



Granite State Geologist

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MESSAGE FROM THE PRESIDENT

The warm summer pictures of this summer's field trip contrast sharply with the chilled nights presaging the fall equinox. I've been eying my sweaters, although I still keep pairs of shorts at hand. We'll be holding our fall dinner meeting in a few weeks—yes, mid-October is almost here. Nelson Eby will present on trinitite, a rock with atomic origins. We'll be meeting at Makris Lobster House—make your reservations—and the new GSNH tee shirts will be available for sale. Again, our fall meeting coincides with Earth Science Week 2015 (October 11-17). This year's theme is "Visualizing Earth Systems" about the many ways earth scientists monitor and represent information. You can use the link to example visualizations taking in climate, energy, hazards, minerals, water, and planetary views at <http://www.earthsciweek.org/visualizations>.

If you missed our summer field trip, you can visualize being there with some pictures on the following pages. Over forty attendees rode in the comfort of a chartered bus to two sites on the Souhegan and Suncook Rivers to investigate the changing geomorphology resulting from a dam removal and an avulsion, respectively. We were fortunate to have the expert guidance from people who have studied and worked for years at these sites.

Some things I didn't get to put in the newsletter that I'll mention. Speculation seems confirmed that there is water on Mars after a September 29 announcement by NASA. Maybe you want to visualize life on Mars. According to the NY Times, the average temperature of Mars is about minus 70 degrees Fahrenheit, but summer days near the Equator can reach an almost balmy 70.

http://www.nytimes.com/2015/09/29/science/space/mars-life-liquid-water.html?_r=0. Another interesting article describes how Neolithic man may have used stones carved to uniform size as ball bearings in wooden tracks to move the large stones like those at and around Stonehenge.

<http://www.sciencedaily.com/releases/2010/11/101130010931.htm>.

There are some days that I visualize all the possible content for a geological society's newsletter. Ranging from earthquakes to mineralogy, from energy production to space exploration.

What is there in the world and beyond it that couldn't interest a geologist? But now it's time to visualize putting it in the mail to you.

2015 SUMMER FIELD TRIP by Russ Wilder

FLUVIAL GEOMORPHOLOGY – MERRIMACK VILLAGE DAM REMOVAL AND SUNCOOK RIVER AVULSION - On July 11th, GSNH sponsored a summer field trip to learn about the effects of the Merrimack Village Dam Removal in Merrimack and the Suncook River Avulsion in Epsom. Matt Collins, NOAA and Noah Snyder, Boston College conducted the visit to Merrimack and Shane Csiki, NHGS, Thor Smith, USGS and Meghan Arpino, Department of Earth Sciences at UNH along with Anne Lightbody, Assistant Professor of Earth Science, led the visit to the Suncook River avulsion site. Over 40 geologists and interested individuals attended the trip. The weather was hot and dry but the coach bus provided worked great and provided air conditioned relief between stops.



Merrimack Village Dam - Noah Snyder & Matt Collins Photos by Russ Wilder

The Merrimack Village Dam on the lower Souhegan River was removed in August 2008 and provided a field-scale experiment in river response to a major change in sediment flux and base level. The dam removal caused a near-instantaneous 3.9-m drop in base level in the impoundment and the river incised rapidly through the impounded sand and removed over 50% of it within two months. This added sediment load resulted in up to 3.2 m of deposition in the downstream reach. After the initial, rapid phase of channel adjustment, ongoing erosion of impoundment sediment depended primarily on flood events that could access sediment stored outside of the newly developed, active channel. This process was modulated by the recruitment of large wood from terraces through bank erosion, which subsequently armored the banks. By 2012, less than 20% of the impounded sand remained.

After an introduction by Matt Collins and Noah Snyder at the former dam site, we spent the morning observing important features of the evolving former impoundment and in the downstream reach. The trip leaders pointed out evidence for rapid geomorphic adjustment, sedimentary structures in the remaining impounded sediment and active channel, and historical artifacts and structures. The role of vegetation changes and large wood in the impoundment and adjacent wetland in the ongoing geomorphic evolution of the site was explored.

After a picnic lunch, we traveled by motor coach to Epsom and visited the May 2006 avulsion site of the Suncook River. Shane Csiki and Thor Smith provided an overview of the avulsion event and Meghan Arpino reviewed her nutrient transport and retention study using EAARL-B bathymetry data collected by USGS in November 2013. Bathymetric data can be used for understanding geomorphological changes over time. We saw the location of several cross-sections surveyed following the avulsion, as well as landscape features that appear on the 2013 EAARL-B LiDAR.

We explored (waded to) low-lying areas adjacent to the main channel that can be hotspots for nutrient uptake due to longer water residence times and high levels of biological activity. High-resolution remote sensing techniques more accurately depict small scale variations in bathymetry and topography, which are important for understanding residence time in heterogeneous river reaches. The extent of connectivity between the main channel and slowly flowing areas in the channel margins is influenced by bathymetry and water surface elevations.

GSNH wishes to thank all those who attended and especially the trip leaders that freely gave of their time and expertise and helped us understand these important fluvial geomorphic events.



Meghan Arpino leading us to some low-lying areas at the Suncook River site!



Shane Csiki describes the May 2006 avulsion of the Suncook River at this summer's field trip.



GSNH Field Trip at the Souhegan River

WHAT IS YOUR BOARD DOING? By Lea Anne Atwell

On September 17th, Doug Allen hosted the quarterly Board meeting at the Haley & Aldrich offices in Bedford, NH. Key items discussed at our meeting are summarized below.

- The Friends of the Madison Boulder have been busy making improvements at the Madison Boulder Natural Area, including improving access and installing a gate and a kiosk. The Madison Boulder was mentioned in the press twice this summer, with articles in both the Union Leader and the Hippo. GSNH visited the Madison Boulder Natural Area on our summer field trip in 2010 and has been partnering with the Friends of the Madison Boulder to promote access, maintain the area, and educate the public about the boulder. For more information, visit www.nhstateparks.org/explore/state-parks/madison-boulder-natural-area.aspx.

- We discussed upcoming dinner meeting locations and speakers. If you know someone who may be interested in giving a talk at an upcoming meeting, or who would be interested in being on our "stand-by" list in case of a last minute speaker cancellation, please contact Erin Kirby. Also, we are considering another meeting in 2016 in Manchester, possibly at the Puritan, where our April 2015 meeting was held. If you have any feedback, please contact a Board member.

- GSNH, along with the NH Geological Survey, and the Capital Mineral Club, sponsored a mineral identification workshop for teachers on September 22nd. Participants received a mineral kit and dichotomous key for attending. The NH Mining Products display at the NHDES offices was also recently updated.

- We discussed ways to coordinate with the newly established MA Geological Society.

- We hope to have a summary on our webpage of interesting geological sites in New Hampshire to visit – stay tuned.

Our next meeting will be on Thursday, December 10, 2015 at the USGS offices in Pembroke, NH. All members are welcome to attend our meetings. Please let a Board member know if there is something you would like added to our agenda!

NASA EXPLAINS WHY JUNE 30 WILL GET EXTRA SECOND

NASA/GODDARD SPACE FLIGHT CENTER

http://www.eurekalert.org/pub_releases/2015-06/nsfc-new062615.php

The day will officially be a bit longer than usual on Tuesday, June 30, 2015, because an extra second, or "leap" second, will be added.

"Earth's rotation is gradually slowing down a bit, so leap seconds are a way to account for that," said Daniel MacMillan of NASA's Goddard Space Flight Center in Greenbelt, Md.

Strictly speaking, a day lasts 86,400 seconds. That is the case, according to the time standard that people use in their daily lives -- Coordinated Universal Time, or UTC. UTC is "atomic time" -- the duration of one second is based on extremely predictable electromagnetic transitions in atoms of cesium. These transitions are so reliable that the cesium clock is accurate to one second in 1,400,000 years.

However, the mean solar day -- the average length of a day, based on how long it takes Earth to rotate -- is about 86,400.002 seconds long. That's because Earth's rotation is gradually slowing down a bit, due to a kind of braking force caused by the gravitational tug of war between Earth, the moon and the sun. Scientists estimate that the mean solar day hasn't been 86,400 seconds long since the year 1820 or so.

This difference of 2 milliseconds, or two thousandths of a second -- far less than the blink of an eye -- hardly seems noticeable at first. But if this small discrepancy were repeated every day for an entire year, it would add up to almost a second. In reality, that's not quite what happens. Although Earth's rotation is slowing down on average, the length of each individual day varies in an unpredictable way.

Typically, a leap second is inserted either on June 30 or December 31. Normally, the clock would move from 23:59:59 to 00:00:00 the next day. But with the leap second on June 30, UTC will

move from 23:59:59 to 23:59:60, and then to 00:00:00 on July 1. In practice, many systems are instead turned off for one second.

Previous leap seconds have created challenges for some computer systems and generated some calls to abandon them altogether. One reason is that the need to add a leap second cannot be anticipated far in advance.

"In the short term, leap seconds are not as predictable as everyone would like," said Chopo Ma, a geophysicist at Goddard and a member of the directing board of the International Earth Rotation and Reference Systems Service. "The modeling of the Earth predicts that more and more leap seconds will be called for in the long-term, but we can't say that one will be needed every year."

From 1972, when leap seconds were first implemented, through 1999, leap seconds were added at a rate averaging close to one per year. Since then, leap seconds have become less frequent. This June's leap second will be only the fourth to be added since 2000. (Before 1972, adjustments were made in a different way.)

Scientists don't know exactly why fewer leap seconds have been needed lately. Sometimes, sudden geological events, such as earthquakes and volcanic eruptions, can affect Earth's rotation in the short-term, but the big picture is more complex.

Proposals have been made to abolish the leap second. No decision about this is expected until late 2015 at the earliest, by the International Telecommunication Union, a specialized agency of the United Nations that addresses issues in information and communication technologies.

THE NH GEOLOGICAL SURVEY GROUND WATER LEVEL NETWORK SUMMARY

Submitted by Lee Wilder of the NHGS

May 2015 NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from May 26 – May 31, 2015. The statewide May 2015 average groundwater level for **wells in the overburden** (in soils on top of the bedrock) showed a decrease of -0.84 feet from April 2015. When compared with May 2014, the statewide average groundwater level for May 2015, in these wells, also decreased -0.84 feet. The May 2015 average groundwater level in the new **bedrock wells** showed a decrease of -1.33 feet when compared with April 2015. When compared with May 2014, the bedrock wells showed a decrease of -2.53 feet for April 2015.

June 2015 NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from June 23 – June 30, 2015. The statewide June 2015 average groundwater level for **wells in the overburden** (in soils on top of the bedrock) showed a decrease of -0.17 feet from May 2015. When compared with June 2014, the statewide average groundwater level for May 2015, in these wells, also decreased -0.29 feet. The June 2015 average groundwater level in the new **bedrock wells** showed a decrease of -0.14 feet when compared with May 2015. When compared with June 2014, the bedrock wells showed a decrease of feet -0.04 for June 2015.

July 2015 NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from July 27 – July 31, 2015. The statewide July 2015 average groundwater level for **wells in the overburden** (in soils on top of the bedrock) showed a decrease of -0.48 feet from June 2015. When compared with July 2014, the statewide average groundwater level for July 2015, in these wells, also decreased -0.80 feet. The July 2015 average groundwater level in the new **bedrock wells** showed a decrease of -0.81 feet when compared with June 2015. When compared with July 2014, the bedrock wells showed a decrease of feet -0.80 for July 2015.

The groundwater level measurements for the deeper of the two Concord bedrock wells (CVWB-1) are **not** presently available in real-time. Past data are on the USGS website at: http://waterdata.usgs.gov/nh/nwis/uv/?site_no=431034071340501&PARAMeter_cd=72019.

The data for all of the wells in the NH Groundwater Level Network are shared with and posted on **a new USGS website** at: <http://groundwaterwatch.usgs.gov/statemap.asp?sc=33&sa=NH>.

CONSTRUCTION BEGINS ON BLOCK ISLAND WIND FARM BUT DEBATE CONTINUES August 21, 2015 <http://www.theday.com/article/20150821/NWS01/150829833>

A few issues ago, I noted that a wind farm is being installed off the coast of Rhode Island near Block Island to supply the island with power other than deisel generators. Here I have an update taken from an article by Judy Benson.

Some see the developing infrastructure as a reliable link to the power grid and internet and others as a blight on the seascape. Regardless, Jeff Grybowski, chief executive officer of Deepwater, says, "Construction at the site will continue through this fall, with the goal of having all five platforms built and anchored into the sea floor before winter." Deepwater Wind, a subsidiary of the \$35 billion international investment firm D.E. Shaw Group's agreement with the state calls for the turbines to be decommissioned and dismantled after 20 years. The island, however, would keep the power cable and fiber optic connection to the mainland.



The foundation of one of the five wind turbines being built three miles off the southwest shore of Block Island is under construction on July 27, 2015, the day town, state and company officials visited the site by boat for a ribbon-cutting ceremony. (Ken Lacoste/Special to The Day)



The first foundation jacket installed by Deepwater Wind in the nation's first offshore wind farm construction project is seen next to a construction crane on Monday, on the waters of the Atlantic Ocean off Block Island, R.I. Stephan Savoia/AP from <http://www.npr.org/2015/08/01/428076271/winds-of-change-rhode-island-hopes-for-first-offshore-wind-farm>.

NEW EPA RULES MOTIVATE MONTANA TO LOOK BEYOND COAL

<http://www.npr.org/2015/09/10/439152956/new-epa-rules-motivate-montana-to-look-beyond-coal> September 10, 2015

Colstrip, Montana exists because of coal. "Our coal's getting deeper, like everywhere else, because everybody's mining. They're getting into the deeper stuff," says Kevin Murphy, who has worked in the Rosebud Mine for 15 years running a bulldozer in the open pits.

The goal of the EPA's Clean Power Plan is to reduce carbon emissions from the power sector by 30 percent nationwide from 2005 levels. Murphy's wife, Marti says she wants a healthy environment, but talk of shutting down coal-fired power plants feels threatening in Colstrip.

Economist Mark Haggerty says the real threat to Colstrip may not be the Clean Power Plan. "There are larger market trends that are already forcing a big transition away from coal towards natural gas," he says. Those trends could be good for Montana. The state does produce some natural gas, and it's also rich in renewable resources, like wind. The American Wind Energy Association ranks Montana third among states with potential land-based wind power generation. But it's currently 21st in the nation for actual wind production. Haggerty says the infrastructure to move wind energy toward population centers is one of the primary things holding it back.

Editor's note : One commenter on this article said the following. "Coal plants release far more radioactive material than nuclear plants, always have. Several decades ago the Washington state legislature had a proposed bill with stringent radioactive material release limits for power plants. That proposal was allowed to quietly die when it was noted that the only non-hydro power plant in the state that could meet the limits was the nuclear power plant on the Columbia River near Richland." I wonder if that's correct.

GSNH TEE SHIRTS

If you didn't get yours at the Society's summer field trip, you can try to be first in line at the October dinner meeting for one of these great tee shirts. A six-color GSNH logo on the back and the Old Man with hammer and auger logo in black on the front of a high quality, grey, cotton tee shirt. Shirts come in a variety of sizes and cost \$18. Proceeds go to support the Society's Charles Spalding Speaker's Fund.



Promoting Geological Science & Education

CHILE ROCKED BY 8.3 MAGNITUDE EARTHQUAKE

SANTIAGO, Chile -- A powerful magnitude-8.3 earthquake hit off Chile's northern coast September 16th, causing buildings to sway in Santiago and bringing flooding from small tsunami waves in some shore towns. Officials reported five deaths, and roughly a million people fled their homes. The Pacific Tsunami Warning Center initially issued a tsunami watch for Hawaii, but later downgraded its advisory and said no major tsunami was expected.



A magnitude-8.8 quake and ensuing tsunami in central Chile in 2010 killed more than 500 people, destroyed 220,000 homes, and washed away docks, riverfronts and seaside resorts. That quake released so much energy, it actually shortened the Earth's day by a fraction of a second by changing the planet's rotation. The quake had huge ramifications, both political and practical, prompting the Andean nation to improve its alert systems for both quakes and tsunamis.

Chile is one of the world's most earthquake-prone countries because just off the coast, the Nazca tectonic plate plunges beneath the South American plate, pushing the towering Andes cordillera to ever-higher altitudes. The strongest earthquake ever recorded on Earth happened in Chile -- a magnitude-9.5 tremor in 1960 that killed more than 5,000 people.

<http://www.cbsnews.com/news/tsunami-warning-issued-for-hawaii-after-chile-earthquake/>

TRINITITE – THE ATOMIC ROCK OCTOBER GSNH DINNER MEETING PRESENTATION PREVIEW

by Nelson Eby

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On Monday, 16 July, 1945, the atomic age began with the detonation of a plutonium bomb at the Alamogordo Bombing range. One of the products of this nuclear explosion was a glassy material called trinitite, the first atomic rock. The trinitite layer had a radius of ~300 m and was ~2 cm thick. The protolith for the glass is arkosic sand. The majority of the glass is bottle green in color, but a red variety is found in the northern quadrant of the test site. Glass beads and dumbbells, similar in morphology to micro-tektites, are also found at the Trinity site. The original trinitite layer was bulldozed under shortly after the blast, but trinitite beads are found at the surface around anthills. The talk will deal with all facets of trinitite including radioactivity, distribution of Pu, and mineral and glass chemistry. There will be samples of trinitite for your viewing pleasure.

ARCHAEOLOGISTS FIND 4,000-YEAR-OLD ARTIFACTS AT SEABROOK NUCLEAR PLANT

By Max Sullivan Posted Aug. 13, 2015 at 1:27 PM

SEABROOK — New archaeological findings on land protected by Seabrook Station nuclear power plant could shed light on the New Hampshire Seacoast's indigenous people and its climate change history, a University of Maine anthropologist said.

The 4,000-year-old artifacts, which range from fish bones to archaeological remnants of Native American huts, tell researchers about the lives of indigenous people, what they fished and possibly why some fish species no longer exist in the Gulf of Maine, according to UMaine's Dr. Brian Robinson, who headed a recent excavation.

Robinson, an associate professor at the university's Department of Anthropology and Climate Change Institute, was accompanied by graduate students from UMaine and the University of Connecticut. They completed the excavation over the course of three weeks, ending this past Sunday.

This was Robinson's second visit to the location. In the 1970s, he and his team discovered human remains on site, which have since been repatriated to the Abenaki tribe. They also found swordfish remains, which indicated the species, now gone from the Gulf of Maine, was abundant 4,000 years ago. He said swordfish were likely caught with harpoons and floats attached to boats.



Sky Heller (right) and Emily Blackwood mapping post molds just below the beach sand. Post molds are evidence of huts that existed 4,000 years ago. Photo by Brian Robinson.

Returning to Seabrook this summer allowed Robinson to reinvestigate the site with more advanced tools than he had on his last visit. "We're doing things we can do now that we could literally not do 40 years ago," Robinson said. "We keep getting more and more precise perspectives and that takes increasingly precise work."

One of the big differences between the first dig and the one this summer is the use of finer screens to sift through soil for smaller animal bones and charred plant remains, Robinson said.

Forty years ago, Robinson's team used one-quarter-inch screens and lost most small fish remains, he said. On this trip, team member and UMaine graduate student Sky Heller used a screen finer than window mesh to sift through tiny fish bone particles.

"It's just a wealth of small fish remains and of other animals that we used to lose," Robinson said. "Without quantifying smaller bones it would not be possible to tell whether moose or herring was a more important food source"

It will take months to process the bones, Robinson said, but the tiny bone particles could show more species fished by the Native Americans 4,000 years ago.

The team's awareness of climate change this time around made a big difference as 40 years ago it wasn't on archaeologists' radar, he said.

"Even a decade ago, (climate change) was sort of new. Twenty years ago, we weren't even worried about it, not in terms of public awareness," Robinson said. "Now we know how important it is in the present, so we're looking over these things in the past."

Learning patterns of fish stocks over the past 4,000 years will help researchers better understand how the Gulf of Maine ecosystem changed over time, Robinson said.

In addition to the fish bones, Robinson's team found evidence of huts much larger than expected.

The team found archaeological remnants of structural posts called post molds, Robinson said. Native Americans bent long posts to form the base for the huts they lived in, he said.

While the team knew they'd find post molds there, Robinson was surprised by how large they were. Their size indicated the huts were used for more than just one year, indicating a more permanent residence, he said. Before agriculture was adopted in the Northeast, Robinson said it is thought that most houses were temporary structures with small wood poles.

"These were substantial structures," he said. "We knew there were post molds, but I didn't know there were as many of them or that they were as large... it wasn't a major focus, but now it is."

The team also found a plummet, a heavy object used as a fishing weight, standing upright inside the post molds, Robinson said. The position indicated it had been found in the exact place it was left by the hut's occupant. Artifacts left in this manner can tell archaeologists a lot about previous cultures, he said.

Robinson said his team owes a lot to Seabrook Station for allowing them to access the site, especially considering how unique it is for its bone preservation. In the 1970s, he took note of the preservation and had hopes of finding similar sites.

Since then, only four other sites have been found in the Gulf of Maine similar to the one in Seabrook, he said, and those sites are above sea level. The fact that sea level rose 10 to 15 feet in the last 4,000 years, he said, makes the site at Seabrook particularly unique. It allowed the site to be protected by marsh sod, allowing for the preservation, he said.

Without Seabrook Station protecting the land, the sites could have been destroyed, he said.

"The preservation and the fact that the site is still there so we can do these kinds of analyses, is largely because the site is within a protected zone of the Seabrook nuclear power station," Robinson said. "It's because of that that we can do all these different things, and hopefully we'll be able to come back again in 40 years."

NextEra Energy Seabrook Station spokesman Alan Griffith said the company was proud to be involved in the effort.

"It's been fascinating to support Brian and his team as they are opening a window into the past giving us a better view of how people lived thousands of years ago," Griffith said. "Our desire and obligation to be responsible stewards of this property go well beyond the safe operation of our plant."

<http://www.seacoastonline.com/article/20150813/NEWS/150819568/101017/NEWS>

globally unique double crater identified in Sweden

Researchers have found traces of two major meteorite impacts in Sweden, a twin strike that occurred around 460 million years ago. One is enormous, while the other is a tenth of the size of the first. The largest crater has a diameter of 7.5 kilometers.

Around 90 meteorites from meteorite impacts have been found on Kinnekulle over the past fifteen years. "Small meteorites survive the fall, while large ones explode and disintegrate. In Jämtland we have only found minerals from the meteorites, small grains of chromite.

The fact that active quarrying is conducted on Kinnekulle is the reason why researchers have found meteorites there. And because meteors have been discovered as long ago as the 1940s, the individuals working in the quarry know what to look for.

<http://www.sciencedaily.com/releases/2015/09/150911095337.htm>

FLOSAGJÁ CANYON IN THINGVELLIR NATIONAL PARK, ICELAND

I put this in just for the picture found at <http://epod.usra.edu/blog/2015/08/flosagja-canyon-thingvellir-national-park-iceland.html>. Text linked to this says that Iceland is a place where a mid-ocean ridge can be seen on land. (<http://www.icelandontheweb.com/articles-on-iceland/nature/geology/tectonic-plates>).



The photo above shows Flosagjá Canyon in Thingvellir National Park, Iceland, It's in this rift valley, on the Mid-Atlantic Ridge, where the European tectonic plate and the North American tectonic plate meet. Both plates are drifting away from each other -- spreading apart about 1 in (2.5 cm) per year. Thingvellir was chosen in the tenth century as a centrally located meeting place for a general assembly of the people of Iceland. Photo taken on May 26, 2015.

NEW HORIZONS DISCOVERIES ABOUT PLUTO

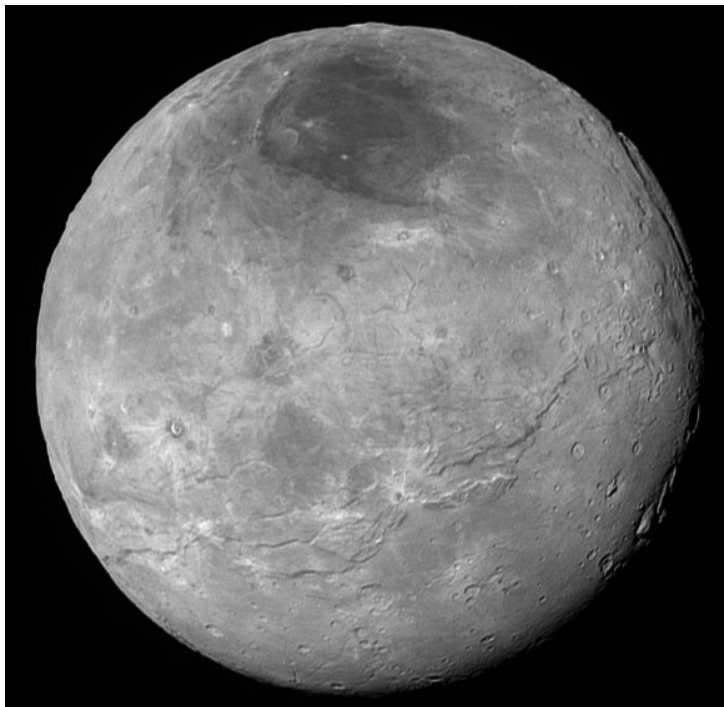
http://www.sentinelsource.com/news/national_world/mind-blowing-pluto-has-ice-mountains-and-water/article_6a822ab5-d4bf-568c-b46d-b038506b7405.html

The new imagery of Pluto shows a crisp, clear view of its surface covered with wide smooth areas, lumpy terrain and mountains. Huge mountains. “They would stand up respectably against the Rocky Mountains,” said John Spencer, a planetary scientist on the New Horizons mission. The height of the mountains is important because it’s a clue that there may be water on Pluto. Scientists know that Pluto’s surface is covered with nitrogen ice, methane ice and carbon monoxide ice. But Spencer says, “You can’t make mountains out of that stuff. It’s too soft.” That leaves H₂O — water ice like we have here on Earth. “The steep topography means that the bedrock that makes those mountains must be made of H₂O — of water ice,” said Stern. “We can be very sure that the water is there in great abundance.”

Where are the craters? A striking thing about the close-up image of Pluto is what’s missing: impact craters. Pluto is in the Kuiper Belt, a region of space filled with other icy objects. The New Horizons team expected that Pluto’s surface would have been pelted with some of these objects. “I would never have believed that the first close up picture we get of Pluto didn’t have a single impact crater on it,” said Spencer. “That’s just astonishing.” That lack of craters means the surface of Pluto is young, less than 100 million years old, the researchers said. That’s a small fraction of the age of the solar system — 4.5 billion years.

NASA’S NEW HORIZONS SPACECRAFT HAS SENT BACK NEW, BETTER IMAGES OF PLUTO’S LARGEST MOON, CHARON, AND THE DWARF PLANET’S SMALLER SATELLITES NIX AND HYDRA.

The images were taken by the sensitive Long Range Reconnaissance Imager (LORRI) on board New Horizons on July 14, 2015. The views were taken from distances between 480,000 and 124,300 miles (770,000 – 200,000 km).



This image of Charon, taken by New Horizons ten hours before its closest approach to Pluto on July 14, 2015 from a distance of 290,000 miles (470,000 km), is a recently downlinked, much higher quality version of a Charon image released on July 15. The smallest visible features are 2.9 miles (4.6 km) in size. Image credit: NASA / Johns Hopkins University Applied Physics Laboratory / Southwest Research Institute.

They reveal that each moon is unique and that Charon's geological past was a tortured one. Charon, which is 750 miles (1,200 km) in diameter, displays a surprisingly complex geological history, including tectonic fracturing; relatively smooth, fractured plains in the lower right; several enigmatic mountains surrounded by sunken terrain features on the right side; and heavily cratered regions in the center and upper left portion of the disk.

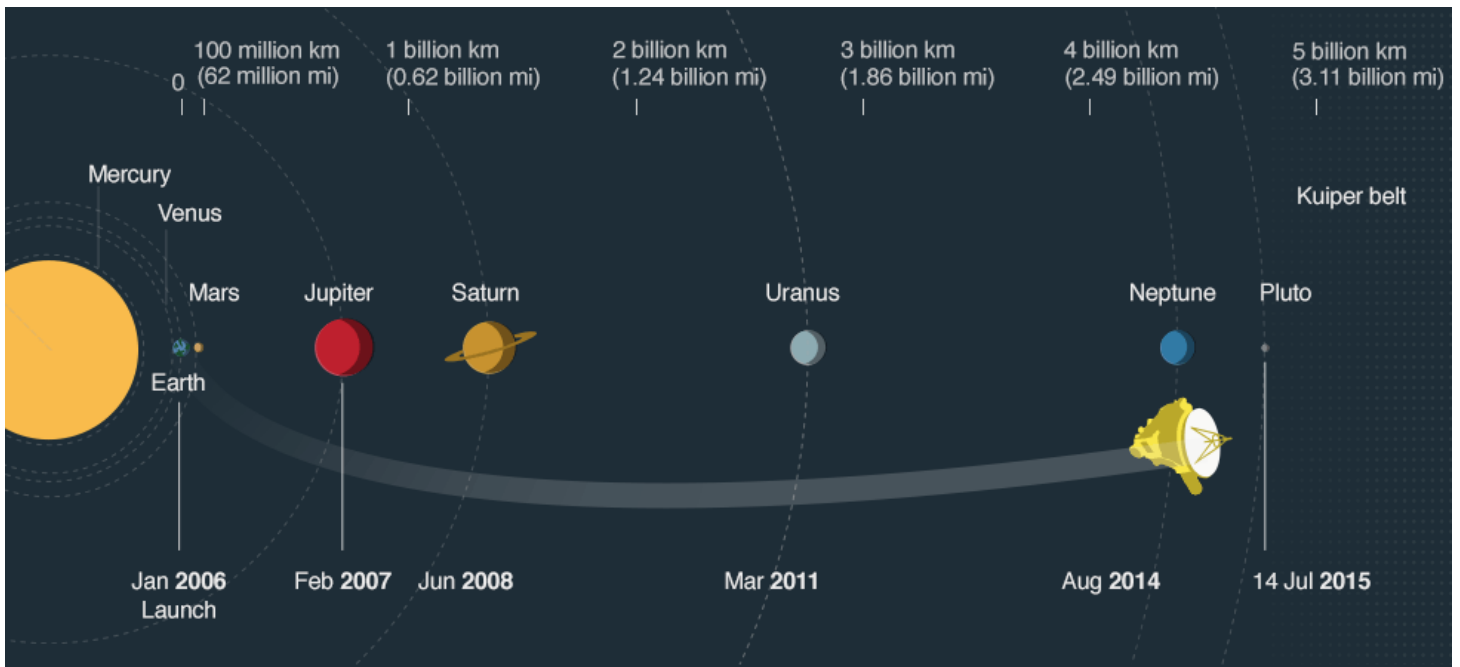
There are also complex reflectivity patterns on the large moon's surface, including bright and dark crater rays, and the conspicuous dark north polar region at the top of the image.

Nix and Hydra are much smaller than Charon and have irregular shapes.

Nix is estimated to be 26 miles (42 km) long and 22 miles (36 km) wide. Hydra is 34 miles (55 km) long and 25 miles (40 km) wide.

New Horizons is now 3.07 billion miles (4.94 billion km) from Earth and 46.5 million miles (74.8 million km) beyond Pluto. The spacecraft is healthy and all systems are operating normally.

Sep 15, 2015 by Sci-News.com <http://www.sci-news.com/space/science-new-horizons-charon-pluto-03239.html>

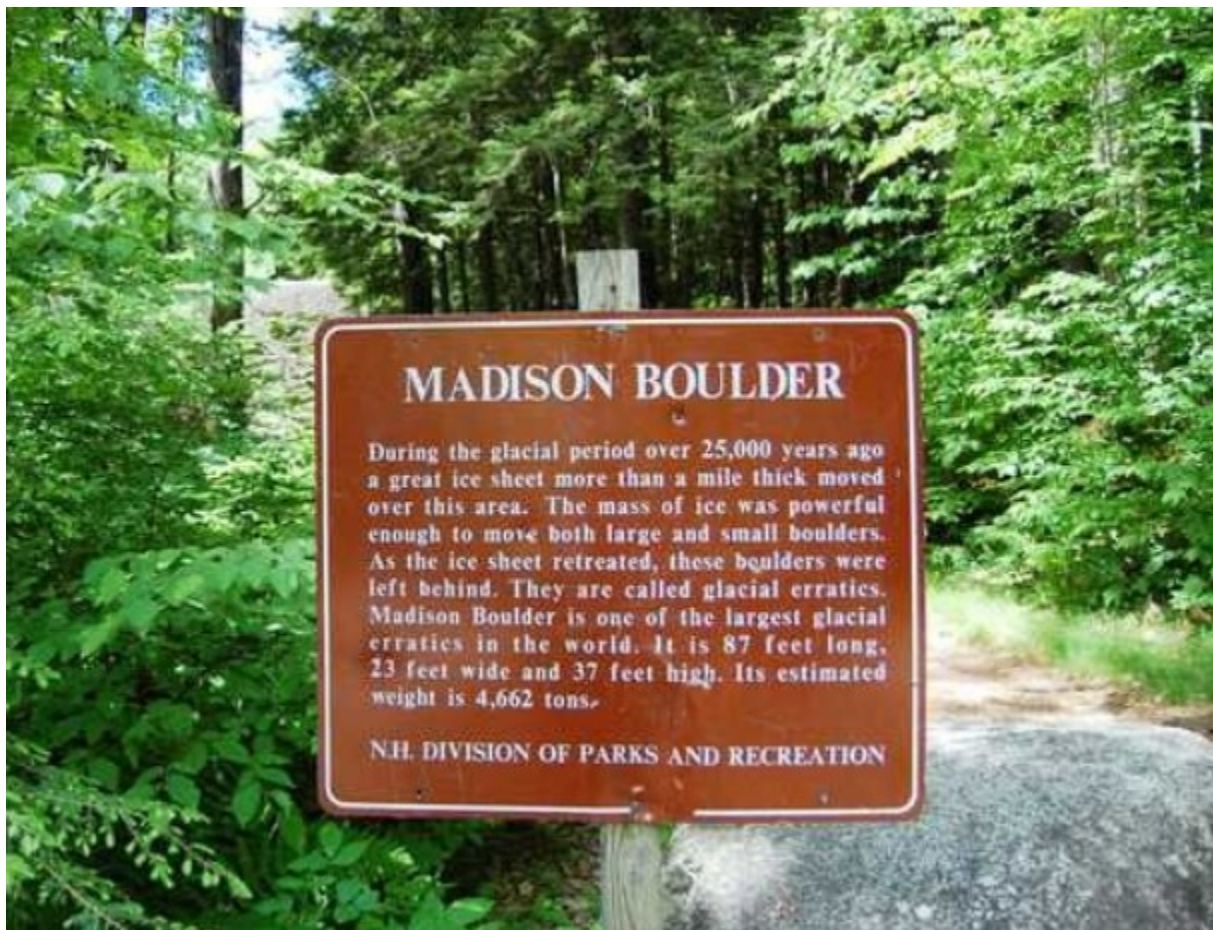


Source: NASA



A REAL GEOLOGIST WEARING A REAL GEOLOGY TEE SHIRT

Bill Abrahams-Dematte models the Society's new tee shirt at the start of the 2015 summer field trip. Proceeds go to the Society's Speaker Fund.



MADISON - To some, it's just a large rock, but to geology-philes, the Madison Boulder is the largest glacial erratic in North America and it's a hidden New Hampshire gem.

About 20,000 years ago - when much of the Granite State, including Mount Washington, was covered by a mile-thick layer of ice - a glacier began gnawing on the Conway granite that makes up Whitton Ledge. Although it took 5,000 years, the glacier - while also carving out what is now Whitton Pond - eventually ripped up a humongous chunk of granite and transported it, erratically, about a mile and a half southeast to its current location in a forested glade at the end of Boulder Road, off New Hampshire Route 113. According to the New Hampshire Division of Parks and Recreation, the boulder is 83 feet long, 23 feet tall, 37 feet wide and weighs about 5,000 tons. The state acquired the 17-acres, now the Madison Boulder Natural Area, in 1946.

In 1970, the site was designated a National Natural Landmark by the U.S. Department of the Interior which noted the boulder "is an outstanding illustration of the power of an ice sheet to pluck out very large blocks of fractured bedrock and move them substantial distances." The Madison Boulder, the state and most experts agree, is the largest glacial erratic between Canada and Colombia and is also one of the largest glacial erratics in the world.

Despite being at the end of a short but choppy dirt and gravel road,^{*} the boulder nonetheless gets it fair share of visitors, something that delights the Friends of the Madison Boulder. A non-profit, volunteer group, the friends are working with the Division of Parks and Recreation, the New Hampshire Geological Survey and the Geological Society of New Hampshire to maintain the natural area while also promoting access to it and educating the public about the boulder.



A friend, if not outright fan, of the Madison Boulder is Brian Fowler, who is also a resident of the boulder's hometown, as well as the newly-minted president of the Mount Washington Observatory and a retired geologist. He notes that just what is seen above ground of the boulder makes it one of the largest glacial erratics on the planet. "God only knows how much is beneath the surface," said Fowler, but he estimated that it's "a significant portion." For the record, there are many bigger boulders, he said, but they're not glacial erratics which makes the Madison Boulder "really quite special geologically."

"We are lucky to have the boulder," said Fowler, adding that "just by chance," the glacier whose "snout" was somewhere in Long Island, N.Y., chose to leave it in the lower Mount Washington Valley.

www.unionleader.com/article/20150726/NEWHAMPSHIRE03/150729331/0/NEWS0206



*Editor's note: Work at the site this summer, administratively supported by the Society and more actively by some members, has put the road to the boulder into great shape. Russ Lanoie says, "The road and path to the boulder are freshly graded with 150 yards of Coleman's finest ledge-based 3/4 crushed gravel" and "the boulder remains a popular spot, there must have been at least 15 cars come while I was working yesterday."

PYROLUSITE <http://geology.about.com/od/minerals/ig/oxides/minpicpyrolusite.htm>



Pyrolusite is manganese oxide, MnO_2 , the most common mineral in [dendrites](#) like these. Identifying the manganese oxide minerals is a crapshoot without expensive lab equipment, so generally black dendrites and crystalline occurrences are called pyrolusite while black crusts are called [psilomelane](#). There is an acid test for manganese oxides, which is that they dissolve in hydrochloric acid with the release of nasty-smelling chlorine gas. Manganese oxides are secondary minerals that form by weathering of primary manganese minerals like [rhodochrosite](#) and [rhodonite](#) or by deposition from water in bogs or the deep sea floor as manganese nodules.

RETREATING SEA ICE LINKED TO CHANGES IN OCEAN CIRCULATION, COULD AFFECT EUROPEAN CLIMATE

Retreating sea ice in the Iceland and Greenland Seas may be changing the circulation of warm and cold water in the Atlantic Ocean, and could ultimately impact the climate in Europe resulting in a cooling over western Europe, says a new study by an atmospheric physicist. Traditionally, the Gulf Stream moves warm water north toward western Europe, says professor G.W.K. Moore of UTM's Department of Chemical & Physical Sciences, where it loses heat and moisture to the atmosphere, acting to moderate the climate in this region. The resulting colder, denser water sinks and returns south at a great depth eventually rising to the surface in the tropics, where the cycle, known as the Atlantic Meridional Ocean Circulation, begins all over again.

The Iceland and Greenland Seas are among the only places worldwide where conditions are right and this heat exchange is able to change the ocean's density enough to cause the surface waters to sink. The largest air-sea heat exchange in these seas occurs at the edge of the sea ice.

http://www.eurekalert.org/pub_releases/2015-06/uot-rsi062415.php

NASA FINDS AN EARTH-SIZED PLANET Originally reported by WMUR -

<http://www.nasa.gov/ames/kepler/nasas-kepler-discovers-first-earth-size-planet-in-the-habitable-zone-of-another-star/>.

NASA said Thursday that its Kepler spacecraft has spotted the first nearly Earth-size planet to be found in the habitable zone of a star similar to our own. The planet, Kepler-452b, is about 1,400 light-years from Earth in the constellation Cygnus. It's about 60% bigger than Earth, NASA says, and is located in its star's habitable zone -- the region where life-sustaining liquid water is possible on the surface of a planet. A visitor there would experience gravity about twice that of Earth's, and planetary scientists say the odds of it having a rocky surface are "better than even." While it's a bit farther from its star than Earth is from the sun, its star is brighter, so the planet gets about the same amount of energy from its star as Earth does from the sun. And that sunlight would be very similar to Earth's, Jenkins said. The planet "almost certainly has an atmosphere," Jenkins said, although scientists can't say what it's made of. But if the assumptions of planetary geologists are correct, he said, Kepler-452b's atmosphere would probably be thicker than Earth's, and it would have active volcanoes. It takes 385 days for the planet to orbit its star, very similar to Earth's 365-day year, NASA said. And because it's spent so long orbiting in this zone -- 6 billion years -- it's had plenty of time to brew life, Jenkins said.

NASA discovered other planets outside their stars habitable zone in 2011.

http://www.nasa.gov/mission_pages/kepler/news/kepler-20-system.html

INAUGURAL MEETING AND FIELD TRIP OF THE NEWLY FORMED MASSACHUSETTS GEOLOGICAL SOCIETY (MAGS) by Jutta Hager

Massachusetts now has its own geological society (MaGS), which already has 182 members. On June 4th, MaGS had its inaugural membership meeting, with 73 attendees, at the AECOM Chelmsford office., with Massachusetts State Geologist, Steve Mabee, Ph.D., presenting a talk entitled "So Massachusetts Has a Geological Survey."

On July 18th MaGS had its first field trip, led by Drs. Lindley Hanson and Rory McFadden of Salem State University, who provided an informative and entertaining geological excursion among the rocks and landforms of the Lynn Woods and Breakheart Reservations. Thirty-nine geologists and geologist friends attended the field trip. Topics of interest included the Peabody and Dedham Granites, the Walden Pond Fault, the Neoproterozoic Dedham North and surrounding Neoproterozoic volcanic rocks, and the Westboro Formation, the oldest formation in the Avalon Terrane. Thanks to both the trip leaders and the large number of attendees for making the field trip so successful.

For more information about MaGS, including photos from the field trip, visit the MaGS website at

www.massgeosociety.org.

EARTH SCIENCE WEEK HAS DAILY WEBCASTS

Each day during Earth Science Week 2015 (October 11-17), science teachers, students, and the public are invited to focus on a webcast covering different areas of Earth science.

- International EarthCache Day (October 11)
- Earth Science Literacy Day (October 12)
- No Child Left Inside Day (October 13)
- National Fossil Day (October 14)
- Geoscience for Everyone Day (October 15)
- Geologic Map Day (October 16)
- International Archaeology Day (October 17)

To view the "Focus Days" webcast, visit <http://www.earthsciweek.org/webcasts/index.html>.

FOSSILS OF *HOMO NALEDI* ARE DISCOVERED – IS THIS YOUR UNCLE?



A trove of bones hidden deep within a South African cave represents a new species of human ancestor, scientists announced Thursday in the [journal eLife](#). *Homo naledi*, as they call it, appears very primitive in some respects—it had a tiny brain, for instance, and apelike shoulders for climbing. But in other ways it looks remarkably like modern humans.

Scientists reacted with a mix of awe and exasperation to the news Thursday of the [discovery of fossils in South Africa](#) that are said to define a new species of human ancestor, *Homo naledi*. The awe was inspired mostly by the sheer number of fossils—more than 1,500 bones, all of them from a remote chamber in the cave system called Rising Star, 30 miles northwest of Johannesburg.

In East Africa, datable volcanic ash layers provide “time stamps” that have allowed the age of famous hominin finds, such as the 3.2-million-year-old [Lucy](#) skeleton, to be determined precisely. In contrast, South African cave finds are notoriously difficult to place in time. Often the age is estimated from the types of extinct animal bones found in the same deposits. But aside from an owl bone and a few rodent teeth, no other animal bones were found in the cave chamber that yielded the *Homo naledi* fossils. Until the fossils’ age is known, some scientists say, their real value to science hangs in limbo. Many more clues remain to be found in the cave. The majority of the bones excavated so far came from a single patch of sediment of around one square meter (11 square feet), and initial investigation suggests hundreds of bones—maybe thousands—remain. And while there are no immediate plans to resume excavation, the team is actively pursuing the matter of the fossils’ age, employing several experimental techniques.

<http://news.nationalgeographic.com/2015/09/150910-human-evolution-change/> and http://news.nationalgeographic.com/2015/09/150910-homo-naledi-human-ancestor-species-reaction-science/?rptregcta=reg_free_np&rptregqcampaign=2015012_invitation_ro_all#

DATES TO REMEMBER

October 9,10 and 11, 2015 - The New England Intercollegiate Geological Conference will be held at Wesleyan University in Middletown, Connecticut. Details on the fields trips are on the NEIGC webpage at <http://w3.salemstate.edu/~lhanson/NEIGC/Conference.html>.
REGISTRATION DEADLINE—form and a check in the mail by **Tuesday September 22nd**.

November 1-4, 2015 - GSA 50th Annual Meeting & Exposition; Baltimore, Maryland. *For more information:* see the [GSA website at http://community.geosociety.org/gsa2015/home](http://community.geosociety.org/gsa2015/home).

March 21–23, 2016 - GSA Northeastern Section 51st Annual Meeting
CALL FOR PROPOSALS Empire State Plaza Convention Center, Albany, NY
<http://www.geosociety.org/Sections/ne/2016mtg/>

BENEATH ALASKAN WILDFIRES, A HIDDEN THREAT: LONG-FROZEN CARBON'S THAW By Nate Rott, July 27, 2015 <http://nhpr.org/post/beneath-alaskan-wildfires-hidden-threat-long-frozen-carbons-thaw>

Some of Alaska's wildfires are dramatic: flames, vast plumes of smoke and firefighting battles. But even fires that look far quieter, like they're all burned out, can continue to smolder underground — and pose a dangerous threat to permafrost.

The Fish Creek Fire in Interior Alaska isn't much to look at. It's about 7,500 acres in size, sitting about an hour south of Fairbanks near the twisty Tanana River. The main fire front flamed out more than a week ago, leaving behind a quiet charred landscape. And though the Fish Creek Fire looks benign, with little wisps of white smoke as its only sign of life, it's not.

A little fire like this could have a huge impact on the surrounding environment and ecosystem — not just here in Alaska, but across the planet. The Fish Creek Fire is mostly done burning the trees and brush above ground and has moved on to the organic matter underground — organic matter that goes, meters and meters deep. all of that biomass is made up of carbon — the same carbon that's a leading cause of climate change.

That's why ecologists and climatologists are watching this year's fire season with so much interest. Roughly 4.7 million acres of boreal forest and land have burned in Alaska this summer. Millions more have burned in Canada, where scientists estimate half of the land is underlain with permafrost. In total, more than 11 million acres have burned between the two places — an area roughly the size of Connecticut. When a fire comes through it may burn 15 to 25 centimeters of the 40 centimeter blanket of duff that protects the permafrost beneath. This is particularly problematic given the changing climate in the planet's higher latitudes. Alaska has already warmed by more than 3 degrees Fahrenheit in the past 50 years, rendering much of the permafrost here unstable.

Fires in the subarctic are nothing new. The vast majority of the land burned by wildfire in North America every year is in Alaska and Canada and are far from cities and towns. All of the carbon that was trapped in that permafrost is available to be put back in the atmosphere.

What that means is debatable. Some scientists think that the ecosystem will be able to compensate for all of that new carbon with new plant life. They point to an increase in the number of hardwood trees in Alaska, which grow faster and absorb more carbon, as a potential sign.

Other scientists are less optimistic. They do believe that the environment can compensate for the carbon that's released when a fire burns up trees and brush, and even the carbon that's been piling up for hundreds of years in duff. But what about the carbon that gets released from thawing permafrost? The atmosphere thought it lost that carbon and all of a sudden it's being returned to the atmosphere after a prolonged period of time.

That's the kind of carbon pulse to the atmosphere that actually can invoke additional climate change, above and beyond human emissions. And more climate change, she says, could mean hotter temperatures, which could mean more fires, which could mean more permafrost lost.



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:

(Employer): _____

Home Telephone: _____

Office Telephone: _____

New Hampshire PG # (if applicable) _____

Education: Degrees received or in progress:YearDegreeMajorCollege or University

I volunteer to help with one of the following committees or tasks: Membership Committee Regulations Committee Communications Committee (Newsletter Legislative Committee Education Committee

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: _____