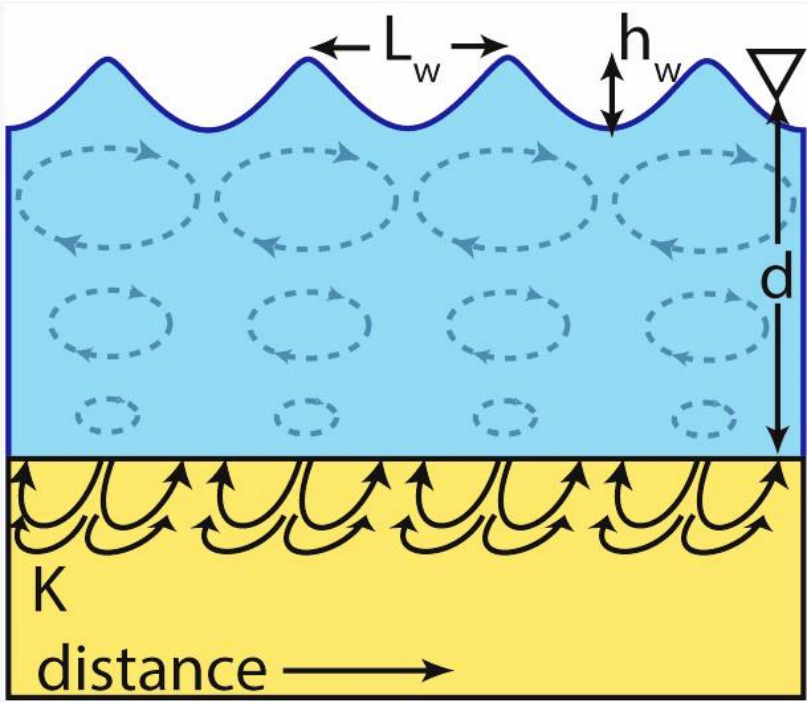
# PITTSBURGH GEOLOGICAL SOCIETY

Celebrating 75 Years

## The Effect of Waves on Benthic Exchange: Measurement And Estimation Over A Broad Range Of Spatial And Temporal Scales




**Dr. Christopher Russoniello**

**Department of Geology and Geography, West Virginia University**

**November 13, 2019**

**NEW MEETING TIMES**

| | |
|---|---|
| Social Hour | 5:30 PM |
| Dinner | 6:30 PM |
| Speaker | 7:30 PM |

**NEW DINNER COSTS**

$35.00 regular member
$15.00 student member
$40.00 non-member

**FOR RESERVATIONS**

Email your name and number of attendees to:

pgsreservations@gmail.com

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

**MEETING LOCATION**

Cefalo's Banquet & Event Center, Carnegie PA

**Make Reservations by Wednesday, November 6**

# Speaker Abstract

The loads and speciation of nutrients, metals, and carbon that discharge to coastal waters have impacts on nearshore marine ecosystems. Seabed sediments host high rates of chemical reactivity, and hydrodynamic mixing (benthic exchange) of water and solutes between seabed sediments and the overlying water column is an essential control on solute fluxes and reaction rates in these coastal ecosystems. Reactions in sandy seabed sediment drive meaningful rates of remineralization and nearly half of global denitrification. These reactions are clearly important, but the benthic exchange that supplies new reactants is poorly constrained. Wave pumping is recognized as the largest benthic exchange driver, but wave pumping rates and variability over spatial and temporal scales has been difficult to estimate and poorly quantified.

In this talk, I will present field and numerical methods to measure and quantify wave pumping rates and results of a study that upscales those findings to understand the impact of wave pumping on global and decadal scales. First, a field and modeling study quantified how wave pumping varied over time in a shallow estuary and validated a technique to upscale site-scale measurements to larger geographic areas. Those results allowed the construction of a global wave pumping model that quantified wave pumping rates and associated temporal and spatial variability over the entire globe over the 31 years from 1979 to 2010. The average annual rate of 1.8x105 km3/yr is equivalent to 6.1 m/yr over the entire global shelf area. This rate is also equivalent to 4.5 times global river discharge and would flush global oceans every 7600 years. We also explore seasonal variability, the effect of tropical cyclones, and the effect of a changing climate on wave pumping rates and impacts.

# Speaker Biography

Dr. Chris Russoniello started as a hydrogeologist at West Virginia University in August and brings his interest for understanding how surface water and groundwater interact in marine and freshwater settings. Dr. Russoniello teaches Physical Hydrogeology and Groundwater Modeling, and is developing a lab group to study local water issues, continue generic and applied modeling studies to understand fresh/saline mixing at the coast, and examine novel methods to upscale process- and site-scale results to understand global implications.

A native of New Jersey, Dr. Russoniello completed his undergraduate degree at Colby College in Maine. Following graduation, he travelled to Alaska to work for the Park Service and then spent four years working as a terrestrial and hydrographic surveyor working throughout the state. He returned east to earn an MS and a PhD from the University of Delaware with work that focused on how freshwater travels to the coast, how geologic heterogeneity controls those flowpaths and fresh/saline mixing, how hydrodynamics drive surface water/groundwater exchange, and how these hydrologic controls drive transport and processing of nutrients in coastal waters. He was most recently a teaching postdoc at Syracuse University where he studied the effect of beaver dams on seasonal stream discharge in the American mountain west, and examined how simple visualization tools could improve classroom teaching.

# PRESIDENT'S STATEMENT

*The fall colors have arrived.*

The beauty of fall has taken over the landscape. Before we know it, the leaves will blanket the ground, only to be recycled. Fall is also the time of year when we ask our current Corporate Sponsors to continue their financial support, and I invite former and potential new sponsors in the region to join in support of the PGS. This program year (2019-2020) is the 75th anniversary of PGS, and from what I have observed during my short time as president, PGS is financially strong and able to support a professional program only because of our dedicated members and committed Corporate Sponsors.

The Pittsburgh Geological Society, founded in 1944, has provided a forum for geologists in multiple disciplines, including natural resource extraction, geotechnical and environmental applications, academics, and general geologic interests. The Society is composed of professional, corporate, student, and honorary members. The Board of Directors consists of member volunteers who make the Society a welcoming and educational place for students and professionals. Our primary mission as a society is to disseminate geologic knowledge and to provide a forum for discussions on geologic problems by offering a speaker series at our monthly meetings. We also offer Continuing Education Credits (CEUs) to licensed professional geologists and engineers who attend the monthly meetings, and provide networking and training opportunities for students. Students also benefit from the annual April Student Night and spring drilling workshop. This year we will be organizing a special 75th anniversary field trip highlighting the energy, environmental, and geotechnical industries in the Pittsburgh area. The activities that we have planned would not be possible without the financial support of our Corporate Sponsors.

Corporate membership plays a vital role in making the Society a place where professionals and students can interact and stimulate geologic thought. In order to make the society even stronger, I am asking our corporate members to encourage their younger geological employees to become active PGS members, to attend and participate in our monthly meetings. We are seeking to increase our young professional membership who attend the monthly meetings to serve as mentors for our ever-growing student membership. Mentoring is valuable not only for the mentees but for the mentors as well. The mentees receive advice on developing strengths and overcoming weaknesses, guidance on professional development and advancement, and are provided connections to the industry. The mentors receive recognition as a subject expert and leader, an opportunity to reflect on their own goals and practices, and to develop leadership skills.

In closing, I would like to ask the professional membership to find the time to attend the monthly meetings and speak to the student attendees, offering advice as they prepare to graduate and enter the workforce. PGS should remain an important organization for all geologists in the region for many years to come.

*Tamra*

## LOCAL GEOLOGICAL EVENTS

### HARRISBURG GEOLOGICAL SOCIETY

**November 14, 2019 6:30 PM – 8:00 PM**

"Challenges of Source Water Protection Implementation – How One Municipality Balances Economic & Public Health Interests" by Mark Eisner, P.G., Vice-President, Barton & Loguidice

**AEG Offices 441 Friendship Road, Harrisburg PA**

### ACS ENERGY TECHNOLOGY GROUP

**November 21, 2019 6:00 PM - 8:30 PM**

"Advanced Functional Nanocomposite Materials for Power Conversion and Harsh Environment Sensing Devices" by Dr. Paul Ohodnicki, National Energy Technology Laboratory.

**Lombardozzi's Restaurant, Pittsburgh PA**

### AMERICAN SOCIETY OF CIVIL ENGINEERS – GEO-INSTITUTE

**November 21, 2019 6:00 PM - 9:00 PM**

The 2019 Terzaghi Lecture: "Response of Soil Sites during Earthquakes: A 60-year Perspective" by Dr. Izzat Idriss, U.C. Davis

**Engineers Society of Western PA, Pittsburgh**

### PENNSYLVANIA GEOLOGICAL SURVEY

**December 6, 2019 9:00 AM – 3:00 PM**

100th Anniversary Celebration of the 4th Survey of the PA Geological Survey

**PA Geological Survey Offices, Middletown, PA**


**The Pittsburgh Geological Society welcomes two new professional members:**

Brynn A. Yochim, Geologist
Moody and Associates, Inc.

Susan G. Wacaster, Research Geologist
NIOSH Mining Research Division

**We also welcome new student members.**

**From California University:**
Hunter C. Bailey, Austin M. Bonazzoli, Keon M. Dohn, Lindsay M. Kastroll, Rose C. Semeneck, Challen D. Spitznogle, Jack W. Urso

**From Slippery Rock University:**
Matthew P. Fisher

## The Pittsburgh Geological Society Endowment Fund

*Established May 8th, 2014 through the*

COMMUNITY FOUNDATION

# UPCOMING PGS MONTHLY MEETING

The next PGS Dinner Meeting will be held on December 18, 2019.

**Dr. Patrick Burkhardt**

**A Journey to Machu Picchu and the Galapagos**

**Department of Geography, Geology and the Environment, Slippery Rock University**

# 2020 PGS SPEAKER SCHEDULE

| ***Meeting Date*** | ***Scheduled Speaker*** | ***Presentation Topic*** |
|---|---|---|
| January 15, 2020 | James Hamel<br>Joint Meeting with ASCE and AEG | I-79 Landslides near Pittsburgh |
| February 19, 2020 | Speaker TBA | TBA |
| March 18, 2020 | Kendra Murray,<br>Hamilton College | Geomorphology |
| April 15, 2020 | Student Research Night<br>Joint Meeting with ASCE and AEG | Student Posters & Presentations |
| May 13, 2020 | Randy Blood, PGS Award Winner<br>DRB Geological Consulting | Energy Resources |

# OTHER EVENTS OF INTEREST TO PGS MEMBERS

## ACS-Energy Technology Group
## Joint Meeting with ASM International
***Thursday, November 21, 2019***

## Advanced Functional Nanocomposite Materials for Power Conversion and Harsh Environment Sensing Devices


## Dr. Paul R. Ohodnicki, Jr.
## National Energy Technology Laboratory



**Abstract**

A number of emerging societal trends are increasing the needs for (1) improved visibility across the U.S. energy infrastructure as well as (2) enhanced and efficient control over the flow of electrical power. Novel sensors and power conversion device technologies are therefore of increasing importance and innovations in enabling advanced functional materials can allow for unprecedented improvements at both device and overall system level. This presentation will discuss the relevance of both oxide-based and metal-based nanocomposite materials for a wide range of functional device applications through tailoring of relevant electronic, photonic, and magnetic properties. Specific examples of engineered nanocomposite material systems realized through materials chemistry optimization and advanced manufacturing processes will also be presented in the context of power magnetics components such as inductors and transformers as well as harsh environment sensing devices such as optical fiber-based sensors.


**Biography**

**Dr. Paul Ohodnicki, Jr.** is a senior materials scientist at the National Energy Technology Laboratory where he serves as the PI for a number of projects in the areas of soft magnetic materials and devices as well as photonic and wireless sensor technologies and enabling functional sensor materials. He is a Pittsburgh native and an alumnus of both the University of Pittsburgh (B.S.) and Carnegie Mellon University (M.S., PhD), and has been the recipient of a number of major early career awards including the Presidential Early Career Award for Scientists and Engineers (2016) as well as the Carnegie Science Center Advanced Manufacturing and Materials Award (2017, 2019). He has authored or co-authored over 125 journal and conference publications with more than 25 patent applications and 10 awarded to date, and, will be named chair of the TMS Functional Materials Division at the TMS Annual 2020 meeting.

**Cost is $30 (cash or check),** walk-ins welcome but RSVP is preferred.

**Buffet Dinner Menu:** Chicken Romano, Roast Beef au Jus, Rigatoni, Fresh Steamed Broccoli, Fried Zucchini & Potato Balls, Tossed Salad, Bread & Butter

**RSVP by Monday November 18 to**: ACS.ETG@gmail.com **Agenda - Check In:** 6:00-6:30 PM**, Dinner:** 6:30-7:15 PM**, Presentation** 7:30-8:15 PM, **Announcements and wrap up** 8:15-8:30 PM

**Location:** Lombardozzi's Restaurant - Bloomfield, 4786 Liberty Ave, Pittsburgh, 15224

# THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

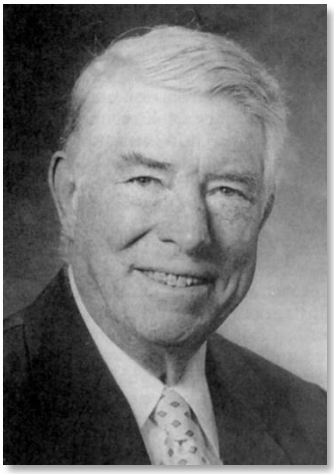
Scottdale, a borough in Westmoreland County, was named in honor of Thomas A. Scott, former president of the Pennsylvania Railroad and Assistant Secretary of War during the Civil War. In the mid-19th century, the local post office was known as Fountain Mills. Both the Pennsylvania Railroad and Baltimore and Ohio Railroad built branch lines through the community in the early 1870s, spurring the local economy to shift from agriculture to manufacturing and mining. Two of the local farmers, brothers Peter and Jacob Loucks, laid out a small townsite consisting of 24 lots and put them up for sale in 1872. It became Scottdale and was incorporated on February 5, 1874. Scottdale is situated on major coal deposits, so the community flourished from mining and coke manufacture. Henry Clay Frick and his coke company were headquartered there. Local factories produced iron pipe, tin, knives, steam engines, and caskets in the early 20th century. West Overton Village, Frick's birthplace, is the only pre-Civil War village still intact today in Pennsylvania. It was named to the National Register of Historic Districts in 1985 as an outstanding example of a 19th-century rural industrial village complete with farm, industrial tools, Blacksmith Shop, a wash house and a smokehouse. The West Overton Museum, which formerly was the Overholt Distillery, is a stop on the American Whiskey Trail.


**The Overholt springhouse at West Overton Village in Scottdale is the birthplace of coke magnate, Henry Clay Frick (1849-1919). In the background is the West Overton Museum, formerly the Overholt Distillery.**

## DID YOU KNOW . . . ?

Looking back 75 years ....

The first President of the Pittsburgh Geological Society was George "Red" Grow, a well-known oil and gas geologist in the Pittsburgh area. George Capernicus Grow, Jr. (1916-1983) was born in Stafford, New York (type locality of the Middle Devonian Stafford Limestone, the boundary between the Marcellus and Skaneateles formations). He received his BS in Geology at Lehigh University and then went to work for Standard Oil of New Jersey in Venezuela. Soon after that, he came to Pittsburgh where he spent the next 11 years working first as a geologist and later as the chief geologist for Peoples Natural Gas. While there, he took some graduate courses at Carnegie Institute of Technology (now Carnegie Mellon). In 1951, Red went to work for the Transcontinental Gas Pipe Line Corporation, later acquired by the Williams Company, as chief geologist of their eastern area. He retired in 1973 to become a consulting geologist. His leadership and organizational talents stood him in good stead when he helped



**George C. Grow, Jr., one of the founders, and first President, of the Pittsburgh Geological Society.**

organize the Pittsburgh Geological Society and served as its first president in 1945. That same year, the Geological Society of America held its annual meeting in Pittsburgh and George was selected to be general chairman of the conference. Three years later, when the AAPG held its Midyear Meeting in Pittsburgh, George, who had been an AAPG member since 1942, edited the first guidebook PGS ever produced (you can find it on the PGS website). He also contributed to other aspects of AAPG, including:

- Member, Board of Certification (1971-1974)
- VP, Division of Professional Affairs (1972-1974)
- Chairman, East Coast Offshore Symposium (1973)
- AAPG treasurer (1974-1976).
- Advisory Council (1976-1979

The AAPG recognized George's numerous contributions by awarding him the Distinguished Service Award in 1979 and Honorary Membership in 1989. He was a Fellow of the Geological Society of America, a Legion of Honor member of the Society of Petroleum Engineers, and a member of the American Institute of Mining and Metallurgical Engineers, the American Institute of Professional Geologists, the American Gas Association, and the Potential Gas Committee. He also served on the Advisory Council of the Lamont-Doherty Geological Observatory of Columbia University.

Although Native American and early European settlers in western Pennsylvania "studied" the rocks in this area in order to find essential mineral resources for hunting, farming, trading, and defense, the date of the first *published* geological study in the area did not occur until 1786. According to J. Peter Lesley, second State Geologist of Pennsylvania and an authority on the history of American geology, the first such publication was a report on Ohiopyle Falls by Captain Thomas Hutchins. Hutchins (1730-1789) was born in Monmouth County, NJ, and served as an engineer in the British colonial army before the American Revolution. Later, as a result of his sympathy for his homeland, he was imprisoned in London at the outbreak of the war. When he escaped to America, Benjamin Franklin used his influence to make Hutchins "Geographer to the United States of America" in 1781, which seems to mean that he was in charge of the government surveys. He was the only person who ever held that title. Hutchins was also the surveyor who devised and instituted the township and range system west of the 13 original colonies that divided the land into a grid of townships and smaller sections with border lines oriented strictly north-south and east-west. He lived in Philadelphia after the war, but owned land in Allegheny County and was well known in Pittsburgh.

**Surveying teams such as this mapped the lands of the US west of the original 13 colonies.**

On January 23, 1786, Hutchins read his account of Ohiopyle Falls before the American Philosophical Society in a paper titled, *Description of a remarkable rock and cascade, near the western side of the Youghiogeny river, a quarter of a mile from Crawford's ferry, and about twelve miles from Union-Town, in Fayette county, in the state of Pennsylvania.* The society published the paper in its second volume of Transactions that same year, on pages 50-51. From a modern perspective, Hutchins' report leaves a lot to be desired, but it is important to remember that geology was still in its infancy at the time of its publication. James Hutton did not read his dissertation *Concerning the System of the Earth, its Duration and Stability* before the Royal Society until 1785, and William Smith only began developing his concept of stratigraphy in the 1790s. Hutchins' published report is short enough to include here in its entirety:

"*This cascade is occasioned by a rock of a semicircular form, the chord of which, from one extreme end of the arch to the other, is nearly one hundred yards; the arch or circular part is extensive, and upwards of twenty feet in height, exhibiting a grand and romantic appearance. This very curious production is composed of stone of variegated colours, and a species of marble beautifully chequered with veins running in different directions, presenting on a close inspection a faint resemblance of a variety of*

*mathematical figures of different angles and magnitudes. The operations of nature in this structure seems to be exceedingly uniform and majestic; the layers or rows of stone of which it is composed are of various lengths and thicknesses, more resembling the effects of art than nature. A flat thin stone from eight to ten inches thick, about twenty feet wide, forms the upper part of this amphitheatre, over which the stream precipitates. The whole front of this rock is made up from top to bottom, as well as from one extremity of the arch to the other, of a regular succession, principally, of limestone, strata over strata, and each stratum or row, projecting in an horizontal direction a little further out than its base, until it terminates into one entire flat, thin, extensive piece, as already mentioned; and which sets out at right angles or in a parallel line with the bottom, over which it impends fifteen or twenty feet, and that without columns or even a single pillar for its support. This circumstance, together with the grand circular walk between the front of the rock and the sheet of water falling from the summit, exhibits so noble and singular an appearance, that a spectator cannot behold it without admiration and delight."*

Paleontologists have discovered a 360-million-year-old fossilized forest of lycopsid trees near Xinhang in China's Anhui province. This is the oldest known fossil forest in Asia. The Xinhang forest covered an area of at least 62 acres and grew in a coastal environment prone to flooding during the Devonian Period. The tree fossils are visible in the walls of two clay quarries both below and above a 13-foot thick sandstone layer.

Lycopsid trees were very common during the Mississippian and Pennsylvanian periods (think *Lepidodendron* and *Sigillaria*) but were beginning to die out around the Middle/Late Pennsylvanian. Some of them resembled modern palm trees in that they had branchless trunks and leafy crowns. Like *Lepidodendron* and *Sigillaria*, the Chinese lycopsids, named *Guangdedendron*, had no flowers and no seeds, but shed megaspores. They were unusually small for lycopsids, only 10.5 feet on average, although the tallest found so far was estimated at 25.3 feet (the researchers used diameters of tree trunks to estimate the trees' heights).

The large density of the trees, along with their small size, reminded researchers of a patchy sugarcane field. They have also been compared with mangroves in that they occurred in a similar environment and probably had similar ecological roles. Some of the plant fossils found included pinecone-like structures with megaspores.


**Reconstruction of *Guangdedendron*.**

**http://www.sci-news.com/paleontology/xinhang-forest-07484.html**

Earth always has lots of extraterrestrial dust floating through the atmosphere and settling to the ground, so it is not surprising that researchers recently found some in 466 ma rocks. What is significant, however, is that the "normal" dust typically represents only a very small fraction of other dust types found in the atmosphere (e.g., volcanic ash, desert fine sands, sea salt). Now, the researchers believe, an asteroid about 93-miles wide broke apart in the asteroid belt between Mars and Jupiter circa 466 ma, during the Darriwillian Stage (Middle Ordovician), creating a lot more dust than usual.

Earth receives about 40,000 tons of extraterrestrial material every year. If you multiply that by a factor of 1,000 to 10,000, you get 40 million to 400 million tons, an enormous amount. If you have trouble imagining that, think of tractor trailers loaded with asteroid dust. Normally about 1,000 trucks would be hauling the stuff, but 466 ma you would have needed 10 million trucks to do the job. The researchers, from the University of Chicago and Lund University in Sweden, looked for traces of space dust in Middle Ordovician rocks, and compared them to reference micrometeorites from Antarctica, then studied the Ordovician extraterrestrial matter to figure out what it was and where it came from. They speculate the amount of extraterrestrial dust

falling to Earth over a period of at least two million years played an important role in changing the climate on Earth by at least partially blocking the sun and contributing to global cooling.

We already know from other evidence that Earth was in the throes of a global ice age around this

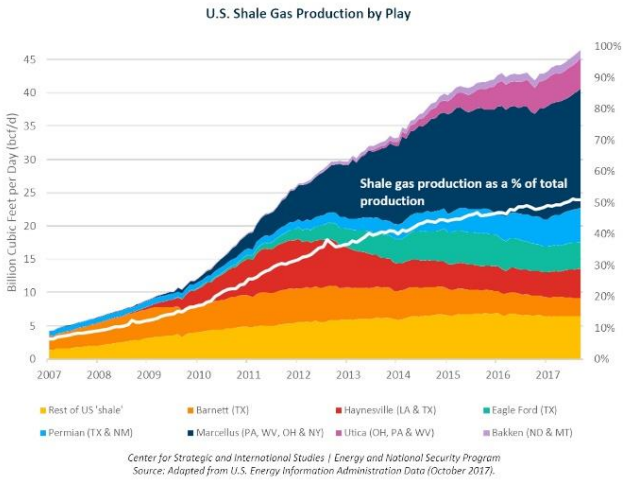
**The Middle Ordovician ice age might have been triggered by extra dust in the atmosphere of Earth from the breakup of a giant asteroid in the main asteroid belt.**

time, so this is the first study to show that the Ordovician ice age coincided with the extra dust in the atmosphere. The timing appears to be perfect - extra dust in the atmosphere explains the ice age by filtering out sunlight and instigating global cooling. And since the dust settled on Earth over at least two million years, the cooling would have been gradual enough for life to adapt and possibly even benefit from the changes. Many new species evolved as the Earth's biota adapted in regions with different temperatures.

**http://www.sci-news.com/space/asteroid-dust-mid-ordovician-ice-age-07608.html**

Estimated US gas resources increased to a record 3,374 trillion cubic feet (tcf) by the end of 2018, according to the Colorado School of Mines' Potential Gas Committee (PGC) and American Gas Association. That was a 20% increase over 2016, representing the largest 2-year increase in the assessment's 54-year history. The report confirmed that the US has more natural gas than at any point in its history and assures American consumers that they can continue to rely on natural gas as a clean, reliable, and affordable source of energy. This was the 7th consecutive record-high resource evaluation by the PGC that confirmed the US has an abundance of natural gas present at in a wide variety of reservoirs both onshore and offshore.

The latest increase resulted from reassessments of shale gas resources in the Atlantic and Midcontinent areas and conventional and tight gas in the Midcontinent and Rocky Mountain regions. The year-end 2018 assessment includes 3,218 tcf potentially recoverable from traditional reservoirs such as conventional tight sands, carbonates, and shales, as well as 157 tcf coalbed methane resources. Traditional resources increased by 559 tcf or 21%, whereas coalbed methane resources decreased by 2 tcf. Because PGC estimates POTENTIAL reserves, whereas the US Department of Energy estimates PROVED gas reserves, it should be noted that when the two resource estimates are combined the US future supply of gas stands at a record 3,838 tcf, up 22% (697 tcf) more than the previous evaluation.




These increases have been attributed to more well drilling and continuous improvements in completion and stimulation technologies that have been leading to better delineation and characterization of gas resources, especially in shale and tight reservoirs. The Atlantic area, including Pennsylvania's Marcellus and Utica reservoir areas, ranked as the country's richest gas resource region with 41% of total US traditional resources, followed by the Midcontinent with 19%, the Gulf Coast and Gulf

of Mexico with 16%, and the Rocky Mountains with 16%. Changes in the total assessment from year-end 2016 to yearend 2018 arose primarily from the evaluation of recent drilling, well tests, and production data from these four areas.

Experts say the increases are all about innovation, using technological know-how to find and produce from previously inaccessible reservoir rocks. As a result, the US is seeing both record production and consumption as well as low and stable gas prices. Gas consumption in 2019 (so far) increased 5% as of September, with an average of one new consumer is added every minute. Exports to Mexico, and liquid natural gas (LNG) to other countries accounted for 55% of the growth in demand without affecting domestic prices. It seems obvious that natural gas has transformed the American economy and energy future for the better and that any realistic plan toward a cleaner energy future will have gas as a foundation.

**https://www.ogj.com/general-interest/article/14039686/us-gas-resource-base-broke-records-by-yearend-2018-pgc-reports**

Researchers have identified a previously unknown volcanic-intrusive complex that originated as the result of melting of mantle material at the northern edge of the Ionian slab in the Mediterranean Sea. Subduction and retreat of the Adriatic–Ionian microplate beneath the Eurasian plate controlled much of the tectonic and stratigraphic evolution of the western Mediterranean. The microplate is a sliver of oceanic crust that separated from Africa during the Cretaceous. Subduction of the microplate created Mount Vesuvius and other southern Italian volcanoes, as well as their well-known geohazards.

Episodes of rapid rollback of the subducting slab led to the opening of basins that include the Tyrrhenian Sea between Sardinia and Sicily, and mainland Italy. Tearing and faulting of subducting oceanic plates are common in such systems, sometimes producing faults called subduction-transform edge propagators, or STEP faults, at slab edges. These faults propagate perpendicular to the strike of the subducting plate, which allows upwelling magma caused by subduction-induced mantle flow to rise to the surface. This has been suggested as an explanation of the presence of volcanic seamounts beneath the southern Tyrrhenian Sea.

This magmatism had been poorly documented until recently when a team of Italian researchers report the results of a detailed investigation of a large volcanic-intrusive complex located about 9.5 miles off the Tyrrhenian coast of Calabria in southwestern Italy. They used a suite of geophysical data, including multibeam sonar bathymetry, seismic reflection, and magnetometric and seismological data to characterize the complex, which formed within the past 780,000 years. The team's data indicated the presence of numerous magmatic intrusions that reached the seafloor in several locations to form seamounts and other volcanic features like chimneys and lava flows.

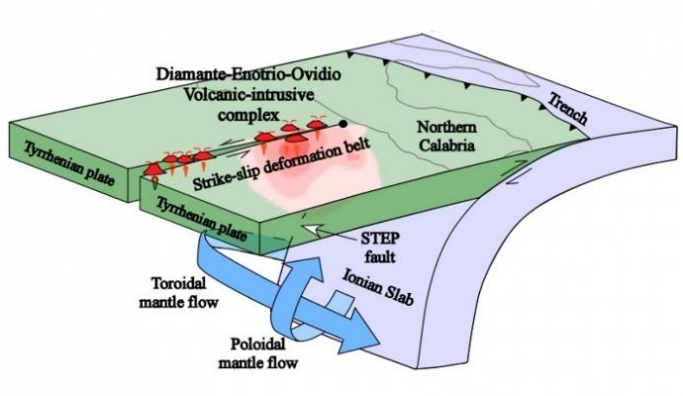



**Diagram of the Diamante–Enotrio–Ovidio volcanic-intrusive complex on the floor of the southern Tyrrhenian Sea off the coast of Calabria, Italy.**

The team divided the complex into two distinct realms: 1) an eastern domain called the Ovidio seamounts that is characterized by a series of flat-topped volcanic edifices; and 2) a western domain called the Diamante and Enotrio seamounts where strike-slip faults deform the volcanic structures. Altogether, their results affirm that this newly identified volcanic-intrusive complex originated from decompression-melting of mantle material at the northern edge of the Ionian slab. The researchers suggested that a strike-slip belt associated with the formation of a STEP fault controlled the magma's ascent and the location of the complex. These findings shed light on

magmatic processes occurring along the edges of subducting slabs as well as on the potential geohazard risk in a densely populated region whose volcanic activity used to be considered one of the best characterized in the world.

**https://eos.org/research-spotlights/new-volcanic-complex-found-below-the-southern-tyrrhenian-sea**

Australian government agency that manages the Great Barrier Reef (GBR), has downgraded its outlook for the corals' condition from "poor" to "very poor" due to warming oceans. In a report, which is updated every five years, the authority indicated the latest bad news for the 133,360 $mi^2$ reef network as climate change and coral bleaching take their toll. The report found the greatest threat to the reef remains climate change. Other threats are associated with coastal development, land-based water runoff, and human activity such as illegal fishing. The report said that significant global action to address climate change is critical to slowing the deterioration of the reef's ecosystem and heritage values and supporting recovery. If such actions are taken, they would complement and greatly increase the effectiveness of local management actions in the GBR and its catchment.

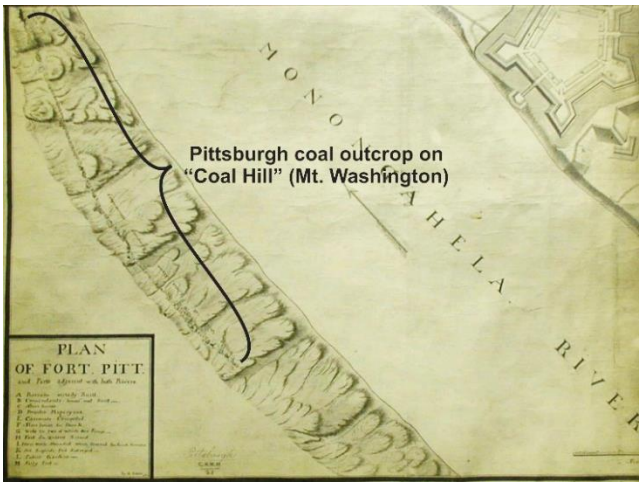
This was the third report documenting continuing deterioration since the first was released in 2009. The deterioration in the reef's outlook mostly reflects the expanding area of damage by coral bleaching and coral killed by predators such as the star-of-thorns starfish that prey on coral polyps. Such attacks were cited as multiple, cumulative and increasing. The accumulation of these impacts, through time and over an increasing area, is reducing the GBR's ability to recover from disturbances. A study of coral bleaching on the reef published in 2017 found that as much as 91% of the coral reef had been bleached at least once during three bleaching events of the past two decades, with the most serious event occurring in 2016. A fourth major bleaching struck later in 2017 after the study had been published. Bleaching occurs when corals are stressed by unusual environmental changes, such as increased sea temperature. They respond to such changes by expelling symbiotic algae living in their tissues, causing the coral to turn white. The algae are vital for the coral, which often don't survive afterwards.

**The Great Barrier Reef is one of the most extensive marine ecosystems in the world, and is being stressed by starfish and oceanic warming.**

The GBR has experienced four such events related to above-average sea temperatures since 1998. Authorities expect the periods between future bleaching events to shrink as global warming intensifies. Although the GBR is the world's largest coral reef system, it is not the only one in dire straits – coral reefs around the world are under stress from warming ocean temperatures as well.

**https://www.cbsnews.com/news/great-barrier-reef-australia-downgrades-outlook-coral-very-poor-ocean-warming-today-2019-08-30/**

The earliest mention of coal in Pennsylvania appears to have been a notation on a map made by John Pattin (1725-1754), a trader, mapmaker, and explorer from Wilmington, DE. A map he made in 1752 indicated the presence of coal at a site along the Kiskiminetas River a few miles below the present town of Saltsburg, Indiana County.




**A portion of Ratzer's 1761 *Plan of Fort Pitt and Parts Adjacent* showing the location of the Pittsburgh coal outcrop mined for use at the fort.**

The first recorded use of coal in southwestern Pennsylvania occurred seven years later when a detachment of British colonial soldiers under the command of Col. James Burd (1725-1793) was constructing a road from what is now Mount Braddock to the Monongahela River in Fayette County during the French and Indian War. On September 21, 1859, they were camped on a bluff overlooking the Monongahela near the present town of Brownsville. The next day, Burd wrote in his journal, "The camp moved two miles to Coal Run. This run is entirely paved in the bottom with fine stone coal, and the hill on the south of it is a rock of the finest coal I ever saw. I burned about a bushel of it on my fire."

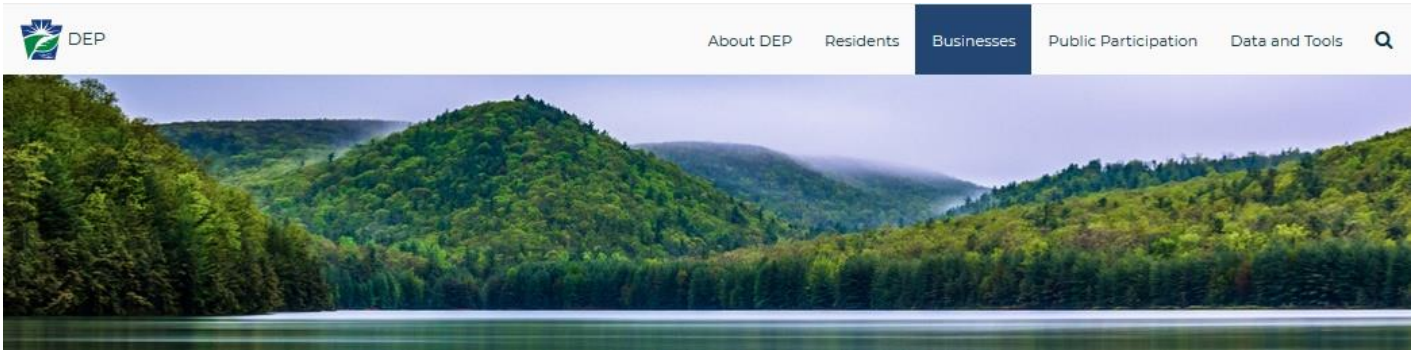
Of course, the first actual mining of coal probably occurred as soon as European settlers arrived in the western wilderness, but the first record of extensive coal mining in southwestern Pennsylvania is shown on Bernard Ratzer's 1761 *Plan of Fort Pitt and Parts Adjacent*. The mines were located across the Monongahela River from the fort near the top of Coal Hill (now called Mt. Washington). The early miners, under the direction of Major Edward Ward of the Fort Pitt garrison, removed tons of coal from what we now call the Pittsburgh coal bed, the basal unit of the Upper Pennsylvanian Monongahela Formation. This deposit is the most extensive coal in the Appalachian basin and has been called the world's most valuable single mineral deposit.

On a less positive note, the Coal Hill mine was also the site of the first mine fire. In 1766, a Presbyterian minister named Charles Beatty wrote, "A fire being made by workmen not far from where they dug the coal, and left burning when they went away, by the small dust communicated itself to the body of the coals and has set it on fire, and has been burning almost a twelve month entirely underground . . ."

All birds lay eggs, and many of them have very colorful ones. Since birds are the only extant species that have colored eggs, scientists have long assumed the pigments that color them developed after birds evolved from dinosaurs. Now new evidence indicates that some dinosaurs also laid colored eggs. A team of paleontologists and geologists have examined a variety of dinosaur eggs using Raman spectroscopy to distinguish true egg-color pigments from colors produced by other fossilized proteins. This process showed that the eggs of some species of theropods, the ancestors of birds, had the same pigments as modern birds, indicating a single evolutionary origin for egg color. The dinosaurs with colored eggs also made exposed, aboveground nests, a nesting behavior that is similar to that of birds with colorful eggs. These factors suggest other similarities, such as paternal care for eggs and young, might also be likely.

**Bird eggs come in many varieties of colors, such as the gray emu egg on the left and the variously colored corvid eggs surrounding the textured gray dinosaur egg on the right.**

# PGS WEBSITE OF THE MONTH




**https://www.dep.pa.gov/Business/Land/Mining/Pages/PA-Mining-History.aspx**

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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*

Not all turkeys say “gobble, gobble”. Only the males do that. The females make clicking sounds. Have a Happy Thanksgiving but don’t eat too much.

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