PITTSBURGH GEOLOGICAL SOCIETY

Joint Meeting with AEG and ASCE

JANUARY 17, 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

Function and Performance of PHYTO-INTEGRATED™ Remediation Systems on Deep Groundwater and/or Targeted Horizons – Hydraulics and Treatment

Dr. Edward Gatliff

President, Applied Natural Sciences

Deadline for reservations is noon on Monday, Jan 15.

SPEAKER ABSTRACT

Function and Performance of PHYTO-INTEGRATED™ Remediation Systems on Deep Groundwater and/or Targeted Horizons – Hydraulics and Treatment

Dr. Edward Gatliff
Applied Natural Sciences, Inc.,
Hamilton, Ohio, USA
(ans@treemediation.com)

PHYTO-INTEGRATED™ remediation systems incorporate the use of plants (primarily trees) in groundwater remediation systems that are often paired with other treatment methodologies. *TreeWell*® technology is a commonly employed phytoremediation methodology, typically addressing remediation of VOCs, that utilizes large-diameter (36 to 60-inch) borings excavated to the depth of the horizon of the targeted chemicals of concern (COCs). The borehole is lined to promote vertical root development and exclude non-target soil solution/groundwater and backfilled with amended soil and other treatment media.

A tree or other vegetation is planted inside the lined boring. Then as the vegetation grows and transpires, the *TreeWell* unit functions as a solar "pump" that pulls water from the targeted horizon into and through the soil/media column. This soil column functions as a "bioreactor treatment column" that treats COCs via:

- anaerobic mechanisms in the saturated portion,
- aerobic mechanisms in vadose zone with the microbial rich rhizosphere (area around the roots),
- and into the plant for in-plant degradation and/or transpiration into the atmosphere for photodegradation by sunlight.

This presentation will offer a review of case histories where *TreeWell* technology has been used to remediate groundwater ranging in depth from 10 to over 100 feet. The role that the *TreeWell* column plays in the degradation / detoxification of a wide range of contaminant types and concentrations in groundwater will be included. Case histories will cover a wide range of hydrogeologic conditions. Predictive hydraulic models will be compared to actual results. Remedial results for VOCs including PCE, TCE and other chlorinated compounds (e.g. 1,4-Dioxane, CCl4, Chlorobenzene) as well as petroleum hydrocarbons will also be discussed.

SPEAKER BIOGRAPHY

Dr. Edward Gatliff earned his B.S. in Agriculture from The Ohio State University and his Ph.D. in Agronomy from the University of Nebraska-Lincoln. He has over 39 years of professional experience and, through his understanding of vegetation and agronomic principles, has been applying phytoremediation related technologies to successfully remediate contaminated soil and groundwater since 1987.

As founder and president of Applied Natural Sciences, Inc., Dr. Gatliff developed a *PHYTO-INTEGRATED*™ remediation system approach, known as the *TreeMediation*® program, whereby trees and other vegetation are utilized in remediation systems that provide hydraulic and remedial effects on shallow and deep soil and groundwater. He has pioneered and patented several *PHYTO-INTEGRATED*™ systems including the *TreeWell*® technology whereby trees extract groundwater from specific horizons of an aquifer 40 or more feet deep. His company, Applied Natural Sciences, was started in 1993 and for 24 years has provided *PHYTO-INTEGRATED* Remediation system design and implementation services at over 70 sites across the U.S., Canada, Chile, and Europe.

About Our Joint Meeting Co-Sponsors

The January 2018 meeting will give Pittsburgh Geological Society members the opportunity to meet and mingle with members of two fellow professional earth science societies in our region.

The ASCE Geo-Institute (G-I) is a national specialty organization focused on the geo–industry. Created by the American Society of Civil Engineers in October 1996, their 10,400+ members and 37 member organizations now include scientists, engineers, technologists, and organizations interested in improving the environment, mitigating natural hazards, and economically constructing engineered facilities. Locally, the G-I's Pittsburgh Chapter strives to provide a venue for speakers with topics of interest to members on both a global and local scale. G-I events are also a forum for geotechnical professionals to discuss technical and policy issues and networking events where peers make contacts and learn more about the region's geo-industry. For more information, http://www.asce-pgh.org/Geotechnical

The Association of Environmental & Engineering Geologists (Pittsburgh Chapter) brings together geoscientists working on all aspects of applied geology in the environment. The society's mission is to contribute to its members' professional success and the public welfare by providing leadership, advocacy, and applied research in environmental and engineering geology. The Pittsburgh Chapter (formerly known as the Allegheny-Ohio Chapter) brings in both local and national speakers, and also sponsors student chapters at Kent State University and California University of Pennsylvania. AEG members receive local and national newsletters, access to national databases and job boards, and numerous networking opportunities. For more information, http://www.aegweb.org/group/AO

Preview of our Next Meeting

PRESIDENT'S STATEMENT

After serving for several years as the Vice President of the Pittsburgh Geological Society, this is the first time that I write to you as President. I would like to begin by expressing my appreciation to the board for offering me the opportunity to lead this group of talented and dedicated professionals that serve on the Board of Directors. They invest countless hours working to support the professional community of Pittsburgh and the surrounding areas. They also dedicate their time by offering networking and educational experiences to the students of the earth sciences. I want to express my sincere gratitude to past president Peter Michael, for his dedication and leadership over the last several years. We wish Peter well on his move to set up a new residence near his family. And special thanks to Dan Harris who will step in as Vice President and to Erica Love for assisting with the program responsibilities.

For those of you who do not know me, let me introduce myself. I've been in education most of my career and for the past 16 years I have taught in the Geography, Geology and Environment department at Slippery Rock University. I am the paleontologist and stratigrapher in the department and am responsible for teaching the "soft" rock courses along with historical and introductory geology classes. I grew up in Endicott NY, received my initial introduction to geology at SUNY Plattsburgh where I developed a real passion for field work. Those formative years prepared me to be a lifelong learner of the earth sciences. I received my advanced degrees in Geology/Paleontology from Boise State University and the University of Idaho, specializing in Permian ammonoids. My research has focused on taxonomy of ammonoid species from Nevada and the use of ammonoids to understand the timing and tectonic development of the Upper Paleozoic western margin of North America.

Our first get-together of the year will be a joint meeting with AEG and ASCE Geo-Institute. With the combined attendance of geologists and engineers, it will be a great night to socialize and network with colleagues from across professional disciplines. I hope that everyone will interact with the variety of professionals in attendance to increase the all-important networking circles that is essential to any professional's success.

In closing, I would like to acknowledge the most recent new and renewing Corporate Sponsors that have committed their support to our next year of initiatives: American Geotechnical & Environmental Services, Inc., Ammonite Resources, Applied Geology and Environmental Science, Inc., Billman Geologic Consultants, Inc., DiGioia, Gray & Associates, LLC, DORSO LP, Falcede Energy Consulting, LLC, Geo-Environmental Drilling Co., Inc., Groundwater & Environmental Services, Inc., HDR Engineering, Inc., Howard Concrete Pumping Co., Inc., Huntley & Huntley, Laurel Mountain Energy, LLC, Moody and Associates Inc., Range Resources - Appalachia, LLC, Rosebud Mining Co., Seneca Resources Corporation, and THG Geophysics, Ltd. Many, many thanks for your financial support.

Best Wishes to everyone in this New Year. I hope to see you at our upcoming meetings during this year and encourage you all to attend our monthly meetings, help when you can, visit our updated website, and let the board know what we can do to keep our organization growing and improving.

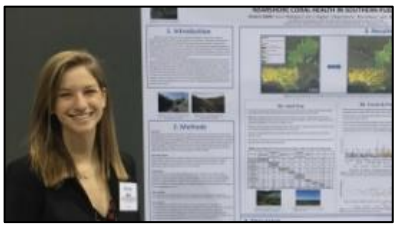
Cheers,

Tamra

Tamra Schiappa, President

PGS – AEG – ASCE STUDENT NIGHT

April 18, 2018



Students will once again have the chance to present their research locally 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, and receive the benefits that go along with it. Students who present their original research grow from the experience by improving their public speaking skills, networking with professionals and experts in their fields, listing a presentation on their resume and possibly winning a cash award.

Each of the three sponsoring societies will select one student paper (graduate or undergraduate) for oral presentation. Additional abstracts will be accepted for poster presentations. All presenters will receive certificates of recognition and appreciation, as well as complimentary dinner. The three oral presenters will receive awards of $100, while the three best poster presenters will receive $50. Abstracts must be submitted to Dan Harris (Harris_D@calu.edu) by February 15, 2018.

PCPG STUDENT POSTER SESSION & COMPETITION

The Pennsylvania Council of Professional Geologists (PCPG) has announced their 2018 Undergraduate Student Research Poster Session and Competition. Students pursuing undergraduate degrees in the geosciences at colleges and universities located within Pennsylvania and contiguous states are eligible. The posters must be illustrative of research performed by the entrant generally within the disciplines of geology, geochemistry or geophysics.

Ten students will be selected from the abstracts to present posters at PCPG's Annual Meeting scheduled for March 20, 2018 in Harrisburg, Pennsylvania. Students selected for the session will have their travel and printing expenses will be reimbursed up to $200. Posters will be judged by a committee of PCPG members who will determine 1st place ($2500) and 2nd place ($1000) winners.

Following these guidelines is a requirement for being selected to present your poster at PCPG:

- Abstracts must be 300 words or less.
- Abstracts must be signed and dated by the student and their faculty research advisor.
- Abstracts must be submitted via email to posters2018@pcpg.org by midnight January 29, 2018.
- Email subject line should contain your last name followed by 2018 Poster Abstract. (Example: Smith 2018 Poster Abstract)
- Posters should be on 20-30 pound paper, in landscape orientation, 4 feet by 8 feet in size. The posters will be displayed on the walls using poster putty supplied by PCPG.
- Students must have their posters set up and ready for presentation by 10:00 AM the day of the competition.

Donor Spotlight

Thank You!

The following members and friends of PGS have donated in the past month to the Galey Fund for student activities or to the PGS Endowment Fund:

Wendell Barner
John Harper
Michael Bikerman
Rick Wice & Batelle

CALL FOR PAPERS
Abstract deadline: March 1, 2018

Proceedings will be published in *Oil-Industry History*

Send Abstracts to:
Dr. William Brice
wbrice@pitt.edu

2018 HISTORY OF OIL SYMPOSIUM
PETROLEUM HISTORY INSTITUTE
SALT LAKE CITY

MAY 17-19, 2018, MARRIOTT RESEARCH PARK, SALT LAKE CITY, UTAH

GEOLOGICAL EVENTS

SOCIETY OF PETROLEUM ENGINEERS

January 9, 2018 (11:00 AM - 1:00 PM)

"Evaluating the Selection and Use of Polymers in Environmentally Conscious Areas" by SPE Distinguished Lecturer Sam Lewis

Cefalo's Banquet & Event Center, Carnegie PA

GEOPHYSICAL SOCIETY OF PITTSBURGH

January 10, 2018 (11:30 AM - 1:00 PM)

GSP Roundtable Discussion Luncheon
Cefalo's Banquet & Event Center, Carnegie PA

HARRISBURG AREA GEOLOGICAL SOCIETY

January 11, 2018 (6:30 PM)
Evaluation of Radon Occurrence in Groundwater from 16 Geologic Units in Pennsylvania by Eliza Gross, USGS
AEG Office 441 Friendship Road, Harrisburg PA

OHIO GEOLOCIAL SOCIETY WINTER GALA

January 19, 2018

Holiday Inn Columbus-Worthington
7007 N. High St., Worthington, OH

PA COUNCIL OF PROFESSIONAL GEOLOGISTS

February 1-2, 2018

2-Day PG Review Course for the Practicing Geologist & ASBOG Exam Candidate

Facility TBA, Cranberry PA

Science Fair Judges Needed!

The Intel International Science and Engineering Fair (ISEF), the world's largest pre-college science competition, is returning to the David L. Lawrence Convention Center in Pittsburgh on May 15 and 16, 2018. This competition brings together 1700 students in grades 9-12 from 75 countries, regions and territories. These are the best and brightest in the world, having won at local, regional, state and national fairs in order to get here.

Approximately 1000 judges are needed in 22 categories, covering the whole of science and engineering. Judges are required to have a B.A., B.S. or a master's degree with a minimum of six years related professional experience OR a Ph.D., M.D., or equivalent. Judges should be available from Tuesday afternoon (register no later than 5:00 PM) May 15 through Wednesday evening May 16, 2018 to complete their judging assignments. Judge training is available. Parking and all meals are provided free.

Judging at Intel ISEF is wonderful. The students consistently rank talking with the judges as the high point of their experience. The opportunity to meet these students is a tremendous experience for you. The positive energy in the exhibit hall with the students is inspiring! Judging is also a great opportunity to network with fellow judges - over 1000 professionals from around the region and around the world.

Intel ISEF was held in Pittsburgh in 2012 and 2015, and was a huge success. Join us to help make the 2018 fair even better. It's easy to sign up – just head to https://student.societyforscience.org/grand-award-judges and click Apply to be a Grand Awards Judge at Intel ISEF 2018 Pittsburgh.

PGS WANTS TO HEAR FROM YOU!

The Board of Directors invites all members of the Pittsburgh Geological Society to submit their feedback or ideas for:

- Speakers or topics for future monthly meetings
- Future field trips or workshops PGS could sponsor
- Suggestions for ways to mentor PGS student members

(*Editor's note: I have no idea why these stock photo scientists are wearing lab coats out in the field. Didn't they ever consider why they're called lab coats?)*

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THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

When James Powers arrived in O'Hara Township, Allegheny County around 1790, he was probably the first non-native settler. Soon after, more people moved in and soon there were farms, businesses, schoolhouses, and churches. In 1831, John Fox emigrated from Germany and began farming the land. When he died in 1889, his daughter Eliza donated some of the land to the local church for a chapel to be named in honor of her father, and so it was named Fox Chapel.

In 1928, a group of landowners got together and voted to incorporate the "Fox Chapel District Association". Upon the recommendation of the Association, the Allegheny County Court ordered the incorporation of Fox Chapel as a full-fledged borough on August 9, 1934. Fox Chapel's wooded hills and uncrowded residential developments are considered a regional asset. The H. J. Heinz family has lived in the area for generations. Teresa Heinz Kerry, widow of Senator John Heinz and wife of former Secretary of State John Kerry, still maintains a large estate there.

One of Fox Chapel's many large estates, this one belonging to Teresa Heinz Kerry.

Fox Chapel is also home to the 134-acre Beechwood Farms Nature Reserve, one of the largest nature reserves in western Pennsylvania and the headquarters of the Audubon Society of Western Pennsylvania. Its facilities include the Audubon Nature Store, the Audubon Center for Native Plants, a Natural History Library, the DiscoverGround Nature Play area and more than 5 miles of walking trails through woodlands, wetlands and fields.

DID YOU KNOW . . . ?

A new study suggests that ticks sucked the blood of feathered dinosaurs 99 million years ago. Modern ticks have been biting humans and other mammals, and sucking blood, for a long time. Ticks are an ancient form of arthropod, and the scientists who study their evolution have wondered for years what (or who) they bit before there were mammals to feed on. Now scientists at the Oxford University Museum of Natural History studied specimens of amber from Myanmar, which is famous for its large amber deposits, to arrive at the conclusion that feathered dinosaurs were among the creatures on the menu.

Fossil tick encased associated with a dinosaur feather encased in Cretaceous amber.

In one specimen[1], a tick was trapped alongside a feather from a Cretaceous dinosaur. Amber, which is fossilized tree sap, is able to capture small bits of the ecosystem almost instantly, as any fan of Jurassic Park can tell you. It can actually preserve interactions between organisms, as in the case of the feather and the grasping tick. Actually, this tick-and-feather pair help confirm the hypothesis that ticks dined on dinosaurs that was based on other ticks trapped in Cretaceous amber. Although none of the previous specimens had dinosaur feathers encased with them, there were little hairs that resemble those left behind by a type of beetle larva that lives in bird nests. This research is something of a surprise for paleontologists. Until this research, many paleontologists though ancient ticks fed on the blood of amphibians, reptiles, and the ancestors of modern mammals, but not on feathered dinosaurs. The evidence doesn't exclude these other animals, of course, since feathered dinosaurs weren't the only kinds that lived in nests. In addition, there needs to be follow-up research to study how the tick in the amber fits into the scheme of tick systematics. It would be ideal to obtain more amber specimens from where that one was found also. Another specimen contained a tick engorged with blood, but the researchers couldn't analyze the blood because the tick wasn't entirely encased in amber, so the iron in the blood was contaminated with minerals. Who knows – perhaps someday someone will actually find some preserved blood in amber that can be analyzed. Jurassic World, anyone?

https://wysu.org/content/npr/amber-trapped-tick-suggests-ancient-bloodsuckers-feasted-feathered-dinosaurs

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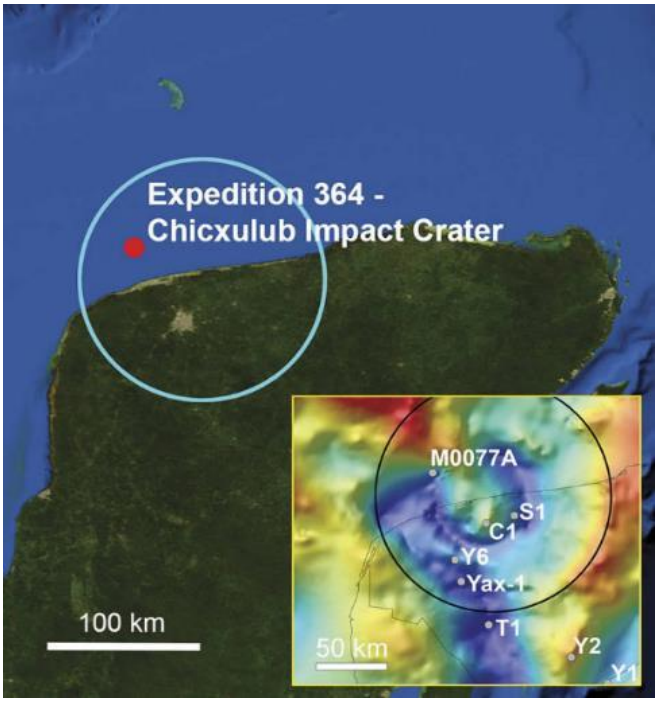
[1] *This study was co-authored by our featured PGS speaker from May 2017, Scott Anderson. Scott writes: "I found the first 'Dracula's terrible tick' in fall of 2013. It is the engorged female referenced in the article. I tracked down and purchased two additional specimens (the one with two ticks seen in the article and the single female) from a fellow collector/dealer in Canada.*

"I studied the specimens and presented my preliminary analysis at the 2016 Amber World Congress in 2016, focusing on the odd features of the ticks and presence of iron in the engorged specimen. There, I met my co-authors, who were researching a similar specimen in comparably old Spanish amber (their specimen proved too incomplete to include in the paper). We teamed up to provide a comprehensive summary of the various pieces (and I was a little out of my league on debating the finer morphological features of ticks and how they compare to modern specimens). Researchers from the American Museum of Natural History (AMNH) joined the team a few months later as they had the specimen with a tick entangled with a feather, completing the story.

*"I donated the piece with two ticks (with beetle hairs on body) to the AMNH in NYC and the other two specimens (engorged and un-engorged females) to the Carnegie Museum of Natural History in Pittsburgh, PA. For the past few years, I have been working with the curator of the **Dinosaurs in Their Time** display (main dinosaur hall in the museum) to set up a permanent display of Cretaceous amber in the dinosaur hall. I have assembled additional specimens outlined in the paper (feather and same tick holding onto feather) so that we can build a display case that features the main ideas and shows examples of all aspects of this paper. So, those of you who live around Pittsburgh will one day be able to see most of these specimens although it's probably at least 6 to 9 months away."*

(Thanks to Erica Love for help with this news item!)

The Chicxulub crater off the coast of Mexico, which is linked to the Cretaceous-Tertiary mass extinction, is the only well-preserved peak-ring crater on Earth. The Cretaceous-Tertiary mass extinction occurred at about the same time that an asteroid about 6-mi in diameter hit our planet in what is now the Yucatán Peninsula. Geologists have speculated for decades that the impact would have triggered earthquakes, tsunamis, and even volcanic eruptions, contributing to the extinction of many species on land and in the sea.



Location of the Chicxulub crater (blue circle) and gravity signature of the structure with locations of boreholes. Red dot shows location of M0077A borehole in the peak ring.

Now, geologists have drilled into the peak ring of the crater in the International Ocean Discovery Program and International Continental Scientific Drilling Program (IODP-ICDP) Expedition 364. Peak rings, like those seen on the Moon, form when rocks rebound into a peak inside the crater and then collapse, leaving a center ring of rock within the larger crater. The IODP-ICDP data indicate that the peak-ring morphology was produced by the collapse of an uplifted central peak, as expected. But the drilling also found that the peak ring consists of granite derived from mid-crustal depths.

The Chicxulub impact created an environmental calamity and induced a vast sub-surface hydrothermal system that altered a portion of the Maya tectonic block. The team estimated that the amount of sulfur and CO^2 released into the atmosphere, including a second phase of gas release when the ejecta was re-vaporized, created a cooling event of more than 68^{o}F, with sub-freezing temperatures for three years. They also found that soon after the impact the crater became an oasis for the recovery of life and allowed expansion into momentarily vacant niches that, when filled, defined the modern world. They looked at the recovery of life at ground zero, focusing on a 30-inch transitional layer and the limestone just above it, that recorded the devastation of the impact. They found trace fossils from surviving species, and fossils within the limestone, that revealed life was back to normal within 30,000 years.

http://www.sci-news.com/geology/expedition-chicxulub-impact-crater-05360.html

Some dinosaurs showed sophisticated color patterns to hide from and confuse predators, just like today's animals. In fact, a team of British paleontologists working with an artist showed how *Sinosauropteryx prima*, a small Early Cretaceous theropod dinosaur from China, used its color patterning to avoid being detected by its predators and prey. Among its colors were a bandit's mask-like stripe across its eyes and a banded tail.

Vision was probably very important in dinosaurs, just like with modern birds, and so it isn't surprising that they would have evolved elaborate color patterns. As it turns out, remnants of pigmented feathers occur on the best-preserved available specimens of *Sinosauropteryx prima*. By making comparisons among three specimens, the team was able to reconstruct how the dinosaur looked. The bandit mask is a pattern seen in numerous living animals today, such as the common raccoon. The dinosaur also had darker coloring on top and lighter underneath, suggesting that it lived in more open habitats rather than in dense forests.

Artist's conception of *Sinosauropteryx prima*

Once the paleontologists reconstructed the color pattern, they created 3D models of the dinosaur. Then they photographed them under different lighting conditions to see where the animal's coloration would have hidden it best from potential predators. They concluded that *Sinosauropteryx prima* must have spent lots of time out in direct sunlight rather than in the shade. The findings are especially interesting because an earlier reconstruction of the color patterns of *Psittacosaurus*, an early relative of Triceratops, showed that *Psittacosaurus* was also colored, but in a manner suggesting that it lived in the forest. This distinction between species suggests that the environment where these dinosaurs lived was diverse and able to support dinosaurs adapted to life in different environments.

http://www.sci-news.com/paleontology/sinosauropteryx-prima-bandit-mask-striped-tail-05368.html

New England appears to be one of the geologically quiet areas of the country. It has no volcanoes and very few earthquakes. But if you look beneath the surface, it turns out that this lovely area of the northeastern U.S. might be sitting on a rising mass of warm rock, smaller and slower than those beneath well-known volcanic zones, but there nonetheless. A team of researchers at Rutgers and Yale universities used an advanced array of seismic sensors to see what lies below our feet. The team studied data from EarthScope, a National Science Foundation program that deploys hundreds of geophysical instruments across the United States. The project's Transportable Array picked up readings from small earthquakes and observed the motions of seismic waves in various regions. The team started with previous research that showed a relatively hot spot beneath New England's upper mantle, then used data from EarthScope to observe a localized plume of warm rock beneath central Vermont, western New Hampshire, and western Massachusetts. They also found geologic evidence that it's moving upward.

The Berkshires of New England

This research helps put the planet in perspective. New England traditionally has been thought of as a geologically unchanging area, but the EarthScope data suggests that the subsurface reality is anything but standing still. The discovery suggests that it may be time to rethink New England's geology. The average person tends to think of mountains, lakes, forests, and oceans, essentially the whole Earth, as permanently in place, and they are not. Geologic change, like climatic and oceanographic change, is inevitable. But New England residents don't need to panic because the upwelling is likely tens of millions of years old, i.e., a relatively recent development, and it's moving very slowly. It isn't close enough to the surface to change anything or create any new volcanoes. It's possible the hot spot isn't even big enough to do any of that. The team suggested coming back in 50 million years to see what happened.

https://news.nationalgeographic.com/2017/12/magma-bubble-rising-under-new-england-volcanoes-science/

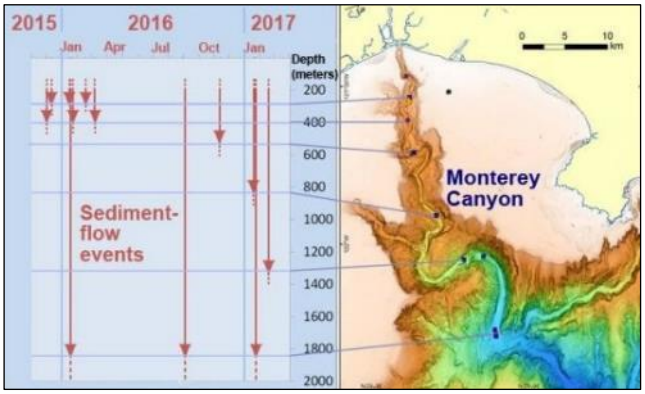
Paleontologists from the New Mexico Museum of Natural History and Science and the University of Colorado at Denver recently described a new 245 million-year-old horseshoe crab from Idaho. They named it *Vaderlimulus* because the animal's head shield resembles the helmet worn by Darth Vader from the Star Wars movies. *Vaderlimulus* is the first Triassic horseshoe crab described from North America. Although dinosaurs and mammals were just beginning to evolve during the Triassic, horseshoe crabs were already an ancient lineage with fossils dating back to at least the Middle Ordovician 470 million years ago.

***Vaderlimulus,* a new Triassic horseshoe crab from Idaho**

There are only four species of horseshoe crabs alive today, and their populations are decreasing. They actually are not crabs; they are more closely related to scorpions and spiders. Although they often are called "living fossils because they show little apparent change in physical appearance over geologic time, *Vaderlimulus* has unusual body proportions that give it an odd appearance, which led the team to conclude that it belonged to the Austrolimulidae, an extinct family. Austrolimulid species expanded their ecological range from marine into freshwater environments during the Triassic and often exhibit body modifications that, by modern standards, provided them with strange appearances.

http://media.newmexicoculture.org/release/664/vaderlimulus-245-million-year-old-horseshoe-crab-fossil-named-after-star-wars-darth-vader

Turbidity currents are the dominant process carrying sediments and organic carbon from coastal areas into the deep sea. They are capable of destroying underwater cables, pipelines, and other human structures. But they are very difficult to study and measure. The Coordinated Canyon Experiment (CCE), recently completed in Monterey Canyon off the coast of California, was the most extensive long-term effort to monitor turbidity currents ever attempted. From October 2015 until April 2017, an international team of researchers from the Monterey Bay Aquarium Research Institute, the U.S. Geological Survey, the University of Hull, the University of Southampton, the University of Durham, and the Ocean University of China observed and measured at least 16 turbidity currents using dozens of instruments at seven different locations in the canyon. These instruments allowed researchers to track sediment flows over a 30-mile stretch of canyon, from depths of about 820 to 6,070 feet.



Sixteen sediment-flow events documented in Monterey Canyon during the Coordinated Canyon Experiment. The arrows indicate minimum estimates of how far each event traveled down the floor of the canyon.

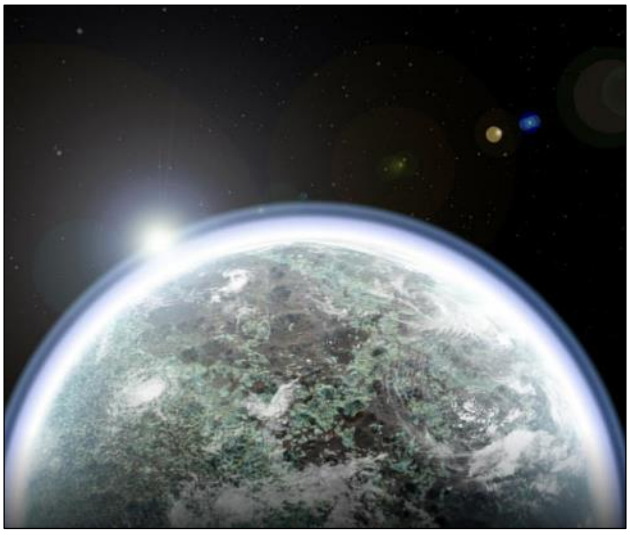
This 18-month project challenged existing ideas about what causes turbidity currents, what they look like, and how they work. Researchers monitored physical processes within the turbidity currents at spatial scales ranging from centimeters to kilometers over time periods ranging from seconds to months. The resulting data yielded a new and unexpectedly complicated view of a globally important phenomenon that has been studied and modeled for nearly 100 years. The CCE showed that sediment-transport events in Monterey Canyon are more common and more complex than previously thought. Instead of being simply sediment-laden water flows, some turbidity currents involved large-scale movements of the

entire seafloor and others changed character as they moved down-canyon. This suggests that no single flow model can explain all the processes involved. Another surprise to the researchers was that there appeared to be no relationship of turbidity current to the types of triggers typically proposed, such as earthquakes and floods. Only a few of the currents coincided with extreme surf events. Is it possible that the sediments build up around the edges of the canyon until they reach a threshold of stability, at which point weaknesses in the canyon walls cause them to fail and the currents to take over?

https://www.sciencedaily.com/releases/2017/12/171211145728.htm

On Mars, phyllosilicate (clay) minerals are common in terrains dating to the Eoarchian Period, 4.1 to 3.7 billion years ago. Phyllosilicates form by the interaction of water with volcanic rock, leading many planetary geologists to conclude that surface water, groundwater, or active hydrothermal systems must have been sustained at some point in Martian history. But climate models suggest an early Mars where the temperature rarely crept above freezing and where water flow on the surface was sporadic and isolated. As a result, scientists couldn't create a concept where surface weathering could produce enough mineral alteration to account for the amount of clay seen on the surface.

Now, researchers at Brown University suggest that the clays may have formed during the creation of the Martian crust itself, before any water flowed on the Red Planet. To make clay, you take rock and add heat and water. At the beginning of the Solar System, Mars and other rocky planets are believed to have been covered by oceans of molten magma. As the magma ocean on Mars began to cool and solidify, water and other dissolved volatiles would have been outgassed to the surface where they would have formed a thick, steamy atmosphere surrounding the planet, probably the hottest and wettest Mars ever was. The moisture and heat from such a high-pressure "steam bath" would have changed large portions of the newly solidified surface to clay. Then, over billions of years, volcanic activity and asteroid bombardments would have covered the clays in some areas and exposed them in others. This would have led to the widespread, patchy distribution of clay seen on the Martian surface today. This concept offers a way to create widespread clay deposits that doesn't require a warm and wet climate or a sustained hydrothermal system early in the planet's history.



Artist's conception of how Mars might have looked with oceans of magma and a steamy atmosphere

The researchers synthesized rock samples matching the composition of Martian basalt in order to demonstrate that the mechanism they proposed is plausible. Then they used a high-pressure device to recreate temperature and pressure conditions the may have been present in a steamy atmosphere created by a magma ocean. After two weeks, they checked to see how much clay had been created. Based on their results, the researchers estimated that, if the steam atmosphere and magma ocean survived for as long as 10 million years, as much as 2 miles of clay would have been created on the primordial Martian surface. Based on that, they created a computer model to simulate a slab of Martian crust with a 2-mile clay layer on top to determine what might have happened in the first billion years of Martian history when volcanic activity and asteroid bombardment were most prevalent. Their model showed that the burial, excavation, and scattering of clays over time matched the distribution of exposed clay deposits similar to those seen on Mars today.

http://www.sci-news.com/space/martian-clays-ancient-steam-bath-05510.html

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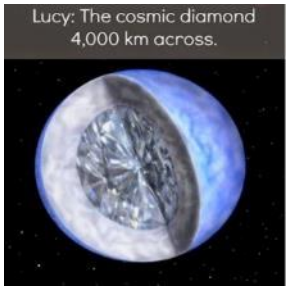

Fun Fact Having Nothing to Do with Geology

The largest known diamond in the universe is a white dwarf star with a carbon interior that crystallized into a 10-billion-trillion-trillion-carat gem. The star, named Lucy after the Beatles song “Lucy in the Sky with Diamonds”, is 50 light years from Earth.

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