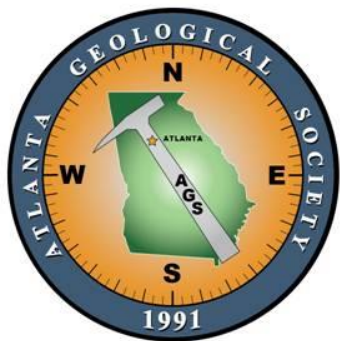




Atlanta Geological Society Newsletter

ODDS AND ENDS

Dear AGS members,

Attached to this month's meeting reminder you will find the 2017 Operating Plan for the Atlanta Geological Society. As a new president, I thought recent discussions with the members and amongst the officers and committee heads about improvements needed to be formalized into a working document. Having it in writing and reviewed by the members and officers gives it more authority. It gives the officers and committee heads some goals for this year. Additionally, it acts as a communication tool to the current and future membership about what they can expect and how they can volunteer to help meet the goals.

One topic for discussion this time is a change in the dues. Dues are the main source of our funding for our expenses but there are many inter-related parts of operation that related to our revenue. For example, if we have more dues revenue, we can offer more Mini Grants for Earth Science teaching. The Operating plan goes into greater detail about the various aspects. As a matter of perspective, even if we doubled our dues, they would still be less than half of a couple of the other geologic organizations in town.

Please look over the Operating Plan and come prepared to discuss it at the meeting. Hope to see you Tuesday!

Ben Bentskowski, President

February Meeting

Join us **Tuesday, February 28, 2017** at the Fernbank Museum of Natural History, 760 Clifton Road NE, Atlanta GA. The meeting/dinner starts at 6:30 pm and the meeting starts approximately 7 p.m.

This month our presentation is provided by Mr. Lee Lemke of the Georgia Mining Association. The title of his talk is: State of the Mineral Industry in Georgia. Please find Mr. Lemke's bio on the next page.

Please come out, enjoy a bite to eat, the camaraderie, an interesting presentation and perhaps discussion.

In an effort to publicize other geologic events of local interest, inside please find details about two upcoming events. The first is a Joint Meeting with the Georgia Mineral Society: **Georgia Microscopical Society Overview & Young Peoples Course** Wednesday, March 8, 2017 at 7:30 p.m. and secondly, the Tellus Museum is hosting Mineral Symposium 2017 on **HYDROTHERMAL MINERALIZATION**, Saturday March 25, 2017, 9a.m. to 5 p.m. and a field trip on Sunday March 26, 2017, 9a.m. to 5 p.m. with collecting.

Lee Lemke's Bio:

Lee Lemke has been the Executive Vice President of the Georgia Mining Association, China Clay Producers Association, and Georgia Mining Foundation for the last 30 years. In addition to managing the associations, he handles all governmental affairs. As the Association's State lobbyist, he provides a strong voice by representing our industry and members on many state and federal levels regarding regulatory practices and legislation. Lee resides on the Ocmulgee River in Monroe County with his wife Leslie; an attorney in Warner Robins, his 4 year old grandson, and their 2 dogs. He is also the proud grandfather of 6 additional beautiful grandchildren under the age of 6.



GEORGIA MICROSCOPICAL SOCIETY

March Meeting

Joint Meeting with the Georgia Mineral Society: Georgia Microscopical Society Overview & Young Peoples Course

Wednesday, March 8, 2017 at 7:30 p.m.

Location – MVA Scientific Consultants

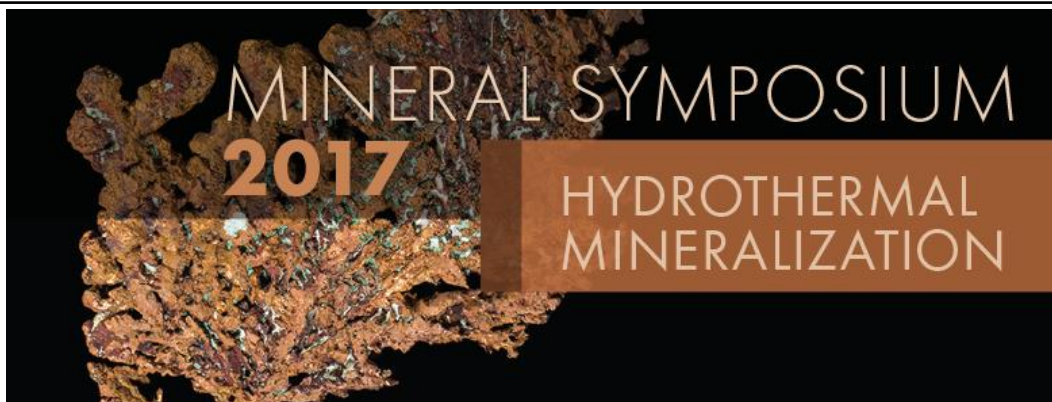
3300 Breckinridge Blvd, Suite 400, Duluth, GA 30096

Directions: <http://mvascientificconsultants.com/wp-content/uploads/2015/04/accommodations2015.pdf>

The Georgia Microscopical Society (GMS) has invited the Sand Section of the Georgia Mineral Society (the other GMS) to be its guests for the March Meeting. Georgia Microscopical Society members will present an overview of the society with focus on the Young Peoples Course - How to Use the Microscope. Our guests will also be given a tour of MVA Scientific Consultants showing the value of microscopical techniques in solving everyday problems.

Any questions, please contact Steve Compton (scompton@mva-inc.com) or Randy Boltin (rboltin@mva-inc.com). Both can be reached at (770) 662-8509.

The Georgia Microscopical Society is a Non-profit Organization dedicated to the advancement of all forms of Microscopy.
Current Mailing Address is: 3300 Breckinridge Blvd # 400 Duluth, GA 30096-8983 (770) 662-8509

**Saturday, March 25, 2017**

At the Tellus Mineral Symposium 2017, you'll learn how hydrothermal mineralization is responsible for creating hundreds of different minerals – from facetable amethysts, to stunning calcite and fluorite specimens, to industrial minerals such as copper, galena, and barite. Join experts in the field at the Tellus Mineral Symposium 2017 to learn about these fascinating deposits that are not only found on Earth but as you will learn at the symposium, have also been found on Mars! This mineral symposium requires pre-registration. In addition to the presentations, registration includes breakfast and lunch, museum admission and discounted registration to the Sunday field trip.

NEW THIS YEAR Network and share ideas at the new poster session. Posters by students, professional geologists, and local rock-hounds will touch on all aspects of geology!

This is a scientific mineral symposium. Geologic background and general mineral knowledge is recommended to increase comprehension. Please follow the link below to find the Speakers and abstracts for Saturday's technical talks.

Field Trip Information Meet at Tellus at 9 AM on Sunday March 26, 2017

Join Tellus Curator Sarah Christensen and Tellus Staff on this all-day field trip to two mines in the Atlanta area with hydrothermal origins. Expanding on the Saturday Mineral Symposium, this trip will provide a unique opportunity to see and collect hydrothermal minerals in your own backyard.

10 AM – NEW RIVERSIDE OCHRE Founded in 1905, New Riverside Ochre mines and processes iron oxide pigments and barite from the Emerson Mine and barite processing plant in Cartersville, GA.

NOON – Lunch

2 PM – RED OAK QUARRY Red Oak Quarry is one of many mining operations owned by Martin Marietta, a leading supplier of aggregates and heavy building materials. Though mined primarily for granite, Red Oak has some complex and interesting hydrothermal mineralization which you will be able to see and collect on this visit.

5 PM – Return to Tellus Science Museum

Please click the link below to get the full details:

<http://tellusmuseum.org/museum-events/mineral-symposium-2017/#1484082404381-d66bb349-afa5>

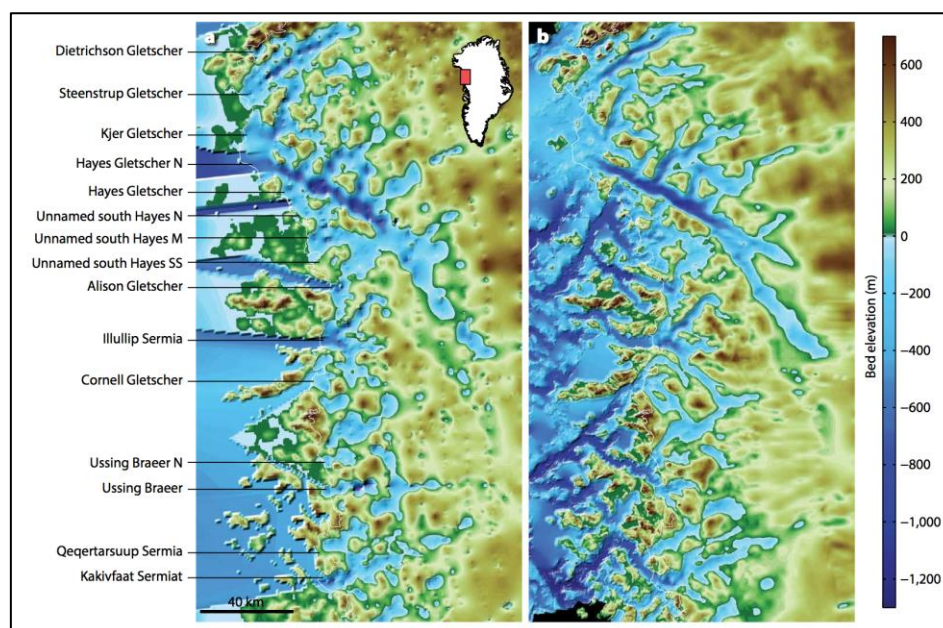
NASA, UCI Reveal New Details of Greenland Ice Loss

Less than a year after the first research flight kicked off NASA's Oceans Melting Greenland (OMG) campaign last March, data from the new program are providing a dramatic increase in knowledge of how Greenland's ice sheet is melting from below. Two new research papers in the *Journal of Oceanography* use OMG observations to document how meltwater and ocean currents are interacting along Greenland's west coast and to improve seafloor maps used to predict future melting and subsequent sea level rise.

The five-year OMG campaign studies the glaciers and ocean along Greenland's 27,000-mile coastline. Its goal is to find out where and how fast seawater is melting the glacial ice. Most of the coastline and seafloor around the ice sheet had never been surveyed, so the 2016 flights alone expanded scientists' knowledge of Greenland significantly. Future years of data collection will reveal the rate of change around the island.

The water circulating close around the Greenland Ice Sheet is like a cold river floating atop a warm, salty ocean. The top 600 feet (200 meters) of colder water is relatively fresh and comes from the Arctic. Below that is saltwater from the south, 6 to 8 degrees Fahrenheit (3 to 4 degrees Celsius) warmer than the fresher water above. The layers don't mix much because freshwater weighs less than saltwater, so it stays afloat.

If a glacier reaches the ocean where the seafloor is shallow, the ice interacts with frigid freshwater and melts slowly. Conversely, if the seafloor in front of a glacier is deep, the ice spills into the warm subsurface layer of saltwater and may melt relatively rapidly. Satellite remote sensing can't see below the surface to discern the depth of the seafloor or study the layers of water. OMG makes these measurements with shipboard and airborne instruments.



Maps of the northwest Greenland coastline before (left) and after (right) OMG data were incorporated. The coastline itself -- the edge of the glacier ice -- appears as a faint white line. The right-hand image shows several previously unknown troughs revealed by the OMG seafloor survey.

Tracking meltwater far into the North

In one of the two new papers, Ian Fenty of NASA's Jet Propulsion Laboratory, Pasadena, California, and coauthors tracked water up the west coast to see how it changed as it interacted with hundreds of melting coastal glaciers. They found that in northwest Greenland, cold and fresh water flowing into glacial fjords from the melting surface of the ice sheet is cooling the warmer subsurface water, which circulates clockwise around the island. In one instance, evidence for meltwater-cooled waters was found in fjords 100 miles (160 kilometers) downstream from its source. Fenty noted, "This is the first time we've documented glacier meltwater significantly impacting ocean temperatures so far downstream. That shows meltwater can play an important role in determining how much ocean heat ultimately reaches Greenland's glaciers."

NASA, UCI Reveal New Details of Greenland Ice Loss (Continued)

The OMG data have enough detail that researchers are beginning to pinpoint the ice-loss risk for individual glaciers along the coast, according to OMG Principal Investigator Josh Willis of JPL. "Without OMG, we wouldn't be able to conclude that Upernavik Glacier is vulnerable to ocean warming, whereas Cornell Glacier is less vulnerable," he said.

Improving maps used to project sea level rise

In the second paper, lead author Mathieu Morlighem of the University of California, Irvine, used the OMG surveys to refine and improve maps of the bedrock under some of the west coast glaciers. Glaciologists worldwide use these and other maps in modeling the rate of ice loss in Greenland and projecting future losses.

A coastal glacier's response to a warming climate depends heavily not only on the depth of the seafloor in front of it, as explained above, but on the shape of the bedrock below it. Before OMG, virtually the only measurements Morlighem had of these critical landscapes were long, narrow strips of data collected along flight lines of research aircraft, sometimes tens of miles inland (upstream) from a glacier's ocean front. He has been estimating the shape of the bedrock outside of the flight lines with the help of other data such as ice flow speeds, but has had no good way to check how accurate his estimates are at the coastline.

Morlighem noted, "OMG [data are] not only improving our knowledge of the ocean floor, they're improving our knowledge of the topography of the land, too." This is because the campaign's seafloor survey revealed features under the ocean, such as troughs cut by glaciers during the last ice age, that must continue upstream under the glacial ice. Therefore, Morlighem said, "By having OMG's measurements close to the ice front, I can tell whether what I thought about the bed topography is correct or not." Morlighem was pleasantly surprised to discover that 90 percent of the glacier depths he had estimated were within 160 feet (50 meters) of the actual depths recorded by the OMG survey.

The two papers are available online:

Oceans Melting Greenland: Early Results from NASA's Ocean-Ice Mission in Greenland:

<https://doi.org/10.5670/oceanog.2016.100>

Improving bed topography mapping of Greenland glaciers using NASA's Oceans Melting Greenland (OMG) data...

<https://doi.org/10.5670/oceanog.2016.99>

<https://www.nasa.gov/feature/jpl/nasa-uci-reveal-new-details-of-greenland-ice-loss>

NASA Studies a Rarity: Growing Louisiana Deltas

The Louisiana coastline is sinking under the Gulf of Mexico at the rate of about one football field of land every hour (about 18 square miles of land lost in a year). But within this sinking region, two river deltas are growing. The Atchafalaya River and its diversion channel, Wax Lake Outlet, are gaining about one football field of new land every 11 and 8 hours, respectively (1.5 and 2 square miles per year). Last fall, a team from NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, showed that radar, lidar and spectral instruments mounted on aircraft can be used to study the growing deltas, collecting data that can help scientists better understand how coastal wetlands will respond to global sea level rise. The basics of delta building are understood, but many questions remain about how specific characteristics, such as vegetation types, tides, currents and the shape of the riverbed, affect a delta's growth or demise. That's partly because it's hard to do research in a swamp.

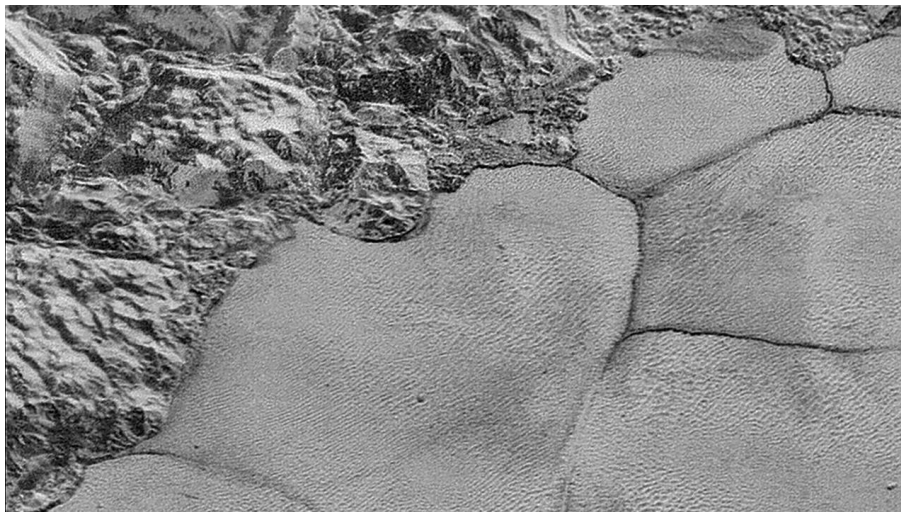
When the tide goes out, water drains from the marshes, carrying sediment and carbon. The JPL instruments took measurements during both rising and falling tides to capture these flows. They also made the first complete measurement of the slope of the water surface and topography of the river bottom for both rivers from their origin at the Mississippi River to the ocean -- necessary information for understanding the rivers' flow speeds.

Three JPL airborne instruments, flying on three planes, were needed to observe the flows and the movement of carbon with the water. The team measured rising and falling water in vegetated areas using the Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) instrument. They measured the same changes in open water with the Airborne Snow Observatory (ASO) lidar. The Airborne Visible/Infrared Imaging Spectrometer-Next Generation (AVIRIS-NG) was used to estimate the sediment, carbon and nitrogen concentrations in the water.

Now that the team has demonstrated that these airborne instruments can make precise and detailed measurements in this difficult environment, the researchers plan to use the new data to improve models of how water flows through marshes. Scientists use these models to study how coastal marshes will cope with rising sea levels. View a slideshow of the growth of the two deltas over the last 30 years: http://earthobservatory.nasa.gov/Features/WorldOfChange/wax_lake.php

<https://www.nasa.gov/feature/jpl/nasa-studies-a-rarity-growing-louisiana-deltas>

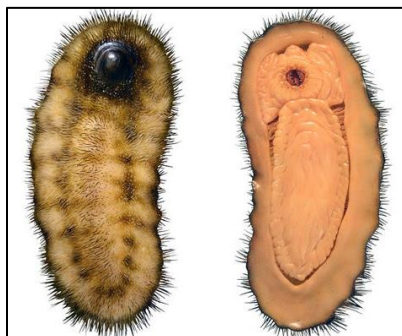
Scientists Explain ‘lava lamps’ on Pluto



When the New Horizons probe zipped past Pluto last July, it spotted weird, kilometers-wide polygonal features (lower right of image above) within a broad icy plain dubbed Sputnik Planum. Now, researchers have come up with an explanation for these odd shapes: Each one is an immense mass of ice that’s picking up the dwarf planet’s internal heat at its base, rising toward the surface at its center, and then circulating outward from there and downward at its edges, à la huge versions of tabletop “lava lamps” popular in the 1960s. Using images gathered during the flyby, scientists estimate that the generally flat surface of each circulating mass is up to 50 meters higher in elevation than average at its center, where material is upwelling, and is surrounded by a trough as much as 100 meters deep where material circulates downward. Other data have shown the icy plains are predominantly made of nitrogen but also include carbon monoxide and methane, all of which are soft enough to flow at Pluto’s frigid 37 K (–236°C). The team’s computer simulation of the glacierlike flow within each mass suggests that the surface ice moves horizontally at no more than a few centimeters each year, which nevertheless is quick enough to totally resurface each polygonal cell every 500,000 years or so. This repaving helps explain why the surface is relatively crater-free. It may also explain why other bodies in the Kuiper belt are unusually bright, the researchers say: Fresh ice is typically much brighter than an ancient stagnant surface on which dust and substances produced by interactions with sunlight or other radiation have built up through the ages.

<http://www.sciencemag.org/news/2016/06/scientists-explain-lava-lamps-pluto>

Earliest Mollusk Probably Looked Like a Spiky Slug



Today’s mollusks are a wildly diverse bunch, from octopuses and oysters to snails and slugs—a modern miscellany that has made it tough for scientists to envision what the group’s oldest common ancestors looked like. Now, a handful of 480-million-year-old fossils from southeastern Morocco suggests that those progenitors may have resembled a spine-covered slug that wore a small toenail-shaped shell on its head. Paleontologists have placed the creature in a new genus named *Calvapilosa* (“hairy scalp” in Latin). Complete fossils range from 16.7 to 68.3 millimeters long, but fragments hint that it may have grown to at least 120 mm, the researchers report today in *Nature*. The upper part of the creature’s body (artist’s reconstruction at left) was a cloak of flesh covered with tiny plates of chitin that in turn sported hollow spines possibly made of chitin, the same material as the shells of modern-day shrimp. Underneath (right), the creature had a snaillike foot for locomotion and a mouth whose rasplike radula was covered with at

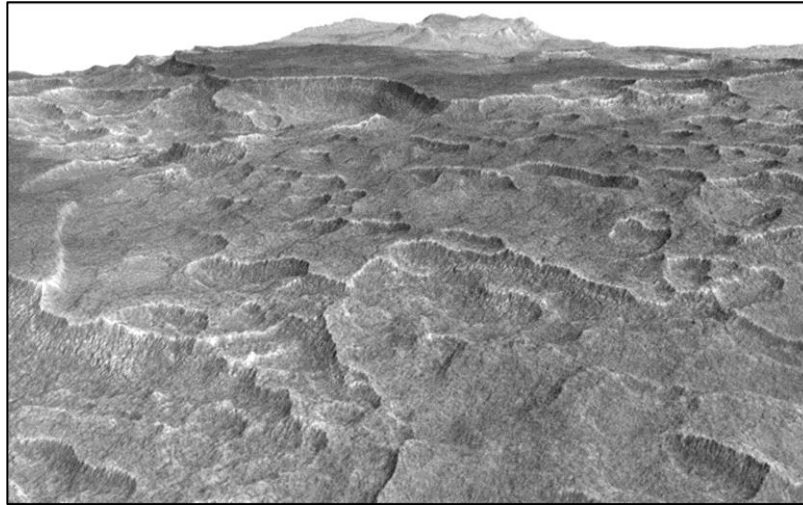
least 125 rows of tiny teeth. The fine-grained sandstones that held the *Calvapilosa* fossils don’t appear to have been exposed to waves or strong currents, so the animal probably lived in deep waters. *Calvapilosa* wasn’t the oldest creature in its primitive lineage, the researchers note, but it is the best known because fossils of its closest kin have been extremely fragmentary. Previous studies have suggested the oldest mollusks evolved about 535 million years ago. And although some previous studies suggested that the first mollusks didn’t have shells, the new findings hint that the oldest species in the group actually did sport a hardened structure made out of calcium carbonate.

http://www.sciencemag.org/news/2017/02/earliest-mollusk-probably-looked-spiky-slug?utm_campaign=news_daily_2017-0207&et rid=17048804&et cid=1149143

Mars Ice Deposit Holds as Much Water as Lake Superior

Frozen beneath a region of cracked and pitted plains on Mars lies about as much water as what's in Lake Superior, largest of the Great Lakes, researchers using NASA's Mars Reconnaissance Orbiter have determined. Scientists examined part of Mars' Utopia Planitia region, in the mid-northern latitudes, with the orbiter's ground-penetrating Shallow Radar (SHARAD) instrument. Analyses of data from more than 600 overhead passes with the onboard radar instrument reveal a deposit more extensive in area than the state of New Mexico. The deposit ranges in thickness from about 260 feet (80 meters) to about 560 feet (170 meters), with a composition that's 50 to 85 percent water ice, mixed with dust or larger rocky particles.

At the latitude of this deposit -- about halfway from the equator to the pole -- water ice cannot persist on the surface of Mars today. It sublimates into water vapor in the planet's thin, dry atmosphere. The Utopia deposit is shielded from the atmosphere by a soil covering estimated to be about 3 to 33 feet (1 to 10 meters) thick. Mars today, with an axial tilt of 25 degrees, accumulates large amounts of water ice at the poles. In cycles lasting about 120,000 years, the tilt varies to nearly twice that much, heating the poles and driving ice to middle latitudes. Climate modeling and previous findings of buried, mid-latitude ice indicate that frozen water accumulates away from the poles during high-tilt periods.



These scalloped depressions on the surface are typically about 100 to 200 yards or meters wide. The foreground of this view covers ground about one mile (1.8 kilometers) across. The perspective view is based on a three-dimensional terrain model derived from a stereo pair of observations by the High Resolution Imaging Science Experiment (HiRISE) camera on the Mars Reconnaissance Orbiter. Similar scalloped depressions are found in portions of the Canadian Arctic, where they are indicative of ground ice.

Martian Water as a Future Resource

The name Utopia Planitia translates loosely as the "plains of paradise." The newly surveyed ice deposit spans latitudes from 39 to 49 degrees within the plains. It represents less than one percent of all known water ice on Mars, but it more than doubles the volume of thick, buried ice sheets known in the northern plains. Ice deposits close to the surface are being considered as a resource for astronauts.

"This deposit is probably more accessible than most water ice on Mars, because it is at a relatively low latitude and it lies in a flat, smooth area where landing a spacecraft would be easier than at some of the other areas with buried ice," said Jack Holt of the University of Texas, a co-author of the Utopia paper who is a SHARAD co-investigator and has previously used radar to study Martian ice in buried glaciers and the polar caps.

The Utopian water is all frozen now. If there were a melted layer -- which would be significant for the possibility of life on Mars -- it would have been evident in the radar scans. However, some melting can't be ruled out during different climate conditions when the planet's axis was more tilted. "Where water ice has been around for a long time, we just don't know whether there could have been enough liquid water at some point for supporting microbial life," Holt said. Utopia Planitia is a basin with a diameter of about 2,050 miles (3,300 kilometers), resulting from a major impact early in Mars' history and subsequently filled. NASA sent the Viking 2 Lander to a site near the center of Utopia in 1976. The portion examined by Stuurman and colleagues lies southwest of

Mars Ice Deposit Holds as Much Water as Lake Superior (continued)

of that long-silent lander.

Use of the Italian-built SHARAD instrument for examining part of Utopia Planitia was prompted by Gordon Osinski at Western University in Ontario, Canada, a co-author of the study. For many years, he and other researchers have been intrigued by ground-surface patterns there such as polygonal cracking and rimless pits called scalloped depressions -- "like someone took an ice-cream scoop to the ground," said Stuurman, who started this project while a student at Western.

Clues from Canada

In the Canadian Arctic, similar landforms are indicative of ground ice, Osinski noted, "but there was an outstanding question as to whether any ice was still present at the Martian Utopia or whether it had been lost over the millions of years since the formation of these polygons and depressions." The large volume of ice detected with SHARAD advances understanding about Mars' history and identifies a possible resource for future use.

SHARAD is one of six science instruments on the Mars Reconnaissance Orbiter, which began its prime science phase 10 years ago this month. The mission's longevity is enabling studies of features and active processes all around Mars, from subsurface to upper atmosphere. The Italian Space Agency provided the SHARAD instrument and Sapienza University of Rome leads its operations. The Planetary Science Institute, based in Tucson, Arizona, leads U.S. involvement in SHARAD. JPL, a division of Caltech in Pasadena, manages the orbiter mission for NASA's Science Mission Directorate in Washington. Lockheed Martin Space Systems of Denver built the spacecraft and supports its operations.

<http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA21136>

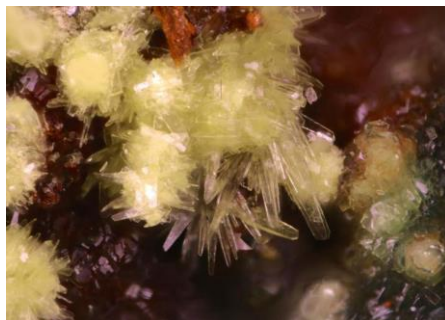
GEOLOGY NEWS FEBRUARY 8, 2017

Geologists Uncover Three New Uranyl Minerals

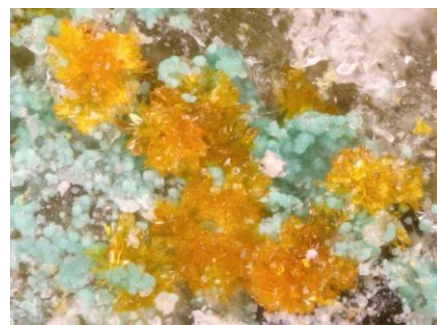
A US scientist has found three new uranium-rich secondary minerals in the Red Canyon region of Utah, growing on the walls of the area's old uranium mines. The three new minerals are, leesite, leoszilárdite and redcanyonite, will allow researchers to study how different forms of uranium can propagate in the natural environment.



Leesite



Leoszilárdite



Redcanyonite

<http://www.sci-news.com/geology/new-minerals-leesite-leoszilardite-redcanyonite-04604.html>

The Quality of the Nation's Groundwater: Progress on a National Survey

The U.S. Geological Survey is near the midpoint of a complex undertaking to survey the quality of the nation's largest drinking-water resource. From 2012 – 2023, the USGS is assessing groundwater throughout the country through extensive sampling. The latest results from five regional aquifers have become available and now available online. About half of the nation's population relies on groundwater for drinking water. As the nation's population grows, the need for high-quality drinking-water supplies becomes even more urgent.

Groundwater - The Invisible and Vital Resource



(Jennifer Wilson, USGS)

About 140 million people
rely on groundwater for drinking water

68 regionally extensive aquifers
(called principal aquifers)
supply nearly 50 percent of the Nation's drinking water

20 principal aquifers
supply about 75 percent of the groundwater used for public supply;
their water quality is being intensively evaluated from 2012-23

400 deep public-supply wells
sampled from 5 principal aquifers in 2012-13

The USGS has identified 68 principal aquifers, or regionally extensive aquifers that can be used as a source of drinking water, across the nation. Groundwater pumped from these aquifers provides nearly 50 percent of the nation's drinking water. Twenty of these principal aquifers account for about 75 percent of the nation's groundwater pumped for public supply and 85 percent of the groundwater pumped for domestic supply. These 20 principal aquifers are being intensively evaluated by the USGS National Water-Quality Assessment Project between 2012 and 2023.

A Deep Look at an Unseen Resource

USGS scientists are assessing water quality in source (untreated) water from wells in principal aquifers. Most consumers receive water that has been treated by local utilities to meet federal drinking-water standards. Understanding what constituents are in untreated water can help decision makers manage and treat water resources.

This comprehensive sampling, carried out over principal aquifers across the country, is focused on public-supply wells that tap deeper groundwater. Along with detailed information on geology, hydrology, geochemistry and chemical and water use, this data can be used to explain how and why aquifer vulnerability to contamination varies across the nation.

These regional aquifer studies provide water utilities and resource managers with information about:

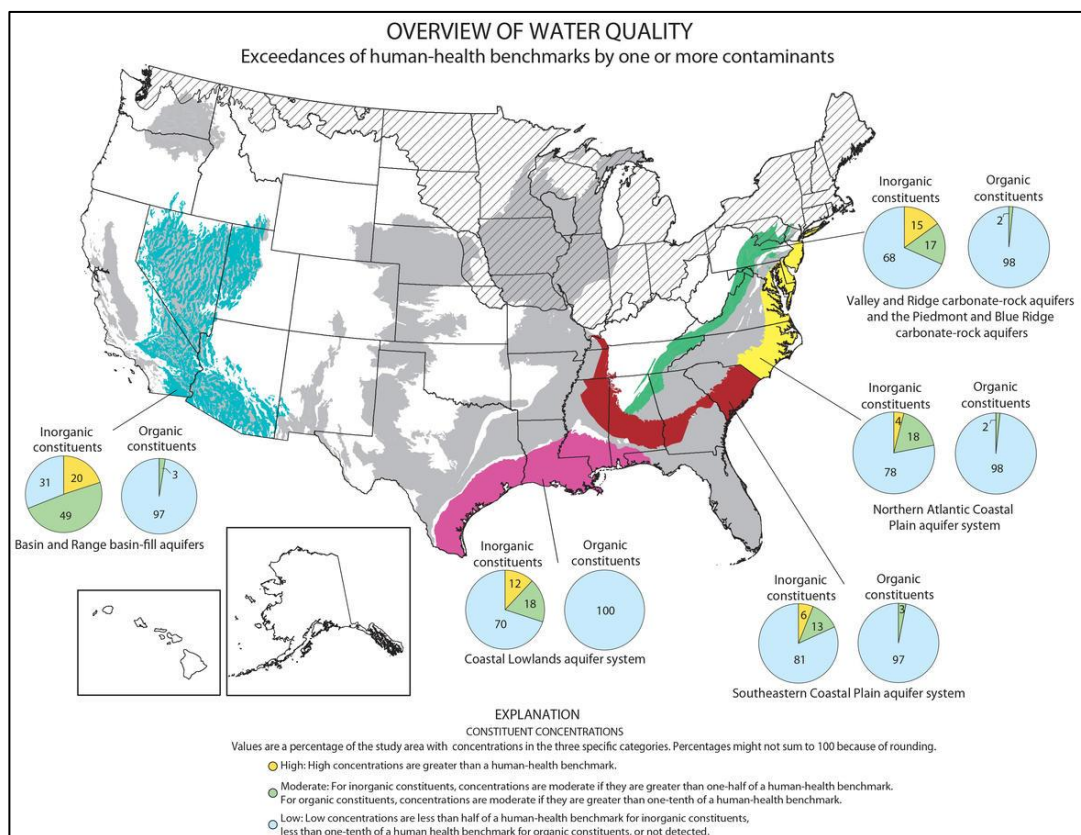
- Regulated and unregulated constituents from natural or human sources
- Pesticides, pharmaceuticals, hormones and other constituents of concern for human health
- Understanding present groundwater quality, to be compared with future condition
- Regional and national statistics on water quality, as context for individual wells
- A comparison of water quality in the shallow and deep parts of aquifer systems
- Environmental tracers that can be used to understand sources and sustainability of groundwater supplies
- Improving understanding of local, regional and national hydrogeology

New Regional Aquifer Studies

In-depth, regional-scale assessments conducted or planned for 2012 through 2023 focus on 20 of the most heavily used aquifers in the nation. Groundwater quality results for principal aquifers sampled in 2012 and 2013 are available today and summarized in the fact sheets below. Almost 400 feet deep public-supply wells were sampled within these aquifers, which were analyzed for a broad range of water-quality constituents.

- [Basin and Range basin-fill aquifers \(western U.S.\)](#)
- [Valley and Ridge carbonate-rock aquifers and the Piedmont and Blue Ridge carbonate-rock aquifers \(eastern U.S.\)](#)
- [Northern Atlantic Coastal Plain aquifer system \(east coast of U.S.\)](#)
- [Southeastern Coastal Plain aquifer system \(southeastern U.S.\)](#)
- [Coastal Lowlands aquifer system \(south central U.S.\)](#)

The Quality of the Nation's Groundwater: Progress on a National Survey (continued)



This map showing location and summary of water-quality results for five principal aquifers currently available. For more details, please refer to the linked resources within this story.

Findings

- One or more inorganic constituents exceeded human-health benchmarks in 4 to 20 percent of samples collected from the five principal aquifers.
- Organic contaminants were not found at levels of concern.
- Contaminants from geologic sources – primarily trace elements such as arsenic, fluoride and manganese – were the most common to exceed human-health benchmarks.
- Radioactive constituents exceeded human-health benchmarks by small percentages – 1 to 3 percent – in all but one (Basin and Range basin-fill aquifers) of the five aquifers studied.
- The nutrient nitrate was the only constituent from manmade sources that exceeded the human-health benchmark. These findings were in the Valley and Ridge carbonate-rock aquifers and the Piedmont and Blue Ridge carbonate-rock aquifers at a low percentage (2 percent).
- Understanding how natural features and human activities affect groundwater quality helps to predict how and why aquifer vulnerability to contamination varies across the nation.

Technical Announcements for Five Aquifers Audited:

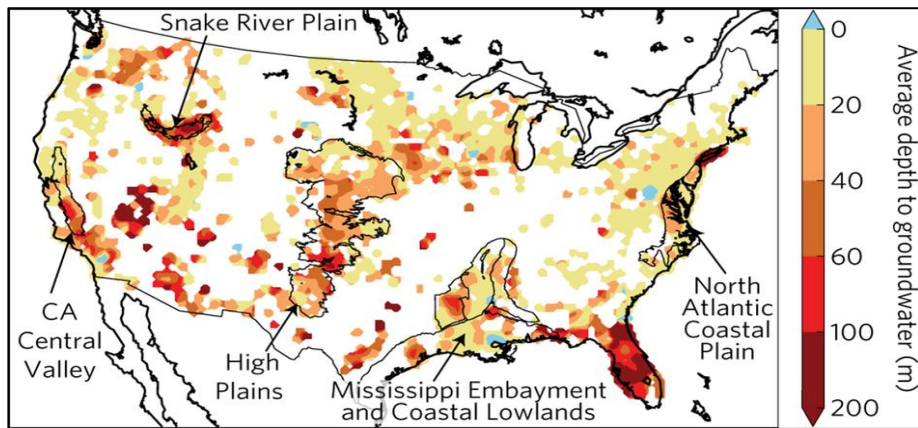
- [Basin and Range basin-fill aquifers \(western U.S.\)](#)
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- [Northern Atlantic Coastal Plain aquifer system \(east coast of U.S.\)](#)
- [Southeastern Coastal Plain aquifer system \(southeastern U.S.\)](#)
- [Coastal Lowlands aquifer system \(south central U.S.\)](#)

Deep Groundwater Aquifers Respond Rapidly to Climate Variability

Changes in climate can rapidly impact even the deepest freshwater aquifers according to Penn State and Columbia University hydrologists. The researchers found that responses to climate variations can be detected in deep groundwater aquifers faster than expected—in many cases within a year. Because rain water may take years to reach deep aquifers through natural infiltration, the findings suggest another factor is involved, such as pumping of aquifers done by agricultural industries.

"We saw a rapid response in deep groundwater levels to both major climate cycles and local precipitation," said Tess Russo, R.L. Slingerland Professor of Geosciences at Penn State. "These aquifers are so deep, we expect it takes years for precipitation to make its way down, so if it's not natural recharge causing the response of groundwater to changes in precipitation, then it may be coming from pumping changes."

The research, published in *Nature Geoscience*, sheds new light on groundwater budgets in the U.S. and better defines how water held in deep aquifers could change with the climate. Groundwater used by municipalities and industry is almost always drawn from deep wells, which provide a more reliable source of water than shallow aquifers, especially during times of drought. Despite the importance of these deep aquifers, no one really knows how much water they contain or how they might react to climate change.



Depletion and response of deep groundwater to climate-induced pumping variability.

"Groundwater doesn't move very fast so we typically think of deep aquifers as having a delayed response to what's going on at the surface, including our changing climate," said Russo, who is also an associate in Penn State's Earth and Environment Systems Institute. "But we actually see a relatively rapid response."

Russo and Upmanu Lall, of the Columbia Water Center at Columbia University, analyzed relationships between climate and groundwater data from across the United States, and used a small set of regional pumping data from wells in Kansas to demonstrate the potential connection. Russo said evidence suggests that pumping represents an intermediate connection between precipitation and deep groundwater levels. Changes in temperature and rainfall can affect crop water requirements, for example, leading to changes in reliance on water from deep wells. "If you look at agricultural areas where you have crop water demand changing as a function of precipitation, that is going to control pumping variability over time," Russo said. "Pumping could be an intermediate connection between climate and groundwater—one that causes an immediate response. "Though evidence suggests pumping causes the rapid response between deep groundwater and climate, scientists were not able to conclusively link them because of a lack of pumping data across the U.S."

"We need more data collection on human activities," Russo said. "We need pumping records if we are really going to nail down the connection between climate and groundwater."

<https://phys.org/news/2017-02-deep-groundwater-aquifers-rapidly-climate.html>

Fernbank Events & Activities



Astronomy Day

Saturday, February 18, 2017

Join our mission to discover space, astronomy and how scientists learn about our universe.

[Learn more](#)



Fernbank Forest Guided Tour

Wednesday, March 8, 2017

This special tour will focus on the unique history of this 65-acre urban oasis as well as recent restoration efforts.

[Learn more](#)



Fernbank Forest Guided Tour

Saturday, March 11, 2017

This special tour will focus on the unique history of this 65-acre urban oasis as well as recent restoration efforts.

[Learn more](#)



Science of Spirits

Friday, March 10, 2017

Explore the science behind some of Atlanta's most popular adult libations. Ages 21+ only.

[Learn more](#)

FERNBANK MUSEUM of NATURAL HISTORY



Wildwoods and Fernbank Forest

WildWoods features 10 acres of lush woodlands, highlighted by hands-on exhibits for all ages, tree pods suspended in the canopy, a nature gallery, immersive adventures, and meandering trails emphasizing dramatic slopes and stunning views. This interpretive nature experience serves as the new entrance into Fernbank Forest.

[Learn more](#)



Wild Weather

Showing January 28 – May 7, 2017

Wild Weather investigates some of nature's more powerful and destructive forces as you put yourself directly in the path of a tornado, inside the eye of a hurricane and in the midst of a raging winter storm. Get drawn into the science behind tornadoes, hurricanes, heat waves, thunderstorms and winter storms through interactives, multimedia experiences, models and large-scale graphics.

[Learn more](#)



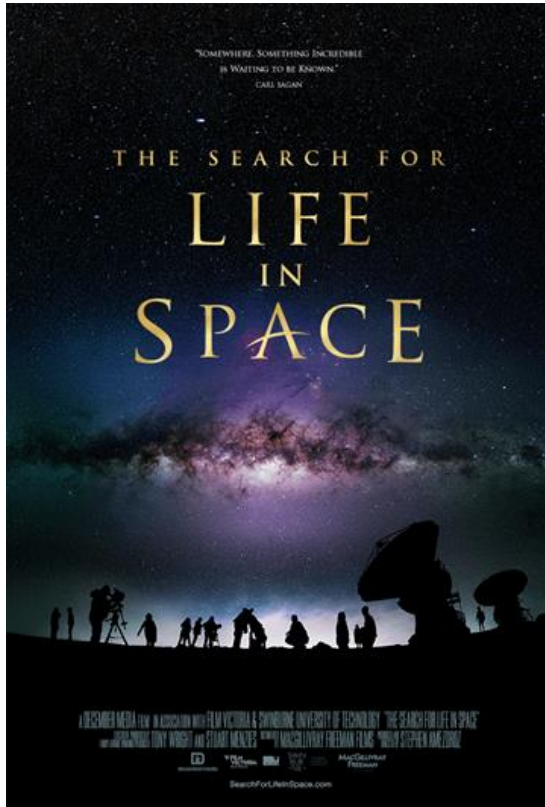
FERNBANK MUSEUM

of NATURAL HISTORY

Fernbank Museum of Natural History

(All programs require reservations, including free programs)

Now showing in the Fernbank IMAX movie theater:



[The Search for Life in Space](#)

Showing February 4 – March 3, 2017

A new era of space exploration has begun. It's the search to find something that changes everything — signs of life somewhere else in the universe. Journey from the depths of the Pacific Ocean, to the ice moons of Jupiter and Saturn, beyond our solar system and out into the far reaches of space in search of planets like ours.

[Extreme Weather 3D](#)

Showing February 4 – May 19, 2017

Weather is one of the most dynamic forces shaping our planet, but now it's more extreme and complex than ever. *Extreme Weather* takes us to the frontlines where few have gone. Travel to the edge of 300-foot-tall glaciers collapsing, to the front lines of massive wildfires, directly in the path of deadly, yet mesmerizing tornadoes. Follow researchers and everyday heroes as they uncover surprising connections to help us understand and adapt to our ever-changing weather.

AGS Officers

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johnsalvino@bellsouth.net

Past President: Shannon Star George

AGS 2017 Meeting Dates

Listed below are the planned meeting dates for 2017. Please mark your calendar and make plans to attend.

2017 Meeting Schedule

February 28

March 28

April 25

May 30

June 27

PG Study Group meetings

Contact Ken Simonton for the details.

February 25

March 25

April 29

May 27

June 24

AGS Committees

AGS Publications: Open

Career Networking/Advertising: Open

Continuing Education: Open

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Field Trips: Open

Georgia PG Registration: Ken Simonton

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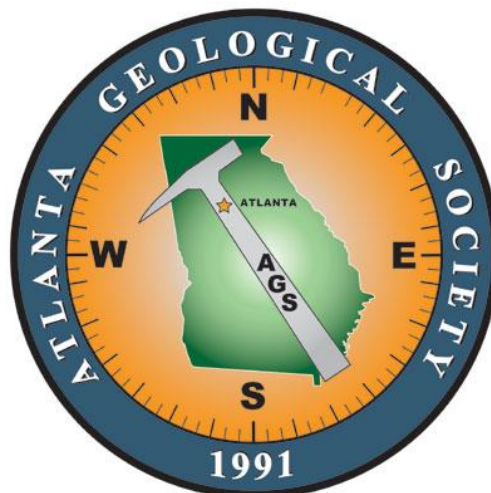
DATE: _____

NAME: _____

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TELEPHONE (1): _____ TELEPHONE (2): _____

EMAIL (1): _____ EMAIL (2): _____



STUDENT \$10 ☐

PROFESSIONAL MEMBERSHIP \$25 ☐

CORPORATE MEMBERSHIP \$100 ☐

(Includes 4 professional members, please list names and emails below)

NAME: _____ EMAIL: _____

NAME: _____ EMAIL: _____

NAME: _____ EMAIL: _____

NAME: _____ EMAIL: _____

For further details, contact the AGS Treasurer:

John Salvino johnsalvino@bellsouth.net

Please make checks payable to the "Atlanta Geological Society" and bring them to the next meeting or remit with the completed form to:

Atlanta Geological Society, Attn: John Salvino
3073 Lexington Avenue
Woodstock, Georgia 30189

CASH ☐ CHECK (CHECK NUMBER: _____)