

The FOSSILETTER

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March 2020

March Meeting

The March section meeting is on Tuesday, March 10, (**NOTE: Not** the first Tuesday, March 3rd) at 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 the December newsletter for details on the fossils being reviewed. If you want that issue resent, we will.

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.

Please Support Science Olympiad

By Fred Haynes

The Fossil Section of the Rochester Academy of Science has invited Middle School Science

Olympiad Fossil competition participants to an informal evening of fossil viewing with local experts and enthusiasts—that would be us! RAS fossil section members will display fossils from the competition list and be available to answer questions.

The event will be very similar to last year's session that was attended by over 20 Science Olympiads and coaches. No formal presentations are planned, but all who attend will be able to see, handle, and learn about many of the creatures that once roamed our planet and our region while getting prepared for the Science Olympiad competition. Coaches, parents, siblings, and guests of all student competitors are also invited. Mark your calendars and join us.



Five Middle School Fossil Science Olympians work at the Fossil Section "testing" table in February 2019, with about 100 different fossils to be identified, overseen by Dan Krisher. In background, Jutta Dudley explains the differences between mastodons and mammoths.

For RAS Fossil section members this is an excellent opportunity to view fossils of all types and meet with the members who have brought them. All this while watching middle school students eagerly working to identify about 100 different fossils and place them within the geologic time table and earth's tectonic history.

We've done this three times in the past now and each time the room has been full of fossil energy! The students are preparing for the regional competition which will take place Saturday, March 14th at St. John Fisher College.

President's Report

by Dan Krisher

The Section's February meeting was held on 2/3 and featured a talk by section member Michael Grenier. Michael provided the group with an update on recent research for the dinosaurs, birds and mammals of the Mesozoic. As always, this was one of our more well attended meetings and pulled in a few visitors. The business portion of the meeting was short. Section members were given details on the upcoming March training session for the Science Olympiad and were informed the Mendon Ponds Winterfest had been rescheduled for 2/23.

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 15th from 6pm to 8pm.

RAS Annual Meeting x

Don't forget the Annual Meeting of the RAS on Thursday, April 2nd in the Brighton Town Hall Downstairs Meeting Room at 7:15 p.m. Following a short business meeting we will be treated to a lecture by Laura Helft, Ph.D. Members saw in the Bulletin last month that she is a co-author of the paper published last October and splashed all over the news, "Decline of the North American

avifauna." She will present the team's findings on how North American bird populations have been decimated by the environmental stresses that affect so much of the world's wildlife. Read more about this in the upcoming RAS Bulletin. The meeting is open to the public, so invite friends.

There will be refreshments and a reception afterwards.

Membership Renewal Time

We are still awaiting several of our members to make their renewal of membership (which expired 12/31/2019). 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.

Spring 2020 Central NY Earth Science Student Symposium

The Syracuse University Department of Earth Sciences invites us to join them for the Central New York Earth Science Student Symposium on **Saturday April 4th, 2020** at Heroy Geology Laboratory on Syracuse University's campus.

If you wish to attend, you can get more information (including a campus parking map) at <http://geologyclub.syr.edu/symposium.html>.

You'll find the registration section about half-way down the page. We will organize a car pool from Rochester. No registration fee is indicated.

The keynote speaker this year is by Dr. Rebecca Barnes, a noted biogeochemist and ecosystem ecologist from Colorado College. Her interests include understanding how aquatic and terrestrial ecosystems process and export carbon and nitrogen. She is particularly interested in how disturbance and global change drivers (e.g., nitrogen deposition, land use change, and warming) affect ecosystem warming.

Schedule

9:30-10:00 AM: Registration (coffee and light breakfast)

10:00 - 11:00 AM: Poster Session 1

11:00 - Noon: Student Talks Session 1

Noon - 1 PM: Lunch

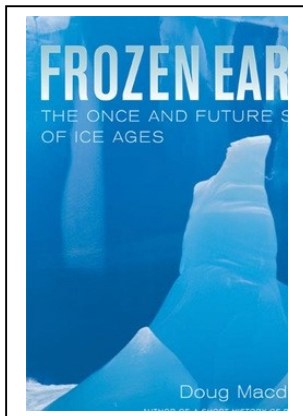
1:00 - 2:00 PM: Student Talks Session 2

2:00 - 3:00 PM: Poster Session 2

3:00 - 4:15 PM: Keynote Presentation, by Dr.
Rebecca Barnes, Colorado College
5:00 - 5:30 PM: Lava Pour (Comstock Art Building)
5:30 - 8:30 PM: Reception (InnComplete)

Book Review

A recent discussion with a friend about the Byron dig and mastodons led to a discussion about the end of the recent ice age and then about previous ice ages. That led me to look for a good book on the subject, which led me to this book, which I quickly acquired. So, this month, I am happy to present **Frozen Earth: The Once and Future Story of Ice Ages**, by Doug Macdougall. University of California Press, 2004. 248 pages, 26 illustrations.



First, here is the review by Publishers Weekly, “With all the concern about global warming, it may be surprising to read that ‘today’s climate is just a geologically short warm spell in a continuing ice age.’ In this lucid and informative book, Macdougall (A Short

History of Planet Earth), an earth science professor at the Scripps Institution of Oceanography, introduces some of the scientists who have studied the Earth’s ice ages, including the celebrated 19th-century naturalist Louis Agassiz, who put forth the theory, revolutionary at the time, of a global ice age; the amateur scientist James Croll, who propounded the idea that cycles of glacial and interglacial climates are related to changes in Earth’s orbit around the Sun; and J. Harlan Bretz, who studied the catastrophic glacial flood that produced the ‘Channeled Scablands’ of Washington state. That glaciers once extended from the North Pole to the Mediterranean was a fact accepted only gradually, and Macdougall examines in detail the clues—rock formations, glacial deposits, fossils and sediment cores—that scientists have used to prove the existence of

continental ice sheets, as well as to study them. He closes with a discussion of our current ice age, suggesting that global warming may bring it to a premature end. Some of the science can get a bit technical, but Macdougall’s readable style makes it accessible to the interested layperson.”

I found the book to be an easy read, definitely accessible by readers with little background in the topic. The first few chapters set up what we know and how we know it. This includes an extensive discussion of Dr. Louis Agassiz’s career, his recognition of the existence of the Pleistocene ice age and assembly of evidence for it, and how it came to be accepted. Particularly interesting to me is the chapter (“Defrosting Earth”) on the dramatic geological and erosional effects of the massive amounts of moving water in a very short period as the continental glaciers quickly melted. There is also a very understandable chapter on Milankovitch cycles—the predictable perturbations of Earth’s axis tilt and wobble, axis direction in space, eccentricity of orbit shape, and other repeating factors that influence the amount of sunlight Earth receives.



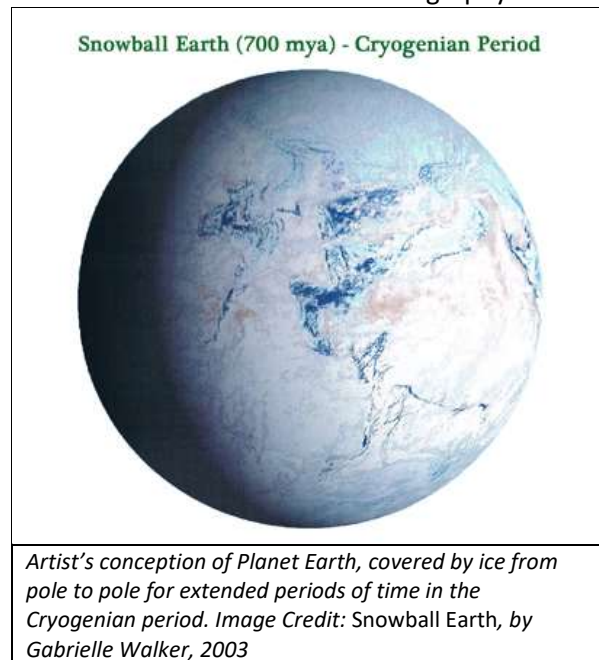
Doug Macdougall is a writer, geoscientist and educator. He is a former Professor of Earth Sciences (now Emeritus) at the Scripps Institution of Oceanography, University of California San Diego, where he taught and carried out research in geochemistry for many years. His non-fiction books aim to bring the excitement of geoscience research to a wide range of readers. Macdougall currently lives and writes in Edinburgh, Scotland.

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The biographical information on important contributors is a gentle and friendly way to introduce concepts that could be complex. Terminology is well-defined to build a foundation of knowledge. As noted in the review above, this book is very well written for those with little background in the subject.

After dealing with the recent ice age, and with the reader well-grounded, he reviews those known to have occurred before. These have good evidence for the more recent ones (recent being a

relative term in geologic time), such as that in the Carboniferous, and the one at the end-Ordovician implicated in that mass extinction. As we go further back in time, the evidence becomes sketchier, as time, erosion, and tectonics destroys evidence. I was excited to read about the ice ages (at least four known) that define the Cryogenian ("cold birth") geologic period (720 to 635 million years ago). This is geologic period before the Ediacaran (which is followed by the Cambrian, of course). Two of the glaciations—the Sturtian and Marinoan—appear to have been the greatest ice ages ever occurring on Earth. There is scientific controversy over whether these glaciations covered the entire planet (the so-called "Snowball Earth") or whether some equatorial open sea remained (so-called "slushball Earth"). The Cryogenian period was codified in 1990 by the International Commission on Stratigraphy.



When we think of the earth's warming climate, we must remember that on a geological time scale, the earth has been cooling for the past 35 million years and is still in the midst of a three-million-year ice age--the Pleistocene Ice Age. The Holocene interglacial began about 11,700 years ago when the last melting of the continental glaciers began. The Earth has been warming since, with two cooler periods from about 3000 to 2000 BP and from about 1250–1850 CE. Without

humans, the climate would likely continue to warm until a climatic optimum was reached, remain warm for a while, and then cool until the next glacial advance. (Or maybe not, if we are at the end of the current cycles of warm-ice-warm.) The Holocene is the sixth interglacial in just the last 254,000 years, with continental glacial advances between them. Human-caused warming appears to be proceeding faster than previous natural warmings, and may become more intense than has occurred during other interglacials.

Fossil News

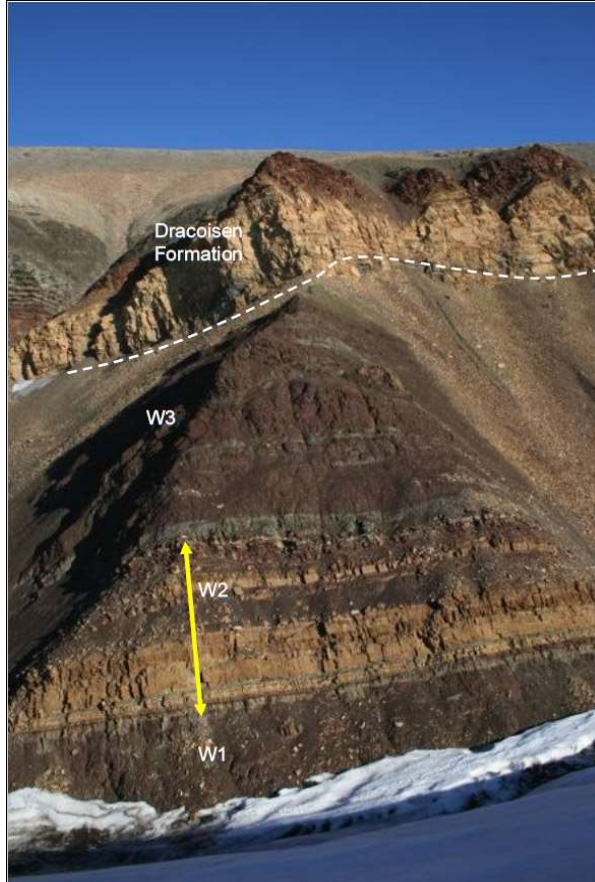
New light shed on end of Snowball Earth period (sciencedaily.com/releases/2015/08/150824114240.htm) Material by University of Birmingham.

The second ice age during the Cryogenian period was not followed by the sudden and chaotic melting-back of the ice as previously thought, but ended with regular advances and retreats of the ice, according to research published by scientists from the University of Birmingham in the journal *Nature Geoscience*. The researchers also found that the constant advance and retreat of ice during this period was caused by the Earth wobbling on its axis.

These ice ages are explained by a theory of Snowball Earth, which says that they represent the most extreme climatic conditions the world has ever known and yet they ended quite abruptly 635 million years ago. Little was known about how they ended -- until this study, in which scientists analyzed sedimentary rocks from Svalbard, Norway that were laid down in that ice age. The deposits preserved a chemical record which showed high levels of CO₂ were present in the atmosphere. Carbon dioxide was low when the ice age started, and built up slowly over millions of years when the whole Earth was very cold -- this period is represented only by frost-shattered rubble under the sediments.

Eventually the greenhouse warmth in the atmosphere from carbon dioxide caused enough melting for glaciers to erode, transport and deposit sediment. The sedimentary layers showed ice retreat and advance as well as cold arid conditions. They reveal a time when glacial advances alternated with even more arid, chilly

periods and when the glaciers retreated, rivers flowed, lakes formed, and yet simple life survived.



Benn et al. 2015, Figure S2. Upper members of the Cryogenian Wilsonbreen Formation in northeast Svalbard and overlying Ediacaran Dracoisen Fm. The Wilsonbreen is subdivided into three members (W1, W2 and W3).

As theory predicts, this icy Earth with a hot atmosphere rich in carbon dioxide had reached a 'Goldilocks' zone -- too warm to stay completely frozen, too cold to lose its ice, but just right to record more subtle underlying causes of ancient climate change. In theory, the advances and retreats of ice during this period were caused by the Earth wobbling on its axis in 20,000 year periods. The rocks and the models agreed: slight wobbles of the Earth on its spin axis caused differences in the heat received at different places on the Earth's surface. These changes were small, but enough over thousands of years to cause a change in the places where snow accumulated or melted, leading the glaciers to advance and retreat. During this time the whole Earth would have looked like the Dry Valley regions of Antarctica -- a very dry landscape, with lots of bare

ground, but also containing glaciers up to 3 km thick. The team reported that, "The sediment analysis has given us a unique window on what happened so many millions of years ago. We know that the Earth's climate is controlled by its orbit, and we can now see the effect of that in this ancient ice age too."

This paper, (Benn, Douglas I., et al. "**Orbitally forced ice sheet fluctuations during the Marinoan Snowball Earth glaciation.**" *Nature Geoscience* 8.9 (2015): 704-707.), is available for download at ResearchGate if you are a member, or you can get a copy from Michael Grenier.

Earth's oldest asteroid strike linked to 'big thaw'
<www.sciencedaily.com/releases/2020/01/200122100546.htm> Material by Curtin University.

With this report just released on January 22nd, we have a link between our "Frozen Earth" book review and our October lecture by Ashley Pollock on "The Late Heavy Bombardment and the Origin of Life".

Scientists have discovered Earth's oldest known asteroid strike occurred at Yarrabubba, in outback Western Australia, and coincided with the end of a global glacial period. The research, published in the leading journal *Nature Communications*, used isotopic analysis of minerals to calculate the precise age of the Yarrabubba crater for the first time, putting it at 2.229 billion years old -- making it 200 million years older than the next oldest impact.

Lead author Dr. Timmons Erickson, from Curtin's School of Earth and Planetary Sciences and NASA's Johnson Space Center, together with a team from Curtin's School of Earth and Planetary Sciences, analyzed the minerals zircon and monazite that were 'shock recrystallized' by the asteroid strike, at the base of the eroded crater to determine the exact age of Yarrabubba. The team inferred that the impact may have occurred into an ice-covered landscape, vaporized a large volume of ice into the atmosphere, and produced a 70km diameter crater in the rocks beneath. Professor Kirkland said the timing raised the possibility that the Earth's oldest asteroid impact may have helped lift the planet out of a deep freeze.

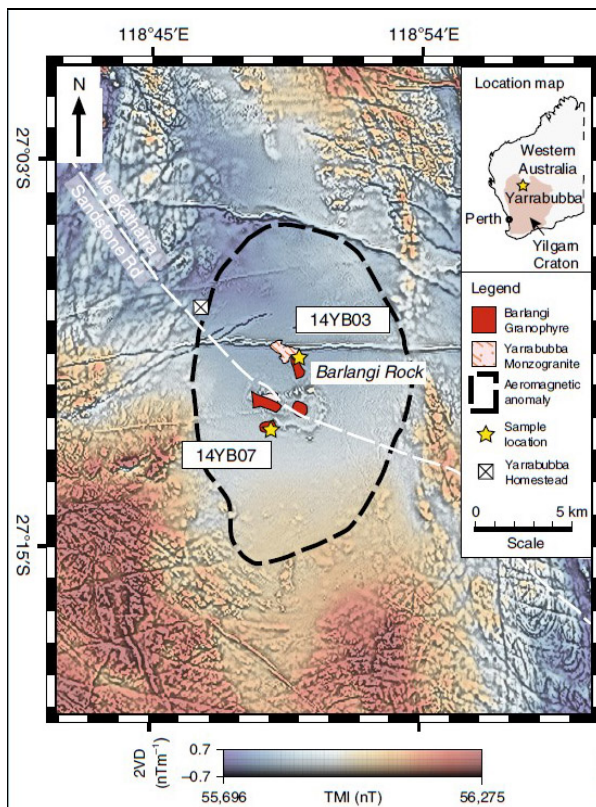


Fig. 1 (Erickson, *et al.* 2020) Map of the Yarrabubba impact structure and sample localities. Composite aeromagnetic anomaly map of the Yarrabubba impact structure within the Yilgarn Craton, Western Australia, showing the locations of key outcrops and samples used in this study. The image shows the total magnetic intensity (TMI, cool to warm colors). The anomaly centered on the outcrops of the Barlangi granite is the eroded remnant of the central uplift domain, which forms the basis of the estimated 70 km crater diameter.

"Yarrabubba, in central Western Australia, had been recognized as an impact structure for many years, but its age wasn't well determined," Professor Kirkland said. "Now we know the Yarrabubba crater was made right at the end of what's commonly referred to as the early Snowball Earth (*editor's note: not the same as the Cryogenian "Snowball Earth"*)—a time when the atmosphere and oceans were evolving and becoming more oxygenated and when rocks deposited on many continents recorded glacial conditions." The team noted the precise coincidence between the Yarrabubba impact and the disappearance of glacial deposits. "The age of the Yarrabubba impact matches the demise of a series of ancient glaciations. After the impact,

glacial deposits are absent in the rock record for 400 million years. This twist of fate suggests that the large meteorite impact may have influenced global climate," Timms said. "Numerical modelling further supports the connection between the effects of large impacts into ice and global climate change. Calculations indicated that an impact into an ice-covered continent could have sent half a trillion tons of water vapor -- an important greenhouse gas -- into the atmosphere. This finding raises the question whether this impact may have tipped the scales enough to end glacial conditions."

This paper, (Erickson, *et al.* **Precise radiometric age establishes Yarrabubba, Western Australia, as Earth's oldest recognised meteorite impact structure.** *Nature Communications*, 2020; 11 (1) DOI: [10.1038/s41467-019-13985-7](https://doi.org/10.1038/s41467-019-13985-7)), is available for download at <https://www.nature.com/articles/s41467-019-13985-7.pdf>

Another Terrific Fact about Trilobites

By Mark Mancini

ONE CHINESE TRILOBITE WAS NAMED AFTER A STAR WARS CHARACTER

Around the start of the last decade, paleontologist Samuel Turvey happened upon several new species of trilobites while exploring in China. He gave one new invertebrate the genus name Han, which it shares with China's biggest ethnic group. When the time came to pick species names, Turvey couldn't resist bolstering his Star Wars cred, and named one particular trilobite Han



Han solo, *published in 2005.*

solo. (It helped that Han solo was the only species in the genus.)

(Editor's note: This agnostid trilobite specimen is from the Middle Ordovician of southern China. It was found in marine strata of the Arenig to Llanvirn-aged Zitai Formation.

Trilobites in the Ice Age

From the American Museum of Natural History (www.amnh.org, "Trilobites In History")

In the spring of 1886, a group of intrepid archaeologists began exploring a series of limestone caves located near the French community of Arcy-sur-Cure. They were in search of human relics -- including spear points and bone utensils -- dating back to the Pleistocene epoch. What they found was something considerably older... and totally unexpected.

Inside one of the caves, in a layer that was subsequently dated to 15,000 years ago, they discovered a 400 million-year-old trilobite with a hand-drilled hole through its tail, a detail which then allowed the fossil to be displayed as an amulet or fetish. From its well-worn, rather weathered appearance, it was clear to these explorers that this trilobite had once been held in high esteem as a treasured totem by those who once inhabited what eventually came to be known as the Grotte du Trilobite.

Despite the roughly 250 million years that separate the demise of the trilobite line and the rise of our own species, there has been a surprising degree of interaction between trilobites and humans throughout our span on Planet Earth.

Trilobites in Pre-Columbian America

(Also from AMNH "Trilobites in History")

While some of our Ice Age ancestors in Europe apparently revered trilobites, so did a variety of Native American tribes, especially those located in the southwestern desert. There, members of the Ute tribe routinely wore 500 million year old *Elrathia kingi* specimens around their necks as talisman to ward off evil spirits. Indeed, petroglyphs that seemingly depict trilobites have been found adorning cliff walls in southern Utah... and these man-made images could be hundreds, if not thousands, of years old. Evidence of this tribal fascination with trilobites extends all the way up to British Columbia, and all the way down to Australia, where amulets featuring trilobites of varying sizes and shapes have been discovered in a number of Aboriginal sites.



Probable trilobite petroglyph, photographed by Frank Beckwith in 1931. Beckwith's label reads "A shield (?) shaped like a trilobite." The local Ute name for trilobite fossils translated roughly as "little water bug in stone," indicating that they recognized their organic nature.

CALENDAR OF EVENTS

March

Tuesday March 10, FOSSIL MEETING 7:00 PM Brighton Town Hall Auditorium 2300 Elmwood Ave. Science Olympiad coaching session for middle- and high-school students. Please help.

April

Tuesday April 7, FOSSIL MEETING 7:30 PM Brighton Town Hall Auditorium 2300 Elmwood Ave. Program to be determined. 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 March to May at 7:30 pm at the Brighton Town Hall, Community Meeting Room, 2300 Elmwood Avenue, Rochester, NY unless otherwise listed.

OFFICERS

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Director (one-year-term): Fred Haynes	585-203-1733	fred.patty.haynes@gmail.com
Director (three-year-term): <i>Open</i>		

APPOINTED POSITIONS

Field Trip Coordinator: Dan Krisher	585-293-9033	DLKFossil@gmail.com
FossilLetter Editor: Michael Grenier	585-671-8738	mgrenier@frontiernet.net

The FossilLetter 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 FossilLetter 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.

