



# Granite State Geologist

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## In this issue:

- **Mt. Ascutney field trip pictures**
- **Want to take a Grand Canyon rafting geo trip?**
- **Diamonds in Uranus?**
- **European ice sheet**
- **What is your Board doing?**
- **Close fly-by of meteor Florence – did we survive?**
- **Burgess shale 508,000,000 anniversary on August 30**
- **Upcoming Events and Much More!**

## MESSAGE FROM THE PRESIDENT

There are a lot of pictures in this quarter's newsletter. Partly because of the number of photo-worthy events that have happened or are about to happen. Also, because this is such a good construct for high-quality photos now since the Society no longer has to print a paper newsletter and this online version can be in color. So get ready to be wowed by this summer's events and also by upcoming events you may be interested in taking part in. The pictures include this summer's GSNH field trip to the Mt. Ascutney area led by USGS's Greg Walsh and also snaps from Grand Canyon geo-rafting expeditions. Maybe you'll want to attend next year's outings. (If you do, send me the pictures!!!)

My son's internship at a fancy spa in the Poconos ended mid-August and that meant dad to pick him up and deliver him to back to college. I drove through Port Jervis, NY where Route 97 passes through the Delaware River Scenic and Recreational River. The road overlooks the river from scenic vistas that most geologists will miss because they are looking at the road cuts of grey, bedded outcrops that form sheer walls on the other side of the road. Well I took some pictures and picked up a hand sample, but I didn't know what I was looking at until I did a web search to find that Route 97 from Port Jervis climbs up through the dark gray fossiliferous shale and mudstone of the Mahantango Formation of the Middle Devonian Hamilton Group into the dark sandstone cliffs consist of lower Late Devonian Catskill Group (or Genesee Group). Geology – to paraphrase either Buckaroo Banzai, Confucius or Yogi Bera - "No matter where you are, there it is." Pictures to whet your appetite for that area included.

There are a lot of pictures in this year's NEIGC field guide, too. This year's field guide is available on line for free—all 355 pages of it. There are scads of color maps, stereonets, outcrop views, cross sections, concept drawings, ternary diagrams, scenic vistas, lidar images, and even a picture of sweaty geologists from the past to motivate you and help you decide which field trips you want to sign up for September 29 through October 1. I hope to see you there and at the October 12 dinner meeting.

## WHAT IS YOUR BOARD DOING? Submitted by Shane Csiki, Secretary

On Thursday, September 7, Sharon Lewandowski hosted a meeting of the Geological Society of New Hampshire Board of Directors at the AECOM office in Manchester. As always, the Board discussed a number of items. These include attendance at the recent summer field trip and at the dinner meetings during the past year. The Board is very pleased with the attendance at, and success of, these events!

The annual summer field trip, held on Saturday, July 29, was a success, with the exploration of the Mount Ascutney area, led by Greg Walsh. Many individuals expressed their appreciation of Greg's knowledge and expertise. And, the weather cooperated! While Greg conducted the field trip, it should be noted that the field trip would not have happened without the work of Thor Smith and Lee Wilder, who made the arrangements. Thank you, Thor and Lee!

Our next dinner meeting will be held at the Makris Steak House in Concord on Thursday, October 12. Steve Arcone will be presenting about Antarctica. The winter meeting will be held on Thursday, January 11. At this time, the Board does not yet have a speaker lined up for the winter meeting. If you have any ideas for a topic, or specific speakers that you think would be of broad geological interest to the GSNH membership, we would like to hear from you! Feel free to reach out to any Board member with your ideas and suggestions. A specific facility has not yet been lined up for the January 11 meeting, and that information will be forthcoming, so stay tuned.

As reported in the last newsletter, the Board continues to discuss the establishment of a website that provides a map and information of geological sites of interest here in New Hampshire. With Vice President Tom Fargo leading this effort, the Board is in continued discussions as to the appropriate online platform to host the site, as well as potential partners.

The Board has further discussed the non-profit status of GSNH, and possible 501(c)(3) or 501(c)(6) organization status. The Board will be providing an informational update at the October dinner meeting.

Our next Board of Directors meeting will be held on Thursday, December 7, 2017, at 6 PM at the Department of Environmental Services in Concord. 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.

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## GSNH TEE SHIRTS LOOK GOOD ON YOU!

Ask Julie Spencer or Tom Fargo about buying one at the next dinner meeting!

Still only \$18.



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## 2017 GSNH FIELD TRIP TO THE MT. ASCUTNEY AREA

A big thank you to all who helped make the Ascutney Geology Field Trip a success, especially trip leader, Greg Walsh, for sharing his mapping writing the trip field log and made arrangements with the Mt. Ascutney Auto Road; also Thor Smith for the original idea and invitation to Greg. Lee Wilder signed folks up for the trip and made arrangements with Saint Gaudens for parking at Blow-Me-Down Farm. Also to Sharon Lewandowski and Bill Abrahams-Dematte who signed folks in and Julie Spencer who sold GSNH T-shirts. There were 44 attending including Greg and the weather was perfect! The field guide for this trip is available on the GSNH website at

[www.gsnh.org/uploads/9/2/8/6/92861090/gsnh\\_mnt\\_ascutney\\_summer\\_2017\\_field\\_trip\\_guidebook.pdf](http://www.gsnh.org/uploads/9/2/8/6/92861090/gsnh_mnt_ascutney_summer_2017_field_trip_guidebook.pdf).

**PICTURES FROM THE 2017 GSNH FIELD TRIP**



**GSNH Summer Field Trip leader Greg Walsh at the hang glider platform on the west side of the Mt. Ascutney Summit.**



A hay wagon makes a great easel for Greg to introduce the GSNH Summer Field Trip objectives. The present day remnants of the Mt. Ascutney volcano in the background.



Greg Walsh explaining one of the outcrops along the Ascutney State Park auto road at the GSNH Summer Field Trip



**GSNH Summer Field Trip participants viewing volcanic outcrops at the hang gliders platform, near the summit . . .**



... and no one fell off!!!

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GSNH Summer Field Trip -spectacular view off to the NW and Camel's Hump in VT.



## **DELAWARE RIVER DRIVE-BY GEOLOGY submitted by W. Ives**

The Delaware River is the only remaining undammed river in the eastern United States. However, in 1962, Congress authorized 11 dams in the Delaware River basin, ten on tributaries and one, the Tocks Island Dam, on the Delaware itself. The Tocks Island Dam was to be 160 feet high and would have created a 140 foot deep reservoir stretching 37 miles upstream, almost to Port Jervis. Local groups opposed the dam, primarily because of the land that would be taken to build it and the reservoir. They met with little success, but after the first Earth Day in 1970, the project became a focus of the budding national environmental movement and the Save the Delaware Coalition. Their efforts, combined with geological conditions that made construction problematic (and resulting cost overruns) led to the project being indefinitely delayed (but not cancelled) in 1975. In 1978, the Delaware became part of the National Wild and Scenic River system, further damaging prospects for the dam, but it was not until 1992 that the project was finally scrapped by Congress. [John Fedors, Jr ]



**Outcrop along Rt. 97 from Port Jervis, NY above the Delaware River. (Photos by W. Ives)**

According to Prave, the dark gray fossiliferous shale and mudstone of the Mahantango Formation of the Middle Devonian Hamilton Group [which may be important because it overlies the Marcellus shale] is the earliest basinward prograding clastic wedge of the Acadian orogeny comprised of sandstone, siltstone, mudstone, and limestone (Prave et al, 1996 via <https://scholarsphere.psu.edu/downloads/np5547s06s>). Overlying the Mahantango are the dark sandstone cliffs consisting of lower Late Devonian Catskill Group (or Genesee Group). See also <https://3dparks.wr.usgs.gov/nyc/valleyandridge/sedimentaryapp.htm>.



**Outcrop of Mahantango Formation of the Middle Devonian or lower Late Devonian Catskill Group next to Rt. 97.**

A more dedicated searcher might find more studies specific to the Port Jervis area. I was a little surprised by the number of near misses – studies to the north, studies to the west, etc. Here is one of the sources that one might read about conditions at the Port Jervis area:

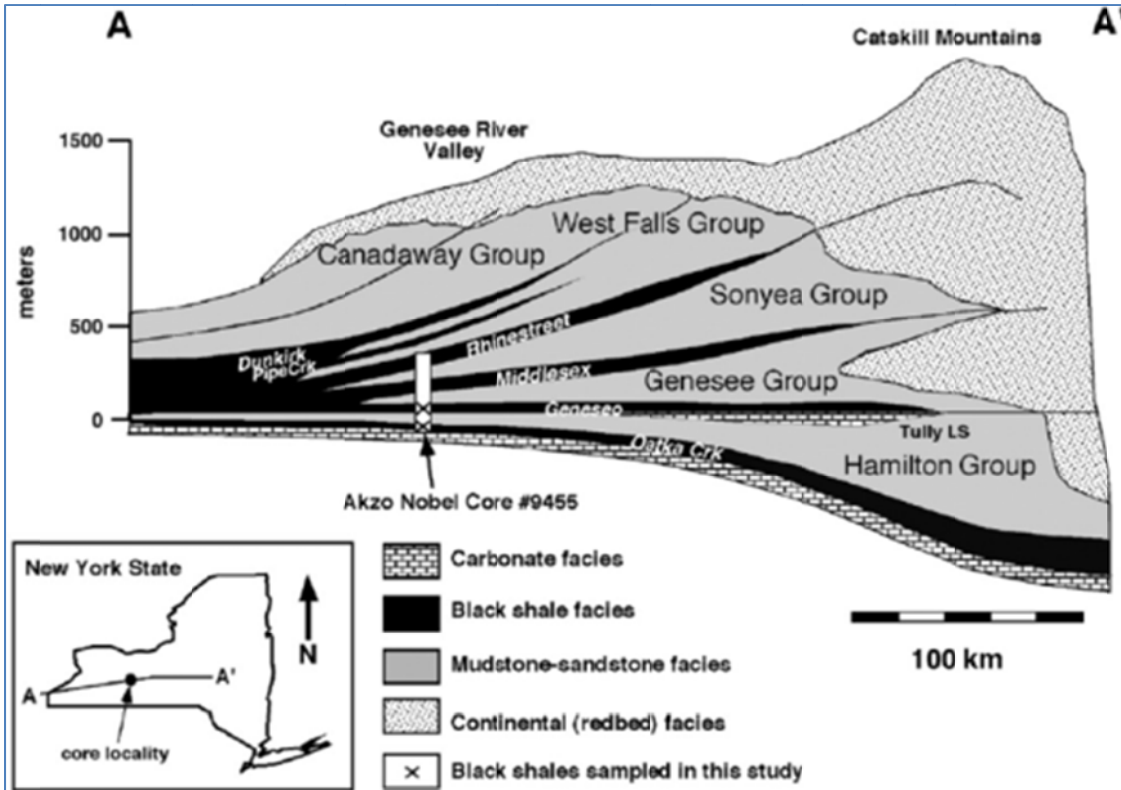
<https://3dparks.wr.usgs.gov/nyc/parks/loc38.htm>



The green star marks Port Jervis, NY. Port Jervis near the junction of the New York, Pennsylvania and New Jersey borders.



Delaware River from Rt. 97. A site many geologists may never have seen. ;-)



Nearest cross-section with a map that I could find that illustrates the Hamilton and Genesee groups, which are found near Port Jervis, NY. Port Jervis is south of A' near the Pennsylvania border.

[https://www.researchgate.net/figure/223388785\\_fig2\\_Fig-2-Geological-cross-section-of-the-Oatka-Creek-Formation-OCF-and-the-Genesee](https://www.researchgate.net/figure/223388785_fig2_Fig-2-Geological-cross-section-of-the-Oatka-Creek-Formation-OCF-and-the-Genesee)

## **IT MAY RAIN DIAMONDS INSIDE NEPTUNE AND URANUS** by Jason Daley, August 22, 2017

<http://www.smithsonianmag.com/smart-news/its-raining-diamonds-inside-neptune-and-uranus-180964589/>

Diamonds may rain down deep within Neptune and Uranus. The physics of these “ice giants” differ greatly from that of Earth. These planets have a solid core surrounded by icy oceans made up of hydrocarbons, water and ammonia. Deep inside these planets, some 6,200 miles from the surface, the pressure is so intense physicists have long speculated that a shower of diamonds may form. Now, as Nicola Davis reports for *The Guardian*, a new experiment simulating this process has provided the first evidence that this diamond rain is possible.

Past researchers have tried to simulate this “diamond rain” before, Davis reports, but were never able to produce the immense pressures that are expected in the interiors of ice giants. So an international team of scientists tried a new approach.

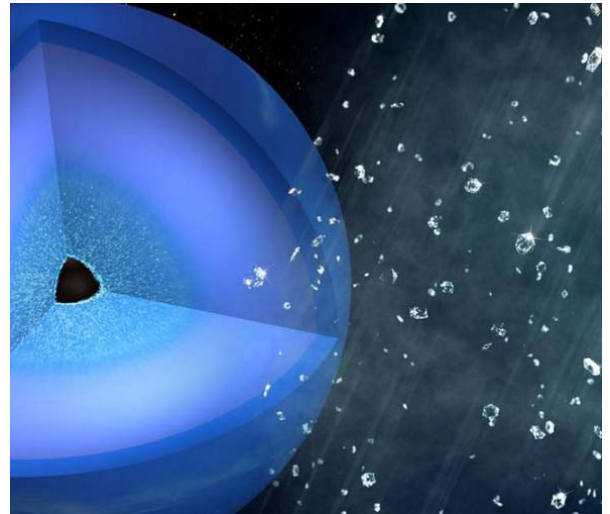
According to a press release, the team exposed polystyrene, a type of plastic composed of carbon and hydrogen, to shock waves produced by a high-powered optical laser and x-rays. The shock waves compressed the plastic at pressures of 150 gigapascals and temperatures of over 9,000 degrees Fahrenheit. This intense reaction broke the bonds between the hydrogen and carbon molecules and compressed carbon atoms into a microscopic diamond. The research appears in the journal *Nature Astronomy*.

“The experimental time is very short,” Dominik Kraus, of the German research laboratory Helmholtz-Zentrum Dresden-Rossendorf tells Davis. “That we saw this very clear signature of diamonds was actually very, very surprising.” Kraus, lead author of the study, tells Bryson Masse of *Gizmodo* that there is likely a large envelop of diamond rain around the cores of Neptune and Uranus. And it’s possible the interiors of the planets are even weirder.

“If the temperature is high enough close to the core (some calculations predict that) it could also be ‘oceans of liquid carbon’ with gigantic ‘diamond icebergs, swimming on top of it,” Kraus says. “But most theories suggest that diamond would remain solid, at least inside Neptune and Uranus, but this may be different for some exoplanets.”

The diamond rain could also solve another mystery about the ice giants, Davis reports. Uranus and Neptune are hotter than most models predict, but Kraus explains that since the diamonds are heavier than the surrounding hydrocarbon medium in which they form, they would sink towards the planet's core over thousands of years. Those sinking stones would create friction, giving off heat, which would produce the temperature boost.

Aside from improving planetary modeling, the new simulation could have practical applications. Currently, tiny artificial diamonds used in electronics and surgical tools are created by blasting. This new laser-based process could lead to a more precise and efficient method of creating the tiny gems.



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## **BURGESS SHALE DISCOVERED AUGUST 30, 1909**

A window opens on a world half a billion years old -- Paleontologist Charles Walcott was almost at the end of his 1909 fieldwork in the Canadian Rockies of British Columbia when he discovered the Middle Cambrian Burgess Shale, a formation teeming with the fossils of soft-bodied organisms 508 million years old. Read more at these pages:

<http://paleobiology.si.edu/burgess/>

<http://www.ucmp.berkeley.edu/cambrian/burgess.html>

<https://www.burgess-shale.bc.ca/>

<https://crowfootmedia.com/2017/08/22/burgess-shale/>

## GRAND CANYON GEOLOGY RAFT TRIP - August 6-13, 2018 – from Fred Beck

Next summer (2018), Fred Beck (Geological Society of Maine) and Alison Jones (GSM and Geological Society of Arizona) will again be leading a raft trip through 188 miles of the Grand Canyon - an 8-day trip on 2 motorized 34-foot inflatable rafts. You can go, too! No paddling or rowing on his trip. This will be the 10th trip for Alison and 8<sup>th</sup> for Fred. We will be going “down section” from the late Permian into the Precambrian, and making numerous geologic, archaeological and just fun stops along the way. We will be camping out each night on sandy beach deltas. As in the past, our trip will be run by Hatch River Expeditions, the oldest raft concessionaire in the Grand Canyon.

Hatch provides everything; two rafts which each comfortably carry 16 people, all camping gear and food, and three licensed experienced guides who run the boats, do the cooking, and assure that everyone will have the experience of a lifetime. In the past we have had about 50% geologists and the rest spouses, friends, teen-aged children, or just people who want to learn about geology in perhaps



**Above: Raft going through rapids on Grand Canyon trip.**

the grandest classroom in the world. It may be that this trip would qualify for continuing education credits for those who need these credits.

This trip has proved very popular and the available spots usually are all filled by late summer or early Fall. A deposit of \$800 is required to hold a spot. The balance of \$2560 is due in March. Returning “river rats” get a @100 discount. In case of cancellation, the deposit will be returned if the spot can be filled. Since we always have had a waiting list, we’ve never failed to return deposits and fill vacated spots. For more detailed information, contact Fred Beck at [fmbeck@fmbeck.net](mailto:fmbeck@fmbeck.net), or Alison Jones at [ajones@clearcreekassociates.com](mailto:ajones@clearcreekassociates.com).



**Right: End of day camp site**



**GRAND CANYON - Rafting down the Colorado River on the Grand Canyon geo-rafting trip.**



**GRAND CANYON - Anasazi granaries high up in the cliffs above the river.**



**GRAND CANYON - Two boats at a lunch stop in Redwall Cavern.**





**GRAND CANYON - left: Butte Fault; right: The view down the river from the Anasazi granaries)**

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**GRAND CANYON - A clear warm water stop at a side-canyon on the Grand Canyon geo-rafting trip.**

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## **GEOLOGIC MAPS FOR THE APPALACHIAN TRAIL** From the NHGS, Lee Wilder, Public Outreach Coordinator

The Geologic Resource Division of the National Park Service has recently completed a state by state listing of existing geologic maps that cover the Appalachian Trail. The Appalachian National Scenic Trail geologic map index is a collection of zipped multipage PDF documents showing available geologic mapping for 7.5 minute quadrangles. Additionally, a map index readme file (APPA\_map\_index\_ReadMe.pdf) describes the index map content and organization.

Access the listing of those maps by using the download link at:

<https://irma.nps.gov/DataStore/Reference/Profile/2243686> GRI Geologic Map Index for the Appalachian National Scenic Trail (GRI MapCode APPA)

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## **DATES TO REMEMBER**

**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. Preliminary list of field trips at [http://w3.salemstate.edu/~lhanson/NEIGC/2017/June%2025\\_TripList.pdf](http://w3.salemstate.edu/~lhanson/NEIGC/2017/June%2025_TripList.pdf).

**October 8-14, 2017** - Earth Science Week. See the details of focus days beginning with International Earthcache Day and ending with International Archeology Day at <http://www.earthsciweek.org/focus-days>.

**December 11-15, 2017** - American Geophysical Union Fall Meeting in New Orleans, Louisiana. Biogeochemical and Microbial Dynamics of Shale Formations and Hydraulic Fracturing Fluids. General information about the conference can be found at <http://fallmeeting.agu.org/2017/>.

**December 12, 2017** - GSNH Board of Directors meeting at NH DES at 6pm.

**March 18–20, 2018** – GSA Northeastern Section 53rd Annual Meeting • Burlington, Vermont Sheraton Hotel and Conference Center  
[https://www.geosociety.org/GSA/Events/Section\\_Meetings/GSA/Sections/ne/2018mtg/home.aspx](https://www.geosociety.org/GSA/Events/Section_Meetings/GSA/Sections/ne/2018mtg/home.aspx)

**August 6-13, 2018 - GRAND CANYON GEOLOGY RAFT TRIP** – See article in this issue. Fred Beck (Geological Society of Maine) and Alison Jones (GSM and Geological Society of Arizona) lead an eight-day trip on two motorized 34-foot inflatable rafts through 188 miles of the Grand Canyon.

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## **ABOUT EARTH SCIENCE WEEK** From Lee Wilder, NHGS

Since October 1998, the American Geosciences Institute has organized this national and international event to help the public gain a better understanding and appreciation for the Earth Sciences and to encourage stewardship of the Earth. This year's Earth Science Week will be held from October 8-14, 2017 and will celebrate the theme "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.

Earth Science Week 2017 learning resources and activities are engaging young people and others in exploring the relationship between human activity and the geosphere (earth), hydrosphere (water), atmosphere (air), and biosphere (life). This year's theme promotes public understanding and stewardship the planet, especially in terms of the ways people affect and are affected by these Earth systems.

**KYANITE** from <https://www.thoughtco.com/what-are-silicate-minerals-4123211> and <http://geology.com/minerals/kyanite.shtml>

Kyanite,  $\text{Al}_2\text{SiO}_5$ , is a distinctive mineral with a light sky-blue to gray-blue color that is popular with collectors. It has a bladed mineral habit and a pearly or glassy luster. The color is often uneven, as in this specimen. It has two good cleavages. Kyanite occurs in metamorphic rocks like schist and gneiss, typically of pelitic origin.

**Kyanite's Unusual Hardness** - The long crystals have a Mohs hardness of about 4.5 to 5 if tested parallel to the length of a crystal, and a hardness of 6.5 to 7 if tested across the short dimension of a crystal. The mineral was once commonly called "disthene" which means "two strengths." Kyanite is a



Photo Andrew Alden

the automotive and railroad industries where heat resistance is important.



A faceted kyanite gemstone with a beautiful deep blue color

challenging mineral to cut because it has two distinctly different hardnesses.

**Blue Kyanite - Green Kyanite -**

Most gemstone-quality kyanite is blue in color.

However, kyanite can be clear, green, black, and rarely purple. Some kyanite gemstones are pleochroic (appear to be different colors when viewed from different directions).

**Use in Abrasive Products -**

Kyanite has industrial uses as a refractory in high-temperature bricks and ceramics. Kyanite's heat resistance and hardness make it an excellent material for use in the manufacture of grinding wheels and cutting wheels. It is not used as the primary abrasive; instead, it is used as part of the binding agent that holds the abrasive particles together in the shape of a wheel.

Kyanite is also in products used in the automotive and railroad industries where heat resistance is important. Mullite, a form of calcined kyanite, is used to make brake shoes and clutch facings. Kyanite is also used in some of the more common forms of porcelain, such as those used to make dentures, sinks, and bathroom fixtures.

**Expansion of Kyanite When Heated** - Kyanite, unlike most other minerals, can expand significantly when heated. Depending upon particle size, temperatures, and heating conditions, kyanite can expand to up to twice its original volume when heated. This expansion is predictable. In the manufacture of certain refractory products, specific amounts of kyanite are added to the raw material (which shrinks during heating) to maintain volume in the finished product.

## COLLAPSE OF EUROPEAN ICE SHEET CAUSED CHAOS IN PAST

<https://www.sciencedaily.com/releases/2017/06/170626180557.htm>

The Eurasian ice sheet was an enormous conveyor of ice that covered most of northern Europe some 23,000 years ago. Its extent was such that one could have skied 4,500 km continuously across it -- from the far southwestern isles in Britain to Franz Josef Land in the Siberian Arctic. Suffice to say its existence had a massive and extremely hostile impact on Europe at the time.

This ice sheet alone lowered global sea-level by over 20 meters. As it melted and collapsed, it caused severe flooding across the continent, led to dramatic sea-level rise, and diverted mega-rivers that raged on the continent. A new model, investigating the retreat of this ice sheet and its many impacts has just been published in *Quaternary Science Reviews*.

**Ten times the melt of Greenland and Antarctica today** - "Our model experiments show that from 15000 to 13000 years ago, the Eurasian ice sheet lost 750 cubic kilometres of ice a year. For short periods, it peaked at ice loss rates of over 3000 cubic kilometres per year." says first author Henry Patton, researcher at CAGE Centre for Arctic Gas Hydrate, Environment and Climate at UiT The Arctic University of Norway.

A cubic kilometre of ice is difficult to imagine, but think of a cube that is 1km long on each side: It will contain 1,000,000,000 tonnes of water. Now multiply that by 3000.

"There is an event in this deglaciation story called Meltwater Pulse 1A. This was a period of very rapid sea level rise that lasted some 400-500 years when global temperatures were rising very quickly. During this period, we estimate that the Eurasian Ice Sheet contributed around 2.5 metres to global sea level rise" states Patton.

"To place it in context," says professor Alun Hubbard, the paper's second author and a leading glaciologist, "this is almost ten times the current rates of ice being lost from Greenland and Antarctica today. What's fascinating is that not all Eurasian ice retreat was from surface melting alone. Its northern and western sectors across the Barents Sea, Norway and Britain terminated directly into the sea. They underwent rapid collapse through calving of vast armadas of icebergs and undercutting of the ice margin by warm ocean currents." "This is a harbinger of what's starting to happen to the Greenland ice sheet" warns Hubbard.

**All rivers in Europe unite** - The influence of the Eurasian ice sheet extended far beyond what was directly covered by ice. One of the most dramatic impacts was the formation of the enormous Fleuve Manche. This was a mega-river network that drained the present-day Vistula, Elbe, Rhine and Thames rivers, and the meltwater from the ice sheet itself, through the Seine Estuary and into the North Atlantic.

"Some speculate that at some points during the European deglaciation this river system had a discharge twice that of the Amazon today. Based on our latest reconstruction of this system, we have calculated that its catchment area was similar to that of the Mississippi. It was certainly the largest river system to have ever drained the Eurasian continent," says Patton.

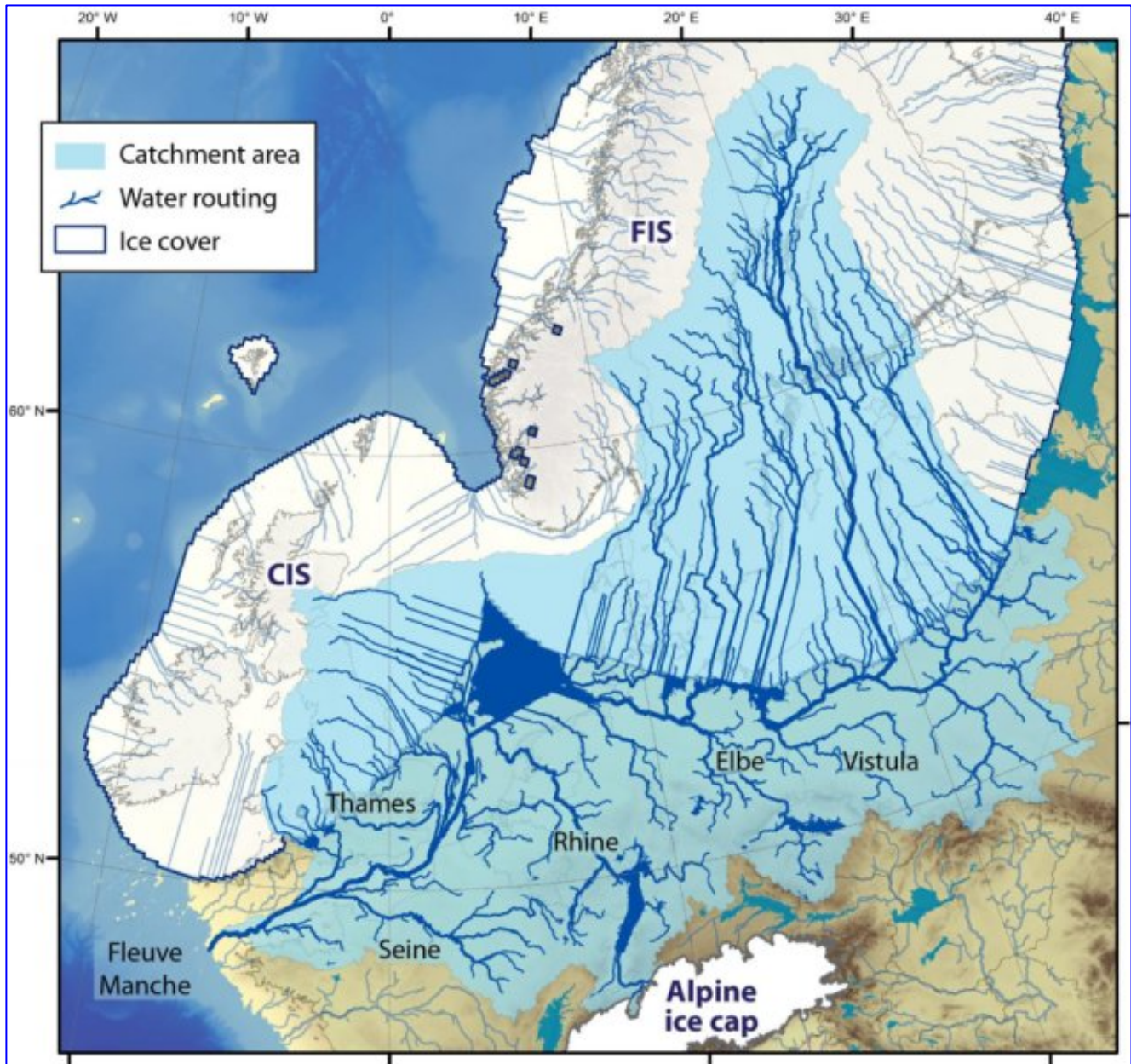
**The original Brexit is a fact** - The vast reach of this catchment meant that this mega-river had the capacity to contribute enormous volumes of cold freshwater directly into the North Atlantic, enough to have severely modified the Gulf Stream -- a major climate influencer.

Also, the sea level rise and the colossal amounts of meltwater discharged from the collapsing ice sheet meant that areas that previously were land eventually became seabed.

"Britain and Ireland, which had been joined to Europe throughout the last ice age, finally separated with the flooding of the English Channel around 10,000 years ago. It was the original Brexit, so to speak" says Alun Hubbard.

**The ice retreats, the humans advance** - The ice reconstruction in this study provides a fascinating image of a changing Europe during the time prehistoric humans came to populate the continent. The environmental challenges they met must have been spectacular.

"One thing that we show pretty well in this study is that our simulation is relevant to a range of different research disciplines, not only glaciology. It can even be useful for archaeologists who look at human migration routes, and are interested to see how the European environment developed over the last 20 000 years." says Patton.



Based on the latest reconstruction of the famous ice age river system, Fleuve Manche, the scientists have calculated that its catchment area was similar to that of the Mississippi. Illustration Credit: H. Patton/ CAGE

This model reconstruction has already proven a vital constraint for understanding complex systems beyond the ice sheet realm. For example, data from this study has been used to examine the evolution of gas hydrate stability within the Eurasian Arctic over glacial timescales, exploring the development of massive mounds and methane blow-out craters that have been recently discovered on the Arctic seafloor.

See also “New reconstruction of an ancient ice sheet” A new model reconstruction shows in exceptional detail the evolution of the Eurasian ice sheet during the last ice age. At <https://www.sciencedaily.com/releases/2017/01/170118082419.htm>.

### **OCTOBER DINNER MEETING WILL BE AT MAKRIS**

This fall’s dinner meeting is a non-election year annual meeting that will be held at Makris in Concord. Steven Arcone will present on his studies in Antarctica using robotic Ground Penetrating Radar on the Ross Ice Shelf.

## **MEET FLORENCE, THE GIANT ASTEROID THAT WILL BUZZ [ALREADY HAS BUZZED] BY EARTH THIS SEPTEMBER** By Jason Daley August 22, 2017

<http://www.smithsonianmag.com/smart-news/meet-florence-giant-asteroid-will-pass-earth-september-180964583/>

The 2.7-mile-long, near-Earth object will give astronomers a chance to study the asteroid up close. Now that solar eclipse-mania has passed, it's time to get excited for another astronomical event: an asteroid passing by. On September 1, a space rock dubbed Florence will become the largest asteroid to zoom past Earth since near-Earth asteroids were discovered a century ago, reports Eddie Iridary at *EarthSky*. The space rock, officially called Asteroid 1981 ET3, was first detected at Australia's Siding Spring Observatory in 1981 and was named Florence 3122 in honor of Florence Nightingale, the mother of modern nursing.

Measurements made by the Spitzer Space Telescope and NEOWISE asteroid-hunting instrument suggest that Florence is around 2.7 miles across, according to NASA. The asteroid will pass 4.4 million miles from Earth, about 18 times the distance from the Earth to the moon. That is a long ways, but on the galactic scale, it's a hair's breadth.

"While many known asteroids have passed by closer to Earth than Florence will on September 1, all of those were estimated to be smaller," Paul Chodas, manager of NASA's Center for Near-Earth Object Studies said. NASA has tracked these near-Earth objects since 1998, and Florence tops the charts.

While there's no chance that the asteroid will hit Earth, NASA says its size and proximity makes a perfect target for ground-based radio telescope observations, which may produce images of the asteroid with a resolution as clear as 30 feet.

It will be clearly visible in the night sky for amateur astronomers, passing through the constellations of Piscis Austrinus, Capricornus, Aquarius and Delphinus beginning on August 27. "[Its] visible magnitude of 9 is really bright," according to Rüdiger Jehn, co-manager of the European Space Agency's Near Earth Object segment. "Every amateur astronomer will be able to see it."

Florence isn't the first or last asteroid to dance with Earth this year. In January of 2017, asteroid AG13 snuck up on astronomers. The space rock was between 36 and 111 feet wide and passed Earth at half the distance to the moon. Another asteroid in the same size range, 2012 TC4 is scheduled to pass roughly one-fourth the distance to the moon—between 4,200 miles and 170,000 miles—on October 12, 2017. Currently, NASA is tracking 1,826 near-Earth objects classified as Potentially Hazardous Asteroids, which have some risk of striking our planet in the future. Among those, reports Iridary, are several even larger than Florence, including 1999 JM8 at 4.3 miles across, 4183 Cuno at 3.5 miles across and 3200 Phaeton at 3.2 miles across. But none has come as close as Florence will next month. There's no chance the space rock will collide with Earth anytime soon. Florence won't make a closer pass until around the year 2500.

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## **2017 NEIGC - FRIDAY SEPTEMBER 29 THROUGH SUNDAY OCTOBER 1 IN MAINE**

Hosted this year by Bates College Geology Department, Lewiston Maine. The conference location will be centered around Bethel Maine. The "footprint" of NEIGC 2017 field trips will be the foothills and mountains of western Maine and the adjacent White Mountains of New Hampshire. Think of an area including Bethel, Rumford, Fryeburg, Conway, Lancaster, and Berlin. Friday night reception will be held at the new Maine Mineral Museum and the Saturday night banquet at Gould Academy's Ordway Hall. Preliminary list of field trips at [http://w3.salemstate.edu/~lhanson/NEIGC/2017/June%2025\\_TripList.pdf](http://w3.salemstate.edu/~lhanson/NEIGC/2017/June%2025_TripList.pdf) Find the trip description document below at

[HTTP://W3.SALEMSTATE.EDU/~LHANSON/NEIGC/2017/NEIGC%202017\\_TEASER.PNG](HTTP://W3.SALEMSTATE.EDU/~LHANSON/NEIGC/2017/NEIGC%202017_TEASER.PNG)

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## **USGS IDENTIFIES US GROUNDWATER WELL RESPONSES TO DECEMBER 8 EARTHQUAKE IN MEXICO**

Jim Degnan and Thor Smith of the NH-VT USGS have provided preliminary information to the GSNH newsletter that groundwater wells in Virginia, Iowa and California have demonstrated water level responses to the magnitude 8.1 earthquake in Mexico September 8, 2017. They expect to have more complete information for the winter edition of this newsletter.

## 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>.



Found sitting upon the top of the data logger at the Campton observation well in July 2017. Photo by Lee Wilder, NHGS



# Geoscience and New Hampshire

## WHAT IS GEOSCIENCE?

Geoscientists study the Earth's systems — the complex geologic, marine, atmospheric, and hydrologic processes that sustain life and the economy. Geoscience expertise enables us to develop solutions to critical economic, environmental, health, and safety challenges.



Satellite image: NASA/USGS Landsat Program. State outline: Matt Battison.

## By the numbers: NEW HAMPSHIRE

- \$131 million: value of nonfuel mineral production in 2016<sup>7</sup>
- 1,540: **geoscience employees** (non-federal/self-employed)<sup>1</sup>
- 500: **jobs** in extractive industries in 2015<sup>2</sup>
- 24 severe storm, hurricane/tropical storm, and tornado disaster declarations since 1953<sup>8</sup>
- \$42.3 million: NSF grants awarded in New Hampshire in 2016<sup>18</sup>
- \$17.7 million: NSF GEO grants awarded in New Hampshire in 2016<sup>18</sup>

## WORKFORCE IN NEW HAMPSHIRE

- 1,540: **geoscience employees** (non-federal/self-employed) in 2015<sup>1</sup>
- \$73,570: average median geoscience employee salary<sup>1</sup>
- 500: **jobs** in extractive industries in 2015<sup>2</sup>
- 5: academic geoscience departments<sup>3</sup>

## WATER IN NEW HAMPSHIRE

- 90 million gallons/day: total groundwater withdrawal<sup>4</sup>
- 1.1 billion gallons/day: total surface water withdrawal<sup>4</sup>
- 91 million gallons/day: public supply water withdrawal<sup>4</sup>
- 18 million gallons/day: self-supplied industrial fresh water withdrawal<sup>4</sup>
- 66% of the population is served by public water supplies<sup>4</sup>
- 8 counties in 2015 and 2016, designated as primary natural disaster areas caused by drought<sup>5</sup>
- 33 USGS stream gages in **New Hampshire**<sup>6</sup>

## ENERGY AND MINERALS PRODUCTION IN NEW HAMPSHIRE

- \$131 million: value of nonfuel mineral production in 2016<sup>7</sup>
- 419,180 megawatt hours: wind power produced in 2015<sup>2</sup>
- 1.4 million megawatt hours: hydroelectricity produced in 2015<sup>2</sup>

## NATURAL HAZARDS IN NEW HAMPSHIRE

### FEMA statistics for New Hampshire

- 18 severe storm disaster declarations since 1953<sup>8</sup>
- 6 hurricane/tropical storm disaster declarations since 1953<sup>8</sup>
- 10 flooding disaster declarations since 1953<sup>8</sup>
- 2 fire disaster declarations since 1953<sup>8</sup>
- \$15 million: individual assistance grants since 2005<sup>8</sup>
- \$43 million: mitigation grants since 2005<sup>8</sup>
- \$106 million: preparedness grants since 2005<sup>8</sup>
- \$130 million: public assistance grants since 2005<sup>8</sup>
- 16 weather and/or climate events, each with costs exceeding \$1 billion (inflation adjusted) 1980-2016<sup>9</sup>

<sup>1</sup> Data Derived from Bureau of Labor Statistics Occupational Employment Statistics (2015)

<sup>2</sup> U.S. DOI Extractive Industries Transparency Initiative

<sup>3</sup> American Geosciences Institute Directory of Geoscience Departments (2016)

<sup>4</sup> USGS Estimated Use of Water in the United States in 2010

<sup>5</sup> USDA Farm Service Agency Disaster Designation Information (2015 Crop Year & 2016 Crop Year)

<sup>6</sup> USGS WaterWatch Total Streamgage Stations (March 10, 2017)

<sup>7</sup> USGS Mineral Commodity Summaries (2017)

<sup>8</sup> FEMA Summary of Disaster Declarations and Grants (2016)

<sup>9</sup> NOAA Billion-Dollar Weather and Climate Disasters: Mapping

AGI is a network of 51 member societies, representing more than 250,000 geoscientists.

Written and compiled by Jeremiah Bernau for AGI, April 2017. This work may be distributed under a Creative Commons BY-NC-ND 4.0 license.

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## U.S. GEOLOGICAL SURVEY (USGS) GEOLOGIC MAPPING

- \$1.06 billion: FY 2016 total USGS budget; 1.6% up from FY 2015<sup>10</sup>
- The USGS National Cooperative Geologic Mapping Program (NCGMP) funds geologic mapping projects by states (STATEMAP) and universities (EDMAP)
- \$1.2 million: **New Hampshire** STATEMAP funding (1993-2016)<sup>11</sup>
- 86 geologic maps in **New Hampshire** created through STATEMAP (1993-2008)<sup>11</sup>
- **University of New Hampshire, Dartmouth College** and **Keene State College** participated in EDMAP<sup>11</sup>

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## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

- \$5.6 billion: total FY 2016 NASA Science budget; 6.6% up from FY 2015<sup>12</sup>
- \$1.9 billion: total FY 2016 NASA Earth Science budget; 7.7% up from FY 2015<sup>13</sup>
- GRACE satellites measure groundwater changes in all of **New Hampshire**<sup>14</sup>
- SMAP satellite measures soil moisture in all of **New Hampshire**<sup>14</sup>

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## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

- \$5.8 billion: total FY 2016 NOAA budget; 5.9% up from FY 2015<sup>15</sup>
- GOES satellites provide state-of-the-art weather forecasting over **New Hampshire**<sup>16</sup>
- DISCOVER satellite monitors radiation and air quality over **New Hampshire**<sup>16</sup>
- 7 National Weather Service Automated Surface Observing Systems (ASOS) stations in **New Hampshire**<sup>17</sup>

<sup>10</sup> DOI Budget and Performance

<sup>11</sup> USGS National Cooperative Geologic Mapping Program

<sup>12</sup> NASA Budget Documents, Strategic Plans and Performance Reports

<sup>13</sup> American Institute of Physics FY2016 Appropriations

<sup>14</sup> Gravity Recovery and Climate Experiment (GRACE); Soil Moisture Active Passive (SMAP)

<sup>15</sup> NOAA Total Budget

<sup>16</sup> Geostationary Operational Environmental Satellite (GOES) & Deep Space Climate Observatory (DISCOVER)

<sup>17</sup> NOAA In Your State

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## NATIONAL SCIENCE FOUNDATION (NSF)

- \$7.46 billion: total FY 2016 NSF budget; 1.6% up from FY 2015<sup>18</sup>
- \$1.28 billion: total FY 2016 NSF Geosciences Directorate (GEO) awards; 1.6% up from FY 2015<sup>18</sup>
- 125 NSF grants in **New Hampshire** totaling \$42.3 million in 2016<sup>18</sup>
- 51 NSF GEO grants in **New Hampshire** totaling \$17.7 million in 2016<sup>18</sup>
- \$8.8 million: NSF GEO grants to **Dartmouth College** in 2016<sup>18</sup>

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## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- \$8.14 billion: total FY 2016 EPA budget; 0% up from FY 2015<sup>19</sup>
- 21 active/proposed superfund sites<sup>20</sup>
- \$195 million: federal grants for Drinking Water State Revolving Fund (DWSRF) in **New Hampshire** (1997-2016)<sup>21</sup>
- \$8.3 million: annual value of federal DWSRF grants in **New Hampshire** in 2016<sup>21</sup>

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## MAJOR FEDERAL FACILITIES IN NEW HAMPSHIRE

- USGS New England Water Science Center, Pembroke
- NOAA Cooperative Institute for Coastal Estuarine Environmental Technology, Durham

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## YOUR STATE SOURCE FOR GEOSCIENCE INFORMATION

### New Hampshire Geological Survey

PO Box 95

29 Hazen Drive

Concord, NH 03302-0095

<http://www.des.nh.gov/organization/commissioner/gsu/index.htm>

(603) 271-1976

<sup>18</sup> NSF Budget Internet Information System

<sup>19</sup> EPA Budget and Spending

<sup>20</sup> EPA Search for Superfund Sites Where You Live (August 2017)

<sup>21</sup> EPA Drinking Water State Revolving Fund National Information Management System Reports

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AGI's Geoscience Policy and Critical Issues programs support well-informed public policy and decision making by providing information and facilitating dialogue between the geoscience community and decision makers at all levels.

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# Geological Society of New Hampshire



## GSNH 2017 Annual/Fall Dinner Meeting

**"Ice Shelf Stability in Antarctica:  
Crevasses and Marine Ice Investigated with Robot GPR"  
Speaker: Steven Arcone**

There are 1.2 million km<sup>2</sup> of ice shelves buttressing most faster moving continental Antarctic ice. Steve will discuss ice shelves, the causes of their instability, and results from his Dartmouth-University of Maine robot ground-penetrating radar project that is investigating the possibly destabilizing flow dynamics, crevassing, marine ice, and exotic wing cracks in a critical shear zone that defines a margin of the massive Ross Ice Shelf.

**THURSDAY, October 12, 2017**

**Makris Lobster House Restaurant  
354 Sheep Davis Rd, Concord, NH 03301**

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

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**RSVP by 4 pm Friday, October 6, 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](mailto:sharon.lewandowski@aecom.com).

Mail to: **Sharon Lewandowski**

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

**Checks payable to: GSNH.**

Name(s) \_\_\_\_\_

Address: \_\_\_\_\_

Your phone or e-mail: \_\_\_\_\_

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



MEMBERSHIP & RENEWAL APPLICATION

Geological Society of New Hampshire

PO Box 401, Concord, NH 03302

Name: \_\_\_\_\_

(Please print clearly)

E-mail: \_\_\_\_\_

Renewing Members: Only update this section if you have changes to your contact information (including email) or educational history.

New applicants: please complete this section.

Preferred address/email to receive GSNH Communication: \_\_\_ Home or \_\_\_ Business

Home Address:

Business Address:

Home address lines

Business address lines (Employer):

Home Telephone: \_\_\_\_\_

Office Telephone: \_\_\_\_\_

New Hampshire PG # (if applicable) \_\_\_\_\_

Education: Degrees received or in progress:

Table with 4 columns: Year, Degree, Major, College or University

I volunteer to help with one of the following committees or tasks:

- Membership Committee, Regulations Committee, Communications Committee, Legislative Committee, Education Committee, (Newsletter or Website, circle preference), Giving a talk at a meeting, Events Committee, Other:

Membership Category:

- Regular Member (Annual Dues \$20.00), Student Member (Annual Dues \$10.00)...Please complete Education section above.

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: \_\_\_\_\_