PITTSBURGH GEOLOGICAL SOCIETY

Celebrating 75 Years

December 16, 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 December 15 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.

A Unique Early Permian Vertebrate Fauna from the Bromacker Quarry, Central Germany

Amy C. Henrici

Carnegie Natural History Museum, Section of Vertebrate Paleontology

Friends and Family are Welcome to View This Meeting!

Please RSVP by December 15 to receive the Zoom link.

Speaker Abstract

Vertebrate fossils were discovered at the Bromacker quarry by geologist Dr. Thomas Martens in 1975, a time period when the region was part of former East Germany. After the reunification of East and West Germany in 1990, the Carnegie Museum of Natural History (CMNH) sponsored a six-month Pittsburgh visit by Martens to work on his fossils with Dr. Dave Berman, an expert on Late Paleozoic tetrapods. This began a collaboration that has continued to present time. The fossils from the Bromacker quarry are preserved in the Early Permian Tambach Formation and are about 290 million years old. The Tambach Formation was deposited in a small, intermontane basin, the Tambach Basin, that was internally drained and at times lacked permanent water, a rarely preserved setting for Early Permian times. Extremely well-preserved, nearly complete and articulated vertebrate fossils primarily occur in two massive sheet flood units in the Bromacker quarry strata. The flooding events that formed these units are thought to have killed and buried the animals preserved within them. The Bromacker vertebrate fauna consists of a variety of terrestrial amphibians and reptiles and is dominated by herbivores. Because no fossils of fish or aquatic animals have been discovered in over 35 years of collecting, they presumably did not inhabit the Tambach basin. This is in stark contrast to vertebrate faunas from contemporaneous localities in the American southwest that were deposited in coastal and alluvial plains. Faunas from these settings contain fish and mainly aquatic and semi-terrestrial amphibians and reptiles, with carnivores outnumbering herbivores. Thus, the invasion of vertebrates into upland regions away from permanent water and the associated food resource of aquatic and semi-terrestrial vertebrates, seems to have led to the diversification of herbivorous tetrapods and the development of the modern terrestrial ecosystem, in which numerous herbivores support a few top carnivores.

Speaker Biography

Amy C. Henrici is a Collection Manager in the Section of Vertebrate Paleontology, Carnegie Museum of Natural History (CMNH). She received a BA in Biology from Hiram College in 1979 and a MS in Geology from the University of Pittsburgh in 1989. She began her career in the Section of Vertebrate Paleontology at CMNH in 1979 as a Laboratory Technician. She became a Curatorial Assistant in 1980 and worked as a Scientific Preparator from 1984–2004. From 2003–2004 she also served as Acting Collection Manager and became Collection Manager in 2005. Her field experiences span the Late Paleozoic–Quaternary. More specifically, she has collected fish, amphibian, and reptile fossils from the Late Paleozoic of western USA and Germany; frog, dinosaur and mammal fossils from the Mesozoic of USA; and mammal and herp fossils, including frogs, from the Cenozoic of USA. Henrici's Master Thesis described fossil frogs she collected from the Eocene of central Wyoming, and she has since published on frog fossils from the Mesozoic–Cenozoic. She began collaborating with Dr. Dave Berman (now Curator Emeritus at CMNH) on research projects involving Late Paleozoic fossil vertebrates in 1998 while preparing fossils under his supervision. This collaboration continues today and currently focuses on vertebrate fossils from the Cutler Group in southeastern Utah and the Bromacker quarry in central Germany.

PRESIDENT'S STATEMENT

I was thinking about the Anthropocene as I graded an exam question. As I read the student's response, I thought about Albert Kollar and his contributions to our understanding of the Anthropocene with his analysis of landscape paintings (Wendel, 2018; Kollar and Hughes, 2017; Kollar and Brezinski, 2010). The student argued that there is no evidence to support the Anthropocene as a formally defined geochronologic unit.

The term Anthropocene was introduced by Crutzen and Stoermer in 2000 for the period in Earth's history that is being altered by human activities. These activities have resulted in extinctions of plant and animal species, polluted oceans and an altered atmosphere. The student claimed there are no data, however, Albert Kollar has provided clear evidence of this in his papers. After reading the response several times, I realized that the student was using the wrong word in the response. I think the student meant to use chronostratigraphic unit instead recognizing the lack of a stratigraphic rock record.

John Kane, *Nine Mile Run Seen from Calvary*, c. 1928.

As I think back about this time last year, I recall the excitement for the holidays and the end of another year. It is amazing how things have changed in a short period of time. Holding virtual meetings and happy hours with friends over Zoom was the farthest thing from my imagination. Last year, I was thinking about the changes in the weather and wondering if the upcoming winter months would result in many hours digging out from a snowstorm the night before. This year, as I stay confined to my home, teaching remotely, I wonder when the pandemic will end and what it will look like. Will we all give a sigh of relief and run outside in one large global dance party. How will this be captured in history? Will there be landscape paintings that will capture these few years? If so, what will the scenes be? Is there any clear evidence in the 2020 landscape that captures the true essence of this time?

At this upcoming holiday meeting, it would be fun to have this discussion with Albert Kollar. I look forward to getting back to the museum and having good discussions with Albert and others about the Anthropocene, ancient life, and societal times. I am sure that during this crazy time our discussions would be rather lively. Please join me Wednesday December 16 for our traditional holiday meeting where we welcome any friends and family (in your Covid-19 bubble) to watch the presentation

with you. Distant friends and relatives can RSVP for the Zoom link at no charge.

In closing, I want to remind you to renew your membership and thank those that already have. Thanks also to our corporate sponsors who help support all the PGS programing throughout the year. As we end the year, please remember that if you are considering a last-minute charitable contribution, please think of PGS.

Have a wonderful holiday, please be safe, stay well and I look forward to seeing you at the last meeting of 2020.

Happy holidays! Tamra

Kollar, A.D., and Kay Hughes. 2017. Geology of the Landscape Paintings at the Carnegie Museum of Art, A Reflection of the Anthropocene, 1860 to 2017. *Geological Society of America, Abstracts with Programs*, v. 49, 243.

Kollar, A.D., and D.K. Brezinski. 2010. Geology, Landscapes and John Kane's Landscape Paintings. PA*l*S Publication 10, 5. (See note below for link.)

Wendel, J. (2018), A window into the emerging Anthropocene…through art, *Eos*, 99, https://doi.org/10.1029/2018EO088375. Published on 09 January 2018.

Editor's Note – Among his numerous other contributions to PGS, Albert Kollar has graciously allowed us to share an archive of PAlS brochures on our website. These were originally created by the staff and volunteers of the Carnegie Museum to provide geologic information about local parks and other topics of geologic interest. You can browse the entire collection, including No. 10, at:

https://pittsburghgeologicalsociety.org/pals-brochures.html

There is one last PGS board member to introduce this month:

Michael Keeliher:

After getting out of the service in 1970, I attended community college and later graduated from the University of Maryland in 1974, all on the GI Bill. My first job was for a geotechnical engineering firm where I worked in a soils lab and stood behind a drilling rig. One of my past professors called us "dirt squeezers". On one project, I went to Frostburg State College, which was underlain by the Pittsburgh Coal seam, to investigate subsidence risk. This was partly in response to a scandal propagated by Spiro Agnew involving bribery and kickbacks for highway engineering contracts awarded in Maryland.

(Editor's note – ASCE has an interesting article about the consequences faced by the highway engineers after this scandal: https://www.asce.org/question-of-ethics-articles/oct-2005/)

Then on to the rest of Maryland and southern West Virginia to explore for coal. I went to Colorado to help run an office and learned about expansive clays. Changed jobs and worked for a division of Island Creek Coal Company, exploring for coal in many parts of the west. That office closed when Occidental Petroleum, the parent company, purchased Cities Service for 4 billion bucks. Landed a job with Michael Baker in Denver. When they closed, I was asked to move to the main office in Beaver County. That's when I joined PGS in 1986.

I was in the environmental division, going out to superfund and CERCLA sites to evaluate all the messes. I went to a consulting firm which had Koppers as a client and worked on even more messes. I have continued to work as a consultant in the environmental sector. I still work part-time for a firm in Sharon, PA. Otherwise I'm semi-retired and clean up weeds in my yard. I am working in my community as a board member for the water authority in Brighton Township.

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	*Scheduled Speaker*	*Presentation Topic*
January 20, 2021	TBA, Joint Meeting with ASCE and AEG	Engineering Geology
February 17, 2021	TBA	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

December 8, 2020 1:00 PM – 2:00 PM

"Introduction to Geophysical Well Logging & Imaging (60 mins.)" by Scott Wendling, P.G., Vice President, ARM Geophysics.

To register: https://pcpg.wildapricot.org/event-4006354

December 16, 2020 8:00 AM – 12:00 PM

"Webinar: The Invisible Gorilla in the Courtroom: Managing Hydrogeologic Risks in the Wake of the SCOTUS Functional Equivalent (225 mins.)" by Thomas Gillespie, P.G., Senior Professional Geologist, Gilmore and Associates.

To register: http://www.pcpg.org/event-4017941

Harrisburg Area Geological Society

December 10, 2020 6:30 PM – 7:30 PM

"The Mississippian-age Mauch Chunk Formation of Clinton County, Pennsylvania: A triple-decker sandwich with a side of Loyalhanna" by Rose-Anna Behr, P.G. - PA Geological Survey

To RSVP, email: secretaryhags@gmail.com

The Pittsburgh Geological Society welcomes the following:

New Recent Graduate Members

Nora E. Vaughan
Archaeological Field Technician
Commonwealth Heritage Group

Marshall G. Carter

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Homewood is a common English name for an area dominated by a manor and surrounding woodlands. As such, there are many places called Homewood, including two in western Pennsylvania. Homewood, in Beaver County, is a small borough near Beaver Falls that is surrounded by the borough of Big Beaver. It is home to Buttermilk Falls and a quarry that is the type locality of the Pennsylvanian Homewood sandstone.

Homewood is also a neighborhood of Pittsburgh that was founded in 1832 by Judge William Wilkins. It was annexed by the city in 1884. From its beginning until the late 1880s, it was mainly associated with the wealthy estates of people like Andrew Carnegie. Starting in 1910, the neighborhood became more diverse as Irish, Italian, German, and upper middle class African American families moved into low-cost housing. In the late 1950s the population became predominantly African American and it remains so today. Homewood was the home of celebrated photographer Charles 'Teenie' Harris, and the National Negro Opera Company founded by Mary Cardwell Dawson in 1941. The building that housed the opera company still stands on Apple Street in Homewood.

Left – Buttermilk Falls in Homewood, Beaver County.

Right – home of the National Negro Opera Company in the Homewood neighborhood of Pittsburgh.

DID YOU KNOW . . . ?

James LeRoy "Pop" Kay (1892-1971) was the Curator of Vertebrate Fossils at the Carnegie Museum of Natural History and a Founder and Charter Member of the Pittsburgh Geological Society. He was born to John T. and Mary Bascom Kay in Mona, Utah. His formal education consisted of public schools and the Uinta State Academy in Vernal, Utah.

Kay started his long career in vertebrate paleontology in 1915 as a quarry worker at the Carnegie Museum's dinosaur quarry located north of the town of Jensen, Utah, now part of Dinosaur National Monument. He worked there under the direction of Dr. Earl Douglass, the museum paleontologist who discovered the site in 1909. In 1923, Kay joined the staff of the museum in Pittsburgh and ten years later was appointed Field Collector and Assistant in Paleontology. In 1938, he was appointed Acting Curator and, in 1941, Curator of Vertebrate Fossils. He held the latter position until he retired in 1957, returning to Utah for the remaining fourteen years of his life. During the course of his work at the museum, he received two honorary doctorates, a ScD from the University of Pittsburgh in 1942 and a LLD from Waynesburg College in 1949.

Throughout his working years, Kay spent his winters in Pittsburgh at the museum and his field seasons looking for and collecting fossils, mostly in Tertiary rocks of the western states. He was most familiar with Utah geology and the rocks of the inter-montane basins of the Rocky Mountains, and it was there that he made many discoveries.

It has been said that one of his discoveries came about because of the need to occupy a kid's attention for a while. As the story goes, he and his team were trying to build a trail down the cliff face at the museum's quarry, but 10-year-old Jesse York, his wife's brother, wanted to help. Kay worried that Jesse would get hurt playing around the heavy equipment used to construct the trail so he told the youngster to go somewhere and dig a hole in the rock for dynamite blasting. Jesse agreed and dug the hole. When the dynamite was dropped in the hole and exploded, the debris included part of a tiny vertebrate skeleton. The quarry team searched for hours until someone found another chunk of rock that had the rest of the skeleton in it. When the rocks were later prepared at the museum, the result was the beautiful skeleton of a tiny 7-inch long terrestrial crocodile that was named *Hoplosuchus kayi*.

Photo of J. LeRoy "Pop" Kay, one of the founders of PGS.

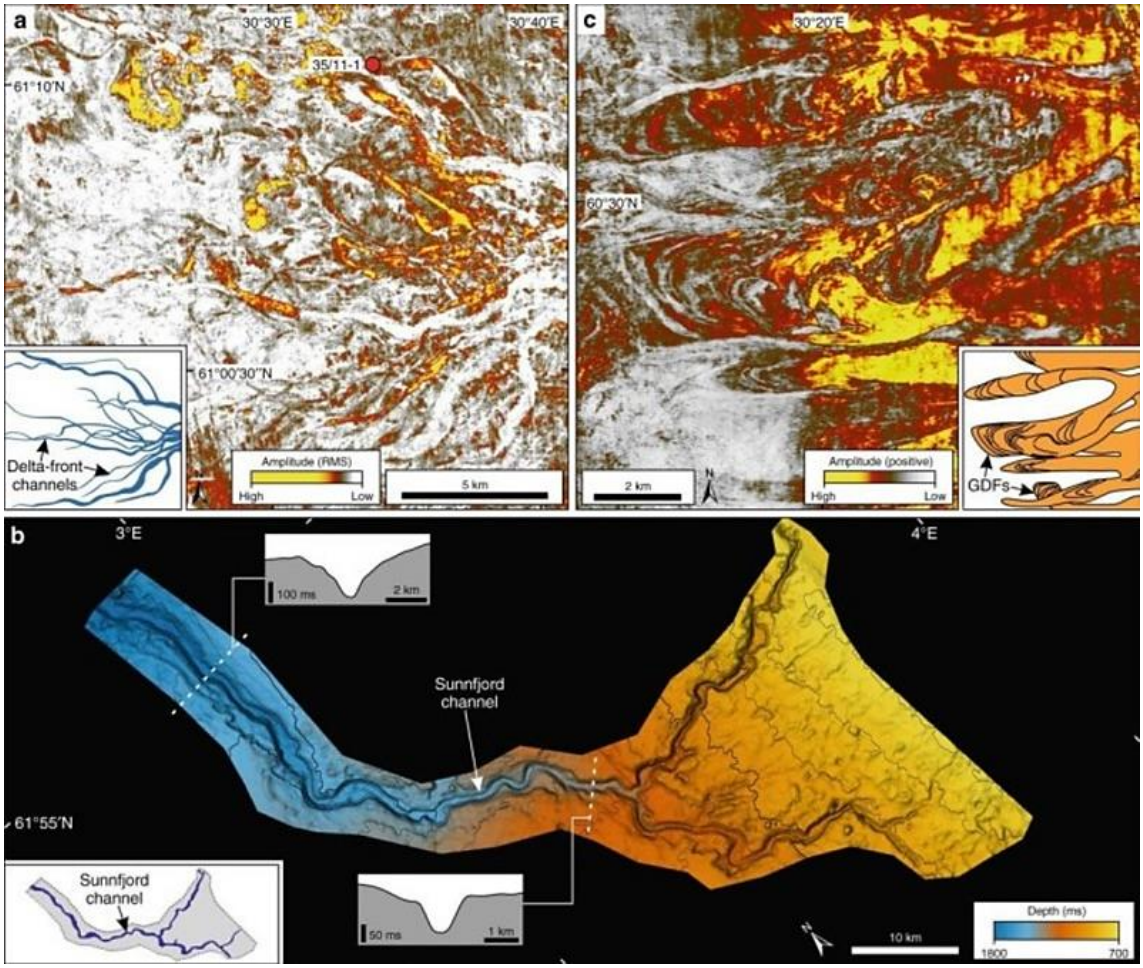
Photo of *Hoplosuchus kayi*, a beautifully preserved crocodilian fossil.

During the course of his long field career, Kay was well known for both his unreserved good humor and his capabilities as a field collector and curator. He was well known in the vertebrate paleontology field and received an honorary life membership in the Society of Vertebrate Paleontologists in 1970.

https://qvcproject.blogspot.com/2010/12/fishy-croc-tale.html

Over the last two million years or so there have been somewhere between 30 and 40 ice ages that changed the landscape of the northern hemisphere, especially in places like Norway (just think of the fjords, mountains, valleys, and low plains along the Norwegian coast). We can see the results of the last of these ice ages, but we actually know little about what occurred because the ice ages themselves effectively removed all but a few traces of them – the aforementioned valleys, fjords, and mountains. There might have been as many as 40 ice ages but we only see the traces of the last one, which lasted for 100,000 years.

Now, researchers are using a new set of 3D images of the North Sea seabed to provide details about the development of all the ice ages, all the way back to the beginning 2.6 ma ago. The remains of these ice ages, and earlier periods in the Earth's history as well, are better preserved on the continental shelf in the North Sea than on land in Norway, due largely to the fact that the North Sea probably is the best mapped seabed in the world. When the first ice sheet covered Norway 2.6 million years ago, it sent large glacial lobes out into the sea the way the glaciers in Greenland and Svalbard are doing today.



Upper left – parts of a large river delta outside Sognefjorden, created just before the onset of the ice ages. Upper right – sedimentary masses spreading out on the continental shelf. Bottom – a large meltwater river flowed out of Sunnfjord at the onset of the ice ages, creating a 65-mi long subsea channel.

The researchers speculated that the first glacial lobe reached into the North Sea where the Sognefjorden, the largest and deepest fjord in Norway, meets the sea. Over time, glacial arms extended out from the Nordfjord, Sunnfjord, and Hardangerfjord systems as well, and the ice that flowed from the mainland spread beyond the continental shelf. At Sunnfjord in the north of Western Norway, for example, a large river seems to have sent huge amounts of meltwater into the sea during the beginning of the first ice age. The meltwater continued to flow as a strong underwater stream, creating a channel at least 1.2 mi wide and 500 ft deep on the seabed 65 mi or more to the west. The Sunnfjord channel sediments are younger than the Sognefjorden valley sediments deposited just before the ice age, but they are older than surrounding masses that were deposited during the ice ages. This allowed

the researchers to establish the time of the Sunnfjord channel to the beginning of the ice ages.

It is interesting that the researchers have only been able to locate the outer part of the Sunnfjord channel in the 3D images. Farther inland on the continental shelf, the Sunnfjord channel and other traces were removed from the seabed by the ice masses that flowed along the South Norway coast, scraping the ocean floor as they went. The broad Norwegian Trench, an elongated depression in the sea floor off the southern coast of Norway, was formed by this ice stream activity. The researchers also believe they can confirm that the ice, starting 2.6 ma, stretched far out to the edge of the continental shelf in the North Sea before breaking up into enormous icebergs.

https://sciencenorway.no/geology-ice-age/scientists-are-seeing-ice-age-beginnings-for-very-first-time/1756240

It has been reported that Chinese survey teams have discovered numerous deposits of beryllium ore, which can be used to manufacture nuclear weapons, thereby potentially adding more tension to China's hopes of dominating supplies of rare earths and other valuable minerals. The survey teams found the beryllium, one of the rarest elements, in "gray stones" (most likely beryl) in the Xinjiang region of northwestern China. Beryllium is highly toxic and may even cause cancer, but it is an indispensable raw material in the missile, aviation, and metallurgical industries, and an excellent material for satellites. Although not one of the 17 rare earth elements, beryllium's scarcity and versatility make it a much sought-after metal. Known stocks from around the world amount to only a few thousand tons. The Chinese discovery has been estimated to be more than 4,000 tons.

"Gray stone" (beryllium ore) found in northwestern China is potentially the largest deposit of the ore in the world.

Scarce elemental ores such as rare earths are used to make electronic devices from smartphones to weapons. China currently controls the world's largest deposits of these minerals, potentially putting tech companies from around the world, especially in the US, at risk of Chinese sanctions. Thus, their control by the Chinese government has become a new front in the Sino-US trade war. Beijing sees an opportunity to control the market and has threatened to impose penalties on companies that reduce its market share, similar to the ways the US is preventing firms from transacting with sanctioned Chinese producers such as Huawei. Instead, the US said it will develop its own rare earth deposits in order to sidestep Chinese production.

The new discovery would make the Xinjiang beryllium mine the largest in the world, which pretty much guarantees China will be able to manufacture various high-end weapons. China also recently discovered associated cobalt ore in the Jinchuan nickel sulfide mine in Gansu Province, China's largest mine, with large proven cobalt reserves. While the total world land reserves of cobalt amount to about 1.48 million tons, China has approximately 470,000 tons or 31% of those world reserves.

https://www.asiatimesfinancial.com/massive-beryllium-find-in-china-raises-stakes-in-rare-earth-tensions

In 1832, the Geological Society of Pennsylvania was formed in Philadelphia, primarily to urge the state to establish and fund a geological survey of the state. It would be four years before the Society's efforts bore fruition, but in the meantime, during 1834 and 1835, the Society published two parts of a single volume of transactions that included many geological reports, including some

from western Pennsylvania. In March 1836, the legislature created a Geological Survey of Pennsylvania and funded it for a period not exceeding five years.

Henry Darwin Rogers, a member of the Society and Professor of Geology at the University of Pennsylvania, was named State Geologist and head of the Survey. He chose a number of assistants who would end up doing most of the field work and get very little credit for it. By 1840, the Survey consisted of 12 geologist and chemists, several of whom went on to become State Geologists of other state surveys.

The Survey's work encountered numerous problems. Base maps were inadequate and Pennsylvania's geology and geography were far more complex than anyone had anticipated. In addition, state insolvency in 1842 led to lack of funding, resulting in the remaining staff leaving and the Survey disbanding. It was revived in the 1851-1852 fiscal year with a smaller number of geologists and draftsmen to work on preparing the final report. Although most of the work centered on eastern Pennsylvania, primarily the anthracite area, and in preparing revisions to a planned multicolored state geologic map, western Pennsylvania did have its share of coverage at the end.

Portrait of Henry Darwin Rogers, First State Geologist of Pennsylvania.

Rogers had described the Survey's work in a series of generalized annual reports between 1836 and 1841 but held back on the big scientific results in order to put everything into a major final report. This final report was published in 1858 in two volumes totaling more than 1,600 pages and containing 23 full-page plates, 18 folded sheets of sections, 778 text-figures, and Leo Lesquereux's first attempt at describing the fossil plants of the coal measures. *The Geology of Pennsylvania: A Government Survey with a General View of the Geology of the United States,* although published 16 years after the end of the Survey's primary field work, was considered a scientific and technical masterpiece. Much of it still holds up today.

Although the Rogers Survey ended most of its geological investigations by 1842, geological research continued in the state independently. Papers published by the American Philosophical Society, the Academy of Natural Sciences of Philadelphia, and the Franklin Institute continued to provide updates and new information on geology, geochemistry, and paleontology of Pennsylvania. Much of the research, mapping, and reporting centered around vital mineral industries such as coal, oil, and iron, which became even more valuable during the Civil War years.

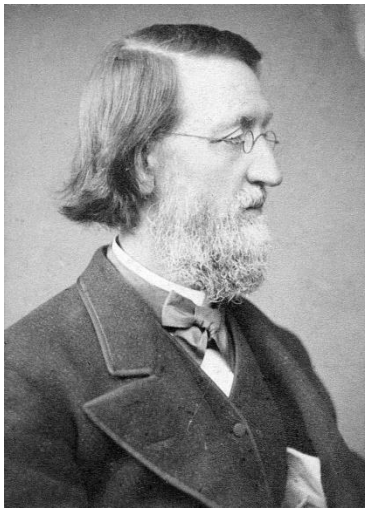


Photo of J. Peter Lesley, Second State Geologist of Pennsylvania.

Finally, in 1874, at the urging of the state's booming mineral industries, the state legislature authorized and funded a Second Geological Survey of Pennsylvania. J. Peter Lesley, who was a geological field assistant and a draftsman on the Rogers Survey, a well-known and respected economic geologist, and Professor of Geology at the University of Pennsylvania, headed the new Survey. Lesley had a staff of 86 geologists, engineers, chemists, and draftsmen over the course of the Second Geological Survey of Pennsylvania. During its 21 years of existence, the Second Survey published 124 reports, most of them on a county basis. They included multicolored county geologic maps, including many with topographic contour maps, as well as topical maps for reports on specific minerals such as coal. The Survey also produced a new state geologic map issued in 1893. The Second Survey ceased operations in 1895.

In 1899, the legislature authorized a topographic and geologic survey of the state to be operated

and funded in cooperation with the U.S Geological Survey and overseen by a three-person commission. The cooperative surveys mapped half of the state topographically at a scale of 1:62,500 and provided geological mapping of 37 of them, including 18 as large-scale USGS Folios. In 1909, the state legislature authorized and funded the Third Topographic and Geological Survey of Pennsylvania with Richard R. Hice, a Beaver County native, named head. Under Hice's guidance, cooperative mapping with the USGS continued but most of the geological mapping and reporting was done primarily by college professors and their graduate students. Funding ceased after 1914, but in the five years of its existence the Third Survey produced 18 reports and the USGS produced nine more folios.

Photo of Richard H. Hice, Third State Geologist of Pennsylvania.

The state legislature established the present Geologic Survey, the fourth, in 1919 as a bureau within the Department of Internal Affairs with George H. Ashley as its first head. Ashley formerly had been Chief of the USGS section dealing with the eastern coal fields. Following his retirement in 1946, Ashley was succeeded over the years by Ralph W. Stone, Stanley H. Cathcart, Carlyle Gray, Arthur A. Socolow, Donald M. Hoskins, Jay B. Parrish, George E. W. Love, and Gail C. Blackmer.

For most of its existence, the Fourth Survey had been referred to as the Bureau of Topographic and Geologic Survey, but recent de-emphasis on topographic mapping led to a name change to Bureau of Geologic Survey, or just Pennsylvania Geological Survey. Similarly, its home within state government changed several times, from the Department of Internal Affairs to the Department of Environmental Protection in 1970, then to the Department of Conservation and Natural Resources in 1995. From the beginning, the

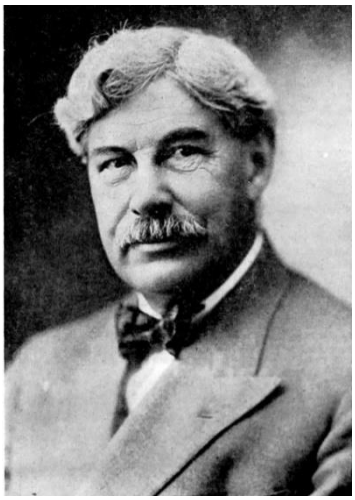


Photo of George H. Ashley, first State Geologist of the Fourth Pennsylvania Geological Survey.

Fourth Survey's emphasis has been on providing geologic information to the public. Over the last 101 years, the Survey instituted a series of reports dealing with everything from water to essential minerals, geochemistry to geohazards, stratigraphy to paleontology, surficial deposits to subsurface oil and gas formations. Essentially, if the subject has to do with geology in Pennsylvania, the Fourth Survey has been busy keeping the citizens of the state informed.

You can read much more about the history and accomplishments of the Pennsylvania Geologic Survey in a special 1987 issue of ***Pennsylvania Geology*** (Vol 18 No. 1) which celebrated the Survey's 150th anniversary:

http://elibrary.dcnr.pa.gov/GetDocument?docId=1752314&DocName=PaGeoMag_v18no1.pdf

NASA scientists have discovered a field of lithified sand dunes estimated to be about 1 ga in the Valles Marineris canyon on Mars. Although they have been heavily eroded, the dunes have withstood the ravages of time pretty well, unlike the wind- and water-eroded fossil sand dunes on Earth. The scientists' estimation of age was based on the dunes' relationships to other geologic units and modern erosion rates. Understanding how these dunes resisted the ravages of time could give scientists a lot of insight into both Martian sedimentary processes and Martian geologic history.

Modern Martian sand dunes that have been whipped up by wind are common features. Their orientation, length, height, shape and slope look

remarkably similar to the newly discovered fossil dunes, suggesting the climate and atmosphere on Mars have changed little over the eons. It also indicates 1) that the major wind directions responsible for the dunes' shape have not changed substantially over time, and 2) that the atmospheric pressure hasn't changed significantly. The scientists used images from the High Resolution Imaging Science Experiment (HiRISE) and Martian topography data to document and date the bedform properties of the canyon. Although the topography of the Valles Marineris canyon is still incomplete, the fossil dunes that can be deciphered do not paint a dramatically different picture than what can be gained from their modern counterparts. Some of the dunes seem to have been buried under material from a speculated catastrophic volcanic

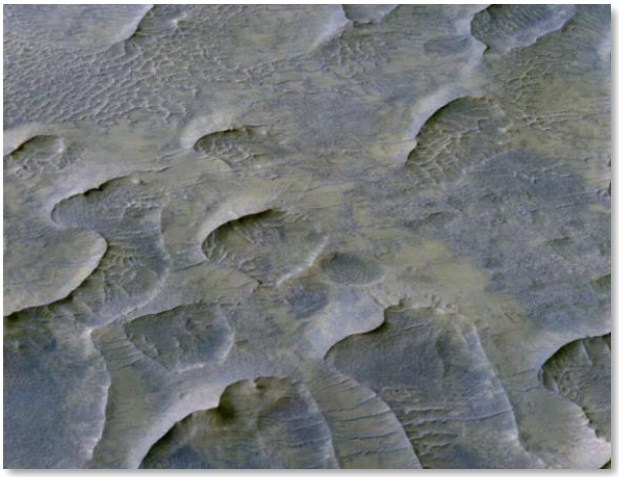


Photo of billion-year-old lithified sand dunes on Mars.

event; they were later lithified by a volatile compound that flowed through them.

On Earth, this same sort of process occurs when groundwater invades a partially buried sand dune, forming layers of lithified sand like the famous striped structures seen in Zion National Park. On Mars, however, lithified sand dunes have far fewer elements to contend with. Exposure to trade winds is the main agent of erosion on Mars, and over deep time the wind helped erode the volcanic shell that once covered the dunes. The scientists say the mere existence and degree of preservation seen in these dunes indicate an important difference in the landscape evolution of Earth and Mars. Although ancient lithified dunes on Earth seem to be rare and are much more eroded, the Martian dunes belong to an extensive paleo-dune field scattered across the basin floor, where many dune forms and their morphology appear largely intact. The water and tectonics that constantly reshape the surface of Earth are not currently a factor on Mars.

https://www.sciencealert.com/the-sands-of-mars-have-been-forming-shifting-dunes-for-a-very-long-time

Mary Anning (1799-1847) was born in Lyme Regis, a town perched above the coastal cliffs of Jurassic rock in Dorset in western England. Her family was poor, dependent on selling specimens of the abundant Jurassic ammonites, belemnites, and other fossils found on the beaches below the cliffs to tourists. Mary's father died when she was barely a teenager. As the best fossil spotter in the family she became essential to their survival. The work was often dangerous since the cliffs are prone to landslides. In her early 20s, Mary became legendary as a fossil hunter. Among her many accomplishments, she found the world's first complete plesiosaur fossil, Britain's British pterosaur, and figured out that coprolites were fossilized dung. She and her family opened "Anning's Fossil Depot" where the fossils were bought by collectors in the US and Europe.

Mary was essentially self-taught in geology and paleontology, but her knowledge of fossil anatomy was such that she not only corresponded and spoke with professors and other naturalists on the subject, they also acknowledged that she understood more paleontology than anyone else in England. She was someone who knew what she was talking about and was quick to let people know it. She was such a major contributor to geology and paleontology at the beginning of their acceptance as valid sciences that she became established in museums and gained worldwide interest. Despite this, Mary did not receive all of the recognition she really deserved because science was a field for gentlemen, i.e., high-class males, and Mary fell into neither category. She had to labor in order to live, and her research was intimately tied to how she made that living. To the Victorian mind, such reliance was distasteful and sullied the pure search for knowledge. Therefore,

she was denied membership (and attendance) in the Geological Society. In addition, she was classified as an amateur because she lacked a formal education.

Throughout the 19th and 20th centuries, Mary was regarded as being barely literate, that she was a lower-class fossil prodigy who had little real input into the science of paleontology. She rarely received credited for her discoveries and thanks in academic publications. It has taken careful work by historians who found the correspondence between Mary and prominent geologists of the day to reveal her knowledge of fossils, and debates centered around the long-lost worlds those fossils revealed. Still another reason for her having so little recognition was the scientific world's bias for grand scientific theories, like the Darwin's Theory of Evolution or Newton's Three Laws of Thermodynamics that were built around how the universe worked. Mary "merely" collected and prepared fossils (although we now know she influenced the debate as well).

In the late 1830s, fossil hunting became more difficult for Mary Anning because of health problems. She sold her last fossil to the British Museum 1840 and died of breast cancer in 1847. But the geological community did not forget her altogether – those who benefitted from her discoveries helped grant her an annuity in 1838.

***Mary Anning Rocks* is a local campaign to raise a statue honoring paleontologist Mary Anning in Lyme Regis, Dorset, England. This photo shows where the statue would be placed above the cliffs of Jurassic rock where Mary collected the fossils she prepared and studied in the early 1800s. To read more: https://www.maryanningrocks.co.uk/**

Today, even during the COVID-19 pandemic, a campaign initiated by a 12-year-old girl and her mother from Lyme Regis called *Mary Anning Rocks* has the townsfolk soliciting funds to erect a statue to Mary, their most famous citizen. Better late than never.

https://theconversation.com/mary-anning-how-a-poor-victorian-woman-became-one-of-the-worlds-greatest-palaeontologists-105183

A chunk of kimberlite from Baffin Island, Canada.

Canadian scientists studying diamond samples from deep below the Chidliak Kimberlite Province in southern Baffin Island, an ice-covered land mass near Greenland, recently discovered a fragment of the North Atlantic Craton, suggesting that it was 10% larger than previously thought. The North Atlantic Craton stretched from present-day Scotland to North America and broke apart 150 ma ago. The scientists stumbled upon the latest evidence while examining exploration samples of kimberlite from Baffin Island. Kimberlites are intrusive igneous rocks that pick up chunks of subsurface rocks on their way to the surface. These chunks of rocks in turn often carry a wealth of details on conditions far beneath the surface of Earth over long periods of geologic time.

One kimberlite sample had a mineral signature that matched other portions of the North Atlantic Craton. These "lost" pieces are like missing pieces of a jigsaw puzzle, so finding them can be very exciting for geologists. Previous reconstructions of the Earth's plates had been based on shallow rock samples formed at depths of one to six miles. Since the discovery adds about 10% to the known size of the craton, our knowledge is literally and symbolically deeper than it used to be.

https://www.bbc.com/news/world-us-canada-51989255

Hollis Dow Hedberg (1903-1988), although not a founder of PGS, was a long-time member during his tenure with Gulf Oil Corporation in Pittsburgh. Born in Falun, Kansas, Hollis was a farmer's son who helped his family work their fields while he attended Falun Rural High School. After graduating in 1920, he attended the University of Kansas in Lawrence as a journalism major, but later decided to study geology instead and, during the summers of 1924 and 1925, had an internship with the Kansas State Geological Survey as a field assistant. He received his BA in Geology Phi Beta Kappa in 1925, then moved to Ithaca, New York to attend Cornell University where he earned his MS in Geology in 1926. His first paper resulting from his graduate work was published in 1926 advancing the hypothesis that porosity in shales is an index of pressure metamorphism that could be used as an indicator of oil potential. This idea was ahead of its time.

Photo of Hollis D. Hedberg, Vice-President of Exploration for Gulf Oil Corporation and a long-time member of PGS.

Following graduation from Cornell, Hollis joined the Lago Petroleum Company, a Venezuelan subsidiary of Standard Oil of Indiana, as a petrographer in their Maracaibo laboratory. While there, he published a paper expressing his belief that criteria other than fossils could be used for correlating and dating rocks. However, dissatisfied with his job at Lago, in 1928 he joined the Venezuelan Gulf Oil Company, one of Gulf Oil Corporation's many subsidiaries, and worked first as a stratigrapher, then as head of their geological laboratory in Maracaibo. While he had normal laboratory duties to perform, he took field trips to many areas of Venezuela and Colombia where he established a network of consistently measured, described, and dated stratigraphic sections.

In 1934, he returned to the US on leave of absence to attend Stanford University where he completed his requirements toward a PhD. He returned to Venezuela in 1935 and resumed his duties as director of Gulf's geological laboratory while he wrote a dissertation that, among other things, made a clear distinction between age (Time), stage (Time-Stratigraphic), formation (Lithogenetic), and zones (Faunizone, Mineral-zone, etc.). This work was the basis of concepts of stratigraphic classification that he defended later in life. He was awarded a PhD *in absentia* from Stanford in 1937.

Hollis was put in charge of geological operations in eastern Venezuela for the Mene Grande Oil Company (formerly Venezuelan Gulf). He was transferred to New York in 1946 as chief geologist of the Foreign Exploration Division of Gulf Oil, which put him in charge of geological activities in all foreign countries except Venezuela and Canada. He later became exploration manager of that division in 1951. In 1952 he became chief geologist responsible for all geological activities of Gulf Oil Corporation worldwide, which brought him to Pittsburgh where he joined PGS.

In further promotions, he was named exploration coordinator in 1953 and vice-president for exploration in 1957. While there, he became increasingly discouraged by Gulf Oil Company's de-emphasis and decentralization of petroleum exploration while placing emphasis on short-term returns. He requested retirement from Gulf in 1959 and accepted a full, part-time professorship of geology at Princeton University, a position that lasted until 1972. Gulf's CEO would not accept his retirement request, however, so Hollis stayed on as vice-president until 1964, then as exploration advisor to the executive until 1968, when he finally retired. Having moved his family to Princeton in 1959, he commuted between Princeton and Pittsburgh until his official retirement, when he ceased his membership in PGS as well.

Besides stratigraphy, Hollis made many significant contributions to the geology of the oceans. For example, he chaired the Project Mohole committee from 1962 to 1963. He was committed to defending offshore limits and urged the US government to protect its offshore petroleum

resources, proposing a consortium of corporations, government, and academic institutions to evaluate the offshore potential. He was opposed to the UN's attempt to limit the jurisdiction of a country to an arbitrary 200 nautical miles limit because it would cause a 250,000-mi^2 jurisdictional loss of territory to the US for deep water exploration. As a result of his influence, the US refused to ratify the UN Law of the Sea Convention during the Reagan administration.

Hollis received many honors during his lifetime, including:

- Medalla de Honor de la Instruccion Publica, awarded by the Venezuelan Government in 1941 (the first foreign recipient)
- AAPG Sidney Powers Medal, 1963
- University of Kansas Distinguished Service Award, 1963
- Geological Society of London William Smith Lecture, 1970
- AAPG President's Award, 1972
- Princeton University Conference on Petroleum and Global Tectonics, 1972
- National Academy of Science Mary Clark Thompson Award, 1973
- AAPG Human Needs Award, 1973
- Offshore Technology Conference Distinguished Achievement Award, 1975
- Geological Society of London Wollaston Medal, 1975
- Doctor Honoris Causa, University of Uppsala, Sweden, 1977
- Geological Society of America Penrose Medal, 1980
- AAPG Hedberg Research Conference honoree, 1981
- AGI Ian Campbell Medal, 1983
- Louisiana State University Hollis D. Hedberg Award in Energy, 1983
- AGI William Heroy Jr. Award, 1987

In 2019, the Energy Geology Division of The Geological Society of America (GSA) established a new award: **The Curtis-Hedberg Petroleum Career Achievement Award**. This Award will be considered annually in accordance with the bylaws of the Society. The award will go to a GSA member who has had a career in petroleum geology and has made contributions to the discovery of petroleum reserves or the development of a new idea(s) and/or technology that increased petroleum resources. Considerations will be given for nominees' publications as well as contributions to geoscience societies and institutions.

The award honors two former GSA presidents with outstanding contributions to petroleum geoscience, Dr. Doris Malkins Curtis and Dr. Hollis Hedberg. Doris Malkin Curtis was a pioneer in the field of petroleum geology and coauthored the book "How to Try to Find an Oil Field" in 1981. Her hard work resulted in many milestones including being the first female President of GSA (1991). Hollis Hedberg was not only an oil-finder, he was also a consummate scientist and developed an international reputation both in the petroleum industry and academia. He received numerous awards and published over 70 research papers.

For more information about this award: https://community.geosociety.org/energydivision/awards/curtishedberg

PGS WEBSITE OF THE MONTH:

oceanresearchproject.org/

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Memberships: For information about memberships, please write PGS Membership Chair, PO Box 58172, Pittsburgh PA 15209, or e-mail jharper.pgs@gmail.com. Membership information may also be found at our website: www.pittsburghgeologicalsociety.org.

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Fun Fact Having Nothing to Do with Geology

The term “yuletide” originates from a Norse tradition of chopping down a tree and burning it to usher in the Winter Solstice. The fire was supposed to last for twelve days, which was the basis of the Christian tradition of the Twelve Days of Christmas.

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