PITTSBURGH GEOLOGICAL SOCIETY

Celebrating 75 Years

March 18, 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

Cenozoic Magmatism: A Key to the Dramatic Landscapes of the Colorado Plateau

Canyonlands, Utah. Photo Credit: Luke Parsons

Dr. Kendra Murray

Assistant Professor
Idaho State University

Registration Deadline: Wednesday, March 11

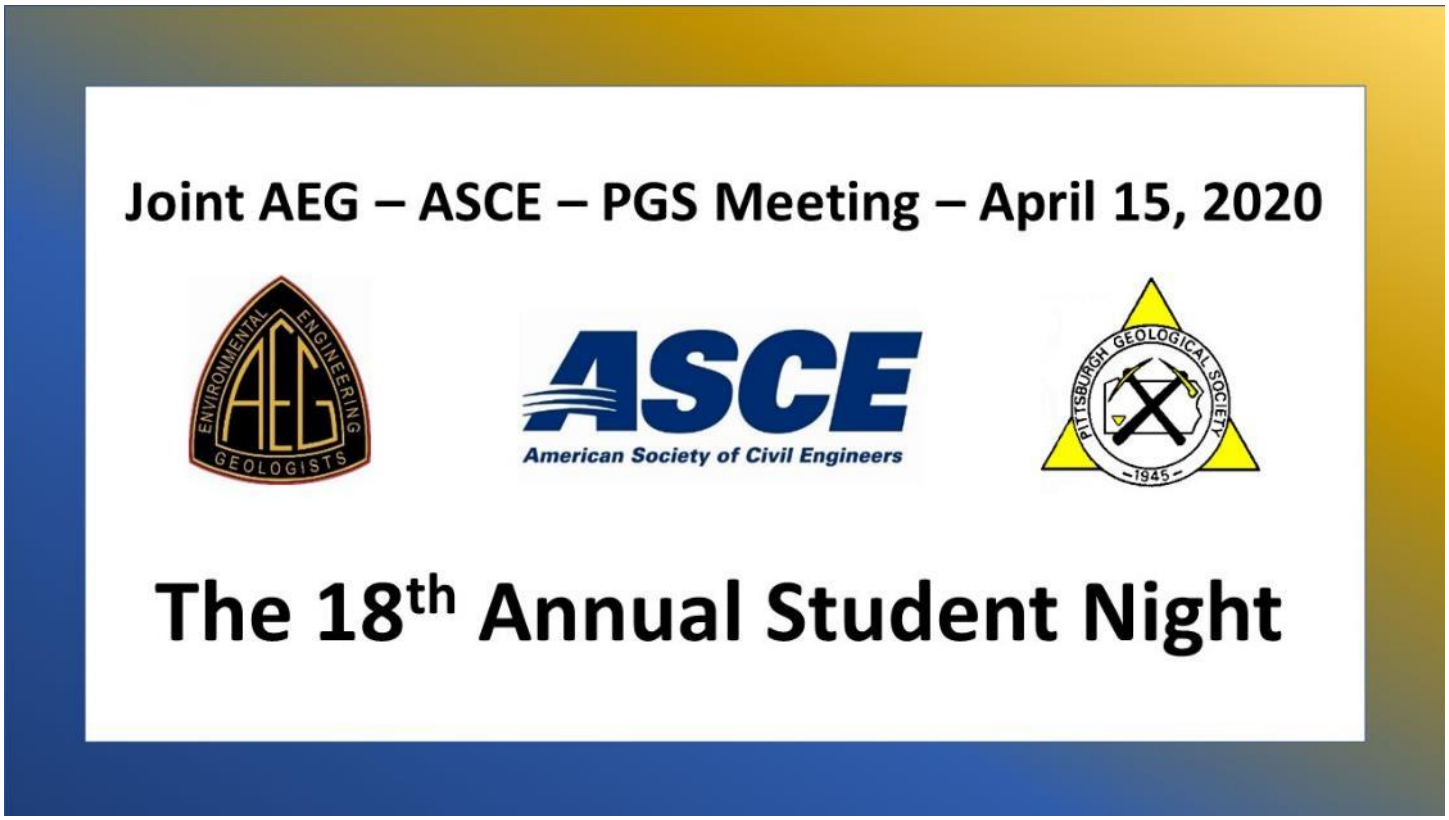
Speaker Abstract

Deciphering the geodynamic history of eroded landscapes like the Colorado Plateau (southwestern USA) is challenging because erosion destroys the rock record. Even with excellent exposures of distinctive Paleozoic and Mesozoic strata, which offered late 19th century geologists a guide to the total amount of rock removed from the Plateau by Cenozoic erosion, it was not until the development of low-temperature thermochronology a century later that it became possible to infer the spatial and temporal scales of erosion itself—using rock cooling as a proxy for rock exhumation via erosion. Apatite thermochronology is, in principle, uniquely suited to document the Cenozoic erosion of the Colorado Plateau and settle generations of debate regarding the region's history of uplift, erosion, and fluvial incision, including the formation of world-famous features like the Grand Canyon. However, the protracted near-surface history of the Colorado Plateau bedrock complicates the temperature sensitivity of apatite thermo-chronometers. This has confounded efforts to see clear evidence of late Cenozoic erosion, especially in the central Colorado Plateau, where this problem is compounded by the diverse detrital apatite grains in the region's sedimentary bedrock. We overcome this problem in the thermal aureole of the Oligocene (ca. 28-25 Ma) Henry Mountains intrusive complex in SE Utah, where these sandstones were heating during magmatism and therefore have apatite (U-Th-Sm)/He ages that clearly resolve a distinctive late Cenozoic history. Thermal history modeling results strongly suggest that the central Colorado Plateau was a stable Miocene landscape that was rapidly exhumed ~1.5–2 km during the past 5 m.y., likely in the past 3–2 m.y. This demonstrates that substantial late Cenozoic erosion of the north-central Plateau interior postdates the ca. 5.6 Ma integration of the Colorado River that lowered regional base level.

Speaker Biography

Kendra Murray is a geologist who uses geochemistry, along with fieldwork and numerical modeling, to study the deep-time evolution of mountain belts and landscapes. During the last decade, she has evolved from an igneous petrologist interested in lithosphere-scale tectonics to a thermochronologist who investigates the many magmatic, geomorphic, and tectonic processes that change rock temperatures—from wildfire to the eruption of large igneous provinces. She has worked in Nova Scotia, Tierra del Fuego, the Antarctica Peninsula, Nepal, the central Andes of Chile and Argentina, and across the western United States. Much of her active work is focused on the geodynamic evolution of Colorado Plateau and Rocky Mountains from Proterozoic to Recent time. She also has an ongoing interest in active learning in geology classrooms. Kendra graduated from Carleton College and has a M.S. and Ph.D. in Geosciences from the University of Arizona. Prior to joining the faculty at Idaho State University in 2019, Kendra was Postdoctoral Research Fellow at the University of Michigan–Ann Arbor and a Visiting Assistant Professor at Hamilton College in Clinton, NY.

NEXT MONTH'S PGS MEETING



OTHER UPCOMING PGS EVENTS

Date	*Event*	*Speaker / Organizer*
March 28, 2020	75th Anniversary Field Trip 1 Landslides in the Pittsburgh Region	James Hamel, PhD PG PE
April 3-4, 2020	PGS 2-Day Student Field Workshop	Kyle Fredrick, CalU
May 13, 2020	PGS Monthly Dinner Meeting: Energy Geology Topic	Randy Blood, DRB Geological Consulting
Sept 19, 2020	75th Anniversary Field Trip 2 – Geology, Energy, And Industry That Made Pittsburgh Great	Albert Kollar, Carnegie Museum of Pittsburgh

PRESIDENT'S STATEMENT

Teaching scientific writing is often challenging. For students never exposed to technical writing, it can be overwhelming, difficult and time- consuming. Writing scientifically requires that one learn a certain style or method of scientific communication. The formats and techniques can vary depending on the journal in which you seek to publish your results or the audience for whom you are writing. Regardless of the various technicalities, there are still certain guidelines that science writers must follow. One is to write clearly, concisely and to eliminate any unnecessary words or what I refer to as "fluff."

Students often ask me why the scientific writing style is important to learn. The simple answer is that it is the best way to clearly communicate the results and significance of one's research, while keeping in mind that readers may have differing levels of knowledge on your topic. Readers of your report have the potential to make important decisions based on their understanding of it. Knowing this can make scientific writing even more overwhelming, especially if the comprehension of the topic is still being developed. Having to express your grasp of a discipline that you may not fully understand yourself can be very difficult for new geologists in training.

I constantly edit my students' writing to show them proper scientific writing style. But I often question if it really hurts to break the rules sometimes. What about giving them the opportunity to write creatively every so often to express their comprehension of the content. There is value in expressing one's knowledge in a variety of ways. One way I incorporate creative writing in my classes is to ask the students to write poetry. Haikus are a great way to get the students to record their observations about a landscape or geological feature they are investigating. Another creative outlet is Syntu poems, which I asked my paleontology class to write last week. Syntu is a five-line poem written about a natural feature of the Earth. The emphasis is on the five senses and the writer must follow 5 simple rules.

- Line 1: a noun, what you are writing about
- Line 2: an observation about line 1 using one of the five senses
- Line 3: a thought or feeling about line 1
- Line 4: another observation about line 1, using a different sense than used in line 2
- Line 5: a noun, different from line 1 with the same meaning

For example, here is one from my paleo class. Check out all the other Syntu poems on page 5.

Fumarole
Hot steamy hole
The Earth's breath
Smells like sulfur
Opening

-- Lexi Chambers, 2020

Students like to have opportunities to write without following strict scientific rules. Here is what some students have to say. "Creative writing in science allows writers to express feelings and opinions regarding a topic" (Pounds, 2020). "To write scientifically is to understand our world, but to write creatively about science is to understand we are part of it" (Chambers, 2020). "Creativity in writing expresses passion" (Byers, 2020). "Writing creatively in the sciences is a good way to make science more human, more relatable to more people" (Luczak, 2020).

Ultimately, as scientists it is important to record and report the results from our work. But occasionally it is fun to just write.

I would like to remind students to review the deadlines for registering for the drilling workshop, abstract submission for student night, and applying for the PGS Frank Benacquista Scholarship.

Thanks to our corporate sponsors and professional members for all the support that keep the society strong and moving forward.

See you at the meeting.

Tamra

GEOLOGIC SYNTU POEMS FROM SLIPPERY ROCK STUDENT GEOLOGISTS

Unconformity
Visually missing strata
Gap in time
Fossils hold key
Erosion
(Marissa Wiggins)

Earth
Green and Blue
One for all
Land and sea
Home
(Ellis Peet)

Quartz
Silicon-dioxide tetrahedral
Hard, dense, cold
Smoky, amethyst, clear
Crystal
(Marissa Schmitt)

Ocean
Vast glistening water
Powerful limitless boundaries
Warm salty breezes
Sea
(Kaitlynn Bittler)

Volcano
Big and explosive
Dangerous and unforgiving
Loud and rumbling
Mountain
(Matt Fisher)

Caldera
Relic of supervolcano
Preserves historical eruption
Thundering, deafening explosion
Depression
(Concetta Pounds)

Outcrop
Coarse sand texture
We see histories
Fossiliferous above sand
Knowledge
(Madeline Marshall)

Forest
Quiet rustling wind
Tranquil peace mindfulness
Decay wetness soil
Trees
(Tiffany Wolf)

Cavern
Deep and dark
Lonely, isolated, peaceful
Cold, cramped, rock
Opening
(Eric Luczak)

Ripple
Lines of symmetry
Delicate and beautiful
Created by waves
Energy
(Carly Leventhal)

Beach
Gritty, warm, flowing
Refreshing, moving, inspiring
Crashing, wind, birds
Life
(Cory Olix)

Sand
Soft and warm
Peaceful easy feeling
Small granular minerals
Sediment
(Matt Rechenberg)

Waterfall
Cascading, roaring waters
Tranquility and strength
Cold, light mist
Water
(Emilee Lucas)

River
Cold flowing water
Meandering yet restrained
Trickling now rushing
Flood
(Colton Byers)

Lake
Tranquil, precipitation, quiet
Soothing, relaxing, peaceful
Smell early dawn
Life
(Nicole Gloeckner)

Cave
Dark, moist, cavity
Place to hide
Shelter for many
Cavern
(James Cochran)

Esker
Snakes on land
Earth needs glaciers
Smell of ice
Power
(Michael Behe)

Forest
Bright green shades
Bold and free
Creaking and rustling
Woods
(Casey Marchand)

Meandering
Cool laminar flow
Tranquility and grace
Lapping of ripples
River
(Autumn Moehler)

Desert
Dry and hot
Vast landscape alone
Silent, empty, quiet
Barren
(Erin Mallen)

IN MEMORIAM

Dr. Alfred Curtis Ackenheil

Oct 8, 1917 - Jan 29, 2020

Dr. Alfred Curtis Ackenheil, age 102, formerly of Mt. Lebanon, passed away peacefully at Friendship Village of the South Hills Health Center on January 29, 2020. He was a consulting civil engineer for 65 years and formed several geotechnical consulting firms including Ackenheil Engineers, Inc., which is now owned and operated by his daughter Susan.

Doc Ackenheil was a Professor of Civil Engineering at the University of Pittsburgh for 42 years. There he taught more than 4000 students in a wide variety of undergraduate and graduate courses including engineering geology.

He earned his BS in Civil Engineering and Structures from the University of Pittsburgh in 1939. In 1940, he received his Master's in Civil Engineering, emphasizing soil mechanics, from Harvard University, and in 1954 he earned his Ph.D. in Geology from the University of Pittsburgh in 1954. His dissertation "A Soil Mechanics and Engineering Geology Analysis of Landslides in the Area of Pittsburgh, Pennsylvania" is still a valuable reference on landslides and landslide history in the Pittsburgh area. Topics covered include:

- Tabulation of data on 97 landslides from 1920 to 1954 (96 from 1936 to 1954), with many photographs
- Detailed Case Histories for 8 of these landslides
- Discussion of landslide types, processes, causes, methods of analysis, remedial measures, legal aspects

In 2015, a video honoring Dr. Ackenheil as a GeoPioneer was uploaded to YouTube by Bob DiGoia. It is a wonderful summary of his career and impact on Pittsburgh, and can be viewed here: https://www.youtube.com/watch?v=49wiPT0nozg

The PGS newsletter editor thanks Dr. James Hamel for his assistance in preparing this remembrance.

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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. A detailed itinerary of this field trip along with photos of the planned stops can be found on the following page.

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 75th ANNIVERSITY FALL FIELD TRIP PITTSBURGH EAST

GEOLOGY, HISTORY, ENERGY, AND INDUSTRY THAT MADE PITTSBURGH GREAT

19 September 2020 8 AM – 4:45 PM

Leader Albert D. Kollar

Stop 1: Carnegie Museum Parking Lot: Carnegie Museum, University of Pittsburgh, Carnegie Mellon University, Geology of Oakland, John Kane Landscape Painting - Cultural and Education Center of Pittsburgh.

Stop 2: Schenley Park: George Westinghouse Memorial - Industry.

Stop 3: Calvary Cemetery: Appalachian Plateau Geology, Monongahela River Valley, John Kane Landscape Painting – Geology and Industry.

Stop 3a: Squirrel Hill: "Summerset at Frick Park" Slag Dump - Industry.

Stop 4: Frick Park: Pre-Pleistocene Geology, Landslides, Fern Hollow Trail, Conemaugh Group Geology, Nine Mile Run Gas Belt – Geology - Energy.

Stop 5: Lunch. Frick Park Environmental Center. Modern restrooms.

Stop 6: North Braddock: Braddock's Battlefield History Center - French and Indian War History c. 1755, George Washington Monument - History.

Stop 6a: Braddock: Braddock Carnegie Library open in 1889 was Andrew Carnegie's first library in U.S. The library expanded in 1893 - Architecture.

Stop 7: Braddock: Edgar Thomson Plant, first Carnegie Steel 1875 – Industry.

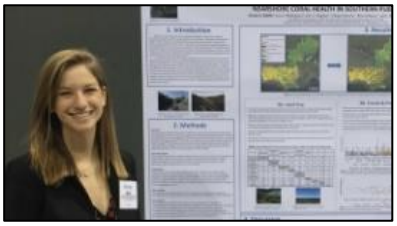
Stop 8: East Pittsburgh, PA: George Westinghouse Memorial Bridge built 1932, John Kane's Turtle Creek Valley No. 1 circa 1930, and George Westinghouse Electric Company East Pittsburgh Plant open 1886 – Industry and transportation.

Stop 9: East Pittsburgh, PA: 2018 Landslide of Rte. 30 – Geohazard.

End of field trip return to Carnegie Museum.

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

April 3 and 4, 2020
California University of Pennsylvania

The Pittsburgh Geological Society is pleased to announce our 16th annual student field workshop.

This event is a hands-on, practical demonstration of the tasks, knowledge, and skills of a typical early-career field geologist. Participating students will learn how environmental and geotechnical drilling is done and understand how to prepare for a career in geology and environmental sciences.

WORKSHOP SCHEDULE

Friday, April 3 (4 PM - 9 PM): How to Prepare for your Geoscience Career and Your First day On the Job (Dinner Provided)

Thanks to donations from Wally and Susan Scott Phillips in memory of George O. Scott and from the PGS Galey Fund, a block of rooms has been reserved for students near the drilling site to reduce student travel time and costs for the field workshop. This hotel stay is included in 2-day pricing.

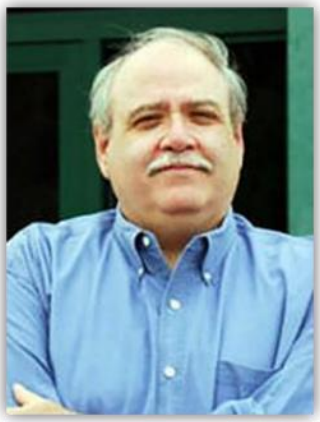
Saturday, April 4 (8 AM - 4 PM): Drilling and Sampling Field Workshop. A light breakfast (in addition to the hotel's complimentary breakfast) and lunch are provided.

REGISTRATION OPTIONS

- **$40.00 (Both days with meals and hotel stay provided.)**
- **$25.00 (One day only with meals, no hotel stay. Can choose either day.)**

To register and pay for the field workshop, please click on this link:
https://pittsburghgeologicalsociety.org/field-workshop.html

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

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

OHIO GEOLOGICAL SOCIETY

March 4, 2020 **10:00 AM – 4:00 PM**

Fundamentals of GeoSteering Workshop
Hilton Columbus at Easton, Columbus, OH

ASCE GEO-INSTITUTE

March 19, 2020 **6:00 PM – 9:00 PM**

"Application of Cast-in-Place Piles in Intermediate Geomaterials" by Willie M. NeSmith, P.E., former chief geotechnical engineer for Berkel & Company.

Hyatt House Pittsburgh / South Side, Pittsburgh, PA

ACS ENERGY TECHNOLOGY GROUP

March 19, 2020 **6:00 PM - 8:30 PM**

"Powering the Future: Pittsburgh International Airport Microgrid" by Jeffrey Nehr, Vice President of Business Development, Peoples Natural Gas.

Lombardozzi's Restaurant, Pittsburgh PA

GEOPHYSICAL SOCIETY OF PITTSBURGH

April 7, 2020 **11:30 AM – 1:00 PM**

Luncheon meeting on "MSEEL Update and Milestones" by Dr. Tim Carr, West Virginian University

Cefalo's Banquet and Event Center, Carnegie, PA

The Pittsburgh Geological Society welcomes four new professional members:

Stephen E. Perdziola, GIT
Staff Geologist
Geosytec Consultants

Jake M. Podrasky
Geologist I
Digioia Gray & Associates, LLC

Philip M. Ruggeri
Geologist
Wellsite Geology Consultants

Saher S. Uddin
Account Manager
CGG

We also welcome six new student members:

From Slippery Rock University

Lucas L. Eichner
Jeremy Eisele
Mackenzie D. Gerhart
Tyler M. Miller
Dylan G Szczurek

From California University of PA

Sara Gilmore

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Historic photo of the Swissvale Railroad Station.

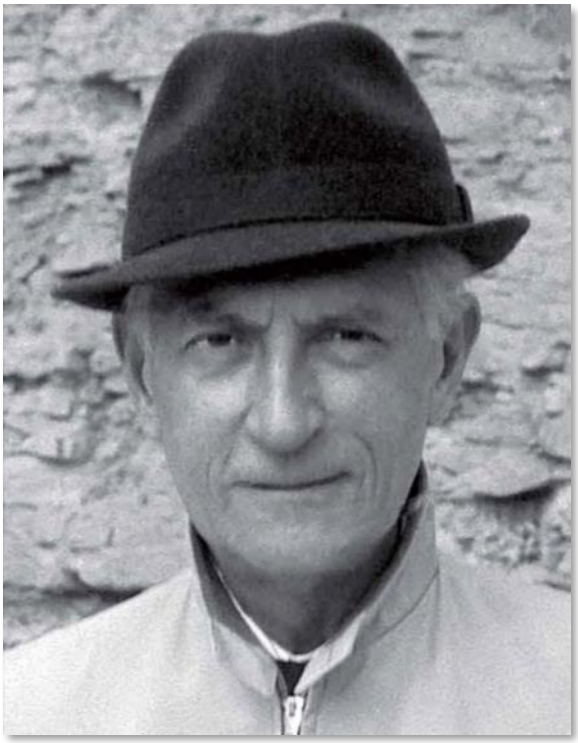
John Swisshelm (1752–1838) came from Germany and served under General George Washington in the Revolutionary War. He was a veteran of Valley Forge. Around 1800, he built a small log cabin in what is now Nine Mile Run Hollow. In 1808, he acquired a tract of land in Wilkins Township that included a grist mill located approximately where the Parkway East passes over South Braddock and West Swissvale Avenues. The site included an old block house and, in 1814, Swisshelm built a stone barn. His son James continued to live on the farm following his father's death. James married Jane Grey Cannon, a teacher, business owner, feminist, publisher of the Pittsburgh Saturday Visitor, an abolishionist newspaper, and an organizer of the Underground Railroad. Jane lived in the old log cabin, and the view of the Monongahela River valley below inspired her to name the area Swiss-vale, and this name came to be used for the nearby village which by then was teeming with families and businesses. When the Pennsylvania Railroad came through the area, the railroad named its station Swissvale. John Swisshelm's grist mill and barn had crumbled by 1892, and the Swisshelm housestead burned down in 1904. Swissvale was home to the Allegheny Car & Transportation Shops, which George Westinghouse later purchased and formed the Union Switch and Signal Company. Some of Swissvale's most famous citizens included Pirates shortstop Dick Groat, Frank Conrad, creator of KDKA Radio, and Vladimir K. Zworykin, one of the principal inventors of television.

DID YOU KNOW . . . ?

Looking back 75 years ….

Dr. W. C. Krumbein, senior geologist at the Beach Erosion Board of the U.S. Corps of Engineers, gave the fifth talk at a PGS meeting, in March 1945, entitled "Sedimentation and Its Relation to Oil Finding." He was another AAPG Distinguished Lecturer.

William Christian Krumbein (1902-1079), or "Bill" as he was known to his friends and colleagues, was born in Beaver Falls, PA, to German immigrants, but his family moved to Chicago when he was a young boy. He graduated from the Lane Technical High School in Chicago and then attended the University of Chicago where he earned his Ph.B. in business administration (Phi Beta Kappa) in 1926. While there, he was

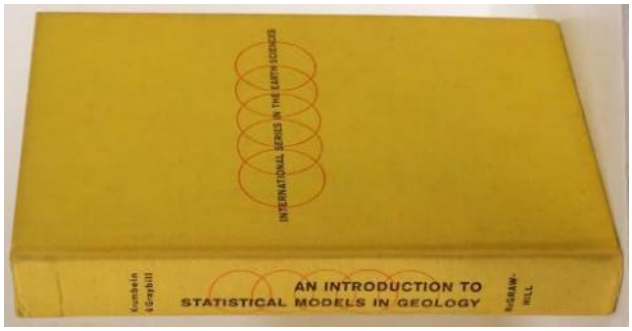


Dr. W. C. Krumbein, the famous sedimentologist and computer geologist who was born in Beaver Falls, PA, gave only the fifth talk at a PGS meeting.

influenced by Paul MacClintock who stimulated his interest in geology, and especially by Francis Pettijohn who piqued his interest in sedimentary geology with a potential for application of statistics. He went on to earn an MS in geology (1930), and a Ph.D. 1932), also at the University of Chicago, and while there he shared an office with M. King Hubbert who reinforced his belief that mathematics, physics, and chemistry were important for geological studies.

After obtaining his Ph.D., Bill joined the faculty at Chicago and advanced from instructor to associate professor. During World War II, he worked in beach-landing intelligence for the Beach Erosion Board. He worked at Gulf Research and Development for a year then moved to Northwestern University as a full professor in 1946 where, later, he was named William Deering Professor of Geological Sciences and retired in 1970 as a Distinguished Professor Emeritus. He also consulted for various petroleum companies, the Geography Branch of the Office of Naval Research, and the Engineering Research Center of the U.S. Army Corps of Engineers. After retiring, he moved to California for the climate and taught part-time at UCLA. In 1979, he received an honorary Doctor of Science from Syracuse University.

Krumbein was known as a masterful teacher who was devoted to his students. He used skill, patience, and humor to impart knowledge to both students and colleagues, and continually pursued innovative methods using mathematics to express the natural phenomena of geology. He developed specialties in the study of the physical properties of sediments, application of statistics to sedimentology, the dynamics of sedimentary processes, and regional sedimentary analysis. He is considered to be the father of computer geology, a pioneer in the application of quantitative methods, especially statistical techniques to sediments and sedimentary rocks, and an innovator of sediment analyses. His first published papers were on the mechanical analysis of fine-grained sediments. Over the next 56 years, he explored sampling, textures, size distribution, diagenesis, transport, properties, and classification of modern and ancient sediments. He extensively applied statistical techniques, including descriptive statistics, Latin square experiments, regression analysis, Markov chains, and probabilistic modeling, to geological problems. His analytical mind could cut through all the extraneous material directly to the problem. In the mid-1950s, he stopped using calculators and applied his statistical analyses to computers. He was one of the first to use geologically-oriented computer programs to reach the results of work published in a major geological journal. He carefully formulated and presented his ideas in 130+ publications, including five books. His coauthored the *Manual of Sedimentary Petrography* with Francis Pettijohn in 1938 and *Stratigraphy and Sedimentation* with L. L. Sloss in 1951 (revised in 1963), both of which became standard texts for several decades. But it was *An Introduction to Statistical Models* with Frank Graybill in 1965 that put him in the forefront of quantitative sedimentology.



Krumbein was a member or fellow of many organizations, including the following:

- Geological Society of America (Councilor, 1962-64; and Associate Editor of GSA Bulletin, 1963-74)
- American Academy of Arts and Sciences
- American Statistical Association
- SEPM (President, 1950)
- Society of Exploration Geophysics
- AAPG (editor and member of the Executive Committee, 1955–56)
- American Geophysical Union
- Illinois Academy of Science
- Sigma Xi (President of the Northwestern Chapter, 1962–63
- International Association for Mathematical Geology (IAMG) (Charter Member and first Past-President)

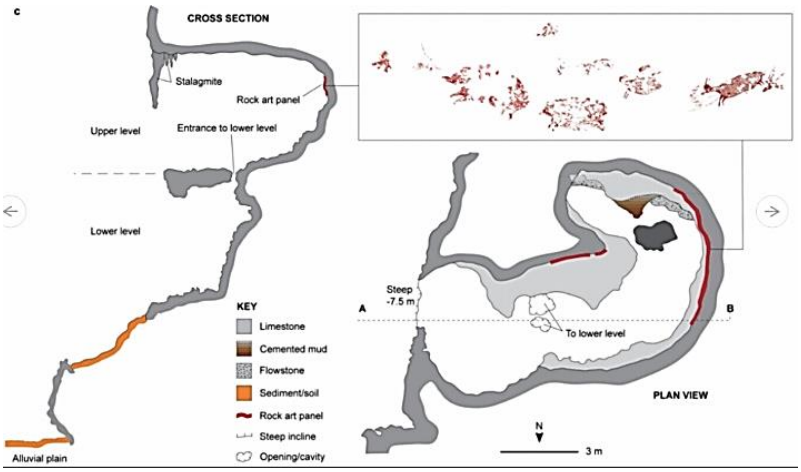
His honors and awards included:

- A commendation for Meritorious Civilian Service during WWII (1945)
- The prestigious Twenhofel Medel by SEPM (1977)
- A Guggenheim Fellowship
- Named a Fulbright Lecturer
- Named a President's Fellow at Northwestern University.
- The William Christian Krumbein Medal, the IAMG premier award, was named in his honor (1976).

A newly discovered painting in a remote cave on the Indonesian island of Sulawesi depicts a hunting scene that archaeologists say is the oldest story ever recorded (so far). It could also be the first record of spiritual belief. The painting stretches almost 15 feet across a rock wall about 10 feet above the floor of a hard-to-reach upper chamber of a site called Liang Bulu'Sipong 4. Sunlight shining through an opening in the northeast wall of the cave illuminates a scene depicting wild pigs and dwarf buffalo (called anoa) facing off against a group of strangely tiny hunters in monochrome dark red. A dark red hand stencil at the left end of the mural suggests an ancient artist's signature.

The mural seems to suggest a game drive, meaning that somebody created a firsthand record of how they made a living circa 44 ka. Some aspects of the mural, however, suggest something other than a real-world experience. Up close, the tiny hunters don't look quite human, with many of them having strangely elongated faces; one seems to have a tail, and another appears to have a beak. The figures could represent human hunters clad in skins or masks, but they look more like therianthropes – human-animal hybrids known from cultures around the world, including in 15.5 ka paintings in the Lascaux caves of France and a 40 ka carved figure from Germany.

The prey animals in the mural are of such monstrous or mythological proportions that it suggests a scene out of a legend rather than a record of another day's hunting. This means that Liang Bulu'Sipong 4 may have been a sacred place to the people who once lived in the area. Archaeologists found no trace of the stone tools, discarded bones, and cooking fires that are the typical debris of ancient human life. The fact that Liang Bulu'Sipong 4 is located in a cliff 65.5 feet above the valley floor indicates that you don't just walk in and have a party.



Maps showing the interior of Liang Bulu'Sipong 4 cavern and the location and layout of the 44 ka cave painting.

Liang Bulu'Sipong 4 is still being reshaped by flowing water with layers of calcium carbonate growing over the painting in places. The calcium carbonate includes small traces of uranium that has been decaying over time into thorium-230. Unlike the uranium, the thorium isn't water-soluble, so it can only get into the rock via decay. By measuring the ratio of uranium-234 to thorium-230 in the rock, archaeologists have found that the calcium carbonate is 43.9 ka, which means the painting itself is probably a lot older than that, making the Liang Bulu'Sipong 4 mural the oldest known record of an actual story.

Unfortunately, there's no way to know who the hunter figures were, or what they meant to the people of Sulawesi. The long-ago artist may have been memorializing the content of a spiritual leader's recent vision or a scene from a legend already well known to their people. The image may have conveyed something important about the connection between humans and animals or predator and prey, or it may have been an origin story or a dire warning. The painting might provide the oldest hint about spiritual beliefs, and it could contribute to the ongoing debate about how our species developed religion. It could have a lot to say about how and when hominins evolved the cognitive ability to think about myth and religion and about how human cultures developed shared beliefs about the supernatural.

In the meantime, archaeologists are racing against time and weather. At nearly every rock-art site in Sulawesi, they've noticed that the paint, which has held on for tens of thousands of years, is now flaking away.

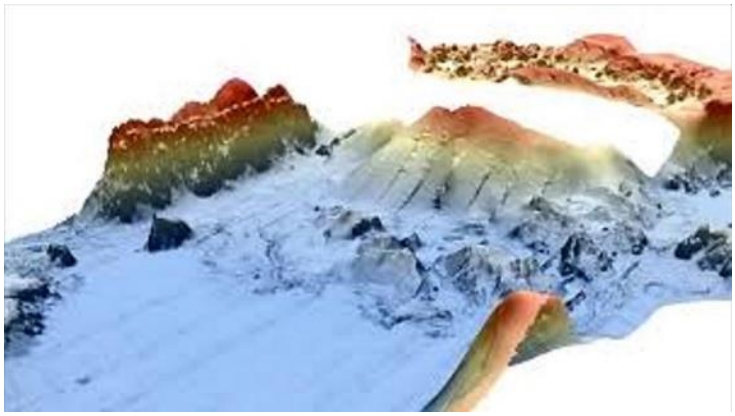
https://arstechnica.com/science/2019/12/a-43900-year-old-cave-painting-is-the-oldest-story-ever-recorded/

While we are speaking of Indonesia, a team of scientists has used sonar equipment to get pictures of giant chunks of rock that slid into the ocean when one side of Anak Krakatau collapsed during its eruption last year, an eruption that generated a devastating tsunami in Indonesia. Some of the blocks that fell into the ocean were 230 to 295 feet high. When they hit the water, they produced a tsunami that tore across the shorelines of Java and Sumatra just before Christmas, 2018.

More than 400 people around the Sunda Strait died in the nighttime disaster, and thousands more were injured and/or displaced. Trees up to 260 feet above normal sea level, on islands in the immediate vicinity of the volcano, were torn from their roots. Much of the wave energy took a path to the southwest away from the volcano in the direction of the collapse. This resulted in 33-feet-high waves laying waste to a corner of Ujung Kulon National Park on Panaitan Island over 30 miles from Anak Krakatau. Residents of the island were fortunate that the collapse directed the waves to the southwest because few people live in that direction.

Researchers tried to reconstruct exactly what occurred, but their studies to had been based originally on what can be seen above the water. Satellite imagery delivered the early data, but it provided only images of the subaerial parts of the volcano. The research team realized they needed to determine how much mass was missing from the volcano in order to get a full description of its epic failure, so they brought in a multibeam echosounder to map the bathymetry. It showed the ocean floor was over 650 feet deep. The sonar images showed coherent triangular-shaped blocks that, before the collapse, formed the southwestern flank of Anak Krakatau. The debris field runs out to 1.2 miles from the volcano. A seismic survey also conducted by the team showed that the material layered on top of older deposits.

This newer imaging allowed the team to revise its estimate for the volume of rock involved in the flank failure – it's smaller than previously thought. Previous calculations, based on above-water measurements of the remains of the once 1100-feet-high volcano, suggested it had lost 0.065 cubic miles; the revised assessment now pointed to 0.045 cubic miles sliding into the ocean. This revision required that the simulation of how the waves generated in the collapse moved across the Sunda Strait had to be re-run with the smaller number, even though the original numbers proved a good match for what had been observed at tide gauges.

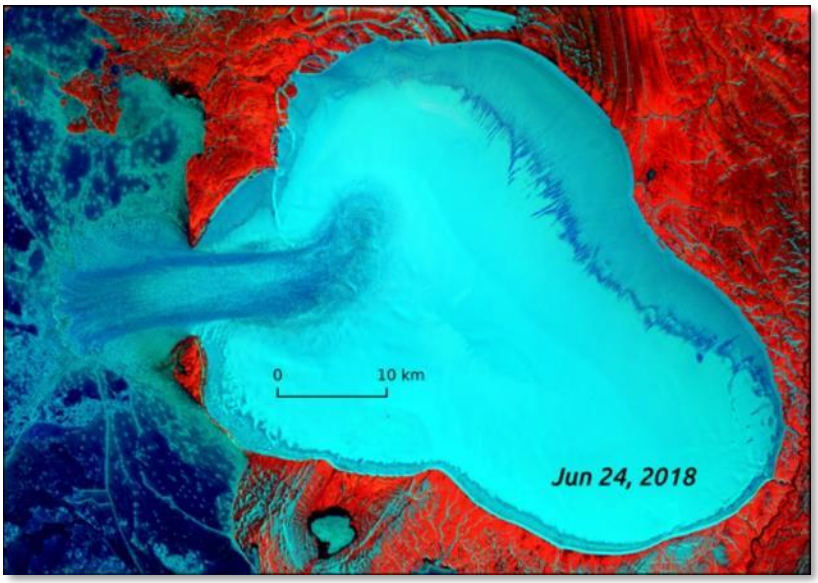


Scientists used a multibeam echosounder to generate a bathymetric map of the ocean floor on the southwest side of the Anak Krakatau volcano where a landslide generated the December 2018 tsunami in Indonesia.

But, as it turned out, the new numbers also worked because the team discovered that the angle of slope along the failure plane was shallower than earlier assumptions. The shallower slide occurred almost like a ski jump, maintaining the collapse material closer to the surface and making it more conducive to generating a tsunami than a steeper failure. Now, the lessons learned from Anak Krakatau are being used to assess the hazards at other volcanoes. There are about 40 other locations around the world where scientists consider flank collapse into surrounding water a danger.

https://www.bbc.com/news/science-environment-50798253

A team of glaciologists argue that they have discovered a fast-moving river of ice being born. Such ice streams are rapid, long-lasting flows of ice that form in the middle of static ice sheets. Only a few of them are known to occur on Earth and, until now, no one had ever seen one emerge. They form in remote parts of the Arctic and Antarctic and, once established, can last decades or even centuries.



This satellite image from June 24, 2018 shows how ice in the Vavilov Ice Cap flowed in a stream-like pattern toward the sea.

The team thinks a short-term event that began in 2013 at a site known as the Vavilov Ice Cap in the Russian Arctic may have sparked the emergence of a longer-lasting ice stream. The event, where a lot of ice comes loose and bursts out in a rush toward the ocean, is called a glacier surge; it is basically a frozen flood. Following the initial surge in 2013, the glacier continues to retain its fast flow at about 1.1 miles per year, an unusually high and long-lasting speed for a glacier surge.

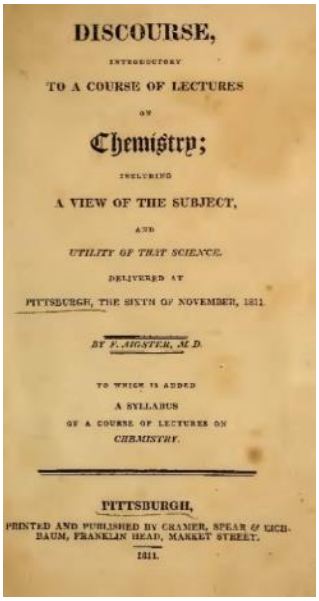
Until the team's research, glaciologists thought surges occurred as part of the normal grow/shrink cycles of ice caps that simply replenish themselves naturally and independent of the current global warming trend. Ice streams were thought to be separate and unrelated to surges. The recent event challenges that view, however, as well as the view that surges are not primarily driven by climate change. The initial ice surge has stretched into a years-long event that has permanently transformed the region. Because the area is a polar desert, very little new ice is added from year to year. About 10.5 billion tons (~11%) of the ice mass in the region has flowed into the ocean, and the average elevation of the ice cap has drop significantly. The ice from the surge, therefore, is not replenishing itself after events of this kind as glaciologists expect.

Satellite images seem to indicate that the entire west side of the ice cap is being discarded into the ocean. The most important evidence that the surge has turned into an ice stream is the emergence of "shear margins" around the stream. Like liquid water streams, ice streams have clearly-delineated paths across the landscape. In satellite images, the edges of the new ice stream are darker and less reflective, indicating the existence of a long-lasting region of fast-moving ice meeting the slower region around it.

The team believes no one has ever seen the formation of shear margins over the course of two to three years. They, and other researchers continue working to understand ice surges, how they relate to ice streams, and how climate change drives them. Still, the Vavilov surge is an important new data point to help piece that story together.

https://www.livescience.com/first-evidence-glacier-surges-become-ice-streams.html

Dr. Charles Frederick Aigster, M.D., was a physician and chemist who set up shop in downtown Pittsburgh in the vicinity of Market Square. He was a young German scientist with good credentials who had been hired to teach chemistry at Dickinson College, in Carlyle, PA, in 1810, but was soon discovered to be "insane" and dismissed at the cost of a year's salary. When he moved to Pittsburgh, he began lecturing on chemistry to anyone who wanted to know about the subject and, in 1811, published *Discourse, Introductory to a Course of Lectures on Chemistry; Including a View of the Subject, and Utility of That Science*.



DISCOURSE,

INTRODUCTORY

TO A COURSE OF LECTURES

ON

Chemistry;

INCLUDING

A VIEW OF THE SUBJECT,

AND

UTILITY OF THAT SCIENCE.

DELIVERED AT

PITTSBURGH, THE SIXTH OF NOVEMBER, 1811.

BY F. AIGSTER, M.D.

TO WHICH IS ADDED

A SYLLABUS

OF A COURSE OF LECTURES ON

CHEMISTRY.

PITTSBURGH,

PRINTED AND PUBLISHED BY CRAMER, SPEAR & EICHBAUM, FRANKLIN HEAD, MARKET STREET.

1811.

Title page of Frederick Aigster's Discourse on Chemistry, published in Pittsburgh in 1811, shortly after he arrived in the city and began lecturing on chemistry and mineralogy.

These lectures apparently helped lead to the formation of the Chemical and Physiological Society, organized in Pittsburgh in 1813. As a result of his lectures and his book, Aigster became well known in the city. He also was one of the founders of a company that manufactured sulphuric acid.

At some point in the early 1810s, Aigster described some of the rocks and minerals in the Pittsburgh area, supposedly in *Cramer's Magazine-Almanack*. Although the original write-up seems to have gotten lost, part of it was published in 1813 in *The Medical Repository of Original Essays and Intelligence Relative to Physic, Surgery, Chemistry, and Natural History*. *The Medical Repository*, founded in 1797, was the first American medical journal. Aigster's contribution toward a mineralogy of Pittsburgh was extracted from *Cramer's Magazine-Almanack*, described as "a very interesting and statistical work . . . as a flattering specimen of the progress of science and useful knowledge in a region, which not many years ago, was literally, a wilderness." A search of all of Cramer's almanacs for the years 1810 to 1813, however, has not turned up Aigster's article.

Here is the full text of what appeared in *The Medical Repository*, new series, v. 1, p. 211-212.

Earthy Substances.

Common Limestone is abundant in the neighbourhood of Pittsburgh. It lies generally below the coal-bed, from which it is separated by a stratum of indurated clay. Its colour is gray, and the lime burnt from it, retains generally the same colour. Chemical analysis shows this to be owing to the admixture of the black oxide of Manganese, which in some parts is so abundant, that when exposed to a strong fire, it runs with the lime into a brilliant black enamel. Limestone of a light blue colour is found near Saw-Mill Run.

Dark grey marble with black veins has been lately discovered in the vicinity of Pittsburgh, on the land of Col. O'Hara. It owes its colour most likely to a mixture of the oxides of Manganese and iron. It takes a very fine polish. The extent of the quarry has not yet been ascertained.

Pieces of limestone containing a variety of shells are frequently met with in the bed of Allegheny river.

Veins of calcareous spar are frequently found in the common limestone. Some of them are white, others are partially transparent crystals and colorless

Marls of various kinds are abundant in the neighbourhood of Pittsburgh.

Sulfate of lime, or *Plaster of Paris,* has been lately discovered on Cuyahoga river, state of Ohio. It is of a coarse earthy texture, intermixed with clay and silica. Beautiful transparent crystals of *Selenite* are inbedded in it. They are formed of six-sided prisms, terminated by four-sided summits. Two of the surfaces are considerably larger than the other four. These crystals are easily separable into thin laminae, in a direction parallel to the larger surfaces. Another variety of selenite found on the same spot, is formed like the barbed head of an arrow, two smaller crystals springing out laterally from the opposite sides of the larger crystal.

Steatites, or *Soap-stone* Hs been recently found at seven miles from Pittsburgh, near the Allegheny river. Its colour *is* greenish white. It contains, besides silica, magnesia and some little iron, a more than usually great proportion of alumina; and bids fair to become an important article for our manufactories.

Loosely fibrous and flexible amianthus occurs near Brownsville. Its fibres have the softness and lustre of silk. Its colour is white inclining to yellow. It is probable, that the incombustible cloths of the ancients were woven from a similar substance.

Clays of various descriptions are abundant in the vicinity of Pittsburgh. Still the discovery of a *fat clay, that* is to say, such a one that contains neither silica nor lime, which alone is proper to the construction of glasshouse crucibles, as being not acted on by alkalies, remains yet a desideratum. Several of the clays of this part of the country, contain a considerable quantity of magnesia.

Yellow and red ochres occur very frequently, but they are mostly too coarse to be used conveniently as a pigment.

(To be continued.)

Unfortunately, no additional information was provided in later volumes of *The Medical Repository*.

Many people who think we're heading for a collapse in global species diversity refer to the current situation as the "sixth mass extinction." Some scientists argue, however, that we should be calling it the "seventh mass extinction." Of the well-known current "Big Five" extinctions, the end-Permian, which occurred around 252 ma and eliminated 95% of marine species, was the greatest extinction event of all time.

But the end-Permian overshadowed an extinction event that happened at the end of the Guadalupian Epoch (Middle Permian) just 8 ma earlier. During the last 30 years, geologists have been studying the end-Guadalupian extinction and now suggest that this event was big enough to rank among the largest of the past apocalypses. They propose renaming the group of major extinction events the "Big Six."

Flood basalts exposed on Emeishan Mountain in Sichuan Province, China, point to the probable cause of the newest of the "Big Six" mass extinction events in Earth's history.

During geologic history, there have been many setbacks to life on Earth. By singling out and studying the largest ones, geologists hope to unearth patterns and search for common causes. Increasing evidence suggests that oxygen-depletion in the oceans, a symptom of greenhouse warming, was associated with many global extinctions, including the end-Guadalupian event. That mounting evidence has scientists worrying about the implications for present-day climate change effects. Although the end-Permian event came closer to wiping out all life, in germs of percentages, the end-Guadalupian was really bad for biodiversity – the loss of Guadalupian species actually was greater than what happened at the end of the Permian.

The Emeishan Traps in southwestern China, a 260-ma flood basalt resulting from an eruption in the ocean over 386 square miles, occurred at end of the Guadalupian. The eruption unleashed plumes of CH_4 and CO_2 that killed off as much as 60% of marine species in the shallow tropical waters around the margins of Pangea. Flood basalts like the Emeishan Traps, which exist worldwide, correlate with the "Big Five." But geologists studying mass extinctions didn't always look for flood basalts, thanks to the hypothesis that a bolide impact at Chicxulub in the Yucatan Peninsula, wiped out the dinosaurs. As a result, teams of geologists have been searching in vain for evidence of bolide strikes that could explain the other four mass extinctions.

Since such evidence has not come to light, some geologists began to suspect flood basalts were a major culprit in extinctions. They noted that the Deccan Traps in India had formed around the same time as the Chicxulub impact and the end-Cretaceous extinction. The end-Permian was marked by the even bigger Siberian Traps. Thus, a lot of research has been focused on correlating flood basalts with the other three major mass extinctions, as well as with periods of oxygen-depletion and acidification in the oceans.

In the past five years, advanced radiometric dating methods have provided increasingly accurate timestamps for geologic events. Uranium-lead zircon dating has superseded the much less accurate argon-argon dating, and margins of error that used to span millions of years now span thousands, greatly increasing the resolution of the data. Geologists can now confidently say that the Emeishan Traps lava flood happened within 100,000 years and coincided with the end-Guadalupian extinction documented in the fossil record.

Ecosystem changes at that time were dramatic – large coral and sponge reefs suffered widespread collapse, giant clams with flanged shells and many species of ammonites went extinct as well as many other organisms with calcareous exoskeletons that would have dissolved in the acidifying water. Less is certain about correlative terrestrial extinctions, but among those that are known were a group of large, thick-skulled proto-mammals called dinocephalians. Even among plants, the dominant seedless ferns were replaced by seed-bearing gymnosperms such as conifers and ginkgoes.

The revised dating also clarified the timing of first and last appearances of Late Paleozoic species that had been mistakenly attributed to the end-Permian. The new data now place the extinction record of end-Permian marine species closer to 80%.

https://www.nationalgeographic.com/science/2019/12/earth-had-more-mass-extinctions-than-realized-end-guadalupian/

Dr. Shailer S. Philbrick (1908-1994), was a founder and the first treasurer of the Pittsburgh Geological Society. Born in Columbia, MO, he attended undergraduate school at DePauw University where he received an AB in geology in 1930. After graduation, he studied at Johns Hopkins University where he received his PhD in 1933 with dissertation dealing with contact metamorphism of the Onawa pluton in Maine, published in the American Journal of Science in 1936. His need for a good topographic map of his research area led him to construct his own, and that mapping effort eventually established the route of that portion of the Appalachian Trail, which Philbrick described in the original trail guidebook.

Philbrick joined the U.S. Geological Survey as a Junior Topographic Engineer in 1934, before moving to the Soil Conservation Service in Zanesville, OH, in 1935. A year later, he joined the Army Corps of Engineers as a civilian employee and worked most of his career out of the Pittsburgh office. During his thirty years with the Corps, he played a major role in many Corps projects. For example, he was in charge of geologic and foundation investigations and planning for three locks and dams on the upper Ohio River and six locks and dams on the Monongahela River. He designed the landside portion of the spillway for the Youghiogheny Dam. He also applied geological information to the site location and design of the Kinzua Dam on the Allegheny River, completed in 1968, which resulted in substantial cost savings.

Portrait of Dr. Shailer S. Philbrick, Founding Member and first Treasurer of PGS.

Philbrick also taught at the university level, first as a Visiting Lecturer in Geology at Northwestern University in 1960, then as a Visiting Professor at Cornell University in 1963 and 1964. When a permanent position opened up in 1966, he left the Corps of Engineers to become a full-time faculty member where he applied the same energy, vitality, and dedication that he had brought to the Corps. From 1966 to 1975, he consulted for the Buffalo District of the Corps of Engineers and participated in the Niagara Falls preservation project. He finally retired in 1972 as an Emeritus Professor, then provided geological engineering expertise to his local community as a Trustee of the Village of Cayuga Heights and a member of the Southern Cayuga Lake Intermunicipal Water commission.

Dr. Philbrick was a charter and founding member of the Pittsburgh Geological Society, where he served as Treasurer in 1945-1946 and President in 1947-1948. He also was an active member or fellow of many professional societies, including the American Institute of Professional Geologists, the Society of Economic Geologists, and the Geological Society of America, serving as Chair of the Engineering Geology Division in 1955. The Association of Engineering Geologists awarded him the Claire P. Holdredge Award in 1977 for his 1976 paper “Kinzua Dam and the Glacial Foreland”, and an honorary membership in 1986 for his distinguished practice, teaching and writing, and setting an outstanding example of professional excellence in engineering geology.

In the words of Dick Gray and Brian Greene, his memorialists, “Shailer S. Philbrick was a giant in the field of engineering geology. During his long and distinguished career with the U.S. Army Corps of Engineers, he played a key role in the site selection, design, and construction of the system of dams that now protects Pittsburgh and the Upper Ohio Valley from its devastating floods. He set high standards and generously shared his knowledge with colleagues through his teaching and writing. All subsequent engineering geologists in the region have followed his approach and utilized his classification procedure.”

https://www.geosociety.org/documents/gsa/memorials/v26/Philbrick-SS.pdf

The Mars InSight lander’s Seismic Experiment for Interior Structure (SEIS) instrument measured and recorded a faint seismic signal believed to be a likely “marsquake” on April 6, 2019. This is the first recorded trembling that appears to have come from inside the planet, as opposed to being caused by forces above the surface, such as wind. NASA scientists still are examining the data to determine the exact cause of the signal. NASA had been collecting background noise up until now, but this event officially kicked off the new field of Martian seismology.

Mars does not have tectonic plates, but it still experiences quakes caused by the planet’s continual process of cooling and contraction creating stress. This stress builds over time, until it is strong enough to break the crust, causing a quake.

The seismic event observed recently was too small to provide good data on the Martian interior, one of InSight's main objectives. The Martian surface is extremely quiet, allowing SEIS to pick up faint rumbles. The event was still exciting because its size and duration fit the profile of moonquakes detected on the lunar surface during the Apollo missions.

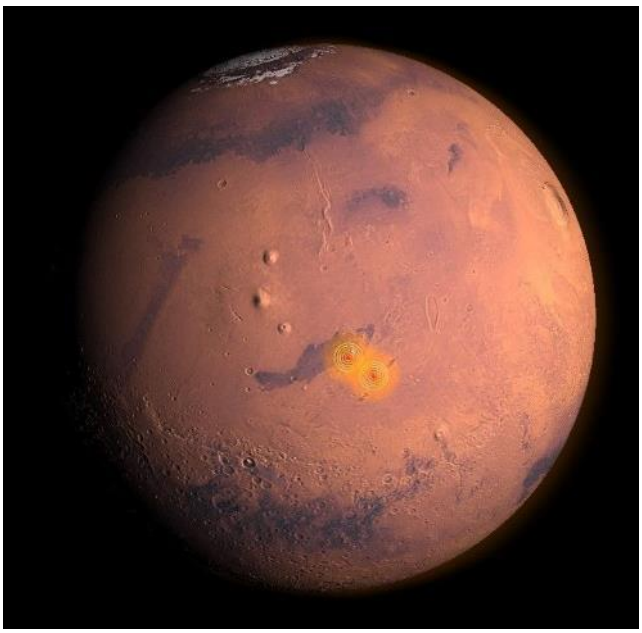


Image of Mars showing the epicenters of two marsquakes detected by the Mars InSight lander’s SEIS equipment. The lander is about 1,000 miles west of the epicenters.

By studying the deep interior of Mars, NASA scientists hope to learn how other rocky worlds formed, including Earth and the Moon. As it happened, three other seismic signals occurred earlier, but the signals were smaller and therefore even more ambiguous in origin. The team will continue to study these events to try to determine their cause. They find it exciting to finally have proof that Mars is still seismically active and are looking forward to sharing detailed results once they've had a chance to analyze the seismic data.

https://www.space.com/mars-insight-mole-moving-marsquake-zone-discovery.html

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Fun Fact Having Nothing To Do With Geology

Based on information from employers, American companies lose as much as $1.9 billion in wages during March, money that is paid to unproductive workers who spend company time on March Madness betting pools.

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Many thanks!