



Granite State Geologist

The Newsletter of the Geological Society of New Hampshire,
Summer Edition – June 2016 – Issue No. 93

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MESSAGE FROM THE PRESIDENT

Those lazy, hazy days of summer are here and I'm feeling too lazy to write this column when I could be sitting on my deck with my dog enjoying the weather. Something about summer, more than the heat, does that to me, while alternatively the spring and fall make me want to finish projects.

It's coming up on the Fourth of July, which according to my grandmother marked the end of summer so it won't be long. Summer does seem to evaporate after the Fourth, but this year the GSNH field trip will extend the season through to August 6 with an excellent geological tour up to and around the Mount Washington summit and into the facilities there followed by a catered lunch back at the bottom. See the details on the GSNH website and get your reservations in before you head out to the deck.

I got a taste of summer traveling done to Virginia to Skyline Drive and the Blue Ridge Parkway. We went to Jefferson's home at Monticello and hiked some trails—even went a good 20 feet on the Appalachian Trail, just to say we had. But the most geologic part of the trip was to the Tom Sawyer-esque Luray Caverns boasting some enormous stalactites and stalagmites (Do you remember the difference?). I recommend the tour if you are anywhere nearby. We also stopped in Front Royal Virginia at the north end of Skyline Drive and had dinner at Jalisco's Mexican Restaurant. All I'll say about that dinner is I had the carnitas and a margarita and on the last day of our trip, I drove 105 miles to get back there to have it all again!

Elections are coming up this fall at the October meeting. There's a great crew on the Board moving the Society forward, so if you want to be a part of that, let Thor Smith or Abby Fopiano know (emails to the left). There are board positions open due to term limits and there are also unelected positions on committees. We always seem to have plenty to do at every meeting, but I always leave smiling. Next meeting is September 8th—just before the end of summer!!!

WHAT I DID ON MY VACATION by Wayne Ives



In the town of Luray, in northern Virginia, and not far west of the beautiful roadway comprising Skyline Drive and the Blue Ridge Parkway, are the Luray Caverns. The entrance is discouragingly Disneyland-touristy with a big parking lot and fancy entry building, but the tour is excellent, taking you 163 feet underground to a series of caverns filled with beautiful dripstone and flowstone formations well lighted for viewing and photography. At the end of the tour, the guide plays a Bach masterpiece on a unique organ in the deepest cavern by striking notes on various stalactites.

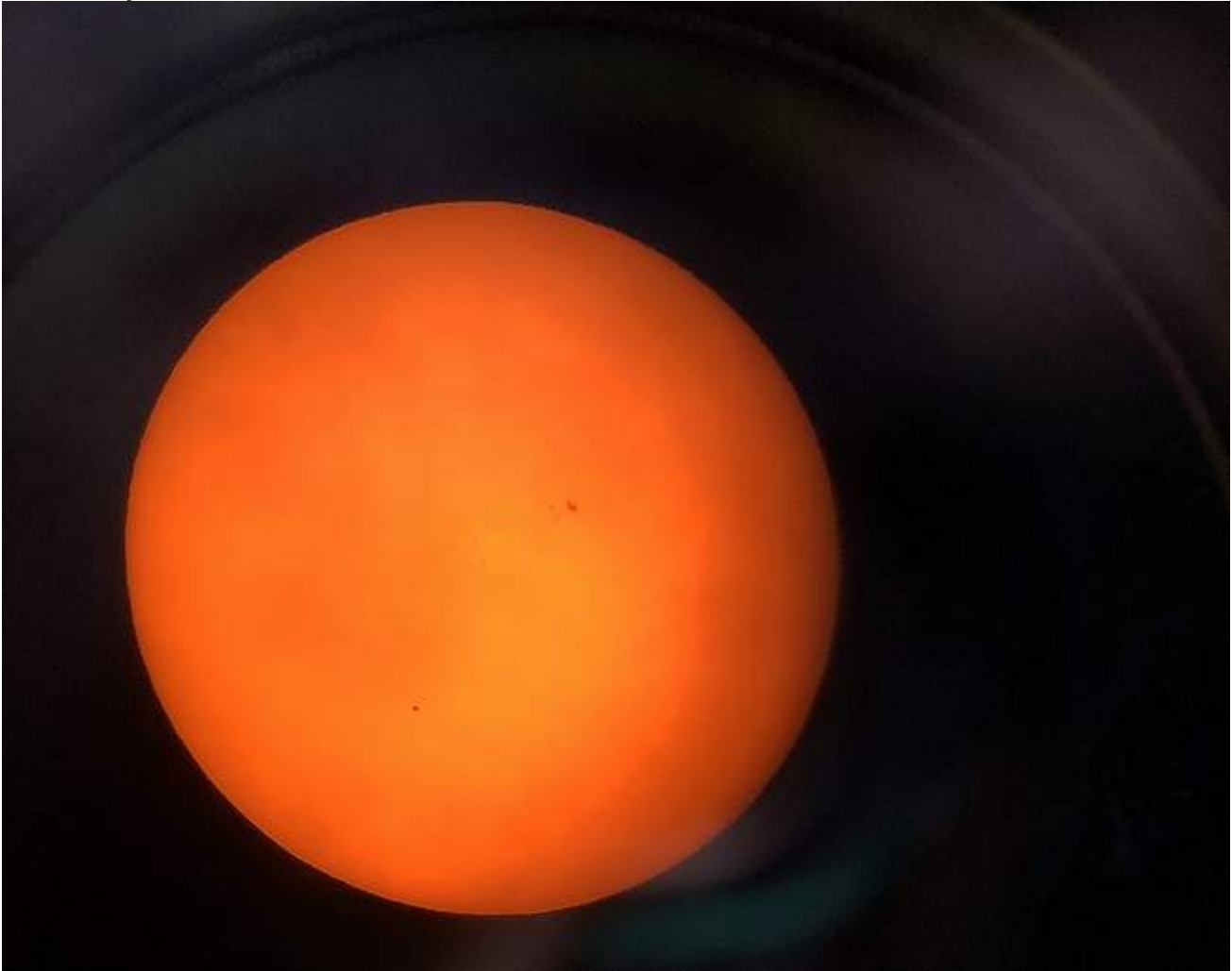
With the price of admission comes access to the Car & Carriage Caravan Museum, which is well worth visiting for the many early cars in pristine condition including one owned by Rudolph Valentino.



MERCURY CROSSING THE SUN APPEARS 13 TIMES PER CENTURY

<http://www.seacoastonline.com/article/20160509/NEWS/160509201>

Mercury crossed in front of the sun from Earth's perspective on May 9. Mercury's path across the sun was visible in Portsmouth on Monday from 7:14 a.m. through 2:42 p.m. It will pass across the sun again in 2019, then the next time in 2032. Mercury was 61 million miles away as it threw a shadow across the sun located another 30 million miles behind it.



Mercury, the solar system's smallest, innermost planet resembles a black dot (lower left) as it passes in front of the sun. NASA says the event occurs only about 13 times a century. The photo was taken through a high-powered telescope provided by the New Hampshire Astronomical Society in Portsmouth.

Photo by Rich Beauchesne/Seacoastonline

RUSS WILDER WILL BE GIVING A TALK IN JULY

Russ Wilder, former Council VP, will be giving a talk on the Geology of the Belknap Mountains. The Appalachian Mountain Club's Three Mile Island Camp on Lake Winnepesaukee inquired of GSNH about a possible speaker on New Hampshire geology as part of their summer camp program. Russ has been active in conservation efforts in the Belknap Mountains for many years and agreed to be their evening speaker on Three Mile Island on July 5th.

APRIL RAFFLE WINNERS

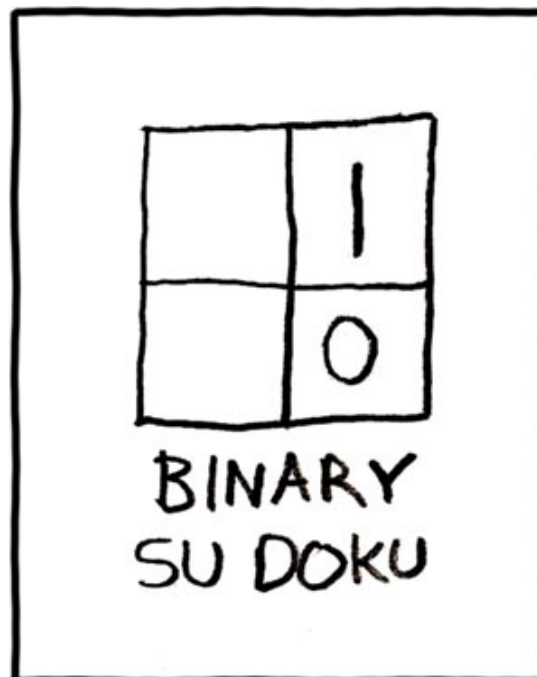
At the April meeting, three fine mineral samples were donated and three lucky people won them. Andrew Cramb won a piece of massive talc ($\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$) donated by UNH Earth Sciences Dept. who also donated a lodestone (magnetite) (Fe_3O_4) won by Jim Degnan. George Maslas won a terminated, clear quartz crystal (SiO_2) donated by Bob Whitmore.

WHAT IS YOUR BOARD DOING? By Tom Fargo

On Thursday, June 9th, Lee Wilder hosted the quarterly Board meeting at Toad Hall in Hopkinton. Key items discussed included:

- So far, we've sold approximately half of the GSNH t-shirts, the proceeds of which are going to our Charles Spaulding Speaker's Fund. We still have plenty of t-shirts available for \$18 each; t-shirts can be purchased at our field trip and the upcoming dinner meeting in October.
- BOD elections are coming up in October! Members serve two year terms. We have a slate of current officers who are willing to serve again, some in different positions due to term limits. The nominating committee is looking for additional interested individuals, particularly for the vacant Secretary position. Talk to a current BOD member if you are considering running.
- To accommodate the NEIGC field trips this year, we are moving our October dinner meeting from our usual Thursday night to Wednesday, October 12th so that we can continue the tradition of having our meeting during Earth Science week.
- The BOD is evaluating options for automating (web-based?) dinner meeting reservations with pre-payment. We have experienced problems with several reservation no-shows and untimely receipt of some payments at recent meetings. A web-based, third-party system may alleviate these issues.
- The BOD formally hired Lilly by Design to help with re-designing our website. We are also moving ahead with developing a directory of interesting NH geological locales that would be linked to the GSNH website. We seek your suggestions of significant geological sites or classic localities (on publicly-accessible lands) for inclusion in this web-based field guide.
- The BOD is evaluating formalizing our status as a non-profit, tax-exempt organization under IRS 501(c)(3) or 501(c)(6) rules. Such designation would enhance our ability to receive and distribute grants.

Our next Board of Directors meeting will be on Thursday, September 8, 2016 at the Haley & Aldrich, Inc. office in Bedford. All members are welcome to attend our meetings. Please let a Board member know if you will attend or if there is something you would like added to our agenda!



CORALS ADAPT TO WARMER OCEANS

By Morgan Chilson, 26 Jun 2015

<http://www.newsmax.com/TheWire/corals-adapt-warm-oceans/2015/06/26/id/652422/#ixzz45ogr4SW>

New research found that coral populations are beginning to adapt to warmer ocean waters, and it may now be possible to help the endangered coral reefs through the new genetic changes taking place. Researchers crossed corals from cooler waters with those in warmer areas in Australia and found that coral larvae that had a parent from cooler temperatures were “up to 10 times as likely to survive heat stress,” the University of Texas at Austin reported.



Branching Coral and various fish on the Great Barrier Reef Marine Park Australia. Pniesen/Dreamstime.com

A team of scientists from that university, as well as the Australian Institute of Marine Science and Oregon State University, conducted the research on coral from the warmer Great Barrier Reef in Australia and from cooler waters to the south. The researchers identified how the biology for handling heat tolerance worked and found that it could evolve rapidly in genetic variations.

"Our research found that corals do not have to wait for new mutations to appear. Averting coral extinction may start with something as simple as an exchange of coral immigrants to spread already existing genetic variants," said Mikhail Matz, an associate professor of integrative biology at UT. "Coral larvae can move across oceans naturally, but humans could also contribute, relocating adult corals to jump-start the process."

Matz told The New York Times that the heat tolerance genetic quality is “highly heritable,” meaning it transfers easily between coral generations. The quality will spread naturally across the waters, but Matz told The Times that humans can make it occur more quickly. But this also isn’t a solution to climate change and warming ocean waters.

"This is not a magic bullet," Matz told the newspaper. "The existence of this gene variation buys us some time."

See also: [Crossbreeding Could Help Coral Survive Warming Waters](http://www.nytimes.com/2015/06/30/science/crossbreeding-could-help-coral-survive-warming-waters.html?_r=1) By Sindya N. Bhanoo, June 25, 2015 http://www.nytimes.com/2015/06/30/science/crossbreeding-could-help-coral-survive-warming-waters.html?_r=1

FIREBALL LIGHTS UP SKYLINE: \$20K AWARD OFFERED FOR PIECE OF METEOR

Derived from stories by Elizabeth Dinan May 17, 2016 at 3:46 PM in <http://www.seacoastonline.com/article/20160517/NEWS/160519241>, by Jody Houle in <http://www.newhampshirelakesandmountains.com/Articles-Berlin-Reporter-c-2016-05-25-162111.113119-Meteor-lights-up-the-sky-rumbles-Andoscoggin-Valley.html>, and by Danielle Waugh and Allison Freedman in <http://www.necn.com/news/new-england/Scientists-Narrow-In-On-Zone-In-Maine-Where-Meteorite-Could-Have-Fallen-380296691.html>

A meteor burning in the atmosphere occurred on Tuesday, May 17 at 12:50 a.m., and was visible in much of northern New England. A trail of light that lit up the early Tuesday morning sky may have been a meteor, "space junk," or debris from Haley's Comet, said Portsmouth astronomer Tom Cocchiaro. The terminal explosion of the meteor is reported to have occurred about 18.6 miles west of Rangeley, Maine in Franklin County. According to an article in the Berlin Daily Sun, many locals experienced the meteor, including Theodore Bosen, who saw the light from his Cates Hill home and felt his house shake. Cindy Pepin and Joanne Caron, both of Milan, said they heard the blast and Norman Caouette said he saw and heard it.



A fireball is seen over the Piscataqua River in Portsmouth early Tuesday morning. Photo by Michael McCormack

According to the American Meteor Society, the so-called fireball was reported Tuesday at 12:50 a.m. and was seen in Maine, Mass., New Hampshire, Vermont, New Jersey, New York, Pennsylvania and parts of Canada. Mike McCormack, who owns a web cam overlooking the Piscataqua River, captured the fireball through his camera and was fielding requests for copies of the image all Tuesday morning, he said.

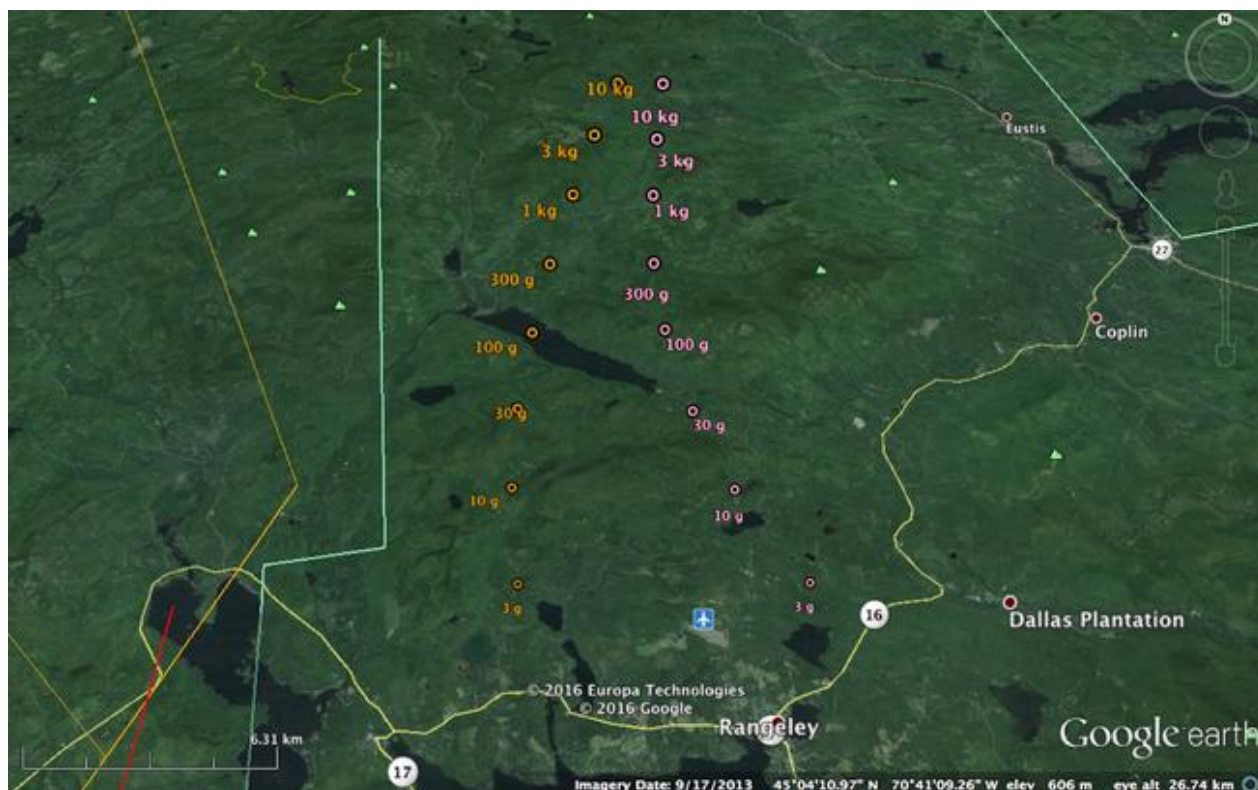
Cocchiaro, a member of the NH Astronomical Society, said scientific tracking reports predicted the reentry of space junk on Thursday. Because the fireball appeared green, he said, it could indicate the presence of copper and mean it was metal debris. However, he said, there is nickel in meteorites and that burns light green.

Cocchiaro said the Earth is also passing through the debris field of Haley's Comet and "maximum meteorite fall" was on May 5, but, "We're probably still somewhere in the cloud even now." "Debris from Haley's Comet is part of the annual Eta Aquarid Meteor Shower," he said, while reporting that 'earthgrazers' — long-lasting meteors that travel horizontally — are seen before dawn. The local astronomer said the scientific term for a fireball is a 'bolider' and that it's "an extremely bright meteor," "almost as bright as a full moon." Cocchiaro said meteors seen in showers are comprised of particles the size of piece of dust. The one seen early Tuesday, he said, "could've been the size of a marble, or a softball, or larger." "It probably hit the ground somewhere," he said. "It could've gone across quite a large area across the earth and it could've been hundreds of miles away."

Museum Director Barbra Barrett said in a press statement, "This is an exciting opportunity and we need the public's help." She said that with museum exhibits set to open in the spring of 2017, the museum "will be celebrating Maine's rich mining history and, in the course of doing so, will exhibit the most spectacular minerals and gems ever mined in Maine."

"In addition, there will be an extremely comprehensive meteorite collection featuring large specimens of the Moon, Mars and more," she said. The museum has a piece of the meteorite that famously fell in Russia three years ago and was also captured on camera. "As fireball observations go, this one was huge and a similarly huge reward awaits" a lucky person who finds it. Extraterrestrial treasure hunters are encouraged to first go to meteorite identification sites on the internet so they know what they're looking for. Based on the number of bursts in the sky, a number of meteorites may have made it to Earth." If it was a meteor, anyone who found one weighing more than a kilogram and turns it in to the Maine Mineral and Gem Museum in Bethel, Maine will be offered a \$20,000 reward, the museum announced. The meteorite will then rest in "a place of honor in the museum's Meteorite Hall," said Museum Director Barbra Barrett.

Barrett said that the week before the meteorite that the museum conducted meetings on its pending "Maine Fireball Network" that it's in the process of establishing. The museum will be setting up special cameras throughout the state which, when used together, "can determine the speed and orbit of the fireball, as well as assist in the recovery of possible meteorite fragments," she said. For more information contact Barrett at bbarrett@mainemineralmuseum.org.



Scientists were able to narrow in on the location where the meteorite fell on Tuesday morning in Maine. [Numbers on the map seem to be the mass of the particles found. – Ed.]

Rob Matson and Marc Fries, aerospace scientists, were able to create a map to calculate where the meteorite fell in Maine. According to the Maine Mineral and Gem Museum, the zone is an area three miles directly north of Rangeley and extends for about 10 miles. The smaller meteorites are found where the zone is the widest at its beginning.

"The chances of finding a meteorite are very slim," said mineral hunter Zoltan Matolcsy, who owns Maine Mineral Adventures in Woodstock, Maine. He advised people use a metal detector, magnet, and GPS when searching for one. "I would say your chances of winning Megabucks is probably a lot better," he laughed. But his wife, and business partner Jody said she might be willing to search, and get that reward. "I mean if it's out here, I'll be out here looking!" she said. "The more people who are looking, the better!"

EARTH'S OLDEST ROCKS HOLD ESSENTIAL INGREDIENT FOR LIFE By Becky Oskin - June 13, 2014 - http://www.livescience.com/46318-life-ingredient-found-in-greenland-rocks.html?li_source=LI&li_medium=more-from-livescience

SACRAMENTO, Calif. — A critical building block for creating the first life on Earth was found in 3.8-billion-year-old rocks from Isua, Greenland, researchers reported this week here at the annual Goldschmidt geochemistry conference. For the first time, rich concentrations of the element boron have been found in Isua's ancient marine rocks, study author Takeshi Kakegawa, a professor at Tohoku University in Japan, said Monday (June 9, 2014). The discovery signals that boron was circulating in seawater and was absorbed by marine clays, which eventually became tourmaline, he said.



Early Archean serpentine mud volcanoes in Isua, Greenland. Scientists have found a critical building block for the first life on Earth in 3.8-billion-year-old rocks from Isua. Credit: PNAS/Marie-Laure Pons, et al.

Boron can stabilize ribose, one of three key components of RNA. Ribose, an organic sugar molecule, has a short half-life and naturally decomposes without a stabilizer. Many researchers think life on Earth descended from RNA, which self-assembled from building blocks such as ribose.

Until now, theories for the origin of RNA life pointed to RNA-based chemicals arriving on Earth from Mars. That's because Earth's first rocks and oceans seemed devoid of boron, which takes the form of borate minerals on Earth. On Mars, clays with boron and another RNA stabilizer, molybdenum, are abundant.

"I want to challenge this idea that the early ocean was borate free," Kakegawa said. "The early ocean already contained borate, and therefore, early Earth — not Mars — could provide environments to stabilize ribose."

The Isua rocks are among the oldest pieces of crust still around from Earth's earliest eons. The layers were deposited under a liquid water ocean, perhaps when life was first emerging. After billions of years of continental smashups, the rocks have been heated, faulted and folded, but geologists can still decipher their original history. Some of the rocks were seafloor sediments, such as mud and chert, and others were lavas erupted from underwater volcanic vents, such as pillow basalts.

Kakegawa discovered the boron in tiny tourmaline crystals trapped inside garnets in the ancient seafloor sediments. The garnets and tourmalines formed after the sediments were deposited, when the rocks were metamorphosed. Boron is one of the major elements of tourmaline.

Isua's volcanic rocks also carry boron-rich tourmalines, according to a separate study reported Wednesday (June 11, 2014) by Edward Grew, a professor at the University of Maine. Hydrothermal fluids circulating in the rocks are the likely source of the boron, Grew said.

Boron has two isotopes (elements with different numbers of neutrons in their nuclei). The boron isotope ratio in Isua's volcanic rocks also suggests early oceans carried enough boron to support RNA-based life, Grew reported. "This is consistent with the scenario Dr. Kakegawa suggested," Grew said. "There could have been a role for boron in the stabilizing of ribose in the RNA origin of life."

Grew found evidence for boron-rich seawater cycling through the Isua volcanic rocks, despite a lack of continental crust. The tourmaline formed in an environment resembling today's deep-sea hydrothermal vents, where superheated seawater and other fluids spew from volcanic fractures. The abundant tourmalines indicate the fluids circulating through the ancient rocks were rich in boron, Grew said. "There is no convincing evidence of seawater boron concentrations being lower at 3.8 billion years ago than at the present," Grew said.

See more at: http://www.livescience.com/46318-life-ingredient-found-in-greenland-rocks.html?li_source=LI&li_medium=more-from-livescience#sthash.BLIyT7M3.dpuf.

See also "7 Theories on the Origin of Life" By Charles Q. Choi at: <http://www.livescience.com/13363-7-theories-origin-life.html#sthash.ozA2ILID.dpuf>.

TONY GIUNTA RECOGNIZED FOR BUSINESS LEADERSHIP IN NEW HAMPSHIRE

Tony Giunta, Senior Client Manager in Nobis' Concord office, was recognized by the Business Industry Association of New Hampshire with an "Above and Beyond" Award. The award was presented at the group's annual business meeting and member reception held Thursday, May 12 at the Radisson Hotel Manchester.

The Above and Beyond Award recognizes members who demonstrate outstanding achievement in helping BIA meet its mission which is "To promote a healthy business climate and robust economic future for New Hampshire. Through advocacy with state legislators and regulators, [BIA] shapes business-friendly public policy and provides counterbalance to legislation and regulations that threaten the growth and prosperity of New Hampshire business."

"We are pleased with Tony's efforts to help build business for Nobis and community leaders in New Hampshire and excited about the recognition he received from BIA," said Ken Koornneef, President.

<http://www.nobisengineering.com/news/article/tony-giunta-recognized-for-business-leadership-in-new-hampshire>

GSNH SUMMER 2016 GEOLOGY FIELD TRIP

Saturday August 6, 2016

RSVP by 4 PM Friday, July 29, 2016
to LeaAnne Atwell at:

scott.leanne@gmail.com

The plan is to meet at the base of the Mt. Washington Auto Road at 9:30 AM for sign-in and car pool set-up; stop for geology on the drive up the auto road to the summit of Mount Washington; at the summit, tour the Mount Washington Observatory's weather facilities and experience during the summer, the winter conditions on Mt. Washington at the new Extreme Mount Washington exhibit at the Summit Museum; tour the summit and hear about latest cosmogenic dates on the summit and what they say about glacial ice that covered the Mountain, and about the latest work on post-Late Wisconsinan cirque glacier activity; then return to the base of the auto road for a delicious catered lunch.

Cost and details at http://gsnh.org/meeting_events/nexttrip.shtml.



Field trip guide Brian Fowler at Mt. Washington summit; P. Thom Davis will also be a guide.

Shouldn't you get a pH.D. if you get a doctorate in chemistry?

WAS THE FUKANG METEORITE STOLEN???

AN UPDATE ON A STORY IN THE LAST NEWSLETTER



This "Fukang meteorite" in question is at the heart of a battle between Stephan Settgast of Marin County, Calif. and the Maine Mineral And Gem Museum in Maine. Date unknown.

A gold-flecked meteorite that has traveled from the asteroid belt near Mars to the mountains of Fukang, China, and finally Marin County, California, is at the center of a vicious ownership battle being waged in federal court.

The 227-pound iron "pallasite" meteorite is estimated to be 4.5 billion years old. First discovered in Fukang, China about 15 years ago, it could be worth as much as \$1 million, according to Stephen Settgast, an asteroid collector who claims he's the rightful owner. He sued a museum in Maine and a New York meteorite expert in February alleging breach of contract [in a suit filed February 23, 2016 - <https://assets.documentcloud.org/documents/2797103/Meteorite-Lawsuit.pdf>] over the sale of the meteorite. But they have now filed a counterclaim, alleging that Settgast, who is staying in Marin County, is behind a "blatant theft of a unique and precious meteorite."

The countersuit alleges Settgast sold the meteorite for \$425,000, then engaged in an "outrageous act of seller's remorse" by stealing back the space rock for himself. "This isn't a typical theft," said Wayne Minckley, undersheriff in Miami County, Kansas. A sheriff is involved in the out-of-this-world case because authorities aren't yet ready to decide who stole the meteorite until the suit is settled. "It's a complicated case in the mere fact that the individual who sold it to the folks in Maine is our suspect in the theft," Minckley said.

More at <http://www.necn.com/news/national-international/Stolen-Meteorite-Marin-County-Settgast-Pitt-Sheriff-Federal-Lawsuit-374758791.html>.

SENATE PUSHES USGS DIRECTOR FOR MORE ACTION

U.S. senators pressed Suzette Kimball, December's newly confirmed director of the USGS to beef up its minerals and hazards programs at a 7 April oversight hearing about the agency's priorities, budget, and cutting-edge science.

<https://eos.org/articles/senate-pushes-usgs-director-for-more-action-on-minerals-hazards>

NINTH PLANET MAY EXIST BEYOND PLUTO By Kenneth Chang Jan. 20, 2016

There might be a ninth planet in the solar system after all, and it is not Pluto. Two astronomers reported on [January 20] that they had compelling signs of something bigger and farther away — something that would satisfy the current definition of a planet, where Pluto falls short.

“We are pretty sure there’s one out there,” said Michael E. Brown, a professor of planetary astronomy at the California Institute of Technology. What Dr. Brown and a fellow Caltech professor, Konstantin Batygin, have not done is actually find that planet. In a paper published in *The Astronomical Journal*, Dr. Brown and Dr. Batygin laid out a detailed circumstantial argument for the planet’s existence in what astronomers have observed: a half-dozen small bodies in distant elliptical orbits.

What is striking, the scientists said, is that the orbits of all six loop outward in the same quadrant of the solar system and are tilted at about the same angle. The odds of that happening by chance are about 1 in 14,000, Dr. Batygin said. A ninth planet could be gravitationally herding them into these orbits.

For the calculations to work, the planet would be at least an equal to Earth, and most likely much bigger — perhaps a mini-Neptune, with a small but thick atmosphere surrounding a rocky core and mass about 10 times that of Earth. That would be 4,500 times the mass of Pluto.

Pluto, at its most distant, is 4.6 billion miles from the sun. The potential ninth planet, at its closest, would be about 20 billion miles away; at its farthest, it could be 100 billion miles away. One trip around the sun would take 10,000 to 20,000 years. “We have pretty good constraints on its orbit,” Dr. Brown said. “What we don’t know is where it is in its orbit, which is too bad.” Alessandro Morbidelli of the Côte d’Azur Observatory in France, an expert in dynamics of the solar system, said he was convinced. “I think the chase is now on to find this planet,” he said.

This would be the second time that Dr. Brown has upended the map of the solar system. In January 2005, he discovered a Pluto-size object, now known as Eris, in the Kuiper belt, the ring of icy debris beyond Neptune. The next year, the International Astronomical Union placed Pluto in a new category, “dwarf planet,” because in its view, a full-fledged planet must be the gravitational bully of its orbit, and Pluto was not.

The first indication of a hidden planet beyond Pluto had come a couple of years earlier. The Kuiper belt extends outward from Neptune’s orbit, about 2.8 billion miles from the sun, to a bit less than twice Neptune’s orbit, about five billion miles. Astronomers expected that beyond lay mostly empty space. Thus, they were surprised when Dr. Brown and two colleagues spotted a 600-mile-wide icy world at a distance of eight billion miles that remained well outside the Kuiper belt even at the closest point in its orbit.

No one could convincingly explain how the object, which Dr. Brown named **Sedna**, got there, and the hope was that the discovery of more Sedna-like worlds would provide enlightening clues. Instead, astronomers looked and found nothing, deepening the mystery.

Finally, in 2014, Chadwick Trujillo, who had worked with Dr. Brown on the Sedna discovery, and Scott S. Sheppard, an astronomer at the Carnegie Institution for Science in Washington, reported a smaller object in a Sedna-like orbit, always remaining beyond the Kuiper belt. Dr. Trujillo and Dr. Sheppard noted that several Kuiper belt objects had similar orbital characteristics, and they laid out the possibility of a planet disturbing the orbits of these objects. “It was the best explanation we could come up with,” Dr. Trujillo said.

But the particulars of their proposed planet did not explain what was in the sky, Dr. Brown said. “The theorists didn’t really take it seriously,” he said. “They figured it was all some observational effect. The observers didn’t take it seriously, because they figured it was all some theoretical thing they couldn’t understand.” Still, the peculiarities of the orbits appeared genuine. Dr. Brown said he and Dr. Batygin “sat down and beat our heads against the wall for the last two years.”

First, they focused on the six objects in stable orbits and disregarded others that had been recently flung out by Neptune. That made the picture clearer. “They all point into the same overall direction,” Dr. Batygin said. “This is in stark contrast with the rest of the Kuiper belt.” Besides the long odds of this alignment being coincidental, Dr. Batygin said, this pattern would disperse over time.

That argued for the force of some unseen body guiding Sedna and the others. Dr. Batygin, a theorist, tried placing a planet among them using computer simulations, which scattered some Kuiper belt objects, but the orbits were not sufficiently eccentric. Then he examined what would happen if a ninth planet were looping outward in the opposite direction. That, Dr. Batygin said, gave “a beautiful match to the real data.”

The computer simulations showed that the planet swept up the Kuiper belt objects and placed them only temporarily in the elliptical orbits. Come back in half a billion years, Dr. Brown said, and Sedna will be back in the Kuiper belt, while other Kuiper belt objects will have been pushed into elliptical orbits. Another strange result in the simulations: A few Kuiper belt objects were knocked into orbits perpendicular to those of the planets. Dr. Brown remembered that five objects had been found in perpendicular orbits. “They’re exactly where we predicted them to be,” he said. “That’s when my jaw hit my floor. I think this is actually right.”

Dr. Morbidelli said a possible ninth planet could be the core of a gas giant that started forming during the infancy of the solar system; a close pass to Jupiter could have ejected it. Back then, the sun resided in a dense cluster of stars, and the gravitational jostling could have prevented the planet from escaping to interstellar space. Dr. Brown has begun searching for the planet, and thinks he will find it within five years. If the planet exists, it would easily meet the definition of planet, Dr. Brown said. “There are some truly dominant bodies in the solar system, and they are pushing around everything else. This is what we mean when we say planet.”

http://www.nytimes.com/2016/01/21/science/space/ninth-planet-solar-system-beyond-pluto.html?_r=1

THE NH GEOLOGICAL SURVEY GROUND WATER LEVEL NETWORK SUMMARY

Submitted by Lee Wilder of the NHGS

March 2016 - NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from March 28, 2016 – April 04, 2016. The statewide March 2016 average groundwater level for wells in the overburden (in soils on top of the bedrock) showed an increase of +0.39 feet from February 2016. When compared with March 2015, the statewide average groundwater level for March 2016, in these wells, increased +0.91 feet. The March 2016 average groundwater level in the new bedrock wells showed an increase of +0.91 feet, when compared with February 2016. When compared with March 2015, the bedrock wells showed an increase of +0.97 feet for March 2016.

April 2016 - NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from April 25, 2016 – April 30, 2016. The statewide April 2016 average groundwater level for wells in the overburden (in soils on top of the bedrock) showed a decrease of -0.06 feet from March 2016. When compared with April 2015, the statewide average groundwater level for April 2016, in these wells, decreased -0.46 feet. The April 2016 average groundwater level in the new bedrock wells showed an increase of +0.06 feet, when compared with March 2016. When compared with April 2015, the bedrock wells showed an increase of +0.53 feet for April 2016.

May 2016 - NH Groundwater level measurements were collected by the NH Geological Survey staff and volunteers from May 23, 2016 – May 31, 2016. The statewide May 2016 average groundwater level for wells in the overburden (in soils on top of the bedrock) showed a decrease of -0.48 feet from April 2016. When compared with May 2015, the statewide average groundwater level for May 2016, in these wells, decreased -0.18 feet. The May 2016 average groundwater level in the new bedrock wells showed a decrease of -1.01 feet, when compared with April 2016. When compared with May 2015, the bedrock wells showed an increase of +0.90 feet for May 2016.

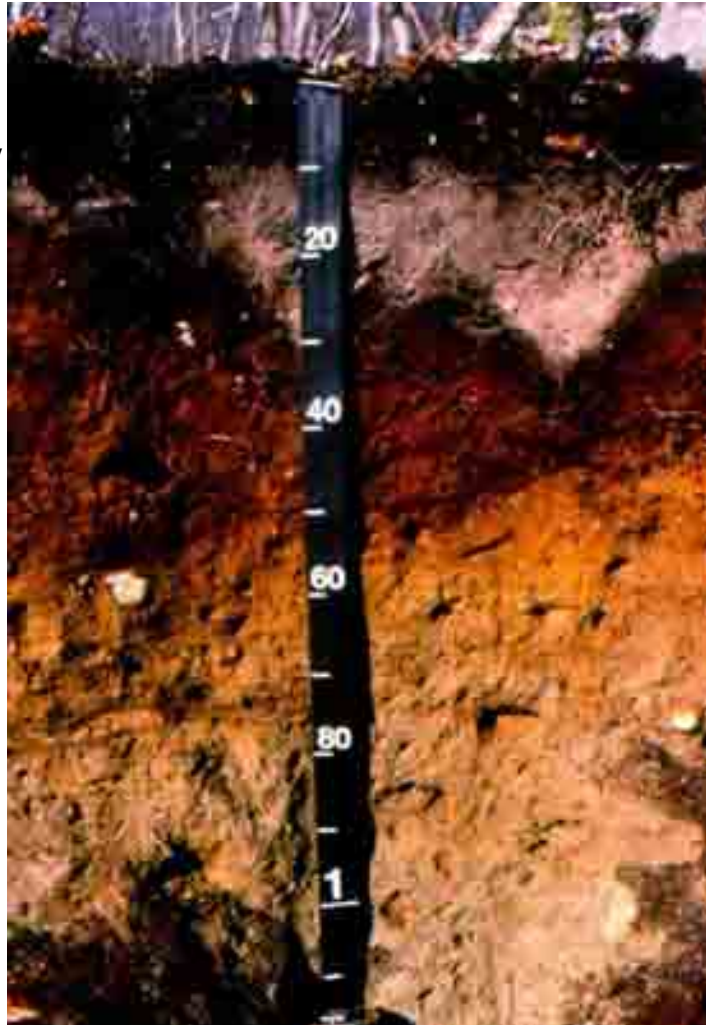
The groundwater level measurements for the deeper of the two Concord bedrock wells (CVWB-1) are **not** presently available in real-time. Past data are on the USGS website at: http://waterdata.usgs.gov/nh/nwis/uv/?site_no=431034071340501&PARAMeter_cd=72019.

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

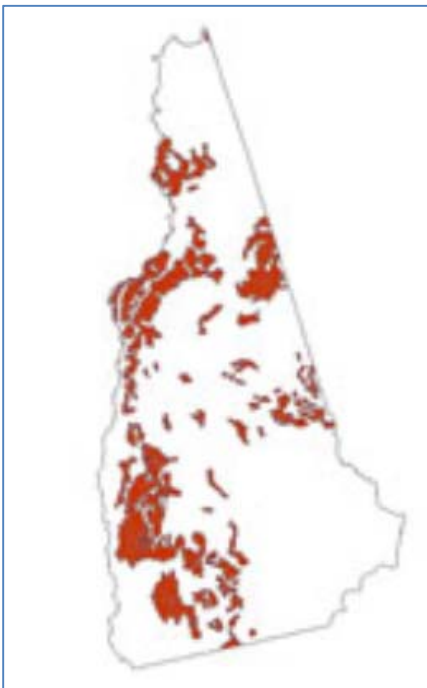
MARLOW - THE NEW HAMPSHIRE STATE SOIL

The Marlow series was established in 1939 and named for the town of Marlow in Cheshire County, New Hampshire. It is a well-drained soil that has a very firm substratum of basal till that was deposited by the glacier during its last advances over the northeast about 15,000 years ago. Marlow soils occur on smooth, rounded drumlins as well as in the glaciated uplands of the mountains.

From rock-lined rolling fields to the steep forested uplands of the White Mountains, Marlow soils underlie much of the picturesque backdrop of rural New Hampshire. Many of the State's current farms are located on this same land that the early settlers cleared of trees and stones. The broad, gently sloping hillsides and summits of these loamy drumlins are some of the most productive soils for agriculture in the harsh granitic landscapes of New Hampshire. Marlow soils are also economically important soils for timber products, where the climax forest typically consists of shade-tolerant hardwoods such as sugar maple and beech.



The picture (above) is a typical Marlow Soil, dug down to about 1 meter.



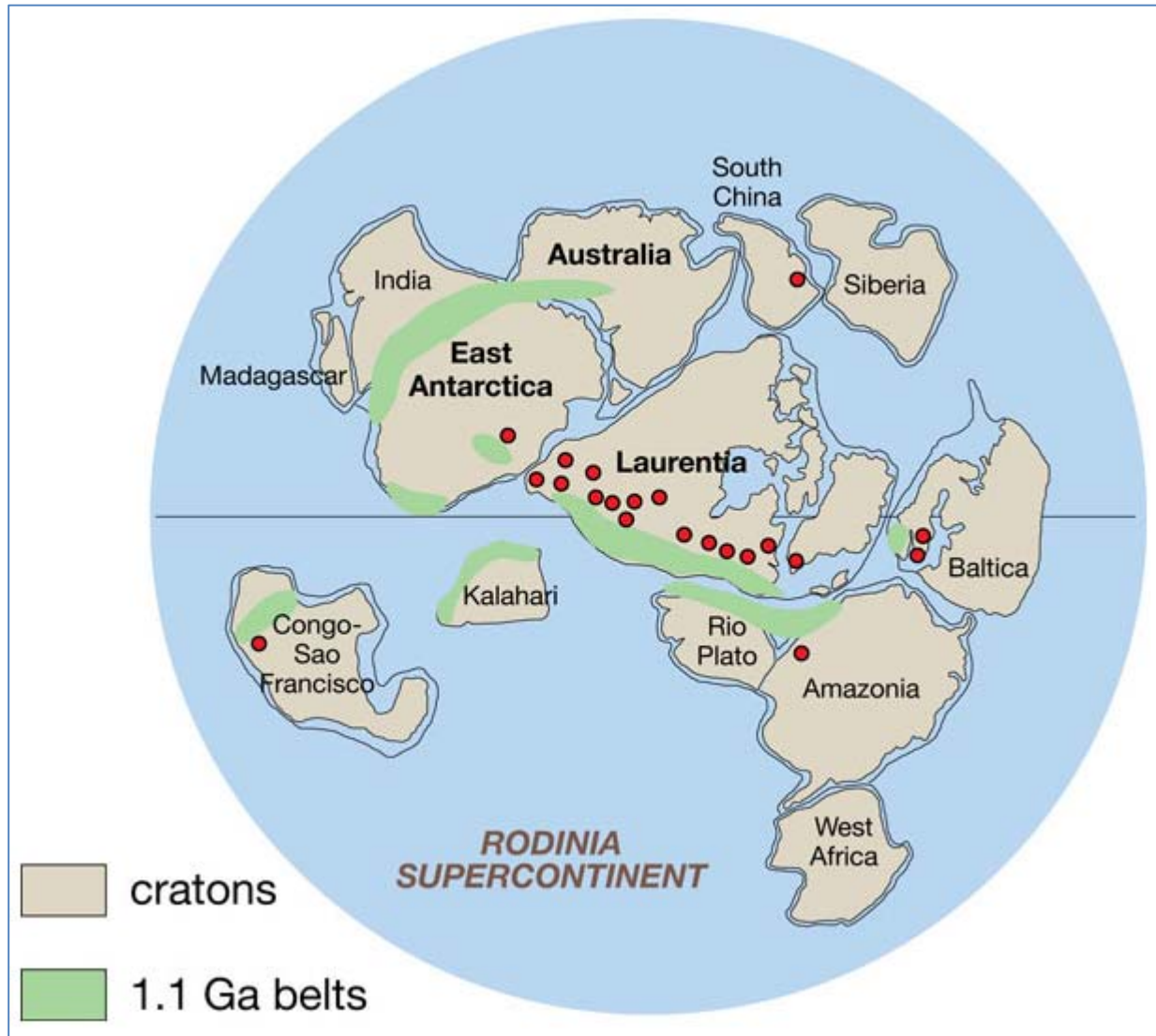
Although not officially adopted as the State Soil by the Legislature, Marlow was chosen by a committee of New Hampshire Soil Scientists several years ago, and is recognized as the State Soil nationally by the USDA - Natural Resources Conservation Service.

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nh/soils/?cid=nrcs144p2_015724

The map at left shows the extent of Marlow Soil in New Hampshire.

PAPER SUGGESTS EAST ANTARCTICA AND NORTH AMERICA ONCE LINKED

An international team of researchers has found evidence that parts of North America and Antarctica were connected 1.1 billion years ago. “I can go to the Franklin Mountains in West Texas and stand next to what was once part of Coats Land in Antarctica,” said Staci Loewy, a geochemist at California State University, Bakersfield, referring to a stretch of East Antarctica along the Weddell Sea. “That’s so amazing,” added Loewy, lead author of a paper published in *Geology*.



Proposed reconstruction of ancient Rodinia. Graphic Credit: John Goodge

Loewy and her colleagues discovered that rocks collected from both locations have the exact same composition of lead isotopes. Earlier analyses showed the rocks were the same age and had the same chemical and geologic properties.

The find offers further evidence for the so-called SWEAT (Southwest United States-East Antarctica) hypothesis. The theory suggests that ancestral North America and East Antarctica were joined in an earlier supercontinent called Rodinia.

Loewy and her colleagues reported that rocks barely peeking through the ice in Coats Land reflect a former continuation of the North American rift system.

The approximately 1.1-billion-year-old North American Midcontinent Rift System extends from the Great Lakes to Texas. Volcanic rocks associated with the rift are well exposed in the Keweenaw Peninsula of the Upper Peninsula of Michigan from which they take their name, the

Keweenaw large igneous province. The rift extends in the subsurface beneath Minnesota, Iowa, Nebraska, Kansas and Oklahoma to the Franklin Mountains near El Paso, Texas where related rocks are exposed.

The work also sheds light on ancestral North America's connections with southern Africa, according to the authors. The Coats Land rocks are identical in age to both the Keweenaw large igneous province of the North American mid-continent rift and the contemporaneous Umkondo large igneous province of southern Africa. Isotopic composition of the rock also provides evidence for the link.

The tiny Coats Land block of Antarctica is a "tectonic tracer," providing critical clues to the geographic relationships between three of the major continents of the planet about a billion years ago, just prior to the opening of the Pacific Ocean basin, the hypothesized Snowball Earth glaciations and the rise of multi-cellular life.

<http://antarcticsun.usap.gov/science/contenthandler.cfm?id=2497>. See also "One in a million: Granite boulder links Antarctica to western United States as part of ancient supercontinent at <http://antarcticsun.usap.gov/science/contenthandler.cfm?id=1505>.



DINOSAUR DIE-OFF NOT A RESULT OF VOLCANOES, STUDY SAYS

By Jim Shelton, Pincelli Hull, James Rae, and Daniela Schmidt - April 25, 2016

http://news.yale.edu/2016/04/25/dinosaur-die-not-result-volcanoes-study-says?utm_source=YNemail&utm_medium=email&utm_campaign=ynewsletter-04-25-16

A new study suggests that volcanic eruptions did not lead to the extinction of the dinosaurs, and also demonstrates that Earth's oceans are capable of absorbing large amounts of carbon dioxide — provided it is released gradually over an extremely long time.

Scientists have long argued over the cause of the Cretaceous-Paleogene extinction event, during which three-quarters of all plant and animal species, including the dinosaurs, went extinct roughly 65 million years ago. Most researchers favor the idea that a catastrophic, sudden mechanism such as an asteroid hit triggered the mass die-off, while others say a gradual rise in CO₂ emissions from volcanoes in what is now India may have been the cause.



(Image from Shutterstock)

Scientists at Yale and in the United Kingdom say they may have a more definitive answer. “One way that has been suggested that volcanism could have caused extinction is by ocean acidification, where the ocean absorbs CO₂ and becomes more acidic as a result, just as it is doing today with fossil fuel-derived CO₂,” said Michael Henehan, a postdoctoral associate at Yale and lead author of a study appearing April 25 in the journal *Philosophical Transactions of the Royal Society B*.

“What we wanted to do was gather all the evidence that’s been collected from ocean sediments from this time and add a few new records of our own, and consider what evidence there is for ocean acidification at this time,” Henehan said.

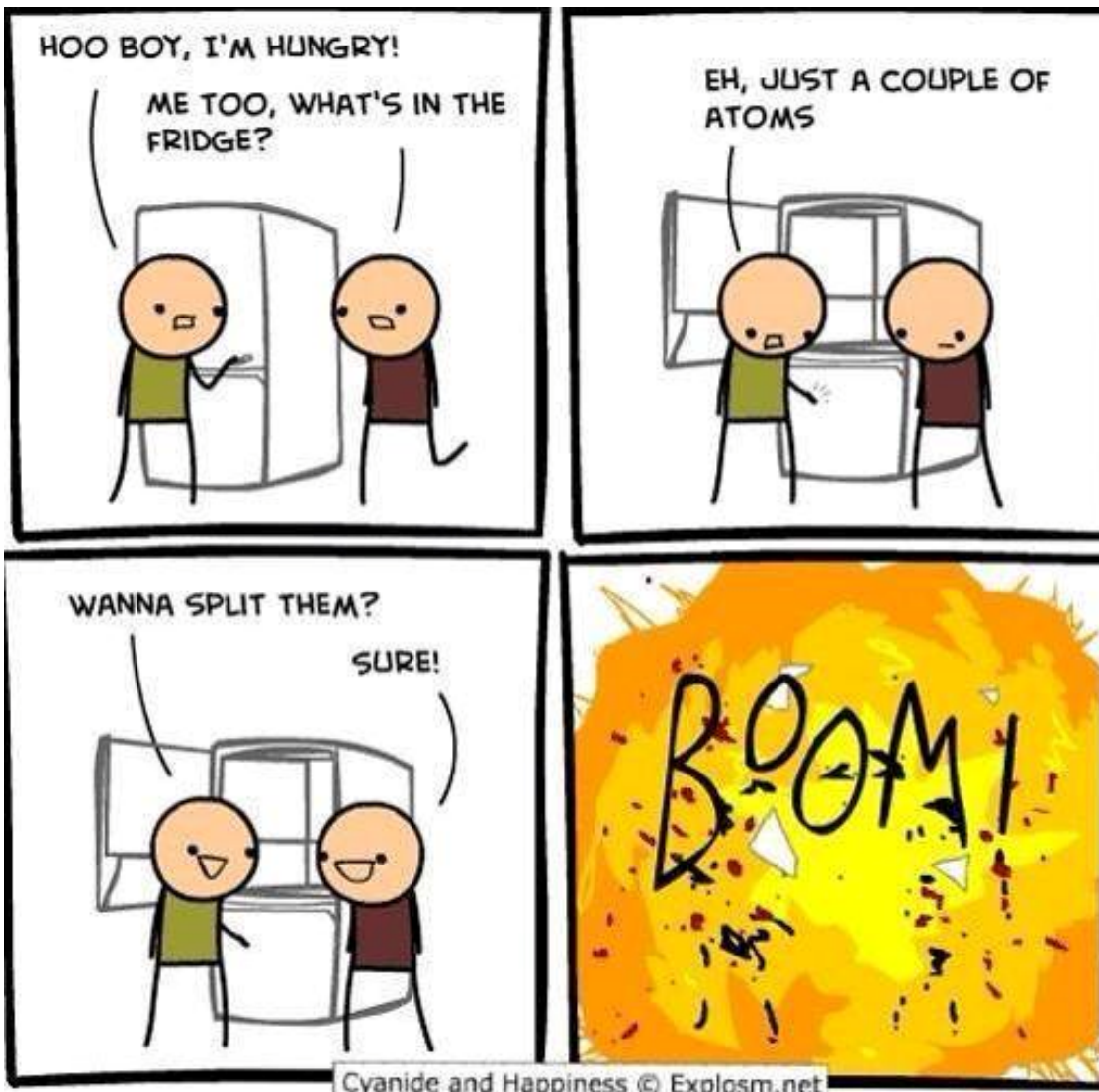
Henehan and his colleagues analyzed sediments from the deep sea, looking for signs of dissolution that would indicate more acidic oceans. The researchers found that the onset of volcanism did cause a brief ocean acidification event. Critically, though, the pH drop caused by CO₂ release was effectively neutralized well before the mass extinction event.

“Combining this with temperature observations that others have made about this time, we think there is a conclusive case that although Deccan volcanism caused a short-lived global warming event and some ocean acidification, the effects were cancelled out by natural carbon cycling processes long before the mass extinction that killed the dinosaurs,” Henehan said. This

is not to say that CO₂ released by volcanoes did not prompt climate effects, the researchers noted: Rather, the gases were released over such a long timescale their effect could not have caused a sudden, species die-off.

The study also has implications for understanding modern climate change, the researchers noted. They said it adds to an increasing body of work that suggests restricting CO₂ release to much slower and lower levels over thousands of years can allow the oceans to adapt and avoid the worst possible consequences of ocean acidification. "However, if you cause big disturbances over rapid timescales, closer to the timescales of current human, post-industrial CO₂ release, you can produce not only big changes in oceanic ecosystems, but also profound and long-lasting changes in the way the ocean stores and regulates CO₂," Henehan said.

The researchers said their work also suggests that disruption of marine ecosystems can have profound effects on Earth's climate. "The direct effects of an asteroid impact, like massive tsunamis or widespread fires, would have lasted only for a relatively short time," said co-author Donald Penman, a postdoctoral associate at Yale. "However, the loss of ecologically important groups of organisms following impact caused changes to the global carbon cycle that took millions of years to recover. This could be seen as a warning for our future: We need to be careful not to drive key functional organisms to extinction, or we could be feeling the effects for a very long time."



DATES TO REMEMBER

June 26-29, 2016 - 50th US Rock Mechanics/Geomechanics Symposium to be held in Houston, Texas. For information on the symposium, accommodations and sponsorship, visit www.armasyposium.org.

August 6, 2016 – GSNH Summer Field Trip to the Mt. Washington summit, observatory and new museum. Stops on ride to summit. Barbeque. Rain or shine. Look for details at <http://www.gsnh.org/>.

October 12, 2016 – GSNH Fall Dinner Meeting – TBA – This meeting will be held on **WEDNESDAY** night so you can make it to NEIGC Friday am. <http://www.gsnh.org/>

October 14-16, 2016 – NEIGC - New England Intercollegiate Geological Conference - Geology of the Maine Coast from Maquoit Bay to Muscongus Bay
<http://w3.salemstate.edu/~lhanson/NEIGC/Conference.html>

November 12-15, 2017 - Mount Washington Observatory Regional Climate Science Colloquium – Bringing together climate scientists and related educators to assess the status of climate science investigations and education. Keep an eye out.

A MESSAGE TO FIELD TRIP LEADERS AND GUIDEBOOK AUTHORS FROM GEOLOGY LIBRARIANS REGARDING FIELD TRIP GUIDEBOOKS

Field trip season is underway! As a member of the Geoscience Information Society (GSIS) Guidebooks Committee, I'd like to draw your attention to some free, helpful tools for guidebooks, as well as make an appeal for your help in preserving and indexing field trip guidebooks.

The publication *Guidelines for Authors, Editors, and Publishers of Geologic Field Trip Guidebooks*, revised 2015, is available for download in pdf format: <http://www.geoinfo.org/Guidebook%20guidelines%20for%20authors%202015.pdf>. These guidelines were compiled by the GSIS Guidebooks Committee. These standards, if followed, will enhance both discovery and durability of this valuable information. The 2015 revision includes suggestions for digital as well as hard copy guidebooks.

GSIS also makes an annual award (http://www.geoinfo.org/best_guidebook.html) for the recently published guidebook that best exemplifies these standards.

The three major resources for identifying geologic field trip guidebooks, and finding a copy are: AGI's GeoRef (many universities have a subscription); the free, searchable "Geologic Guidebooks of North America Database" (GGNAD) (<http://www.americangeosciences.org/georef/online-database-products>) and WorldCat. If you publish a guidebook, let me know and I will pass the information along to the GGNAD and GeoRef indexers. Many guidebooks are unique and valuable sources of information long after the trip is over and these guidelines will help ensure that the information that you publish is available to future researchers. Thank you very much for your consideration.

Regards, Thelma Thompson / Lee Wilder

ROCKIN' QUOTES

Rocks are records of events that took place at the time they formed. They are books. They have a different vocabulary, a different alphabet, but you learn how to read them. -John McPhee

With their four-dimensional minds, and in their interdisciplinary ultra verbal way, geologists can wiggle out of almost anything. -John McPhee



MEMBERSHIP & RENEWAL APPLICATION

Geological Society of New Hampshire

PO Box 401, Concord, NH 03302

Name: _____

(Please print clearly)

E-mail: _____

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

New applicants: please complete this section.

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

Home Address:

Business Address:

Home address lines

Business address lines (Employer):

Home Telephone: _____

Office Telephone: _____

New Hampshire PG # (if applicable) _____

Education: Degrees received or in progress:

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

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

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

Membership Category:

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

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

Signature: _____ Date: _____