A publication of the Rochester Academy of Science
FOSSIL SECTION

The FOSSILETTER

VOL. 40 Number 2 November 2022

November Meeting

The November section meeting is on Tuesday, November 8, at 7:30 PM. We will meet again at the Community Meeting Room at the NEQALS (North East Quadrant Advanced Life Support) building at 1030 Jackson Rd, Webster, 14580. From Route 104, 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. This hybrid meeting will also be broadcast on Zoom. Details on how to login in are in the accompanying email.

At this meeting we will celebrate one of the most influential naturalists of the 19th and early 20th centuries—**Henry Augustus Ward**–whose impact on shaping natural history museum collections and helping found many of today's museums worldwide was immeasurable and whose legacy remains relevant today. Fossils were an important part of any museum collection, and Henry had a keen interest in these, as well as meteorites, rocks and minerals, and preserved biological specimens.

Our speaker is Dr. Robert Minckley, Professor of Instruction at the University of Rochester. His principal research interest is in the biology, evolution, conservation of bees, and you may have met him at our recent annual Scientific Papers Session. However, he is also Director of the Ward Project, which seeks to compile and disseminate information on remaining collections and correspondence/documents related to Henry Ward. "This project grew out of the realization that the third largest natural history museum in North America in the late-1800's was at the University of Rochester and the museum was closely affiliated with Ward's Natural Science Establishment, a supplier of natural history materials for colleges, universities and museums worldwide. Many relict specimens remain from the University of Rochester Natural History Museum in the Departments of Biology and Earth & Environmental Sciences, and the correspondence, records, and catalogs associated with the museum and Ward's Natural Science Establishment are housed in the Department of Rare Books and Special Collections." With that as the foundation, the Ward Project began and grew. Bob has his Ph.D. and Masters in Entomology from the University of Kansas, and his B.Sc. from the University of Arizona. He frequently returns to Arizona to study desert bees.

Dr. Robert Minckley, University of Rochester

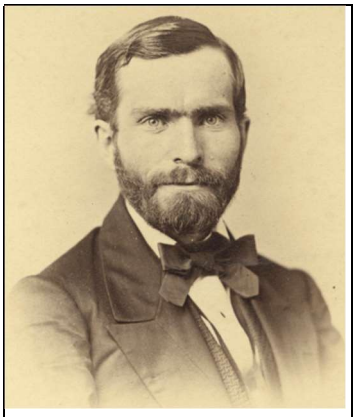
Bob has entitled his talk, *Rochester and the birth of natural history museums; Ward's Natural Science Establishment before 1900.*

He provides the following notes: "The spectacular surge of interest in natural history that occurred after the Civil War and through 1900 resulted in greatly increased public awareness about biodiversity and the establishment of many natural history museums. Rochester, New York played a central role in this revolution because of Ward's Natural Science Establishment, a business dedicated to furnishing museums, schools, and collectors with specimens that filled cabinets arranged to illustrate the breadth of earth's geological and biological evolution. The University of Rochester was involved in this museum-building movement early on; in the 1870's the third largest

natural history museum in the United States was on its downtown campus where the Memorial Art Gallery is today. This presentation will talk about materials from Ward's Natural Science Establishment that are still housed at the University of Rochester and a project (wardproject.org) to make a virtual museum of Ward's material from the UR and other museums worldwide."

Henry Augustus Ward (1834 – 1906)

Henry Ward was born in Rochester, NY in 1834. He attended Williams College and studied at Harvard under the famous Louis Agassiz. In Paris, he studied at the Jardin des Plantes, the Sorbonne, and the School of Mines, and then at the universities of Munich and Freiberg. While there, he also traveled throughout Europe, the Middle East, and North Africa, building a collection, selling redundant material to finance the travel, and developing plans to provide exemplary specimens to museums back home.



Henry Augustus Ward (courtesy of The Ward Project)

In 1860, he returned to an appointment as professor of Natural History at the University of Rochester. In 1862. he founded Ward's Natural Science, a business which collected specimens and castings from all, parts of the world and then mounted and sold them to colleges and museums. He left the U of R in 1865 to pursue this full time.

He was an early member of the Rochester Academy of Science and was made a Fellow in 1889. His research publications included *Notices of the* Megatherium Cuvieri*, The Giant Fossil Ground-Sloth of South America* (1864).

He was a frequent contributor to the *Proceedings of the Rochester Academy of Science* where he frequently published on meteorites—*Preliminary Notice of a New Meteorite from Japan* (1893), *The St. Genevieve Meteorite* (1901), *Bacubirito; or. The Great Meteorite of Sinaloa, Mexico* (1902), *Description of Four Meteorites (Andover, Cuernavaca, Arispe, Bald Eagle)* (1904) *Williamette Meteorite* (1904), *Great Meteorite Collections and Their Composition* (1904), *Bath Furnace Aerolite* (1905), and *Three New Chilean Meteorites* (1906).

Ward in 1906 with the Santa Rosa meteorite in front of the church in Santa Rosa de Viterbo, Boyacá, Columbia. (courtesy of ResearchGate)

His commercial publications included the extensive *Catalogue of Casts of Fossils: From the principal Museums of Europe and America, with short Descriptions and Illustrations* (1866) in which he offered castings to museums and educators from the thousands of molds he had made during his travels and visits to museums. He also had a huge stock of real specimens of all sorts.

At that time, most museums especially in the U.S. had small collections of local materials, and usually scrappy when anything other than "corals, crinoids, brachiopods and trilobites." "But," he wrote, "to accomplish the purposes of public instruction, a cabinet *(editor's note: "collection")* of fossils should be as complete as possible, covering the whole ground, and giving an unbroken view of ancient life." His novel plaster castings, painted to

match the originals in coloring, enabled museums everywhere to display near perfect replicas of famous fossils from all over the world, an approach still employed by museums today, in which nearly all dinosaur skeletons (and many other displays) are castings of fossils in storage elsewhere.

His enterprise, Ward's Natural Science, remains in business today in Rochester, supplying museums, educators, and collectors with specimens, science kits, models, apparatus, chemicals, and more. www.wardsci.com/store/

You can see their fossil offerings starting on page 482 of their on-line catalogue, with mineral specimens in the same section.

Among many fascinating stories, my favorite is that when P.T. Barnum's huge elephant Jumbo, purchased from the London Zoo in 1882, was killed when struck by a locomotive in 1885, he had Jumbo preserved by Ward's taxidermy lab. The stuffed Jumbo was exhibited by Barnum's traveling circus for two years, then donated to Tufts University, where it was destroyed in a fire in 1975. (See more on this at en.wikipedia.org/wiki/Jumbo.)

He was struck and killed by a car in 1906 in Buffalo, NY at age 72—that city's first automobile fatality.

Membership Renewal Time

Unless you are a life member, note that your membership will expire on December 31st, 2022. Don't wait—renew now while you are thinking of it. You can get a membership form or even complete the renewal at **rasny.org/mbform.pdf**.

President's Report by Dan Krisher

The Section's October 4th meeting was a hybrid meeting both live and on Zoom. The meeting was led by Section Vice-President Michael Grenier as the President was unavailable. Our speaker was Dr. Lisa Amati, the New York State Paleontologist. She spoke on "New York's Finest Fossils," showing slides of some of the spectacular fossils in the NYS Museum. Several of these specimens from the museum were displayed at the meeting. We had twenty-two people in attendance, including several guests. Another nearly 60 people were in the Zoom session from all over the country and one from Japan.

Before our meeting, Dr. Amati conducted a "Fun with Fossils" educational event for about 20 youngsters with their parents. The parents and kids were very appreciative of this hands-on outreach event.

Lisa Amati with member Amber Benoit's children and their eurypterid stuffed animal from PRI at the "Fun with Fossils" event. One of several cases of fossils from the NY State Museum is in the background. (photo by editor)

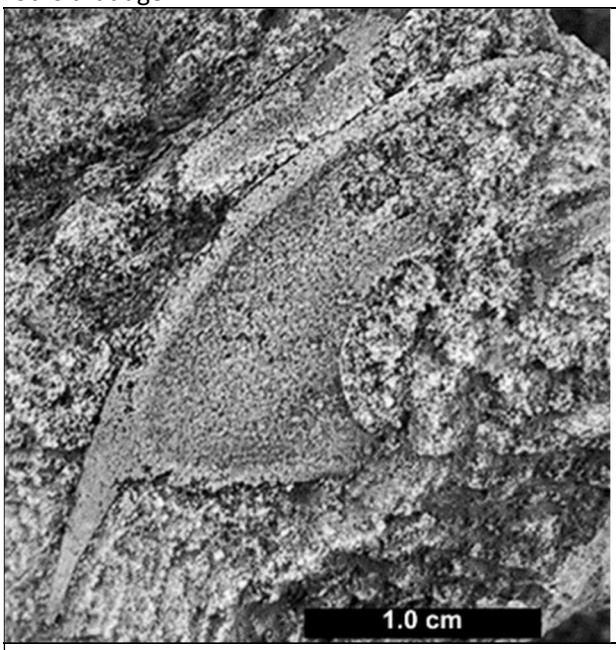
The following day, Michael escorted Dr. Amati to RMSC for a behind the scenes tour, conducted by member and RMSC Curator Emeritis George McIntosh.

October Meeting Recap by Michael Grenier

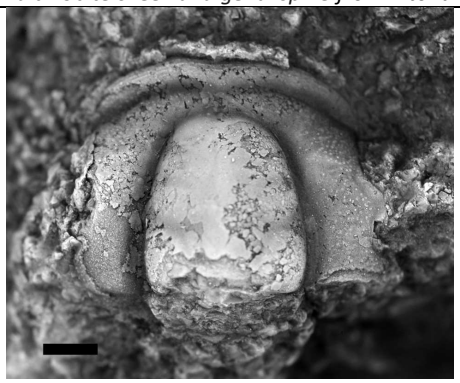
We had a great meeting in October with Dr. Lisa Amati. She spoke at length on "*New York's Finest Fossils*." Good news for those who were not at the meeting – this talk and others are recorded and listed on our calendar page at the RAS website. Go to https://rasny.org/fossil-section-calendar and scroll down to the first past talk. Click on the underscored talk title.

Lisa started off with the oldest sedimentary rocks in New York, the Middle Cambrian Potsdam Sandstone, located primarily north and west of the Adirondack Mountains. The formation is thickest in the northern Champlain Valley–about 450 meters (1,480 ft) and is also exposed in Ausable Chasm and on the Raquette River. The Potsdam Sandstone lies unconformably on a surface of Precambrian metamorphic rock. In fact, it lies on the continent- wide "Great Unconformity", which Lisa also discussed. The Ausable Member was the oldest known with the Keesville Member lying

atop it. Then in 2009, an even older member was found below the Ausable—the Altona Formation. Lisa was able to date this unit to the Lower Cambrian by the find of an Olenellid trilobite, only found in rocks that age.



Olenellid trilobite cheek and genal spine from Altona Fm



Talbotina sp., *a new species of Ptychopariid trilobite. This and other trilobites from the Potsdam were discussed.*

She discussed the fascinating Keesville Member trace fossil, *Climactichnites*; and Cambrian stromatolites. The Ordovician has the Chazy Reef–the oldest reef containing fossils and the Day Point Reef, as well as the Walcott-Rust and Beechers quarries trilobites. There are plenty of pages of Silurian eurypterids, and for the rest, including our only dinosaur, you'll just have to watch the lecture. It is one hour, fifteen minutes long.

I just had to include this Devonian "Sea Star Buffet" with several Devonaster eucharis *starfish about to lunch on* Cornellites *bivalves, perhaps.*

Fossil News

Land plants changed Earth's composition, say scientists University of Southampton Press release issued: *30 August 2022*
https://www.southampton.ac.uk/news/2022/08/land-plants-changed-earths-composition.page

Scientists at the University of Southampton have discovered that the evolution of land plants caused a sudden shift in the composition of Earth's continents. The Southampton researchers, led by Dr. Tom Gernon, working with team members from Queen's University Canada, University of Cambridge, University of Aberdeen, and China University of Geosciences Wuhan, studied the effects of land plant evolution on Earth's chemical composition over the past 700 million years. The researchers' findings are published in the journal *Nature Geoscience*.

The evolution of land plants took place about 430 million years ago during the Silurian Period,

when North America and Europe were conjoined in a landmass called Pangaea. The proliferation of plants completely transformed Earth's biosphere – those parts of the planet's surface where life thrives – paving the way for the advent of dinosaurs about 200 million years later. "Plants caused fundamental changes to river systems, bringing about more meandering rivers and muddy floodplains, as well as thicker soils," says Dr. Spencer, "This shift was tied to the development of plant rooting systems that helped produce colossal amounts of mud (by breaking down rocks) and stabilized river channels, which locked up this mud for long periods."

The Silurian genus Cooksonia *is the oldest known plant to have a stem with vascular tissue. It is transitional between the primitive non-vascular bryophytes and the vascular plants. Cooksonia fossils were first discovered in Britain in 1937. (courtesy PhytoImages.siu.edu)*

The team recognized that Earth's surface and deep interior are linked by plate tectonics – rivers flush mud into the oceans, and this mud then gets dragged into the Earth's molten interior (or mantle) at subduction zones where it is melted to form new rocks. "When these rocks crystallize, they trap in vestiges of their past history," says Dr. Gernon. "So, we hypothesized that the evolution of plants should dramatically slow down the delivery of mud to the oceans, and that this feature should be preserved in the rock record – it's that simple."

To test this idea, the team studied a database of over five thousand zircon crystals formed in magmas at subduction zones – essentially 'time capsules' that preserve vital information on the chemical conditions that prevailed on Earth when they crystallized. The team uncovered compelling evidence for a dramatic shift in the composition of rocks making up Earth's continents, which coincides almost precisely with the onset of land plants. Notably, the scientists also found that the chemical characteristics of zircon crystals generated at this time indicate a significant slowing down of sediment transfer to the oceans, just as they had hypothesized. The researchers show that vegetation changed not only the surface of the Earth, but also the dynamics of melting in Earth's mantle. (Spencer, Christopher J., et al. "Composition of continental crust altered by the emergence of land plants." *Nature Geoscience* 15.9 (2022): 735-740.)

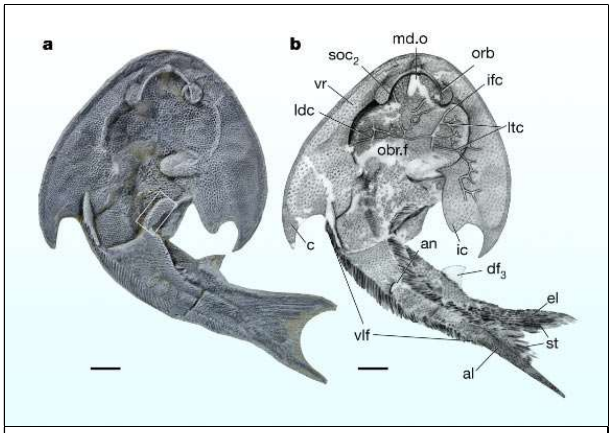
Ancient fish breathes new life into the evolutionary origin of fins and limbs. University of Bristol Press release issued: 4 October 2022
http://www.bristol.ac.uk/biology/news/2022/dead-fish-breathes-new-life-into-the-evolutionary-origin-of-fins-and-limbs.html

The holotype specimen of the fossil Tujiaaspis vividus *from 436 million-year-old rocks of Hunan Province and Chongqing, China. (Zhikun Gai)*

A trove of fossils in China, unearthed in rock dating back some 436 million years, have revealed for the first time that the mysterious galeaspids, a jawless freshwater fish, possessed paired fins. The discovery by an international team shows the primitive condition of paired fins before they separated into pectoral and pelvic fins, the forerunner to arms and legs. Until now, the only surviving fossils of galeaspid fish were heads, but these new fossils originating in the rocks of Hunan Province and Chongqing and named *Tujiaaspis* after the indigenous Tujia people who live in this region, contain their whole bodies.

Theories abound on the evolutionary beginnings of vertebrate fins and limbs – the evolutionary precursors of arms and legs - mostly based on

comparative embryology. There is a rich fossil record, but early vertebrates either had fins or they didn't. There was little evidence for their gradual evolution.



Photograph (a) and interpretative drawing (b) of Tujiaaspis vividus.

Life reconstructions of Tujiaaspis vividus. *(Qiuyang Zheng)*

The anatomy of galeaspids has been something of a mystery since they were first discovered more than half a century ago. Tens of thousands of fossils are known from China and Vietnam, but almost all of them are just heads – nothing has been known about the rest of their bodies – until now. The new fossils are spectacular, preserving the whole body for the first time and revealing that these animals possessed paired fins that extended continuously, all the way from the back of the head to the very tip of the tail. This 'fin-fold' hypothesis has been popular but has lacked any supporting evidence until now. The discovery to *Tujiaaspis* resurrects the fin-fold hypothesis and reconciles it with contemporary data on the genetic controls on the embryonic development of fins in living vertebrates.

The new study suggests that the ancestor of jawed vertebrates likely possessed paired fin-folds, which became separated into pectoral and pelvic regions. Eventually, these primitive fins evolved musculature and skeletal support, which allowed our fishy ancestors to better steer their swimming and add propulsion.

This paper, (Gai, Zhikun, et al. "Galeaspid anatomy and the origin of vertebrate paired appendages." *Nature* 609.7929 (2022): 959-963) is available from the editor.

Warming Spawned the Age of Reptiles

Harvard University Press release issued: August 19, 2022 https://mcz.harvard.edu/news/global-warming-spawned-age-reptiles

Studying climate change-induced mass extinctions in the deep geological past allows researchers to explore the impact of environmental crises on organismal evolution. One principal example is the Permian-Triassic climatic crises, a series of climatic shifts driven by global warming that occurred between the Middle Permian (265 million years ago) and Middle Triassic (230 million years ago). These climatic shifts caused two of the largest mass extinctions in the history of life at the end of the Permian, the first at 261Ma and the other at 252Ma, eliminating 86% of all animal species worldwide.

The end-Permian extinctions are important not only because of their magnitude, but also because they mark the onset of a new era in the history of the planet when reptiles became the dominant group of vertebrate animals living on land. During the Permian, vertebrate faunas on land were dominated by synapsids, the ancestors of mammals. After the Permian extinctions, in the Triassic Period (252-200 million years ago), reptiles evolved at rapid rates, creating an explosion of reptile diversity. This expansion was key to the construction of modern ecosystems and many extinct ecosystems. These rapid rates of evolution and diversification were believed by most paleontologists to be due to the extinction of competitors allowing reptiles to take over new habitats and food resources that several synapsid groups had dominated before their extinction.

However, in a new study in *Sciences Advances* researchers in the Department of Organismic and Evolutionary Biology and the Museum of Comparative Zoology at Harvard University reveal the rapid evolution and radiation

of reptiles began much earlier, before the end of the Permian, in connection to the steadily increasing global temperatures through a long series of climatic changes that spanned almost 60 million years in the geological record. They found that these periods of rapid evolution of reptiles were intimately connected to increasing temperatures. Some groups changed very fast and some less fast, but nearly all reptiles were evolving much faster than they had before.

In this study, collaborators worked to examine early amniotes, which represent the forerunners of all modern mammals, reptiles, birds, and their closest extinct relatives, at the initial phase of their evolution. At this point in time the first groups of reptiles and mammal ancestors were splitting from each other and evolving along their own separate evolutionary paths.

Artistic reconstruction of the reptile adaptive radiation in a terrestrial ecosystem during the warmest period in Earth's history. Image depicts a massive, big-headed, carnivorous erythrosuchid (close relative to crocodiles and dinosaurs) and a tiny gliding reptile at about 240 million years ago. The erythrosuchid is propelling itself using a fossilized skull of the extinct Dimetrodon (early mammalian ancestor) in a hot and dry river valley. Credit: Image created by Henry Sharpe

Reptiles were relatively rare during the Permian compared to mammalian ancestors. However, things took a major shift during the Triassic when reptiles underwent a massive explosion in the number of species and morphological variety. This led to the appearance of most of the major living groups of reptiles (crocodiles, lizards, turtles) and several groups that are now entirely extinct.

The researchers created a dataset based on extensive first-hand data collection of more than 1,000 fossil specimens from 125 species of reptiles, synapsids, and their closest relatives during approximately 140 million years before and after the Permian-Triassic extinction. They then analyzed the data to detect when these species first originated and how fast they were evolving using state-of-the-art analytical techniques. The researchers then combined the new dataset with global temperature data spanning several million years in the geological record to provide a broad overview of the animals' major adaptive response towards climatic shifts.

Results revealed that periods of fast climatic shifts and global warming are associated with exceptionally high rates of anatomical change in most groups of reptiles as they adapted to new environmental conditions and this process started long before the Permian-Triassic extinction, since at least 270 million years ago.

The physiology of organisms is dependent on their body size. Small-bodied reptiles can better exchange heat with their environment. The first lizards and tuataras were much smaller than other groups of reptiles, not that different from their modern relatives, and so they were better adapted to cope with drastic temperature changes. The much larger ancestors of crocodiles, turtles, and dinosaurs could not lose heat as easily and had to quickly change their bodies in order to adapt to the new environmental conditions.

This strong association between rising temperatures in the geological past and a biological response by dramatically different groups of reptiles suggests climate change was a key factor in explaining the origin and the explosion of new reptile body plans during the latest Permian and Triassic.

This paper, (Simões, Tiago R., et al. "Successive climate crises in the deep past drove the early evolution and radiation of reptiles." *Science Advances* 8.33 (2022): eabq1898) is available from the editor.

CALENDAR OF EVENTS

November
Tuesday November 8, FOSSIL MEETING 7:30 PM. NEQALS Community Meeting Room, 1030 Jackson Rd, Webster, 14580. Speaker is Dr. Robert Minckley on the Ward Project**. NOTE 2nd Tuesday date due to elections.**

December
Tuesday December 6, FOSSIL MEETING 7:30 PM NEQALS Community Meeting Room, 1030 Jackson Rd, Webster, 14580. Our traditional Show-and-Tell with pizza and drinks provided by the section. This is a great opportunity to show off your finds from the past year. 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 are now held as hybrid meetings, live but also broadcast on Zoom. 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.

Supporting the current Simões et al. paper out of Harvard, with our current global warming, we have already seen evidence of reptiles taking over the earth again.