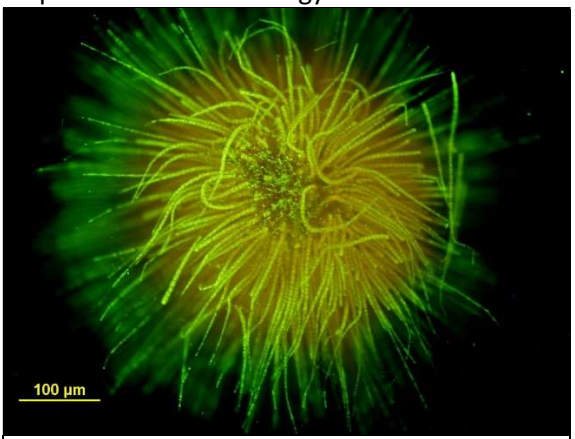
There are other glowing reviews by famous paleontologists of this magnificent volume, but they become repetitious, so I will stop, as I am certain you have the general idea of what a desirable publication this is. If you do not have it, you should borrow it. In the Rochester area, it is available at the Rochester Public Library Central and at the Chili Public Library. I sure you will find it in libraries in other areas. At our meeting, you may borrow it from me.

Fossil News

Oxygen could have been available to life as early as 3.5 billion years ago

(sciencedaily.com/releases/2018/11/181127131552.htm)

Microbes could have performed oxygen-producing photosynthesis at least one billion years earlier in the history of the Earth than previously thought. The finding could change ideas of how and when complex life evolved on Earth, and how likely it is that it could evolve on other planets. Oxygen in the Earth's atmosphere is necessary for complex forms of life, which use it during aerobic respiration to make energy.



Gloeotrichia echinulata *Spherical colony of radiating straight filaments stained with high-affinity nucleic acid stain.*

The levels of oxygen in the atmosphere rose around 2.4 billion years ago, but why it happened then has been debated. Some scientists think that 2.4 billion years ago is when cyanobacteria first evolved, which could perform oxygen-producing (oxygenic) photosynthesis. Other scientist think that cyanobacteria evolved long before 2.4 billion years ago but something prevented oxygen from accumulating in the air. Cyanobacteria perform a sophisticated form of oxygenic photosynthesis -- the same type of photosynthesis that all plants do today. It has been suggested that simpler forms of oxygenic photosynthesis could have existed earlier, before cyanobacteria, leading to low levels of oxygen being available to life.

A research team led by Imperial College London have found that oxygenic photosynthesis arose at least one billion years before cyanobacteria evolved. Their results show that oxygenic photosynthesis could have evolved very early in Earth's 4.5-billion-year history.

If oxygenic photosynthesis evolved early, it could mean it is a relatively simple process to evolve. The probability of complex life emerging in a distant exoplanet may then be quite high. It is difficult for scientists to figure out when the first oxygen-producers evolved because the older the rocks, the rarer they are, and the harder it is to prove conclusively that any fossil microbes found in these ancient rocks used or produced any amount of oxygen. Instead, the team investigated the evolution of two of the main proteins involved in oxygenic photosynthesis. In the first stage of photosynthesis, cyanobacteria use light energy to split water into protons, electrons and oxygen with the help of a protein complex called Photosystem II, which is made up of two proteins called D1 and D2. Originally, the two proteins were the same, but although they have very similar structures, their underlying genetic sequences are now different. Knowing how long ago they were identical could reveal when this ability first evolved.

Using powerful statistics methods and known events in the evolution of photosynthesis, they determined that the D1 and D2 proteins in Photosystem II evolved extremely slowly. They calculated that the time between the identical D1 and D2 proteins and the 30 percent similar versions in cyanobacteria and plants is at least a billion years, and could be more than that.

Dr. Cardona said: "Our study shows that oxygenic photosynthesis likely got started long before the most recent ancestor of cyanobacteria arose. This is in agreement with current geological data that suggests that whiffs of oxygen or localized accumulations of oxygen were possible before three billion years ago.

This paper, (Tanai Cardona, *et al*. **Early Archean origin of Photosystem II**. *Geobiology*, 2018; DOI: 10.1111/gbi.12322), is available for download at **onlinelibrary.wiley.com/doi/pdf/10.1111/gbi.12322**

Ancient climate change triggered warming that lasted thousands of years

(www.sciencedaily.com/releases/2019/01/190122104515.htm)

Fossiliferous core from Maryland drilling site. Credit: Rosie Oakes / Penn State

A rapid rise in temperature on ancient Earth triggered a climate response that may have prolonged the warming for many thousands of years, according to scientists. Their study provides new evidence of a climate feedback that could explain the long duration of the Paleocene-Eocene Thermal Maximum (PETM), which is considered the best analogue for modern climate change. The findings also suggest that climate change today could have long-lasting impacts on global temperature even if humans are able to curb greenhouse gas emissions.

"We found evidence for feedback that occurs with rapid warming that can release even more carbon dioxide into the atmosphere," said Shelby Lyons, a doctoral student in geosciences at Penn State. "This feedback may have extended the PETM climate event for tens or hundreds of thousands of years. We hypothesize this is also something that could occur in the future."

Increased erosion during the PETM, approximately 56 million years ago, freed large amounts of fossil carbon stored in rocks and released enough carbon dioxide, a greenhouse gas, into the atmosphere to impact temperatures long term, researchers said. Scientists found evidence for the massive carbon release in coastal sediment fossil cores. They analyzed the samples using an innovative molecular technique that enabled them to trace how processes like erosion moved carbon in deep time.

Global temperatures increased by about 9 to 14.4 degrees Fahrenheit during the PETM, radically changing conditions on Earth. Severe storms and flooding became more common, and the warm, wet weather led to increased erosion of rocks. As erosion wore down mountains over thousands of years, carbon was released from rocks and transported by rivers to oceans, where some was reburied in coastal sediments. Along the way, some of the carbon entered the atmosphere as greenhouse gas. Carbon in these samples did not share common isotope patterns of life from the PETM and appeared oily, as if it been heated over long periods of time in a different location.

The researchers developed a mixing model to distinguish the sources of carbon. Based on the amount of older carbon in the samples, scientists were able to estimate how much carbon dioxide was released during the journey from rock to ocean sediment. They estimated the climate feedback could have released enough carbon dioxide to explain the roughly 200,000-year duration of the PETM, something that has not been well understood. This paper (Lyons, S.L. *et al*., **Palaeocene–Eocene Thermal Maximum prolonged by fossil carbon oxidation**. *Nature Geoscience*, 2018; 12 (1): 54) is not available for download, but a copy can be had from the editor.

Fossils suggest flowers originated 50 million years earlier than thought
(www.sciencedaily.com/releases/2018/12/181218115205.htm)

Scientists have described a fossil plant species that suggests flowers bloomed in the Early Jurassic, more than 174 million years ago.

Angiosperms (flowering plants) were thought to have a history of no more than 130 million years. The discovery of the novel flower species, named *Nanjinganthus dendrostyla*, questions widely accepted theories of plant evolution, by suggesting that they existed around 50 million years earlier. *Nanjinganthus* also has a variety of 'unexpected' characteristics according to almost all of these theories.

Angiosperms are an important member of the plant kingdom, and their origin has been long debated among evolutionary biologists. Many thought angiosperms could be no more than 130 million years old. However, molecular clocks have indicated that they must be older than this. Until now, there has been no convincing fossil-based evidence to prove that they existed further back in time. "Researchers were not certain where and how flowers came into existence because it seems that many flowers just popped up in the Cretaceous from nowhere," explains lead author Qiang Fu, of Nanjing Institute of Geology and Paleontology, China.

This is a Nanjinganthus *fossil, showing its ovary (bottom center), sepals and petals (on the sides) and a tree-shaped top. Credit: Fu et al., 2018*

The team studied 264 specimens of 198 individual flowers preserved on 34 rock slabs from the South Xiangshan Formation -- an outcrop of rocks in the Nanjing region of China renowned for bearing fossils from the Early Jurassic epoch. The abundance of fossil samples used in the study allowed the researchers to dissect some of them and study them with sophisticated microscopy, providing high-resolution pictures of the flowers from different angles and magnifications. They

then used this detailed information about the shape and structure of the different fossil flowers to reconstruct the features of *Nanjinganthus dendrostyla*.

The key feature of an angiosperm is 'angio-ovuly' -- the presence of fully enclosed ovules, which are precursors of seeds before pollination. In the current study, the reconstructed flower was found to have a cup-form receptacle and ovarian roof that together enclose the ovules/seeds. This was a crucial discovery, because the presence of this feature confirmed the flower's status as an angiosperm. Although there have been reports of angiosperms from the Middle-Late Jurassic epochs in northeastern China, there are structural features of *Nanjinganthus* that distinguish it from these other specimens and suggest that it is a new genus of angiosperms.

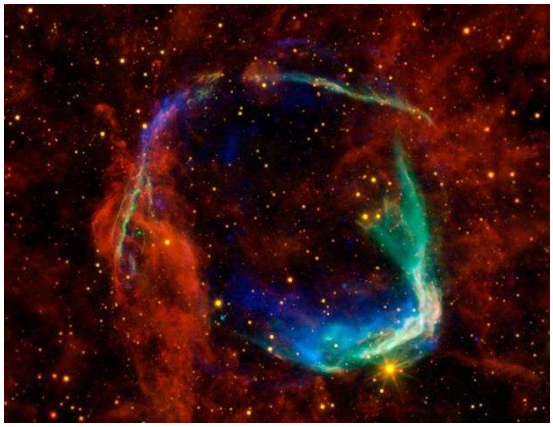
Having made this discovery, the team now wants to understand whether angiosperms are either monophyletic -- which would mean *Nanjinganthus* represents a stem group giving rise to all later species -- or polyphyletic, whereby *Nanjinganthus* represents an evolutionary dead end and has little to do with many later species.

"The origin of angiosperms has long been an academic 'headache' for many botanists," concludes senior author Xin Wang, Research Professor at the Nanjing Institute of Geology and Paleontology. "Our discovery has moved the botany field forward and will allow a better understanding of angiosperms, which in turn will enhance our ability to efficiently use and look after our planet's plant-based resources." This paper (Qiang Fu, *et al*. **An unexpected noncarpellate epigynous flower from the Jurassic of China**. *eLife*, 2018; 7) is available for download at **cdn.elifesciences.org/articles/38827/elife-38827-v2.pdf**

Another Terrific Fact about Trilobites

By Mark Mancini

TRILOBITES WERE WIPED OUT BY THE BIGGEST EXTINCTION IN HISTORY



NASA/JPL-Caltech/UCLA (WISE),Wikimedia Commons

Some call it the "Great Dying"—250 million years ago, 90 percent of all species on earth suddenly perished. Possible causes include everything from increased volcanic activity to exploding supernovas. Regardless, the event—also known as the Permian Extinction—killed off a number of insects, sharks, armored fish, mammal-like creatures, and countless other organisms. Trilobites, however, are by far the most famous lineage to have met their end this way.

CALENDAR OF EVENTS

February
Tuesday February 5, FOSSIL MEETING 7:30 PM Brighton Town Hall Auditorium 2300 Elmwood Ave. Science Olympiad coaching session for middle- and high-school students. Please help.

March
Tuesday March 12, FOSSIL MEETING 7:30 PM Brighton Town Hall Auditorium 2300 Elmwood Ave. Michael Grenier will present a slide-show talk on "Dinosaur Research in 2018: New Findings in Dinosaur Evolution, the End-Cretaceous Extinction, Eggs & Babies, Evolution of Flight & Feathers, & Other Amazing Finds." Visitors welcome.

Visitors are welcome to all Fossil Section meetings! Refreshments are served. 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 are held the first Tuesday of each month from October to December and from February to May at 7:30 pm 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.

Biochemistry professor Dr. Alan Drummond, a professor of biochemistry at the University of Chicago, creates highly detailed 3D printed trilobites such as this Ceraurus.