PGS Newsletter

http://www.pittsburghgeologicalsociety.org/

Vol. LXVIII, No. 8 | Karen Rose Cercone, Editor | April, 2016

Wednesday, April 20 2016

jointly present

The 14th Annual Student Night

The Pittsburgh Geological Society presents:

Late Paleozoic Sedimentation Patterns and Paleo-environment Reconstructions in the Northern Appalachian Foreland Basin by Baylee Kushner, Slippery Rock University

The American Society of Civil Engineers Pittsburgh Section presents:

Molecular Dynamics Simulations of Carbon Dioxide Sequestration in Depleted Shale Gas Reservoirs by Mohammad Kazemi, West Virginia University

The Association of Environmental & Engineering Geologists Allegheny-Ohio Section presents:

Effects of Hurricane Joaquin on the Sandy Hook Washover Fan Complex on San Salvador Island, Bahamas by Jamie Scacchetti, Youngstown State University

[Speakers' abstracts and list of poster presenters begin on page 3.]

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 Monday, April 18.

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

PRESIDENT'S STATEMENT

Welcome to April, the Spring season, and our 14th annual Student Night. The April meeting has always been jointly hosted by the American Society of Civil Engineers (ASCE), the Association of Engineering Geologists (AEG), and the Pittsburgh Geological Society (PGS) with each organization selecting a "top" student to present an oral presentation. The three selected receive a monetary award and, more importantly, a spot at the podium to present their research.

I would like to congratulate all of the students, and acknowledge their universities, for submitting 11 abstracts for this year's Student Night. They are as follows: Oral presenters, PGS; Baylee Kushner, Slippery Rock University (SRU), AEG, J.L. Scacchetti, M. Zaller, and R. D. Yocichin, Youngstown State University (YSU), and ASCE, Mohammad Kazemi, West Virginia University. Poster Presentations, Savannah Irwin, Indiana University of Pennsylvania (IUP), Wesley Taylor Kamerer (IUP), Cathleen Bressers (IUP), Jonathan King (IUP), Michael Chojnacki, Logan Jacobs, and Patricia Campbell (SRU), Christy Miller (SRU), Blake Wallrich and Michael Zieg (SRU), and A. M. Seidler, A. M. Bell, O. L. Costantino, B. L. Johnson, and S. F. Farhan (YSU). Each participating hosting society will present an award for their choice of best poster presentation.

For all of the Society's graduating student members, we congratulate you on your accomplishment and wish you a smooth transition and much success in beginning your career or continuing your education. Please remember that wherever your career takes you geographically, remaining a member of the PGS has lasting value. You need to continue networking throughout your career and membership in professional societies are one of the best ways to do it.

I would like to recognize the Baron Group, Inc., Pennsylvania Soil & Rock, Inc., and Woodard & Curran, Inc. as our most recent returning corporate sponsors. The Society truly appreciates all of our corporate members. Without their backing we could never accomplish all of the initiatives of the Society.

In closing, I would like to acknowledge the Pennsylvania Council of Professional Geologists for their generous monetary contribution in support of our student initiatives and tonight's meeting.

Ray Follador

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

Shane Loveday
California University of Pennsylvania

Nicole Kelley
Indiana University of Pennsylvania

Late Paleozoic Sedimentation Patterns and Paleoenvironment Reconstructions in the Northern Appalachian Foreland Basin

KUSHNER, B. and SCHIAPPA, T.A., Department of Geography, Geology and the Environment, Slippery Rock University, Slippery Rock, PA

A complex network of fluvial systems filled the Appalachian Foreland Basin from a variety of provenance regions during the Late Mississippian-Early Pennsylvanian periods (325-315 Ma). This basin formed in response to the accretion of the Taconic, Avalonian, and Acadian terranes and the collision of paleocontinents Laurentia and Gondwana, forming the Alleghenian orogen. Previous research of immature fluvial systems along the orogen compared U-Pb dated mineral ages to known provenance regions of various tectonic ages on Laurentia. These studies concluded that sediments were transported into the adjacent Appalachian Foreland Basin from the Acadian and Taconic terranes, uplifted Precambrian Greenville basement, and Canadian Shield. This research compared the contribution by these sediment sources along the orogen to their contribution along the northern shoreline of the Appalachian Foreland Basin, sampled in Venango County, Pennsylvania. Petrographic analysis and paleocurrent data were used to interpret paleoenvironmental changes between sandstone units. Point count compositional data was plotted on QFL diagrams to compare provenance of each unit. Based on our results a fluvial model for this section of the basin was produced. This research indicates that mature fluvial sediments comprising subsurface strata in northwestern Pennsylvania originated primarily from the Alleghenian orogen during the Late Mississippian-Early Pennsylvanian periods. Future research will include U-Pb mineral dating to quantify sediment contribution by minor provenance regions during these periods, as well as analysis of older rock units to determine when provenance and paleoenvironment changes occurred. Understanding these sedimentary trends is integral to safe and efficient resource extraction and geologic modeling of other foreland basins in North America.

Molecular Dynamics Simulations of Carbon Dioxide Sequestration in Depleted Shale Gas Reservoirs

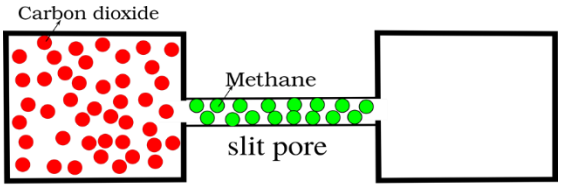
KAZEMI, Mohammad, Department of Petroleum and Natural Gas Engineering
West Virginia University, Morgantown WV

With large scale production of gas from shale resources, large volumes of pore space have been recently vacated. Therefore, there is a huge capacity of carbon dioxide (CO_2) that could be stored. Furthermore, due to the higher affinity of the organic nanopores to CO_2 compared to methane, injection of CO_2 can enhance the recovery of natural gas. The objective for this work is to investigate displacement and sorption (adsorption of CO_2 and desorption of methane) in organic nano-capillaries using Molecular Dynamics simulations.

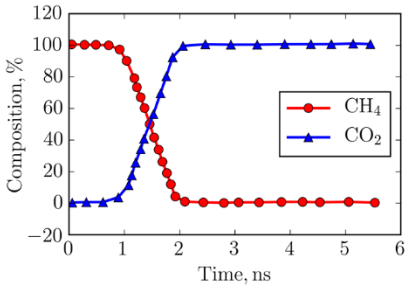
In this study, sorption capacity of two adsorbing gases (methane and CO_2) is compared by performing Molecular Dynamics (MD) simulations in identical setups of carbon nanotubes. MD simulations are performed for different capillary sizes, pressures, and temperatures. Excess and absolute adsorption isotherms of these gases are plotted and compared. To simulate the displacement process, methane molecules are initially adsorbed on the walls of the nanotube. Then, CO_2 is injected to replace the methane molecules. Finally, composition profiles of pure CO_2 displacing methane with time are examined.

(continued on next page)

According to MD simulation results, adsorption capability of CO_2 is found to be higher under the same pressure and temperature. As pore size increases, the adsorption structure of methane changes from single layer to multilayer adsorption. As the temperature increases, the amount of adsorbed molecules for both gases decreases. It is found that the CO_2 molecules replace adsorbed methane molecules due to their higher adsorption capacity. A slow breakthrough and sharp front is observed in this displacement process. The results show that the amount of CO_2 storage and methane production rate are increased as CO_2 injection pressure increases. Furthermore, the rate at which CO_2 could be injected is higher than the rate of methane production.



Schematic of MD simulation models



Composition profiles of Methane and Carbon Dioxide after injection of Carbon Dioxide.

Effects of Hurricane Joaquin on the Sandy Hook Washover Fan Complex on San Salvador Island, Bahamas

SCACCHETTI, J.L., ZALLER, M., and YOVICHIN, R.D., Department of Geological and Environmental Sciences, Youngstown State University Youngstown, Ohio 44555

San Salvador lies along the eastern edge of the Bahamas archipelago. Forty-seven hurricanes and tropical storms have impacted the island in the last one hundred and forty five years with four major hurricanes striking the island since 1996. The combination of storm frequency, little commercial development of the island and near-shore inland lakes makes San Salvador an ideal location for the study of ancient storms or paleotempestology. The work presented here is part of on-going paleotempestology research on the island.

The most recent storm to hit the island is hurricane Joaquin, which made landfall on October 2, 2015, as a category four hurricane having a maximum wind speed of one hundred and thirty five knots. Being an island with little development, the physical impacts of recent hurricanes may remain in place for many years. Long-term records of hurricanes may be preserved in the sediments of near-shore lakes present along much of the island's coast. The sediments of one lake located near Sandy Hook along the southeastern coast of the island ($23^0$56'52.54"N, $74^0$30'28.36"W, WGS 84) that have shown evidence of past hurricanes was impacted by hurricane Joaquin in the form of a large wash over fan deposit that transported marine sand a distance of approximately 140 meters inland. The research presented here focused on this wash over fan as an effort to characterize this type of storm deposit and to better understand ancient storms in general.

The research is based on the premise that inland lakes are dominated by non-marine gradual fine sediment and organic deposition and the presence of marine sand deposits within a lake is evidence of ancient storms. In order to characterize the lake deposits and the over wash fan, a total station survey was performed for survey location and elevation control, sediment core and auger samples were collected to sample and characterize the lake deposits and ground penetrating radar transects were performed to better define the contact between lake deposits and the underlying bedrock. The collected data was integrated using Arc GIS 10.3 in an effort to show the lateral extent and depth of the material deposited by the storm.

Student Poster Presentations

At least one student from each research team will be present during the 6:00-7:00 social hour to discuss their research project and answer any questions.

Insights from Analog Modeling the Chinese continental margin fracture zone promontory in Taiwan
BRESSERS, Cathleen, Geoscience Department, Indiana University of Pennsylvania

Depositional and Structural Features of the Basal Morgantown Sandstone, Mt. Nebo Pointe, Pittsburgh, PA
CHOJNACKI, Michael, JACOBS, Logan and CAMPBELL, Patricia, Department of Geography, Geology and the Environment, Slippery Rock University

Ibexian faunas of the Jones Ridge Formation, Ogilvie Mountains, east-central Alaska
IRWIN, Savannah, Geoscience Department, Indiana University of Pennsylvania

Refined age-dating and correlations of Cambrian-Ordovician limestone deposits in Alaska and the Yukon based upon agnostoid arthropods
KAMERER, Wesley Taylor, Geoscience Department, Indiana University of Pennsylvania

Micromorphology of a Mississippian Structure at the Lawrenz Gun Club Site, Illinois
KING, Jonathan[1], MONAGHAN, William G. [2], and HOMSEY-MESSER, Lara[1]
[1]Indiana University of Pennsylvania, [2] Indiana Geological Survey

Ostracodes as Proxies for Paleoenvironment Reconstruction of the Late Pennsylvanian Pine Creek Limestone in Western PA.
MILLER, Christy and SCHIAPPA, Tamra A., Department of Geography, Geology and the Environment, Slippery Rock University

Characterization of Surface and Subsurface Morphology of Sandy Point, San Salvador, Bahamas
SEIDLER, A.M., Bell, A.M., COSTANTINO, O.L., JOHNSON, B.L., and FARHAN, S.F., Department of Geological and Environmental Sciences, Youngstown State University

Petrographic and Textural Analysis of the Black Sturgeon Sill, Nipigon Canada
WALLRICH, Blake M. and ZIEG, Michael J., Department of Geography, Geology, and the Environment, Slippery Rock University

CALENDAR OF EVENTS

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

April 12, 2016
AAPG Distinguished Lecturer Larry Garmezy - The Similarities And Differences In The Hunt For Unconventional And Conventional Hydrocarbons
Cefalo's Event Center, Carnegie PA.

2016 PITTSBURGH PLAYMAKERS FORUM

April 13, 2016
An educational and networking event for petroleum geologists focusing on the geology of key plays across Eastern North America.
Pittsburgh Airport Sheraton, Coraopolis

PTTC – EFD Workshop

May 19, 2016
Learning from Shales: Applying New Technology to Old Plays
WVU Alumni Center, Morgantown, WV

HARRISBURG GEOLOGICAL SOCIETY

April 14, 2016
Charles Cravotta, USGS – Hydrological, Geochemical, and Geophysical Investigations in Support of Watershed Restoration in the Upper Schuylkill River

May 12, 2016
Ted Daeschler, Academy of Natural Sciences and Drexel University – New Discoveries from the Age of Fishes in PA and Beyond

AAPG 2016 EASTERN SECTION MEETING

September 25-27, 2016
Lexington Convention Center, Lexington KY

12th Annual PGS Student Field Workshop Shows Students Their Future in Geoscience

A day spent watching a drill rig in action showed geoscience students from across the Pittsburgh region what their lives could be like when they are out in the real world. The students who attended the field workshop expressed their sincere gratitude to Frank Benacquista PG and all of his colleagues for taking the time to put together such a valuable educational experience for them.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Although Jumonville, on the crest of Chestnut Ridge near Uniontown in Fayette County, refers specifically to a Methodist camping and retreat center, generally speaking the whole area is referred to as Jumonville. It was named for Joseph Coulon de Villiers de Jumonville, an ensign in the French marines. Jumonville was in charge of a troop of Canadian and French soldiers sent to discourage a company of Virginia militia and Indian allies, commanded by Lieutenant Colonel George Washington, from attempting to protect workers building a fort in French-claimed territory at the forks of the Ohio River (later known as Pittsburgh). A large band of French soldiers had chased the workers away and began building Fort Duquesne at the forks. Washington and his small band were on their way to the site when they encountered Jumonville and his men. The battle, which lasted only 15 minutes on May 28, 1754, became known as the Battle of Jumonville Glen.

Jumonville Glen, site of the beginning of the French and Indian War

Ten French soldiers were killed outright, and 21 were captured, including Ensign Jumonville who was carrying diplomatic papers. Although he was being treated honorably as a prisoner of war, without notice, one of the Indians walked up to Jumonville and killed him with a tomahawk while Washington stood by dumbfounded. After these events, Washington and his men retreated to nearby Fort Necessity where they eventually surrendered to Canadian forces from Fort Duquesne. The terms of Washington's surrender included a statement in French (which Washington could not read) stating that Jumonville had been assassinated. Washington, in his journals, gave no details of the incident, so the exact circumstances of Jumonville's death are still controversial to this day.

The Battle of Jumonville Glen is credited as the opening salvo of the French and Indian War, The event, as brief and seemingly innocuous as it was, also had international repercussions – it is credited with starting the Seven Years War, the real first world war. The Seven Years War lasted from 1756 until 1763, and was fought by every major European power across North America, Europe, Africa, and Asia. And the beginning of it happened right at the top of Chestnut Ridge, one of the very few major anticlines found in western Pennsylvania

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DID YOU KNOW . . . ?

Although many researchers believe that Earth's early oceans were very hot, reaching as much as 176°F, new research from South Africa indicates that both the land and the ocean were much colder than that. In analyzing both volcanic and sedimentary rocks in the Barberton Greenstone Belt in South Africa, the researchers found that some of the mudrocks existing with deep-submarine volcanic rocks contain gypsum, which is produced under high pressure and at very cold temperatures such as in the present deep ocean. show a remarkable resemblance to those known from more recent ice ages. The researchers believe this indicates that the Earth experienced an extensive, possibly global, ice age about 3.5 billion years ago. Although they don't expect the geological community to blithely accept a paradigm shift blithely, they are hoping the concept will stimulate additional research. Not only does this potentially change the way we think about the early Earth, it also raises important questions about the origin of life.

A new study by scientists at the University of Hawaii and the University of California used the chemical and biological signatures of deep sea sediments to look at changes in the Earth's temperature and atmospheric CO_2 since the end of the Mesozoic. Their findings suggest we humans are releasing carbon around ten times faster than during any event in the past 66 million years. Until this study, the Paleocene-Eocene Thermal Maximum (PETM), which occurred around 56 million years ago, was the largest carbon release since the dinosaurs became extinct.

But now, according to the new data, the PETM was much smaller than the current input of carbon to the atmosphere. The maximum sustained carbon release rate during the PETM was estimated to be less than 4 billion metric tons of CO_2 per year. By comparison, the 2014 carbon-release rate was a record high of about 37 billion metric tons of CO_2, about ten times the PETM estimate. As such, the current carbon-release rate is unprecedented in Earth's post-Mesozoic history, so there is no analogue that can be used to determine what will happen in the future.

Researchers used the JOIDES Resolution to take deep sea cores across the PETM interval

The researchers' study indicates that we are in uncharted territory when dealing with the rate of carbon being released into the atmosphere and oceans. And, if the PETM is any indication, the consequences of our massive fossil fuel burning will have a much, much longer tail. While the world seems to be focused on what the Earth will be like in 2100, what happens after that is anyone's guess.

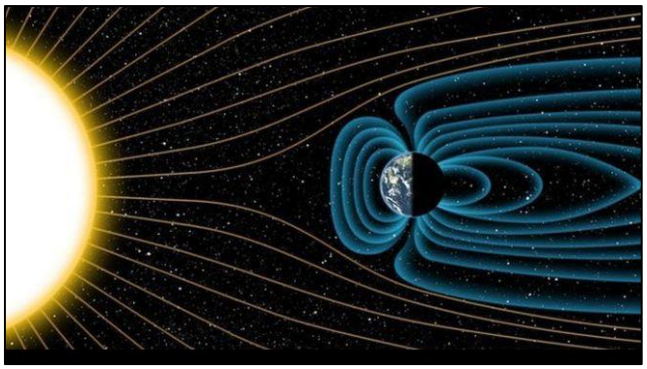
There has been much written and spoken about why the wooly mammoths, giant sloths, and other large mammals disappeared during the Ice Age. Typically, the rise of humans who overhunted them to extinction has been the primary concept. More recently, however, a team of researchers from Australia has suggested that severe climate change through the Late Pleistocene was capable of causing extinctions before humans showed up.

Pleistocene megafauna – was climate change or human hunters to blame for their extinction?

The researchers used statistical correlations between sudden warming events (interglacials) and the extinctions of large animals. They pointed out that the interglacials were the single biggest magnitude change in climate to have occurred in the past 2 ma, with temperatures rising as much as 10oC in just a few decades. That kind of climate change would cause huge disruptions in weather patterns and vegetation growth.

Of course, there are still many researchers who feel that humans were to blame. For example, about 50 genera went extinct in South America during the time of the Wisconsinan glaciation in the northern hemisphere, yet there were few if any extinctions in Africa at that time, even though the climate was probably similar to that of South America. As the idea goes, humans had been hunting in Africa for 2 ma and their prey were adapted to the predatory pressures. South America, however, had just recently (geologically speaking) been invaded by human predators and had not had time to adapt before going extinct.

Life arose on Earth something less than four billion years ago. And according to the prevailing dogma, life appeared because Earth had a rocky surface, liquid water, a blanketing atmosphere, and warmth. Now, thanks to a new research, we can say the Earth's magnetic field probably played, and continues to play, a key role in making the planet conducive to life.



Earth's magnetic field probably protected early life from the Sun's powerful solar winds and flares

The new research involved studying Kappa Ceti, a star located 30 light-years away in the constellation Cetus. It is remarkably similar to our sun, but is much younger, probably only about 400-600 million years old, meaning it formed sometime between the Late Neoproterozoic and Early Devonian when complex life was evolving on Earth. Like other stars its age, Kappa Ceti is very magnetically active, with a surface blotched with many giant sunspots. It also throws a steady stream of ionized gases into space, generating a solar wind 50 times stronger than our Sun's, which would play havoc with the atmosphere of any planet in the habitable zone that was unshielded by a magnetic field.

It is possible that a planet without a magnetic field could lose most of its atmosphere, a fate similar to what Mars suffered. By modelling the Kappa Ceti solar wind and its effect on an Earth-like planet, the researchers found that the early Earth's magnetic field probably was about 1/3 to 1/2 as large as it is today – not as much as today, but apparently enough to protect evolving life.

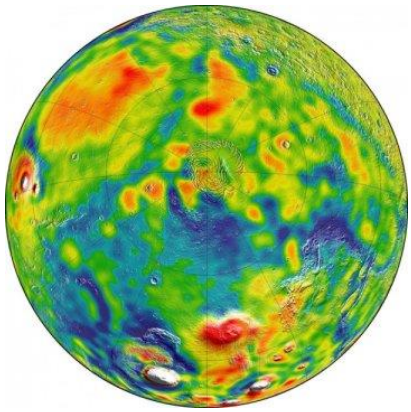
Finally, someone has decided what the worm-like creature called *Tullimonstrum gregarium* must have been in life. The Tully Monster, as it has been dubbed**,** is the official state fossil of Illinois, having been collected from the Pennsylvanian Francis Creek Shale at the famous Mazon Creek collecting locality in that state for decades. It has even appeared in paintings on the sides of U-Haul trucks. Eugene Richardson named the fossil in 1966 for Francis Tully, the person who collected it, but he was so unsure of what it represented that he simply filed it under "animal". Some folks thought it was a bizarre worm, others some kind of snail, and the nut cases even suggested it was an early relative of the Loch Ness Monster. No one was could decide conclusively where it belonged in the tree of life.

Until recently, that is. Now an international team of researchers believes they have figured out what this mystery critter was. Having looked at more than 1,200 specimens of the fossil, the researchers say the Tully Monster was actually a type of fish akin to modern lampreys. The clue to this relationship lay in a pale line visible on the fossils that stretched from the eye stalks to the end of the tail. The researchers recognized this as a notochord, which made *Tullymonstrum* a vertebrate rather than an invertebrate. With this revelation, other features started to become recognizable. Large complex eyes, tri-lobed brain, horny teeth, and a tail with a fin fit the new model.

Reconstruction of *Tullymonstrum gregarium*

There are still some bizarre traits in the *Tullymonstrum* anatomy, of course. The stalked eyes and the jaws on the end of a long snout have yet to be worked out, along with determining how the beast fits into the lamprey family tree. Until more research is done, and probably even after the last mystery is finally solved, this 300 million year old anomaly will continue to deserve its popular name, Tully Monster.

There is a new detailed gravity map of Mars, thanks to three NASA spacecraft, and it is providing a glimpse into the hidden interior of the planet. The new gravity map should be helpful for future Mars exploration because knowledge of the planet's gravity anomalies helps mission controllers place spacecraft more precisely into orbit. The gravity map was compiled from about 16 years of data collected continuously in orbit around Mars. However, orbital changes from uneven gravity are tiny, and other forces that can perturb the motion of the spacecraft had to be carefully accounted for, such as the force of sunlight on the spacecraft's solar panels and drag from the Red Planet's thin upper atmosphere.

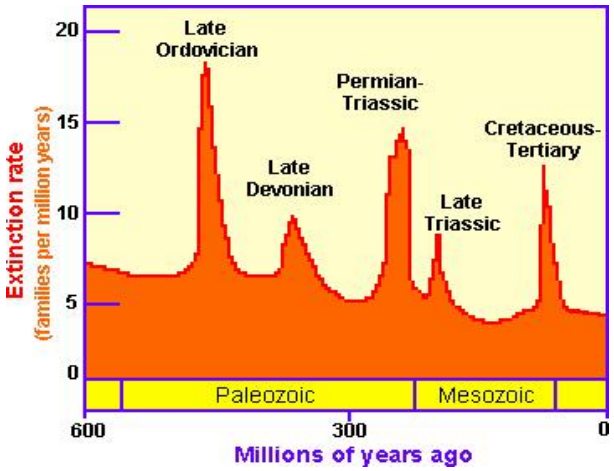


New gravity map of Mars

It took two years of analysis and computer modeling to remove the motion not caused by gravity. But it was worth it. The improved resolution of the map will help scientists better understand the as yet unknown formation of certain areas of Mars. Improved resolution of Mars' gravity map suggests there is a new explanation for how some features formed on the planet. Also, the team studying the NASA data confirmed that Mars has a liquid outer core of molten rock. The team also observed that, by studying how Mars' gravity has changed over a cycle of solar activity, the massive amount of CO_2 that freezes out of the atmosphere onto a Martian polar ice cap moves between the south pole and the north pole with the change of seasons.

While we know that there were at least five great mass extinctions in Earth history, and that many scientists feel we are currently undergoing a sixth, a new study indicates that the many species now going the way of the Great Auk and the Dodo may vanish with no permanent record of their ever having been here. This leads inevitably to the concept that the earlier extinctions probably are grossly underestimated in their loss of life as well. Researchers at the University of Chicago, University of New Mexico, and National Museum of Natural History compared lists of what are currently considered to be the most endangered species on the planet with several databases of living species and three databases of fossils. Their statistical analysis, run to determine which threatened species were most likely to disappear without leaving evidence of their existence, found that more than 85% of the mammal species at high risk of extinction lack a fossil record. Animals at the highest risk are about half as likely to leave a fossil record as those at lower risk.

The five big extinctions



Which ones are most at risk of having no record? The smaller, "cute and fuzzy ones" (rodents, bats, etc.). Because bigger animals tend to leave a fossil record, as do animals with larger geographical ranges, the magnitude of the current mammal die-off appears to be much reduced. But think about birds and reptiles. They probably have an even more distorted extinction record than mammals – only 3% of threatened bird species and 1.6% of threatened reptile species have a known fossil record. There is still a lot left to learn.

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PGS Website of the Month

http://www.fossilmuseum.net/Tree_of_Life/Stromatolites.htm

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Officer Contacts: If you wish to contact a current PGS Officer, you can email Ray Follador, President, at geodawg@comcast.net; Tamra Shiappa, Vice President, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Karen Rose Cercone, Secretary, 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: To contact the Webmaster, Mary McGuire, with questions or suggestions, please either email marykmcguire@comcast.net or use the site's "Contact Us" link at www.pittsburghgeologicalsociety.org.

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

News items: If you have news items you would like to have included in the PGS newsletter, please send them to Karen Rose Cercone at kcercone@iup.edu.

Fun Fact Having Nothing to Do with Geology

Analysis of 15 separate studies in Europe found that myopia (near-sightedness) is becoming more common there, with the increase linked to education level. This suggests that reading and working with computers is at least one contributing factor.