THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: February 27 Time: 7:45 p.m.

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

Wulfenite

Red Cloud Mine, Arizona

Smithsonian National Museum of Natural History
Photo: Dana Penland

Deadline for Submissions

March 1

Please make your submission by the 1st of the month! Submissions received later might go into a later newsletter.

Volume 58, No. 2
February 2017
Explore our Website!

February Meeting Program:

Amphiboles in the Gogebic Range

In this issue …

Mineral of the Month
Wulfenite

by Sue Marcus

Wulfenite is an eye-popping mineral (as you can tell from the cover). It is found in exquisite crystals and colors. It is a welcome addition to most mineral collections.

Although some collectors pay tens of thousands of dollars for a single wulfenite specimen, the rest of us can afford lovely smaller pieces to grace our collections. Wulfenite specimens may also be purchased at our mineral club auctions. That's where I obtained my favorite wulfenite.

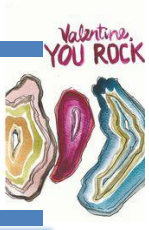
Collectors should be grateful that wulfenite was renamed. In 1772, it was originally called "plumbum spatosum flavo-rubrum, ex Annaberg, Austria." In 1781, it acquired the German name *kärnthnerischer Bleispath*, which translates roughly as "lead spar from Carinthia" (in Austria). (The term *Spat*—as in *Feldspat*, or feldspar—connotes perfect cleavage.)

Other names were also used before the name it was given in 1845 finally stuck. Wulfenite was named for a Jesuit, Franz Xavier von Wulfen, who authored a monograph on the lead ores of Bleiberg, Austria. The mineral (of whatever name) was apparently first reported from Austria.

Wulfenite is often associated with other lead minerals or with vanadium or zinc minerals like vanadinite, smithsonite, mimetite, and galena. Tungsten can substitute for molybdenum atoms so that wulfenite forms a solid solution series with stolzite; that is, the minerals form a chemical spectrum from containing only molybdenum (wulfenite) to containing only tungsten (stolzite).

Wulfenite occurs as a secondary mineral in deposits rich in lead and molybdenum oxide. The deposits are left by water and other fluids leaching materials from the host rock or as hydrothermal fluids percolating upward through the rock. Host rocks in Austria are carbonates (limestones and dolomites). In Arizona, altered igneous rocks are the hosts.

Crystals of wulfenite appear to be tabular. They are more beautiful when they are transparent or translucent, perched on the host rock, showing off (like the specimen on the cover).



Happy Valentine's Day!

Northern Virginia Mineral Club members,

Please join our February speaker, Carlin Green, for dinner at the Olive Garden on February 27 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.

Thicker, opaque, tabular orange crystals are more common, such as those from Sierra de Los Lamentos, Chihuahua, Mexico (see the specimen below). Wulfenite can be used as an ore—economic source—of molybdenum, so many stunning specimens have probably gone to the crushers.

Red Cloud, AZ, is a world-famous locality for exceptional wulfenite specimens. Wulfenite is also found at other sites in Arizona. Mexico also has several noted wulfenite localities.

Wulfenite from the Ahumada Mine, Sierra de Los Lamentos, Chihuahua, Mexico. Source: Smithsonian Mineral Gallery; photo: Chip Clark.

China and Iran are relatively recent specimen producers, while Congo, Morocco, and Namibia are also well-known localities for specimens. The old locality of Bleiberg, Austria, though not an active mine site, is still treasured for lovely historic specimens.

Most wulfenite specimens are not fluorescent, although some specimens from Arizona are reported to fluoresce under short-wave ultraviolet light, probably with uranium as an activator. Long-wave fluorescence is also reported, although without specific details about where the specimens came from, along with confirming photographs.

Though attractive, wulfenite is far too brittle, fragile, and soft for jewelry. Still, it has been faceted or used in jewelry as a novelty.

Technical details:

Chemical formula .....$PbMoO_4$

Crystal form .....tetragonal

Hardness 2.5–3

Density .....6.5–7.0, g/cm^3 (measured) (depending on source)

Color: .....usually orange but can range from yellow to orange-red and brown

Streak .....white

Cleavage .....perfect in one direction

Fracture .....conchoidal to uneven

Luster .....resinous, adamantine, vitreous (sources vary)

Sources

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Velebil, 2006. Lead and zinc deposit Bleiberg in Carinthia (Austria). Abstract. Mineral 13(1): 41.

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Amphiboles in the Ironwood Iron-Formation of Northern Wisconsin

February 27 Program

Carlin Green, a student at George Mason University and a recipient of a grant from the NVMC's Fred C. Schaefermeyer Scholarship Fund, will give a presentation on a project he is working on for the U.S. Geological Survey. Carlin is studying amphiboles in the Ironwood Iron-Formation of northern Wisconsin.

The Ironwood Iron-Formation lies in the Gogebic Range of northern Michigan and Wisconsin (fig. 1), one of the iron-producing ranges of the Lake Superior region. The western portion of the Gogebic Range is one of the largest undeveloped iron resources in the region. It will likely receive great interest in the future as a potential source of taconite, or iron ore.

What makes this part of the range so interesting—and controversial—is the contact metamorphism of the Ironwood Iron-Formation by an intrusive igneous body. One result is the development of amphibole minerals, which present a challenge for resource development, especially solid mine waste management practices. Several species of amphibole are federally classified as asbestos, posing potential risks to miners and the community at large.

Despite the health risks associated with asbestos, amphibole is a common rock-forming mineral that is generally benign. The absence of detailed mineralogical knowledge of the amphiboles in the Ironwood Iron-Formation of the western Gogebic Range has led

Figure 1—*The Gogebic Range straddles the border of Wisconsin and Michigan. The study area (arrow) contains undeveloped reserves of iron ore. Source: Wikipedia.*

to a lively debate as to whether or not this iron resource can be safely developed, with strongly opinionated and often uninformed voices on both sides.

As an unbiased investigator with mineralogical expertise, USGS generates information to help environmental and medical professionals make sound decisions about health and environmental risks and to help mineral resource developers build safe and reliable frameworks for any potential mines. Accordingly, Carlin's project is specifically focused on the distribution, morphology, and chemistry of amphiboles related to contact metamorphism in the Ironwood Iron-Formation.

Carlin is a native Virginian who got interested in mineral collecting at a young age. He has been seriously collecting minerals for about 3 years. In 2015, he graduated from GMU with a bachelor of science in geology. He got an opportunity to pursue a master of science at GMU starting in 2016, working with his supervisor, Dr. Robert Seal, on the USGS project that doubles as his master's project. He plans to finish his degree at the end of 2017 and continue in the field of mineralogy.

The Prez Sez

by Bob Cooke, President

I thank all of you who put up with my ramblings at the last meeting. But, as painful as it was, we did get a budget approved and you gave me helpful advice on a number of perplexing issues. I just hope we don't have to go through that experience again for a long time.

Last Saturday was the annual trip to James Madison University. About 30 people from the NVMC, the Micromineralogists of the National Capital Area, and the Mineralogical Society of the District of Columbia descended upon Harrisonburg, VA. Professor Lance Kearns had a superb selection of minerals, textbooks, and magazines for us to peruse.

A book on cave minerals caught the eye of both Richard Palaschak and me; for a few minutes, it was a scene worthy of Filene's Bargain Basement, but Richard eventually won. I was, however, able to grab the nine-volume set of Goldschmidt's Atlas of Crystal Forms and a goodly number of micromounts.

Top: *Professor Lance Kearns standing next to a display case in the JMU Mineral Museum donated, in part, by the NVMC.* **Bottom:** *Three JMU recipients of awards from the NVMC's Fred C. Schaefermeyer Scholarship Fund; from left to right: Noah Fleischer, Austin Mathews, and Grant Colip. Photos: Kathy Hrechka.*

Quite a haul for me. And I noticed that practically everyone else was leaving JMU with a good-sized bundle.

We also presented Fred C. Schaefermeyer Scholarship Fund awards to three JMU students: Grant Colip, Noah Fleischer, and Austin Mathews. It was a pleas-

ure talking with all three, but it was amazing how young they were compared to the average NVMC member. (We couldn't possibly be getting older, could we?)

This was the last time for Lance to host a visit prior to his retirement later in the year. However, he will continue on as curator of the JMU Mineral Museum. He will oversee the expansion of the museum to incorporate Peter Via's donation of his mineral collection (the largest value donation in the history of JMU). Keep your fingers crossed; NVMC may get an invitation to see the new museum next year!

Bob

NVMC members Hutch Brown and Sue Marcus admiring specimens in the JMU Mineral Museum. Photo: Kathy Hrechka.

Meeting Minutes
January 23, 2017

by David MacLean, Secretary

President Bob Cooke called the meeting to order at 7:45 p.m. at the Long Branch Nature Center in Arlington, VA.

The minutes of the November 2016 meeting were approved as published in *The Mineral Newsletter*. The president recognized the past presidents in attendance—Sue Marcus, Rick Reiber, and Barry Remer. The president also recognized Sue for organizing the food for the 2016 Holiday Party on December 19, 2016. (See page 8 for the story.)

Treasurer's Report

Acting Treasurer Rick Reiber reported the balances in the NVMC account and in the Fred C. Schaefermeyer Scholarship Fund. The balances for both are healthy.

Old Business

By motion duly made and seconded, the members by acclimation elected the following officers for 2017:

President .....Bob Cooke

Vice-President .....Ti Meredith

Secretary .....David MacLean

Rick Reiber, the acting treasurer, volunteered to train a new treasurer when a candidate is willing to serve. By motion duly made and seconded, the members voted to give President Bob Cooke authority to sign checks for the NVMC.

New Business

The president presented the board-recommended budget for 2017. The members changed several line items in the budget, including adding additional disbursements for the Schaefermeyer scholarship fund.

As part of the budget discussion, the president raised issues associated with the newsletter, including the cost of mailing black-and-white hardcopies to 18 recipients. Two of the recipients are nature centers that club members said should be able to print out their own hardcopies from the emailed version. The president agreed to contact all 18 recipients to persuade them, if at all possible, to receive the newsletter online rather than by mail.

Members recognized that some recipients might not have easy access to a computer or be able to use a printer. One option raised was to ask those choosing to receive the newsletter by mail to pay an extra fee on top of their annual dues.

Another issue associated with newsletter costs is participation in the annual newsletter contest sponsored by the EFMLS Bulletin Editors' Advisory Committee (BEAC): Should the club save the cost of participating in a contest it might never be able to win?

The judging criteria include categories that do not apply to the NVMC, such as news about individual members, so the club newsletter automatically loses points in the contest. Moreover, the judging can be unfairly subjective, costing more points. However,

the editor pointed out that the newsletter has occasionally improved based on comments made by judges in the past.

Accordingly, the members agreed with the editor to see how the judging goes in 2017 and then take up the issue again for 2018. In any case, the club will continue to participate in the BEAC contest for individual articles.

By motion duly made and seconded, the members approved the 2017 budget as modified at the meeting. Copies of the NVMC 2017 budget are available to members on request.

Announcements

On Saturday, February 18, from 10 a.m. to 4:30 p.m., there will be a Family Day at the National Building Museum. The theme will be Discovering Engineering

The Gem, Lapidary, and Mineral Society of Montgomery County will hold its annual club show on the weekend of March 18–19. The hours will be 10 a.m. to 6 p.m. on Saturday and 11 a.m. to 5 p.m. on Sunday. The show will be at the Montgomery County Fair Grounds in Rockville, MD.

Mineral Giveaway

Instead of the usual program, the NVMC asked members to bring in rocks and minerals to give away. The tables in the Long Branch Nature Center were covered with flats of rocks and minerals. It was a great opportunity in particular for the kids present to collect many attractive items.

Fred Schaefermeyer Scholarship Awards

by Bob Cooke, President

In the last newsletter, we reviewed the personal accomplishments of Fred Schaefermeyer and traced the history of the scholarship fund he created. Fred was a remarkable leader who served as president of our club, editor of our newsletter, and in many other capacities, including as president of both our regional and our national federation. He left a lasting legacy, in part through the Fred C. Schaefermeyer Scholarship Fund, which gives grants to deserving students in fields related to our hobby.

Here, I'd like to mention the latest recipients of the scholarship awards.

Professor Julia Nord of George Mason University nominated Carlin Green for a 2016 award. Carlin is a graduate student at GMU who is conducting his thesis research on amphibole characterization in a metamorphosed iron formation (see his program description on page 3). You'll get to meet Carlin at the February meeting; he's our guest speaker.

Professor Lance Kearns of James Madison University nominated Austin Mathews for a 2016 award. Austin had the highest grade in last year's Mineralogy class and is very interested in minerals.

Professor Kearns also nominated two students to jointly receive the 2017 award. Noah Fleischer is currently taking the JMU Mineralogy course, is one of Lance's student assistants, has won the award for most promising new major, and is very interested in minerals. Grant Colip was also in last year's Mineralogy class, had the second highest grade (of 20 students), and is extremely interested in minerals (he is an avid collector). Both Grant and Noah plan to work together this year on the mineralogy of a pegmatite in Patapsco State Park outside of Baltimore.

On January 28, three students at James Madison University received awards from the NVMC's Fred C. Schaefermeyer Scholarship Fund. From left to right are Bob Cooke (NVMC president), Austin Mathews, Grant Colip, Cindy Kearns, Noah Fleischer, and Professor Lance Kearns. (Cindy is a geology instructor at JMU and Lance's wife.) Photo: Kathy Hrechka.

Club Contest: New Design for NVMC Name Tags

by Bob Cooke, President

The design used for NVMC name tags, as well as for the logo in the newsletter masthead, is old.

"How old?" you ask.

Well, old enough for the company that made our current name tags to go out of business. In fact, our design of the Virginia state outline with a cluster of quartz crystals is at least 43 years old. The template for it went the way of the dodo bird long ago.

How can we fix the problem? Have a contest, of course. All members are encouraged to put on their thinking caps and make a new design that can be used for new name tags and a new masthead. Consider something modern and up to date, and remember that most of us get our newsletter now electronically in full color.

Bring your designs to the April meeting, where we'll make a final selection. If you're unable to attend the meeting, please submit your design by email to me at rdotcooke@verizon.net.

NVMC Masthead: We Need a New One

by Hutch Brown, Editor

You know that line drawing on the cover of our newsletter? The one with the name of our club and the radiating crystals?

We need something new.

In the publishing world, a "line drawing" is a black-and-white graphic with lettering and simple artwork. This one dates at least to the 1970s. It first appeared in the November 1974 issue of our newsletter.

The newsletter had no photos or graphics at the time, so introducing a line drawing for the masthead was a huge breakthrough. The editor still used a typewriter, so the typewritten front page was probably photocopied (remember the old Xerox machines?) onto paper preprinted with the line drawing at the top.

That ancient line drawing is the same one we use today, with the same lettering, banner, crystals, and map. The only difference is that the crystals are now colored blue. Oh—and the original template is gone, so the graphic we use today is badly degraded.

A good example is the thick black dot above the largest crystal (see the red arrow above). Ever wonder what that dot is supposed to represent?

In the 1974 newsletter, it wasn't a dot at all but rather a white star in a black circle, like the capital of a state might appear on a map. The intent, no doubt, was to highlight the fact that our club is located in northern Virginia. Decades of photocopying must have worn it away, leaving the grainy and washed-out graphic we have today.

So what was once crisp and state-of-the-art now looks dowdy and shopworn, at least to me. But even a good line drawing would look quaint and out of place in the masthead of a full-color newsletter like ours, especially when the cover features a splendid photo of a gorgeous mineral.

So it's time for something new. See President Bob Cooke's call for a contest above.

Club Holiday Party
December 19, 2016

by Sue Marcus

Vice-president Ti Meredith presided over the NVMC/MSDC Holiday Party for 2016, along with former President Sue Marcus, who won well-deserved acclaim for organizing the affair.

At least 30 members, guests, and families enjoyed barbeque and potluck dishes, with lots of yummy desserts. People had so much fun that, amazingly enough, no one missed having a business meeting!

Among the revelers were some who had come to the NVMC show in November and wanted to join our club, particularly for the field trips. The young people in attendance received special presents, thanks to Ken Reynolds. It was wonderful to see Alec Brenner and Conrad Smith again.

A shoutout of thanks to Gerry Cox for bringing Karen Lewis! Kudos to Pat Flavin, Sue Marcus, Ti Meredith, Barry Remer, and Sheryl Sims for making all the arrangements and hanging the decorations.

Thanks to Sheryl Sims for the photos!

Snow Crystals 101: A Lesson in Snow Crystal Photomicrography

by Kathy Hrechka

Editor's note: *The piece is adapted from* The Mineral Mite *(newsletter of the Micromineralogists of the National Capital Area), January 2017, p. 3.*

On January 7, while anticipating 2 inches of snow at my home in Alexandria, VA, I was determined to photograph snowflakes through my microscope.

I set up my Olympus microscope outdoors on the front porch. I had created portable 5-by-5-inch snow-collecting stages topped with light-blue or royal-blue felt panels. My digital camera is a Canon Power Shot ELPH 110 HS, 16.1 megapixels. I simply held the camera up to the microscope's left eyepiece, with a coupling to block out light between the microscope and camera.

The temperature at 9 a.m. was 27 °F. I knew the temperature was just right for great crystal definition. I had to get started because the snowflakes were clustered and falling fast. My portable stages were rapidly collecting snow.

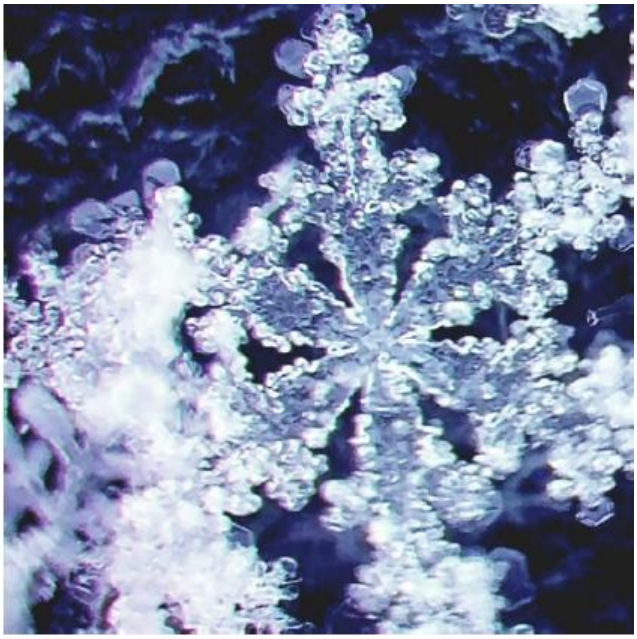
My microscope was set between 25 and 30 power magnifications because the snowflakes were tiny. My hands were chilled while constantly adjusting the microscope and camera above freshly collected snow crystals.

I was in awe at my camera screen as I watched crystal dendrites and hexagonal shapes land on my stages as my first subjects. Interestingly, the snow crystals did not melt, but some had tiny spheres of water under the crystal extensions.

I snapped my first photos. At times, I turned my microscope light off to reduce glare on the ice. Many forms of ice crystals were interconnected while landing on my stages. I had much work to do as the snow and temperature continued to drop.

While freezing outdoors myself, I continued until 1 p.m., when the temperature dropped to 25 °F. While I was waiting for more perfect crystals, the snow abruptly stopped. I was grateful that I had begun my snow crystal photography early in the morning, because Mother Nature is unpredictable.

With the snowfall finally ending, my work was done. I shall be ready and waiting for the next snow crystal storm.



Safety Matters
Master of the Obvious

by Ellery Borow, AFMS Safety Chair

Editor's note: *The article is adapted from* A.F.M.S. Newsletter *(April 2016), p. 4.*

I have, from time to time, been called the Master of the Obvious.

Well, I have been called a lot worse, so I will accept that title. Actually, I kinda like it. Master of the Obvious—yes, it can work for me.

Why is this a topic for a Safety Matters article? I'm glad you asked. I do indeed at times try to be a Master of the Obvious because the obvious is all too frequently overlooked or forgotten in the heat of rockhound excitement.

Permit me to cite some examples of missing the obvious. Let's say you are furiously digging out that just visible pocket or vug full of crystal treasures. Are you aware of the increasing overhang of the dirt and rock over your position?

Or let's say you're feverishly hammering that rock outcrop on the wall of a positively sweltering rock quarry. You're profusely perspiring, so why aren't you responding to your body's plea for water? Indeed, if you're feeling thirsty, it means your body is already experiencing dehydration.

How are those obvious hazards being missed? All through our hobby, passion and excitement exude through every pore of our being. Those passions sometimes overrule our physical well-being.

Consider, if you will, the following situations:

- You awaken early, drive 4-1/2 hours to a dig, and once there immediately race up the mountain to the excavation site. You take no rest, don't stretch stiff and cramped muscles, don't have a drink of water before heading uphill. There could easily be problems with this approach.
- You have been gem-grinding for hours and are getting close to where you want to be in the process ... so very close. You need better visibility; your safety glasses are laid aside, your hearing protection is not comfortable so that too is laid aside. Your front is splashed with water but you are not drinking a drop of water ... so very close to finishing. There could easily be problems with this approach.

You may be enjoying your hobbies, but can you imagine what your body is telling you?

We all have limits, but sometimes we ignore those limits. Sure, we can race uphill with a full pack of rock-collecting tools, and we can make our way back downhill with an even fuller pack, but tomorrow's aching muscles may pay a price—unless we are in good physical shape and well exercised for the trip.

Being the Master of the Obvious with respect to what your body is telling you can be a good thing. Tempering the passion and excitement of rockhounding can be a good thing if it keeps us safe and well.

If you plan ahead, bring your meds, get plenty of sleep, keep hydrated, exercise regularly, dress appropriately for the occasion, and otherwise master the obvious needs of your body and the requirements of your adventure, those masteries become second nature. Having a thing become second nature can take care of your first priority—the health and safety of your body and the enjoyment of our hobby.

I don't know about you, but I'm going to enjoy my new title of Master of the Obvious. Take good care of yourself. Please be safe! Your safety matters.

GeoWord of the Day

(from the American Geoscience Institute)

karrenfeld (KAR-ren-feld)

A karstic surface on limestone characterized by solution grooves. [*Karre* is German for cart; *Feld* means field, so "field of ruts from carts," sort of what it looks like.] Cf: *limestone pavement*.

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

Karrenfeld in Burren, Ireland. Source: Wikipedia.

2017 Regional Federation Conventions

by Bob Livingston, Coordinator

Editor's note: *The article is adapted from* A.F.M.S. Newsletter *(October 2016), p. 4. (I thought club members might be interested in knowing all the regional federation conference dates and locations this year.)*

Looks like we have one regional conflict in 2017: the Southeast and Eastern Federations hold their annual meetings on the same weekend. I know that avoiding conflicts is not always possible, but let's try in the future.

March 18–19 ..... Rocky Mountain Fed'n
Albuquerque, NM

May 6–7 ..... Midwest Federation
Brainerd, MN

May 19–21 ..... Northwest Federation
Hamilton, MT

June 9–11 ..... **AFMS**/California Fed'n
Ventura, CA

October 20–22..... Southeast Federation
Knoxville, TN

October 21–22..... **Eastern Federation**
Bristol, CT

November 10–12..... South Central Fed'n
Humble, TX

Save the Dates!

Field Trip Opportunities

George Mason University
February 18, 2017

In appreciation for the success of our last mineral show, Professor Julia Nord of George Mason University's Department of Atmospheric, Oceanic, and Earth Sciences has invited NVMC members to visit GMU's geology facilities on Saturday, February 18. We will meet on campus in Exploratory Hall, room L505 (in the basement), at 10 a.m. for a demonstration of the mineralogical laboratory and a tour of the mineral museum. An optional lunch will follow. No special arrangements have been made for parking, so please plan to use the pay parking garage.

Northern Virginia Community College *Geology Field Trips*

NOVA's Annandale campus offers 1-day weekend courses related to our hobby. You can register and get more information at the Field Studies in Geology—GOL 135 Website.

Paleozoic Geology of Virginia and West Virginia. One-day field trip via college van on Saturday, April 1, 2017, 7 a.m. to 9 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.

Cretaceous Geology of Maryland and Fossil Hunt. One-day field trip starting at 10 a.m. on Sunday, April 23, 2017. Well-known dinosaur expert and paleontologist Dr. Peter M. Kranz will lead this fun outdoor expedition to nearby fossil sites, where you can discover many exciting fossils to take home.

Website Review

Mid-Atlantic Geo-Image Collection (M.A.G.I.C.)

by Hutch Brown

The program at our club meeting in November 2016 featured Marissa Dudek, a student at Northern Virginia Community College who received a scholarship from our club. Her topic was a NOVA project to collect detailed geology-related images using a photographic technology called GigaPan.

The project is called the Mid-Atlantic Geo-Image Collection, or M.A.G.I.C. You can find a summary of Marissa's presentation in the December 2016 issue of our newsletter. By way of supplementation, here's a brief overview of the M.A.G.I.C. Website.

Hosted by the broader GigaPan Website, the NOVA collection has hundreds of images organized by country, geographic area, and topics such as thin sections,

Figure 1—*A cropped M.A.G.I.C. GigaPan showing lamprophyre dikes (arrows) in Mather Gorge along the Potomac River (on the Maryland side). The metagraywacke bedrock is part of the Mather Gorge Formation; the igneous lamprophyre weathers more rapidly than the metamorphic matrix, hence the incised dikes.*

paleobotany, weathering, and karst/travertine. One such topic, with 93 GigaPans and hundreds of smaller snapshots," is Corridor H, a virtual field trip through the physiographic provinces and rock formations of western Virginia and West Virginia. A search function helps you find images on more specific topics. For our immediate area, for example, you can find GigaPans of Mather Gorge (fig. 1).

Each GigaPan image comprises hundreds of smaller images, letting you zoom in to see minute details at high resolutions. Many GigaPans of rock formations are linked to "snapshots" of smaller areas, usually taken by NOVA Professor Callan Bentley, who comments on many of the details you can see.

Some GigaPans are striking, and you can order prints at various scales for a price. You can also join GigaPan for free and take your own "snapshots" of GigaPan details; GigaPan will then send the image details to your email, presumably as electronic files.

Unfortunately, I couldn't get this feature to work for me: The Website wouldn't recognize my password, no matter what I did. Hopefully, GigaPan's technical support can help you through any problems like this.

But I gave up because I don't need detailed snapshots right now. To illustrate articles for our newsletter, I hope to use Word software to copy and paste the full GigaPan images, then crop them to size (fig. 1).

And that makes this a valuable resource, especially for someone like me!

Bench Tips

Use Your Thumb

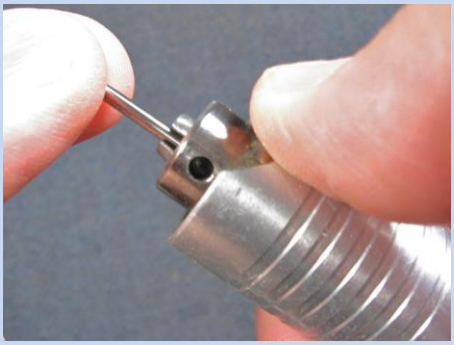
Brad Smith

When using multiple bits in a Foredom, we often have to deal with several different shaft sizes—the usual 3/32-inch burs, the larger 1/8-inch shaft sizes, and of course the many different sizes of drills. For some reason, I really dislike having to turn the key multiple times to open or close the jaws of the handpiece chuck.

So I have two ways to speed up that task. For opening up the jaws, I just remember "four," the number of turns I have to make to open the chuck just enough from the 3/32-inch bur shaft size to the larger 1/8-inch bur shaft size.

For closing the jaws around a smaller shaft, there's a neat trick. Hold the new bit in the center of the open jaws of the chuck, put your thumb lightly onto the outer toothed collar of the chuck, and gently start up the Foredom. As the chuck turns, it will naturally tighten the jaws around the bur shaft or the drill bit. Then all you have to do is a final tightening with the key.

See Brad's jewelry books at
amazon.com/author/bradfordsmith



Editor's Corner

Tradeoffs and Choices

by Hutch Brown

Editors make tradeoffs. One tradeoff involves white space.

White space includes margins and spaces between articles and paragraphs, the spaces that rest your eye. White space isn't wasted; it has its own function in any publication.

By using a double-column format, our newsletter adds an extra margin of white space. It also gives our newsletter a clean and professional look, like newspapers have.

Nevertheless, too much white space can look like empty space—like a gap. Our newsletter uses humor, short articles, stand-alone sidebars, and other techniques to fill such gaps.

Some publications solve the problem of empty space by interrupting articles and moving them to later pages ("continued on page X"). We don't, because it's a distraction for the reader. A basic rule of technical editing is to avoid reader distractions.

Another technique for filling empty space is to add an image to illustrate an article. Illustrations are important, anyway! I often crop or expand images to make everything fit into the right space.

The idea is to balance the pages and columns by making them look like they contain roughly the same amount of content. That, too, gives a publication a clean and professional look.

Full justification—making lines equal in length—conveys the same formal impression. That's why newspapers use it; we do, too.

The tradeoff is that the spaces between words are not always the same from line to line, which can be distracting. Using hyphenation helps, but hyphenation makes a text harder to read.

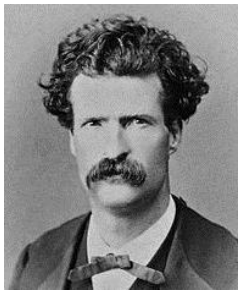
These are some of the tradeoffs and choices that editors make, but that doesn't make them right or wrong. The choices are arbitrary.

So if you have other ideas or preferences for our newsletter, please let me know!

Humor

Oyster Fossil Beds

by Mark Twain



Editor's note: *In 1869, Samuel Clemens published a travelogue called* Innocents Abroad. *On the coast of Turkey, he ascended a hill and made a remarkable discovery.*

In one place, five hundred feet above the sea, the perpendicular bank on the upper side of the road was ten or fifteen feet high, and the cut exposed three veins of oyster shells, just as we have seen quartz veins exposed in the cutting of a road in Nevada or Montana. The veins were about eighteen inches thick and two or three feet apart, and they slanted along downward for a distance of thirty feet or more, and then disappeared where the cut joined the road. …

Now how did those masses of oyster-shells get there? … I am reduced at last to one slender theory: that the oysters climbed up there of their own accord.

But what object could they have had in view? What did they want up there? What could any oyster want to climb a hill for? To climb a hill must necessarily be fatiguing and annoying exercise for an oyster. The most natural conclusion would be that the oysters climbed up there to look at the scenery.

Yet when one comes to reflect upon the nature of an oyster, it seems plain that he does not care for scenery. An oyster has no taste for such things; he cares nothing for the beautiful. An oyster is of a retiring disposition, and not lively—not even cheerful above the average, and never enterprising. But above all, an oyster does not take any interest in scenery—he scorns it.

What have I arrived at now? Simply at the point I started from, namely, those oyster shells are there, in regular layers, five hundred feet above the sea, and no man knows how they got there. I have hunted up the guide-books, and the gist of what they say is this: "They are there, but how they got there is a mystery."

Death Becomes It

by Sheryl E. Sims

What phosphate mineral takes the form of bluish crystals on human bodies buried in soil or ice, often victims of trauma or freezing to death?

I had no idea until I ran across an article that NVMC Webmaster Casper Voogt pointed out on Facebook. Caspar stated that vivianite is one of his favorite minerals.

Vivianite is a very soft mineral. Its Mohs hardness is only about 1-1/2 to 2. Interestingly, its color gets darker in water, and it is not radioactive. It can be found in a variety of colors, such as very pale green, blue, darker green, brown, purple, and purplish black. The streak is white, altering to dark blue or brown.

Crystals are transparent to translucent, with a vitreous luster, pearly on the cleavage surface or dull and earthy. Unaltered specimens are colorless.

Curiously, vivianite is strongly pleochroic: The same crystal will appear green, for example, from one direction and blue from another.

Other physical properties:

Chemical formula ..... $Fe^{2+}Fe_2^{2+}(PO_4)_2 \cdot 8H_2O$

Crystal system..... Monoclinic

Crystal habit..... Flattened, elongated prismatic crystals, may be rounded or corroded; as stellate groups, incrustations, concretionary, earthy or powdery

Vivianite (the blue mineral on this bone fragment) can displace buried organic matter, including bones and teeth. The phosphate in the organic matter interacts with wet, iron-rich environments to form vivianite. Source: Hrala (2016), from Terry O'Connor/BoneCommons.

Fracture.....Fibrous

Ultraviolet fluorescence ...None

A hydrated iron phosphate mineral, vivianite is found not only in the United States but also in Cameroon, Canada, England, Germany, Japan, Kosovo, Mexico, and Russia.

The name of this beautiful mineral came from a Welsh-Cornish politician, John Henry Vivian. Vivian was a mine owner and mineralogist who lived in Cornwall, England. It was there that he discovered this unique mineral.

Sources

Hrala, J. 2016. This strange mineral grows on bodies and turns them blue. ScienceAlert. 28 October.

N.a. 2016. Vivianite. Wikipedia.

Vivianite tabular crystal, transparent with some opacities, perched on a matrix of siderite and pyrite. The crystal is a little over 3 inches high and about 1-1/2 inches thick. It was found in 2013 in the Huanuni Mine, Dalence Province, Oruro Department, Bolivia. Source: N.a. (2016); photo: Carles Millan.

The Rocks Beneath Our Feet

Theodore Roosevelt Island: The River

by Hutch Brown

Editor's note: *This is the second in a three-part series on the geology of Roosevelt Island. You can find the first part (on the island's bedrock) in the November 2016 issue of the newsletter. The third part will be on the island's sedimentary margins.*

The Potomac River changes as it approaches Washington, DC. The relatively narrow and swift-flowing channel in Mather Gorge, a spectacular canyon to the northwest of the nation's capital, becomes a broad and lazy river barely above sea level, influenced by the tides. The Potomac begins to look like rivers around the world that drain broad flat plains, with wide meandering turns.

The initial turn is around Theodore Roosevelt Island on the Washington side of the river. It is called the Georgetown Channel; the smaller channel on the Virginia side of the island is known as Little River.

The Bedrock

The core of the island is a riverine high point in the basement rock that underlies the Piedmont in Virginia and Maryland. It is metamorphic rock, a metasedimentary melange known as the Sykesville Formation.

Sedimentary melanges typically originate in ocean trenches. They include sands, silts, and embedded rocks of various sizes. Mountain-building events metamorphose the melange, turning it into a gray crystalline rock rich in quartz.

Outcrop of the Sykesville bedrock at the northern end of Theodore Roosevelt Island. Note the quartz grains and embedded rocks. Photo: Hutch Brown.

Theodore Roosevelt Island in 1950, from the north looking south. The main channel to the left, a river meander, is called the Georgetown Channel; the smaller channel on the right, on the Virginia side, is known as Little River. Source: National Park Service.

The Sykesville Formation originated at least half a billion years ago, probably through the interaction of tectonic plates in the ocean that preceded the Atlantic. Over more than a billion years, the ocean in our area has opened and closed multiple times. The corresponding mountain-building events (what geologists call orogenies) have molded the geology of our area.

In particular, an event called the Alleghanian Orogeny beginning about 320 million years ago placed the Sykesville Formation where it is today. In the immediate vicinity of Theodore Roosevelt Island, the Sykesville also underlies North Arlington in Virginia and part of Georgetown in Washington, DC.

So we know what the bedrock is and how it got to where it is today. But that story ended with the Alleghanian Orogeny about 280 million years ago.

What has happened since? How did this particular slice of the Sykesville bedrock become an island?

Pangaea

The Sykesville formed no islands 280 million years ago. In fact, the entire formation lay buried under miles of other rock that is long since gone.

The Alleghanian Orogeny occurred when the proto-African continent slammed into proto-North America, completely closing the ocean that preceded the Atlantic. Proto-Africa rode up over proto-North America, forming a mountain range as high as the Himalayas (fig. 1).

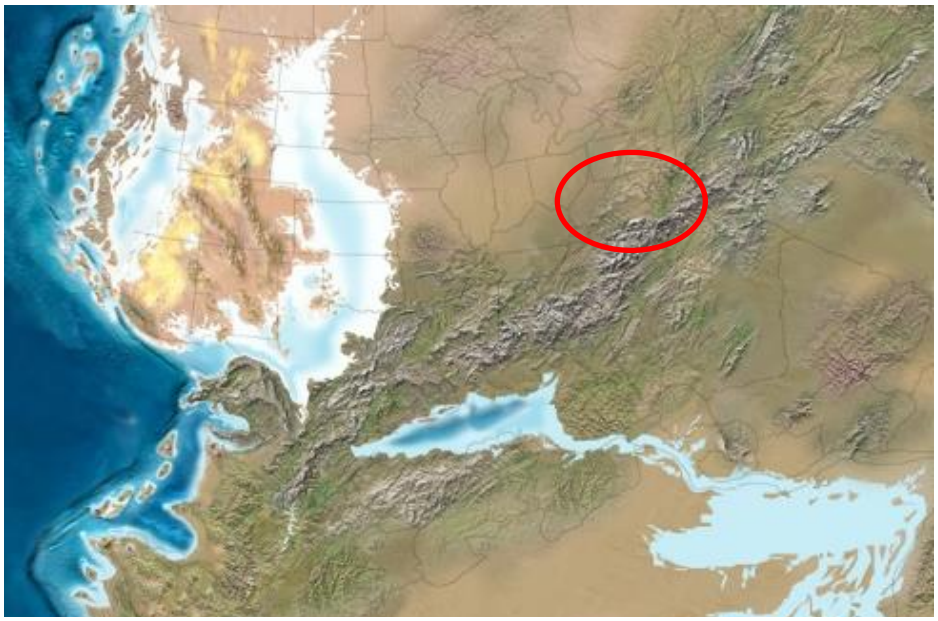


Figure 1—*Map detail of our area (circled) as part of Pangaea about 290 million years ago. Proto-Africa is at lower right, proto-North America at upper left, with the Alleghanian Mountains covering the seam between them. Source: Blakey (2011).*

The Alleghanian Mountains covered our area for tens of millions of years. Our part of them drained toward the "west." (It might have been some other direction, because continental drift over hundreds of millions of years has rotated continents across the points of the compass. For simplicity, though, let's just call it "west," as in figure 1.)

So our area drained toward the shallow seas that covered what is now the western United States (fig. 1). At the time, all of the Earth's continents were joined together in a supercontinent called Pangaea. The Alleghanian Mountains covered the seam between proto-Africa and proto-North America, with our area smack dab in the middle (fig. 1).

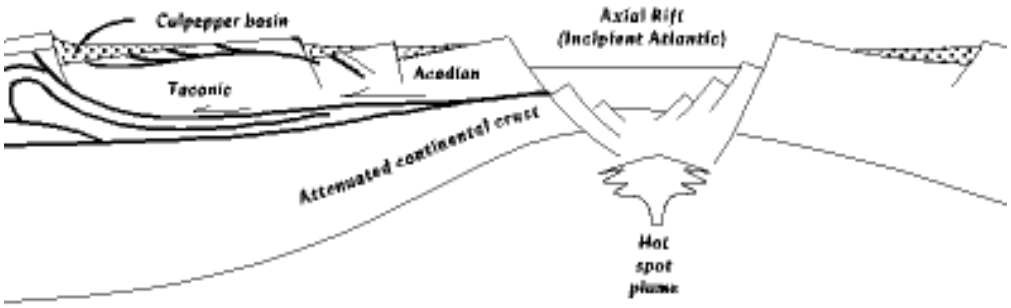
After weathering away, the Alleghanian Mountains left an immense plain in the middle of the continent. Like the mountains, the plain tilted to the west. Nothing like the Potomac River yet existed, and the ocean was nowhere nearby (fig. 1).

Triassic Basins

About 230 million years ago, during the Triassic Period, Pangaea began to break up along the ancient continental suture lines (fig. 2). A magma plume under the supercontinent domed our area and thinned the crust. By about 175 million years ago, Africa had broken away from North America, and a widening Atlantic Ocean was forming over the hot spot.

The breakup reactivated old fault lines. To understand those old fault lines, we need to backtrack a bit.

Long before the Alleghanian Orogeny, pieces of oceanic crust collided with proto-North America. Called terranes (labeled Taconic and Acadian in figure 2), they attached themselves to the continental bedrock along suture (or fault) lines. The Taconic Terrane joined itself to the ancient Grenville continental rock, the core of today's Blue Ridge Mountains; in turn, the Avalon (or Acadian) Terrane joined itself to the eastern edge of the Taconic Terrane. Both terranes now underlie the Piedmont and Coastal Plain provinces in our area, and both have dormant thrust faults along the ancient suture lines.



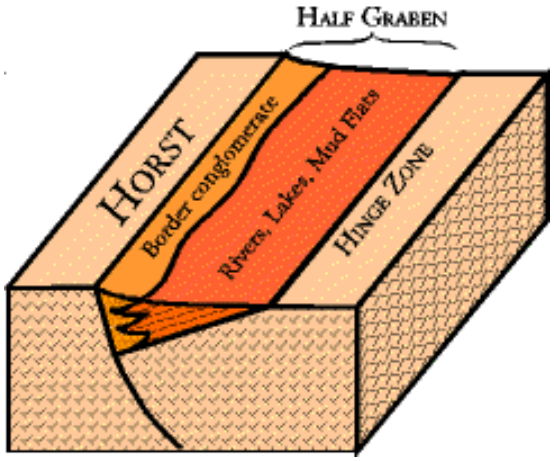


Figure 2—*As Africa (on the right) pulled apart from North America during the Triassic Period, the crust stretched and thinned. The terrane rocks (Taconic and Acadian) sank along reactivated fault lines, forming a series of half-grabens, with a full graben in the middle, where the widening ocean formed. The Triassic basins (such as the Culpepper Basin) gradually filled with sediments, particularly from the eroding horsts (right). Source: Fichter and Baedke (1999).*

As Africa and North America pulled apart, the faults between the terranes and the continental bedrock became reactivated (fig. 2). As the crust thinned and stretched, great blocks of Taconic Terrane rock (for example) dropped down the fault along the eastern face of the Blue Ridge as if on a hinge, forming enormous escarpments and great rift valleys.

Geologists call the valleys half-grabens (from the German word *Graben*, meaning pit or grave); and they call the overlooking ridges horsts (from the German word *Horst*, meaning eyrie). Today's Catoctin Mountain in Maryland and Bull Run Mountain in Virginia, both made up of Blue Ridge rocks, formed great horsts overlooking enormous rift valleys such as the Culpeper Basin (fig. 2), much like the ones in East Africa today along the Great Rift Valley.

The Triassic basins caught runoff from the valley slopes, forming lakes and rivers oriented southwest to northeast (fig. 3). As the land sank along the horsts, the rivers steadily cut through the hinge zones to the east to flow into the widening sea. Forerunners of the Potomac River thus began in the Triassic basins—the Culpeper Basin in what is now Virginia and the Gettysburg Basin in what is now Maryland.

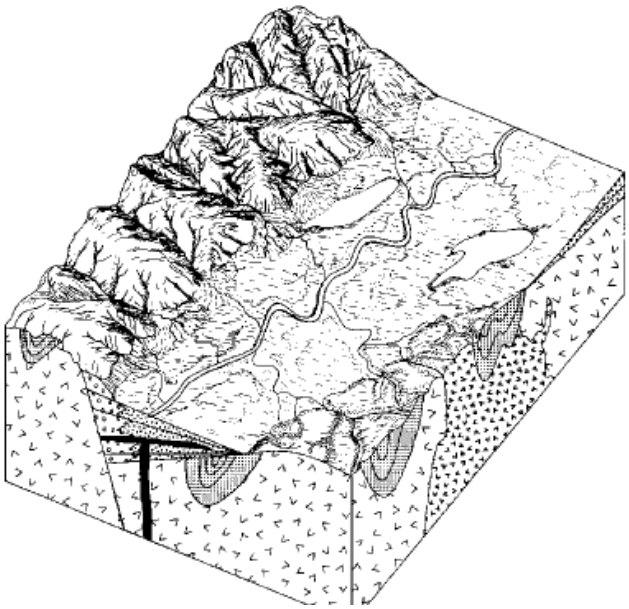


Figure 3—*Schematic cross-section of the Culpeper Basin about 200 million years ago. The basin gradually fills with sediments eroded from the horst (left) and carried in by the river that drains the basin. The Vs indicate bedrock; the black bars are a dike and lava flow; the wedges and downfolds are sedimentary rock; the dots on the right indicate igneous plutonic rock. Source: Fichter and Baedke (1999).*

Point of Rocks in Maryland marks the Potomac River's water gap through Catoctin Mountain. Source: Wikipedia.

However, the east-flowing rivers in our area were limited to the area east of the Blue Ridge by the towering escarpments that loomed over the Triassic basins. On the plains beyond the escarpments, rivers continued gently meandering to the west, just as they had for millions of years, ever since the Alleghanian Mountains weathered away.

Yet somehow the Potomac River managed to cut through the escarpment. We see the evidence today at Point of Rocks in Maryland, where the Potomac traverses Catoctin Mountain.

How did the Potomac manage to pass through a mountain?

Headward Erosion

The answer lies in a hydrologic process called headward erosion. Streams pouring down from the horsts gradually carved side valleys (fig. 3). To the west of the horst, the slope was gentle, with rivers meandering through plains, much as they do today on East Africa's Serengeti Plain. But to the east, the streams formed rushing torrents that cut down swiftly through the steep rift valley wall, forming deepening canyons.

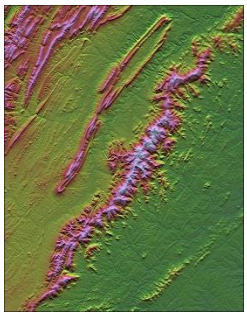
Eventually, the downcutting east-flowing streams intersected the headwaters of their meandering west-flowing counterparts. Because the eastern channels were deeper, they captured the west-flowing streams, which now flowed toward the east and extended the proto-Potomac River system that was already forming in the Triassic basins.

In the same way, the Potomac River later cut through other Blue Ridge rocks to the west, forming more water gaps, such as the one at Harpers Ferry, WV. By capturing other rivers and streams, the Potomac lengthened its course and multiplied its flows, coming to drain all of northwestern Virginia and beyond. Today, the Potomac has a massive flow, with a watershed reaching through the Blue Ridge and Valley and Ridge provinces into the Allegheny Plateau of West Virginia.

But how did the Potomac River choose its course in a way that cut off a piece of the Sykesville rock in the Piedmont, forming Theodore Roosevelt Island?

Fractures and Faults

No one knows for sure. As they flow downhill, rivers choose the course of least resistance. That means following faults, folds, and fissures in the rock. But after multiple mountain-building events over more than half a billion years, the metamorphic rock in our area has so many faults, folds, and fissures that it is nearly impossible to tell which way a river flowing over them might turn.



One clue might be the orientation of Theodore Roosevelt Island. The Alleghanian Orogeny placed the ridges and other landforms in our area in roughly parallel positions, ranging from southwest to northeast. The same holds true for the Sykesville and other rock formations in the Piedmont; they, too, range from southwest to northeast.

By contrast, the orientation of Roosevelt Island is just the opposite (fig. 4). The island forms a low ridge with a narrow plateau of bedrock running down its spine and the high point at its waist. The orientation is slightly toward the northwest.

The island's orientation suggests that weaker, more fractured, more easily erodible parts of the Sykesville rock lie to the east and west of it, leaving a harder north/south core for the river to flow around.

Interestingly, the Rock Creek Shear Zone lies just to the north in the District of Columbia. The shear zone is a series of faults that affect the course of Rock Creek, which enters the Potomac across from Roosevelt Island (fig. 4, red arrow). Conceivably, such apparent weaknesses in the rock extend to the main Potomac channel at Georgetown, across from Roosevelt Island.

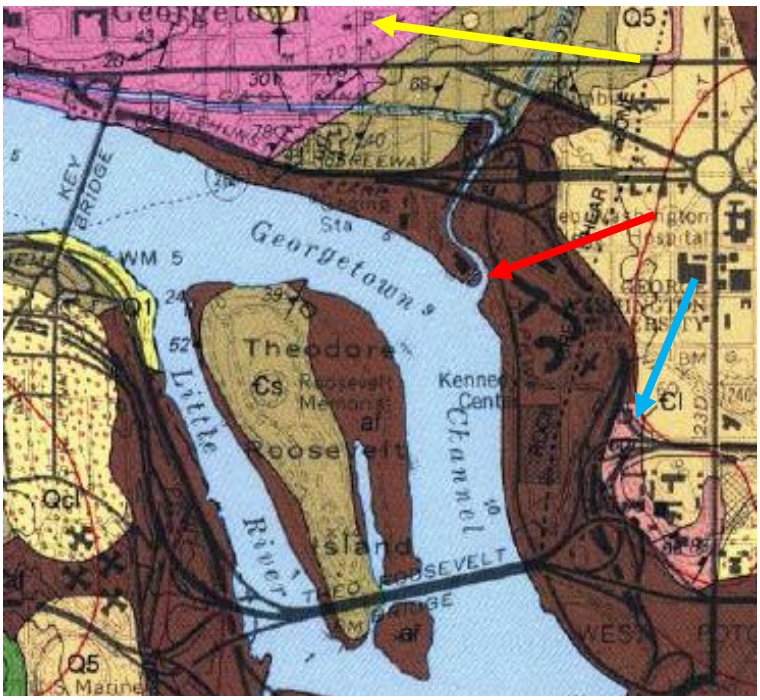


Figure 4—*Map detail showing the geology of Theodore Roosevelt Island and areas nearby; Rock Creek is shown by a red arrow. Light brown = Sykesville Formation; light pink = Laurel Formation (blue arrow); dark pink = Georgetown intrusive tonalite (yellow arrow); yellow/tan = Quaternary sediments; dark brown = artificial fill; black = structures. Source: Fleming and others (1994).*

Moreover, figure 4 shows an outcrop of the neighboring Laurel Formation (light pink, blue arrow) across the Georgetown Channel to the east, not far from the Sykesville Formation on Roosevelt Island. Sediments (fig. 4, dark brown) hide the contact zone between the two rock formations, but the fault line might lie directly under the river between the Sykesville and Laurel Formations.

And to the northeast of the Laurel Formation in Georgetown, adjacent to the Sykesville Formation there (fig. 4, light brown), lies a massive igneous intrusion called tonalite (fig. 4, dark pink, yellow arrow). It is directly across the river from the Sykesville Formation in Arlington, VA. Key Bridge connects the two (fig. 4), suggesting another underwater contact zone between disparate rock formations.

So perhaps the Potomac River *does* follow fault lines at Roosevelt Island between the Sykesville and other rock formations!

Riverine Sediments

But it hasn't always.

For hundreds of millions of years, rivers have flowed through our area toward the sea, changing course over time. For example, the red sandstone used to build the Smithsonian Castle on the Washington Mall was quarried from a lens of rock formed from sediments left by a river about 200 million years ago in the Triassic basin near today's Seneca Creek in Maryland. That river is long since gone.

In the early Cretaceous Period (from about 140 million to 100 million years ago), river systems crossing the Fall Line in our area dumped vast quantities of sediments on top of the bedrock, creating a layer of rounded stones and other riverine deposits called the Potomac Formation. In the late Tertiary Period (from about 10 million to 5 million years ago), the pattern resumed, covering the Potomac Formation with similar riverine deposits called Tertiary Terraces. More recent riverine sediments in the Quaternary Period cover the Tertiary deposits in parts of our area.

In fact, figure 4 shows Quaternary sediments (in yellow and tan) on both sides of the Potomac River. Yet the map shows none on the island itself.

Why not? Are there none?

The Sykesville Formation is well exposed in the northern part of the island (fig. 5), as you might expect from looking at the geologic map. But I have seen no bedrock exposures to the south. On fully two-thirds of the island, including its highest point (where the John Mason house once stood), the bedrock appears to be buried under loads of sediment.

For the nearby Quaternary sediments in Virginia and the District of Columbia, the geologic map describes "gravel, sand, silt, and clay" that are middle Pleistocene to Holocene in age (Fleming and others 1994). On Theodore Roosevelt Island, exposures at the bases of trees and the rootwads of toppled trees show just such materials, including rounded river rocks (fig. 6). The materials are almost certainly Quaternary or earlier in origin.

A Remarkable Story

The sliver of Sykesville bedrock that forms Theodore Roosevelt Island was once buried beneath some of the world's highest mountains. Later, it lay beneath some of the world's broadest plains, drained by rivers flowing to the west, far from the sea.

Figure 5—*Outcrops of the Sykesville bedrock at the northern end of Theodore Roosevelt Island. Photo: Hutch Brown.*

Today, improbable though it might seem, that sliver of Sykesville bedrock is nearly at sea level, in the middle of a great river flowing generally southeast, the surrounding waters influenced by the tides.

And those lazy tidal waters are full of sediment. Even a casual observer will notice the Potomac River turning brown following a hard rain. Accordingly, the same processes of riverine deposition that have covered the bedrock in our area with sediment below the Fall Line have been at work on Theodore Roosevelt Island as well (fig. 6).

Yet the island itself shows no mapped sediments—only crystalline bedrock and artificial fill (fig. 4, light brown and dark brown, respectively). Today, the artificial till makes up much of the island, underlying its swamps and marsh.

Figure 6—*Sediments between tree roots (left) and exposed in the rootwad of a toppled tree (right) on Theodore Roosevelt Island. The sediments range in size from cobble to silt; the rounded stones (many of them quartz) are clearly riverine in origin, suggesting that they are Quaternary or older deposits left by the Potomac River or its predecessors, much like those in Arlington, VA. Photos: Hutch Brown.*

But it wasn't always that way. Three hundred years ago, the island had little if any swamp or marsh.

So what about that "artificial fill"? How artificial is it really? Where did it come from and why is it there?

Next: The mapped artificial fill that makes up much of Theodore Roosevelt Island today.

Acknowledgment

The author thanks NVMC member Sue Marcus for reviewing and improving the article. Any errors are the author's alone.

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In the Habit of Botryoidal Bubbles

by Sheryl E. Sims

It's not that hard to wrap my mind around why I'm attracted to botryoidal minerals. They're cool looking.

Usually, I'm attracted to the chiseled angles of both clear and brightly colored minerals formed perfectly and beautifully underground or embedded in layers of rock. Many minerals and crystals look like tiny replicas of the Washington Monument.

These, however, are different. Botryoidal minerals, with their amazing textures and globular mineral habits, have always interested me. I can't get over the way they are found in every color of the rainbow. Some look like wads of bubble gum. Others look like bunches of grapes. Still others look like cotton candy and even pearls! Interestingly enough, the word "botryoidal" derives from *botrus*, meaning "bunch of grapes" in Greek.

Many minerals with this characteristic are composed of carbonate, sulfate, and iron oxides. I especially like the way botryoidal hematite looks. It looks like molten lava, taking me back to old cartoons: One of the Fantastic Four was a botryoidal strongman.

How do botryoidal minerals form? Layers of mineral material are deposited radially around mineral nuclei or particles of sand or dust. The spheres gradually grow larger and overlap nearby spheres. Fusing of the spheres creates the botryoidal form or cluster.

Minerals with botryoidal habits include chrysocolla, fluorite, malachite, agate, hematite, mimetite, prehnite, rhodochrosite, jade, apatite, siderite, willemite, wavellite, and even muscovite mica.

Sources

About Education. 2016. Botryoidal habits.
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February 2017—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 MSDC mtg, Wshgtn, DC; Show: Tucson, AZ;	2 **Groundhog Day** Show: Tucson, AZ	3 Show: Tucson, AZ	4 Show: Tucson, AZ
5 Show: Tucson, AZ	6 Show: Tucson, AZ	7 Show: Tucson, AZ	8 Show: Tucson, AZ	9 Show: Tucson, AZ	10 Show: Tucson, AZ	11 Show: Tucson, AZ
12 Show: Tucson, AZ	13 GLMSMC mtg, Rockville, MD	14 **Valentine's Day**	15	16	17	18 **Field trip: GMU**
19	20 **Presidents Day**	21	22 MNCA mtg, Arlington, VA	23	24	25
26	27 **NVMC mtg, Arlington, VA**	28				

Event Details

1: Washington, DC—Monthly meeting; Mineralogical Society of the District of Columbia; 1st Wednesday of the month, 7:45–10; Smithsonian Natural History Museum, Constitution Avenue lobby.

1–12: Tucson, AZ—Annual Gem, Mineral, and Fossil Show; Eons Expos; 600 W. 22nd St (corner of I–10 and 22nd St); daily 9–6; free; info: Heather Grana, Heather@EonsExpos.com; www.22ndStreet.Show.

13: Rockville, MD—Monthly meeting; Gem, Lapidary, and Mineral Society of Montgomery County; 2nd Monday of the month, 7:30–10; Rockville Senior Center, 1150 Carnation Drive.

18: George Mason University—Field trip, mineral museum; Exploratory Hall, GMU, Fairfax, VA; meet at 10 a.m.; info: Bob Cooke, rdotcooke@verizon.net.

22: Arlington, VA—Monthly meeting; Microminerologists of the National Capital Area; 4th Wednesday of the month, 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.

27: Arlington, VA—Monthly meeting; Northern Virginia Mineral Club; 4th Monday of the month, 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.

Fire agate on chalcedony, in the botryoidal habit. This polished specimen is probably from Aguascalientes, Mexico. Source: The Quartz Page.

THE NORTHERN VIRGINIA MINERAL CLUB INC

Crystals are the flowers of the Mineral Kingdom

Mineral of the Month: Wulfenite

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Visitors are always welcome at our club meetings!

RENEW YOUR MEMBERSHIP!

SEND YOUR DUES TO:
Treasurer, NVMC
PO Box 9851, Alexandria, VA 22304

OR

Bring your dues to the next meeting.

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).

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

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 22204. (No meeting in July or August.)

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