PITTSBURGH GEOLOGICAL SOCIETY

FEBRUARY 21, 2018

Social hour	**6:00 PM**
Dinner	**7:00 PM**
Program	**8:00 PM**

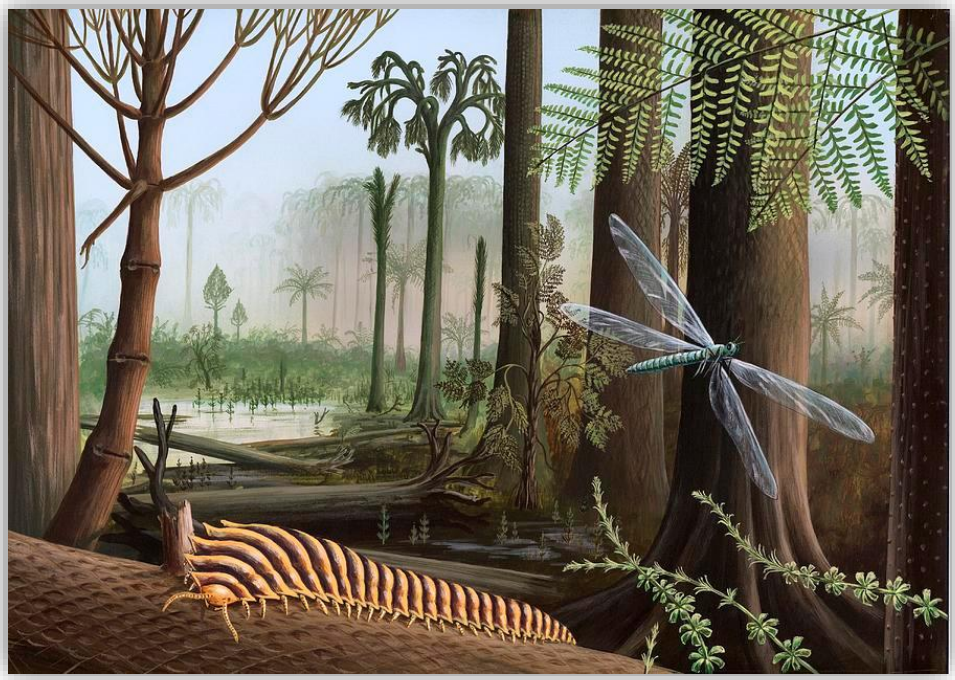
Dinner costs
$30.00 per person
$10.00 student member

Reservations
Email your name and number of attendees in your party to: pgsreservations@gmail.com

You can also reserve and pay via PayPal on: https://www.pittsburghgeologicalsociety.org/

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

The oldest evidence of leaf eating insects from the Price Formation (Lower Mississippian) of West Virginia



Dr. Michael T. Dunn
Department of Biological Sciences
Cameron University, Oklahoma

Deadline for reservations is noon on Monday, Feb 19.

SPEAKER ABSTRACT

The Lower Mississippian Price Formation of Virginia and West Virginia includes some of the oldest commercially mined coal in the U.S. to the east and becomes marine/brackish to the west.

The Alta locality of the Price Formation in southern West Virginia is a relatively recently discovered outcrop that continues to produce a diverse assemblage of Mississippian age plants. The Alta strata are loosely dated as Tournaisian to Visean due to nearby complex faulting, and may represent a series of over-bank flood deposits that preserved the plant remains as compressions in fine-grained sandstones to mudstones.

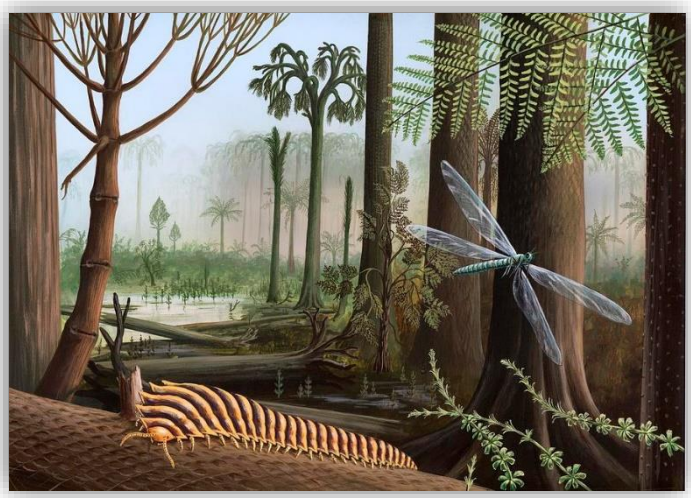
The flora consists of at least 10 plant organ taxa representing seed plants, lycopsids, and possibly ferns and progymnosperms. Foliage taxa include *Charbeckia macrophylla*, *Genselia compacta*, *Chlidanophyton* sp., *Rhodea* sp., and *Protobarinophyton* sp., and stem taxa include specimens previously assigned to *Lepidodendropsis*. Ovules and ovulate cupules include *Lagenospermum*, *Gnetopsis*, and several undescribed specimens, plus fertile axes assignable to *Chlidanophyton.*

A recent re-evaluation of the Alta flora suggests that some of these plant remains reveal the oldest evidence of insects feeding on leaves. This evidence includes hole feeding, margin feeding, piercing and sucking, leaf mining, and possible galling. As the Price Formation covers nearly all of the infamous ‘Romer’s Gap’ with its paucity of vertebrate and arthropod evidence, these data add to our rapidly increasing understanding of the distribution and diversity of Mississippian age terrestrial colonization.

SPEAKER BIOGRAPHY

Mike Dunn earned his Bachelors Degree in Biology and Masters Degree in Geology from Boise State University, and his PhD in Biology, specializing in Paleobotany, from Ohio University. His expertise is in Mississippian aged plants, but he also enjoys forays into the Pennsylvanian, Permian, and Miocene. Publications and collaborations include Mississippian plants from Arkansas, Mississippi, West Virginia, and Scotland. He has also studied Pennsylvanian plants from Texas, Penn-Permian palynology from Kazakhstan, Permian plants from China, and Miocene plants from Idaho. He has served as Secretary Treasurer of the Paleobotanical Section of The Botanical Society of America, and of the International Organization of Palaeobotany. Dunn is currently a professor at Cameron University in Lawton, Oklahoma.

About Our Cover Photo



Carboniferous Insects is a work of art created by artist Richard Bizley who describes his painting as “Artwork of a millipede (*Arthropleura*) and a dragonfly (*Meganeura*) in the forests of the Carboniferous Period (354-290 million years ago). At this time, the land was dominated by insects and other invertebrates, some of which evolved to sizes much larger than found today. This millipede is 2 metres long, and this dragonfly has a wingspan of 60 centimetres. Swamp plants, which dominated the land, eventually formed large beds of coal underground. Plants shown here are *Sphenophyllum emarginatum* (lower right), *Calamites* (down left), tree fern (upper right) and *Medullosa noei* (centre). Most of the plants are *Lepidodendron* (large and fallen trunks).”

This painting of ***Carboniferous Insects*** can be viewed on the Fine Art America website where it can be purchased as a print, a phone case or a set of greeting cards.

Preview of our Next Meeting

PRESIDENT'S STATEMENT

WE OWE IT ALL TO THE PLANTS!

Geologic time is one of the more difficult concepts to wrap your head around as a student of the Earth Sciences. I remember first learning about geologic time. I thought that this is relatively easy to understand when memorizing the eons, eras, periods and epochs. As I continued in my exploration of Earth's history and began using the geologic time scale, the immensity of it all came to light. To think, the evolution of the animal kingdom took over 600 million years to get where we are today. During that relatively short period of time, invertebrates ruled the oceans, primitive fish evolved to leave the water and became fierce predators of the terrestrial world. One thing is for sure, the tetrapods would never have been able to venture out of the water if the plants and arthropods (insects and such) hadn't tried it first.

The migration of plants away from the water was a major evolutionary step that provided the necessary environment for the tetrapods to follow close behind. Plants provided not only potential food but the shelter the tetrapods needed to escape the elements, hide, nap and lay their eggs. Terrestrial metazoans should be grateful that the plants provided the much-needed atmosphere, shelter and food that enabled their emergence from water. This brings me to paleobotany, the topic to be explored at this month's meeting. Just like the marine and non-marine Animalia fossil record, the fossil record of the plants provides us with a snap shot of how vastly different the ecosystems of the past are from today. Paleobotany studies enhance our understanding of how life evolved to thrive in the complex landscapes on Earth. This month's talk will give us a glimpse into these diverse and intricate systems of the past.

As always, I would like to acknowledge the following Corporate Sponsors that have committed their support to our 2017-2018 initiatives: AWK Consulting Engineers, Inc. and The Baron Group. A special thanks to Sue and Wally Phillips for their generous donation to help support the student drilling workshop over the next five years. I would also like to thank Peter Michael (past President) for his service and leadership and donation to PGS. Many thanks for your financial support as well.

In closing, I would like to acknowledge the efforts of Albert Kollar (2011-2014 PGS President) and Ray Follador (2014-2016 PGS President and current Director-at-large) who went back to school as instructors at Shady Side Academy Middle School Sixth Grade class on January 17th. They were invited to be part of an initiative by Earth Science teacher Matt Brunner to teach the students about energy resources. The students had the opportunity to learn and debate the pros and cons of Energy Sources and Marcellus Shale. Ray and Albert presented a slide show and answered a variety of questions from the students. The class was later divided into energy sectors such as, Fossil Fuels, Nuclear, Bio-waste (wood), Hydroelectric, Wind, Solar, and Geothermal that reflect the highest to lowest sources of energy used in the United States.

I hope you will consider joining us this month for a night of networking and socializing with professional and student members. I also encourage you to provide feedback and let the board know what we can do to enhance our organization. We welcome any suggestions for future speakers to invite who might be interested in presenting at a monthly meeting.

Best wishes,

Tamra

Tamra Schiappa

PGS Mentorship Program for Students

The PGS Student Liaison Committee would like to create a mentorship program for student members with young professional geologists who can offer advice about career paths and graduate schools, insights into what life as a working geologist is like, guidance for those who want to eventually become a licensed PG, and other helpful information.

If you have entered the profession within the last ten years and would be interested in this progran, please contact President Tamra Schiappa by email (tamra.schiappa@sru.edu) or chat with Student Liaison Chair Philip Graves at a PGS meeting.

PGS Donor Spotlight

The Pittsburgh Geological Society would like to especially acknowledge and thank **Sue and Wally Phillips**, owners of Dorso Energy, LP, this month for their very generous contribution to the PGS Endowment Fund. This contribution was made in memory of the late **George O. Scott**, Sue's father, who was the Chief Geologist and later, Vice President, for the Peoples Natural Gas Company prior to forming Dorso Energy, a PGS Corporate Sponsor, in 1978. George was a well-known and respected petroleum geologist who had a passion for structural geology and never passed up an opportunity to converse with and share his knowledge with younger geologists. The directive of this contribution will be to assist in the financial support of the PGS Student Drilling Workshop (see page 8) over the next five years.

GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

February 6, 2018
"Geophysics Applications of Borehole Acoustic Data" by Edgar Velez, Schlumberger

Cefalo's Banquet & Event Center, Carnegie PA

HARRISBURG AREA GEOLOGICAL SOCIETY

February 8, 2018
"Use of Satellite-Derived Precipitation Data in the Identification of Spring Recharge Areas and its Relationship to Boiling Springs, Cumberland County, PA" by Timothy Bechtel, PhD, P.G. – F&M College and Enviroscan, Inc.

AEG Office 441 Friendship Road, Harrisburg PA

SOCIETY OF PETROLEUM ENGINEERS

February 12, 2018 (11:00 AM - 1:00 PM)
" Lean Processing and Performance Improvement in Appalachian Basin" by Andrés Acuña, Senior Petroleum Production Engineer, Chevron Corporation.

Cefalo's Banquet & Event Center, Carnegie PA

ASCE GEO-INSTITUTE – PITTSBURGH CHAPTER

February 15, 2018
"Risk Assessment in Geotechnical Engineering" by Vaughan Griffiths, Professor of Civil Engineering at the Colorado School of Mines

Cefalo's Banquet & Event Center, Carnegie PA

OHIO OIL & GAS ASSOC. WINTER MEETING

March 7-9, 2018
Annual meeting, including a 1-day workshop sponsored by the Ohio Geological Society (p.10)

Hilton Columbus at Easton, Columbus OH

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

Renee M. Heldman, GIT
Geologist 1, TetraTech Inc.
Pittsburgh, PA
2016 MS in Geoscience from West Chester University

Jessica L. Maier
Geologist
2016 BS in Geology from University of Pittsburgh.

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

From California University of Pennsylvania:
Samuel A. Formica
William C. Greene

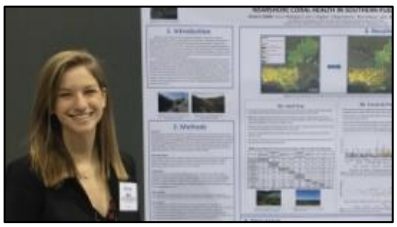
From Indiana University of Pennsylvania:
Nicholas Bradley

From Dickinson College
Ben Eppinger

We look forward to seeing all of you at an upcoming society event!

PGS – AEG – ASCE STUDENT NIGHT

April 18, 2018



University students, please consider presenting the results of your college research projects at the **16th Annual PGS – AEG – ASCE Student Night**. If you have been conducting undergraduate or graduate research in any geological or geotechnical field, here is an opportunity to show off your work to members of three professional scientific societies. Students who present their original research grow from the experience by improving their public speaking skills, networking with professionals and experts in their fields, listing a presentation on their resume and possibly even winning a cash award.

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

The process of submitting abstracts for student night has been revised this year. Please consult the **Student Night Guidelines** and download the **Student Abstract Submission Form** from our website:

http://pittsburghgeologicalsociety.org/2018-student-events.html.

The Student Night Guideline document contains the formatting rules to be used in the abstract submission and also the rules to be followed for the presentations themselves when the time comes. The Student Abstract Submission Form is a three-page fillable PDF document consisting of the following:

Page 1: a cover sheet with digital signatures by the student and faculty mentor

Page 2: the abstract itself describing the research project

Page 3: a brief letter of support by a faculty mentor or sponsor

A completed form with the student's name in the title should be submitted via email to the PGS Program Chair, Dr. Daniel Harris, at **Harris_D@calu.edu**. If you are unable to complete the fillable PDF with the abstract and letter of support, send them as attachments along with a completed and signed cover sheet.

Some additional links that students may find helpful in putting together their abstracts and presentations are:

- The American Geophysical Union's oral presentation style guide with advice on best practices. http://www.projectionnet.com/Styleguide/presentationstyleguide.aspx
- Dennis Jerz's Tips on Oral Presentations. Dennis Jerz is an English professor at Seton Hill, and he's stellar at what he does. Do read and retain his coaching on oral presentations: it's top-notch. https://jerz.setonhill.edu/writing/technical-writing/oral-presentations-tips/
- The Professor's Guide to 15 Strategies for Giving Oral Presentations from US News & World Report. https://www.usnews.com/education/blogs/professors-guide/2010/02/24/15-strategies-for-giving-oral-presentations
- Rice University's site on oral presentations skills. There are sample clips to show you what to do (and not do) in your oral presentation. http://www.owlnet.rice.edu/~cainproj/ih_presentation.html
- The National Institute of Health's Ten Simple Rules for a Good Poster Presentation' and 'Ten Simple Rules for Making Good Oral Presentations' https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1876493/

The deadline for abstract submissions has been moved to 5 PM on Friday, March 9. Acceptance decisions will be announced on Friday, March 16.

Pittsburgh Geological Society
Spring 2018 Student Field Workshop

SPECIAL 2 DAY EVENT

APRIL 6 & 7, 2018

California University
California, Pennsylvania

Friday (4/6) Evening Program:
Networking and Preparing for a Career in the Geosciences

Saturday (4/7): Drilling and Environmental Sampling Field Workshop

Registration: $35.00 (Two days) or $20 (One day)
YOU MUST CONTACT US TO SAVE YOUR PLACE

The Pittsburgh Geological Society again invites students of geology to attend the 14th installment of the "Student Field Workshop."

- **Friday Evening (5pm-?): Classroom and Networking event. Dinner will be provided.**
- **Saturday (8am-3pm): Field Demonstrations. Light Breakfast and Lunch will be provided.**

A block of rooms has been reserved at a local hotel, less than a mile from the morning drill site.

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

What will you experience?

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

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

- **Pre-payment can be made through PayPal to pgsreservations@gmail.com or by check (payable to "Pittsburgh Geological Society") mailed to P.O. Box, 58172 PITTSBURGH PA, 15209**
- **Cash, check, or charge payments may be made in advance at a PGS meeting**
- **Charge or PayPal payments may be made directly through the PGS website.**
- **To register or for more information: Frank Benacquista PG at: *fbenacquista@kuresources.com***

MARK YOUR CALENDARS FOR A POSSIBLE PGS SPRING FIELD TRIP!

Are you curious about how geology and industrial history have combined to shape our region? Then mark your calendar for **Saturday, May 26, 2018** - the tentative date for our spring PGS field trip. The schedule is still a work in progress, but this tentative draft gives you an idea of what to expect. While field trip organizers Albert Kollar and John Harper hammer out the final details, keep an eye on the PGS newsletter and website for future announcements and registration information.

GEOLOGY OF THE EARLY IRON INDUSTRY IN FAYETTE COUNTY, PA

Please note that this is the current proposed trip itinerary. Locations, times and order of stops may change as our plans are firmed up. Right now, we are shooting for a date of Saturday May 26 but nothing is set in stone.

Meet at Century III Mall, West Mifflin. Rent van(s) nearby. Drive south on PA 51 to Uniontown. Merge onto US 119/40 bypass and follow US 40 east toward and up Chestnut Ridge.

Stop 1: Scenic Overlook: This pull-off near the summit of Chestnut Ridge provides us with a chance to briefly discuss the geology of the area and the early iron industry in western Pennsylvania.

Leave Stop 1 and continue east on US 40.

Stop 2 (tentative): Thompson Quarry: Thompson Quarry is one of the best fossil collecting sites in western PA (Wymps Gap Limestone, Upper Mississippian). This stop will depend on the good graces of PennDOT, which uses part of the quarry for maintenance and storage. We will try to get permission.

Leave Stop 2 and drive west on US 40 to Wharton Furnace Road (SR 2003). Drive south to Stop 3.

Stop 3: Wharton Furnace: This is one of about 20 charcoal blast furnaces that operated in Fayette County in the early 1800s. We will discuss the process of smelting pig iron from local iron ore (siderite), and the geology of the material needed to erect the furnace and create a useful product.

Drive west on Shephard Road to Skyline Drive. Drive north on Skyline Drive about 500 feet and pull to the side of the road.

Stop 4: North Summit Gas Storage Well: We will discuss the geology of North Summit field, particularly the structure and stratigraphy of the reservoir (Middle Devonian Huntersville Chert).

Drive north on Skyline Drive to US 40. Drive west on US 40 to US 119/40 bypass. Follow bypass to PA 51. Drive north on PA 51 to intersection with Laurel Hill Road (to the right) and Keisterville Upper Middletown Road (to the left).

Stop 5: First Puddling Furnace Historical Marker: We will discuss the importance of puddling iron furnaces to iron and steel production in western Pennsylvania and the rest of the world.

Drive east on Laurel Hill Road and West Crawford Avenue to US 119 in Connellsville. Drive north on US 119 to intersection with PA 819. Drive south on PA 819 to West Overton Village.

Stop 6 (tentative): West Overton Village and Museum: This is the birthplace of Henry Clay Frick, the multi-millionaire coal and coke magnate. Coal and coke are essential to the steel-making process. As a young man, Frick worked at the West Overton distillery where Old Overholt rye whiskey was originally produced (now produced at the Jim Beam distillery in Kentucky). The museum features life-size dioramas that highlight the industries of West Overton Village between 1800 and 1919. Displays include coverlet weaving, coal and coke production, and whiskey distillation. For a fee, you can sample Old Overholt.

Leave West Overton Village and return to US 119. Drive north on US 119 to I70. Drive west on I70 to PA 51. Drive north on PA 51 to Century III Mall. End field trip.

GEOLOGICAL EVENTS OF INTEREST TO MEMBERS

GEOPHYSICAL LOG ANALYSIS WORKSHOP

Reading the Rocks All in Four "Easy" Tracks

Instructor: Dr. Tim Carr, Professor of Geology, West Virginia University

Sponsored by the

Ohio Geological Society

in conjunction with the

Ohio Oil and Gas Association Winter Meeting

When: March 7th, 2018 from 10:00am to 4:00pm with one hour for lunch (on your own) and two-15 minute breaks (provided)

Where: Hilton at Easton Town Center, 3900 Chagrin Dr, Columbus, OH 43219, phone (614) 414-5000

What: Dr. Carr will lead instruction of four tracks or modules each covering the background, basic concepts, and uses of major geophysical log suites. Each track includes exercises in log analysis using EXCEL spreadsheets. *Bring your own laptop with EXCEL loaded.*

Who should attend: This course is for new and experienced geologists, geoscience technicians, and engineers who work with geophysical logs and seek to learn how best to use them or refresh their log interpretation skills. OGS will offer 0.5 CEUs or 5 PDHs upon completion of the workshop.

Cost : *Professional rate $125 per person; Student rate $100/person with a limit of 10 student tickets.*

Overview: Basic questions in the petroleum geosciences require knowledge of the sub-surface reservoir properties, and the spatial distribution of stratigraphic units and facies. This course is structured around four main tracks of wireline and LWD logs. Attendees will learn some background and theory of the log type, but more of the practical applications of select geophysical logs using a range of methods. Attendees will gain hands-on experience to address real-world challenges of understanding the subsurface. Attendees will get Excel templates and undertake brief exercises around each of the four tracks. OGS will provide copies of all materials. OGS offers 0.5 CEUs or 5 PDHs to participants upon completion. The four tracks and exercises include:

Track 1 – Gamma Ray and Caliper
Track 2 – Porosity Logs and Lithology
Track 3 – Resistivity and Water Saturation
Track 4 – Sonic and Geomechanics

IMPORTANT: If you have a laptop with Excel, please bring it. If not, you can look on a table-mates screen. If you have an LAS log with an interesting question, please feel free to bring it.

Coffee, refreshments in the late morning and in the afternoon will be provided as part of the Workshop. Lunch will be on you own and not part of the workshop.

To register or obtain more information about this OGS workshop:
https://ohiogeosoc.org/events/geophysical-log-analysis-workshop/

To register or obtain more information about the OOGA Winter Meeting (March 7-9, 2018: http://oogawintermeeting.com/

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

The Rook Rail Yards and Green Tree's iconic water tower seen on the hill above.

The borough of Green Tree, where PGS meets every month between September and May, was named for a large sycamore tree that grew along Greentree Road near Western Avenue (Greentree Road began as an American Indian trail that George Washington traveled in 1753 looking for a direct route between Fort Pitt and Fort Henry in Wheeling, WV). Stagecoaches delivered mail there in the late 1700s, and it was also a place for the community to meet. In all their usual wisdom and respect for history, a utility company cut the borough's name-sake tree down in 1945! Someone made a gavel from one of its branches for the borough's women's club that is still being used today.

The farmland that became Green Tree had at various times been part of Peters, St. Clair, Chartiers, and Union townships, as well as part of Banksville, before the borough was incorporated in 1885. The local farmers wanted to separate from Union Township and Banksville, so when they were to appear in court with their petition, someone piled railroad ties on the tracks between Banksville and West End to keep protesters from getting to court. As a result, their petition was approved. In the early 1900s, Green Tree grew because of the Wabash Railroad, which established Rook Station and the Rook Rail Yards. The rail yards, now owned by the Wheeling & Lake Erie Railway and used as a distribution facility for Marcellus and Utica well drilling supplies, can still be seen between the Parkway West (I-376/US-22/US-30) and Mansfield Street.

DID YOU KNOW . . . ?

Iceland's Bárðarbunga volcano system produced four large earthquakes at the end of October 2017. The temblors had magnitudes measured at 3.9, 3.2, 4.7, and 4.7, a sign that pressure is building up in the volcano's magma chamber and will eventually lead to an eruption. It is difficult to determine when, and how big, the eventual eruption will be. Bárðarbunga, which is 6,591 ft above sea level, is one of the largest, most active volcanoes on the island. Because it lies, in part, beneath Vatnajökull, Europe's largest ice cap, the volcano could be especially dangerous if and when it erupts because volcanoes that erupt under ice can be highly explosive and produce lots of fine ash.

Even though Bárðarbunga is remotely located on Iceland, it is not harmless. An eruption could have

Bárðarbunga volcano spewing lava and smoke in southeast Iceland.

effects beyond Iceland. Remember when Eyjafjallajökull volcano erupted in 2010? The ash clouds wreaked havoc with air travel worldwide. Even worse than that, in 1783 when Laki volcano

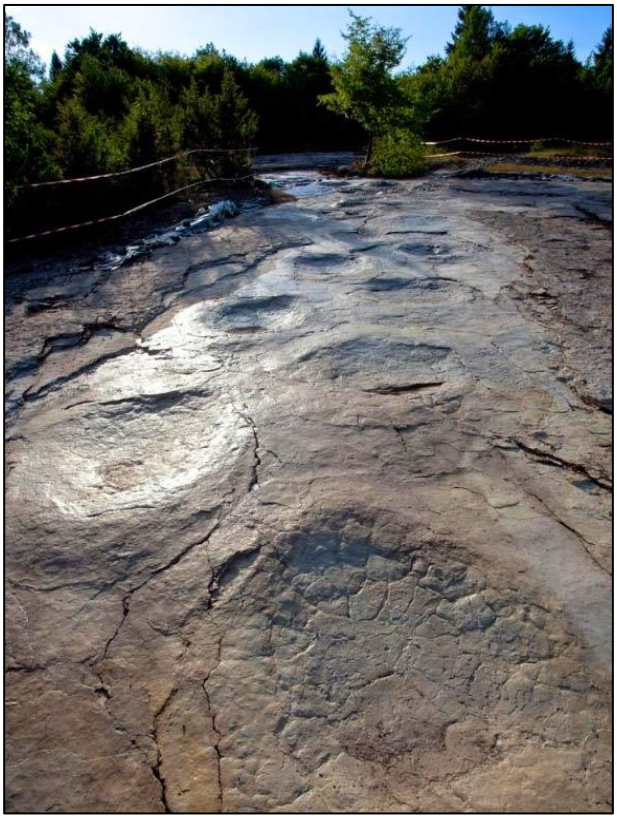
erupted, it blanketed parts of Europe in toxic ash and changed climate patterns worldwide for several years.

Volcanic earthquakes don't necessarily mean the volcano is going to explode immediately. Bárðarbunga's previous eruption started in August 2014 and ended in February 2015 and spewed air pollution across Western Europe. But an imminent eruption could have varying impacts, depending on where it happens in the system. With 1/3 of the volcano system covered by ice, an eruption could trigger explosions by turning large volumes of ice into steam, and as magma hits the steam it would explode into fine particles that can shoot high into the atmosphere. Alternatively, lava from an eruption could melt the ice and cause flooding, like what happened when Eyjafjallajökull erupted. The "when" is the $64,000 question. Based on data collected over the years, Bárðarbunga erupts once every 50 years on average, and the last eruption started in 2014. But Bárðarbunga isn't the only volcano under the ice. Three other Icelandic volcanoes were showing increased activity that signals they are heading for eruption also.

https://news.nationalgeographic.com/2017/11/iceland-volcano-getting-ready-to-blow-spd/

The longest-known trackway of a plant-eating sauropod dinosaur has been found and excavated in the Jura Mountains of France. It is located less than a mile west of the village of Plagne, Ain Department, in southern France. It was discovered in 2009 by members of the 'Société des Naturalistes d'Oyonnax,' a group of amateur geologists who specialize in the geology of the Jurassic Period. Paleontologists from Claude Bernard Lyon 1 University confirmed that the Plagne trackway extends more than 508 feet in length, which makes this specimen a few feet longer than the Middle Jurassic sauropod trackways from Galinha, Portugal, which were previously the longest known in the world.

The trackway comprises 110 successive paces and is generally well-preserved. The prints measure between 3.3 and 10 feet in diameter!!! Based on the footprints, the dinosaur that made the trackway was at least 115 feet long, weighed between 35 and 40 tons, had an average stride of 9.2 feet, and traveled at a speed of 2.5 mph. The footprints reveal five elliptical toe marks, while the handprints are characterized by five circular finger marks arranged in an arc. They were made approximately 150 million years ago during the latest Jurassic, the Tithonian Stage.



110 separate steps characterize the world's longest sauropod trackway, found in the Jura Mountains of France in 2009.

Paleogeographic reconstructions of Europe during this stage indicate an archipelago landscape, where the emergent islands were occasionally connected during periods of relatively low sea level, which presumably allowed faunal expansion or migration. The researchers stated that the new trackway site, when taken with other Jurassic Swiss and French tracksites yielding thousands of sauropod and theropod tracks, can be considered the largest dinosaur megatracksite in Europe. The trackway represents a new ichnospecies, called *Brontopodus plagnensis*.

http://www.sci-news.com/paleontology/worlds-longest-sauropod-trackway-05437.html

Long before zinc was identified as an element, it was alloyed with copper to make brass and for medicinal purposes. Indians produced metallic zinc and zinc oxide sometime between the 11th and 14th centuries and the Chinese did it in the 17th century. It was not identified as an element until 1746. The primary ore mineral of zinc is sphalerite (ZnS). Other zinc minerals don't contain sulfur, and much of the early zinc production was from non-sulfide sources. Once these were exhausted, however, production shifted to sphalerite.

McArthur River Mine, the world's second largest supply of zinc.

In the past 30 years, advances in extractive metallurgy have resulted in renewed interest in non-sulfide zinc deposits. When refined and freshly cast, metallic zinc is bluish-white. It is hard and brittle at most temperatures and has relatively low melting and boiling points. Zinc readily alloys with other metals and is chemically active. On exposure to air, it develops a thin gray oxide film that inhibits deeper oxidation. The metal's resistance to corrosion is an important characteristic in its use.

Zinc is currently the 4th-most widely used metal in the world after iron, aluminum, and copper. About one-half of the zinc that is produced is used in zinc galvanizing, the process of adding thin layers of zinc to iron or steel to prevent rusting because it has strong anticorrosive properties and bonds well with other metals. The second leading use of zinc is as an alloy – with copper, it forms brass, and with other materials it is used in the manufacture of automobiles, electrical components, and household fixtures. The third leading use is in producing zinc oxide, used in rubber manufacturing and protective skin ointment. Zinc is also a necessary element for in the growth and development of plants and animals, including humans. It is needed for the body's enzymes and immune system to function properly. It is also important for taste, smell, and healing wounds. Trace amounts of the element occur in many foods. The US is not a leading producer of zinc by any standard, but six states have zinc mines. Most other zinc is imported from Canada, Mexico, Kazakhstan, and the Republic of Korea.

https://geology.com/usgs/uses-of-zinc/

Chinese media recently reported that a large deposit of silver had been found at Shuangjianzi Mountain in Inner Mongolia. The deposit reportedly contains over 100 million metric tons of silver ore, although it isn't clear if the number refers to resource or reserves. Presumably, it refers to resources because, according to the USGS, Chinese reserves currently stand at only 39,000 metric tons (since China often inflates their mining statistics, an accurate estimate is difficult at best).

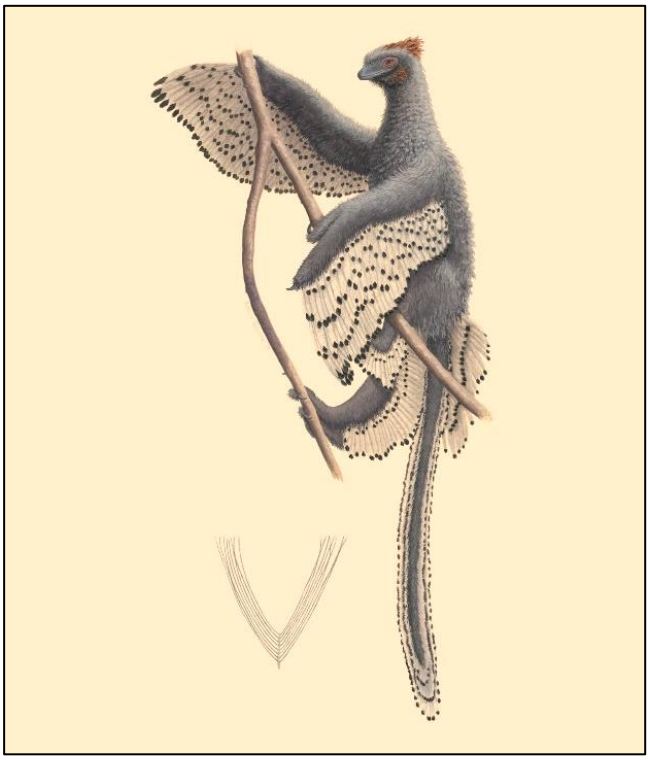
Silver is often found associated with zinc and lead, like this galena crystal.

The USGS ranks China fifth in terms of worldwide silver production and reserves, behind the United States, Australia, Bolivia, and Chile. Mexico is the number one producer at 5,600 metric tons, but Peru has the largest reserves at 120,000 metric tons. In 2015, China reportedly produced 3,646

metric tons of silver, primarily as a byproduct of lead and zinc mining. The two primary silver mines are the Ying mine (owned by a Canadian company), which produced 184 metric tons in 2017, and the Shizishan mine owned by China Polymetallic, which produced 68 metric tons in 2013 (latest production number available).

http://www.mining.com/huge-silver-deposit-discovered-inner-mongolia/

Paleontologists at the University of Bristol in England have discovered a small dinosaur they named *Anchiornis* that lived in what is now northeastern China about 160 million years ago, during the Jurassic period. Its arms bore wings and its legs and tail were long. This dinosaur had wing-bearing arms, long legs, and a long tail. Although only 1.3 ft long, it had a wing span of up to 1.64 ft and weighed 0.2 to 0.6 lb.



***Anchiornis* and its contour feather**.

The researchers compared the fossilized feathers of an exceptionally preserved specimen to those of other dinosaurs and extinct birds. The new dinosaur's contour feathers revealed a newly-described, extinct, primitive feather form consisting of a short quill with long, independent, flexible barbs erupting from the quill at low angles to form two vanes and a forked feather shape. These would have given *Anchiornis* a fluffy appearance unlike the streamlined bodies of modern flying birds, whose feathers have tightly-zipped vanes forming continuous surfaces.

The "unzipped" feathers of *Anchiornis* could have affected the animal's ability to control its temperature and repel water, and possibly was less effective than most modern feathers. The shaggy plumage also would have increased drag when *Anchiornis* glided. In addition, the wing feathers of *Anchiornis* lack the aerodynamic, asymmetrical vanes of modern flight feathers. The study showed that these vanes were also not tightly-zipped compared to modern flight feathers, a feature that would have hindered the feather's ability to form a lift surface. Unlike modern birds, dinosaurs like *Anchiornis* apparently compensated for this by packing multiple rows of long feathers into the wing, where most of the wing surface is formed by just one row of feathers.

Anchiornis and similar feathered dinosaurs had what were essentially four wings – long feathers on the legs in addition to the arms, and elongated feathers forming a fringe around the tail. This increase in surface-area likely allowed for gliding before the evolution of powered flight. The researchers had an artist reconstruct *Anchiornis* climbing a branch in the manner of hoatzin chicks, the only living birds whose juveniles retain a functional claw, rather than showing it perched on top of a branch like a modern bird.

http://www.sci-news.com/paleontology/tokummia-katalepsis-cambrian-marine-predator-04820.html

A team of geologists recently found evidence of a previously unknown 60 ma meteorite impact on the Isle of Skye, northwest Scotland, the first recorded mid-Paleocene impact event in the region. They also found it to be coincident with the onset of magmatism in the British Paleogene Igneous Province. The team initially found a 3.6-ft thick layer of ejecta at the base of a 60 ma lava flow near Loch Slapin. Originally thought to be an ignimbrite, when analyzed using an electron microprobe, the rock turned out to contain rare minerals from outer space, including vanadium-

rich and niobium-rich osbornite, mineral forms that have never been reported on Earth. But they WERE collected as space dust when by NASA's Stardust Comet Sample Return Mission sailed through the wake of the Wild 2 comet in 2004. In addition, the osbornite is unmelted, suggesting that it was an original piece of the meteorite. The scientists also identified: 1) reidite, an extremely high pressure form of zircon that is only ever associated in nature with impacts; 2) native iron; and 3) other exotic minerals like barringerite that are linked to impact. The team found a second site, 4.3 mi away from the first that had a 6.5-ft thick ejecta layer with the same mineralogy found at the first site.

The meteorite impact crater on the Isle of Skye is above the treeline in the mid-ground far side of Loch Slapin.

The discovery leaves many unanswered questions. For example, is the same ejecta layer found elsewhere in the British Paleogene Igneous Province? Where exactly did the meteorite actually hit? Could the impact have triggered the outpouring of lava that began at the same time, or be related to volcanism in the larger North Atlantic Igneous Province? The researchers have gone one to find samples from another site on Skye that contain a similar mineralogy, including another mineral like one found in comet dust. Considering the number of geologists who have studied the rocks of Skye, it is surprising that the ejecta had not be previously identified.

http://www.sci-news.com/geology/meteorite-impact-scotlands-isle-of-skye-05539.html

Dead zones are areas of oceans and large lakes that are hypoxic or low in oxygen, which is caused by excessive nutrient pollution from human activities and other factors. Now, according to the Smithsonian Tropical Research Institute and the Smithsonian Environmental Research Center, warmer waters, mixed with other climate change factors, could expand these dead zones significantly.

Dead zones form in waters where oxygen plummets to levels too low for fish and most invertebrate animals to survive. Dead zones can last for months in deeper waters, the annual summer dead zone in the Chesapeake Bay for example. Temporary dead zones can also occur in shallow waters at night. The largest known dead zones in the Gulf of Mexico and Baltic Sea often cover more than 20,000 mi^2 of the sea floor. To make matters worse, the number of dead zones is growing exponentially. They have doubled every decade since the 1960s. Many people living in coastal communities have been experiencing increasing fish kills and harmful algal blooms, the effects of which have a direct impact on our lives.

The primary reason for dead zones is massive algal blooms that pull oxygen from the water during respiration or decomposition. These algal blooms form as a result of excess runoff of nutrients like nitrogen and phosphorus used in agriculture, or from untreated wastewater. Warm water holds less oxygen, so as temperatures

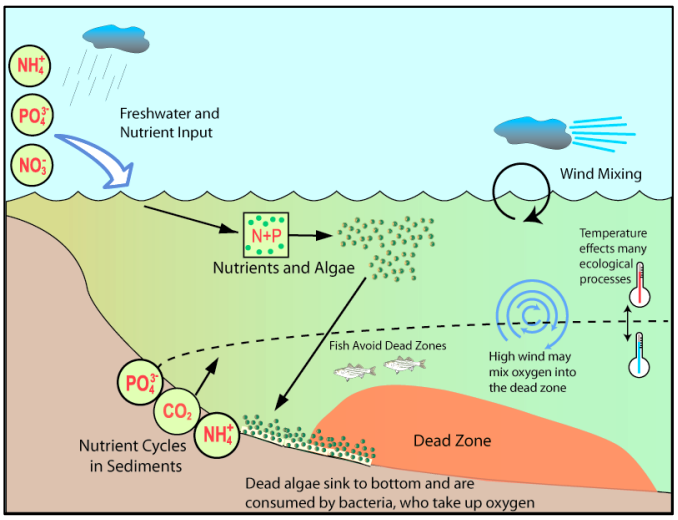
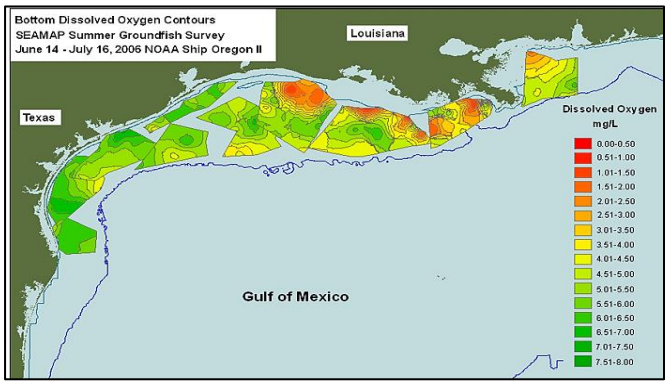


Diagram showing how dead zones form
http://www.teachoceanscience.net/teaching_resources/education_modules/dead_zones/get_started/

increase, animals need more oxygen to function and survive, but the ocean is less able to provide it. As a result, climate change could enable dead zones to form more easily and even increase those already established.

The Smithsonian study was the first to consider more than a dozen direct and indirect effects of climate change on dead zones. It suggests that its contribution to the growing dead zone problem and impacts on marine life has been severely underestimated. The scientists who authored the study looked at data from more than 400 dead zones around the world and then overlaid them on a map of the annual temperature anomalies expected to occur in each region.



The Gulf of Mexico dead zone (zone of hypoxia).

A moderate scenario indicated that 94% of dead zones are in areas expected to warm by 3.6°F or more by 2099. In addition to making it harder for water to hold oxygen, rising temperatures stifle ocean mixing that can keep dead zones from expanding, or even existing over many seasons (dead zones can be dissipated by sinking oxygenated waters from above). Because warmer waters rise to the surface, oxygenated waters don't sink. In addition, sea-level rise leads to the expansion of bays and estuaries, raising the overall volume of water susceptible to low oxygen and destroy wetlands, one of the best defenses against dead zones since they filter out excess nutrient pollution that feeds massive algal blooms.

Shifting ocean currents could further expand dead zones by flooding them with more oxygen-starved waters, such as is already happening in the St. Lawrence Estuary. The only positive impact from rising ocean temperatures the study uncovered is that animal metabolism rises with higher temperatures. Therefore, zooplankton and algal grazers could eat up the algal blooms that create dead zones. There are cases where this is happening. It is unclear, however, what influence other climate change impacts will have. Even if we, as humans, are unable or unwilling to do anything about climate change, we can still have an impact on dead zones through local control of nutrient pollution.

https://serc.si.edu/media/press-release/dead-zones-likely-expand-coastal-waters-warm

A team of paleontologists from the Royal Ontario Museum and the University of Toronto has reinvestigated *Habelia optata*, a bizarre arthropod predator from the Burgess Shale that was originally described and named by C. D. Walcott in 1912. This enigmatic Cambrian creature evolved an extremely complex head to hunt and eat shelly animals, according to the Canadian team. *Habelia optata* was a well-armored arthropod, a sea predator about 0.8 in long, with a tail as long as the rest of the body. It lived approximately 508 million years ago during the Middle Cambrian period.

Artist's reconstruction of *Habelia optata*, a Cambrian predator.

As with all arthropods, *Habelia optata* is characterized by a segmented body, an external skeleton, and jointed limbs, but no one was sure until recently what sub-group of arthropods it belonged to. Early studies linked with the Mandibulata, a highly diverse group whose members have antennae and a pair of specialized appendages known as mandibles, usually used to grasp, squeeze and crush their food. Later studies weren't so sure, and *Habeilia optata* was relegated to the trash bin of unresolved arthropods from the Burgess Shale.

The new study analyzed 41 specimens of the fossil, most of which were acquired by recent fieldwork in the Burgess Shale. The team found that the fossil was instead a close relative of the ancestor of the Chelicerata, another sub-group of arthropods still living today that have appendages (chelicerae) in front of the mouth used to cut food. *Habelia* had a head similar to the chelicerates and two small chelicerae-like appendages.

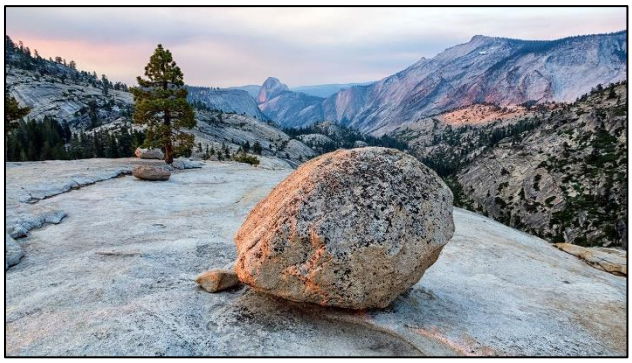
Indeed, the animal shows the body architecture from which chelicerates emerged in great detail, allowing paleontologists to solve some long-standing questions, such as why horseshoe crabs have a reduced pair of limbs called the chilaria at the backs of their heads. It turns out they are relics of fully-formed appendages – chelicerates originally appear to have had heads with at least seven pairs of limbs. In fact, the well-armored body of *Habelia optata* was covered in a multitude of different spines and was divided into a head, thorax, and post-thorax, similar to other chelicerates like scorpions and eurypterids.

All of the Cambrian animal's segments bore different types of appendages. The thorax had five pairs of walking legs, while the post-thorax had rounded appendages probably used for respiration. The biggest difference between *Habelia optata* and later chelicerates is that scorpions and eurypterids have walking appendages only in the head segment whereas *Habelia* had walking appendages on its thorax, allowing it to evolve a complex head containing a series of five appendages made of a large plate with teeth for mastication, a leg-like branch with stiff bristle-like spines for grasping, and an elongate, slender branch modified as a sensory or tactile appendage. This complex apparatus of appendages and jaws made *Habelia optata* an exceptionally fierce predator for its size.

http://cdn.sci-news.com/images/enlarge4/image_5567e-Habelia-optata.jpg

Loss of water from the rocks of California's Sierra Nevada caused the mountain range to rise nearly an inch (24 millimeters) in height during the drought years from October 2011 to October 2015, a new NASA study finds. In the two following years of more abundant snow and rainfall, the mountains have regained about half as much water in the rock as they had lost in the preceding drought and have fallen about half an inch (12 millimeters) in height. Significantly more water was lost from cracks and soil within fractured mountain rock during drought and gained during heavy precipitation than hydrology models show.

The research team used advanced data-processing techniques on data from 1,300 GPS stations in the mountains of California, Oregon and Washington, collected from 2006 through October 2017. These research-quality GPS receivers were installed as part of the National Science Foundation's Plate Boundary Observatory to measure subtle tectonic motion in the region's active faults and volcanoes. They can monitor elevation changes a few millimeters.



The Sierra Nevada range rose almost an inch during California's recent drought

Earth's surface falls locally when it is weighed down with water and rebounds when the weight disappears. Many other factors also change the ground level, such as the movement of tectonic plates, volcanic activity, high- and low-pressure weather systems, and Earth's slow rebound from the last ice age. The team corrected for these and other factors to estimate how much of the height increase was solely due to water loss from rock.

Before this study, scientists' leading theories for the growth of the Sierra were tectonic uplift or Earth rebounding from extensive groundwater pumping in the adjoining California Central Valley. Argus calculated that these two processes together only produced 7 millimeters of growth -- less than a third of the total.

https://www.jpl.nasa.gov/news/news.php?feature=7023

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https://minerals.usgs.gov/minerals/pubs/mcs/2017/mcs2017.pdf

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Fun Fact Having Nothing to Do with Geology

During your lifetime, you will produce enough saliva to fill two swimming pools.

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