PITTSBURGH GEOLOGICAL SOCIETY

October 20, 2021

MEETING TIMES

Social Hour	**5:30 PM**
Dinner	**6:30 PM**
Speaker	**7:30 PM**

DINNER COSTS

$35.00 regular member
$15.00 student member
$40.00 non-member

RESERVATIONS

Email your name and number of attendees to: pgsreservations@gmail.com

Or reserve and use PayPal: https://www.pittsburghgeologicalsociety.org/

MEETING LOCATION

Cefalo's Banquet & Event Center, Carnegie PA

COVID19 POLICY

Members must wear masks and maintain social distance at the meeting.

Forensic Geophysics and Delineation of Clandestine Graves

Photograph of YSU's ground penetrating radar device overlying a suspected clandestine grave site at a cold case file crime scene.

Tom Jordan, Ph.D. PG

Youngstown State University
Key Environmental Inc.

Make Reservations by Wednesday, October 13

Speaker Abstract

Youngstown State University (YSU) has initiated a forensic geophysics and clandestine grave research project with the intent of providing a better understanding of long-term and seasonal relationship between organic decomposition and geophysical signatures from human proxies buried in shallow graves in northeastern Ohio. A review of the FBI's database reveals 609,275 persons were reported missing in the US in 2019 of which 607,104 were found by year's end resulting in a net of 2,171 people who remain missing, presumed deceased, and their remains possibly placed in clandestine graves.

Locating clandestine graves through the use of geophysics or cadaver dogs has always been expensive and problematic with a reported success rate of 30%. The anticipated outcomes from our research project will be used to identify methodologies and approaches based on inputs such as burial timing and seasonality in an effort to improve successes and reduce government agency costs. This presentation will include a discussion of sanitized results from recent work completed by YSU's researchers involving two cold case murder files, provide background information on some rather grisly details involving research completed by others, and will provide information on the approach and configuration of our research facility located in rural Columbiana County, Ohio.

An electromagnetic induction survey being completed at an abandoned cemetery for the purpose of delineating unmarked graves.

This research is presently being supported through grants provided by YSU's Office of Research Services, the YSU College of Science, Technology, Engineering, and Mathematics (STEM), and through geophysical equipment and software donations provided by THG Geophysics Ltd.

Speaker Biography

Dr. Tom Jordan is part-time teaching and research faculty at Youngstown State University and a Supervising Geologist / Geophysicist with Key Environmental, Inc. located in Carnegie, Pennsylvania. He has a B.A. in geology from Alfred University, an MS in geology from SUNY at Fredonia, and a Ph.D. in geology / geophysics from the University at Buffalo.

Dr. Jordan is a member of the PCPG Board of Directors, is a licensed PG in 10 states by ASBOG examination or reciprocity, and has 35 years of professional experience working on geophysical projects for clients in the environmental, engineering, and resource exploration sectors.

Next month's PGS Dinner Meeting will be held on November 10, 2021.

Dr. Thomas H. Anderson

APPALACHIAN OROGENESIS: A MANIFESTATION OF INTERACTIONS BETWEEN CRUST AND MANTLE IN RESPONSE TO PLATE COLLISION, COUPLING AND CAPTURE?

Professor Emeritus
Department of Geology and Environmental Science
University of Pittsburgh

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	***Scheduled Speaker***	***Presentation Topic***
December 15, 2021	Mary Hubbard, Montana State University	Geology of the Himalayas
January 19, 2022	Darcy Lecturer	TBA
February 16, 2022	David King, Auburn University	Chicxulub Crater Geology
March 16, 2022	Jamie Farrell Utah State University	Geology of Yellowstone
April 20, 2022	19th Annual Student Research Night	
May 11, 2022	TBA	Oil and Gas Industry Topic

The Pittsburgh Geological Society welcomes several new members:

Marion T. Divers, GIT (Senior Scientist, Drummond Carpenter, PLLC)

Isabel Chopra (Recent graduate, Virginia Tech)

Lacy K. Westover (Student, CalU)

RaeLynn M. Zaksek (Student, CalU)

Amber L. Netherton (Student, CalU)

PRESIDENT'S STATEMENT

October is finally here again and in the coming weeks we will see the temperatures turn mild and the leaves change, providing my favorite running conditions. After such a warm summer, with July checking in as "the hottest month ever recorded" according to the NOAA, I can't be the only one ready for cooler weather.

During that transition from summer to fall, the PGS was finally able to hold its first in-person meeting since February of 2020, which was a welcome step in the return to ordinary operations. I would like to take a moment to thank those that were in attendance for making the night a success and for carefully socially distancing and following our COVID guidelines to ensure the health and safety of our membership.

Along with our wonderful September talk provided by Dr. Ryan Kerrigan, there were also a series of exciting announcements including the news that Karen Rose Cercone was the recipient of the Walt Skinner award for meritorious service to PGS in recognition of her never-ending dedication and service to the society, including her long stint as editor of the newsletter and her design of the current PGS website.

The Frank Benacquista memorial scholarship was also awarded to two very deserving students, Austin Keirs of Slippery Rock University and Ellie Ruffing of California University. Our ability to award two memorial scholarships to two equally well-qualified students was made possible thanks to a very generous donation from one of our long-time corporate sponsors, THG geophysics.

The September meeting was also the pilot for the new ability for corporate sponsors to host bar service for part of the meeting and was hosted in September by the California University of PA Geology program. While those are just a few of the many exciting announcements, they well represent how good it is for the society to return to activity again after the summer break, and even more exciting since they were able to be delivered in person.

I do hope to see even more of the membership at the next meeting in October and I look forward to more excellent conversation over dinner. The talks this year look great and sound even better while surrounded by excellent friends and colleagues.

I hope you all are healthy and happy and remain so through what will hopefully be the conclusion of this lengthy pandemic. Stay strong and stay safe. I will see you at a PGS meeting soon!

Dan

LOCAL GEOLOGICAL EVENTS

SOCIETY OF WOMEN ENVIRONMENTAL PROFESSIONALS (SWEP)

October 14, 2021 **5:00 – 8:00 PM**

"Annual Charity Event to Benefit Dress for Success-Pittsburgh"

Helltown Brewing – Strip District, 1700 Penn Avenue, Pittsburgh PA 15222

Details and RSVP link: https://swep3rivers.org/event-4488354

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

October 21, 2021 **5:30 – 7:30 PM**

"ASCE Geo-Institute October Meeting"

Engineers' Society of Western Pennsylvania, Pittsburgh, PA 15222

Meeting notice: https://www.asce-pgh.org/event-4441590

SOCIETY OF PETROLEUM ENGINEERS (SPE)

October 21, 2021 **11:00-1:00 PM**

"Data Science Applications to Time-Series Data -- A Hydraulic Fracturing Case Study" by 2021 SPE Distinguished Lecturer Jessica Iriarte

Cefalo's Banquet Center, Carnegie PA 15106

November 2-3, 2021 **Multi-Day**

"2021 SPE Eastern Regional Meeting"

Nemacolin Woodland Resort, Farmington, PA 15437

Details for both events: https://connect.spe.org/pittsburgh/home

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS (PCPG)

November 16, 2021 **2:00 - 3:00 PM**

"Geology and Geomorphology of the Youghiogheny River and Laurel Highlands" by Frank J. Pazzaglia, PhD, Dept. of Earth and Environmental Sciences, Lehigh University (Webinar: 60 minutes)

Details and registration: https://pcpg.wildapricot.org/event-4478980

PGS President Daniel Harris Receives Teaching Honor

Dr. Daniel Harris, an Associate Professor in the Department of Biology, Geology, and Environmental Sciences at California University of Pennsylvania and current President of the Pittsburgh Geological Society, has been announced as the 2021 Recipient of his university's Presidential Distinguished Merit Award for Excellence in Teaching.

In addition to his demonstrated excellence as a classroom instructor, Dr. Harris has developed new elective classes and lab offerings designed to make Cal U geology students more competitive in the current job market. He also gives geology presentations at public schools, organizes science workshops for children, and recruits high school students to Cal U's geology program from schools throughout Pennsylvania. Dr. Harris' regular attendance at meetings of professional geologists has helped his students present joint faculty-student research and network with industry professionals as a means of introducing them to potential careers. Congratulations, Dan, and keep up the great work!

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

On May 8, 1777, a pioneer from New Castle, Delaware named Sheshbazzar Bentley purchased a tract of 1,050 acres on Pigeon Creek in Washington County for 400 pounds and built a grist mill on the creek. His son, Sheshbazzar, Jr., laid out a town on the land on March 4, 1816, which became the town of Bentleyville, located 15 miles southeast of Washington, PA. A post office was established in 1822, and Bentleyville was incorporated as a borough on May 20, 1868. One of the men most instrumental in its organization was John W. Stephens, who later served in the Pennsylvania House of Representatives.

Historical photo of coke ovens at the Acme mines of the Pittsburgh-Westmoreland Coal Co. in Bentleyville, PA.

By 1870, Bentleyville had 36 residences, three stores, a schoolhouse with two apartments, one church, a literary society, two grist and saw-mills, a steam tannery, and a population of about 300. The Ellsworth Branch of the Pennsylvania Railroad was laid through the town in 1900. The Braznell coal mines opened northeast of Bentleyville in 1906 and were purchased by the Pittsburgh-Westmoreland Coal Co. in 1909. The coal company also built coke ovens, and the coal and coke works caused a boom in the town's economy.

DID YOU KNOW . . . ?

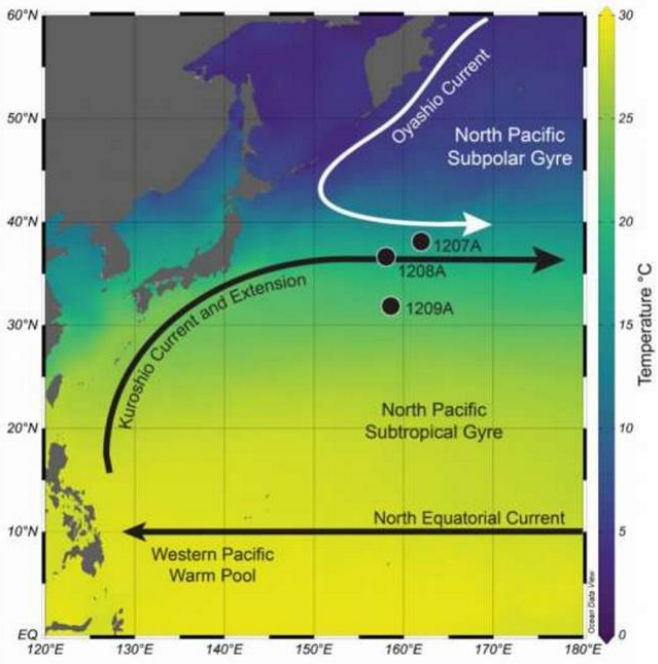
Earth's ocean currents are very old, weaving their way from the tropics to the poles and back for millions of years, and tracing their history is the kind of work paleoceanographers do for a living.

A team of paleoceanographers from several US and British universities recently studied the Kuroshio Current, the major western boundary current in the northern Pacific Ocean. This current is analogous to the Gulf Stream flowing along North America's east coast. Boundary currents like these that are driven by the wind move heat, salt, and gasses from the equatorial seas to the middle latitudes.

Because they help distribute heat from the tropics to higher latitudes, corals within the Kuroshio Current occur where the waters are still warm – at their highest latitude anywhere on the globe. The warmth comes from surface waters collecting in the western Pacific along the equator called the Western Pacific Warm Pool. The Kuroshio Current moves this water north past Japan, and then eastward at the 36°N latitude where it joins the open Pacific Ocean. At that point it becomes the Kuroshio Current Extension.

Both the current and its extension expel large amounts of heat and moisture into the lower atmosphere in the Northern Hemisphere. As a result, they help create patterns of precipitation over both Japan and North America's West Coast. They also dictate the paths of typhoons. The Kuroshio Current probably also likely affects the northern Pacific climate, although the researchers admit that its impact on thousand- and million-year time scales is still unclear.

In addition to weather and climate, the Kuroshio also plays a major role in ecosystems and the fishing industry. Where the Kuroshio meets the cool-water Oyashio Current in the the northwest Pacific, a strong temperature gradient forms due to the mixing of warm and cool waters and also creates a region of upwelling where nutrient-rich waters from the deep ocean are brought to the surface as the currents flow eastward. This allows warm- and cool-water organisms that live in the respective currents to flow together in a transition area between ecosystems. These include several



Modern-day sea surface temperature map of the northern Pacific Ocean.

species of fish and plankton, which are instrumental in fueling Japan's fishing industry.

Since these currents have such a major impact on biodiversity, weather, and climate, understanding how boundary currents will respond to climate change and increasing atmospheric CO_2 levels is critical. The researchers found that these currents are currently warming two to three times faster than other areas of the ocean, and that the extension is shifting northward and increasing its transport capacity.

Their research into reconstructing the Kuroshio as it was during the Pliocene is the first of its kind, and it may help answer some questions about the current's future. At that time, CO_2 levels (about 350 to 450 ppm) were similar to those today – 415 ppm. The Pliocene included the mid-Piacenzian Warm Period (mPWP) during which CO_2 increased and global warming occurred. Once the mPWP ended, Earth cooled and glaciers and sea ice grew in the high latitudes of the northern hemisphere.

The researchers used geochemical signatures from fossil marine plankton such as forams, as well as three deep-sea cores from the Shatsky

Rise on the northwest Pacific seafloor to reconstruct the Kuroshio during the mPWP. Their study indicated that the current warmed up and potentially shifted its latitudinal position northward during the first phase of mPWP warming. It then cooled back down and possibly shifted its position back south during a brief period of global cooling. Marine plankton diversity was highest at the northernmost site of the Shatsky Rise from 12 ma ago until today, indicating that the environment created by the current has been around for a very long time. Most likely, the Kuroshio has as well. The researchers don't know HOW warm the current became during the mPWP, nor how much the biochemistry was affected by salinity and temperature changes. This will be part of their future studies.

https://phys.org/news/2021-08-written-reconstructing-ancient-history-ocean.html

The Great Unconformity, that huge time gap in the rock record that stands out in many places across the globe, may have been triggered by the uplift of an ancient supercontinent. Where it exists, the GU horizon, as it is known, typically displays very different rock types above and below. It has puzzled geologists ever since John Wesley Powell first noticed it in the walls of the Grand Canyon in 1869.

The Great Unconformity between the deformed Precambrian Vishnu Schist and the overlying flat-lying Cambrian Tapeats Sandstone in the Grand Canyon.

What is especially fascinating is that it marks where about one billion years of rock seems to be missing, between really old, 3 ga and relatively young, 550 ma rock sitting directly on top of it. In the Grand Canyon, for example, the relatively flat-lying Cambrian Tapeats Sandstone sits directly on deformed Precambrian Vishnu Schist. In the St. Francois Mountains of the Ozark Plateau, 500 ma sandstone lies directly over 1.4 ga granite and rhyolite. Interestingly, the approximately 550 ma age of the rocks above the GU horizon is only a few million years before the Cambrian explosion when the widespread appearance of complex life on Earth occurred.

Now a new study suggests that rather than a single unconformity, there may have been a series of them roughly coincident around the world. And, intriguingly, they all may have had to do with the formation of the supercontinent Rodinia about a billion years ago. The new research is based on thermochronology. The researchers analyzed rock samples from a GU horizon site in Pikes Peak, Colorado, where the lower layer is about a billion years old and the rock above it from no older than 510 ma. The research revealed that the lower layer had been thrust upward to the surface about 700 ma ago, when it would have been subjected to erosion that scoured away its upper layers.

Geologists believe that Rodinia formed through extrovert assembly, a process in which pieces of an older supercontinent that broke apart reformed after having traveled around the planet. During the journey, the edges of the plates experienced significant erosion before colliding and forming mountain belts. These mountains would have experienced large amounts of erosion. During its existence, the researchers speculated, the formation and eventual break-up of Rodinia may have wreaked havoc all over the world.

The researchers speculate that what remained was a feature that looks similar across the world but which, in fact, may have been the result of multiple great unconformities. Thus, the Great Unconformity was more complicated than originally believed, forming at different times in different locations and for different reasons. Considering the Great Unconformity's temporal proximity to the Cambrian explosion, this research might finally solve the 200-year-old puzzle known as Darwin's

dilemma – why life seemed to begin geologically instantaneously at the beginning of the Cambrian.

https://bigthink.com/surprising-science/great-unconformity

A team of researchers from Austria, Scotland, and England have created the first 3D reconstruction of a 407 ma (Lower Devonian) plant based exclusively on fossil evidence. The fossil sheds light on the development of the earliest known form of roots, and the findings demonstrate that the appearance of different axis types at branching points resulted in the evolution of complexity soon after land plants evolved sometime before 400 ma ago. The evolution of roots at that time was an extraordinary event that impacted Earth and its atmosphere, resulting in transformative ecological and climatic alteration.

An artist's reconstruction of *Asteroxylon mackiei,* a Lower Devonian plant from Scotland. This is probably what it would have looked like in life. Each leafy shoot is roughly 1 cm in diameter.

The evidence-based 3D reconstruction of *Asteroxylon mackiei*, a structurally complex plant from the Rhynie Chert of Aberdeenshire, Scotland, indicates how roots and other types of axes developed in this ancient plant. The Rhynie Chert contains exceptionally preserved plants, fungi, lichen, and animal material preserved in place by overlying volcanic deposits, with the bulk of the fossils consisting of primitive plants. The specimens are exceptionally well-preserved, with individual cell walls easily visible in polished specimens.

Asteroxylon belongs to the group of plants called the lycophytes, a class of vascular plants that includes the well-known Pennsylvanian scale tree *Lepidodendron* and the extant "groundpine" *Lycopodium*. The 3D reconstruction has allowed scientists to assemble both anatomical and developmental information of this mysterious fossil for the first time. This is significant because previous interpretations of the structure of the plant had been based mainly on comparisons of fragmentary images and extant plants. The reconstruction showed that these plants developed their roots in an entirely different way than modern plants. The rooting axes of *A. mackiei* are the oldest known structures that resemble modern roots. They developed when a shoot-like axis formed a fork where one prong maintained its shoot identity and the second developed root identity. This mechanism, called "dichotomous branching," occurs in living plants within tissues that share structural identity. However, living plants do not develop roots that way, indicating that this type of root formation is extinct.

Now, 100 years after the discovery of the Rhynie fossils, it can be demonstrated what *Asteroxylon* and its relatives looked like. Understanding the structure and evolution of Early Devonian plants provides insight into events at a key time in geologic history, just after plants colonized the land. Their evolution, radiation, and spread across all continents had a dramatic impact on the Earth system. Plant roots reduced atmospheric CO_2 levels, stabilized the soil, and revolutionized water circulation across the surfaces of continents.

https://scitechdaily.com/400-million-year-old-fossils-reveal-how-the-first-roots-evolved/

During the Eocene, Antarctica was covered by lush forests, but by the beginning of the Oligocene the forests had been replaced by thick continental ice sheets, such as those that occur in Antarctica today. The main driver of this greenhouse to icehouse transition is widely debated, but little information has been available about how climate changed on land.

Artist's reconstruction of Antarctica's tropical rainforest.

Now, new research by scientists from the University of Bristol using molecular fossils preserved in coal to reconstruct land temperature across this transition demonstrates that mean annual temperatures in southeastern Australia gradually declined from around 81ºF during the Middle Eocene to about 72-75ºF during the Late Eocene. This decline was followed by a 4.3ºF-step cooling across the Eocene/Oligocene boundary 33.9 ma ago. Between about 40 and 33.9 ma ago, Earth's climate underwent a major climatic transition.

The new research used a novel approach based on the distribution of bacterial lipids preserved in ancient wetland deposits. The lipid compounds originally comprised the cell membranes of bacteria living in those wetlands, and their structures changed slightly over time to help the bacteria adapt to changing temperature and acidity. The compounds were then preserved for tens of millions of years, allowing the researchers to reconstruct the ancient environmental conditions.

In order to reconstruct temperature changes across the greenhouse/icehouse transition, the researchers applied their approach to coals in Australia's Gippsland Basin, which were deposited over 10 ma of Earth history. The new data indicate that terrestrial temperatures cooled alongside those in the ocean, and by a similar magnitude of about 5.4ºF. Climate model simulations helped the team to explore causes of the temperature decline.

As it turned out, the only simulations that could reproduce cooling consistent with the temperature data from the coals included a decline in atmospheric CO_2. This led the researchers to conclude that the data provide further evidence that atmospheric CO_2 plays a crucial role in driving Earth's climate, including the formation of the Antarctic ice sheet. The data, they acknowledge, form an important point of reference for testing climate model performance, sea-land interaction, and climatic forcing at the onset of a major Antarctic glaciation.

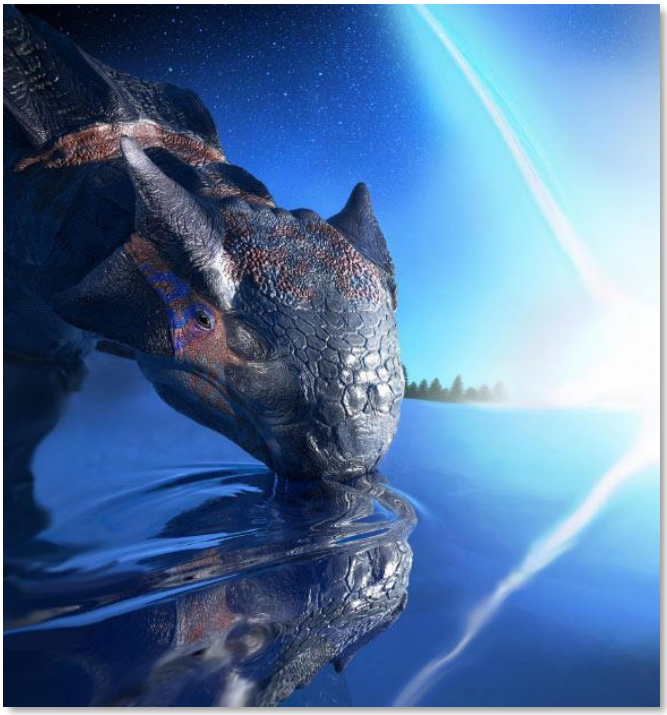
http://www.sci-news.com/othersciences/paleoclimatology/carbon-dioxide-eocene-oligocene-cooling-09921.html

We've all heard, *ad nauseum*, that the dinosaurs became extinct because an asteroid or comet struck the Earth in Chicxulub, Mexico, at the end of the Cretaceous, 66 ma ago. The impact released an astonishing amount of climate-altering gases into Earth's atmosphere, triggering a chain of events that led to the extinction of non-avian dinosaurs and 75% of life on the planet. Since the discovery of the Chicxulub crater, much has been

learned about the event, but every advance has led to new questions.

Two critical unanswered questions include: 1) what was the source of the impactor; and 2) how often did such impact events occur on Earth during geologic history. A team of planetary scientists from the Southwest Research Institute has provided evidence from both computer models of asteroid evolution and observations of known asteroids to investigate the frequency of the kinds of events that occurred at Chicxulub.

The Chicxulub impactor was similar to the carbonaceous chondrite class of meteorites,



An ankylosaur calmly takes a sip of water 66 million years ago, not realizing its world is about to become Hell-on-Earth as a 6-mile-wide asteroid crashes into what will eventually become the Yucatan Peninsula.

which are some of the most pristine materials in the Solar System. Although carbonaceous chondrites are common among the many large bodies that approach Earth, none have been found with any kind of reasonable probability that are close to the 6-mi-wide impactor that produced the Chicxulub impact. So the researchers decided to look for where other Chicxulub impactor-size bodies might be hiding. They used computer models that track how objects escape the main asteroid belt between the orbits of Mars and Jupiter. Over many millions of years, thermal forces allow these bodies to drift into dynamic escape zones where planetary gravitational kicks can push them into orbits nearing Earth. Using NASA's Pleaides Supercomputer, they followed 130,000 model asteroids evolving in this slow, steady manner for hundreds of millions of years. Special attention was paid to asteroids located in the outer half of the asteroid belt, which is farthest from the Sun.

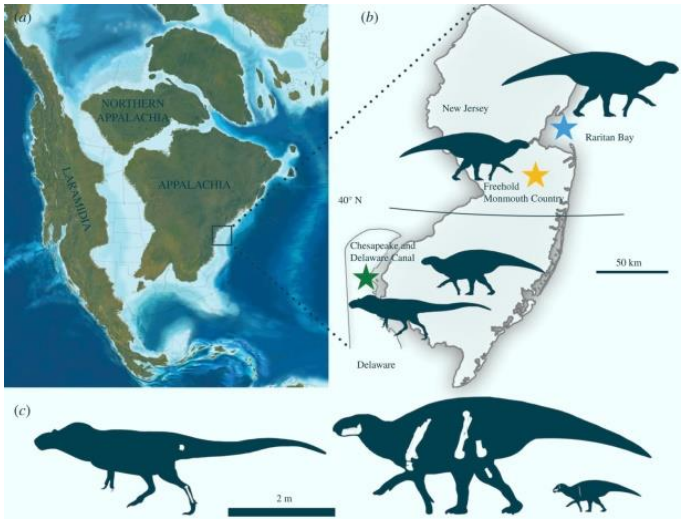
Surprisingly, they found that 6-mi-wide asteroids from this region strike Earth at least 10 times more often than previously calculated. Their results are fascinating because: 1) the outer half of the asteroid belt is home to large numbers of carbonaceous chondrite impactors; and 2) the simulations can, for the first time, reproduce the orbits of large asteroids on the verge of approaching Earth. It all corresponds with what is already known about how asteroids evolve.

Overall, the researchers found that Chicxulub-size asteroids hit Earth on average once every 250 ma. This timescale yielded reasonable odds that the Chicxulub crater occurred 66 million years ago. In addition, almost half of the impacts were from carbonaceous chondrites, which matches with what is known about the Chicxulub impactor. The new study should help researchers better understand the nature of the Chicxulub impact, as well as letting them know where other large impactors from Earth's deep past might have originated.

http://www.sci-news.com/space/chicxulub-asteroid-main-belt-09919.html

And speaking of the Cretaceous and dinosaurs, two new dinosaurs that lived in Appalachia during the Late Cretaceous about 85 ma ago, including a herbivorous hadrosaur and a carnivorous tyrannosaur, have been described from fossils found in the Merchantville Formation in New Jersey and Delaware.

While hadrosaurs, tyrannosaurs, ceratopsians, and diverse other dinosaurs living in Laramidia, the western landmass of North America, have been well known for over 100 years, much less is known about dinosaurs that lived in eastern North America. That's because Laramidia's geographic



Geographic setting of the Merchantville dinosaur fauna, including: (a) a map of North America during the Late Cretaceous that shows the location of New Jersey and Delaware; (b) a map of New Jersey and Delaware showing the locations where the described specimens were recovered; (c) a diagram showing preserved bones (white) and relative sizes of (left to right) the tyrannosaur and the hadrosaur (both adult and juvenile).

and geologic conditions were more favorable to the formation of sediment-rich fossil beds than Appalachia's.

The new dinosaur specimens were collected in the 1970s but were only recently described by a paleontologist from Yale University who found they help explain certain mysteries in the fossil record of eastern North America. They also help to better understand how geographic isolation affected the evolution of dinosaurs. The specimens include a partial skeleton of a large predatory therapod, most likely a tyrannosaur. The fossil shares several features in its hind limbs with *Dryptosaurus*, a tyrannosaur that lived about 67 ma ago in New Jersey. It had different hands and feet than *Tyrannosaurus rex*, such as massive claws on its forelimbs, suggesting that it represents a distinct family of the predators that evolved solely in Appalachia.

While many dinosaur experts believe that all tyrannosaurs must have evolved a specific set of features to become apex predators, they must have evolved into giant predators in a variety of ways instead, because the Merchantville tyrannosaur lacks the typical foot and hand features associated with western North American or Asian tyrannosaurs. In addition, the partial skeleton of the hadrosaur provided important new information on the evolution of the shoulder girdle in that group of dinosaurs. The fossils also provide one of the best records of hadrosaurs from east of the Mississippi and include some of the only juvenile dinosaur fossils found in eastern North America.

http://www.sci-news.com/paleontology/two-new-appalachian-dinosaurs-10006.html

Scientists have long agreed that the Moon formed when a protoplanet, called Theia, struck Earth in its infancy some 4.5 ga. Now, a team of scientists has a provocative new proposal: Theia's remains can be found in two continent-size layers of rock buried deep in Earth's mantle.

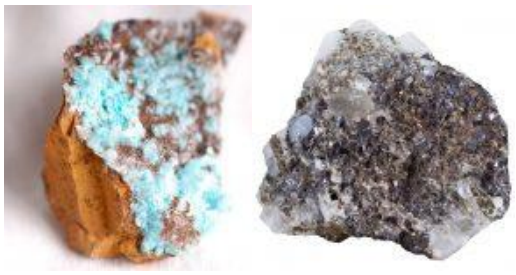
For decades, seismologists have puzzled over two blobs, which sit below West Africa and the Pacific Ocean and straddle the core like a pair of headphones. Seismic waves from earthquakes abruptly slow down when they pass through the layers, which suggests they are denser and chemically different from the surrounding mantle rock. The large low-shear velocity provinces (LLSVPs), as seismologists call them, might have crystallized out of the depths of Earth's primordial magma ocean. Another possibility is that they represent dense puddles of primitive mantle rock that survived the trauma of the Moon-forming impact. But based on new isotopic evidence and modeling, scientists from Arizona State University have proposed that the LLSVPs are the remains of Theia, the protoplanet that caused the impact.

The new model suggests that after the collision, Theia's core would have quickly merged with Earth's. A massive Theia would also explain the scale of the LLSVPs, which together contain six times more mass than the Moon. If they are extraterrestrial, only an impactor as large as Theia could have delivered them.

https://www.science.org/news/2021/03/remains-impact-created-moon-may-lie-deep-within-earth

WEBSITE OF THE MONTH:

https://mineralseducationcoalition.org/mining-minerals-information/minerals-database/



Aurichalcite (left) and zinc (right)

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Officer Contacts: If you wish to contact a PGS Officer, you can email Dan Harris, President at Harris_D@calu.edu; Pete Hutchinson, Vice-President at pjh@thggeophysics.com; Kyle Fredrick, Treasurer, at fredrick@calu.edu; or Diane Miller, Secretary, at dianemiller123@msn.com.

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 Pete Hutchinson, Program Chair at pjh@thggeophysics.com.

Newsletter: To contact the Newsletter Editor, Karen Rose Cercone, with questions or suggestions for articles, job postings or geological events, please email kcercone@iup.edu.

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Fun Fact Having Nothing to Do with Geology

Dogs have about 1700 taste buds (cats have about 470), whereas humans have about 9000. Now you know why dogs will eat anything, including feces.

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www.gesonline.com

Howard Concrete Pumping Company.
www.howardconcretepumping.com

Huntley & Huntley, Inc.
www.huntleyinc.com

Michael Baker International
www.mbakerintl.com

Moody and Associates Inc.
www.moody-s.com

Pennsylvania Drilling Co.
www.pennsylvaniadrillingco.com

Pennsylvania Soil and Rock
http://www.pasoilrock.com/

THG Geophysics, Ltd.
www.THGGeophysics.com