PITTSBURGH GEOLOGICAL SOCIETY

April 20, 2022

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

See page 3 for current guidance.

The 19th Annual Student Night

Poster Session (5:30-6:30 PM)
Oral Presentations (7:30 PM)

Co-sponsored by the Association of Environmental and Engineering Geologists (Greater Pittsburgh Chapter) and the American Society of Civil Engineers Geo-Institute (Pittsburgh Chapter)

Generously supported by a donation from the Pennsylvania Council of Professional Geologists

Please RSVP by Wednesday, April 13

PGS Judges' Selection for 2022

The Vertebrate Fauna of the Birmingham Shale

ZACHARY LYONS-WEILER, University of Pittsburgh/Carnegie Museums of Pittsburgh

The Birmingham Shale of the Casselman Formation of the Conemaugh Group has consistently yielded vertebrate and invertebrate fossils for more than a century. However, these vertebrates have not received attention in the literature for almost 50 years. Presented here is a comprehensive analysis of the vertebrates of the Birmingham Shale, including their taxonomic standing, biostratigraphic importance, and biogeographic relationships. The fauna occurs in two distinct stratigraphic zones, one lacustrine and one deltaic, hereafter referred to as Fauna A and Fauna B, respectively. Fauna A occurs in finel-grained black shale and consists mostly of isolated osteichthyan bones, teeth, scales, and coprolites. Rare, complete specimens of at least five distinct actinopterygians are present, most of which are referred to *Elonichthys peltigerus*, but two others are novel species. Other specimens are referred to the condrichthyan genera *Orthacanthus*, *Xenacanthus*, and *Hybodus allegheniensis*. Remains from *Acanthodes* are also known. Fauna B occurs 1-2 meters above the base of the Birmingham Shale and consists of specimens of *Palaeoxyris appendiculata*, often in direct association with plant material. These represent the first occurrence of *Palaeoxyris* in the Conemaugh Group. Fauna A bears a strong resemblance to other older vertebrate assemblages, such as those of the Mason Shale and the Freeport Coal. It differs considerably from faunas from the Monongahela Group and above, with only one actinopterygian present continuing through to the Fishpot shale of the Monongahela Group. The fauna is also greatly similar to the vertebrate assemblage present in the Late Carboniferous deposits of Czechia.

ASCE-Geo-Institute Judges' Selection for 2022

Microcontaminants in Indiana, PA's Freshwater Systems

GAVIN VASHIE, Indiana University of Pennsylvania

The study of microplastics is often an unthought of problem due to their size, yet they negatively impact our environment. This work sets out to quantify the growing concern of microplastic pollution. With the detection and identification of microplastics, we can begin to understand the levels of unseen pollution in Indiana, PA's municipal water. The sampling site was the Indiana Borough Regional Wastewater Treatment Facility where the surrounding area's water gets processed and released into two local bodies of water (Stoney Run and Two Lick Creek). The samples of effluent are taken a liter a month then processed through a 63 and 125 micron sized sieves. Once the liquid solution of H202 and H20 has evaporated via kiln the quantification and identification of the microplastics are examined under a stereoscopic microscope where the present microplastic particles vary from classification from microfibers, microbeads, fragments and films. Eighty-three microplastics were detected and found including all types in the two sizes tested. The presence of these microplastics suggests that Indiana is affected by the breakdown of plastics, which has an impact on the surrounding environment along with the organisms within it. In the future hopefully the wastewater treatment facility will install a filter/screen to prevent microplastics from being released freely into the local waterways.

AEG Judges' Selection for 2022

Daily changes to the efficiency of Wingfield Pines passive acid mine drainage treatment system

IRELAND KILLEN, California University of Pennsylvania

Acid mine drainage (AMD) is a common problem in southwestern Pennsylvania due to regional abundance of abandoned coal mines. As water passes through abandoned mines, metals such as iron leach out and contaminate the water. Wingfield Pines is a passive treatment site for AMD located in Upper Saint Clair, Pennsylvania. The site consists of five settling ponds and a wetland that flows into Chartiers Creek. The contaminated water passes through each of the ponds and precipitates out metals. The goal of this project is to investigate changes to the efficiency of pond one in response to sunlight and temperature variation seen during a daily cycle. Dissolved Fe, Al, Cu, and Mn concentrations were measured at the entrance and exit points of pond one in the morning and again in the evening. Conductivity, pH, temperature, and sunlight intensity data were also collected at these locations at the same times. Concentrations in dissolved Mn, Fe, and Al showed a minor decrease at the entrance from morning to evening though showed a more noticeable increase at the exit across the same time frame. Concentrations in Cu demonstrated the opposite trend. Overall, pond one demonstrated dissolved Mn, Cu, Fe, and Al concentration decreases by 33% (1.2 mg/L to 0.8 mg/L), 61% (0.87 mg/L to 0.34 mg/L), 89% (11.788 mg/L to 1.242 mg/L), and 100% (0.083 mg/L to not detectable) respectively from the entrance to the exit in the morning. In the evening, dissolved Mn increased by 33% (0.9 mg/L to 1.2 mg/L) and Cu, Fe, Al concentrations decreased by 82% (0.95 mg/L to 0.17 mg/L), 86% (11.644 mg/L to 1.642 mg/L), and 36% (0.039 mg/L to 0.025 mg/L) respectively from the entrance to the exit in the evening. This suggests pond one is less efficient in decreasing dissolved Mn, Fe, and Al concentrations in the evening than in the morning. Concentrations in Cu followed the opposite trend. These changes in efficiency are likely due to a response in sunlight intensity and temperature changes related to bacterial influence.

2022 STUDENT POSTER SESSION

- Daniel Cross, Indiana University of Pennsylvania, "Phase 1 ESA of Braddock Farms"
- Hannah Hagley & Konrad Holland, Pittsburgh Allderdice High School "Characterizing Road Runoff in Frick Park Soil"
- Brett McClinton, Slippery Rock University, "Geographic Information Systems as a Tool for Geologic Interpretive Programming – A Virtual Landslide Field Trip near Pittsburgh, Pennsylvania"
- Josh Mericho, Indiana University of Pennsylvania, "Assessing and Qualifying Changes in Rainfall and Temperature Patterns in Indiana PA"
- Lauren Rockwell, California University of Pennsylvania, "Assessing water quality impacts in the Pike Run Watershed, Washington County, PA"
- Christian Vizza; Indiana University of Pennsylvania, "Using diatoms to model Antarctic sea-ice during the mid-Pleistocene**"**

Please note that PGS is monitoring the COVID-19 situation closely and will continue to modify our mask policy based on the recommendation of national and local experts. The US Centers for Disease Control and Prevention (CDC) currently recommends the following:

- Those who are not vaccinated should wear a mask indoors in all public places.
- Those who have a condition or are taking medications that weaken their immune system should wear a mask indoors in all public places.
- If you are fully vaccinated, to maximize protection from the Delta and Omicron variants and to prevent possibly spreading it to others, you should wear a mask indoors in public places if in an area of substantial or high transmission. Allegheny County is classified as an area of high transmission.

To best align with the recommendations of the CDC, PGS strongly recommends that meeting attendees wear a mask and maintain social distancing to protect other meeting attendees and themselves. Masks may be removed when eating or drinking; however physical distancing is encouraged for those times. Please note that some members in attendance may qualify as immunocompromised, or may be caregivers for those who are, regardless of vaccination status.

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	***Scheduled Speaker***	***Presentation Topic***
May 11, 2022	Jim McDonald Ohio Geological Survey	History of Structure Contour Mapping in the Appalachian Basin: 1870-1917

The Pittsburgh Geological Society welcomes six new members:

New Regular Members:

Dennis C. Stock
Daniel P. Thames, GIT, Vibra-Tech Engineers

New Recent Graduate Member:
Elizabeth R. Adamczyk

New Student Members:
Colby Myers, Slippery Rock University
Arabella Kulasa, University of Pittsburgh

PRESIDENT'S STATEMENT

I'm still thinking about the dynamic animations and images from our exciting meeting in March where our invited lecturer, Dr. Jamie Farrell of the University of Utah, provided an incredible talk showing off some amazing geophysical datasets collected in Yellowstone National Park. Thanks again, Dr. Farrell!

Spring has officially begun and I'm sure I'm not the only one excited about warmer weather and coming opportunities to get outside. April is always one of my busiest months with a lot of exciting activities on the horizon. This is also an exciting month for PGS because it will feature an already sold-out landslide field trip (actually in late March), our 2-day drilling workshop event, and our annual student research night meeting, all of which will be a return to in-person events!

Our landslide trip has been developed over the past few years by Mary Ann Gross, Brian Dunst, John Harper, Tamra Schiappa, Jeremiah Brown, Brett McClinton, and trip-leader Jim Hamel, as well as several others involved in many organizing meetings and emails. This has also culminated in a newly published field guidebook that can be found on our PGS website. Related is our virtual field trip, free to all members and created by the same committee with special thanks to Brett McClinton who volunteered his time to compile the online offering. Brett will be discussing his work at one of our student night poster sessions, so be sure to stop by if you want to see how this was accomplished.

The drilling event is another exciting April event, happening on April 8th and 9th and will feature a dinner program: "Preparing for a Geoscience Career" on the 8th and an all day environmental field skills program on Saturday. Thanks to Kyle Fredrick for his dedication to planning this wonderful experience for our students.

Finally, our April meeting, scheduled for April 20th is our 19th annual student research gathering and will feature several posters and oral presentations from students in the region. This meeting is also a collaborative meeting between PGS, ASCE-GI, and AEG, so special thanks to those organizations for being involved and for helping with the selection of abstracts. Special thanks also go to Pete Hutchinson, our program coordinator, for collecting and organizing the abstracts and applications. Getting this meeting prepared is a huge undertaking.

Finally, we want to recognize the generous donation from the Pennsylvania Council of Professional Geologists, which helps to underwrite this student-focused event. I'm looking forward to seeing some special talks from our up-and-coming geologists in the region and I hope to see you all there!

Dan

LOCAL GEOLOGICAL EVENTS

PITTSBURGH AREA PETROLEUM GEOLOGISTS (PAPG)

April 21, 2022 **10:15 AM – 12:00 PM**

"Phase Associations of Rare Earth Elements and Critical Minerals in Marcellus and Haynesville shale: Implications on Release and Recovery Strategies" by Shailee Bhattacharya

For more information: https://www.papgrocks.org/

Cefalo's Banquet and Event Center, Carnegie, PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS (PCPG)

April 19, 2022 **9:00 AM - 4:00 PM**

"Essentials of Borehole Geophysics with Field Demonstration" (In-person Workshop, 300 minutes) by Scott Wendling, P.G., Vice President, ARM Geophysics.

Details and registration: https://pcpg.org/event-4530196

3240 Schoolhouse Road, Middletown, PA

April 26, 2022 **1:00 - 2:00 PM**

"Factors affecting groundwater quality used for domestic supply in Marcellus Shale region of north-central and north-east Pennsylvania" by Charles "Chuck" Cravotta, PhD, P.G., Research Hydrologist/Geochemist, U.S.G.S. Pennsylvania Water Science Center (Webinar: 60 minutes)

Details and registration: https://pcpg.wildapricot.org/event-4653733

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

April 28, 2022 **5:30 PM – 9:30 PM**

"SR 68 Midland Road Emergency Landslide Repair" by Jonathan Moses, District Geotechnical Engineer, PennDOT District 11-0 and Brian Heinzl, Geotechnical Project Manager, Gannett Fleming

Details and registration https://www.asce-pgh.org/event-4772608

Cefalo's Banquet and Event Center, Carnegie, PA

UPSTREAM PITTSBURGH

May 4, 2022 **6:00 PM – 7:00 PM**

"Stormwater Solutions: Rain Gardens, Rain Barrels, and Sub-surface Storage Methods." (webinar)

Details and registration https://upstreampgh.org/events/stormwater-solutions-webinar/

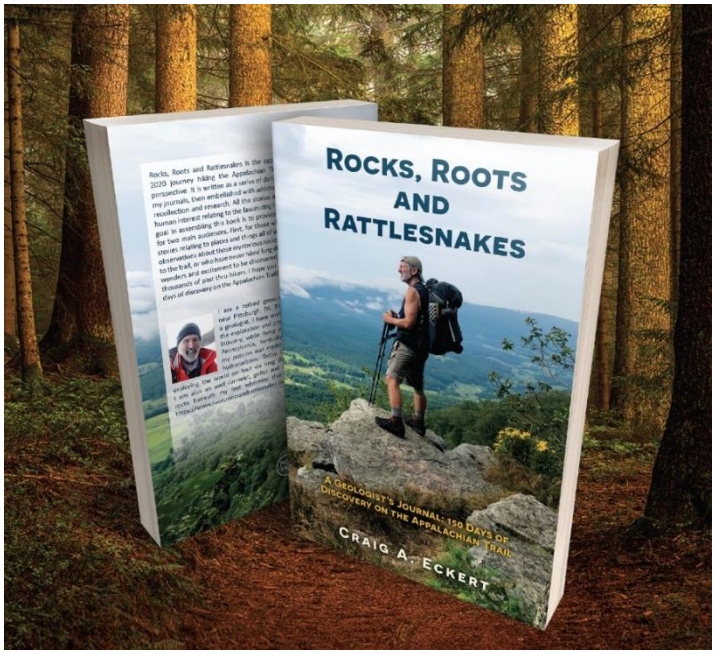
YOU CAN STILL ORDER YOUR OWN PGS SWAG!

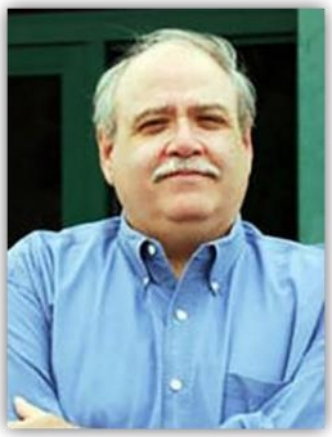
Show off your PGS Membership by purchasing a hoodie, t-shirt, or bumper sticker at the new PGS merchandise store. All proceeds support geology student participation in PGS society meetings!

https://apparelnow.com/pittsburgh-geological-society-apparel

READ A BOOK WITH A LOCAL GEOLOGY CONNECTION!

In June of 2020, Pittsburgh-based geologist and former PGS President Craig Eckart set off on a thru-hike of the Appalachian Trail, a journey which took him past numerous rocks and scenic landscapes. He decided to keep a daily log about the geologic observations he made along the way. In *Rocks, Roots, and Rattlesnakes*, Craig reflects on the sedimentary, igneous, metamorphic and tectonic history of our favorite local mountain chain, weaving an assortment of published data with his own geologic observations. His book makes a great gift for a geologist or a future trail hiker. You can purchase it now at Craig's website: https://www.rocksrootsandrattlesnakes.com/.





The Frank Benacquista Undergraduate Scholarship

The PGS Frank Benacquista Undergraduate Scholarship is an award of $500 to an undergraduate-level earth science student. This scholarship, created in honor of a long-time PGS member and student advocate, is intended to assist a student with college education costs and to promote student participation in the Pittsburgh Geological Society. Any student who is majoring in the earth sciences, is at least a sophomore, and attending a four-year accredited college or university in the Pittsburgh region is eligible to apply. The applicant must be a student member of PGS or must have applied for student membership at the time the application for the Frank Benacquista scholarship is submitted.

Required Materials

The full application must include the following:

- One-page resume
- Cover letter introducing yourself and elaborating on key points of your resume with a focus on activities outside of the classroom such as research projects, academic club service, or community involvement
- One-page essay describing your background, decision to pursue earth science, career goals, and academic objectives beyond the bachelor's degree (if any)
- Copy of your transcript (unofficial) and documentation that you are a current student. The requisite standard to apply is a minimum of 12 semester credits of earth science courses. Successful applicants should have a strong academic record that can be achieved through course work, research or service
- Letter of recommendation from a professor or another professional in the earth science field that provides information on your performance and activities in the classroom, in the department, or at an affiliated or non-affiliated institution. The letter should address your work ethic and your character in how you work and assist others in the classroom or field.

Scholarship Application Process

The application may be sent in digital form (email with attachments) to the current PGS President at harris_d@calu.edu. Follow these instructions when sending as an email:

- In subject line of email message, please type "PGS Scholarship, Your Last Name"
- Include a professional message to the President stating that you are submitting your application for the PGS Frank Benacquista Undergraduate Scholarship
- Attach all documents required as Word or PDF documents. Please make sure that each document is titled with your last name. For example: Jones Resume.pdf, Jones Essay.pdf

Application Deadline and Award Date

All applications must be received by **May 3, 2022**. The scholarship will be awarded at the first meeting of the Pittsburgh Geological Society in September, 2022.

Acceptable Fund Uses

Students may use the scholarship toward tuition fees, for field camp, to purchase equipment required for hands-on exploration as required by academic course work (e.g., rock hammers, hand lens), to attend geologic conferences, educational field trips, the PGS field trip, or the Field Conference of PA Geologists.

Basis of Awards

Awards will be based on the cover letter, recommendation letter, transcript, and the content and creativity of the essay as judged by the Scholarship Committee. The decision of the scholarship committee is final.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

The Borough of Hookstown, a small town in Beaver County close to the West Virginia border, was named for Matthias Hook, an early settler in the region who arrived from Maryland in the late 1700s, apparently following the American Revolution where he had been a soldier. In 1797, Hook paid the expenses for a lawsuit against someone who had unlawfully transported a boy named Evans out of Pennsylvania and sold him into slavery. In return, Evans agreed to work for Hook for a year, for which Hook furnished him food, clothing, and shelter.

The Beaver County borough of Hookstown has a very small population, but it is home to the Hookstown Fairgrounds and the South Side Historical Village Association, a historical village with many early American buildings and educational activities.

Hookstown established a post office around 1818 and was eventually incorporated as a borough in 1843. For much of the 19th century, it was considered to be a town of physicians, as many were born or educated there, and others resided there for at least part of their professional careers. In 1889, oil was discovered in a well that produced 600 barrels from the Upper Devonian Berea Sandstone at about 1200 feet. Early wells produced no water with the oil, but an accidental water flood essentially ruined the best production. Hookstown was never a large community. Throughout its history, it rarely ever had more than 300 residents; as of the 2020 census, only 138 people live there. Hookstown is the site of the Hookstown Fair Grounds, which includes the South Side Historical Village Association, a historical village committed to the education and preservation of local early American history. It consists of the Mercer School House, Porter Blacksmith Shop, Johnson Log Cabin, a doctor's office, a covered bridge, an 1858 bank barn, an oil derrick, artisan shop, general store, and outdoor bake oven.

DID YOU KNOW . . . ?

While concentrations of CO_2 in the atmosphere continue to rise and propel climate change, researchers have been looking at options not only to lower CO_2 emissions but also to remove it from the atmosphere. Geologists, in particular, have been pursuing many carbon capture and storage (CCS) methods in an attempt to trap gaseous or water-dissolved CO_2 in underground storage reservoirs such as depleted oil and gas fields, but these could leak and release greenhouse gas back into the atmosphere through subsurface faults and fractures, as well as damaged or

Dunite, an olivine-rich igneous rock, is a promising candidate for long-term storage of atmospheric CO_2.

improperly sealed wells. Since CO_2 is a gas, it will always move toward areas of lower pressure. But using carbon mineralization, the CO_2 is stored as a solid mineral that can be stably stored for a very long period of time.

Mineral carbon storage involves dissolving CO_2 in water where it can react chemically with rocks to form new minerals with carbon in the makeup. In order to store carbon in rock, the rock's geochemistry has to be able to remove the carbon from CO_2 molecules and turn it into a mineral such as olivine, which is common in igneous rocks. This process has been occurring in nature for hundreds of millions of years. It stores the carbon within solid minerals for hundreds or thousands of years with little danger that it will escape back into the atmosphere. Unfortunately, the storage capacity is limited because the carbonized water needs to seep into the rock, and the mineralization process tends to block the pore space, thereby reducing the permeability. Eventually, water can't reach new surface areas to react with.

Researchers at Columbia University in New York tested how the permeability of the igneous rock dunite, which is rich in olivine, changed during a month of carbon mineralization. After the expected initial period of clogging, the mineralization created new fractures in the rock that exposed more reactive surfaces. The cracking extended the duration of the reaction and enhanced the rock's carbon storage capacity. The dunite was first ground down to a known grain size for controlled testing, injected with carbonized water, and monitored for from four to 35 days. The olivine (Mg_2SiO_4) reacted with the CO_2 to form silica (SiO_2) and magnesite ($MgCO_3$). The carbonized minerals began clogging the rock and reducing permeability. But the end products took up more volume than the original material, and the magnesite and the silica ran out of empty space inside the rock while new crystals kept forming. The carbonate minerals began pushing outward, trying to create more room to fit, and ultimately created fractures in the sample.

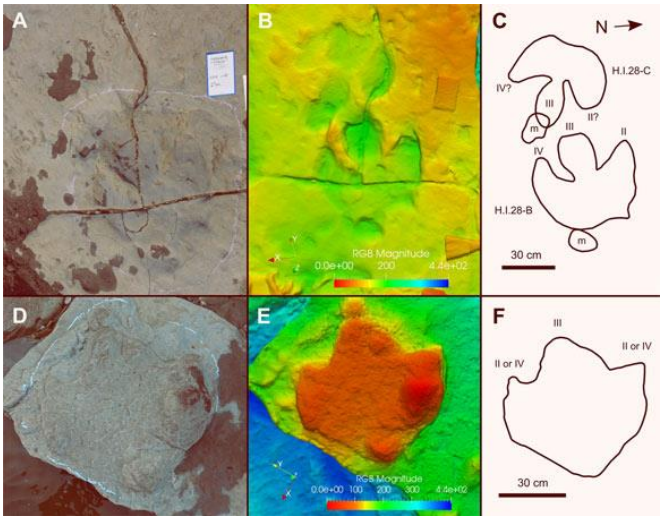
Before injection, the dunite sample comprised mostly jagged olivine crystals roughly 50 µm in size. Following and carbon mineralization, the olivine transformed into blocky magnesite crystals 10 µm or smaller and tiny amorphous silica minerals. Although the permeability was very low, fracturing allowed some fluid to keep moving through it and it kept cracking. That means some of the reaction was still happening and some of the CO_2 was still being captured. The rock actually became slightly more permeable for a short while due to the fracturing, increasing permeability and allowing the sample to mineralize more carbon than it could have done without the fracturing.

There have been some field tests of carbon mineralization in basalt, but there is still a lot of research needed into how well the process works with different types of rock and under various conditions before it can be engineered into a large-scale carbon storage solution. Therefore, it is essential to understand the geochemistry of the system first, and to investigate whether these mechanisms have altered the petrophysical and mechanical properties of the storage medium to conclude that CO_2 storage is safe for a site of interest. Future experiments at Columbia will explore dunite mineralization at different temperatures, with natural unprocessed rocks instead of aggregates, and with a focus on the solid products that are produced. The researchers are hoping to find a way to optimize this process so they can help implement more pilot projects around the world.

https://eos.org/articles/good-news-rocks-crack-under-pressure-from-mineral-co2-storage)

An international team of paleontologists recently documented a large number of Late Cretaceous dinosaur footprints near Grande Prairie, Alberta, Canada. More than 100 hadrosaurid and tyrannosaurid footprints dating to 72.5 ma ago are preserved at the Tyrants Aisle locality, the largest tracksite known from the Late Cretaceous Wapiti Formation, within the southern bank of the Redwillow River near Grande Prairie. The tracks are preserved in at least three layers of the formation, indicating that different groups of dinosaurs crossed the area for some time. It is possible they were following the margins of an ancient river system.

The Redwillow River submerges the site for much of the year and erosion is continuously occurring so that, by the time the researchers found the site, a lot of the tracks had already been lost, and the remainder will eventually be lost as erosion continues. Thus, it was important that the researchers carefully documented the site while it is still available for study. Fortunately, their work assures that the present site information will continue to be available for generations to come. Because the researchers are using digital technology, 3D models of the most significant footprints and trackways are available for future study.



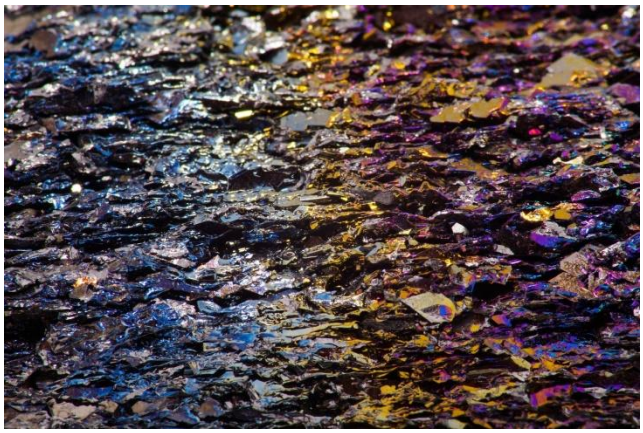
Hadrosaurid tracks from the Wapiti Formation near Grande Prairie, Alberta. A and D – photographs. B and E – digital elevation models. C and F – interpreted illustrations.

Hadrosaur tracks represent the most abundant tracks at the site, with the largest footprints measuring 25.6 inches long. This suggests the animal was about 8.5 feet tall at the hips. The researchers think this represents *Edmontosaurus regalis*, a species of comb-crested hadrosaurid. The tracks suggest these animal might have acted like cows, roaming in herds and grazing on low-growing vegetation. Other footprints, three-toed and theropod-like as much as 19.7 inches long, were identified as tyrannosaurids, possibly *Albertosaurus sarcophagus*, an early relative of *Tyrannosaurus rex*. Still other, smaller footprints available at the site have been attributed to troodontid and ornitomimid dinosaurs, as well as pterosaurs.

http://www.sci-news.com/paleontology/tyrants-aisle-footprints-10556.html

Researchers have worked out a process in which metals important in the manufacture of renewable energy technologies are transported from Earth's mantle to the crust. The research team discovered a zone at the base of the crust where the temperate is just right for metals to be passed to shallower depths where they can be mined. They called this the "Goldilocks zone." The metals such as copper, cobalt, tellurium, and platinum are very important because of their use in electrical wiring, battery storage devices, solar panels, and fuel cells. The team hopes their results will lead to more targeted, but less costly and more environmentally friendly, exploration and extraction practices for these key metals.

The metals are stored primarily in the Earth's mantle more than 15.5 miles deep where they are inaccessible by mining. In certain parts of the world, magma flows bring these metals to the surface, but how that happens has been uncertain. Now, the team has identified a temperature-dependent zone at the base of the crust that acts like a valve, intermittently allowing the metals to travel upward to the upper crust. When magmas reach the base of the crust, critical metals frequently get trapped and can't reach the surface because the temperature is either too high or too low.



Metal ore deposits containing copper and other critical minerals often result from magma flows from "Goldilocks zones" at the base of Earth's crust to shallower, mineable depths.

But, like Goldilocks in the fairy tale of Goldilocks and the Three Bears, if the temperature is "just right" (about 1832°F), metals like copper, gold, and tellurium can escape and rise towards the surface to form ore deposits. This research sheds new light on magmatic processes that operate deep in the Earth's crust that exert control on the accessibility of critical metals. The results will facilitate more targeted mineral exploration while decreasing the environmental footprint associated with the discovery and exploitation of these metals.

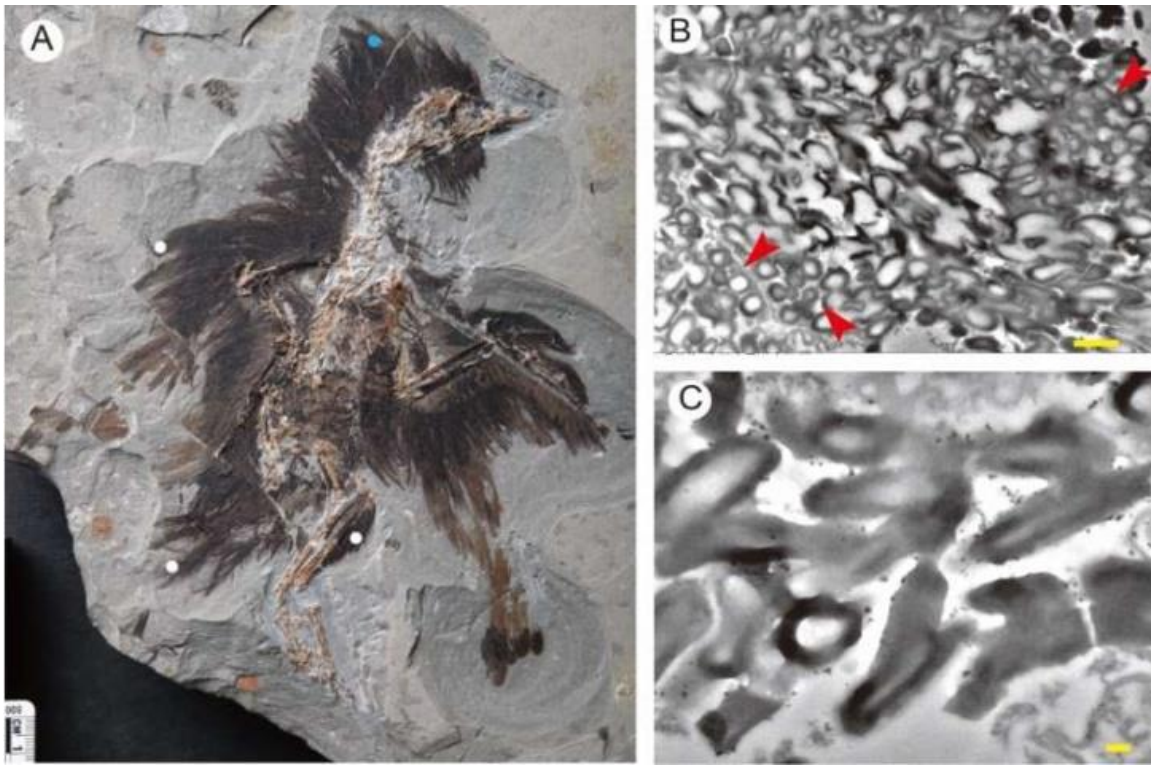
https://phys.org/news/2022-01-scientists-geological-goldilocks-zone-formation.html

Scanning and transmission electron microphotographs of the feathers of an Early Cretaceous bird from China show the earliest record of hollow melansomes (organelles of pigment cells in which melanins are synthesized and stored) from feathers. The research was done on a "basal bird" called *Eoconfuciusornis* from 130 ma old lake deposits in Fengning, Hebei Province, northern China. The melanosomes are preserved as rods with air holes and are approximately circular in cross section.

Hollow melanosomes are important because the color of feathers in extant birds is largely produced by pigments or structures. Brilliant, iridescent colors (color changes that depend on the reflectance spectra of sunlight at different viewing angles), such as those seen in some extant birds like African starlings and birds of paradise, are unique. Melanosomes that cause iridescent plumage in these extant birds vary in shape and include solid cylindrical, solid flattened, hollow cylindrical, and hollow flattened forms.

Hollow melanosomes had not been reported in fossil birds previously, although flattened melanosomes had been reported from a feathered dinosaur. The researchers noted that the hollow melansomes of *Eoconfuciusornis* were observed only from feathers on the top of the head, not from feathers in other areas of the same specimen. They suggest this might have been for sexual display. Some of the hollow melanosomes seen in SEM and TEM appear to be more or less fused, with the air holes merged. This could be due to taphonomic alternation. Previous work by the team confirmed that melanosomes could be fused during taphonomic processes.

https://phys.org/news/2022-01-hollow-fossil-melanosomes-earliest-brilliant.html

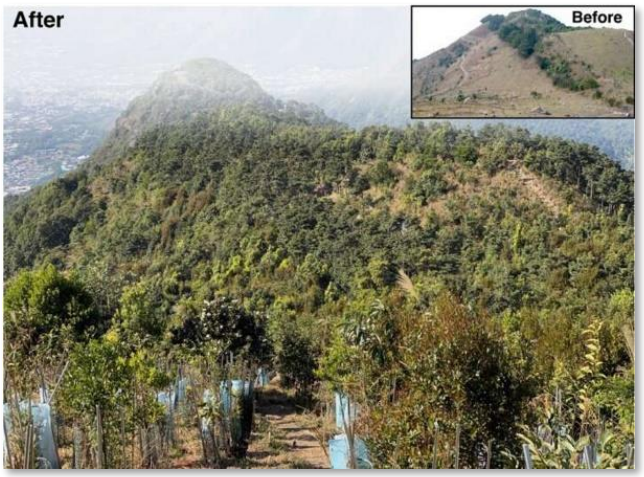


Photos of an Early Cretaceous bird from China, *Eoconfuciusornis*.

A – the actual fossil.

B and C – TEM images of melanosomes from the head feathers. Yellow scale bars = 1000 nm in B and 200 nm in C.

One of the ways scientists are trying to deal with removing CO_2 from the atmosphere is a nature-based solution that involves replanting previously forested landscapes in the tropics. The question is whether the new forests will be able to withstand the future climate changes. Some researchers are hopeful that such restored tropical forests will survive until the end of the century. Current solutions to combat global warming involve reductions in anthropogenic emissions of CO_2 and other greenhouse gases, but we also need to take steps to remove excess CO_2 from the atmosphere.



Before and after photos of a tropical forest restoration project in Hong Kong.

Restoration of previously deforested landscapes could be one of the least expensive and most reliable ways of removing and storing CO_2 for centuries by incorporating carbon into wood and soils. We might see large investments made in forest restoration projects over the next few decades. But in order to plan such projects, it is imperative to determine if such stored carbon will be preserved when subjected to future climate changes. Heat, drought, and wildfires, among other natural and human-caused problems, influence how tropical forests fare and will continue to fare in the future.

Researchers are now performing hundreds of computer simulations using a dynamic global vegetation model that is driven by an array of possible future climate scenarios and ecophysiological responses to CO_2 concentrations. As a result of their studies, the researchers found that carbon accumulated in tropical forests that are regrowing will remain in the forests even under the most severe future climate change scenarios. They also tested scenarios hypothesized to contain only half of the available land restored and with sites selected by lowest cost of land, the potential to accumulate the most carbon, or both. It was not surprising that selection of the cheapest available land resulted in the lowest carbon drawdown, but restoring all potential tropical forests is probably not feasible for multiple reasons. Therefore, prioritizing which forest should be restored is important.

Another aspect of the research was using simulations to point to places where climate change impacts are less severe and better suited for concentrating replanting efforts. For example, the computer simulations demonstrated that restoring degraded landscapes in natural areas in Hong Kong and southern China would be worth the expense and effort because the new forests in those areas will continue to accumulate carbon until the end of the century. Although large-scale tree planting won't be enough to avoid climate disaster it can play a positive role, and if it is done with biodiversity and the people who call these forests a home in mind, forest restoration can have multiple benefits. So far, the researchers only looked at carbon. Other aspects such as biodiversity in restored forests also suffer from the impact of climate change, and assessing those impacts will be the next step in the research.

https://phys.org/news/2022-02-earth-scientists-simulated-future-forest.html

Toward the end of the Pleistocene's last glaciation, the Wisconsinan continental glaciers locked up huge amounts of water in vast ice sheets. They were so large and heavy, they actually pushed down the Earth's crust beneath them. Once they melted, the land rebounded and tremendous floods gouged channels into the face of the Earth. The remains of one of the largest of these primordial deluges can be seen in the Channeled Scablands in eastern Washington state. Glacial Lake Missoula formed when the Cordilleran ice sheet dammed the Clark Fork

Photo of Palouse Falls. Located in the Channeled Scablands of eastern Washington state, the falls and other topographic features speak to the power of megafloods from water escaping from melting glaciers.

Valley, and glacial melt water built up behind it. Eventually, the dam broke between 18,000 and 15,500 years ago and the first glacial megaflood occurred in eastern Washington. Once enough water had escaped, the ice dam reformed and the water began to build up again. This process probably occurred several times over the next few thousand years.

Until recently, reconstructions of ancient megaflood routing had investigated how different variables like erosion and the movement of sediment, three-dimensional mechanics of the environment, and how ice dams break, would affect them. Such studies were based on present-day topography, only approximating how past landscapes might have looked. Now, using modeling of ancient megafloods, researchers have decided to test whether glacial isostatic adjustment (GIA) might have affected the routing flow and erosion in two prominent Scabland tracks. They used relatively simple, but plausible, numerical experiments to test whether GIA could have had a substantial impact on flood routing and erosion for two major scabland tracts, Cheney-Palouse and Telford-Crab Creek. They modeled GIA to reconstruct the topography of the Channeled Scabland at different times during the period of Pleistocene flooding. Previous studies had been looking at high water marks and trying to reconstruct the size of these floods, but all of the estimates were based on looking at the present-day topography. Then geologists began to realize that the effects melting glaciers were having on Earth's crust were also likely playing a role in the routing and behavior of these megafloods.

The researchers estimate that GIA caused crustal deformation in the Channeled Scabland with rates up to 10 millimeters per year, orders of magnitude above regional tectonic uplift rates; therefore, GIA probably influenced flood routing, affecting the course of ancient glacial outburst floods. Reconstructing these events helped the researchers understand how floods shape landscapes on Earth, and Mars as well. The researchers think the deformation of Earth's crust due to the expanding and contacting of the ice sheets would have altered the elevation of the landscape by hundreds of feet during the multiple formation of Lake Missoula. So now they want to simulate past megaflood events that incorporate multiple factors determining their routing. Understanding the role that Pleistocene crustal deformation played during flood routing and erosion in the megafloods is a step in the right direction. The research also has pointed out how truly dynamic the landscape once was, with steep canyons hundreds of feet deep, dry falls, and massive potholes. These and other geological artifacts tell the tale of a land that was once subject to titanic forces.

https://www.sciencealert.com/ancient-megafloods-tilted-the-very-direction-of-earths-crust-scientists-find

WEBSITE OF THE MONTH

https://volcano.si.edu/

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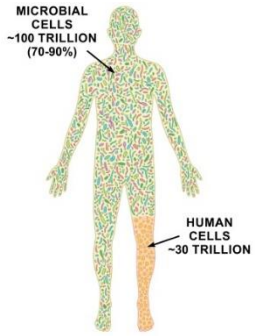
Fun Fact Having Nothing to Do with Geology

Bacterial cells in the human body outnumber human cells 10 to 1. Since they are much smaller than human cells, however, they make up only 1 to 2% of human body mass (and about ½ of our body waste). Still, if removed from the human body, they would be able to fill a half-gallon jug.



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