Granite State Geologist

~ 30 Years of GSNH! ~

The Newsletter of the Geological Society of New Hampshire,
Winter Edition – December 2020 – Issue No. 111
Newsletter Editor: jlambert@nobis-group.com **Website:** http://www.gsnh.org/

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MESSAGE FROM THE PRESIDENT

Hello Friends,

This is my first note as newly-elected President of GSNH. To start, I want to thank everyone who participated in the October 15, 2020 on-line annual meeting for making it a success. It would have been much more enjoyable to see attendees in person, but thanks to the efforts of dedicated Board members and our speaker NHDES Waste Management Division Director Michael Wimsatt, we persevered when faced with the difficult COVID-19 situation. Second, I want to thank departing Board members Sharon Lewandowski and Julie Spencer for their years dedicated to keeping GSNH relevant and successful. We welcome to the Board Nelson Eby and Lee Wilder, both of whom have long shared their passion for geological education, the primary mission of GSNH.

Speaking of geological education, with more time at home I've found myself exploring what's available on YouTube. I've discovered several channels that I find very engaging that you might enjoy as well.

- **PBS Eons** is a channel that focuses on paleontology and historical geology, with some anthropology. Episodes are generally 10 minutes long and cover contemporary topics.
- **Benjamin Burger** is a paleontologist and geology professor at Utah State University in Vernal, UT. His YouTube channel includes 10 to 30-minute lectures regarding vertebrate paleontology, many about dinosaurs. His channel also includes a series "Rocks of Utah" where he explores, in the field, Phanerozoic strata familiar to us eastern geologists who have had the opportunity to travel to the that region.

- **Nick Zenter** is a geologist and professor at Central Washington University, in Ellensburg, WA. Nick is a prolific You-Tuber who regularly uploads videos in various series, Nick on the Rocks, Nick on the Fly, Nick at Home, etc. His early videos, available on the **Central Washington University channel**, were done as community lectures and provide an introduction to the geology of central Washington, covering topics such as the Columbia River flood basalts, and glacial lake Missoula outburst floods that created the channeled scablands and associated deposits. In his latest uploads, Nick has been exploring various exotic terranes that have traveled from Baja to BC. Unfortunately, most of these videos are over an hour long, but in several Nick talks with notable geologists who have deciphered how these far-traveled rocks came to be.
- One non-geology YouTube channel I recommend is **Catherine Gregory.** Catherine is a solo hiking YouTuber who produces stunning 10 to 15-minute photographic tours of western US locales that are familiar to many geologists. A good channel to watch to get inspired to travel when the pandemic is over.

Stay well, and I encourage you reach out to someone you haven't talked to in a while.
Tom

GSNH T-Shirts Available!

We have GSNH t-shirts available in size small, medium and large (sorry, sold out of extra large). T-shirts will be shipped to you – no need to wait until the next in-person meeting! See order form on second to last page (right before the renewal form).

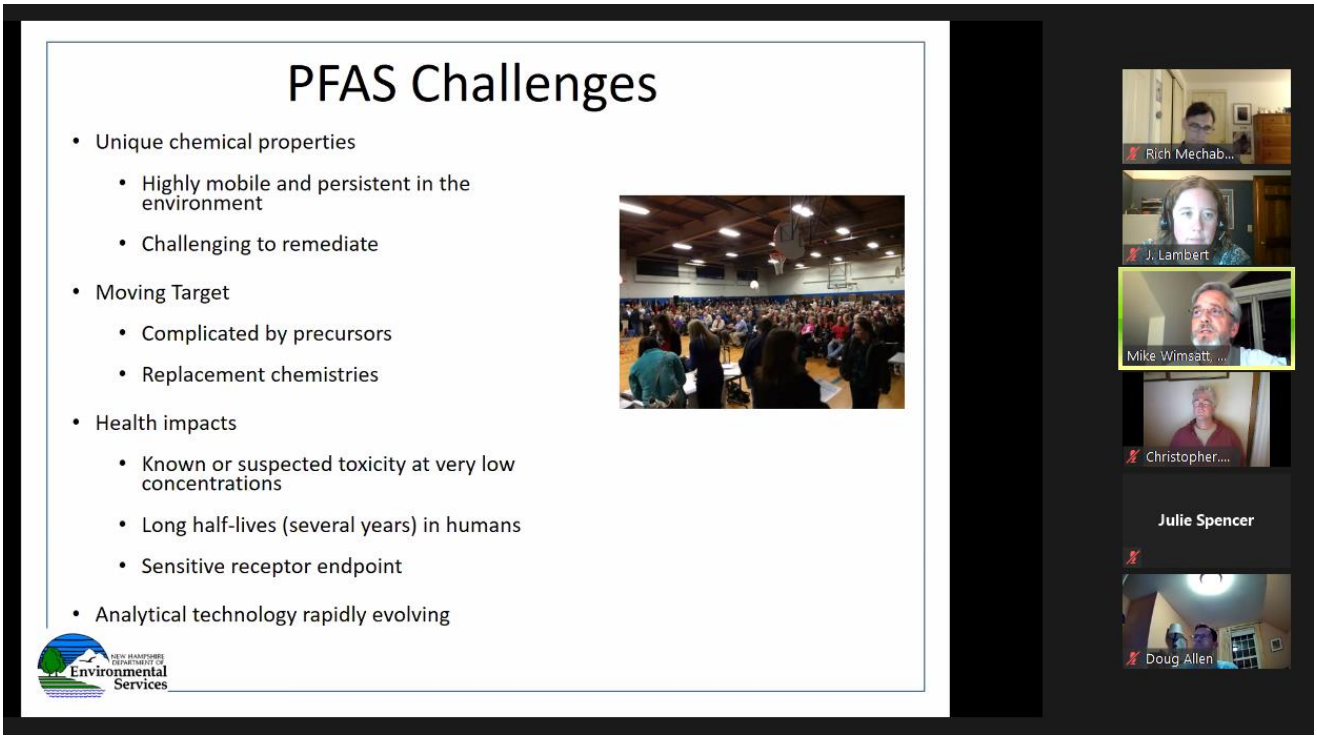
Front (left photo) and back (right photo) of GSNH t-shirt.

October GSNH Meeting Recap

We held our first virtual meeting on October 15, 2020 via Zoom. The meeting started with a vote on proposed changes to the GSNH constitution and bylaws (after a discussion lead by Shane Csiki) so that we could hold a virtual meeting (and election!). Once we were “legal to vote”, Abby Fopiano, our webmaster, provided a meeting-specific code so that attendees could securely and anonymously vote for the upcoming slate of officers.

Screenshot with some of the attendees at the October virtual meeting.

Michael Wimsatt, Director of the New Hampshire Department of Environmental Services (NHDES) Waste Management Division, gave a presentation on per- and polyfluoroalkyl substances (PFAS) in New Hampshire, starting with an overview of PFAS initial discovery and sources. He also described the regulatory setting for PFAS rules and the timeframe for implementation and summarized the status of the ongoing PFAS investigations that the NHDES is overseeing. At the end of the talk, outgoing president Wayne Ives used the magic of Zoom to present a speaker’s gift.



Michael Wimsatt describes some of the issues facing PFAS investigations and cleanup.

At the end of the meeting, the votes were tallied and new members elected to Board positions. These included:

President: Tom Fargo

Council Vice President: Doug Allen

Society Vice President: Nelson Eby

Treasurer: Abby Fopiano

Secretary: Shane Csiki

Members-at-Large: Bill Abrahams-Dematte, Jennifer Lambert, and Lee Wilder

Wayne Ives has moved into his new role as Past President.

It's Time to Renew Your Membership!

'Tis the season to renew your GSNH membership! With membership, you get a discount on dinner meetings and field trips (which will happen at some point!), 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.

See last page of this newsletter for a membership renewal application.

Presumpscot River Resumes Flow after Landslide that put Westbrook in State of Emergency

By Nick Sambides Jr. From the Bangor Daily News, September 16, 2020.
https://bangordailynews.com/2020/09/16/news/portland/landslide-near-sappi-mill-has-blocked-river-in-westbrook/

A section of the Presumpscot River downstream from the Sappi mill in Westbrook was completely blocked by a landslide for several hours on Wednesday, but began to flow without forcing the evacuation of residents and businesses.

Mayor Michael Foley, who signed an emergency declaration shortly after 2 p.m., said later in the afternoon that water levels had fallen significantly and seemed likely to continue declining.

“The risk of imminent flooding is not really there,” Foley said Thursday.

The river, which gained notoriety when a giant ice disk formed in it in January 2019, was blocked after a landslide near an excavation contractor’s facility at 161 Warren Ave. that was reported at about 11:30 a.m.. The river rose from just under 2 feet to a peak level of 13.3 feet at 2:30 p.m. before dropping to 12.2 feet about three hours later., said Mike Ekster, a meteorologist at the National Weather Service office in Gray.

“It’s slowly receding and that’s what we want to see,” Ekster said.

Foley consulted with the Maine Emergency Management Agency before signing the declaration, which mobilized relief efforts and will help secure remediation funding from federal and state sources.

The flood watch advisory covering coastal Cumberland County that the weather service issued shortly after noon will continue into the evening as a precaution, Ekster said.

That area of Westbrook has a lengthy history of landslides because it has large deposits of marine or quick clay, Foley said — soft soil typically found in coastal areas that is notorious for causing landslides.

About 25 miles long, the Presumpscot is the largest freshwater input into Casco Bay, running from Sebago Lake through Windham, Gorham, Westbrook, Falmouth and Portland. It is a watershed of 648 square miles, according to presumpscotriver.org.

Differing accounts detailed the start of the landslide. Chris Wilson, owner of the excavating firm, said the slide began around 9 or 9:30 a.m. on an adjoining parcel owned by Sappi and the Portland Water District and consumed piles of aggregate he was keeping on his lot. He said his property extends toward the river from Warren Avenue, but stops before the river, the Portland Press Herald reported.

"After their land failed, my land and the neighbor's land followed," Wilson told the Press Herald. "A lot of money [his piles of aggregated material] went over the edge."

Another witness, Jeremy Tardif, who was working on a job site finishing a concrete foundation that overlooks the area, said a bucket loader on the Wilson property was dumping earth on top of a large pile before the slide.

The city is investigating what started the landslide, but Foley said he doubted that any one cause will be found.

"There is really no instant solution," he said. "I don't think it is necessarily any one person's fault. There is a long-term history of construction work and other things here."

The January Meeting will be Online

Just like our October meeting (see page 3), we will have an online (virtual) meeting on January 21 via Zoom. This time we are planning on having Zoom breakout rooms before the presentation in order to allow for more mingling in small groups and to help prompt conversation. The breakout room meet and greet will be from 6:30 to 7:00 PM, and the presentation will start at 7:00 PM. Details regarding the presentation will be provided in January.

Please watch for an email from Doug Allen providing presentation and registration details. You will need to register in order to receive the Zoom invitation for the meeting; you can register by emailing Sharon Lewandowski (Sharon.A.Lewandowski@des.nh.gov). Doug will send a zoom link to those who have registered a few days before the meeting.

What's Your Board Been Doing? Submitted by Shane Csiki, Secretary

The officers of the GSNH Board, from both the previous and newly elected boards, met for its quarterly meeting on the evening of December 10th. Once again, the meeting took place via Zoom.

As you may imagine, a primary topic for much of the Board meeting centered around the ongoing COVID-19 pandemic. To start, the Board discussed the October meeting, and overall felt that the Zoom meeting went well, and that this is a viable option now and into the future when GSNH cannot meet in person.

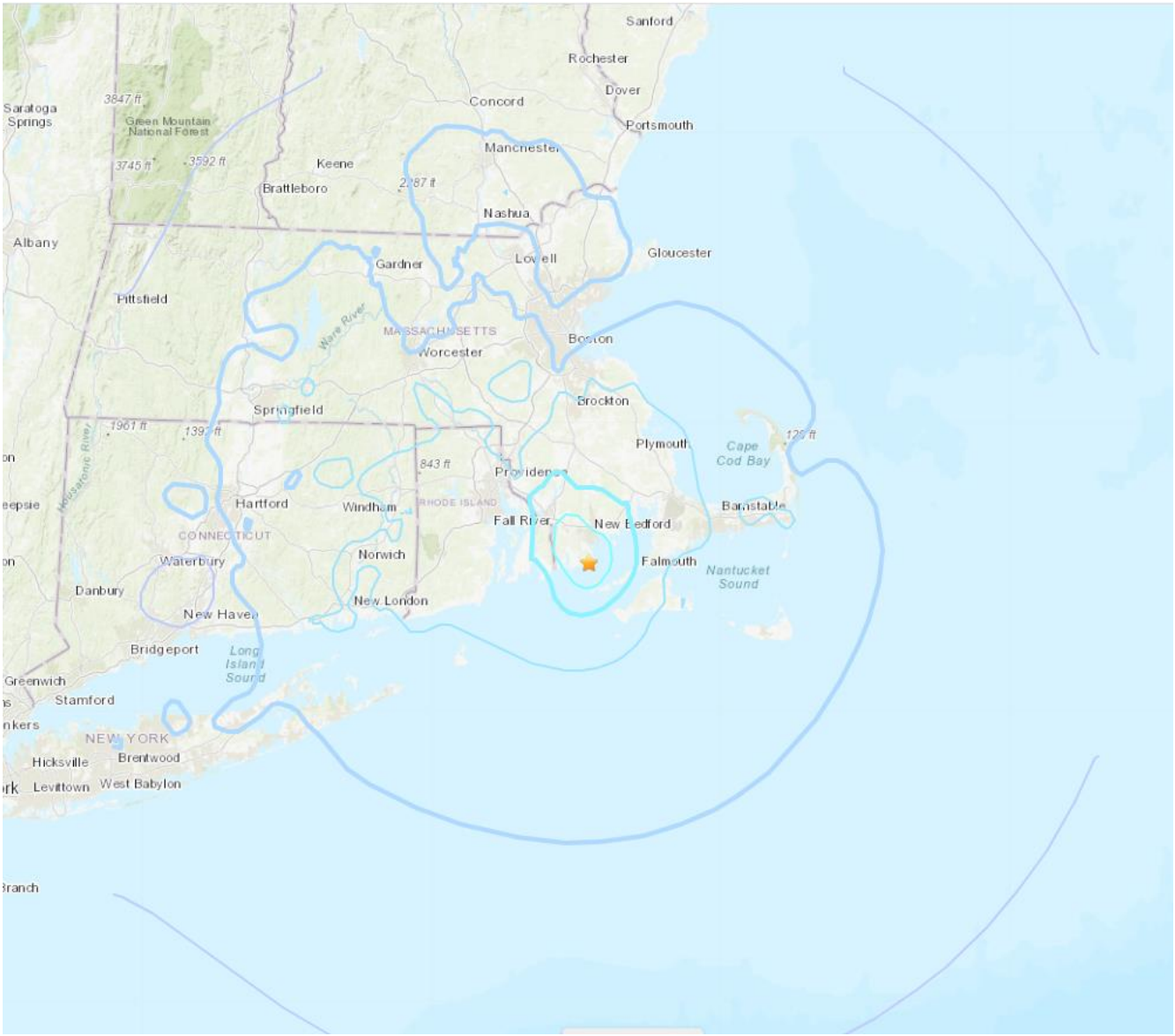
The Board then discussed at length the best strategy for continuing GSNH meetings, while recognizing the reality that the upcoming January meeting will again be virtual. The April meeting will likely be so as well. The Board did not make the decision to continue to meet virtually in the short-term lightly, as everyone's preference is to provide the opportunity for everyone to interact in person. However, the Board felt that this is the most prudent course of action for the safety of all GSNH members at this time. The Board's intent is to hold a January virtual meeting if at all possible. The Events Committee, with the assistance of several Board members, are currently working on plans to line up one or more speakers for the January meeting. Further details about the January meeting will be forthcoming. So, stay tuned to your e-mail! The Board discussed how the virtual meeting format expands the list of potential speakers. Though, Board members felt that, despite this, talks should work to maintain a connection to New Hampshire. If any GSNH member has any ideas for potential speakers, let a Board member know. At our next Board meeting in March, the COVID-19 situation will be reassessed. The Board also mentioned the desire to conduct a summer field trip in 2021, given that the 2020 trip was cancelled.

The next GSNH Board meeting is planned for Thursday, March 11, 2020, virtually.

New Bedford, MA Earthquake – November 8, 2020

From the U.S. Geological survey:
https://earthquake.usgs.gov/earthquakes/eventpage/us7000cc4d/executive

If you were in eastern Massachusetts (or even southeastern New Hampshire) on the morning of November 8, you might have felt this earthquake, which was centered 10 km beneath Buzzards Bay off the coast of New Bedford. For details, see the USGS link above and the impact map on the following page.



Modified Mercalli Intensity (MMI) map of the earthquake. Thick dark blue line indicates 2.5 on the MMI scale, thick light blue indicates 3.5, and thin light blue indicates 4.

USGS/AASG Mapping Survey Request by Tom Fargo, President

The U.S. Geological Survey (USGS) and the Association of American State Geologists (AASG) have requested the assistance of allied organizations to conduct a survey to establish systematically the value of geologic mapping and geologic maps. This effort, endorsed by the New Hampshire Geological Survey, is trying to reach a broad spectrum of map users, including licensed geologists. If you are a Maine-Licensed Geologist, you may have already received a request from the Maine Geologic Survey to provide input. Likewise, if you are a New England Water Works Association member, you may have received the same request.

This assessment is the largest and most comprehensive study of its kind ever conducted for the discipline of geology. It comes at a time when (1) significant improvements to infrastructure have long been identified at the Federal, State, and local levels, and now more than ever are required for optimum economic recovery, (2) the uncertainty of climate change looms large on the horizon with a real threat to that infrastructure and human livelihood in many areas, (3) understanding geologic hazards are increasingly important due to population growth and existing/expanding infrastructure, and (4) mineral (especially critical minerals) assessments are crucial for technological advancements and economic diversification/recovery.

Please follow this link to the survey: https://www.surveygizmo.com/s3/5772757/e216571551c0

It may take 20-30 minutes of your time to complete this survey. For the questions that request a dollar value for mapping, please use your best estimate – a time-consuming, rigorous analysis is not necessary.

It will be very helpful if you would complete this survey by December 31.

Thank you for your assistance!

Tree Rings May Hold Clues to Earthly Impacts of Distant Supernovas

By Daniel Strain, University of Colorado Boulder. From CU Boulder Today, November 11, 2020.
https://www.colorado.edu/today/2020/11/11/tree-rings-may-hold-clues-impacts-distant-supernovas-earth

Massive explosions of energy happening thousands of light-years from Earth may have left traces in our planet's biology and geology, according to new research by CU Boulder geoscientist Robert Brakenridge.

The study, published this month in the International Journal of Astrobiology, probes the impacts of supernovas, some of the most violent events in the known universe. In the span of just a few months, a single one of these eruptions can release as much energy as the sun will during its entire lifetime. They're also bright—really bright.

"We see supernovas in other galaxies all the time," said Brakenridge, a senior research associate at the Institute of Arctic and Alpine Research (INSTAAR) at CU Boulder. "Through a telescope, a galaxy is a little misty spot. Then, all of a sudden, a star appears and may be as bright as the rest of the galaxy."

The remnants of a supernova in the Large Magellanic Cloud, a dwarf galaxy that sits close to the Milky Way. (Credit: NASA/ESA/HEIC and The Hubble Heritage Team).

A very nearby supernova could be capable of wiping human civilization off the face of the Earth. But even from farther away, these explosions may still take a toll, Brakenridge said, bathing our planet in dangerous radiation and damaging its protective ozone layer.

To study those possible impacts, Brakenridge searched through the planet's tree ring records for the fingerprints of these distant, cosmic explosions. His findings suggest that relatively close supernovas could theoretically have triggered at least four disruptions to Earth's climate over the last 40,000 years.

The results are far from conclusive, but they offer tantalizing hints that, when it comes to the stability of life on Earth, what happens in space doesn't always stay in space.

"These are extreme events, and their potential effects seem to match tree ring records," Brakenridge said.

Radiocarbon spikes

His research hinges on the case of a curious atom. Brakenridge explained that carbon-14, also known as radiocarbon, is a carbon isotope that occurs only in tiny amounts on Earth. It's not from around here, either. Radiocarbon is formed when cosmic rays from space bombard our planet's atmosphere on an almost constant basis.

"There's generally a steady amount year after year," Brakenridge said. "Trees pick up carbon dioxide and some of that carbon will be radiocarbon."

Sometimes, however, the amount of radiocarbon that trees pick up isn't steady. Scientists have discovered a handful of cases in which the concentration of this isotope inside tree rings spikes—suddenly and for no apparent earthly reason. Many scientists have hypothesized that these several-year-long spikes could be due to solar flares or huge ejections of energy from the surface of the sun.

Brakenridge and a handful of other researchers have had their eye on events much farther from home.

"We're seeing terrestrial events that are begging for an explanation," Brakenridge said. "There are really only two possibilities: A solar flare or a supernova. I think the supernova hypothesis has been dismissed too quickly."

A bubble of gas expanding at roughly 11 million miles per hour created by the shockwave from a supernova. (Credit: NASA)

Beware Betelgeuse

He noted that scientists have recorded supernovas in other galaxies that have produced a stupendous amount of gamma radiation—the same kind of radiation that can trigger the formation of radiocarbon atoms on Earth. While these isotopes aren't dangerous on their own, a spike in their levels could

indicate that energy from a distant supernova has traveled hundreds to thousands of light-years to our planet.

To test the hypothesis, Brakenridge turned to the past. He assembled a list of supernovas that occurred relatively close to Earth over the last 40,000 years. Scientists can study these events by observing the nebulas they left behind. He then compared the estimated ages of those galactic fireworks to the tree ring record on the ground.

He found that of the eight closest supernovas studied, all seemed to be associated with unexplained spikes in the radiocarbon record on Earth. He considers four of these to be especially promising candidates. Take the case of a former star in the Vela constellation. This celestial body, which once sat about 815 light-years from Earth, went supernova roughly 13,000 years ago. Not long after that, radiocarbon levels jumped up by nearly 3% on Earth—a staggering increase.

The findings aren't anywhere close to a smoking gun, or star, in this case. Scientists still have trouble dating past supernovas, making the timing of the Vela explosion uncertain with a possible error of as much as 1,500 years. It's also not clear what the impacts of such a disruption might have been for plants and animals on Earth at the time. But Brakenridge believes that the question is worth a lot more research.

"What keeps me going is when I look at the terrestrial record and I say, 'My God, the predicted and modeled effects do appear to be there.'"

He hopes that humanity won't have to see those effects for itself anytime soon. Some astronomers think they've picked up signs that Betelgeuse, a red giant star in the constellation Orion, might be on the verge of collapsing and going supernova. And it's only 642.5 light-years from Earth, much closer than Vela.

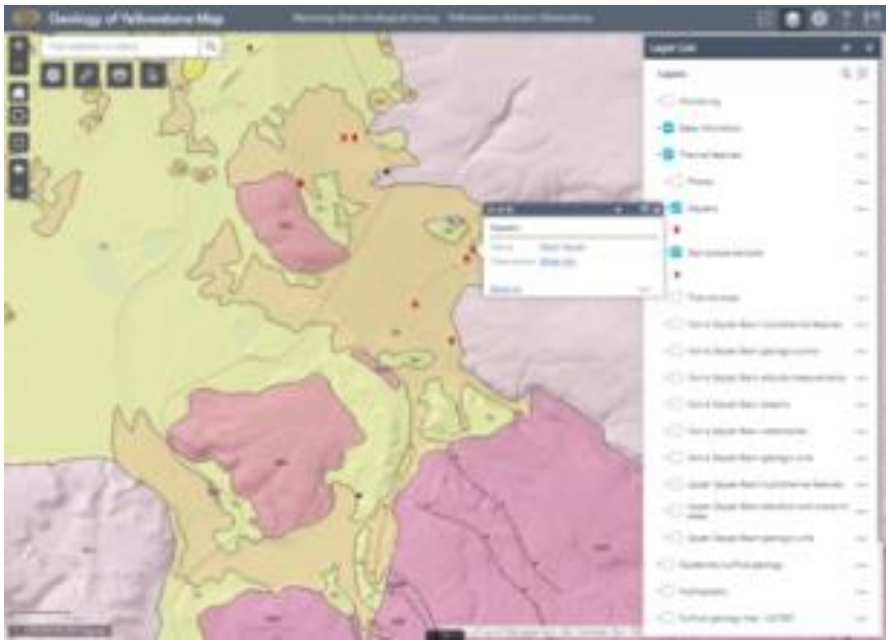
"We can hope that's not what's about to happen because Betelgeuse is really close," he said.

New Interactive Map on Yellowstone's Geology

By James Mauch, Wyoming State Geological Survey. From U.S Geological Survey (USGS), Yellowstone Caldera Chronicles, June 1, 2020.
https://www.usgs.gov/center-news/new-interactive-map-yellowstone-s-geology

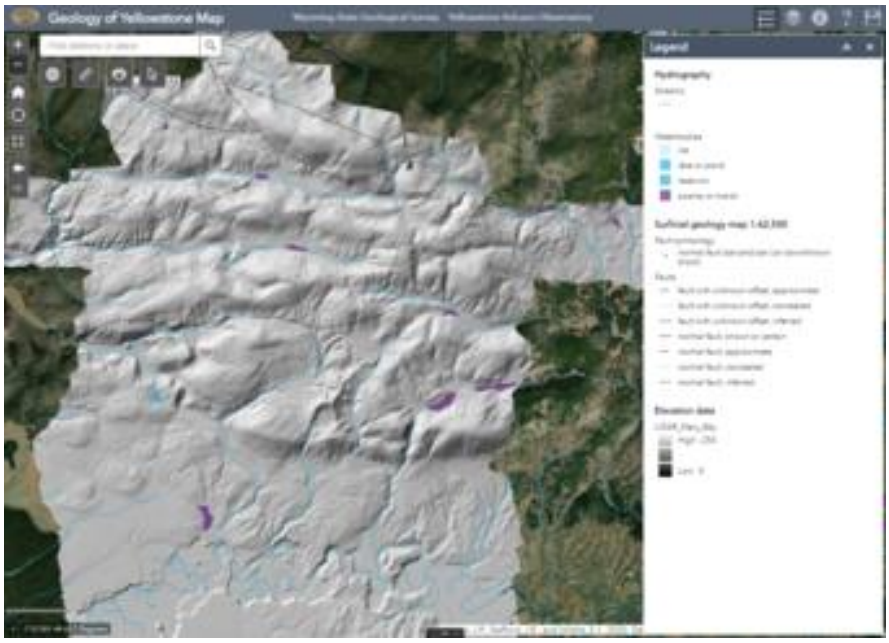
If you're as into Yellowstone geology as we are, then you probably enjoy staring at maps of the park's geology, earthquake activity and other details. For the most part, though, this information has been hosted on different websites by different institutions. Not anymore. The Wyoming State Geological Survey (WSGS)—one of the YVO member institutions—has created an online interactive map all about Yellowstone! The Geology of Yellowstone Map displays a wealth of geospatial data and provides scientists, managers, and the general public with a one-stop-shop to digitally explore Yellowstone's unique geologic landscape.

To develop the map, the WSGS compiled publicly available geospatial data from YVO partners and other external sources. Traditionally, anyone wishing to access geology-related geospatial data for Yellowstone has had to search online, download, and view these datasets individually. This can be time consuming when dealing with multiple datasets from different sources, and downright impossible for those who do not have access to a geographic information system. This new map allows users to easily view data and link back to the original data sources—an Internet connection is all that's required.



Geology of Yellowstone Map zoomed into the Lower Geyser Basin. This view shows a park-wide geologic map overlaid on a shaded relief layer from a digital elevation model. Red diamonds and black circles show geysers and gas sample locations, respectively. (Public domain.).

The Geology of Yellowstone Map contains nearly 100 distinct layers that users can toggle on and off to show and hide. Many of the map layers, including several bedrock and surficial geologic maps that cover the entire park, were published by the U.S. Geological Survey and National Park Service. Users will also find layers depicting Yellowstone's thermal features, water resources, topography, geologic hazards, and basic orientation information.



A Light Detection and Ranging (LiDAR) shaded relief image overlaid on an aerial imagery basemap. The Sulphur Hills, part of the Sour Creek Resurgent Dome, are visible in the upper half of the image, while the floodplain and meanders of Pelican Creek are visible at the bottom. Black lines show faults, blue lines symbolize watercourses, and shaded polygons show waterbodies (Public domain.).

So where do I find this map, and how do I use it? Access the map through the direct link or via the interactive maps panel on the WSGS homepage. An initial welcome screen will walk you through some of the map functions, and after that you're free to explore!

Users can interactively pan and zoom to areas of interest on the map, search for specific locations in the search bar, and open attribute tables to view the data in tabular form. Clicking on a feature leads to a pop-up window with more information. Menus on the map provide an explanation of each layer and a web link to the original data source. This is helpful for users who want more information or would like to download the data for themselves.

The abundance of geologic data contained in the Geology of Yellowstone Map pairs well with the real-time monitoring data displayed in YVO's Monitoring Map. These two maps can be used together to paint a comprehensive picture of Yellowstone's geologic history and present activity.

The WSGS plans to make ongoing updates and additions to the map as new studies are published and more data are released. The agency welcomes suggestions on how to improve the Geology of Yellowstone Map going forward and encourages inquiries from researchers interested in displaying their data on the map. Get in touch at wsgs-info@wyo.gov.

Whether as a tool for geologic research and data access, or as a portal for armchair exploration and dreaming about your next trip, the Geology of Yellowstone Map provides a treasure trove of geospatial information at your fingertips. So take a look, and happy mapping!

Schöllenen Gorge

From Earth Science Picture of the Day, October 26, 2020
Photographer: Michela Meda; Summary Author: Michela Meda and Stu Witmer
https://epod.usra.edu/blog/2020/10/schollenen-gorge.html

The Schöllenen Gorge, shown above, is an excellent place to see the effects of the collision of the African and European tectonic plates. It's located in the canton of Uri, Switzerland, between the municipalities of Göschenen in the north and Andermatt in the south. The gorge is situated on the Ruess River in the southern part of the Central Aar Granite, a granitic batholith that intruded about 300

million years ago. Up to 1,968 ft (600 m) in depth, the gorge shows the fracture systems brought about primarily by uplift and shear as the continents moved together.

An impediment to travel throughout human history, bridges have been built across the gorge since the 13th century. The first stone bridge, called the Devil's Bridge, was built about 1585. Photo taken August 11, 2020.

Photo Details: Pentax K5 and Smartphone Huawey P20 Lite

Schöllenen Gorge, Switzerland Coordinates: 46.647236, 8.590465

Related links:

Aletsch Glacier

Dent De Morcles

The Geological and Tectonic Framework of Europe

Student links:

Rock Paper Glacier!

Stress and Strain

Earth Observatory

Grosser Aletschgletscher

DATES TO REMEMBER and CANCELLATIONS

Please check online or the contact info below to confirm the status of these events. The list is current as of publication date but may change.

January 21, 2021 – **GSNH Dinner Meeting** – Virtual meeting via Zoom: look from an email from Doug Allen to register. See page 6 for details.

March 11, 2021 – **GSNH Board of Directors Meeting** – location TBD

March 14-16, 2021 – **Geological Society of America Northeastern Section Meeting** – online meeting: https://www.geosociety.org/GSA/Events/Section_Meetings/GSA/Sections/ne/2021mtg/home.aspx

March 2021 – **NH Water & Watershed Conference** – **Cancelled for 2021**

March 31 – April 1, 2021 – **Maine Sustainability & Water Conference** – online, virtual format for 2021. https://umaine.edu/mitchellcenter/event/2021-maine-sustainability-water-conference/

April 15, 2021 – **GSNH Dinner Meeting** – location TBD

April 17 -18, 2021 – **Southeastern New Hampshire Mineral Club Show** – 282 Durham Road (Dover Elks Lodge #184), Dover, NH.

May 17 – 19, 2021 – **Geological Association of Canada/Mineralogical Association of Canada (GAC-MAC) Joint Annual Meeting** – hybrid in-person (London, Ontario) and virtual meeting. https://gacmac2021.ca/

Looking for some continuing ed credits? Some webinar series are below:

- clu-in.org compiles webinars of interest to EPA and the environmental community here: https://clu-in.org/training/#upcoming
- The geoscience online learning initiative (GOLI) has several webinars and short courses that are free, but do include an administrative fee for continuing ed credits: https://www.americangeosciences.org/workforce/goli

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Remembering Jason Fopiano

Jason Fopiano died on November 13 at the age of 43 from complications of multiple sclerosis. He leaves behind his wife, Abby (GSNH treasurer and webmaster), daughter Roslyn, parents Shirley and Stephen, sister Nicole, and brother Stephen. Jason was an active member of GSNH, UNH graduate, and regulator for New Hampshire Department of Environmental Services (NHDES).

Jason was born on August 10, 1977 in Stoughton, Massachusetts, and grew up in Marshfield, Mass. From a young age, Jason was an avid outdoorsman and loved spending time in the mountains. After high school, Jason headed to Penn State, where he majored in chemical engineering, introduced the

college's Outing Club to his favorite hikes in the Whites, and got hooked on Big 10 football. He later enrolled in graduate school at UNH, earning a masters degree in geochemical systems. He was employed as an environmental engineer in the private sector before working for NHDES.

Muriel Robinette noted, *I had the privilege of first meeting Jason when he applied for a position at New England EnviroStrategies. Jason had a calm dignity about him that impressed me of his maturity and life perspectives beyond his age. As he worked with us on a variety of forensic projects, he delighted us with his astute observations, quiet demeanor and understated dry humor. Jason was a delight to work with, always reliable and a consummate team player. The geological community is missing a wonderful human being. RIP Jason.*

Please address condolences and remembrances to Abby and Roslyn Fopiano at 615 Cherry Valley Road, Gilford, NH 03249. Abby wanted to note that she is very grateful for the sympathies and heartfelt notes received from their "geo-geek" family over the past month. Abby writes, "Jason really loved being a part of this industry and especially enjoyed the company, conversation and comradery of GSNH."

Virtual Travel – Colorado by Drone

The following link has some nice drone footage of Colorado scenery, if you would like some virtual travel this winter: https://player.vimeo.com/video/186483277

Still from drone footage in video linked above

NH Board of Professional Geologists Updates

From Nikki Delude Roy, Chair of the NH Board of Professional Geologists

We will have four new NH Professional Geologists (PGs) based on the results of the October 2020 Association of State Boards of Geologists (ASBOG) exam. In addition, at the most recent Board meeting (December 10), four applicants were approved to take the full exam for PG licensure and there were two applicants for the Fundamentals exam (to become geologists in training, or GITs).

As a reminder, the Governer's emergency order #29 has waived all continuing education requirements for those licenses that were scheduled to renew between March 13, 2020, and December 31, 2020. This order has not been extended past December 31.

The deadline for professional geologist (PG) licensure applications was December 1st for those who wanted to take the March 19, 2021 ASBOG exam. The next 2021 ASBOG exam date is October 1.

Finally, a new Standing Order now authorizes the Office of Professional Licensure and Certification (OPLC) enforcement staff to receive and investigate complaints of alleged professional misconduct in violation of professional licensure statutes and/or administrative rules (pursuant to NH RSA 310-A: 1-d, II(2)).

Top New Hampshire Geological Formations according to TripAdvisor

https://www.tripadvisor.com/Attractions-g28950-Activities-c57-t59-New_Hampshire.html

Many New Hampshire geologists will be familiar with these points of interest (they're not really formations in a geological sense, but that's ok). Do you agree with the ranking?

1. The Basin at Franconia Notch State Park, Franconia
2. Cathedral Ledge, North Conway
3. The Flume Gorge, Franconia
4. Quechee Gorge, Quechee, VT
5. Black Cap Hiking Trail, North Conway
6. Old Man of the Mountain Profile Plaza, Franconia
7. Indian Head, Lincoln

8. Sculptured Rocks Natural Area, Hebron

9. White Horse Ledge, North Conway

10. Crawford Notch, Hart's Location

11. Tuckerman's Ravine, Sargent's Purchase

12. Madison Boulder, Madison

13. Sandwich Notch, Sandwich

Magma 'Conveyor Belt' Fueled World's Longest Erupting Supervolcanoes

From Curtin University. November 4, 2020. Updated November 10, 2020.
https://news.curtin.edu.au/media-releases/magma-conveyor-belt-fuelled-worlds-longest-erupting-supervolcanoes/

International research led by geologists from Curtin University has found that a volcanic province in the Indian Ocean was the world's most continuously active — erupting for 30 million years — fuelled by a constantly moving 'conveyor belt' of magma.

It's believed this magma 'conveyor belt,' created by shifts in the seabed, continuously made space available for the molten rock to flow for millions of years, beginning around 120 million years ago.

Research lead Qiang Jiang, a PhD candidate from Curtin's School of Earth and Planetary Sciences, said the studied volcanoes were in the Kerguelen Plateau, located in the Indian Ocean, about 3,000 kilometres south west of Fremantle, Western Australia.

"Extremely large accumulations of volcanic rocks — known as large volcanic provinces — are very interesting to scientists due to their links with mass extinctions, rapid climatic disturbances, and ore deposit formation," Mr Jiang said.

"The Kerguelen Plateau is gigantic, almost the size of Western Australia. Now imagine this area of land covered by lava, several kilometres thick, erupting at a rate of about 0.2 millimetres every year.

"0.2 millimetres of lava a year may not sound like much but, over an area the size of Western Australia, that's equivalent to filling up 184,000 Olympic-size swimming pools to the brim with lava

every single year. Over the total eruptive duration, that's equivalent to 5.5 trillion lava-filled swimming pools!

"This volume of activity continued for 30 million years, making the Kerguelen Plateau home to the longest continuously erupting supervolcanoes on Earth. The eruption rates then dropped drastically some 90 million years ago, for reasons that are not yet fully understood.

"From then on, there was a slow but steady outpouring of lava that continued right to this day, including the 2016 eruptions associated with the Big Ben volcano on Heard Island, Australia's only active volcano."

Co-researcher Dr Hugo Olierook, also from Curtin's School of Earth and Planetary Sciences, explained such a long eruption duration requires very peculiar geological conditions.

"After the partial breakup of the supercontinent Gondwana, into the pieces now known as Australia, India and Antarctica, the Kerguelen Plateau began forming on top of a mushroom-shaped mantle upwelling, called a mantle plume, as well as along deep sea, mid-oceanic mantle ridges," Dr Olierook said.

"The volcanism lasted for so long because magmas caused by the mantle plume were continuously flowing out through the mid-oceanic ridges, which successively acted as a channel, or a 'magma conveyor belt' for more than 30 million years.

"Other volcanoes would stop erupting because, when temperatures cooled, the channels became clogged by 'frozen' magmas.

"For the Kerguelen Plateau, the mantle plume acts as a Bunsen burner that kept allowing the mantle to melt, resulting in an extraordinarily long period of eruption activity."

Research co-author, Professor Fred Jourdan, Director of the Western Australia Argon Isotope Facility at Curtin University, said the team used an argon-argon dating technique to date the lava flows, by analysing a range of black basaltic rocks taken from the bottom of the sea floor.

"Finding this long, continuous eruption activity is important because it helps us to understand what factors can control the start and end of volcanic activity," Professor Jourdan said.

“This has implications for how we understand magmatism on Earth, and on other planets as well.”

The Curtin-led research was a collaboration with Uppsala University in Sweden and the University of Tasmania.

The research paper, *Longest continuously erupting large igneous province driven by plume-ridge interaction* was published in *Geology* and can be found online here.

University of Vermont Plans to Cut Geology Program

On December 2, the University of Vermont announced a proposal to cut 12 majors, 11 minors, and 4 masters’ programs from its College of Arts and Sciences, including geology (BA and BS) undergraduate majors, undergraduate minors, and graduate program. Other colleges in the university were not targeted for program cuts. The cuts were made in response to an $8.6 million budget deficit. The geology department on average had about 27 students over the last three years and awarded on average 7 degrees. The proposed changes would not take effect until after the spring term.

For more information, see the articles below:

- Burlington Free Press, December 3: These UVM programs could be on the chopping block to make up for $8.6 million deficit: https://www.burlingtonfreepress.com/story/news/2020/12/03/uvm-proposals-cut-12-majors-other-programs-respond-deficit/3806864001/
- Inside Higher Ed, December 7: Not-So-Fait Accompli: https://www.insidehighered.com/news/2020/12/07/u-vermont-faculty-members-pledge-fight-planned-cuts-liberal-arts
- VTDigger, December 7: UVM provost stands by the administration’s plan to cut 23 humanities programs: https://vtdigger.org/2020/12/07/uvm-provost-stands-by-the-administrations-plan-to-cut-23-humanities-programs/

Point Gratiot Disconformity

From Earth Science Picture of the Day, December 14, 2020
Photographer/Summary Author: James R. Ebert
https://epod.usra.edu/blog/2020/12/point-gratiot-disconformity.html

Point Gratiot, a rocky headland in Dunkirk, New York, protrudes one kilometer into Lake Erie, one of the Laurentian Great Lakes. The point is underlain by the Upper Devonian Dunkirk Shale, a black shale deposited under anoxic conditions in the Appalachian Foreland Basin during the Acadian Orogeny. Here, the Dunkirk Shale is overlain by Pleistocene glacial deposits producing a disconformity that represents the loss of approximately 375 million years of Earth's history.

The eastern side of Point Gratiot (upper picture) is usually difficult to access. However, during fall 2020, a small beach formed at the base of the cliff enabling access. The shale clearly shows two sets of joints (stress release fractures) that are nearly perpendicular to each other.

The lower photo shows the disconformity between the Devonian shale and the Pleistocene glacial sediments. The top of the shale is marked with glacial striations and grooves accented by sand blown from the adjacent beach. This erosional surface is overlain by 10-20 cm of cobble-bearing glacial till deposited directly by the ice. Above the till is over one meter of well-sorted silt that displays spectacular contorted bedding. Contorted bedding results from the rapid dewatering of sediment as it compacts. This silt was deposited in the Pleistocene precursors of Lake Erie. Photos taken October 13, 2020.

Point Gratiot, New York Coordinates: 42.4882, -79.35304

Related Links

Glacial Grooves State Memorial

Devonian Black Shales of Western New York

Penecontemporaneous Deformation Structures

Strand lines and chronology of the Glacial Great Lakes in Northwestern New York

Student Links

Keeping Up with Coastal Erosion

Earth Observatory

Coastal Spit, Lake Erie

[ed. note: The outcrops at Point Gratiot show the effects of the global first Kellwasser Event or crisis at the end of the Frasnian. The Hangenberg Event occurred 13 MA later at the end of the Famennian, i.e., the Devonian-Mississippian boundary.]

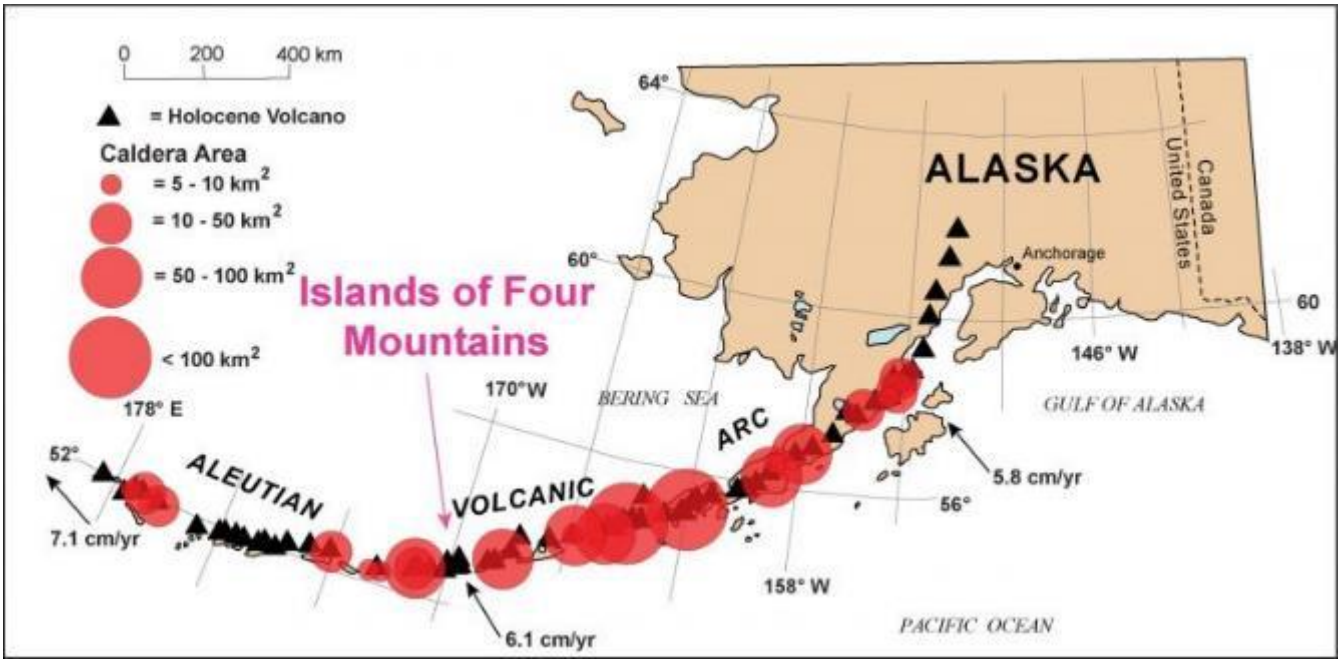
Cluster of Islands in Alaska Could Be Single Gigantic Interconnected Volcano

By American Geophysical Union. December 8, 2020. From SciTech Daily:
https://scitechdaily.com/cluster-of-islands-in-alaska-could-be-single-gigantic-interconnected-volcano/

A small group of volcanic islands in Alaska's Aleutian chain might be part of a single, undiscovered giant volcano, say scientists that presented the findings Monday, December 7, 2020, at AGU's Fall Meeting 2020. If the researchers' suspicions are correct, the newfound volcanic caldera would belong to the same category of volcanoes as the Yellowstone Caldera and other volcanoes that have had super-eruptions with severe global consequences.

An aerial oblique photo of the volcanoes in the Islands of Four Mountains, Alaska, taken in July 2014. In the center is the summit of Mount Tana. Behind Tana are (left to right) Herbert, Cleveland, and Carlisle Volcanoes. Credit: John Lyons/USGS.

The Islands of the Four Mountains in the central Aleutians is a tight group of six stratovolcanoes named Carlisle, Cleveland, Herbert, Kagamil, Tana and Uliaga. Stratovolcanoes are what most people envision when they think of a volcano: a steep conical mountain with a banner of clouds and ash waving at the summit. They can have powerful eruptions, like that of Mount St. Helens in 1980, but these are dwarfed by far less frequent caldera-forming eruptions.



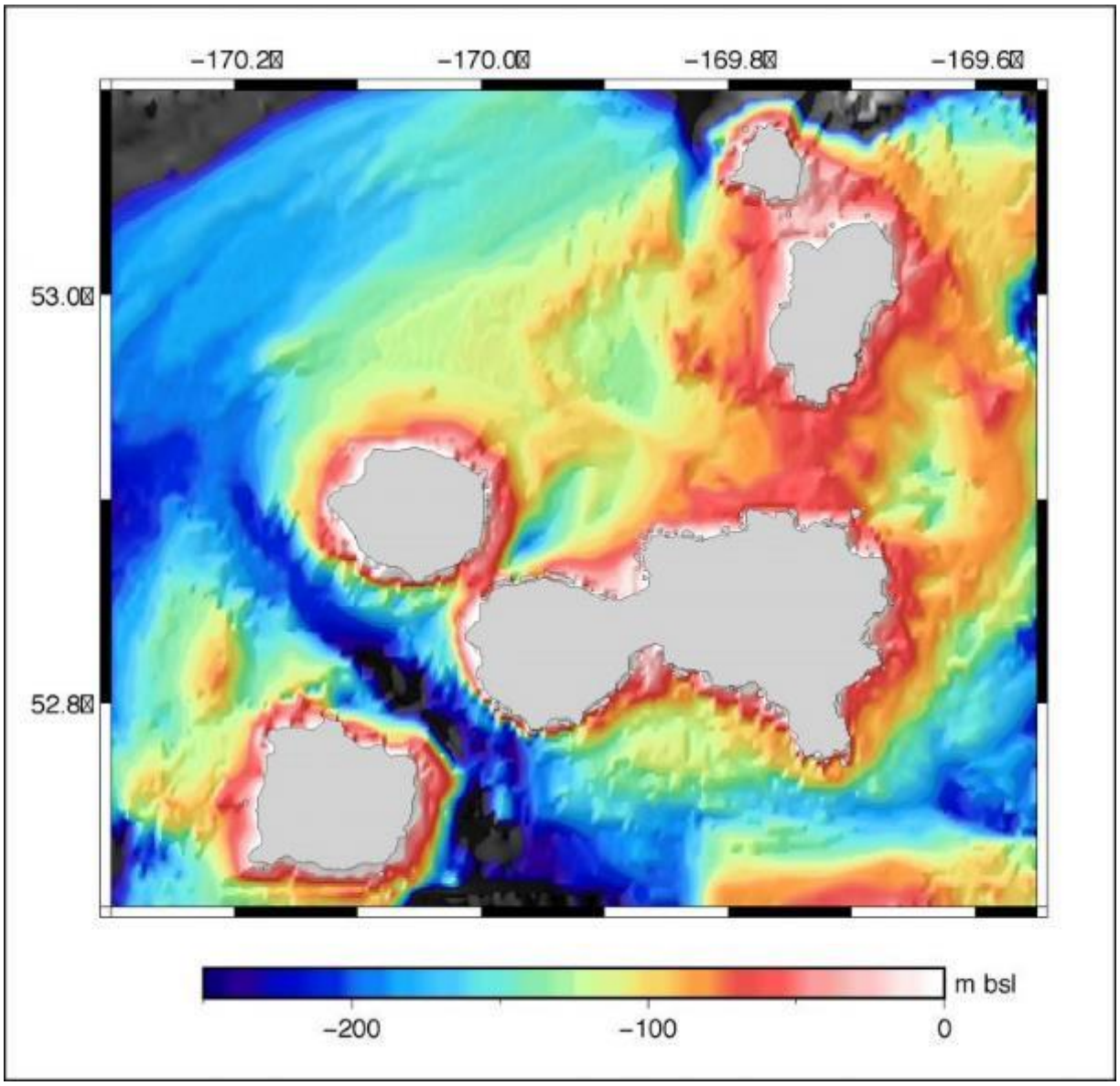
Location map of the Islands of Four Mountains in the Aleutian arc. This also shows the position and approximate areas of known calderas along the arc. Credit: John Power/USGS.

Researchers from a variety of institutions and disciplines have been studying Mount Cleveland, the most active volcano of the group, trying to understand the nature of the Islands of the Four Mountains. They have gathered multiple pieces of evidence showing that the islands could belong to one interconnected caldera.

Unlike stratovolcanoes, which tend to tap small- to modestly-sized reservoirs of magma, a caldera is created by tapping a huge reservoir in the Earth's crust. When the reservoir's pressure exceeds the strength of the crust, gigantic amounts of lava and ash are released in a catastrophic episode of eruption.

Caldera-forming eruptions are the most explosive volcanic eruptions on Earth and they often have had global effects. The ash and gas they put into the atmosphere can affect Earth's climate and trigger social upheaval. For example, the eruption of nearby Okmok volcano in the year BCE 43 has been recently implicated in the disruption of the Roman Republic. The proposed caldera underlying the Islands of the Four Mountains would be even larger than Okmok. If confirmed, it would become the first in the Aleutians that is hidden underwater, said Diana Roman of the Carnegie Institution for Science in Washington, D.C., co-author of the study.

"We've been scraping under the couch cushions for data," said Roman, referring to the difficulty of studying such a remote place. "But everything we look at lines up with a caldera in this region."



The bathymetry for the Islands of Four Mountains area, based on depth soundings collected in the mid-20th century. Credit: Hélène Le Mével

Despite all these signs, Roman along with John Power, a researcher with the U.S. Geological Survey at the Alaska Volcano Observatory and the study's lead author, maintain that the existence of the caldera is not by any means proven. To do that the study team will need to return to the islands and gather more direct evidence to fully test their hypothesis.

"Our hope is to return to the Islands of Four Mountains and look more closely at the seafloor, study the volcanic rocks in greater detail, collect more seismic and gravity data, and sample many more of the geothermal areas," Roman said.

The caldera hypothesis might also help explain the frequent explosive activity seen at Mount Cleveland, Roman said. Mount Cleveland is arguably the most active volcano in North America for at

least the last 20 years. It has produced ash clouds as high as 15,000 and 30,000 feet above sea level. These eruptions pose hazards to aircraft traveling the busy air routes between North America and Asia.

Mount Cleveland's summit crater emits a vigorous steam and gas plume. The small lave dome with a diameter of roughly 50 m is present within the summit crater. Credit: Cindy Werner/USGS

"It does potentially help us understand what makes Cleveland so active," said Power, who will present the work. "It can also help us understand what type of eruptions to expect in the future and better prepare for their hazards."

Reference: "Multi-Disciplinary Evidence for a Large, Previously Unrecognized Caldera in the Islands of Four Mountains, Central Aleutian Arc, Alaska" by John A Power, Diana C. Roman, Kirsten P Nicolaysen, Pavel E Izbekov, Cynthia A Werner, Helen A Janiszewski, Daniel Evan Portner, Lara S Wagner, Terry A Plank, Daniel J. Rasmussen, John J Lyons, Matthew M Haney, Helene Le Mevel1and Max Kaufman, 7 December 2020, *AGU Fall Meeting 2020*.
Abstract

Legislative Committee Report – December 2020

By Tom Fargo

The November 3, 2020 election has resulted in the Republican Party holding majorities in both the NH House and Senate, along with the re-election Republican Governor Sununu. During the first year of each biennium, the General Court prepares the State budget. The impacts of the COVID-19 pandemic will create great challenges for balancing revenues and expenditures in the upcoming two-year budget. As of this writing, it is unclear how the General Court, particularly the 400-member House of Representatives, will conduct its business with public health protection measures in place. There are significant partisan differences relative to precautions to be followed. Neither the State Capitol nor the Legislative Office Buildings have air filtration systems. The Joint Session scheduled for January 7, 2021, for the Governors inauguration, is currently planned to be outdoors in the State House plaza.

The last day for House members to submit Legislative Service Requests (LSRs or proposed bills) is December 30, 2020. Senate-introduced bills do not have an early deadline. Expectations are that the usual number of approximately 1,000 bills submitted each year cannot be managed in the upcoming session. The House rules, which need to be approved by January 15, 2021, may address this reality. The next issue of Granite State Geologist will include a list of bills potentially of interest to GSNH.

New Hampshire Geological Survey - Fieldwork

From Joshua Keeley, New Hampshire Geological Survey (NHGS)

Sometimes it rains during a drought! Photo taken of data upload from a monitoring well in Barnstead, New Hampshire along Little River.

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

Signature: _____ Date: _____