A publication of the Rochester Academy of Science
FOSSIL SECTION

The FOSSILETTER

VOL. 39 Number 3 December 2021

Membership Renewal Time

Unless you are a Life Member, note that your membership will expire on December 31, 2021. Please renew your membership at your earliest convenience. A membership form is included with this newsletter. Remember, on the form, you have to add the Rochester Academy of Science membership ($10 individual/$15 family) and Fossil Section membership ($10 individual or family, $5 student).

December Meeting

The December section meeting is a bit out-of-the-ordinary this month. Instead of our traditional December "Show-n-Tell" pizza party meeting, we will have a Sunday tour (Live! and in person!) on December 5th at the local Rochester Museum and Science Center. RMSC paleontologist and RAS Fossil member George McIntosh will lead a behind-the-scenes guided tour of the RMSC's newest traveling exhibit, "Expedition: Dinosaur!," (https://rmsc.org/dinosaurs/).

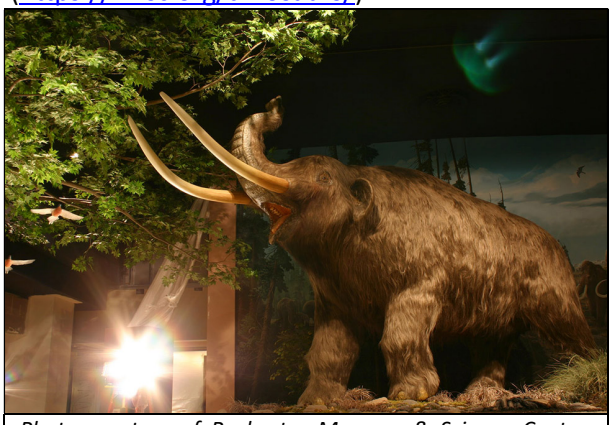


Photo courtesy of Rochester Museum & Science Center. (This is not one of the dinosaurs, but you will want to visit this mastodon in the regular exhibits while you are there.)

We have a special group rate admission of $8 (the normal RMSC at-the-door admission is $20), we can only accommodate 12 people in this group, and you must be a Fossil Section member. However, if you are already a member of the RMSC you do not need to pay.

You must by there by 3 p.m. sharp! That's when we take attendance in the lobby, hand out tickets or whatever and launch into the museum. Members MUST register in advance—write to paleo@frontier.com. The tour will be about an hour. Then you can do all the hands-on activities on your own time or even wander down to see their regular paleontology exhibits in their Expedition Earth exhibit, including parts of the Farview mastodon and of the East Bloomfield mastodon. There is also a mounted skeletal cast on display and a full-sized furry model of a mastodon as believed to appear in life. George McIntosh has recently retired from his position as Rochester Museum & Science Center Director of Collections. Although as a researcher, George is a crinoid specialist, he had to be a generalist at the museum. He oversaw recovery of both the Farview and the East Bloomfield mastodons. But if you want to get him animated, ask him about the functional morphology of Devonian and Mississippian cladid crinoids.

Dr. George McIntosh, Rochester Museum & Science Center. Photo from ResearchGate.

NO January Section Meeting

The Section will not hold a January meeting or issue a newsletter due to the holiday season. The next meeting will be Tuesday, February 1st, 2022 at 7:30 PM.

Expedition: Dinosaur! Exhibit

by Michael Grenier

I visited the new RMSC Expedition: Dinosaur! Exhibit on November 5th, which was the members' night the day before the official opening. Among the special activities there for kids was the opportunity to talk to a real live paleontologist about dinosaurs. Yep, it was George McIntosh and he looked like he was having a good time with all the families that were attending. I have been to quite a few dinosaur exhibits in various museums, and I was quite impressed with this one.

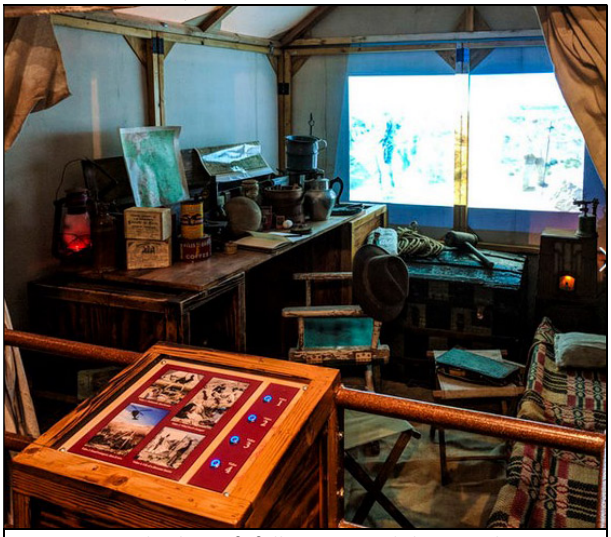
Albertosaurus sarcophagus *is much smaller than its larger and more famous relative Tyrannosaurus rex, growing 26 to 33 ft(8 to 10 m) and possibly weighing 2.8 tons or less. This animated model is full-sized.*

Expecting the exhibit to be targeted to children, I was prepared to be disappointed in the quality of the science presented. However, they really did a very good job and the exhibit can be quite engaging for adults as well. I did find the placards identifying the dinosaur models to be somewhat scant on information, but they made a decision to have very short descriptions limiting the amount of material that could be presented.

The key attraction is the 11 dinosaur models in nine different exhibits, and most kid's favorite dinosaurs are here. You'll find *Albertosaurus, Amargasaurus* (a "young one" so it doesn't have to be too big), *Carnotaurus, Dilophosaurus, Iguanodon,* two *Pachycephalosaurus,* two *Velociraptors, Stegasaurus,* and *Triceratops*.

Triceratops

Motions in each of the animated models is directed from a control panel which kids and adults play with enthusiastically. The motions are "realistic" as they are based on the actual movement limitations of the joints. Necks swing, heads move up-and-down, jaws open and close, and tails shake, all at the press of various buttons. The dinosaurs also make noises on command, which kids love, but for which there is no basis.



Interactive display of fully equipped late 19th century paleontologist's field tent in western United States

Many of the interactive supporting exhibits are really only of interest to children— such things as dinosaur tracing, dino operation game, dinosaur dig in sand, mix-n-match dinosaur spinner, and others; there are also a number that I found intriguing and expect that most adults would enjoy. These include a Pangea puzzle to understand tectonic plate movement and the shape of continents before modern history, the dinosaur egg scanner to learn about these interesting fossils,

the interactive 3d topography sandbox, the field campaign tent, and tools of the trade.

That said, there are a few flaws in the exhibit. One concerns size, of *Velociraptors* specifically. Ever since the *Jurassic Park* movie, *Velociraptors* have frequently been confused with the related and much larger *Deinonychus*. Steven Spielberg loved the name *Velociraptor* but wanted something much larger for his movie raptors.

"Velociraptors" at RMSC with a mom & son for scale.

So what's the problem? The largest adult *Velociraptor* fossil is of an animal that is a bit more than 2 meters (6' 9") long in which more than half that length is tail, 0.5 meter (1' 7") high at the hip, and weighing about 15 kg (33 lb). This is the size of a 25-pound Thanksgiving turkey, plus long tail, long neck with big head, and long legs and wings.

AMNH diagram showing relative sizes of (left to right) a human, a Velociraptor*, and a* Deinonychus*. Compare this to the photograph above.*

The take away from this is that the model is an excellent representation of two *Deinonychus*. The minor flaw is that the sign mistakenly says *Velociraptor*.

President's Report by Dan Krisher

The Section held a meeting via ZOOM on October 9th as the first Tuesday of the month was an election Day. The membership was reminded of the possibility of a show-n-tell and pizza gathering at the Brainery for December. Members were asked to sign-up no later than Sunday the 14th. As of the 15th only a handful of members had expressed an interest in meeting at the Brainery so the Board decided to pursue a behind-the-scenes tour of the new Dinosaur exhibit at the Rochester Museum and Science Center instead. The speaker for the meeting was Carl Fechko, member and past president of the North Coast Fossil Club in Cleveland. His talk was entitled "The Geology, History, and Fossils of the Fossil Lake Sediments of the Green River Formation".

Turn Your Shopping into RAS $$$

If holiday shopping at Amazon.com, please do it at their Smile Amazon site. If you set up RAS to benefit, Amazon will make a donation of part of the proceeds to the RAS, at no extra cost to you. The gift purchases you make at Amazon will provide the extra gift of helping to support your Academy! To start, simply go to **smile.amazon.com** and sign up.

"Green River Fossils" Talk

Carl Fechko's talk (77 minutes, plus Q&A) was recorded and is at: https://youtu.be/hSEF6ppX_y0

Carl decided in 2017 to do collecting in the Eocene Green River Formation of Wyoming with its spectacular preservation of fossils. Access for collectors is through commercial operations that own quarries. Carl investigated several and found that all but one keep the valuable fossils you find and let you take the common ones. (This sounds like a pretty good business model to me--people pay you money to dig up fossils for you to sell, hmmmm.) Anyway, he did find one, American Fossil in Kemmerer, WY (SW corner of state), which charges a reasonable fee and allows you to keep any fossil you find, except extraordinarily rare ones with a value of over $100,000. These require a 50% buy-out fee to the owner of the property. This sounds a lot more fair, and Carl thought so too—his first season (2017) was so enjoyable and rewarding that he has returned every year since.

Carl described the geological setting for the Green River formation. Regional uplift during the Eocene eventually eliminated both the land bridge to Asia and the Western Interior Seaway, and left a basin which supported three large, long-lived lakes,

A view of the Aerican Fossils quarry.

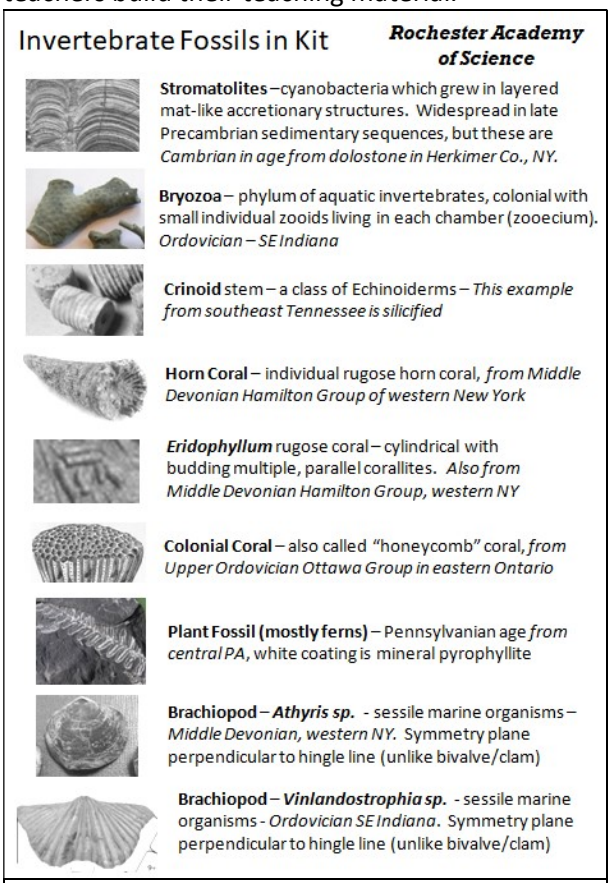
whose 14 members make up the Green River Formation. The most fossiliferous of the of the formation is the. The known aquatic diversity of Fossil Butte Member, in which American fossil has its quarry, exceeds that of the other 13 members combined. The region was warm, wet, and subtropical in the Eocene, but it is a high mountain desert today.

Knightia is one of the two most common fish and is often found for sale in fossil shops and at mineral shows. It is the state fossil of Wyoming.

Carl showed examples of both common and very rare fossils that he collected there, and some collected by others such as birds, bats, and horses. He covered their ecology based on the evidence of the fossils and the strata. Here are a couple of the more common fossils, but to see all the others, including amazingly rare ones, you'll have to watch the video. If anyone is thinking of collecting out there, Carl has arranged a group discount (10%) and invites any of our members to take advantage of that. (Contact carlfechko@hotmail.com)

Science Teachers Outreach **by Fred Haynes**

Last month we reported on the donation of fossils the Section had acquired. We were pleased to be able to distribute some of the brachiopods and corals from the collection to high school earth science teachers at the Science Teachers Association of New York State (STANYS) conference in Rochester in early November. Fred Haynes constructed the kits of mostly invertebrate fossils he had collected in addition to those from the donated collection. Approximately 40 teachers obtained the fossil kits at the RAS booth in the convention center where the Symposium was held. In addition to the nine fossils, the teachers also received a short summary page that identified the fossils, their geologic age, and where they were found. It is always rewarding to help enthusiastic teachers build their teaching material.


Invertebrate Fossils in Kit

Rochester Academy of Science

Stromatolites – cyanobacteria which grew in layered mat-like accretionary structures. Widespread in late Precambrian sedimentary sequences, but these are *Cambrian in age from dolostone in Herkimer Co., NY.*

Bryozoa – phylum of aquatic invertebrates, colonial with small individual zooids living in each chamber (zooecium). *Ordovician – SE Indiana*

Crinoid stem – a class of Echinoiderms – *This example from southeast Tennessee is silicified*

Horn Coral – individual rugose horn coral, *from Middle Devonian Hamilton Group of western New York*

Eridophyllum rugose coral – cylindrical with budding multiple, parallel corallites. *Also from Middle Devonian Hamilton Group, western NY*

Colonial Coral – also called "honeycomb" coral, *from Upper Ordovician Ottawa Group in eastern Ontario*

Plant Fossil (mostly ferns) – Pennsylvanian age *from central PA*, white coating is mineral pyrophyllite

Brachiopod – ***Athyris sp.*** - sessile marine organisms – *Middle Devonian, western NY.* Symmetry plane perpendicular to hingle line (unlike bivalve/clam)

Brachiopod – ***Vinlandostrophia sp.*** - sessile marine organisms - *Ordovician SE Indiana*. Symmetry plane perpendicular to hingle line (unlike bivalve/clam)

Fossil Summary page for earth science teachers

Fossil News

Uncovering the Secrets Behind Earth's First Major Mass Extinction

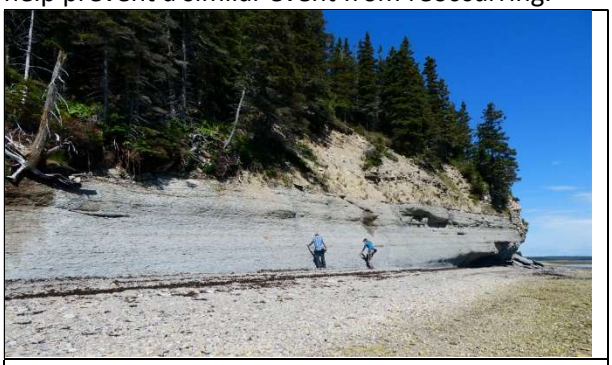
Syracuse University Press Release Nov. 1, 2021, by Dan Bernardi

https://thecollege.syr.edu/news-all

A team of researchers have published a new study in Nature Geoscience exploring the cause of the Late Ordovician mass extinction.

There are five significant mass extinctions, known as the "big five," where at least three quarters of all species in existence across the entire Earth became extinct during a particular geological

period of time. Discovering the root cause of Earth's mass extinctions has long been a hot topic for scientists, as understanding the environmental conditions that led to the elimination of the majority of species in the past could potentially help prevent a similar event from reoccurring.



Researchers examine an Ordovician Period outcrop on the shoreline of Anticosti Island, Quebec, Canada. (Credit: André Desrochers, University of Ottawa).

An international team of scientists from Syracuse University's Department of Earth and Environmental Sciences and seven other colleges and universities recently released a paper exploring the Late Ordovician mass extinction (LOME), which is the first, or oldest of the mass extinctions. The second worst mass extinction known to science, this event killed an estimated 85 percent of all species, most of which lived in shallow oceans near continents during that time ~445 million years ago.

Brachiopod fossils from the Ordovician Period outcrop on Anticosti Island, Quebec, Canada. (Credit: André Desrochers, University of Ottawa)

Lead author Alexandre Pohl (UC Riverside) and co-authors investigated the ocean environment before, during, and after the extinction in order to determine how the event was brewed and triggered. The results from their study have been published in the journal *Nature Geoscience*.

Mass extinction expert Seth Finnegan, (UC Berkeley) says that Late Ordovician seas were full of biodiversity. Oceans contained some of the first reefs made by animals, but lacked an abundance of vertebrates. "If you had gone snorkeling in an Ordovician sea you would have seen some familiar groups like clams and snails and sponges, but also many other groups that are now very reduced in diversity or entirely extinct like trilobites, brachiopods and crinoids" says Finnegan.

Unlike with rapid mass extinctions, like the Cretaceous-Tertiary extinction event where dinosaurs and other species died off suddenly some 65.5 million years ago, Finnegan says LOME played out over a substantial period of time, with estimates between less than half a million to almost two million years. One of the major debates surrounding LOME is whether lack of oxygen in seawater caused that period's mass extinction. To investigate this question, the team integrated geochemical testing with numerical simulations and computer modeling.

Prof. Zunli Lu (Syracuse) and his students took measurements of iodine concentration in carbonate rocks from that period, contributing important findings about oxygen levels at various ocean depths. The concentration of the element iodine in carbonate rocks serves as an indicator for changes in oceanic oxygen level in Earth's history.

Their data, combined with computer modeling simulations, suggested that there was no evidence of anoxia (lack of oxygen) strengthening during the extinction event in the shallow ocean animal habitat where most organisms lived, meaning that climate cooling that occurred during the Late Ordovician period combined with additional factors likely was responsible for LOME.

On the other hand, there is evidence that anoxia in deep oceans expanded during that same time, a mystery that cannot be explained by the classic model of ocean oxygen, climate modeling expert Alexandre Pohl says.

"Upper-ocean oxygenation in response to cooling was anticipated, because atmospheric oxygen preferentially dissolves in cold waters," Pohl says. "However, we were surprised to see expanded anoxia in the lower ocean since anoxia in Earth's history is generally associated with volcanism-induced global warming." Computer

modeling results at UC Riverside show that climate cooling likely altered ocean circulation pattern, halting the flow of oxygen-rich water in shallow seas to the deeper ocean.

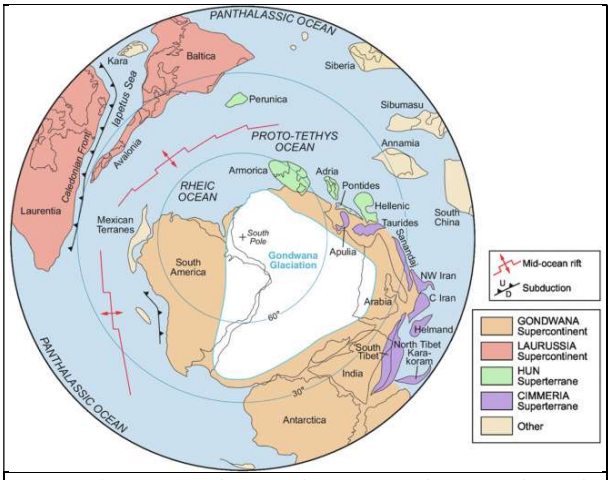
Zunli Lu, professor at Syracuse University

According to Lu, recognizing that climate cooling can also lead to lower oxygen levels in some parts of the ocean is a key takeaway from their study. "For decades, the prevailing school of thoughts in our field is that global warming causes the oceans to lose oxygen and thus impact marine habitability, potentially destabilizing the entire ecosystem," Lu says. "In recent years, mounting evidence point to several episodes in Earth's history when oxygen levels also dropped in cooling climates."

While the causes of Ordovician extinction are not fully agreed upon, this study rules out changes in oxygenation as a single explanation for the LOME and adds new data favoring temperature change being the killing mechanism for LOME.

(Editor's note: At the end of Ordovician, massive glaciation locked up huge amounts of water in an ice cap that covered parts of a large south polar landmass. This ice age may have been caused by the creation of the Appalachian Mountains. Atmospheric carbon dioxide would have been dramatically reduced in making carbonates during the large-scale weathering of these uplifted rocks, thereby cooling the Earth. The evidence is that sea levels dropped by hundreds of feet, with extinctions due to warms waters chilling and most continental shelf habitat becoming uninhabitable dry land.)

Pohl is hopeful that as better climate data and more sophisticated numerical models become available, they will be able to offer a more robust representation of the factors that may have led to the Late Ordovician mass extinction.



Late Ordovician earth map, showing Gondwana with south pole at center and area covered by continental glaciation (Credit: www.sciencedirect.com)

This paper (Pohl, A., Lu, Z., Lu, W., Stockey, R.G., Elrick, M., Li, M., Desrochers, A., Shen, Y., He, R., Finnegan, S. and Ridgwell, A., 2021. Vertical decoupling in Late Ordovician anoxia due to reorganization of ocean circulation. *Nature Geoscience*, pp.1-6.) is available for purchase at www.nature.com or can be had from the editor.

Primates' ancestors may have left trees to survive asteroid

By Krishna Ramanujan | Cornell Media Relations Office | October 11, 2021

When an asteroid struck 66 million years ago and wiped out dinosaurs not related to birds and three-quarters of life on Earth, early ancestors of primates and marsupials were among the only tree-dwelling (arboreal) mammals that survived, according to a new study. Arboreal species were especially at risk of extinction due to global deforestation caused by wildfires from the asteroid's impact.

In the study, computer models, fossil records and information from living mammals revealed that most of the surviving mammals did not rely on trees, though the few arboreal mammals that lived on, including human ancestors, may have adapted temporarily to the loss of trees.

"One possible explanation for how primates survived across the K-Pg boundary, in spite of being arboreal, might be due to some behavioral flexibility, which may have been a critical factor that let them survive," said Jonathan Hughes, the paper's co-first author and a doctoral student in

the lab of Jeremy Searle, professor of ecology and evolutionary biology. The study, "Ecological Selectivity and the Evolution of Mammalian Substrate Preference Across the K-Pg Boundary," was published in *Ecology and Evolution*.

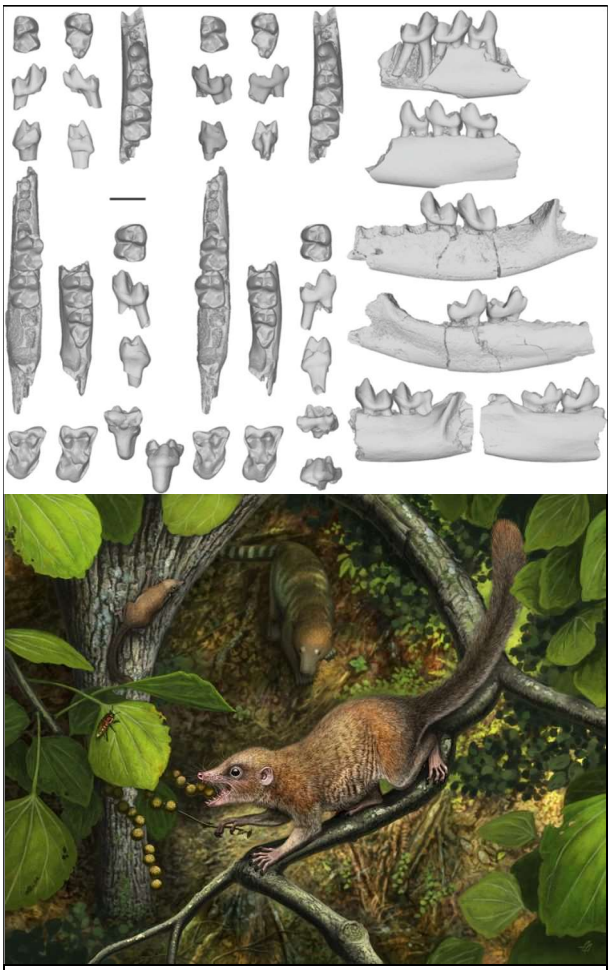
The earliest mammals appeared roughly 300 million years ago and may have diversified in tandem with flowering plants expansion about 20 million years prior to the K-Pg event. When the asteroid struck, many of these lineages died off, Hughes said. "At the same time, mammals that did survive diversified into all the new ecological niches that opened up when dinosaurs and other species became extinct," Hughes said.

In the study, the researchers used published phylogenies (branching, tree-like diagrams that show evolutionary relatedness among groups of organisms) for mammals. They then classified each living mammal on those phylogenies into three categories – arboreal, semi-arboreal and non-arboreal – based on their preferred habitats. They also designed computer models that reconstructed the evolutionary history of mammals. Mammal fossils from around the K-Pg are very rare and are difficult to use to interpret an animal's habitat preference. The researchers compared information known from living mammals against available fossils to help provide additional context for their results.

The models showed that surviving species were predominantly non-arboreal through the K-Pg event, with two possible exceptions: ancestors of primates and marsupials. Primate ancestors and their closest relatives were found to be arboreal right before the K-Pg event in every model. Marsupial ancestors were found to be arboreal in half of the model reconstructions. The researchers also examined how mammals as a group may have been changing over time. "We were able to see that leading up to the K-Pg event, around that time frame, there was a big spike in transitions from arboreal and semi-arboreal to non-arboreal, so it's not just that we are seeing mostly non-arboreal [species], but things were rapidly transitioning away from arboreality," Hughes said.

This paper (Hughes, J.J., Berv, J.S., Chester, S.G., Sargis, E.J. and Field, D.J., 2021. Ecological selectivity and the evolution of mammalian substrate preference across the K–Pg boundary. *Ecology and evolution*) is open access at https://onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.811

(Editor's note: The earliest known stem primates are *Purgatorius janisae* and *P. mckeeveri*, both found in Hell Creek Formation deposits in northeastern Montana, constrained to be within 105–139 thousand years post-K/Pg boundary according to a paper published earlier this year. Both are represented by several tooth and jawbone fossils.



Above, fossils of Purgatorius janisae and *P. mckeeveri. Below, life restoration of P. mckeeveri (credit:* Andrey Atuchin)

CALENDAR OF EVENTS

December
Saturday December 5, FOSSIL MEETING & FIELD TRIP 3:00 PM. At Rochester Museum & Science Center. Tour Guide of "Expedition: Dinosaurs! Exhibit is George McIntosh.

February
Tuesday February 1, FOSSIL MEETING 7:30 PM LOCATION To Be Determined. Speaker Dr. Sara H. Burch, Associate Professor, SUNY Geneseo speaking on the biomechanics of the T. rex forelimb. 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 December 2021. Meetings are held the first Tuesday of each month from October to December and from February to May at 7:30 pm. In person meetings, when they can be held again, are at the Brighton Town Hall, Community Meeting Room, 2300 Elmwood Avenue, Rochester, NY unless otherwise listed.

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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.

IS IT A MOLD OR A CAST? By Fred Haynes

In 1962, the Netherlands issued a semi-postal stamp featuring an ammonite. If you rotate one of the stamps 180 degrees so that it is upside down you will see an interesting optical effect. The upside-down stamp on the left looks like an external cast. However, when the stamp is viewed right side up, it looks like an internal mold. Both clearly show the outside of the fossil ammonite, but they certainly look different. This stamp was part of a five-stamp set commemorating the International Congress of Museum Exports, held in July of 1962 in Amsterdam.

A semi-postal stamp means that the second denomination on the stamp (in this case 4ct) is a donation that the postal service will make on behalf of the purchaser of the stamp.