PITTSBURGH GEOLOGICAL SOCIETY

February 17, 2021

Virtual Meeting Times

Board Meeting	6:00 PM
Social Gathering	7:00 PM
Presentation	7:30 PM

Pre-Registration is Required

To receive the Zoom link, PGS members and guests must RSVP at: pittsburghgeologicalsociety.org

PDH Certificates are Available

Attendees can receive an emailed PDH certificate at their request. Non-PGS members are asked to kindly donate $10 to either the Pittsburgh Geological Society Endowment Fund or the PGS Galey Fund for Students when they request a certificate on the PGS website.

Online Meeting Guidelines

All attendees are encouraged to join the meeting no later than 7:20 PM when announcements will be made. PGS requests all attendees to mute their own audio and video during the presentation to avoid disruptions and to lower bandwidth.

Drilling to Magma

Viti Crater in Krafla Caldera, Iceland. Photo credit: Yevhenii Chulovskyi, Shutterstock.com

John C. Eichelberger

GSA Continental Scientific Drilling Division
2020 Distinguished Lecturer

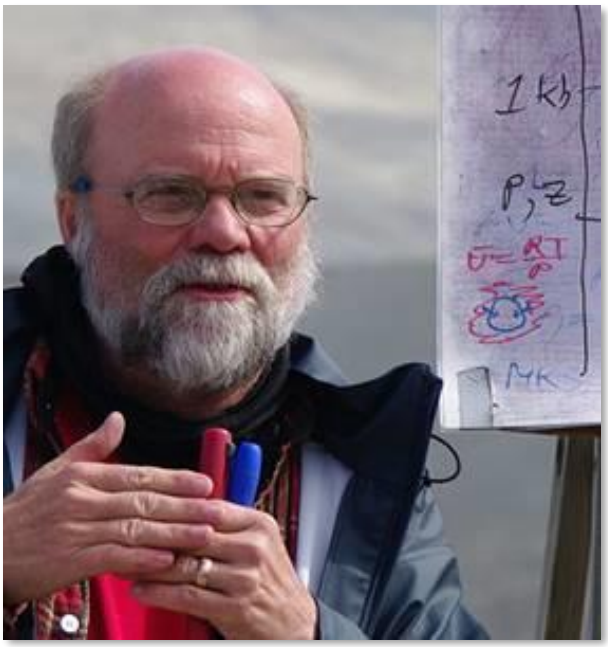
International Arctic Research Center
University of Alaska Fairbanks

Please RSVP by February 16 to receive the Zoom link.

Abstract

The geosciences provide a long history of surprises when some thought the big discoveries were over: basalt as an igneous rock, an old but hot Earth, evolution, plate tectonics, life punctuated by extraterrestrial events, and climate change caused by humans. Drilling to magma will likely provide another such surprise. Although we tend to believe our untested cartoons, consider whether the characteristics of hydrocarbon reservoirs would have been accurately rendered without drilling. We must drill to magma to understand how continental crust formed, how to use heat of crystallization coupled with enthalpy of magmatic water and thermal cracking as a clean energy source, and how to forecast catastrophic volcanic eruptions from direct measurements in magma. I will trace the progression from coring lava lakes, through shifts in thinking about magma bodies, to exciting data from accidental drilling encounters with real magma, to what the future of scientific drilling to magma could hold.

Speaker Biography



John Eichelberger's career spans volcanology, scientific drilling, and international Arctic education. Educated at MIT and Stanford, he was on the research staff at Los Alamos and Sandia National Laboratories in New Mexico from 1974-1979 and 1979-1991, respectively. In 1991 he became Professor of Geology and Geophysics at the University of Alaska Fairbanks (UAF) where he greatly expanded volcano monitoring and student engagement in the Alaska Volcano Observatory. During that time, he initiated cooperative volcano monitoring, research, and educational programs with the Institute of Volcanology and Seismology, Russian Academy of Sciences in Petropavlovsk-Kamchatsky. He was also co-originator of the Unzen Scientific Drilling Project, which cored through the conduit of Unzen Volcano, Kyushu, Japan after the volcano's eruption ended.

Eichelberger left UAF in 2007 to serve as Program Coordinator for Volcano Hazards at the U.S. Geological Survey headquarters in Reston, Virginia but continued to work on Russian-US collaborations in natural hazards under the Bilateral Presidential Commission. He returned to UAF in 2012 as Dean of the Graduate School. The European Geosciences Union awarded him the Soloviev Medal in Natural Hazards in 2015 and the Geological Society of America designated him Distinguished Lecturer for Continental Scientific Drilling for 2020-2021. He is now semi-retired but continues development of the Krafla Magma Testbed, Iceland, following his career-long goal to sample magma directly by drilling.

PRESIDENT'S STATEMENT

Science is back!

Welcome to February. This is the month of new beginnings. Derived from the Latin word *Februa,* meaning "to purify," February is the time to start anew after spending the month of January to reflect. It seems quite fitting this year after having spent a tortuous January transitioning to a new administration in our country. The new administration has pledged to put scientists into key positions and the new administration will hopefully make evidence-based decisions guided by the best available science. I am hopeful that science will guide the decision-making process and provide solutions to many tasks at hand, like climate change and the pandemic. I feel once again that I and my discipline have value.

Now is the time for geologists to shine and let our voices be heard. Geology as a discipline has seen its ups and downs over time, and far too often geology programs are on the chopping block. The strength of geology departments has traditionally been measured in enrollment numbers, which reflect hiring by the petroleum, mineral, and environmental industries. When industry is hiring, students flock to geology programs, but when layoffs are in the news, students tend to stay away. Unfortunately, as the world we live in begins to wean itself off fossil fuels and address the need for solving the climate crisis, it is more important than ever that we train a new generation of geologists to develop alternatives and solutions.

Why geologists? Having a solid understanding of Earth's natural processes and geologic time will be essential to address the issues of climate change. Students of the earth sciences are well trained and learn to think about the world much differently than a biologist or chemist. Geologists tend to put everything into perspective and apply what has been learned about the past to deal with what is to come. We observe phenomena from the microscopic to planetary scale and use these data to answer a variety of questions. Because our way of thinking gives us this privilege, we should strive to be part of the team of scientists making decisions and setting policy that will change the way we do business and interact with nations around the world.

It is time for geologists to come to the forefront and demonstrate the need for a "*geologist way"* of thinking. We need to inform the politicians, deans of colleges, chancellors of higher education, and others in administrative roles about the importance of geology and the need to continue funding strong geology programs. As we train the next generation of geologists, we must emphasize that it is their training and way of thinking that will help them contribute to a better world.

I would like to thank all the Corporate members who have already renewed their memberships and encourage those who have not yet done so to step up and support PGS's commitment to the next generation of geologists. I also want to thank all our current members for renewing their memberships and welcome the new professional and student members to the society.

I look forward to seeing everyone at the meeting this month. Stay safe and, if and when you have the chance, please promote geology to enhance the viability of academic programs and help save the world

Tamra

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	*Scheduled Speaker*	*Presentation Topic*
March 17, 2021	Kendra Murray, Idaho State University	Cenozoic Magmatism on the Colorado Plateau
April 21, 2021	Student Research Night Joint Meeting with ASCE and AEG	Student Posters & Presentations
May 19, 2021	Thomas Bardol, Seneca Resources	Oil and Gas Industry Talk

OTHER GEOLOGICAL EVENTS

Pennsylvania Council of Professional Geologists

February 1 to February 17, 2021 6:00 – 8:30 PM Monday and Wednesday evenings

6-Webinar Package: PG Review Course for the Practicing Geologist and ASBOG® Exam Candidate (900 minutes total). Individual webinars can also be taken separately. See page 5 for details.

For more information: https://pcpg.wildapricot.org/event-4047621

Harrisburg Area Geological Society

February 11, 2021 6:30 PM – 7:30 PM

"Recent Discoveries of Fossils from the Kinzers Formation (Lancaster and York Counties, PA) Extend the Important Role of its Fauna as a Record of the Great Early Cambrian Diversification of Marine Life on Earth" by Roger D.K. Thomas, PhD – Franklin & Marshall College

To RSVP: secretaryhags@gmail.com

ASCE Geo-Institute Pittsburgh Chapter

February 18, 2021 12:00 PM – 1:00 PM

"A Summary of the Technical Causes of Feijão Dam 1 Failure" by Lucas de Melo, Ph.D. P.E., Geosyntec Consultants, Inc.

To register: https://us02web.zoom.us/webinar/register/WN_DG35xwGLTkm1NlnBL7uwcA

PA Sea Grant Webinar Series

February 26, 2021 1:00 PM – 2:00 PM

"Assessing Bluff Recession Using High Resolution Geospatial Data" by Mike Naber, Ph.D., Associate Teaching Professor of Geosciences, Penn State Behrend.

For more information and to register: https://seagrant.psu.edu/node/1152

JOIN PCPG

COURSES & EVENTS

CORPORATE MEMBERS

RESOURCES

MEMBERS ONLY

6-Webinar Package: PG Review Course for the Practicing Geologist and ASBOG® Exam Candidate (900 mins.)

Start February 01, 2021
6:00 PM
End February 17, 2021
8:30 PM
Location Webinar

Registration

- Members – $399.00
- Non-Member – $599.00
  To save $200 over the cost of six sessions, return to home page and Join PCPG.

VISA MasterCard DISCOVER AMERICAN EXPRESS OFFLINE

PENNSYLVANIA COUNCIL of PROFESSIONAL GEOLOGISTS

You are registering for a **six-part webinar series** as noted below. If you intended to enroll for a single date, please return to the home page calendar and select the date for the topic(s) noted below.

Post-webinar recordings will not be available.

Our usual and customary cancellation policy applies to the six-part webinar series, and cancellation must be requested five business days prior to the first webinar scheduled for February 1. Partial refunds will not be made for missed webinars.

Reference materials will be sent ahead of each webinar, with some handouts available during the live webinar. If joining by mobile phone, please be familiar with the GoToWebinar app's control panel so you readily locate the attachment downloads under the Handouts tab.

Monday, February 1, 2021 • 6:00 - 8:30 pm

• Introduction and General & Field Geology

Martin Helmke, PhD, PG, West Chester University

• Seismology, Exploration Geophysics, and Well Logging

Thomas E. Jordan, PhD, PG, Key Environmental, Inc.

Wednesday, February 3, 2021 • 6:00 - 8:30 pm

• Mineralogy and Igneous/Metamorphic Petrology

Kurt Friehauf, PhD, PG, Kutztown University

• Sedimentology, Stratigraphy, and Paleontology

Tamra Schiappa, PhD, Slippery Rock University

Monday, February 8, 2021 • 6:00 - 8:30 PM

• Structural Geology and Tectonics

• Geomorphology

Daniel Harris, PhD, California University of Pennsylvania

Wednesday, February 10, 2021 • 6:00 - 8:30 PM

• Hydrogeology and Geochemistry

Chris Mulry, PG, Groundwater and Environmental Services, Inc.

Kyle Fredrick, PhD, California University of Pennsylvania

Monday, February 15, 2021 • 6:00 - 8:30 PM

• Engineering Geology

Matthew Morris, PG, Gannett Fleming, Inc.

Gary MB Kribbs, PG, AEON Geoscience, Inc.

Wednesday, February 17, 2021 • 6:00 - 8:30 PM

• Economic and Resources Geology: Mining

Kurt Friehauf, PhD, PG, Kutztown University

• Economic and Resources Geology: Petroleum and Coal

Kristin Carter, PG, DCNR Geologic Survey

Our instructors are wholly focused on your learning experience, and remain available via Email and telephone to answer questions after the webinar concludes.

Mock tests are a component of the seminar.

Visit *What others have said about this course.*

PCPG Review Course Participant / Future ASBOG® Exam Candidates:
The components of this seminar are aligned with the general subject areas contained in the ASBOG® Geologist Examinations. However, the course is not intended as a sole-source for your test preparation. It is instead a proven resource and guide for your further preparation efforts. As such, the course provides a concentrated review and a general refresher for the practicing, Professional Geologist.

During this seminar about one hour is devoted to review a full-semester, college course. *The webinars are not intended as a "How to take the Test" review.* Seminar registrants usually take this course 6 to 12 months from their intended exam date with the understanding that significant, additional preparation will be needed prior to sitting for their examination.

We are certain that you will find the provided information helpful to your preparation, enabling you to better succeed in the ASBOG® Examinations.

ASCE

The Geo-Institute
Pittsburgh Chapter
is hosting:

GEO-INSTITUTE
Pittsburgh Chapter

Webinar - February 18th, 2021

A SUMMARY OF THE TECHNICAL CAUSES OF FEIJÃO DAM I FAILURE

by:
Lucas de Melo, Ph.D., P.E. – Geosyntec Consultants, Inc.

1.0 PDH available

To determine what triggered the failure of Feijão's Dam I and why the failure occurred when it did. A panel that included Lucas de Melo of Geosyntec, carried out an investigation into the technical causes of the failure. The investigation into the causes of the failure included: (i) evaluating the nature of the materials in the dam and their properties; (ii) assessing the dam construction and operation methods and their impact on the dam and tailings material properties; (iii) assessing the condition of the dam before and during the failure using analyses of available images, such as video, ground-based radar, laser (LiDAR), satellite (InSAR and photographs), drone videos; and (iv) numerically modeling the conditions just prior to failure.

The assessment of material properties included sampling and laboratory analysis of materials from the site to allow critical state deformation and stability analyses of the tailings dam structure. Numerical analyses of water flow through the tailings and dam were performed to assess the impact of pore water pressures on the stability of the structure. The panel's evaluation was informed by detailed assessments of the history of construction, historical geotechnical data, historical instrumentation data, and seismic evaluations of the region around and at the site.

Lucas de Melo has over 25 years of experience in mining and dam-related projects, geotechnical design and field studies, and hazardous materials remediation, and solid waste management facilities. His portfolio of clients includes public-c and private entities. He currently manages a branch of more than 120 scientists, engineers, and designers at Geosyntec's Columbia, Maryland office. In addition, Mr. de Melo is responsible for the geotechnical curriculum at the Johns Hopkins University (his alma mater), where he acts as a Lecturer.

WHERE	TIME
Zoom – Webinar	12:00 PM – 1:00 PM EST
Link to Registration: Here	

Program Chair: Randall Booker (Email – rbooker@agesinc.com)

PGS STUDENT DELEGATE PAGE

Message to the Students

Time is an illusion that we as humans have yet to completely understand. I struggle to truly understand the value of time. There are days, weeks, and even months where I find myself constantly running out of time. As soon as I accomplish one task, it seems three more are added to my plate. Such is life and I would like to think it gets better but it truly never does. We just become better at managing it.

For many of us we are now fully integrated into a new semester of classes, challenges, and deadlines. Whether it be our last semester or first the tasks never end. February is the shortest month of the year in terms of days but is often the most important to a student's success for the semester. Do not forget scholarship, research, graduate school deadlines are fast approaching, and these are the steppingstones to our future. Stay ahead of the curve and meet these deadlines. Give yourself time to focus on the most important piece of our future, Ourselves. Make time to think, reflect, and focus on your present and future prospects.

This upcoming month is exciting when it comes to PGS and future opportunities. In addition to the general PGS meeting on the 17th of the month, we will be hosting a Student Zoom Meeting on the 9th at 7 PM. The Zoom link is https://sru.zoom.us/j/93083707968 and the topic this month is "How to become a Professional Geologist". We will cover the licensing process, timeline, fees, and required coursework as an undergraduate needed for the exam. PG's from the state of PA will be joining us to answer questions and provide additional guidance. I look forward to seeing all the student members take advantage of the opportunities the Pittsburgh Geological Society is affording us. The only cost is your time.

Michael P. Behe, Slippery Rock University
For more information: **mpb1017@sru.edu**

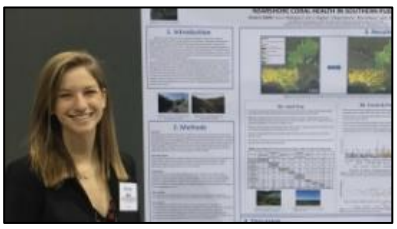
The Pittsburgh Geological Society welcomes the following:

New Recent Graduate Member
Nicholas D. Helfer
2020 BS in Geology, Edinboro University

New Student Member
Emily R. Jackson
Graduate Student, WVU

PGS – AEG – ASCE STUDENT NIGHT

April 21, 2021



University students, please consider presenting the results of your college research projects at the **19th Annual PGS – AEG – ASCE Student Night Meeting**. If you have been conducting undergraduate or graduate research in any geological or geotechnical field, here is an opportunity to show off your work to members of three professional scientific societies. Students who present their original research grow from the experience by improving their public speaking skills, networking with professionals and experts in their fields, listing a presentation on their resume and possibly even winning a cash award.

Each of the three sponsoring societies will select one student paper (graduate or undergraduate) for oral presentation. Additional abstracts will be accepted for poster presentations. All presenters will receive certificates of recognition and appreciation, as well as complimentary dinner. The three oral presenters will each receive awards of $100, while the three best poster presenters will each receive $50.

Guidelines and Submission Forms can be downloaded from the PGS website:

https://www.pittsburghgeologicalsociety.org/student-night.html

The Student Night Guideline document contains the formatting rules to be used in the abstract submission and also the rules to be followed for the presentations themselves when the time comes. The Student Night Abstract Submission Form is a two-page fillable PDF document consisting of a cover sheet with digital signatures by the student and faculty mentor and an abstract describing the research project. A letter of support for the project must be submitted separately to PGS by the faculty advisor of the project.

Abstract submission forms and letters of support should be emailed to the PGS Program Chair, Dr. Daniel Harris, at Harris_D@calu.edu.

Some additional links that students may find helpful in putting together their abstracts and presentations:

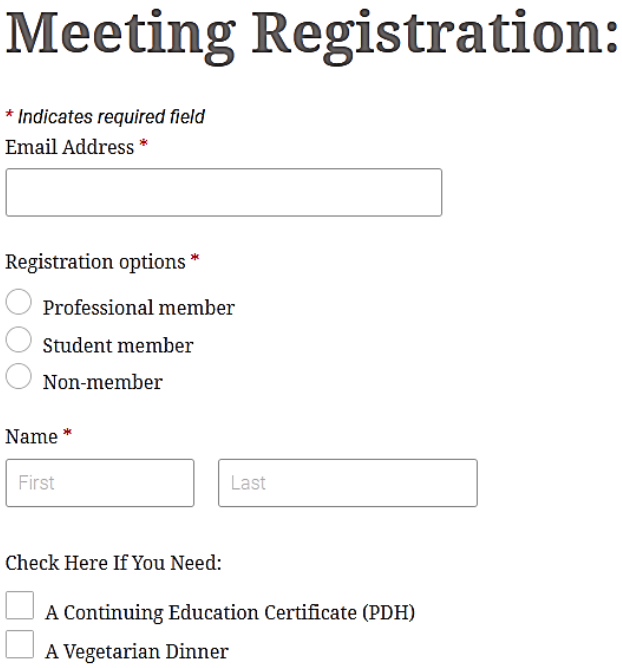
- The American Geophysical Union's oral presentation style guide with advice on best practices. http://www.projectionnet.com/Styleguide/presentationstyleguide.aspx
- Dennis Jerz's Tips on Oral Presentations. Dennis Jerz is an English professor at Seton Hill, and he's stellar at what he does. Do read and retain his coaching on oral presentations: it's top-notch. https://jerz.setonhill.edu/writing/technical-writing/oral-presentations-tips/
- The Professor's Guide to 15 Strategies for Giving Oral Presentations from US News & World Report. https://www.usnews.com/education/blogs/professors-guide/2010/02/24/15-strategies-for-giving-oral-presentations
- Rice University's site on oral presentations skills. There are sample clips to show you what to do (and not do) in your oral presentation. http://www.owlnet.rice.edu/~cainproj/ih_presentation.html
- The National Institute of Health's Ten Simple Rules for a Good Poster Presentation' and 'Ten Simple Rules for Making Good Oral Presentations' https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1876493/

The deadline for abstract submissions is March 26, 2021 by 5:00 PM. Acceptance decisions will be announced in early April.

PROFESSIONAL DEVELOPMENT HOUR (PDH) CERTIFICATES

PGS issues one PDH unit for those attending meetings and requesting a certificate. Virtual meetings complicate matters a bit. Please be sure to enter your full name with the email address where you want the PDH certificate sent when registering to ensure accurate recordkeeping.

Don't forget to check the PDH box on the website form.



PGS ANNUAL NOMINATIONS & ELECTIONS

It is February and a good time to consider becoming more involved in the future of the Pittsburgh Geological Society. As the PGS monthly meetings carry on virtually during these COVID times, our officers and Board members also continue to meet virtually on a monthly basis to plan and provide for our membership's educational and professional needs. Between now and April we look to fill a ballot with qualified and energetic members for our May election.

If you have no previous experience in participating in governing a professional society then you may want to consider running for one of the three Director-at-Large positions that are filled every year by the Society. In this position you will assist the officers and committee chairs in the monthly functions of the PGS. The Director-at-Large position is a 2-year commitment and requires regular attendance at the Board meetings that are typically held one hour prior to the social period of each monthly meeting.

If you are a past officer/board member, you are always welcome back. Previous experience is very useful at our Board meetings, whether you want to return as an officer or take the gradual approach as a Board member.

If you are an active professional member of the Society and have an interest in being a candidate, or know of a member that you think would be a good candidate, please contact Ray Follador, Nominations and Elections Committee Chair, at geodawg@comcast.net or (724) 744-0399. A list of all candidates will be announced at the April meeting with the election to be held at the May meeting.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Mt. Morris, in Greene County on the border with West Virginia, was founded and settled by Levi Morris in 1765. He first purchased a farm along Dunkard Creek and after living there for a while, he purchased another farm on an elevated area at the intersection of Dunkard Creek and Wades Run. When the farm became a community, it was named Morristown in his honor. The name was changed to include an indication of the elevation when the town secured its charter. Mt. Morris later became part of the underground railroad.

Historical photo of Mt. Morris, Greene County, PA, showing the town as it existed in the 1800s, with oil wells producing from the "Big Injun sand" (Mississippian Burgoon Sandstone).

Oil was first discovered in Mt. Morris seeping from "rock crevices" and settlers dug small holes in the ground to collect it; in other places it seeped into Dunkard Creek and was collected using woolen blankets laid on the water and wrung out. The oil was called "ground oil" and was first used primarily as medicine. Numerous wells were dug or drilled in the newly discovered Mt. Morris field in the mid-1860s, beginning an era of oil and gas exploration that lasted many years. Originally produced from the Dunkard sands (the driller's name for sandstones in the Pennsylvanian Glenshaw Formation at around 700 ft), oil later was discovered in the Big Injun sand (Mississippian Burgoon Sandstone) and that became the field's primary reservoir. Mt. Morris field is the northern extension of the historic Mannington field of West Virginia where I. C. White demonstrated the utility of the anticlinal theory of oil and gas production.

DID YOU KNOW . . . ?

At long last, we have the answer to one of life's burning questions: Why can't our technologically advanced society create concrete that will last longer than 50 years when Roman concrete made during the Iron Age more than two thousand years ago is still as solid as ever? The Roman Empire crumbled to dust about 1500 years ago, yet many of its concrete structures are still standing. Concrete is essential in modern life for roads, buildings, bridges, monuments, and other works, so this question is more than just academic.

The ruins of the ancient Roman city of Jerash, Jordan still stand 2000 years after construction because of the method Romans used for making concrete.

History contains many references to the durability of Roman concrete. A cryptic note written in 79 B.C.E. described concrete that had been exposed

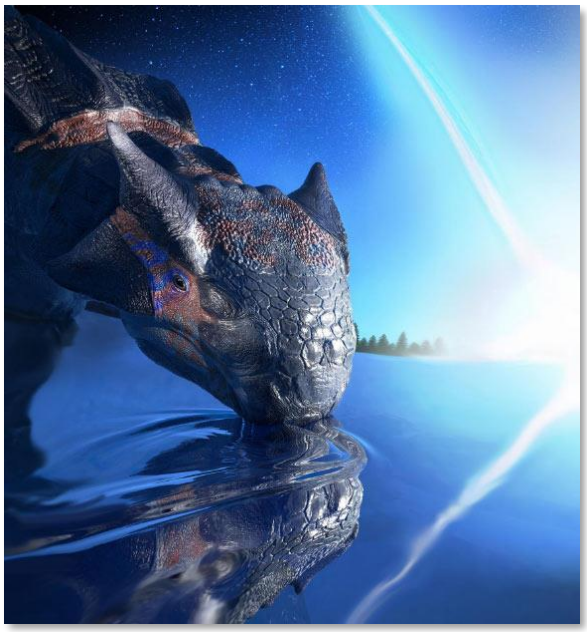
to seawater as a single mass of stone that was indestructible by sea waves and grew stronger every day. How was this possible?

It turns out there is a special ingredient that makes the cement grow stronger over time rather than weaker, and researchers only recently figured out what it is. The answer begins with an ancient recipe for mortar devised by a Roman engineer named Marcus Vitruvius in 30 B.C.E. that called for a blend of volcanic ash, lime, and seawater that was then mixed together with volcanic rocks, spread into wooden molds, and submerged in more sea water. The researchers studied cores drilled at a Roman harbor in Pozzuoli Bay near Naples, Italy. When the cores had been analyzed, they found that the seawater had dissolved components of the volcanic ash that allowed new binding minerals to grow.

After less than 10 years, aluminum tobermorite, or Al-tobermorite, a rare hydrothermal mineral, had formed in the concrete. Al-tobermorite, which gives Roman concrete its strength, can be made in the lab but is very difficult to incorporate in modern concrete mixtures. The researchers, however, found that when seawater percolates through a Roman-type cement matrix, it reacts with volcanic ash and crystals to form Al-tobermorite plus a porous mineral called phillipsite.

While stronger piers, breakwaters, and other ocean-side structures may be constructed in the near future as a result of this research, what about road, buildings, bridges, and monuments in the heartland? Both Al-tobermorite and phillipsite take centuries to strengthen concrete, and there's the added expense of transporting volcanic ash, volcanic gravel, and seawater to construction sites. So it might be a while before we see construction crews along the Pennsylvania Turnpike, or contractors erecting skyscrapers, pouring Roman-style concrete into roads, buildings, bridges, monuments, and other works.

https://www.sciencemag.org/news/2017/07/why-modern-mortar-crumbles-roman-concrete-lasts-millennia



An ankylosaur calmly takes a sip of water while a large comet or asteroid plunges toward the Earth.

Non-marine vertebrates apparently have experienced at least 10 discrete episodes of extinction events during the past 300 ma, eight of which were penecontemporaneous with known marine mass extinctions. These events suggested a periodicity of 26.4 to 27.3 ma. Now a team of scientists from New York University and Carnegie Institution for Science have done a statistical analysis of the ten currently recognized non-marine mass extinctions and found what they believe to have a statistically significant periodicity of 27.5 ma. The team also found what they suggest is the influence of large bolide impacts and Earth activity that create flood-basalt volcanism occurring on the same 27+ ma rhythm as the extinctions, possibly governed by Earth's orbit in the Milky Way Galaxy.

Paleontologists have known for decades that mass extinctions of marine life with as much as 90% of species disappearance were not random events but seemed to be cyclical. The new study showed the record of terrestrial mass extinctions coincided with the marine extinctions, but what was causing the cyclicity? The ages of impact craters also follow a cycle similar to the extinction cycle. Astrophysicists have suggested that periodic comet showers occurring in the Solar System every 26 to 30 ma are the culprits because the

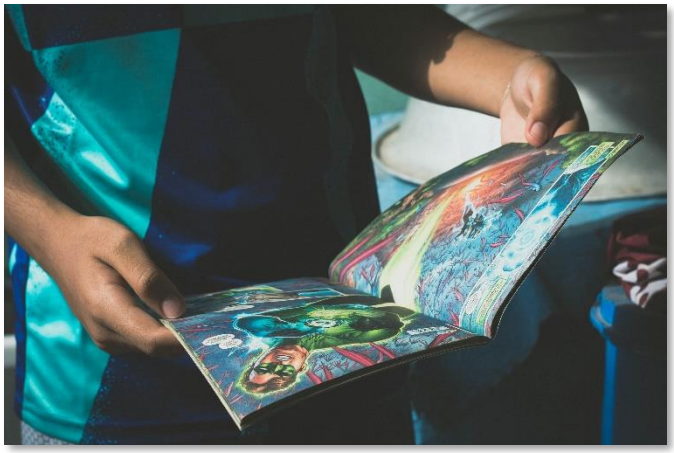
Solar System cycles through the dense mid-plane of the Milky Way about every 30 million years. As a result, at those times, comet showers are possible, which could lead to large impacts on the Earth, creating conditions such as global dark, cold conditions, wildfires, acid rain, and ozone depletion. The new research indicates that sudden mass extinctions on both land and sea and the 26- to 27-ma cyclicity lend credence to the concept of periodic, global, catastrophic events triggering the extinctions. The team concluded that global mass extinctions apparently were caused by the largest cataclysmic impacts and massive volcanism, sometimes possibly working in concert.

http://www.sci-news.com/space/periodic-non-marine-mass-extinctions-09146.html

Many of us grew up reading comic books like Superman or The Fantastic Four, comic strips like Blondie or Dilbert in the newspapers, and comic-illustrated books like Dr. Seuss's *How the Grinch Stole Christmas*. Even if superheroes didn't interest you, there was always Bugs Bunny and Donald Duck. Comics have been a source of enjoyment for many young people around the world for many decades, and their influence has grown exponentially as they've branched out into TV, movies, video games, and many other facets of society.

Over the years, academics have debated whether comic books are or are not a tool that enhances scientific learning. Articles in major journals and educational websites discuss teaching and science-related comics, addressing how scientific comics are effective at capturing student attention and keeping them intrigued in scientific topics. Unfortunately, while the articles and websites assert that comics have the capability to improve academic performance and interest, they provide little or no evidence for these assumptions. So, can comics improve academic performance, interest, and attitude in science classes or not? Why focus on comics rather than on more mainstream teaching tools such as written textbooks and online lecture videos? Do comics improve learning and student performance in science classes? The latest research says yes . . . and no . . . and, honestly, it's just too early to tell right now! Very few studies have been done to address the issue, and even with those the quality of the research ranges from incredibly well-conducted to not very applicable. And even the most well-conducted studies produced the most complex and unexpected results.

One relatively well-conducted study in 6th grade science classes at a New York middle school analyzed whether humorous cartoons could be used to effectively teach rock and mineral concepts. It ultimately concluded that humorous cartoons improve information retention and academic performance during teaching of rock and mineral concepts to 6th graders. The researchers incorporated both pre- and post-tests and established a control group to compare their studies results.



It is possible that reading comic books and watching cartoons can help improve students' science-learning ability.

Although the study was well-conducted overall, it had flaws that place the conclusions in doubt. For example, because both control and experimental groups were from the same school, and the cartoons were fun and entertaining, the control group students complained that it was unfair for them to not be learning with the cartoons like their experimental group counterparts. In older-age groups, this might not have been an issue. Although more research is needed, the studies demonstrated that comics undoubtedly increased interest in science topics. Because of their current unconfirmed ability to improve academic performance, however, there is no

justification for implementing them across all pre-college academic systems. Right now it's probably best to continue conducting research on comics due to the promising leads they possess. Besides, who doesn't like to have some fun while learning?

https://scicomm.plos.org/2020/10/20/can-comics-improve-pre-college-science-education/

There is a cluster of volcanoes in the Aleutian Islands, far from the mainland of Alaska, that some scientists think might represent the exposed portion of a massive supervolcano similar to that beneath Yellowstone National Park. The cluster includes mounts Cleveland, Carlisle, Herbert, Kagamil, Tana, and Uliaga, known as the Islands of Four Mountains. Most seem to be inactive. Although there seems to be nothing out of the ordinary about these volcanoes, there are hints that point to the possibility that a large caldera lies hidden deep underground, including the chemistry of certain gases escaping Mount Cleveland, and the way vents on several of the mountains are oriented.

The Islands of Four Mountains in the Aleutian Arc might be the surface exposure of a massive supervolcano caldera similar to Yellowstone.

If the researchers are correct, the Aleutian Arc could be the first indications of a monster supervolcano. The Aleutians contain some 80 volcanoes and dozens of them have erupted many times in recent history. Mount Cleveland, for example, has erupted more than 20 times in the past 200 years and others have erupted catastrophically. One of the volcanoes erupted in 1944 with a catastrophic level of 3 (on a scale of 0 to 8) on the logarithmic-scale volcanic explosivity index (VEI). The index level is dependent on how much volcanic material is thrown out, to what height, and how long the eruption lasts.

If the hypothetical Aleutian supervolcano actually erupted, we would certainly know it. At an 8 on the VEI (the projected level for Yellowstone), the debris blown into the atmosphere would affect global climate for years. One of the Aleutian volcanoes, Okmok, erupted about 2 ka ago with enough ferocity that scientists have speculated it was at least partially responsible for the downfall of the Roman Republic. And the Islands of Four Mountains caldera would be a far bigger eruption. But before anyone panics, scientists need to collect far more data. They plan on lookng more closely at the seafloor, studying the volcanic rocks in greater detail, collecting more seismic and gravity data, and sampling a lot more of the geothermal areas. Yet, even if the hypothesis is confirmed, the inner workings of the caldera will take a lot more time to understand. After all, the Aleutians, unlike Yellowstone, are not in the most accessible place in the world. But even if the caldera hypothesis turns out to be a red herring, studying the volcanoes can help scientists to understand what type of eruptions might be expected in the future and better prepare for their hazards, especially to air travel in that part of the world.

https://www.sciencealert.com/geologists-think-they-ve-found-an-alaskan-version-of-yellowstone-s-supervolcano

Researchers have discovered the fossil remains of an early mammal that lived on Madagascar 66 ma ago close to the end of the Cretaceous Period. Nicknamed "crazy beast", it is described as unlike any mammal ever known, living or extinct. About the size of the American opossum, this creature had an assortment of peculiar traits that hadn't been seen in an individual previously, highlighting the kinds of evolutionary peculiarities that can result when evolution takes place in isolated areas (think of Australia's plethora of native marsupials).

Artist's rendering of *Adalatherium hui*, a newly discovered Mesozoic mammal from Madagascar that has scientists puzzled.

Madagascar is home to other living and extinct species that are found nowhere else in the world. The new fossil is the most complete and well preserved skeleton of what is called a gondwanatherian – a mammal that lived on the supercontinent Gondwana. Mesozoic Gondwana fossils are relatively sparse, typically consisting of items such as a single skull, or bits of jaw bone and teeth. The new mammal, described as looking a bit like a badger, is so well preserved that it includes cartilaginous tissue, small bones, and the creature's short tail. The researchers named it *Adalatherium hui*, with the generic name combining the Malagasy word for "crazy" and the Greek word for "beast." Believed to be a juvenile weighing around seven pounds, it was quite large for a Cretaceous mammal. Most other Gondwana mammals living at the time were the size of mice.

It is difficult for scientists to think that a mammal like *Adalatherium* could have evolved because the skeleton contains some strange features that they can't quite figure out. For example, the animal had more holes on its face, called foramina, than any known mammal. Foramina create pathways for blood vessels and nerves, and this animal had many more than normal. These would have led to its having an incredibly sensitive snout that was probably covered in whiskers. It also had a large hole at the top of the snout that isn't comparable to that of any other known living or extinct mammal. Its teeth are structured in a bizarre way that can't be explained.

There are also more vertebrae in its backbone than any known Mesozoic mammal, and since the front and back halves of the animal don't match, it must have walked in a strange way. The forearms and shoulders were placed under the body, similar to modern cats and dogs, which was unusual for early mammals that walked more like reptiles. The back legs, however, seem to have spread out more like reptiles and had strong, long claws suggesting that it dug using its hind legs rather than its forelegs. The two patterns in one animal implies that it walked very differently than anything living today. The researchers described *Adalatherium* as the oddest of oddballs, and that trying to figure out how it moved is nearly impossible because its front end tells a very different story than its back end.

https://www.cnn.com/2020/12/18/world/crazy-beast-fossil-mammal-scn-trnd/index.html

Scientists have long debated when plate tectonics and subduction began on Earth; estimates range from 0.85 to 4.2 ga ago. If we could discover when plate subduction began we could pinpoint when the planet became one composed of longstanding continents where long-term biogeochemical cycles are controlled by volcanic degassing and recycling into Earth's interior. Plate tectonics is responsible for the way Earth looks, creating continental plates and ocean basins, as

well as being the primary control on the chemical characteristics of the planet's surface. Thus, plate tectonics is likely responsible for Earth's ability to sustain life and provides an important control on climate by regulating the amounts of CO_2 in the atmosphere as well. Now, a new study suggests that the plate subduction reshaping Earth's surface could have started 3.75 ga ago and set the stage for a planet hospitable to life in the process.

Geochemists think the composition of Precambrian rocks, especially of titanium, provide evidence of Earth's earliest habitability. Samples for this study were taken from the 4.02 ga (Hadean Eon) Acasta Gneiss Complex in the Canadian tundra, the oldest known rocks on the planet. The new research focused on titanium isotopes from the gneiss, which were analyzed by mass spectrometer and compared with titanium isotopes from newer rocks known to have formed in subduction zones. Samples from 3.75 ga were so similar in structure and composition to those from the newer rocks that they suggest plate subduction began at about that time. The rocks had been carefully dated previously and provided with geochemical and petrological context.

Analyzing the history and onset of ancient subduction zones is especially difficult because rocks are constantly destroyed during plate subduction when the crust is driven into the mantle, providing very few samples dating back into Earth's earliest history. Although the trend in the titanium isotope data does not provide evidence that plate tectonics was happening globally, it does indicate the presence of wet magmatism, which supports subduction at this time.

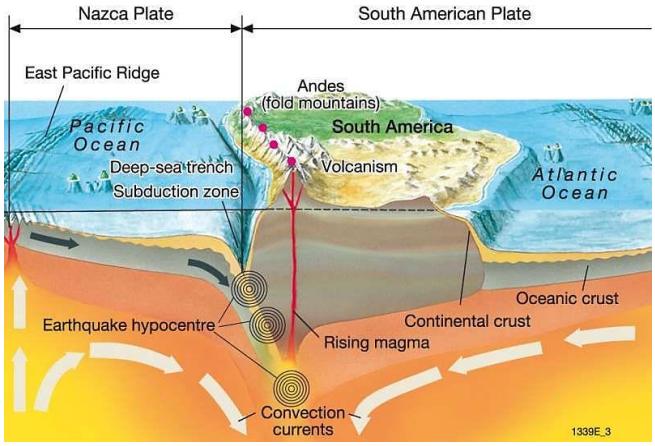


Plate subduction zones like this one today first appeared on Earth around 3.75 billion years ago.

https://phys.org/news/2020-12-earth-plate-subduction-began.html

A recent study shows the extraordinary speed and scale of increases in energy use, economic productivity, and global population growth that have pushed the Earth towards the so-called Anthropocene. The research, which was led by scientists at Colorado University at Boulder, documented the natural drivers of environmental change throughout the Holocene Epoch and found that dramatic physical, chemical, and biological changes to our planet's rocks began around 1950. Such changes altered oceans, rivers, lakes, coastlines, vegetation, soils, chemistry, and climate. This was the first documentation of humanity's geological footprint on such a comprehensive scale in a single report.

Since 1950, we have surpassed all of the energy consumption of the preceding 11,700 years, mostly through fossil fuel combustion, which in turn allowed for a historic increase in human population, industrial activity, pollution, environmental degradation, and climate change. The study resulted from work by the Anthropocene Working Group, an interdisciplinary group of scientists working to make the case for recognizing the Anthropocene as a valid geological epoch on the official Geological Time Scale.

Within the Holocene Epoch, there are several officially recognized ages, but the Anthropocene Working Group wants the Anthropocene to be recognized as a separate Epoch within geologic time. The group argues that, even if we stopped burning fossil fuels, which they recognize as the primary culprit of greenhouse gases, there would still be geologic record of an enormous change on the Earth. The researchers compiled a list of 16 major planetary impacts caused by increased energy consumption and other human activities, which spiked significantly in and after 1950. For example, between 1952 and 1980, more than 500 thermonuclear weapons were exploded above

ground globally as part of nuclear weapons testing, creating a clear signature of human-caused radionuclides on or near the surface of the entire planet.

Other examples of planetary change since around 1950 include: 1) doubling of the amount of fixed nitrogen through industrial production for agriculture; 2) creation of at least one hole in the ozone layer through the industrial-scale release of CFCs; 3) release of enough greenhouse gasses from fossil-fuel burning to cause global climate change; 4) creation of tens of thousands more synthetic mineral-like compounds than occur naturally on Earth; and 5) reduction in almost 1/5 of global river sediment reaching the ocean because of construction of dams, reservoirs, and other diversions. We have also produced so many megatons of plastic each year since the mid-20th century that microplastics are forming an almost ubiquitous and unambiguous sedimentary marker.

Pieces of plastic cover a beach in South Africa.

The researchers acknowledge that not all of these global changes currently define a geological age, but they maintain that if these trends continue, they might well lead to markers in the rock record that will. They also acknowledge that, although we got ourselves into this fix, we all need to work together to reverse the environmental trends and work our way out of the mess we have been continuing to make.

https://scitechdaily.com/humanitys-geologic-footprint-transformed-by-unprecedented-energy-use-since-1950/

A team of seismologists, led by the University of Southampton, have discovered new evidence for upwelling in the mantle coming from depths of more than 375 mi beneath the Mid Atlantic ridge. Upwellings beneath ridges are typically thought to originate from much shallower depths of around 37 mi, but the new research shows that is not always the case.

Over the course of two research cruises on the RV Langseth and RRV Discovery, the team placed 39 seismometers on the Atlantic sea floor as part of the PI-LAB (Passive Imaging of the Lithosphere-Asthenosphere Boundary) experiment and EURO-LAB (Experiment to Unearth the Rheological Oceanic Lithosphere-Asthenosphere Boundary). The resulting data provides the first large scale and high-resolution imaging of the mantle beneath the Mid-Atlantic Ridge. This allowed the team to image variations in the structure of the Earth's mantle near depths of 255 mi and 410 mi -- depths that are associated with abrupt changes in mineral phases. The observed signal was indicative of a deep, sluggish and unexpected upwelling from the deeper mantle.

https://www.sciencedaily.com/releases/2021/01/210127122426.htm

PGS WEBSITE OF THE MONTH

https://www.maine.gov/dacf/mgs/explore/index.shtml

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Fun Fact Having Nothing to Do with Geology

When Oreos were introduced in 1912, the price for a one-pound novelty can of cookies was 25 cents.

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