Granite State Geologist

The Newsletter of the Geological Society of New Hampshire,
Spring Edition – March 2023 – Issue No. 120
Newsletter Editor: jlambert@nobis-group.com **Website:** http://www.gsnh.org/

In this issue:

MESSAGE FROM THE PRESIDENT

The October 2022 meeting of the Society was the first in-person gathering of the membership since the start of the COVID pandemic. Based on attendance (which was lighter than expected for a bi-annual Board election meeting), it appeared that society members were still cautious about gathering in group settings or have become accustomed to virtual on-line meetings, or both. Prior to and after the October 2022 meeting, Board members received numerous requests from members to conduct future meetings with both in-person and remote attendance options. It is clear to me that in our post-pandemic world, providing such options may be necessary to sustain a healthy organization.

The December 8, 2022 GSNH Board meeting included in depth discussions about what would be necessary to offer combined on-line and in-person membership meetings. Board members identified the following as essential components for providing such meetings:

1. Those who choose to attend virtually (via Zoom or other platforms) would need to pay a fee, perhaps half the cost for attending in-person. Such a fee would need to be paid in advance to receive a link for the on-line meeting. To make this work, a third-party provider would be needed to receive credit card, PayPal or other electronic transfer payments. Board members are currently evaluating vendors used by similar organizations for processing on-line payments and meeting registrations, and verifying attendance for continuing education certificates.

2. Unlike classroom settings, the venues we normally use for in-person meeting may not have reliable high-speed internet. In addition, we would need to have someone whose technically capable (a moderator) in attendance to assure that the video

and audio stream from the meeting reaches on-line attendees. A moderator would also be needed to relay on-line attendee's questions back to the speaker.

3. Discussions with our usual meeting venue providers have identified significant financial considerations associated with the anticipated reduced number on in-person attendees that will drive up per-meal costs, along with adding bar and other facility use fees. Based on inquiries to date, the Society would need to provide significant financial support to keep the per-meal cost reasonable.

4. Finally, we would need to secure speakers who would be comfortable and adept with presenting to two audiences: in-person and on-line.

Based on the above considerations, the Board, at its March 16th meeting, concluded that the Society is not prepared to offer combined on-line and in-person membership meetings at this time. The next scheduled membership meeting on April 20, 2023, is being planned as on-line only. I hope to see you then.

Thanks, Tom

GSNH T-Shirts Available!

We have a few GSNH T-shirts still available – no XL, and we have just a couple in size L and a few more M and S sizes left. Send in your order before they're gone! T-shirts will be shipped to you. See order form on second to last page (right before the renewal form).

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

New Hampshire Geological Survey Update

By Shane Csiki, State Geologist and Director, March 2023

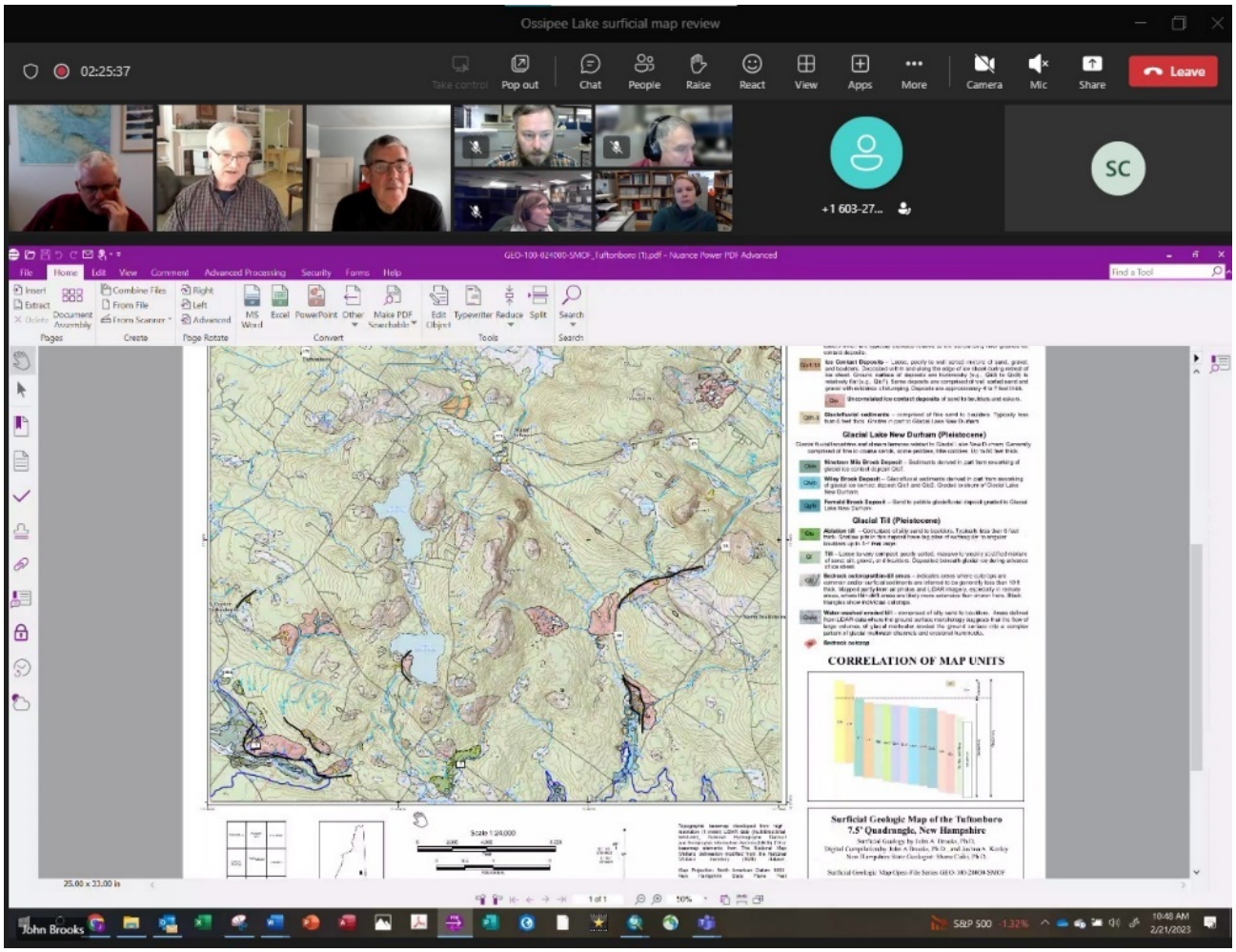
This winter season has found the NHGS team working to put the finishing touches on projects and field work conducted last summer, while also starting to prepare for new and ongoing projects for the summer of 2023. 2023 is already shaping up to be another very busy year for NHGS, across all of our programs.

In fact, as of the morning of this writing, we have received word from the USGS Geologic Data Preservation Program that our grant proposal to repackage the Redstone Core and transport it to a more permanent storage facility will be awarded. As many of you know, a substantial portion of the Redstone Core, which represents New Hampshire's deepest core drilled from the Redstone Quarry in Conway, has resided on the property of a private landowner for more than 20 years. This project, in partnership with Columbia University and the New Hampshire Department of Transportation, will serve to transport the core to a more appropriate climate-controlled geologic core storage facility based at Columbia University. This is a fantastic opportunity to preserve this unique and important geologic resource. NHGS' role will be to repackage the portions of the core with depth information preserved into new core boxes to prepare them for transport this summer. Rebecca LeCain and Mike Howley will be working with me on this project. Stay tuned for more details about the project in a future update!

We have been continuing to implement our Collaborative Peer Review process for geologic maps. With the maps themselves now submitted to USGS, during February and March we have engaged in "Phase 2" of the review process for the maps. In this phase, the maps and companion documents are made available to individuals from the geologic mapping community who agree to review each map prior to a virtual discussion. These discussions have exceeded all expectations for considering ideas and will lead to higher-quality published maps. In fact, the discussions have run over their originally scheduled allotted time, with participants still engaged in lively debate. We completed the sessions for all but one of the 1:24,000 scale maps from the 2022 field season. The mappers are currently working with Josh Keeley on their edits. NHGS will host the remaining discussions for the Cowen Hill bedrock geologic map and three surficial 1:100,000 compilation maps during the month of March.

NHGS will be the host to a suite of summer interns once again this year. We will have 6 interns in total. Two interns will be working as a team on stream crossing field assessments and data cleanup, while two additional interns will be working with Brian Hauschild to perform quality control review of incoming stream crossing data from collectors around the state, and from an NHDES funded project in southeast New Hampshire, with UNH. We will have one intern working with both me and Mike Howley to address a variety of tasks associated with both our stream crossing and subsurface geologic

datasets. Lastly, we will be hosting one intern who will be performing field mapping with both contract mapper Dyk Eusden (north half of Shelburne quadrangle, bedrock) and Josh Keeley (south half of Mount Osceola quadrangle, surficial).



NHGS' annual geologic mapping workshop will be held on Tuesday, April 4 in the NHDES Auditorium, and more information is provided elsewhere in this GSNH newsletter (page 24). We will be having a presentation by Mary DiGiacomo-Cohen from the USGS on some of her early efforts to use machine learning techniques to develop draft delineations of surficial geologic map units to aid the creation of surficial geologic maps, as well as updates and discussions of NHGS activities and that of our mappers.

As you can see, we've been busy and another busy year is ahead. As always, if you have any suggestions as to how NHGS can better serve you, please reach out to any NHGS staff member.

Have You Renewed your Membership?

It's now 2023, so consider renewing your membership if you haven't already! With your membership, you get a discount on dinner meetings (which will happen at some point!) and field trips, information of upcoming events of interest to the geological community, voting privileges at Society business meetings, and automatic subscription to this newsletter! Membership dues also help to support outreach for the greater community.

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

Geology learning resource: Geology Bites

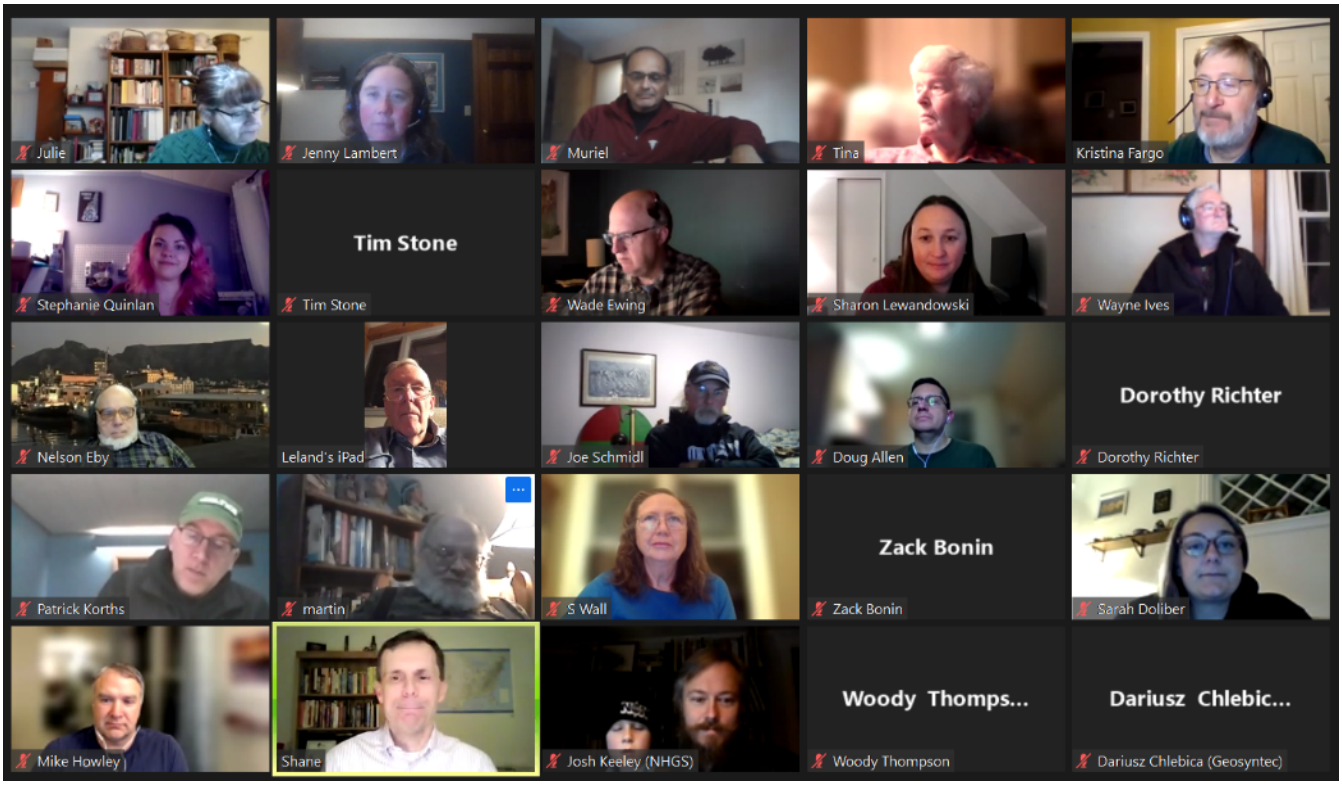
Geology Bites (https://www.geologybites.com/) is a podcast series with more than 70 episodes, each one featuring a different geologist and their research. We highly recommend checking it out!

January 2023 Meeting Presentation Recap

Our winter GSNH meeting was held on January 19 via Zoom. We had a presentation from Thomas Hale, who is a PhD student at the University of Delaware, program assistant for the Minerals, Material and Society (MMS) program at the University of Delaware, and host of the "A Rock & A Hard Place" podcast. He also operates a self-established nonprofit in Virginia called Friends of Mineralogy Virginia (FMVA), which works with industry and teacher associations, along with academic institutions and museums, to increase awareness around minerals. His team recently published their first book on Northern Virginia Trap Rock Quarries and is working on the second focusing on the Mineral Resources of the Virginia Piedmont." His mineral collection is focused on Virginia mineral localities and critical materials.

Thomas Hale was unable to give a live presentation because of unexpected fieldwork, but did provide a recorded presentation. The presentation discussed the importance of minerals and basic components of global supply chains; the key issues and policy changes related to critical minerals, conflict minerals, and rare-earth elements (REEs); the mineral-security nexus and its relationship to national, human, and environmental security; data visualization, and use of mineral diplomacy to explore global issue. The initial plan was to show just the summary presentation, but once that was finished, the group wanted to also watch "second part" of the presentation, which included case studies.

Thomas Hale provided an introduction to the presentation.



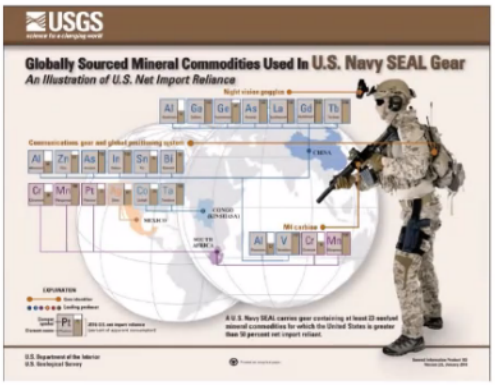
We had good turnout for the presentation. A few slides are provided on the next page.

Critical Minerals

- Critical minerals are defined as "*minerals*" deemed critical to both the economic and national security of the country. They are important for specialized applications, yet they are at risk for supply disruption.
- "Minerals" are a technically a misnomer. Most are elements.
- **What defines a supply risk?** *Single Points of Failure, Concentrated Markets, Political, Cyber, Geo-Hazards, COVID-19**
- Criticality is country specific and fluid depending on market and technology trends (*Who? When?*). Private industry implements their own internal criticality assessments.
- China dominates the mineral industry since the mid 90s. This is a multi-faceted issue from extraction, processing, and manufacturing.
- In 2018, the first critical minerals list was developed, providing 35 critical minerals. On February 22, 2022, the new USGS list was released with 50 total commodities.

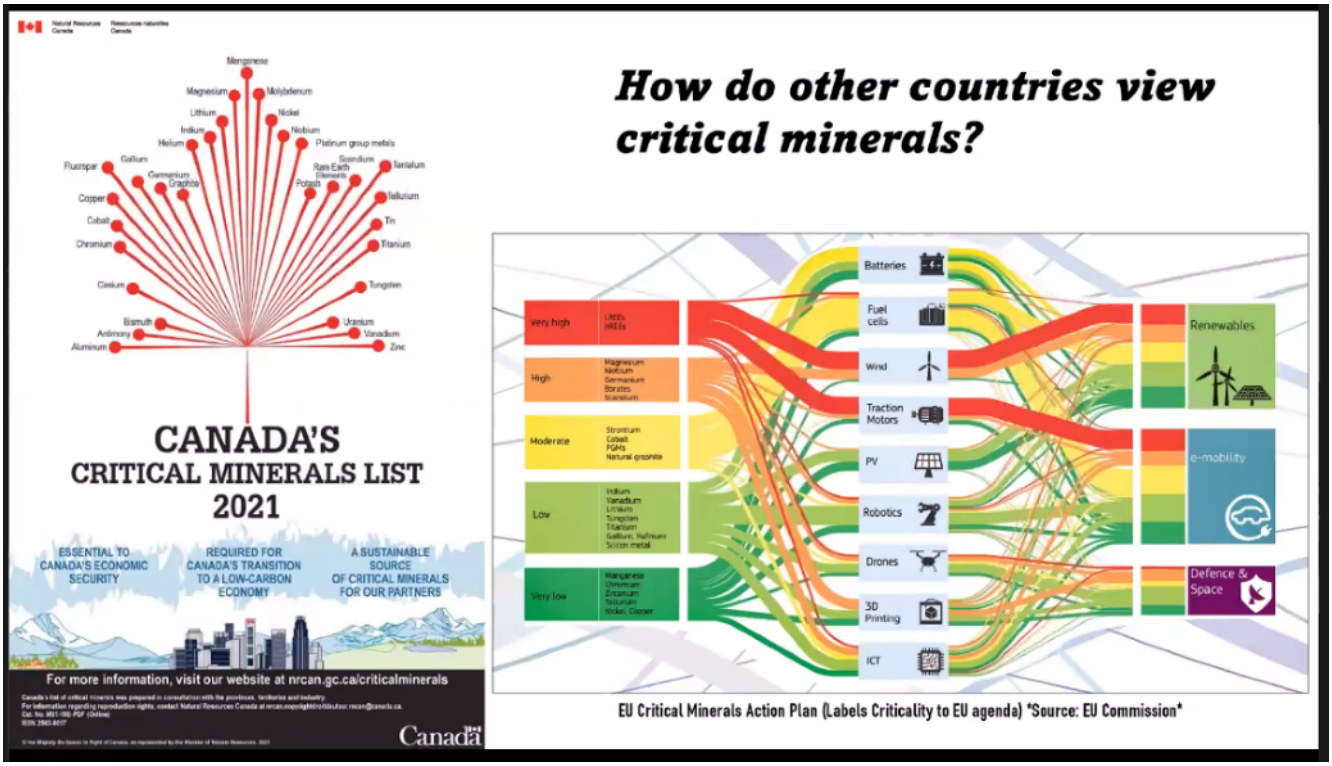
Interesting Notes about 2022 List:

- PGM's and REE's now separated.
- (+) Zinc & Nickel, (-) Uranium, Helium, Strontium, Potash, Rhenium
- The 2022 list of critical minerals is based on data through the year 2018, so impacts of the pandemic are not reflected.



Energy	Technology	Industrial	Steel	Batteries	Research
HAFNIUM	GERMANIUM	BERYLLIUM	MAGNESIUM	LITHIUM	HELIUM
RHENIUM	INDIUM	ZIRCONIUM	CHROMIUM	COBALT	RUBIDIUM
TANTALUM	GALLIUM	TUNGSTEN	TIN	ANTIMONY	CESIUM
URANIUM	RARE EARTHS	ALUMINUM	TELLURIUM	GRAPHITE	BISMUTH
		PGMs	MANGANESE		
		BARITE	VANADIUM		
		FLUORSPAR	NIOBIUM		
		ARSENIC			
		SCANDIUM			
		STRONTIUM			
		TITANIUM			
		POTASH			

Bottom Photo: Visual Capitalist (Data from DOI)



EU Critical Minerals Action Plan (Labels Criticality to EU agenda) *Source: EU Commission*

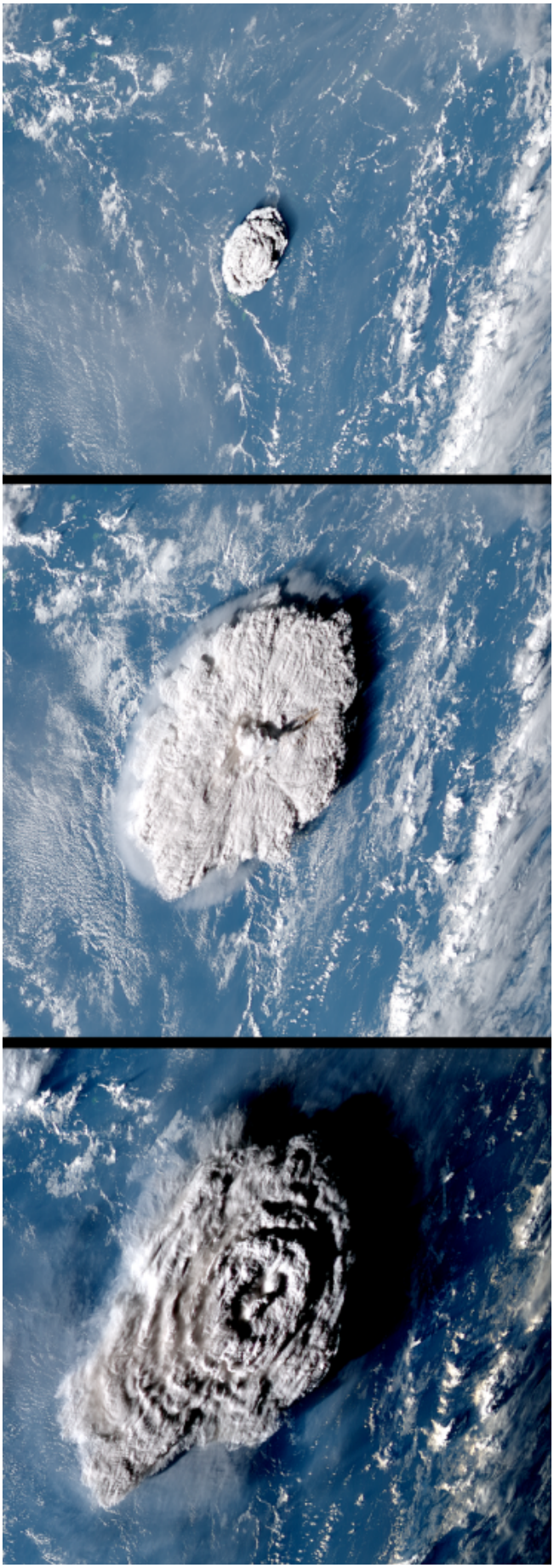
Tonga volcano had highest plume ever recorded, new study confirms

From University of Oxford, November 4, 2022.
https://www.ox.ac.uk/news/2022-11-04-tonga-volcano-had-highest-plume-ever-recorded-new-study-confirms

A new analysis led by Oxford University researchers has shown the devastating Hunga Tonga–Hunga Ha‘apai eruption in January 2022 created the tallest volcanic plume ever recorded. The research has been published in the journal *Science*.

At 57km high (35 miles), the ash cloud generated by the eruption is also the first to have been observed in the mesosphere, a layer of the atmosphere more commonly associated with shooting stars. The previous record-holder, the 1991 eruption of Mount Pinatubo in the Philippines, caused a plume was recorded as 40km high, although accurate satellite images, such as those taken over Tonga, were not available at the time.

The Tonga eruption took place under the sea, around 65km from the country’s main island, causing tsunamis felt as far away as Russia, the United States, and Chile. The waves claimed six lives, including two people in Peru, 10,000km away.



‘It’s the first time we’ve ever recorded a volcanic plume reaching the mesosphere. Krakatau in the 1800s might have done as well, but we didn’t see that in enough detail to confirm,’ said Dr Simon Proud, a National Centre for Earth Observation senior scientist at the University of Oxford and the Science and Technology Facilities Council’s RAL Space facility.

Normally, the height of a volcanic plume can be estimated by measuring the temperature at its top and comparing it to the standard air temperatures found at various altitudes. This is because, in the troposphere, the lowest layer of the Earth’s atmosphere, temperature decreases with height. But, if the eruption is so large the plume penetrates the higher layers of the atmosphere, this method becomes unreliable, as air temperatures begin to increase again with height.

To overcome this problem, the researchers developed a technique based on a phenomenon called ‘the parallax effect’.

This effect can be seen by closing your right eye, and holding out one hand with the thumb raised upwards. If you switch eyes, so your left is closed and your right is open, the thumb will appear to shift slightly against the background. By measuring this apparent change in position, and combining this with the known distance between your eyes, you can calculate the distance between your eyes and your thumb.

The location of the Tonga volcano is covered by three geostationary weather satellites, 36,000km up in space, so the researchers were able to apply the parallax effect to the aerial images these captured.

Crucially, during the eruption itself, the satellites recorded images every 10 minutes, enabling the rapid changes in the plume's trajectory to be documented.

'Thirty years ago, when Pinatubo erupted, our satellites were nowhere near as good as they are now. They could only scan the earth every 30 minutes. Or maybe even every hour,' said Dr Proud.
'We think for Pinatubo we actually missed the peak of the activity and the points where it went the highest: it fell between two of the satellite images and we missed it. In reality it probably went quite a bit higher than the estimates that we have for its height.'

The mesosphere reaches between approximately 48km and 80km high and is the third layer of the atmosphere, above the troposphere and the stratosphere. Meteors falling to earth often burn up in the mesosphere, causing shooting stars in the night sky. It is the coldest part of Earth's atmosphere, with temperatures near the top reaching as low as -143°C.

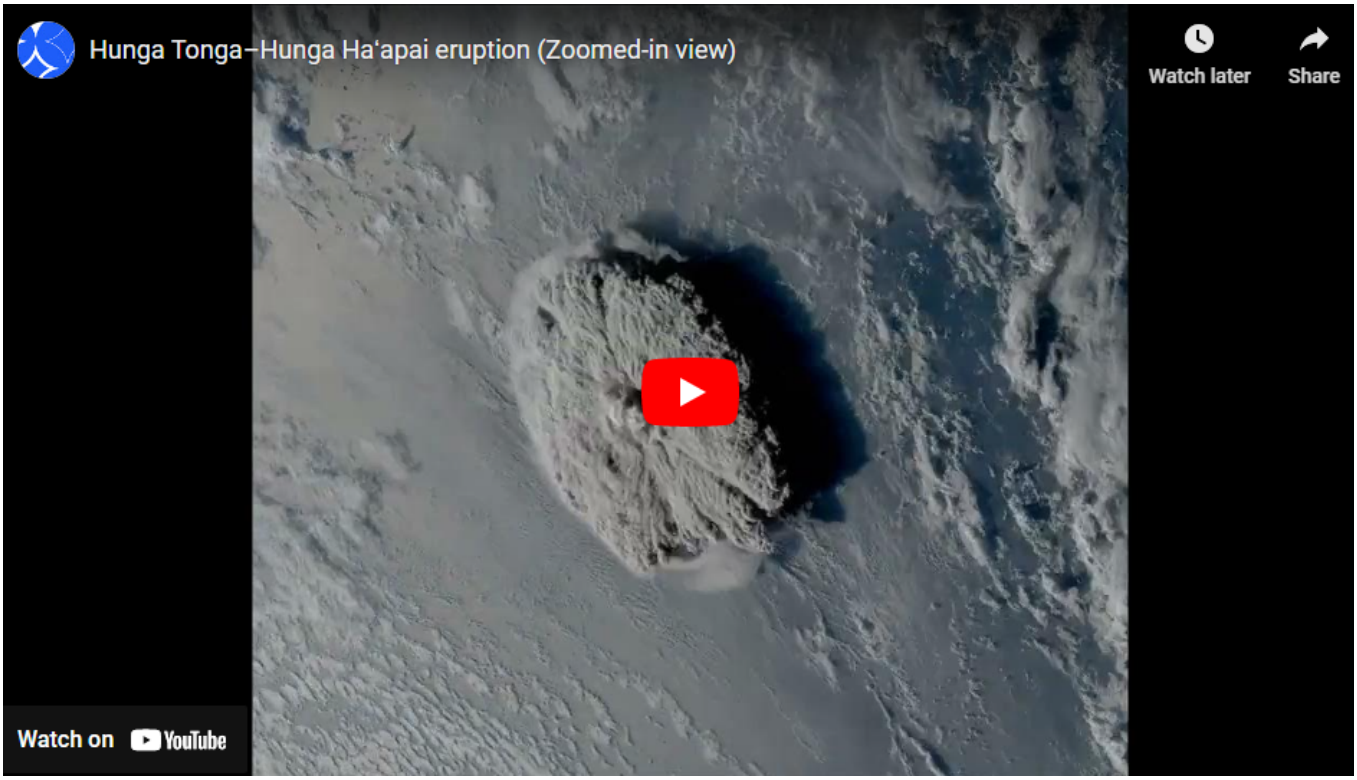
'The interesting thing is, this eruption put a lot of water into the mesosphere, which is usually a very dry part of the atmosphere,' said Dr Proud. 'This makes the eruption a useful test case for how well our climate and weather models can cope with unexpected and extreme conditions.'

The researchers now intend to construct an automated system to compute the heights of volcano plumes using the parallax method. Co-author Dr Andrew Prata from Oxford's department of Atmospheric, Oceanic & Planetary Physics, said, 'We'd also like to apply this technique to other eruptions and develop a dataset of plume heights that can be used by volcanologists and atmospheric scientists to model the dispersion of volcanic ash in the atmosphere.'

'Further science questions that we would like to understand are: Why did the Tonga plume go so high? What will be the climate impact of this eruption? And what exactly was the plume composed of?'

The study, 'The January 2022 eruption of Hunga Tonga-Hunga Ha'apai volcano reached the mesosphere' has been published in the journal *Science*.

The three satellites used to capture and evaluate the eruption were GOES-17 (USA), Himawari-8 (Japan) and GeoKompSat-2A (Korea). The open-access data was processed by the UK's Jasmin Supercomputer at the Science and Technology Facilities Council's Rutherford Appleton Lab.



A zoomed-in view of the Hunga Tonga–Hunga Ha'apai eruption on 15 January 2022, recorded by NOAA's GOES-17 weather satellite [https://youtu.be/pYf6QXn4l4g]. Credit: Simon Proud / STFC RAL Space / NCEO / NOAA

What's Your Board Been Doing?

The GSNH Board of Directors met on Thursday March 16th via Zoom. They discussed the upcoming April meeting (see separate information in this newsletter) and increasing interest in, and membership numbers for, GSNH.

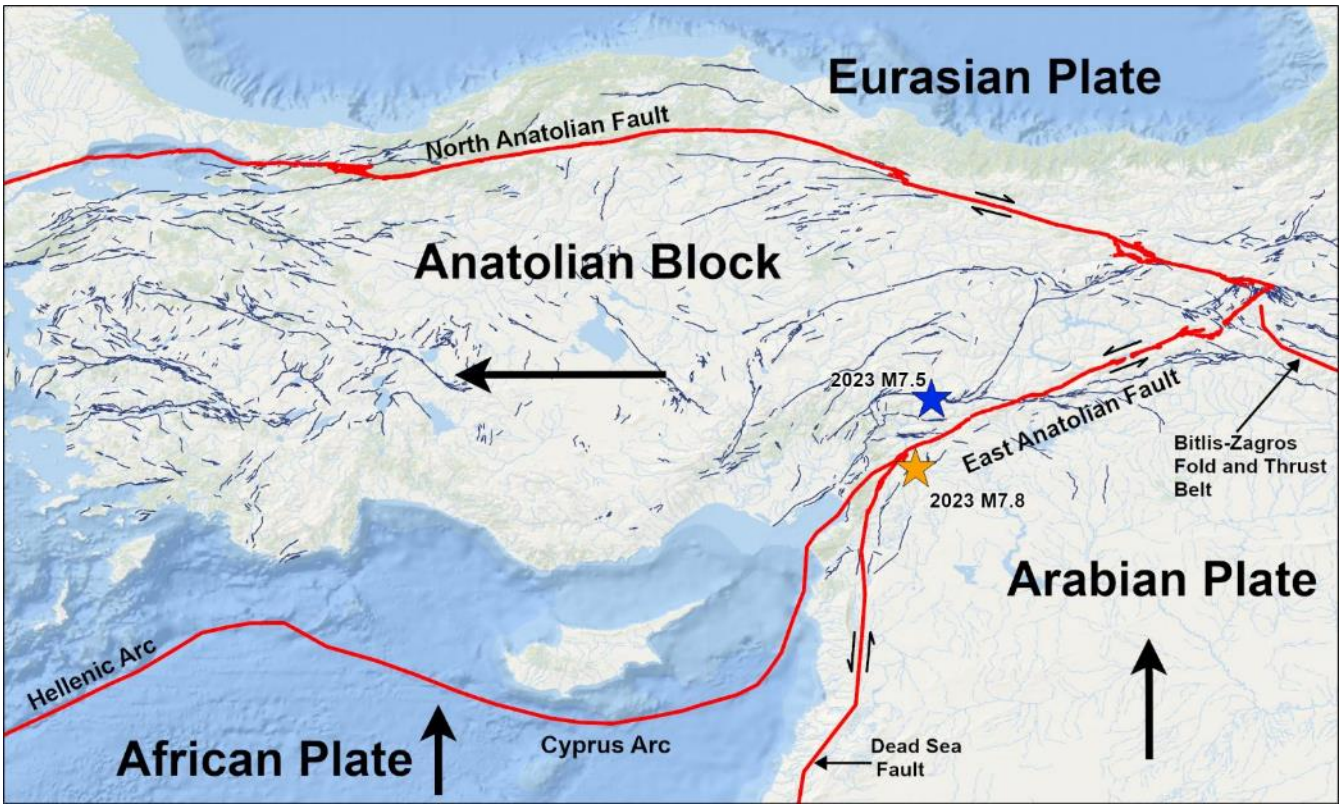
Other matters discussed:

- Recent legislature affecting oversight of professional certifications.
- Logistics for the summer 2023 field trip, more information to come!

New Interactive Geonarrative Explains the 2023 Turkey Earthquake Sequence

From USGS.
https://www.usgs.gov/programs/earthquake-hazards/news/new-interactive-geonarrative-explains-2023-turkey-earthquake

A new geonarrative explains the tectonic setting of Turkey, historical seismicity of Turkey from 1900, details on both the M 7.8 and M 7.5 earthquake sequences, kinematics of the earthquake rupture, remote sensing observations that show displacements across the active faults. Interactive maps show the sequence of earthquakes, including a M 6.7 earthquake on January 24, 2020, that occurred on the adjacent section of the East Anatolian fault. Watch the earthquakes occur on an animated timeline and learn about the stress around the faults before and after the earthquake sequence.



This tectonic map of the Turkey region shows the tectonic plates in the area and their direction of motion (arrows). The red lines indicate the plate boundaries and the small black arrows next to the red lines show the relative motion across the plate boundaries. The gold star shows the location of the M7.8 mainshock on February 6, 2023, and the blue star shows the location of the M7.5 aftershock later on February 6, 2023. Sources/Usage: Public Domain.

[Story map website is here: https://earthquake.usgs.gov/storymap/index-turkey2023.html]

This meteorite material could power our clean energy future

By Kristin Houser, Freethink.com. Published November 21, 2022.
https://www.freethink.com/energy/permanent-magnets

By figuring out how to manufacture in the lab a rare mineral, previously found only in meteorites, two teams of researchers may have just helped secure America's clean energy future.

Permanent magnets

Of the 118 elements on the periodic table, 17 fall into the category of "rare earths," and contrary to their name, these materials aren't terribly rare — each is more common than gold, and one is more plentiful than even copper.

Rare earth elements are used to make a slew of products, from smartphone screens to x-ray machines, but permanent magnets are arguably the most important.

These are objects that, once magnetized, create their own magnetic fields, and we need them to build wind turbines, EV motors, and other products that play a vital role in the battle against climate change.

A shaky supply

Rare earth elements may not be exactly "rare," but because they are widely dispersed in the Earth's crust, miners need to go through the environmentally destructive process of extracting, and processing, a lot of material to get a small amount of rare earths.

That hasn't deterred China from tapping into its large supply of rare earth elements, though — the nation dominates the rare earth market and manufactures more than 90% of the world's rare earth permanent magnets.

Tetrataenite could end the US's reliance on China for permanent magnets — but it's found almost exclusively in meteorites.

The idea

Given the tense US relationship with China — and China's willingness to withhold rare earth elements in response to unrelated political tiffs — it makes sense that the US is looking for ways to reduce its dependence on China for permanent magnets.

The mineral tetrataenite has magnetic properties that make it a leading contender for replacing traditional rare earth elements in permanent magnets. The problem is that it basically doesn't naturally

form on Earth — it's found almost exclusively in meteorites, which cooled extremely slowly over millions of years.

What's new?

In October 2022, two different groups — one at Northeastern University and one at the University of Cambridge — announced that they'd figured out how to make tetrataenite in the lab.

They aren't the first to manufacture the meteorite material, but unlike past techniques — which required scientists to expose iron-nickel alloys to radiation — their methods have the potential for mass production.

How it works

The Northeastern team found that it could manufacture tetrataenite by heating and cooling an iron-nickel alloy, while applying extensional stress and a magnetic field.

Cambridge's technique, meanwhile, centers on the mixing of precise quantities of phosphorus with iron and nickel.

"What was so astonishing was that no special treatment was needed: we just melted the alloy, poured it into a mold, and we had tetrataenite," said lead researcher Lindsay Greer.

Looking ahead

Northeastern researcher Laura Lewis told NPR that her team still needs to test its tetrataenite to see if it holds up against the kind that comes from meteorites. Even if it does, it would be at least 5 to 8 years before it could be used to make permanent magnets.

The Cambridge team says it also needs to research whether its synthetic tetrataenite could be used to make permanent magnets — it hopes to suss that out with the help of major magnet manufacturers.

The big picture

If the US could manufacture its own tetrataenite, it could reduce our dependence on China for permanent magnets, but we'd still be reliant on Chinese supply chains for the rare earth elements needed to make other products.

For that to change, the US will need to explore other sources of these valuable elements, such as the heaps of fly ash leftover from burning coal — or the surface of the moon.

December 28, 2022 rockslide behind the Merrimack Premium Outlets

From Mike Howley

On Wednesday morning, 12/28/22, there was a rockslide along a drilled and excavated rock face located west of (behind) the Merrimack Premium Outlets, which resulted in damage to a gas line and gas leak that closed the mall for the day. The lateral run of the debris is approximately 55 feet, and the height of the rock face is approximately 85 feet (elevation at top 363 ft, elevation at base 278 ft). From the videos and still images, it looks as though the failure occurred along a pre-existing near-vertical joint / fracture plane oriented sub-parallel to the artificial rock face. Frost wedging in the shallow portion of the open, near-vertical fracture is a likely contributor to the rockslide as you can see ice on the rock face from groundwater seeps in the areas adjacent to the failure. Images below are screenshots from aerial video on the WMUR webpage; see story link here:
https://www.wmur.com/article/rockslide-gas-leak-merrimack-premium-outlets/42354678

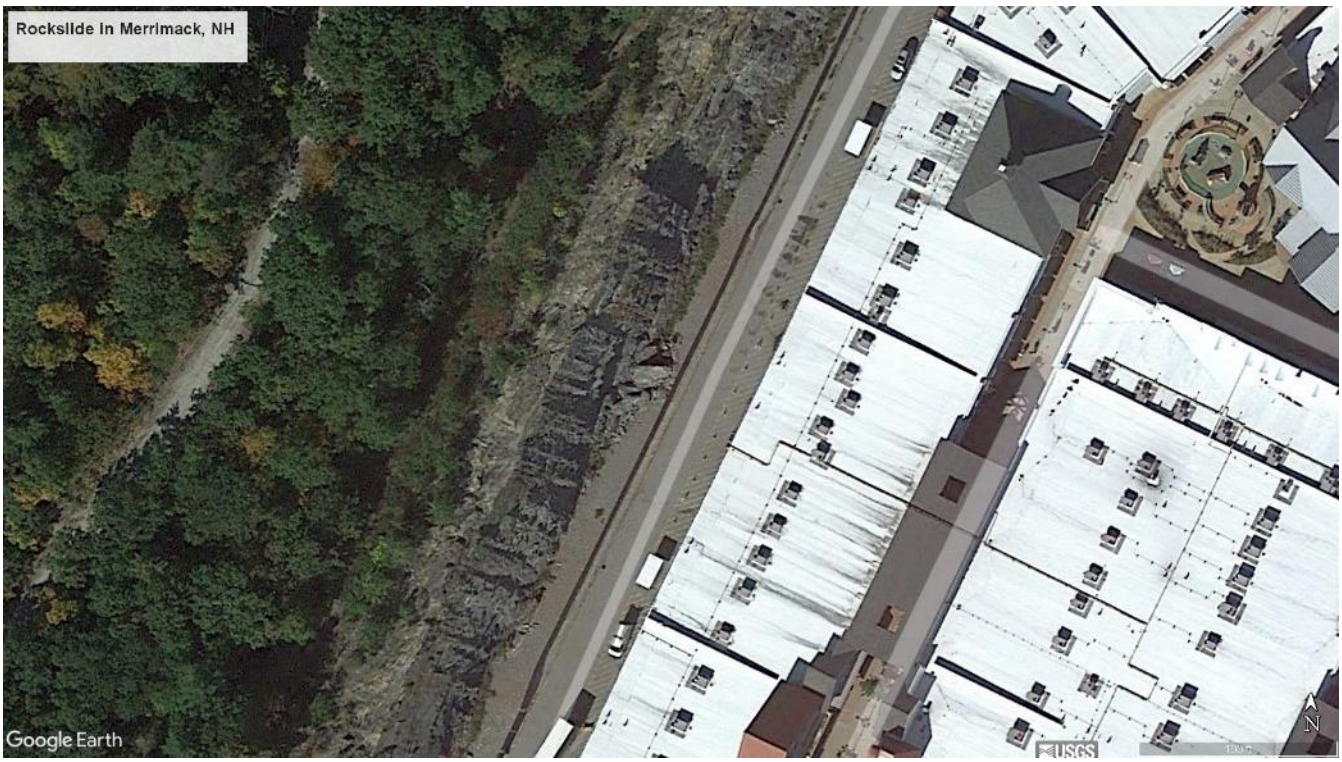
Rockslide looking toward the north. From WMUR video footage.

Rockslide looking toward the southwest. From WMUR video footage.

Close-up of rockslide looking to the southwest. From WMUR video footage.

For a more complete video of the rockslide (more than 6 minutes) see facebook video here:
https://www.facebook.com/7NEWS/videos/1307135276686162/

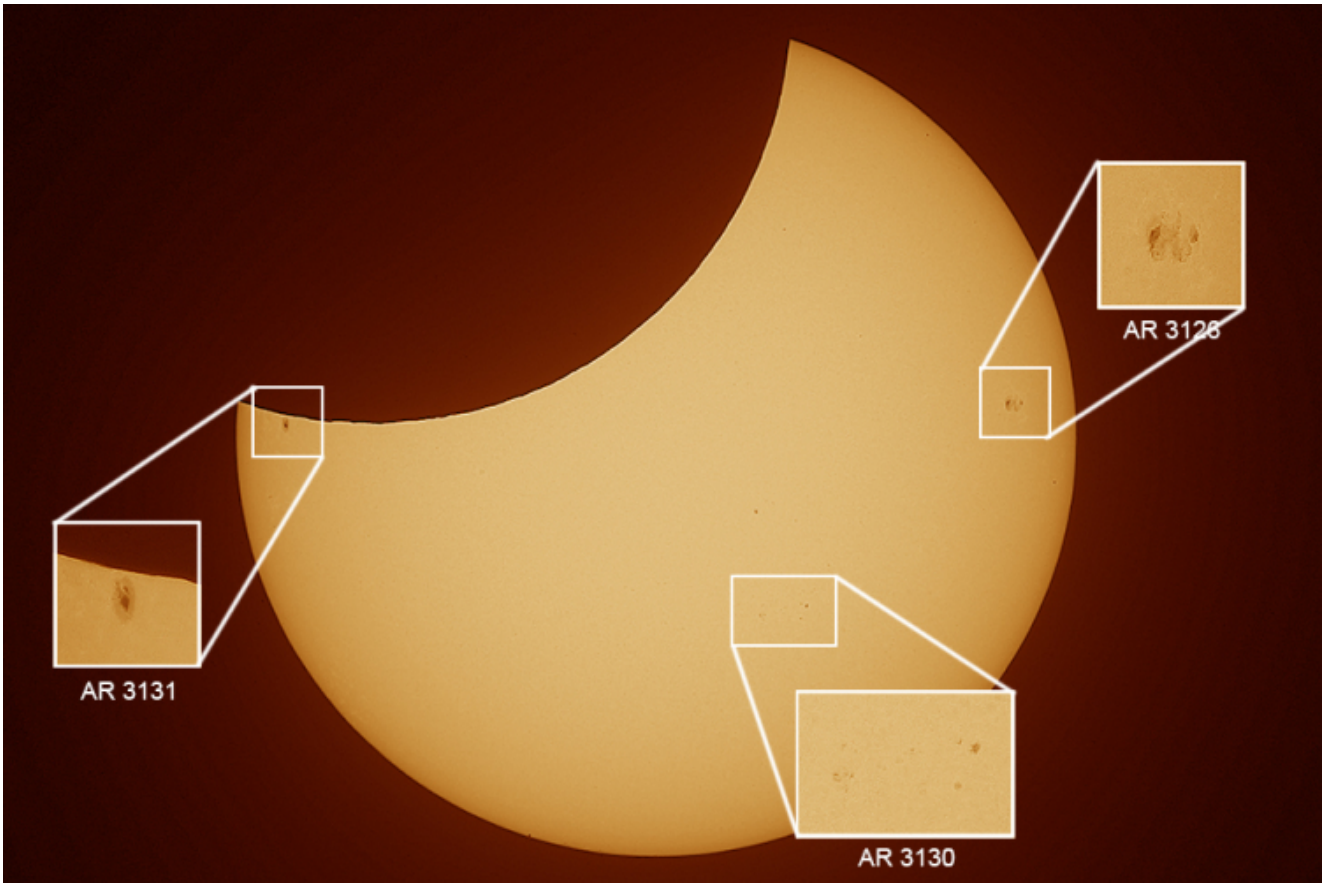
From the Google Earth imagery dated October 2021, it does look like there had been a previous rock topple / mass wasting event at the same location. See image below.



Partial Solar Eclipse of October 25, Observed over Athens

From Earth Science Picture of the Day, November 18, 2022.
Photographer and Summary Author: Anthony Ayiomamitis
https://epod.usra.edu/blog/2022/03/archive-upheaval-dome.html

We were very fortunate to have had a great stretch of weather here in Greece during late October that allowed us to observe the second and final solar eclipse for 2022. This was a partial eclipse, on October 25, but it shaded as much as 86% of the Sun for some parts of western Siberia. It was visible to residents of Europe, northeast Africa, the Middle East and western Asia. The eclipse depth for Athens, Greece, was approximately 38%, with the eclipse having a duration of two hours and fifteen minutes. Maximum eclipse occurred at 13:42:56 (UT+3 local time). Note, as an added bonus there were three active solar regions; one at each of the limbs to the east and to the west (AR3131 and AR3126, respectively) as well as another fainter group just south of center (AR3130).



Athens, Greece Coordinates: 37.9838, 23.7275

Related Links

- Sunrise Partial Eclipse
- Anthony's Website

Paleotsunami Detectives Hunt for Ancient Disasters

By Nathaniel Scharping, Hakai Magazine. Published February 16, 2023.
https://hakaimagazine.com/news/paleotsunami-detectives-hunt-for-ancient-disasters/

A boulder weighing more than 40 tonnes sits on the sand high above the ocean. Dwarfing every other rock in view, it is conspicuously out of place. The answer to how this massive outlier got here lies not in the vast expanse of the Atacama Desert behind it but in the Pacific Ocean below. Hundreds of years ago, a tsunami slammed into the northern Chilean coast—a wall of water 20 meters high, taller than a six-story building, that swept boulders landward like pebbles.

The tsunami that lobbed this behemoth happened before written records existed in Chile. But we know about it today thanks to the detective work of a small group of researchers who are uncovering the

signs of ancient tsunamis around the globe. Using a diverse array of scientific techniques, these paleotsunami researchers have found evidence of previously undocumented colossal waves. In the process, their work is revealing that coastal communities could be in far more danger from tsunamis than they realize.

As scientists expand their search, they have continued to find ancient tsunamis bigger than those found in historical records, says James Goff, a paleotsunami researcher at the University of Southampton in England. The implications are clear: if a huge tsunami happened once in a given location, it could happen again. The question is whether we're prepared for it.

Untold tsunamis hit coastal communities before anyone logged them in written records. Paleotsunami researchers are on a quest to uncover these forgotten disasters. Photo by North Wind Picture Archives/Alamy Stock Photo

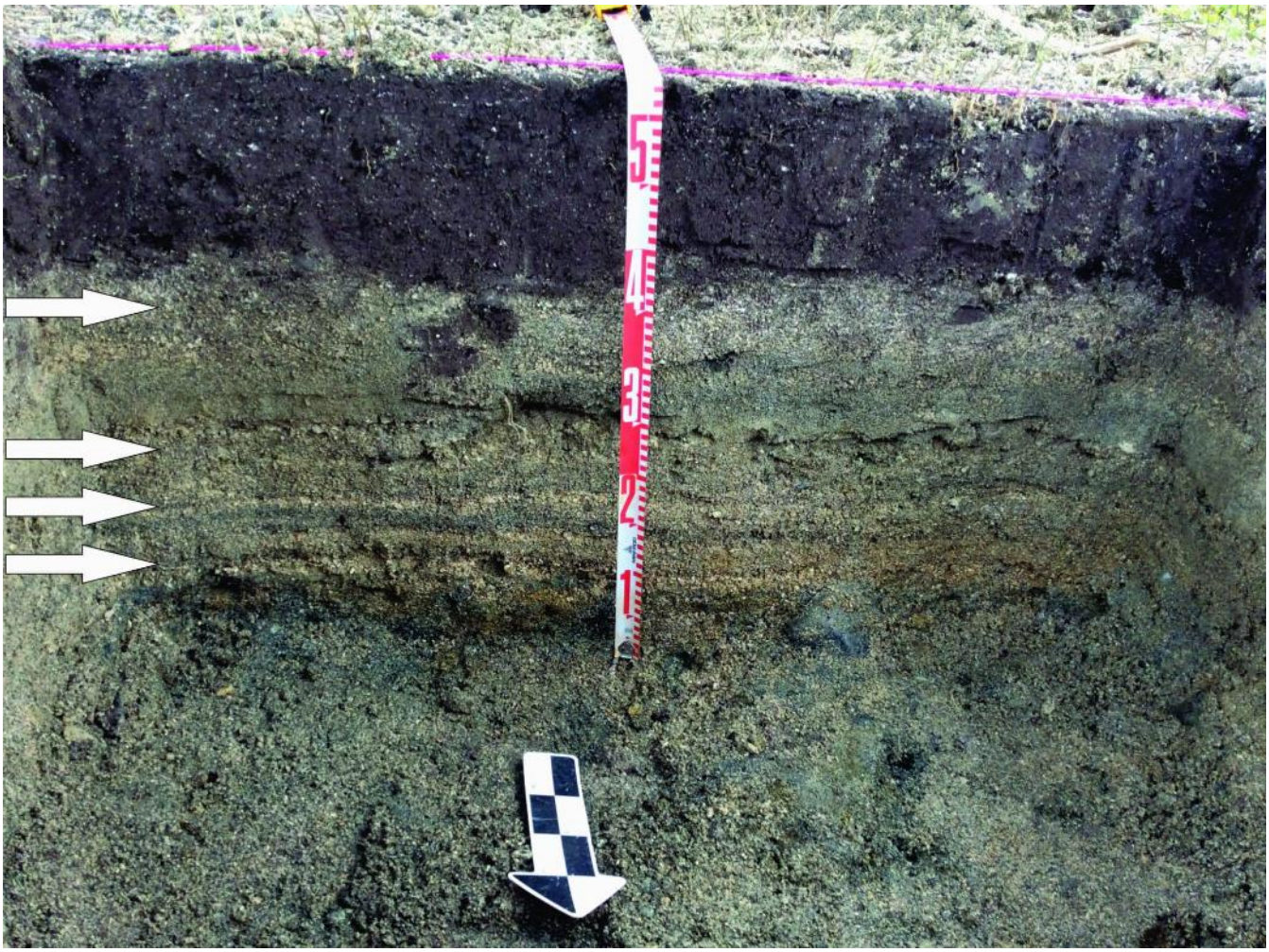
A tsunami is more than just a big wave. Conventional waves, even those tens of meters high, are usually generated by the wind and involve only the uppermost layers of water. They carry relatively little energy, and typically crash harmlessly on the shore.

A tsunami, by contrast, is spawned by geological forces—an earthquake, volcanic eruption, or the side of a mountain crashing into the sea. A tsunami involves the entire water column. While large tsunamis can measure 20 meters or more in height—with some particularly monstrous ones rising hundreds of meters—they need not be exceptionally tall to cause widespread damage. Instead of collapsing on the beach, a tsunami rushes ashore like a battering ram. After racing hundreds of meters or more inland, the water recedes into the depths, carrying away nearly everything in its path. But tsunamis almost always leave evidence of their passage—like an out-of-place boulder high in the desert.

Goff has been searching for ancient tsunamis for almost three decades, mostly in countries bordering the Pacific Ocean. He's one of just a few scientists worldwide who specialize in finding evidence of paleotsunamis, or tsunamis that predate written records.

The easiest way to tell that a tsunami hit hundreds or thousands of years ago is to look underground, Goff says. When the wave recedes, it leaves traces of everything it contained strewn across the surface. This thin layer of silt, rocks, tiny shells, and other marine deposits gets buried over time, preserving the tsunami's path between layers of sediment. In some places, the layers are so well preserved that researchers can see evidence of multiple tsunamis stacked on top of each other like a layer cake.

In southern Chile, you can dig a hole near many coastal rivers and count the bands. "One, two, three, four," Goff says. "And you can just see these layers, and you know that they're paleotsunamis."



An excavation in Maui, Hawai'i, shows four bands marking tsunami deposits. Scientists have yet to deduce when these tsunamis occurred. Photo by Scott Fisher

In places with rocky or more barren terrain, a paleotsunami's track can be harder to discern, and the techniques used must be tailored to the environment. Goff and other researchers also look for microscopic marine organisms like diatoms and foraminifera, ancient DNA from marine life, changes to geochemistry, and, as in the Atacama, unexpected boulders.

That Atacama tsunami likely happened in 1420, says Tatiana Izquierdo, a paleotsunami researcher based at the University Rey Juan Carlos in Spain who helped to discover it. She and her colleagues dug underneath the boulder to find undisturbed sediment. They radiocarbon dated some of the marine shells they found, giving a range of potential dates from the 14th to the 16th centuries. With further research, the team found historical records of a tsunami in Japan in 1420 that fit with their dates. Izquierdo says their tsunami likely originated off the Chilean coast following a large earthquake and crossed the Pacific to Japan.

In other cases, paleotsunami researchers have drawn insights from the archaeological record. Izquierdo says archaeologists in Chile previously noted that suddenly, around 3,800 years ago, a number of coastal sites were systematically abandoned, with new sites soon appearing farther inland. Additional evidence, like shell middens that bore evidence of having been eroded by strong currents, hinted at a potential paleotsunami.

Those dates line up perfectly with a huge paleotsunami that Goff found evidence for an ocean away, in New Zealand, where boulders the size of cars had been tossed almost a kilometer inland. It's a disaster that doesn't appear in historical records, Goff says, and it's a tsunami that likely affected islands all across the South Pacific, including in Vanuatu, Tonga, and the Cook Islands. Paleotsunami researchers have yet to look for corroborating evidence on those islands, so they don't yet know the full scale of the destruction it caused.

Finding out how big and how bad a paleotsunami was is more than a matter of historical interest. That data has a lot of value for contemporary coastal communities.

Predicting tsunamis is impossible. At best, residents might have minutes to hours of warning from agencies like the National Tsunami Warning Center in the United States and Canada that use buoys and seismometers to detect potential tsunamis before they reach land. The resulting alerts are based on computer models fed data on how past tsunamis behaved. If they're missing key events that don't show up in the historical record—like the ones paleotsunami researchers are steadily uncovering—the warnings may not be fully accurate.

Goff points to the 2011 Tōhoku tsunami in Japan as a prime example of the perils of ignoring evidence of past events.

That 2011 tsunami, generated by a Magnitude 9.0 earthquake in the seafloor off Japan, spawned waves up to 40 meters high that traveled as far as 10 kilometers inland. The water overwhelmed sea walls and inundated more than 100 designated tsunami evacuation sites. It destroyed entire towns and crippled the Fukushima Daiichi Nuclear Power Plant. More than 15,000 people died.

Part of the problem was Japan's inadequate defenses. Researchers knew of three large tsunamis from historical records dating back as far as the 17th century, one of which produced waves nearly as tall as the 2011 tsunami. Yet officials based their tsunami defense preparations, including the construction of a sea wall and the location of tsunami evacuation zones, on a 1960 tsunami generated by an earthquake on the Chilean coast that produced waves in Japan just six meters tall.

"We knew how big they could be [in Japan]. We knew that these things must have been generated just off the Japanese coast. And yet, we were completely unprepared for it," Goff says.

The 2011 Tōhoku tsunami was more destructive than nearly any other in modern times. But as paleotsunami research is showing, it was hardly unprecedented.

Back in Chile, Izquierdo says she's particularly worried about what would happen if a tsunami comparable in size to the one that flung boulders into the Atacama Desert hit today. In popular vacation spots, like outside the city of Caldera, people have built homes right near the beach. Should a tsunami hit, those homes could be in grave peril.

Paleotsunami researchers are revealing that the tsunamis we don't know about were often more destructive than the ones we do. Those disasters may have happened thousands of years ago, and those locations may never see such big waves any time soon. But somewhere, sometime, we will.

NHGS Annual Geologic Mapping Workshop 2023

The 2023 New Hampshire Geological Survey (NHGS) Mapping Workshop will be on Tuesday, April 4, 2023 from 8:30 AM to 1:00 PM at the NHDES Auditorium and via Microsoft Teams (hybrid). Registration is required (registration closed before press time for in-person attendance). The agenda is on the next page:

8:00-8:30 Continental Breakfast and Posters (Auditorium Anteroom)

8:30 - 8:50: *Welcome and New Hampshire Geological Survey Update*
Shane Csiki, State Geologist and Director

8:50 - 9:20: *Using Deep Learning Pixel Classification to Create Preliminary Surficial Geologic Maps*
Mary DiGiacomo-Cohen, U.S. Geological Survey

9:20 - 9:40: *Mapping in New Hampshire: Implementing Collaborative Peer Review*
Rebecca LeCain (Outreach Coordinator) and Joshua Keeley (Geologist), New Hampshire Geological Survey

9:40 - 10:00: *Passive-Seismic Investigation to Determine Depth of Bedrock In Support of Surficial Geologic Mapping in the Ossipee Lake Quadrangle*
Michael Howley (Geoscience Program Specialist), New Hampshire Geological Survey

10:00 - 10:30: *Retreat of the Laurentide through Central New Hampshire: East Versus West*
Robert Newton (Professor Emeritus, Department of Geosciences), Smith College

10:30 - 10:50: Break and Posters

10:50 – 11:10: *A Tale of Two Lakes in the Eastern Ossipee Mountains*
Daniel Tinkham (Senior Consultant and Hydrogeologist), Emery & Garrett Groundwater Investigations, a Division of GZA

11:10 - 11:30: *The Surficial Geology of the Tuftonboro 7.5' Quadrangle*
John Brooks

11:30 - 11:50: *Bedrock Geology of the Mount Moosilauke 7.5' Quadrangle*
Peter Thompson

11:50 - 12:10: *Pull Up a Bench and Have a Seat for the Surficial Geology of Mount Moosilauke*
P. Thompson Davis, Bentley College

12:10 - 1:20 Lunch

1:20 - 1:40: *Surficial Geology of the Shelburne Quadrangle, New Hampshire and Maine*
Woody Thompson

1:40 - 2:00: *Surficial Geology, Mount Tripyramid 7.5' Quadrangle (NH)*
Brian Fowler, Quarry Asset Management

2:00 - 2:20: *Updated Siluro-Devonian Geology in the Indian Stream Republic (1832-1835)*
David Converse

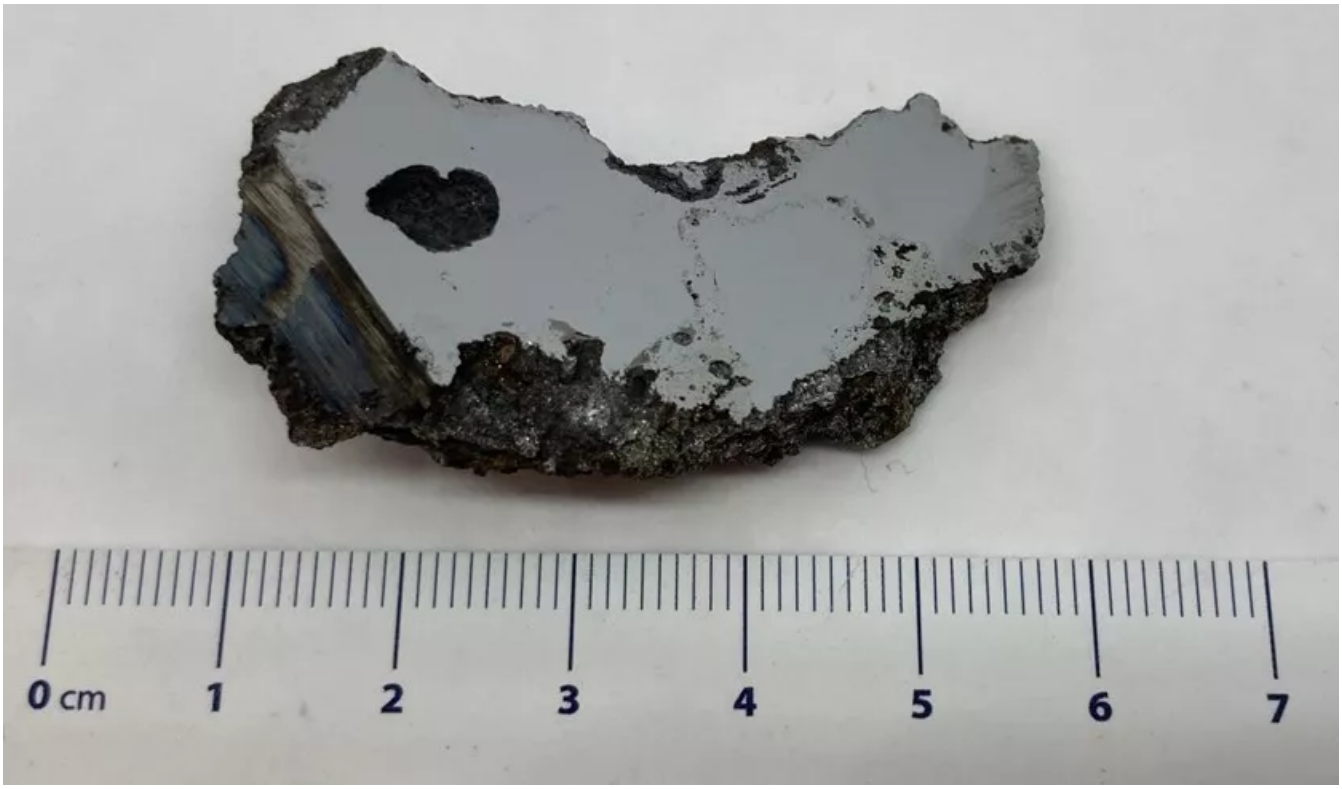
2:20 - 2:30: *Closing Remarks*
Shane Csiki, State Geologist and Director

Two minerals never seen before on Earth found inside 17-ton meteorite

By Ben Turner, November 28, 2022. From Live Science:
https://www.livescience.com/two-new-minerals-found-inside-meteorite

Two minerals that have never been seen before on Earth have been discovered inside a massive meteorite in Somalia. They could hold important clues to how asteroids form.

The two brand new minerals were found inside a single 2.5 ounce (70 gram) slice taken from the 16.5 ton (15 metric tons) El Ali meteorite, which was found in 2020. Scientists named the minerals elaliite after the meteor and elkinstantonite after Lindy Elkins-Tanton, the managing director of the Arizona State University Interplanetary Initiative and principal investigator of NASA's upcoming Psyche mission, which will send a probe to investigate the mineral-rich Psyche asteroid for evidence of how our solar system's planets formed.



The 2.5-ounce slice which contains the two brand-new minerals. (Image credit: University of Alberta Meteorite Collection)

"Whenever you find a new mineral, it means that the actual geological conditions, the chemistry of the rock, was different than what's been found before," Chris Herd, a professor in the Department of Earth and Atmospheric Sciences at the University of Alberta, said in a statement. "That's what makes this exciting: In this particular meteorite you have two officially described minerals that are new to science."

The researchers classified El Ali as an Iron IAB complex meteorite, a type made of meteoric iron flecked with tiny chunks of silicates. While investigating the meteorite slice, details of the new minerals caught the scientists' attention. By comparing the minerals with versions of them that had been previously synthesized in a lab, they were able to rapidly identify them as newly recorded in nature.

The researchers plan to investigate the meteorites further in order to understand the conditions under which their parent asteroid formed. "That's my expertise — how you tease out the geologic processes and the geologic history of the asteroid this rock was once part of," Herd said. "I never thought I'd be involved in describing brand new minerals just by virtue of working on a meteorite."

The team is also looking into material science applications of the minerals.

However, future scientific insights from the El Ali meteorite could be in peril. The meteorite has now been moved to China in search of a potential buyer, which could limit researchers' access to the space rock for investigation.

Scientists Detect Molten Rock Layer Hidden Under Earth's Tectonic Plates

By The University of Texas at Austin, February 6, 2023.

https://www.jsg.utexas.edu/news/2023/02/scientists-detect-molten-rock-layer-hidden-under-earths-tectonic-plates/

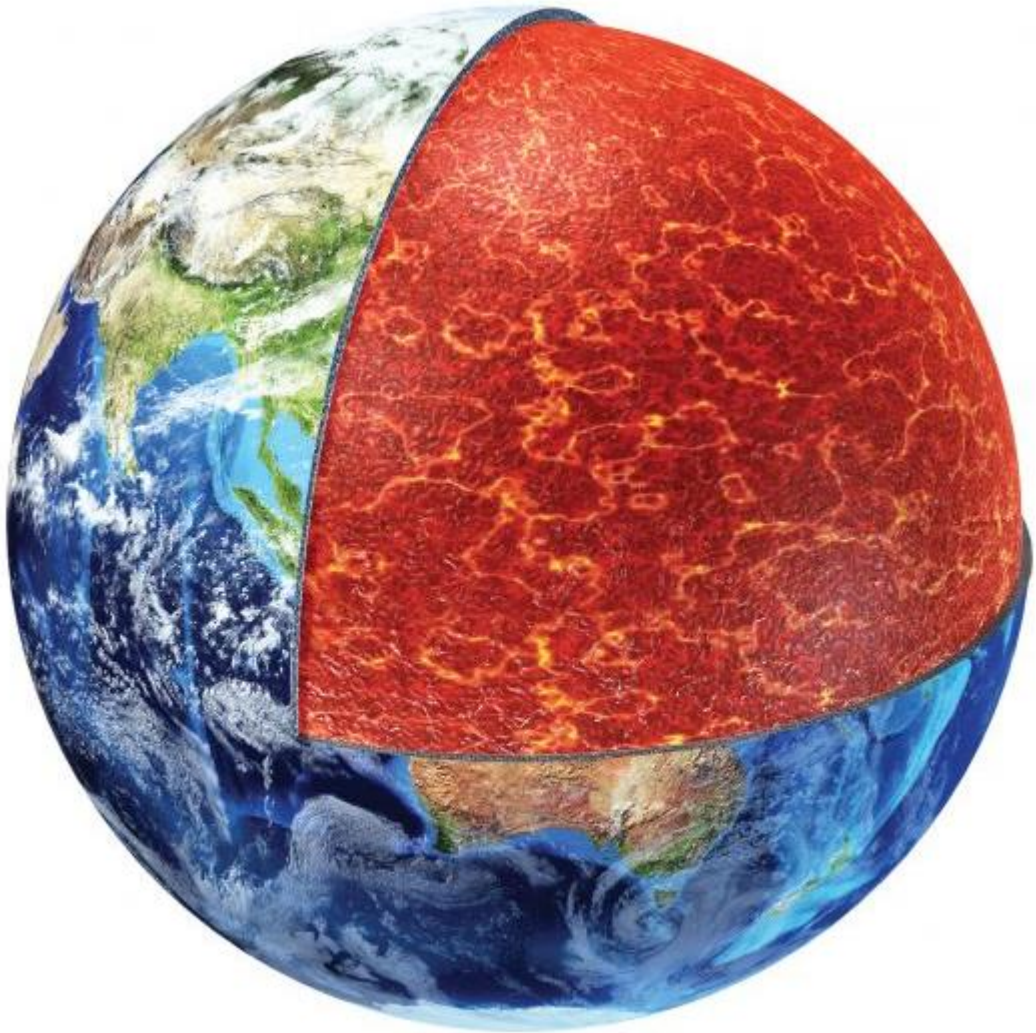
Scientists have discovered a new layer of partly molten rock under the Earth's crust that might help settle a long-standing debate about how tectonic plates move.

Researchers had previously identified patches of melt at a similar depth. But a new study led by The University of Texas at Austin revealed for the first time the layer's global extent and its part in plate tectonics.

The research was published Feb. 6, 2023, in the journal *Nature Geoscience*.

The molten layer is located about 100 miles from the surface and is part of the asthenosphere, which sits under the Earth's tectonic plates in the upper mantle. The asthenosphere is important for plate tectonics because it forms a relatively soft boundary that lets tectonic plates move through the mantle.

The reasons why it is soft, however, are not well understood. Scientists previously thought that molten rocks might be a factor. But this study shows that melt, in fact, does not appear to notably influence the flow of mantle rocks.



The Earth with the upper mantle revealed. Researchers at The University of Texas at Austin have discovered a previously unknown layer of partly molten rock in a key region just below the tectonic plates. Credit: Leonello Calvetti/Dreamstime

“When we think about something melting, we intuitively think that the melt must play a big role in the material’s viscosity,” said Junlin Hua, a postdoctoral fellow at UT’s Jackson School of Geosciences who led the research. “But what we found is that even where the melt fraction is quite high, its effect on mantle flow is very minor.”

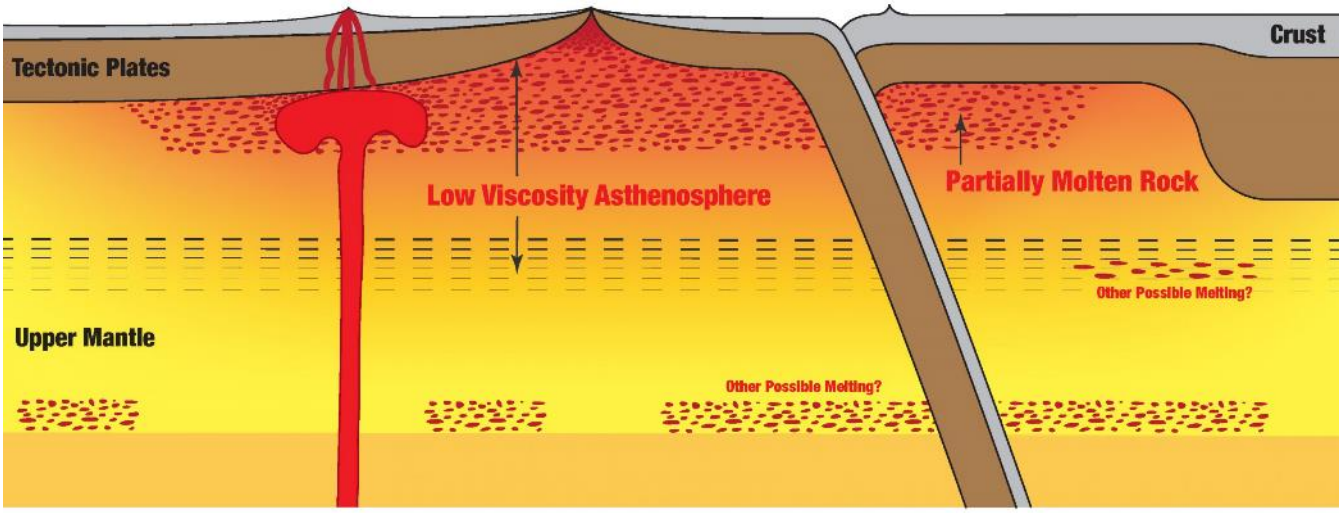
According to the research, which Hua began as a graduate student at Brown University, the convection of heat and rock in the mantle are the prevailing influence on the motion of the plates.

Although the Earth's interior is largely solid, over long periods of time, rocks can shift and flow like honey.

Showing that the melt layer has no influence on plate tectonics means one less tricky variable for computer models of the Earth, said coauthor Thorsten Becker, a professor at the Jackson School.

"We can't rule out that locally melt doesn't matter," said Becker, who designs geodynamic models of the Earth at the Jackson School's University of Texas Institute for Geophysics. "But I think it drives us to see these observations of melt as a marker of what's going on in the Earth, and not necessarily an active contribution to anything."

The idea to look for a new layer in Earth's interior came to Hua while studying seismic images of the mantle beneath Turkey during his doctoral research.



A diagram of the asthenosphere, which aids plate tectonics, where researchers at the UT Austin Jackson School of Geosciences say they detected a global layer of partial melt (shown in speckled red). Credit: Junlin Hua, UT Jackson School of Geosciences

Intrigued by signs of partly molten rock under the crust, Hua compiled similar images from other seismic stations until he had a global map of the asthenosphere. What he and others had taken to be an anomaly was in fact commonplace around the world, appearing on seismic readings wherever the asthenosphere was hottest.

The next surprise came when he compared his melt map with seismic measurements of tectonic movement and found no correlation, despite the molten layer encompassing almost half the Earth.

“This work is important because understanding the properties of the asthenosphere and the origins of why it’s weak is fundamental to understanding plate tectonics,” said coauthor Karen Fischer, a seismologist and professor at Brown University who was Hua’s Ph.D. advisor when he began the research.

The research was funded by the U.S. National Science Foundation. Collaborating institutions included the UT Oden Institute for Computational Engineering and Sciences and Cornell University. For more information, contact: Anton Caputo, Jackson School of Geosciences, 210-602-2085; Constantino Panagopulos, University of Texas Institute for Geophysics, 512-574-7376.

New Maps Predict Areas of Elevated Radon, Uranium in New Hampshire’s Groundwater

By New England Water Science Center, December 30, 2022

https://www.usgs.gov/centers/new-england-water-science-center/news/new-maps-predict-areas-elevated-radon-uranium-new

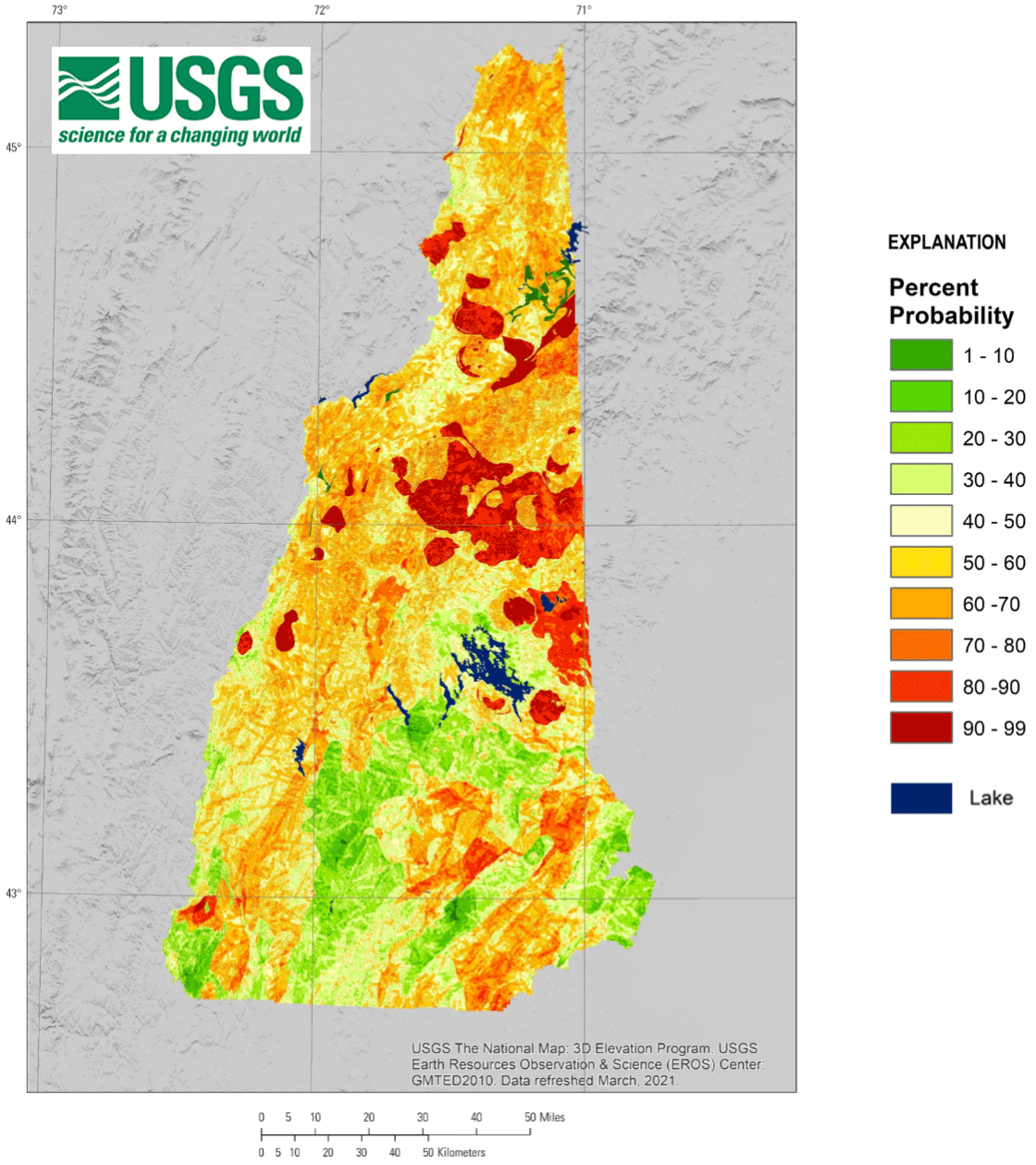
U.S. Geological Survey (USGS) scientists have produced statewide maps that show where elevated concentrations of radon and uranium may occur in New Hampshire’s groundwater.

The new study, done in cooperation with the New Hampshire Department of Health and Human Services (NHDHHS) Environmental Public Health Tracking (EPHT) Program, investigated where these naturally-occurring radioactive substances may exceed drinking water standards or health advisory levels set by the U.S. Environmental Protection Agency (EPA).

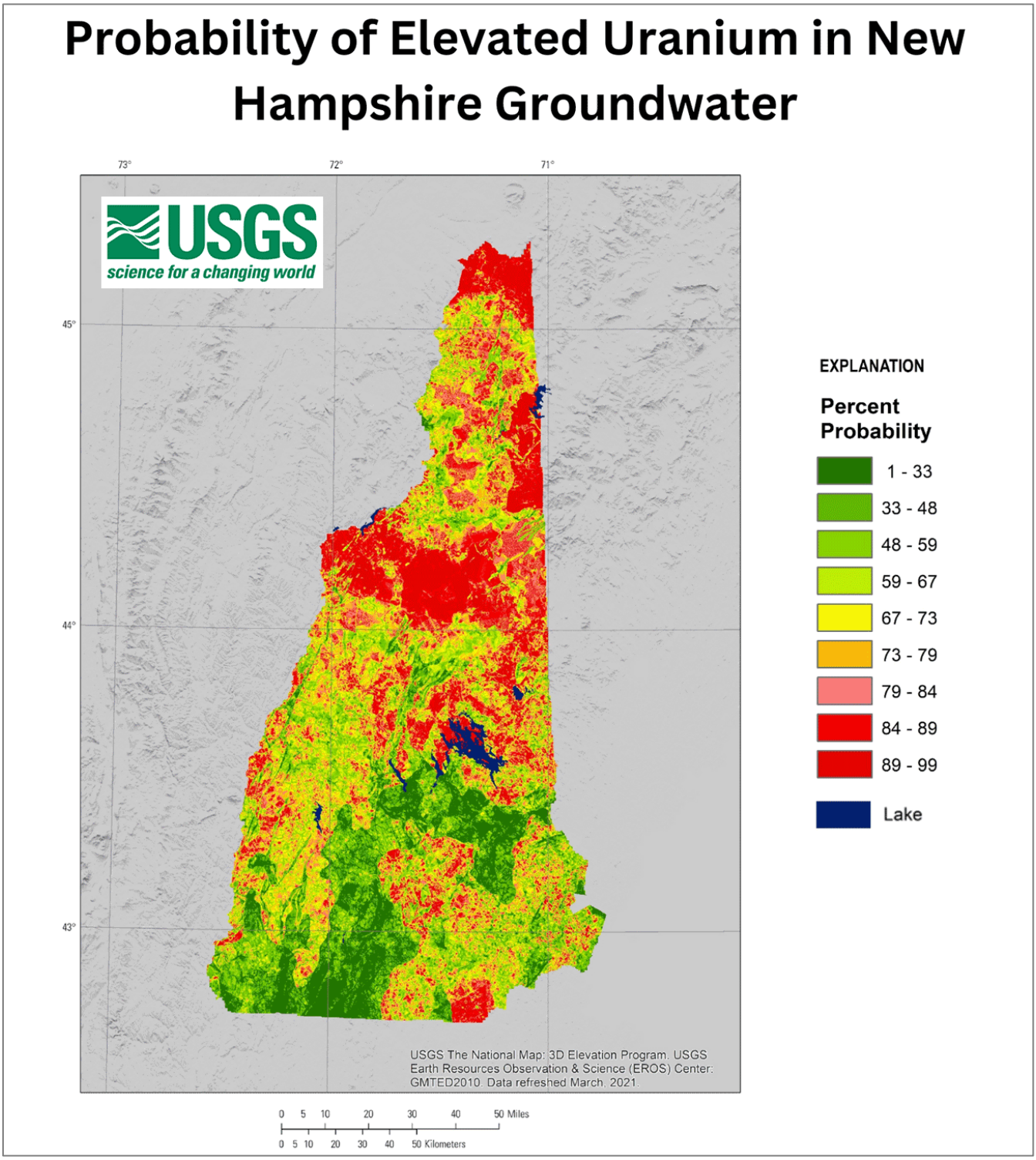
Both radon and uranium in groundwater are of particular concern to human health in communities that have private wells, and approximately 40% of New Hampshire residents rely on private wells for drinking water. The EPA regulates public water supplies, but maintenance, testing and treatment of private water supplies are the responsibility of the homeowner. These findings highlight the importance of private well owners working with their local and state officials to determine the best way to test and, if necessary, treat their water supplies.

“You may not know that you are living in an area of high probability for elevated uranium or radon in your well water,” said USGS hydrologist and lead author Richard B. Moore. “Although the people who live in the parts of New Hampshire that are indicated by red on these maps may be at higher risk, unless wells are tested, there’s no way to confirm the presence or absence of elevated concentrations of these contaminants.”

Probability of Elevated Radon in New Hampshire Groundwater



The probability of exceeding a threshold concentration of 2,000 picocuries per liter of radon in groundwater. This map was developed from the following USGS study: Predicted uranium and radon concentrations in New Hampshire (USA) groundwater—Using Multi Order Hydrologic Position as predictors - Moore - JAWRA Journal of the American Water Resources Association - Wiley Online Library
Sources/Usage: Public Domain. Visit Media to see details.



The probability of exceeding a threshold concentration of 1 microgram per liter for uranium in groundwater. This map was developed from the following USGS study: [Predicted uranium and radon concentrations in New Hampshire (USA) groundwater—Using Multi Order Hydrologic Position as predictors - Moore - JAWRA Journal of the American Water Resources Association - Wiley Online Library]
Sources/Usage: Public Domain.

Of the sample analyses results available, radon was the contaminant more likely to have elevated concentrations. About 55% of the radon analyses results were above 2,000 picocuries per liter (pCi/L),

while about 7% of the uranium results were above 30 micrograms per liter (µg/L), two commonly used standards or health advisory levels.

Although a metal commonly found in bedrock around the world, uranium in water can increase the risk of cancer and kidney toxicity when ingested if it exceeds the maximum contaminant level set by the EPA. Radon is a radioactive gas that is a byproduct of uranium radioactive decay. It often seeps into homes from the ground through foundation cracks, but it also dissolves into groundwater. If present in the well water, radon can dissipate from household water-use into the air. According to the World Health Organization, long-term exposure to high concentrations of radon in indoor air increases the risk of lung cancer.

“The Environmental Public Health Tracking Program at NH DHHS is committed to sharing data that drives public health action,” said Dr. Katie Bush, EPHT Program Administrator. “These probability estimates help us identify high-risk areas across the state and focus our outreach and education efforts in places where it will have the most impact.”

The presence of both radon and uranium is partly correlated with the geologic make-up of an area’s bedrock, which is the solid rock that lies beneath loose materials such as soil, clay, sand, till, or gravel. New Hampshire’s bedrock mostly comprises plutonic igneous rocks, such as granite, and metamorphic rock, which has a high potential for containing uranium and its byproducts, including radon.

Published in the Journal of the American Water Resources Association, this USGS study provides uranium estimates and expands upon previous findings that link the concentration of radon in groundwater with mapped bedrock units. The study also produced more precise approximations of radon occurrence in groundwater by including additional predictors and more comprehensive statistical analyses. In addition to geology, the researchers considered the long-recognized idea that groundwater quality is impacted by its location within a watershed.

“With groundwater, it’s not just the local watershed that’s defined by the immediate landscape,” said Moore. “Groundwater can travel much more regionally, so as you go deeper into the ground, or closer to a large river, you are more apt to be capturing water from farther away, from a larger groundwater watershed.”

The scientists looked at variables related to the depth of the groundwater flow paths, the distance to a receiving water body, and where the groundwater is located within local and regional watersheds, by

using a dataset called the Multi-Order Hydrologic Position. Variables associated with both large and small watersheds showed up as noteworthy predictors for radon presence in the study.

"To me, the way in which the local landscape showed up as significant for radon indicates that the closer the groundwater well is to the local watershed divide, the more likely it is that there will be a higher concentration of radon - other factors being equal," Moore said. "This is because the groundwater originating from local precipitation picked up by some wells has not been transported underground for very long and has not yet lost its radon from radioactive decay. Radon has a very short half-life of only 3.8 days - unlike uranium, which has a half-life of 4.5 billion years!"

A lot of the high probabilities for radon and uranium are found in the White Mountains of northern New Hampshire, where the state population density is lower. However, radon and uranium can be at a concentration that is of health concern in any groundwater source in the state, and the only way to be positive of its concentration is through well-water testing.

The State of New Hampshire and the EPA recommend all private well owners test for common groundwater contaminants every three to five years. New Hampshire residents interested in testing their private wells for radon and uranium can find more information on the New Hampshire Department of Environmental Services website. The NH Radon Program within NH DHHS offers free radon in air testing through an EPA funded program, request your free test kit here.

Well water should be treated if uranium concentrations are greater than the EPA standard of 30 micrograms per liter (µg/L) or if radon concentrations are greater than the NH standard of 2,000 picocuries per liter (pCi/L).

The geospatial data used in this USGS study are available for download here.

March 2023 Legislative Update

By Tom Fargo

In his bi-annual budget proposal, Governor Sununu requested the Legislature to make significant changes to the State statutes regulating professional certifications stating: *"Licensure exists to protect the public, not to increase the barrier of entry to our workforce or create an anti-competitive industry climate. To that end, the budget [proposal] eliminates 692 unnecessary statutory provisions, 14 unnecessary regulatory boards, and 34 license types"*. Types of professional licensure proposed for elimination included many medical professions along with State licensure requirements for

professional Foresters, Wetlands, Soil and Natural Scientists. Elimination of licensure requirements for Geologists was not initially proposed.

The Legislature is now considering two bills to codify this Governor's initiative. House Bill Two (HB-2, the so-called budget trailer bill) would make changes to statutes necessary to eliminate funding for future administration of the licensure requirements proposed to be cut – thereby eliminating such programs. In addition, HB-655 provides for funding and administrative staff changes in the Office of Professional and Certification that would (as of this writing) continue to administer licensure of Professional Geologists as outlined in RSA 310-A: 120. HB-655 was passed, with amendments, by the full NH House of Representatives on March 16th.

This grand trail will one day connect Washington, D.C., to Washington State

By Stephen Starr, National Geographic, February 15, 2023.
https://www.nationalgeographic.com/travel/article/great-american-rail-trail-helps-revive-small-towns?

The Great American Rail-Trail will link towns and cities along a dedicated, 3,700-mile path that uses dozens of converted railways.

When completed, the ambitious Great American Rail-Trail will take hikers and bikers clear across the country from Washington, D.C., to Washington State. Not only will it be an epic journey from mountains to plains to the clear waters of the Pacific, but it will also be a way to help re-energize dozens of communities along the way.

"How the Great American could help communities was a huge part of our criteria for determining where this would go," says Liz Thorstensen of the Rails-To-Trails Conservancy, the organization overseeing the project.

A tale of rebirth

For much of the 20th century, America's Midwest was an industrial powerhouse, using trains to carry goods from New York to Wisconsin. But as manufacturing demands declined, thousands of miles of railway lines that snaked through Midwestern towns and cities lay unused.

Now, those same railways—converted into rail trails—are presenting new opportunities, and rebuilding and reconnecting formerly thriving enclaves.

Nebraska's 219-mile Cowboy Recreation and Nature Trail, one of the longest rail trails in the nation, connects to the new Great American Rail-Trail, a 3,700-mile cross-country, multiuse route. Photograph by Lisa Conrad, fourandahalffeet.art

The National Mall in Washington, D.C. (seen in this composite photograph, shot over a 16-hour period), marks one end of the Great American Rail-Trail. Photograph by Stephen Wilkes.

Running 3,700 miles through 12 states and Washington, D.C., the "Great American" starts (or ends) at the National Mall in downtown Washington. The route takes in iconic landscapes and experiences,

crossing the Appalachian Mountains and the mighty Mississippi River. Further west, it ascends the Continental Divide east of Butte, Montana, and traverses Puget Sound in Seattle, before reaching the Pacific Ocean at La Push, Washington.

This composite photograph, shot over the course of a single day, shows Shi Shi Beach in Olympic National Park, Washington, the other end of the Great American. Photograph by Stephen Wilkes.

More than 50 percent complete (it could take another 20 years for the entire trail to be linked up), the trail is already seeing a demand for campsites, bike repair services, restaurants, and breweries, as well as a host of other activities and venues along the route.

The Rails-To-Trails Conservancy estimates that 50 million Americans live within 50 miles of the proposed route of more than 145 existing rail trails, greenways, and other multipurpose paths. When completed, the Great American could generate close to $230 million in annual visitor spending and 25,000 new jobs over 10 years for communities that lie on or near the trail, according to a May 2022 report.

Full steam ahead

Muncie, Indiana, a city of 65,000 people, is one of many small towns ready to put its once bustling railway lines to use again.

“The fact that we are a paved and a multiuse trail puts us as a prime trail to visit,” says Angie Pool, who heads the Cardinal Greenways, a 62-mile stretch along the Great American that passes through Muncie. “The Great American Rail-Trail will just enhance this opportunity for lovers of trail-riding across the country.”

For businesses such as Kirk’s Bike Shop, a Muncie staple since 1865 situated less than a mile from the trail, that could be a major boon.

Residents of Muncie, Indiana, hope that the Great American will bring new economic opportunities and social events, such as the Ironman race pictured here. Photograph by Patrick McDermott, Getty Images for Ironman

“A large majority of our customers are local, but [the Great American] could help grow tourism. It could open the eyes of local people to what’s out there, too,” says Jason Allardt, the store owner.

In Muncie, the route connects to the Minnetrista Museum & Gardens, a city landmark with 40 acres of orchard and gardens, a farmers market, and canning and glass-making workshops that are open to the public. Cafés, breweries, and restaurants are nearby, too.

Muncie isn’t alone.

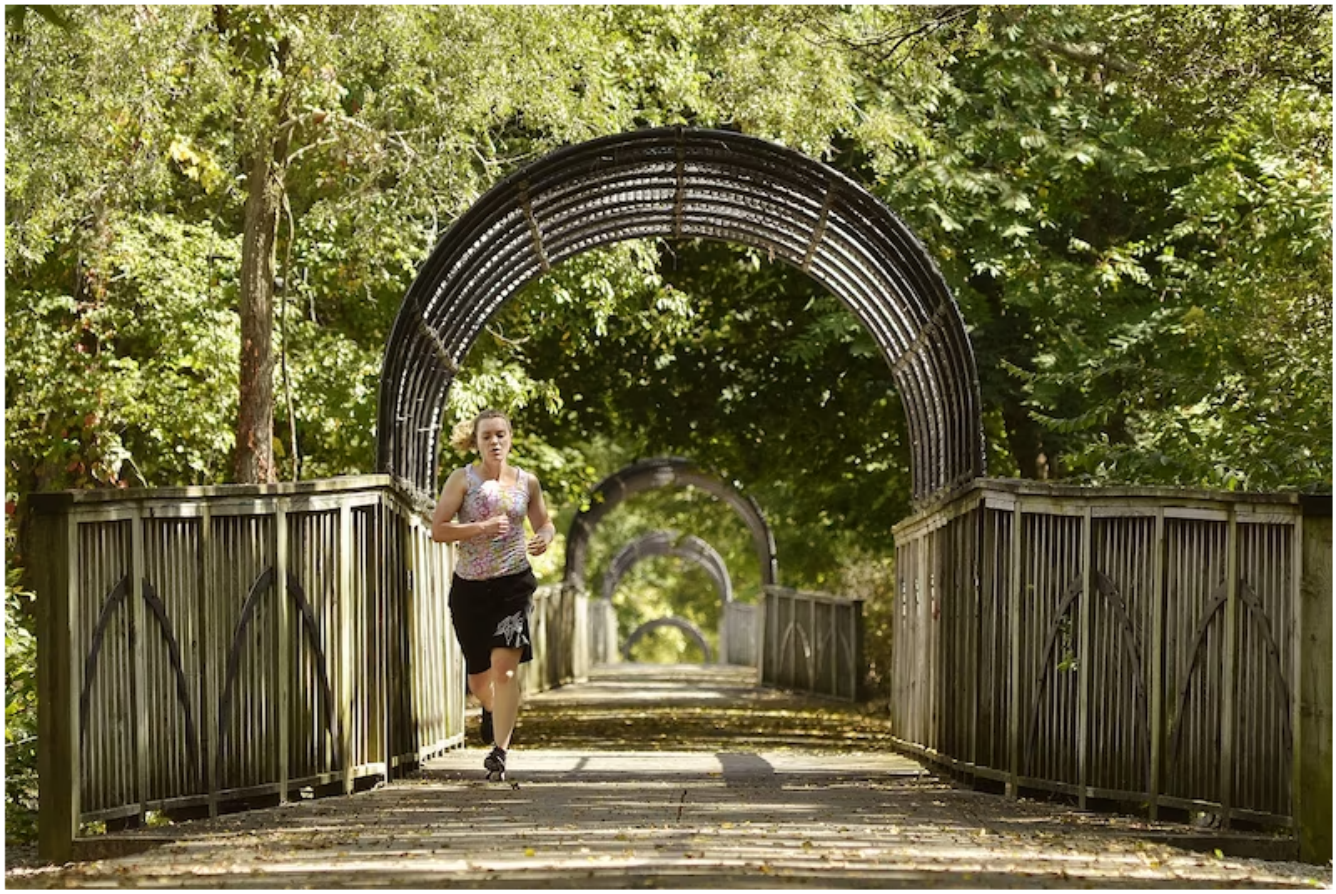
The Great American invites visitors to explore the less traveled areas of the U.S., like Steptoe Butte State Park in Washington. Photograph by Rod Hoekstra.

In western Iowa, Council Bluffs has embarked on a major urban revival project near sections of the Great American that pass through the heart of the city. Around 60 percent of the town's residents live within just one mile of the First Avenue rail trail that is being developed as a "linear park," incorporating trail plazas, shade structures, and green spaces. Officially opening this spring, it's also set to serve as an important transport corridor.

"We want people to be able to get to their jobs, and with the commuter in mind, we spent a great deal of money on lighting the trail so it can be used 24/7 and have prioritized it for snow removal," says Brandon Garrett, chief of staff for the City of Council Bluffs.

Developers chose an asphalt trail surface to better suit joggers and people using wheeled transportation, such as walkers, strollers, wheelchairs, and power chairs.

"We are part of a metro area that's the largest [on the Great American route] between Chicago and Seattle, so whether travelers are just going across Iowa or Nebraska, or are doing a larger segment, they would probably circle here as a main stop on their adventure," Garrett says.



A woman runs on the Cardinal Greenways, the longest rail-trail in Indiana. Photograph by Jeff Morehead, the Chronicle-Tribune/AP

Nearly 1,500 miles west of Council Bluffs, a similar story is playing out in Port Angeles, a community of around 20,000 people in Washington State. There, railway lines built and expanded upon in the 1800s are now where travelers can spot orcas and seals on the Olympic Discovery Trail section of the Great American. Further west, it passes through the northern section of the stunning Olympic National Park.

With the Great American route set to pass through downtown Port Angeles, locals are already building out new trail infrastructure. Last year, a bike repair store opened in a previously vacant spot on the trail in downtown Port Angeles, while hotels in the area have begun supplying guests with e-bikes to use on the pathway.

“We already get people cycling across the country stopping here. [The Great American is] only going to improve and expand on that,” says Jeff Bohman of the Peninsula Trails Coalition, a local advocacy group.

While travelers can take advantage of the route now, there are still more than 80 trail gaps, including large sections of unmapped routes in Wyoming and Montana.

Beginning at the Maryland–Pennsylvania border, the 150-mile Great Allegheny Passage is one of the several preexisting routes that are now part of the Great American. Photograph by Edwin Remsberg, VW Pics/Universal Images Group/Getty Images

“Sometimes it’s the geography that presents a challenge, or there’s a particular bridge that needs to be rehabbed,” says Thorstensen. “It’s about lining up the funding.”

Still, major progress has been recorded in recent years. Since a route plan was first announced in 2019, more than $75 million in public and private funding has been secured to help build out the trail. More than a hundred miles are currently in development.

GSNH T-Shirt Order Form

	Number of Shirts	Price per Shirt	Total
GSNH Small T-Shirt		$18.00	
GSNH Medium T-Shirt		$18.00	
GSNH Large T-Shirt		$18.00	
~~GSNH Extra Large T-Shirt~~		~~$18.00~~	
		Subtotal	
		Shipping & Handling	
		Total	

Shipping & Handling costs	
One Shirt	$4.00
Two Shirts	$7.00

Ship to:

Name	
Street Address	
City, State, Zip Code	
Phone # (in case of questions about your order)	

Please make checks payable to "GSNH" and mail with this completed order form to:

GSNH
P.O. Box 401
Concord, NH 03302

APRIL MEETING ANNOUNCEMENT

TOPIC: Virtual Tour of the Maine Mineral and Gem Museum

SPEAKER: Myles Felch, Curator, Maine Mineral and Gem Museum

DATE/TIME: 7PM, Thursday, April 20, 2023

Join us as Myles Felch, the curator for the Maine Mineral and Gem Museum, gives a virtual presentation about the museum, its activities, collections, and exhibits.

Please send Sharon Lewandowski an email to request a Zoom invite for the April meeting: sharon.lewandowski@des.nh.gov.

DATES TO REMEMBER

April 20, 2023 – **GSNH dinner meeting** – (Virtual Via Zoom): Myles Felch, curator of the Maine Mineral and Gem Museum, gives a presentation about the museum, its activities, collections, and exhibits.

April 29-30, 2023 – **Southeastern New Hampshire Mineral Club 18th Annual 2022 Rock, Gem and Mineral Show**, Dover Elks Lodge #184, 282 Durham Road, Dover, NH. https://www.senhmc.org/show

May 6, 2023 – **New England Gem & Mineral Show 2023**. Coolidge Hall at the Topsfield Fairground. https://www.topsfieldfair.org/event/new-england-gem-mineral-show-2/2022-04-30/

June 15, 2023 – **GSNH Board meeting** – Location TBD.

June 24-25, 2023 – **Gilsum Rock Swap 2023**. Gilsum Elementary School and Community Center, 640 Route 10, Gilsum, NH. https://gilsum.org/rockswap/

July 15, 2023 (rain date July 16) – **GSNH Field Trip: Franconia Notch** – More details to follow!

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: https://www.americangeosciences.org/workforce/goli

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: _____