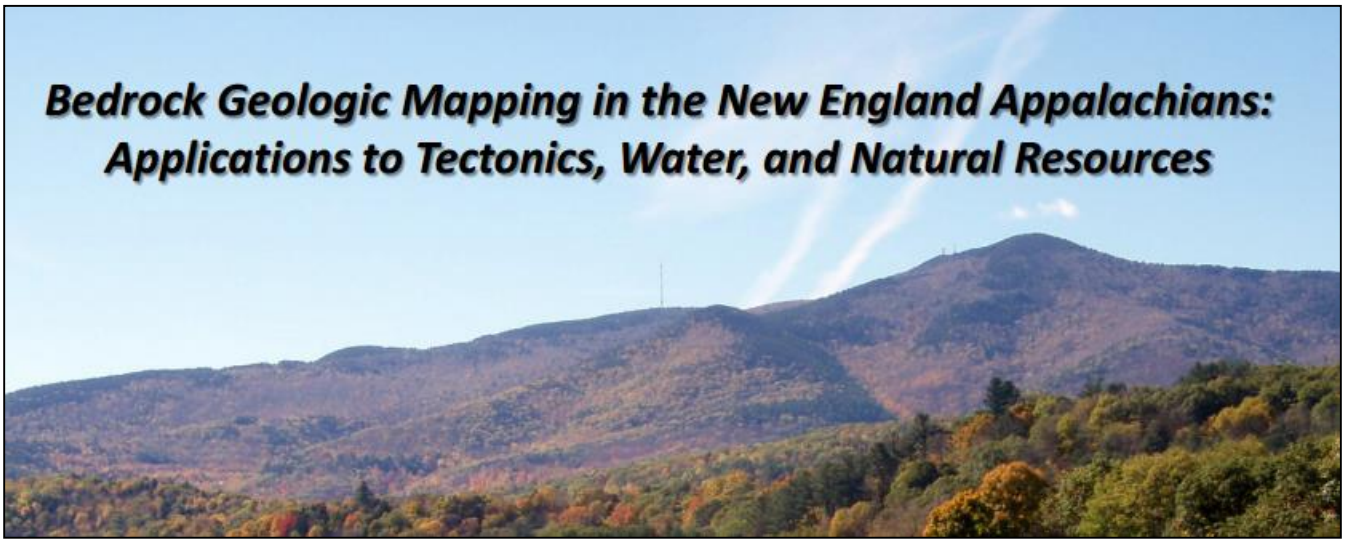
PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 1 | Karen Rose Cercone, Editor | September, 2015

Wednesday, September 16, 2015

The Pittsburgh Geological Society presents



Gregory Walsh, United States Geological Survey, Montpelier VT

The rocks in the New England Appalachians span 1.4 billion years of Earth history. Multiple episodes of deposition and erosion are attributed to repeated cycles of rifting and orogenesis. Major mountain building events with their associated deformation are punctuated by plutonism and metamorphism, all of which has produced a region underlain by highly complex geology. Geologic mapping has long been the key to unravelling the complex evolution of complicated rocks and, when combined with topical studies, has yielded not only scientific advances to the nature of mountain belts but also improvements to our understanding of groundwater and natural resources. This talk will highlight the region's diverse tectonic history and provide case studies illustrating the links between geologic mapping and our natural resources.

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, September 14.

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

SPEAKER BIOGRAPHY

Greg Walsh has been a Research Geologist with the USGS since 1992. He is currently the Project Chief in charge of bedrock geologic mapping activities in the northeastern United States. He has managed two international mapping projects in Morocco and conducted mapping in Madagascar. Greg specializes in the structure and tectonics of complexly deformed rocks, the integration of geologic data with hydrogeologic studies, and the use of GIS as a mapping and analysis tool. He has trained many geologists in geologic mapping, GIS, GPS, digital mapping, and U-Pb geochronology by SHRIMP.

PRESIDENT'S STATEMENT

Welcome back for a new year of PGS meetings and I am happy to serve as President of the Society for another year. I am very fortunate to have a great group of officers and board members who are dedicated to serve the entire membership. We do have a new arrangement of officers this year that will make a seamless transition into their positions. Tamra Schiappa will be our new Vice President after serving on our Board for the previous two years. She will also be acting as our Program Committee Chair and be responsible for planning and corralling all of the interesting speakers that present at our meetings. If you have any suggestions give her a call because we are always looking for a good geologic presentation. Kyle Fredrick, our previous VP for the past three years, will take over as our new Treasurer and track all things financial for the Society. We welcome back Karen Rose Cercone, a past president of the Society (1991-92), as she returns as our Secretary to keep minutes of all our doings as well as act as our new Newsletter Editor.

To round out our Board, I again look forward to working with the following current and new members. Counselors John Harper (also Chair of the Membership Committee) and Chuck Shultz (also Chair of the Ad-hoc Constitution Committee) both have a long record of service with the Society. We have three returning Directors at Large with one year remaining on their terms. Erica Love begins her 13th year on the Board and continues to serve as our Communication Committee Chair. Mark Barnes and Peter Michael also return and continue to make contributions to several committees. Our newly elected directors begin with Ken LaSota returning to the Board and continuing as our acting Chairman of the Education Outreach Committee. We also welcome back two past Presidents; Wendell Barner (2000-01) and Peter Hutchinson (1994-95). Wendell will also be serving as Chairman of our Audit Committee. Albert Kollar, our active Past President, continues to serve as our new Chairman of the Awards Committee.

We also have dedicated members that chair or are members of committees that take on responsibilities that are vital to our operations but not voting members of our Board. It is important that we recognize Frank Benacquista (Continuing Education Committee and our Hospitality Chair), Mary McGuire (Webmaster), Judy Neelan (Archives Chair/Historian), Mike Bikerman, Ed Girard, Dan Harris, Steve McGuire, and our AAPG Delegates Dan Billman and Andrea Reynolds for their efforts.

In closing, I look forward to seeing everyone at our September 16th meeting. Our guest speaker, Greg Walsh of the USGS, will be presenting a wonderful talk on bedrock mapping in the New England Appalachians. Please don't forget…it's that time to pay your membership dues.

Ray Follador

AAPG EASTERN SECTION NEEDS VISITING GEOSCIENTISTS!

The Eastern Section of AAPG has 46 active Student Chapters, but only 10 Visiting Geoscientists ... which makes it almost impossible to have a professional geoscientist visit each school at least once a year or even once every two years. The aim of AAPG's program is to give students a flavor of a professional life in energy resources. It also hopes to encourage dialog between industry and academia.

To be a Visiting Geoscientist bearing the AAPG flag, you are asked to have at least 5 years of experience and make at least one visit per year to a university. It can be a school with an AAPG Student Chapter, or a college/university without one. Your choice.

Here are the Eastern Section schools with student AAPG Chapters:

Akron	Augustana College	Brooklyn College
Bryn Mawr College	California Univ. of Pennsylvania	Cincinnati
Concord University	Cornell University	Georgia
Hope College	Illinois	Illinois State
James Madison	Kent State	Kentucky
Marietta	Marshall	Maryland
Massachusetts	Miami of Ohio	Michigan
Michigan Tech	North Carolina	Ohio State
Penn State	Pitt	Slippery Rock
South Carolina	Southern Illinois	St Lawrence University
Syracuse	Tennessee at Knoxville	Tennessee Tech
Toledo	SUNY Buffalo	Western Georgia
Virginia Polytech	Washington and Lee	West Virginia
Western Illinois	Western Kentucky	Western Michigan

Contact **Ione Taylor**, AAPG Eastern Section Coordinator (ione.taylor@queensu.ca) or **Robbie Gries**, co-Chair VGP committee, Denver (rrgries@aol.com) if you are interested in being a Visiting Geoscientist.

A MILESTONE FOR AN HONORARY PGS MEMBER

President Ray Follador and Honorary PGS Member Paul Garrett

I had the great privilege and honor, along with fellow PGS member Jeff Greenawalt and our wives, to attend the 90th birthday celebration of Paul Garrett on July 1st, 2015. Paul, a retired petroleum geologist, who spent his career with Peoples Natural Gas and CNG Development Company, is a long time and Honorary Member of the PGS. Paul served as the Society's Secretary in 1953-54 but is best remembered as our longtime Historian, a position he retired from in 2009.

CALENDAR OF EVENTS

Pennsylvania Council of Professional Geologists

September 2, 2015
Hydrogeology for the Consulting Geologist. Comfort Inn East, Monroeville, PA

September 17, 2015
Geophysical Methods for Effectively Mapping Bedrock Fractures and Other Subsurface Conditions in Urbanized Environments. Regional Learning Alliance, Cranberry Twp., PA

Geophysical Society of Pittsburgh

September 8, 2015
Jianli Yang of Seneca Resources Corp. "Appalachian Basin 3D Seismic Acquisition, What Have We Learned after 12 Surveys?" Penn Brewery, Pittsburgh PA

Pittsburgh Association of Petroleum Geologists

September 17, 2015
Christopher Gonsalves of Shell Appalachia "Unlocking the Deep Utica Play in Northeast Pennsylvania" Cefalo's Event Center, Carnegie PA

Association of Engineering Geologists

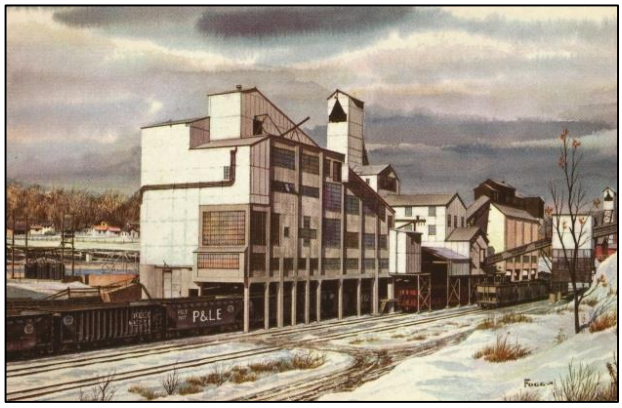
September 21-26, 2015
The 2015 AEG National Meeting "Conference at the Confluence" Wyndham Grand, Pittsburgh PA

Geological Society of America

November 1-4, 2015
The 2015 GSA National Meeting Baltimore Convention Center Baltimore MD

THE ORIGINS OF WESTERN PENNSYLVANIA PLACE NAMES

Mather is a small community in Morgan Township, Greene County that was named in honor of Samuel Mather, senior member of the firm of Pickands, Mather & Company, and William G. Mather, of the Cleveland-Cliffs Iron Company. Mather was home to the Mather Colliery a mine built by Picklands, Mather & Co. in 1917 to supply coal to the Cleveland-Cliffs Iron Company coke ovens in Ohio.



Painting of the Mather Mine by Howard Fogg

The town's major claim to fame occurred at 4:07 PM on May 19, 1928 when an explosion in the mine killed 195 men. Of the 209 men that were in the portion of the mine where the explosion occurred, 193 died in the explosion or were suffocated and two died after they reached the hospital. Fourteen men escaped to safety. The disaster was the result of a methane gas and dust explosion that was triggered by an arc from a battery powered locomotive being operated in the mine. The Mather Mine disaster ranks as the seventh worst mining disaster in U.S. history and the second worst in Pennsylvania history. The Mather Mine closed in the mid-1960s.

PROFILES OF THE PITTSBURGH GEOLOGICAL SOCIETY

Starting this month, the Communications Committee will spotlight the accomplishments of the geologists who belong to our society. We will be circulating questionnaires to members (both students and professionals) at our meetings this year, and we hope many of you will share your interesting lives with us.

Our new PGS secretary and newsletter editor has volunteered to start us off.

Member Name: Karen Rose Cercone

Company, title, years with company:
Professor at Indiana Univ. of PA for 29 years

How long have you been a member of PGS?
28 years

Have you held any officer positions?
Vice-President '89-'90 and President '90-'91

Education:
AB Bryn Mawr College '79, PhD University of Michigan '84, MFA University of Pittsburgh '05

What is the best and worst thing about your current job?
"Students" is the correct answer for both of those questions!

What was your first geology job out of college? I worked for a year at Gulf Research back when the lab was still in Harmarville PA.

What is your dream geology job?
The one I have right now.

What is one thing you wish someone would have told you when you were starting out in the geology profession?
Break in your boots before field camp!

What is the most exciting place you have been geologically?
Between the volcanoes, beaches and glow worm caves, it has to be New Zealand.

What is your favorite geology movie and why?
Dante's Peak – great lahar special effects!

What's your favorite rock, mineral, or fossil?
Kyanite – I named my border collie after it.

If you could choose anyone, who would you pick as your mentor?
John Harper. He knows more about rocks in Pennsylvania than anyone else I know.

If you could meet any geologist, living or dead, who would you meet?
Henry De La Beche, the first director of the British Geological Survey – and a really wicked cartoonist!

Anything else you would like to share about yourself?
I am a watercolor artist in my spare time, but I find it very challenging to paint rocks so they look realistic.

Karen Rose winning second place in a recent plein air painting contest with a rock picture.

To submit your member profile, just answer some of the questions on the next page and email it (along with an interesting picture) to Erica Love at **EricaLove.PGS@gmail.com**.

Find us on Facebook

MEMBER PROFILE QUESTIONS

Please return your responses to the questions below and a photo of yourself to Erica Love at EricaLove.PGS@gmail.com

Required:

- Name/certifications/email
- Company, title or role, years with company, any interesting internships/previous work history
- Education (school, degree, expected graduation date)
- How long have you been a member or PGS?
- Have you held any officer positions (can you remember when)?

Suggested List for Professionals
Please answer as many of the following questions as you like but try to answer at least two (2).

- What are some of your day-to-day responsibilities in your current role?
- What is the best and worst thing about your current job?
- What was your first geology job out of college or weirdest geology job and did you learn anything you would like to pass on to students?
- What is one thing you wish someone would have told you when you were starting out in the geology profession?
- What is one class (geology or otherwise) you wish you would have taken in college that would have helped you after graduation?
- If you could choose anyone, who would you pick as your mentor?

Suggested List for Student Members
Please answer as many of the following questions as you like but try to answer at least two (2).

- Any ideas on student related activities that you wish PGS would do?
- Are you working on any research topics, please list title, describe?
- What is your favorite subject/area of study?
- What are your plans following graduation? (Continuing with your education, academia, or into the job market)?
- What are your plans if money was not a issue?
- What is the most exciting place you have been geologically or one play you wish you could visit?

Professionals and Students
Please answer at least 4 of the following.

- What is your dream geology job?
- What is your favorite PA geology site/fun fact/phenomenon, etc.?
- What is the most exciting place you have been geologically?
- What is your favorite or least favorite “Bad” geology movie or book and why?
- What is your favorite rock, mineral, or fossil?
- What is your favorite song (of all time or right now) or your favorite geology related song?
- What is one of your favorite quotes (geology related or not)?
- If you could meet any geologist, living or dead, who would you meet?
- Anything else you would like to share about yourself.

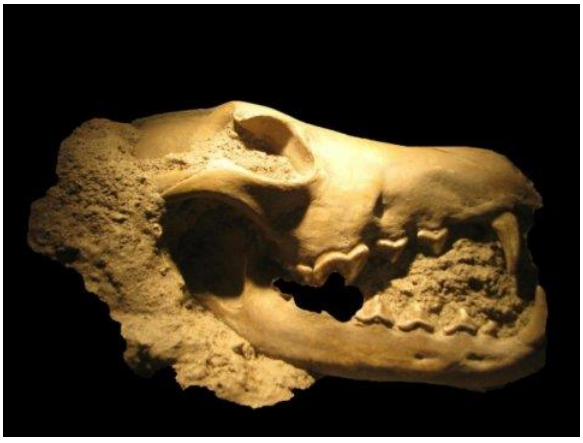
FUN FACT HAVING NOTHING TO DO WITH GEOLOGY:

Do you still use charcoal when you grill outdoors? If you do, you can thank Henry Ford. The founder of the Ford Motor Company, and the man who brought the assembly line to automobile manufacturing, was also the developer of the charcoal briquette, which he produced under the name “Kingsford” (as in Kingsford Match Light).

DID YOU KNOW . . . ?

A team of scientists from the Universities of Gothenburg Sweden, Brazil, and Switzerland analyzed more than 2,000 fossils to reveal that the arrival of cats to North America from Asia had a deadly impact on the diversity of the dog family, contributing to the extinction of as many as 40 species. Although climate change plays an overwhelming role in the evolution of biodiversity, competition among different carnivore species proved in this case to be even more devastating for canids (wolves, foxes, and their relatives).

The dog family originated in North America about 40 ma and reached a maximum diversity around 22 ma with more than 30 species inhabiting the continent. Today, only nine species live in North America. Members of the family grew progressively larger in body size and became specialized as large predators. Some of them were more than 66 pounds, among the largest carnivores in North American. Although some large carnivores today face a higher extinction risk than smaller species, there is no evidence of a similar pattern in ancient species.



Skull of an Extinct Canid

The evolutionary success of carnivorous animals is linked inevitably to their ability to obtain food. A limited amount of prey animals will impose strong competition among predators sharing the same geographic range (think wild dogs, hyenas, lions, cheetahs, and leopards in Africa) are constantly competing with each other for food. Ancient North American carnivores probably followed similar dynamics, with much of the competition occurring among species of the dog family and from ancient cats and dogs. Interestingly, while cats appeared to have a strongly negative impact on the survival of ancient dogs, the opposite is not true. This suggests that cats must have been more efficient predators than most of the extinct species in the dog family.

A multinational group of researchers using undersea vehicles in the waters off the Greek island of Santorini has discovered an interconnected series of subsea pools containing high concentrations of carbon dioxide. The pools, which get their distinctive color from opal particles, may hold answers to questions related to deep sea carbon storage as well as provide a means of monitoring the Santorini volcano for future eruptions.

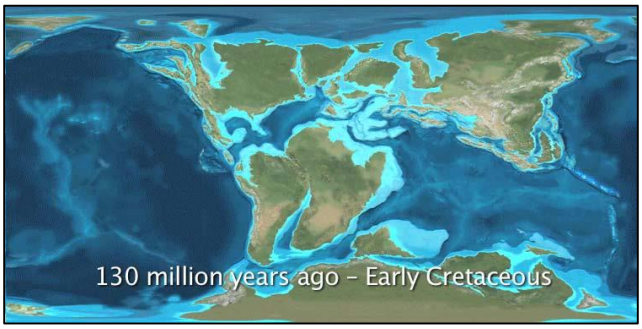
The previous best estimate of the age of the Earth's magnetic field was 3.45 billion years old. But now, a team of researchers led by John Tarduno, a geophysicist at the University of Rochester and a leading expert on Earth's magnetic field, say they believe the Earth's magnetic field is at least four billion years old. Their new results are based on the record of magnetic field strength fixed within magnetite found within zircon crystals collected from the Jack Hills of Western Australia. The zircons were formed over more than a billion years and have come to rest in an ancient sedimentary deposit. By sampling zircons of different age, the history of the magnetic field can be determined.

Researchers at the University of Utah have discovered a new layer in the mantle. Most layers are defined by the minerals that are present. Essentially, we have discovered a new layer in the Earth. The main layers in the Earth include a thin crust (4-50 miles deep), the mantle extending 1,800 miles deep, and the iron-rich core. Most layers within the mantle are defined by their mineralogy, but the new layer is defined by the strength, rather than the presence of its mineralogy.

The dominant minerals in the lower mantle are bridgmanite and ferropericlase. The research team identified the likely presence of a superviscous layer in the lower mantle by using presses equipped with gem-quality diamond anvils to squeeze samples of ferropericlase to pressures like those in Earth's lower mantle. This discovery could explain some deep earthquakes, hint that Earth's interior is hotter than believed, and suggest why magmas feeding midocean-ridge volcanoes, such as those on Iceland, differ chemically from magmas supplying island volcanoes like those on Hawaii.

When the western part of Gondwana broke up around 130 ma, Africa and South-America started to separate and the South Atlantic Ocean opened. It has commonly been assumed that enormous masses of magma ascended in a large plume, called the Tristan mantle plume, from the deep mantle up to higher levels, and that this plume weakened the continental lithosphere, eventually causing the break-up of Gondwana.

Now a group of German scientists is questioning this hypothesis. Using seismic measurements, they showed that impacts of the mantle plume on the continental crust were actually small, so the idea that a mantle plume would have a dominant or controlling role in the break-up of a continent is questionable.



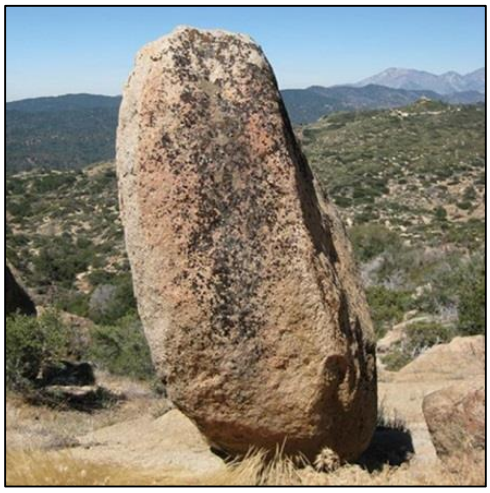
The Breakup of Southern Gondwana

Large amounts of hot mantle material upwelling produce regions of crustal and mantle rocks with different seismic velocities than surrounding, unaffected regions. The researchers used seismic surveys along several lines both onshore and offshore Northern Namibia where the Walvis Ridge joins the African continent.

They found a distinctive high-velocity anomaly in the lower crust between 12 and 25 miles deep related to the intrusion of magmatic material in the lower crust of the Earth as is expected according to current perception. The size of the anomaly, however, was far too small to be created by a large plume head playing an active role in the break-up process. Thus, the break-up of Gondwana and, generally, the role of mantle plumes in continental break-ups needs to be re-evaluated.

A golf-ball sized chunk of rock was found recently in a diamond mine in Yakutia, northeastern Russia that contains at least 30,000 colorless, octahedral micro-diamonds – all 10 to 700 microns in size, many occurring in clusters**.**

There have been five major mass extinction events in the Earth's history, including the demise of the dinosaurs and numerous other plants and animals at the Cretaceous/Tertiary boundary. Paleontologists believe that, in general, animals occupying wide geographic ranges are less likely to become extinct than animals with smaller geographic ranges because they are insured against regional environmental catastrophes.



A Balanced Rock near the San Jacinto Fault

However, a recent study found this insurance is rendered useless during global mass extinction events, and that widely distributed animals are just as likely to suffer extinction as those that are less widespread. The study, which explored the fossil record of terrestrial vertebrates, including dinosaurs, from the Triassic and Jurassic, found that large geographic ranges do offer insurance against extinction. This insurance disappeared, however, at the end-Triassic mass extinction event, which has been associated with massive volcanic eruptions and rapid climate change. Approximately 80% of species on the planet went extinct at that time allowing the dinosaurs to rise to dominance in the Jurassic Period. The results of this study are similar to those obtained from the marine invertebrate fossil record.

A group of balanced rocks that dot the countryside in California should have been knocked over by earthquakes centuries ago. For about 20 years, a handful of researchers has been discovering the power of centuries-old earthquakes along the San Andreas fault by studying how easy or how hard it should be to tip the balanced rocks. It seem apparent that, if precariously balanced rocks have stood for centuries, the risk or frequency of large quakes is probably low in that area. But if only very sturdily balanced rocks are found, then it's probable that more frequent or strong quakes knocked everything else down. This is indirect evidence of what has or has not happened.

A few years ago, however, researchers found a bunch of balanced rocks in the San Bernadino Mountains, northeast of Los Angeles that defied common sense. They were very close to the San Jacinto Fault where it edges near the San Andreas. Using cosmogenic dating techniques, they determined that the rocks had been in place for at least 18,000 years.

Okay, so maybe the rocks aren't as fragile as they look? But tests of fragility indicated that the rocks were not as tough as they should have been. Finally it occurred to the researchers that the San Andreas and San Jacinto faults are very close together and began to wonder if it was a situation where one fault ruptures and then the rupture ends and jumps over to a nearby fault. The faults were modeled and the results showed not only that it was a possibility, but that such a situation could have created a region of less shaking where the balanced rocks are found. The modeling indicated that a rather low shaking could occur near the nucleation point of a quake.

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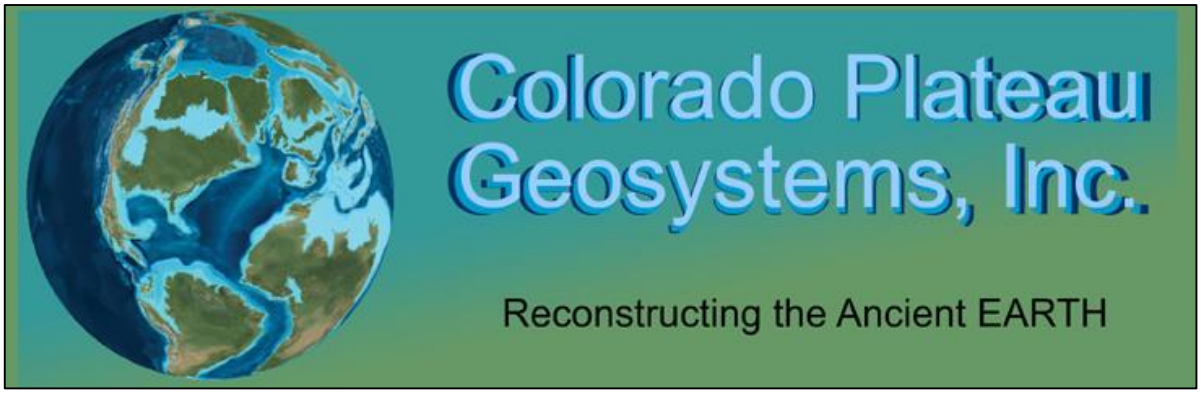
PGS Website of the Month



http://cpgeosystems.com/paleomaps.html

PGS Board-of-Directors

President:	Ray Follador	**Director-at Large:**	Erica Love	**Director-at Large:**	Wendell Barner
Vice President:	Tamra Schiappa	**Director-at Large:**	Mark Barnes	**Director-at Large:**	Peter Hutchinson
Treasurer:	Kyle Frederick	**Director-at Large:**	Peter Michael	**Counselor:**	John Harper
Secretary:	Karen Rose Cercone	**Director-at Large:**	Ken LaSota	**Counselor:**	Charles Shultz
Past President:	Albert Kollar				
Other PGS Positions		**Historian:**	Judy Neelan	**AAPG Delegate:**	Andrea Reynolds
Webmaster:	Mary McGuire	**Continuing Ed:**	Frank Benaquista	**AAPG Delegate:**	Dan Billman

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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.

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Wednesday, October 21, 2015

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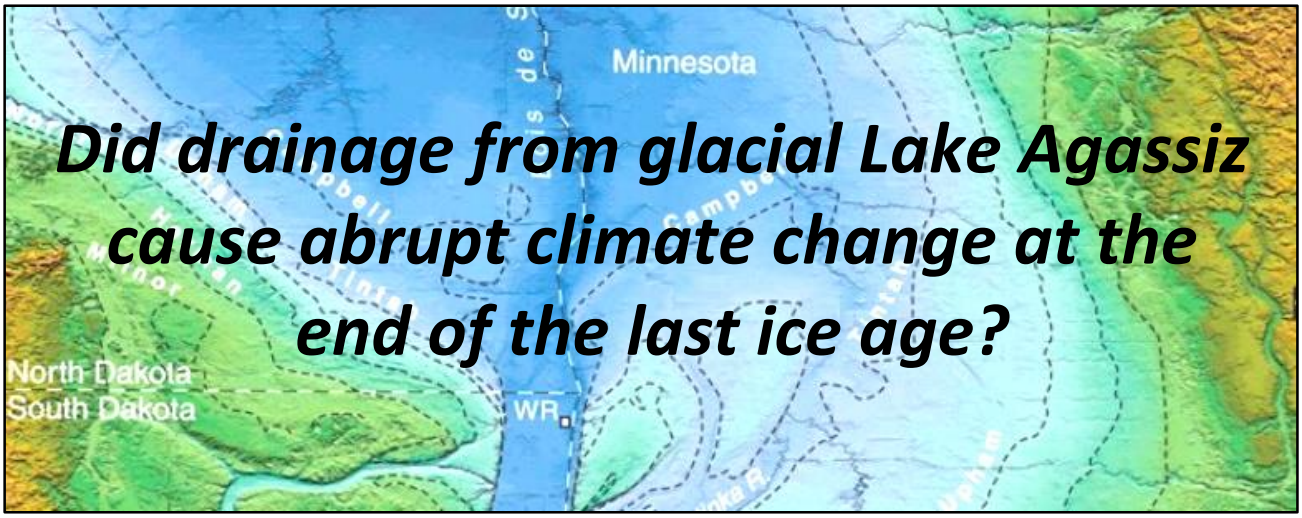


Dr. Timothy Fisher, The University of Toledo

Glacial Lake Agassiz was an immense proglacial lake that evolved over a span of 6000 years, extending from west-central Minnesota to Hudson Bay in Canada. Meltwater and rivers attempting to drain to Hudson Bay were dammed by the Laurentide Ice Sheet receding to the north. The dammed water formed Lake Agassiz, which drained through outlets cut across sub-continental drainage divides. Meltwater was routed to the Gulf of Mexico, the North Atlantic and to the Arctic Ocean throughout the lakes history. It has long been proposed that sudden diversion of meltwater routing, accompanied by rapid drops in lake level, altered thermohaline circulation in the North Atlantic to cause the global, Younger Dryas cold period between 12.9–11.6 thousand years ago. Selected data collected over the past 25 years will be summarized to evaluate how the meltwater drainage history reconciles with periods of abrupt climate change to answer the question: did drainage from glacial Lake Agassiz cause abrupt climate change at the end of the last ice age?

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, October 19.

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

SPEAKER BIOGRAPHY

Timothy Fisher has worked as a Quaternary Geologist at The University of Toledo for the past 12 years. Previously he worked at Indiana University NW for nine years. Currently, he is a Professor and Chair of the Department of Environmental Sciences. Tim's research interests involve reconstructing past events at the close of the last ice age, including the evolution of glacial Lake Agassiz in the Midwest, and the progression of ice recession and proglacial lake development in the Great Lakes region. A secondary interest in the past 15 years has been trying to understand the timing and frequency of aeolian coastal dunes along the Great Lakes, with the goal of understanding triggering events of dune mobility. He has published more than 65 papers and has trained many graduate students in glacial geology.

PRESIDENT'S STATEMENT

Our September meeting kicked off a new year and was well attended by both our professional and student membership. The Board continues to emphasize the need for a good balance at our meetings between these two membership categories since students need to network with the people that have career knowledge and our professional members need to know who the candidates for future jobs are. Speaking of our student members…

Last year the Society instituted our first Student Board Representative along with individual university student liaisons to create better communication between our student members and the Board. The process was well received and did work but will always be subject to refinement. Christy Miller, of Slippery Rock University, will continue to act as the Society's Student Board Representative this year and have a non-voting seat on our Board. At this time, due to graduation, there is a need to fill many of the student liaison positions that communicate with Christy from their respective universities. Each university's geology club should discuss a potential candidate and submit her/his name to your University Faculty Coordinator (your professor with ties to the PGS), along with a personal statement and resume. We would like to fill these positions in October. If any student has questions please feel free to contact me.

At this time I would like to take a moment to point out a recent scientific article published in Pennsylvania Geology (Summer 2015 Issue) by a couple of our Society Board members. John Harper and Albert Kollar co-authored "Reflections on "Spirifer disjunctus", a Group of Late Devonian Brachiopods Useful for Correlation in Pennsylvania". The article highlights this Late (Upper) Devonian fossil found in Pennsylvania and New York that is a very important worldwide index fossil. If you haven't had the opportunity to review this article you can find it at this link:

http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20031134.pdf.

I hope you can all join us at the October meeting. Our guest speaking will be Dr. Timothy Fisher, Professor of Geology from the University of Toledo. He will be presenting an excellent talk on the drainage of glacial Lake Agassiz and its possible impact on climate change at the end of the last ice age.

Ray Folladar

AAPG EASTERN SECTION STILL NEEDS VISITING GEOSCIENTISTS!

The Eastern Section of AAPG is still looking for professional geoscientists to visit their student chapters once every year or two years. The aim of AAPG's program is to give students a flavor of a professional life in energy resources. It also hopes to encourage dialog between industry and academia.

To be a Visiting Geoscientist bearing the AAPG flag, you are asked to have at least 5 years of experience and make at least one visit per year to a university. It can be a school with an AAPG Student Chapter or without one. Here are the Eastern Section schools with student AAPG Chapters:

Akron	Augustana College	Brooklyn College
Bryn Mawr College	California Univ. of Pennsylvania	Cincinnati
Concord University	Cornell University	Georgia
Hope College	Illinois	Illinois State
James Madison	Kent State	Kentucky
Marietta	Marshall	Maryland
Massachusetts	Miami of Ohio	Michigan
Michigan Tech	North Carolina	Ohio State
Penn State	Pitt	Slippery Rock
South Carolina	Southern Illinois	St Lawrence University
Syracuse	Tennessee at Knoxville	Tennessee Tech
Toledo	SUNY Buffalo	Western Georgia
Virginia Polytech	Washington and Lee	West Virginia
Western Illinois	Western Kentucky	Western Michigan

Contact **Ione Taylor**, AAPG Eastern Section Coordinator (ione.taylor@queensu.ca) or **Robbie Gries**, co-Chair VGP committee, Denver (rrgries@aol.com) if you are interested in being a Visiting Geoscientist.

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

Jeff S. Tubbs
The Montrose Environmental Group LLC
2014 BS in Geology
The University of Pittsburgh

Margaret E. Kroehler
2007 MS in Geosciences
The University of Texas at Austin

We are also delighted to welcome the following new student members:

Christopher Davis
California University of Pennsylvania

Donald W. Fike
California University of Pennsylvania

Michael J. Haezebrouck
California University of Pennsylvania

Jensen L. Hufnagel
California University of Pennsylvania

Janine B. Krippner
The University of Pittsburgh
2009 MS in Volcanology
The University of Waikato,
New Zealand

CALENDAR OF EVENTS

Geophysical Society of Pittsburgh

October 6, 2015
Barry Fish of NanoSeis. "Surface Microseismic: How many events are enough?" Penn Brewery, Pittsburgh PA

Pittsburgh Association of Petroleum Geologists

October 8, 2015
Greg Wrightstone of Wrightstone Energy Consulting. "Upper Devonian Burket/Geneseo Shale - Appalachia's Little Brother to the Marcellus" Cefalo's Event Center, Carnegie PA

Harrisburg Area Geological Society

October 15, 2015
David Allard of Pennsylvania DEP. "Elevated radon in the Lehigh Valley" Lancaster Brewing, Harrisburg PA

Society for Mining, Metallurgy, and Exploration / Pittsburgh Coal Mining Institute of America

October 22-23, 2015
2015 Annual Joint Meeting
Hilton Garden Inn-Southpointe, Canonsburg PA

Ohio Geological Society

October 29, 2015
Challenges and Strategies for Monitoring Induced Seismicity.
Worthington OH

Geological Society of America

November 1-4, 2015
The 2015 GSA National Meeting
Baltimore Convention Center
Baltimore MD

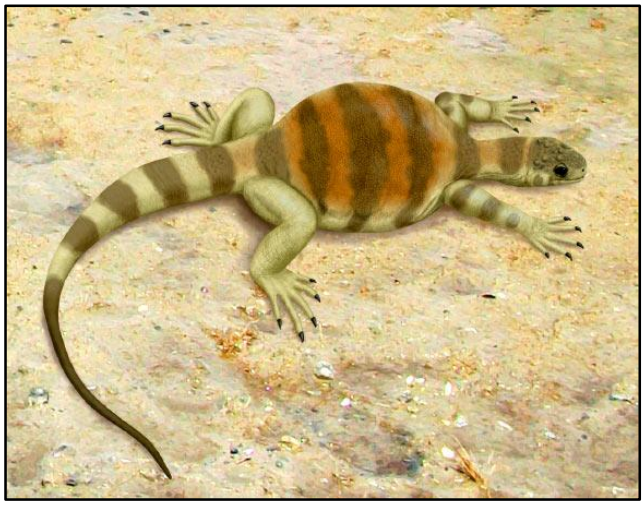
THE ORIGINS OF WESTERN PENNSYLVANIA PLACE NAMES

Although Ananias Allen, an obvious Englishman, was probably the first settler in the area now occupied by Wurtemburg, Lawrence County when he arrived there around 1795, the town actually takes its name from the fact that a number of Germans who settled there in the 1800s were from Wurtemburg, Germany. As a result, the town used to have the nickname "Dutch Town". Wurtemberg is situated on the Slippery Rock Creek about ½ mile its confluence with Connoquenessing Creek. The area was considered to be so picturesque in the 19th century that Pittsburgh artists would visit every summer to sketch and paint. The May 1890 Pittsburgh Dispatch published a story about a dozen young women from the Pittsburgh School of Design (with a chaperone, of course) spending the first week of June in Wurtemburg. Some were concerned for their safety because the previous year they had been scheduled to spend time in Johnstown around the time of the great flood. Wurtemburg doesn't have a lot of geologic resources. A salt well drilled there in 1820 to about 500 feet produced about two barrels of salt per day for nine years, and several companies drilled for oil in the 1860s and 1870s, but the little oil they discovered was not in paying quantities.

Bridge over Slippery Rock Creek in Wurtemburg

DID YOU KNOW . . . ?

A 260 ma fossil reptile from South Africa named *Eunotosaurus africanus* provides a long-awaited glimpse into the origins of turtles. Although the fossil looks more like a lizard that swallowed a frisbee than a turtle, and lacks the iconic turtle shell, its wide ribs and distinctively circular torso are the first indications that this ancient animal represents an important clue to the origin of turtles.



Artist's reconstruction of Eunotosaurus africanus

Until recently, however, all of the studies of this species lacked detailed analyses of the skull, which possesses a complex anatomy. High-resolution CT (computed tomography) scans digitally dissected the bones and internal structures of multiple *Eunotosaurus* skulls, providing convincing evidence of the important role played by this species in the history of turtle evolution. The CT scans showed that the fossil reptile possessed structures that probably represent the first steps in the evolution of the turtle shell.

A team of German-American scientists has discovered that the craton below the North American continent is extremely deformed. Its root is shifted relative to the center of the craton by 530 miles to the west-southwest. Previously, it was assumed that the craton did not undergo substantial changes after its formation 2.5 to 3.8 billion years ago.

The team combined and analyzed several data sets from Earth's gravity field, topography, seismology, and crustal structure, and constructed a three dimensional density model of the composition of the lithosphere below North America. During this study, it became apparent that the lower part of the cratonic root was shifted. But what caused the deformation of what used to be thought of as a stable and solid craton?

A model of the movement within the mantle below North America reveals that the mantle material below 125 miles flows westward at a velocity of about 4 millimeters per year, similar to the movement of the tectonic plate. But the lower part of the cratonic lithosphere is shifted as a result of basal drag, indicating that the craton is not as solid nor as insensitive to mantle flow as was previously assumed. There is far more mechanical, chemical, and thermal interaction between the craton of billions of years in age and its surrounding in the upper mantle of Earth than previously thought.

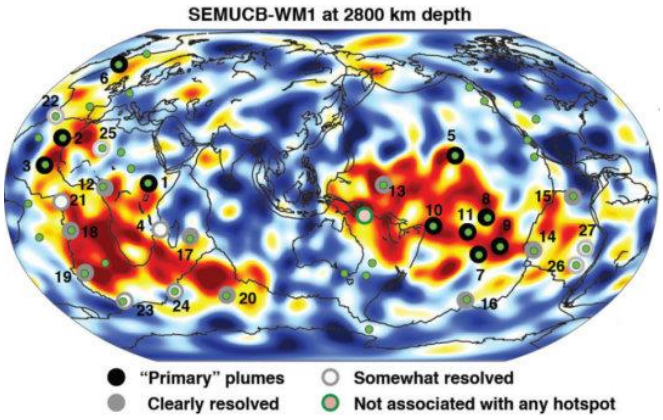
According to 23 years of satellite data from NASA and its partners, sea level is rising a few millimeters a year, just a fraction of an inch. But that's an average; it isn't constant globally. For example, if you if you have a cottage on the Jersey Shore or at Cape Hatteras, sea level is rising two or three times faster than average. If you know someone living in Norway or Sweden, their sea level is

falling. China's Yellow River delta is swamped every year by sea level rise of more than nine inches. These regional differences in sea level change will become even more apparent in the future, as ice sheets melt.

A team of Swedish scientists has found traces of two large meteorite impacts in the Swedish county of Jämtland that occurred during the Ordovician about 458 million years ago. Jämtland was under the sea at the time, with a water depth of 1,640 feet at the points where the two meteorites struck simultaneously. Based on years of meteorite studies, it has been known that a large disruption of an asteroid occurred about 470 million years ago in the asteroid belt between Mars and Jupiter that caused a large amount of asteroid debris and dust. Some of that debris crossed Earth's orbit, resulting in an increased influx of small meteoritic material

lasting for a couple of million years. It is likely that that disruption also caused much larger meteoritic material to strike Earth, accounting for the relatively high number of Ordovician craters that are known on the planet.

Seismologists from the University of California-Berkeley have produced the first sharp, three-dimensional scan of Earth's interior that conclusively connects plumes of hot rock rising through the mantle with surface hotspots that generate volcanic island chains such as Hawaii, Samoa and Iceland. This is basically a CT (computed tomography) scan of the Earth's interior.



CT scan of hot spots in Earth's interior

The seismologists mapped the mantle plumes by analyzing the paths of seismic waves bouncing around Earth's interior after 273 strong earthquakes that shook the globe over the past 20 years. Although other studies previously detected pockets of hot rock rising in areas where plumes have been proposed, it was never clear whether they were connected to volcanic hotspots at the surface or the roots of the plumes at the core mantle boundary 1,800 miles below the surface.

The new, high-resolution map of the mantle shows not only the connections for many hotspots on the planet, it also reveals that below about 620 miles the plumes are between 375 and 650 miles across, up to five times wider than geophysicists thought. The plumes are likely at least 750^{o}F hotter than surrounding rock.

Iran has discovered an unexpectedly high reserve of uranium and will soon begin extracting it at a new mine. Of course, any indication Iran will become more self-sufficient in nuclear power will be watched by the world powers.

A group of scientists from Japan have decoded the first lingulid brachiopod genome using Lingula anatina. The results show that, despite Lingula's reputation as a "living fossil", its genome is actively evolving. Brachiopods are one of the first known examples of multicellular life, with the earliest recorded species dating to the early Cambrian period, approximately 520 million years ago. Brachiopods dominated the seas during the Paleozoic and left an abundance of fossils.

Lingula anatina; <u>not</u> a living fossil

Unlike their articulate relatives though, inarticulate brachiopods like Lingula appeared to change so little since their first appearance that Darwin himself referred to them as "living fossils", a term that often misleads people into believing that these animals have not evolved in hundreds of millions of years. In addition, the new phylogenetic analysis of the Lingula genome indicates that, at least at the molecular level, brachiopods are closely related to molluscs, and more distantly related to segmented worms.

According to a new study published in the Proceedings of the National Academy of Sciences, microbes lived in ancient rocks deep below the seafloor. Evidence comes from cores of mantle rocks that were thrust by tectonic forces to the seafloor during the Early Cretaceous. The discovery confirms a long-standing hypothesis that interactions between mantle rocks and seawater can create potential for life even in hard rocks deep below the ocean floor.

And finally, here's something for Star Trek fans: Remember those episodes where the team geologist got to find all sorts of neat new rocks and minerals (and get killed because he was wearing a red shirt!!!)? Well, research predicts that Earth has more than 1,500 undiscovered minerals and that the exact mineral diversity of our planet is unique and could not be duplicated anywhere in the cosmos. So, grab your phaser and tricorder,

hop aboard the USS Enterprise, and go looking for all those OTHER unique minerals waiting to be discovered in the universe.

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Vista Resources, Inc.

Woodard & Curran, Inc.

Wrightstone Energy Consulting

PGS Website of the Month

http://www.mbari.org/volcanism/Hawaii/

PGS Board-of-Directors

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Vice President:	Tamra Schiappa	**Director-at Large:**	Mark Barnes	**Director-at Large:**	Peter Hutchinson
Treasurer:	Kyle Frederick	**Director-at Large:**	Peter Michael	**Counselor:**	John Harper
Secretary:	Karen Rose Cercone	**Director-at Large:**	Ken LaSota	**Counselor:**	Charles Shultz
Past President:	Albert Kollar				
Other PGS Positions		**Historian:**	Judy Neelan	**AAPG Delegate:**	Andrea Reynolds
Webmaster:	Mary McGuire	**Continuing Ed:**	Frank Benaquista	**AAPG Delegate:**	Dan Billman

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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

Willard Scott, former weatherman and all-around entertainer for the Today Show and the Weather Channel, was the very first Ronald McDonald.

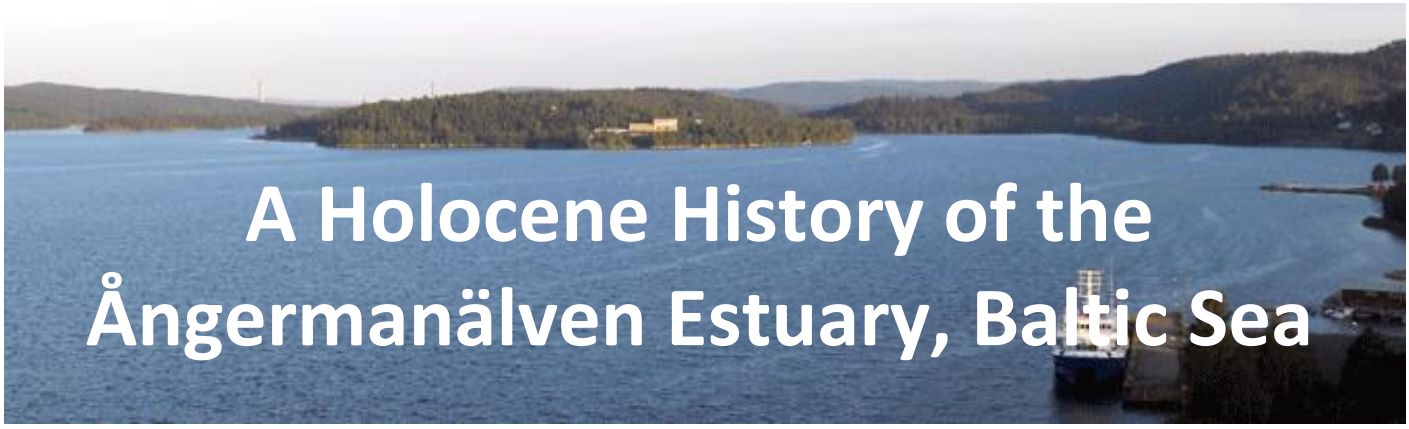
PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 3 | Karen Rose Cercone, Editor | November, 2015

Wednesday, November 18, 2015

The Pittsburgh Geological Society presents
Dr. Jonathan Warnock, Indiana University of Pennsylvania



The Baltic Sea is significant for the economies and industries of many European nations. Unfortunately, the Baltic is currently experiencing severe bottom water anoxia and high nutrient and heavy metal loads related to human activity. The Baltic has been experiencing human-induced change since medieval times and has a complex natural history resulting from deglaciation and subsequent uplift. International Ocean Drilling Expedition 347 cored the Baltic basin in the Fall of 2013 with the goal of generating a comprehensive basin-wide Baltic climate history for the Holocene as well as to document medieval and industrial-age human impacts to the Basin. Diatoms are a diverse group of single-celled algae which create siliceous cell walls. Diatoms respond quickly to environmental change, and their cell walls are readily preserved in sediments. Diatoms from two cores taken during IODP Expedition 347 have been analyzed in order to understand the history of the Ångermanälven Estuary in the northern Baltic Sea. The influence of natural and human impacts to the Baltic will be discussed.

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, November 16.

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

SPEAKER BIOGRAPHY

Jonathan Warnock is a first-semester assistant professor at Indiana University of Pennsylvania. He completed his PhD at Northern Illinois University in 2013, studying the drivers of the silica cycle in the Southern Ocean. His dissertation led to the development of the first fully quantitative proxies of diatom dissolution and silica cycling for Southern Ocean sediments and sediment cores. In addition to Antarctic work, Jonathan uses diatoms to study the climate history of the Baltic Sea. In the summer he spends his time in Utah researching Jurassic dinosaur taphonomy and ecology.

PRESIDENT'S STATEMENT

I would like to begin this month's statement on a solemn note with a few words of remembrance for PGS Honorary and long time Board member Mary Robison. Mary passed away last month (see obituary in this newsletter) after a long and courageous battle with cancer. I first met Mary in 1986 when I first joined the PGS Board. At that time, she was the Society Treasurer and on her way to her ascent to President, a position she held in 1988-89. Following her service at various officer positions Mary remained on the Board for years to come as a Director-at-Large and, most recently, Counselor, a position she only resigned from in May of this year. Mary was one of the most active and committed PGS members in our history. She was a quiet leader who spoke when it was necessary, and whose words often settled issues that confronted the Board. She will be dearly missed.

I am pleased to announce that the Board recently approved our new or returning student liaisons representing their participating universities. We welcome Charles Cavallotti (IUP), Dakota Barella (Pitt), Philip Graves (RMU), Arienne Valerio (CALU), and Blake Wallrich (SRU). The liaisons will continue to work with acting Student Board Representative Christy Miller (SRU) to communicate student needs and views with our Board. We remain open to add additional universities and liaisons in the future. Please contact me or any Board member if you have interest in doing so.

It is November and the month that we begin our Corporate Sponsorship campaign. As usual, I will be contacting select employees of all our current, past, and potential corporate sponsors for another year of support. The generosity of our sponsors reached an all time high last year and was directly responsible for supporting our initiatives in a year that we experienced record attendance numbers at our meetings. The Society is grateful for your continuing monetary contributions to the general fund, the Galey Fund in support of our student initiatives, and the underwriting of our monthly meetings or events such as field trips, workshops, etc. I would like to acknowledge and thank GEO-COM, LLC as our initial and newest corporate sponsor of 2015-16.

I hope you can all join us at the November meeting. Our guest speaker will be Dr. Jonathan Warnock, an assistant professor of Geology from the Indiana University of Pennsylvania. He will be presenting his research on the geologic history of the Baltic Sea and the impact that human-induced change has had upon it since medieval times.

Ray Follador

IN MEMORIAM

MARY RITA SCHLICHTE ROBISON

November 17, 1938 - October 26, 2015

Long time Honorary Member Dr. Mary Robison, 76, passed away on October 26, 2015 after a long illness. Mary was a passionate and committed member of the PGS who was one of the longest serving Board members in the history of the Society. Mary served as PGS Treasurer in 1985-86 and 1986-87, Vice President in 1987-88, President in 1988-89, and Past President in 1989-90. When not acting as an officer Mary continuously returned as a Director-at-Large on the Board and acted as one of the Society's Counselors from 2010 until May of 2015. Mary was the recipient of the PGS Walt Skinner Award in 2013 for her exceptional service to the Society and geologic community at large.

Dr. Robison received her BS in Chemistry from Marian College (now Marian University) in 1960, her MS in Biochemistry from the Medical College of Georgia in 1963, and her PhD in Geochemistry from the University of Pittsburgh in 1978. Mary had a long and successful career working for employers such as the Mellon Institute, the NUS Radiation Laboratory, the NUS Department of Nuclear Safety, the NUS Geology Department, and the OHM Corporation. She spent most of her career examining and analyzing groundwater and soil samples from hazardous waste investigations.

Mary's passions outside of her professional career ranged from politics to the arts. A small sample of what she dedicated herself to over the years includes; serving as an Allegheny County Democratic Committeewoman from 1968-2004 and Judge of Elections until 2013; with her husband, Jonathon, publishing an election newsletter for decades to inform and engage voters; being an avid pianist and violinist and an active member of the Tuesday Musical Club where she performed as a member of their String Ensemble. Mary's leadership roles in the Tuesday Musical Club led to her being the recipient of WQED's Volunteer in the Arts (VITA) Award in 1999.

Mary is survived by her husband, Jonathon, daughter and son in law, Joy and Ian Hargraves, two grandchildren, and several brothers and sisters.

CALENDAR OF EVENTS

JOINT MEETING: Geophysical Society of Pittsburgh and Pittsburgh Association of Petroleum Geologists

November 4, 2015
SEG distinguished lecturer Dan Whitmore "Concepts and applications of imaging with multiples and primaries" Cefalo's Event Center, Carnegie PA

Ohio Oil and Gas Association

November 4-5, 2015
Technical Conference and Oilfield Expo. Pritchard Laughlin Civic Center Cambridge, OH

Ohio Society of Petroleum Engineers

November 11, 2015
Andy Martin - Schlumberger
"Modern Perforating Techniques: Key to Unlocking Reservoir Potential" McCall's Restaurant – Canton, OH

AIPG-Ohio Annual Meeting

November 12, 2015
Dr. David L. Meyer – Univ. of Cincinnati
"The Sea Without Fish: Life in the Ordovician Sea of the Cincinnati Region"
La Scala Bistro – Dublin, OH

Harrisburg Area Geological Society

November 12, 2015
Felicia Bechtel – Enviroscan, Inc.
"Hey, this geophysics #$@&% Really Works!" GTS Technologies, 441 Friendship Road, Harrisburg, PA

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

Samuel C. Webb, Jr.
1985 B.S. in Horticulture
Delaware Valley University

Payton W. Mann
Technical Specialist
GAI Consultants, Inc.
2015 B.A. in Geological Engineering
The University of Mississippi

We are also delighted to welcome the following student members from California University of Pennsylvania to the society:

Ellyn M. Gazda
Eli P. Ramsay
Ashleigh V. Schimmel
Jesse E. Spara
Rachel E. Yesenchak

Other new student members include:

Daniel P. Lapikas
Penn State University

Charles Cavallotti
Indiana University of Pennsylvania

THE ORIGINS OF WESTERN PENNSYLVANIA PLACE NAMES

84 Lumber Logo

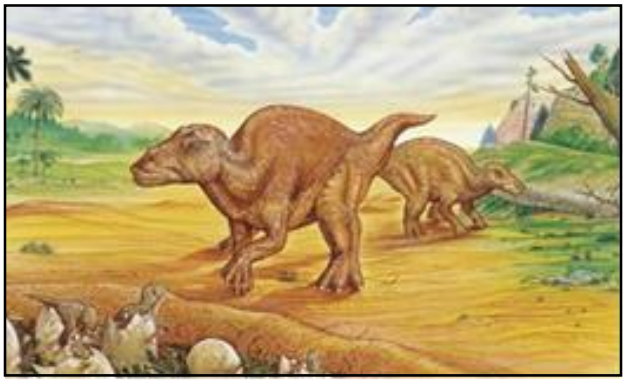
The town of Eighty Four in Washington County originally was named Smithville. Because another town, in Lancaster County, had the same name, however, the name was changed to "Eighty Four" on July 28, 1884. There are at least three versions about the origin of the name:

1) the most popular is that the town was named in honor of the election of Grover Cleveland as US President in 1884;
2) it was named for a mile marker on the Baltimore & Ohio Railroad; and 3) it was named for the year the town's Post Office was built, by a postmaster who apparently didn't have a whole lot of imagination.

Eighty Four is, of course, the corporate headquarters of the 84 Lumber Company.

DID YOU KNOW . . . ?

After decades of research on the dinosaur *Maiasaura peeblesorum* – the "good mother lizard" – paleontologists now know more about the life history of a dinosaur than ever before. A team of researchers led by a doctoral student at Montana State University



Artist's reconstruction of *Maiasaura*

examined the histology (fossil bone microstructure) of 50 Maiasaura shin bones to reveal information about growth rate, metabolism, age at death, sexual maturity, skeletal maturity, and how long it took to reach adult size. Because the entire growth history of an animal is recorded within bone, major life events, including the rates at which different-aged animals died, are recorded in their growth.

The researchers discovered a wealth of new information about how Maiasaura grew up. For example, it had bird-level growth rates throughout most of its life, and its bone tissue most closely resembled that of modern day warm-blooded large mammals such as elk. Sexual maturity occurred within the third year of life, and Maiasaura reached an average adult mass of 2.5 tons in eight years. The average mortality rate for those less than a year old was 89.9%; it was 44.4% for animals eight years old and older. This study makes Maiasaura a model organism to which other dinosaur population biology studies can be compared.

Similarly, an international team of paleontologists has unearthed an exceptional block of baby *Saurolophus angustirostris*, a hadrosaurid dinosaur, with associated eggshell fragments, in the Gobi Desert in Mongolia.

New collaborative research done at the University of London and Southern Illinois University reveals widespread fire occurred on Earth more than 80 million years after plants probably first invaded the land in the Early Silurian. Although there were land plants at that time, there is very little evidence of fire occurring. Instead, the researchers discovered evidence of fire in the Late Devonian after analyzing charcoal that was washed into the epeiric sea that covered parts of North America at that time. Apparently it wasn't the climate or lack of fuel that prevented widespread fires, but that the atmospheric oxygen levels were too low. Oxygen levels supposedly need to be above 17% for widespread fires to occur (today's oxygen level is 21%). The new data suggests that the threshold was reached around 360 million years ago, in the latest Devonian, and probably never went below this level for the rest of geological history.

A team of Swedish scientists has found traces of two large meteorite impacts in the Swedish county of Jämtland that occurred during the Ordovician about 458 million years ago. Jämtland was under the sea at the time, with a water depth of 1,640 feet at the points where the two meteorites stuck simultaneously. Based on years of meteorite studies, it has been known that a large disruption of an asteroid occurred about 470 million years ago in the asteroid belt between Mars and Jupiter that caused a large amount of asteroid debris and dust. Some of that debris crossed Earth's orbit, resulting in an increased influx of small meteoritic material that lasted for a couple of million years. It is likely that that disruption also caused much larger meteoritic material to strike Earth, accounting for the relatively high number of Ordovician craters that are known on the planet.

For more than three decades, researchers have argued about a controversial hypothesis relating to periodic mass extinctions and asteroid/comet impact craters on Earth. Now researchers from the Carnegie Institution of Washington and New York University suggest they have data showing a cyclical pattern over the past 260 million years indicating that both impacts and extinction events have been taking place every 26 million years.

Artist's conception of the End-Cretaceous Chicxulub bolide impact

This cycle has often been linked to the periodic motion of the Sun and planets through the mid-plane of the Milky Way Galaxy, with gravitational perturbations of the Oort comet cloud leading to periodic comet showers in the inner Solar System. The researchers performed time-series analyses of impacts and extinctions using data that offered more accurate age estimates. They found what they believe is a strong correlation between six mass extinction events and times of enhanced impact cratering on Earth over the past 260 million years (including the End-Cretaceous Chicxulub impact in the Yucatan), suggesting a cause-and-effect relationship.

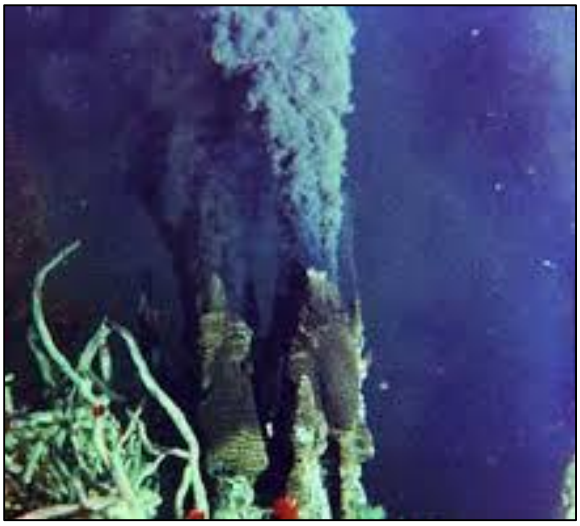
It is well known that an earthquake in one part of the world can trigger others thousands of miles away. For example, the 2012 earthquake off the coast of North Sumatra, which had a magnitude of 8.6, is known to have been followed by two earthquakes in Japan each with a magnitude greater than 5.5. New research reveals that these triggered earthquakes are only one outward sign of widespread changes taking place below Earth's surface.

Earthquakes can change the elastic properties of Earth's crust up to 3,700 miles away, altering its ability to withstand stresses for a period of up to a few weeks. When a surface wave from an earthquake passes through a distant fault region, it changes the frictional properties between the surfaces of the fault blocks, the elasticity that allows the crust to withstand strain, and the stress state that can cause it to fail. So, if a fault with high stress is ready to fail, it will accumulate even more stresses, and an earthquake could occur at any time.

To take the example of the two Japanese earthquakes, that region of Earth's crust was already critically stressed following the major Japanese earthquake of 2011. The additional stress caused by the surface wave passing through was enough to trigger another cluster of quakes. In addition, cracks in the rock under the Japanese mainland were closing as a result of compressive stress, increasing the shear strength of the crust.

Geochemists have found probable evidence for life on Earth at least 4.1 billion years ago -- 300 million years earlier than previously documented, pushing the origin of life close to when the planet formed 4.54 billion years ago.

The amount of dissolved organic carbon in the oceans is as large as all of the carbon in the atmosphere. Phytoplankton, the primary source of dissolved organic carbon in the oceans, remove CO_2 from the atmosphere and convert it to more complex carbon compounds. Dissolved organic carbon concentrations remain almost constant throughout the world's oceans and are thought to be resistant to biological breakdown, yet concentrations in the deep sea are not increasing.



Typical hydrothermal vent

One long-outstanding question concerned whether hydrothermal vents act as a source or a sink of organic carbon. Now, a team from the National Oceanography Centre and the University of Southampton in England has shown that hydrothermal vent fluids contain almost none of the organic carbon that accumulates in the oceans. That means the vents are a sink for such unreactive stored carbon. This work highlights the importance of deep ocean water circulation through hot hydrothermal systems as one of the main removal processes in this environment balancing the supply. The vent systems convert the biologically resistant long-lived carbon into more readily available carbon that vent organisms can then use.

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PGS Website of the Month

http://www.sepmstrata.org/page.aspx?&pageid=1&1

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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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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

If the Statue of Liberty wore US women's shoes, her shoe size would be 879. And you thought YOU had big feet!

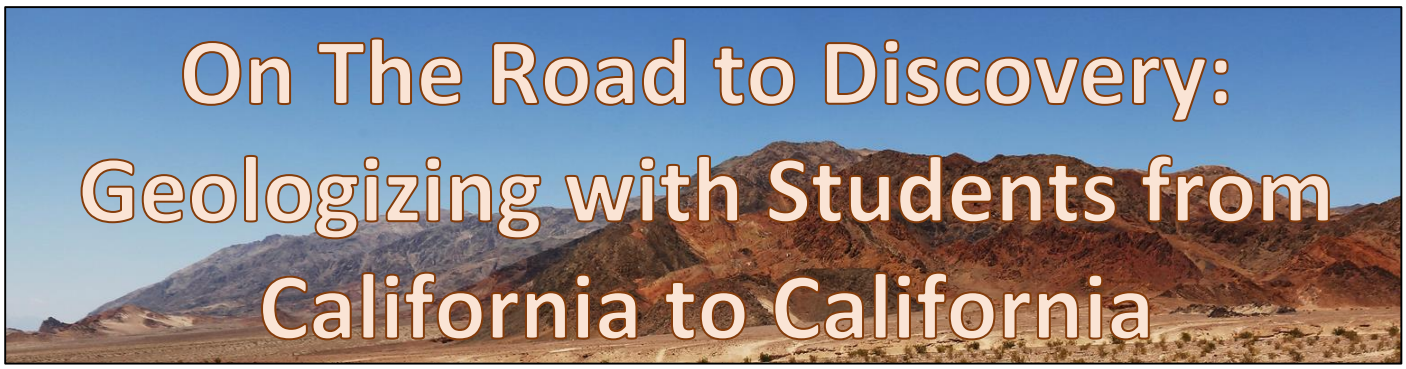
PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 4 | Karen Rose Cercone, Editor | December, 2015

Wednesday, December 16, 2015

The Pittsburgh Geological Society presents
Dr. Kyle Fredrick, California University of Pennsylvania



For the past eight years, California University has sponsored extended summer field courses through the Geology program and the Department of Earth Sciences. Geoscience education research clearly shows that field experiences are essential to developing students who can apply traditional classroom knowledge outside the classroom. But a recent trend of diminishing field opportunities for US students has reduced the readiness of graduates for field work typical of entry-level geology positions. At CalU, both the university and the Earth Sciences Department have continued to support and encourage field experiences that include in-course and club field trips, as well as extended traveling trips. From Mt. Katahdin in Maine to the Tuolumne Meadows in California, students from Pennsylvania have ventured to see and experience the beautiful places of the United States. From year-to-year the students and the destinations have changed, but one thing remains constant: the impact of travel and field geology benefit students in ways that are hard to quantify and impossible to overstate!

Note – our year-end program is designed to be enjoyable for both geoscientists and non-geoscientists. Members are encouraged to bring along a spouse, partner, relative or friend.

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, December 14.

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

SPEAKER BIOGRAPHY

Dr. Kyle C. Fredrick is a Professor of Geology in the Department of Earth Sciences at California University of Pennsylvania (CalU). He joined the faculty in Fall 2007 and has directed the Geology Program since that time.
Kyle received his B.S. in Geology from the University of Wisconsin – River Falls in May 2000. He moved on to the University at Buffalo (UB), in Buffalo, NY, where he received his PhD in Geology in June 2008. His doctoral work focused on large-scale groundwater modeling and surface/ground water interactions. Dr. Fredrick has enjoyed a wide variety of field experiences as both a student and faculty. After his undergraduate degree, he attended the geological field camp of UB, mapping in Colorado, Utah, and Wyoming. Kyle began his teaching career as a teaching assistant for the UB field camp in 2001 and 2002, following up as a field camp instructor five times since 2004. His first full-time teaching was at Buffalo State University from Spring 2005 through Spring 2006. He completed a one-year position at Hobart and William Smith Colleges in Geneva, NY as a Visiting Instructor during 2006-07 before starting at CalU. After completing his first year as a tenure-track professor, Kyle led his first regional field trip to the Colorado Plateau with 17 CalU students. He has followed that up with trips each summer to regions including the Yellowstone area, New England, and eastern California.

PRESIDENT'S STATEMENT

We are about to finish another calendar year and our annual Corporate Sponsorship campaign is underway. Sponsorship letters and forms have recently been mailed to current, past and prospective sponsors whose monetary contributions to the Society is the life blood that supports our monthly operations and initiatives. If your company has not been approached and you would like to support the Society, speak to any Board member and we will gladly provide you with a sponsorship form. The forms can also be found on our website. Contributions can be directed to our general fund or to the Galey Fund, which supports student initiatives. All corporate sponsorships help cover our annual costs of operations.

Above and beyond corporate sponsorship is the PGS Endowment Fund, established in May 2014 through the Community Foundation Serving the Heart of Western Pennsylvania. In accordance with the mission of the Foundation the Fund is to be used for the charitable purpose of the support of the Society in the years to come. The "charitable purpose" of the Fund may be applied, in whole or in part, to the monetary needs of students (awards, membership, student meeting subsidization), community outreach, field trips, educational seminars, monthly operations, or whatever the Society's Board defines as a given charitable need. In essence, the Fund will provide a financial vehicle to protect the future longevity of the Society, in existence since 1945, for many years to come. Contributions can be made through bequests, memorials, and gifts to the Pittsburgh Geological Society / Endowment Fund or directly to the Community Foundation Serving the Heart of Western Pennsylvania. If you wish to seek any further information on the Fund feel free to contact me or Jessica Coil, the Development Officer for the Community Foundation at (724) 548-1261 or jessica@servingtheheart.org.

COMMUNITY FOUNDATION
Serving the Heart of Western Pennsylvania
220 South Jefferson Street, Suite B, Kittanning, PA 16201

I hope you can all join us at the December meeting. Our guest speaker will be our Society's Treasurer, Dr. Kyle Fredrick. Kyle, a Professor of Geology from the California University of Pennsylvania, will present "On the Road to Discovery: Geologizing with Students from California to California".

Ray Follador

(724) 744-0399 / geodawg@comcast.net

CALENDAR OF EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH, SOCIETY OF PETROLEUM ENGINEERS AND PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

December 10, 2015
Annual Christmas Party
Cefalo's Event Center
Carnegie, PA

OHIO OIL AND GAS ASSOCIATION

December 17, 2015
Annual Holiday Membership Reception
Cherry Valley Lodge
Newark, Ohio

PENNSYLVANIA GROUND WATER ASSOCIATION

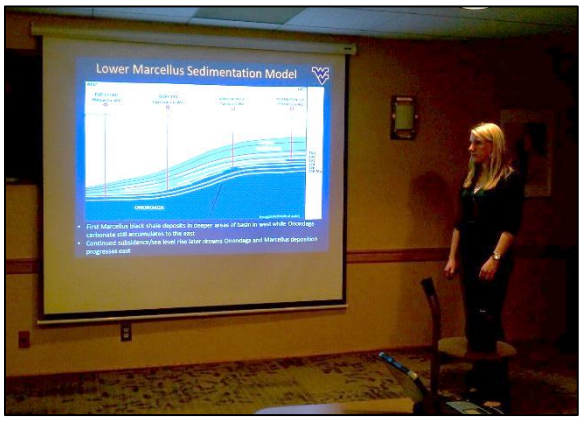
January 28 and 29, 2016
Winter Conference and Trade Show
Harrisburg / Hershey Holiday Inn
Grantville, PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

March 15, 2016
Annual Meeting Luncheon
And Annual PCPG Job Fair
Red Lion Hotel – Harrisburg East
Harrisburg, PA

14th ANNUAL PGS / AEG / ASCE STUDENT NIGHT

Wednesday April 20, 2016



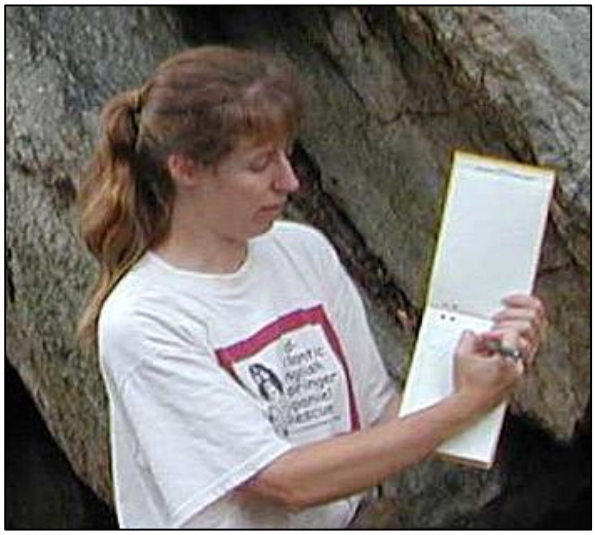
Students will once again have the chance to present their research at the 14th Annual Student Night on April 20, 2016 at Foster's Restaurant, #10 Foster Plaza, Greentree. If you have been conducting undergraduate or graduate research in any geological or geotechnical field, here is an opportunity to show off your work to members of the three societies, and receive the benefits that go along with it. Students who present their original research grow from the experience by improving their public speaking skills, networking with professionals and experts in their fields, listing a presentation on their resume and possibly winning a cash award!

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

Professors: please pass this information on to your students who are doing research.

Abstracts of 300 words or less should be emailed to Dr. Tamra Schiappa at tamra.schiappa@sru.edu by Monday, March 4, 2015 for consideration.

MEET OUR NEW STATE GEOLOGIST



Dr. Gale Blackmer PG was appointed as DCNR's Director of the Bureau of Topographic and Geologic Survey effective November 2, 2015. In this role, Gale will serve as the Commonwealth of Pennsylvania's State Geologist responsible for managing and directing the statewide program of collecting, preserving and disseminating impartial information on the Commonwealth's geology, geologic resources, and topography.

Gale served as Acting Director for the bureau following the departure of George Love, the previous State Geologist, who retired in May, 2015. Prior to assuming the acting position, Gale was the Assistant Bureau Director and manager of the Geologic Mapping Division where, among many other things, she was responsible for the activities related to the StateMap federal grant program, oversaw the management of the Pennsylvania Groundwater Information System, and managed the South Newark Basin study.

Gale has been with DCNR and the Bureau of Topographic and Geologic Survey for over 15 years starting as Geologic Scientist and working her way through the ranks to now be bureau director. She holds a Bachelor's degree from the University of Pennsylvania in Geology, a Master's degree from Penn State in Geology and Doctorate from Penn State in Geology.

The Pittsburgh Geological Society is pleased to welcome four new student members.

From California University of Pennsylvania:
Allie G. Brooks
George T. Hammond
Emily Pruden

From the University of Pittsburgh:
Edward R. Schneider

SPRING 2016 12th ANNUAL PGS STUDENT FIELD WORKSHOP

The Pittsburgh Geological Society invites students across our region to attend a field workshop on **Saturday, April 2, 2016** 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! For more information, please see the full flyer at the end of the newsletter.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Nemacolin Castle in Brownsville, PA

Toward the end of the American Revolution, a colonial-era businessman and land speculator named Thomas Brown acquired land on the Monongahela River at the mouth of Redstone Creek in Fayette County. He soon realized the land would be a natural launch pad for settlers who wanted to travel west to Ohio and beyond. Although he had sold some land to both Jacob Bowman and Jacob Yoder in 1780, it was only after laying out lots in 1785 that he created a new town and named it Brownsville. Jacob Yoder made a name for himself by inventing the flat boat, thereby beginning the watercraft construction business that made Brownsville an industrial powerhouse for years. The town eventually became an early center of the steamboat-building industry in the 1800s. Jacob Bowman founded a tavern and trading post, and eventually built the famous Nemacolin Castle (also called Bowman Castle). Brownsville was in the right place at the right time. It soon became a major hub on the National Pike, now US Route 40, and a railroad yard on the B & O Railroad.

DID YOU KNOW . . . ?

Paleontologists are really excited about some new information on feathered dinosaurs.

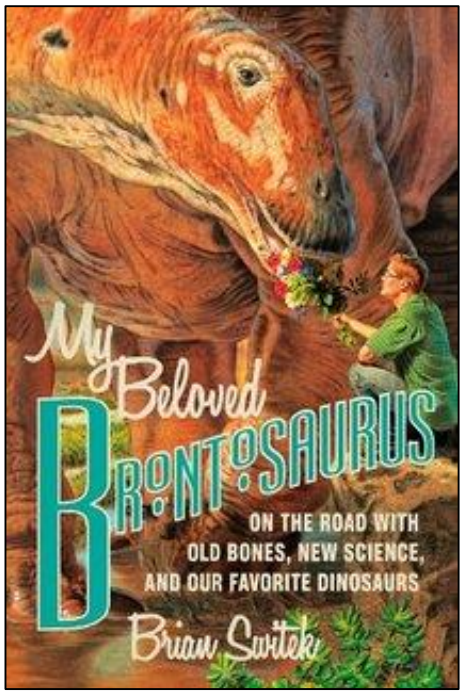
Reconstruction of *Ornithomimus*, a feathered dinosaur

In 2009, scientists found a well-preserved partial skeleton and some soft tissue of an *Ornithomimus* in Alberta, Canada. The remains included some fossilized feathers. A new analysis of the feathers suggests what the plumage might have looked like and what it was used for. Although it has been known for years that theropod dinosaurs and birds had a common ancestor, no one even suspected that non-flying dinosaurs could have the same basic feather architectural structure and composition as birds. The information provided by the *Ornithomimus* feathers strongly suggest that feathers evolved well before flight.

The researchers looked at the keratine structure of the plumage under SEM and noticed that the pattern was remarkably similar to that of an ostrich. The feathers also did not extend beyond mid-femur on the dinosaur (the same for ostriches). So, the researchers concluded, *Ornithomimus* feathers had the same function as the feathers of ostriches – body temperature regulation. Ostriches, which possess the same plumage patterns as those of

Ornithomimus, can control their body temperature very efficiently. That means *Ornithomimus* probably maintained thermoregulation by the same process, and probably performed it just as efficiently as modern birds like ostriches, rheas, cassowaries, and emus.

And speaking of which, if you don't like the concept that dinosaurs had feathers like birds, you're not alone. Creationists want to take dinosaurs back to the days when they were thought to be scaly, pea-brained, lumbering, tail-dragging monsters. Ken Ham, president of Answers in Genesis, the organization that established the fundamentalist Creation Museum in Petersburg, Kentucky, opined that dinosaurs had been kidnapped by secular humanists. He wants to appropriate them for the creationist movement instead.

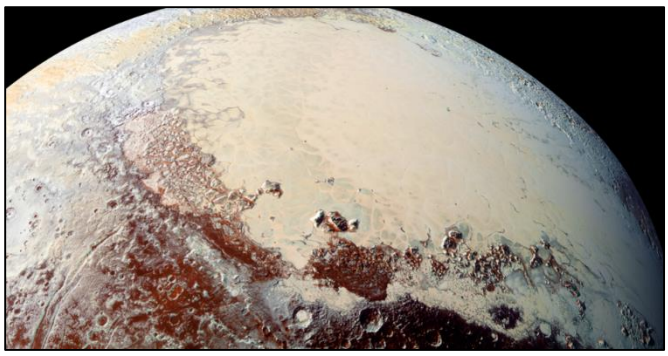


But, according to Brian Switek, author of *My Beloved Brontosaurus*, the creationist campaign is actually more about marketing than science. Switek claims that Ham is angry that natural history museums, unlike the Creation Museum, use dinosaurs to help visitors learn about evolution. Although dinosaurs aren't specifically mentioned in the Bible, creationists like Ham fervently believe that Behemoth and Leviathan of the Old Testament were actually dinosaurs, despite all the scientific and historical evidence to the contrary. They also believe birds were created on Day 5 of the Genesis story (a mere 6,000 years ago!!!), whereas dinosaurs were created on Day 6.

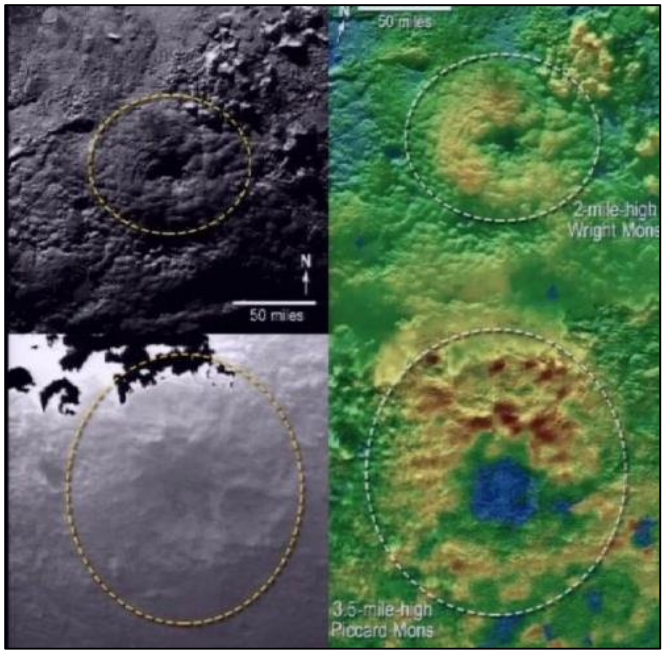
This, of course, is completely out of order with the fossil record. There is a mountain of scientific evidence that birds are living dinosaurs. *Velociraptor*, for example, had feathers as evidenced by quill knobs preserved along its arm bones, thus revealing its kinship to the ancestors of primitive birds like *Archaeopteryx*. Dinosaurs with feathers document the evolution of plumage from fluff to aerodynamic structures that allowed them to take to the air, so creationists must abhor dinosaur feathers. Answers in Genesis doesn't feature feathery dinosaurs in their literature and museum exhibits. They prefer to promote the out-of-date monsters that those of us who are from an older generation grew up loving.

"Dinosaurs are powerful symbols not only of extinction, but also of evolution," Switek writes, "and dinosaurs must be stripped of their most interesting aspects in order to fit the fundamentalist dogma that these animals were a distinct 'kind' that were created, saved upon Noah's ark, and totally wiped out for some unspecified reason during the past 4,300 years or so."

The Earth's inner core is a ball of solid iron a little larger than Pluto that is surrounded by a liquid outer core. In a new study, researchers from the University of Liverpool in England analyzed magnetic records from ancient igneous rocks and found that there was a sharp increase in the strength of the Earth's magnetic field between 1 and 1.5 billion years ago, a likely indication of the first occurrence of solid iron at Earth's center.



Speaking of Pluto, new images from NASA show that the dwarf planet may have some geological surprises up its icy sleeves. Two mountains near its South Pole appear to be round in shape with a summit depression in the center of each. The New Horizons science team at NASA is not yet ready to label these features, 2 mile high Wright Mons and 3.5 mile high Picard Mons, as definite ice volcanos, but it seems increasingly likely that despite its frigid temperatures, Pluto may still be geologically active. Make it so!



Contrasting images of Wright Mons (top) and Picard Mons (bottom) on Pluto

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While solar storms and the particles they release can result in spectacular auroras, they can also cause serious risk to our society by, in extreme cases, causing major power outages. They could also lead to breakdowns of satellites and communication systems. It has been known for some time that you can find traces of cosmic rays from the Galaxy and the sun everywhere on Earth, and that the traces often occur as low levels of radioactive carbon.

Spectacular aurora in Norway caused by a solar storm

Several years ago, researchers found traces of a rapid increase of radiocarbon in tree rings dating from 774-775 AD and 993- 94 AD, but the no one was certain what caused it. Now, according to a new study, researchers found corresponding increases in radiocarbon for exactly the same periods in ice cores from Greenland and Antarctica, confirming extreme solar storms as the cause of these increases. So, Earth was hit by two extreme solar storms more than 1,000 years ago.

The study also provided the first reliable assessment of the particle fluxes connected to these events. If such enormous solar storms hit Earth today, they would most likely have devastating effects on our power supplies, satellites, and communication systems. Since these solar storms far exceeded any modern events observed by instrument readings. The findings should lead to a reassessment of the risks associated with solar storms.

Methane hydrate, a crystalline solid consisting of a methane molecule surrounded by water molecules, is a kind of "ice" that occurs naturally in subsurface deposits where temperature and pressure conditions are favorable for its formation. Enormous amounts of methane hydrate have been found beneath Arctic permafrost, beneath Antarctic ice, and in sedimentary deposits along continental margins worldwide. In some places, the deposits are closer to high-population areas than any natural gas field, so they could allow countries that currently import natural gas to become self-sufficient. The current challenge is to inventory this resource and find safe, economical ways to develop it.

Washington, D.C. is expected to sink 6 inches in the next 100 years. During the last Ice Age, the Laurentide ice sheet pushed underlying mantle outward south of Long Island. This created a forebulge in the area around Chesapeake Bay. With the retreat of the glaciers about 12,000 years ago, the forebulge has been sinking, and so has the land Washington was built on. Add to that the prospect of global sea-level rise and it's likely our nation's capital will see significant flooding throughout the city within the next 100 years.

Pyrrhotite is an iron sulfide mineral found in basic igneous rocks, pegmatites, vein deposits, and contact metamorphic deposits. It is slightly magnetic. Pyrrhotite is mined primarily because it is associated with pentlandite, sulfide mineral that can contain significant amounts of nickel and cobalt.

An international team of scientists examined how changes in ocean currents in the Atlantic Ocean were related to climate conditions in the northern hemisphere during the last ice age by examining data from ice cores and fossilized plankton shells. The team found that variations in ocean currents and abrupt climate events in the North Atlantic region were tightly linked in the past, and that changes in the polar regions affected the ocean circulation and climate on the other side of the world.

Arctic icebergs

The researchers determined that, as large amounts of fresh water were emptied into the North Atlantic when icebergs broke off the North American and Eurasian ice sheets, the deep and shallow currents in the North Atlantic rapidly slowed down. This led to the formation of sea ice around Greenland, and the cooling of the Northern Hemisphere. It also strongly affected conditions in the South Atlantic within a matter of one to two hundred years. The team also showed how climate events in the Northern Hemisphere were tightly coupled with changes in the strength of deep ocean currents in the Atlantic Ocean, and how that may have affected conditions across the globe.

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PGS Website of the Month

http://www.deepseadrilling.org/

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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

The character and story of Rudolph the Red-Nosed Reindeer were created in 1939 by Robert May, a copywriter for Montgomery Ward department store, and printed as a booklet to give to children during the Christmas holidays. When the song debuted ten years later, given life by the "Singing Cowboy", Gene Autry, it sold 2 million copies.

ANNOUNCEMENT

Pittsburgh Geological Society
Spring 2016 Student Field Workshop

SATURDAY APRIL 2nd

California University
California, Pennsylvania
Start: 9 AM Finish: Late Afternoon

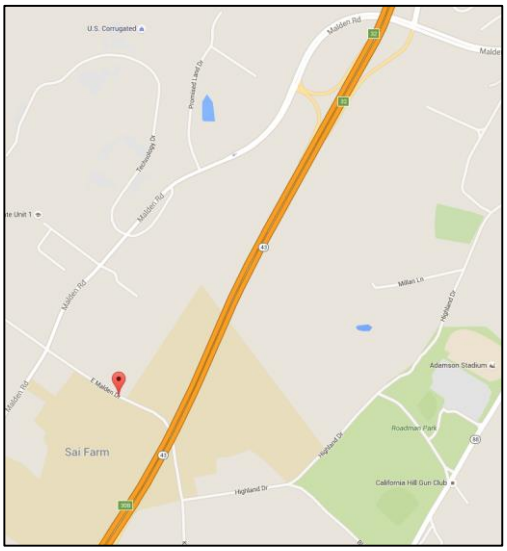
Registration: $20.00
Cash or checks (payable to "Pittsburgh Geological Society")

YOU MUST CONTACT US TO SAVE YOUR PLACE

Register/Contact: Frank Benacquista, PG at: *fbenacquista@kuresources.com*

The Pittsburgh Geological Society again invites students of geology to attend the 12th installment of the "Student Field Workshop."

Have you wondered what you might be doing on that first job? Chances are you'll be on a drill rig. You will have the opportunity to work alongside an experienced drilling contractor and field-wise professionals. The Workshop will be supervised by professionals in the industry, so not only is this an excellent learning opportunity, it is your chance to ask all those questions regarding life after college. So brush up on those networking skills.



What will you experience?

- Soil sampling using a drill rig
- Basic sampling techniques
- Basic monitoring equipment
- Soil & Rock descriptions
- Well installation basics
- Designing a drilling program

Light Breakfast and Lunch will be provided.

As with all field work, this will be a *RAIN* or *SHINE* event. So watch the weather forecast carefully and prepare yourself. The drilling process can be dusty, wet, and muddy -- so leave the designer jeans and flip-flops behind. We also do ask that you be an active student – please no corporate trainees.

PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 5 | Karen Rose Cercone, Editor | January, 2016

Wednesday, January 20, 2016

The Pittsburgh Geological Society & ASCE Geo-Institute of Pittsburgh jointly present

Peter R. Michael, PG

On October 11, 2000, an estimated 306 million gallons of water and coal waste slurry drained from an impoundment in Martin County, eastern Kentucky into an adjacent underground coal mine. Approximately 230 million gallons of the water and slurry discharged from two mine portals and affected over 75 miles of streams in Kentucky and West Virginia. In response to this and several other similar events over just half a decade, the U.S. Office of Surface Mining Reclamation and Enforcement and other institutions undertook investigations to assess: the causes of the events; the potential for additional breakthroughs in the future; available methods for preventing them; and the effectiveness of state and federal regulatory programs in ensuring that adequate preventative measures are utilized by impoundment designers and operators. Several studies are sited in the hollows of Appalachia where numerous coal seams and steep topography combine to result in large numbers of mined coalbeds intersecting and underlining impounding facilities. Key factors under consideration include: (1) full accounting of all mineable coal seams intersecting and underlying the impoundment; (2) identification and accurate location of underground mines close enough to the facility to potentially affect its stability; (3) assessment of the stability of coal barriers between the impoundment and adjacent mines and stability of roof rock and pillars in mines subjacent to a facility; (4) determination of the flowability of the impounded slurry when expanding or undermining the facility are being considered; and (5) special measures undertaken to reduce breakthrough potential when necessary.

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, January 18.

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

PRESIDENT'S STATEMENT

Happy New Year! I hope all of our members enjoyed their holiday season surrounded by family and friends in full health and happiness.

As we begin 2016 it is important to mark our new calendars and organizers with important upcoming events. To begin, a reminder to all of our student members….April 2 is the date for this year's Drilling Workshop to be held, again, at CALU. There are 10 to 12 slots open for each university so do not hesitate to register when the announcement is made because the event fills up quickly. The April meeting (4/20/16) is also our 14th Annual Student Night. If you are a student and you want to present a paper or poster at this meeting, now is the time to begin preparing. Professors – please alert your students who are doing research to this opportunity.

On April 13th the AAPG Playmakers Forum will return to Pittsburgh at the Airport Sheraton. This Forum, cosponsored by the PGS and the PAPG, should be of great interest to our professional members working in the oil and gas industry. The Society is also in the beginning stages of planning a spring field trip. Details of this trip, to be led by Society Vice President Tamra Schiappa of SRU, will be announced in the near future.

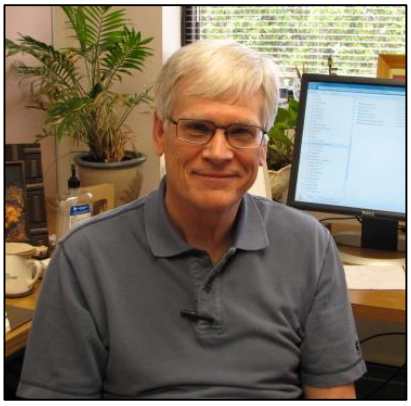
I would like to acknowledge the most recently received, new and renewing corporate sponsors that have committed their support to our 2016 initiatives; Ammonite Resources, AWK Consulting Engineers, Inc., ARK Resources, Inc., Barner Consulting, LLC, Enviro-Equipment, Inc., Geo-Mechanics Inc., HDR Engineering, Inc., Insite Group, Inc., Natural Energy Development Corporation, THG Geophysics, Ltd, and Vista Resources, Inc.. Thank you all for your continued support.

In closing, our January meeting brings Board member Peter Michael to our podium to present some of his experiences in working with the impacts of coal mining during his long and successful career with the U.S. Office of Surface Mining Reclamation and Enforcement. I hope that you can join us.

Ray Follador

SPEAKER BIOGRAPHY

Our January speaker, Peter Michael PG, recently retired as a Geologist serving the Appalachian Regional Office of the U.S. Office of Surface Mining Reclamation and Enforcement (OSMRE) in Pittsburgh. During the 33 years he worked for the agency, he performed numerous geotechnical investigations and programmatic services pertaining to coal mining impacts on human health and safety, property, and the environment. The scope of his work included such areas as the stability of coal mine waste slurry impoundments, coal combustion residue placement at mine sites, excess spoil fill stability, landslides, mine blasting, and mine subsidence.



Prior to working with OSMRE, Mr. Michael served for four years as a Peace Corps volunteer in Thailand, compiling reconnaissance landform maps for the Royal Thai Department of Land Development. Mr. Michael has a BS in Geology from Rider University and MA in Geology from Binghamton University. He currently serves as Director at Large on the Board of Directors of Pittsburgh Geological Society and is an Associate at the University of Pittsburgh Center for Philosophy of Science.

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

January 14. 2016
"South-eastern Ohio Point Pleasant: a shale play?" by Chadwick J Cunningham
Cefalo's Event Center
Carnegie, PA

APPALACHIAN BASIN GAS PROCESSORS ASSOCIATION

January 26, 2016
New Year's Kick-Off Meeting
Ten Penny Eatery
Pittsburgh PA

PENNSYLVANIA GROUND WATER ASSOCIATION

January 28 and 29, 2016
Winter Conference and Trade Show
Harrisburg / Hershey Holiday Inn
Grantville, PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

February 4-5, 2016
PG Review Course for the Practicing Geologist and ASBOG Exams
Pittsburgh Marriott North
Cranberry Township, PA

OHIO OIL AND GAS ASSOCIATION

March 16-18, 2016
OOGA Winter Meeting
Hilton Columbus at Easton
Columbus, Ohio 43219

14th ANNUAL PGS / AEG / ASCE STUDENT NIGHT

Wednesday April 20, 2016

If you have been conducting undergraduate or graduate research in any geological or geotechnical field, here is an opportunity to show off your work to members of three local professional societies societies. Students who present their research improve their public speaking skills, plus they get to network with professionals and experts in their fields, list a presentation on their resume and possibly even win a cash award!

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

Professors: please pass this information on to your students who are doing research.

Abstracts of 300 words or less should be emailed to Dr. Tamra Schiappa at by Monday, March 4, 2016 for consideration.

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

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Recent Publications on Pennsylvania Geology

From the Pennsylvania Geological Survey:

Open-File Miscellaneous Investigation (November 2015): Water depth of Tobyhanna Lake—Tobyhanna State Park, Monroe County, Pennsylvania

Open-File Miscellaneous Investigation (November 2015): Water depth of Pinchot Lake—Gifford Pinchot State Park, York County, Pennsylvania

Educational Series (October 2015): Second edition of Sinkholes in Pennsylvania

Open-File Oil and Gas Report (October 2015): Using geophysical and remote sensing techniques to evaluate deep geologic formations in Indiana County, Pennsylvania—Well Data

From the Proceedings of the National Conference on Undergraduate Research

Muon Radiography of the Pocono Mountains of Pennsylvania by Varvara Budetti (King's College, Wilkes-Barre)

[Click on titles for link to full articles.]

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

5th Avenue in downtown Coraopolis

In 1769, Andrew Montour was granted a patent for about 350 acres along the Ohio River near what is now the mouth of Montour Run. More than likely, he didn't live there for long, if at all. The first permanent settler in the area, therefore, was Captain Robert Vance, a Virginian who had been part of George Washington's regiment during the French and Indian War who moved to the vicinity of Montour's tract around 1773 and established a fort to protect other settlers. A small community grew up around Fort Vance, as it was called, and in 1861, the community became known as Middletown for its location about midway between Pittsburgh and Beaver. However, because there already were several Middletowns in Pennsylvania, the name was changed to Coraopolis in 1886, based on the Greek words for "maiden city". Oil was discovered at both ends of town in 1890, but although it stimulated a population boom, the amount of oil found was modest at best and the boom was short lived.

Coraopolis native Michael Keaton as Batman in 1989

In 1892, another population boom occurred because of construction of the nation's first high-speed (up to 40 mph) electric streetcar system. Like most communities along the Allegheny and Ohio rivers, Coraopolis obtained its water supply from the glacial outwash beneath the rivers, that is, Pittsburgh's notoriously mythological "Fourth River". PGS Membership Chair John Harper, a Coraopolis native, remembers his father saying that the Borough got its water from a large underground lake. It took a few years, but eventually John learned the truth!

Coraopolis is, among other things, the birthplace of 1989's Batman, actor Michael Keaton.

DID YOU KNOW . . . ?

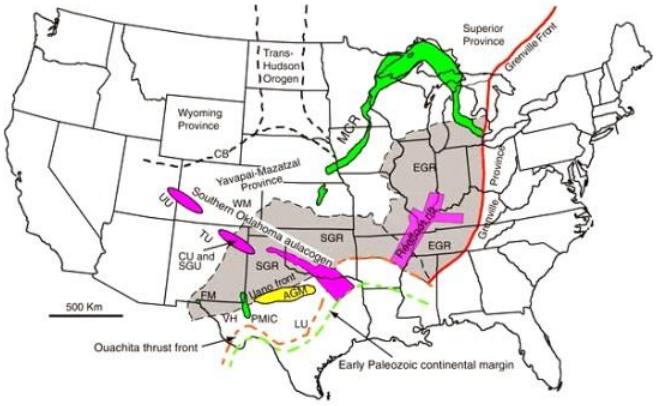
Brood care, where the adult carries its eggs or juveniles to help increase their survival, was an important evolutionary step. However, little is known about how and when this strategy began. A new study published in the journal Current Biology reveals the oldest direct evidence of brooded embryos in *Waptia fieldensis*, an extinct organism dating back to the Cambrian Explosion. The research shows that 12 eggs per side are held below a two-part shield on *Waptia's* body. This parental care coincides with the emergence of the first predators during the Cambrian Period and may have evolved to protect eggs from harm.

The global climate has been changing for hundreds of millions of years, as most geologists are aware. Now a core from the Santa Barbara Basin provides an ultra-high-resolution record of the history of a shift from a glacial to an interglacial climate that began about 630,000 years ago. Research on the core demonstrates that the transition developed over seven centuries, but that the initial shift occurred in only 50 years and was associated with melting of the large Northern Hemisphere ice sheets. The sea surface temperatures rose about 40 degrees almost immediately at the beginning of the climate shift, with an additional 5 degree increase occurring over the remainder of the warming period.

So the $64,000 question is, “What process can possibly push Earth's climate so fast from a glacial to an interglacial state?” According to the geochemists researching the problem, the warming was associated with releases of methane, a potent greenhouse gas, from gas hydrates on the ocean floor. Considering that the rapid warming and the destabilization of gas hydrates were essentially simultaneous suggests that methane hydrate instability and ocean warming are somehow linked.

So, should we worry about modern global warming in the ocean destabilizing methane hydrates? It appears to be occurring already, according to recent research on methane hydrates off the coast of Washington, Oregon, and British Columbia. This research suggests that the hydrates are destabilizing in response to a bottom-water temperature increase of 32.5oF during the past 44 years, and that methane gas plumes are billowing upward from the ocean floor. Other research indicates ocean margin areas are also showing similar responses to ocean warming.

Lake Superior is situated on the Midcontinent Rift, a 1.1-billion-years-old, 2,000-mile-long rift system that curves in an arc from Michigan to Kansas. During the Late Precambrian, North America started to split apart along several rifts, such as the Midcontinent Rift and the Reelfoot Rift beneath the present Mississippi River. Volcanic rocks poured out of this split and filled the deep valley instead of splitting the continent apart, the rift died, leaving what is known as an aulacogen. One arm of this rift system ran through Kentucky and West Virginia through Pennsylvania. It is called the Rome trough, named for the Cambrian Rome Formation of Kentucky.



Late Precambrian rift systems in the US. The Midcontinent Rift is in green

According to new research, a quantitative estimate of the degree and nature of the effects that continental flood basalt eruptions had on Earth's climate, vegetation, and oceans throughout geologic time is likely to have been much less severe than previously thought. This is important to the discussion

about mass extinctions because flood basalts and bolide impacts have been cited at the two most probably causes of extinction events over the past 500 million years. For example, when the dinosaurs reigned, numerous long-lasting eruptions that created flood basalts took place over the course of about a million years. Each such eruption is likely to have occurred over years or even decades, with eruptions separated by periods of volcanic inactivity.

Researchers used computer simulations of the spread of the gas and particulates to show that the impact of flood basalts wasn't nearly as bad as previously thought. The research suggested that climatic impacts from such eruptions would only have had a severe effect on plants and animals if the basalts had oozed for hundreds of years without interruption.

Artist's conception of the Deccan Traps eruptions in India 65 million years ago

Using the duration and intensity of eruptions such as those that created the Deccan Traps flood basalts, which covered about a large portion of India 65 million years ago, they were able to estimate the climatic and environmental effects of the huge quantities of sulfur dioxide gas emitted by these eruptions. These simulations indicated that global temperatures would have fallen by 40oF as a result of the eruptions, but that they would have returned to normal within 50 years after an eruption ceased. These findings will challenge the researchers to re-examine the causes of mass extinctions and the role of volcanism.

Researchers studying sediment in the High Sierra of California have found that cold, steep, high-elevation slopes with less vegetation produce coarser and larger sediment than low-elevation, gentle slopes, thus quantifying how sediment production varies with topography. This suggests that variations in climate, topography, and weathering rates may shape the evolution of mountain landscapes by influencing sediment size.

The Andes Mountains of South America, some of the highest mountains on Earth, formed when oceanic crust subducted beneath the South American continent. Generally speaking, such high mountain chains don't unusually form in subduction zones, so it is important to determine when and how it happened. This has been debated for a number of years.

The prevailing concept is that the Andes developed between 10 and 6 million years ago when a large volume of rock was removed from the base of the crust in response to over-thickening, and the remaining portion of the crust was rapidly uplifted. The timing of this is important for understanding how mountains form and erode

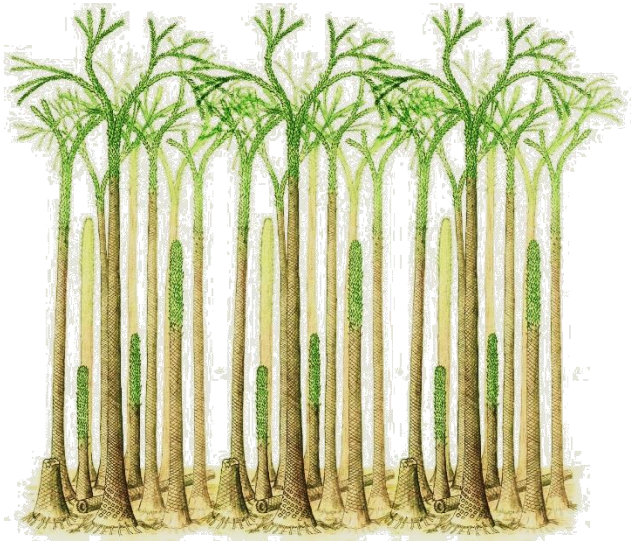
and what the impact of this may have had on global atmospheric circulation patterns and climate.

Photo of the Andes Mountains

Researchers from Great Britain used geochemistry based on the abundance of cosmogenic helium (He-3) to study this. Cosmic radiation creates He-3, a rare form of the element, in minerals at the Earth's surface. Since the abundance of He-3 depends on the altitude of the Earth's surface at the time it is created, it can be used to determine the altitude of a rock surface at that time. Analyzing samples from boulders at elevations around 6,500 feet in the western margin of the Andes, the researchers have shown that the mountains were already near their present elevation 14 million years ago. The Andes most likely grew over the last 30 million years, at least, as a result of the gradual thickening of the Earth's crust. This suggests that they probable effected large scale atmospheric circulation patterns at least 4 million years before previously thought.

Fossilized tree stumps have been discovered from a 380-million-year-old (early Late Devonian) forest in Svalbard (formerly Spitzbergen), with trees that resembled palm trees growing up to 13 feet high. The trees, named *Protolepidodendropsis pulchra*, were lycopods similar to the Pennsylvanian species that dominated the Late Paleozoic forests and coal swamps in western Pennsylvania.

Researchers suggest the forest might help explain the 15-fold reduction in atmospheric CO2 during that time period. Cardiff University paleobotanist Chris Berry thinks trees such as this might help take excess CO2 out of the atmosphere. "What if we could engineer a new tree with the powerful CO2-absorbing abilities of these early lycopods?" he said. "They sound perfect for cities where space is at a premium. And with temperatures rising, I bet they'd thrive."



Artist's reconstruction of a Svalbardian forest full of lycopods

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Sluggish rhyolitic lava can slowly exude from a volcano and pile-up around the vent. This can produce a mound-shaped structure known as a "lava dome", some of which have grown to a height of several hundred feet.

Lava domes can be dangerous because, as additional magma extrudes, the brittle domes can become highly fractured and unstable. The ground can also change slope as the volcano inflates and contracts. Such activity can trigger a dome collapse that can lower the pressure on the extruding magma, resulting in an explosion. It can also result in a debris avalanche of material falling from the collapsing dome. Many pyroclastic flows and volcanic debris avalanches have been triggered by a lava dome collapse.

Paleontologists found a treasure trove of exceptionally preserved "Burgess Shale-type" soft-bodied marine fossils in Early Ordovician deposits in southeastern Morocco. The fossils greatly expand our understanding of the animals and ecosystems of the early Paleozoic. The team found more than 1,500 fossils of soft-bodied marine animals, many of which are complete fossils, in the newly discovered sites. Fossils include sponges, annelid worms, mollusks, and a horseshoe crab that is very similar to the ones found on modern beaches, indicating that this type appeared about 30 million years earlier than previously suspected.

A cheloniellid arthropod

The Early Ordovician is considered to be "the Great Biodiversification Event", a time when the number of marine animal genera increased exponentially over a period of 25 million years following the Cambrian Period.

Hard shells like those of mollusks and brachiopods tend to become fossilized and preserved much more readily than soft tissue, so paleontologists have had an incomplete concept of Ordovician marine life. While the early Ordovician was a critical moment when massive diversification increased, they saw only a small piece of the picture based almost exclusively on the shelly fossil record. But we know from modern communities that normal faunas are dominated by soft-bodied organisms. Exceptionally well-preserved soft-bodied fossils are, therefore, helping fill in a lot of the picture of the diversification.

Conditions at the fossil site during the Ordovician were very conducive to preserving the soft tissues of the creatures that lived in its waters so long ago. These included generally calm waters, some rapid burial events that protected the animals from scavengers, and favorable chemical conditions within the sediment that allowed for the rapid mineralization of soft tissue.

The Moroccan discovery also blows away the long-held concept that "Burgess Shale-type" faunas disappeared at the end of the Middle Cambrian. Discovery of "Burgess Shale-type" species in the Early Ordovician indicates that they, in fact, survived and would have had a major impact on ecosystems and evolution

PGS Thanks Our Corporate Sponsors

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PGS Website of the Month

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Past President:	Albert Kollar				
Other PGS Positions		**Historian:**	Judy Neelan	**AAPG Delegate:**	Andrea Reynolds
Webmaster:	Mary McGuire	**Continuing Ed:**	Frank Benaquista	**AAPG Delegate:**	Dan Billman

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

Gustave Eiffel, the architect who designed the Eiffel Tower in Paris, France, had dyslexia and was afraid of heights.

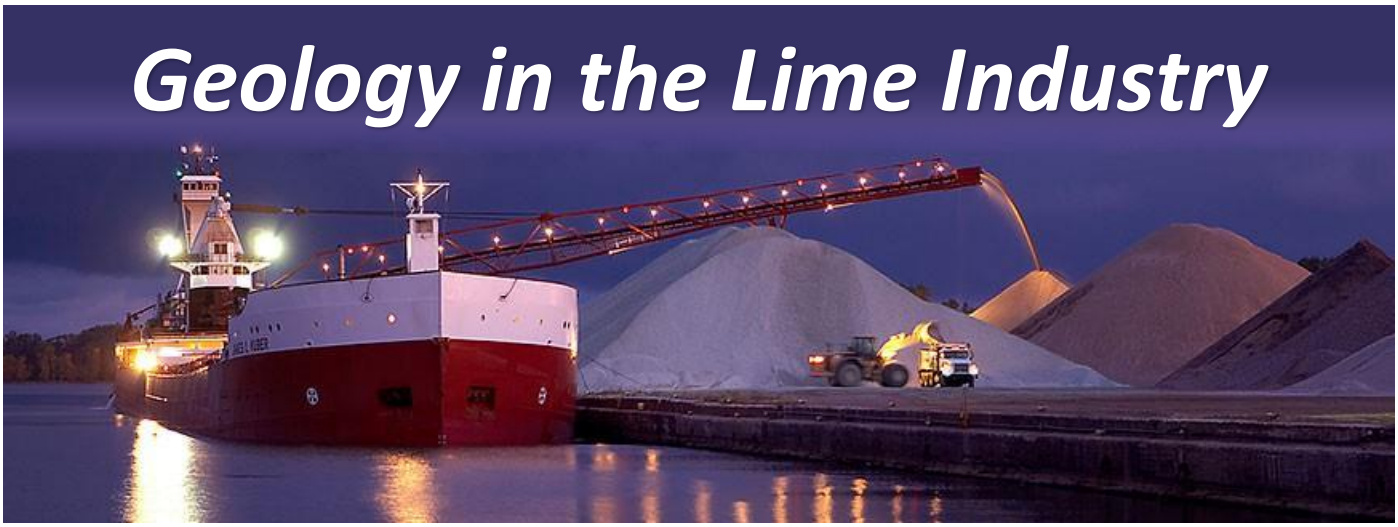
PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 6 | Karen Rose Cercone, Editor | February, 2016

Wednesday, February 17, 2016

The Pittsburgh Geological Society presents



Dr. John Groves

Manager of Geology, Carmeuse Lime and Stone

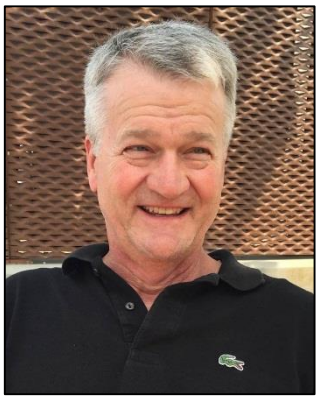
Quicklime (or just “lime”) is CaO obtained by the calcination of limestone. Lime is used in a number of industrial and environmental applications, with steel manufacturing and flue gas desulfurization being the biggest markets. Commercially acceptable lime must contain < 6% impurities. Because impurities are concentrated by a factor of nearly two during the calcination process, the precursor limestone must be exceptionally pure. Geologists in the lime industry prospect for chemically pure limestone, they evaluate calcination behavior, perform resource and reserve estimates, and develop 3-dimensional models to determine the geometry and chemical variability of ore deposits. All of these activities depend on the synthesis of information gleaned from extensive testing, both chemical and physical.

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, February 15..

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

SPEAKER BIOGRAPHY



Our February speaker is Dr. John Groves, Manager of Geology for Carmeuse Lime and Stone in Pittsburgh. John joined Carmeuse in 2012 after having spent the previous 12 years as Professor of Geology at the University of Northern Iowa. Prior to his academic career he worked 15 years with Amoco Production Company in Denver and Houston. John earned B.S. and M.S. degrees in Geology at the University of Oklahoma, and a Ph.D. in Geology at the University of Iowa. He specializes in micropaleontology and carbonate depositional environments, having authored more than 60 peer-reviewed articles dealing mostly with Paleozoic foraminifera.

PRESIDENT'S STATEMENT

In review, thus far, of this program year's meeting attendance from September 2015 through January 2016, I'm pleased that we have averaged nearly 70 members per meeting. Our attendance reflects the hard work of our Program Committee to bring in relevant and dynamic speakers (kudos Dr. Schiappa – Program Chair) that interest our professional and student members alike. The attendance of our professional members currently outnumbers that of the student members, giving the students plenty of opportunities to network with working geologists. Our professional members have the added benefit of earning PDH credits. The benefits of attendance for all! Speaking of PDH credits - the Society continues to communicate PDH opportunities to our membership as they present themselves in the region. An important upcoming opportunity will be the AAPG Pittsburgh Playmaker Forum, co-sponsored by the PGS and PAPG, on April 13, 2016. Details will be made available in the future emails and newsletters. If you know of any other upcoming PDH opportunities in the Pittsburgh area, please share them with us so we can get the word out.

I would like to ask our membership to consider participating in the outreach efforts of the Society. Our Outreach Committee, chaired by Ken LaSota, has been very active on many fronts, participating in local educational conferences for K-12 educators through the Allegheny Intermediate Unit, visiting local schools for science and career fairs, or just responding to general requests that appear via our website. From time to time we get small requests from schools, youth and scouting organizations, etc. that could easily be covered by a PGS member that may live in the community of the request. In such a case we will send out an email to our membership to increase our pool of participants and reduce the burden and travel time for a willing member that may live a county away. Please consider participating and helping in our efforts to educate the public. You can contact me or any Board member if you want to get involved.

I would like to acknowledge the following corporate sponsors that have committed their support to our 2016 initiatives since last month's newsletter; ACA Engineering, Inc., American Geosciences, Inc., American Geotechnical & Environmental Services, Inc., Billman Geologic Consultants, Inc., DC Energy Consultants, DiGioia, Gray & Associates, LLC, DORSO LP, Geo-Environmental Drilling Company, Inc., Groundwater & Environmental Services, Inc., Hayward Natural Resources, Inc., Howard Concrete Pumping Company, Inc., Huntley & Huntley Energy Exploration, LLC, Moody & Associates, Inc., Oil & Gas Management, Inc., Pennsylvania Drilling Company, and Seneca Resources Corporation. Thank you all for your continued support.

In closing, please join us at the February meeting. Our guest speaker this month is Dr. John Groves of Carmeuse Lime and Stone. His presentation will encompass how geologists in the lime industry prospect for and develop high quality limestone reserves for commercial use. I hope that you will join us.

Ray Follador

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

February 18, 2016
Petrophysical Interpretation of Electromagnetic Measurements in Clay- and Pyrite-Bearing Formations: Toward Improved Water Saturation Estimates by Siddharth Misra, University of Oklahoma
Cefalo's Event Center, Carnegie PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

February 4-5, 2016
PG Review Course for the Practicing Geologist and ASBOG Exams
Pittsburgh Marriott - North
Cranberry Township, PA

HARRISBURG GEOLOGICAL SOCIETY

February 11, 2016
Mapping the Source: The Challenges of Protecting Pennsylvania's Unconventional Springs by Alfred Guiseppe, SSM Group
GTS Technologies, Harrisburg PA

OHIO GEOLOGICAL SOCIETY

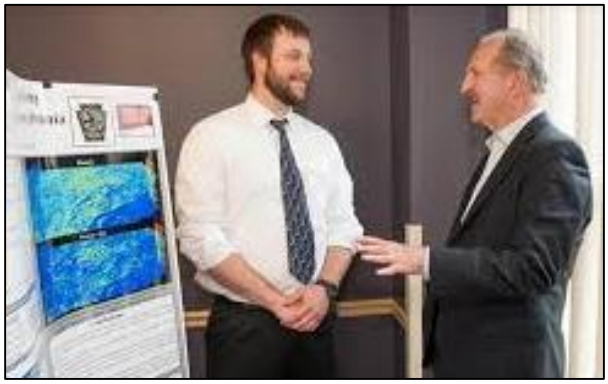
February 18, 2016
Full Tensor Gravity Gradiometry: How it is being used to advance exploration by Colm Murphy, Bell GeoSpace Inc.
Holiday Inn Columbus, Worthington OH

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

14th ANNUAL PGS / AEG / ASCE

STUDENT NIGHT

Wednesday April 20, 2016



If you have been conducting undergraduate or graduate research in any geological or geotechnical field, here is an opportunity to show off your work to members of three local professional societies. Students who present their research improve their public speaking skills, plus they get to network with professionals and experts in their fields, list a presentation on their resume and possibly even win a cash award!

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

Professors: please pass this information on to your students who are doing research.

Abstracts of 300 words or less should be emailed to Dr. Tamra Schiappa at by Monday, March 4, 2016 for consideration.

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.

The Pittsburgh Geological Society is pleased to welcome a new student member, James A. Bader from California University of Pennsylvania.

Recent Publications on Pennsylvania Geology

Pressley, Katie. "Anisotropic groundwater modeling in the Cumberland Valley, southcentral Pennsylvania." (2015). Shippensburg University of Pennsylvania Master's Thesis.

Lu, Jun, et al. "Transitional geology and its effects on development and longwall mining in Pittsburgh Seam." International Journal of Mining Science and Technology 26.1 (2016): 31-37.

Phan, Thai T., et al. "Factors controlling Li concentration and isotopic composition in formation waters and host rocks of Marcellus Shale, Appalachian Basin." Chemical Geology 420 (2016): 162-179.

Lee, Jin-Yong, Matthew Weingarten, and Shemin Ge. "Induced seismicity: the potential hazard from shale gas development and CO_2 geologic storage." Geosciences Journal 20.1 (2016): 137-148.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Raccoon Presbyterian Church in Candor, Washington County

In 1774, Col. Samuel Beelor settled on some land in northwestern Washington County, and he was soon joined by others who erected a church there, Raccoon Presbyterian Church, one of the oldest churches in western Pennsylvania. The settlement was small until after 1817 when Rev. Moses Allen became pastor of the church. He is credited with founding the village of Candor at that location. As the story goes, his son Watson, a store keeper, traveled to Philadelphia for supplies. When asked for an address where they could be delivered, he thought for a few moments before replying, “Candor”, a word meaning “frankness” or “the quality of being open”. That became the official name of the village. A post office was opened there, but since there was already a Candor Post Office elsewhere in Pennsylvania, it was affiliated with the post office in the nearby village of Bulger. Candor was the site of bituminous coal mines for many years. It also gives its name to an anomalous geologic structure in the area called the Candor dome.

DID YOU KNOW . . . ?

The USGS announced in September, 2015 that Denali, previously known as Mount McKinley, has a new official elevation – 20,310 feet, 10 feet less than the previous estimated elevation. But Denali hasn’t shrunk. The USGS used GPS technology to determine the new elevation, technology that wasn’t available in 1950 when the mountain was measured.

Kyanite is a mineral found mainly in metamorphic rocks. It most often forms from the high pressure alteration of clay minerals during the metamorphism of sedimentary rocks. It is found in the schists and gneisses of regionally metamorphosed areas and less often in quartzite or eclogite.

Kyanite's typical habit is a bladed crystal although it sometimes occurs as radiating masses of crystals. It is often associated with other metamorphic minerals such as garnet, staurolite and corundum.

Kyanite is used to manufacture a wide range of products, such as refractory bricks, mortars and kiln furniture used in high temperature furnaces. For foundries, the molds that are used for casting high temperature metals are often made with kyanite. It is also in products used in the automotive and railroad industries where heat resistance is important. Mullite, a form of calcined kyanite, is used to make brake shoes and clutch facings.

***Arsinotherium*, an Eocene relative of elephants and manatees**

***Archaeotherium*, an Eocene relative of hippopotami and whales**

While hordes of children and adult visitors pack the dinosaur halls in our nation's museum, the fossil mammal halls are basically empty. People want to see the astonishingly huge dinosaurs, not the much less impressive mammals. This despite the fact that, after the dinosaurs went extinct and the mammals rose to dominance on the planet, many became as bizarre and spectacular as any dinosaur. There are even some museum visitors who, assuming that any skeleton in a museum must be from the Age of Dinosaurs, mistakenly think giant sloths, multi-toed horses, and enormous elephants must be dinosaurs.

The mammals of the past 65 million years, as well as many that lived alongside the dinosaurs, were some of the most fantastic animals to ever live on this planet. Yet, before the word "dinosaur" was coined, mammals were the stars of the fossil record. Thomas Jefferson cited the existence of the American mastodon to demonstrate that the New World was just as able to produce vibrant and interesting life as the Old World. And during the "Bone Wars" of the late 1800s, Edward Drinker Cope and Othniel Charles Marsh were as famous for discovering rhinoceras-like brontotheres, early horses, and other mammals as they were for all the dinosaurs they discovered.

Dino-mania only began to take hold in the early 1900s when the American Museum of Natural History in New York City, the Field Museum in Chicago, and the Carnegie Museum in Pittsburgh competed to establish themselves as the best dinosaur museum. Yet, through all the years of dino-mania, the professional vertebrate paleontologists still preferred fossil mammals. Although Brontosaurus, Stegosaurus, and Tyrannosaurus sold the tickets, the experts were more concerned with what came after the Cretaceous mass extinction. There were far more fossil mammals than dinosaurs, and their history could be traced through the

constantly changing arrangements of their teeth, making them ideal for drawing big-picture conclusions of how life evolves through time. Dinosaurs were considered something of a prehistoric sideshow to the point where some paleontologists proposed that they became extinct because they got too big and weird to function anymore.

So, why are we so gaga over dinosaurs? Well, for one thing, they have been so well marketed by the media – books, movies, social media, and newspaper and TV coverage of every new discovery, no matter how mundane. One pundit even went so far as to say we've gone beyond dino-mania and are now in full-blown dino-psychosis.

Yet museum cabinets are full of fossil mammals that are just as strange as any dinosaur. For example, because of fossils, we know that whales started off as hoofed mammals, like *Pakicetus*, that walked on land. The age of mammals is still young compared with the 180-million-year-long reign of the dinosaurs, which are, admittedly, strange and deserving of wonder, but they are popular simply because they are so popular.

We, a species of mammals with our own wonderful evolutionary history, have turned dinosaurs into unbearable exhibitionists with large numbers of popular science headlines. It's time we learned to appreciate our relatives. Anyone for mammal-mania?

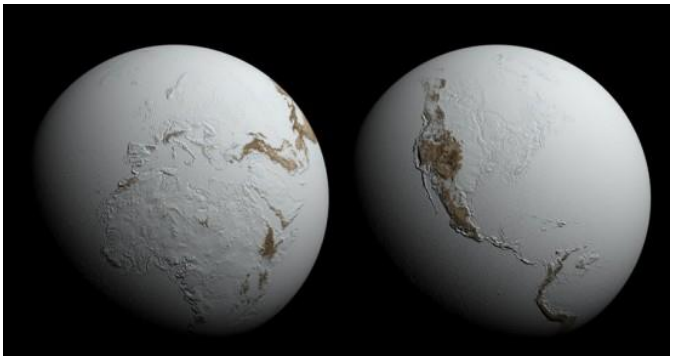
***Pakicetus*, an Eocene mammal and the oldest member of the whale family**

***Moeritherium*, an Eocene relative of elephants and manatees**

While we are on the topic of dinosaurs, a new study suggests that our perennially popular reptile friends probably evolved more rapidly than scientists had previously thought. According to the study, dinosaurs emerged less than 5 million years after the so-called "pre-dinosaurs", shaving about 10 million years off the previously accepted evolutionary timeline.

Scientists have shed new light on the earthquake that devastated Nepal in April 2015, killing more than 8,000 people. They used the latest satellite technology to measure land height changes across the entire eastern half of Nepal. The highest Himalayan peaks in that dropped by up to 24 inches in the first seconds of the earthquake. Mt. Everest was too far away to be affected.

At the end of the Precambrian, around 720 to 640 ma, large areas of the Earth's surface were covered in ice during a glacial period that lasted tens of millions of years, a time often referred to as “Snowball Earth”. Although the evidence for this is well established, some aspects of the extreme glaciation remain uncertain.



Artist’s conception of “Snowball Earth” near the end of the Precambrian

It is a common conception that the breakup of the supercontinent Rodinia at that time caused increased river discharge into the ocean, which changed ocean chemistry and reduced atmospheric CO_2. This had the effect of increasing global ice coverage and Earth lapsed into severe icehouse conditions. As the land surface became covered in ice, continental weathering basically stopped, locking the planet into the “Snowball Earth” state until CO_2 increased enough to warm the atmosphere so that the ice could melt.

But where did the increase in CO_2 come from? From volcanic activity. Apparently, this was also a period of explosive underwater volcanoes. Many geological and geochemical phenomena associated with “Snowball Earth” are consistent with extensive submarine volcanism along shallow mid-ocean ridges.

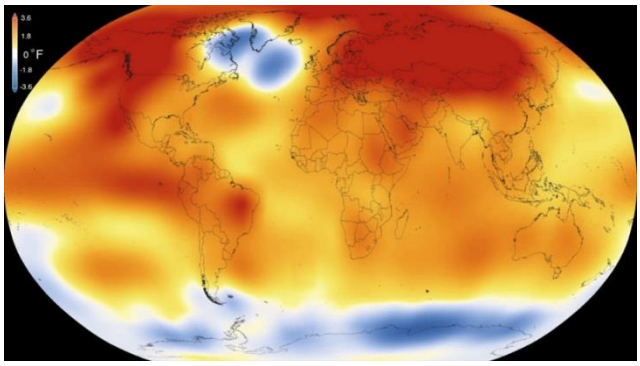
Another aspect of “Snowball Earth” is the existence of hundreds-of-feet-thick deposits of “cap carbonates”, continuous layers of limestone and/or dolostone that sharply overlie Precambrian glacial deposits and sub-glacial erosion surfaces where the glacial deposits are absent. According to researchers at the University of Southampton in England, while Rodinia was breaking up, thousands of miles of mid-ocean ridge formed over tens of millions of years. The lava erupted explosively in shallow waters producing large volumes of hyaloclastite, a glassy pyroclastic rock.

When volcanic material is deposited in the oceans, it is rapidly altered chemically, which impacts the biogeochemistry of the oceans. As hyaloclastite piled up on the sea floor, rapid chemical changes released massive amounts of calcium, magnesium, and phosphorus into the ocean. Over time, the calcium and magnesium deposits became limestones and dolostones, while the phosphorus may have acted as a catalyst for the origin of complex animal life on Earth.

Photo of a dolomite “cap carbonate” overlying a glacial deposit in Namibia

According to independent analyses issued by both the National Oceanic and Atmospheric Administration (NOAA) and NASA's Goddard Institute for Space Studies in New York (GISTEMP), Earth's 2015 surface temperatures were the warmest since modern record keeping began in 1880.

Globally-averaged temperatures increased over 2014 by 0.23ºF (0.13ºC), continuing a long-term warming trend. It should be pointed out that, because weather station locations and measurements change over time, there is some uncertainty in the individual values in the GISTEMP index. Because of this uncertainty, NASA's estimates indicate that there is a 94% certainty that 2015 was the warmest year on record.



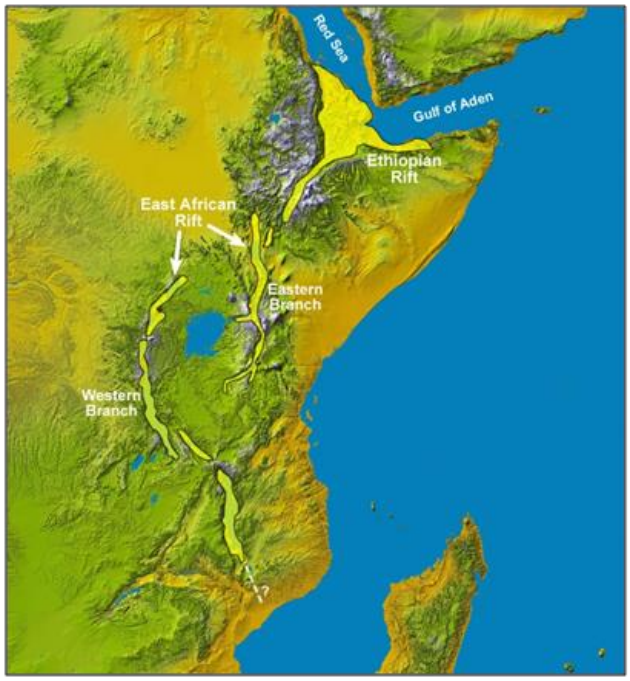
According to NASA and NOAA, 2015 was the warmest year on record since 1880

NASA's analyses incorporate surface temperature measurements from 6,300 weather stations, ship- and buoy-based observations of sea surface temperatures, and temperature measurements from Antarctic research stations. Then the climatologists use an algorithm to analyze the raw measurements that considers the varied spacing of temperature stations around the globe and urban heating effects that could skew the conclusions if left unaccounted for. The result of these calculations is an estimate of the global average temperature difference from a baseline period of 1951 to 1980.

NOAA's scientists used much of the same raw temperature data, but a different baseline period and different methods to analyze Earth's polar regions and global temperatures. Earth's average surface temperature has risen about 1.8ºF (1.0ºC) since the late-1800s. Most of the warming occurred in the last 35 years, with 15 of the 16 warmest years on record occurring since 2001. 2015 was the first time the global average temperatures were 1.8ºF or more above the 1880-1899 average. It was also a year in which a warming El Niño was in effect for most of the year.

Scientists think that CO_2 from Earth's interior is released into the atmosphere through degassing from active volcanoes, but it can also escape along faults away from active volcanic centers. Tectonic degassing such as this is poorly constrained, and until recently had been largely unmeasured. Most people believe that natural carbon emissions come mostly from active volcanoes.

Now, scientists at the University of New Mexico, in an attempt to quantify magmatic CO_2 from non-volcanic and continental rift regions, conducted research to study carbon emissions through fault systems in the East African Rift (EAR) by measuring diffuse CO_2 flux from the Magadi-Natron basin between Kenya and Tanzania. The EAR is the world's largest active continental rift system. Large volumes of CO_2 are emitted by active volcanoes and significant amounts are stored in large anoxic lakes in this region.



The East African Rift System

Gas samples collected along fault zones in the Magadi-Natron basin indicated an elevated CO_2 flux, providing evidence that faults act as permeable pathways for at least 10% of all the escaping deep-sourced CO_2 in the entire Natron-Magadi region. When the scientists compared gas data from all samples with data from a local active volcano, they found the carbon isotope compositions indicate a strong magmatic contribution to the fault-related CO_2. They also found that: (1) about 4.5 megatons of mantle-derived CO_2 is released in the basin annually; and (2) seismicity detected 10 to 20 miles deep during the research suggests that extensional faults in the basin might penetrate the lower crust. The ultimate source of the CO_2, therefore, is the lower crust or the mantle, consistent with carbon isotopes in the gas.

Extrapolating the measurements to the entire Eastern branch of the rift system implies a CO_2 flux of almost 80 megatons per year, which is comparable to CO_2 emissions from the entire global mid-ocean ridge system, <60 to >105 megatons per year. The implications are interesting. For example, widespread continental rifting and super-continent breakup could produce massive, long-term CO_2 emissions like those at the end of the Precambrian, and contribute to prolonged greenhouse conditions like those at the end of the Cretaceous. But, by comparison, these numbers are dwarfed by emissions from fossil fuel use – as much as 36 gigatons in 2013.

Primeval diamonds from Witwatersrand, South Africa, suggest that the early Earth may have had a recycling mechanism similar to modern-style plate tectonics. Geologists from the University of the Witwatersrand in South Africa analyzed nitrogen isotopes in diamonds from some of the oldest rocks on Earth (3.1 billion years). The researchers found that up to 3 percent of the nitrogen in the diamonds was nitrogen-15 rather than the more common isotope, nitrogen-14.

That ratio is much higher than the typical nitrogen isotopic composition of the mantle, and instead resembles the nitrogen isotopic ratio of both ancient and modern crust. This suggests that sometime prior to 3.5 billion years ago, crust from the surface had somehow made its way down deep into the mantle, where the diamonds formed.

While the results clearly show that crust was being recycled during the Earth's early years, plate tectonics aren't the only possible explanation. Dripping or sagging of the Earth’s weak early crust could also have been responsible for recycling the nitrogen that ended up in these ancient diamonds.

PGS Thanks Our Corporate Sponsors

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Wrightstone Energy Consulting

PGS Website of the Month

https://www.nasa.gov/multimedia/imagegallery/iotd.html

PGS Board-of-Directors

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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

The first item to be scanned by a bar code reader was a 10-pack of Wrigley's Juicy Fruit chewing gum in 1974. The 67-cent pack of gum is displayed today at the Smithsonian Institute's National Museum of American History.

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

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.

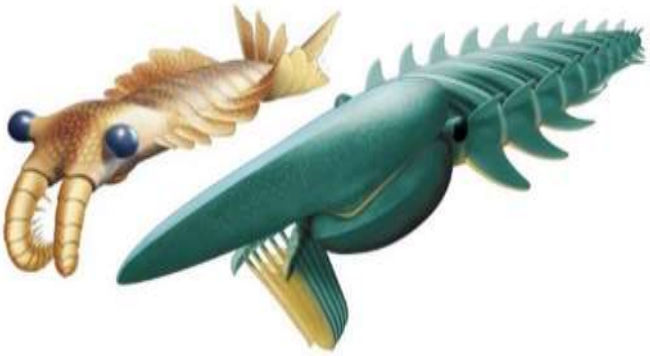
DID YOU KNOW . . . ?

Apatite crystals

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 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.

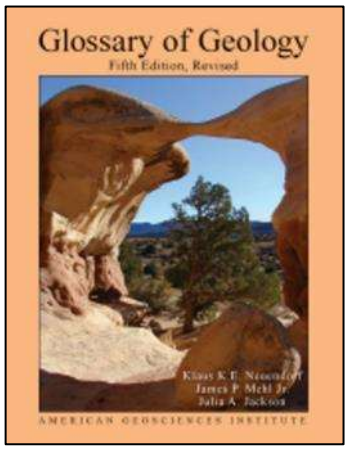
Apparently, the Cambrian extinction event that occurred about 40 ma after the Cambrian Explosion 540 ma didn't actually happen, at least not the way paleontologists thought. New well-preserved fossils found in 480-ma (Early Ordovician) rocks in Morocco show that the animals continued to thrive. The problem 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.

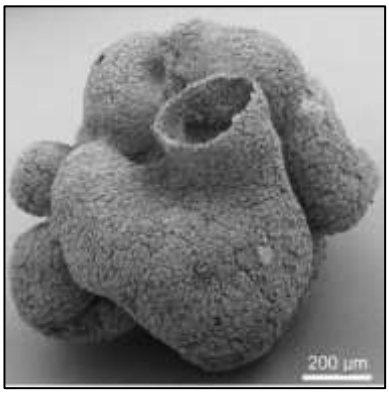
The American Geosciences Institute has released the latest upgrade of the *Glossary of Geology* app for the Android and iOS platforms, which have been discounted to $19.99, $10.00 off the list price, until March 31. The Glossary contains



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

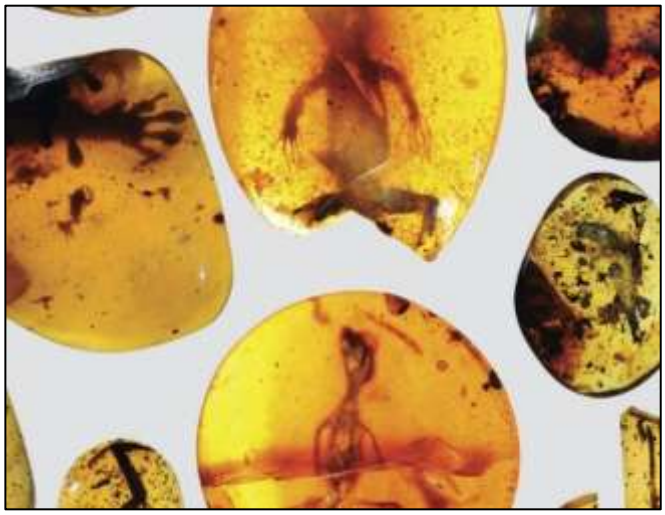
that an “evolutionary lag” explanation for the creation of Late Paleozoic coal is inconsistent with geochemistry, sedimentology, paleontology, and biology. They showed that not all of the plants that existed during the Carboniferous possessed high concentrations of lignin, a cell wall polymer that helps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

PGS Board-of-Directors

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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.

PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 8 | Karen Rose Cercone, Editor | April, 2016

Wednesday, April 20 2016

jointly present

The 14th Annual Student Night

The Pittsburgh Geological Society presents:

Late Paleozoic Sedimentation Patterns and Paleo-environment Reconstructions in the Northern Appalachian Foreland Basin by Baylee Kushner, Slippery Rock University

The American Society of Civil Engineers Pittsburgh Section presents:

Molecular Dynamics Simulations of Carbon Dioxide Sequestration in Depleted Shale Gas Reservoirs by Mohammad Kazemi, West Virginia University

The Association of Environmental & Engineering Geologists Allegheny-Ohio Section presents:

Effects of Hurricane Joaquin on the Sandy Hook Washover Fan Complex on San Salvador Island, Bahamas by Jamie Scacchetti, Youngstown State University

[Speakers' abstracts and list of poster presenters begin on page 3.]

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, April 18.

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

PRESIDENT'S STATEMENT

Welcome to April, the Spring season, and our 14th annual Student Night. The April meeting has always been jointly hosted by the American Society of Civil Engineers (ASCE), the Association of Engineering Geologists (AEG), and the Pittsburgh Geological Society (PGS) with each organization selecting a "top" student to present an oral presentation. The three selected receive a monetary award and, more importantly, a spot at the podium to present their research.

I would like to congratulate all of the students, and acknowledge their universities, for submitting 11 abstracts for this year's Student Night. They are as follows: Oral presenters, PGS; Baylee Kushner, Slippery Rock University (SRU), AEG, J.L. Scacchetti, M. Zaller, and R. D. Yocichin, Youngstown State University (YSU), and ASCE, Mohammad Kazemi, West Virginia University. Poster Presentations, Savannah Irwin, Indiana University of Pennsylvania (IUP), Wesley Taylor Kamerer (IUP), Cathleen Bressers (IUP), Jonathan King (IUP), Michael Chojnacki, Logan Jacobs, and Patricia Campbell (SRU), Christy Miller (SRU), Blake Wallrich and Michael Zieg (SRU), and A. M. Seidler, A. M. Bell, O. L. Costantino, B. L. Johnson, and S. F. Farhan (YSU). Each participating hosting society will present an award for their choice of best poster presentation.

For all of the Society's graduating student members, we congratulate you on your accomplishment and wish you a smooth transition and much success in beginning your career or continuing your education. Please remember that wherever your career takes you geographically, remaining a member of the PGS has lasting value. You need to continue networking throughout your career and membership in professional societies are one of the best ways to do it.

I would like to recognize the Baron Group, Inc., Pennsylvania Soil & Rock, Inc., and Woodard & Curran, Inc. as our most recent returning corporate sponsors. The Society truly appreciates all of our corporate members. Without their backing we could never accomplish all of the initiatives of the Society.

In closing, I would like to acknowledge the Pennsylvania Council of Professional Geologists for their generous monetary contribution in support of our student initiatives and tonight's meeting.

Ray Follador

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

Shane Loveday
California University of Pennsylvania

Nicole Kelley
Indiana University of Pennsylvania

Late Paleozoic Sedimentation Patterns and Paleoenvironment Reconstructions in the Northern Appalachian Foreland Basin

KUSHNER, B. and SCHIAPPA, T.A., Department of Geography, Geology and the Environment, Slippery Rock University, Slippery Rock, PA

A complex network of fluvial systems filled the Appalachian Foreland Basin from a variety of provenance regions during the Late Mississippian-Early Pennsylvanian periods (325-315 Ma). This basin formed in response to the accretion of the Taconic, Avalonian, and Acadian terranes and the collision of paleocontinents Laurentia and Gondwana, forming the Alleghenian orogen. Previous research of immature fluvial systems along the orogen compared U-Pb dated mineral ages to known provenance regions of various tectonic ages on Laurentia. These studies concluded that sediments were transported into the adjacent Appalachian Foreland Basin from the Acadian and Taconic terranes, uplifted Precambrian Greenville basement, and Canadian Shield. This research compared the contribution by these sediment sources along the orogen to their contribution along the northern shoreline of the Appalachian Foreland Basin, sampled in Venango County, Pennsylvania. Petrographic analysis and paleocurrent data were used to interpret paleoenvironmental changes between sandstone units. Point count compositional data was plotted on QFL diagrams to compare provenance of each unit. Based on our results a fluvial model for this section of the basin was produced. This research indicates that mature fluvial sediments comprising subsurface strata in northwestern Pennsylvania originated primarily from the Alleghenian orogen during the Late Mississippian-Early Pennsylvanian periods. Future research will include U-Pb mineral dating to quantify sediment contribution by minor provenance regions during these periods, as well as analysis of older rock units to determine when provenance and paleoenvironment changes occurred. Understanding these sedimentary trends is integral to safe and efficient resource extraction and geologic modeling of other foreland basins in North America.

Molecular Dynamics Simulations of Carbon Dioxide Sequestration in Depleted Shale Gas Reservoirs

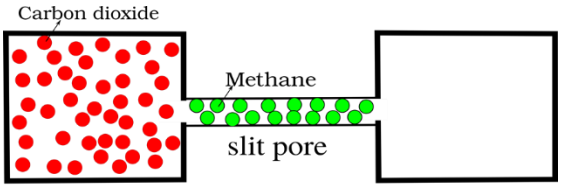
KAZEMI, Mohammad, Department of Petroleum and Natural Gas Engineering
West Virginia University, Morgantown WV

With large scale production of gas from shale resources, large volumes of pore space have been recently vacated. Therefore, there is a huge capacity of carbon dioxide (CO_2) that could be stored. Furthermore, due to the higher affinity of the organic nanopores to CO_2 compared to methane, injection of CO_2 can enhance the recovery of natural gas. The objective for this work is to investigate displacement and sorption (adsorption of CO_2 and desorption of methane) in organic nano-capillaries using Molecular Dynamics simulations.

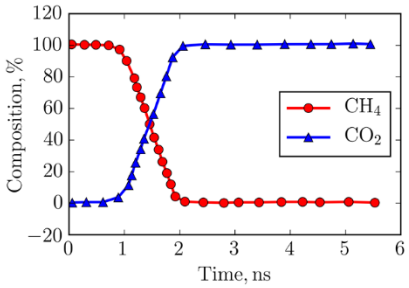
In this study, sorption capacity of two adsorbing gases (methane and CO_2) is compared by performing Molecular Dynamics (MD) simulations in identical setups of carbon nanotubes. MD simulations are performed for different capillary sizes, pressures, and temperatures. Excess and absolute adsorption isotherms of these gases are plotted and compared. To simulate the displacement process, methane molecules are initially adsorbed on the walls of the nanotube. Then, CO_2 is injected to replace the methane molecules. Finally, composition profiles of pure CO_2 displacing methane with time are examined.

(continued on next page)

According to MD simulation results, adsorption capability of CO_2 is found to be higher under the same pressure and temperature. As pore size increases, the adsorption structure of methane changes from single layer to multilayer adsorption. As the temperature increases, the amount of adsorbed molecules for both gases decreases. It is found that the CO_2 molecules replace adsorbed methane molecules due to their higher adsorption capacity. A slow breakthrough and sharp front is observed in this displacement process. The results show that the amount of CO_2 storage and methane production rate are increased as CO_2 injection pressure increases. Furthermore, the rate at which CO_2 could be injected is higher than the rate of methane production.



Schematic of MD simulation models



Composition profiles of Methane and Carbon Dioxide after injection of Carbon Dioxide.

Effects of Hurricane Joaquin on the Sandy Hook Washover Fan Complex on San Salvador Island, Bahamas

SCACCHETTI, J.L., ZALLER, M., and YOVICHIN, R.D., Department of Geological and Environmental Sciences, Youngstown State University Youngstown, Ohio 44555

San Salvador lies along the eastern edge of the Bahamas archipelago. Forty-seven hurricanes and tropical storms have impacted the island in the last one hundred and forty five years with four major hurricanes striking the island since 1996. The combination of storm frequency, little commercial development of the island and near-shore inland lakes makes San Salvador an ideal location for the study of ancient storms or paleotempestology. The work presented here is part of on-going paleotempestology research on the island.

The most recent storm to hit the island is hurricane Joaquin, which made landfall on October 2, 2015, as a category four hurricane having a maximum wind speed of one hundred and thirty five knots. Being an island with little development, the physical impacts of recent hurricanes may remain in place for many years. Long-term records of hurricanes may be preserved in the sediments of near-shore lakes present along much of the island's coast. The sediments of one lake located near Sandy Hook along the southeastern coast of the island ($23^0$56'52.54"N, $74^0$30'28.36"W, WGS 84) that have shown evidence of past hurricanes was impacted by hurricane Joaquin in the form of a large wash over fan deposit that transported marine sand a distance of approximately 140 meters inland. The research presented here focused on this wash over fan as an effort to characterize this type of storm deposit and to better understand ancient storms in general.

The research is based on the premise that inland lakes are dominated by non-marine gradual fine sediment and organic deposition and the presence of marine sand deposits within a lake is evidence of ancient storms. In order to characterize the lake deposits and the over wash fan, a total station survey was performed for survey location and elevation control, sediment core and auger samples were collected to sample and characterize the lake deposits and ground penetrating radar transects were performed to better define the contact between lake deposits and the underlying bedrock. The collected data was integrated using Arc GIS 10.3 in an effort to show the lateral extent and depth of the material deposited by the storm.

Student Poster Presentations

At least one student from each research team will be present during the 6:00-7:00 social hour to discuss their research project and answer any questions.

Insights from Analog Modeling the Chinese continental margin fracture zone promontory in Taiwan
BRESSERS, Cathleen, Geoscience Department, Indiana University of Pennsylvania

Depositional and Structural Features of the Basal Morgantown Sandstone, Mt. Nebo Pointe, Pittsburgh, PA
CHOJNACKI, Michael, JACOBS, Logan and CAMPBELL, Patricia, Department of Geography, Geology and the Environment, Slippery Rock University

Ibexian faunas of the Jones Ridge Formation, Ogilvie Mountains, east-central Alaska
IRWIN, Savannah, Geoscience Department, Indiana University of Pennsylvania

Refined age-dating and correlations of Cambrian-Ordovician limestone deposits in Alaska and the Yukon based upon agnostoid arthropods
KAMERER, Wesley Taylor, Geoscience Department, Indiana University of Pennsylvania

Micromorphology of a Mississippian Structure at the Lawrenz Gun Club Site, Illinois
KING, Jonathan[1], MONAGHAN, William G. [2], and HOMSEY-MESSER, Lara[1]
[1]Indiana University of Pennsylvania, [2] Indiana Geological Survey

Ostracodes as Proxies for Paleoenvironment Reconstruction of the Late Pennsylvanian Pine Creek Limestone in Western PA.
MILLER, Christy and SCHIAPPA, Tamra A., Department of Geography, Geology and the Environment, Slippery Rock University

Characterization of Surface and Subsurface Morphology of Sandy Point, San Salvador, Bahamas
SEIDLER, A.M., Bell, A.M., COSTANTINO, O.L., JOHNSON, B.L., and FARHAN, S.F., Department of Geological and Environmental Sciences, Youngstown State University

Petrographic and Textural Analysis of the Black Sturgeon Sill, Nipigon Canada
WALLRICH, Blake M. and ZIEG, Michael J., Department of Geography, Geology, and the Environment, Slippery Rock University

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

April 12, 2016
AAPG Distinguished Lecturer Larry Garmezy - The Similarities And Differences In The Hunt For Unconventional And Conventional Hydrocarbons
Cefalo's Event Center, Carnegie PA.

2016 PITTSBURGH PLAYMAKERS FORUM

April 13, 2016
An educational and networking event for petroleum geologists focusing on the geology of key plays across Eastern North America.
Pittsburgh Airport Sheraton, Coraopolis

PTTC – EFD Workshop

May 19, 2016
Learning from Shales: Applying New Technology to Old Plays
WVU Alumni Center, Morgantown, WV

HARRISBURG GEOLOGICAL SOCIETY

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

May 12, 2016
Ted Daeschler, Academy of Natural Sciences and Drexel University – New Discoveries from the Age of Fishes in PA and Beyond

AAPG 2016 EASTERN SECTION MEETING

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

12th Annual PGS Student Field Workshop Shows Students Their Future in Geoscience

A day spent watching a drill rig in action showed geoscience students from across the Pittsburgh region what their lives could be like when they are out in the real world. The students who attended the field workshop expressed their sincere gratitude to Frank Benacquista PG and all of his colleagues for taking the time to put together such a valuable educational experience for them.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Although Jumonville, on the crest of Chestnut Ridge near Uniontown in Fayette County, refers specifically to a Methodist camping and retreat center, generally speaking the whole area is referred to as Jumonville. It was named for Joseph Coulon de Villiers de Jumonville, an ensign in the French marines. Jumonville was in charge of a troop of Canadian and French soldiers sent to discourage a company of Virginia militia and Indian allies, commanded by Lieutenant Colonel George Washington, from attempting to protect workers building a fort in French-claimed territory at the forks of the Ohio River (later known as Pittsburgh). A large band of French soldiers had chased the workers away and began building Fort Duquesne at the forks. Washington and his small band were on their way to the site when they encountered Jumonville and his men. The battle, which lasted only 15 minutes on May 28, 1754, became known as the Battle of Jumonville Glen.

Jumonville Glen, site of the beginning of the French and Indian War

Ten French soldiers were killed outright, and 21 were captured, including Ensign Jumonville who was carrying diplomatic papers. Although he was being treated honorably as a prisoner of war, without notice, one of the Indians walked up to Jumonville and killed him with a tomahawk while Washington stood by dumbfounded. After these events, Washington and his men retreated to nearby Fort Necessity where they eventually surrendered to Canadian forces from Fort Duquesne. The terms of Washington's surrender included a statement in French (which Washington could not read) stating that Jumonville had been assassinated. Washington, in his journals, gave no details of the incident, so the exact circumstances of Jumonville's death are still controversial to this day.

The Battle of Jumonville Glen is credited as the opening salvo of the French and Indian War, The event, as brief and seemingly innocuous as it was, also had international repercussions – it is credited with starting the Seven Years War, the real first world war. The Seven Years War lasted from 1756 until 1763, and was fought by every major European power across North America, Europe, Africa, and Asia. And the beginning of it happened right at the top of Chestnut Ridge, one of the very few major anticlines found in western Pennsylvania

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DID YOU KNOW . . . ?

Although many researchers believe that Earth's early oceans were very hot, reaching as much as 176°F, new research from South Africa indicates that both the land and the ocean were much colder than that. In analyzing both volcanic and sedimentary rocks in the Barberton Greenstone Belt in South Africa, the researchers found that some of the mudrocks existing with deep-submarine volcanic rocks contain gypsum, which is produced under high pressure and at very cold temperatures such as in the present deep ocean. show a remarkable resemblance to those known from more recent ice ages. The researchers believe this indicates that the Earth experienced an extensive, possibly global, ice age about 3.5 billion years ago. Although they don't expect the geological community to blithely accept a paradigm shift blithely, they are hoping the concept will stimulate additional research. Not only does this potentially change the way we think about the early Earth, it also raises important questions about the origin of life.

A new study by scientists at the University of Hawaii and the University of California used the chemical and biological signatures of deep sea sediments to look at changes in the Earth's temperature and atmospheric CO_2 since the end of the Mesozoic. Their findings suggest we humans are releasing carbon around ten times faster than during any event in the past 66 million years. Until this study, the Paleocene-Eocene Thermal Maximum (PETM), which occurred around 56 million years ago, was the largest carbon release since the dinosaurs became extinct.

But now, according to the new data, the PETM was much smaller than the current input of carbon to the atmosphere. The maximum sustained carbon release rate during the PETM was estimated to be less than 4 billion metric tons of CO_2 per year. By comparison, the 2014 carbon-release rate was a record high of about 37 billion metric tons of CO_2, about ten times the PETM estimate. As such, the current carbon-release rate is unprecedented in Earth's post-Mesozoic history, so there is no analogue that can be used to determine what will happen in the future.

Researchers used the JOIDES Resolution to take deep sea cores across the PETM interval

The researchers' study indicates that we are in uncharted territory when dealing with the rate of carbon being released into the atmosphere and oceans. And, if the PETM is any indication, the consequences of our massive fossil fuel burning will have a much, much longer tail. While the world seems to be focused on what the Earth will be like in 2100, what happens after that is anyone's guess.

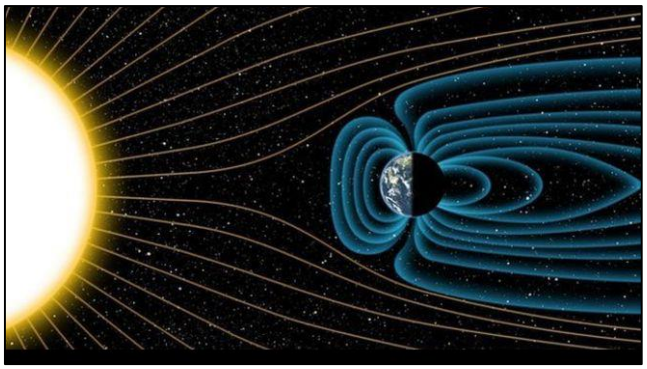
There has been much written and spoken about why the wooly mammoths, giant sloths, and other large mammals disappeared during the Ice Age. Typically, the rise of humans who overhunted them to extinction has been the primary concept. More recently, however, a team of researchers from Australia has suggested that severe climate change through the Late Pleistocene was capable of causing extinctions before humans showed up.

Pleistocene megafauna – was climate change or human hunters to blame for their extinction?

The researchers used statistical correlations between sudden warming events (interglacials) and the extinctions of large animals. They pointed out that the interglacials were the single biggest magnitude change in climate to have occurred in the past 2 ma, with temperatures rising as much as 10oC in just a few decades. That kind of climate change would cause huge disruptions in weather patterns and vegetation growth.

Of course, there are still many researchers who feel that humans were to blame. For example, about 50 genera went extinct in South America during the time of the Wisconsinan glaciation in the northern hemisphere, yet there were few if any extinctions in Africa at that time, even though the climate was probably similar to that of South America. As the idea goes, humans had been hunting in Africa for 2 ma and their prey were adapted to the predatory pressures. South America, however, had just recently (geologically speaking) been invaded by human predators and had not had time to adapt before going extinct.

Life arose on Earth something less than four billion years ago. And according to the prevailing dogma, life appeared because Earth had a rocky surface, liquid water, a blanketing atmosphere, and warmth. Now, thanks to a new research, we can say the Earth's magnetic field probably played, and continues to play, a key role in making the planet conducive to life.



Earth's magnetic field probably protected early life from the Sun's powerful solar winds and flares

The new research involved studying Kappa Ceti, a star located 30 light-years away in the constellation Cetus. It is remarkably similar to our sun, but is much younger, probably only about 400-600 million years old, meaning it formed sometime between the Late Neoproterozoic and Early Devonian when complex life was evolving on Earth. Like other stars its age, Kappa Ceti is very magnetically active, with a surface blotched with many giant sunspots. It also throws a steady stream of ionized gases into space, generating a solar wind 50 times stronger than our Sun's, which would play havoc with the atmosphere of any planet in the habitable zone that was unshielded by a magnetic field.

It is possible that a planet without a magnetic field could lose most of its atmosphere, a fate similar to what Mars suffered. By modelling the Kappa Ceti solar wind and its effect on an Earth-like planet, the researchers found that the early Earth's magnetic field probably was about 1/3 to 1/2 as large as it is today – not as much as today, but apparently enough to protect evolving life.

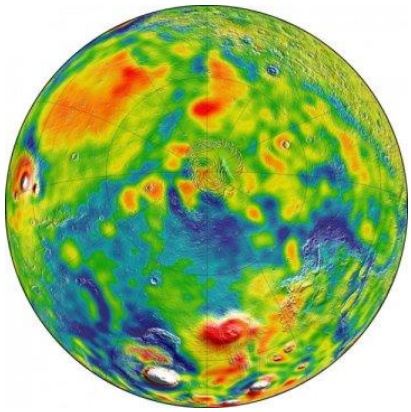
Finally, someone has decided what the worm-like creature called *Tullimonstrum gregarium* must have been in life. The Tully Monster, as it has been dubbed**,** is the official state fossil of Illinois, having been collected from the Pennsylvanian Francis Creek Shale at the famous Mazon Creek collecting locality in that state for decades. It has even appeared in paintings on the sides of U-Haul trucks. Eugene Richardson named the fossil in 1966 for Francis Tully, the person who collected it, but he was so unsure of what it represented that he simply filed it under "animal". Some folks thought it was a bizarre worm, others some kind of snail, and the nut cases even suggested it was an early relative of the Loch Ness Monster. No one was could decide conclusively where it belonged in the tree of life.

Until recently, that is. Now an international team of researchers believes they have figured out what this mystery critter was. Having looked at more than 1,200 specimens of the fossil, the researchers say the Tully Monster was actually a type of fish akin to modern lampreys. The clue to this relationship lay in a pale line visible on the fossils that stretched from the eye stalks to the end of the tail. The researchers recognized this as a notochord, which made *Tullymonstrum* a vertebrate rather than an invertebrate. With this revelation, other features started to become recognizable. Large complex eyes, tri-lobed brain, horny teeth, and a tail with a fin fit the new model.

Reconstruction of *Tullymonstrum gregarium*

There are still some bizarre traits in the *Tullymonstrum* anatomy, of course. The stalked eyes and the jaws on the end of a long snout have yet to be worked out, along with determining how the beast fits into the lamprey family tree. Until more research is done, and probably even after the last mystery is finally solved, this 300 million year old anomaly will continue to deserve its popular name, Tully Monster.

There is a new detailed gravity map of Mars, thanks to three NASA spacecraft, and it is providing a glimpse into the hidden interior of the planet. The new gravity map should be helpful for future Mars exploration because knowledge of the planet's gravity anomalies helps mission controllers place spacecraft more precisely into orbit. The gravity map was compiled from about 16 years of data collected continuously in orbit around Mars. However, orbital changes from uneven gravity are tiny, and other forces that can perturb the motion of the spacecraft had to be carefully accounted for, such as the force of sunlight on the spacecraft's solar panels and drag from the Red Planet's thin upper atmosphere.

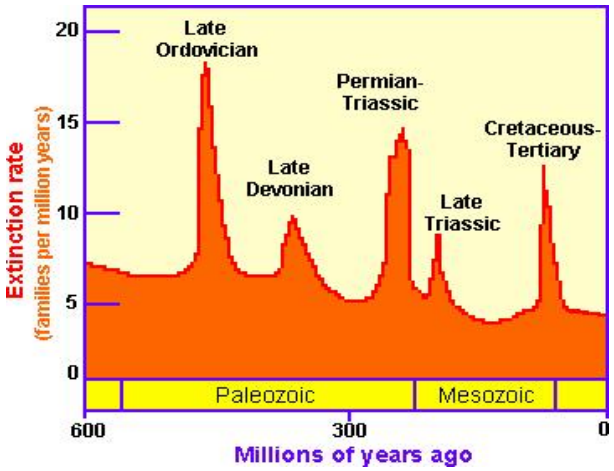


New gravity map of Mars

It took two years of analysis and computer modeling to remove the motion not caused by gravity. But it was worth it. The improved resolution of the map will help scientists better understand the as yet unknown formation of certain areas of Mars. Improved resolution of Mars' gravity map suggests there is a new explanation for how some features formed on the planet. Also, the team studying the NASA data confirmed that Mars has a liquid outer core of molten rock. The team also observed that, by studying how Mars' gravity has changed over a cycle of solar activity, the massive amount of CO_2 that freezes out of the atmosphere onto a Martian polar ice cap moves between the south pole and the north pole with the change of seasons.

While we know that there were at least five great mass extinctions in Earth history, and that many scientists feel we are currently undergoing a sixth, a new study indicates that the many species now going the way of the Great Auk and the Dodo may vanish with no permanent record of their ever having been here. This leads inevitably to the concept that the earlier extinctions probably are grossly underestimated in their loss of life as well. Researchers at the University of Chicago, University of New Mexico, and National Museum of Natural History compared lists of what are currently considered to be the most endangered species on the planet with several databases of living species and three databases of fossils. Their statistical analysis, run to determine which threatened species were most likely to disappear without leaving evidence of their existence, found that more than 85% of the mammal species at high risk of extinction lack a fossil record. Animals at the highest risk are about half as likely to leave a fossil record as those at lower risk.

The five big extinctions



Which ones are most at risk of having no record? The smaller, "cute and fuzzy ones" (rodents, bats, etc.). Because bigger animals tend to leave a fossil record, as do animals with larger geographical ranges, the magnitude of the current mammal die-off appears to be much reduced. But think about birds and reptiles. They probably have an even more distorted extinction record than mammals – only 3% of threatened bird species and 1.6% of threatened reptile species have a known fossil record. There is still a lot left to learn.

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PGS Website of the Month

http://www.fossilmuseum.net/Tree_of_Life/Stromatolites.htm

PGS Board-of-Directors

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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

Analysis of 15 separate studies in Europe found that myopia (near-sightedness) is becoming more common there, with the increase linked to education level. This suggests that reading and working with computers is at least one contributing factor.

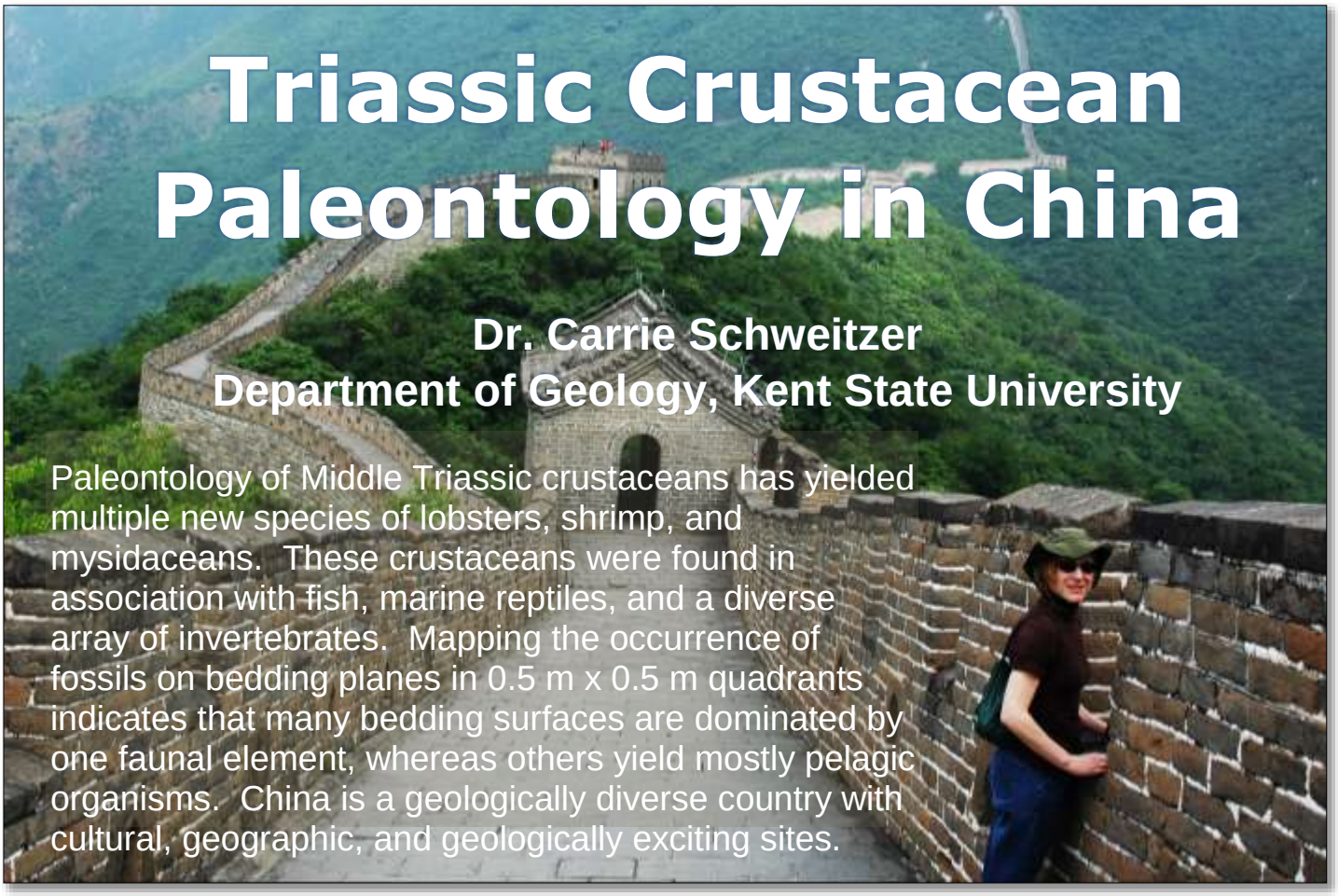
PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 9 | Karen Rose Cercone, Editor | May 2016

Wednesday, May 18, 2016

The Pittsburgh Geological Society presents



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, May 16.

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

SPEAKER BIOGRAPHY

Dr. Carrie Schweitzer carries out research at Kent State University's main campus in Kent and teaches introductory geology courses at the Kent State University Campus at Stark, in North Canton, Ohio. Dr. Schweitzer's research focuses on the taxonomy, systematics, and evolution of fossil decapod crustaceans - the shrimp, lobsters, and crabs. While her work concentrates on Jurassic, Cretaceous, and Eocene groups, it has spanned the full range of the decapod Crustacea and also includes the paleobiogeography and paleoecology of these animals. Dr. Schweitzer has worked on decapod faunas both in the field and from museums across North America, the Caribbean, Argentina, Chile, New Zealand, Asia and eastern Europe as well as China.

PRESIDENT'S STATEMENT

As the 2015-2016 Society year comes to a close with the May meeting I would like to thank my fellow officers and Board members for their dedicated service to the Society. It has been another rewarding year in which our membership numbers have remained steady in the professional category and slightly decreased in the student and corporate categories. These are common fluctuations and have had little impact on our meeting attendance which has averaged 70 attendees per meeting with a professional/student average of 42 /28, a great mix! I hope to see us strengthen these numbers in the future.

May, of course, is Society election month as we look to fill future officer and Board positions. I would like to thank all of our professional members who chose to be nominees. I encourage all of our professional members to VOTE via internet, U. S. Mail, or at the May meeting (the ballot should accompany this newsletter). Please feel free to use the write-in slot if you feel there is a good candidate that is not represented on the ballot. I would like to send out a big thank you to outgoing Board member Erica Love who has been an active Board member for 13 consecutive years in which she has spent time serving as Chair of the Communications Committee as well as Secretary for a period of time. I would also like to acknowledge all of our new and returning corporate sponsors whose monetary contributions to the Society make all the difference. Lastly, it has been an honor to again serve as president of the PGS the last two years. Our Society is a strong as ever in our 71 year history and that is a credit to our membership, officers and board members.

Please join us at our May meeting. Our speaker this month is Carrie Schwietzer, Professor of Geology at Kent State University. Carrie has performed considerable global field research the areas of the taxonomy, systematics, and evolution of the fossil decapod crustaceans, the shrimp, lobsters, and crabs. She will present "Triassic Crustacean Paleontology in China". Hope to see you there. Please remember to VOTE.

Ray Follador

CALENDAR OF EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

May 3, 2016
John Castagna, University of Houston – A New Three-Dimensional Look at Faulting on Seismic Data
Cefalo's Restaurant, Carnegie PA

HARRISBURG GEOLOGICAL SOCIETY

May 12, 2016
Ted Daeschler, Academy of Natural Sciences and Drexel University – New Discoveries from the Age of Fishes in PA and Beyond
GTS Technologies, Harrisburg, PA

OHIO GEOLOGICAL SOCIETY

May 13, 2016
Erica Howat; Battelle Memorial Institute – Lessons Learned from Wireline Logs and Core Analysis of an Appalachian Basin Cambrian-Ordovician Core: Exploration for Vugular Carbonate
Ohio Geological Survey, Collins Core and Sample Repository, Delaware, OH

PTTC – EFD Workshop

May 19, 2016
Learning from Shales: Applying New Technology to Old Plays
WVU Alumni Center, Morgantown, WV

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

June 3-4, 2016
PAPG Spring Field Trip to the Blue Ridge
(Dr. Thomas Anderson, Trip Leader)

AAPG 2016 EASTERN SECTION MEETING

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

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

Daniel A. Guy
Geologist, BioMost Inc.
2010 BS in Geology
Slippery Rock University of PA

William R. Baker
Current Student
California University of PA

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Monroeville Mall opened in 1969

In 1807, the Northern Turnpike (now US 22) was completed between Philadelphia and Pittsburgh. A little village on the border of Allegheny and Westmoreland counties, 13 miles east of Pittsburgh, became the first east-bound stagecoach stop on the new turnpike. By 1810 there were two blacksmiths, two stores, and an inn. Then a local farmer named Joel Monroe began selling off lots along the road, thus forming the core of the modern borough now called Monroeville. In the late 1800s, Monroeville was still mostly a farming community. Pittsburgh's coal industry began extending eastward, however, and the area around the town became enriched by the mining boom. When coal mining ran its course by the early 1900s, many of the town's inhabitants went to work at the Westinghouse plant or the railroad yards on nearby Turtle Creek.

In due course, Monroeville eventually grew from a farming village to a flourishing suburban community with a major highway running through the middle of it. In 1950, Monroeville was designated as the Pittsburgh interchange for the Pennsylvania Turnpike. Soon, shopping centers, gas stations, car dealerships, fast food restaurants, banks, and other businesses sprang up along US 22. In 1963, the eastern extension of the Parkway East (now I-376) was completed, resulting in a dramatic surge in population. The area also grew in importance as a retail center, with the opening of the Monroeville Mall in 1969. Monroeville today boasts about 30,000 residents, two hospitals and many shopping plazas, but travel and transportation remain mainstays of the community.

DID YOU KNOW . . . ?

The gem known as lapis lazuli (pronounced lap'-iss laz'-you-lee) is a beautiful blue rock composed of multiple minerals. The blue color comes mainly from lazurite, $(Na,Ca)_8(AlSiO_4)_6(S,Cl,SO_4,OH)_2$, a blue silicate mineral of the sodalite group.

Two cut and polished specimens of lapis lazuli

Besides lazurite, lapis lazuli typically contains calcite and pyrite, and might contain sodalite, dolomite, diopside, wollastonite, mica, and other minerals as well. Calcite commonly represents the second most abundant mineral present in the rock. It appears as white layers, fractures, or mottling, and when finely mixed with lazurite, it produces a rock that looks like faded denim.

Where pyrite occurs, it typically consists of tiny, randomly spaced grains with a contrasting gold color, and where it is abundant, the grains might concentrate into distinct layers or patches. Pyrite can also occur as a fracture-filling mineral.
To be called "lapis lazuli," the rock has to have a distinctly blue color and contain at least 25% blue lazurite.

Lapis lazuli forms near igneous intrusions where lazurite replaces portions of carbonate rocks that

have been altered by contact metamorphism or hydrothermal metamorphism. It often develops preferentially within bands or layers. The world's leading producer of lapis lazuli is Afghanistan; mining of the rock is known to have occurred in northeastern Afghanistan as early as 7000 BC.

Lapis beads, small jewelry items, and small sculptures have been found at archaeological sites dating back to about 3000 BC in Afghanistan, Egypt, Iraq, and Pakistan. Other producing countries include Argentina, Canada, Chile, Pakistan, and Russia, and even Arizona, California, and Colorado have been known to produce it in small amounts. Europeans began importing lapis lazuli during the Middle Ages in the form of jewelry and finely ground pigment. Lapis lazuli is still used today in jewelry and ornamental objects. Its use as a pigment has been replaced with modern materials, however, except by artists who strive to use historical methods.

An international team of paleontologists led by Derek Briggs of Yale has found a fossilized arthropod in Herefordshire, England that carried its young in pouches tethered to the parent's body, like a stream of tiny kites. The ancient creature, named *Aquilonifer spinosus*, lived on the sea floor during the Silurian Period (the generic name comes from '*aquila*,' meaning kite [the eagle-like bird, not the toy], and '*fer*,' meaning carry. *Aquilonifer spinosus* grew to less than 1/2 inch long. Ten juveniles of different stages of development were found attached to it with thin, flexible threads. It is the only known example of this unusual parenting method. Many different arthropods adopt different strategies to protect their young from predators, including attaching them to their limbs, holding them under their shell, or enclosing them within a special pouch until they are old enough to be released. But no known arthropod living today attaches the young by threads to its upper surface. Thus, the adult *Aquilonifer spinosus* would have postponed molting until the juveniles were old enough to hatch, otherwise the juveniles would have been shed with the animal's exoskeleton.

Aquilonifer spinosus

Eruption of two volcanoes apparently caused adverse weather in the 530s and 540s AD

Chroniclers writing in the years 536 and 537 AD talked about a "mystery cloud" that dimmed the light of the sun above the Mediterranean. It was discovered that tree rings indicated poor growing conditions over the entire Northern Hemisphere during that time, and a series of unusual natural phenomena occurred afterwards. Numerous crises, including the first pandemic European plague beginning in 541, have come to be associated with the "mystery cloud".

Just recently, an international team of climate scientists found conclusive proof of a volcanic origin for the 536 solar dimming, based on traces of volcanic sulfur from two major eruptions dated to 536 AD and 540 AD in ice cores from Greenland and Antarctica. Using the new ice core data, historical evidence, and climate models, the researchers found that the impact of the volcanic double event of 536/540 on Northern Hemisphere climate was stronger than any other documented or reconstructed event of the past 1,200 years. Either of the eruptions would have led to a significant cooling of Earth's surface. Two of them so close together in time caused what is probably the coldest decade of the past 2,000 years. Using

the available data from ice cores and the descriptions from ancient scholars, the team estimated the magnitude of the eruptions and their approximate locations, and then simulated the spread and impacts of the aerosol clouds resulting from the volcanic injection of sulfur into the stratosphere. This revealed that following the eruptions, the solar radiation at Earth's surface was strongly reduced over the Northern Hemisphere for several years, and caused decreases in the hemispheric average temperature of up to 2°C.

The team used climate model simulations to directly estimate the impact of the eruptions on agriculture in Europe, and identified Northern Europe, and Scandinavia in particular, as the most likely locations to have suffered under the cold conditions after the eruptions. This result supports the theory of a connection between the eruptions and archaeological evidence of a large-scale societal crisis in Scandinavia in the 6th century. Each one of the eruptions would have strongly impacted societies, and it happened twice within four years.

Were the dinosaurs wiped out by an asteroid, or were they already on the way out?

The team has not identified which particular volcanoes were at fault. There are several candidates being discussed, including volcanoes in Central America, Indonesia and North America.

The current concept of the demise of the dinosaurs is that they reigned throughout the Mesozoic right up to the bolide impact, and it's the impact that drove their final extinction. In reality, they were already in decline long before that. A study of dinosaurs conducted two years ago indicated that some forms were in decline within the last few million years before a 6-mile-wide asteroid slammed into Earth 66 ma, at the end of the Cretaceous Period. A new assessment, however, suggests the creatures were already in a long-term decline, supposedly because they could not cope with the ways Earth was changing.

The researchers analyzed the remains of dinosaurs from 231 ma up to the point where they went extinct. At the beginning, new species appeared at an explosive rate, but evolution started to slow about 160 ma, leading to a decline in the number of species beginning around 120 ma. Climatic conditions 230 ma were perfect for the dinosaurs when they first emerged – warm and lush from equator to pole. As the climate changed and sea levels shifted due to plate tectonics, the dinosaurs were subjected to new evolutionary pressures.

The analysis showed that the giant sauropod dinosaurs like *Diplodocus* declined the fastest, whereas the theropods like *Tyrannosaurus* declined more gradually. It is probable that the dinosaurs' 50-ma decline rendered them even more susceptible to the environmental catastrophes that followed the asteroid impact. Mammals, which evolved at about the same time as dinosaurs, are much better adapted to colder climates. Thus, even if the asteroid hadn't hit, thanks to plate tectonics and shifting global climates, mammalian supremacy might eventually have occurred anyways.

Chemical weathering occurs when minerals in rock react with water. The chemical reactions physically weaken rock by altering its structure. Rocks in streambeds then become more susceptible to erosion by physical processes, such as sediment impacts in flowing water. It has been established that chemical weathering influences rock strength, but scientists lacked comprehensive data on the extent to which chemical weathering influences river erosion.

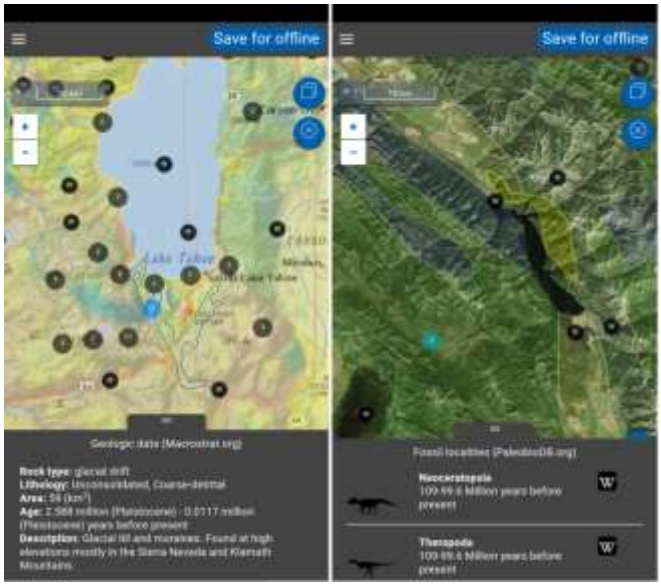
Chemical weathering of volcanic basalt by extreme precipitation

To explore the issue, a team of researchers travelled to Hawaii where volcanic basalt makes up the bedrock to collect data on chemical weathering, rock strength, and erosion rates in streams across wet and dry regions of the island. Hawaii, with its uniform lithology and extreme precipitation gradient, is a simple, natural laboratory for studying how climate controls river erosion. The team measured the strength of the rock using a device that measures surface hardness in the field, and also analyzed the chemistry and density of rock samples back in the lab to determine the influence of chemical weathering. They found that bedrock was more chemically weathered and physically weaker where local precipitation rates were greater. In addition, they found that locations of high precipitation could maintain high erosion rates despite continuously exposing "fresh rock"; this weathers rapidly when exposed at the surface, weakening the rock and allowing it to be eroded efficiently by the river.

The chemical weathering data drastically improved their ability to predict patterns of river incision, so based on their findings, the team was able to modify a numerical model describing how rivers cut into a landscape. Despite examining only a single rock type, the team decided that the mechanism linking chemical weathering to rock strength and erosion should apply to all types of rock. Understanding the relationship between erosion and chemical weathering can help tease out the role climate has on sculpting landscapes and influencing global cycles.

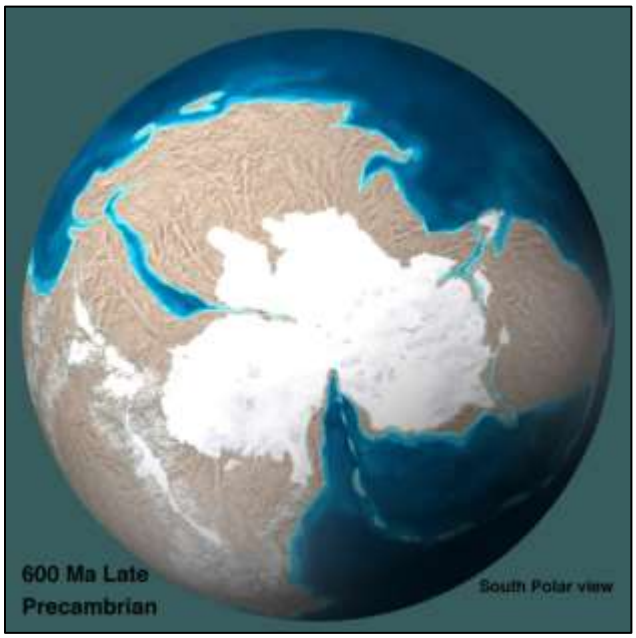
Have you ever seen an interesting geological feature from the window of your plane and wondered exactly what it might be? Well, pull out your smart phone, because it turns out there's an app for that! Invented by geology master's student Shane Loeffler of the University of Minnesota and funded by the National Science Foundation, the free app called "**Flyover Country**" shows you what geology lies beneath your flight path – or along your car ride.

Once you tell the app where you're taking off, and where you're going, it tells you what interesting geological features, including fossil localities, you might be passing along the way. You can also track your journey via GPS and save the information to use offline, in case you're far away from a cell tower.



Flyover Country can be downloaded for Android or I-Phone from: http://fc.umn.edu/

The age-old riddle of how continents were arranged in two Precambrian supercontinents, Nuna-Columbia and Rodinia, may have been answered, and it might have future economic implications for mining companies.



Ron Blakey's reconstruction of the Late Precambrian supercontinent

According to a researcher from the University of Wyoming and his coworkers, the rocks now exposed in southern Siberia were once connected to northern North America for nearly a quarter of the Earth's history. Those two continental blocks now form the cores of modern-day Asia and North America. The researchers used the ages, orientations, and paleomagnetic characteristics of short-lived (1-10 million years in duration) mafic dike swarms as piercing points to determine nearest-neighbor continents in the past. They determined the magmatic ages of numerous dikes through uranium-lead radiometric dating. These linear dikes are relatively narrow, roughly 330 feet or less, but can be 620 to 930 miles in length, and typically erupt in a radial pattern.

The project determined the ages of nearly 250 mafic dikes worldwide, a number large enough to build a database comparison between all of the older continental fragments from roughly 500 ma to 2,700 ma. The research group also worked on more recent dikes, from about 400 ma to 100 ma.

As the supercontinents split up, each continental fragment preserves a dike swarm record, so that comparing the temporal records of, they were able to test whether the cratons were close enough to share dike swarms. In this new study, the team believes that northern Laurentia (now North America) and southern Siberia were joined for nearly 1.2 billion years, from 1,900 bma to 700 ma. The team's findings disprove previous constructions of Nuna-Columbia and Rodinia, and establish new arrangements of the continental blocks within them.

A consortium of mining companies funded the research project for five years because the continental reconstructions for times when major, known metal deposits formed would be useful for prospecting new finds. These new deposits may be buried under hundreds of feet of younger rock. A lot of the major metal deposits in the earth formed in the early part of Earth's history, so by establishing which continents were next to the known deposits when they formed, the hope is that additional minerals may be found in the future.

An example of a mafic dike on the Baranof Cross-Island Trail, Alaska

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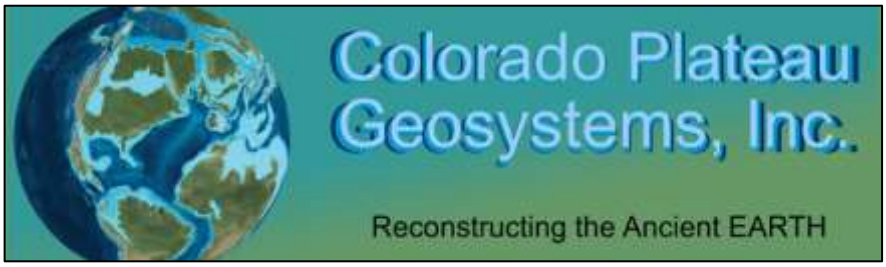

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Fun Fact Having Nothing to Do with Geology

Smokey the Bear has his own zip code. He received so much fan mail over the years that, in 1964, the US Post Office gave him the zip code 20252.