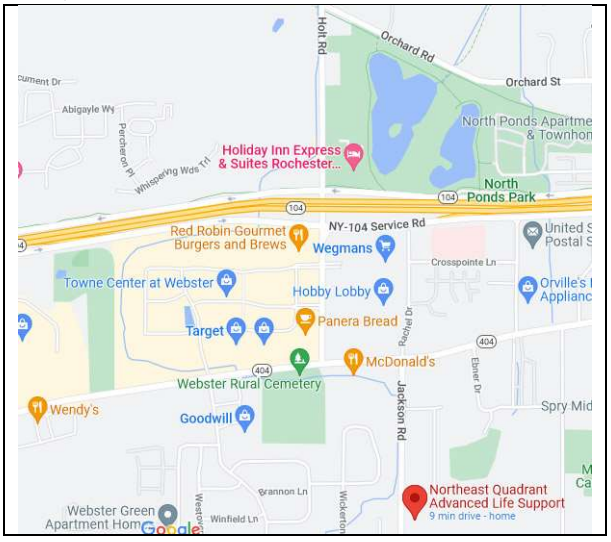
A publication of the Rochester Academy of Science FOSSIL SECTION

The FOSSILETTER

VOL. 39 Number 6 April 2022

April Meeting

The April section meeting is on Tuesday, April 5th, at 7:30 PM. This meeting will be at a new location due to the Brighton Town Hall meeting rooms remaining unavailable. We will meet at a new state-of-the-art Community Meeting Room at the NEQALS (North East Quadrant Advanced Life Support) building at 1030 Jackson Rd, Webster, 14580. Take Holt Road exit south to end, turn left on Ridge Road, take first right at light onto Jackson Road, look for NEQALS on the left.



We are excited to have Dr. Pennilyn Higgins as our guest and speaker who will discuss her recent experiences in doing "*Paleontology at the End of the Rope*."

Natural Trap Cave (NTC) is an 80-foot-deep sinkhole-type pit in the Bighorn Mountains, in northern Wyoming. It provides important paleontological information on the North American Late Pleistocene dating from 20,000 years ago, due to a rich layer of fossils from animals that became trapped in the cave. Over 30,000 specimens have been collected from the cave over the years, mostly from extinct animals, including mammoth, short-faced bear, collared lemming, lion, cheetah, and camel.

Dr. Pennilyn Higgins

Natural Trap Cave is a paleontologist's dream. Fossils on the floor of NTC have been a source of fascination and mystery since their first excavation in the 1970s. Today, the cave is only accessible by single-rope techniques, which means climbing in and out has to be done on a single, vertical rope. In this talk, Dr. Higgins will discuss some challenges that researchers face while collecting fossils within NTC as well as some exciting discoveries that have been made there!

Penny writes that, "This talk will be part travelogue and part science. We will explore the challenges of working in a cave which is on top of a mountain about a one-hour drive from the nearest town. We'll also dig into the data about how we can know that pronghorns were the prey of American cheetahs and some of the interesting conclusions and future work that are coming from Natural Trap Cave."

Penny also writes that she regards herself as a storyteller, an artist, and a scientist, in no particular order. She has a Ph.D. in Geology and has been an active researcher in paleontology for over 20 years. Her specialty is the study of the chemistry of bones and teeth and of rocks to make

inferences about past environments and climate. Her work puts special emphasis on times of rapid climate change and the impact that change had on mammals. She has traveled to and collaborated with scientists on projects in South America, Australia, and the high Arctic, in addition to her current involvement in projects in the states of Utah and Wyoming.

Penny is also a small business owner with EPOCH Isotopes, a consulting firm for geochemical research and PaleoPix, focused on pet portraits and digital art. Penny also runs Mew-Mew House, a retirement home and hospice for cats.

The opening of Natural Trap Cave when secured.

The interior of NTC..

Paleontology at the End of the Rope

by Dr. Pennilyn Higgins

Natural Trap Cave is in north-central Wyoming. So far north, in fact, that you can see Montana from there! Its name belies its reality, for it is a great gaping hole in the earth that is almost invisible until you're right on top of it. It's big enough that a car could fall in! If you miss it, you're in for an 80-foot fall. The opening on the surface is large but does represent the full size of the cave. The interior is a massive and roomy bell-shaped chamber that remains at about 45 degrees Fahrenheit year-round.

In the late 1970's and into the 1980's the University of Kansas (KU) excavated thousands of vertebrate fossils documenting the end of the most recent global glacial event and the transition into our modern period of relative warmth. Every fossil collected represented an animal that had fallen in, and included hooved mammals like horses, bison, bighorn sheep, and pronghorn "antelope" as well as their carnivorous counterparts, wolves, bears, coyotes, and now-extinct carnivores like North American lions and American cheetahs.

The cave was closed to research and exploration in the 1980's to be re-opened in 2014. Advancements in analytical techniques and the perfect preservation conditions at Natural Trap Cave made it possible to extract DNA from the bones and teeth preserved there, giving scientists an opportunity to explore in more detail the relationships among the species present in the cave and their modern relatives. This opportunity was compelling enough for various funding bodies (including the National Science Foundation and the National Geographic Society) to support the research and the Bureau of Land Management to grant permission to collect in the cave for the first time in 30 years.

I was brought into the project as a geochemist. My specialty is the study of carbon and oxygen in tooth enamel to draw inferences about ancient climate change, local environments of the past, and dietary habits of long-extinct animals, particularly horses and bison. I also brought my experience in screen washing sediments to find what we call "micro-vertebrates," which are all the small animals like snakes, lizards, and birds, as well as little mammals like shrews and mice. The combination of the large mammals with the micro-vertebrates makes it possible to paint a complete picture of what northern Wyoming was like during the last glaciation.

Of the animals found at Natural Trap Cave that continue to roam in the region, the pronghorn is among the most intriguing. Pronghorns are the second fastest land mammal on Earth and endemic to North America. The only land mammal that's faster is the cheetah, *Acinonyx*, found in Africa. The discovery of the American cheetah, *Miracinonyx*, in Natural Trap Cave by researchers from KU provided a possible explanation for the remarkable speed of the pronghorn. At the time of

the discovery of *Miracinonyx* there was no way to 'prove' this hypothesis, but the scientific community thought it was reasonable and left it at that.

Just as with DNA extraction, other chemical techniques were developed in the intervening 30 years between KU's explorations and renewed investigations in the 21st century that could directly test the potential predator-prey relationship between pronghorns and the American cheetah.

We joke in the stable isotope community that "You are what you eat, plus a few permil." This means that if we know the stable isotopic values, termed "delta values," of a food source, the organism that eats that food will have a slightly more positive delta value. The units of a delta value are permil (‰). For mammals we know just how much more positive the predator's delta value should be over its prey. If we measure nitrogen isotopes from collagen in bones, there is generally about a 3‰ increase in delta values from prey to predator. Because of the exquisite preservation conditions at Natural Trap Cave, collagen is often present in both bones and teeth and now we have a data set that can be used to examine predator-prey relationships within the animals that once lived together at the cave.

In doing this project, we didn't limit ourselves to only cheetahs and pronghorns, we extracted collagen from as many identifiable specimens as we could. And, as it happens, we did radiometric dating on several specimens which happens to also provide stable isotopic data from collagen. With this large (and growing) data set we're able to begin to construct a food web for large mammals that co-existed at Natural Trap Cave thousands of years ago. Much to our delight, the evidence suggests that in fact, cheetahs did prey upon antelope, though the story is a little more complex than we'd originally anticipated.

Like all good science, the answers have resulted in more good questions.

President's Report *by Dan Krisher*

The Section's March meeting was on 3/1 via ZOOM. The meeting opened with a brief business portion in which members were updated on the upcoming first fieldtrip of the season (4/23) and the status of outreach events. The status of our April meeting was discussed and, due to the considerable background work by vice-president Michael Grenier, it was tentatively decided that our April meeting will be a hybrid meeting. The live portion of the meeting will be in a new venue in Webster which boosts state-of-the-art features. This is of course subject to change based on the whims of COVID, but we are all excited about our first face-to-face since February of 2020. The second portion of the meeting featured a talk by Dr. Sara Burch, Associate Professor of Biology at SUNY Geneseo. Dr. Burch's talked dealt with the functional morphology and purpose of the ridiculously short arms found on many of the larger theropod dinosaurs. We had a total attendance of approximately sixty-five.

It has been a long winter, but Spring is finally here and the Fossil Section is ramping up its activities for the coming months. First, and most welcomed, is that April will mark the return of our in-person Section meetings. Our last physical meeting was two long years ago in February of 2020. The changed to remote meetings was a bit rocky but once we got our feet under us, they proved to be something of a bonus. The remote meetings enable us to pick from a wider pool of speakers and due to the reciprocal arrangements with other groups, our monthly meetings often approached 60 attendees. As we resume meeting in person one change you a likely already aware of is the venue. The Brighton Town Hall, which has long hosted us, is not capable of holding public meetings for the foreseeable future. Starting in April we will be meeting in the NEQALS (Northeast Quadrant Advanced Life Support) building at 1030 Jackson Rd, Webster, 14580. This is a new state-of-the-art facility which will help the Section solidify and build on the digital improvements we have made. As the Section resumes its in-person meetings the Board is determined to not lose the advances we have gained through remote meetings. All though many of our speakers will be local we will also continue the practice of sourcing speakers from outside the area. We will also be simultaneously broadcasting our meetings on ZOOM to remote Section members as well as clubs

and groups where we have existing reciprocal arrangements. Once again, these changes may be a bit bumpy at times however our Section will be all the stronger for the efforts. The last two years have been challenging and adapting to the new realities has required the efforts of all the Section Board however a special acknowledgment needs to be given to Section Vice-President Michael Grenier. His efforts around speaker sourcing, the mechanics of ZOOM, and the new venue have been instrumental for the Section's success. On behalf of the Board, we hope to see you at the up-coming meeting.

Fossil Section Election – Need Volunteers

It is once again time for the Fossil Section to nominate its slate of officers for the 2021-2022 year. PLEASE consider helping and nominate yourself to be President, Secretary, or Board member. We promise that it is not much work! If you might be interested in running for any of these positions but would like additional information as to the duties and time involved, please contact one of the current Officers or Board members. The finalized ballot will appear in the June newsletter. Current RAS Fossil Section Officers are listed on last page.

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.

Below is the list of the currently scheduled field trips for the season. I have also sent the listing to our members as a PDF. As in years past, I will be sending out an email about a week to a week and a half before the trip. If you wish to attend simply respond with an email at least 2 days before the trip. I will acknowledge your email and will contact all attendees the day before the trip with additional information.

Welcome to the 2022 field trip season for the FOSSIL Section. Below is a list of the field trips currently scheduled for this season. Please note that the dates for two of the trips are still tentative as we are in the process of getting approval for our visits.

4/23 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 is 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.

5/21 Road Cut Near Tioga, PA. A large road cut near Tioga PA exposes Upper Devonian strata of the Frasnian Lock Haven Group. The rock is primarily siltstone and sandstone and contains a fauna of brachiopods and bivalves. This site was visited during the 2017 New York State Geological Association annual meeting in 2017 and detailed information on the site can be found in the NYSGA 2017 guidebook.

6/18 Swamp Road and Pompey Center. The first is a family-friendly 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 consists primarily of bivalves and gastropods with a small variety of brachiopods, Bryozoa, and cephalopods. The occasional trilobite can also turn up. The second is a family friendly large road cut east of Syracuse which primarily exposes the Delphi Station member of the Skaneateles formation. Bivalves are common as well as gastropods, trilobite parts and nautiloids.

7/16 Little Beard's Creek. 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.

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

7/30 Jaycox Run. The trip will visit the Jaycox Run site between Avon and Geneseo with collecting 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.

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

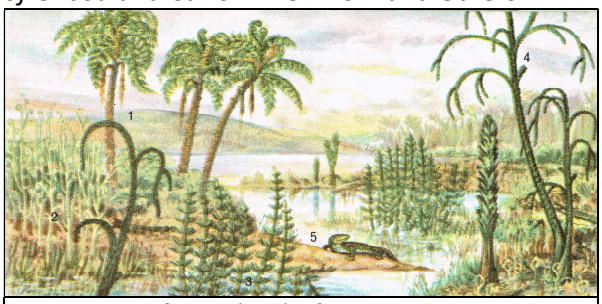
8/6 (Tentative) Gilboa, Cairo, NYS Museum, & Rickard Hill. We are working on a field trip to the Rickard Road cut in Schoharie New York with guided visits to the Gilboa and Cairo museums mentioned in our recent talk on Devonian forests. First stop will be the NYS Museum to see their collection of Devonian forest material. Additional information on this trip will be shared via newsletter and email as it becomes available. No collecting at the first three stops, of course, but the large Rickard Road cut is a family-friendly site near Schoharie, New York southwest of Albany.

8/13 (Tentative) Portland Point. A new site for the Section first visited last year. Exposes Middle Devonian siltstones, and shales. A wide variety of Hamilton Group fauna are available for collecting however organisms that favored sandier environments are typical at this site. If weather and water levels allow, we will also visit a second near-by site at Sandy Creek. 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 process for "signing up" for one of these trips is quite straight forward. 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 back 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

"Devonian Forests" February Talk

In the February section meeting on Tuesday, February 1, our guest speaker was Dr. Christopher Berry who discussed "*The Devonian Fossil Forests of Gilboa and Cairo in New York and Others*".



A Devonian forest (not!), from Fossils A Guide to Prehistoric Life*, Golden Press, page 41, copyright 1962.*

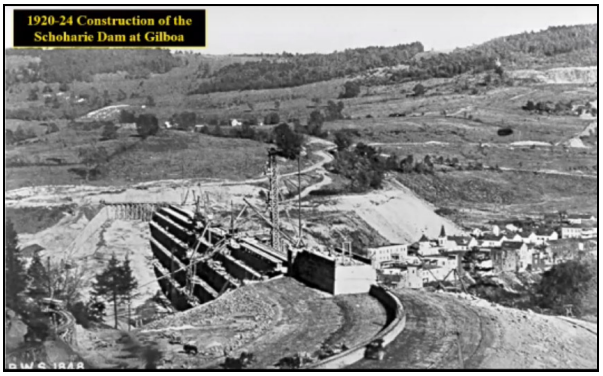
The earliest known forests are known from the Middle Devonian. We see an increase in size and complexity of land plants from the lowest Devonian. Christopher shared with us that his first fossil book when he was a child was called *Fossils, A Guide to Prehistoric Life*. Remarkably, he still has that book. He showed an illustration of a Devonian forest from it, which is now known to be almost entirely wrong, but which helped lead him to a 30-year (so far) career. Recognizing the picture, I searched my own library and discovered that I still had my copy which I purchased when I

was 13. The image is reproduce directly here and not from a grainy screenshot.

Christopher started his tour of Devonian forests with one at Lindlar in Germany, where they worked starting in 2009, with publication in 2013.

Figs. 4 & 5, Calamophyton primaevum *from the Schiffarth Quarry, Lindlar, from Berry (2013) Reconstruction and Growth of the Early Tree Calamophyton . . .*

He showed a new artistic recreation showing the Lindlar "forest" with the disclaimer that the plants were only 2-3 feet high. From here he moved on to the Gilboa Forest which fossils were found in the 1860s by the Rev. Samuel Lockwood and studied by NYS Paleontologist James Hall and by John William Dawson, who wrote the paper describing them. More extensive fossils were found when a dam was constructed on Schoharie Creek in the 1920s.



For more, see the complete video of the talk, for which you must contact paleo@frontier.net to sign a non-disclosure agreement.

"Theropod Arms" March Talk

In the March section meeting on Tuesday, March 1, Dr. Sara Burch of SUNY Geneseo shared her current research on "Forelimb Function in Predatory Dinosaurs" with us.

Dan opened the meeting with announcement of the Field Trip schedule, reports on the Buffalo Gem & Mineral Show with its theme of "Fossils in NY" and that Penn-Dixie will hold its "dig with the Experts" event on June 4 & 5 – see https://penndixie.org/ for more info. Our June meeting will be a picnic at the ASRAS Iona Observatory.

Dr. Burch has been working on theropod arms since she was an undergrad. Theropods started out in the Triassic with long gracile arms, and many retained those throughout time, but her interest is in the very short arms that several lineages developed. From fossil bone, it is possible to reconstruct the musculature, cartilage, and joint range of motion to get insight into the function of arms. Muscle attachment points, length, and size together with bone size and length enables us to understand muscle strength and usage. By the way, *T. rex* doesn't even have the shortest arms relative to size. To learn more, get the link to her talk at our website meetings page, https://rasny.org/fossil-section-calendar.

Fossil News **by Michael Grenier**

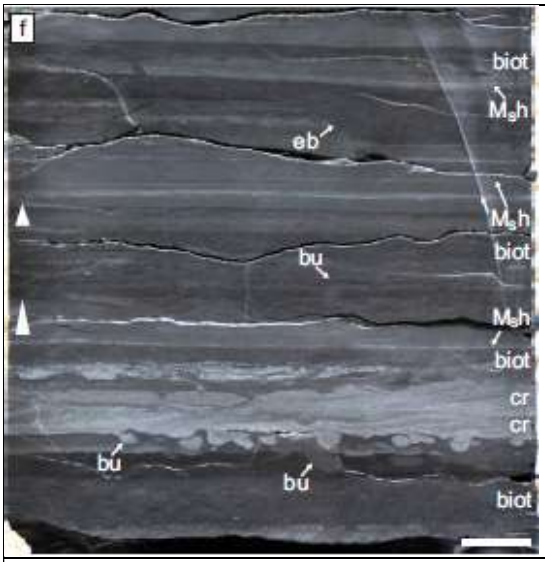
Modern animal life could have origins in delta

Original material provided by University of Exeter. https://www.exeter.ac.uk/news/research/title_905000_en.html

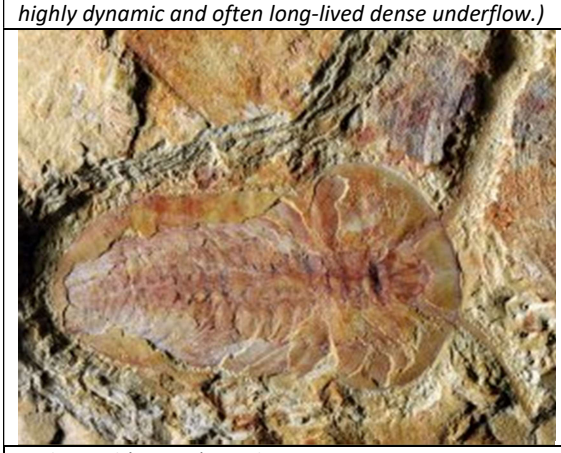
The ancestors of many animal species alive today may have lived in a delta in what is now China, new research suggests. The Cambrian Explosion, more than 500 million years ago, saw the rapid spread of bilaterian species – symmetric along a central line, like most of today's animals. The Cambrian Explosion is now universally accepted as a genuine rapid evolutionary event, but the causal factors for this event have been long debated, with hypotheses on environmental, genetic, or ecological triggers.

The 518-million-year-old Chengjiang Biota – in Yunnan, south-west China – is one of the oldest groups of animal fossils currently known to science, and a key record of the Cambrian Explosion. Fossils of more than 250 species have been found there, including various worms, arthropods and even the earliest vertebrates. The new study finds for the first time that this

environment was a well-oxygenated, nutrient-rich, shallow -water delta affected by storm-floods.



Saleh et al. 2022 Fig. 2- f Rippled fine-grained sandstone (cr) with sharp-lined firmground burrows (bu) penetrating from the base of a hyperpycnal flow layer into an intensely bioturbated mudstone initially colonized under softground conditions. Fluid mud deposits with normal-graded mudstone (white triangles), coarse mudstone laminae (Msh), and erosive bases (eb) are observed, interbedded with bioturbated intervals (biot). (Ed. Note: A hyperpycnal flow forms when a relatively dense land-derived gravity flow enters into a marine or lacustrine water reservoir. As a consequence of its excess of density, the incoming flow plunges in coastal areas, generating a highly dynamic and often long-lived dense underflow.)



Arthropod (Naroia). Credit Dr Xiaoya Ma

The area is now on land in the mountainous Yunnan Province, but the team studied rock core samples that show evidence of marine currents in the past environment. Senior author Dr Xiaoya Ma, a paleobiologist at the University of Exeter and Yunnan University said, "The discovery of a deltaic environment shed new light on understanding the possible causal factors for the flourishing of these Cambrian bilaterian animal-dominated marine communities and their exceptional soft-tissue preservation. The unstable environmental stressors might also contribute to the adaptive radiation of these early animals." Storm floods transported these organisms down to the adjacent deep oxygen-deficient settings, leading to the exceptional preservation we see today.

The results of this study are important because they show that most early animals tolerated stressful conditions, such as salinity (salt) fluctuations, and high amounts of sediment deposition. This contrasts with earlier research suggesting that similar animals colonized deeper-water, more stable marine environments.

This paper, (Saleh, F., Qi, C., Buatois, L.A., Mángano, M.G., Paz, M., Vaucher, R., Zheng, Q., Hou, X.G., Gabbott, S.E. and Ma, X., 2022. The Chengjiang Biota inhabited a deltaic environment. *Nature Communications*, *13*(1), pp.1-9) is open access at https://www.nature.com/articles/s41467-022-29246-z

Early Evolution of Echinoids

New insight on the origins and early evolution of echinoids, a group that includes the sea urchins, the sand dollars, and their relatives, was published March 22 in the journal *eLife.*

The study suggests that modern echinoids emerged approximately 300 million years ago, survived the Permo-Triassic mass extinction event – the most severe biodiversity crisis in Earth's history – and rapidly diversified in its aftermath. These findings help address a gap in knowledge caused by the relative lack of fossil evidence for this early diversification.

For more information, see https://www.sciencedaily.com/releases/2022/03/220322122555.htm. This will include a link to this open source paper.

CALENDAR OF EVENTS

April
Tuesday April 5, FOSSIL MEETING 7:30 PM. LOCATION: NEQALS Community Meeting Room, 1030 Jackson Rd, Webster, 14580. Speaker Dr. Sara H. Burch, Associate Professor, SUNY Geneseo speaking on the biomechanics of the *T. rex* forelimb. Visitors welcome.

May
Tuesday, May 3, FOSSIL MEETING 7:30 PM. LOCATION: NEQALS Community Meeting Room, 1030 Jackson Rd, Webster, 14580. Speaker Section VP Michael Grenier on Dinosaur (and others) research results over past two years. Visitors welcome.

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.

Another from Hugh Murphy's *T-Rex Trying* charming collection of drawings on the limitations of short arms. To learn what they ARE good for, view Dr. Sarah Burch's talk.