PITTSBURGH GEOLOGICAL SOCIETY

Celebrating 75 Years

October 21, 2020

Virtual Meeting Times

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

Pre-Registration is Required

PGS members and guests must RSVP by October 20 to receive the meeting Zoom link. Register here: pittsburghgeologicalsociety.org

PDH Certificates are Available

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

Online Meeting Guidelines

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

Landslides Ahoy: How Ice Age Stream Pirates Captured St. Lawrence River Drainage and Created the Mon Valley's Chaotic Topography

Photo courtesy of WVDOH

Dr. Steven Kite

Emeritus Professor
Department Of Geology And Geography
West Virginia University

Please RSVP by October 20 to receive the Zoom link.

Speaker Abstract

The Lenape people showed profound geological insight in naming the Monongahela, which means “river of falling banks” in their Unami language. The “Mon” drainage basin lies at the north end of the largest area of high landslide incidence in the coterminous United States. The upper basin includes a large part of West Virginia, which may have a higher per capita landslide damage than any other state. FEMA has designated landslides as the Mountain State’s second greatest natural hazard, second only to flooding. Southwestern Pennsylvania shares similar risk.

Much of the regional landslide susceptibility is associated with underlying bedrock geology and anthropogenic processes, but the exceptional slope-failure hazard also stems from Late Cenozoic events, such as neotectonics, climate fluctuation, glaciation, and complex drainage rearrangement. An ongoing statewide landslide inventory compiled in the West Virginia GIS Technical Center shows a strong spatial association between the distribution of landslides and major rivers and their tributaries. Dr. Mark Swift (Chair of Music at Washington & Jefferson College) completed a 2020 stream-profile study that illustrates Monongahela River tributaries have experienced relatively recent (Pleistocene?) knickpoint development and lower-valley incision indicative of present-day landscape disequilibria. Unlike the idealized concept of a graded stream, many of Swift’s study streams have steeper gradients near the Monongahela River than farther upstream. Most upper reaches seem to be graded to long-abandoned high river terraces, not the present-day river profile.

Pleistocene diversion of the ancestral Monongahela (a.k.a. Pittsburgh River) drainage from the St. Lawrence River into a greatly expanded Ohio River explains much of the disequilibria along river and creeks and nearby over-steepened hillslopes. This glaciation-induced drainage reconfiguration is best known for creation of Glacial Lake Monongahela and its associated Carmichaels Formation sediments that fill isolated abandoned river valley segments. However, the re-creation of a new drainage system after Lake Monongahela has more long-term importance to environmental geology in this landscape. The most dramatic disequilibria may be at Midland (PA) and New Martinsville (WV) where preglacial upland drainage divides were transformed into 120 to 140 m (400 to 450 ft) deep canyons, but there are many less-dramatic rearrangements throughout the region to which the fluvial and colluvial processes are still playing “catch up”.

Speaker Biography

Dr. J. Steven Kite is engaged in a FEMA-funded statewide landslide risk assessment for West Virginia, the most landslide-prone of all 50 states. This ambitious project is a collaboration of the West Virginia GIS Technical Center and several WVU faculty. Steve retired from teaching Geomorphology and Surficial Geology in August 2019. He was Chair of the Department of Geology and Geography from 2010 to 2015, after serving as Chair of the WVU Faculty Senate during an “interesting time” in 2007-2008. Steve has been Chair and Secretary-Treasurer of the Quaternary Geology and Geomorphology Division of the Geological Society of America and was a founder of and long-time mailing-list keeper for SEFOP, the Southeast cell of the Friends of the Pleistocene. Steve came to WVU in 1983 with a PhD in Geography and Geology at the University of Wisconsin, after earning Geology degrees from the University of Maine (MS) and James Madison University (BS). Susan Carlton Kite, his trusty sidekick since 1977, worked at the West Virginia Geological and Economic Survey for 27 years. Steve’s earliest datable memory is linked to Hurricane Hazel flooding in 1954 and his first landslide observations were of June 1949 debris flows that John Hack used to formulate a genesis model that has been the basis for debris flow studies for over a half century.

PRESIDENT'S STATEMENT

It is the beginning of Fall; the leaves are starting to change, and the temperatures are beginning to cool. Fortunately, we have had some rain this week to help with the dried up, wrinkled vegetation and I noticed that the amphibians were enjoying the much-needed moisture as well.

This month, I would like to introduce to you some members of the PGS Board. All too often we go from meeting to meeting, working together as Board members, and interacting with the members without ever really knowing each other. Individuals run for offices, but we never get the opportunity to meet them. I know when I became a member of PGS many years ago, I knew a few board members from my affiliation with Slippery Rock University and met others while socializing and enjoying a meal.

Unfortunately, due to Covid-19 we are unable to meet in person and socialize and enjoy the fine meal at Cefalos making it even harder to get to know each other. Because most board members have plenty to say, I will introduce some in this newsletter and others in the next.

I would like to take a moment to congratulate Lindsay Kastroll from CalU. Lindsay received the 2020 PGS Frank Benacquista Scholarship Award. Lindsay is working toward a double major in Geology and Biology to prepare for graduate school and a career in paleontology.

I also want to remind everyone to renew your 2020-2021 PGS membership either at the meeting or via the website. See you at the next meeting. Stay Safe!

Tamra

Officers

Tamra Schiappa, President - I graduated with a BA Geology Degree from SUNY Plattsburgh in 1983. Plattsburgh did not have a BS degree at the time. I spent the next 8 years teaching high school and working as a cartographer in North Carolina and Washington DC. In 1991, I began working on a MS in Earth Science Education/Geology at Boise State University (1993), and then a Ph.D. in Geology at the University of Idaho (1999). My MS and Ph.D. involved Early Permian ammonoid and conodont biostratigraphy of Nevada and Russia. I was hired at SRU in 2002 where I teach stratigraphy, paleontology, earth history, oceanography, and many other courses for our department. I have been a member of PGS since 2004, served as Vice President from 2015-December 2017, and President since January 2018.

Diane Miller, Secretary – I graduated from IUP in 1988 with a BS degree in Geology. I spent most of the next 30 years working as an environmental consultant both in the Baltimore and Pittsburgh areas. I passed the ASBOG exam and earned my PG license in 2010. At the end of 2019 I chose to step away from Environmental Consulting for a while and I am currently working part-time at my family's business in Butler. I enjoy keeping my hand in Geology by being involved with PGS and maintaining connections with friends and colleagues.

Directors-at-Large

Wendell Barner is President and Owner of Barner Consulting, LLC providing environmental consulting services. Wendell has more than 35 years of experience in the environmental industry with particular interest in karst hydrogeology. He is experienced in environmental remediation technologies, site assessment programs, hazardous waste studies, remedial design and construction management, program management, regulatory compliance and negotiation, site decontamination and decommissioning, and procurement services. Wendell is a professional registered geologist in the states of Pennsylvania, Tennessee, Missouri, and Arkansas, a Certified Professional Geologist through the American Institute of Professional Geologists.

Michael Bikerman is an emeritus geology professor from the University of Pittsburgh teaching physical geology, historical geology, geochemistry, ore deposits, general geology, the geology of National Parks, and World Geography. He earned a BS in chemistry at Queens College [NYC], a BS in geology at New Mexico Tech [NMIMT, Socorro, NM] and MS and PhD degrees in geology at the University of Arizona [Tucson, AZ]. He is a retired registered geologist in Pennsylvania.

Michael went around the world three times on Semester at Sea, as a geology professor on the S91 voyage and as the Academic Dean on the F00 and F04 trips. Since retiring he has shared his lifelong love of Planet Earth with occasional classes in geology and world geography at the Community College of Allegheny County, at Duquesne University, for groups in the Mt. Lebanon, PA public library, and in retirement communities. Post retirement he has lectured successfully on many cruises: the first one on Royal Caribbean to Alaska, then on Regent Seven Seas on trans-Atlantic and Panama Canal cruises. For several years he has lectured on Holland America cruises: Hawaii-to-San Diego and back, Trans-Atlantic repositioning cruises, Hawaii/French Polynesia cruises, Panama Canal transits, trips to the eastern and western South America coasts, and from Indonesia to Australia.

Other recent travel has been to Colombia, France, Turkey, Peru [Machu Picchu] and Ecuador [Galapagos and volcanoes near Quito], Spain, Scotland and Northern Ireland, Mexico, Italy, and New Zealand. Within the United States Michael has recently visited national parks in southern Utah and the Grand Canyon, including a six-day raft trip through the Canyon.

Dan Billman P.G, C.P.G. - AAPG Delegate has approximately 30 years of experience in the Appalachian Basin with the last 26 as a consulting geologist and president of Billman Geologic Consultants, Inc. Prior to independent consulting, Dan worked as an exploration and development geologist for Mark Resources Corporation and Eastern States Exploration Company. Dan is a registered Professional Geologist (PG) in the state of Pennsylvania and an American Association of Petroleum Geologist, Certified Petroleum Geologist (CPG). He received his BS in Geology from the University of Toledo (Ohio) and his MS in Geology from WVU. He is a member of AAPG and is currently the AAPG Delegate representing the Pittsburgh Geological Society.

Karen Rose Cercone, Newsletter Editor, is a native of Trafford, PA. She has been a member of PGS since 1988, serving as Secretary, Treasurer, Vice-President and President in the early 1990's and then again as the editor of the PGS monthly newsletter since 2015.[1] Karen Rose earned her degrees in geology from Bryn Mawr College (AB 1979) and the University of Michigan (PhD 1984). After teaching at SUNY Stony Brook for two years, she was fortunate to be offered a position in hydrogeology and geochemistry at Indiana University of Pennsylvania (IUP) where she has taught ever since. She currently holds a three-quarters appointment in university administration as the Provost's Associate in charge of Academic Programs and Planning.

In her spare time, Karen Rose has dabbled in a variety of hobbies ranging from writing science fiction and mystery novels to competing in dog obedience trials with her border collies Thanks to the pandemic, she currently spends most of her spare time birding and playing video games.

John A. Harper, Membership Chair, native of Coraopolis, PA. John holds academic degrees from IUP (BS, Geography & Earth Science), University of Florida (MS, Geology), and Pitt (PhD, Paleontology). John worked for 35 years at the Pittsburgh office of the Pennsylvania Geological Survey and retired in 2012. John has been a PGS member since 1978, serving the society as President, 1992-1993. John remains very active in PGS as the membership chair, frequent field trip organizer, and contributor to the newsletter.

John searching for tiny platyceratid gastropods attached to tiny crinoids in Fayette County in the mid-1980s.

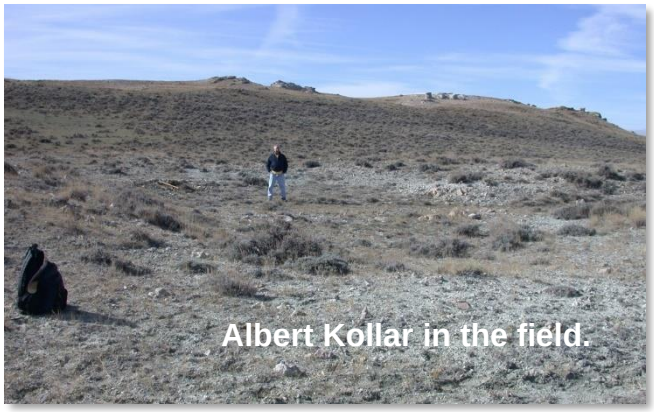
[1] The position of PGS newsletter editor will be open starting in September 2021.

Mary Ann Gross has been employed for 47+ years in various fossil fuel careers. She began her career in the 1970's with the federal Bureau of Mines and the Department of Energy on projects that took her underground in US and UK coal mines. In the 1980's until retirement in August 2020, she worked for oil and gas companies as a geologist and landman. Flexibility was a career-saving skill. She is thankful for the help and many friendships made with geologists from across the tri-state region. As a PGS member since the 1980s Mary Ann has filled several Board positions and led many field trips. Learning to fly, motorcycling, spelunking, volunteering for a variety of organizations, martial arts training and keeping her BMW 335i six-speed coupe near the speed limit are some of her enjoyments.

Albert D. Kollar, is the invertebrate paleontologist and geologist in the Section of Invertebrate Paleontology at the Carnegie Museum of Natural History. He served as President of PGS for three terms from 2011 – 2014. Albert was elected to the board as Director at Large 2004 – 2011 and 2015 – 2020 and currently serves as Chair of the Awards Committee.

In 2017, Kollar received the George V. Cohee Public Service Award from the Eastern Section of AAPG. In 2019, the GSIS Award for Best Guidebook (professional), *Geology of the Early Iron Industry in Fayette County, Pennsylvania,* was presented to John A. Harper and Albert D. Kollar by the Geological Society of America.

Kollar has presented three PGS monthly talks and has authored/co-authored three PGS Guidebooks in 2019, 2018, and 2008. His PA*/*S regional Geology Guides are available to download from the PGS website.



Albert Kollar in the field.

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	*Scheduled Speaker*	*Presentation Topic*
November 18, 2020	Jonathan B. Martin, University of Florida	High Latitude Hydrology
December 16, 2020	Amy Henrici, Carnegie Museum	Vertebrate Paleontology
January 20, 2021	TBA, Joint Meeting with ASCE and AEG	Engineering Geology
February 17, 2021	TBA	
March 17, 2021	Kendra Murray, Idaho State University	Cenozoic Magmatism on the Colorado Plateau
April 21, 2021	Student Research Night Joint Meeting with ASCE and AEG	Student Posters & Presentations
May 19, 2021	Thomas Bardol, Seneca Resources	Oil and Gas Industry Talk

OTHER GEOLOGICAL EVENTS

Pennsylvania Council of Professional Geologists

October 13, 2020 1:00 PM-2:00 PM

“Webinar: Shale Play Water Management in Pennsylvania: Meeting the Needs with Brine Disposal” by Dan Billman, Billman Geologic Consultants, Inc.

To register: https://pcpg.wildapricot.org/event-3986231

Pittsburgh Association of Petroleum Geologists

October 15, 2020 12:00 PM – 1:00 PM

"Far-field tectonic controls throughout Ohio: Examples from high-density mapping across Eastern Ohio” by Dr. Julie Bloxson, Black Shale Research Facility, Stephen F. Austin State University.

To register: https://www.papgrocks.org/meetings/upcoming-meeting

American Society of Civil Engineers Geo-Institute

October 15, 2020 11:00 AM-12:00 PM

“Combi Piles - Lessons Learned to Manage Active Piping Erosion at Deep Foundations” by Dr. Fatma Ciloglu of Michael Baker International.

To attend: https://us02web.zoom.us/webinar/register/WN_4b-yeO2zSm-qZSVW21yR4g

PGS NOVEMBER MEETING

2019 Birdsall-Dreiss Distinguished Lecture

High Latitude Hydrology: Water in a changing World

Dr. Jonathan B. Martin, Professor,
Geological Sciences, University of Florida

ABSTRACT. Retreat of continental ice sheets has exposed ~15% of Earth's surface since the Last Glacial Maximum (LGM) and deposited fine-grained sediments in "deglaciated" watersheds. These sediments are susceptible to enhanced chemical weathering, which may vary in intensity and reaction mechanisms depending on exposure times and precipitation. Thus, ice retreat should alter solute fluxes to the ocean and gas exchange with the atmosphere as reflected by the rise in seawater Pb isotopes following the LGM. Solute and gas fluxes will depend on both riverine concentrations and discharges. Although discharge may be orders of magnitude greater for individual proglacial than non-glacial streams, their specific discharge (normalized to drainage area) is similar in western and southern Greenland. However, chemical compositions are distinct between proglacial and deglaciated watersheds and among deglaciated watersheds depending on their exposure ages and precipitation. Newly deglaciated watersheds have dissolved $^{87}Sr/^{86}Sr$ ratios that are 0.003 greater than bedload values but this difference decreases to near zero in watersheds with longer exposure ages, reflecting greater chemical weathering. The dominant weathering reactions shift with exposure age from carbonic acid weathering of carbonate minerals to sulfuric acid weathering of silicate minerals, thereby altering CO_2 consumption and production. Compared to proglacial watersheds, deglaciated watersheds have enhanced dissolved organic carbon (DOC) specific yields but the DOC is more recalcitrant than proglacial DOC. Among proglacial watersheds CO_2 and CH_4 fluxes vary, depending on magnitudes of subglacial mineral weathering and organic matter contents. These results indicate ice retreat is an important control on mass fluxes from periglacial environments. Understanding causes of these differences could improve analyses of how past ice retreat altered ocean and atmospheric chemistry and provide predictive capability for changes in fluxes with continued ice retreat in a future warmer world.

Zoom Lecture November 18 at 7:30 PM

THE GEOLOGICAL SOCIETY OF AMERICA®
HYDROGEOLOGY DIVISION

Sponsored by the
Geological Society of America
Hydrogeology Division

The Pittsburgh Geological Society welcomes the following:

New Professional Member
Dr. Linda L. Davis
Senior Scientist, Vesuvius USA

New Student Members from California University:
Riley A. Jupin, Ireland R. Killen, and William F. Simmen

New Student Members from Slippery Rock University:
Amber N. Delahunty, Bailey M. Hoffman, and Austin M. Keirs

New Student Members from Indiana University of Pennsylvania:
Susie A. Adams, Rebecca Harris, Joshua J. Merichko, and Eric L. Reynolds

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Sometime before May 1780, Col. John Canon, a Revolutionary War veteran, miller, and justice at Fort Pitt, bought some land along Chartiers Creek in what is now Washington County, Pennsylvania (it was part of Virginia until 1781), and built a mill. In 1788, he created a plan for a town adjacent to his mill and began selling lots a year later. The emerging town, named Canonsburg in his honor, was eventually incorporated in 1802.

Part of a Canonsburg Fourth of July parade.

Canonsburg's earliest claim to fame was as the midpoint along the road from Washington, PA, to Pittsburgh. The first institution of higher learning west of the Alleghenies, Jefferson College, was founded in Canonsburg in 1802. In 1865, the college merged with Washington College to become Washington and Jefferson College, and physically moved to Washington PA in 1868. At the time, Jefferson College had been Canonsburg's largest source of income. It took until the Pennsylvania Railroad built its Chartiers Branch from Carnegie to Washington in 1871 before Canonsburg was able to recover its financial loss. Today, Canonsburg is known as the home of Sarris Candies and the second largest Fourth of July parade in Pennsylvania (only Philadelphia has a larger one).

DID YOU KNOW . . . ?

Richard Ellis Sherrill (1899-1952), Professor and Head of the Geology Department at the University of Pittsburgh, was a founding member of the Pittsburgh Geological Society. He was born in Haskell, Texas, one of five children, whose family were pioneers in the region; his father was a prominent merchant and businessman in Haskell. Upon graduating with honors from high school, he attended the University of Texas for a year, spent a year at Wooster College in Wooster, Ohio, and the final two years of his undergraduate education at Washington and Lee University in Lexington, Virginia. Although he received his BS degree in Chemistry from Washington and Lee in 1922, he also had interest in physics and geology, serving as a lab assistant in physics in his senior year and receiving the university's Award in Geology.

Upon graduation, Sherrill served as an Instructor in Physics at the university for a year. He then went west to work with the Ray Consolidated Copper Company at Ray, Arizona, spending time sampling, surveying, and doing some geological work. A year later, he returned to Washington and Lee where he served as Assistant Professor of Geology for two years. He soon became interested in petroleum geology and returned to Texas to spend a year as a field geologist with the Marland Oil Company and The Texas Company. Now definitely started on a career in geology, he felt the need for graduate-level training.

Sherill attended Cornell University in Ithaca, New York, on an Eleanor Tatum Long Scholarship in Structural Geology and did his graduate studies and research on structural problems in Oklahoma. After earning his MS degree in Geology from Cornell in 1928, he accepted an appointment as Instructor in Geology at the University of Pittsburgh. In 1930, he was promoted to Assistant Professor. During the 1932-33 academic year, he took a leave of absence to return to Cornell where he wrote his dissertation and received his PhD. The Journal of Geology published his dissertation, *Symmetry of Northern Appalachian Foreland Folds*, in 1934 and for many years it was considered the final word on Appalachian structural geology.

Sherrill returned to Pitt as Assistant Professor of Geology in the fall of 1933. In 1934, he was advanced to an Associate Professorship, and in

Photo of Richard E. Sherrill, Professor of Geology and Head of the Geology Department at the University of Pittsburgh. Sherrill was a PGS founding member.

1938 to full Professor. Later that year, he was appointed Head of the Oil and Gas Department at Pitt where he served until the end of World War II in 1945. He then was appointed as Acting Head of the Geology Department and a year later the title and its responsibilities became permanent. During his time as Department Head, department personnel increased from two professors to four, plus several part-time instructors and graduate assistants. He has been described as an excellent teacher and an efficient administrator.

Besides teaching and department administration, Sherrill is also well known for his association with the Pennsylvania Geological Survey as a co-operating geologist starting in 1936. He was author or coauthor of several important Survey publications on the oil regions of Venango County, contributing much toward arriving at a better understanding of the geological factors that have a bearing on the occurrence of oil and gas in western Pennsylvania. He also consulted with the South Penn Oil Company and other operators to study the oil and gas possibilities of Lower Paleozoic rocks of the Appalachian basin.

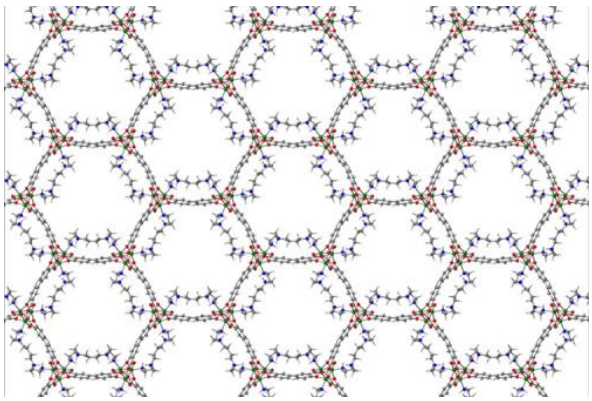
Sherrill died in his childhood home of Haskell, Texas, while on leave of absence from his duties at Pitt. He had been ill for some time and had gone back to Haskell to spend time with his family and to receive care from two doctors who were relatives of his wife. He had been a member of several prominent organizations, including:

- American Association of Petroleum Geologists (Associate Member while a graduate student at Cornell, 1927; Member, 1929.)
- Geological Society of America (Fellow)
- American Association for the Advancement of Science (Fellow)
- American Institute of Mining and Metallurgical Engineers (Member)
- American Petroleum Institute (Member)
- Appalachian Geological Society (Member)
- Engineers Society of Western Pennsylvania (Member)
- Pittsburgh Geological Society (Founder and Charter Member)
- Phi Beta Kappa
- Sigma Xi
- Sigma Gamma Epsilon
- Sigma Tau

Scientists from ExxonMobil, the University of California at Berkeley, and the Lawrence-Berkeley National Laboratory announced they have developed a new way to capture more than 90% of industrial-source CO_2 using low-temperature steam, which would require less energy for the carbon capture (CC) technology. The new technology, consisting of tetraamine-functionalized metal organic frameworks (MOFs), is touted as being able to capture CO_2 emissions up to six times more effectively than conventional amine-based carbon capture technology. Because it uses less energy to capture and remove carbon, it could potentially reduce costs and eventually support commercial applications.

Power plants currently strip CO_2 from flue emissions by bubbling flue gases through organic amines in water, which bind and extract the CO_2. The liquid is then heated to 250-300°F to release the CO_2, and the liquids are retained for reuse. The entire process consumes approximately 30% of the power generated. Sequestering the CO_2 underground represents an additional cost.

Six years ago, the research team discovered a chemically modified MOF that readily captures CO_2 from concentrated power plant flue. Then they found that by adding diamine molecules to a magnesium-based MOF they could catalyze the formation of polymer chains of CO_2 that could then be purged by flushing with a humid stream of carbon dioxide. By manipulating the structure of the MOF material, they were able to condense a surface area the size of a football field into one gram of mass (about the same mass as paperclip) that acts like a CO_2 sponge.



A representation of the interior of a metal-organic framework (MOF) based on magnesium (green) with tetraamine molecules (blue & gray) added to the pores to absorb CO_2 more efficiently from power plant emissions.

The team has worked together since then to develop this potential CC solution that demonstrates stability in the presence of water vapor, without oxidation, allowing CO_2 to be captured from various sources under a number of conditions. The materials have truly great capacity for capturing CO_2 and can be regenerated for repeated use by using low-temperature steam for the process, requiring less energy for the overall carbon capture process. Additional research and development will be needed to develop this technology on a larger scale to act as a pilot project, and ultimately to expand it to an industrial scale.

https://www.greencarcongress.com/2020/07/20200725-mof.html

A team of American scientists, including paleontologists and mechanical and biomedical engineers, recently compared CT scans of the fossilized bones of both living and extinct animals, including dinosaurs, birds, and mammals. Paleontologists have been wondering for years how large dinosaurs were able to support weights as large as 52 tons. The largest terrestrial dinosaurs were enormous creatures whose body mass placed massive gravitational loads on their skeletons.

A team of researchers studied the bone structure of hadrosaurs and other dinosaurs to learn the secret of how such large dinosaurs were able to support their own weight.

Previous studies investigating the bone strength and biomechanics of dinosaurs had neglected to look for relationships between spongy bone (called trabecula) architecture and mechanical behavior. The new team found that the trabecular bone architecture of dinosaur was uniquely capable of supporting their large weights. The structure of the trabecula that formed within the interior of bones is unique within dinosaurs. The trabecular bone tissue surrounds tiny spaces or holes in the interior part of the bone, similar to what you can see in ham and steak bones. But, unlike the trabecular bone of mammals and birds, it does not increase in *thickness* as dinosaur body size increases. Rather, it increases in *density*. Without this weight-saving adaptation of the skeletal structure, large dinosaurs would have been so heavy that the animals would have had great difficulty moving around. The researchers were the first to use engineering failure theories and allometry scaling to analyze CT scans of the lower part of the femur (thigh bone) and upper part of the tibia (larger calf bone) of several different kinds of dinosaurs, allowing them to better understand the bone structure of extinct species and the first to assess the relationship between bone architecture and movement in dinosaurs. They then compared their findings to scans of extinct and living mammals, including deer, sheep, tiger, rhinoceros, Asian elephant, and Columbian mammoth. By studying the mechanics of the trabecular architecture of dinosaurs, the team has helped to understand the design of other light-weight and dense structures.

http://www.sci-news.com/paleontology/dinosaur-trabecular-bone-architecture-08769.html

The modern petroleum industry began on August 27, 1859 when the Drake Well near Titusville, Pennsylvania, struck oil at 69½ feet. "Colonel" Edwin L. Drake put Titusville and Pennsylvania on the map, generating much excitement and concern of the kind still seen today in the Mid-East, the Gulf Coast and Gulf of Mexico, Alaska, and many other parts of the world. But Drake wasn't, as most of us were told by our history teachers, the first person to discover oil, to produce oil, nor even to drill an oil well. The ancient Sumerians, Assyrians, Persians, and Egyptians all dealt in oil and oil products such as asphalt long before 4,000 B.C. The Chinese were drilling oil wells, constructing bamboo pipelines, and even shipping oil by boat as early as 100 B.C. When Europeans arrived in the Americas in the 1500s, they found the natives were using oil for waterproofing, embalming, and medicine. In fact, it was the

Iconic photo of the Drake Well taken by John Mather in 1866. "Colonel" Edwin L. Drake is standing on the right with his good friend Peter Wilson, a Titusville druggist.

Native Americans who taught European settlers the value of oil as it was then perceived.

Europe first learned of oil in America from the journals of 17th century French missionaries. Eventually, numerous exploratory maps and reports noted the presence of oil from natural seeps and salt wells from New York to the Kentucky territory. Some people used oil for lubricating wagon wheels and gristmill axles, for waterproofing clothing and boats, or for medicinal purposes. However, most people considered it to be a nuisance; it spoiled salt production, produced a thick, foul-smelling smoke when burned, created fire hazards, and contaminated canals and fishing streams.

Prior to August 27, 1859, there were several deliberate attempts to drill or dig for oil in places like Germany, Azerbaijan, and Canada, including the successful operations of James Williams in Ontario, and oil-distilling operations in Baku, Azerbaijan, in 1837. But even these successful attempts had little effect on history. So, why was the Drake well different? Why is Drake credited with founding the modern petroleum industry? The answer lies in a series of events that began in Pittsburgh in 1850:

- By 1850, whale oil, the primary fuel for lighting, was rapidly being depleted due to over-whaling, and the price was more than $100 per barrel. That year, Samuel M. Kier, a Pittsburgh businessman who sold crude oil from salt wells for medicinal purposes, developed a successful method of refining oil to kerosene, as well as a lamp that would burn the kerosene with a bright flame and with little or no smoke and odor
- In 1853, Francis B. Brewer, a Titusville physician, took a small bottle of oil from a seep on the property of his family's lumber company on Oil Creek in Venango County, Pennsylvania, to Dartmouth College and gave it to Dr. Dixi Crosby, one of his former professors
- A few weeks later, a New York City lawyer named George H. Bissell visited Dartmouth where he saw the bottle of oil in Crosby's office and immediately recognized its potential
- Bissell and his partner, Jonathan G. Eveleth, bought the Brewer, Watson & Company property and organized the Pennsylvania Rock Oil Company in New York in 1854. They engaged Benjamin Silliman, Jr., a famous chemist at Yale College, to test the oil for its potential. He distilled oil into eight distinct, potentially useful products and wrote a report in 1855 that convinced numerous businessmen to invest in the Pennsylvania Rock Oil Company

Photos of the major players who helped Drake become the man behind the modern petroleum age, clockwise from top left: Samuel M. Kier, Francis B. Brewer, George H. Bissell, Benjamin Silliman, Jr., James M. Townsend, and William "Uncle Billy" Smith.

- In 1855, James M. Townsend, a Connecticut banker and Pennsylvania Rock Oil Company investor, convinced Bissell and Eveleth to reincorporate the company in Connecticut.
- In 1857, Townsend hired Edwin L. Drake, a former railroad conductor, to travel to Titusville to examine the former Brewer, Watson & Company property. Drake's report convinced Townsend of the property's potential

- In 1858, Townsend and his associates, being major stockholders in the Pennsylvania Rock Oil Company, organized, and transferred the property to their Seneca Oil Company
- Later that year, Drake returned to Titusville to see if he could successfully produce oil. He hired William A. Smith, known as "Uncle Billy", an experienced salt well driller from Tarentum, Pennsylvania, to acquire a drilling rig, transport it to Titusville, and drill a well on the property near some of the oil seeps

When the Drake Well came in on August 27, 1859, the world was more than ready for a new and inexpensive form of illuminant. Eventually, the inventive mind of man would find other uses for oil and the world would never again be the same. There were earlier wells drilled, earlier oil discoveries, and earlier distillation processes. But Kier was an exhaustive promoter, publicizing his refining process and lamp better than anyone else had done before. The Seneca Rock Oil Company was a better advocate of oil than its predecessors in other parts of the world. The stage was set for what we now recognize as the modern petroleum industry, an industry that has continued to develop for over 150 years. It could have happened anywhere in the world where oil is found. It could have occurred as a series of interconnected events involving any other group of people who had imagination and resources. But it did not, so history tells us the modern petroleum business started right here in western Pennsylvania.

Mass extinction events have long puzzled geologists and paleontologists. Were they the result of terrestrial causes such as volcanic eruptions, plate tectonics, diseases, or climate change, or were they the result of extraterrestrial events such as bolide impacts or massive solar flares? Although some of the great extinction causes have been explained satisfactorily, there are several still up for grabs. Fans of both terrestrial and extraterrestrial origins have touted the Devonian-Carboniferous, or End-Fammenian, extinction approximately 359 million years ago as an example of their favorite hypothesis.

Now comes a new study suggesting multiple supernova explosions about 65 light-years from Earth caused several extinction events at the Devonian-Carboniferous boundary. This hypothesis suggests that supernovae may have contributed to ozone depletion because Devonian-Carboniferous boundary rock samples contain malformed plant spores that seem to have been sunburnt by ultraviolet light, which suggests a long-term ozone-depletion event. Terrestrial catastrophes such as large-scale volcanism and global warming can destroy the ozone layer too, but there is inconclusive evidence for either of those causes at the time.

Artist's conception of a supernova.

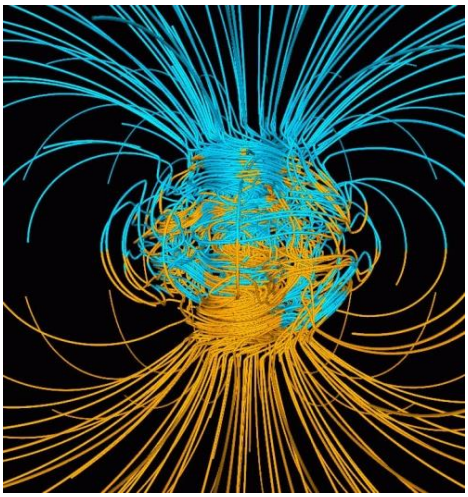
In this new study, researchers analyzed all sorts of potential terrestrial and extraterrestrial causes responsible for the protracted loss of ozone, including meteorite impacts, solar eruptions, and gamma-ray bursts. Such events end quickly, however, and are unlikely to cause long-lasting ozone depletion of the kind postulated for the end of the Devonian. In contrast, a nearby supernova explosion would immediately bathe Earth with damaging UV, X-rays, and gamma rays. Somewhat later, supernova debris would travel through the Solar System, subjecting the planet to long-lived irradiation from accelerated cosmic rays. Under this scenario, the damage to Earth and its ozone layer could last for up to 100,000 years.

The fossil evidence, however, indicates a 300,000-year decline in biodiversity leading up to the Devonian-Carboniferous mass extinction, which suggests the possibility of multiple catastrophes, including possible multiple supernova explosions. The researchers claim this

is entirely possible because massive stars typically occur in clusters, with other supernovae likely to occur soon after the first explosion. The radioactive isotopes ^{244}Pu and ^{146}Sm in the rocks and fossils deposited at the time of extinction would help support the supernova hypothesis, since neither isotope occurs naturally on Earth today. The only way they can get here, therefore, is via cosmic explosions. ^{244}Pu is has a half-life of 80 ma, longer than any of the other plutonium isotopes, and ^{146}Sm has a half-life of 10 ma, so it also is fairly long-lived. It would be possible to find evidence of these isotopes from 259 ma, but not in large quantities. The scientists have not yet searched for these isotopes in Devonian-Carboniferous boundary rocks, but suggest it might be possible to find evidence of them.

http://www.sci-news.com/astronomy/nearby-supernovae-late-devonian-extinctions-08760.html

A team of researchers from China and the US have improved the estimate of the age of Earth's solid inner core by creating conditions akin to the center of the planet inside a laboratory chamber. Their results put the new age at between 1 and 1.3 ga. This places the core at the younger end of an age spectrum that usually runs from about 1.3 to 4.5 ga. It also makes the age much older than a recent estimate placing it at only 565 ma. The experiments and accompanying hypotheses also help determine how the core conducts heat and the energy sources that power the mechanism that sustains the Earth's magnetic field (geodynamo). This is important to know because the geodynamo and the strength of the magnetic field contribute to Earth's habitability by protecting us from harmful cosmic rays.



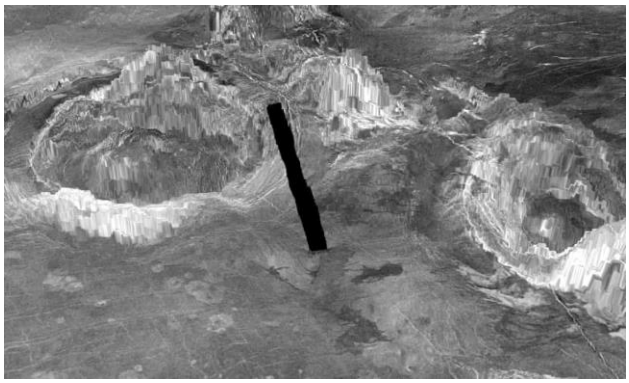
Computer simulation of Earth's magnetic field, generated by heat transfer in the Earth's core.

The Earth's core consists mostly of iron, with the inner core being solid and the outer core being liquid. The effectiveness of the iron's thermal conductivity is key to determining other attributes about the core, including when the inner core formed. Estimates for core age and conductivity have gone from very old and relatively low, to very young and relatively high. The younger estimates tended to create a paradox – the core would have had to reach unrealistically high temperatures to maintain the geodynamo for billions of years before the formation of the inner core. The new research found a solution to the paradox by directly measuring the conductivity of iron under core-like conditions. The pressure at the Earth's core is greater than 1 million atmospheres and its temperature can reach those found on the surface of the sun. The researchers achieved these conditions by squeezing laser-heated samples of iron between two diamond anvils, taking two years to achieve suitable results.

The team's newly measured conductivity is 30 to 50% less than the conductivity of the young core estimate, suggesting that two different energy sources and mechanisms, thermal convection and compositional convection, maintained the geodynamo. In the beginning, thermal convection alone maintained the geodynamo, but now each mechanism plays an approximately equally important role. Using this improved information on conductivity and heat transfer over time, the team was able to make a more precise estimate of the age of the inner core. They were able to think about when the Earth cooled enough that the inner core began to crystalize. The revised age of the inner core could correlate with a spike in the strength of Earth's magnetic field that has been recorded by paleomagnetic readings from rocks that formed around that time. Together, the evidence suggests that the formation of the inner core was an essential part of creating today's robust magnetic fields.

https://scitechdaily.com/solving-a-paradox-new-younger-age-estimate-for-earths-inner-core/

Scientists from Germany and the US have identified 37 volcanic structures on our sister planet Venus that appear to have been active recently and might still be today. If so, they paint a picture of a geologically active planet rather than the dormant world we've long considered it to be. The research focused on ring-like structures called coronae that are caused by upwelling hot rock from deep within Venus's interior. Coronae are essentially fields of lava flows and major faults spanning a large circular area. According to the researchers, these provide compelling evidence of widespread recent tectonic and magmatic activity on the planet's surface, suggesting that some of its interior heat is still able to reach the surface today.



A pair of coronae on the surface of Venus. The black line indicates a gap in the imaging data.

The researchers determined the type of geological features that could exist only in a recently active corona, such as telltale trenches surrounding the structures. We've known for a long time that Venus is covered by clouds of sulphuric acid and has surface temperatures hot enough to melt lead, so the team studied radar images of Venus taken by the Magellan spacecraft in the 1990s to find coronae that fit the bill. Of 133 coronae examined, 37 appear to have been active in the past 2 to 3 ma, relatively recent in geological terms. And they believe the structures are still active today. Many of the 37 coronae reside within in a gigantic ring in the southern hemisphere, and include a colossal corona called Artemis, which is 1,300 miles in diameter.

https://www.theguardian.com/science/2020/jul/21/likely-active-volcanoes-found-on-venus-defying-theory-of-dormant-planet

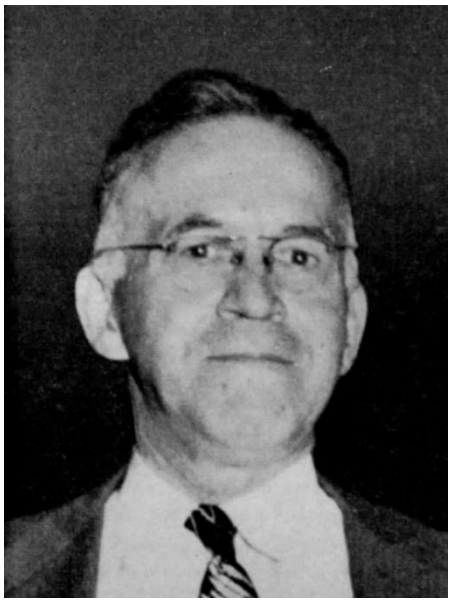


Photo of Charles R. Fettke, Professor of Geology at Carnegie Institute of Technology and one of the founders of PGS.

Charles Reinhard Fettke (1888-1959), one of the Founders of the Pittsburgh Geological Society, was born in San Francisco, California, to German parents who had emigrated shortly after the middle of the 1800s and were some of the early pioneers to the western US. His family moved to the state of Washington where he attended school in Tacoma. His father had prospected in Arizona, Colorado, and New Mexico and the tales he brought home inspired Charles to become a mining engineer. Upon graduation from high school, he entered Washington State University but transferred to the University of Washington after only a year.

Although he graduated *cum laude* in mining engineering in 1910, his interests had gradually shifted to geology during his undergraduate years. He received a scholarship to Columbia University and received his MS degree in Geology in 1911 and his PhD in Geology and Physical Chemistry in 1914. During his tenure at Columbia, he served as an assistant to Dr. James Furman Kemp, who was famous for his work with both the New York and US geological surveys on the Adirondacks. Kemp had profound influence on Charles later in his career.

After completing his graduate work at Columbia, Charles obtained a teaching position at Carnegie Institute of Technology in Pittsburgh (now Carnegie Mellon University) and advanced through all the ranks to become a full Professor in

1929. He spent 43 years at Carnegie Tech, retiring as Professor Emeritus in 1956. Upon retiring, and until his death three years later, he consulted for the Consolidated Natural Gas System, which included the New York State Natural Gas Corporation among other companies, studying the potential for gas production from the Cambrian and Ordovician rocks of the Appalachian Basin.

Fettke had a heavy teaching schedule but he also had an equally heavy load of research and writing, yet he always took time for both his students and former students, many of whom constantly sought his advice. He was a perfectionist who strove to impress all who were under his guidance with the importance of geology, not only in their future careers but as an absorbing life interest. Geology was an avocation as well as a vocation for him. He thus devoted countless extracurricular hours to his students, spending weekends on field trips to make geology come alive for those students who participated. Many of his students went on to have impressive careers themselves as a result of his teaching.

Although Charles had a long career as a distinguished and dedicated teacher, he had many other interests, especially spending summers doing all kinds of geological field work. Starting in 1914 and continuing until his death, he worked as a cooperating geologist with the Pennsylvania Geological Survey. During this tenure, he accomplished some of the most important work of his lifetime in the fields of clays, glass sands, and especially petroleum geology. He found it very relaxing to spend several hours after dinner each night describing oil and gas well drill cuttings. He also found time to work in Puerto Rico, Tennessee, Kentucky, and Montana. During his lifetime he published more than 130 important papers on geology, many of which, like the Survey's Bradford oil field report, are still considered important major works.

Charles Fettke was a member of the following organizations:

- The Geological Society of America (Fellow beginning in 1924)
- The American Association of Petroleum Geologists (Member beginning in 1920)
- Mineralogical Society of America (Fellow)
- American Association for the Advancement of Science (Fellow)
- Society of Economic Geologists
- American Geophysical Union
- American Institute of Mining, Metallurgical and Petroleum Engineers
- American Ceramic Society
- American Chemical Society
- American Association of University Professors
- Pittsburgh Geological Society (Founder and Charter Member)
- Appalachian Geological Society
- Sigma Xi
- Theta Tau

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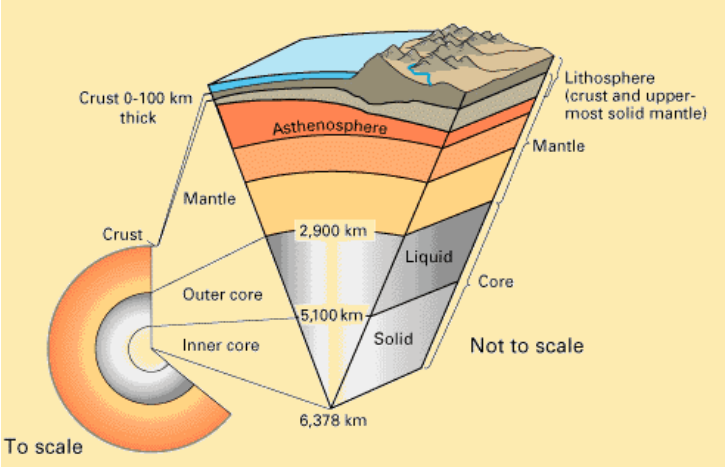
HTTPS://PUBS.USGS.GOV/GIP/DYNAMIC/INSIDE.HTML



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Fun Fact Having Nothing to Do with Geology

Oktoberfest began on October 12, 1810 when Prince Ludwig of Bavaria decided to celebrate his marriage to Princess Therese of Saxony-Hildburghausen with the good people of Bavaria.

Editor's Note – since this involves beer, does it really have nothing to do with geology?

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