PITTSBURGH GEOLOGICAL SOCIETY

November 14, 2018

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 at: https://www.pittsburghgeologicalsociety.org/

Location
Foster's Restaurant
Foster Plaza Bldg. 10
Green Tree PA

My life as a faux astronaut: How exploring Earth's lavas helps us search for extraterrestrial life

Dr. Shannon Kobs Nawotniak

Idaho State University

Deadline for reservations is noon on Monday, Nov 12.

Speaker Abstract

Are we alone in the solar system? Gone are the days of imagining little green men on Mars or a moon made of cheese, but could there have been microbes living on Mars? The NASA BASALT (Biologic Analog Science Associated with Lava Terrains) research project uses volcanoes in Idaho and Hawaii as analogs for Mars in order to study how natural alteration of the basaltic lava affects microbial habitat, and at the same time learn how best to put real geologists on the red planet in the future.

Using simulated crewed missions, complete with realistic latency between the astronauts on "Mars" and a mission control team on Earth, the BASALT project is providing new insight into where we should look for evidence of life on Mars and how we should go about it.

Speaker Biography

Dr. Shannon Kobs Nawotniak is an Associate Professor of physical volcanology at Idaho State University. She completed her BS in Geology from Michigan Technological University and her PhD in Geology from the University at Buffalo.

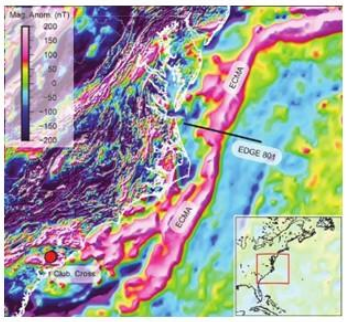
Dr. Kobs Nawotniak uses field work, remote sensing, lab analyses, and computer simulations to understand the relationship between volcanic processes and their products on Earth, Mars, and other planetary bodies. She is a member of four different research teams funded by NASA to study volcanoes on other planets and moons.

About the Cover Image

Dr. Shannon Kobs Nawotniak has been a frequent guest on ***Science Friday***, the weekly science radio show on National Public Radio. The image on our cover (Credit: Christopher Intagliata) comes from the episode titled "Reimagining A Martian Mission On A Hawaiian Volcano" which first aired on April 14, 2017. In this show, Dr. Kobs Nawotniak and other members of the NASA-funded project BASALT (Biologic Analog Science Associated with Lava Terrains) talked about how Hawaiian basalt flows make good models for the Martian surface, allowing them to pilot new ways of finding life on Mars.

More recently, *Science Friday* featured Dr. Kobs Nawotniak and co-investigators Dr. Darlene Lim and Dr. Julie Huber discussing underwater exploration of microbial life on the brand-new Hawaiian volcano Lo'ihi in an episode titled " A Deep Ocean Dive Is Training NASA For Space" which aired on August 31, 2018. All episodes of *Science Friday* are available to stream as pod-casts on your computer from **Sound Cloud** or you can listen on your phone using your favorite pod-casting app.

Geo PRISMS *Geodynamic Processes at Rifting and Subducting Margins*



A new view on the deep structure of the Eastern North American Margin: implications for continental breakup and early seafloor spreading history

Dr. Anne Becel

2018 Geo-PRISMS National Lecturer

Assistant Research Professor

Lamont - Doherty Earth Observatory
Columbia University

Next month's PGS Dinner Meeting will be held on December 19, 2018.

PRESIDENT'S STATEMENT

It's hard to believe that November is here, it seems like yesterday when I was writing the first statement for the new PGS season.

November means 'the ninth month' but then why is it the 11th month in the year? When the calendar was first organized, November was the 9th month of the first Roman calendar, which started the year with the month of March. When the months of January and February were added to the Julian version of the calendar, November became the 11th month of the year but retained its original name.

November also marks the point in the year when the cold, damp weather returns to chill the bones and the dreary days begin to set in. In old English, November literally meant "blood-month" for the time of year of animal sacrifice and hunting to stock up on food for the long cold winter ahead.

Today, November is the month of giving thanks and expressing gratitude for all that we have or have accomplished during the year. It is the time of year where we give selflessly to others, donate our time so others can eat as the cold months set in, or donate money to our favorite charities to provide services to others less fortunate.

For PGS, November marks the start of the Corporate Membership drive. We will be sending out letters to our current corporate sponsors as well as to former and potential new sponsors. If you are a professional member and do not know if your company is a corporate sponsor, kindly ask and if they are not, please encourage your employer to become one.

The Society depends on corporate sponsors to help support the offering of educational programing and offset the cost for speakers each month. In return for your donation, your company's name, logo and website link are featured in every issue of our newsletter as well as on our webpage.

I would like to congratulate our new Student Board Representative Jacob Podrasky (CalU) and the university liaisons Nicholas Russo (SRU) and Morgan Jones (CalU). The Board is still looking to fill the university liaison positions from IUP and UPitt and any other interested universities. These are important positions that enhance our connection to our large student population.

In closing, I would like to remind everyone to renew your membership. Membership forms can be filled out at the next meeting or can be downloaded from the PGS Website and turned in at a meeting or mailed. If you are a renewing member, you can also use the PayPal function on our website to renew as long as none of your contact information has changed since last year.

I look forward to seeing you at the upcoming meeting.
.

Tamra

LOCAL GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

November 6, 2018

"The complexity just below our feet and the implications for the fidelity of land seismic data" by Dr. Christine Krohn, 2018 SEG Honorary Lecturer

Cefalo's Banquet & Event Center, Carnegie, PA

ASSOCIATION OF ENVIRONMENTAL & ENGINEERING GEOLOGISTS

November 8, 2018

"Why is Applied Geology Important for Nuclear Power Plant Siting? Thinking in 4 Dimensions" by David Fenster, AEG President

Foster's Restaurant, Greentree, PA

SOCIETY OF PETROLEUM ENGINEERS

November 13, 2018 (lunch meeting)

"Reducing Completion Time and Improving Production Through the Use of an Engineered Diversion Strategy" by Kevin Wutherich of Drill2Frac

Cefalo's Banquet & Event Center, Carnegie, PA

SOCIETY OF WOMEN ENVIRONMENTAL PROFESSIONALS – THREE RIVERS CHAPTER

November 14, 2018 (3:00-5:00 pm)

"Women in Business: Optimizing Communication and Career Trajectory"

Alcosan Office, 3300 Preble Ave., Pittsburgh, PA

ACS ENERGY TECHNOLOGY GROUP

November 15, 2018

"Advancing Coal through New Technology Development for Mining and Beneficiation" by Dan Connell, CONSOL Energy.

Lombardozzi's Restaurant, Pittsburgh, PA

NATIONAL ACADEMIES ROUNDTABLE ON UNCONVENTIONAL HYDROCARBONS

November 15, 2018

"Environmental Legacies and Produced Water Related to Oil & Gas Production"

Pittsburgh Airport Marriott, Coraopolis, PA

The Pittsburgh Geological Society welcomes the following new student members to the society:

From California University of Pennsylvania:
Dillon S. Gaudet
Nicolas J. Immekus
Emilee R. Leydig

From Slippery Rock University of Pennsylvania
Andrea J. Malacaman
C. J. Moore
Evan A. Wagner

Students, you have a new representative on the PGS board. Please say hello to Jacob Podrasky at a PGS meeting and pass along any questions or comments you would like him to present to our board of directors.

The following universities also have new PGS student liaisons:

From California University of Pennsylvania:
Morgan Jones

From Slippery Rock University of Pennsylvania
Nicholas Russo

PGS AWARDS PRESENTED AND RECEIVED AT THE AAPG EASTERN SECTION MEETING IN PITTSBURGH

PGS had a very prominent place at the 2018 AAPG Eastern Section meeting in Pittsburgh this October.

David “Randy” Blood of EQT Production Co. won the **Pittsburgh Geological Society Award for Best Presentation on Appalachian Geology**, chosen by judges at the 2017 meeting in Morgantown, WV. Randy also won the **Ralph L. Miller Memorial Best Energy Minerals Division Paper Award (Eastern Section)** for his oral presentation, *“Deposition, Diagenesis and Hydrocarbon Generation in the Ordovician Point Pleasant Limestone and the Devonian Marcellus Shale: Comparing and Contrasting Two Appalachian Basin Unconventional Reservoirs.”* This is the second year in a row that Randy has won the PGS award.

Left to right, Ray Follador, Randy Blood, and John Harper all won honors and awards at the 2018 AAPG Eastern Section meeting in Pittsburgh.

In addition, the following awards and honors were presented to PGS members:

- PGS Director-at-Large and Chair of the Nominations and Elections and Finance committees, Ray Follador, won the **George V. Cohee Public Service Award**, presented *“In recognition of a lifetime of outstanding service and leadership to the geological community, and for providing a voice of reason for the concerned citizens of western Pennsylvania.”*

- PGS Councilor and Chair of the Membership Committee, John Harper, received the AAPG Eastern Section’s second highest award, the **Honorary Membership Award** *“Acknowledging John’s four decades of Appalachian geologic research, including advancing knowledge of basin stratigraphy and structure, and supporting responsible exploration and development of petroleum resources.”*

Craig Eckert (left) receives his Presidential Award from Ed Rothman, AAPG Eastern Section Awards Chair, at the 2018 Eastern Section AAPG Meeting in Pittsburgh.

- PGS member and past PGS president (1990-91) Craig Eckert received AAPG Eastern Section’s **Presidential Award** “*In recognition of exceptional leadership in Eastern Section and on the AAPG Advisory Council, and for serving as an exemplar of geological knowledge and professional integrity.*”

- PGS member Michele Cooney won the **Division of Environmental Geosciences Meritorious Contributions Award** “*In recognition of and gratitude for her energy, passion and voice on environmental issues associated with petroleum geology, including serving as Editor-in-Chief of Environmental Geosciences.*”

Michele Cooney receives her Meritorious Contributions Award from Awards Chair Ed Rothman.

Congratulations to all five for jobs very well done!

ANNOUNCEMENT – A JOURNEY THROUGH CROATIA

Interested in seeing some of the most beautiful cities in eastern Europe? Join Albert D. Kollar, geologist, paleontologist, and architectural historian at the Carnegie Museum of Natural History, and current chair of the PGS Awards Committee, on a journey to Croatia from May 17 to 23, 2019.

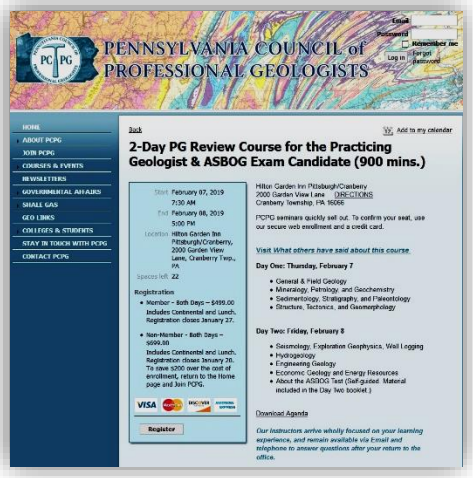
The beautiful and romantic port city of Rovinj, Croatia

This Museum-sponsored tour will explore a country full of scenic beauty, rich with history, from its historic landscapes of Roman, Venetian, Austro-Hungarian, and Croatian culture, to its plethora of indigenous stones that reveal its geological history. In the heart of Zagreb, Croatia's capital, you will explore the train station and botanical gardens, ride the funicular, visit Capital Square, home of Nikola Tesla, then continue on to Istria to stay in the seaport of Rovinj.

An optional May 14-17 prelude tour will explore the old city of Dubrovnik, and then on to Split where the Roman Emperor Diocletian's palace can be seen intact. An optional May 23-25 postlude tour will explore Venice. By special arrangement, you will visit an active stone quarry and fabrication yard where one of the great architectural building stones of the Carnegie Museum came from. Additional visits include Aguae Isae, examples of Hapsburg house, Pula Arena, and even a truffle-hunting excursion with specially trained dogs. If you are interested in going, or just want more information, contact Barbara Tucker at the Carnegie Museum at 412-578-2618.

PLANNING TO TAKE THE ASBOG EXAM NEXT YEAR? PCPG HAS A REVIEW COURSE FOR YOU IN CRANBERRY!

The Pennsylvania Council of Professional Geologists will hold a two-day review course for the practicing geologist and ASBOG candidate on **February 7 and 8, 2019**, in Cranberry Township. This course has been designed specifically to prepare candidates to answer exam questions about general and field geology, mineralogy, petrology, geochemistry, sedimentology, stratigraphy, paleontology, structure, tectonics, geomorphology, seismology, exploration geophysics, well logging, hydrogeology, engineering geology, economic geology and energy resources (whew!). It includes sample questions and advice from experienced instructors. A $200 discount is offered to members of PCPG. Warning: these courses sell out quickly. For more info, or to register: **https://pcpg.wildapricot.org/event-3092836**



ORIGINS OF WESTERN PA PLACE NAMES

When the Revolutionary War ended, soldiers of the Continental Army were awarded land as compensation. One of these soldiers, James Semple of Cumberland County in central PA, settled along Girty's Run, located up the Allegheny River near what is now the 40th Street Bridge. When he found out that the land was deeded to James Sample, a misspelling, he changed his name to match the deed.

This historic stone house on Evergreen Road in Millvale PA was built sometime before 1826 on a 230-acre tract granted to John Wilkins.

Somewhat later, the city of Allegheny (now Pittsburgh's North Side) bought 164 acres of the Sample property for a Poor Farm, which brought in industry, including a forge in 1847 that became Henry Phipps's rolling mill where Andrew Carnegie worked briefly as a bookkeeper. In 1857, the Pennsylvania Railroad purchased the right-of-way of the Pennsylvania Canal System, which ran down the north side of the Allegheny River, and the industrial revolution began in earnest in western Pennsylvania.

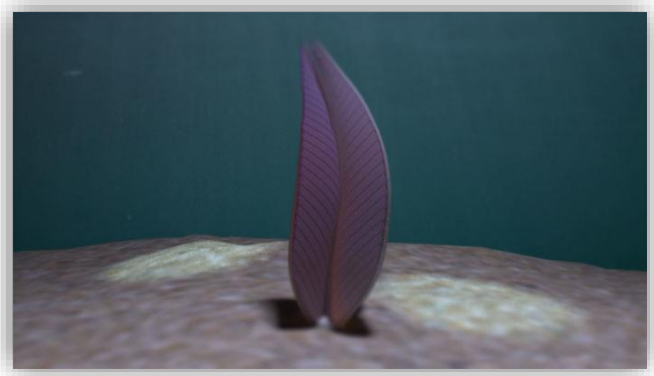
Before long, the area became populated and the railroad established a station they named Bennett. Finally, in February 1868, the area became incorporated as Millvale Borough, named for both its major industry (the mill) and its location along Girty's Run (a valley). It quickly expanded after the Civil War and prospered after connection with Lawrenceville was established by covered bridge and a narrow gauge railroad that would become part of Pittsburgh's trolley system. By the beginning of the 20th century, Millvale had three schools, three breweries, an opera house, a grocery store, a candy store, and a Masonic lodge. Although Millvale experienced expansion after World War II, a combination of the energy crisis of the 1970s and the downfall of the manufacturing and steel industries in the 1980s left Millvale with dwindling population. But, more recently, Millvale has developed its riverfront for recreation as well as business, and craft breweries (Strange Roots and Grist House) have moved back into the town. Now, if only Girty's Run would stop flooding!

DID YOU KNOW . . . ?

The organisms found in Ediacaran rocks have puzzled paleontologists for decades. These organisms, which look like tube- or frond-shaped plants as much as 6½ feet long, dominated Earth's seas 600 million years ago. They were first discovered in 1946 in South Australia's Ediacara Hills. Researchers have since identified about 200 different types in rocks of the same age all over the world. Almost all forms seem to have died out by the "Cambrian explosion" 541 million years ago, when fossils of familiar animals like sponges and arthropods appeared.

One reason these strange creatures proved so tricky to place in the tree of life is that many of them had unique anatomies. Some of them had bodies made up of branched fronds with a fractal architecture – the frond subunits resembled small versions of the whole frond. For decades, scientists couldn't figure out whether they were algae, fungi, or even an completely different kingdom of life that disappeared before the Cambrian. Until now, that is. Now two paleontologists from England and China think they have finally established the identity of the mysterious creatures. They were animals, and although some could move around, they were unlike anything living on Earth today.

The researchers analyzed more than 200 fossils of a 518-million-year-old marine species named *Stromatoveris psygmoglena*, which paleontologists previously had concluded was some sort of animal because it was found alongside other known animals, and all of the fossils were preserved in a similar way. They were all found beautifully preserved in Yunnan province in southwestern China. The researchers argue that *S. psygmoglena*, rather than being a typical Early Cambrian organism, was an Ediacaran species that somehow survived through the Cambrian explosion. What made these new specimens so great is that, like some of the typical Ediacaran organisms, *Stromatoveris* was made up of several radially repeated, branched fronds with a fractal internal architecture.

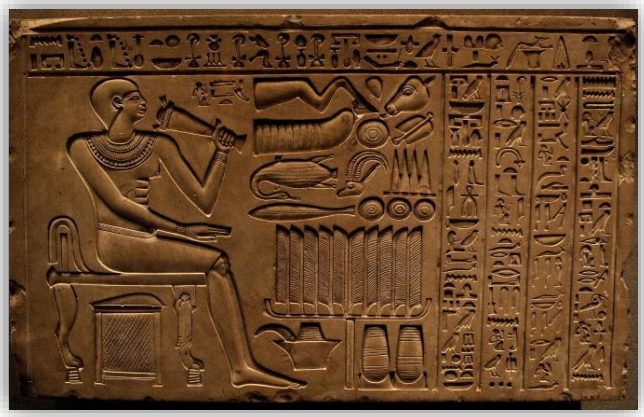


Artist's reconstruction of Stromatoveris psygmoglena, an Ediacaran marine animal.

The researchers ran a computer analysis using anatomical features to reconstruct evolutionary relationships. The analysis suggested that *Stromatoveris* and the Ediacaran organisms don't belong to any living phylum. Instead, they cluster on their own branch in the animal evolutionary tree between sponges and complex animals with a digestive cavity like worms, mollusks, and vertebrates. The new branch, called the Petalonamae, could well be a new phylum, and it seems to lack any extant descendants. The researchers argued that they were similar to some Ediacaran organisms, although others later questioned that link. Not everyone is convinced, of course. Although many think the Ediacaran organisms were animals, many are not sure *Stromatoveris* was an Ediacaran survivor. So now a question occurs: If the Ediacaran organisms represent the first major explosion of complex life on Earth, and they thrived for 30 million years, why did they die out? Their demise typically is linked to the appearance of animals in the Cambrian explosion, but that turns out to be a very simple explanation that doesn't work well if Ediacaran organisms really were animals themselves, and if some survived for tens of millions of years into the Cambrian. Why did they go extinct? Like their name, it's very hard to say.

http://www.sciencemag.org/news/2018/08/these-half-billion-year-old-creatures-were-animals-unlike-any-known-today

As reported in the September PGS Newsletter, we're living in the Meghalayan Age, which began 4,200 years ago, based on evidence of a megadrought (a drought that last at least two decades) found in the Mawmluh Cave speleothem from a cave in India. The drought significantly impacted civilizations all over the world, according to archaeologists. It had profound societal effects – cities and towns were abandoned, and humans went from urban societies to rural ones. Some of the civilizations severely impacted by the megadrought included Egypt's Old Kingdom and the Akkadian Empire in Mesopotamia, both of which collapsed. Large cities like Mohenjo Daro and Harappa in the Indus Valley of modern-day Pakistan and India also were abandoned around this time.



Funerary monument from Egypt's First Intermediate Period, ca. 2050 B.C. Some researchers think a megadrought occurred 4,200 years ago causing the Old Kingdom to collapse and plunging Egypt into the much more chaotic First Intermediate Period.

But, just so you don't think controversies don't exist in science, a scuffle has broken out over exactly what marks the beginning of the

Meghalayan Age. An Egyptian researcher doesn't agree with the "consensus". In his reading of the archaeological evidence, those societal collapses occurred at different times, rendering the argument that a single, global climate event precipitated them moot. In Egypt, for example, the "collapse" of the Old Kingdom was really a slow fragmenting of centralized power, and in the Indus Valley the society moved away from urban centers over a long period of time. This new interpretation argues that things aren't usually as simple as climate change equals collapse. More often than not, societies just reorganized. The only thing archaeologists can agree on is the resilience of humans to regroup, no matter what caused their societies to dissipate.

But if this all seems controversial, perhaps it's because archaeologists are taking credit for the new age. In fact, the press release that was sent out, giving people the impression that the Meghalayan Age was conditioned on archaeological events, was inaccurate. It was never about archaeology and ancient societies. The divisions of the Holocene were based on purely climatic events, and if an archaeological event corresponds to it, that just adds credibility. Evidence for the megadrought occurs in a range of geomorphological, stratigraphical, and archaeological records from many parts of the world, meaning that it constitutes an appropriate temporal marker.

https://www.nationalgeographic.com/science/2018/09/news-meghalayan-holocene-megadrought-archaeology/

An asteroid about the size of a pickup truck came within 10,000 miles of Earth's surface on the morning of October 19 and then continued on its way without incident. There have been only three asteroids known to have come closer to Earth since 1900, according to NASA records. This particular asteroid, designated 2018 UA, was a mere 9,544 miles above the surface of the planet at its closest approach, much nearer than most of the large man-made satellites in currently in orbit. Of the four closest asteroid flybys recorded by NASA, 2018 UA is the second largest. It is approximately 16 feet in its longest dimension.

A truck-sized asteroid flew past Earth recently.

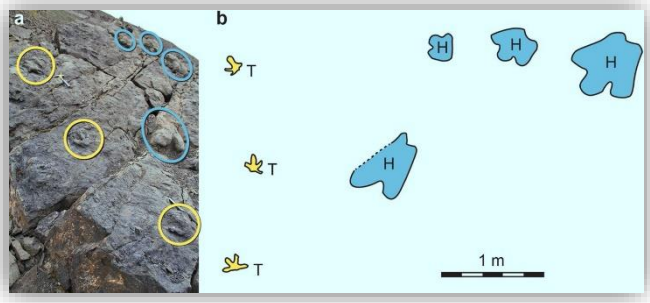
The NASA records for closest fly-bys don't include the ones that actually became meteorites when they impacted the Earth's atmosphere. For example, a bolide exploded over Russia in 2013. A small asteroid might have made it all the way to the ground in Africa in June. Fortunately for us, most of the big ones get away. In the case of 2018 UA, Earth's gravity even managed to warp its orbit around the sun.

https://www.cnet.com/news/in-rural-farm-country-forget-broadband-you-might-not-have-internet-at-all/

Paleontologists have discovered new evidence for a land bridge between Asia and North America. They discovered distinct footprints in Denali National Park, in the central Alaska Range made by therizinosaurs, a kind of predatory dinosaur believed to have become herbivores. But what was most unusual was the occurrence of dozens of hadrosaur footprints as well.

Reconstruction of the co-occurrence of hadrosaurs and therizinosaur based on fossil tracks found in Denali National Park in Alaska.

Although hadrosaur fossils are commonly found in Denali National Park, they had not been found previously alongside therizinosaur fossils. Skeletons of hadrosaurs and therizinosaurs are known to occur together in rock units in Mongolia, but finding evidence of them in Alaska was very unusual. In fact, this track association seems to be the only one of its kind in North America.



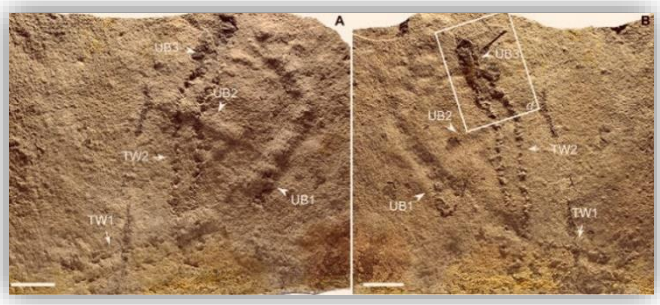
Dinosaur trackways from Denali National Park. The larger blue footprints belonged to hadrosaurs, while the smaller yellow prints were left by the therizonisaurs.

Plant-eating therizinosaurs are rare and unusual creatures in the fossil record. They had long skinny necks, little teeth, a small beak for cropping plants, and big torsos accompanied by large hind feet and long arms. Their best and most diverse fossil record is from Asia right up to the time of their extinction. The researchers believe that Alaska during the Cretaceous Period could have been a thoroughfare for fauna migrating between Western North America and Asia, the two continents sharing each other's fauna and flora in the latest stages of the Cretaceous.

To support the theory, the researchers worked to establish if the tracks were those of a therizinosaur and to study any unique aspects of the ecosystem. They determined that this particular area of Denali was a wet, marsh-like environment and that one fossil in particular looked like a water lily, supporting the hypothesis that there were ponds and standing water in the area. They suspect that both therizinosaurs and hadrosaurs liked these wetter locations. The Alaskan discovery may help connect these animals environmentally, and perhaps behaviorally, to other therizinosaurs in central Asia.

http://www.sci-news.com/paleontology/cretaceous-alaska-hadrosaur-therizinosaur-tracks-06284.html

And speaking of footprints, the oldest known animal "footprints" found on Earth were made by bilaterian animals with paired appendages about 545 million years ago in China. Bilaterians are animals, such as arthropods and annelids, that have paired appendages. They are among the most diverse animals in the fossil record and living today. They have often been thought have appeared and radiated suddenly during the Cambrian explosion, about 541-510 million years ago, despite the suspicion that their evolutionary ancestry was rooted in the Ediacaran period (635-541 million years ago – see above). Until now, however, animals with appendages had never appeared in the Ediacaran fossil record.



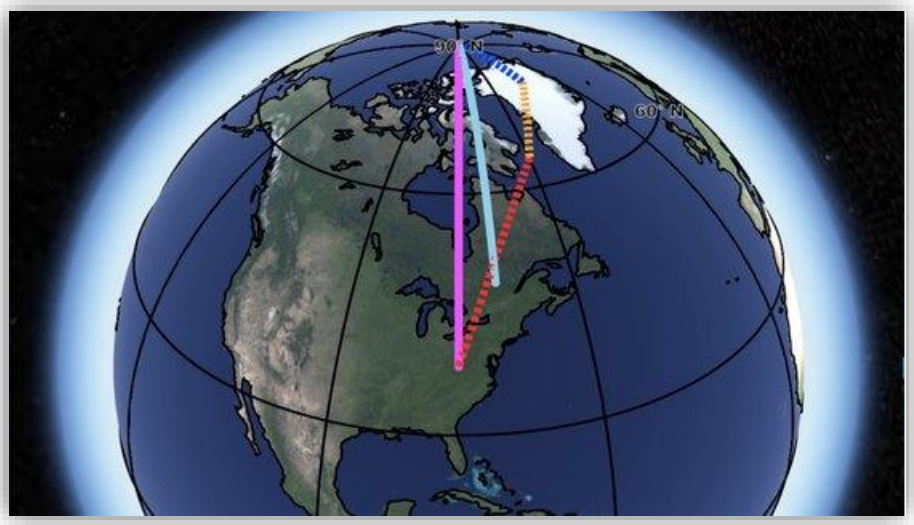
Ediacaran trackways (TW1 and TW2) and burrows (UB1 to UB3) excavated in situ from the Shibantan Member, Dengying Formation, China. A – top bedding surface and B – bottom bedding. Scale bars = 2 cm.

Paleontologists from China have studied trace fossils from the Ediacaran Shibantan Member (551-541 million years old) of the Dengying Formation in the Yangtze Gorges area, China. Thee trace fossils include apparently connected burrows and trackways preserved in close proximity. The trackways are somewhat irregular and consisting of two rows of imprints arranged in series or repeated groups. They probably were made by tiny (millimeter-sized) bilaterian animals with paired appendages that raised the animals' bodies above the sediment-water interface.

Although the animals that made them have not yet been found, the trace fossils represent some of the earliest known evidence for animal appendages and extend the earliest trace fossil record of animals with appendages from the Early Cambrian to the Late Ediacaran period.

http://www.sci-news.com/paleontology/oldest-animal-footprints-06088.html

The Earth's axis of spin has shifted about 34 feet since 1899. Now, thanks to the Jet Propulsion Laboratory (JPL), we appear to know why.



Earth's spin is wobbling because Greenland is losing ice (blue dotted line), melting glaciers are causing rebound (orange-yellow dotted line), and there is convection in the mantle (red dotted line).

There is no single process driving the alteration of Earth's axis. New research has quantified the reasons, finding that fully a third is due to melting ice and rising sea levels, particularly in Greenland, and placing the blame on anthropogenic climate change. Another third of the wobble is due to landmasses expanding upward as the glaciers retreat and lighten their load (eustatic rise). The final portion is the fault of the slow churn of the mantle, the viscous middle layer of the planet. Scientists have known for a long time that the distribution of mass around the Earth determines its spin. In addition, Earth's spin isn't perfectly even anyways thanks to slight gravitational wiggles in the movements of the stars. And space-based measurements made since the 1990s have confirmed that the Earth's axis of rotation drifts by a few centimeters a year, generally in the direction of Hudson Bay in northeastern Canada. Researchers know that part of this wobble had been caused by glacial isostatic adjustment since the end of the last ice age 16,000 years ago. As glaciers retreat, the landmass beneath them gradually rises over thousands of years, or collapses in those places where the ice had forced the land to create bulges.

The JPL researchers, however, found that glacial isostatic adjustment was responsible for only about 1.3 inches, or about 1/3 of the 4 inches of axis wobble per year observed during the 20th century. To find the remain 2/3, the research team built a computer model of the physics of Earth's spin, feeding in data about changes in the balance of land-based ice and ocean waters over the 20th century. They also accounted for other shifts in land and water, such as groundwater depletion and the building of artificial reservoirs. The results revealed that such environmental processes cause another 1.7 inches of wobble every year.

Greenland's melting ice sheet was a particularly important contributor because Greenland has released a huge amount of water into the oceans, where its mass has been redistributed. Mountain glaciers and smaller ice caps have also contributed to sea-level rise, but they aren't as concentrated, and their effects on the Earth's rotation often cancel each other out.

That left the final 1/3 of the wobble to be discovered, and the team looked to mantle convection as the culprit. By including convection in the model of Earth's wobble, the researchers finally accounted for the last 1/3 of the changes in the spin over the 20th century. The researchers pointed out that the Earth's wobble is not a prelude to some kind of environmental calamity. It doesn't affect agriculture or climate, but it does give scientists a way to figure out where Earth's mass is going. For example, Greenland's melt has become an increasingly large contributor to changing the axis location in the past 15 years, which is pushing the drift eastward. This is an important concept for climate scientists, because they can now understand which are the most important global mass transports that are going on today.

https://amp.livescience.com/63655-why-earth-wobbles.html)

Speaking of the mantle, scientists have discovered that mysterious blobs deep in the mantle could be minerals precipitated out of an ancient magma ocean formed by the collision that also created the moon. The blobs, called ultralow velocity zones, occur deep in the mantle, close to the core. We know they exist only because seismic waves from earthquakes traveling through them slow dramatically, indicating that the blobs are different from other parts of the mantle. But, no one was sure what they were.

Mysterious blobs in the Earth's mantle might be minerals precipitated from an ancient magma ocean formed during the creation of the moon.

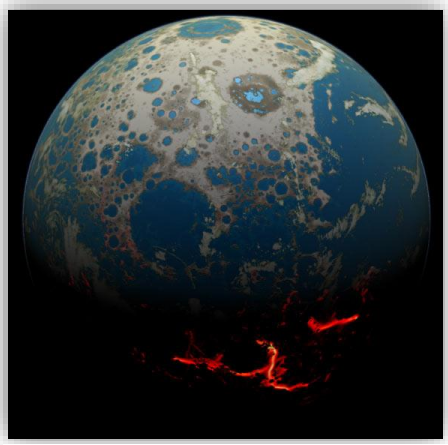
Now, new research suggests that the blobs could be an iron oxide-rich mineral, called magnesiowüstite, possible evidence for a magma ocean that might have existed 4.5 billion years ago. Back then, scientists speculate, a huge chunk of space rock slammed into Earth, spinning off the material that would become the moon, and possibly melting large portions of the Earth. If the blobs actually contain magnesiowüstite, it would indicate that a magma ocean had existed and the iron-rich oxide precipitated out and sank down to the base of the mantle.

The mantle is around 1,800 miles thick, and the ultralow velocity zones range from less than a mile to up to 62 miles thick and wide. They slow down seismic waves that travel through them by 30 to 50%. Because studying the blobs directly isn't possible (despite what Edgar Rice Burroughs and the producers of "The Core" might think), the researchers had to imitate the pressures of the deep mantle in the lab. They took a small sample of magnesiowüstite, put it in a pressure chamber, and squeezed it hard with a pair of diamond anvils. Then they bombarded the sample with X-rays and measured the energy of the X-rays as they exited the sample.

They found that at atmospheric pressure the energy exiting the mineral sample is always the same, no matter what direction they travel through it, whereas at high pressures everything changes. At core-mantle boundary pressures, the difference can be up to a 60%, depending on how it passes through. What does this mean for the real mantle? If the cooling-magma-ocean theory is true and there is magnesiowüstite deep in the mantle, it could be pushed, squished and nudged into an anisotropic configuration by pieces of oceanic crust that have been pushed deep into the mantle by subduction. It would be really good evidence to suggest the interaction of ancient slab subduction and ultralow velocity zones containing magnesiowüstite. The researchers hope to work with seismologists to see if seismic waves that enter ultralow velocity zones come out differently depending on the direction of travel. If they do, it will further bolster the magnesiowüstite hypothesis.

https://amp.livescience.com/63694-mantle-blobs-ancient-magma-ocean.html

Researchers from the US and Great Britain have looked into the distribution of helium-3 (^{3}He) and neon-22 (^{22}Ne) in order to present a new hypothesis that the Earth's tectonic plates developed over the course of billions of years. Previous models suggested the current ratio of these isotopes on Earth resulted from large-scale impacts, such as the one that created the Moon. A series of such impacts would have produced massive magma oceans that increased the $^{3}He/^{22}Ne$ ratio on Earth as they cooled and degassed over time.



Artist's depiction of the early Earth.

Although this is still possible, the researchers thought it was unlikely, and speculated it would

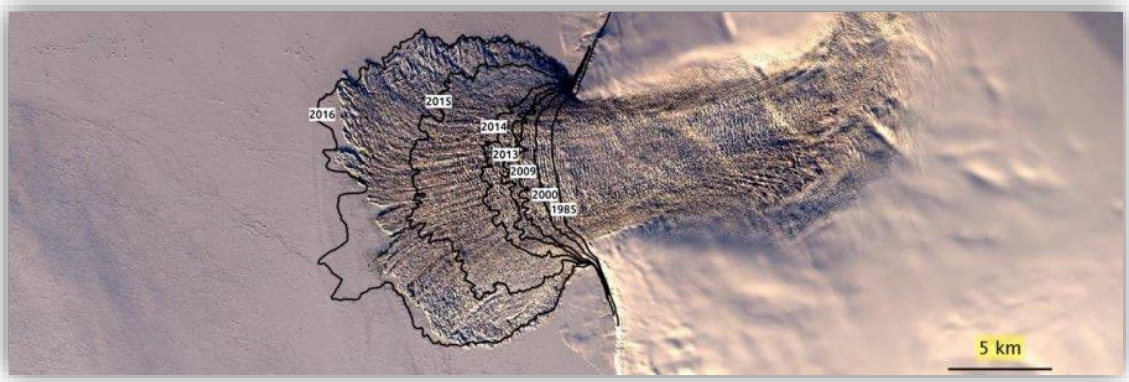
have raised the Earth's $^{3}He/^{22}Ne$ ratio only under very specific conditions. Instead, they suggest, as crust is continuously formed through plate tectonics, the ratio of helium to neon in the mantle beneath the crust increases. The researchers found that, by calculating the $^{3}He/^{22}Ne$ ratio in the mantle beneath the crust, and considering how this process would affect the whole of the Earth over long periods of time, they could devise a rough timeline of how long tectonic plate cycling has been occurring.

Because ^{3}He and ^{22}Ne were produced during the formation of the Solar System, and not by other means, they provide valuable insight into Earth's earliest conditions and subsequent geologic activity. This is important because, the we understand about ancient plate tectonics, the better we can appreciate how Earth got to be the way it is now.

http://www.sci-news.com/othersciences/geoscience/plate-tectonics-active-earths-beginning-06459.html

Glaciers and ice caps like the Vavilov Ice Cap in the Russian High Arctic cover nearly 300,000 mi^2 of Earth's surface and, if melted, would raise sea level by about one foot.

In a warming climate such as is currently occurring, acceleration of glacial melting is becoming more and more common. The rate of ice loss at Vavilov is extreme, however, and unexpected, according to researchers. In fact, scientists have never seen such acceleration in this kind of ice cap before, raising the possibility that other, currently stable ice caps may be more vulnerable than expected.



The Vavilov Ice Cap in the Russian High Arctic was accelerating as much as 82 feet per day in 2015, dwarfing the previous average speed of about 2 inches per day. This is challenging scientists' assumptions about the stability of Earth's high latitude ice caps.

As part of a new assessment, researchers used remote sensing from satellites operated by DigitalGlobe Inc. of Westminster, Colorado to observe the advancing ice and the ice cap's deterioration. This enabled them to watch ice on the cap creep slowly forward for several years, before it accelerated in 2010 and then surged rapidly forward in 2015. The researchers thought the initial, very slow advance was caused by a shift in the direction of precipitation that occurred about 500 years ago. Prior to that time, snow and rain came from the southeast; afterward it came from the southwest. Then, when the western part of the ice cap arrived at the ocean, the ice surged forward.

"Cold" ice caps, such as Vavilov, typically occur in areas having very little precipitation; they normally are frozen to their beds and flow only due to bending of the ice under the force of gravity. Those having beds above sea level normally are insulated from the kinds of changes that occur at glaciers in less frigid regions, where they melt from below because of warm sea water, or slide faster when warm surface meltwaters drain to the bed of the ice.

The researchers suspected the ice cap began to advance dramatically when the bottom of the ice cap became wetter and the front of the glacier advanced onto slick marine sediments. As ice flow began to speed up, friction caused some of the ice underneath the glacier to melt, supplying more water to the bottom of the ice. This, in turn, further reduced friction, causing the ice to speed up, which again produced more water. The researchers suspected some of this water might have mixed with clay beneath the glacier thereby reducing friction even further and allowing the astonishing sliding speeds to occur. By 2015, the sediments

and rock in the bed beneath the ice became so slippery that friction couldn't stop the ice from flowing. It took only two years for the base of the ice cap base transform into a nearly frictionless zone, well-lubricated and highly mobile. The glacier continues to slide today at accelerated speeds of more than 15 to 30 feet per day. The Vavilov Ice Cap advanced about 1.25 miles and lost about 0.3 mi^3 in total volume during the 30 years prior to speedup. In the year between 2015 and 2016, it advanced another 1.5 miles and lost about 1.07 mi^3 of ice, enough to cover Manhattan with about 250 feet of water, or the entire state of Washington with an inch!

Many scientists assume that polar ice caps sitting above sea level will respond slowly to climate warming. The researchers of this study, however, think this assumption needs to be questioned because the rapid collapse of the Vavilov Ice Cap has ramifications for glaciers in other polar regions, especially those fringing Antarctica and Greenland. And it is unlikely the ice cap will be able to recover ice mass as long as climate warming continues.

https://www.sciencedaily.com/releases/2018/09/180919144910.htm

Mount Soputan, a volcano on Sulawesi Island in Indonesia, erupted shortly after the island was struck by a powerful earthquake and tsunami in October. Authorities warned planes about volcanic ash in the air as the volcano spewed a massive amounts of ash more than 19,685 feet into the sky. Now a government volcanologist said it's possible the eruption was accelerated by the magnitude 7.5 earthquake that caused the devastating tsunami, although he couldn't say with any certainty that there was a direct link because of the distance of the mountain from the earthquake epicenter.

In response, geophysicists and geologists from the University of Syiah Kuala and the Indonesia Institute of Science stressed that there was no concrete evidence to link the two incidents. While it was possible that the earthquake triggered the eruption, it was not conclusive and needs to be investigated further. Although seismic waves from the earthquake could increase pressure in the volcano's magma chamber and cause an eruption, no one knows for sure yet if that happened. For example, geologists connected the eruption of Mount Talang in Sumatra early in 2005 to a devastating earthquake and tsunami in the Indian Ocean late in 2004.

The eruption of Soputan should not surprise anyone since Indonesia sits on the "Ring of Fire," and it is one of the most active volcanoes on Sulawesi. Fortunately, the winds on the island were not blowing in the direction of the tsunami devastation, so planes carrying aid and helping with evacuations didn't have to worry about ash. Unfortunately, social media seemed to show villagers fleeing from billowing black smoke from the volcano and a long smoldering lava river, both obviously hoaxes. In fact, no injuries or deaths had been reported.

On a side note, Indonesia's government seismologists are amazing people – they are constantly monitoring 139 active volcanoes in their country, more than any other nation on Earth.

https://www.stuff.co.nz/world/asia/107582992/volcano-erupts-on-same-indonesian-island-as-earlier-quake

Mount Soputan erupts in North Sulawesi, Minahasa, Indonesia

PGS WEBSITE OF THE MONTH

PGS Board-of-Directors

President:	Tamra Schiappa	**Director-at-Large:**	Albert Kollar	**Director-at-Large:**	Wendell Barner
Vice President:	Dan Harris	**Director-at-Large:**	Ray Follador	**Director-at-Large:**	Erica Love
Treasurer:	Kyle Fredrick	**Director-at-Large:**	Brian Dunst	**Counselor:**	John Harper
Secretary:	Ken LaSota	**Director-at-Large:**	Mary Ann Gross	**Counselor:**	Charles Shultz
Past President:	Peter Michael				

Other PGS Positions: **Newsletter Editor / Webmaster**: Karen Rose Cercone; **Historian:** Judy Neelan; **AAPG Delegates:** Dan Billman and Andrea Reynolds; **Continuing Ed:** Frank Benacquista

Officer Contacts: If you wish to contact a PGS Officer, you can email Tamra Schiappa, President, at tamra.schiappa@sru.edu; Dan Harris, Vice President at Harris_D@calu.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; or 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 Dan Harris, Program Chair at Harris_D@calu.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.

Facebook: Follow the PGS at https://www.facebook.com/PittsburghGeologicalSociety

Twitter: PGS can be followed on Twitter by searching out the username @PghGeoSociety

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

Fun Fact Having Nothing to Do with Geology

The average American will consume 4,500 calories and 229 grams of fat during a typical Thanksgiving feast with turkey and all the trimmings.

PGS THANKS OUR 2018 CORPORATE SPONSORS

ACA Engineering, Inc.
www.acaengineering.com

American Geosciences, Inc.
www.amergeo.com

American Geotechnical & Environmental Services, Inc.
www.AGESInc.com

Ammonite Resources
www.ammoniteresources.com

Applied Geology and Environmental Science, Inc.
www.appliedgeology.net

APTIM Environmental & Infrastructure, Inc.
www.aptim.com

AWK Consulting Engineers, Inc.
www.awkengineers.com/

Barner Consulting, LLC

The Baron Group Inc.

Billman Geologic Consultants, Inc.
www.billmangeologic.com

DiGioia, Gray & Associates, LLC
http://www.digioiagray.com

DORSO LP

Falcede Energy Consulting, LLC

Gannett-Fleming
http://www.gfnet.com/

Geo-Environmental Drilling Co., Inc.
www.geoenv.com

Groundwater & Environmental Services, Inc.
hwww.gesonline.com

HDR Engineering, Inc.
www.hdrinc.com

Howard Concrete Pumping Co., Inc.
www.howardconcretepumping.com

Huntley & Huntley, Inc.
www.huntleyinc.com

The Insite Group
http://insitegroup.org/

Laurel Mountain Energy
laurelmountainenergy.com

Montrose Air Quality Services
www.montrose-env.com

Moody and Associates Inc.
www.moody-s.com

PA Council of Professional Geologists
http://www.pcpg.org/

Pennsylvania Drilling Co.
www.pennsylvaniadrillingco.com

Pennsylvania Rock and Soil
http://www.pasoilrock.com/

Range Resources - Appalachia
www.rangeresources.com

Rosebud Mining Company
www.rosebudmining.com/

Seneca Resources Company LLC
www.natfuel.com/seneca

Stahl Sheaffer Engineering
http://www.sse-llc.com/

TD Geologic LLC
https://www.tdgeologic.com/

THG Geophysics, Ltd.
www.THGGeophysics.com

Your Company's Name Could be Here!

Support the educational mission of the Pittsburgh Geological Society by becoming a Corporate Sponsor.

https://pittsburghgeologicalsociety.org/corporate-sponsors.html