PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXIX, No. 2 | Karen Rose Cercone, Editor | October 2016

Wednesday, October 19, 2016

Hydrology from Space
Water Quality and Availability from Lake Erie to the Middle East

Dr. Richard Becker

The University of Toledo

Water resources continue to be critical issue underpinning health and sustainable development across the world. This is especially true in regions where allocation and management of transboundary water resources poses political challenges, such as in the Nile, and the Tigris-Euphrates. It is also evident across state boundaries, with examples coming from water quality and management issues in a water abundant area, the Laurentian Great Lakes. Recent advances in remote sensing can provide great insight in these areas. With the widespread availability of data from a number of recent satellite sensors (e.g. Landsat, MODIS, GRACE, GPM, combined with traditional airborne and UAS sensors) with increasingly longer continuous data acquisition, it is possible to answer fundamental water quality and availability questions. In this presentation, I address using hyperspectral satellite, airborne and UAS images to asses water quality in Lake Erie, specifically harmful algae blooms (HABs) that caused major water problems for the Toledo area in the summer of 2014. I then move to a broader scale and look how changes in climate and land and water use affect globally significant wetlands in Africa (Sudd), and the Middle East (Iraq), using a combination of GRACE gravity and MODIS visible data.

Social hour - 6:00 p.m. **Dinner - 7:00 p.m.** **Program - 8:00 p.m.**

Dinner costs $30.00/person, students $10.00; checks preferred. For reservations, please email pgsreservations@gmail.com with your name and number of attendees in your party. You can also reserve and pay for dinners via PayPal on our website http://pittsburghgeologicalsociety.org. Please include your name and number of attendees in your party. Deadline for reservations is noon on Monday, October 17.

Meeting will be held at Foster's Restaurant, Foster Plaza Building 10, Green Tree.

SPEAKER BIOGRAPHY

Dr. Richard Becker is an associate professor in the Department of Environmental Sciences at The University of Toledo. His work focuses on utilizing satellite remote sensing techniques, combined with traditional field based measurements and to gain insight into geologic process. This has included using satellite imagery for tectonic plate reconstruction, land subsidence, land use change, aquatic water quality, and water availability.

PRESIDENT'S STATEMENT

According to the PGS Constitution and By-Laws, one of the responsibilities of the PGS president is to "…have the general and active management of the business of the Society during summer recess of the Board of Directors…." My interpretation of that phrase is that I am supposed to be doing whatever needs to be done during the summer while the rest of the Board is on recess. I knew I was in trouble before I barely got started as your new president when I anticipated my visit with family and friends in Thailand during the whole month of August. On reflection I could have officially delegated the task to the Vice President. But I shouldn't have worried. While abroad I had a few opportunities to "listen in on" the email conversations among the Board members. PGS business hummed along seamlessly across the days of my departure and return. What I said about the quality of the Board members in my September newsletter statement is a lot more than a president's cheerleading rhetoric. Speaking of which, I wish to express deep gratitude to John Harper for his generous monetary contribution to cover the inaugural minting of our society's Eastern Section AAPG award for the Best Paper on Appalachian Geology; this after his tireless effort in obtaining AAPG's approval of the award, seeking the services of an engraving company, and designing and redesigning the plaque several times. I cannot overemphasize John's contribution to the interests of PGS over the years.

There are many other projects and initiatives that we are undertaking. If you attended the September meeting you know that we will resume awarding our visiting speakers with a simple token of appreciation, namely a mug and flash drive. We initially were going to settle on just a flash drive but Tamra Schiappa, our Vice President and Program Chairperson, brought to our last meeting two sample mugs, each with its own design. She told us to take our pick between the flash drive and the mug and we picked both.

Other undertakings you'll hear more about in the future include a field trip in the early spring of next year, the society's co-convening of the Playmaker's forum this April and at the Eastern AAPG meeting in 2018, and the development of a new PGS website. Another project with which I've been involved to a minute degree is the society's participation in the Math and Science Collaborative (MSC) of the Allegheny Intermediate Unit. Ken LaSota has been initiating and coordinating our interaction with MSC over several years. Earlier this year I attended two "classes" in which Kyle Frederick demonstrated use of Arc-GIS as an earth-science instruction tool. Ken, Ray Follador, and I were present to give Kyle moral support and occasionally make supplementary remarks to the "students."

As is the case every year, this November is a critical month for us since that is when we contact current and potentially new sponsors for financial support. We've been blessed by generous contributions in the past. PGS has been providing valuable support to professionals, students, and avid rock collectors since the last year of World War II, and I want to do my part to "keep this train running."

I look forward to seeing you on the 19th.

Peter R. Michael

President

FIRST PGS AWARD PRESENTED AT AAPG EASTERN SECTION MEETING IN LOUISVILLE, KENTUCKY

Joan Crockett, AAPG ES Honors and Awards chair, presents Christopher Laughrey with the PGS Award for Best Presentation on Appalachian Geology at the 2015 ES AAPG

In 2015, PGS approached the AAPG Eastern Section (ES) Awards Committee with a proposal to provide an award at the annual AAPG ES meeting for the best presentation on Appalachian geology, regardless of subject matter. The award could be given for either an oral presentation or a poster, and by either a professional or a student.

The very first PGS Award, chosen by judges at the 2015 meeting in Indianapolis, IN, was presented on September 25 at the 2016 meeting in Lexington, KY, to Christopher Laughrey, Senior Petroleum Systems Analyst with Weatherford Laboratories' Geochemical Interpretive Services in Golden, CO.

It is especially appropriate that Christopher won this first award because he is a PGS member and a past president of the Society. The winning presentation by Christopher and his coauthor, Thomas Darrah, was titled, "The stable isotope and noble gas geochemistry of Point Pleasant, Utica, Tuscarora and Trenton/Black River Formation production gases, northern Appalachian Basin."

Congratulations to Christopher Laughrey and Thomas Darrah from your friends at the Pittsburgh Geological Society!

GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

October 4, 2016
Orlando Teran, MicroSeismic Inc. – Mapping Reservoir Stress Conditions Using Hydraulic Fracturing Microseismicity. Cefalo's Event Center, Carnegie PA.

HARRISBURG GEOLOGICAL SOCIETY

October 13, 2016
Bob Beard, P.G., Leidos – "The Mid-Atlantic Rockhound" Fiesta Mexico Restaurant, Harrisburg PA

THE ASCE PITTSBURGH SECTION GEO-INSTITUTE CHAPTER

October 19, 2016
Dr. Tom O'Rourke, Cornell University – 2016 Karl Terzaghi Lecture: Ground Deformation Effects on Subsurface Pipelines and Infrastructure Systems. Engineer's Society of Western Pennsylvania.

11TH ANNUAL PENNSYLVANIA BROWNFIELDS CONFERENCE

October 25-26, 2016
"Transforming Communities" Lancaster County Conference Center, Lancaster PA. Sponsored by the Engineer's Society of Western Pennsylvania.

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

October 27, 2016

Dr. Tim Carr, West Virginia University – Marcellus Shale Energy and Environmental Laboratory (MSEEL) Update. Cefalo's Event Center, Carnegie PA.

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

Ian A. Thomas, PG
Geologist, MS in Geology, University of London (1994)

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

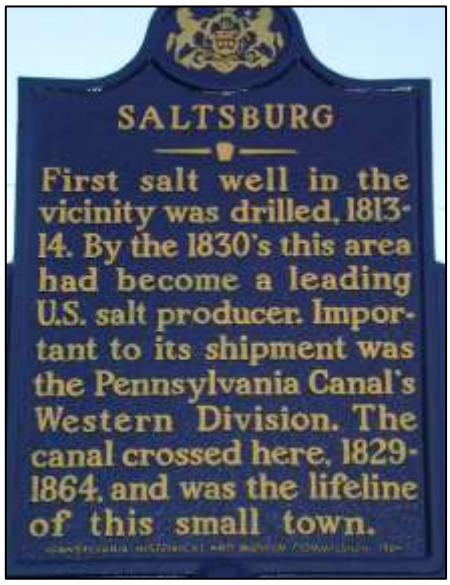
From California University of PA

Edward P. Barlow
Derek J. Hussak
David C. Rine
Greg S. Sleith
Robert W. Downs
Danica R. Pils
Addison R. Seman

From Slippery Rock University of PA:

Ryan S. Naylor
Joseph C. Price

UPCOMING EVENTS OF INTEREST TO PGS MEMBERS



SAVE THE DATE - SATURDAY, APRIL 8, 2017

PGS SPRING FIELD TRIP

PGS will sponsor a one-day field trip that examines the geology and industrial history of the Western Division of the Pennsylvania Main Line Canal in southern Indiana County. Participants will visit the type location of the Saltsburg Sandstone, and examine paleosols and stream channels in a section of the Glenshaw Formation exposed along Bow Ridge near the Conemaugh River Lake. Additional stops will be made at the Rebecca Haddon Stone House Museum in Saltsburg, the Tunnelview Historic Site, and the US Army Corps of Engineers Conemugh River Lake flood control dam near Tunnelton. Stay tuned for more information and registration deadlines in upcoming newsletters!

2017 GSA Joint Section Meeting

NORTHEASTERN (52ND) AND NORTH-CENTRAL (51ST)

Shale Gas Production:

Views from the Energy Roller Coaster

19–21 March 2017 • Pittsburgh, Pennsylvania, USA

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Tidioute, a tiny borough (population <1,000) in southwestern Warren County, lies just a few miles up the Allegheny River from Tionesta (see September's newsletter). The name supposedly is derived from an Iroquoian word meaning "protrusion of land" (Tidioute lies on a sharp bend in the river).

Tidioute was part of the great oil boom of the late 1800s and early 1900s, but it was probably more well-known for its connection with the cutlery industry. In the late 1800s, groups of British cutlery workers migrated to the region from factories in New England to establish their own businesses. Tidioute became the home of the Tidioute Cutlery Company, a knife manufacturer founded in 1897, but the company later folded and reformed as the Union Cutlery Company of Olean, New York in 1911.

Tidioute Bridge, site of the annual reenactment of *The Bridge at Remagen*

Today, Tidioute is known as a destination for nature lovers and outdoors enthusiasts. For example, it is home to the Pennsylvania State Championship Fishing Tournament, hosted during the last full weekend of September. Main events include the two-day fishing tournament, a children's fishing derby, a carnival, and a parade. Also, as of 2009, Tidioute has become the home of the reenactment of a 1945 World War II battle at the Ludendorff Bridge in Germany. During the last months of WWII, the 9th Armored Division approached the town of Remagen and captured the Bridge. Although the actual battle occurred over a week, the reenactment (and a 1969 movie called *The Bridge at Remagen*, starring George Segal, Ben Gazzara, and Robert Vaughn) significantly shortens the actual length of the hostilities. The reenactment takes place using the Tidioute Bridge over the Allegheny River and in Tidioute itself during the first weekend of every August.

DID YOU KNOW . . . ?

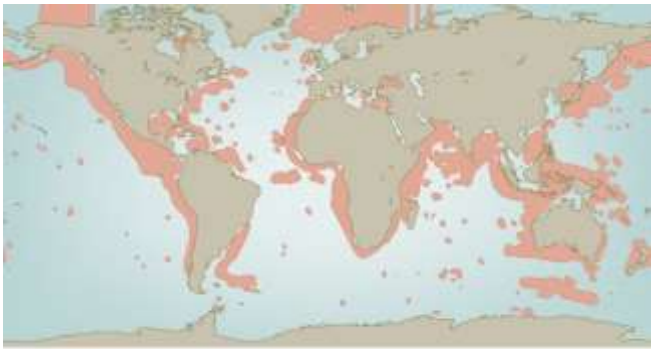
A new collaborative study between Western University (Canada) and Blaise Pascal University (France) proves that the Earth and other planetary objects that formed in the early years of the Solar System share similar chemical origins, a concept that scientists have disparaged for decades. The researchers used thermal ionization mass spectrometry to demonstrate that the Earth and other extraterrestrial objects share the same initial levels of the isotope Neodymium-142 (^{142}Nd), which is widely distributed in the Earth's crust. It has been known for about 10 years that there are small variations in ^{142}Nd between chondrites, the stony meteorites considered essential building blocks of the Earth, and terrestrial rocks. Originally, this was interpreted as an early differentiation between the interior of the Earth and the chondrites during the first 30 ma Earth

The Solar System was built from both ancient and new space debris

history. The new study, however, showed that these differences in ^{142}Nd were already present during the growth of Earth and not introduced later as previously believed. The researchers' vastly improved measurement techniques helped them deduce that different meteoritic bodies had both neodymium and samarium, but with slightly

different isotopic compositions, which indicated that the Solar System was not uniform during its earliest times. They also determined that materials formed from previous generations of stars were incorporated in various proportions into the building blocks of solar planets.

It appears that the release of methane from seafloor hydrates during a rapid global warming event 56 ma was much slower than previously thought. During the Paleocene-Eocene Thermal Maximum (PETM), temperatures in the deep ocean rose by about 5o C and sea surface temperatures increased by up to 9o C. This hot period, which lasted for about 100,000 years, caused an extinction event.



Map showing global methane hydrate occurrences

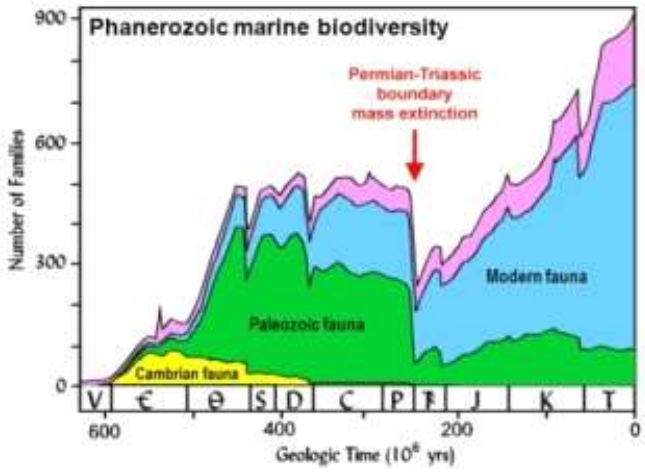
The standard hypothesis is that while the oceans were warming, there was a rapid and massive release of methane into the ocean and atmosphere. Now, computer models of the warming process have allowed researchers from the University of Southampton in England to simulate the effects of PETM ocean warming on sediments that may have contained methane hydrates, and to track how methane transport mechanisms would have affected its release into seawater.

Their results showed that, although hydrate melting could be triggered by ocean temperature change, the result would not necessarily be a rapid release of methane because the gas formed would spend time traveling up to the seabed, and along the way it could refreeze or dissolve and be consumed by microbes. The researchers suggested that only a fraction of the methane would escape into the ocean, and the part that did escape could take thousands of years to do so.

But more hydrate would have to have been present globally than is considered to be reasonable for the warm late Paleocene Ocean in order to explain the melting of that much hydrate. Also, the researchers speculated, there would need to be cracks and fissures in the sea floor to allow the methane to rise to the quickly.

Their findings challenge not only the currently accepted concept of the role methane hydrates played in the PETM, but also raise questions about the potential for present-day methane hydrates to exacerbate current climate change. Some observations of present-day hydrate melting and methane release have led to suggestions that the process could be happening today. Thus, this new research could allow scientists to better understand the potential effects of rising ocean temperatures worldwide on current and future climate change.

We are all aware that the Permian-Triassic extinction event was the worst in Earth history, when 96% of all marine species and 70% of all terrestrial species died off. By comparison, the end-Cretaceous extinction event, when the dinosaurs disappeared, was a hiccup in the procession of life.



The Permian mass extinction was the worst in Earth history

But did you know that it took an inordinately long time for life to recover? Although scientists have argued for decades over the cause of the Permian-Triassic extinction – a bolide impact, an atmosphere poisoned by volcanic gases, or some other event – many now agree that it was due to

extreme global warming triggered by great volcanic eruptions such as the Siberian Traps flood basalts in Russia. These eruptions, which lasted for about 1 ma and emitted enormous amounts of volatiles such as carbon dioxide and methane, made the Earth unbearably hot and led to the mass extinction of life. Then it took life from 5 to 9 ma to recover.

Why the recovery was so delayed has remained a mystery. Now a new study from the University of Tromsø in Norway suggests it may have been due to a significant nutrient gap. This hypothesis further suggests that the global oceans were severely poor in nutrients such as nitrogen as a result of extremely high ocean surface temperatures in the aftermath of the extinction. High temperatures would have caused deepening of both the thermocline and nutricline in the oceans so that upwelling of nutrients from the bottom to the surface of ocean ceased, stalling marine algae productivity. The lack of algae, the base of the food chain, would have meant that the life in the ocean could not thrive. The oceans finally started cooling 6 or 7 ma after the extinction, allowing nutrient rich waters to return and life to return. The results of the study illustrate the potential long-term impacts on marine ecosystems in response to global warming.

There are two competing hypotheses about the origin of the Moon. One suggests that a low-energy impact left the proto-Earth and Moon shrouded in a silicate atmosphere. The other suggests that a much more violent impact vaporized the impactor and most of the proto-Earth, expanding to form a superfluid disk more than 500 times bigger than today's Earth out of which the Moon eventually crystallized. Now, researchers from Washington University and Harvard report that isotopic differences between Moon and Earth rocks provide experimental evidence that support the high-energy hypothesis.

The researchers examined seven lunar rock samples from different lunar missions and compared their potassium isotope ratios to those of eight terrestrial rocks representative of Earth's mantle. Potassium has three stable isotopes, but only two of them, ^{41}K and ^{39}K, are abundant enough to be measured with sufficient precision for such a study. The lunar rocks were enriched by about 0.4 ppm in the heavier ^{41}K isotope. The only process that could have separated the isotopes that way would have been incomplete condensation of potassium from the vapor phase during the Moon's formation because, by comparison to ^{39}K, ^{41}K would preferentially fall out of the vapor and condense. However, if this had occurred in an absolute vacuum, it would have led to an enrichment of ^{41}K in lunar samples by about 100 ppm, whereas higher pressures would have suppressed fractionation. The researchers predicted that the Moon condensed in a pressure of more than 10 bar, or roughly 10 times the sea level atmospheric pressure on Earth. These findings contradict the low-energy silicate atmosphere model, which predicts that lunar rocks should contain less ^{41}K than terrestrial rocks, rather than more as the researchers found.

The Moon formed after a high-energy impact destroyed most of the proto-Earth

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The Geology and Art departments at Appalachian University in Boone, NC, have teamed up to build a life-sized model of *Gorgetosuchus pekinensis*. The animal was an aetosaur, a kind of armored reptile related to, but more primitive than crocodiles. It is not a dinosaur, but rather a reptile

An artist's conception of *Gorgetosuchus*

that lived in what is now North Carolina during the Triassic Period, about 230 million years ago.

The process to build the *Gorgetosuchus* began with art students creating drawings done proportionally to scale, using them for reference during the modeling process. The students are also incorporating newer digital technologies to generate 3D rendered and printed models for reference. The project is helping the geologists learn more about aetosaurs while, by studying this one so closely, the art students are getting the opportunity to hone their technical and professional skills.

Once the final sculpture is complete, it will become part of the geology department's science and education outreach program. When people see the sculpture, it should give them a sense of how different the North Carolina landscape must have looked in the Triassic. The project is a great opportunity for students to recognize all the opportunities for research available to them and connect that research with multiple communities in the professional world. The model is scheduled to be finished by the end of the current semester.

Helium, the noble gas that has inflated balloons and induced many serious persons to speak in silly, squeaking voices, has never been found intentionally. It has always been accidentally discovered in small quantities during oil and gas drilling operations. But it is a critical component in many aspects of scientific research and is needed in a number of high-technology processes. Unfortunately, known reserves are quickly running out. Now, researchers from Norway and England have used a new exploration approach to discover a world-class helium gas field in Tanzania.

High concentrations of helium in the region are most likely related to the heating and fracturing of the Archean Tanzanian Craton and Proterozoic Mozambique Belt by the younger arms of the East African Rift System. The volcanic activity in the region provided the intense heat necessary to release the gas from ancient, helium-bearing rocks. The distribution of helium seeps along active faults indicates increased communication between the deep crust and the subsurface. This, combined with the presence of gas traps, suggests that there may be a significant helium resource available. If the traps are located too close to a volcano, however, the helium could be heavily diluted by volcanic gases such as carbon dioxide.

The researchers have been working to identify what they call "the goldilocks-zone" between the ancient crust and the modern volcanoes where the balance between helium release and volcanic dilution is just right. They used a combination of helium geochemistry and seismic imaging to locate helium trap structures. Now, other experts calculate the area contains a probable resource of 54 billion cubic feet (Bcf) of helium in just one part

Carl Fredricksen used helium-inflated balloons to move his house in Disney/Pixar's animated film "Up"

of the Rift Valley. To put this into perspective, global consumption of helium is about 8 Bcf per year. The US Federal Helium Reserve, the world's largest supplier, has a current reserve of 24.2 Bcf, and total known reserves in the US amount to about 153 Bcf. The new helium exploration process will, hopefully, change the way we find helium and secure society's helium needs for the future.

An international team of scientists from Australia and England recently discovered the world's oldest fossils in a remote area of Greenland, revealing that microbial life thrived on our planet 3.7 billion years ago. The team discovered 3.7 ga stromatolite fossils from a newly exposed outcrop in the Isua Greenstone Belt along the edge of Greenland's icecap. The metacarbonate rocks contain 1- to 4-cm high stromatolites, indicating that microbial life was already diverse as far back

as 3.7 ga, suggesting that life emerged within the first few hundred millions years of Earth's existence. This also agrees with what biologists have calculated based on the preserved genetic code of Earth's biota. These particular stromatolite fossils predate the previously considered oldest evidence of life (3.48 ga stromatolites from Western Australia) by 220 million years.

Recent stromatolites in Shark Bay, Australia

Stromatolites, which range in age from the early Precambrian to the Recent, are the most persistent evidence of life during Earth history. The Greenland stromatolites became exposed by recent melting of a perennial snow patch. They grew in a shallow marine setting as indicated by seawater-like rare-earth element plus yttrium trace element signatures of the metacarbonates, and by interlayered detrital sedimentary rocks with cross-lamination and storm-wave generated breccias. The fossils and the rock they are preserved in provide the first direct evidence of an environment in which early life thrived, so that for the first time we know which conditions and environments could sustain life. Such a groundbreaking find could point to similar life structures on Mars, which had a damp environment 3.7 billion years ago.

Since the first fossils of coelacanths were described in 1844, they have been found in sediments from the Early Devonian to the Late Cretaceous, implying that they successfully diversified in the past. Coelacanths disappeared from the fossil record at the end of the Cretaceous, leading paleontologists and biologists to believe they died out during the K-T mass extinction event 65 ma. The discovery of *Latimeria chalumnae* off the coast of South Africa in 1938 created a sensation within the scientific community. Now, coelacanths are called "living fossils" because their morphology has essentially unchanged from the fossil record. Additional specimens were collected in the Comoros archipelagos, and off the coasts of Mozambique, Madagascar, Kenya, and Tanzania. A second species, *L. menadoensis*, was found off Indonesia on the other side of the Indian Ocean, and phylogenetic studies demonstrate that the coelacanths from off the coast of Tanzania are genetically distinct from those of Comoros. Coelacanths belong to the group that includes both lobe-finned fishes and tetrapods. In fact, molecular phylogenetic studies clearly indicate that coelacanths and lungfishes are more closely related to tetrapods than to bony fishes.

The living coelacanth, *Latimeria chalumnae*

Do you know an outstanding earth science educator? The American Association of Petroleum Geologists (AAPG) is looking for their 2017 Teacher of the Year, a U.S.-based K-12 Earth science teacher who is exceptionally dedicated, knowledgeable and skilled in providing excellence in geoscience education.

The Teacher of the Year winner will receive a $6,000 prize, half of which is given to the teacher for personal use and the other half to his or her school for educational purposes under the teacher's supervision. Each semi-finalist will receive an honorable mention and a $500 cash prize for their nominations.

The deadline for application is January 15, 2017. For more information, check out the AAPG website at **www.aapg.org**.

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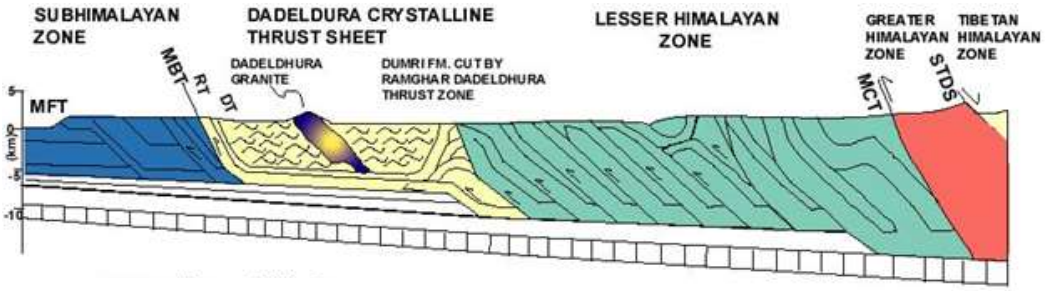
PGS Website of the Month



http://www.geo.arizona.edu/geo5xx/geo527/Himalayas/geology.html

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Officer Contacts: If you wish to contact a current PGS Officer, you can email Peter Michael, President, at shabell9@comcast.net; Tamra Schiappa, Vice President and Speaker Coordinator, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Karen Rose Cercone, Secretary and Newsletter Editor, at kcercone@iup.edu.

Memberships: For information about memberships, please write PGS Membership Chair, PO Box 58172, Pittsburgh PA 15209, or e-mail jharper.pgs@gmail.com. Membership information may also be found at our website: www.pittsburghgeologicalsociety.org.

Programs: If you would like to make a presentation at a PGS meeting or have a suggestion for a future speaker, contact Tamra Schiappa, Program Chair at tamra.schiappa@sru.edu.

PGS Website: The Society's Website is currently being re-designed and may not be fully functional during the month of October. We hope to have a new website up and running soon!

Facebook: Follow the PGS at https://www.facebook.com/PittsburghGeologicalSociety for breaking news, announcements and interesting geological facts.

Twitter: PGS now has a Twitter Feed! You find it at https://twitter.com/ on the web or look for **@PghGeoSociety** on your mobile Twitter app.

Fun Fact Having Nothing to Do with Geology

When he died in 2002, Edward "Steady Ed" Headrick, the man credited with the phenomenal success of Wham-O's Frisbee flying disk, was cremated and his ashes were molded into a limited number of Frisbees that were given to his family and close friends or sold to benefit the Ed Headrick Memorial Museum in Georgia.