PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 7 | Karen Rose Cercone, Editor | March, 2016

Wednesday, March 16, 2016

The Pittsburgh Geological Society presents

The Complexity of Air Permitting and Greenhouse Gas Emissions in the Natural Gas Industry

T. R. Andrake

Project Manager, Tetra Tech Incorporated

The production of natural gas in the US has dramatically increased in recent years due to technological advances used in extracting natural gas from unconventional sources and the rise in the demand. The natural gas industry is comprised of four major sectors in the process of exploration and extraction of the resource: production, processing, transmission and storage, and distribution. The air emissions resulting from natural gas system operations include combustion, fugitives, and venting of natural gas during production. Air emissions can also be measured through the distribution and secondary emissions associated with ancillary supporting operations. Throughout each of the natural gas industry sectors, sources of emissions may require air quality permits for the control and regulation of the air emissions. This presentation will discuss the types of operations involved in each of the industry sectors, the associated emissions sources, applicable regulatory requirements and the permitting process and associated challenges. Additionally, greenhouse gas (GHG) emissions have become an increasing concern within the natural gas industry. Scrutiny of methane, the primary component of natural gas, has especially increased because its global warming potential is higher than CO_2. This presentation will review the sources of GHGs and provide an objective view of the potential impacts natural gas may pose to the environment.

Social hour - 6:00 p.m. **Dinner - 7:00 p.m.** **Program - 8:00 p.m.**

Dinner costs $30.00/person, students $10.00; checks preferred. For reservations, please email pgsreservations@gmail.com with your name and number of attendees in your party. You can also reserve and pay for dinners via PayPal on our website http://pittsburghgeologicalsociety.org. Please include your name and number of attendees in your party. Deadline for reservations is noon Monday, March 14.

Meeting will be held at Foster's Restaurant, Foster Plaza Building 10, Green Tree.

PRESIDENT'S STATEMENT

Soon winter will be winding down and the PGS has a busy calendar in the upcoming months. Important dates for our student members to recognize:

- Friday March 18th is the deadline to submit your abstract for student night on April 20th. Check with your PGS school liaison for more details if you are interested in presenting a talk or poster.

- On Saturday April 2nd the Student Field Workshop will be held again at CALU. If you plan to attend this event, make your reservations soon because past years' workshops were usually full by mid-March.

- For student and professional members, our PGS Field Trip is planned for Friday April 15th through Sunday April 17th. This year Dr. Tamra Schiappa of SRU will be leading our trip to the state of Indiana and Whitewater State Park to observe Ordovician strata and do some fossil collecting. Dr. Schiappa and her students will disembark from SRU and attending PGS professional members will depart from a point yet to be determined in the Pittsburgh area. If you plan to attend please respond ASAP (deadline to be announced shortly) so arrangements can be made by the PGS for travel vans.

I would like to say a few words about service to your professional society. As you are aware though recent announcements, the PGS is looking for nominees/candidates to serve as officers and board members for the upcoming program year. I am looking to fill out a ballot for our May election by the April 20th meeting. If you are a professional member, and regularly attend our meetings, please consider getting involved in the dynamics of operating this society. If you have an interest, the board always welcomes new faces and ideas. If you are a student member and wish to become more involved, please consider volunteering to be your university's liaison. We will also be looking to fill the Student Representative position on the Board this upcoming year.

I would like to acknowledge the following corporate sponsors that have committed their support to our 2016 initiatives since last month's newsletter; Gannet Fleming, Inc. and Key Environmental Inc. Thank you all for your continued support.

In closing, please join us at the March meeting. Our guest speaker this month is T. R. Andrake of Tetra Tech Inc. in Glen Allen, Virginia**.** His presentation is on the very timely topic of greenhouse gas emissions and the complexity of air permitting in the natural gas industry. I hope that you will join us.

Ray Follador

SPEAKER BIOGRAPHY

T.R. Andrake has 20 years of professional experience in the environmental field working in both the private and government sectors as a specialist in air quality permitting, environmental compliance, and environmental due diligence. He has managed numerous air permitting and compliance projects for the oil and gas industry as well as various other industrial operations. Mr. Andrake has been a technical lead working directly with a major natural gas distribution company managing air quality issues on FERC 7C projects as well as compliance at existing compressor stations. As a project manager at Tetra Tech, Mr. Andrake provides environmental services including air quality permitting and regulatory compliance, facility compliance audits/evaluations, and due diligence.

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

March 24, 2016
PAPG Annual Student Night – A Panel Discussion and Presentations on the Current State of the Oil & Gas Industry.
Cefalo's Event Center, Carnegie PA.

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

March 15, 2016
PCPG Annual Meeting Luncheon, Program, Networking and Student Job Fair
Red Lion Hotel, Harrisburg PA

HARRISBURG GEOLOGICAL SOCIETY

March 10, 2016
Seth Pelepko, DEP – Integrating Stray Gas Migration and Well Integrity GIS Datasets to Assess for the Presence of Anthropogenic Methane Flux

April 14, 2016
Charles Cravotta, USGS – Hydrological, Geochemical, and Geophysical Investigations in Support of Watershed Restoration in the Upper Schuylkill River

OHIO GEOLOGICAL SOCIETY

March 16, 2016
Determination of Wellbore Orientation in the Utica Shale of Southeast Ohio by
Joseph P. Smith, PDC Energy, Inc.
Hilton Easton, Columbus OH

AAPG 2016 EASTERN SECTION MEETING

September 25-27, 2016
Lexington Convention Center, Lexington KY

14th ANNUAL PGS / AEG / ASCE

STUDENT NIGHT

Wednesday April 20, 2016

Calling all students in the local region!
Here is your opportunity to get professional exposure for your graduate or undergraduate research, thoughtful feedback on your project from working scientists and the chance to win an award that will look great on your resume!

Each of the three sponsoring societies will select one student paper (graduate or undergraduate) for oral presentation. Additional abstracts will be accepted for poster presentations. All presenters will receive certificates of recognition and appreciation, as well as complimentary dinner. The three oral presenters will each receive awards of $100, while the three top poster presenters will each receive $50.

Abstracts of 300 words or less should be emailed to Dr. Tamra Schiappa at tamra.schiappa@sru.edu by Friday, March 18, 2016 for consideration.

NOTE – THE DEADLINE HAS BEEN EXTENDED SO YOU CAN STILL SUBMIT YOUR ABSTRACT FOR STUDENT NIGHT!

PGS SPRING 2016 12th ANNUAL STUDENT FIELD WORKSHOP

Saturday, April 2, 2016

The Pittsburgh Geological Society invites students across our region to attend a field workshop at California University of Pennsylvania. Students will work alongside an experienced drilling contractor and field professionals to take samples of soil and water, install a monitoring well and learn the basics of field geology for environmental and engineering applications. This workshop will be held rain or shine! To reserve your space, contact Frank Benacquista, PG at fbenaquista@kuresources.com.

COMMUNITY FOUNDATION

Serving the Heart of Western Pennsylvania

220 South Jefferson Street, Suite B, Kittanning, PA

The Pittsburgh Geological Society is delighted to welcome the following new members to the society:

James D. Coffman
Geophysicist/Geologist
Tetra Tech, Inc.
Pittsburgh, PA
MS in Geophysics - University of Akron

Devin B. Kuberry
Civil Associate-Geologist
Michael Baker International
Moon Township, PA
BS in Geology - Clarion University of Pennsylvania.

Joshua T. Maurer
Geologist
Carmeuse Lime & Stone
Pittsburgh, PA
M.S. in Geology - Bowling Green State University

Harrison M. Hirsh
BA in Geology - University of Colorado at Boulder

Find us on Facebook

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Former Midway National Bank Building

A small settlement was made on Robinson Run, the boundary between Smith and Robinson Townships, Washington County, just north of Washington, PA, around 1825. This settlement was called Egypt, a name it kept for 40 years. Three mills were built there over that period, each burning down and making way for a new one. The last one, which burned sometime around 1858, was called Egypt Mill. In the 1860s, the tract of land the settlement occupied was sold to a company that had it surveyed. That occurred on November 20, 1865, the same year that the Cincinnati, Chicago, and St. Louis Railroad (later part of the Pennsylvania Railroad system) was completed. Because the village location was midway between the Steubenville, OH, and Pittsburgh, it was renamed Midway. Interestingly, the railroad station there was not named for the village. Like many communities in Washington County, coal became the primary industry, especially after the railroad came through. The Pittsburgh Coal Company was the major, although not the first, company in the area. Midway was incorporated as a borough in 1903. Dick Haley, former cornerback for the Washington Redskins, Minnesota Vikings, and Pittsburgh Steelers, and Player Personnel Director of the Pittsburgh Steelers from 1971 to 1990 and NY Jets from 1991 to 2002, is a Midway native. He is also the father of Todd Haley, current offensive coordinator with the Steelers.

DID YOU KNOW . . . ?

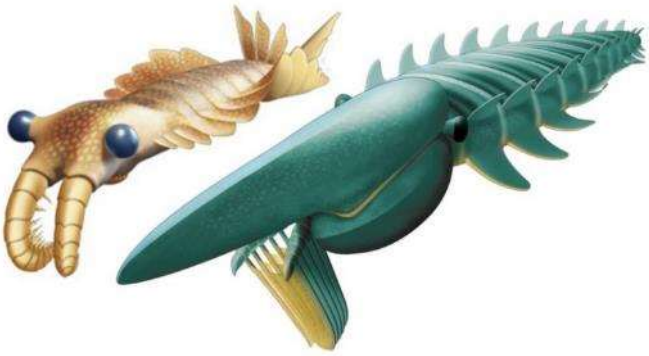
The mineral apatite has many uses, and its chemistry has recently led to new concepts of its importance in wide range of geological processes such as magmatism and metasomatism, and tools for use in planetary geochemistry and geochronology. Researchers from England have expanded the usefulness of apatite by providing a new way to fingerprint magma chemistry and petrogenesis using trace element data from apatite mineral inclusions shielded within magmatic zircon and titanite. They showed that apatite inclusions and host titanite chemistries allow them to estimate the whole-rock Sr and SiO2, allowing them to assess the degree of fractionation of the host magma and calculate key trace element abundances and ratios. The researchers also demonstrated that the inclusions could be related to separate times in the crystallization history of the host phases, which would provide insight into petrogenesis. Their results emphasize that apatite compositions might

Apatite crystals

differentiate granitoids younger than 2.5 billion years old from much older transitional granitoid compositions. This means that the process has the potential for interpreting provenance and provides a better understanding of the secular evolution of the continental crust.

Researchers recently used a new gravity field map of the ocean floor to establish that the plate collision that produced the Himalayan Mountains occurred exactly 47 million years ago.

You probably have heard of *Anomalocaris*, the ridiculously strange Middle Cambrian predatory critter belonging to a family of animals thought to be closely related to ancestral arthropods.



***Anomalocaris canadensis* (left) and *Aegirocassis benmoulae* (right) were almost 7 feet long**

The first anomalocarids were found as separate body parts in the Burgess Shale in the 1890s – a grasping claw thought to be the arm of a lobster-like animal; a mouth ring described as a jellyfish; another feeding appendage thought to have been a shrimp tail; a body originally considered to be a sponge.It took until the 1980's for paleontologists to realize that all those body parts, and more, were from a single strange animal.

Now, Belgian paleontologists described a 6.6-foot long Early Ordovician fossil found by a Moroccan fossil collector. Called *Aegirocassis benmoulai,* it apparently was a relative of *Anomalocaris*. Interestingly, *Aegirocassis* apparently was a filter feeder rather than a predator, reminiscent of the difference between the filter feeding giant Whale Shark (over 40 feet long) and its much smaller cousin, the Great White Shark (a mere 20 to 25 feet long).

The New York State Office of Parks has announced its intention to temporarily dewater the American Falls and Bridal Veil Falls, two of the three adjacent waterfalls that, collectively, are known as Niagara Falls. The object of this temporary "turning off the spigot" would be to replace an aging set of bridges that connect various parts of Niagara Falls State Park. The concrete arch bridges, which cross the Niagara River to provide pedestrian access to Goat Island, are more than a century old and they have deteriorated significantly since their construction in 1900. Park authorities closed them in 2004 and ordered the construction of two temporary bridges above them. A new environmental impact report has concluded that the original bridges are far too deteriorated to be successfully rehabilitated, and should be completely replaced.

Dewatering Niagara Falls is not as Herculean a task as it might seem, since more than 80% Niagara River flows over Horseshoe Falls, the other waterfall that makes up Niagara Falls. The park proposal calls for a cofferdam to redirect the entire river over Horseshoe Falls, leaving the smaller American side dry. The entire construction process is slated to take two years, but the dewatering phase should take less than six months.

1969 photo of the American Falls at Niagara Falls State Park in New York when the falls had been dewatered

The American side of Niagara Falls was last dewatered in 1969, when the U.S. Army Corps of Engineers conducted a geological survey to investigate erosion of the falls. It is interesting to note that the dry American Falls back then became a tourist attraction of its own – it is reported that, in a single weekend, 89,790 tourists visited the park to see the dewatered falls.

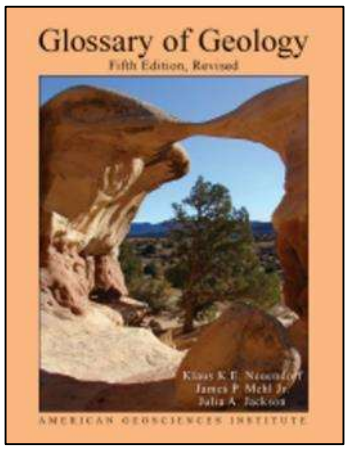
Apparently, the Cambrian extinction event that occurred about 40 ma after the Cambrian Explosion 540 ma didn't actually happen, at least not the way paleontologists thought. New well-preserved fossils found in 480-ma (Early Ordovician) rocks in Morocco show that the animals continued to thrive. The problem is that the changes in ocean chemistry prevented the mostly soft-bodied fauna from being preserved in the fossil record.

Geologists have long debated when plate tectonics first got underway on Earth. Some proposed that the process began as early as 4.5 billion years ago whereas others suggest a much more recent start within the last 800 million years. Now, a study from the University of Maryland provides new geochemical evidence for a more accurate date that actually falls between these two extremes. By analyzing trace element ratios that correlate to magnesium (Mg) content in ancient Earth's crust, the researchers provide first-order geochemical evidence for when plate tectonics first got underway, about 3 billion years ago.

The study zeroed in on one key characteristic of Earth's crust that sets it apart from other terrestrial planets in the solar system – although the early Earth's crust closely resembled that of its solar cousins, the Earth's current continental crust contains less Mg when compared with those of Mars, Mercury, Venus, and the Moon. At some point, Earth's crust evolved to contain more granite, a Mg-poor rock that forms the basis of Earth's continents. Many geologists believe that the beginning of plate tectonics propelled this transition by dragging water underneath the crust, a necessary step in making granite.

But how do you figure out when this began? Since Mg tends to erode quickly when exposed at the surface, the researchers had to look for proxies that are not as water soluble as Mg. One of the researchers, a graduate student, discovered that trace insoluble elements correlate with a major element. From there, the researchers looked at nickel (Ni), cobalt (Co), chromium (Cr), and zinc (Zn) because higher ratios of Ni to Co and Cr to Zn correlate to higher Mg content in the original rock. They compiled trace element data from a variety of rocks that formed during the Archean (between 4 and 2.5 billion years ago), used those data to determine the Mg content in the rocks when they were first formed, and then constructed a computer model of the early Earth's geochemical composition. Their model suggests that the Earth's crust had roughly 11% MgO by weight 3 billion years ago, and that within a 500 million years, that number had dropped to about 4% percent, close to the 2 or 3% MgO seen in today's crust. This suggested that plate tectonics began about 3 billion years ago, giving rise to the continents we see today.

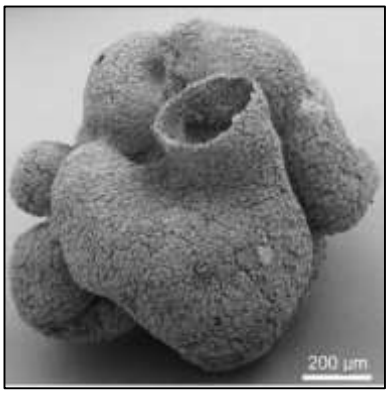
The American Geosciences Institute has released the latest upgrade of the *Glossary of Geology* app for the Android and iOS platforms, which have been discounted to $19.99, $10.00 off the list price, until March 31. The Glossary contains



definitions of nearly 40,000 terms used in the earth and environmental science literature. It has long been considered the definitive reference by geoscientists, both professionals and students, needing fully-supported and detailed definitions of earth science terms. Traditionally published as an 800+ page hardbound book, the app version provides all of the rich and detailed content with portability and the power of full-text searching of the entire glossary. In addition to definitions, many entries include background information on origin

and usage. This is a must-have for all geoscientists, engineers working with earth-related issues, and students and other professionals who have questions about Planet Earth. Special enhancements for this version of the app include full-text search, hyperlinked See-Also, flag and store terms, share terms and definitions, and special access to AGI's GeoWord of the Day with a simple touch.

A tiny fossil, smaller than a sesame seed, is telling us a lot about what happened early on in the evolution of animal life on Earth.



Tiny sponge-like fossil found in China

Paleontologists had for years thought that the animals that gave rise to sponges, corals, worms, and arthropods first appeared around 600 or 700 ma, but there was no direct evidence prior to about 575 ma.

The tiny fossil, found in Precambrian rocks in southern China, had its body exquisitely preserved by phosphate minerals, including hundreds of thousands of microscopic cells. Just like modern sponges, the fossil consists of vase-like openings with walls perforated by pores. The same rocks, called the Doushantuo Formation, previously had been found to contain other tiny fossils of eight to 16 cells that are thought to be sponge embryos. The researchers studying these fossils feel the formation contains what might be the secret of early life, and all they need to do is dig up more fossils.

Neon, the inert gas that allows the advertising world to glow at night, makes up 0.0018% of the Earth's atmosphere. We recycle it and other inert gases every day by inhaling and exhaling. They also continuously recycle between the atmosphere and the Earth's mantle through the actions of exhumation and subductions. These gases have been around since our solar system formed 4.6 billion years ago from a large cloud of gas and dust.

Store sign lit by neon, one of the inert gases

Because inert gases don't react with other elements, this makes them excellent tracers for understanding the geochemical evolution of Earth and its atmosphere. Although they don't react with other elements, they do form isotopes, which are slightly different in the deep subsurface than they are in the atmosphere. By measuring the isotopic composition and concentrations of neon and argon, another inert gas, that were trapped in minerals at mantle depths, researchers can understand where these noble gases originated. One research team recently discovered an area in New Guinea some of the minerals formed at ultra-high pressures about 8 million years ago at depths greater than 55 miles.

According to a new study, the formation of the supercontinent Pangea from the Earth's sundry continental plates about 300 million years ago played a key role in the formation of the coal that was one of the central geologic resources of the Appalachians. This is in contradiction to an earlier hypothesis from the 1990s suggesting that the formation of Carboniferous coals was attributable to the time lag between the first appearance of forests and the first appearance of wood-eating microbes and bacteria that could break down dead plant material.

In the new study, the researchers demonstrated

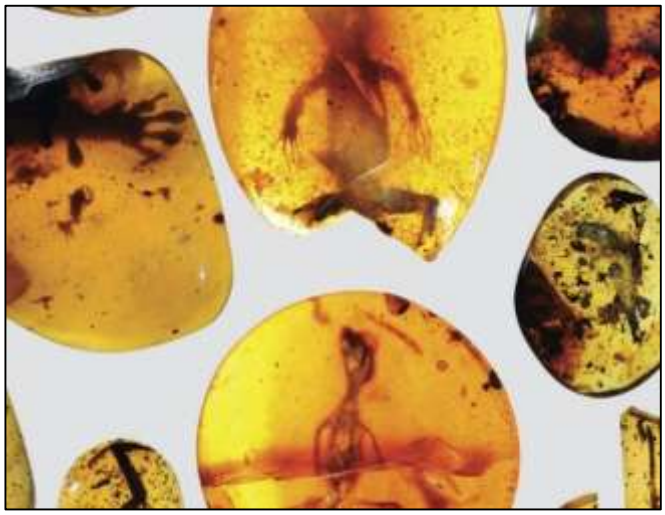
that an “evolutionary lag” explanation for the creation of Late Paleozoic coal is inconsistent with geochemistry, sedimentology, paleontology, and biology. They showed that not all of the plants that existed during the Carboniferous possessed high concentrations of lignin, a cell wall polymer that helps give plant tissues their rigidity.

According to the “evolutionary lag” hypothesis, lignin is the biochemical component of plants that ancient bacteria and fungi were unable to break down. Many Carboniferous forests were dominated by lycopisids such as *Lepidodendron* and *Sigillaria*, which had very little if any lignin, contrary to the central assumption of the “evolutionary lag” model. Instead, the researchers argued, the combination of plate tectonics and climate shifting between warm-and-wet and cool-and-dry that occurred during the formation of Pangea was responsible for the formation of forests and swamps that eventually became coal deposits.

Carboniferous coal forest

Another key element required for large coal deposits like the Pittsburgh coal, one of the largest deposits on Earth, was an accommodation space, essentially a low area like a basin where organic matter could accumulate over long periods without being subjected to erosion. Simply put, the “new” hypothesis states that you need a tropical climate and a hole in the ground in order to generate a coal deposit, and that the presence or absent of bugs has nothing whatsoever to do with it.

A fossilized lizard found preserved in amber dates back some 99 million years, making it the oldest specimen of its kind to be found to date.



Lizard specimens trapped in ancient amber deposits from Myanmar

The new lizard fossil is about 75 million years older than the oldest previously known specimen, according to scientists at the Florida Museum of Natural History. The museum scientists believe that the preserved reptile was just a hatchling when it got stuck in tree resin in an area of Southeast Asia that was a tropical rain-forest at the time. It was actually found decades ago in a mine, along with other ancient, well-preserved reptile fossils, but U.S. scientists were able to analyze the finds only recently. The other reptiles trapped in the amber, including a gecko and an arctic lizard, were also largely intact.

“It was incredibly exciting to see these animals for the first time,” said Edward Stanley, a member of the research team. “It was exciting and startling, actually, how well they were preserved.” The research team was able to view the creature’s entire body, including its eyes and colorful scales, using high-resolution digital X-ray technology without destroying the ancient amber in which it was encased.

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PGS Website of the Month

DOLOMITE!

http://www.mindat.org/min-1304.html

Deodat Gratet de Dolomieu first described dolomite.

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Officer Contacts: If you wish to contact a current PGS Officer, you can email Ray Follador, President, at geodawg@comcast.net; Tamra Shiappa, Vice President, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Karen Rose Cercone, Secretary, at kcercone@iup.edu.

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.

Programs: If you would like to make a presentation at a PGS meeting or have a suggestion for a future speaker, contact Tamra Schiappa, Program Chair at tamra.schiappa@sru.edu.

PGS Website: To contact the Webmaster, Mary McGuire, with questions or suggestions, please either email marykmcguire@comcast.net or use the site's "Contact Us" link at www.pittsburghgeologicalsociety.org.

Facebook: Follow the PGS at https://www.facebook.com/PittsburghGeologicalSociety for breaking news, announcements and interesting geological facts.

News items: If you have news items you would like to have included in the PGS newsletter, please send them to Karen Rose Cercone at kcercone@iup.edu.

Fun Fact Having Nothing to Do with Geology

Pennsylvania was the first state of the fifty United States to list their web site URL on a license plate.