



Granite State Geologist

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MESSAGE FROM THE PRESIDENT

Well we've finally gone and done it. After nine years, we are raising our dinner meeting rates. October 2008 was the first meeting at \$22 for a reserved member. But dinner costs have risen and the Society has taken a loss for years. The changes, starting with \$25 for members who have made reservations, should bring us closer to breaking even. Students are still \$10 reflecting the Society's mission to promote geologic education. Contact Sharon to make your dinner reservation for Dwight Bradley's presentation "Ages and Plate Tectonic Settings of Lithium-Cesium-Tantalum Pegmatites in New England"

This summer's field trip led by trip leader Greg Walsh is centered on the beautiful St. Gaudens National Historic Site. We will look at the recent- and historical mapping of the geology in the quadrangles surrounding Mt. Ascutney. See notice.

Woody Thompson has a paper coming out-see the article below. UNH student Abigail R. D'Ambrosia and professor Will Clyde, our speaker at the last meeting, and others have published "Repetitive mammalian dwarfing during ancient greenhouse warming events" describing more on the hypertherms in geologic history that Will spoke to us about. You can read it at <http://advances.sciencemag.org/content/3/3/e1601430>.

The Society's website <http://www.gsnh.org/> is still under construction, but is much improved and will continue to be



tweaked into shape. Some of that will have to wait because our webmaster, Abby Fopiano, and her husband, Jason, both Society members, have their hands full with February newborn, **Roslyn Fopiano**.

Society member, Jim Schmidl, was kind enough to agree to meet with the Boy Scouts of Troop 610 in Pelham to help them earn their geology merit badge.

UW-MADISON GEOSCIENTIST OFFERS FRE, GEOLOGIC EXPLORATION APP

By David Tenenbaum 9/29/16

<http://news.wisc.edu/uw-madison-geoscientist-offers-free-geologic-exploration-app/>

Plenty of apps are born over a cup of joe or a glass of wine or beer. Here's an idea brewed over a beer by a couple of geologists who were fiddling with Untappd, an app covering the who, what and where of microbrews.

As Shanan Peters, a professor of geoscience at the University of Wisconsin-Madison, and Patrick McLaughlin, formerly at the Wisconsin Geological and Natural History Survey, mulled it over, the kernel of a great idea emerged: Why not do the same thing for geology and open a two-way channel between experts and amateurs?

"Here was this app that allows you to rate a beer and see what others think about it," says Peters. "It was fun to use, because you can easily learn who made the beer, where it was brewed. The data were there, ready to be tapped when you wanted to."

Rockd, the outcome of that musing, is now available free at the App Store and will be submitted to Google Play shortly. People can use it as a portable, GPS- powered field guide, but Peters hopes its interactive features will raise the sum

of geologic knowledge. "The big idea is, 'Tell us what you saw and I will tell you what I saw,'" Peters says. "Users can upload their observations and photos, and compare those to what others think or know about that location."

With its GPS-driven accuracy, Rockd overcomes a key limitation on geologic maps: their focus on big structures. "Using a map, it can be hard to tell specifically where to go to see a particular rock unit exposed at the surface," Peters says.

Rockd serves both amateur rock lovers and professional geologists, he says. For amateurs, "the goal is to help people discover the natural history that is recorded all around them. People see rocks at highway cuts, and some may wonder what they are and when they formed. The answers to many of these questions exist in the databases that we tap into."

The new app should also help students, Peters says, and may lead to learning innovations. "Making a map after you are dropped in the middle of nowhere is a foundational skill in geology, but we already have maps. They are not perfect and often need to be redone at a finer scale, but maybe we can leverage what we already know to greater effect."

For working professionals, the app "puts maps in your hands in the field, and gives you a simple way to annotate them," Peters says. "A geologic map is often a big sheet of paper that you attach by magnet to the side of the van, but it's difficult to use that knowledge as you walk through the field. Now you can leave the paper map behind, dig into the digital data and record what you see right when you see it, and link it to existing knowledge."

Rockd could also engender friendly competition, Peters says. "There's an adage: the best geologist is the one who has seen the most rocks. It's tongue-in-cheek, but now we can measure that."

Peters has spearheaded several web-based interfaces to ease access to large geologic data sets in projects like Macrostrat, the Paleobiology Database. "The special sauce for Rockd," he says, "is the rich data we draw on because we have instant access to data from thousands of digitized studies of geology and paleontology."

Uniquely, Rockd will also expand the sum of geologic knowledge, Peters says. "Data gathered through Rockd's crowd-sourcing aspect can feed back into our data structure, so we end up with a richer database to do our analyses. It also can help us plan fieldtrips with students or for research."

This project was supported by grants from the National Science Foundation (EAR-I 150082), the UW-Madison Department of Geoscience, and other sources.

WHATEVER HAPPENED TO THE HOLE IN THE OZONE?

Erin Blakemore blogs daily for Smithsonian.com and wrote "The Ozone Hole was Super Scary, So What Happened to It?" <http://www.smithsonianmag.com/science-nature/ozone-hole-was-super-scary-what-happened-it-180957775/?no-ist>



MOERAKI BOULDERS IN NEW ZEALAND

No wonder the Māori tribes on the coast of New Zealand's South Island created mythical origins for the Moeraki Boulders of Koekohe Beach. The large rocks seem a little too well formed to be a natural occurrence. Perhaps more prosaically than the myths would suggest, the boulders actually formed when clay and silt under the surface of the sea became cemented together with calcite, like giant oyster pearls. As the calcite hardened and erosion washed away loose silt, the hollow 'concretions' were left behind on the beach. Over time, cracks appear on the boulders' surfaces and most will eventually crumble apart. <http://www.moerakiboulders.com/>



DATES TO REMEMBER

April 13, 2017 – GSNH Spring Dinner Meeting - "Ages and Plate Tectonic Settings of Lithium-Cesium-Tantalum Pegmatites in New England" Speaker: Dr. Dwight Bradley, USGS Research Geologist -<http://www.gsnh.org/> Reservations by April 7. **New price structure – See reservation form.**

May 5, 2017 - NH Geological Survey Lunchtime Lectures 12:00 – 12:45 PM, Room 208c, NHDES, 29 Hazen Drive, Concord, New Hampshire, **"Travels in England: Mines, Minerals, Museums (and More)"** Geologist Woody Thompson brings together highlights from four recent trips to England. The talk will focus on England's mining history that enriched the nation's economy and provided beautiful crystal specimens sought by museums and collectors worldwide. Touristy bits and cultural attractions will be included along the way. R.S.V.P., please contact the NH Geological Survey at: geology@des.nh.gov.

July 29, 2017 – GSNH Summer Field Trip – "Highlights of Mt Ascutney-Area Geology" led by Greg Walsh. See the article in this newsletter describing preliminary plans.

August 26-27, 2017 – 54th Annual Capital Mineral Club Gem, Mineral, Fossil & Jewelry Show; Everett Arena, Concord, NH http://www.capitalmineralclub.org/54th_annual.php.

September 29 to October 1, 2017 - Bates College will be hosting **NEIGC 2017** out of Bethel, Maine. Dyk Eusden is planning on having many field trips in nearby northern NH.

WHAT IS YOUR BOARD DOING?

On Thursday, March 16, 2017, Sharon Lewandowski hosted the quarterly board meeting at the Manchester offices of AECOM. The Board voted to restore its tax exempt status as a 501(c)(6) organization. The Board also discussed improving ways to perpetually store electronically our logos, newsletters, membership list, meeting minutes and quarterly and annual financial reports. A plan was discussed for presenting financial updates in the quarterly newsletter. Annual financial reports will be provided in March newsletters, but not this one—see the June edition. Membership is at 91 active and 96 who need to catch up with one or two years of dues. The new rate structure for dinner meetings was approved. The Society has been consistently subsidizing dinners for many years and the new rates will help balance out the losses.

The next dinner meeting will be held at the Pappas Room at the Puritan in Manchester on April 13, 2017. Dwight Bradley will present on dating of pegmatites. Prices at banquet halls with catered meals were found to be too expensive and that idea was dropped. For now we will have to close reservations when the available restaurant space is filled. This has already meant that people were turned away from the last meeting, so don't delay your reservations. The new website is up and running. The new structure is in place, but we will be adding and revising content for some time. A card was circulated for Abby and Jason Fopiano congratulating them on the birth of their daughter Roslyn. She has kept Webmaster Abby busy.

The Board will be contacting teachers to let them know about our grant opportunities. Plans were made for our summer field trip and fall dinner meeting. The field trip is introduced elsewhere in this edition. The next fall dinner meeting is planned for Makris, likely on October 12. The plans for developing a web-interactive map showing publically-accessible geologic features of the state continues. Board members are beginning to list features we would like to see included. Each site would be shown as a feature on a map of the state that would open up pictures and a document describing the feature.

Our next Board of Directors meeting will be held on Thursday, June 29, 2017, at Toad Hall in Contoocook. All members are welcome to attend our meetings. Please let a Board member know if you would like to attend or if there is an item of interest that you would like added to the agenda.

GSNH SUMMER 2017 GEOLOGY FIELD TRIP - HIGHLIGHTS OF MT ASCUTNEY AREA

GEOLOGY Submitted by Lee Wilder and Thor Smith

As of this writing, the GSNH is planning a Summer 2017 Geology Field Trip in the Mount Ascutney Area of west central NH – east central VT. Mark your calendar for Saturday July 29, 2017. Look for an e-mail announcement to membership (and registration instructions) as the time gets closer.



We plan to meet near Saint- Gaudens National Historic Site in Cornish, NH at 0900 for sign-in, coffee and pastries. Under the leadership of Greg Walsh (USGS mapper in that area) we will leave in a carpool promptly at 1000. Bring your own brown bag lunch (GSNH will provide cold drinks and fruit snacks). We will explore interesting geologic sites that Greg has mapped in the Mt Ascutney area.

We plan to return to the field trip departure site by 15:00, giving folks enough time in the late afternoon to visit (on their own) the famous Saint-Gaudens National Historic site.

<https://www.nps.gov/saga/index.htm>

GSNH TEE SHIRTS AVAILABLE Ask Tom Fargo at the next dinner meeting!



LEGISLATIVE COMMITTEE REPORT by Thomas Fargo

Below are listed 2017 Bills before the NH General Court of potential interest to geologists. HB = House Bill; SB=Senate Bill; Hypertext links will open text of each bill. ITL means that the bill has been "killed"

Of particular note are HB-485 and HB-463 which are related to drinking-water impacted by perfluorochemicals, PFOA and PFOS. The prime sponsor of HB-485 is Representative Mindi Messmer, NH Professional Geologist from Rye. HB-591, which would prohibit the use of suction dredging for the purposes of recreational prospecting, was approved by the House but is likely to be killed by the Senate.

Bill Number	Title	Description	Bill Status – March 22, 2017
HB-77	AN ACT relative to dam fees for nonprofit organizations	This bill allows the department of environmental services to waive certain dam fees for nonprofit organizations.	Voted Inexpedient to Legislate (ITL) by full House 02/09/2017
HB-119	AN ACT making appropriations to the department of environmental services for the purpose of funding eligible drinking water and wastewater projects under the state aid grant program.	This bill makes appropriations to the department of environmental services for funding specific water and wastewater projects.	Voted Inexpedient to Legislate (ITL) by full House 02/02/2017
HB-101	AN ACT relative to certification for solid waste operators.	This bill lengthens the time a solid waste operator certificate is valid from one year to 3 years. This bill also exempts volunteer solid waste operators from the certification requirement.	Retained in House Executive Departments and Administrative Committee 03/15/2017
HB-145	AN ACT requiring municipal approval for siting high voltage transmission lines.	This bill prohibits high voltage transmission lines from being located in any municipality without a vote of approval by the municipality.	Voted Inexpedient to Legislate (ITL) by full House 02/09/2017
HB-146	AN ACT relative to the definition of energy cost saving measure and relative to energy performance contracting.	This bill expands the definition of "energy cost saving measure" to include utility cost savings. This bill also requires an energy performance contract to include a guarantee of utility cost savings over the term of the contract. This bill was requested by the department of environmental services.	Voted Inexpedient to Legislate (ITL) by full House 02/02/2017
HB-114	AN ACT relative to minimum electric renewable portfolio standards.	This bill reduces the percentage of total megawatt-hours of electricity from class 1 sources to be supplied by each producer to its customers in 2025 and thereafter under the minimum electric renewable portfolio standards.	Retained in House Science Technology and Energy Committee 02/15/2017
HB-485	AN ACT relative to standards for emerging contaminants in drinking water	This bill requires the department of environmental services to use exposure scenarios in children and other vulnerable populations to determine ambient groundwater quality standards.	Retained in House Finance Committee 03/16/2017
HB-173	AN ACT relative to regulations restricting the use of water for outdoor usage.	This bill extends the authority of selectmen to restrict outdoor water usage. Note: includes public water systems and private wells.	Recommended as Ought to Pass with Amendment to full House by Municipal and County Government Committee 03/23/2017
HB-376	AN ACT relative to the disturbance of sediments in estuarine waters	This bill requires the commissioner of the department of environmental services to adopt rules relative to requiring persons undertaking major projects which will dredge estuarine waters to make certain reports	Voted Inexpedient to Legislate (ITL) by full House 03/09/2017
HB-230 and	AN ACT relative to the referendum procedure for	These bills: (1) changes the referendum procedure for public water systems; and (2)	HB-230: Voted Inexpedient to Legislate

HB-585	public water systems. and: AN ACT abolishing fluoridation in water	prohibits the introduction of fluoride into the drinking water of the state.	(ITL) by full House 02/15/2017 HB-585: Voted to Table by full House 03/09/2017
HB-431	AN ACT establishing a commission to study long term goals and requirements for drinking water in the seacoast area.	This bill establishes a commission to study long term goals and requirements for drinking water in the seacoast area.	Approved by full House with Amendment. Referred to Senate 03/09/2017
HB-463	AN ACT regulating groundwater pollution caused by polluting emissions in the air.	This bill: (1) Allows the department of environmental services to make rules regarding air pollution and the deposit of such pollutants on soils and water. (2) Regulates devices emitting or having the potential to emit air pollutants that may harm soil and water through the deposit of such pollutants. This bill is a request of the department of environmental services.	Recommended as Ought to Pass with Amendment to full House by Science Technology and Energy Committee 03/23/2017
HB-507	AN ACT establishing a committee to study the responsibility of a person who through their pollution makes drinking water non-potable.	This bill establishes a committee to study the responsibility of a person who through their pollution makes drinking water non-potable.	Approved by full House. Referred to Senate Energy and Natural Resources Committee 02/16/2017
HB-591	AN ACT relative to suction dredging in the surface waters of the state.	This bill defines recreational prospecting and also prohibits the use of suction dredging for the purposes of recreational prospecting	Approved by full House with Amendment 02/15/2017. Referred to Senate Energy and Natural Resources Committee 02/16/2017. Committed report: Inexpedient to Legislate.
SB-57	AN ACT making appropriations to the department of environmental services for the purposes of funding eligible drinking water and wastewater projects under the state aid grant program.	This bill makes appropriations to the department of environmental services for the purposes of funding eligible drinking water and wastewater projects under the state aid grant program.	Approved by full Senate and Laid on Table 03/09/2017. (Note: Likely to be taken up when level of funding is determined.)
SB-117	AN ACT making an appropriation for stormwater management and flood resilience grants.	The bill makes an appropriation to the department of environmental services for stormwater management and flood resilience grants.	Approved by full Senate and Laid on Table 03/09/2017. (Note: Likely to be taken up when level of funding is determined.)
SB-118	AN ACT defining pervious surfaces in the shoreland water quality protection act.	This bill defines pervious surfaces under the shoreland water quality protection act.	Approved by full Senate with Amendment. Referred to House Resources, Recreation and Development Committee 02/16/2017
SB-186	AN ACT establishing a committee to study the tax characterization of stormwater utility fees.	This bill establishes a committee to study the tax characterization of stormwater utility fees.	Voted Inexpedient to Legislate (ITL) by full Senate 02/23/2017

New research suggests state sits atop ‘upwelling’ of magma

Could the Granite State be sitting atop a slowly rising reservoir of molten rock? Some new science suggests the answer is yes, and it could also be contributing to some of the state’s unique geological features, like the height of our mountains.

If their findings are correct, scientists say a volcano could form in New Hampshire, but fear not; it won’t happen anytime soon. In fact, it’s likely the rising magma will not come close to the Earth’s surface for several hundreds of millions of years. So we’ve got some time.

Still, some 120 miles below us, an upwelling like this could explain certain natural phenomena and maybe even lend the White Mountains their formidable altitudes. Mount Washington is the tallest mount in the Northeast, after all.

To Bill Menke, a geologist with the University of Columbia’s Lamont-Doherty Earth Observatory, a feature like New Hampshire’s 7,000-footer [sic] was an early clue that something was up — or down, as it were. “I have been interested for many years about what makes New Hampshire the special places it is,” Menke said.

Other clues included spikes in helium found in the state’s groundwater, something a magma upwelling would explain, overhot underground temperatures, and the occasional earthquake. “The fact that we have earthquakes in New England is somewhat anomalous because we don’t have faults,” said New Hampshire state geologist Rick Chormann. [Editor – I asked Rick about this odd statement and he explained the reporter had left out a critical adjective “active”. I buy that story, since I know Mt.

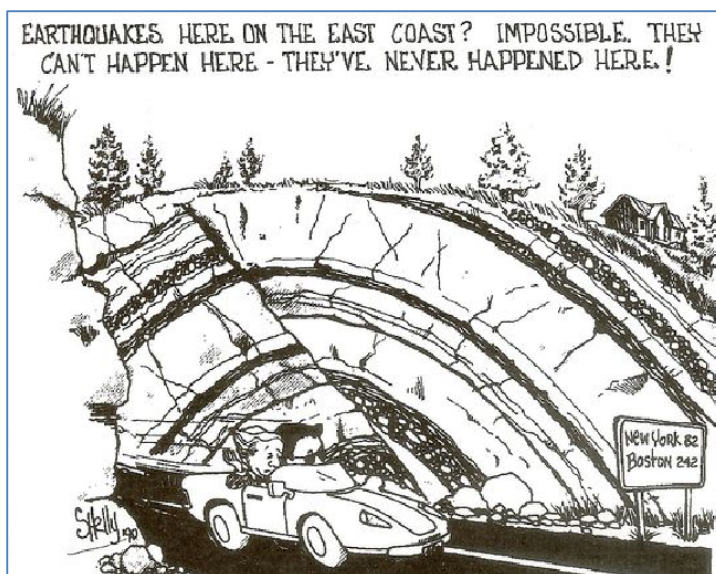
Washington isn’t 7,000 feet tall either.]

Some of these features have been known by scientists for decades. They dubbed it the Northern Appalachian Anomaly. But they believed the NAA was an effect from a hotspot that passed under this area of the continent.

“The prevailing theory for why New Hampshire looks so different than other parts of the Appalachian Mountains had to do with this hotspot that passed New Hampshire about 100 million years ago,” Menke said. The hotspot is known as the Great Meteor hotspot, named after the ship that discovered it. “It has nothing to do with a meteor in the astronomical sense.”

As the surface of the Earth has shifted over the upper mantle, a pock-marked undersea trail has revealed the presence of the ancient hotspot, and a line can be traced back from its current location in the Atlantic Ocean to New Hampshire and Quebec. But the high underground temperatures, helium fizz and tall mountains have a present-day phenomenon at work behind them, Menke said. By studying data from the Transportable Array seismograph network and his own sensitive instruments, he was able to infer the presence of a current upwelling 250 miles across and 100 miles thick from top to bottom under central and southern New Hampshire.

Chormann says this may settle a longstanding debate about the formation of the White Mountains and the present-day NAA. “Not everyone agrees that that active magmatic episode [which created the White Mountains] was related to the hotspot,” Chormann said. He said the White Mountain batholith (an upward injection of magma deep inside the crust) was created in the Jurassic period between 160 million and 180 million years ago, hardened into rock and became exposed over millennia of erosion, transforming into the mountains we know today. Instead of owing that injection to the hotspot, it’s possible this upwelling has been around just as long. Menke believes it’s caused by the flow of upper mantle beneath our continent forcing up magma on the other end, like the bubbling water in the wake of a boat. He’s found similar phenomena in Virginia and parts of Louisiana.



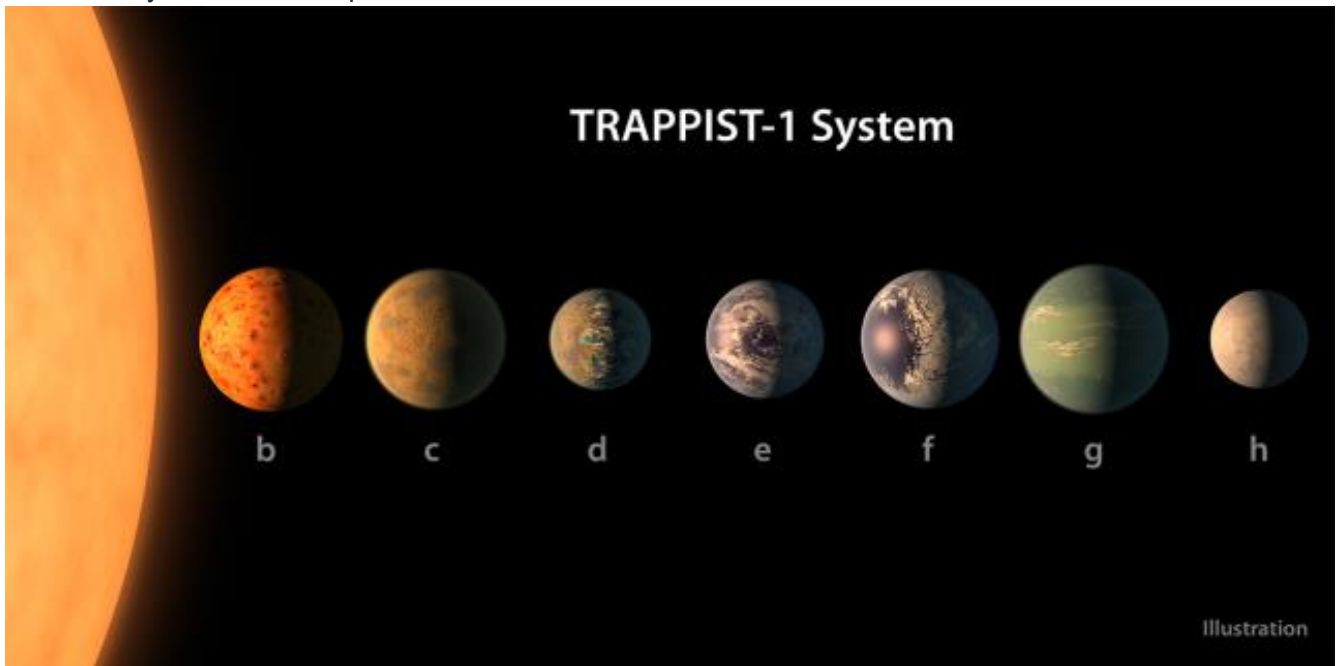
EXOPLANET DISCOVERY - NASA TELESCOPE REVEALS BATCH OF EARTH-SIZE, HABITABLE-ZONE PLANETS AROUND SINGLE STAR Feb. 22, 2017

TRAPPIST (TRANSiting Planets and Planetesimals Small Telescope) is a project driven by the Origins in Cosmology and Astrophysics group (OrCA) at the Department of Astrophysics, Geophysics and Oceanography (AGO) of the University of Liège (Belgium). Mostly funded by the Belgian Fund for Scientific Research (F.R.S.-FNRS) and the Liège University, TRAPPIST is devoted to the detection and characterization of planets located outside our solar system (exoplanets) and to the study of comets and other small bodies in our solar system. It consists of two 60cm robotic telescope located at the ESO La Silla Observatory in Chile and at Oukaïmeden Observatory in Morocco.

http://www.trappist.ulg.ac.be/cms/c_3300885/en/trappist-portal

In a press release on February 22, 2017, NASA announced the discovery of the most Earth-sized planets found in the habitable zone of a single star, called TRAPPIST-1. This system of seven rocky worlds—all of them with the potential for water on their surface—is an exciting discovery in the search for life on other worlds. There is the possibility that future study of this unique planetary system could reveal conditions suitable for life. Three of these planets are firmly located in the habitable zone, the area around the parent star where a rocky planet is most likely to have liquid water.

At about 40 light-years (235 trillion miles) from Earth, the system of planets is relatively close to us, in the constellation Aquarius. Because they are located outside of our solar system, these planets are scientifically known as exoplanets.



This artist's concept shows what the TRAPPIST-1 planetary system may look like, based on available data about the planets' diameters, masses and distances from the host star. Credit: NASA-JPL/Caltech

In contrast to our sun, the TRAPPIST-1 star—classified as an ultra-cool dwarf—is so cool that liquid water could survive on planets orbiting very close to it, closer than is possible on planets in our solar system. All seven of the TRAPPIST-1 planetary orbits are closer to their host star than Mercury is to our sun. The planets also are very close to each other. If a person were standing on one of the planet's surface, they could gaze up and potentially see geological features or clouds of neighboring worlds, which would sometimes appear larger than the moon in Earth's sky.

The planets may also be tidally locked to their star, which means the same side of the planet is always facing the star, therefore each side is either perpetual day or night. This could mean they have weather patterns totally unlike those on Earth, such as strong winds blowing from the day side to the night side, and extreme temperature changes.

Find more at: <https://www.nasa.gov/press-release/nasa-telescope-reveals-largest-batch-of-earth-size-habitable-zone-planets-around/>

Explore TRAPPIST-1 d at <https://exoplanets.nasa.gov/newworldsatlas/1969/>

WOODY THOMPSON ET AL. PAPER AVAILABLE ONLINE

Deglaciation and late-glacial climate change in the White Mountains, New Hampshire, USA

by Woodrow B. Thompson, Christopher C. Dorion, John C. Ridge, Greg Balco, Brian K. Fowler, Kristen M. Svendsen

Woody said, in January, "Our paper in Quaternary Research has just been published online! So far it looks great."

Share this article with your peers using co-author access code:

3E37B6EF8116203FA5D9B25AA1EDD29C

Woody also said, "I'm not sure how this works, but it appears that you first need to register on the QR website and then log in. Then you'll see a space for the access code. I had to do that just to access the article, but I haven't found a "sharing" link. It's much easier just to forward the pdf directly!

Thanks everybody for your valuable contributions to the paper. I'll let you know when there's a chance to order reprints. The journal has yet to be printed. Cheers, Woody"

So if you want a copy, maybe just ask Woody or one of the co-authors for one?!?!?

UNH RESEARCHERS DEVELOP SAFER, RELIABLE MANGANESE BATTERY

Dec 15, 2016 <https://www.unh.edu/unhtoday/news/release/2016/12/14/unh-researchers-develop-new-safer-and-reliable-battery-option>

DURHAM - Researchers at the University of New Hampshire have developed an alternative energy storage system that could lead to a less dangerous and more cost effective battery technology than some currently on the market. The more environmentally friendly device could offer a less harmful alternative to the more potentially combustible batteries that have been making headlines for catching on fire in cell phones, hover boards and automobiles.

The team of researchers at UNH set out to look for a solution that could lead to a rechargeable energy storage device that would offer more enhanced safety yet be reliable and low cost. In their study, recently published in Nature Communications, they outline their approach of modifying a unique form of manganese oxide known as Mn₅O₈.

"This manganese oxide mineral was first studied back in 1965 but since then very few people have considered it in designing today's rechargeable energy storage," says Xiaowei Teng, associate professor of chemical engineering. "The challenge with creating electrode materials for aqueous, or water based, energy storage like this one is being able to get enough charge, or discharge, cycles and a good amount of storage capability. So we thought altering the way the Mn₅O₈ was prepared for use in battery electrodes might make it a viable option."

Aqueous electrochemical energy storage devices have attracted significant attention lately because their electrolyte is water-based and, therefore, less likely to combust once exposed to air or moisture. Besides having more potential to cause a fire, lithium batteries are made from an expensive element that is in scarce supply and according to some experts, might be in danger of depletion at the current consumption rate. Cost-effective energy storage has long been described as the key for the widespread adoption of renewable energy practices. Rechargeable aqueous batteries, especially ones using earth-abundant and non-toxic materials, have shown great promise for many applications owing to their high safety, low cost and environmental friendliness. However, they traditionally have had narrow applications because of their limited capacity and are not always easy to charge to a high voltage.

Teng and his team, Xiaoqiang Shan and Daniel Scott Charles, both PhD candidates in the chemical engineering department at UNH, altered the way that the manganese oxide materials were used as an electrode in the energy storage device. This allowed for the potential of creating a more reliable aqueous battery with more energy storage (3.0 V, which is comparable to most standard non-aqueous devices), as well as increased power performance and charge cycles (85 percent energy efficiency after 25,000 charge-discharge cycles; much longer than existing non-aqueous devices). Also, as an aqueous phase energy storage device, preparation of electrodes under air- and moisture-free environment is unnecessary, resulting in lower cost of production and cell packaging when compared to non-aqueous, or lithium, devices.

THE NH GEOLOGICAL SURVEY GROUND WATER LEVEL NETWORK SUMMARY

Submitted by Lee Wilder of the NHGS

The NHGS is now posting its monthly groundwater levels from its network of NH Observation Wells online at: <http://www.des.nh.gov/organization/commissioner/pip/publications/geologic/groundwater-levels.htm>. The data for all of the wells in the NH Groundwater Level Network are shared with and posted on the USGS website at: <http://groundwaterwatch.usgs.gov/statemap.asp?sc=33&sa=NH>. A map of both the New Hampshire and Vermont Groundwater Level Network is at <https://groundwaterwatch.usgs.gov/netmapT2L1.asp?ncd=NHV>.



Measuring water level at the Albany NH well in February was interesting...

OPAL'S PALS

MUSCOVITE (OR WHITE MICA) HAS BEEN FOUND AS LARGE, FLAT CRYSTALS IN WHICH THE LAYERS OF MICA EASILY PEEL AWAY. THESE MICA CRYSTALS ARE CALLED MICA BOOKS.



ROUGHLY 120 SMALL QUAKES RATTLE MOUNT ST. HELENS By Kale Williams

Published by The Oregonian/OregonLive on December 12, 2016

Roughly 120 small earthquakes rumbled beneath the slopes of Mount St. Helens late last month, officials said, though the recent seismic activity does not necessarily foretell an impending eruption.

While the mountain responsible for the deadliest eruption in American history does not appear to be on the precipice of blowing its top, the recent quake swarms serve as a reminder that Mount St. Helens is still very active.



Mount St. Helens, November 28, 1981. R. G. Bowen/Special to The Oregonian

"Each of these little earthquakes is a clue and a reminder we are marching toward an eruption someday," Weston Thelen, a seismologist with U.S. Geological Survey's Cascades Volcano Observatory in Vancouver, told The Columbian, which first reported the story. "There's nothing in this little modest seismicity, and none since 2008, that is a really good indicator of when that eruption will be," Thelen added.

36 YEARS AGO, MOUNT ST. HELENS ERUPTED By Tony Hernandez | The Oregonian/OregonLive May 18, 2016

For weeks in spring 1980, Mount St. Helens' northern flank rose about 5 feet a day as magma pushed the ground higher.

Then on May 18, the ground shook violently as much of the volcano's northern side collapsed in a massive landslide, causing an eruption that spewed ash almost 80,000 feet into the air.

Today -- 36 years later -- that ground collapse is continuing to help scientist who study volcanos and eruptions identify other past and present magmatic events.

The eruption dropped the volcano's elevation by 1,300 feet, killed 57 people and destroyed 27 bridges and more than 200 homes. Volcanic activity in the 1980s and in 2000s has sent lava flowing onto the crater floor, and domes taller than the Empire State Building have restored 7 percent of the lost volume, according to the U.S. Geological Survey.

http://www.oregonlive.com/pacific-northwest-news/index.ssf/2016/05/36_years_ago_mount_st_helens_e.html

Little is known about the exact origin of Mount St. Helens' magma. Recently, scientists found that the inside of the volcano was surprisingly cool and theorized that molten rock actually flowed in an underground plumbing system from east of the mountain.

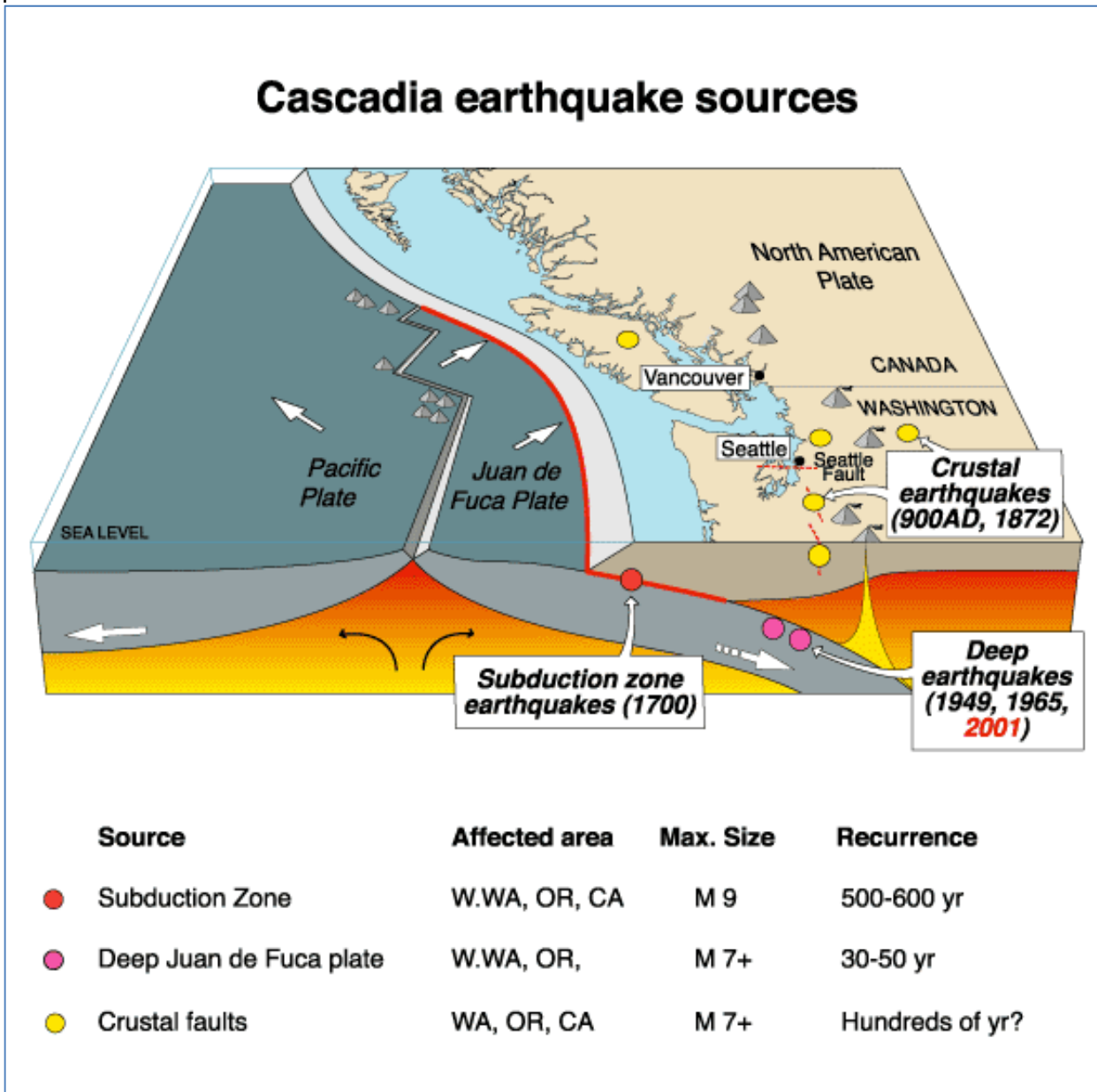
Wherever the magma comes from, it constantly releases gas within the volcano, which experts believe could be the cause of the recent quakes. Most of the temblors were 1 to 2 miles beneath the surface and all of them were too weak to be felt above ground.

"We know Mount St. Helens is slowly repressurizing," Liz Westby, a Cascades Volcano Observatory geologist, told The Columbian. "We can't see it, but we think it's inflating subtly."

And...

RESEARCH RAISES QUESTIONS ABOUT THE MYSTERIOUS SOURCE OF MOUNT ST. HELENS' MAGMA By Kale Williams | The Oregonian/OregonLive November 02, 2016

Most volcanoes draw their magma from chambers deep under the earth's surface, usually a result of their proximity to borders in tectonic plates. The Cascadia arc, a string of volcanoes that runs on a north-south line parallel to the Cascadia Subduction Zone, is just such an example, with magma pushing toward the surface from where the Juan de Fuca plate wedges under the North American plate.



Courtesy/U.S. Geologic Survey

According to the data collected by researchers with the Imaging Magma Under St Helens project, however, Mount St. Helens does not conform to conventional wisdom. Through a series of experiments involving explosive-induced earthquakes, scientists found that the type of rock under the west side of

the mountain, serpentine, was in fact cold and hydrated, not exactly what you would expect to find while looking for a super-heated magma chamber.

That startling discovery was revealed in a study [<http://www.nature.com/articles/ncomms13242>] conducted by scientists at the University of New Mexico and published Tuesday in the journal *Nature Communications* and led to the obvious question: if the magma beneath Mount St. Helens wasn't coming from directly underneath it, where was it coming from and how did it get there?

To answer those questions, Steve Hansen, lead author of the study, had to look deep beneath the volcano at the border between the earth's crust and the mantle, which is around 25 miles beneath the surface. That's where the plumbing system that feeds magma to the mountain can be found.

Hansen led a team to the volcano in the summer of 2014 and deployed almost 1,000 seismographs on the roads and trails around the mountain. Once the measuring instruments were in place, nearly two dozen holes were drilled and filled with explosives and the subsequent blasts triggered a series of small earthquakes.

"Once we fired off the shots, we pretty much just sat back and listened," Hansen told The Oregonian/OregonLive.

And what they heard came as a surprise to all of them, Hansen said. The seismic waves caused by the earthquakes bounced around beneath the earth's surface and the speed, or amplitude, at which they reflect varied depending on what type of rock they are traveling through.

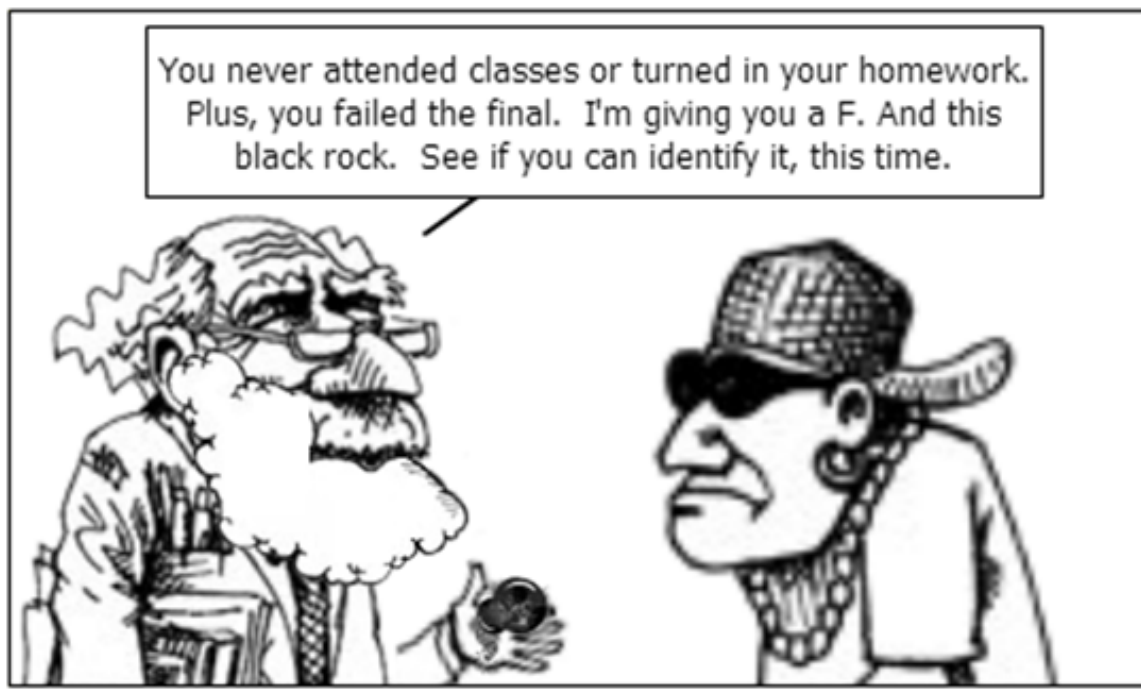
"The amplitude changed dramatically across Mount St. Helens," Hansen said. "The east side of the mountain had high reflection, but the west side had almost no reflection at all."

The results of those tests are what led Hansen and his team to guess that the rock underlying the mountain was serpentine, which usually only occurs west of the Cascades arc. But Mount St. Helens is an anomaly of the arc, sitting significantly west of the north-south line along which Mount Adams, Mount Hood and the area's other volcanoes lie.

Still, the wedge of cold rock essentially ruled out a large magma chamber directly underneath the mountain. Hansen said that, although there is a small magma chamber under the mountain, the source of the magma that flows into Mount St. Helens remains a mystery. Hansen's team has speculated it likely originates east of the volcano, where the mantle is hot enough to create molten rock, and flows laterally to the mountain similar to a volcanic plumbing system.

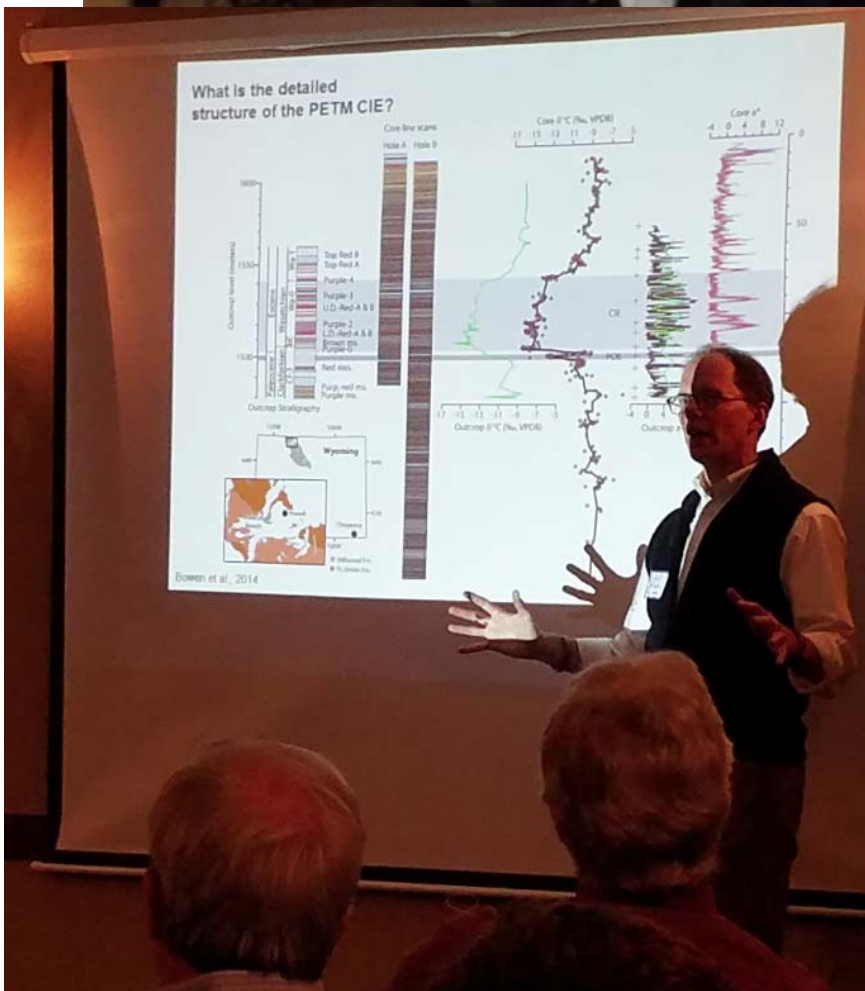
http://www.oregonlive.com/pacific-northwest-news/index.ssf/2016/11/research_raises_questions_about.html

if Santa was a Geology Professor by cta



JANUARY DINNER MEETING

Will Clyde presented to a packed house on the hypertherms observed in the Wyoming Basin rock record described in his illustrated book, "Ancient Wyoming"



RAFFLE WINNERS WERE...

There were a lot of swell prizes for the January 12 dinner meeting raffle at Makris Lobster House.

1st prize: Fossil Fish Imprint was won by Gene Simmons. This fossil shows two small herring in Eocene age Limestone from the Green River formation in Wyoming. Donated to by Lee Wilder.

2nd prize: Cluster of terminated amethyst quartz crystals (SiO₂) from New Jersey won by Shane Csiki out of the collection of Robert Jones.

3rd prize: Stream-tumbled obsidian known as an "Apache Rear" won by Ben Gringas from Superior, Texas donated by the UNH Earth Sciences Department.

ALASKAN VILLAGE, CITING CLIMATE CHANGE, SEEKS TO RELOCATE

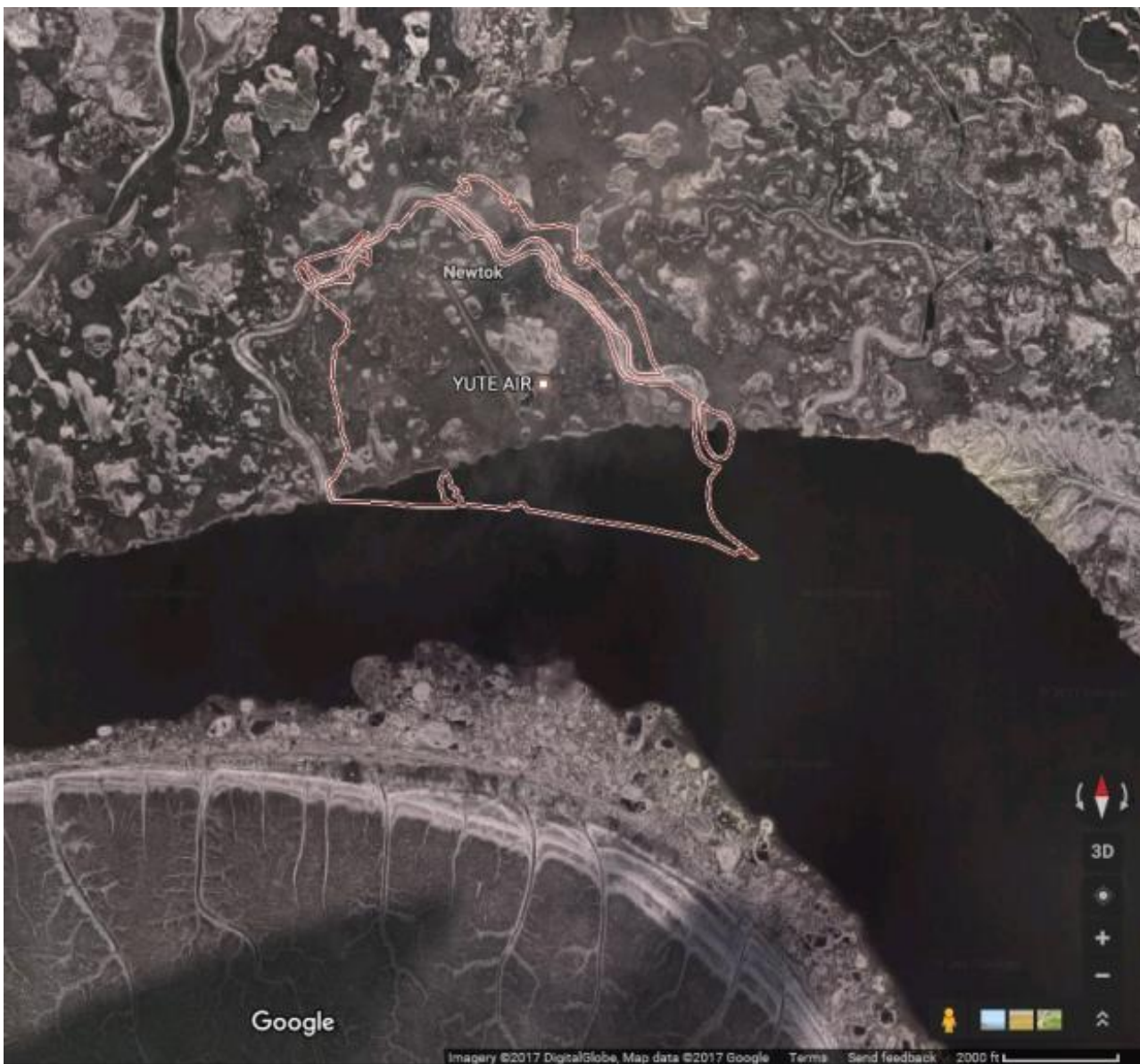
This report comes from Alaska's Energy Desk, a public media collaboration focused on energy and the environment. January 10, 2017

The Ninglick River is eating away at the shoreline in Newtok, Alaska. The tiny village of Newtok near Alaska's western coast has been sliding into the Ninglick River for years. As temperatures increase — faster there than in the rest of the U.S. — the frozen permafrost underneath Newtok is thawing. About 70 feet of land a year erode away, putting the village's colorful buildings, some on stilts, ever closer to the water's edge.

Many of Alaska's villages are dealing with erosion and thawing permafrost. But Newtok's needs may be the most immediate. It has already lost its barge landing, sewage lagoon and landfill. As river water seeps in and land sinks, it expects to lose its source of drinking water this year, and its school and airport by 2020.

Usually, the President, with input from the Federal Emergency Management Agency, declares a disaster after a specific catastrophic event. But Newtok is asking for the declaration based on mounting damage from erosion and thawing permafrost over the past decade.

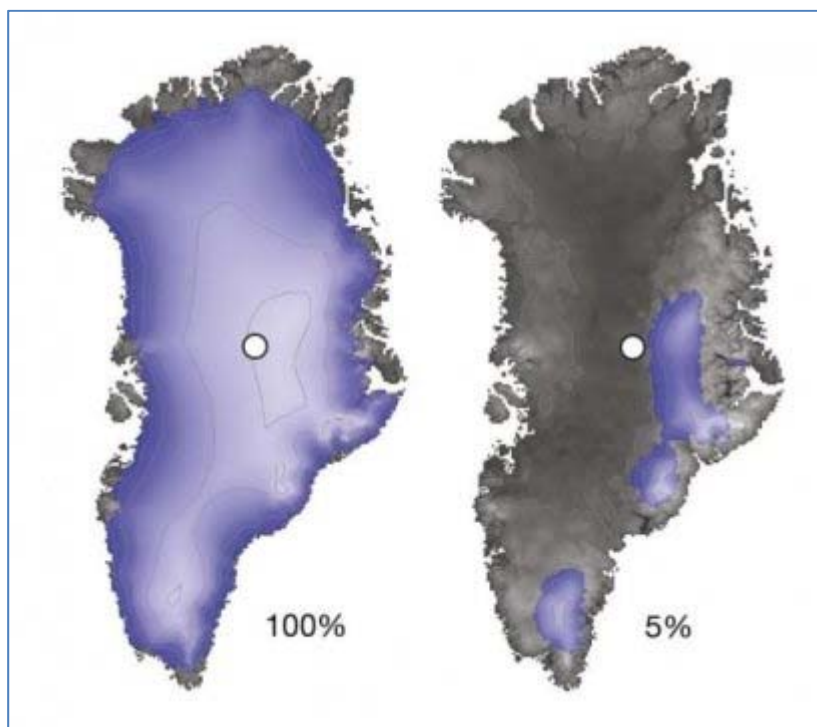
<http://www.npr.org/2017/01/10/509176361/alaskan-village-citing-climate-change-seeks-disaster-relief-in-order-to-relocate>



MOST OF GREENLAND ICE MELTED TO BEDROCK IN RECENT GEOLOGIC PAST, SAYS STUDY

Materials provided by Lamont-Doherty Earth Observatory, Columbia University. December 7, 2016

<https://www.sciencedaily.com/releases/2016/12/161207133453.htm>



Scientists drilled nearly two miles down through the summit of the Greenland ice sheet (white dot, left), to reach bedrock. Isotopes found in the rock indicate that this site and most of Greenland were nearly ice free (right) during the recent geologic past. Credit: Schaefer et al., *Nature*, 2016

Scientists have found evidence in a chunk of bedrock drilled from nearly two miles below the summit of the Greenland ice sheet that the sheet nearly disappeared for an extended time in the last million years or so. The finding casts doubt on assumptions that Greenland has been relatively stable during the recent geological past, and implies that global warming could tip it into decline more precipitously than previously thought. Such a decline could cause rapid sea-level rise. The findings appear this

week in the leading journal *Nature*.

The study is based on perhaps earth's rarest geologic sample: the only bit of bedrock yet retrieved from the ice sheet's base, more than two decades ago. The authors say that chemical isotopes in it indicate that the surface was exposed to open sky for at least 280,000 years over the last 1.4 million years. The reason would have been natural, probably tied to cyclic natural climate changes that have caused ice ages to wax and wane. The scientists say that in the most conservative interpretation, there might have been only one ice-free period that ended 1.1 million years ago. But, more likely, they say, the ice vanished multiple times for shorter periods closer to the present. Greenland contains about 684,000 cubic miles of ice -- enough to raise global sea levels about 24 feet if it were to melt completely.

"Unfortunately, this makes the Greenland ice sheet look highly unstable," said lead author Joerg Schaefer, a paleoclimatologist at Columbia University's Lamont-Doherty Earth Observatory. "If we lost it in periods of natural forcing, we may lose it again." With human-induced warming now well underway, loss of the Greenland ice has roughly doubled since the 1990s; during the last four years by some estimates, it shed more than a trillion tons.

No one knows exactly what it might take to make the ice collapse, or how long that might take. Some models project that it will melt partially or completely over the next 2,500 to 10,000 years, depending on the amount of greenhouse gases humans pour into the air. Ice loss from Greenland now accounts for about a quarter of the currently rising sea level of about 3 millimeters a year, but this could accelerate. Projections of sea-level rise during this century hover around 3 or 4 feet, but many, including the one from the Intergovernmental Panel on Climate Change, do not take Greenland into account. More drastic models put the potential rise much higher.

Coauthor Richard Alley, a glaciologist at Pennsylvania State University, said the study "doesn't say that tomorrow Greenland falls into the ocean. But the message is, if we keep heating up the world like we're doing, we're committing to a lot of sea-level rise." This could take centuries or millennia, he said.

The rock core was recovered in July 1993 by a U.S. scientific team working in southeast Greenland at the highest part of the ice sheet. It took them five summers to drill through 3,056 meters (about 10,000 feet) of ice and sediment. Then they punched 1.55 meters (5 feet) into the underlying bedrock. The ice cores have since formed the basis of many important paleoclimate studies. Scientists tried early

on to analyze the rock as well, but only in the last year or so have lab techniques become sophisticated enough to tease out the needed information, said coauthor Robert Finkel of the University of California, Berkeley, who participated in the ice drilling.

Within the rock, the scientists found traces of radioactive beryllium-10 and aluminum-26 -- isotopes produced by tiny particles from outer space that constantly bombard the planet's surface. The isotopes decay at known rates, and since they cannot be created if the rock is covered with ice, their abundance can be tied to how long ago the rocks were exposed. Modelers agree that the region where the core came from would be one of the last to melt were the ice sheet to disappear. The authors thus concluded that the ice sheet must have been down to less than 10 percent of its current size when this site was ice-free.

The question of how stable the Greenland ice sheet has been in recent geologic times has been controversial. While some recent studies report evidence that it has remained largely unchanged, there is also evidence that it disappeared in the more distant past, and several studies suggesting that the ice wasted to various extents at different points in more recent times. Studies of seafloor sediments off various parts of Greenland have found remains of pollen and other materials dated to a periodic warming cycle about 400,000 years ago, and this has been interpreted to mean that Greenland could have been largely ice-free then. Other studies suggest that the ice surface was substantially reduced during the last major warming cycle some 120,000 years ago, raising sea levels by 12 to 18 feet. But these studies give no clear picture of how long such episodes lasted, and the evidence they use is less direct. "Here we have no question -- we interrogated the surface directly," said Robert Finkel. "Was there ice over you or not?"

Jeff Severinghaus, a paleoclimatologist at Scripps Institution of Oceanography who was not involved in the study, called the evidence "very direct and incontrovertible." The study "challenges some prevailing thought on the stability of the ice sheet in the face of anthropogenic warming," he said. "We can now reject some of the lowest sea-level projections, because the models underpinning them assume continuous ice cover during the last million years."

Thomas Stocker, a climate scientist at Switzerland's University of Bern who also was not involved, said, "It shows that the Greenland ice sheet has been much more dynamic than thought." He agreed that the results have implications for projections of sea level rise.

Scientists have been arguing back and forth about the potential forces that might tip the Greenland ice into quick decline. These could include water percolating from the surface to lubricate the ice sheet's bottom, or massive ice streams discharging icebergs into the ocean. "This study shows we are missing something big about how the system works, and we need to find out what it is, fast," said Schaefer.

While the rock core took five years to emerge and more than 20 years for lab techniques to catch up, such research may move faster now. A consortium of U.S. scientists has designed a new drill capable of penetrating deep ice much faster, with the aim of bringing up bedrock rather than ice cores. The apparatus could take a half-dozen samples each year from Greenland or Antarctica said Severinghaus, who is involved in the project. But it has not yet been deployed; the obstacle is funding, which would probably have to come from the U.S. government.

Joerg M. Schaefer, Robert C. Finkel, Greg Balco, Richard B. Alley, Marc W. Caffee, Jason P. Briner, Nicolas E. Young, Anthony J. Gow, Roseanne Schwartz. **Greenland was nearly ice-free for extended periods during the Pleistocene.** *Nature*, 2016; 540 (7632): 252 DOI: [10.1038/nature20146](https://doi.org/10.1038/nature20146)

EARTH SCIENCE WEEK 2017 THEME ANNOUNCED: 'EARTH AND HUMAN ACTIVITY'

The American Geosciences Institute (AGI) is pleased to announce that the theme of Earth Science Week 2017 is "Earth and Human Activity." This year's event, the 20th annual Earth Science Week celebration, promotes awareness of what geoscience tells us about human interaction with the planet's natural systems and processes. Reaching over 50 million people annually, Earth Science Week has been led by AGI in cooperation with its sponsors and the geoscience community since 1998. Earth Science Week 2017 will be celebrated October 8-14. To learn more, please visit www.earthsciweek.org. To order your Toolkits, please visit www.earthsciweek.org/materials. You may also call AGI Publications to place your order at 703-379-2480.

EXCEPTIONALLY PRESERVED JURASSIC SEA LIFE FOUND IN NEW FOSSIL SITE

Content from University of Texas at Austin

A trove of exceptionally preserved Jurassic marine fossils discovered in Canada, rare for recording soft-bodied species that normally don't fossilize, is expanding scientists' view of the rich marine life of the period.

The preservation of the fossils -- which include soft body parts as well as shells and bones -- ranks the site among the highest quality sources of Jurassic (183 million year old) marine fossils in the world, and the only such site in North America. A paper describing the site and fossils recovered from it was published online in the journal *Geology* in January.



A fossilized mantle of a vampyropod, a relative to the modern vampire squid (pictured on bottom right). The ink sack is the raised structure in the center, and muscles have a striated appearance. Credit: Rowan Martindale/The University of Texas at Austin Jackson School of Geosciences and the Monterey Bay Aquarium Research Institute.

The presence of fossilized soft tissue is especially significant because it offers a more complete view of life in ancient ecosystems and can help fill the gaps in knowledge connecting extinct organisms to those living today, said Rowan Martindale, a professor at The University of Texas at Austin's Jackson School of Geosciences who led research on the fossils.

"In a normal fossil deposit, you only preserve a fraction of the organisms that were alive in the past. When you get an extraordinary fossil deposit with soft tissues preserved, you see significantly more of the community that would have been alive," said Martindale, a paleontologist in the Department of Geological Sciences. "Normally, we wouldn't find many of the animals because they lack a skeleton or have a very soft skeleton."

The new site was found on the Parks Canada Ya Ha Tinda Ranch near Banff National Park in southwest Alberta. Co-author Benjamin Gill, a professor at Virginia Tech, spotted the first exceptional fossil when he noticed his Ph.D. student and co-author, Theodore Them, standing right on top of a lobster.

The new site is about 183 million years old, meaning the fossilized life was alive during the Early Jurassic. These sites are rare. There are only three other sites, all located in Europe, that are known to contain fossils from the Early Jurassic like the Ya Ha Tinda site. Another famous example of a Canadian Lagerstätte is the Burgess Shale, which preserves a community of soft tissue organisms from the Cambrian Explosion (540 million years ago)

More at: <https://www.sciencedaily.com/releases/2017/01/170125145815.htm>

ANCIENT ROCKS HOLD EVIDENCE FOR LIFE BEFORE OXYGEN

November 29, 2016 - by Melanie Schefft with content from University of Cincinnati.

http://magazine.uc.edu/editors_picks/recent_features/bacteria.html

While researchers proclaim the first half of our 4.5 billion-year-old planet's life as an important time for the development and evolution of early bacteria, evidence for these life forms remains sparse including how they survived at a time when oxygen levels in the atmosphere were less than one-thousandth of one percent of what they are today.

Recent geology research from the University of Cincinnati presents new evidence for bacteria found fossilized in two separate locations in the Northern Cape Province of South Africa.

"These fossils represent the oldest known organisms that lived in a very dark, deep-water environment," says Czaja. "These bacteria existed two billion years before plants and trees, which evolved about 450 million years ago. We discovered these microfossils preserved in a layer of hard silica-rich rock called chert located within the Kaapvaal craton of South Africa."

Recent geology research from the University of Cincinnati presents new evidence for bacteria found fossilized in two separate locations in the Northern Cape Province of South Africa.

"These are the oldest reported fossil sulfur bacteria to date," says Andrew Czaja, UC assistant professor of geology. "And this discovery is helping us reveal a diversity of life and ecosystems that existed just prior to the Great Oxidation Event, a time of major atmospheric evolution."

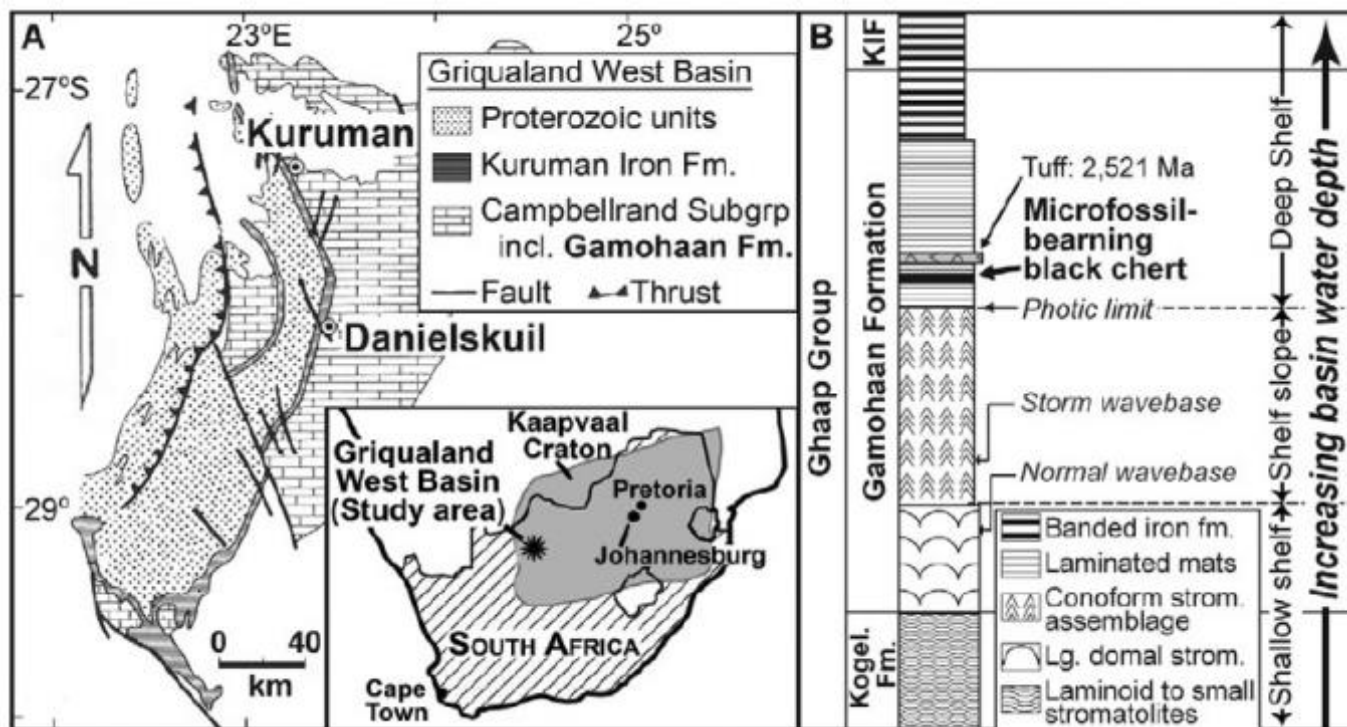
With an atmosphere of much less than one percent oxygen, scientists have presumed that there were things living in deep water in the mud that didn't need sunlight or oxygen, but Czaja says experts didn't have any direct evidence for them until now.

Czaja argues that finding rocks this old is rare, so researchers' understanding of the Neoproterozoic Eon are based on samples from only a handful of geographic areas, such as this region of South Africa and another in Western Australia.



UC Professor Andrew Czaja indicates the layer of rock from which fossil bacteria were collected on a 2014 field excursion near the town of Kuruman in the Northern Cape Province of South Africa. Photo/Aaron Satkoski

According to Czaja, scientists through the years have theorized that South Africa and Western Australia were once part of an ancient supercontinent called Vaalbara, before a shifting and upending of tectonic plates split them during a major change in the Earth's surface.



Based on radiometric dating and geochemical isotope analysis, Czaja characterizes his fossils as having formed in this early Vaalbara supercontinent in an ancient deep seabed containing sulfate from continental rock. According to this dating, Czaja's fossil bacteria were also thriving just before the era when other shallow-water bacteria began creating more and more oxygen as a byproduct of photosynthesis. "We refer to this period as the Great Oxidation Event that took place 2.4 to 2.2 billion years ago," says Czaja.

Czaja's fossils show the Neoproterozoic bacteria in plentiful numbers while living deep in the sediment. He contends that these early bacteria were busy ingesting volcanic hydrogen sulfide then emitting sulfate. "While I can't claim that these early bacteria are the same ones we have today, we surmise that they may have been doing the same thing as some of our current bacteria," says Czaja. "These early bacteria likely consumed the molecules dissolved from sulfur-rich minerals that came from land rocks that had eroded and washed out to sea, or from the volcanic remains on the ocean's floor."

There is an ongoing debate about when sulfur-oxidizing bacteria arose and how that fits into the earth's evolution of life, Czaja adds. "But these fossils tell us that sulfur-oxidizing bacteria were there 2.52 billion years ago, and they were doing something remarkable."

A BIG SOCIETY THANK YOU TO JOE SCHMIDL, EAGLE SCOUT AND GEOLOGIST

Joe Schmidl of Blackwater Environmental Design (<http://www.blackwaterenvironmental.com/>) and Geological Society member deserves our gratitude. Steve Golson, who long ago worked in the oil patch as a geophysicist, and works with Boy Scout Troop 610 of Pelham, NH, agreed to ask around on the troop's behalf for help in earning their geology merit badge. Steve contacted the Society and Joe gladly agreed to meet with the Scouts. Joe is an Eagle Scout himself and the geology merit badge was his first. Thanks Joe!



Geological Society of New Hampshire

GSNH 2017 Winter Dinner Meeting

"Ages and Plate Tectonic Settings of Lithium-Cesium-Tantalum Pegmatites in New England"

Speaker: Dr. Dwight Bradley, USGS Research Geologist, Alaska

How to date a pegmatite, and why do it in the first place? New uranium-lead and argon geochronology from pegmatites from North Carolina to Maine. How these ages fit (or don't fit) into the plate tectonic evolution of the Appalachian?

THURSDAY, April 13, 2017

**The Puritan - Pappas Room
245 Hooksett Rd, Manchester, NH 03104**

5:30 pm Social Hour; 6:30 pm Buffet Dinner; 7:15 pm Speaker

RSVP by 4 pm Friday, April 7, 2017 to get the reservation price
SPACE AT THIS VENUE IS LIMITED TO 80...RESERVE EARLY!

Advance Reservations: _____ Member (Dues Paid) **\$25.00**
_____ Non-member **\$28.00**

_____ **Please indicate the number of vegetarian meals – leave blank for none.**

- Member at the Door **\$27.00**
- Non-Member at the Door **\$30.00**
- Students \$10.00 with valid student ID card (Reservation Requested)

GSNH will also accept dinner reservations by e-mail, which will then allow you to pay at the door. **Please note that e-mail reservations constitute an agreement with the Society for which you will be responsible to pay, whether you are able to attend or not, unless you cancel your reservation by noon the Tuesday before the Dinner.**

Reply via e-mail to: sharon.lewandowski@aecom.com.

Mail to: **Sharon Lewandowski**

GSNH Dinner Meeting, PO Box 401, Concord, NH 03302.

Checks payable to: GSNH.

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The lecture part of the program counts as 1.5 hours of CEU contact hour credit.



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Make checks payable to "Geological Society of New Hampshire." Note that GSNH dues are not deductible as a charitable contribution, but may be deductible as a business expense. Please return this completed application form with any necessary corrections and a check for the appropriate dues to the GSNH at the address above. The Society's membership year runs from January 1 to December 31.

Signature: _____ Date: _____