PITTSBURGH GEOLOGICAL SOCIETY

SEPTEMBER 20, 2017

Social hour 6:00 PM

Dinner 7:00 PM

Program 8:00 PM

Dinner costs
$30.00 per person
$10.00 student member

Reservations
Email your name and number of attendees in your party to:

pgsreservations@gmail.com

You can also reserve and pay via PayPal on:

https://www.pittsburghgeologicalsociety.org/

Location
Foster's Restaurant,
Foster Plaza Bldg. 10,
GreenTree PA

The Hottest Lavas of the Phanerozoic and the Survival of Deep Archean Reservoirs

GeoPRISMS Distinguished Lecturer

Dr. Esteban Gazel

Department of Earth and Atmospheric Sciences
Cornell University

Deadline for reservations is noon Monday, Sept 18.

SPEAKER ABSTRACT

The mantle plume hypothesis is widely accepted for the formation of large igneous provinces and many modern-day hotspot volcanoes. Petrologic models suggest that plume-derived melts originate at high mantle temperatures (>1500°C) relative to those generated at ambient mid-ocean ridge conditions (~1350°C). Earth's mantle has also appreciably cooled during its history due to heat loss and decrease in radioactive heat production, thus the temperatures of modern day basalts are substantially lower than those produced during the Archean (>2.5 Ga), as recorded by komatiites (>1700°C).

Here, we provide evidence that the ~90 Ma Galapagos-related Tortugal Suite accreted in Costa Rica not only record mantle potential temperatures as high as ancient Archean komatiites (~1800°C), but we also collected the highest olivine-spinel crystallization temperatures ever reported in the literature (1600°C). Therefore, to the best of our knowledge, this suite represents the record of the hottest lavas of the Phanerozoic.

This type of magma occurred more frequently during the Archean due to overall higher ambient mantle temperatures, yet our data suggest that anomalously hot, isolated domains still exist in the deep portions of the planet that have survived billions of years of mantle convection and cooling. This finding is in line with the recent results that showed that early-formed 182W/184W mantle heterogeneities, produced during the first 50 million years of planetary accretion, survived to present time and has been sampled by mantle plumes. Our finding supports the existence of primitive Archean reservoirs, although in most plumes cooler ambient mantle entrainment probably dilutes its signature.

SPEAKER BIOGRAPHY

Dr. Esteban Gazel is an Associate Professor at the Department of Earth and Atmospheric Sciences at Cornell University. He uses geochemical and petrological tools to understand intraplate magmatism, subduction zone processes, and deep Earth geochemical cycles.

Ongoing projects for Dr. Gazel include the evolution of mantle plumes (from Large Igneous Provinces to modern hotspots), the role of island arcs in the generation of continental crust, and volatile budgets in the mantle. His research approach integrates a combination of field, lab, statistical, and theoretical methods with interdisciplinary collaboration with other fields in Earth Science.

Dr. Gazel is one of four speakers selected for the 2017-2018 GeoPRISMS Distinguished Lectureship Program. For more information about GeoPRISMS (Geodynamic Processes at Rifting and Subducting Margins), visit their website: http://geoprisms.org/

About This Month's Cover Image

The cover of this newsletter is an artistic interpretation of an Archean komatiite lava flow created by Professor Claude Herzberg of Rutgers University. This figure was featured in the widespread news coverage of Dr. Gazel's research with his doctoral student, Jarek Trela, which was published in *Nature Geoscience*.

Komatiites are ultramafic lava flows which erupted at extremely high temperatures during the Earth's earliest eon, the Archean. They are recognized in the field by their unique spinifex texture, named for its similarity to a perennial coastal grass plant that grows throughout the southern hemisphere.

Komatiite lavas are widely assumed to be 'extinct' on Earth, since our planet has cooled down so much since the Archean. Join us in September to find out whether that assumption is still correct!

Preview of our Next Meeting

PRESIDENT'S STATEMENT

Welcome back!

I hope everyone had a great summer … although I must say that those of us who elected not to go anywhere far may give the season mixed reviews. For one, I don't expect to hear official calls for water conservation and I'm thankful our French drain and sump pump are in good working order. And the cool temperatures may be welcome to those who do not care who do not care to spend much time swimming.

Sarcasm aside, summer is also a time where some things slow down a little and PGS business is no exception. Not that the society fell into a non-interrupted slumber, for we performed two outreach events for the surrounding community. PGS was invited to participate in a geology day camp on July 12 at McConnell's Mill State Park. The event was sponsored by the Lawrence County Conservation District. Karen Rose Cercone represented us and led eight middle school students in a 'build the rock cycle' activity where they learned about the differences between igneous, sedimentary and metamorphic rocks.

About a month later, on the evening of August 8, Brian Dunst, Dan Billman, and I talked about geology to six children and about the same number of adults at the Chartiers-Houston Community Library. Brian and Dan brought their rock collections and Brian came up with the theme: *Every Rock Has a Story*. The eldest attending child was a young lady about to enter the seventh grade. The aspiring paleontologist stayed with us until it was time for the library to close and, I dare say, walked out even more inspired than before.

I am once again spoiled with a board packed with dedication, skill, and experience. Tamra Schiappa will continue to serve a third year as Vice President and Programs Committee Chairperson. Kyle Fredrick will take on a second year of husbanding our monetary resources as Treasurer. Ken LaSota will replace Karen Rose Cercone as Secretary. He will also continue as Chairperson of the Educational Outreach Committee. Karen Rose will continue as Editor of the PGS newsletter and Web Master of the PGS web site.

Returning committee chairpersons not mentioned above include Judy Neelan (Archives), Wendell Barner (Audit), Albert Kollar (Awards), Erica Love (Communications), Frank Benacquista (Continuing Education), Past President Ray Follador (Finance, and Nominations and Elections), and Counselor John Harper (Membership). Other returning board members are Counselor Chuck Shultz, AAPG Delegates Andrea Reynolds and Dan Billman, and returning Directors-at-Large Mark Barnes, Brian Dunst, and Diane Miller. I am pleased to recognize three individuals who will begin new two-year terms as Director-at-Large: Wendell Barner, Mary Ann Gross, and Erica Love. I am also happy to announce that Phil Graves will serve as Student Liaison for a second year. I think we are in excellent shape for 2017-2018.

Normally I'd close by looking forward to seeing all of you at the first PGS meeting, which will occur on September 20. As it is, my wife and I will be watching our grandkids in South Carolina while our daughter and son-in-law run off to celebrate their tenth anniversary. So, I'll see you in October. Finally, I have this friendly reminder: please remember to pay your membership dues.

Peter R. Michael

President

GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

September 13, 2017
“Geophysics and its Role in Appalachian Basin Oil and Gas Exploration and Development” presented by Joel Star of EQT Production

Cefalo’s Banquet & Event Center, Carnegie PA

HARRISBURG GEOLOGICAL SOCIETY

September 14, 2017
“Using Stable Isotopes in Bryozoans to Constrain the Timing of the Formation of the Isthmus of Panama Relative to the Onset of the Gulf Stream and Northern Hemisphere Glaciation” presented by: Professor Marcus M. Key, Dickinson College

AEG Offices, Harrisburg PA

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS

September 11, 2017
“Variability in the Gas Geochemistry of the Appalachian Basin and Contemporaneous Influences on Fate and Transport”

Cranberry Twp., PA

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

September 21, 2017
“Rare Earth Element Enrichment in Sedimentary Rocks in Pennsylvania: Evidence of a Fossil Ion-Adsorbed Deposit' presented by Tracy Bank of the National Energy Technology Laboratory

Cefalo’s Banquet & Event Center, Carnegie PA

THE ASCE PITTSBURGH SECTION - GEO-INSTITUTE CHAPTER

September 19, 2017
“Geopier Rammed Aggregate Application and Regional Case Studies” presented by Keithe J. Merl of GeoStructures, Inc.

Gaetano’s Restaurant, Pittsburgh PA

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

Annie M. Gerry
Geologist/Project Coordinator
3300 Daniel Lane #307
Monroeville, PA 15146

2011 MS in Geology
East Carolina University

Kelly Morgano
Graduate Student
West Virginia University

2016 BS in Geology
Kutztown University of Pennsylvania.

UPCOMING MEETINGS OF INTEREST TO PGS MEMBERS

October 23, 2017

SPEE Monograph 4 Short Course

Estimating Ultimate Recovery of Developed Wells in Low-Permeability Reservoirs

Hilton Garden Inn, Canonsburg PA

Don't miss an opportunity to attend this highly popular class with Dr. W. John Lee, Professor of Petroleum Engineering at Texas A&M University. John holds BS, MS, and PhD degrees in chemical engineering from the Georgia Institute of Technology. He worked for ExxonMobil early in his career and specialized in integrated reservoir studies. He later joined the Petroleum Engineering faculty at Texas A&M, and became Regents Professor of Petroleum Engineering. He served as an Academic Engineering Fellow with the U.S. Securities & Exchange Commission (SEC) in Washington during 2007-2008, and was a principal architect of the modernized SEC rules for reporting oil and gas reserves.

This one-day course will provide fundamental background information and concepts to forecast production for developed wells in unconventional, low-permeability reservoirs as covered in SPEE Monograph 4.

For more information or to register, visit:

https://secure.spee.org/civicrm/event/info?id=140

September 24-27, 2017

ES-AAPG 2017 Section Meeting Morgantown, West Virginia

Join us in the Morgantown, WV for the 2017 annual meeting of the AAPG Eastern Section. The meeting is hosted by the Geological Society of West Virginia and the West Virginia Geological Survey, and will be held in the heart of Morgantown at the Waterfront Hotel (Soon to be Marriott). Our workshops, field trips, and technical sessions will comprise an ambitious program addressing many of the resource opportunities and challenges in the Appalachian, Illinois, and Michigan Basins. Field trips include:

WHAT THE H?

This two-day field trip will allow participants to examine rock outcrops ranging in age from Ordovician through Pennsylvanian along a relatively new stretch of highway with fantastic exposures (US 48, or "Corridor H") and farther south along US 33. The trip will be a west-east traverse from the Allegheny Plateau across the Allegheny Front and into the Valley and Ridge province in eastern West Virginia.

DECKERS CREEK BIKE RIDE

Come join us for a leisurely bicycle ride down the Deckers Creek Rail Trail. There will be stops for a snack and possible side excursion to a pub.

We invite you to join us in Morgantown. For more information or to register, visit:

http://mapwv.gov/ESAAPG/

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

McKees Rocks at the end of the hill that includes the state's largest Native American burial mound

McKees Rocks, a borough on the Ohio River about 4 miles downriver from Pittsburgh, was named for Alexander McKee, a trader and Indian agent who settled there in 1764. McKee was given a 1300-acre tract of land that included a rocky promontory on the river in payment for his services during the French and Indian War. George Washington had considered the promontory as a possible site for Fort Pitt before deciding to rebuild on the ashes of Fort Duquesne.

McKees Rocks was officially founded in 1769 and incorporated as a borough in 1892, but its history goes back well before the French and Indian War. Prior to settlement by Europeans, Native Americans dating at least as to the Adena culture (circa 1000 BC) lived in the region and built what is considered to be the largest burial mound in the state. The mound, which archaeologists believe might have been started as recently as 250 BC, was 16½ feet tall and 85 feet in diameter. First excavated in 1896, the mound yielded 33 skeletons as well as religious and other artifacts from both the Adena and, later, the Hopewell people who conquered and assimilated them. Some of the artifacts were made of copper or marine shells, suggesting the Adena were involved in widespread trading. A historical marker commemorating the Adena people and their mound was placed at an athletic field nearby in 2002.

DID YOU KNOW . . . ?

Paleontologists have reconstructed the face of a tyrannosaurid that lived 75-million-years ago from a fossil skull belonging to *Daspletosaurus horneri* that roamed northern Montana and southern Alberta during the Late Cretaceous. The dinosaur had a face covered in flat scales that were probably extremely sensitive to touch, like those of modern crocodiles.

The researchers based that assumption on the texture of the bone. It might surprise some folks that the tissue beneath the skin can be reconstructed from fossil bones. But living bone is shaped by muscles, nerves, and blood vessels that constantly bump up against and nourish it, and different tissues leave different impressions on the bone that can be seen in fossils.

Reconstruction of the head of the tyrannosaur, *Daspletosaurus horneri*

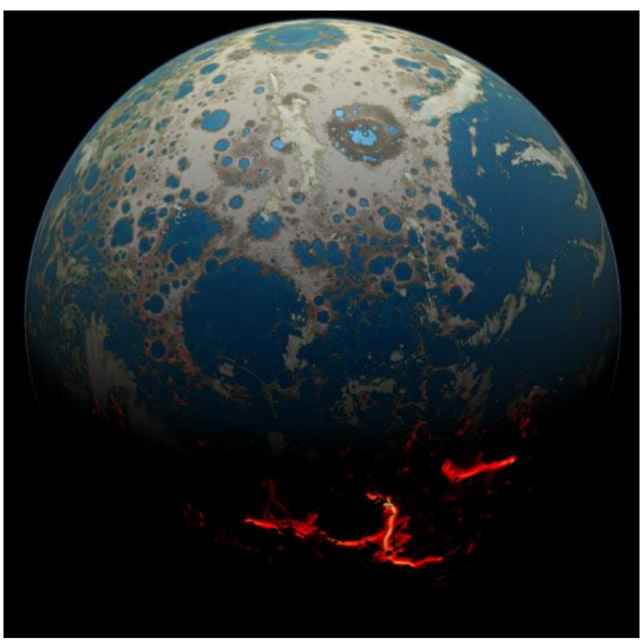
Unlike humans, whose faces are covered with fairly thick, soft tissue, birds and reptiles have very thin skin and sensors that sit directly on bone, giving them very sensitive faces.

Assuming the researchers are correct, and the same was true for *Daspletosaurus*, it and its large relatives, like *Tyrannosaurus rex*, may have had some distinctly crocodile-like behavior. Sensitive faces could have helped them in their predatory behavior, as well as in mating behavior.

Crocodiles, for example, can detect and grab nearby prey, even in complete darkness, because their entire bodies have highly touch-sensitive sensory organs. They also use these sensory organs in their noses to find egg-laying spots at the right temperatures in dirt. The researchers found that the texture of the fossil skull most closely resembled that of the faces of alligators and crocodiles.

(**https://www.nytimes.com/2017/03/31/science/tyrannosaurs-face-dinosaur.html?_r=0**)

The study of Earth's earliest crust is very difficult because tectonic deformation has, for the most part, jumbled it up and driving it back into the planet's interior. Finding remnants of early crust is extremely difficult as a result, and only a few remnants of 4 ga crust still exist in the geologic record. Only isolated zircon grains of have been dated to be older than 4 ga.



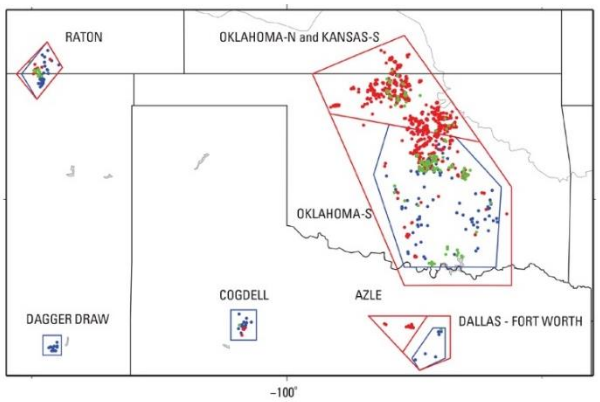
Artist's conception of early Earth

Now, a new approach gives geologists the ability to detect the presence of immensely ancient crust that got reworked into much younger (but still really old) rocks by studying variations in the abundance of neodymium-142 that was created by the radioactive decay of samarium-142, which was present when the Earth formed. Samarium-142 has a half-life of only 103 ma, so it became extinct early in Earth history, and the only reason we know of its existence is from the study of meteorites from the moon and Mars. Variations in the relative abundance of neodymium-142 in preserved rock, compared to other neodymium isotopes not related to samarium decay, reflect chemical processes that changed the samarium/neodymium ratio during the time that samarium-146 was still present on Earth – i.e., before approximately 4 ga.

Canadian researchers studied billion-year-old granitic rocks from the eastern shore of Hudson Bay that, based on their geochemistry, were derived from the re-melting of basaltic oceanic crust that was more than 4.2 ga. Basaltic oceanic crust survives at Earth's surface for less than 200 million years before it sinks back into Earth's interior due to the action of plate tectonics. The researchers' findings, however, suggest that this basaltic crust may have survived at Earth's surface for at least 1.5 ga before later being re-melted into rocks that form a portion of the northernmost Superior craton. This result might imply that plate tectonics was not at work during the earliest part of Earth history. But now researchers can investigate this phenomenon using the neodymium-142 variation to track the role of really old crust in building up somewhat younger sections of Earth's continental crust.

(**http://www.sci-news.com/geology/early-earths-crust-04709.html**)

New research concludes that human-induced and naturally-occurring earthquakes in the central US share the same shaking potential and can cause similar damage. This finding, by scientists at Stanford University, contradicts previous observations suggesting that induced earthquakes exhibit weaker shaking than natural ones and could help scientists make predictions about future earthquakes and mitigate their potential damage. As a result of the study, they can begin to reduce uncertainty about how hard induced earthquakes shake the ground, leading to more accurate risk estimates.



Oklahoma area of induced and natural seismicity.

Earthquakes in the central U.S. have increased over the past 10 years as a result of the expansion of shale-gas and other unconventional oil and gas operations that discard large amounts of wastewater by injecting it into porous formations underground. Stresses released by earthquakes already exists in the subsurface. Injecting water helps to speed up the process. Oklahoma's largest seismic events, three large, >5.0 magnitude events, occurred in 2016, causing significant damage to the area. The number of earthquakes of magnitude 3.0 or greater has dropped since the beginning of 2017, thanks in part to new regulations limiting wastewater injection.

Researchers measure the force driving tectonic plates to slip, known as *stress drop*, by measuring the difference between a fault's stress before and after an earthquake. The Stanford team analyzed seismic data from 39 earthquakes in the central US and eastern North America, both human-induced and natural, ranging from magnitude 3.3 to 5.8. Their results showed the *stress drops* of induced and natural earthquakes share the same characteristics (after accounting for external factors like fault-slip type and earthquake depth).

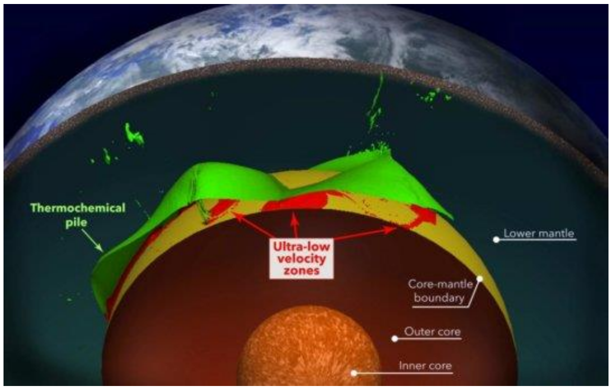
An additional result of the research indicates that most earthquakes in the eastern US and Canada exhibit stronger shaking potential than those in the central US and California because they occur on reverse faults. Even though these typically are very old and relatively stable, and the risk for naturally occurring earthquakes is low, the large populations and fragile infrastructure in the eastern US and Canada makes this area vulnerable when earthquakes do occur.

The researchers also concluded that as quakes occur deeper, the rocks become stronger and the stress drop becomes more powerful. This factor needs to be considered as people begin to revise ground-motion models that describe how strong the shaking will be. And since the types of rocks being exploited by unconventional oil and gas recovery in the North America can be found all over the world, the results of the Stanford study will be widely applicable.

(**https://www.sciencedaily.com/releases/2017/08/170802152517.htm**)

A team of American geoscientists used computer modeling to explain how pockets of mushy rock accumulate at the boundary between Earth's core and mantle. The pockets, known as ultra-low velocity zones because seismic waves greatly slow down as they pass through them, lie approximately 1,800 mi below the surface.
Although they have been known for many years, there has never been an adequate explanation of how they formed. Many geologists have thought the zones are partially molten despite their occurrence in some of the cooler regions of the deep mantle. Originally assumed to be partially molten versions of the rock surrounding them, their global distribution and large variations in density, shape, and size suggest that they actually have a different composition than the mantle.

Seismic evidence allows both possibilities, so the researchers decided to model mantle convection by computer to see the shapes and positions of the zones could provide an answer. The researchers found that two very large structures of rock deep in the Earth are probably made of something different from the rest of the mantle and called them thermochemical piles, or more simply, “blobs”.



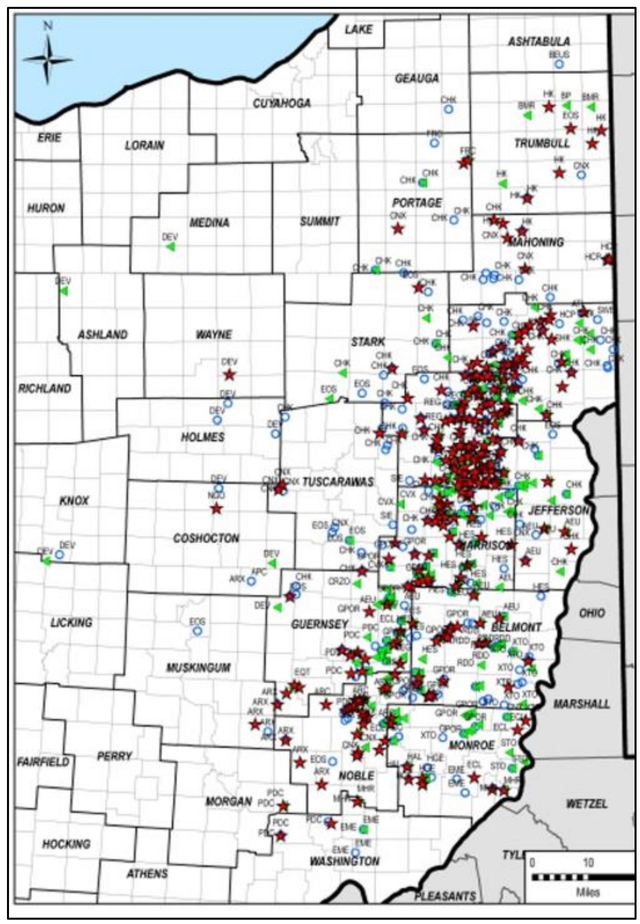
Small areas of a compositionally-distinct rock (red) collect at Earth's core-mantle boundary (tan) near the margins of large thermochemical piles (green) at the base of Earth's mantle.

The origin and composition of the “blobs” are unknown, but the new computer modeling explains how the ultra-low velocity zones are associated with them. The zones typically are many miles tall, and tens or hundreds of miles wide and are mostly located near the edges of the “blobs”, although some appear to be both inside and well away from the “blobs”. The computer modeling indicated that most of the ultra-low velocity zones are compositionally different than the surrounding mantle, and that pockets of rock with different compositions can migrate from anywhere along the core-mantle boundary toward the margins of the “blobs”.

The margins of the thermochemical piles are where mantle-flow patterns converge, providing a sort of collection depot for denser types of rock. Although the details aren’t completely clear, the modeling shows that rocks of different composition respond to mantle convection in a way that gathers compositionally-similar materials together and moves small pockets of chemically-distinct rocks to the edges of the hotter “blobs” above the core-mantle boundary.

The researchers determined that, if ultra-low velocity zones are caused by melting of otherwise normal mantle, they should be located inside the “blobs” where the mantle is hottest. Alternately, if the ultra-low velocity zones have a composition different from the ordinary mantle rock, then mantle convection would continually carry them to the edges of piles where they collect, which is exactly what the researchers were seeing by seismic observations. Where the rock in the ultra-low velocity zones came from originally still needs to be determined.

(**https://www.sciencedaily.com/releases/2017/08/170802082922.htm**)



Horizontal Utica shale wells in Ohio as of 2014.

The Utica Shale in eastern Ohio has transformed from an underappreciated rock unit to one of the most valuable oil and gas drilling targets in North America just within the last three years. Ohio’s Department of Natural

Resources, Division of Oil and Gas Resources, has issued more than 1000 drilling permits during that time, and many of those wells are already producing crude oil, natural gas, and natural gas liquids per month worth millions of dollars.

Drilling pads constructed at the surface typically have one or more vertical wells, and each vertical well usually has a horizontal leg that can travel laterally for one to two miles underground. These horizontal legs are where the hydraulic fracturing and oil and gas production occur.

Very few people know where these horizontal wells travel, and even experienced geologists are surprised when they see the geographic pattern produced by many wells. But once a person understands that the well is drilled through up to two miles of Utica Shale "pay zone," it is much easier to understand how one small-diameter well can yield such high volumes of oil, natural gas and natural gas liquids.

(**http://geology.com/utica.shtml**)

The deadliest and most destructive aspect associated with volcanoes isn't the eruption itself, but the pyroclastic flows associated with them. Pyroclastic flows are fluidlike avalanches of hot gases, ash, and rock fragments that pour down volcanic slopes, destroying everything in their paths. They typically consist of two parts: 1) a dense flow that hugs the slope and valley floor; and 2) a more diluted, gas-rich ash cloud known as a surge. Scientists have modeled the behavior of the dense flows, but they lacked a complete understanding of the physics controlling the surges.

Now researchers have developed a new numerical model that is capable of simulating both flows and surges, as well as their interactions that can spawn one another by exchanging material. Earlier models were more computational; this new model employs an approach that is commonly used to simulate landslides – a depth-averaged method where all physical properties are integrated perpendicular to the ground. It also allows for rapid calculations to assess hazards if an eruption is imminent. Results from the new method indicate that: 1) thick flows move more quickly than thin flows; and 2) any factor that allows a dense flow to attain a speed of about 82 feet per second can create a surge, which helps explain why a change in topography can generate a surge.

The new model was tested by simulating two phases of the intensely studied 2010 eruption of Indonesia's Mt. Merapi on Java, which produced more than 100 pyroclastic flows, killed an estimated 367 people, and caused at least $600 billion in economic losses. The model was able to reproduce the general characteristics of both types of eruptive phases that occurred during the eruption, including the different deposits' extent, volume, thickness, and paths. The research team found some significant differences between the model output and the documented phenomena. The model, however, is the first to simulate both portions of pyroclastic flows. This represents a major advance in the capability to predict ash cloud surges and their devastating consequences.

(**https://eos.org/research-spotlights/a-promising-new-tool-for-forecasting-volcanic-hazards**)

Village of Kinahrejo following the 2010 eruption of Merapi volcano on Java, Indonesia.

Paleontologists have often wondered what the earliest relatives of the dinosaurs looked like. Most have thought that they would have looked like small dinosaurs that walked on two legs. Now, a new discovery of a Middle Triassic reptile named *Teleocrater rhadinus* that pre-dated the first true dinosaurs by 10 million years has proven the popular concepts incorrect.

Teleocrater rhadinus appears in the fossil record just after the archosaurian reptiles split into the two branches that eventually evolved into 1) dinosaurs and birds and 2) alligators and crocodiles. *Teleocrater* was seven to ten feet long, had a long neck and tail, and walked on four crocodile-like legs. The discovery of this "missing link" by paleontologists from Virginia and England fundamentally challenges paleontological models of what the close relatives of dinosaurs would have looked like.

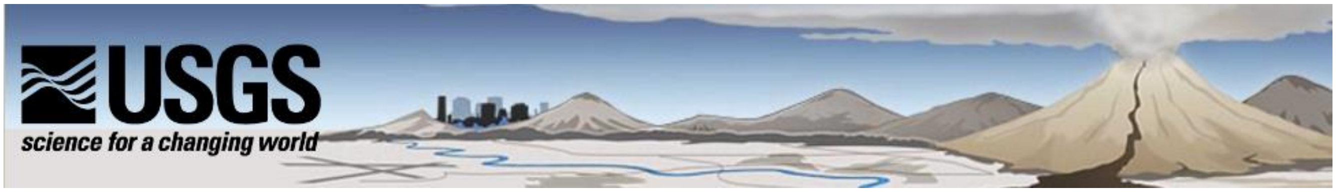
Teleocrater fossils were first discovered in southern Tanzania in 1933 and studied in the 1950s. But the lack of some of the more crucial aspects of the animal, such as the ankle bones, meant those studying the fossils could not determine whether they belonged to the crocodilian branch or the dinosaur branch of reptile evolution. New specimens unearthed in 2015, cleared up that problem. Intact ankle bones and other skeletal parts helped the more recent researchers determine that *Teleocrater rhadinus* is one of the oldest members of the archosaur family tree that had a crocodilian look.

The research team intends to revisit Tanzania to look for still missing parts of *Teleocrater* that could help solve other problems of archosaur evolution. Their research also shows the value of maintaining and re-assessing historical collections such as those at many museums and universities. Who knows how many new discoveries like this one could be made by looking through collections with fresh eyes and unbiased concepts.

(**http://www.sci-news.com/paleontology/teleocrater-rhadinus-04779.html**)

Artist's conception of *Teleocrater rhadinus*

PGS Website of the Month



https://volcanoes.usgs.gov/index.html

Officer Contacts: If you wish to contact a current PGS Officer, you can email Peter Michael, President, at shabell9@comcast.net; Tamra Schiappa, Vice President and Speaker Coordinator, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Ken LaSota, Secretary, at lasota@rmu.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.

Newsletter: To contact the Newsletter Editor, Karen Rose Cercone, with questions or suggestions for articles, job postings or geological events, please email kcercone@iup.edu.

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Twitter: PGS can be followed on Twitter by using the handle @PghGeoSociety

LinkedIn: To join the PGS Group, click https://www.linkedin.com/groups/12018505

Fun Fact Having Nothing to Do with Geology

If you could continually fart for six years and nine months, you would produce enough gas to create the equivalent energy released in an atomic bomb.

Editor's note – this item was submitted by John Harper. 😊

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