



# The Mineral Newsletter

**Meeting: January 28 Time: 7:45 p.m.**

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



## Barite

**Sidi Lachen Quarry  
Nador, Morocco**

*Photo: Bob Cooke.*

**Volume 60, No. 1**

**January 2019**

Explore our [website!](#)

### January Meeting Program:

#### Show and Tell

Bring a specimen—tell a story!  
(details on page 4)

### In this issue ...

Mineral of the month: <b>Barite</b> .....	p. 2
January program details .....	p. 4
Reflections from the president.....	p. 4
December holiday party .....	p. 5
Bench tip: Stiffening earring posts .....	p. 6
GMU/NVMC mineral show for 2018 .....	p. 7
November club meeting program .....	p. 10
Geology walk in Arlington, VA .....	p. 11
Gypsum sands.....	p. 13
<b>AFMS:</b> Earth science history in USA .....	p. 14
<b>EFMLS:</b> Safety matters.....	p. 14
Field trip opportunities .....	p. 15
Wildacres in spring.....	p. 16
Fossil hunting along our local creeks.....	p. 17
Upcoming events .....	p. 21

### Deadline for Submissions

**January 20**

Please make your submission by the 20th of the month!  
Submissions received later might go into a later newsletter.



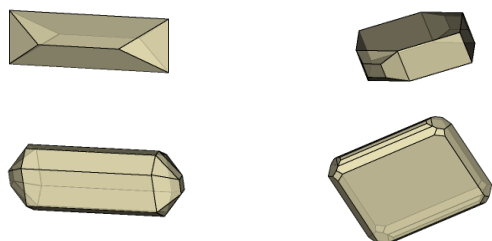
## Mineral of the Month Barite

by Bob Cooke

January's mineral of the month is barite. According to the International Mineralogical Association, the accepted spelling is "Baryte;" but in the United States, we continue to spell it "barite." The pronunciation is the same, however.

Chemically, barite is barium sulfate— $\text{BaSO}_4$ . Barite is an analogue of both celestine and anglesite; replace the barium with strontium, and you get celestine; replace it with lead, anglesite.

All three minerals are in the orthorhombic crystal class, with three axes at right angles to each other but each of a different length. Hence, a rectangular prism. Different crystallization conditions, however, can favor the development of a particular prism or termination face to produce variations such as:



Color is one of the least accurate ways to identify a mineral. Barite proves the point—it can be in colorless, white, yellow, brown, gray, and blue crystals. Its luster is vitreous (like glass). Its hardness on the Mohs scale is 3.



# Happy New Year!

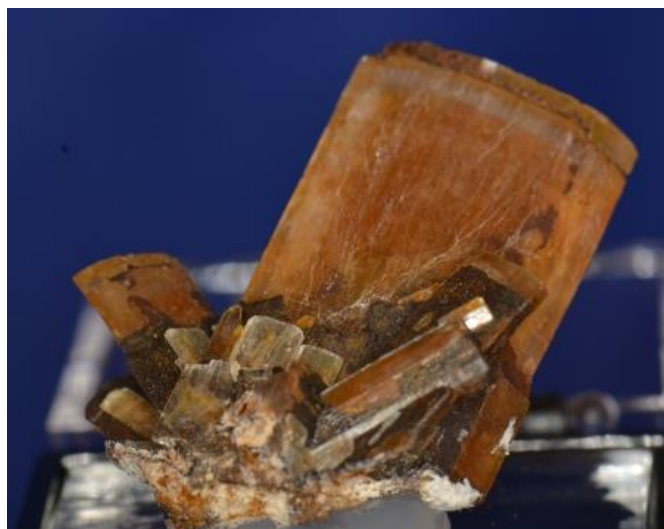


## Northern Virginia Mineral Club members,

Please join your club officers for dinner at the Olive Garden on January 28 at 6 p.m.

*Olive Garden, Baileys Cross Roads (across from Skyline Towers), 3548 South Jefferson St. (intersecting Leesburg Pike), Falls Church, VA*  
Phone: 703-671-7507

Reservations are under Ti Meredith, Vice-President, NVMC. Please RSVP to me at [ti.meredith@aol.com](mailto:ti.meredith@aol.com).



*Barite comes in multiple colors, including orange (above, from the Red Hill Pit, Emerson, GA) and yellow (left, from the Meikle Mine, Elko County, NV). Photos: Bob Cooke.*

Barite was named in 1800 by the German mineralogist Dietrich Ludwig Gustav Karsten from the Greek word βάρυς ("heavy"). It is indeed unusually heavy for a nonmetallic mineral, with a specific gravity of 4.5.

Barite often occurs as concretions and void-filling crystals in sediments and sedimentary rocks. It is especially common in limestone and dolostone formations.

Where these carbonate rock units have been heavily weathered, large accumulations of barite are sometimes found at the soil–bedrock contact. Many commercial barite mines produce from such residual deposits.

Barite is also found as concretions in sand and sandstone. The concretions grow as barite crystallizes within the interstices between sand grains. Sometimes, crystals of barite grow into interesting shapes within the sand. These structures are known as barite roses (see photo at right). They can be up to several inches in length and incorporate large numbers of sand grains. Occasionally, barite is so abundant in a sandstone that it serves as the “cement” for the rock.

Barite is also a common mineral in hydrothermal veins and is a gangue mineral (matrix material) associated with sulfide ore veins. It is found in association with ores of antimony, cobalt, copper, lead, manganese, and silver. In a few locations, barite is deposited as a sinter (hard sulfide deposit) at hot springs.

So what is barite used for (when it’s not being appreciated for its crystal beauty)? Ninety-nine percent of the barite consumed in the United States is used as a weighting agent in drilling muds. These high-density muds are pumped down a drill stem and through the cutting bit (cooling the bit in the process). The rock cuttings float on the heavy mud, and it’s all flushed back to the surface.

Barite can be used as a pigment in paints. Due its heavy weight, it is also used as a weighted filler for paper, cloth, and rubber. Some playing cards have barite packed between the paper fibers to give the paper a



*Barite rose from Cleveland County, OK. Photo: Bob Cooke.*

higher density, allowing the cards to be more easily shuffled and dealt.

Barite is the primary ore of barium, which is used to make a wide variety of barium compounds. Because of barium’s high atomic mass, it makes a good shield against gamma rays and x-rays. When incorporated into concrete construction in hospitals, power plants, or laboratories, barite is a safety feature for blocking x-ray emissions.

Barite compounds are also used in diagnostic medical tests. An x-ray image of a patient who has just introduced a barium compound into his or her digestive track will reveal the location of the barium with high resolution and provide information about the condition of the digestive tract. Without the barium, there would be no contrast between the digestive track and surrounding tissues.

In 2015, worldwide production of barite was approximately 7,400 metric tons. China produced 3,000 tons and India and Morocco 900 tons each. The United States was considerably far down the list of producers, at only 500 tons. ↗

### Sources

King, H.M. N.d. [Barite](#). Geology.com  
Mindat.org. 2018. [Baryte](#).



*Barite from Paraiba, Brazil. Photo: Bob Cooke.*





## Miscellaneous Business Plus Show and Tell January 28 Program

by Ti Meredith, Vice-President

**F**or our first meeting in 2019, we will have a short business meeting to take stock of our club's status and plans for the year. Then we will have another opportunity for show and tell.

### Club Officers

At our December meeting, we elected club officers for 2019 (see minutes below). Our club officers will introduce themselves and take questions.

### Upcoming Events/Budget Status

We will go over the 2019 calendar of events to prepare for the coming year and make sure the right events go into the club newsletter.

We will also report on the status of our club budget. The budget is prepared and approved by the club's executive board, then submitted for approval to the club membership.

The treasurer is preparing a summary of 2018 expenses and receipts, including from the NVMC show at GMU last November.

### 2018 Club Show

We will go over the 2018 club show. We will present awards for volunteers; report on show results, including proceeds for the Fred Schaefermeyer Scholarship Fund; and discuss show-related successes and areas with room for improvement, giving everyone a chance to make comments and suggestions.

### Show and Tell

Club members will have the opportunity to show off acquisition(s) related to our hobby, whether rock, mineral, gem, fossil, or lapidary. (We did the same last November—see page 10.)

Do you have a favorite acquisition from 2018 or before? Self-collected or self-created items go first! ➤

### Writing Tip of the Month

As to the adjective: when in doubt, strike it out.

*Mark Twain*

## Thoughts, Collected

by Sue Marcus, President

**J**oin me in celebrating!

As I write this, Roger and I have recently returned from an amazing trip to Madagascar—more on that in a moment.

First, I want to celebrate and honor the diligence of the club officers who have served us all, volunteering their time for so many years:

- Bob Cooke, president (3 years);
- Ti Meredith, vice-president (3 years);
- Dave MacLean, secretary (5 years); and
- Roger Haskins (entering his 2nd year as treasurer, 46th as my husband).

We also salute the unelected volunteers who keep our club running, including:

- Hutch Brown, newsletter editor (6 years);
- Kathy Hrechka, club historian (3 years);
- Ti Meredith, greeter/door prizes (7 years);
- Amanda Parker, photographer (4 months);
- Steve Parker, field trip chair (4 months);
- Tom Taaffe, club show chair/co-chair (18 years); and
- Casper Voogt, webmaster (9 years).

In coming back from Madagascar to Virginia, I returned from a third-world country to a first-world country. And that kicked me into a celebratory mode: Safe water! Heat and air conditioning! Some understanding of rules!

And yet, in Madagascar, I learned the common phrase “mora,” which I’ve seen translated as “take it easy,” although the Malagasy translated it as “slowly, slowly.” It applies to personal safety (such as watching where you’re walking) as well as mental health.

So, what about minerals in Madagascar? Casper did the Mindat tour. We did a wildlife tour, with minerals as a side note. Oh, the heresy, I know!

But I did score some rhodozite and demantoid, as well as schorl. Nice celestine costs more there than at the Denver show. I was given a pretty piece of petrified wood.



The only vaguely mineral-like shop offered mostly polished labradorite, rose quartz, septarian nodules, and fossils, plus cut stones—and five live pet radiated tortoises.

I had better luck in tourist markets, where mostly T-shirts and locally made crafts were sold—along with the odd, really odd, mineral specimen or two.

This brings me back to celebrating—the new year, along with new collecting and connecting opportunities. Those opportunities are there if you look.

Enjoy the hunt, either with a bucket, shovel, or rock pick. Or use a “silver pick” (money)!

Thanks for being part of the Northern Virginia Mineral Club! Hope to see you at our next meeting. 🐉

*Sue*



*Sue Marcus, mobbed by friendly lemurs in Madagascar.  
Photo: Roger Haskins.*



## **Club Meeting and Holiday Party December 17, 2018**

*by Pat Flavin, Acting Secretary*

Vice-President Ti Meredith called the meeting to order at 6:30 p.m. Ti introduced Dr. Mike Wise of the Smithsonian Institution and presented him with a check for \$500 from the club for the mineral department at the Smithsonian.

Next, Ti introduced new club members Trina and Dale Shaw. There was an update about the November



*Dr. Mike Wise from the Smithsonian Institution speaking at the club meeting. All photos: Amanda Parker.*

## **Club Dues for 2019!**

Due by January 1 of the year: \$15 individual, \$20 family, \$6 junior (under 16, sponsored by an adult member).

Please see Roger Haskins at our monthly meeting or send your dues to him at 4411 Marsala Glen Way, Fairfax, VA 22033-3136.





GMU/NVMC mineral show, with more than \$3,000 collected. (For more details, see the article below beginning on page 7.)

Ti then reintroduced Mike Wise, who gave an update on his department. He mentioned a new acquisition, a 50-carat red topaz, and he spoke of his travels to the Tucson Mineral Show for donations and acquisitions.

Club member Conrad Smith gave an update on his college adventures. He is now at Montgomery College.

Following the presentations, the club held a short business meeting. It was announced that the Gem, Lapidary and Mineral Society of Montgomery County will hold an auction at 10 a.m. on January 19, with a viewing beginning at 9 a.m.

The Club Officer Nominating Committee presented the following nominations for 2019:

President .....Sue Marcus  
Vice-President .....Ti Meredith  
Secretary .....David MacLean  
Treasurer .....Roger Haskins

There were no nominations from the floor. All candidates were elected by unanimous vote.

Following the presentations, club members enjoyed a holiday party, including a dinner organized by Holly Perlick and Marie Johnston. Members who brought a gift participated in a gift exchange. ➤



## Bench Tip: Stiffening Earring Posts

*Brad Smith*

Soldering an earring post will always soften the wire a bit. The easiest way I've found to harden it is to grip it with pliers and twist it a couple half turns. This work hardens the wire and also tests your soldered joint.

See Brad's jewelry books at  
[amazon.com/author/bradfordsmith](https://www.amazon.com/author/bradfordsmith)



## 27th Annual Gem, Mineral, and Fossil Show

November 17–18, 2018

by Bob Cooke and Tom Taaffe

The annual gem, mineral, and fossil show cosponsored by George Mason University and the NVMC was a success—again! We have estimated attendance at 900 adults and a goodly number of inquisitive children. By all reports, every showgoer and participant had an exceptionally fine and worthwhile experience.

Our show had something to offer everyone. Our 20 diverse dealers were happy to hobnob with their long-time customers and engage with visiting rockhounds. Our dealers strove to satisfy the most discriminating of collectors, finding that one unique specimen that was perfect for them. Our popular Kids' Activity Room adjacent to the main ballroom catered to young families, giving kids their first introduction to the mineral and fossil world.

As most of you know, GMU's Department of Atmospheric, Oceanic and Earth Sciences has sponsored our annual event for 20 years. Even more remarkable, one individual, Dr. Julia Nord, has handled all GMU components of our show for 20 years. For example, Julia:

- reserves the facility for us each year,
- procures the two courtesy shuttles and recruits drivers for each,
- hires campus police for our overnight security, and
- negotiates free (or nearly free) parking for all attendees in GMU's Lot A.

Additionally, Julia recruits geology students to help with show setup on Friday and breakdown on Sunday evening. The students place directional signs on campus, help with setup, and often help our dealers in unloading or packing up.

For the past 2 years, we have benefited from extra GMU support. Lesley Irminger of GMU Events helps us unwind all the extra red tape that GMU now requires, and she secures final design and approval for our event. Since Lesley arrived at GMU Events in 2017, we have experienced two shows in a row (in two different buildings, no less) where our floor plan was set up correctly, something we couldn't rely on with past GMU events coordinators.



Photo: Amanda Parker.

NVMC President Bob Cooke and Show Chair Tom Taaffe did much of the advance work to prepare for the show, but it could not have been a success without the support of a large number of volunteers showing up for the 3 days of the show, including the Friday setup.

Crucial to operating our Kids' Activity Room was Ti Meredith, who again took responsibility for setting up and coordinating all those hectic activities. Helping Ti out with the quizzes and Kids' Mini-Mines were Tom Benedict, Germaine Broussard and family, Hutch Brown, Beth Crews and family, Ava Desorrento, Jim Kostka, Dave MacLean, Rosemary Markle, Ethan Walker, and Celia and Jason Zeibel.

Volunteers managing the admissions table included Carolyn Cooke, Phillip Fouts, Ken Rock, Barbara Sky, and John Weidner. Carolyn Cooke anchored this important function.



Ti Meredith (left) in the Kids' Activity Room.

Photo: Tom Taaffe.



It's always a major effort on Friday night to bring all of the club's equipment, display rocks, kids' materials, and exhibits from the club's storage shed to the Hub at GMU. Once our equipment arrives at the Hub, someone has to get down on hands and knees to place, tape, and secure a multitude of electrical cords until every booth has electricity. (This chore is not particularly fun and is tough on your back.) On Sunday, club members need to pack everything up and return it to the storage unit, usually in the cold and dark of night. Club volunteers helping Bob Cooke with these preparatory and cleanup tasks included Hutch Brown, Gary Christmas, Craig Moore, Bill Oakley, and John Weidner.

Our signature event at the show is the Sunday Silent Auction, proceeds from which go to the club's scholarship fund. The auction almost always goes smoothly because experience counts! The same volunteers have set it up and seen it through each year: Jeff Guerber, Diane and Jeff Nesmeyer, and Rob Robinson.

Casper Voogt helped Tom Taaffe in promoting our show on the internet. Websites such as *Rock & Gem Magazine*, the *Vug.com*, and *Mineralfest* are a great way to get the word out to collectors. We hope more club members get involved in show promotion next year.

One enterprising NVMC club member sent email press releases announcing our show to local news entities. We are grateful to her for her contribution. Also, a big thank you goes to Tom Wood on the GMU faculty for shuttle duties performed above and beyond the call.

We are certain that additional people contributed to the success of our show. In the tumult of the show and its aftermath, we find ourselves unable to recall everything. Our apologies for any unintended oversight!

### Friday Parking at November Mineral Show

The NVMC will reimburse parking expenses for the club mineral show volunteers who used the Shenandoah Parking Deck on Friday evening, November 16.

Please see Roger Haskins at our monthly meeting or send your claim to [r1haskins@verizon.net](mailto:r1haskins@verizon.net) or Roger Haskins, 4411 Marsala Glen Way, Fairfax, VA 22033-3136.

Everyone's efforts made a difference and are much appreciated.

Final bills have not yet been submitted, but a preliminary accounting indicates that the NVMC earned about \$2,200.

As is our tradition, about \$1,400 worth of minerals were donated to GMU's geology department in appreciation for sponsoring our show. Dr. Julia Nord selects specimens from our participating dealers for teaching purposes, and our club pays the bill. It's a great way for the NVMC to say thank you.

Our expenses at this year's show were higher than in the past. Because the GMU Department of Atmospheric, Oceanic and Earth Sciences sponsors our annual show, we have always gotten a preferred rate for renting any venue at GMU. Up until this year, we were charged only 25 percent of the going rate. GMU has recently restructured the fee schedule for sponsored programs, and our cost for the Hub rooms became 50 percent of the going rate.

Rest assured, this is still a good deal for the club. Even with the surprise price hike, the club did well financially. We should all be very pleased with the strength of the turnout and thankful for all the positive energy generated by the show. ↗



Photos: Amanda Parker.





# 2018 GMU/NVMC show

Photos: Tom Taaffe





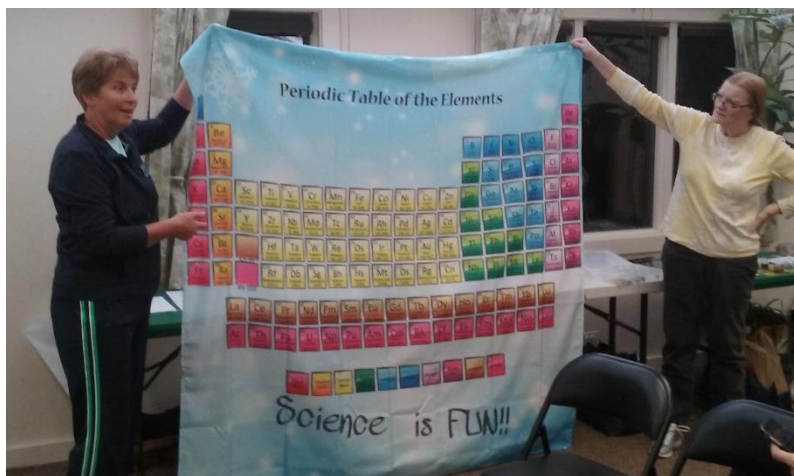
## November 2018 Club Meeting Program Show and Tell!

*Photos by Ti Meredith*

The program for the club meeting on November 12, 2018, was for club members to bring recent finds or acquisitions to show other members. The photos show all of the presentations. ➤



*Jason and Celia Zeibel displaying self-collected geodes, a twinned garnet, and other items.*



*Kathy Hrechka and Carolyn Cooke holding up a shower curtain with the periodic table of the elements, used to teach Cub Scouts about geology as part of a program that Kathy and other club members offered at a Cub Scout camping weekend in October 2018.*



*Dave Hennessey showing off a beautiful arsenopyrite from Panasqueira, Portugal.*



*Germaine Broussard displaying a large piece of Catoctin greenstone from near Frederick, MD.*



*Hutch Brown and Barry Remer displaying locally found quartzite with Skolithos fossils.*



*Tom Taaffe talking about finding baculite fossils in Colorado and surviving a storm with golfball-size hail.*



*Craig Moore showing white kyanite self-collected at an annual open house hosted by the Willis Mountain kyanite mine near Farmville, VA.*



## Geology Walk in Arlington, VA

by Hutch Brown

**M**y main interest in our hobby is in our local geology. Knowing this, Sue Marcus generously offered to pay my fee for a geology field trip sponsored by the Audubon Naturalist Society. I gladly accepted.

The 3-hour geology walk began at the Long Branch Nature Center (where our club meets) on a frigid Saturday afternoon in December—so cold that I bundled up much as I would for a ski trip. (One person got cold enough to give up and head back early.)

About twelve of us gathered in the parking lot with instructor Joe Marx. Joe is a professional geologist who teaches at Northern Virginia Community College's Alexandria campus. He hosts many geology walks in our area, usually through the Audubon Naturalist Society.

Joe led us down the paved walkway from the nature center along Long Branch, the curiously named creek (only a few miles long) that joins Four Mile Run below the nature center. He then took us on a side trail along a hillside and from there down to Four Mile Run, Arlington's main stream.

From the confluence of Long Branch with Four Mile Run, we went downstream to Huffman's Falls. The rough equivalent of Great Falls on the Potomac River, Huffman's Falls drops about 8 feet. Though small, it is the only true waterfall on Four Mile Run.

After we studied the bedrock, Joe led us downstream for one more stop on Four Mile Run, then back up to the nature center. Overall, we made about eight stops.

I live near the Long Branch Nature Center and have familiarized myself with our local geology. The geology walk confirmed my general knowledge.

Joe explained the bedrock (a metamorphic rock originating from sediments in a deepsea trench about 450 million years ago). He also showed us the overlying sedimentary layer of unconsolidated materials deposited by rivers beginning about 140 million years ago. Another thin layer of unconsolidated sediments was laid down beginning about 10 million years ago on top of the ridges where the houses are. (Geologists quibble over the dates but tell the same general story.)

Joe conveyed many details that I didn't know. The highlight of the trip was probably Four Mile Run and



*Huffman's Falls, part of the Fall Line zone for Four Mile Run, downstream from its confluence with Long Branch. Note the waterworn formations of metamorphic bedrock.  
Photo: Hutch Brown.*

Huffman's Falls, where the bedrock is beautifully exposed, as is evidence of water action (potholes and the like). Joe showed us not only white quartz veins in the bedrock but also pink veins of granite I had never noticed before.

Joe also gave me a whole new perspective on the reasons for (and timing of) both recent geologic uplift and stream downcutting in our area. Overall, I learned a tremendous amount. Thanks, Sue! ♪

### Share Your Story in the Newsletter!

Club members appreciate reading stories by other club members, whether it's about a trip they took or a specimen they acquired.

Every show-and-tell story, for example, can easily be turned into an article, no matter how short or long.

Editor Hutch Brown can help you formulate your piece. You don't have to worry about style, grammar, and so on.

So why not share your story with everyone? Just write it up and send it along with a photo of your trip or specimen to Hutch Brown at [hutchbrown41@gmail.com](mailto:hutchbrown41@gmail.com).

## **Humor** **Mineowner Scrooge**

**Editor's note:** The piece is adapted from [Mindat Adventures: Humorous Mineral Stories](#). Thanks to Sue Marcus for the reference!

This happened to me in California in the 1970s.

I wanted to collect low-end lepidolite from the dumps at the Stewart Lithium Mine. The owners refused, instead offering me high-end material for sale. I tried to explain that the material was for sample collections that sold for \$3 each, so I couldn't afford to put \$10 specimens into \$3 boxes. Nothing doing.

I stopped for gas at the nearest convenience store. The attendant saw my obvious disappointment and asked me about it. I told him I wanted to go to the mine dump, and he laughed and said he was about to make my day.

The store was run by Native Americans, and the mine was on private land but the dumps were on their land. He said that, for \$3, I could go and collect all I wanted. He even gave me exact directions and told me to be sure and pick some of the oranges hanging over the dirt road because the orchard was not on their land but the road was.

Best oranges I have ever had! ↗

## **The Whole Family Digs This**

by William B. Sanborn

**Editor's note:** Thanks to Sue Marcus for the reference! The source is The New York Times (December 22, 1974). It's an article introducing readers to mineral collecting.

"Hey, Dad, what's this?" I asked that question some 38 years ago when I picked up what I later learned was a small garnet crystal in my backyard—and I've been an avid collector of crystallized minerals (minerals which are found in beautiful natural shapes) ever since.

Although people who hunt for and collect all types of rocks and minerals are often broadly referred to as "rockhounds," those who collect minerals are actually engaging in only one of three main divisions of this popular pastime. First, there are those who enjoy lapidary work, collecting materials that can be cut and pol-



*Almandine garnet from Paraiba, Brazil.  
Source: Wikipedia.*

ished into precious or semi-precious gemstones. Second, there are the amateur paleontologists, or fossil collectors. The third, and by far the most rapidly growing segment of the hobby at present, are the mineral collectors, specifically those who collect crystallized minerals.

Mineral collecting can be enjoyed by people of all ages who live in almost any part of the country. ... [Read more](#). ↗

### **GeoWord of the Day**

*(from the American Geoscience Institute)*

#### **blue hole**

(a) A subsurface void developed in carbonate banks and islands, also offshore. It is open to the Earth's surface; contains tidally influenced waters of fresh, marine, or mixed chemistry; extends below sea level for the majority of its depth; and may provide access to cave passages. See also: *inland blue hole*; *ocean hole*. (b) An obsolete term for a *resurgence*.

(from the [Glossary of Geology](#), 5th edition, revised)



## Gypsum Sands

by Bill Beiriger


**Editor's note:** The article is adapted from Livermore Lithogram (newsletter of the Livermore Valley Lithophile, Livermore, CA), June 2009, p. 4.

**T**his month, we look at sands formed by evaporation to form  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ , the mineral gypsum.

Gypsum is dissolved from the playa floors of old lake beds. As the solution of calcium sulfate loses its water by evaporation, crystals of gypsum grow in the form of selenite.

The freezing and thawing and the wetting and drying cause the selenite crystals to break down into sand-sized particles. Wind can then carry this sand over a long distance. When the crystals form, they have a pseudocubic shape with sharp edges, and as the wind blows them around, they begin to get rounded off.

The shorelines where these sands formed had high salinity and high summer temperatures. I have samples of gypsum sands from two locations: one near the Great Salt Lake in Utah and the other outside White Sands National Park in New Mexico. The New Mexico crystals have a much better shape than the crystals from Utah.

Outside the White Sands National Park is an area where the gypsum sand collects along the highway just west of the park entrance. You can collect there, but **DO NOT COLLECT IN THE PARK.** 



## The Smithsonian's New Dinosaur Hall

by Ed Yong

**Editor's note:** Thanks to Sue Marcus for the reference!

**A**s I walk into the Smithsonian National Museum of Natural History's partially reassembled dinosaur hall,

the first thing I notice is a Diplodocus peeking out at me. Its long neck cranes out from behind a cutout of a Jurassic tree, and its 150-million-year-old skull is angled in an almost cheeky way. "Oh hi," it seems to say. "It's you. Welcome." ... [Read more.](#)



**Top:** Gypsum sands from White Sands National Park, NM.

**Center:** Gypsum formations in White Sands National Park, source of the sands. **Bottom:** Scene from White Sands National Park. Sources: Wikipedia; National Park Service.



## AFMS The Awakening of the Earth Sciences in the USA

by Jennifer Haley, AFMS Historian

**Editor's note:** The article is adapted from the A.F.M.S. Newsletter (September 2018), p. 1.

Since I began the job of AFMS Historian, I've been intrigued by references in historical files to mineralogical societies in the 1800s. Boy oh boy, did I want to find the sources of that information!

It took a couple of years of looking, but one evening last month, it was like I hit the motherlode. So far, I have been able to trace our hobby's heritage in America back to the late 1700s.

The information comes from personal accounts and presentations written down and kept by the very few who were interested in collecting and identifying minerals. We have them to thank for fostering and inspiring our hobby. I can only imagine that if the forefathers of the early mineral societies could see our hobby today, along with developments in the Earth sciences, they would be overjoyed.

The interest in the study of mineral identification emerged 22 years following the Declaration of Independence in 1776. Thomas Jefferson was passionate about paleontology. He was fascinated by mastodon fossils and believed the animals still roamed the country, possibly out West. Jefferson collected mastodon bones, tusks, and teeth, and he had quite the collection at the White House.

At that time, extinction wasn't an issue because it was believed that any bones or fossils found belonged to a living animal. America was at a point in its history of unfolding exploration and knowledge, with a vast imagination of a future with so many wondrous possibilities.

Europe was already making advances in mineralogy and chemistry long before the United States. Students in America studying the various sciences took notice of what Europe was discovering and wanted the same for America.

Early on, it was mostly those in the medical profession in Philadelphia, Boston, and New York who were the driving force behind a growing awareness of mineral-



*Giant sloth, Megalonyx jeffersonii, first described from fossilized bones found in a West Virginia cave. Based on the bones and a claw, Thomas Jefferson wrote a paper describing a giant species of lion, and he later asked Lewis and Clark to be on the lookout for it on their western expedition from 1804 to 1806. Jefferson was an avid early American naturalist with a lifelong interest in fossils. Source: Georgia Before People.*

ogy in their states. They believed that the study of minerals would have a major impact on the development of our country. Their first obstacle was a lack of mineral collections to inspire students and text books on the subject in the United States.

In 1798, a group in New York formed the American Mineralogical Society. They described their purpose as "The Investigation of the Mineral and Fossil Bodies which compose the Fabric of the Globe, and more especially for the Natural and Chemical History of the Minerals and Fossils of the United States."

There is a lot more to this story about our American Earth science history. More of our story will be told in future AFMS newsletters. ↗



## Safety First Dangers That Lurk in the Dark

by Ellery Borow, EFMLS  
Safety Chair

**Editor's note:** The article is adapted from EFMLS News (June/July 2015), p. 4.

**D**angers that lurk in the dark ... and in the light ... can be present in many of our rockhound activities.





Think of the avid field collector using power tools to drill holes in rocks so that they can be split using feathers and wedges—what a dust cloud is raised! Think of the lapidary artist using her home-made machine with all its exposed drive belts and pulleys, all just waiting to grab a loose sleeve cuff. Think of some kids in a quarry hammering on a rock, with sharp, splintery rock shards spraying in all directions. All the situations just described have obvious dangers: inhaling rock dust; catching clothing, hair, and fingers in equipment pinch points; and sharp shards damaging eyes.

Although those situations harbor obvious hazards, other situations may not be so obvious as hazards.

Let's think of that avid field collector once again. To arrive at his worksite, he may have taken a short cut and walked across a small stream. Well, take it from one who knows, wet rocks can be very—no, make that extremely—slippery. Falling and getting wet may not be all that serious, but falling and breaking a bone most certainly is.

Soldering on that silver pendant may produce a striking work of art; however, the flux and pickling fumes could be highly toxic.

Wandering around a famous quarry to collect fluorescent minerals after dark can help you see incredible treasures. What you might not see are holes of unknown depth. Even a very shallow hole can cause you to lose your balance, especially after dark.

Another commonly ignored and often underappreciated hazard is not keeping your fingers in view. Reaching over an edge for a handhold? Out of sight, your fingers could close not around a handhold but around a very unwelcoming critter hiding there.

Not being able to see your fingers as you hold a rock on that slab saw is just asking for pinchpoint trouble.

Putting your fingers into a hole to pull out the treasures therein? Again, take it from someone who knows from experience, there could be something besides treasures in that hole, pocket, vug, cavity, or crack. There could well be something that bites or stings.

Working at that club show or in your workshop? A simple tester available at most hardware or electrical supply stores can be used to check those outlets, extension cords, and power strips. Although circuits can either work or not, there are additional issues such as poor, faulty, or missing grounds; reversed polarities;

and nonfunctioning GFCI's that are not so noticeable at a glance.

Always keep in mind the potential of hidden dangers lurking in our rockhound hobby. Keep in mind that it is not just the dark of night that harbors hidden hazards, although night is when the monsters come out, isn't it?

Please be safe, no matter what you do, and keep in mind the potential hidden dangers as well as the not-so-hidden dangers lurking just around the corner.

Your safety matters! ⚡



***Save the dates!***

## **Field Trip Opportunities**

### **Northern Virginia Community College Geology Field Trips**

NOVA's Annandale campus offers 1-day weekend courses—essentially, field trips—related to our hobby. You can get more information at the [Field Studies in Geology—GOL 135 Website](#).

#### **Building Stones of the National Mall**

**March 30, 2019, 9 a.m.–7 p.m.** Visit over 20 National Mall sites, examining the geologic history and architecture and the rocks used to construct the federal buildings and monuments there.



#### **Paleozoic Geology of Virginia/West Virginia**

**April 13, 2019, 9 a.m.–7 p.m.** This field trip will let you explore the late Silurian and Devonian geology of western Virginia and West Virginia, considering ancient depositional settings (tropical marine reefs, lagoons, shelves, deep basins, and terrestrial flood plains) and fossils, as well as later deformation (faulting and folding) associated with the Valley and Ridge Province. ⚡



## Wildacres Registration Now Open!

by Steve Weinberger, Wildacres Committee Chair

*Editor's note: The article is abridged from EFMLS News (December 2018), pp. 3–4.*

**W**ildacres is a fantastic retreat located on Pompeys Knob just off the Blue Ridge Parkway about an hour north of Asheville, NC. Signing up for the May 20–26

session will give you the opportunity to take one or two classes; hear excellent talks from our guest speaker, Renée Newman; and participate in a variety of other activities.

Registration is open! You can find a registration form in the EFMLS newsletter, [December 2018 issue](#), or go to the [Wildacres Website](#). Some classes fill quickly, so register early! You can choose from the courses listed below. ➤

### Coming to Wildacres in May 2019 ...

**Cabochons—Basic** (Bernie Emery): Transform rock into a cabochon. Learn trim saw, grinding, sanding, and polishing. Slabs provided or use your own. Bring apron, safety glasses. No experience needed. 2-day class, semester 1.

**Cabochons—Intermediate** (Bernie Emery): Learn techniques for cutting different shapes. Slabs provided or use your own. Bring apron, safety glasses. Prior experience with cabbing and trim saw. 2-day class, semester 2.

**Faceting** (Reivan Zeleznik): Learn to cut/polish a 57-facet round brilliant gemstone, identify well-cut stones, and select rough material. Bring optivisor; jeweler's loupe needed, can be purchased. No experience needed. 4-day class.

**Fold forming/cold connections I** (Micah Kirby): Intro to fold forming & connecting base metals w/o heat. Use forming tools & hammers, wire, tubing, & rivets as fasteners. Explore design concepts w/texturing, using stamps, hammers, & rolling mill, plus forming & tab setting techniques. Design an air chased cuff from copper tubing & a pair of matching earrings. Gain knowledge of texturing & forming the cuff. 2-day class, semester 1.

**Fold forming/cold connections II** (Micah Kirby): Design/fabricate a pair of earrings & pendant, combining multiple pieces & connecting with wire, tube, or rivet. Use stamps, hammer, or rolling mill to texture. The pendant will involve a tab set stone/found object & finish w/tumbling. 2-day class, semester 2.

**Geology I** (Rob Robinson): Learn to interpret rocks to tell geologic history. A field trip to local rock exposures will illustrate local rock types, deformation types, and how to map/interpret structures (limited walking required). Bring loupe, sturdy shoes, outdoor clothes, geologic hammer, safety glasses. No experience needed. 2-day class, smstr 1.

**Geology II** (Rob Robinson): Learn plate tectonics & geologic history of Blue Ridge region/minerals. Discover geologic environments of mineral/gem collecting sites; identify your own collecting localities. Field trip with 1-mile walk over gentle trails. Same clothing/gear as Geology I. Basic knowledge preferred. 2-day class, semester 2.

**Intro to inlay I** (Chuck Bruce): Construct inlay box pendant; your choice thereafter. Bring basic silver tools, pocket-knife or scribe. Bring/purchase 2-3 slabs of rock of similar hardness, wood, fossil ivory, which can be combined for inlay. Pattern stones do well w/plain colored stone. Expect waste rock. 2-day class, semester 1.

**Intro to inlay II** (Chuck Bruce): Finish fabrication of small trapper folding knife. Bring basic silver tools, pocket-knife or scribe. Bring/purchase 2-3 slabs of rock of similar hardness, wood, fossil ivory, which can be combined for inlay. Pattern stones do well w/plain colored stone. Expect waste rock. 2-day class, semester 2.

**Silversmithing I** (Richard Meszler): Learn to work silver sheet & wire to fabricate jewelry. You get a kit with metals/supplies & a step-by-step description of each project. No experience needed. 2-day class, semester 1.

**Silversmithing II** (Richard Meszler): Learn to make a bezel setting & bail for setting a cabochon to make a pendant. You get a kit with all you need. Basic silversmithing experience, including soldering. 2-day class, semester 2.

**Soapstone Carving** (Sandy Cline): Learn the material/tools/methods used to complete a carving. Produce a simple piece; progress toward a more advanced sculpture. No experience needed. 2-day class, both semesters.

**Wirewrapping** (Jacolyn Campbell): Use pliers/gold-filled or sterling silver wire/assorted beads or gemstones/ basic wirecraft techniques to create rings, bracelets, pendants, and earrings. All tools/materials provided.

**Session I (beginner)**: Make an adjustable ring, 2 bracelets, a pendant, & 2 pairs of earrings. 2-day class, semester 1.

**Session II (interm)**: Make a fitted ring, 2 pairs of earrings, a cabochon pendant, & a bracelet. 2-day class, smstr 2.





## **The Rocks Beneath Our Feet Fossil Hunting Along Our Local Creeks**

by Hutch Brown

**T**ake a look at the rock at the right, which I found in October 2018 along Four Mile Run in Arlington, VA. The lines in it are traces of animals that lived more than half a billion years ago.

These are not fossils (fossilized plants and animals) but rather tracks—signatures left by ancient animals, like dinosaur footprints. They are known as trace fossils.

You can easily find trace fossils like this along the creeks in our area. It took me 20 minutes to find this specimen on a gravel bar near the Barcroft Sports and Fitness Center in Arlington. I have found others like it on other gravel bars, including outside the nature center where our club meets.

All it takes is looking down and studying the rocks and gravel.

### **Searching Gravel Bars**

I didn't go there looking for rocks but rather as a volunteer stream monitor for Arlington County. If you fish for trout, you know that trout spend a lot of time nosing through gravel looking for aquatic insects to eat. Some of the insects eventually hatch into mayflies, damselflies, and nastier stuff like midges and mosquitoes. Their airborne adult lives are brief, and they lay eggs for the next generation of aquatic insects.



The presence and number of the various aquatic insects is a measure of stream health: some species are more sensitive than others. Stream monitors collect and identify the bugs, and experts then evaluate stream health. (The health of streams in Arlington is generally poor because stormwater runoff is so great.)

Stream monitoring has down times, so I took the opportunity to search the gravel bar. Gravel bars in northern Virginia store much of the geological record for our entire region, so they fascinate me.

### **Local Bedrock**

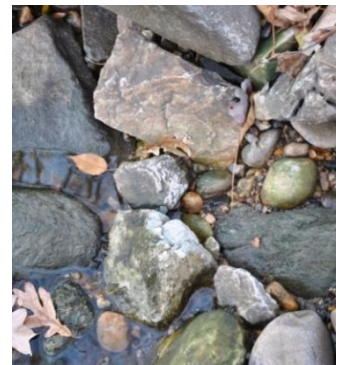
Part of the geological record is the local bedrock. It is a gray or brown metamorphic rock called Indian Run sedimentary melange. Formed in a deepsea trench more than half a billion years ago, it is rich in sands and silts, and you can see lots of glittering mica.



*Antietam quartzite with Skolithos trace fossils, found along Four Mile Run near the Barcroft recreation center in Arlington, VA. Photo: Hutch Brown.*

But I didn't see much of it on the gravel bar where I found the trace fossil. Once broken into pieces, the bedrock darkens and decomposes, forming the deep red mineral soil typical of the Virginia Piedmont. So you don't see that much of it in our local creeks except as boulders or solid bedrock.

I saw a lot of quartz on the gravel bar. The extreme heat and pressure of colliding tectonic plates fractured the bedrock, and hydrothermal processes infused the cavities with veins and lenses of quartz, some of them huge. Although it makes up only a tiny proportion of our local bedrock, quartz resists weathering, so it dominates the gravel bars in our area.



*The light pieces are quartz or sandstone; the dark pieces are metamorphic. Photo: Hutch Brown.*

### **Nonlocal Rocks**

But our local gravel bars also contain rocks that originated far to the west. The specimen I found with trace fossils is a metamorphic rock called Antietam quartzite, named for a Maryland creek of Civil War fame—Antietam Creek, where the Battle of Antietam was fought in September 1862. A tributary of the Potomac River,

Antietam Creek is far to the northwest of Arlington County, upstream from Harpers Ferry, WV.

Our gravel bars in Arlington County also contain sandstone in various colors, including the red variety used to quarry the stones for the Smithsonian Castle in Washington, DC. That sandstone, quarried near Seneca Creek in Maryland, also lies well to the northwest of Arlington County. No sandstone or quartzite underlies Four Mile Run, which is less than 10 miles long, so it couldn't have brought those rocks from where they originated.

So what did?

### Potomac Formation

The sandstones and quartzites in our creeks came from bedrock sources 30 miles away or more. They are worn and rounded from rolling down ancient rivers, predecessors of the Potomac. Deposited up to 140 million years ago, the nonlocal rocks in our creeks became part of a densely packed layer of riverine rocks, gravels, sands, and silts that covers the solid bedrock in our area (fig. 1).

The layer is marked on geologic maps as the Potomac Formation, and it is well exposed by erosion along our creeks, including near the nature center where our club meets. It looks like soil and rock; when I first saw it, I never thought it was an actual geologic formation 100–140 million years old. It took me a while to accept that (I am no geologist).

Loosened by erosion, the rounded river rocks fell out of the Potomac Formation into Four Mile Run. The creek then carried the rocks a few miles—or maybe only a few yards—to whatever gravel bars you find them on today.

### Antietam Quartzite

The rounded sandstones in our creeks are Triassic in age. They originated from sediments that filled ancient basins. The Triassic basins formed in our area beginning about 245 million years ago, when Africa rifted away from the North American continent, creating the Atlantic Ocean.

The quartzites are much older, with completely different geologic origins. Quartzite forms from sandstone under intense heat and pressure, and (like all metamorphic rock) it has various grades, depending on the amount of heat and pressure. The Antietam quartzite in our area is poorly consolidated. By contrast, the



**Figure 1**—Potomac Formation, exposed by erosion along Long Branch, a tributary of Four Mile Run in Arlington, VA. Photo: Hutch Brown.

well-consolidated Weverton quartzite looks crystalline rather than granular, almost like quartz.

Sure enough, my specimen with trace fossils looks to me like sandstone. I assume it is Antietam quartzite partly because I know that the Antietam in our area is poorly consolidated. In fact, some sources call it “quartzose sandstone” rather than quartzite.

But the trace fossils are a dead giveaway—Antietam quartzite is famous for them. The fossil was first described in 1840 by the Pennsylvania geologist Samuel S. Haldeman. He found it in quartzite at Chickies Rock, a landmark on the Susquehanna River near Lancaster in southern Pennsylvania. Haldeman named his find *Skolithos linearis* (perhaps coined from Greek *skolex*, “worm,” and *lithos*, “rock,” combined with Latin *linearis*, “consisting of lines”).

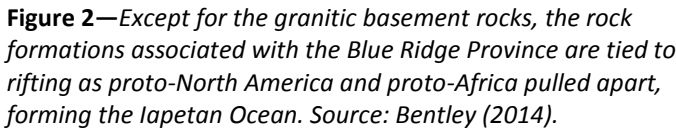
The lines in the rock are burrows in the sand left by wormlike creatures that might be—or might be related to—a marine animal alive today. Phoronids live in shallow marine environments just offshore. They burrow into the sands and use tiny tentacles to filter food from the currents flowing overhead.

So the Antietam quartzite must have originated in an offshore marine environment. Here's how.

### Continental Rifting

About 1 billion years ago, our area was smack dab in the middle of a supercontinent known as Rodinia. We still have some of the ancient bedrock, known to geologists as Grenville granite. You can see Grenville granite yourself in the outcrops of the Blue Ridge Mountains, such as Old Rag Mountain.





Supercontinents eventually break up. Rifting began in earnest about 570 million years ago along the suture zones between proto-Africa and proto-North America as the continents pulled apart. Figure 2 shows the sequence of rock formation as the Iapetan Ocean, predecessor of the Atlantic Ocean, began to form.

Rifting began at the edge of today's Blue Ridge geologic province—Bull Run Mountain in Virginia and Catoctin Mountain in Maryland (the Piedmont and Coastal Plain did not yet exist). As the rock thinned and stretched, it formed basins with streams, and the granitic basement rock was covered by the thin sands and gravels of the Swift Run Formation. Magma welled up through the thinning crust, causing lava flows that later metamorphosed into Catoctin greenstone. As the new ocean formed, it gradually submerged the rocks along the continental margin.

Next came a sequence of nearshore and offshore sediments associated with rising and falling sea levels (what geologists call marine transgressions and regressions). The sands that became Weverton quartzite were

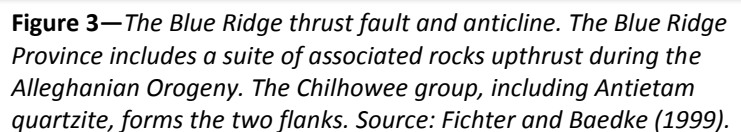
covered by the silts and muds that eventually turned into Harpers phyllite, which in turn gave way to more sands, the origins of Antietam quartzite.

The offshore Antietam sands formed a perfect environment for creatures like phoronids, which burrowed into the sands by the billions and left us the trace fossils we see today. Subsequent tectonic events raised mountains in our area more than once, laying the foundations for the Piedmont and Coastal Plain; the various tectonic events metamorphosed the Weverton, Harpers, and Antietam sedimentary rocks.

Geologists call the Antietam, Harpers, and Weverton Formations the Chillhowee Group because they form a related sequence of rock layers overlying the granitic basement rock of the Blue Ridge geologic province (fig. 2). Together with Catoctin greenstone and other rocks, they formed the great anticline (overturned hump) of the Blue Ridge (fig. 3), which took shape when proto-Africa closed the Iapetan Ocean and collided with proto-North America beginning about 320 million years ago.

As figure 3 shows, the Chillhowee Group forms the two flanks of the anticline. It originally covered the anticline, which has long since been breached by erosion and worn away.

In any case, all of the Blue Ridge rocks, including Antietam quartzite, are linked by the Iapetan rifting that took place about 570 million years ago (fig. 2). They are also linked by the Blue Ridge thrust fault and



anticline associated with mountain building some 320 million years ago (fig. 3), what geologists call the Alleghanian Orogeny.

### Long Geological Record

So the gravel bars along our creeks contain a geological record going back for more than half a billion years. The record spans two geologic provinces (Blue Ridge and Piedmont) and covers more than 50 miles (the distance from Arlington County to Bull Run Mountain, where the Blue Ridge Province begins).

Some of the oldest rocks you can find in our creeks, Cambrian in age, are the Antietam quartzites, derived from ancient offshore sands more than 500 million years ago. They were deposited on the Piedmont more than 100 million years ago by huge rivers long since gone. They contain unmistakable traces of ancient marine life, and they are not that hard to find.

So the next time you are on a gravel bar along one of our creeks with nothing much to do, why not give it a try? Finding ancient fossils is always a thrill! 🦕

### Sources

Bentley, C. 2014. Personal communication, professor of geology, Northern Virginia Community College. 7 February. Annandale, VA.

Fichter, L.S.; Baedke, J.K. 1999. The geological evolution of Virginia and the mid-Atlantic region. Harrisonburg, VA: College of Science and Mathematics, James Madison University.

Wikipedia. 2018. Samuel Stehman Haldeman.

Williams, G.H.; Clark, W.B. 1893. Antietam sandstone. Chapter 3 in: Maryland, its resources, industries, and institutions. Chicago, IL: Maryland Board of World's Fair Managers: 55–88.



*River scene in our area about 100 million years ago, part of a mural at the Dinosaur Park in Laurel, MD. Giant rivers like this carried Antietam quartzite and other rocks from sources far to the west, depositing them in what is now the National Capital Area.*



## January 2019—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 <b>New Year's Day</b>	2 <b>MSDC mtg, Washington, DC</b>	3	4	5
6	7	8	9	10	11	12
13	14 <b>GLMSMC mtg, Rockville, MD</b>	15	16	17	18	19
20	21 <b>Martin Luther King Day</b>	22	23 <b>MNCA mtg, Arlington, VA</b>	24	25	26
27	28 <b>NVMC mtg, Arlington, VA</b>	29	30	31		

### Event Details

**2: Washington, DC**—Monthly meeting; Mineralogical Society of the District of Columbia; 7:45–10; Smithsonian Natural History Museum, Constitution Avenue lobby.

**14: Rockville, MD**—Monthly meeting; Gem, Lapidary, and Mineral Society of Montgomery County; 7:30–10; Rockville Senior Center, 1150 Carnation Drive.

**23: Arlington, VA**—Monthly meeting; Micromineralogists of the National Capital Area; 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.

**28: Arlington, VA**—Monthly meeting; Northern Virginia Mineral Club; 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.



*Barite on matrix from Cerro Huarihuyn, Miraflores, Peru.  
Source: Wikipedia; photo: Carlesmilan.*

Hutch Brown, Editor  
4814 N. 3rd Street  
Arlington, VA 22203



**Mineral of  
the Month:  
Barite**

---

PLEASE VISIT OUR WEBSITE AT:  
<http://www.novamineralclub.org>

---

## 2019 Club Officers and Others

President: Sue Marcus  
[rlhaskins@verizon.net](mailto:rlhaskins@verizon.net)  
Vice-President: Ti Meredith  
[ti.meredith@aol.com](mailto:ti.meredith@aol.com)  
Secretary: David MacLean  
[dbmaclean@maclean-fogg.com](mailto:dbmaclean@maclean-fogg.com)  
Treasurer: Roger Haskins  
[rlhaskins@verizon.net](mailto:rlhaskins@verizon.net)  
Editor: Hutch Brown  
[hutchbrown41@gmail.com](mailto:hutchbrown41@gmail.com)  
Field Trip Chair: Steve Parker  
[stevenlparker@gmail.com](mailto:stevenlparker@gmail.com)  
Greeter/Door Prizes: Ti Meredith  
[ti.meredith@aol.com](mailto:ti.meredith@aol.com)  
Historian: Kathy Hrechka  
[kshrechka@msn.com](mailto:kshrechka@msn.com)  
Photographer: Amanda Parker  
[parkeramandalynn@gmail.com](mailto:parkeramandalynn@gmail.com)  
Show Chair: Tom Taaffe  
[rockcllctr@gmail.com](mailto:rockcllctr@gmail.com)  
Webmaster: Casper Voogt  
[casper.voogt@plethoradesign.com](mailto:casper.voogt@plethoradesign.com)

## The Northern Virginia Mineral Club

**Visitors are always welcome at our club meetings!**

Please send your newsletter articles to:  
[hutchbrown41@gmail.com](mailto: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;  
\$15 individual, \$20 family, \$6 junior (under 16,  
sponsored by an adult member).

This publication may contain copyrighted material for the noncommercial purpose of advancing amateurs' understanding of subjects related to our hobby. This "fair use" of copyrighted material accords with section 107 of the U.S. Copyright Law.

**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.*

You may reprint the materials in this newsletter, but if you use copyrighted material for purposes beyond "fair use," you must get permission from the copyright owner.