THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: September 26 Time: 7:30 p.m.

Long Branch Nature Center, 625 S. Carlin Springs Rd., Arlington, VA 22204

Brucite

Tilly Foster Iron Mine, Putnam County, NY

Source: Mindat. Photo: Harold Moritz.

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September 2022
Explore our website!

September Meeting Program:

Sharing Summer Stories

details on page 7

In this issue …

Mineral of the Month
Brucite

by Sue Marcus

September brings us the opportunity to learn about another Mineral of the Month, this time brucite. This mineral was named for Dr. Archibald Bruce, a physician with a scholarly interest in minerals. Bruce's father, a physician with the British army in New York during the American Revolution, did not want his son to follow in his professional footsteps. Apparently, young Archibald rebelled, as many young people do, and left home in New York to study and become a physician in Europe.

There, he became interested in minerals while meeting the many European scientists whose works were foundational to the organized study of minerals. Bruce was a mineral enthusiast, wanting to share his interest with others, both professional scientists and anyone who might be curious about minerals.

Returning to New York, he founded the *American Mineralogical Journal* in 1810. A fascinating account of the journal is provided in a book review by Sister Luigi Farrell, F.C.J., in *Acta Crystallographica*, section B. We are informed that Bruce created the journal to bring together geological observations by "the miner, the quarrier, the surveyor, the engineer, the collier, the iron master, and even the traveller [*sic*]." What admirably broad appeal (with no mention of geologists or mineralogists)!

Bruce himself used the journal to publish his description of a "magnesia-" bearing mineral from New Jersey. He did not name the mineral, however. His name is usually reported as having been bestowed on it in 1824 by François Sulpice Beudant, a French mineralogist and geologist. Although this is what Mindat tells us, in 1818 another noted mineralogist, Benjamin Silliman, stated that "Brucite" was "A new Species in Mineralogy, discovered by the late Dr. Bruce. We hope to publish in the next Number a description and analysis of it." The original edition of Silliman's first volume of the *American Journal of Science* credits his good friend, Dr. Bruce, with first identification of a natural magnesia hydroxide—"hydrate of magnesia," in Silliman's terms.

The layered crystal structure of brucite leads it to form foliated masses. This mineral species is not part of the mica group; its structure is much simpler, and it does not form flat sheets that can be split. Brucite is uncommon, though not rare. Well-crystalized or otherwise attractive specimens come from few localities, whereas

Fall is almost here!

Northern Virginia Mineral Club members,

No in-person meeting in September!

***** Zoom meeting this month *****

See details on page 7.

Brucite, Bazhenovsk deposit, Asbest, Sverdlovsk Oblast, Russia. Source: Mindat; photo: Rob Lavinsky.

many other localities have produced massive or otherwise unattractive brucite.

Brucite is a secondary mineral that forms from altered igneous, then metamorphic rocks. We might even consider is a tertiary mineral. To cook up some brucite, we start with mafic igneous rocks. (Mafic means rich in magnesium and iron, with little quartz.) These rocks are rich in peridotite or other dark minerals like those in the pyroxene and amphibole groups.

The mafic rocks that eventually form brucite come from deep within the mantle deep within the Earth. Rising through tectonic forces that create mountains, the mafic rocks are exposed to fluids that alter them. Some of the mafic rocks alter to serpentine. Further alteration of serpentine can form many interesting minerals, including brucite.

Unfortunately for collectors, brucite usually forms crusts or thin coatings rather than attractive crystals. Lack of open spaces in the host rocks probably squeezes small amounts of fluids that deposit these thin brucite occurrences. There are exceptions (for which we collectors are thankful) where tectonic forces allow voids in the host rocks in which brucite can form. In many of these types of deposits, such as the ones in Maryland and Pennsylvania, serpentine occurs with asbestiform minerals. Environmental concerns about the dangers of short-fiber asbestiform minerals causing lung damage that can lead to cancer has caused some quarries to close and has limited collecting. There is a fibrous form of brucite, unofficially called nemalite.

Another way that brucite can form is when dolomite is metamorphosed to periclase, which in turn chemically breaks down to become brucite. Industrial brucite mining is usually done in these types of brucite deposits due to the economics of mining bulk material. These deposits are less likely to produce attractive brucite specimens.

Brewster, NY, is home of the famous Tilly Foster Mine. Most brucite from his locality is massive, foliated, and unimpressive. There are exceptions, like unique specimens of brucite rimmed by clinochlore posted on Mindat by Harry Moritz. Other pure brucite crystals were also found at the mine, though never abundantly. The mine closed after a fatal rockslide in 1897 and it is now partly flooded by a reservoir.

The mineral that, once described and named, became brucite was first found at Castle Point near Hoboken,

Brucite, Wessels Mine, Hotazel, Kalahari Manganese Field, Northern Cape, South Africa.
Source: Mindat; photo: Rob Lavinsky.

NJ. The type material was massive, foliated, or fibrous in altered serpentine. A Mindat poster noted that the locality was built over by 1900. Archibald Bruce lived in the vicinity in the early 19th century. He may have found the foliated specimens of the new mineral. Through scientific tests, he determined that it consisted of simply magnesium and water.

The quarries along the Maryland-Pennsylvania border, known as the State Line quarries, are sources of some of the best brucite specimens in the United States. These quarries sold crushed rock for industrial purposes like roads, riprap, and other uses that required some crushing though no extensive processing. Some of the quarries are in Lancaster County, PA, but the

Brucite crystals on display in the Smithsonian Museum of Natural History. The specimen is from the Cedar Hill Quarry, Lancaster County, PA.

mining district extends into Cecil and Hartford Counties, MD, with some quarries crossing the state boundary. This reminds us that geology doesn't respect human borders, although borders are sometimes based on geology.

The best mineral collecting sites may have been the Wood's Chrome Mine and the Cedar Hill and Haines & Kibblehouse Penn-Md Materials quarries in Lancaster County, PA. Williamsite, a translucent form of serpentine, can be found in these quarries, along with brucite, magnesite, and (in a few locations) chromite. Particularly attractive, well-crystallized specimens came from the Wood's Mine. Some of us have collected brucite and other minerals there. I never found any specimens like the lovely ones helping to illustrate this article. Most of what I found was the more typical massive brucite. Note that one of the pictured specimens was obtained from Paul and Jennie Smith, former members of this club.

Magnesite is mined near Gabbs, NV, at the Sierra Mine. Most of the brucite from this area is massive and—well, ugly. Rarely, brucite forms micro- and macrocrystals with a pearly or waxy luster. The best of these are transparent to translucent crystals reaching up to about 1 centimeter in the greatest dimension. During World War II, this deposit was owned by the federal government, though privately mined for magnesium for the war effort. The famous Crestmore Quarry near Riverside, CA, also produced brucite crystals, though they were never common. Roger and I collected in that quarry when we lived in Riverside, but we never found brucite there.

Both the Crestmore and Sierra deposits exploited skarn deposits. Skarns form when intrusive rocks like diorite push into carbonate rocks like limestone and dolomite. The carbonate rocks are metamorphosed, and new minerals like brucite are created. Most of the brucite discussed in this article comes from the other type of brucite formation, in which mafic rocks are transformed into serpentine.

Brazil is a treasure house of minerals. Oddly, I could find nothing more than passing mentions of brucite from there, even though Brazilian magnesite crystals are probably the best in the world. Brucite should be found in Brazil, based on the geologic environments available for its formation. Perhaps this will be the latest exciting mineral discovery.

There are few notable brucite localities in Europe. Mindat exhibits a single specimen from Unst, Shetland

Top: *Brucite crystals and veins in granular chromite, Wood's Chrome Mine, Texas, Little Britain Twp., Lancaster, PA. Photo: Mark Heintzelman.*
Bottom: *Brucite, Swinna Nest, Unst, Shetland Islands, Scotland. Source: Mindat.*

Islands, Scotland. I mention this specimen because it is well crystallized and is 7 centimeters (about 2.8 inches) long. The specimen came from a well-known English collector, Pearl Freemen, with whom a couple of our club members were privileged to trade. It can't have been the only brucite from this locality. Anyone going to the Shetlands and bringing a rock pick?

Brucite marbles have been mined from small quarries in the Cogollo del Cengio municipality of Veneto Province, Italy. The marble formed from the metamorphosis of dolomite by the intrusion of mafic rocks. Although the major material is mostly massive brucite,

Brucite, Killa, Saifullah District, Balochistan, Pakistan. Source: Mindat; photo: Rob Lavinsky.

lovely water-clear microscopic crystals have also been found. Anyone considering using marble for kitchen or bathroom counters should remember the chemistry of the rock. It will stain and be more reactive to acids than many other natural stone options. Microcrystals of brucite have also been found in other Italian locations and from Austria's Styria region, though specimens have never been abundant.

The most attractive brucite specimens have been brought to market in the past few years. They come from Pakistan. This material is bright lemon-yellow and forms aesthetic botryoidal specimens composed of rounded clumps of small crystals or smoother, more resinous blobs, looking like free-form sculptures. Similar white "sculptures" and more unusual bicolored ones, with yellow and white brucite, exemplify different phases of the compositional fluids. Collectors can pay $15 or $2,400, depending on the quality and size of the specimen and the dealer.

The primary source of most brucite from Pakistan seems to be the Killa Saifullah area in the Balochistan Region, where chromite and magnesite are mined. Brucite occurs as a secondary mineral, probably altered from peridotite. The host rocks, including peridotite, formed in the mantle deep within the Earth and were brought to the surface by tectonic activity and later altered by percolating fluids. The fluids could

originate during continuing tectonism as the Hindu Kush range was pushed upward through faulting and folding. They could also come from alteration of buried rocks by fluids from above and below mixing and changing the peridotite. Like in our much closer State Line quarries, Pakistani brucite may be derived from peridotite turning to serpentine and then to brucite.

As part of the location names suggest, the Bazhenovsk deposit, *Asbest*, Sverdlovsk Oblast, Russia, was exploited for asbestos. Beautiful, unusual deep aqua-colored brucite crystals were found here. Brucite was not common and mine has apparently not been active in many decades.

Many beautiful, well-crystalized mineral species have come from the Wessels Mine near Hotazel, South Africa. Manganese is the mine's primary product; it is located in the Kalahari Manganese Fields. Brucite from here can be greenish blue ("seafoam blue") or yellow. Specimens with crystals are attractive and are visually comparable to smithsonite, boasting small brucite crystals that form botryoidal aggregates. Traces of iron could be a contributor to brucite coloration, though this is speculation.

The Mt. Keith deposit in Australia is mined for its huge nickel deposits. Brucite specimens from Mt. Keith are usually green, which is attributed to traces of nickel in the brucite structure. This mineral species is not common here.

Brucite, Wood's Chrome Mine, Texas, Little Britain Twp., Lancaster, PA. Source: Mindat.

Brucite, Mount Keith Open Pit, Wiluna Shire, Western Australia. Source: Mindat; photo: Graham Lee.

Brucite can be a source of metal (magnesium) or used as a bulk industrial compound. Synthetic brucite, also known as magnesium hydroxide, competes with the natural material in some uses. Magnesia from brucite and other minerals is used in high-temperature ceramics (refractories), fire and smoke retardants, plastic fillers, wastewater treatment, odor management, animal feed, and dietary supplements. Brucite is incorporated into some Portland cement products. Industrial uses of brucite may increase because, unlike some alternatives, brucite does not release carbon dioxide (a greenhouse gas) when it is processed. Limiting carbon emissions reduces climate change effects.

Readers of these columns may remember the skills of lapidarists in accepting a challenge to create a cut stone with any possible mineral. That is the situation for brucite. The faceted brucites that I saw for sale on the web were translucent at best. A lemon-yellow, opaque faceted stone of 9.27 carats from Pakistan was offered for about $350, though I saw a similar one offered for $129. A small (0.22-carat) bluish-white translucent stone from South Africa was selling for about $95.

Anyone who wants a brucite specimen should be able to afford one, depending on its size and quality and the person or company doing the selling. As of August 2022, a large (11.5 x 9.0 x 7.5-centimeter) specimen of white crystals from the classic Wood's Chrome Mine locality could cost you $4,500 from a high-end dealer. Small specimens from Pakistan may go for less than

$10. Brucite from Pakistan is readily available, and you may find specimens for sale at local mineral shows.

Note to collectors of fluorescent minerals: Some brucite specimens from the State Line deposits fluoresce blue-white under most wavelengths, though not strongly. Red-fluorescing brucite is reported from the Yngshytte ore field in Värmland, Sweden.

Technical Details

Chemical formula ..... $Mg(OH)_2$

Crystal form ..... Trigonal/hexagonal

Hardness 2.5-3

Specific gravity 2.39-2.4

Color ..... White, yellow, green, blue, gray, brown

Streak ..... White

Cleavage ..... 1 perfect

Fracture ..... Irregular

Luster ..... Pearly, waxy, fibrous

Sources

Alex Strekeisen. N.d. (no date). Brucite.

Beudant, F.S. 1824. Traité élémentaire de minéralogie. Paris, France: Verdière: 487.

Beudant, F.S. 1832, Traité élémentaire de minéralogie. Tome II. Paris, France: Verdière: 539.

Beudant, F.S. 1837. Traité élémentaire de minéralogie. Volume 2. Paris, France: Verdière: 199, 204, 208, 346, 529, 637-638.

Bruce, A. 1810. Bruce on native magnesia from New Jersey. The American Mineralogical Journal: 26-30.

Database of Luminescent Minerals. N.d. Brucite.

Callaghan, E.; Vitaliano, C. 1948. Magnesite and brucite deposits at Gabbs, Nye County, Nevada. U.S. Geological Survey, Open file report 16.

Farrell, S.L. 1969. The American Mineralogical Journal. Archibald Bruce, M.D. Contributions to the history of geology. Book review. Acta Crystallographica, section B. B25, 2421.

Mindat. N.d. Brucite.

Minerals.net. N.d. The mineral brucite.

Rockhound Resource. N.d. Maryland rockhounding location guide & map.

Silliman, B. 1819. Biographical notice of the late Archibald Bruce, M.D. American Journal of Science. 1(3): 299-304; 55.

Silliman, B.; Silliman, Jr., B.; Dana, J.D. 1854. The American Journal of Science and Arts ser. 2, vol. 17 (May).

Simandl, G.; Paradis, S.; Irvine, M. 2007. Brucite—industrial mineral with a future. Geoscience Canada 34(2).

Southwood, M. 2019. Connoisseur's choice: Brucite, Balochistan Province, Pakistan. Rocks & Minerals 94:5: 428-433.

U.S. Geological Survey. 2022. Mineral commodity summaries. Reston, VA. USGS.

Wikimonde. N.d. Brucite.

Wikipedia. N.d. Brucite.

Woodman, N. 2017. There are multiple editions of the first volume of Benjamin Silliman's American Journal of Science—and why it matters. Sherbornia 4(2): 9-21.

Sharing Summer Stories

September 26 Program

For our first fall meeting in 2022, we're going to hold an online-only club meeting on **September 26, 7:30 p.m.** Please join us on Zoom!

[URL]

Meeting ID:
Passcode:

Our September program will be sharing summer stories—a session with members volunteering to make us jealous about where and what they collected or geology they explored. Some members will have returned with news of the Denver shows. They can regale us with tales of eye candy there.

We will also discuss a new opportunity to partner with a school for a lapidary shop. We want to hear about your interest in this. We will consider how much the club should invest in this activity.

We also have to decide on a permanent meeting place. We have a couple of options to share with you.

Finally, we have some decisions to make about the future of our club. President Tom Kim has laid out some of the options on page 8. See you soon!

President's Collected Thoughts

by Tom Kim

Welcome back, rockhounds! I feel like this will be a momentous year. We will reinaugurate our annual show in November; we will resume in-person meetings; we are making some inroads with field trips and educational partners—and we might be finding a new place to meet regularly.

With the progress we've made, I encourage you to re-engage with the club and get more involved. As Tom Taaffe has detailed, we need all hands on deck with our show this year to get it back to its former glory. And many of the initiatives we've pursued these past few years have been with a lean, mean skeleton crew, but more officers and volunteers will mean the greater likelihood that we'll follow through and realize our ambitions.

In fact, I would say that the club is at a bit of an existential crisis right now. We have an impressive membership roll, great contacts, and robust financial savings. However, many of our most prominent and active members are doing double or triple duty with other local mineral clubs. We're still struggling a little with attendance in our in-person meetings. And our current officers are pretty much burned out. I myself will resign at the end of this term, as the tide turns in my life and family.

I see a few options ahead for us. One is for a fresh crew to come in and move the club ahead. Sue and I will certainly do our part to support and help them in the background. Another is for us to merge with another club. MSDC has floated the idea in the past; we can come back to them to see if they're still interested. The nuclear option is to dissolve the club entirely. I don't think anybody wants that.

This has been a tough column to write, but I want to be honest and transparent with you, beloved NVMC members. We are at a crossroads, and the path we take is not up to me. We need to make this decision together.

Tom

Pilots During World War II Depended on Gem Cutters

by Jennifer Haley, AFMS Historian

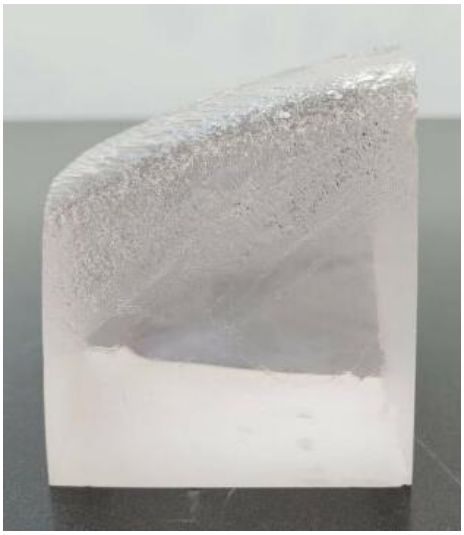
Editor's note: *The article is adapted from* AFMS Newsletter *(February 2022).*

During World War II, hundreds of experienced mineral collectors, though too old to qualify for military service, played a critical role in the security of our country. They cut quartz crystals for frequency control in communication instruments and radar. They also cut sapphires to make precision instruments used in airplanes, bombers, and battleships. A pilot's life often depended on the lapidary skills of the gem cutter. Quartz and sapphire were essential to the war effort. Bombers had about a hundred sapphires in the plane's instruments, and battleships had about four thousand sapphire bearings.

In 1940, America completely depended on Europe for sapphires. When war came, an American company, Linde Air Products, created a synthetic sapphire, vital to the war effort. The stones were used only for industrial purposes and not for jewelry.

Quartz crystal was used for frequency control in radio transmission, radar, and other precision devices. The quality of quartz crystals from mines in Arkansas was finer than from Brazilian mines, and the Arkansas mines came under federal control during the war.

Gemstones, minerals, and gem cutters worldwide have played important roles throughout history. No wonder people hold them in such high regard.



Synthetic sapphire for industrial purposes.

How Turquoise Replaced Emeralds in This Royal Diadem

by Abigail Eisenstadt

Editor's note: *The article is from* Smithsonian Magazine *(16 December 2021). Thanks to Sue Marcus for the reference!*

December's birthstone, turquoise, comes in many forms—the most notable being pristine sky blue.

At the Smithsonian's National Museum of Natural History, visitors can see pieces of this type of turquoise, called Persian turquoise, in a diadem once owned by Napoleon's second wife, the Empress Marie Louise.

"The Marie Louise diadem is one of the few spectacular jewelry pieces that survived that era. It represents that period of time in history, showcasing the symbolism and role gems played back in the early 1800s," said Jeffrey Post, mineralogist and curator-in-charge of gems and minerals at the museum. "But the turquoise pieces were actually latecomers to the diadem." ... *Read more*.

How To Write Good

Don't be redundant; don't use more words than necessary; it's highly superfluous.

(From plainlanguage.gov, a federal website about plain writing.)

EFMLS Convention

September 23-25, Harrisburg, PA

Location

Harrisburg Consistory, 2701 N. 3rd Street (Uptown Harrisburg, next to Zembo).

Events

Friday, September 23: Annual Meeting (7 p.m.)

Saturday, September 24:
8 a.m.—Editor's Breakfast
10 a.m. to 6 p.m.—Central Pennsylvania Rock & Mineral Club Annual Show
1:30 p.m.—EFMLS Auction
6 p.m.—EFMLS Banquet (happy hour)
7 p.m.—EFMLS Banquet (dinner)

Sunday, September 25:
10 a.m. to 4 p.m.—Central Pennsylvania Rock & Mineral Club Annual Show
Morning field trip (details to follow)

Registration

EFMLS website

GeoWord of the Day

(from the American Geoscience Institute)

mountain paper

A paperlike variety of asbestos occurring in thin sheets; also called mountain leather.

(from the *Glossary of Geology*, 5th edition, revised)

Club Show Coming Up!

November 19-20, 2022

by Tom Taaffe, Show Chair

After missing a couple of years due to the coronavirus pandemic, the NVMC is bringing back our annual gem, mineral, and fossil show. The show will be on November 19-20, 2022, in Dewberry Hall, Johnson Center Building, George Mason University (GMU), Fairfax, VA. After setup on November 18, show hours will be from 10 a.m. to 6 p.m. on Saturday, November 19, and from 10 a.m. to 4 p.m. on Sunday, November 20.

Here are various suggestions for ways that NVMC members can help with this year's show.

Staffing the Show

You can volunteer to help during actual show hours on Saturday and Sunday. For example, we need volunteers for the **Kids' Activity Room**. This job entails administering quizzes, helping with puzzles, and awarding free specimens to kids who earn them. It also includes fielding any questions the kids have as well as helping with mineral and fossil identification. The Kids' Activity Room can get a little crazy at times, but it's lots of fun and very worthwhile.

Show volunteers needed!!

We also need volunteers to help with **setting things up** on Friday, November 18. That includes bringing items from the club's storage unit to GMU, helping to set up the Kids' Activity Room, and helping dealers at the unloading dock so that process goes smoothly.

We need volunteer help at the **admissions table**. If several club members take a shift or two, it will make the process less chaotic and more efficient.

When the show ends at 4 p.m. on Sunday, we need volunteers to help **teardown**. We will need volunteers to help pack up the Kids' Activity Room and gather all the club equipment and gear. We will need additional help with bringing it all back to our storage unit as well.

Display at the annual club show in November 2015. Photo: Sheryl Sims.

Donating Specimens for Kids

You can volunteer by donating mineral and fossil specimens for our kids' mines in the Kids' Activity Room. These should be suitable specimens for children, not too big or small (about 1 to 3 inches in size or weighing about 1 to 4 ounces). The specimens should be somewhat interesting and somewhat attractive and hopefully have some educational value.

Donated specimens should not be toxic, sharp, splintery, or otherwise dangerous. They would also be best in their natural unpolished state. Specimens from nearby localities are great choices, such as prehnite, amazonite, amethyst, and garnet. For this year's show, for example, I recently acquired a large quantity of less-than-perfect Herkimer diamonds and a lesser quantity of green muscovite mica books from New Hampshire.

Devising New Quizzes for Kids

You can volunteer to design or create a new mineral challenge, puzzle, or identification quiz for the Kids' Activity Room. Your new mineral quiz should not be too easy or too difficult; you want children to get some of the answers correct while still feeling challenged, and you want them to have learned something. If you have an idea and want feedback, please email me (Tom Taaffe) at rockcllctr@gmail.com.

For your newly designed quiz, you might want to use photos, line art, or even actual specimens. All of these ideas can work. Just remember that you want your quiz to be relatively uncomplicated and straightforward so

that it is easy enough to take and easy to grade. It's been a long time since anyone other than me designed a new quiz for the Kids' Activity Room, so please give it a try!

Getting the Word Out

You can volunteer to help promote our annual show and really get the word out. We always need help with show advertising and promotion. After years with no show, getting out the word will be more important than ever—one or two people taking it on won't be enough. We mail postcards to previous attendees, and we post our show on some rockhound show calendars; but we really could use much more help.

As you might know, myriad social media options and opportunities exist, including Facebook, neighborhood websites, the Patch, websites of regional mineral clubs, and so on. I am sure that several NVMC members are much more fluent in and comfortable with navigating and posting on the web than I am. So please volunteer to get the word out.

When you are ready, please send me (Tom Taaffe) an email at rockcllctr@gmail.com, and I will give you all the specifics you will need to post our show on your selected spots on the web (show dates, place, hours of operation, admission fees, and so on).

A Magnet for Megaquakes

by Donna Sarkar

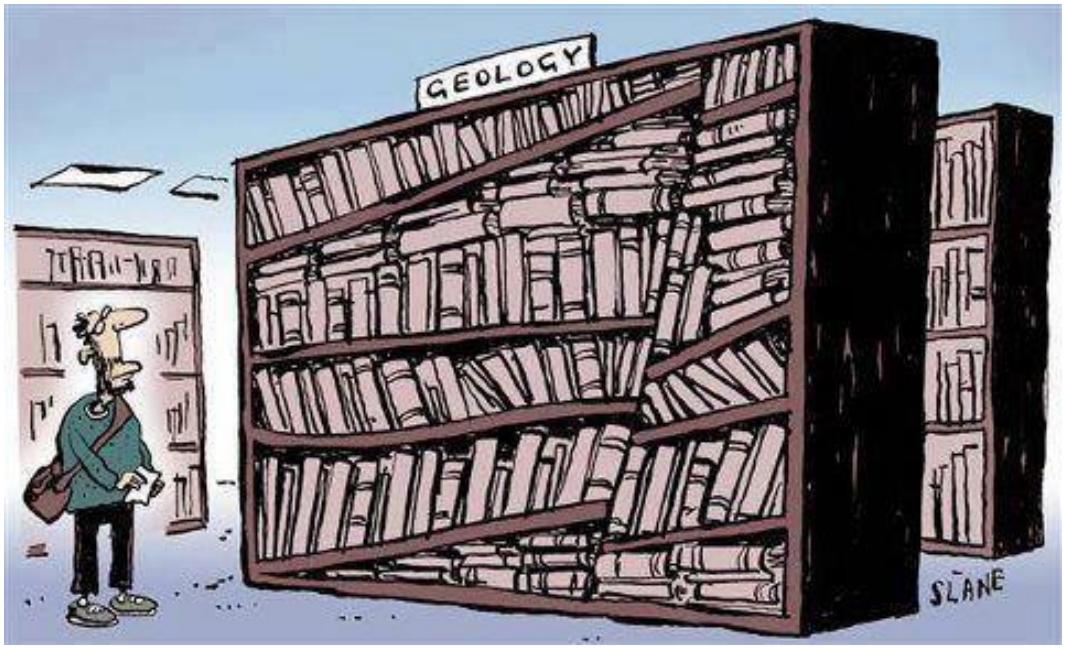
Editor's note: *The article is from* Discover Magazine *(7 March 2022). Thanks to Roger Haskins for the reference!*

Here's how a mountain-sized rock just below the coast of southern Japan may have been the source for disastrous earthquakes.

Over the last decade, Japan has been hit by more than 27 major earthquakes measuring at least 6 on the country's seismic intensity scale. Scientists and researchers have been scrambling to find why the region stands on such shaky ground, and a recent study has provided a glimmer of hope.

Researchers from the University of Texas believe that they have found the culprit: a mountain-sized mass of igneous rock just beneath the coast of southern Japan. The mass, known as Kumano Pluton, was first discovered in 2006. However, the details remained a mystery until now.

Recent findings reveal that the mass has been acting as a magnet for earthquakes in the area. What does this discovery mean for the future of this vulnerable region? ... *Read more*.



Arsenic in Yellowstone's Thermal Waters

Editor's note: *The article is adapted from a piece by the U.S. Geological Survey on December 6, 2021. Thanks to Sue Marcus for the reference!*

Yellowstone's thermal waters are more than just hot—they also contain a variety of elements, some of which are potentially toxic! Arsenic is an example, but the concentrations of this element depend on the style of the thermal feature. Perhaps paradoxically, acidic thermal features contain much less arsenic than neutral ones!

Arsenic, a known carcinogen that occurs naturally in surface and ground waters, is of great public health concern. Thermal waters around the world are known to contain elevated concentrations of geogenic arsenic, and the thermal water in Yellowstone is no exception.

The Environmental Protection Agency (EPA) set the arsenic standard for drinking water at a maximum of 10 micrograms per liter. Thermal waters in volcanic areas contain arsenic concentrations that are often one to three orders of magnitude higher than the EPA drinking water standard, and these elevated concentrations can affect downstream water resources. For example, elevated arsenic concentrations in thermal waters were measured in Lassen Volcanic National Park in California at up to 27,000 micrograms per liter.

Arsenic concentrations are also elevated in Yellowstone thermal waters, with most concentrations in the range of 5 to 4,500 micrograms per liter. Higher concentrations (17,000 micrograms per liter) have been measured in the Ragged Hills area of Norris Geyser Basin, but such levels are rare because arsenic minerals (like orpiment and realgar) can form in most of Yellowstone, which limits the amount of arsenic in thermal waters.

Despite the elevated arsenic concentrations, visitors who follow park rules shouldn't worry. For example, you are not allowed to enter waters entirely of thermal origin, and traveling off designated trails in hydrothermal areas is prohibited. In addition, nearly all the arsenic remains in the water during boiling, so the risk of inhaling arsenic is minimal.

Sulphur Caldron in Yellowstone National Park, an example of an acid-sulfate hydrothermal feature. Waters from Sulphur Caldron contain arsenic concentrations of less than 20 micrograms per liter. Photo: Blaine McCleskey, USGS.

Arsenic in Yellowstone thermal surface waters derives from deep thermal fluids. Complex water/rock interactions depend on subsurface geology (rhyolites, basalts, and sedimentary deposits); temperature; boiling; changes in gas contents; precipitation and dissolution of secondary arsenic minerals; and incorporation into sinter. Arsenic geochemistry is complex because it can exist in several forms and can undergo complex chemical reactions—even reactions that are controlled by the microbes that live in thermal waters! As a result, the three major thermal water types in Yellowstone have distinctly different arsenic concentrations.

Neutral-chloride waters, such as waters those from geysers like Steamboat, generally have elevated arsenic concentrations (1,000 to 3,000 micrograms per liter). These thermal features are prevalent in Upper, Midway, Lower, Shoshone, and West Thumb Geyser Basins, where geysers and pools often have large discharges. The arsenic concentration in a water sample collected from Old Faithful Geyser, in Upper Geyser Basin, was 1,500 micrograms per liter.

The waters of Old Faithful in Yellowstone contain 1,500 micrograms of arsenic per liter. Source: Wikipedia; photo: R. Robinson.

Acid-sulfate waters, like those from Mud Volcano, typically have relatively low arsenic concentrations (less than 50 micrograms per liter). These thermal waters are formed by combining shallow ground water with high-temperature thermal gases that contain little arsenic. Acid-sulfate features typically don't have large discharges flowing away from the features. Sulphur Caldron, a large acid-sulfate pool, contains less than 20 micrograms of arsenic per liter.

Carbonate-rich waters that readily form travertine, like at Mammoth Hot Springs, have moderate arsenic concentrations (50 to 500 micrograms per liter). Two of the largest discharging springs in Yellowstone, the Boiling River in Mammoth and an unnamed large spring in the Snake River Hot Spring area, contain about 440 and 300 micrograms of arsenic per liter, respectively.

Most of the water discharged from Yellowstone's thermal features ultimately ends up in a nearby river. As a result, the arsenic concentrations in the main rivers draining Yellowstone are also elevated because very little arsenic is lost over long distances. By employing the same methods that are used to monitor Yellowstone's rivers for thermal input, the arsenic concentration and flux can also be quantified. Downstream from thermal areas, the summertime river arsenic concentrations are elevated in the Firehole River (about ~380 micrograms per liter), Gibbon River (about 140 micrograms per liter), Madison River (about 250 micrograms per liter), Yellowstone River (20 to 30 micrograms per liter), and Gardner River (about 110 micrograms per liter).

The total arsenic flux from Yellowstone is also large (about 180,000 kilograms per year), and arsenic is transported several hundred kilometers downstream from Yellowstone. As a result, arsenic affects downstream water resources, requiring additional treatment at some drinking water treatment plants.

Yellowstone has popular swim areas, including the Firehole and Boiling River Swim Areas. To minimize the risk of illness from swimming and soaking in Yellowstone rivers, the National Park Service recommends that you avoid swallowing river water and letting water enter your nose. If you submerge your head, wear nose plugs or hold your nose shut.

The chemistry of Yellowstone thermal waters is complex. In addition to arsenic, several other solutes of concern are elevated in Yellowstone thermal waters, including mercury, fluoride, and antimony, and researchers are investigating the source and fate of these chemicals. They may not pose an immediate threat to health in the Yellowstone area despite the elevated concentrations, but they can teach us quite a lot about the geology and geochemistry of the subsurface hydrothermal systems!

AFMS Code of Ethics

A large measure of the enjoyment of our hobby consists of collecting in the field. For that reason, the members are proud to endorse the following:

1. I will respect both private and public property and will do no collecting on privately owned land without permission from the owner.
2. I will keep informed of all laws, regulations, or rules governing collecting on public lands and will observe them.
3. I will, to the best of my ability, ascertain the boundary lines of property on which I plan to collect.
4. I will use no firearms or blasting material in collecting areas.
5. I will cause no willful damage to property of any kind, such as fences, signs, buildings, etc.
6. I will leave all gates as found.
7. I will build fires only in designated or safe places and will be certain they are completely extinguished before leaving the area.
8. I will discard no burning material—matches, cigarettes, etc.
9. I will fill all excavation holes that might be dangerous to livestock.
10. I will not contaminate wells, creeks, or other water supplies.
11. I will cause no willful damage to collecting material and will take home only what I can reasonably use.
12. I will practice conservation and undertake to utilize fully and well the materials I have collected and will recycle my surplus for the pleasure and benefit of others.
13. I will support the rockhound project H.E.L.P. (Help Eliminate Litter Please) and will leave all collecting areas devoid of litter, regardless of how found.
14. I will cooperate with field trip leaders and those in designated authority in all collecting areas.
15. I will report to my club or federation officers, the Bureau of Land Management, or other authorities any deposit of petrified wood or other materials on public lands that should be protected for the enjoyment of future generations or for public educational and scientific purposes.
16. I will appreciate and protect our heritage of natural resources.
17. I will observe the Golden Rule, will use good outdoor manners, and will at all times conduct myself in a manner that will add to the stature and public image of rockhounds everywhere.

September 2022—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5 **Labor Day**	6	7 MSDC mtg, Washington, DC	8	9 Show, Winston-Salem, NC	10 Show, Winston-Salem, NC
11 Show, Winston-Salem, NC	12 GLMSMC mtg, Rockville, MD	13	14	15	16 Show, Fishersville, VA	17 Shows, Fishersville, VA; Poughkeepsie, NY
18 Shows, Fishersville, VA; Poughkeepsie, NY	19	20	21	22 **Fall begins**	23 EFMLS Convention, Harrsbg, PA; Show, VA	24 EFMLS Convention, Harrsbg, PA; Show, VA
25 EFMLS Convention, Harrsbg, PA; Show, VA	26 **NVMC mtg, Arlington, VA**	27	28 MNCA mtg, Arlington, VA	29	30	

Disclaimer: All meetings are tentative during the coronavirus pandemic, and club meetings might be remote. Check the website for each organization for more information.

Event Details

7: Washington, DC—Mineralogical Society of the District of Columbia; meetings via Zoom until further notice; http://www.mineralogicalsocietyofdc.org/.

9-11: Winston-Salem, NC—Annual show; Forsyth Gem and Mineral Club; Educational Bldg, Winston-Salem Fairgrounds, 412 27th St, NW; Fri 10-7, Sat 10-7, Sun 12-5; adults $3, kids to grade 12 free; info: mariona1@yadtel.net, www.forsythgemclub.com.

13: Rockville, MD—Gem, Lapidary, and Mineral Society of Montgomery County; meetings via Zoom until further notice; https://www.glmsmc.com/.

16-18: Fishersville, VA—Annual show; Shenandoah Valley Gem & Mineral Society; Augusta Expo, Main Expo Hall, 277 Expo Rd; Fri 2-6, Sat 10-6, Sun 11-5; adults $4, students/seniors $3, kids 12 & under free; info: Scott Gregory, 727-542-9723, showboss@shenandoahvalleyrockclub.org.

17-18: Poughkeepsie, NY—Annual show; Mid-Hudson Valley Gem & Mineral Society; Golds Gym & Family Sports Center, 258 Titusville Road; Sat 10-5, Sun 10-4; adults $5, seniors/students $3, kids under 12 free; info: Linda Wuest, 845-626-7136, garnet327@hvc.rr.com.

23-25: Richmond, VA—Annual show; Treasures of the Earth, Inc; Richmond Raceway Complex, 600 East Laburnum Ave; Fri 12-6, Sat 10-5, Sun 10-5; $8 adults, 16 & under free; info: www.TreasuresOfTheEarth.com.

23-25: Harrisburg, PA—EFMLS Convention/Central PA Rock & Mineral Club Annual Show; Harrisburg Consistory, 2701 N 3rd Street (Uptown Harrisburg, next to Zembo); https://efmls.org/annual-convention/#.

26: Arlington, VA—Northern Virginia Mineral Club; meetings via Zoom until further notice; https://www.novamineralclub.org/.

28: Arlington, VA—Micromineralogists of the National Capital Area; meetings via Zoom until further notice; http://www.dcmicrominerals.org/.

THE NORTHERN VIRGINIA MINERAL CLUB INC

Crystals are the flowers of the Mineral Kingdom

2022 Club Officers

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The Northern Virginia Mineral Club

Visitors are always welcome at our club meetings!

PLEASE VISIT OUR WEBSITE AT:
http://www.novamineralclub

Please send your newsletter articles to:
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Arlington, VA 22203
hutchbrown41@gmail.com

RENEW YOUR MEMBERSHIP!

SEND YOUR DUES TO:
Roger Haskins, Treasurer, NVMC
4411 Marsala Glen Way, Fairfax, VA 22033-3136

OR

Bring your dues to the next meeting.

Dues: Due by January 1 of each year; $20 individual, $25 family, $6 junior (under 16, sponsored by an adult member).

Club purpose: To encourage interest in and learning about geology, mineralogy, lapidary arts, and related sciences. The club is a member of the Eastern Federation of Mineralogical and Lapidary Societies (EFMLS—at http://www.amfed.org/efmls) and the American Federation of Mineralogical Societies (AFMS—at http://www.amfed.org).

Meetings: At 7:45 p.m. on the fourth Monday of each month (except May and December)* at **Long Branch Nature Center**, 625 Carlin Springs Road, Arlington, VA. (No meeting in July or August.)

**Changes are announced in the newsletter; we follow the snow schedule of Arlington County schools.*