PITTSBURGH GEOLOGICAL SOCIETY

Celebrating 75 Years

An Enigma in the Desert: Discovery of an Extensive Network of Non-Tectonic Synclines in Eocene Limestone in Egypt and the Search for a Plausible Origin

Dr. Barbara Tewksbury

Professor of Geosciences
Hamilton College

February 19, 2020

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 any non-member

RESERVATIONS

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

You can also reserve and pay via PayPal at: https://www.pittsburghgeologicalsociety.org/

MEETING LOCATION

Cefalo's Banquet & Event Center, Carnegie PA

Registration Deadline: Wednesday, February 12

Speaker Abstract

Over the past ten years, we have used high resolution satellite imagery, field work, and geophysical surveys to study an unusual and extensively developed network of thousands of synclines that we discovered in early Eocene limestones in the Western Desert Egypt. These synclines are not typical tectonic fold structures in either scale or geometry. Individual synclines are narrow (100-400 m wide), and syncline scale is strikingly similar everywhere, with no parasitic folds and no larger structures. In many parts of the network, narrow synclines occur with no companion anticlines, and synclines occur as isolated structures 1-3 km apart in otherwise flat-lying limestone. Broad structures that could be described as anticlines do occur, but these are “accidental anticlines” and formed where two synclines are close together. Limb dips are shallow, and fold hinges plunge shallowly.

Many synclines are several kilometers long with multiple basin closures along their length. Some synclines occur as isolated basins. Two dominant orientations are common (NNW-SSE and WNW-ESE) that are parallel to two prominent joint sets, but synclines from the two trends branch, merge, and curve into one another, forming a network. The syncline network is cut by faults associated with opening of the Red Sea, and the network was eroded prior to deposition of fluvial gravels of the Katkut Formation, which pre-dates incision of a through-going Nile in the late Miocene. Both support an Oligocene/early Miocene age for the synclines. Although the synclines are not equally well developed everywhere, we have found them in Early Eocene limestone over an area of nearly 100,000 km^2 across the Western Desert Limestone Plateau and in smaller areas of the Eastern Desert.

The features of the syncline network are best explained by non-tectonic sag of limestone layers accompanying volume reduction at depth, producing sag features similar to those caused by deep mine collapse. The mechanism for volume reduction, however, remains unclear. We have an entire graveyard of failed hypotheses that each account for some, but not all, of the features of the network. Our current preferred model is hypogene karst, with aggressive fluids moving upward from below along joints and faults in the underlying Esna Shale and into the overlying limestones, causing dissolution at deep levels in the limestones and sag at shallower levels. Mafic igneous activity, which was widespread in Egypt after the early Eocene and especially near the onset of Red Sea rifting, could have played a critical role in creating aggressive fluids.

Speaker Biography

Barbara Tewksbury is Professor of Geosciences at Hamilton College, where she has been on the faculty for over 40 years and currently holds the Upson Chair. She is a structural geologist and lead PI on the NSF-funded Desert Eyes Project to study the nature and origin of enigmatic bedrock structures in the Western Desert of Egypt. She is also an Associate Editor of the Journal of African Earth Sciences. For the past ten years, she has been one of a small number of classroom and field instructors for NASA astronaut geology training and has been part of NASA analog field studies for human planetary surface exploration.

(continues on next page)

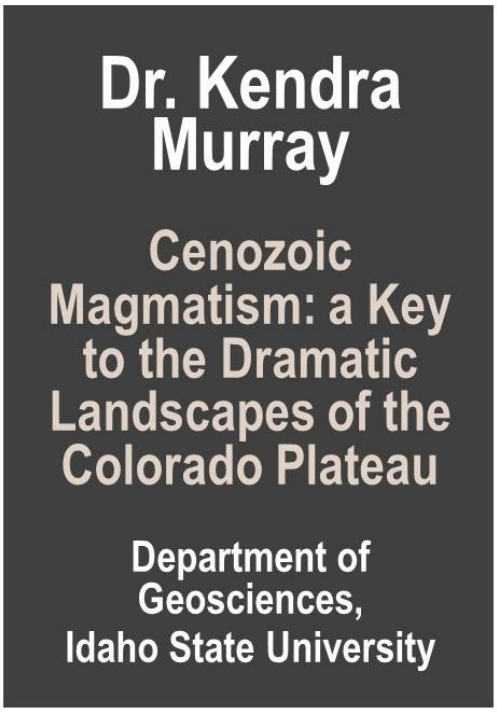
Speaker Biography (continued)

Dr. Tewksbury has also played a leadership role in the national geoscience education community for over 25 years and has given scores of workshops to faculty in departments across the country and abroad. She was co-PI on the NSF-funded project On the Cutting Edge, a national professional development program to improve undergraduate geoscience education. She is a past president of the American Geosciences Institute and the National Association of Geoscience Teachers. She was named New York State Professor of the Year in 1997 by the Carnegie Foundation for the Advancement of Teaching and was the 2004 recipient of Neil Miner Award for exceptional contributions to the stimulation of interest in the Earth Sciences from the National Association of Geoscience Teachers (NAGT).

To learn more about her research, visit http://people.hamilton.edu/btewksbu

FUTURE PGS MEETINGS

The next PGS Dinner Meeting will be held on March 18, 2020.



Meeting Date	***Scheduled Speaker or Event***	***Presentation Topic***
April 15, 2020	Student Research Night Joint Meeting with ASCE and AEG	Student Posters & Presentations
May 13, 2020	Randy Blood, PGS Award Winner DRB Geological Consulting	Energy Resources

PRESIDENT'S STATEMENT

The Pittsburgh Geological Society is celebrating its 75th Anniversary. During the last 75 years, the PGS membership has given generously each year. The financial support from membership dues and donations has helped PGS maintain a healthy budget, essential to meet our mission and goals. The yearly corporate investment in PGS has substantially helped to support opportunities for the geological community in a variety of ways.

We use their generous donations to help support monthly meeting costs, provide opportunities for students, award scholarships to students and teachers and to help sponsor AAPG and GSA professional meetings and workshops. More specifically, last year corporate sponsorship was used to pay for speaker travel costs, sponsor AAPG and GSA sectional meetings, provide a monetary award to the top student researchers at student night, help offset costs of the student drilling workshop, and provide scholarships. We also presented the first PGS Frank Benacquista Scholarship to an undergraduate geology student as well as two scholarships to high school students for excellence at at the regional Covestro Pittsburgh Science & Engineering Fair.

Many of the donations we receive from the membership are given specifically to the Galey Fund. The PGS Board set up the Galey Fund in 1996 in response to the need to provide educational support and promote geological communication and understanding to the community. The fund was named for John Taylor Galey, one of the founders of PGS who also served as President in 1948. He became an Honorary Member in April 1970 at the 25th Anniversary celebration of PGS, along with all of the surviving founders who had maintained membership in the Society.

The money in the Galey Fund is used to offset the student monthly meeting costs and helps to pay for some of the costs of the student drilling workshop. This Fund allows the society to lower the costs of the monthly meetings and drilling workshop for the student membership. I encourage all members to consider donating to the Galey Fund. Large donations are always appreciated but even a few dollars here and there make a difference. I tend to pay a little bit more for each monthly meeting and I request that the remainder go into the Galey Fund. I do this because writing a large check at once can be painful on my personal budget but if I extend it out over the year, it is more manageable.

In closing, I would like to bring to your attention the following events and opportunities:

- The first PGS 75th Anniversary Field Trip will be held on March 28th (see page 5) with registration to open February 15 on the PGS website.
- Information on submitting an abstract for Student Night on April 15th is available on our website and also on page 6 of the newsletter.
- Details about our Student Drilling Workshop on April 3rd and 4th can be viewed on page 7.
- The process for students to apply for the PGS Frank Benacquista Scholarship is on page 8.
- See page 9 for our calendar of other geological meetings in Pittsburgh this month.
- Check out page 11 for information about the Pennsylvania Brownsfield Conference to be held in March if interested.

On behalf of everyone on the PGS Board, I would like to express our sincere gratitude for the generous donations we have received over the year. Your financial support to our mission and goals is greatly appreciated.

See you at the meeting!

Tamra

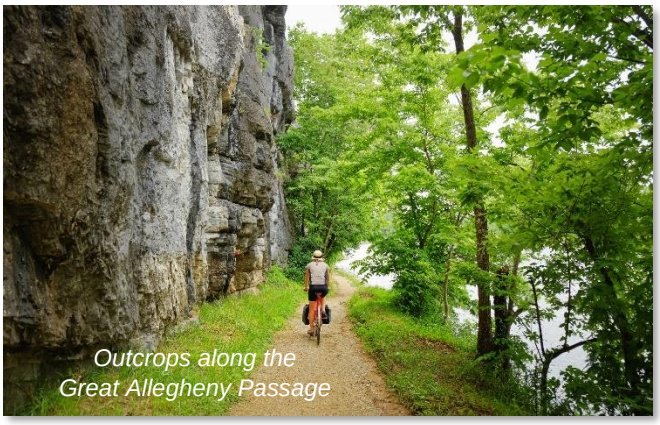
PGS 75th ANNIVERSARY FIELD TRIPS

In celebration of the founding of PGS in 1945, the PGS 75th Anniversary Committee is pleased to offer two or, possibly, three field trips during our anniversary year.

Landslide features north of Pittsburgh

The first field trip will take place on **Saturday, March 28, 2020** when Dr. James V. Hamel, long-time Honorary Member and consulting geologist and engineer, will lead us on a trek to examine landslides along I-79 north (or northwest) of Pittsburgh between the Ohio River/Glenfield Borough area and the Mt. Nebo exit. Jim spoke of his history with these landslides at the January 2020 meeting held jointly with the ASCE Geo-Institute and AEG. In addition to the I-79 slides, we will be investigating slides on the nearby Western Pennsylvania Conservancy property along Toms Run Road and discuss Kilbuck Township's infamous Walmart slide along PA Route 65. Early registration will open on the PGS website on February 15. The early bird price will be $40 ($20 for students) until March 14. If any spots remain open, the price will rise to $45 ($25 for students) until the final closing date of March 23, 2020. **This trip will be limited to 40 participants.**

On **Saturday, September 19**, **2020**, Albert Kollar will take us on a journey from the Carnegie Museum through Schenley and Frick Parks and the eastern Pittsburgh suburbs to the Braddock/East Pittsburgh area to discover the Geology, History, Energy and Industry that made Pittsburgh great. More information about this trip will be provided in future newsletters and on the PGS website.

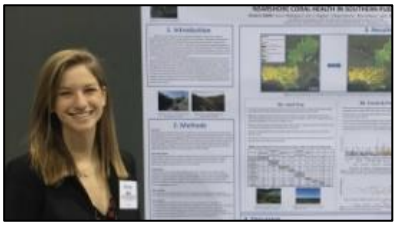


Outcrops along the Great Allegheny Passage

A possible third field trip to examine the geology and history of the Great Allegheny Passage rail trail south of Pittsburgh is being considered for some time during the summer months. Stay tuned to the PGS newsletters, email announcements and the website for more information concerning this trip.

PGS – AEG – ASCE STUDENT NIGHT

April 15, 2020



University students, please consider presenting the results of your college research projects at the **18th 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 20, 2020 by 5:30 PM. Acceptance decisions will be announced in early April.

Pittsburgh Geological Society
Spring 2020 Student Field Workshop

SPECIAL 2 DAY EVENT

April 3 and 4, 2020
California University of Pennsylvania

Have you wondered what you might be doing on that first job? Chances are you'll be assigned to a project that involves taking samples with a drill rig.

In this field workshop, you will have the opportunity to work alongside an experienced drilling contractor and field-wise professionals currently working in the industry.

Not only is this an excellent learning opportunity, it is your chance to ask all those questions regarding life after college and brush up on your networking skills.

What will you experience?

- Soil sampling using a drill rig
- Basic sampling techniques
- Basic monitoring equipment
- Soil & Rock descriptions
- Well installation basics
- Designing a drilling program

As with all field work, this will be a *RAIN* or *SHINE* event. Please watch the weather forecast carefully and prepare yourself. The drilling process can be dusty, wet, and muddy, so leave the designer jeans and flip-flops behind. **You must be an active student, not a corporate trainee.**

- Friday Evening Dinner Program "Preparing for a Geoscience Career"

(A block of rooms has been reserved at a local hotel, less than a mile from the drill site)

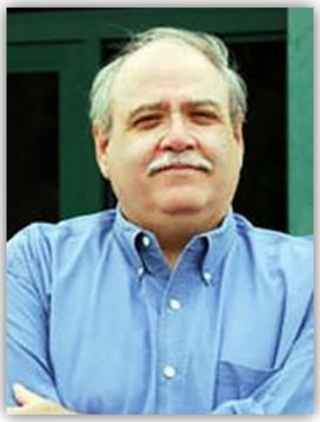
- Saturday Drilling and Sampling Field Workshop.

(A light Breakfast and Lunch will be provided)

Workshop Cost: $40.00 (Friday and Saturday) or $25 (Saturday only)

Registration instructions will be in our March newsletter and on the website.

The Pittsburgh Geological Society is proud to announce



The Frank Benacquista Undergraduate Scholarship

The PGS Frank Benacquista Undergraduate Scholarship is an award of $500 to an undergraduate 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. Submissions will be judged based on cover letter, recommendation letter, transcript, and the content and creativity of the essay as determined by the Scholarship Committee.

Eligibility Requirements and Acceptable Use of Funds

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 of application for the scholarship. Students may use the scholarship toward tuition fees, for field camp, to purchase equipment required for geologic course work or research (e.g., rock hammers, hand lens), to attend geologic conferences or field trips, such as a school-sponsored trip, a PGS field trip or the Field Conference of Pennsylvania Geologists.

Required Materials

- One-page resume
- Cover letter introducing yourself 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 in 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 elsewhere. 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

Your application may be printed and submitted by mail to: **Pittsburgh Geological Society**
Attn: Scholarship Committee
P.O. Box 58172 Pittsburgh, PA 15209

The application may also be sent in digital form (email with attachments) to tamra.schiappa@sru.edu. If submitted by email, please type "PGS Scholarship Application" and include your full name in the subject line. Include a professional message stating that you are submitting your application for the 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 **Friday, May 1, 2020**. The scholarship will be awarded at the first meeting of the Pittsburgh Geological Society in September.

LOCAL GEOLOGICAL EVENTS

ASCE GEO-INSTITUTE

February 13, 2020 **6:00 PM – 9:00 PM**

"A Perspective on Mechanically Stabilized Earth Walls – Pushing the Limits or Pulling Us Down?" by Robert Bachus, PhD, PE, DGE, Senior Principal Engineer at Geosyntec Consultants

Roland's Seafood Grill, Pittsburgh, PA

GEOPHYSICAL SOCIETY OF PITTSBURGH

February 18, 2020 **11:30 AM – 1:00 PM**

Luncheon meeting on "Distributed Acoustic Sensing Processing and Workflows" by Brian Fuller, Sterling Seismic & Reservoir Services

Cefalo's Banquet and Event Center, Carnegie, PA

ACS ENERGY TECHNOLOGY GROUP

February 20, 2020 **6:00 PM - 8:30 PM**

"Pennsylvania Regional Greenhouse Gas Initiative – Observations, Information, Insight & Questions" by Vince Brisini, Director of Environmental Affairs Olympus Power, LLC.

Lombardozzi's Restaurant, Pittsburgh PA

OHIO GEOLOGICAL SOCIETY

February 20, 2020 **11:30 AM – 1:30 PM**

Luncheon meeting on "The Potential for Underground Storage of Natural Gas Liquids in Salt-Solution Mined Caverns in the Appalachian Basin Area" by Mr. Tom Tomastik, ALL Consulting

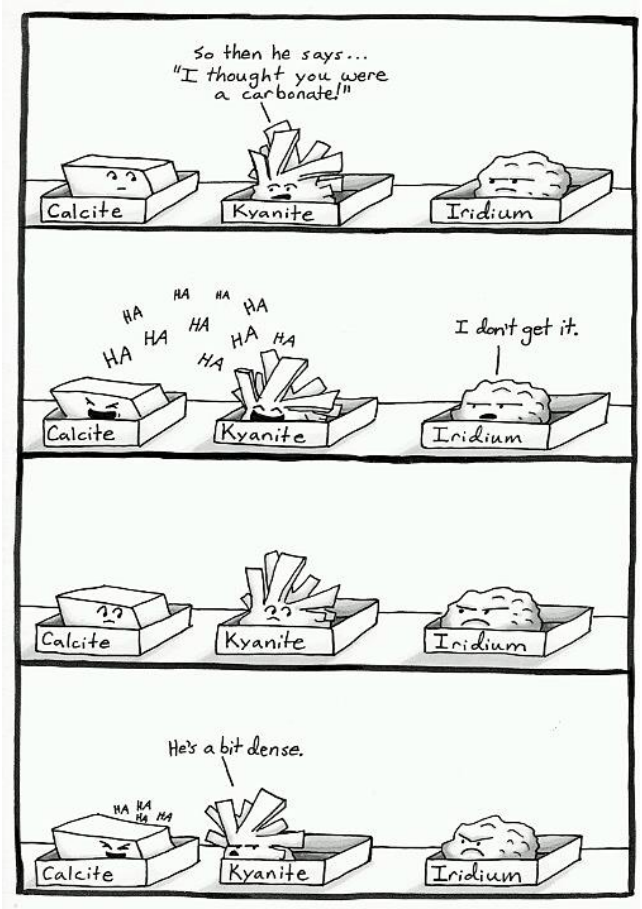
Hilton Doubletree Hotel, Columbus OH

SOCIETY OF PETROLEUM ENGINEERS

March 2, 2020 **11:00 AM – 1:00 PM**

"SPE Distinguished Lecture: "Reservoir Engineering While Drilling" in Horizontal Wells" by Shahid Azizul Haq, Schlumberger

Cefalo's Banquet and Event Center, Carnegie, PA

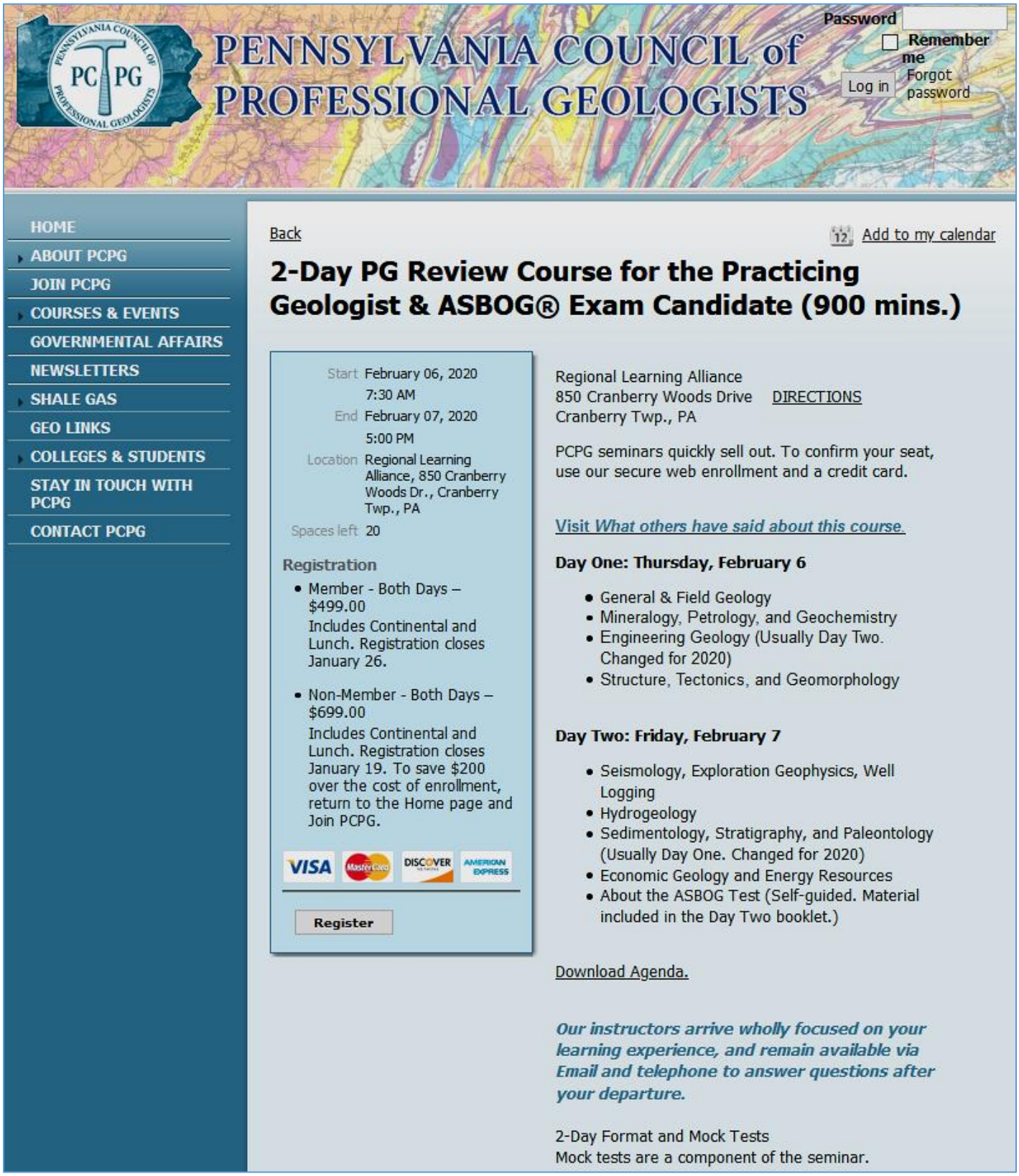


The Pittsburgh Geological Society Endowment Fund

Established May 8th, 2014 through the

COMMUNITY FOUNDATION

OTHER EVENTS OF INTEREST TO PGS MEMBERS



PENNSYLVANIA COUNCIL of PROFESSIONAL GEOLOGISTS

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Add to my calendar

2-Day PG Review Course for the Practicing Geologist & ASBOG® Exam Candidate (900 mins.)

Start February 06, 2020 7:30 AM
End February 07, 2020 5:00 PM
Location Regional Learning Alliance, 850 Cranberry Woods Dr., Cranberry Twp., PA
Spaces left 20

Registration

- Member - Both Days – $499.00
  Includes Continental and Lunch. Registration closes January 26.
- Non-Member - Both Days – $699.00
  Includes Continental and Lunch. Registration closes January 19. To save $200 over the cost of enrollment, return to the Home page and Join PCPG.

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Register

Regional Learning Alliance
850 Cranberry Woods Drive DIRECTIONS
Cranberry Twp., PA

PCPG seminars quickly sell out. To confirm your seat, use our secure web enrollment and a credit card.

Visit What others have said about this course

Day One: Thursday, February 6

- General & Field Geology
- Mineralogy, Petrology, and Geochemistry
- Engineering Geology (Usually Day Two. Changed for 2020)
- Structure, Tectonics, and Geomorphology

Day Two: Friday, February 7

- Seismology, Exploration Geophysics, Well Logging
- Hydrogeology
- Sedimentology, Stratigraphy, and Paleontology (Usually Day One. Changed for 2020)
- Economic Geology and Energy Resources
- About the ASBOG Test (Self-guided. Material included in the Day Two booklet.)

Download Agenda.

Our instructors arrive wholly focused on your learning experience, and remain available via Email and telephone to answer questions after your departure.

2-Day Format and Mock Tests
Mock tests are a component of the seminar.

OTHER EVENTS OF INTEREST TO PGS MEMBERS

THE PENNSYLVANIA

BROWNFIELDS CONFERENCE

MARCH 9-11, 2020

The Penn Stater Hotel and Conference Center

State College, PA

PENNSTATE

Call for Papers, Exhibit & Sponsor Reservations Opening Soon!

Planned in collaboration between;

the Pennsylvania Department of Environmental Protection (DEP) and the Engineers' Society of Western Pennsylvania (ESWP), the conference (which is held in different cities in PA), offers high-quality educational sessions on important brownfield topics! Additional benefits include:

- Earn PDH Credits for select sessions throughout the day and a half conference!
- Conference activities, such as Mobile Workshops and Walking Tours highlighting the best of PA brownfields developments;
- An Exhibit Hall of companies and organizations who can help ensure a successful brownfields project;
- Networking reception and special guest speakers;
- a Special Grant Writing Workshop sponsored by the U.S. Environmental Protection Agency; and much more!

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Felix Brunot, a doctor who was a foster brother of Revolutionary War General Lafayette, came over from France to establish a medical practice in downtown Pittsburgh. In the 1790s he built a home on an island in the Ohio River between what are now the communities of Esplen and McKees Rocks on the southwest side and the Marshall-Shadeland neighborhood on the northeast side of the river. He still lived there when Captain Meriwether Lewis launched his keelboat on Aug. 31, 1803 and stopped at Brunot island for well wishes from the family.

In 1811, a flood devastated the family estate, and they finally moved off the island in 1819. It became farmland until George Westinghouse purchased it for his Pittsburgh Railways Company. Eventually, a coal-fired electric generating station was built there, as well as a railroad bridge that crossed the island from one bank of the river to the other.

Brunot Island sits in the middle of the Ohio River about 1.5 miles downstream (northwest) from the Point. It has been the site of electric generation stations since the early 1900s, but much of the island is returning to nature.

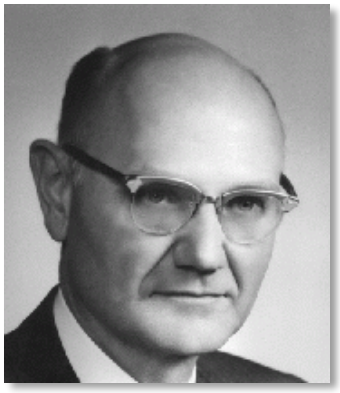
Duquesne Light took over management of the generating station in the early 1900s and, in 1903, a group of businessman who wanted a place to have fun, built a mile-long oval dirt track on the island, which was used for horse and automobile races – the horses and automobiles had to be ferried over, of course. Workers at the power station often used the railway bridge to get to the island. The racetrack closed in 1914 for lack of interest and Duquesne Light constructed a second power plant that supplied hundreds of thousands of kilowatts of electricity to the Pittsburgh. Today, the plant, which is now owned by GenOn, a Houston, TX, company, uses natural gas instead of coal. But that's not the only change. Brunot Island is returning to nature. Yes, old roads and loading docks are still present, but the northern and southern ends team with vegetation, deer, and blue herons

DID YOU KNOW . . . ?

Looking back 75 years ….

W. Bernard "Robby" Robinson received his BS degree in Electrical Engineering from the University of Nebraska in 1930 and went to work for Westinghouse Electric and Manufacturing Company in Pittsburgh. He left there in 1933 to do seismographic interpretations for Gulf Research and Development Company in the Midcontinent and then in Venezuela. He returned to Gulf Laboratories in Harmarville in 1938 to do seismic interpretation and supervision.

While there, he helped found the Pittsburgh Geological Society and served as its first Secretary in 1945-1946. He also served a term in each of the other three officer positions – Treasurer in 1946-1947, Vice President in 1948-1949, and President in 1951-1952.



W. Bernard Robinson in 1970 when he served as President of the Society of Exploration Geophysicists (SEG).

In 1952, Robinson moved to Tulsa, OK, then to Oklahoma City in 1955, where he was a geophysical supervisor for

Gulf. He was active in both the local and national Society of Exploration Geophysicists (SEG), serving as President and District Representative of the local section. He was later named Honorary Lifetime Member of SEG and served as general chairman for the 37th Annual International SEG meeting held in Oklahoma City in 1967. He served as First Vice President of SEG during the 1968-1969 term, and then was elected President of the society in 1970. He also taught courses in geophysics at the University of Oklahoma during the 1970s. In 1980, at its 50th anniversary, SEG featured a special four-part multimedia chronicle of the history of the society and the industry that Robinson helped narrate. In addition to SEG, Robinson was also a member of the Oklahoma City Geophysical Society, the Oklahoma City Geological Society, and AAPG.

A team of researchers from Canada, Australia, China, and the US recently found the first direct evidence that glacial meltwater was crucial in providing a lifeline to eukaryotes during the Precambrian “Snowball Earth”, the time about 700 ma when the Earth experienced the most severe ice age of its history. “Snowball Earth” threatened the survival of much of the planet's life because ice should have prevented the oceans from being able to supply oxygen. Previous research had suggested that oxygen-dependent life may have been restricted to meltwater puddles on the surface of the ice.

The new study provides new evidence of oxygenated marine environments. The researchers studied iron-rich rocks deposited by glaciers in Australia, Namibia, and California to get understand the environmental conditions during the ice age. Using geological maps and clues from locals, they navigated challenging trails to get to important rock formations. Then, they examined the chemistry of the iron formations in these rocks, which enabled them to estimate the amount of oxygen in the oceans around 700 ma and better understand the effects this would have had on all oxygen-dependent marine life.

This evidence suggested that, although much of the oceans during “Snowball Earth” would have been uninhabitable because of the lack of oxygen, in places where the grounded ice sheet began to float there was a critical supply of oxygenated meltwater, which can be explained by what the researchers call a 'glacial oxygen pump'. Air bubbles trapped in the glacial ice were released into the water as it melted, enriching the water with oxygen. Since the global freeze occurred before the evolution of complex animals, the researchers believe there is a link between “Snowball Earth” and animal evolution. The harsh conditions could have stimulated the diversification of simple forms into more complex forms.

Glacial meltwater probably provided a crucial lifeline to eukaryotes during Snowball Earth.

While the study’s findings focused on the availability of oxygen, primitive eukaryotes would also have needed food to survive the harsh conditions of the ice age. Thus, further research is needed to explore how these environments might have sustained a food web, and a starting point could be modern ice environments that host complex ecosystems today. The researchers also suggest that, besides solving the mystery of how early animals may have survived global glaciation, it also helps explains why extensive iron deposits in the geological record returned after an absence of over a billion years.

https://www.sciencedaily.com/releases/2019/12/191202190423.htm

And speaking of Precambrian life and iron formations, new research is uncovering the vital role that Precambrian microbes might have played in two of the early Earth's biggest mysteries. Scientists from Canada, Germany, Spain, and the US found that the ancestors of modern bacteria cultured from an iron-rich lake in Africa might have been a key factor both in keeping Earth's early

climate warm and in forming the world's largest iron-ore deposits billions of years ago.

Lake Kivu, one of Africa's Great Lakes and part of the East African Rift, lies on the border separating Rwanda from the Democratic Republic of Congo.

These bacteria have special chemical and physical features that, in the complete absence of oxygen, allow them to convert energy from sunlight into iron minerals as well as into cellular biomass. Using modern geomicrobiological techniques, the researchers found that certain bacteria expel iron minerals to the bottom of the lake, then become food for other microbes that make methane. The researchers speculate that, during the Precambrian, the produced methane probably kept Earth's early atmosphere warm, even though the sun was not nearly as bright as it is today.

This, then, possibly explains Carl Sagan's "faint-young-sun" paradox, which states that there were liquid oceans on early Earth, but that heat budgets calculated from the early Sun's luminosity and modern atmospheric chemistry imply Earth should have been entirely frozen. A frozen Earth would not have supported very much life. So a methane-rich atmosphere formed in connection to large-scale iron ore deposits and life was initially proposed by an atmospheric scientist named James Walker in 1987. The new study provides strong physical evidence to support the Walker's hypothesis and finds that microscale bacterial-mineral interactions were likely responsible. The fundamental knowledge scientists are gaining from studies using modern geomicrobiological tools and techniques is transforming our view of Earth's early history and the processes that led to a planet habitable by complex life, including, eventually, humans. Knowledge of the chemical and physical processes that occur when bacteria interact with their surroundings is also helpful in developing and designing new processes for resource recovery, new building and construction materials, and new approaches to treating disease. The scientists further suggest that, in the future, such geomicrobiological information will likely be used for large-scale geoengineering efforts that might be used to remove CO_2 from the atmosphere for carbon capture and storage as well as to influence climate through bacterial mineral interactions.

https://www.sciencedaily.com/releases/2019/12/191202102059.htm

University of South Florida (USF) geoscientists have developed and tested a new shallow water buoy capable of detecting small movements and changes in the Earth's seafloor, the kind that often occur prior to deadly natural hazards such as earthquakes, volcanic eruptions, and tsunamis. The tragic earthquake/tsunami sequences in Sumatra in 2004 and Japan in 2011 produced, respectively, the most fatalities and the largest financial losses from a natural disaster in recent history. They acted as wake-up calls that the scientific community has not been very successful at forecasting such events.

The USF buoys will enable precise measurements of sea floor motion in the months and years prior to these events, and should provide improved forecasts, especially for the largest tsunamis. The buoy, installed off Egmont Key in the Gulf of Mexico, has been producing data on the three-dimensional motion of the sea floor. The system ultimately is expected to be able to detect small changes in the stress and strain of the Earth's crust. The equipment includes an anchored spar buoy topped by high precision GPS. A digital compass provides heading, pitch, and roll information that helps capture the crucial side-to-side motion of the Earth that can be diagnostic of major earthquakes-producing tsunamis.

Although there currently are several techniques for seafloor monitoring available, such technology typically works best in the deeper ocean where there is less noise interference. Shallow (less than a hundred feet deep) coastal waters are more

challenging but important for many applications, such as certain kinds of earthquakes. For example, offshore strain accumulation and release processes are critical for understanding megathrust earthquakes and tsunamis.

A team from the University of South Florida deploys a buoy off Egmont Key in the Gulf of Mexico that will measure sea floor motion prior to earthquakes and tsunamis.

The deployed buoy rests on the sea bottom anchored by a heavy concrete ballast. It has been able to withstand several storms, including Hurricane Michael, the category 5 storm that hit Florida and the Gulf of Mexico in 2018. The system is capable of detecting movements as small as one to two centimeters. The team also suggests that the technology has several potential applications in the offshore oil and gas industry as well as volcano monitoring in some places. The system is designed for subduction zone applications in the Pacific Ocean's "Ring of Fire" where offshore strain accumulation and release processes are currently poorly monitored.

One example of where the new system could be deployed is in the shallow coastal waters of earthquake-prone Central America. The Egmont Key test location sits in just 75 feet of water. Although Florida is not prone to earthquakes, the waters off Egmont Key proved an excellent test location for the system because it experiences strong tidal currents that tested the buoy's stability and orientation-correction system. The next step in the testing will be to deploy a similar system in deeper waters of the Gulf of Mexico off Florida's west coast.

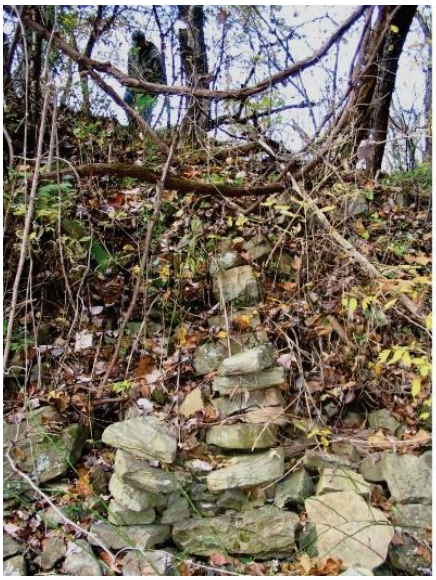
https://www.sciencedaily.com/releases/2019/11/191122113307.htm

Western Pennsylvania played a major role in the history of the American iron industry in the late 1700s and into the 1800s. Long before Pittsburgh became a major industrial center, local iron masters were mining ores extensively and using them in numerous charcoal-fired blast furnaces scattered throughout the area. Iron was a basic necessity in the early history of the United States. Horseshoes, nails, pots and pans, axes and other hand tools, plow shares, wagon wheel rims, and a host of other items were made of iron, and the constant need for additional items kept the iron makers busy around the clock.

Small stone-blast furnaces utilized abundant local raw materials. They used sandstone for masonry to build the furnace and associated infrastructure. Fireclays became refractory bricks that lined the interior of the furnaces. Local deposits of siderite, the most abundant ore, were mined and smelted to produce pig iron. Limestone acted as flux in the furnaces to remove impurities. Charcoal for fuel required the cutting of thousands of acres of timber, which basically denuded much of western Pennsylvania's forests. The final piece of the puzzle, water from local streams, powered the blast equipment and in some cases helped transport resources to the furnaces and/or moved the manufactured iron products to market. Eventually, coke from coal replaced charcoal as fuel (thereby saving the forests from total destruction), ores from the upper Great Lakes area supplanted the local lower-quality ores, and new technologies greatly improved the production of iron and steel.

The first iron furnace to go into production west of Allegheny Mountain was Union Furnace, located near Connellsville, Fayette County. Isaac Meason, arguably the most resourceful and forward-thinking iron master in southwestern Pennsylvania at the time, built the furnace on Dunbar Creek in 1789. It was a small furnace, probably capable of producing only about 1,500 pounds of pig iron per day, but it was financially successful because of the excellent quality of iron produced. Meason abandoned this furnace within three years and built a second, larger stack on the floodplain of Dunbar Creek. Iron ore for the furnaces came from a nearby outcrop. Union Furnace products included teakettles, fire grates,

Franklin stoves, andirons, wagon parts, mill parts, and clock weights. Recognized as one of the most successful furnaces in the region, Union Furnace also produced sugar kettles for Louisiana plantations. Meason would go on to play a pivotal part in the evolution of iron production in North America.



(Left) A few cut stone blocks on the hillside above Dunbar Creek indicate the location of the first Union Furnace, built in 1789. (Right) Scattered sandstone blocks on the south shore of Dunbar Creek indicate the location of the second Union Furnace, built around 1792.

In the Pittsburgh area, Thomas Anshutz, Anthony Beelen, and William Amberson built the first iron blast furnace, the Shadyside Furnace, in 1793. Although no one is certain of its exact location, it supposedly stood about where the old Shadyside Railroad Station stood, at the end of Amberson Avenue. Shadyside Furnace only operated for about one year because the local ore supply was insufficient, and ore imported from Armstrong County was too expensive. When the Pennsylvania Railroad was built through the area around 1860, the furnace was demolished to make way for the railroad station. As a result of the failure of this furnace, Pittsburgh became a center for secondary iron manufacturing – forges and rolling mills and such – that turned pig iron from furnaces in Fayette County and other western Pennsylvania areas into useable products. There is a historical marker on the southeast corner of Bayard Street and Amberson Avenue, next to the Winchester-Thurston school in Shadyside

Life in western Pennsylvania would have been hard without the abundance of local natural resources and the intrepid people who exploited them. Consider this – without those resources, an ordinary cast-iron skillet probably would have cost western Pennsylvanians a small fortune because it would have to have come from eastern Pennsylvania, some other state, or even from across the ocean. Without plentiful coal resources, western Pennsylvania would not have attracted the diverse ethnic populations that became our ancestors. Without abundant water, Pittsburgh would never have been the Steel Capital of the World. Thus, it is fortuitous that all of these materials, and the people who had the foresight to exploit them, are part of western Pennsylvania history.

https://www.pittsburghgeologicalsociety.org/uploads/pubs/2018_PGS_Fieldtrip_Guidebook_Fayette_Co_Iron.pdf

Mars once had salt lakes similar to those on Earth. The planet has gone through wet and dry periods, according to an international team of scientists who examined Mars' geological terrains from Gale Crater, an immense 95-mile-wide rocky basin being explored with the NASA Curiosity Rover since 2012. This crater formed about 3.6 ga when a bolide impacted Mars. Since that time, the crater's terrains have recorded the history of the Martian surface over time.

Studies have shown that Gale Crater reveals signs that liquid water, a key ingredient of microbial life as we know it, had been present during its history. During the drying periods, salt ponds formed. Although it is difficult to determine exactly how large these ponds were, the lake in Gale Crater was present for at least hundreds of years and perhaps for tens of thousands of years. Then Mars probably became dryer over time, and the planet lost its planetary magnetic field, which left the atmosphere exposed to solar wind and

radiation over millions of years. These helped strip the atmosphere and lessened the surface pressure, causing the liquid water to become unsustainable and evaporate.

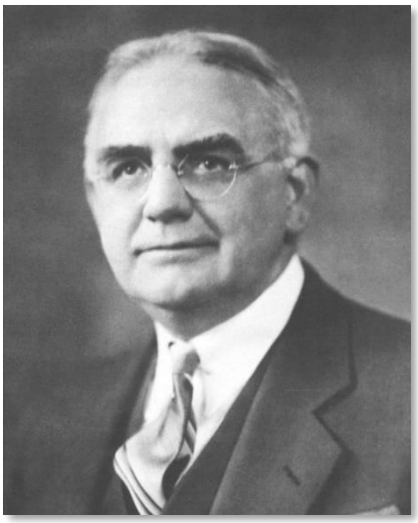
Salt flats like this one in Bolivia have been found on Mars, suggesting the past presence of liquid water and also wet/dry spells on the Red Planet.

The salt ponds on Mars are believed to be similar to some found in a region near the Bolivia-Peru border. This area is an arid, high-altitude plateau where rivers and streams from mountain ranges flow to closed basins, similar to what used to happen at Gale Crater. This creates lakes with water levels heavily influenced by climate. During arid periods, lakes become shallow due to evaporation, and some even dry up entirely. That area also is mostly vegetation free, making it look even more like Mars.

The Mars study showed that the ancient lake in Gale Crater underwent at least one episode of drying before recovering. It is also possible the lake consisted of separate ponds and that some of the ponds underwent more evaporation than others. So far, only one location along the rover's path showed such a drying history, but it might give clues about how many drying episodes the lake underwent before the climate became as dry as it is now. Mars's climate might have dried out over a long time in such a way that allowed for the cyclical presence of a lake. The results indicate a past Mars climate that fluctuated between wetter and drier periods. They also indicate what types of chemical elements were available in the water at the time (for example, sulfur), and show the type of environmental fluctuations Martian life would have had to cope with if it existed.

https://www.sciencedaily.com/releases/2019/10/191018181051.htm

Dr. Philip S. Smith, chief Alaskan geologist of the U. S. Geological Survey, was an AAPG Distinguished Lecturer who gave the fourth talk ever heard by a PGS audience, in February 1945. His topic was “Alaska’s Potential Oil Resources.” Philip Sidney Smith (1877-1949) was born in Medford, MA and attended the public schools of Boston, the Boston Latin School, and the Riverview Military Academy in Poughkeepsie, NY. He received a BA degree from Harvard in 1899 where he had attended a class in geology, which opened his mind to a new and previously unfamiliar subject. This study of earth forms and processes then became his primary interest.



Portrait of Dr. Philip S. Smith, Chief of the Alaskan Branch of the USGS and the fourth speaker to ever speak at a PGS meeting.

Upon graduation, he worked as a field geologist for the USGS in South Dakota. While working on his MA degree at Harvard, he served as an assistant and instructor in geology and physiography, teaching those subjects at both Harvard and Radcliffe. He received his MA in 1900 and his PhD in 1904. He left Harvard in 1906 and joined the Alaska Division of the USGS to gain a wider knowledge of rocks in their natural environments. He spent nine years doing active field work in Alaska, especially in unknown or little-known territories. That was the beginning of an outstanding career. By the end of his first stint in Alaska, Smith’s exceptional ability as an administrator had become evident. In 1915, the USGS appointed him Administrative Geologist, and in 1923, he became its Acting Director.

Smith returned to Alaska as Chief of the Alaskan Branch of the USGS in 1925, a position he held until he retired in 1946. During this 21-year

period, he was occupied primarily with administrative duties, but he also managed to prepare yearly reports on mineral production in Alaska, wrote special papers, carried out two difficult and hazardous expeditions undertaken by the Survey at the request of the Navy Department to investigate the petroleum resources on the Arctic slope of Alaska. Arguably the one report of most general interest to students of Alaskan geology was his "Areal Geology of Alaska," USGS Professional Paper 192, which was a compilation and analysis of all geologic investigations made by him and other members of the USGS up to the time of its publication in 1939.

Smith held membership in a multitude of national and local geologic, geographic, and other scientific or engineering societies, and was either a Fellow or Member of:

- American Association for the Advancement of Science
- American Geographical Society
- American Geophysical Union
- American Institute of Mining and Metallurgical Engineers
- American Polar Society
- Arctic Institute of North America
- Association of American Geographers
- Geological Society of America
- Geological Society of Washington
- National Geographic Society Science Committee
- National Council of American-Soviet Friendship
- Society of American Military Engineers
- Society of Economic Geologists
- Society of Professional Geographers
- Washington Academy of Sciences

Smith was also a founding member of the Arctic Institute of North America, a center for scientific interests in Arctic work in both Canada and the United States. He was elected one of the first American members of the Board of Governors and upon completion of his first three-year term of office in 1946, he was immediately re-elected to another three-year term, which he had almost completed at the time of his death. In 1949, he was elected Secretary of the Board of Governors. His accomplishments in the earth science, especially in Alaska, are notable and give him a secure place among those Alaskan geologists who did the pioneer work and laid the foundations for later workers to build on.

According to a new study, the discovery of gases released from deep beneath the Earth's crust could help explain South Africa's unusual landscape. The Highveld region is so elevated and flat, with unexpectedly hot rocks below the surface, that scientists have been puzzled for years. Now, geologists have found that CO_2-rich gases bubbling up through natural springs in the region originate from a hotspot.

Hotspots, of course, generate volcanic activity in Hawaii, Iceland, and Yellowstone National Park. In South Africa, the hotspot pushes the crust upwards, generating the distinctive landscape consisting mostly of tablelands more than a half mile above sea level. This also explains why rocks beneath the region are hotter than expected. The upside to that, of course, is that the heat could be harnessed to generate geothermal energy.

The KwaZulu-Natal area of South Africa.

A team led by scientists from Scotland analyzed the chemical make-up of gases from a deep crack in the Earth's crust located in KwaZulu-Natal, South Africa. They found that isotopes of helium and neon present in the gas match the composition of a rocky layer in the deep mantle 620 miles below Earth's surface. This is the first physical evidence that South Africa lies on top of a plume of abnormally hot mantle, which until now had been only hypothesized using computer modelling of seismic data.

https://www.sciencedaily.com/releases/2019/11/191119105528.htm

PGS WEBSITE OF THE MONTH

http://www.earthscienceeducation.org/

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Fun Fact Having Nothing To Do With Geology

The month of February is named for an early Roman purification ritual called Februa. It was a sort of ancient spring-cleaning festival.

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