PITTSBURGH GEOLOGICAL SOCIETY

May 16, 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

Petroleum and U.S. Foreign Policy: A Historical Perspective

Thomas R. Moore

Groundhog Professional Services LLC

Deadline for reservations is noon on Monday, May 14.

Speaker Abstract

The relationship between petroleum and United States foreign policy is dynamic and varies from instances of crisis interspersed among long periods of seeming quiescence that often contain the seeds for the next blooming crisis. Although the past 45 years contained the oil shocks of 1973-74 and 1979-81, the petroleum industry crash of 1982-86, the return of peaking high prices with the Second Iraq War and the Arab Spring, and the "shale revolution", there is a much longer history of their symbiotic relationship. Much of the world that we—the Boomers through the Boomlets—have inherited was shaped by that relationship.

This presentation will briefly review some of that history and address some factors that may complicate our energy future—and energy has proven to be fundamental to economics, politics and power. *Omina causa fiunt*: everything happens for a reason.

Speaker Biography

Thomas R. Moore operates a geological and education consultancy, Groundhog Professional Services, LLC, and teaches petroleum, energy, and intro to geology classes for Indiana University of Pennsylvania and Bethany College. Previously, he was Chief Geoscientist for Unconventional Resources with EXCO Resources / North Coast Energy, senior geologist and exploration manager for CDX Gas, and Head of the Coal Section at the Illinois State Geological Survey.

T.R. Moore (far left) showing students around a Marcellus drilling pad in 2016.

Before moving back to the Eastern US, T.R. Moore had earlier established a successful consultancy in northeastern Oklahoma, where Vintage Petroleum was a major client. This was after having spent several years with Phillips Petroleum Company in a variety of positions in both development geology and research and services. At Phillips and since, he has been involved in recruiting, training and mentoring new hire and developing geoscientists and other technical professionals.

T.R. Moore is a Certified Petroleum Geologist through the American Association of Petroleum Geologists and has taught professional short courses for that professional society, employers, and other entities. He holds an M.A. in Geology from the University of Missouri and a B.A. in Geology from Indiana University of Pennsylvania.

PRESIDENT'S STATEMENT

Spring has finally arrived after what seemed like an extra-extended winter. The chilly weather may be a disappointment for some, but this slow transition to mild weather will be beneficial in the long run for the fruit trees, flowering shrubs and grapes. The longer they hold out from flowering, the less likely they are to be damaged by a late frost. As I write this, temperatures have risen and color is returning to the landscape. This means that summer is right around the corner and some of us are planning summer vacations and field work.

The topic for the upcoming meeting is timely and we end the year with an important discussion on petroleum and US foreign policy. I am sure you have noticed an increase at the pump this week. In Pennsylvania gas prices have risen to an average of $3.00 per gallon while in neighboring states the pump costs remain slightly lower. Now, I am not an economist and do not know much about the pricing of gasoline, but I do know that this price difference is controlled in part, by state and federal taxes per gallon of gasoline. Why are gas prices on the rise? It is quite simple: the higher the demand, the higher the production and more trips to the refinery and therefore higher costs. It also follows with an increase in the cost of a barrel of oil. As the cost of oil prices increase, so will the cost of all products of the hydrocarbon-based industries. The higher cost of fuel may become the new norm and while understanding what controls the price of gas is important, it is also important to have knowledge of the global market. This topic should help place it all into perspective. I hope to see you all there to help celebrate the last meeting of the year and to welcome back spring and warmer weather.

Thanks to all that came to our joint society student night last month. This event has been a great opportunity for the students from around the area to professionally present their research and learn about the work of their peers. I know that the presenters have benefited from the interactions with their peers and the professional members. I have heard from students who are grateful for the feedback and words of encouragement. Congratulations to all the 2018 student awardees.

I would like to thank the board members for their hard work throughout the year. I commend your dedication and commitment to PGS. It is because of your hard work that PGS continues to be a thriving professional society. A special thanks to Karen Rose Cercone for maintaining the webpage and for putting the newsletter together, and to John Harper for his editorial skills. It isn't easy getting all the contributions in and out in a timely manner, but our team manages it.

As a reminder, the spring field trip will be on Saturday May 26. Please see the next page of the newsletter for the schedule and a sign-up form, or visit our webpage if you would prefer to register for the trip online.

Wishing everyone a wonderful summer and look forward to a new year with an exciting speaker series. See you in the fall!

Tamra

Tamra Schiappa

2018 PGS SPRING FIELD TRIP
SATURDAY, MAY 26, 2018

Geology of the Early Iron Industry in Fayette County, PA

John A. Harper and Albert D. Kollar, Trip Leaders

The field trip will leave from Century III Mall (Pleasant Hills, PA) at approximately 8:30 am and return at approximately 4:00 pm. There will be five stops in Fayette and Westmoreland Counties, including:

STOP 1: SCENIC OVERLOOK AND INTRODUCTION TO THE GEOLOGY OF CHESTNUT RIDGE

Includes a scenic overview of Uniontown, Fayette County, and the northwest flank of Chestnut Ridge, one of only three "major" anticlinal structures in western Pennsylvania.

STOP 2: HISTORIC WHARTON CHARCOAL BLAST FURNACE

This historic furnace, built and operated by Congressman Andrew Stewart in 1839, was added to the National Register of Historic Places in 1991. The PA Department of Conservation and Natural Resources restored and maintains the site.

STOP 3: NATURAL GAS STORAGE IN NORTH SUMMIT STORAGE FIELD

Summit gas field, discovered in 1937, produced natural gas primarily from the Middle Devonian Huntersville Chert on Chestnut Ridge. Consolidated Natural Gas Corporation converted the largest pool in the field to natural gas storage in 1990. Storage field equipment occurs throughout the area. The subsurface geology is very complex.

STOP 4: AMERICA'S FIRST PUDDLING IRON FURNACE

In 1817 America's first puddling iron furnace was located along Redstone Creek in Fayette County. A puddling iron furnace removed carbon from brittle pig iron creating malleable wrought iron in one step, and in the process making iron production much more efficient and less costly. We will view a recent PA historical marker commemorating that fact, as well as see where the furnace and rolling mill were located. Lunch and break.

STOP 5: WEST OVERTON – BIRTH PLACE OF COKE MAGNATE HENRY CLAY FRICK

Henry Clay Frick was born in a springhouse adjacent to his grandfather Abraham Overholt's rye whiskey distillery in West Overton, Westmoreland County. From these humble beginnings, Frick went on to create an empire based on the production of coke needed for steel manufacturing. Today, West Overton is a historic community that includes the Overholt homestead and distillery, which is now a museum. Tours are available and, if we get enough people to sign up for the trip, the museum will provide samples of Old Overholt for tasting.

Cost of the field trip is $30 per person. We will provide water and snacks, but you will need to bring your own lunch. You can sign up and pay online through PayPal at our website, or print this form and mail with a check, payable to PGS, to John A. Harper, Pennsylvania Geological Survey, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

Name: _____ **Phone:** _____

Email Address: _____ **# of Attendees:** _____

Sign-up deadline is Friday, May 18, 2018, after which John Harper will contact you with additional logistical information about the trip.

UPCOMING EVENTS OF INTEREST TO MEMBERS

hosted by

ODNR Division of Geological Survey

INSTRUCTOR: Dr. Carlton Brett, Professor of Geology, University of Cincinnati

WHEN: Thursday, May 17, 2018, 10:00 a.m.–4:00 p.m.

WHERE: H. R. Collins Core & Sample Repository, 3307 S. Old State Road, Delaware, Ohio 43015

COST: $25, incl. materials, light morning/afternoon refreshments, and a pizza lunch.

REGISTRATION: Limited to 20 attendees. Register online at:
ohiogeosoc.org/events/silurian-stratigraphy-and-core-workshop

WHO SHOULD ATTEND: Professionals and students interested in the complex facies changes in the Silurian section particularly in central and western Ohio.

WORKSHOP OVERVIEW: Dr. Brett will summarize paleogeography and depositional environments of the Silurian System in Ohio and surrounding areas. Attendees will examine cores from Greene and Pickaway Counties, focusing on uppermost Ordovician through lower Silurian units—from the Centerville Shale to the Cedarville Dolomite—identified in central and western Ohio. Attendees will match geophysical logs with lithologies present in the cores, determine contacts, and recognize diagenetic features, sedimentary structures, and fossil indicators. Sequence and event stratigraphy principles and interpretations will be applied to lithologies in the cores along with chronostratigraphic comparison of the two cores.

Detailed directions to the Collins Lab are available at:
OhioGeology.com

UPCOMING EVENTS OF INTEREST TO MEMBERS

7
Oct

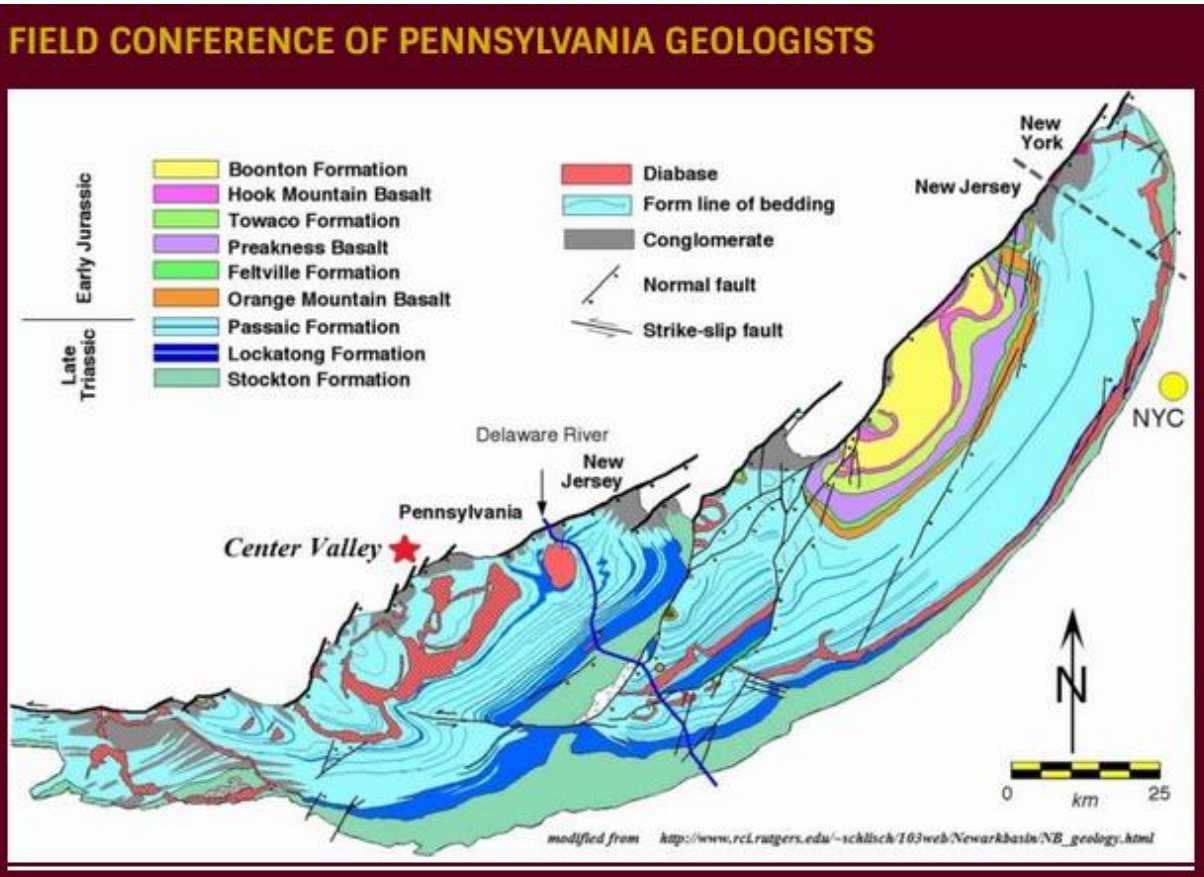
47th Annual 2018 AAPG-SPE Eastern Section Joint Meeting

LOCATED IN PITTSBURGH, PENNSYLVANIA

Join us in Pittsburgh, PA for the 2018 annual joint meeting of the AAPG-SPE Eastern Section. The Pittsburgh Section of the Society of Petroleum Engineers will be collaborating with Eastern Section of AAPG to host this meeting with the Pittsburgh Association of Petroleum Geologists and the Pittsburgh Geological Society. The meeting will be held at the Wyndham Grand Hotel, downtown Pittsburgh. 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. We invite you to save these dates, October 7 to 11, 2018, and join us.

✔ Register for Event | Call for Abstracts | More Information

The 2018 Field Conference of Pennsylvania Geologists will visit the Newark Basin



This year's conference will focus on the Newark Basin in Pennsylvania and New Jersey. Trip leaders are Paul Olsen from Lamont-Doherty/Columbia, Martha Withjack and Roy Schlische from Rutgers, Maryann Malinconico from Lafayette, LeeAnn Srogi from West Chester and Frank Pazzaglia from Lehigh. **The dates are October 4-6**, the first weekend in October.

The headquarters will be the Homewood Suites in Center Valley, south of Allentown/Bethlehem and just off I-78. It is a brand-new hotel that was built near the former Friedensville Zinc mine. Seventy-five rooms have been reserved for the conference at a rate of $102/night. A Springhill Suites/Marriot is also nearby. Registration for the conference should again run around $250.

Registration will begin August 1, 2018 at 9:00 AM.

GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

May 1, 2018
"2D Seismic Swaths Converted into a Pseudo 3D Seismic: An Appalachian Basin Case Study" by Jianli Yang of Seneca Resources

Cefalo's Banquet & Event Center, Carnegie PA

PENN STATE COLLEGE OF AGRICULTURE

May 8, 2018
Pennsylvania Groundwater Symposium (with pre-conference hydrological field trip on May 7)

The Ramada Inn Conference Center
State College, Pennsylvania 16801

AMERICAN CHEMICAL SOCIETY ENERGY TECHNOLOGY GROUP

May 10, 2018
"An Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County PA" by Richard Hammack of the U.S. National Energy Technology Laboratory

Lombardozzi's Restaurant, Pittsburgh PA

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

May 17, 2018
"Delivering on Our E&P Promises, Revisited" by Creties Jenkins P.E., P.G. of Rose and Associates

Cefalo's Banquet & Event Center, Carnegie PA

ASCE – GEO-INSTITUTE OF PITTSBURGH

May 21, 2018 (3:30 to 6:30 PM)
"Advances in the Prediction and Control of Ground Deformations" by Andrew Whittle of MIT, the 2018 ASCE Geo-Institute Cross-USA Lecturer

Hofbrauhaus Restaurant, Pittsburgh PA

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

Alexandra R. Cheek
Geology Department
California University of Pennsylvania

Eric M. Patsilevas
Department of Geology
Kent State University

If The Avengers Had Recruited Geologists

SCENES FROM THE 2018 STUDENT DRILLING WORKSHOP

This past April, another very successful student field workshop was put together by Frank Benacquista and volunteers from PGS. Professional geologists from a range of industries came together over two days to share their career paths and advise students on how to prepare for the jobs of the future. We thank Kyle Fredrick, Dan Harris, Tamra Schiappa, Ray Follador, Steve McGuire, Dan Billman, Dan Martt, Steve Pesch, Heather Krivos, and Erica Love for helping out at the workshop. Geo-Environmental Drilling, Pine Environmental, and KU Resources contributed logistical support, and financial underwriting was generously donated by Wally and Sue Phillips in support of student education. Most of all, we wish to acknowledge Frank Benacquista, whose long-standing commitment to mentoring students has benefitted both our society and our profession.

PGS MEMBER ALBERT KOLLAR BRINGS TOGETHER THE 'TWO CULTURES' OF ART AND SCIENCE

Albert Kollar with Russell Smith's oil painting, "Pittsburgh Fifty Years Ago from the Salt Works on Saw Mill Run" at the Carnegie Museum of Art.

PGS Awards Committee Chair and 3-term former President Albert Kollar has been making news lately through his study of the art of the Carnegie Museum in Pittsburgh. Albert delivered a talk at the annual Geological Society of America meeting in Seattle last October on the use of art to provide information about the changing face of the Earth and mankind's role in it. He had been using his interest in many of the 19th century landscape paintings hanging on public display at the Carnegie Museum of Art to educate museum docents and patrons on the evolution of the so-called "Anthropocene". As Albert told JoAnna Wendel, a staff writer for the American Geophysical Union's magazine, EOS (v. 99, no. 4, p. 15-17 – see link below), 19th and early 20th century landscape paintings record information 21st century geologists can use to determine how much of the Earth has changed due to human influence. "We can look back 150 years and see that what started out as just a landscape that an individual saw was also the beginning of the Industrial Revolution", the time many scientists believe atmospheric concentrations of greenhouse gases began to rise significantly. Some of the paintings Albert used for his talk show Pittsburgh during that period with palls of smoke hanging over the rivers as the salt, transportation, and steel industries, to name a few, belched out clouds of sulfurous gases that also helped denude the city's hillsides. The EOS article has drawn attention from others who find Albert's work on pre-Industrial and Industrial Revolution-era paintings and their relationship to studies of the "Anthropocene" inspiring. Good job, Albert!

https://eos.org/wp-content/uploads/2018/03/april-18-eos-magazine.pdf

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

What is now the Borough of Thornburg was formerly the site of the first railroad built in Pennsylvania to take coal to market, circa 1849. Located between Rosslyn Farms and Crafton, approximately four miles from downtown Pittsburgh, Thornburg was founded in 1899 by cousins Frank and David Thornburg, who formed a company to develop 250 acres of Robinson Township into a suburban community of Pittsburgh. Considered to be a significant example of early suburban planning, it was officially incorporated as a borough in 1909.

View of the Borough of Thornburg with the Thornburg Conservation Park in the foreground.

Thornburg is surrounded by scenic hillsides and is situated on a bluff overlooking Chartiers Creek and the creek valley. What is now the Thornburg Conservation Park was initially laid out as a golf course in 1898, one of the first in Allegheny County. By 1908, a clubhouse had been added; the land was privately owned for many years. The borough finally acquired the golf course property in 2005, and turned it into a conservation area that provides a popular walking trail for people in the area.

DID YOU KNOW . . . ?

Is it possible there were civilizations on Earth long before the evolution of humans? How do we know there weren't numerous such civilizations that rose and fell millions of years ago? That's the question posed in a thought experiment by University of Rochester's Professor Adam Frank and Dr. Gavin Schmidt of NASA's Goddard Institute for Space Studies. Of course, no one has seen any evidence of another industrial civilization, but by looking at the deep past in the right way, a new set of questions about civilizations and the planet appear. Such as: What geological footprints do civilizations leave? Is it possible to detect an industrial civilization in the geological record once it disappears from the face of its host planet?

If an industrial civilization had existed on Earth many millions of years prior to the human era, what traces would it have left, and would they be detectable today?

Such questions make us think about the past and the future in different ways, including how a planetary-scale civilization might rise and fall. The researchers defined civilization by its energy use. Thus, the not-yet-formally-recognized geologic epoch, the "Anthropocene", the time in which human activity strongly influenced the climate and environment. In the "Anthropocene", fossil fuels have become central to the geological imprint humans will probably leave behind on Earth. By looking at this imprint, the team examined what kinds of clues future scientists might study to detect that human beings existed, and in doing so, they laid out what kind of clues might have been left behind if industrial civilizations existed millions of years in the past.

For example, humans began burning fossil fuels more than 300 years ago, marking the beginnings of industrialization. We know, for example, that the burning of fossil fuels has emitted gases and particulates into the atmosphere that has already changed the carbon cycle in such a way that it is recorded in carbon isotope records. Other ways humans might leave behind a geological footprint include: 1) global warming from the release of CO2; 2) perturbations to the nitrogen cycle from fertilizers; 3) greatly increased erosion and sedimentation rates because of agriculture; 4) plastics, synthetic pollutants, and even things such as steroids, which will be geochemically detectable for millions, if not billions, of years; and 5) non-natural radioactive isotopes from nuclear power plant accident, stored radionuclides, and, heaven forbid, possible nuclear war. But, burning fossil fuels may actually cause our civilization to decline, so what imprints would this or other kinds of industrial activity from a long dead civilization leave over millions of years?

Such questions are part of a broader effort to address climate change from an astrobiological perspective, as well as a new way of thinking about life and civilizations across the Universe. In other words, looking at the rise and fall of civilization on Earth in terms of our planetary impacts can also have a bearing how astrobiologists could approach future explorations of other planets.

So, for example, we know early Mars and early Venus were somewhat more habitable than they are now. It is conceivable that someday someone will drill through the sediments there. Will they find any indication of past life, or even a past civilization? If a civilization is able to find a more sustainable way to produce energy without harming the planet, it will leave behind less evidence that it was there. The bottom line, the team decided, is that we need to figure out a way of producing and using energy that doesn't put us at risk.

http://www.sci-news.com/featurednews/silurian-hypothesis-05921.html

An international research team has found that stromatolites from the 1.6-billion-year-old Chitrakoot Formation in India contain abundant fossilized oxygen bubbles. The cyanobacteria ("blue-green algae") that thrived in early shallow waters and built stromatolites produced oxygen by photosynthesis. Sometimes the oxygen became trapped as bubbles within the sticky microbial mats along with sediment. In studying the fossilized Indian sediments, the team found round spheres in the microbial mats, which they interpreted as oxygen "bubbles" created in cyanobacterial biomats in shallow waters 1.6 billion years ago.
Cyanobacteria changed the face of the Earth

Fossilized bubbles and cyanobacterial fabric from 1.6 billion-year-old phosphatized microbial mats of the Chitrakoot Formation

irreversibly because they were responsible for oxygenating the atmosphere. At the same time, they constructed the stromatolites you can still find on Earth today (e.g., the Cambrian and Ordovician rocks of central Pennsylvania are full of them. Also, modern stromatolites, which are quite common in Shark Bay, Australia, indicate that cyanobacteria are still active in Earth's environment). Because of their discovery, the team now thinks that cyanobacteria played a larger role than previously thought in creating phosphorites in shallow waters, thereby allowing today's scientists a unique window into ancient ecosystems.

http://www.sci-news.com/paleontology/oxygen-bubbles-stromatolites-05790.html

Another international research study has discovered that the increase in oxygen that occurred during the Great Oxidation Event about 2.3 ga was much greater than previously indicated. This discovery came from halite taken from a 1.2-mile-deep hole (the Onega Parametric Hole) drilled on the shore of Lake Onega in Karelia in northern Europe. The halite crystals, as well as other salts of Ca, Mg, and K, are over a billion years older than any previously discovered salt deposits. The salt crystals formed during the evaporation of ancient seawater.

The key indication of the increase in oxygen production resulted from the discovery of a surprisingly large amount of sulfate, which was created when sulfur reacted with oxygen, providing very strong evidence that the seawater had high sulfate concentrations (at least 30% of present-day oceanic sulfate). No one had previously considered the sulfate concentration of Precambrian ocean waters as possibly being that high, so scientist must now rethink the magnitude of oxygenation in the early Earth's atmospheric/oceanic system.

Pink-white halite left over from evaporated 2-ga seawater with embedded fragments of calcium sulfate recovered from a drill core in Karelia.

According to geological evidence, oxygen began to show up in the Earth's atmosphere between 2.4 and 2.3 ga, but geologists were uncertain whether the oxygen buildup (caused by the growth of photosynthesizing cyanobacteria) took millions of years or was a much more rapid event. The concepts were difficult to test because there was no evidence about the early Earth's atmospheric concentrations – until the salt crystals from the Onega Parametric Hole provided that evidence. The team believe that their work provides evidence that this period of time involved a lot of oxygen production, and will spur the development of new models to explain what happened after the Great Oxidation Event to cause the accumulation of oxygen in the atmosphere. There may have been important changes in feedback cycles on land or in the oceans, or a large increase in

oxygen production by microbes. Either way it was much more dramatic than science understood before the Onega hole was drilled.

http://www.sci-news.com/geology/sea-salt-earths-great-oxidation-05846.html

Most of us are familiar with *Archaeopteryx,* the iconic fossil from the Late Jurassic of Solnhofen in southeastern Germany that had feathered wings. For many years, no one was certain whether this "dino-bird" was a ground dweller, a glider, or an active flyer. Although it is common knowledge that modern-day birds descended from the dinosaurs, many questions about early bird evolution and the development of avian flight remain unanswered.

Artist's rendering of *Archaeopteryx lithographica*, one of the earliest known birds, and what it might have looked like in flight.

Now comes word that a team of European researchers used synchrotron microtomography to look inside *Archaeopteryx* fossils, enabling them to analyze their internal structures. The exceptional sensitivity of X-ray imaging techniques for investigating large specimens offers harmless microscopic insight into fossil bones and allows virtual 3D reconstructions of extraordinary quality, so that no fossils are damaged during research. The team's results indicate that *Archaeopteryx's* wing bones were adapted for incidental active flight, but not for the advanced style of flying mastered by modern-day birds. *Archaeopteryx* shows a mosaic of anatomical features illustrating the close familial relations between the raptorial dinosaurs and birds. Whereas most modern birds are highly specialized for powered flight, however, many of their most characteristic adaptations, such as the shoulder, are absent in Archaeopteryx, whose primitive shoulder structure is incompatible with the modern avian wing beat cycle. Evolutionary adaptation influences the cross-sectional architecture of an animal's limb bones toward achieving optimal strength while maintaining minimal mass and functional adaptation to the forces experienced during life. Therefore, by comparing the bones of living animals with those of fossils using statistical analysis it is possible to discover new information.

The researchers focused on the middle part of the arm bones, because they knew those sections contained clear flight-related signals in birds. The scans revealed that *Archaeopteryx*'s wing bones, unlike its shoulder girdle, shared important adaptations with those of modern flying birds. They also noticed that the bone walls of *Archaeopteryx* were much thinner than those of typical dinosaurs, but that they looked a lot like conventional bird bones. Data analysis demonstrated that the bones of *Archaeopteryx* plotted closest to those of birds like pheasants that occasionally use active flight to cross barriers or dodge predators; they were not built for the sort of gliding and soaring that hawks, some seabirds, and others use for enduring flight.

Geologists traditionally interpret the region around Solenhofen as a tropical archipelago, which would have been highly suitable for island hopping or escape flight. It is also interesting that *Archaeopteryx* lived during the time when primitive pterosaurs shared the skies (their descendants were the gigantic pterosaurs of the Cretaceous, such as *Pteranodon* and *Quetzelcoatlus*). The team found similar differences in wing-bone geometry between primitive and advanced pterosaurs as those between actively flying and soaring birds.

http://www.sci-news.com/paleontology/archaeopteryx-active-flyer-05814.html

Steep mountain ranges can draw CO_2 out of the atmosphere, something scientists have known for a while. When erosion exposes new rock, a chemical reaction occurs between the rock-forming minerals on hill slopes and CO_2 in the air that results in weathering the rock and producing carbonate minerals like calcite. Now, a new study led by researchers from the Woods Hole Oceanographic Institution has found that erosion can also be a source of new atmospheric CO_2 that can be released back into the atmosphere far faster than it is being absorbed by the newly-

exposed rock. This study helps undo a long-standing hypothesis that more mountains mean more erosion and weathering, which means an added reduction of CO_2.

Mountain erosion is a source of new CO_2 that can be released back into the atmosphere faster than it's being absorbed into newly exposed rock.

The source of the extra CO_2 isn't entirely geological. Instead, tiny microbes in mountain soils are metabolizing ancient bits of organic carbon trapped in the rock and spewing out CO_2. The researchers came to this realization after studying the central range of Taiwan, considered one of the most erosion-prone mountain chains in the world as a result of the number of major typhoons that hit the island nation every year.

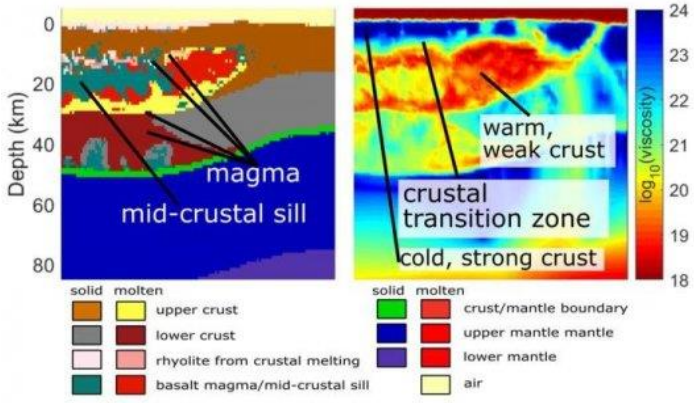
The researchers examined samples of soil, bedrock, and river sediments from the central range, looking for telltale signs of organic carbon in the rock. What they found was surprising. Unweathered rock occurs at the very bottom of the soil profile, followed at the basal soil layer by loose rock that has not been fully broken down. At this point the organic carbon present in the bedrock seemed to disappear entirely, but there was an increase in bacterial lipids.

The researchers don't yet know which bacteria are doing this, something for future research. The total level of CO_2 released by the microbes isn't severe enough to have any immediate impact on climate change. The processes instead take place on geologic timescales. The team's research will probably lead to a better understanding of how lithospheric carbon cycles actually work, which could help generate clues to how CO_2 has been regulated since the Earth itself formed.

https://www.sciencedaily.com/releases/2018/04/180412141023.htm

Yellowstone National Park is a supervolcano known for its explosive eruptions, large calderas, and extensive lava flows. For years, it has attracted the attention of scientists trying to understand the location and size of magma chambers below it. The last caldera forming eruption occurred 630 ka, whereas the last large volume of lava surfaced 70 ka. Recently, a team of scientists from the University of Oregon unveiled a new explanation for the geology based on seismic images taken of magma bodies below the park.

Magma that rises from a mantle plume below the park heats and softens the crust, similar to the source of the magma at Hawaii's Kilauea volcano. Large amounts of water fueling the Yellowstone geysers and hot springs cool the crust and prevent it from becoming too hot. Using computer modeling, the team found that opposing forces 3 to 6 miles deep counter each other, forming a transition zone where cold, rigid rocks of the upper crust give way to hot, ductile, partially molten rock below. The transition traps rising magmas and causes them to accumulate and solidify in a sill up to 9 miles thick. This mid-crustal sill consists mostly of solidified gabbro, whereas the rock above the sill contains a sticky, gas-rich rhyolitic magma that occasionally erupts in huge explosions.



Graphic provides new structural information about the location of a mid-crustal sill that separates the magma under Yellowstone National Park.

Scientists had already detected seismically that a second, larger body of magma existed 12 to 27 miles deep, but could not detect its composition, amount of magma, nor how it came to be. In repeated analyses, the team got results indicating

a large layer of cooled magma with a high melting point forms at the mid-crustal sill, separating two magma bodies with magma at a lower melting point, much of which is derived from melting of the crust. They think that this structure is what causes the rhyolite-basalt volcanism throughout the Yellowstone hotspot, including supervolcanic eruptions. This research does not help predict the timing of future eruptions, but it does provide a new view that helps explain the structure of the magmatic plumbing system fueling the eruptions. It shows where the eruptible magma originates and accumulates; this could help future predictions.

An aerial view of the Yellowstone Caldera, an enormous valley created by an ancient super-volcano eruption.

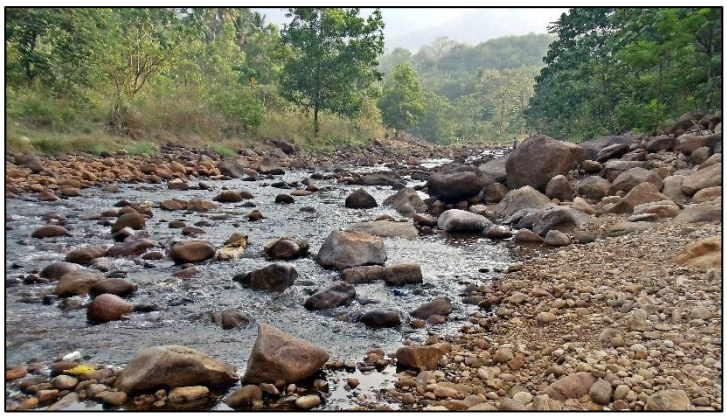
The research also helps explain some of the chemical signatures seen in eruptive materials, and it can be used to explore how hot the mantle plume is by comparing models of different plumes to the actual situation at Yellowstone based on the geologic record. The team believes that, by studying the interaction of rising magmas within the crustal transition zone and how it influences the properties of the magma bodies that form both above and below it, the scientific community should have a better understanding of how mantle plumes influence the evolution and structure of continental crust.

https://www.sciencedaily.com/releases/2018/04/180416185610.htm

By combining mathematical models with laboratory experiments and field measurements from a river, an ocean, and a dune field, a team of researchers from the University of Pennsylvania and Budapest University of Technology and Economics has found that the same general processes guide the rounding of grains from those diverse environments. They showed that wind-blown sand, river pebbles, and wave-worked pebbles all round in the same way by colliding, and, more importantly, they showed how nature selects for the conditions that lead to this universal behavior.

The mathematical models explaining the universality of this evolution were created in recent decades during the effort to prove the Poincaré conjecture, a major breakthrough in pure mathematics. It turns out that the same equations can be used as models for natural shape evolution. Developing this generality about how particles round can help scientists piece together the history of other particles. In fact, the team used it to reconstruct the transport history of pebbles on Mars in an article that affirmed the likelihood of liquid water on that planet.

The work may also enable researchers to track the bits of sediment that chip off of larger particles and end up building wetlands, floodplains, and beaches, and affecting everything from hurricane resiliency to agricultural productivity. In earlier studies, the team showed that particles first



By river, ocean, or wind, rocks round the same way.

become smooth as they bounce down a riverbed, having their sharp corners chipped off, and then become smaller as they continue to collide with other particles.

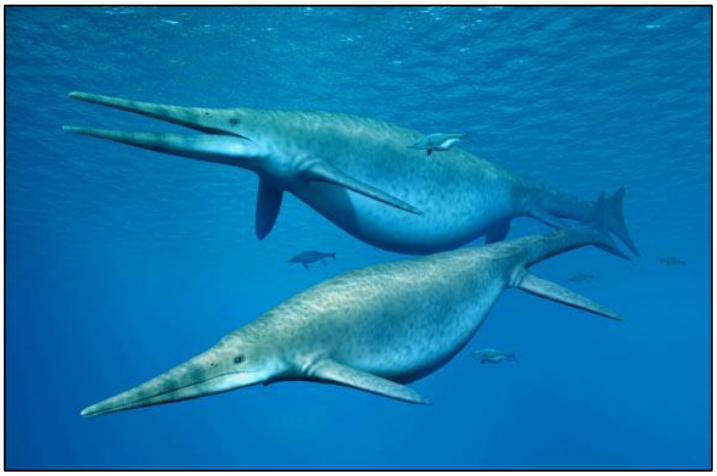
In their new study, they showed how simple geometry predicts a common shape evolution for most sediments, regardless of whether they are wind-blown sand grains, limestone blocks colliding in a rotating drum, or pebbles sloshing around in the wave zone of the ocean. They used data sets from dunes at White Sands, NM, a riverbed in Puerto Rico, a beach in Italy, and their research lab to show that their hypothesis held true. Collisions with other particles caused all of these particles to round in an identical manner.

This is because of constraints that particles traveling along a bed share, regardless of whether the bed belongs to a river, a dune, or an ocean. The particles tend to originate as elongated shapes that collide with similar-sized particles, and do so with a level of force that favors the chipping off small fragments of sediment, rather than succumbing to larger forces that might cause a particle to fragment in large pieces, or weak forces that would wear away a surface like sandpaper. The researchers now have the mathematical tools they need to reconstruct the transport history of any particle of sediment based on its shape, improving their ability to predict landscape evolution over time.

https://penntoday.upenn.edu/news/river-ocean-or-wind-rocks-round-same-way

A fossil collector found a large isolated piece of bone from the lower jaw of a Late Triassic marine reptile found in Somerset, England, a few years ago. What makes this particular piece of bone special is that it belonged to one of the largest animals that ever lived. Studied by paleontologists from England and New York, the bone proved to be part of the lower jaw of a giant ichthyosaur estimated to have been as much as 85 feet long, almost the size of a modern blue whale.

The largest known ichthyosaur, Shonisaurus sikanniensis, a member of the shastasaurid ichthyosaurs, is 69 feet long. There are enough similarities between the new specimen and S. sikanniensis to suggest that the bone fragment also belongs to a giant shastasaurid. Although the bone fragment is large, it is, after all, only a fragment, so it is difficult to provide a size estimate. By using a simple scaling factor and comparing the same bone in S. sikanniensis, however, the paleontologists were able to estimate that the Somerset specimen was about 25% larger than S. sikanniensis. Of course, such estimates are not completely realistic because of numerous differences between species, but scaling is especially common to estimate size when comparative material is scarce.



The giant ichthyosaur *Shonisaurus*

The discovery of the bone fragment also helped resolve another problem. Over the years, several large and/or incomplete bones were described from England that had been identified as dinosaurs and other reptiles. The discovery of the Somerset specimen helps refute the previous identifications including one that claimed some of the bones represented an early experiment of dinosaur-like gigantism in terrestrial reptiles. The bones are, in fact, jaw fragments of giant, previously unrecognized ichthyosaurs, possibly even larger ones than the Somerset animal. But, in order to verify these findings, paleontologists need a complete giant Triassic ichthyosaur from the UK, something that probably never will be found.

http://www.sci-news.com/paleontology/giant-triassic-ichthyosaur-05901.html

PGS WEBSITE OF THE MONTH

https://geology.com/minerals/garnet.shtml

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Fun Fact Having Nothing to Do with Geology

May 29 is officially “Put a Pillow on Your Refrigerator” Day. (And before you ask - no, we have no idea why.)

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