PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

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Wednesday, May 17, 2017

Remarkable Specimens and Behaviors Captured in Cretaceous Burmese Amber

Scott Anderson, PG

The Scott Anderson Amber Collection

Over the last nearly 20 years, the diversity of inclusions in Early Cretaceous Burmese Amber (Burmite) has exploded due to the tireless efforts of many different researchers. Beyond the knowledge garnered from individual specimens, there are numerous examples of interactions and/or behaviors that provide even better understanding of the Early Cretaceous amber forests.

Examples of each of the four typical behaviors are observed in Burmite specimens. Parasitism is observed to include larval sacs on several different dipterans as well as mites feeding on their dipteran hosts. If one chooses to include pollination as a form of mutualism, a recently discovered Spheciform wasp (likely to be Sphecidae) carrying pollen grains on the hind tibia and tarsi demonstrates this behavior.

Commensalism observed in Burmite specimens includes phoretic mites as well as a Baikuris ant carrying a thrip (thought to be removing it from a food source). Predation is also observed in numerous specimens, most notably in a remarkable specimen where a mite is consuming a small beetle.

Because the breadth of diversity of Burmite is so large, numerous other interactions and/or behaviors are also observed. Swarming is fairly common in the insect world, and examples include dipterans, thysanopterans, coleopterans, collembola and arachnids. Although most swarms were probably related to mating, it is likely that the arachnids (eight spiderlings) were preparing to balloon.

(Abstract continues on page 2)

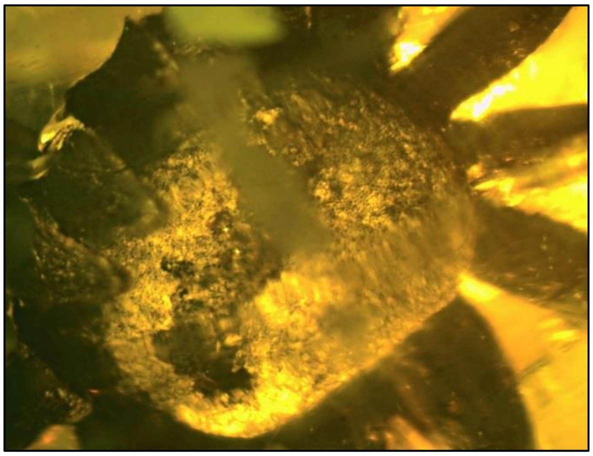
Social hour - 6:00 p.m. | **Dinner - 7:00 p.m.** | **Program - 8:00 p.m.**

Dinner costs $30.00/person, students $10.00; checks preferred. For reservations, please email your name and number of attendees in your party to pgsreservations@gmail.com. You can also reserve and pay for dinners via PayPal on our website http://pittsburghgeologicalsociety.org. Please include your name and number of attendees in your party. **The deadline for reservations is noon on Monday, May 15.**

Meeting will be held at Foster's Restaurant, Foster Plaza Building 10, Green Tree.

Abstract (continued)

Although no direct examples of mating have yet been found in Burmite, a specimen with two dipterans potentially just post mating has been found as well. The will to survive is strong and extends beyond just the capacity to mate. Egg laying is nearly a reflexive reaction to entrapment by the sticky resin, as observed in both dipteran and psocopteran specimens.

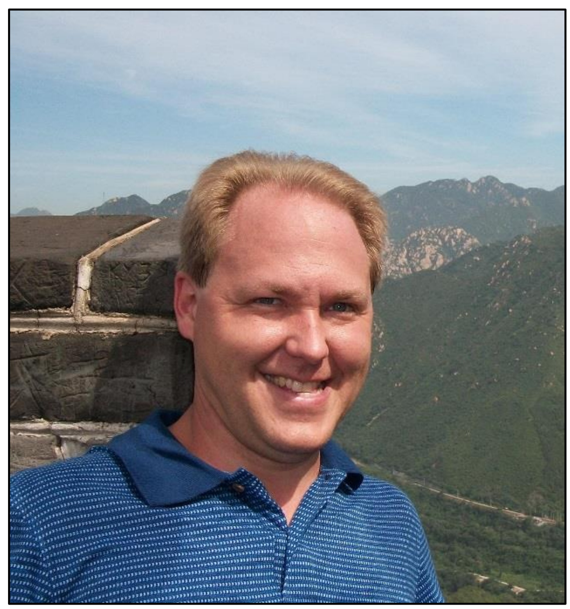


Beyond just interactions and/or behaviors, evidence of social organization is also observed. Evidence of social organization is well represented in Burmite specimens in both the presence of worker ants, termites, and even a blind female zorapteran (primary members in the colony).

Although many (if not most) insects evolve specialized morphologies based on their surroundings to allow them to be better adapted for survival, two specimens found in Burmite exemplify this adaption. An Ampulicidae with elongate trochanters and forelegs with enlarged femurs would be an efficient digger; however, a specimen with these traits as well as large coxa with protruding spines is even better equipped for digging.

Taken on the whole, not only is the breadth of inclusions found in Burmite exceptional, so are the numerous interactions and behaviors found.

May Speaker Biography



Scott Anderson on a recent trip to China

Mr. Scott Anderson, PG, is a Senior Hydrogeologist/Project Manager at Tetra Tech, Inc. (Pittsburgh) with over 20 years of professional experience. Mr. Anderson's primary job responsibilities include hydrogeologic investigations and design; implementation and management of site characterization investigations; environmental site assessments; soil, groundwater and surface water sampling; long-term and short-term aquifer testing; real-time site characterization with high-resolution approaches; and transport and fate analysis including analytical and finite-difference modeling (MODFLOW, MODPATH, MT3D, RT3D).

What began initially as a hobby in the early 1980s has now become a research field for Mr. Anderson, who collects, studies and publishes on inclusions in amber. Mr. Anderson focuses on inclusions in Dominican and Burmese Ambers ranging from insects to vertebrates. Mr. Anderson is a member of the International Paleoentomological Society and works with professionals from museums and universities around the world to ensure that new discoveries are properly shared and communicated to the scientific community. He has attended and presented at the Amber World Congress (held every 3 years and attended by the top researchers in amber inclusions) in 2010 in Beijing, China and in 2016 in Edinburgh, Scotland. Current research interests include diversity of insects, early flowers (angiosperms), blood-feeding insects and captured behaviors in Burmese amber.

PRESIDENT'S STATEMENT

Spring is upon us. In case the warmer weather, flowers and leaves, official declarations on TV and the radio, and your calendar are not enough to convince you I have a couple more pieces of evidence that should put the matter to rest. One is that I'm still recovering from a recent hay fever attack I catch like clockwork at the changeover between winter and spring (I suffer another one between summer and fall too but I digress). The other is that my wife and I had to rush to buy a lawn mower when the old one, after 27 years of faithful operation without servicing—save biannual or triannual oil changes—finally died. The new one, pre-assembled, self-propelled, and able to mulch, cost more than 3X the one we bought in 1990.

But, really, there's so much to be thankful for. The spring PGS field trip, drilling workshop, and Student Night were all successful. It looks like we will be able to hold a program at the Chartiers-Houston Community Library in support of their Family Night program this summer. And I'm especially pleased to announce that the PGS Board re-nominated Dan Billman without hesitation to serve another three-year term as one of our representatives to AAPG. He's done an excellent job for us.

I am also very pleased to acknowledge Board member, Ken LaSota, for his recent and generous donation to the PGS Endowment Fund (the Fund). The purpose of the Fund, established on May 8, 2014, through the Community Foundation Serving the Heart of Western Pennsylvania (the Community Foundation), is to support the long term monetary needs of the Society. The Fund allows for an annual distribution of up to 5% of its net fair market value as of December 31 of the prior year. Currently, the annual allowable distribution is enough to support the awards annually distributed by the Society to our professional and student members, as well as the public. These awards include the Walt Skinner Award, the PGS "Best Presentation on Appalachian Geology Award" given at the AAPG Eastern Section Meeting, Student Night Awards, university geology club attendance award, and the Pittsburgh Regional Science and Engineering Fair awards.

We invite further contributions to the Fund in the form of bequests, memorials, or gifts. Gifts of cash, securities/appreciated assets, life insurance, IRAs, charitable remainder trusts, charitable lead trusts, and charitable gift annuities are all accepted. Contributions should be directed to the Pittsburgh Geological Society / Endowment Fund or directly to the Community Foundation Serving the Heart of Western Pennsylvania at 220 South Jefferson Street, Suite B, Kittanning, PA 16201. If you wish to seek any further information on the Fund feel free to contact Ray Follador at (724) 744-0399 or Mindy Knappenberger, Executive Director for the Community Foundation, at (724) 548-5897.

Speaking of financial contributions, I also wish to recognize and thank returning corporate sponsor, Gannett Fleming, Inc., for their generous contribution to the Society. And once again I want to thank the PCPG for supporting our mission of encouraging student research by underwriting our 17th annual student night. This financial support allowed us to subsidized dinner costs for the large number of students whoe attended this meeting.

Finally, I wish to personally thank the Board of Directors and all members of PGS for supporting me as your president during this 2016-17 term. It's been an eye-opening and very rewarding experience. And by the way, don't forget to vote for your PGS officers and Directors-at-Large for 2017-18. Your last chance will be at the May 17 meeting. See you then.

Peter R. Michael

PGS president

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

May 18, 2017
Jess Hill, Schlumberger "More Accurate GIP Analysis Using Log Data"
Cefalo's Event Center, Carnegie PA

June 2-3, 2017
Annual Field Trip: "Lake Erie, the Niagara Gorge, and the Silurian-Devonian of New York"

HARRISBURG AREA GEOLOGICAL SOCIETY

May 11, 2017
Dr. Akyson Thibodeau, Dickenson College "Using Isotopes to Trace the Source of Turquoise in the Aztec Empire"

May 20, 2017
Kayak Field Trip: "A float through the Devonian" – a 4 hour float down Bald Eagle Creek in Centre County, PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

May 17, 2017
Essentials of Surface and Borehole Geophysical Methods Workshop
Comfort Inn Pgh East, Monroeville, PA

June 9, 2017
Carbonate and Karst Field Trip Including Underground Mine Tour, York, PA

August 24-25, 2017
2-Day PG Review Course for the Practicing Geologist & ASBOG Exam Candidate
Doubletree Suites, Plymouth Meeting PA

2017 PA ABANDONED MINE RECLAMATION CONFERENCE

June 21-22, 2017
"The Future of Reclamation in PA"
Best Western Genetti Hotel, Wilkes-Barre, PA

The Pittsburgh Geological Society welcomes the following new members:

Merril J. Stypula
Geologist
EQT Production Co.
2012 MS in Geology from University of Vermont

Blake J. Restelli
Petrographer
R J Lee Group, Inc.
2016 BS in Geology from Slippery Rock University

Cate Bressers, Student
Indiana University of Pennsylvania

Michael R. Chojnachi, Student,
University of Connecticut

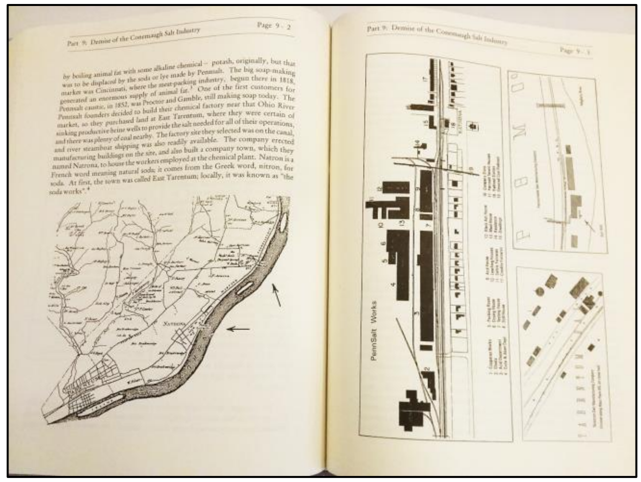
Kayla R. Kroczynski, Student
Indiana University of Pennsylvania

Nicole Lees, Student
Indiana University of Pennsylvania

David H. Mangold Student,
University of Akron

Nicholas E. Russo, Student
Slippery Rock University

A SPECIAL BOOK OFFER FOR PGS MEMBERS ONLY!



Participants on the PGS spring field trip had the opportunity to purchase a unique historical monograph, “Salt in the Conemaugh Valley: The Importance of the Conemaugh Salt Works in the Early American Salt Industry (1800-1860)” by William Dzombak, a former chemistry professor at Saint Vincent College and one of the founding members of the Conemaugh Valley Conservancy. This book not only covers the history of the salt industry near Saltsburg, it also places it in the context of other salt-producing areas around the United States. The book is meticulously researched and includes numerous historical maps, diagrams and original documents.

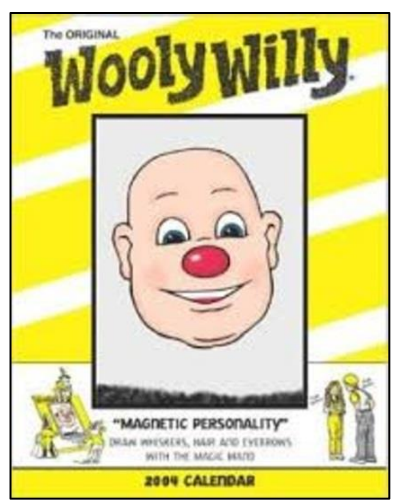
The Saltsburg Historical Society, the original publisher of this volume, has been kind enough to extend their special offer of $20 (plus $8 shipping and handling) to any PGS member who would like to purchase a copy. Please contact **Gary Ball** at gball@gfengr.com to place your order.

Hamlin Lake Park in Smethport, Pennsylania

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Smethport, in McKean County where the valleys of Nunundah and Marvin Creeks converge, was founded in 1807 by Dutch surveyors and land investors, who considered the area northwestern Pennsylvania’s most perfect site for a town. They named it in honor of the De Smeths, a Dutch banking family that financed the land investments. Smethport became the county seat in 1826 and was incorporated as a borough in 1853.

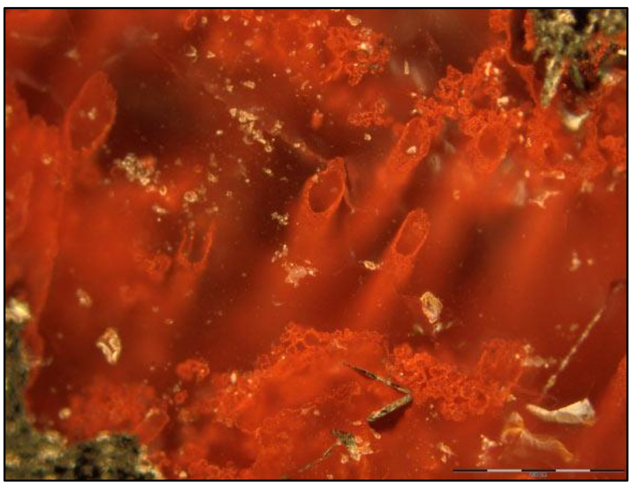
The combination of large lumber assets, oil reserves, and locations of railroads beginning in the 1870s caused McKean County’s economy to skyrocket, and from then until the early 1900s, Smethport was an important center for the East Coast hardwoods industry. The timber-fueled economic boom allowed the construction of many mansions that today make up a historic architectural district. Henry Hamlin, one of Smethport’s more well-known citizens was reported to be the wealthiest private banker in the United States in 1895. Hamlin Lake Park, located in the center of town, was named for the Hamlin family, who donated the land for its usage as a park. Smethport is the site where the first magnetic toys in the country were invented, beginning in 1908. The most famous such toy, Wooly Willy, was a major hit in the 1950s and is still in production. It was created in Smethport by Donald and James Herzog of the Smethport Specialty Company.



Wooly Willy was invented in Smethport, PA

DID YOU KNOW . . . ?

An international team of researchers has discovered the oldest physical evidence of life on Earth, fossils that date back 3.77 ga, in the Nuvvuagittuq Supracrustal Belt in Quebec, Canada. The fossils are microscopic filaments and tubes formed by ancient iron-loving bacteria enclosed in quartz. The Nuvvuagittuq contains some of the oldest sedimentary rocks known on the planet. Prior to this discovery, the oldest accepted evidence for life was the presence of 3.7-ga stromatolites from the Isua Greenstone Belt in south-west Greenland. The new discovery suggests that life emerged from hot seafloor vents shortly after the earth formed, and helps confirm other recently discovered evidence of 3.7 ga sedimentary mounds formed by microorganisms.



Hematite tubes indicate the presence of life on the earth 3.7 billion years ago

The team of researchers studying the fossils thought of many ways the tubes and filaments, which are made of hematite, could have occurred as a result of non-biological activity, such as temperature and pressure changes in the rock during burial of the sediments, but rejected all of them as unlikely. In fact, the hematite structures exhibit the same characteristic branching of iron-oxidizing bacteria found near Recent hydrothermal vents. The fossils were also found associated with graphite, apatite, and carbonates that occur in bones and teeth, and with spheroidal structures that usually contain fossils in younger rocks.

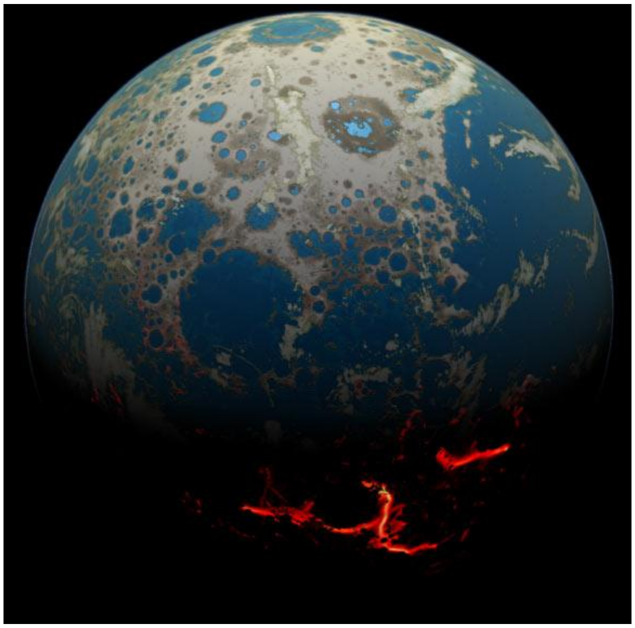
All this suggests that the hematite probably formed when bacteria that oxidized iron for energy were fossilized in the rock. Such structures typically are composed of the minerals formed during putrefaction, as has been well documented throughout the geological record. These fossil discoveries demonstrate that life developed on the planet at a time when both Mars and the earth had liquid surfaces waters. As a result, it’s possible that Martian explorations might find evidence for past life on Mars from as long ago as 4 ga. If not, perhaps the earth IS a special place in the solar system, if not in the universe.

But if you think such structures are inarguably evidence of ancient life on earth, beware: an international team of chemists has created inorganic precipitates from high-pH spring water in the laboratory, without the aid of biology, that resemble the types of structures paleontologists and biogeochemists find in the early geologic record. This discovery blurs the line between processes that are purely biological and those that are geological, which, in turn, can cause complications when trying to study ancient biofossils from very primitive life forms.

Inorganic precipitates resembling biominerals

The team collected spring water with a pH of 11.2 and a high silica content. After adding barium chloride and calcium chloride dihydrates to the water, which contained no organisms, the team watched fantastically-shaped precipitates form. The precipitates resembled “microbial fossils” made of barium carbonate, “silica gardens” of metal-silicate-hydrate tubes, and calcium carbonate “shells”. Since objects like these can be found today in a natural setting, the ability to detect unambiguous “real life” microbial fossils in the deep geological record has become extremely complicated.

Recreating the nature of Earth's early crust is difficult because tectonic activity has removed most of it from the planet's surface and driven it back into the interior. Although some pieces of crust about 4 ga old still exist in the rock record, the only things that have been dated as older than 4 ga are isolated zircon grains. Until now.



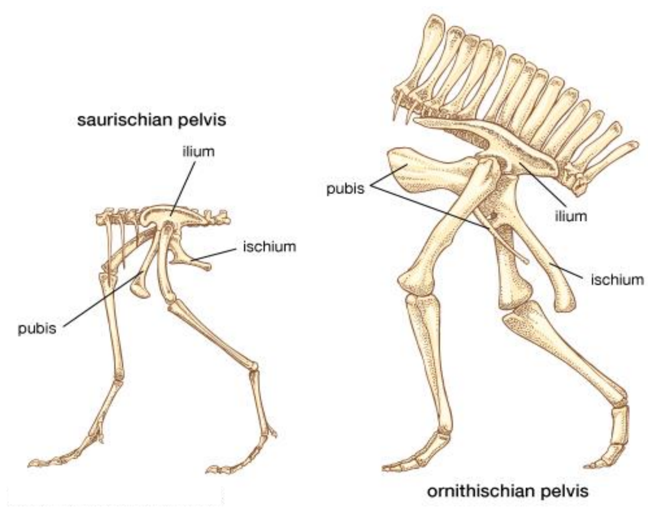
Artist's concept of early Earth

Rocks collected from the Superior Region of Canada, just north of the Great Lakes, apparently include some of the components of basaltic crust that existed during the Hadean Eon, more than 4.2 ga. A new approach involving variations in the abundance of neodymium-142 (^{142}Nd) allows geologists to detect the presence of really ancient crust that has been reworked into rocks that are merely "old". Samarium-146 (^{146} Sa) has a brief half-life; it decays to ^{142}Nd in only 103 ma. As a result, even though ^{146} Sa was present when Earth formed, it became extinct really early in Earth's history. In fact, the only reason they know it existed at all was because of evidence of its existence in moon rocks and meteorites from Mars.

Variations in the relative abundance of ^{142}Nd compared to other neodymium isotopes not related to samarium decay suggest that chemical processes changed the ratio of samarium to neodymium in the rock while ^{146} Sa was still present, that is, before about 4 ga. A team of Canadian researchers studied 2.7 ga granitic rocks from Hudson Bay and found that the amount of ^{142}Nd indicated that they were derived from re-melting basaltic oceanic rocks that were more than 4.2 billion years old. Although basaltic oceanic crust typically is conveyed tectonically back into Earth's interior within 200 ma, the team's findings suggest that the basaltic crust they found survived at the surface for at least 1.5 ga before being re-melted and incorporated in the Hudson Bay granite.

So now the question becomes, "Was plate tectonics active during the earliest part of Earth History?" With ^{142}Nd, variations in isotopic abundance can be used to track the role of truly ancient crust in building up younger (but still old) sections of Earth's continental crust.

Based on a study of thousands of anatomical characters from dozens of fossil skeletons, a team of British paleontologists has proposed radical changes to the dinosaur family tree. For many years, dinosaurs were thought to have fallen into two distinct groups, the Saurichia (lizard-hipped), which included the large sauropods like *Diplodocus* as well as the meat-eaters like *Tyrannosaurus*, and the Ornithischia (bird-hipped), which included dinosaurs like *Triceratops* and *Stegosaurus*. As more dinosaurs were described, they were separated into three distinct lineages, including Ornithischia, Sauropodomorpha (the sauropods), and Theropoda (the meat-eaters).



The differences between dinosaur hips

The new analysis concludes that the ornithischians and theropods should be grouped together because both had the potential to evolve a bird-like hip arrangement (birds evolved from the lizard-hipped theropods). They just did so at different times in their evolutionary histories. The team calls the Ornithischia/Theropoda group Ornithoscelida, a name originally coined by Thomas Henry Huxley (“Darwin’s Bulldog”) in 1870. The bird-hipped dinosaurs, were often considered to be paradoxically named because they appeared to have had nothing to do with bird origins. Now they are firmly attached to the ancestry of the birds. Furthermore, the team concluded that the sauropodomorph grouping actually falls outside the traditional definition of “dinosaur”, so that definition would need to be changed to make sure that *Diplodocus* and its relatives could still be classed as dinosaurs.

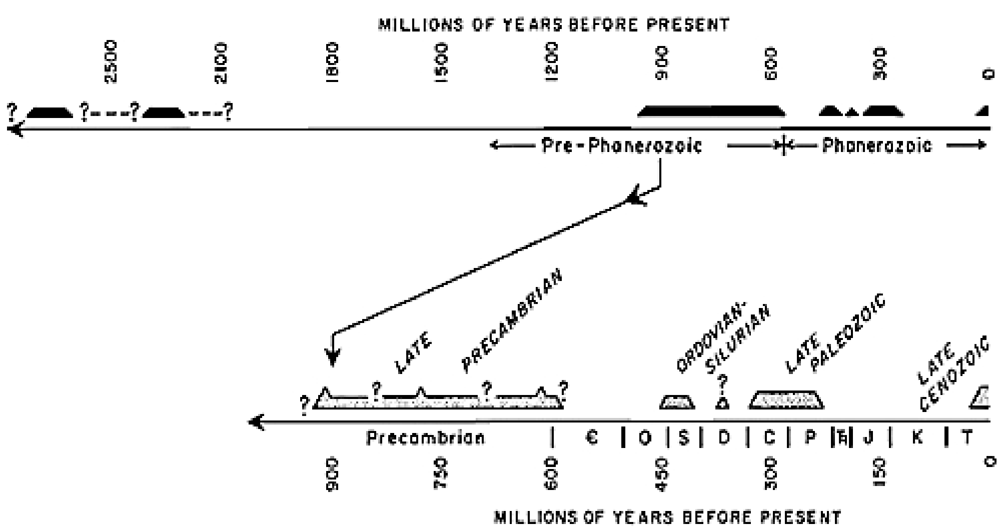
While analyzing the dinosaur family trees, the British team that reorganized the dinosaurs, found another unexpected aspect of these extinct beasts. Dinosaurs were thought to have originated on the southern hemisphere continent of Gondwana because the oldest known dinosaur fossils were found in South America. As a result of their re-examination of key taxa, the team now thinks the dinosaurs could just as easily have originated on the northern hemisphere continent of Laurasia.

Over the last 2.5 ga, the surface temperature of the Earth has been close to the transition between water and its three phases - ice, liquid, and vapor. During that time, ice has accumulated at numerous times to form huge glaciers on the continents. These times have been separated by intervals when the glaciers became much reduced or disappeared entirely.

The first ice ages we know about occurred about 2300 ma, followed by a huge amount of time (1300 ma) when no obvious glaciations occurred. Several glacial events occurred in the Late Precambrian and several during Paleozoic time until about 240 Ma, during the Late Permian. Continental ice sheets disappeared for about 215 million years, beginning again only about 25 Ma.

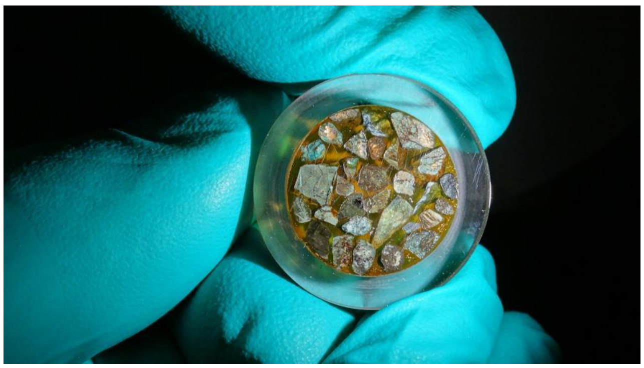
We still live in an ice age, during one of the mild interglacial episodes that occur between glaciations. Studies of ancient glaciations benefit greatly by knowledge of the Late Cenozoic Ice Age we are currently in, both on the land and in deep-sea cores where glacial debris rafted out to sea and dropped to the sea floor when the ice melted (drop-stones). Glacial debris on land can be assigned to an age and location relatively easily. Glacial debris on the sea floor, not so much.

Ancient strata containing drop-stones point to the existence of a glacier, but it takes more to determine when and where the glacial occurred - currents can carry icebergs great distances. If the beds can be dated using fossil or geochemical evidence, the date of glaciation can be determined. Where the ice came from can only be determined with confidence if much is certain about paleogeography and ocean current patterns, which in turn depends on the ability to interpret depositional environments, regional tectonic reconstructions, and how well we can correlate strata over great distances. Unfortunately, the farther back in time the glaciation occurred, the less likely it is to escape erosion, cover by other deposits, and deformation.



Record of continental glaciations through time

Some of the very earliest life-forms on Earth could have survived the early hostile environment of the planet by living as far as six miles below the seafloor. That's the conclusion of a new study that looked at samples of mineral-rich mud from the South Chamorro seamount, a mud volcano near the Mariana Trench. A team of researchers from the Netherlands found traces of organic material in the mud samples that suggest that life can survive even in the extreme environment of a subduction zone. The trench is part of a subduction zone where the Pacific plate slips beneath the Philippine Sea plate, and the seafloor surrounding it is littered with hydrothermal vents and mud volcanoes.

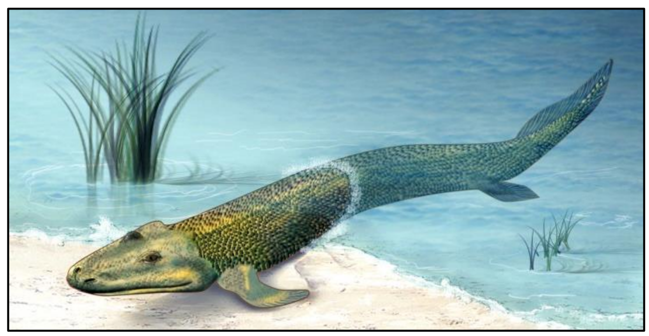


Deep sea serpentine samples include organic material that might be waste from microbes living deep beneath the Mariana Trench

Earth four ga was a hostile place and life was hard. Is it possible that at least some life survived by going deep? Subduction zones are relatively cool – the sinking crust doesn't come into contact with magma until it reaches a lower point in the mantle. The known temperature limit of life is about 250ºF, which in the trench would be about 6 mi below the ocean floor. The research team examined organic material found in serpentine. The serpentine formed when olivine in the upper mantle reacted with water pushed up from within the subduction zone, producing hydrogen and methane gas that can be a banquet for microbes. Called serpentinization, the process is known to create habitats for microbes in other places, such as at hydrothermal vents.

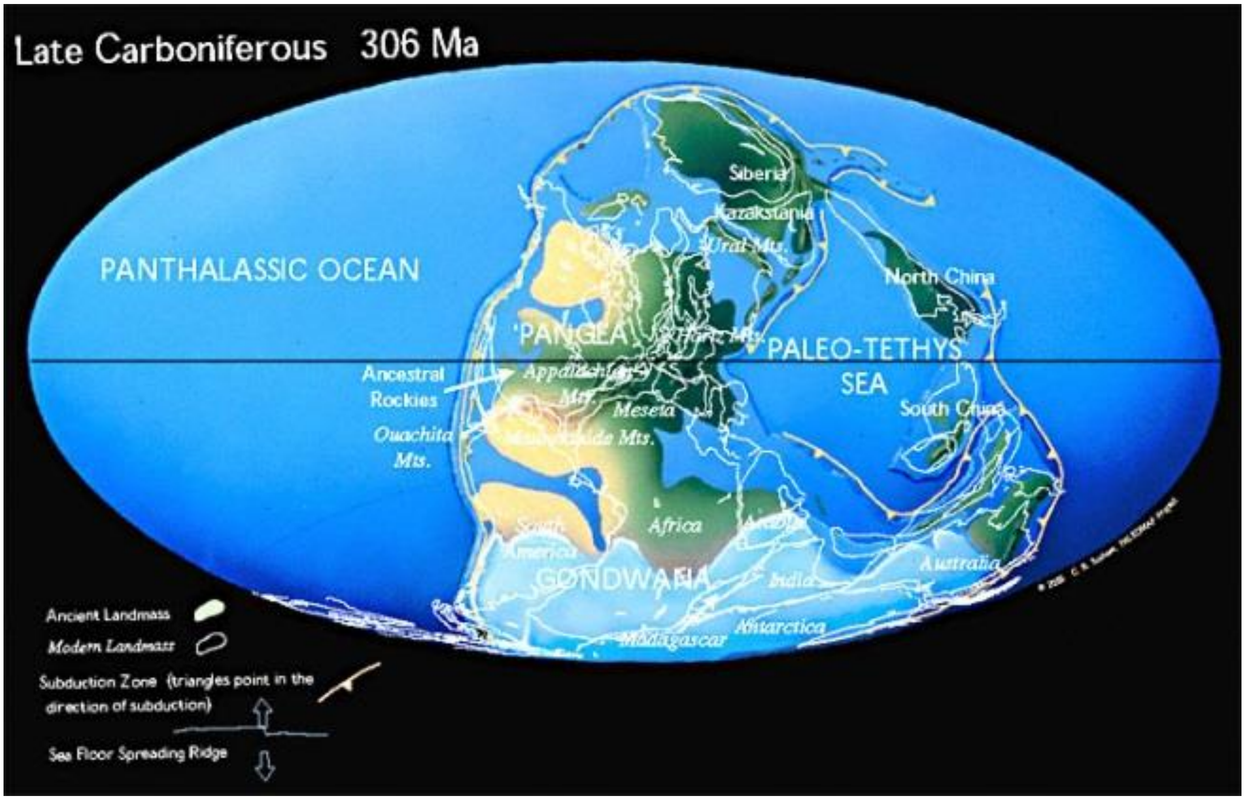
The research team thinks the serpentine samples include waste produced by methane-eating microbes because laboratory tests concluded that the hydrocarbons and lipids from the mud volcanoes are very similar to waste material produced by other bacteria. The organic molecules strongly suggest life, but the source of that life is not entirely clear yet. There is still a chance the organic material could have come from another source closer to the surface, or that it actually is not biological in origin. Still, it is an amazing find.

According to a new study by a group of U.S. paleontologists, development of the eye, rather than improvements in limb structure, is what led some ancient fish to leave the water and evolve into terrestrial vertebrates about 385 million years ago. The researchers studied 59 specimens from the Devonian spanning the time from before the water-to-land transition until after the transition, a span of about 12 million years. They measured the size of each fossil's eye sockets and head length to determine the size of the eyes and the size of the animal. In doing so, they found that, before the water-to-land transition, the average eye socket size was 13 mm, and, at about the time of transition, the average size was 36 mm, almost three times larger. At the same time, the eyes had shifted from the sides of the cranium to the top.



Did vertebrates' eyes evolve to see on land before their limbs evolved to walk instead of swim?

This was a hugely significant increase in visual capability because eyes on the top of the head would have allowed the animal to see above the water line, meaning it could see 70 times farther in air than in water. This, the researchers speculated, would have allowed the fish to SEE the abundance of food (bugs and other invertebrates) already living on land. Once they could see their prey, the fish evolved limbs from fins over the course of millions of years that allow them to exploit this new food source. Because larger eye size is valuable when seeing through air, whatever toll the adaptive enlarging of the eyes took on the animals' metabolism would have been offset by their ultimate ability to find prey on land. The researchers also speculated that expanded visual range may have led eventually to larger brains in early terrestrial vertebrates.



Christopher Scotese's paleogeographic map of Earth during the Pennsylvanian Period, showing glaciation in Gondwana

There are two basic explanations for why ice ages occur: 1) extraterrestrial influences (e.g., solar cycles); and 2) changes occurring on Earth (e.g., plate tectonics). Although variations in solar radiation might cause glaciations, there is no evidence that solar heat fluctuations exceeded more than a few percent. Solar heat might be reduced if the Earth passed through a dust cloud, but there is no evidence for this either. We still have a lot to learn about variations in solar heat flux. The precession of the equinoxes has a period of about 21 ka; changes in the obliquity of the ecliptic occur over about 40ka; and variations in the eccentricity of Earth's orbit occur over about 96 ka. Whether there are significant longer cycles has not been established and currently seems doubtful. These all contributed to climatic variations that accounted for the Late Cenozoic glacial and interglacial stages. Such orbital influences on the amount and pattern of distribution of heat received by the Earth are considered part of the "noise" superimposed on changes taking place on the Earth itself. In addition, the record of ancient ice ages is far too irregular to be explained as the effects of some, as yet cosmic cycle.

So, for the time being we have to look at terrestrial explanations for the causes of ice ages. Plate tectonics and the shifting arrangement of continents have been suggested as a cause of climate change, including glaciation. When continents move to polar or sub-polar sites, and their uplands build up snow and ice long enough to build up an ice cap, glaciation typically occurs. Paleomagnetic studies show that Paleozoic continents having records of continental glaciation occupied high-latitude positions. When Gondwana "drifted" across the south pole, glacial centers roughly followed pole as it migrated. Although the data are incomplete, and there are differences in interpretations, the paths of polar wandering cross sites of glaciation in chronological order throughout the Paleozoic. And, of course, our current Ice Age occurs where the continents (North America and Eurasia in the northern hemisphere and Antarctica in the southern) are close to, or sit on, the poles. So, at least for Paleozoic and Late Cenozoic glaciations, the polar hypothesis appears to be far more correct and acceptable than any extraterrestrial explanations.

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PGS Website of the Month

https://nsidc.org/cryosphere/glaciers/life-glacier.html

Pittsburgh Geological Society Officers and Board of Directors

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Other PGS Positions		**Historian:**	Judy Neelan	**AAPG Delegate:**	Andrea Reynolds
		Continuing Ed:	Frank Benacquista	**AAPG Delegate:**	Dan Billman

Officer Contacts: If you wish to contact a current PGS Officer, you can email Peter Michael, President, at shabell9@comcast.net; Tamra Schiappa, Vice President and Speaker Coordinator, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Karen Rose Cercone, Secretary and Newsletter Editor, at kcercone@iup.edu.

Memberships: For information about memberships, please write PGS Membership Chair, PO Box 58172, Pittsburgh PA 15209, or e-mail jharper.pgs@gmail.com. Membership information may also be found at our website: www.pittsburghgeologicalsociety.org.

Programs: If you would like to make a presentation at a PGS meeting or have a suggestion for a future speaker, contact Tamra Schiappa, Program Chair at tamra.schiappa@sru.edu.

PGS Website: Access many online PGS resources at http://www.pittsburghgeologicalsociety.org/

Facebook: Follow the PGS at https://www.facebook.com/PittsburghGeologicalSociety for breaking news, announcements and interesting geological facts.

Twitter: PGS now has a Twitter Feed! You find it at https://twitter.com/ on the web or look for **@PghGeoSociety** on your mobile Twitter app.

LinkedIn: PGS has added a dedicated LinkedIn page to our social media portfolio. We'll use it to post job opportunities and other professional announcements for our members.

Fun Fact Having Nothing to Do with Geology

Pteronophobia is the fear of being tickled with feathers.

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