Granite State Geologist

The Newsletter of the Geological Society of New Hampshire,
Winter Edition – December 2019 – Issue No. 107
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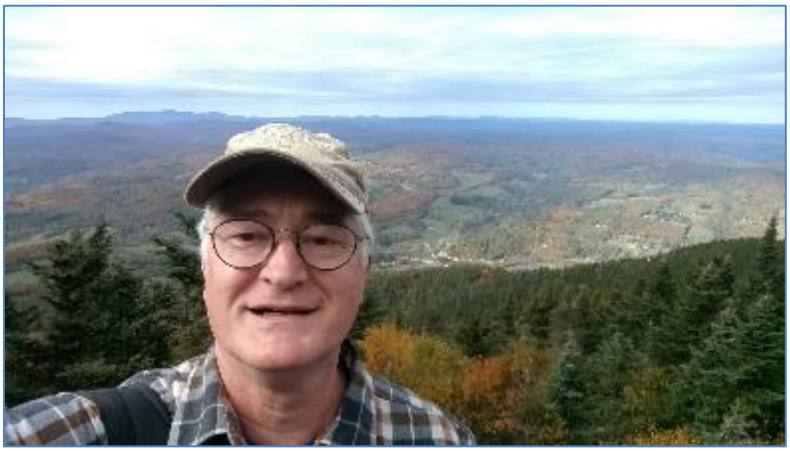
In this issue:

MESSAGE FROM THE PRESIDENT

Hope you are enjoying the change in seasons and had a bountiful Thanksgiving. To tell the truth, I got a little sick of turkey after a week of delicious, but repetitious, turkey and gravy dinners and went out for pad thai last night. I don't ever seem to get tired of pie, mind you. I'll be looking forward to a nice dinner at Makris for our January meeting. See the notice and reserve early. Also, this meeting is a good time to renew your annual membership that starts again in January.

The start of the new year is also a good time to consider becoming a member of the GSNH Board of Directors or one of the Society's committees. Committee members aren't elected. Elections will be held in October for officers and at large members – that's only two quarters away! – so attend a board meeting in June or September and see what you've been missing. (And you get CEHs for being a member.)
It's not hard and it's fun. Your contribution is valuable AND you ← get your name in the newsletter!!!



Lastly, here's a picture of me on Mt. Ascutney.
See you at the meeting!

October Dinner Meeting Recap

By Jenny Lambert

The October dinner meeting was held at Makris Lobster and Steakhouse. We had 62 attendees, including 48 members. Our presenter, Dr. Robert A. Gastaldo, described the terrestrial record of the end-Permian mass extinction (considered to be the most severe ecological event in the fossil record) in the Karoo Basin in South Africa, and specifically the Bethel Valley, which is ground zero for the end-Permian extinction model. Dr. Gastaldo and his students also brought a virtual reality (VR) setup so that attendees could “fly through” a rendering of the Bethel Valley created from drone imaging. They also stayed late after the meeting so that anyone who was interested had the chance to try the VR tour.

Left: Dr. Gastaldo describes the stratigraphic relationships between fossil units; right: Lee Wilder tries a VR fly-through of the Bethel Valley.

For more details about Dr. Gastaldo’s work and the Permian-Triassic ecological crisis, check out the following resources:

- Robert A. Gastaldo, Johann Neveling, John W. Geissman, Sandra L. Kamo; A lithostratigraphic and magnetostratigraphic framework in a geochronologic context for a purported Permian–Triassic boundary section at Old (West) Lootsberg Pass, Karoo Basin, South Africa. GSA Bulletin; 130 (9-10): 1411–1438. doi: https://doi.org/10.1130/B31881.1

- Johann Neveling, Robert A. Gastaldo, and John W. Geissman; 35th International Geological Congress Field Trip Guide: The Permo-Triassic Boundary in the Karoo Basin, 22-27 August 2016.

Fossilised Microbes from 3.5 Billion Years Ago Are Oldest Yet Found

By Michael Marshall, New Scientist, September 25, 2019:
https://www.newscientist.com/article/2217747-fossilised-microbes-from-3-5-billion-years-ago-are-oldest-yet-found/

It is unclear whether stromatolite rock structures like this one in Western Australia are always produced by living organisms (Auscape/Universal Images Group via Getty Images)

We have finally uncovered hard evidence that 3.5 billion-year-old rocks in Australia really do contain fossils of the oldest known microorganisms. The findings put to bed a debate that has raged for years and may even enlighten us as to how some of Earth's earliest life forms functioned.

Raphael Baumgartner at the University of New South Wales in Australia and his colleagues looked at rocks in the Pilbara region of Western Australia. This area contains some of the oldest preserved rocks on Earth. Of the three most important sites, the Dresser Formation is the oldest, with rocks that are 3.48 billion years old.

The Dresser Formation appears to contain layered structures called stromatolites. These are known to form when microbes grow into thin layers, which then become covered in sediment, only for another layer of microbes to form on top, and so forth.

However, many researchers aren't convinced that these rock structures really are stromatolites, arguing that they could have formed without life being present.

Baumgartner and his colleagues drilled into the rocks to get the best-preserved samples. They found many layers that looked like stromatolites. These contained "exceptionally preserved organic matter", says Baumgartner, including strands of the sort seen when microbes form slimy layers called biofilms. Multiple chemical analyses indicate that the organic matter came from living organisms.

"We have found smoking gun evidence for some of the earliest life on Earth," says Baumgartner. "There are no convincing organic matter or microbial remains older than ours."

There are plenty of claims of older fossils, or of chemical traces of life, some dating to over 4 billion years ago. But none have found widespread acceptance.

The organic matter that Baumgartner and his colleagues found was mostly trapped inside a mineral called pyrite or fool's gold, which is based on iron and sulphur.

Fools gold

"The pyrite is extraordinary," says Baumgartner. Because the microbes are so well-preserved, it must have formed quickly – perhaps even while they were alive. If that is true, it could reveal their survival strategy. Some modern microbes live off sulphur and produce pyrite as a waste product. The Dresser Formation microbes may have done the same, says Baumgartner.

Pyrite may even have played a role in the origin of life, if the first life used sulphur as an energy source. This is the basis of the iron-sulphur World hypothesis, which was proposed by Günter Wächtershäuser in the late 1980s.

Baumgartner says it isn't clear what sort of environment his stromatolites were originally formed in. In 2017, his colleague Tara Djokic and her team showed that parts of the Dresser Formation preserve hot springs from on land, but other regions seem to have been shallow seas. Baumgartner suspects the Dresser Formation preserves a coastal region. "From this, we can speculate that the origin of life might have been near," he says.

"They've done a good job," says Lindsay Hays, deputy program scientist for the NASA astrobiology initiative in Washington, DC. "I can't say this is definitely true or definitely not true," she says, as closer examination of the rocks may reveal alternative explanations.

However, she says Baumgartner's evidence is based on multiple techniques, which makes it more reliable: "That has become the standard in this type of work, not to just say 'we looked at this one line of evidence and it showed what we hoped it would show', but 'we looked at multiple lines of evidence and they all line up together'."

Journal reference: Geology, DOI: 10.1130/G46365.1

Time to Renew Your GSNH Membership!

The new year is coming up fast – please renew your membership for 2020 or consider signing up if you aren't already a member. With membership, you get a discount on dinner meetings and field trips, information on upcoming events of interest, voting privileges at Society business meetings, and automatic subscription to this newsletter. Membership dues also help to support important geological outreach for the greater community.

There's a membership and renewal application at the end of this newsletter. You can pay your dues at the **January 23** dinner meeting or mail them in. Please send dues and your membership/renewal form (along with any information updates) to GSNH, PO Box 401, Concord, NH 03302.

AIPG Field Trip Report – Operating Quarries in the Vermont Valley

by Jenny Lambert

The American Institute of Professional Geologists (AIPG) held their 56th annual conference September 14-17 in Burlington, Vermont. Lance Mead, CPG, led a September 15 field trip that involved visits to operating quarries, a calcium carbonate processing plant, and the Vermont Marble Museum.

The field trip followed Route 7 from Burlington to the Vermont Valley along the north-south Vermont marble belt, where the Columbian unit of the Shelburne Formation had been folded on the east limb of the Middlebury Synclinorium. Marble here is a source of dimension stone from the Danby Quarry (www.vermontquarries.com) and high-purity calcium carbonate from the Middlebury Quarry and Hogback Quarry (www.omya-na.com). Other mineral resources in the area include slate to the west and kaolin, talc, iron, copper, and molybdenum to the east.

The first stop was the Middlebury open pit quarry operated by Omya.

Stop 1: While trip participants collected safety gear, Omya geologists James Stewart and Andrew McIntosh discussed operations and local geology, and provided some examples of the range of limestones in the area.

Stop 1: Omya had set up a safety corral within the quarry with a selection of material to sample.

Stop 1: Folding exposed along the walls of the quarry.

Stop 1: Overview of the quarry from an observation point.

The second stop was the Vermont Marble Museum in Proctor, Vermont, which has examples of traditional and modern sculpture; marble samples from all over the world; a resident sculptor who demonstrates carving techniques; and exhibits on geology, the history of the marble workers, current uses of marble products, and plaster models used for sculpture. A visit is highly recommended: https://vermontmarblemuseum.org/

Stop 2: Vermont Marble Museum

The third and fourth (final) stops included a tour of Omya's processing plant in Florence, Vermont and the adjacent Hogback quarry before returning to Burlington.

Stop 4: Hogback Quarry

What's Your Board Been Doing?

By Shane Csiki, Secretary
December 2019

The Board of Directors held its quarterly meeting on December 12, 2019 at the offices of Haley and Aldrich in Bedford. As always, the Board continues to work hard for the benefits of all members.

Our January dinner meeting will be held on **Thursday, January 23** at the Makris Steak House in Concord. This is mentioned elsewhere in this newsletter. However, it does not hurt to mention it here, with a bolded date to take note of, given that the January meeting is being held on a week where you might not typically expect it. Logistical issues necessitated this change. The April dinner meeting will be held on April 16, 2020 at the Puritan in Manchester. Also, on the topic of dinner meetings, Sharon Lewandowski and Lee Wilder are investigating potential future options to increase the diversity of locations where our dinner meetings will be held. Their work will continue in the next few months, and some additional possibilities may present themselves.

For some time, the Board has been discussing the development of a web mapper application to display sites of geological interest in New Hampshire. This project has moved one step closer to eventually becoming a reality. Some information will be presented at the dinner meeting on Thursday, January 23.

Also, the Board is working on the possibility of some new GSNH clothing items. Stay tuned for more on that.

The next GSNH Board meeting will be held on March 12, 2020, at the offices of Nobis Engineering in Concord, starting at 6:00 PM. All GSNH members are welcome to attend.

Kīlauea Lava Fuels Phytoplankton Bloom off Hawaii Island

From Hydro International, June 9, 2019
https://www.hydro-international.com/content/news/kilauea-lava-fuels-phytoplankton-bloom-off-hawaii-island

When the Kīlauea volcano erupted in 2018, it injected millions of cubic feet of molten lava into the nutrient-poor waters off the Big Island of Hawaii. The lava-impacted seawater contained high concentrations of nutrients that stimulated phytoplankton growth, resulting in an extensive plume of microbes that was detectable by satellite, as research of the School of Ocean and Earth Science and Technology (SOEST) shows.

Photo: Kilauea lava entry site on the southeast coastline of Hawaii. Billowing plumes of laze caused by the interaction of hot molten lava and seawater are visible (credit Karin Bjorkman, UH).

A study led by researchers at the University of Hawaii (UH) in Mānoa and University of Southern California (USC) and published in the Science journal revealed that this biological response hinged on

unexpectedly high concentrations of nitrate, despite the negligible amount of nitrogen in basaltic lava. The research team determined that nitrate was brought to the ocean surface when heat from the substantial input of lava into the ocean warmed nutrient-rich deep waters and caused them to rise up, supplying the sunlit layer with nutrients.

Rapid Response Oceanographic Expedition

After observing the phytoplankton bloom in satellite images, the UH Mānoa Center for Microbial Oceanography: Research and Education (C-MORE) organized a rapid response oceanographic expedition on UH research vessel Ka‘imikai-O-Kanaloa from July 13 to 17, 2018—in the thick of Kilauea’s activity. The team conducted round-the-clock operations in the vicinity of the lava entry region to test water chemistry and the biological response to the dramatic event.

Co-lead authors Sam Wilson at C-MORE and Nick Hawco, a USC researcher who will be joining the UH Mānoa Oceanography Department in January 2020, tested the hypothesis that lava and volcanic dust would stimulate microorganisms that are limited by phosphate or iron, which are chemicals found in lava.

Heated Seawater Became Buoyant

As it turned out, since there was so much lava in the water, the dissolved iron and phosphate combined into particles, making those nutrients unavailable for microbes. Further, deep, heated seawater became buoyant and brought up nitrate which caused other classes of phytoplankton to bloom.

It is possible that this mechanism has led to similar ocean fertilization events in the past associated with the formation of the Hawaiian Islands and other significant volcanic eruptions, the authors suggest. Depending on their location, sustained eruption on this scale could also facilitate a large flux of nitrate from the deep ocean and perturb larger-scale ocean circulation, biology and chemistry.

External Nutrients Alter Marine Ecosystems

“The expedition in July 2018 provided a unique opportunity to see first-hand how a massive input of external nutrients alters marine ecosystems that are finely attuned to low-nutrient conditions,” said Wilson. “Ecosystem responses to such a substantial addition of nutrients are rarely observed or sampled in real-time.

"UH has a strong tradition of not only volcanic research but also looking at its impacts on the surrounding environment such as the ocean, groundwater, and atmosphere. This latest piece of

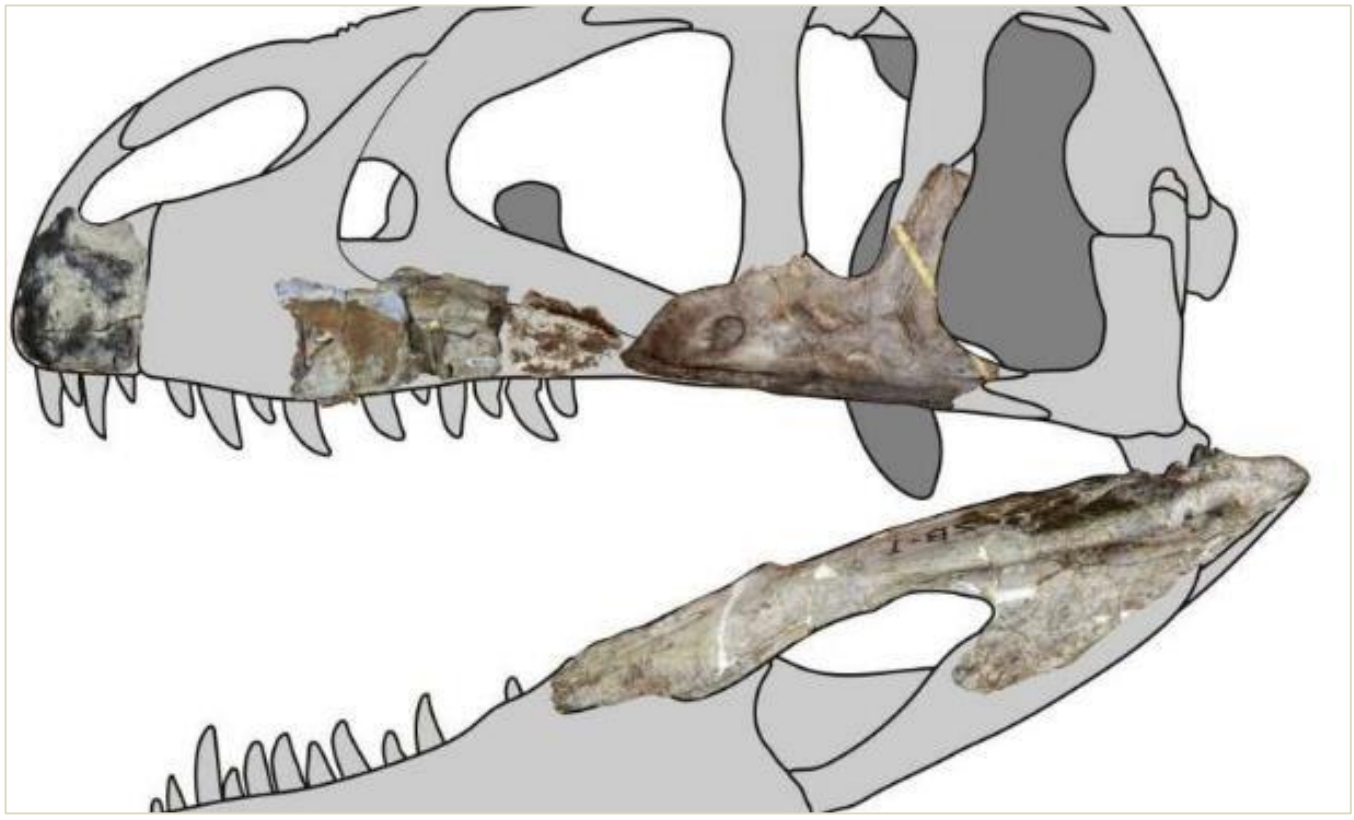
research improves our understanding of lava-seawater interactions within the much broader context of land-ocean connections."

Unique, Interdisciplinary Project

"Science is a team sport," said Dave Karl, senior author and co-director of the UH Mānoa Simons Collaboration on Ocean Processes and Ecology (SCOPE). "SCOPE emphasizes collaboration, where scientists with complementary skills came together to complete this unique, interdisciplinary project." In the future, the team hopes to sample the newly-formed ponds at the bottom of the Halemaʻumaʻu crater and further investigate lava-seawater interactions in the laboratory.

Huge New 'Shark Toothed' Dinosaur Found

By Michael Greshko, National Geographic, October 9, 2019
https://www.nationalgeographic.com/science/2019/10/huge-new-shark-toothed-dinosaur-siamraptor-found-in-thailand/



Excavations in Thailand revealed Siamraptor suwati, a newfound type of predatory dinosaur. The creature belonged to the carcharodontosaurs, a group known for its serrated, knife-like teeth. Image courtesy of Chokchaloemwong et al., 2019

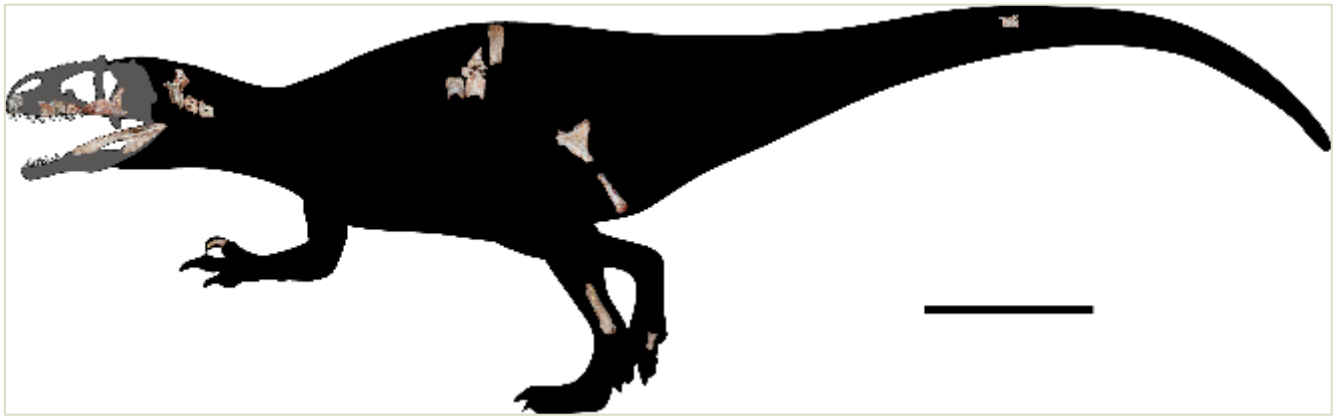
Today, the land near Ban Saphan Hin in central Thailand is dusted with thin reddish soil where local farmers plant corn and tapioca. But more than 113 million years ago, this region hosted ancient floodplains that were terrorized by a fearsome dinosaur with shark-like teeth.

Described today in the journal PLOS One, the newfound predator—called *Siamraptor suwati*—is the most complete dinosaur of its type and age ever found in Southeast Asia. The bones of the 25-foot beast add to a string of major dinosaur finds from the region, and they reveal new insight into how a major group of predatory dinosaurs spread across the ancient world.

“It's one of the most important Thai dinosaurs ever found,” Steve Brusatte, a paleontologist at the University of Edinburgh who reviewed the study for publication, says in an email.

For instance, a team led by Duangsuda Chokchaloemwong, a researcher at Thailand’s Nakhon Ratchasima Rajabhat University, pored over the bones and found that the skeleton is shot through with air sacs. This would have made the dinosaur’s frame lightweight and perhaps helped it breathe faster, an idea that future scans of the bones could put to the test.

“It would have been a fierce, fast, dynamic beast,” Brusatte says.



Researchers scaled the 22 newfound fossils to reconstruct the skeleton of Siamraptor suwati. The scale bar equals one meter, or about 3.3 feet. Image courtesy of Chokchaloemwong et al., 2019

Teeth like a shark’s

Tens of millions of years before giant tyrannosaurs such as T. rex arrived on the scene, another group of large predatory dinosaurs reigned: the allosauroids. Among these meat-eating heavyweights was a group called the carcharodontosaurs (kar-KA-ro-DON-toe-SORES), which were the top predators for most of the Cretaceous.

“It was only with the decline of the carcharodontosaurs that small tyrannosaurs got big and moved into the apex predator role,” Brusatte says

Evidence of the group first arose from the Egyptian Sahara in 1914, when an expedition funded by German paleontologist Ernst Stromer found dinosaur teeth that were serrated like steak knives. The forbidding chompers reminded Stromer of those of *Carcharodon*, the shark genus that includes the great white shark, so in 1931, he named the dinosaur *Carcharodontosaurus saharicus*.

In the following decades, paleontologists found more relatives of Stromer’s shark-toothed dinosaur, including some of the biggest predatory dinosaurs that ever lived. But until recently, no well-preserved carcharodontosaurs had ever been found in Southeast Asia. Was this gap the sign of a true absence, or had their remains simply not yet been uncovered? To find out, scientists needed to start digging.

Digging up a dinosaur

In the last couple decades, Thai paleontologists have found a lot of fossil material from the time of the dinosaurs. Since 2007, an international team called the Japan-Thailand Dinosaur Project has found two new plant-eating dinosaurs named *Ratchasimasaurus* and *Sirindhorna*, as well as an ancient relative of alligators and crocodiles.

“This project is strikingly important to reveal evolutionary history of dinosaurs during the Early Cretaceous period,” study coauthor Soki Hattori, a paleontologist at Japan’s Fukui Prefectural Dinosaur Museum, says in an email. “The comparison of Early Cretaceous dinosaurs from Japan and Thailand enables us to understand deeply about them, such as the history of geographical radiation of dinosaurs.”

The researchers found the plant-eating *Sirindhorna* near Ban Saphan Hin, a village in Nakhon Ratchasima province, within a rock layer thought to have formed about 113 to 125 million years ago. Highs reached 95 degrees Fahrenheit as the team dug, and the site rang out with the constant clang of stone knocking stone.

The hard work was worth it: In addition to turning up *Sirindhorna*, the excavation uncovered 22 disarticulated pieces of a predatory dinosaur. The fossils were from at least four different individuals and included some backbones, parts of the limbs and hips, and fragments of the skull, including a well-preserved lower right jaw. Chokchaloemwong and her colleagues pored over the bones and found that they belonged to a carcharodontosaur.

The discovery shows that carcharodontosaurs were widespread across Earth by the early Cretaceous period. Many other dinosaur groups, including other allosauroids, also expanded their ranges by then. At the time, North America was connected to Europe and Asia, allowing the three continents' dinosaurs to mix and mingle.

Siamraptor also carries significance to Thailand itself, Chokchaloemwong says: "I do hope this discovery will make Thai people realize that our country has so many fossils [we] still need the young generation to discover."

New Analysis of NASA Moon Rocks Leads to Breakthrough on How the Earth and Moon Actually Formed

By Louise Lerner, University of Chicago, October 31, 2019. From SciTechDaily: https://scitechdaily.com/new-theory-of-how-the-earth-and-moon-formed-based-on-reanalysis-of-nasa-moon-rocks/amp/

Ex

Scientists believe the moon formed after a large object crashed into the Earth, but details have been murky about what happened next. Credit: Illustration by William Hartmann

Most people only ever encounter rubidium as the purple color in fireworks, but the obscure metal has helped two University of Chicago scientists propose a theory of how the moon may have formed.

Conducted in the lab of Prof. Nicolas Dauphas, whose pioneering research studies the isotopic makeup of rocks from Earth and the moon, the new study measured rubidium in both planetary bodies and created a new model to explain the differences. The breakthrough reveals new insights into a conundrum about the moon's formation that has gripped the field of lunar science over the past decade, known as the "lunar isotopic crisis."

This crisis kicked off when new methods of testing revealed Earth and moon rocks have strikingly similar levels of some isotopes, but very different levels of others. This confounds both major scenarios for how the moon formed: one being that a giant object smashed into Earth and took a chunk with it on its way to becoming the moon (in which case the moon should have a decisively different makeup, mostly the foreign object); and the other being that this object obliterated the Earth, and the two celestial bodies eventually formed out of the resulting smithereens (in which case the two makeups should be virtually identical).

"There's clearly something missing there," said Nicole Nie, PhD'19, first author of the study, recently published in Astrophysical Journal Letters. A former graduate student in Dauphas' lab, Nie is now at the Carnegie Institution for Science.

Professor Nicolas Dauphas (right) and Nicole Nie, PhD'19, use Apollo lunar rock samples to try to decode the age and composition of the moon. Credit: Photo by Joe Sterbenc

To test different theories, Dauphas' lab has a collection of moon rocks on loan from NASA, (representing every Apollo mission that recovered samples). Nie came up with a rigorous way to measure the isotopes of rubidium—an element that had never been precisely measured in moon rocks because it's so difficult to isolate from potassium, which is chemically extremely similar.

Rubidium is one of a family of elements that consistently shows up with different proportions of isotopes in the moon compared to the Earth. When Nie examined the moon rocks, she found they did in fact contain fewer of rubidium's light isotopes and more heavy ones than Earth rocks do.

"There was really no framework for how this difference happened," Dauphas said, a professor in the Department of Geophysical Sciences. "So we decided to make one."

They started from the idea that both the Earth and the giant object were vaporized after the impact. In this scenario, a mass that will become Earth slowly coalesces, and an outer ring of debris forms around it. It's still so hot, nearly 6,000 degrees Fahrenheit, that this ring is probably an airy outer layer of vapor surrounding a core of liquid magma.

Over time, Nie and Dauphas surmise, the lighter isotopes of elements like rubidium evaporate more readily. These condense onto the Earth, while the rest of the heavier isotopes left behind in the ring eventually form the moon.

This told them more about what the early moon and Earth would have looked like. Because they know exactly how much more of the lighter isotopes evaporated, they worked backward to find out how saturated the vapor layer would have been—the more saturated, the slower the evaporation. (Think of trying to dry out your laundry on a very humid day in the tropics, versus a dry day in the desert.)

This is helpful because exact characteristics of this early phase have been hard to pin down. The results also fit nicely with previous measurements of other isotopes in moon rocks, such as potassium, copper, and zinc. "Our new scenario can quantitatively explain the lunar depletion of not only rubidium, but also most volatile elements," Nie said.

The study is a long-needed step to connect the lines between isotope measurements and physical models of the proto-planetary bodies, Dauphas said.

“This was a link that was missing, and we hope it will help to constrain the scenarios for early moon and Earth formation going forward,” he said.

Reference: “Vapor Drainage in the Protolunar Disk as the Cause for the Depletion in Volatile Elements of the Moon” by Nicole X. Nie and Nicolas Dauphas, 17 October 2019, The Astrophysical Journal Letters. DOI: 10.3847/2041-8213/ab4a16

UNH Researchers uncover clues about life on earth following dinosaurs’ extinction

By Kimberley Haas, New Hampshire Union Leader. October 24, 2019.
https://www.unionleader.com/news/education/unh-researchers-uncover-clues-about-life-on-earth-following-dinosaurs/article_3885b514-7cf3-5f21-b652-1fcbc3b0a9b5.html?block_id=664693

Mammal skulls preserved in egg shaped rocks in Colorado give researchers an unprecedented look into how life recovered after an asteroid struck Earth 66 million years ago.

DURHAM — New details about how life on Earth recovered after an asteroid wiped out dinosaurs 66 million years ago has been revealed through work performed by researchers at the University of New Hampshire.

Professor of Geology William Clyde and masters student Anthony Fuentes, who graduated this past spring, used technology at UNH to help scientists in Colorado Springs, Colo., analyze exceptionally preserved animal and plant fossils from that region to determine that 100,000 years after the mass extinction of dinosaurs, life began to recover in meaningful ways.

“About 100,000 years after the extinction, you see the recovery really come into play, so you really start seeing mammals getting bigger, you see the plants diversifying. By about 300,000 years after the extinction, pretty good recovery has occurred and you really start to get kind of an expansion of the ecosystem at that point,” Clyde said on Thursday.

Clyde said there are very few places on Earth where scientists can track how life came back after an asteroid struck the Yucatan Peninsula in Mexico, causing 75 percent of animal and plant life species to die off.

Clyde explained that the Rocky Mountains were being formed at that time, so animal and plant fossils were preserved in a basin just outside Colorado Springs. Similar fossils from that time period cannot be found in New Hampshire because the White Mountains are hundreds of millions of years old.

Clyde co-authored a study on the work, which was led by Tyler Lyson and Ian Miller from the Denver Museum of Nature & Science.

The study is published in this week’s issue of Science magazine.

The story of their discoveries was also turned into a documentary, “Rise of the Mammals,” a NOVA production which will be broadcast on PBS Oct. 30 at 9 p.m.

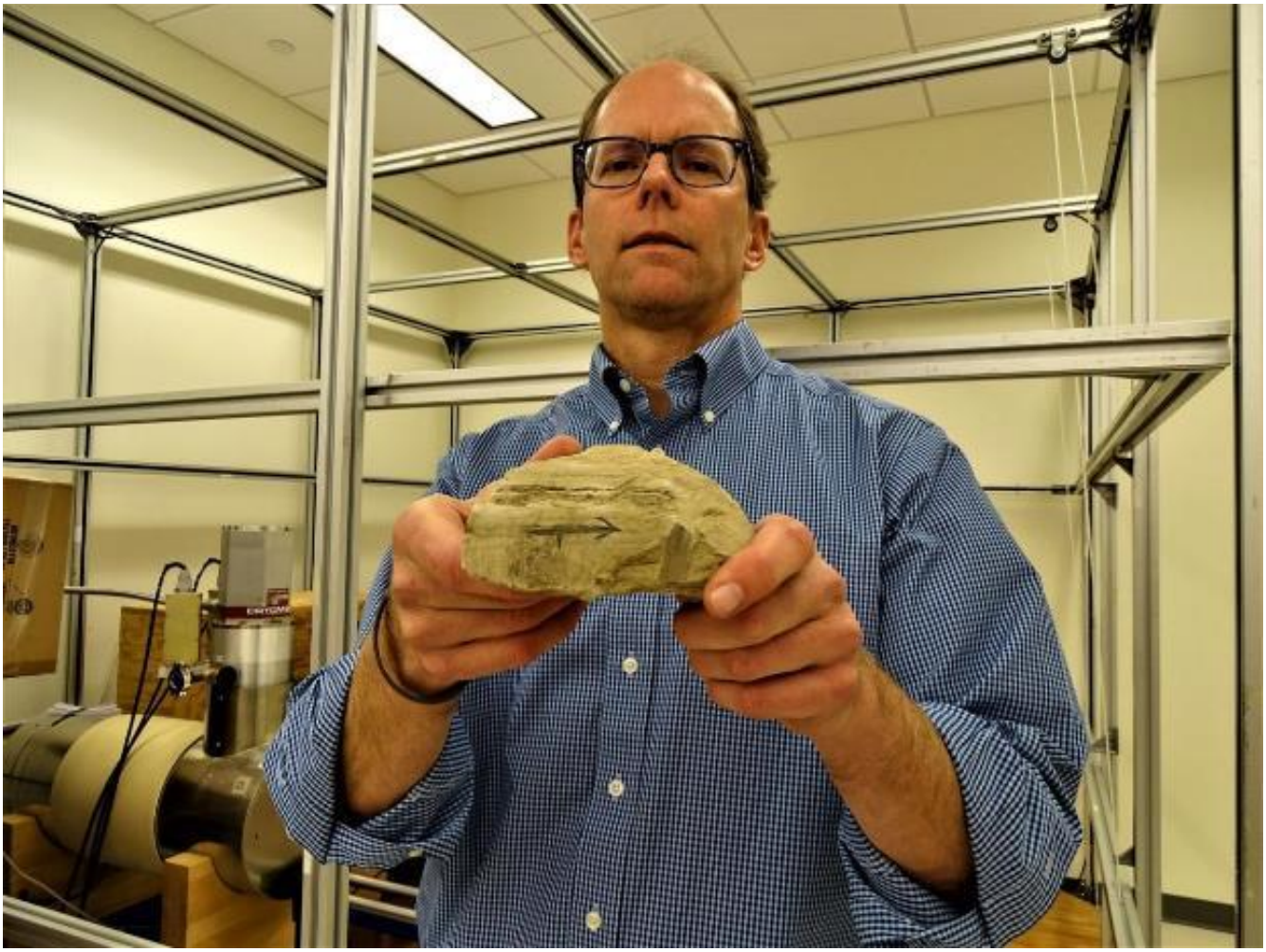
Lyson began his work in 2016 by cracking open egg-shaped rocks called concretions. Inside were skulls of mammals from the early survivors of the mass extinction.

Lyson knew Clyde and called upon him to help determine the ages of the rock layers scientists were working in. Clyde was able to do so by using a special machine at UNH which can determine the Earth’s polarity at the time a rock was formed.

Clyde said the next step in the process is to see if there are similar sites in South America and other parts of the world which are undiscovered.

In the meantime, he is proud to be part of this project which offers people a glimpse into how life rebounded after the Earth's most devastating extinction to date.

"The fossil record never ceases to amaze me," Clyde said.



Geology Professor William Clyde holds one of the unprocessed rocks from a site in Colorado that holds key information about how life recovered after a mass extinction that killed off the dinosaurs 66 million years ago.

Additional collaborators for the project include researchers from City University of New York, University of Washington, Wesleyan University, University of Maryland, Colorado College, the National Museum of Natural History and the Smithsonian Institution.

DATES TO REMEMBER

January 23, 2020 – **GSNH Dinner Meeting:** Makris Lobster & Steak House, Route 106, Concord, NH Speaker: Elizabeth Burakowski, Research Assistant Professor, UNH: *New England's Warming Winters*. New England's winters have warmed over the past 100 years, with impacts on ecosystems and society. What can we expect for the future?

March 12, 2019 – **GSNH Board of Directors meeting** at Nobis Group, Concord, NH

March 13, 2020 – **2020 NH Water & Watershed Conference**, Plymouth State University https://campus.plymouth.edu/cfe/2020-nh-water-watershed-conference/

March 26, 2020 – **2020 Maine Sustainability & Water Conference,** Augusta Civic Center, Augusta, Maine. https://umaine.edu/mitchellcenter/2020-maine-sustainability-water-conference/

April 9, 2020 – **NHGS Mappers Workshop,** NHDES, Concord, NH

April 16, 2020 – **GSNH Dinner Meeting:** Puritan Pappas Room, Manchester, NH.

April 18 and 19, 2020 – **Southeastern New Hampshire Mineral Club Show,** 282 Durham Road (Dover Elks Lodge #184), Dover, NH. 10AM to 4PM both days.

June 6-7, 2020 – **Friends of the Pleistocene Field Trip**, NH Lakes Region, details TBD. See https://www2.newpaltz.edu/fop/

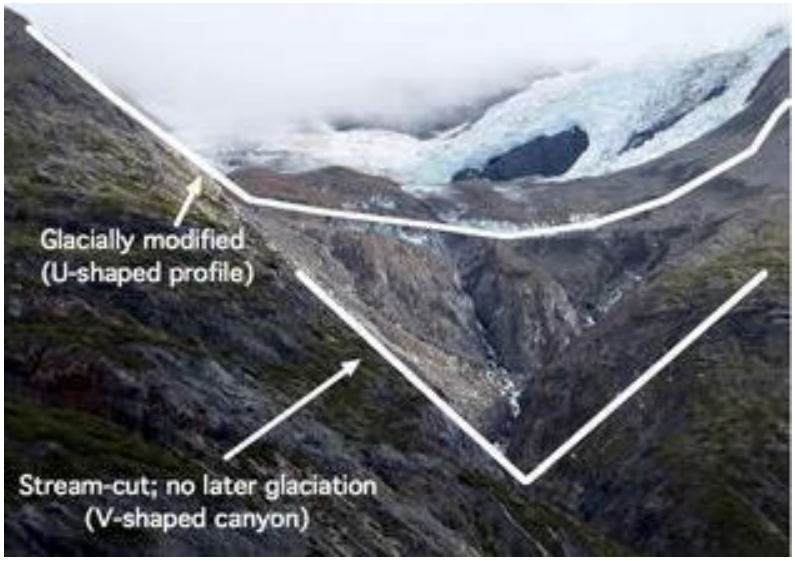
Two Different Valleys at Glacier Bay, Alaska

From Earth Science Picture of the Day, November 3, 2019.
Photographer and Summary Author: Bryce Hand
https://epod.usra.edu/blog/2019/11/archive-two-different-valleys-at-glacier-bay-alaska.html

Each Sunday we present a notable item from our archives. This EPOD was originally published November 6, 2013

The photo shown here features two valleys, one superimposed on another, that were formed in very different ways. It was taken from a cruise ship at Glacier Bay, Alaska. Compare the raw V-shaped, stream-cut canyon with the U-shaped glacially-modified valley. As depicted in the illustration, the meltwater stream has cut through an old moraine, creating a gorge that has subsequently never been subjected to glaciation. As a result, it has a considerably sharper profile. Photo taken on September 1, 2013.

- Glacier Bay, Alaska Coordinates: 58.7, -136.15
- Related Links
  - Blackstone Glacier
  - Glaciated Valley
- Student Links
  - Glaciers carve land and move sediments
  - Glaciers and Glaciation
- Earth Observatory
  - Glacier Bay National Park and Preserve



Why are granite and basalt more common than rhyolite and gabbro?

From Ask GeoMan (Mike Strickler)
http://jersey.uoregon.edu/~mstrick/AskGeoMan/000098_AskGeo.html

There are several interconnected reasons.

To set some ground rules: All of these are igneous rocks. Granite and rhyolite are considered felsic, while basalt and gabbro are mafic (click here for more information on mafic and felsic). Felsic rocks, in general, form the bulk of the continental plates, while mafic basalt forms the seafloor. Since the surface of the earth is covered by oceanic and continental crustal materials, granite and basalt are very common.

So far so good, but what about the rhyolite and gabbro?

Let's think about the differences between intrusive and extrusive igneous rocks for a bit. Basalt is extrusive and comes out of volcanoes, but the lava had to come from somewhere. This is where the concept of a "magma chamber" comes in - the subsurface source of liquid rock to feed an extrusive volcanic event. In simple terms, gabbro is just the cooled magma chamber for the basaltic flows that erupt at the surface. In the same respect, granite is the cooled (and exposed) magma chamber for extrusive rhyolite.

So why do we see the slowly-cooled intrusive version on the continents, but the rapidly-cooled extrusive basalt in the oceans? Well, again there are several contributing factors. One relates to the heat involved. Mafic magma is much hotter than felsic magma. Because of this, it is easier for the basaltic lavas to reach the surface while still in the liquid phase. Felsic magma, starting much cooler, generally crystallizes before reaching the surface. Therefore, more basalt than gabbro, and more granite than rhyolite.

Another reason is the internal crystalline structure of the silicate minerals. Mafic magmas crystallize to form relatively simple atomic structures (isolated tetrahedra and single chains), and therefore flow easily (the higher mafic temperatures also contribute to this ease of movement). Felsic magma on the other hand crystallizes to form more complex atomic structures (double chains, rings, and sheets) which impedes the flow- think of a log jam in a river for an appropriate analogy.

Hope this helps. This is surely oversimplified on several levels, but is (hopefully) a reasonable summary.

Summer Field Trip Announcement

By Woody Thompson

On the weekend of June 5-6-7, 2020, the Friends of the Pleistocene will meet in central New Hampshire for the first time. We will visit the Lakes Region and neighboring areas, for which there is new detailed surficial mapping by the New Hampshire Geological Survey through the USGS STATEMAP program. The trip will examine the glacial and deglacial history of the region, including ice-flow directions, the mode of ice retreat, glacial stratigraphy and geomorphology, and revelations from LiDAR imagery. Dan Tinkham and John Brooks (Emery & Garrett Groundwater Investigations in Meredith, A Division of GZA) will be leading the trip, along with other mappers and colleagues working in New Hampshire under the auspices of the NHGS, and Bob Newton from Smith College.

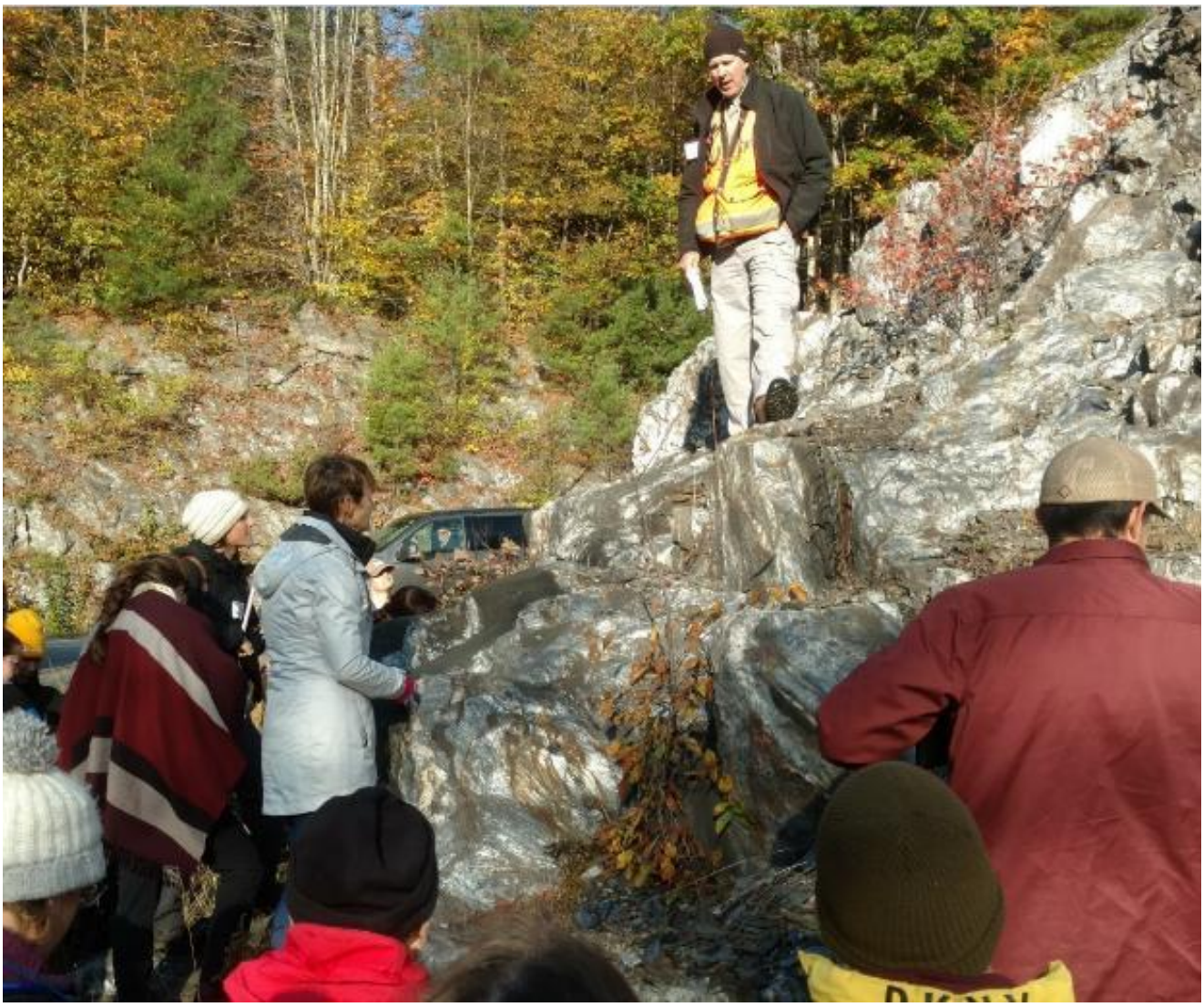
Watch the NEFOP website this winter for a preliminary announcement of the 2020 trip, with registration details to follow when available.

NEIGC Mount Ascutney Field Trip Report

By Wayne Ives

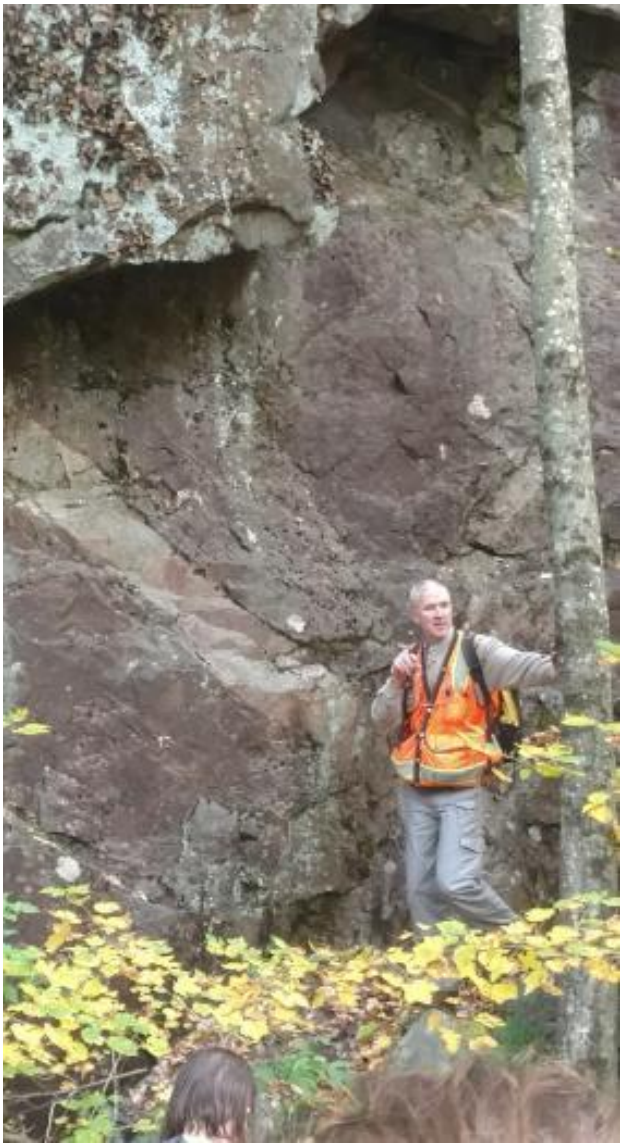
It was a sunny, cool, autumn day and perfect for the Friday morning start to this year's NEIGC field trip. I arrived in Vermont before 8am on October 11th at the Park and Ride lot south of Mt. Ascutney to find trip leader, Greg Walsh, and other friends at our meeting place. Mt. Ascutney is a 3,144 feet tall monadnock and considered Vermont's most famous volcano – at least that's what the trip description says! During the visit we saw the key rock types that make up Ascutney Mountain.

We started by walking across the road to look at the outcrops of the Waits River hornfels country rock near the I-91 off-ramp. From there we drove to the Weathersfield trailhead and hiked in a short way along the trail past the falls, which were dry, to some impressive cliff outcrops of gabbro-diorite forming Little Ascutney west of the main mountain.



Trip leader Greg Walsh describes the country rock at our first outcrop near the highway off-ramp. Photo by Wayne Ives.

Backtracking from the trailhead to the park entrance we drove up the Mt. Ascutney auto road and observed examples of biotite granite at a picnic area part way up the mountain. The wind was blowing pretty good, but the views to the east towards St. Gaudens (part of a GSNH field trip in 2017) were beautiful. Further up the access road at the upper parking lot in a saddle, we unloaded and had lunch then walked in to look at the older volcanic rocks exposed along the Hang Glider Trail that were set in the younger syenite.



Trip leader Greg Walsh describing the outcrops on Weathersfield Trail and at the hang glider launch platform during the NEIGC field trip to Mt. Ascutney. Photo by Wayne Ives.

The Ascutney Mountain igneous rocks (Cretaceous) include older volcanics intruded by a pluton of syenite of similar composition and originally emplaced 6-10 kms below the surface. I had a hard time envisioning how the volcanic rocks and the pluton had gotten to be together. The volcanic rocks that were emplaced at the surface were intruded quite a while later by the pluton at depth and yet they were of similar composition. Shouldn't there have been an evolution of the magma? How it is that they are adjacent is still a matter of speculation since alternative hypotheses like stoping and various subsidence mechanisms have been argued. There were better geologists than me that were okay with the juxtaposition, so I figured I needed to learn more on my own if I'm going to clear up my mystification, but it was fun putting the profs to the test and hear their explanations. Continuing, we

walked the mountain trails leading to the hang glider launch platform, the observation tower and Castle Rock, all of which had spectacular views.

Observing and discussing a syenite outcrop on Mt. Ascutney during the 2019 NEIGC field trip. Photo by Wayne Ives.

2020 Election: Consider Joining the GSNH Board!

Several positions on the Board of Directors have terms expiring in 2020, including the following: President, Society Vice President, Council Vice President, Secretary, and one Member-at-Large position.

GSNH Needs You!

Two positions are term-limited and expiring in 2020, so the Board is particularly looking for volunteers for the position of President and Member-at-Large. For more details regarding these positions, see the GSNH constitution and bylaws at http://www.gsnh.org/gsnh-constitution-and-bylaws.html. If you'd like to reach out to current board members for more information, please see http://www.gsnh.org/board--committees.html.

The election will take place at the October 2020 board meeting, and we are looking to finalize the candidate list by the end of the summer. This is your chance to get more involved in the greater geological community!

December Legislative Committee Report

By Tom Fargo

The following page lists the 2020 Legislative Service Requests (LSRs or draft bills) that have been submitted as of November 19, 2019 that are potentially relevant to members of the Geological Society of New Hampshire. The subject/content of these LSRs is only currently available as titles. The GSNH Legislative Committee will be following these bills and others as the 2020 Legislative Session begins in January.

As can be seen from the Legislative Service Requests submitted for the 2020 General Court Session, there are several common themes for legislative action. These include:

1. Allowing states to establish standards (water quality & vehicle/industrial emissions?) more stringent than Federal standards.
2. Bills to address groundwater shortages due to excessive large groundwater withdrawals by municipal systems or water districts. This is prompted primarily by a recent spate of dry residential water-supply wells in Hampstead.
3. Several bills are proposed regarding PFAS contamination and exposures.
4. Several bills are proposed regarding municipal solid waste reduction, landfill capacity & expansions and permitting new facilities. This appears to be in response to proposed expansion of the North Country Environmental Services landfill in Bethlehem, or permitting of a new landfill in Dalton.
5. Several bills addressing climate change.

Key word searches with no returns: **geology, rock**

LSR Number	Title
Key Word "**Environ**"	
2020-2065 HCR	urging Congress to grant states broader authority to set higher **environ**mental standards than those established in federal law
2020-2231 HB	relative to authorizing the state to set higher **environ**mental standards than those established in federal law
2020-2260 HB	establishing a climate action plan, an office of the **environ**mental advocate, and an oversight commission on **environ**mental services
2020-2597 HB	creating a commission to develop and implement **environ**mental education, outreach, and training programs and initiatives for qualified health care professionals relative to **environ**mental toxins and health
2020-2599 HB	requiring the department of **environ**mental services to maintain a public registry of where certain fire suppressants have been used
2020-2756 SB	establishing the coastal program administered by the department of **environ**mental services
2020-2780 SB	relative to the addition of climate and **environ**mental sciences to the criteria for an adequate education
Key Word "**Water**"	
2020-2005 HB	relative to the labeling of bottled **water**
2020-2075 HB	requiring periodic **water** tests of rental property
2020-2119 HB	abolishing fluoride in **water**
2020-2542 HB	relative to large ground**water** withdrawals from replacement wells
2020-2543 HB	addressing impacts to other **water** users from new sources of **water** for community **water** systems.
2020-2595 HB	relative to standards for perfluorochemicals in drinking **water** and ambient ground**water**
2020-2804 SB	relative to testing for lead in **water** in schools and child care facilities
2020-2809 SB	relative to municipal **water** pollution control
Key Word "Wetland"	
2020-2088 HB	relative to the definition of prime **wetland**
Key Word "Shoreland"	
2020-2736 SB	relative to **shoreland** water quality
Key Word "Waste"	
2020-2284 HB	establishing a moratorium on the issuance of permits for new landfills or the expansion of existing landfills for the purpose of studying the creating of municipal **waste** districts
2020-3058 SB	establishing a statewide solid **waste** disposal reduction goal
2020-3059 SB	establishing the solid **waste** management fund and establishing a solid **waste** disposal surcharge
2020-3102 HB	establishing a solid **waste** working group on solid **waste** management planning
2020-3106 HB	establishing a committee to study the solid **waste** practices of state agencies.
Key Word "**Soil**"	
2020-2181 HB	including **soil** health and **soil** conservation in the state **soil** conservation plan
Key Word "Professional" as potentially related to Geologists	
2020-2975 SB	establishing a oversight committee on the office of **professional** licensure and certification.

Geological Society of New Hampshire

Topic: New England's Warming Winters

New England's winters have warmed over the past 100 years, with impacts on ecosystems and society. What can we expect for the future?

Speaker: Dr. Elizabeth Burakowski, Research Assistant Professor University of New Hampshire - Durham

Thursday, January 23, 2020

Location: Makris Lobster & Steak House
Route 106, Concord, NH 03301

5:30 pm Social Hour - 6:30 pm Dinner - 7:15 pm Speaker Presentation

RSVP by 4 pm Friday, January 17, 2020 to get the reservation price
SPACE AT THIS VENUE IS LIMITED T0 80...RESERVE EARLY!

Advance Reservations: _____Member (Dues Paid) $27.00
_____Non-member $30.00

- Students $10.00 with valid student ID card (Reservation Requested)
- Member at the Door $29.00
- Non-Member at the Door $32.00

Checks payable to: GSNH.

_____**Please indicate special food issues – leave blank for none.**

GSNH will also accept dinner reservations by e-mail, which will then allow you to pay at the door.
Reply via e-mail to: Sharon.Lewandowski@des.nh.gov or
Mail to: **Sharon Lewandowski , GSNH Dinner Meeting,**
PO Box 401,
Concord, NH 03302.

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.

Name(s) _____

Address: _____

Your phone or e-mail: _____

The dinner and lecture program counts as 2.0 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:

(Employer): _____

_____

_____

Home Telephone: _____

Office Telephone: _____

New Hampshire PG # (if applicable) _____

Education: Degrees received or in progress:

Year	Degree	Major	College or University

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

__ Membership Committee
__ Legislative Committee
__ Giving a talk at a meeting

Membership Category:

__ *Regulations Committee*
__ *Education Committee*
__ Events Committee

__Communications Committee
(Newsletter or Website, circle preference)
__ Other:

_____ 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: _____