THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Next meeting: June 2 Time: 7:30 p.m. (doors open at 7 p.m.)

Dunn Loring Fire Station, 2148 Gallows Road, Dunn Loring, VA



Byssolite on amphibole

Knappenwand, Neukirchen am Großvenediger, Zell am See District, Salzburg, Austria

Source: Mindat. *Photo: Gerd Stefanik.*

Volume 65, No. 6
June 2025
Explore our website!

June Meeting Program:

Trilobites

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Mineral of the Month
Byssolite

by Sue Marcus

Before summer break, let's learn about byssolite (pronounced BISS-uh-lite). Byssolite isn't actually a specific mineral but rather a mineral structure. Chemically, it can occur in any member of the Amphibole Supergroup as a hairlike fibrous form of these minerals. Tremolite, actinolite, and ferroactinolite are the amphibolites most likely to form byssolite.

The fibrous crystals of byssolite can be long and flexible, often looking like windblown human hair. The byssolite hairs are usually green, probably due to chlorite; but they can also be white or offwhite. They are delicate and can easily break or be compacted by the touch of a finger.

Name and Geologic Environment

Horace Bénédict de Saussure named the mineral form in 1796 based on the Greek word for high-quality cloth (*byssos*) combined with -ite. The suffix -ite is usually said to derive from Greek *lithos* (rock), though one source attributed it to Latin *ites* (it is).

Fibers of byssolite form in fissures (clefts) and vugs (pockets) created in amphibolites by tectonic forces during orogenies—that is, during mountain-building events caused by the movement of tectonic plates. Such open spaces give the needles room to grow. In places like Pennsylvania, the orogeny occurred long ago in geologic time; in places like the Alps, the orogeny is much more recent; and in places like the Himalayas, mountain building is still occurring.

More rarely, byssolite forms in skarns, wherein calcareous rocks like limestone are heated and altered by intrusions. Even in skarns, byssolite needs vugs or fissures to form.

Epidote is a commonly associated mineral, so if you are seeking byssolite, look for vugs or fissures where epidote has crystallized. Remember that byssolite needles may be tiny, so magnification can be needed to see them.

Relationship to Asbestos

What's the difference between byssolite and asbestos? In a way, it's in the eye of the beholder. Wikipedia states that byssolite is a form of asbestos, but nei-

Summer break ahead!



Northern Virginia Mineral Club members,

Please join our June speaker, Casper Voogt, for dinner on June 2 at 5:30 p.m. at:

BJ's Restaurant & Brewhouse
8027 Leesburg Pike, Suite 100, Vienna, VA
Phone: 703-356-7305

Reservations are under Craig Moore, Vice President, NVMC. If you plan to attend, please email Craig at vicepresident@novamineral.club by noon on the day of the meeting.



Byssolite with epidote, Knappenwand, Zell am See District, Salzburg, Austria. Source: Mindat; photo: Nadya Georgieva.

ther is a distinct mineral species; both are fibrous forms of specific minerals.

I consider byssolite to be free-standing, whereas asbestos is not. Either can have short fibers; but, to me, byssolite needles are clearly individual fibers rather than a parallel, sometimes peelable mat. Asbestos can be firm enough to hit without breaking on an axis perpendicular to the length of the fibers, whereas byssolite is much more delicate.

One distinction might help: all actinolite and tremolite specimens are *not* byssolite, but all byssolite specimens are actinolite or tremolite (or, more rarely, other amphibolites). By analogy, all quartz crystals are not amethyst, but all *purple* quartz crystals are amethyst. By extension, byssolite is rarer than either actinolite or tremolite.

Because byssolite is a fibrous mineral, don't inhale it! Asbestos can cause diseases like mesothelioma, a nasty lung cancer. I encourage you to *always* wash your hands after handling *any* mineral specimens. However, the risk of handling a byssolite specimen or having one in your collection is low. Getting a byssolite needle stuck in your skin would be very uncomfortable, but I have never heard of that happening.



Actinolite (var. byssolite), May-Meade Quarry, Avery County, NC. Source: Mindat; photo: Rolf Luetcke.

Occurrences

Byssolite is easily overlooked. When it occurs as microcrystals, close inspection of specimens is required. Rocks at older localities may have weathered, with byssolite fibers being crushed and therefore uninteresting to collectors if or when they are found.

United States. I use Mindat as an initial source of localities and images, then dig deeper. For Arizona, North Carolina, Vermont, and Washington, Mindat shows a few localities with only one byssolite image, yet it is highly unlikely that byssolite formed only one set of fibers in these places.

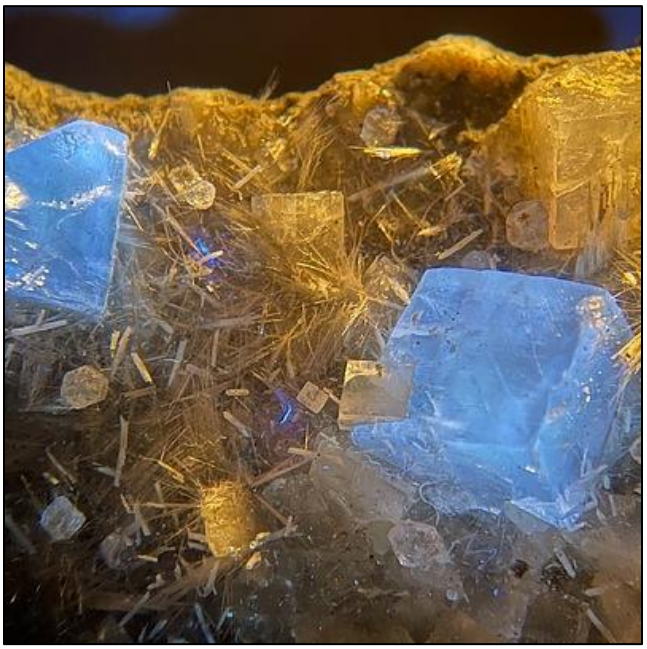
Some localities are now old quarries filled with water and are therefore inaccessible for collecting. Yet the geologic environment is right for byssolite formation in the vicinity of those quarries and in many other places in the United States. I hope you can enrich our hobby by adding new localities. It is also likely that byssolite has been found by academic researchers who noted its occurrence in scientific reports.

In the rest of the United States, byssolite has been recovered as microcrystals that can become lovely additions to micromount collections. More rarely, it has been found as larger specimens.

Alaska. Prince of Wales Island is best known for some of the world's finest epidote crystals. Epidote is a common mineral associated with byssolite, so it is no surprise that byssolite occurred there. Apparently, byssolite was not abundant.

Connecticut. Byssolite specimens are uncommon in Connecticut. Roadcuts and railroad cuts have been the usual sources, for example in Coventry and New Britain. Collecting at roadcuts can be fun and productive, but please use plenty of caution. Obey the law and don't collect if stopping isn't allowed; park carefully off the active roadway; wear bright colors; and don't pull rocks down on yourself or others. Follow the EFMLS rockhound code of ethics!

Massachusetts. A collector found microscopic crystals of byssolite with babingtonite at a quarry in Peabody. A 1-centimeter (0.4-in) specimen was found at a quarry in West Roxbury.



Amphibolite Supergroup (var. byssolite) with laumontite, calcite, chabazite, and quartz, Manassas Quarry, Prince William County, VA. Source: Mindat; photo: David Fryauff.

New Jersey. A few micromounts of white byssolite were found. The locality was the lower level of the George Washington Bridge excavation; the specimens were probably collected in the 1960s.

Pennsylvania. Byssolite specimens were collected at the Keystone Quarry near Cornog, a quarry that used to be a regular collecting locality for clubs like ours. Now, the pit is filled with water. Byssolite occurred as inclusions in calcite, though also as stand-alone macroscopic specimens. Mats byssolite fibers reached at least 6.9 centimeters (3.5 in) in length. Colors include white, green, and golden or orange due to iron staining. Along with calcite, the associated minerals are quartz, adularia (a variety of potassium feldspar), prehnite, and schorl.

The French Creek Mines in Chester County are now closed to collectors, but many types of minerals were found there. Byssolite hairs formed specimens from micromounts up to 5.7 centimeters (in) long, mainly with chalcopyrite, although pyrite, magnetite, and calcite are also associated with some specimens. The mines (two shafts and a pit) were for iron ore, with magnetite as the primary ore mineral. The deposit formed as a skarn in which magnetite partly replaced marble during the emplacement of a Jurassic diabase intrusion related to rifting plates.

Virginia. Virginia has numerous byssolite occurrences, with specimens of all sizes found. At some localities, only of one specimen image has been posted on Mindat, although other unposted specimens were probably recovered from pockets of byssolite. Many of the Virginia localities are quarries in our own area; unfortunately, few, if any, are currently open to rockhounds. We can keep our eyes on gravel extracted from these localities and used on local roads or wherever crushed gravel is used. Sometimes, prehnite and other minerals can literally be found beneath our feet. However, the most delicate byssolite fibers are unlikely to have survived extraction, crushing, and dumping.

Dr. Callan Bentley wrote an explanatory blog about the Vulcan Manassas Quarry near Manassas Mall; his blog generally applies to many traprock quarries in our region. Cal has been a club speaker, and some NVMC members took geology classes and field trips with him when he was teaching at Northern Virginia Community College.

Many of us have been lucky enough to collect at the Manassas Quarry, an active quarry operated for crushed rock, also known as road metal. The quarry exploits diabase and hornfels. The most sought-after minerals are prehnite and apophyllite, although many other minerals have also been found there; rockhounds found byssolite in pockets in boulders at least as recently as 2013. The byssolite crystals are usually white and small, although some are visible without magnification. From my last communication with the quarry, I learned that blasters were no longer operating in the vuggy zone that produced interesting minerals.

Micromount collectors found byssolite specimens at the Bull Run Quarry in Loudoun County. The images of fibers posted on Mindat show white and yellow colors, the latter possibly an effect of the photography.

The Virginia Trap Rock Quarry is one of a couple of localities also called Goose Creek Quarry. It was the source of a few byssolite microminerals found prior to the COVID shutdown in 2020.

At the Cedar Mountain Quarry near Culpeper, diabase is excavated for road gravel. Like at other quarries in our area, excavation revealed pockets and zones of prehnite, zeolites, epidote, and other well-crystallized minerals, but only sporadically.



Amphibole Supergroup (var. byssolite). ***Top:*** *With quartz, Loudoun County, VA. Bottom: Fairfax Quarry, Centreville, Fairfax County, VA. Source: Mindat; photos: Rolf Luetcke (top), Rock Currier (bottom).*

Confusingly, the Fairfax Quarry is not in Fairfax but in Centreville. It produced what are probably the largest byssolite specimens found in Virginia. These are probably older specimens; one, measuring 8 centimeters (3.1 in) in size, is in Harvard University's mineral collection. Another, slightly larger in size at 9 centimeters (3.5 in), was photographed by the late famous collector Rock Currier. Collectors were also delighted by the zeolites and prehnite from this quarry.

Only a single byssolite specimen is shown on Mindat from the Millbrook Quarry in Haymarket. The pit is now filled with water and apparently used by scuba divers, so future collecting—especially for fragile byssolite—is unlikely.

Spain. A few specimens of microscopic byssolite crystals were found at Los Serranos Quarry near Alicante. The crystals range from white through chartreuse to green. The quarry may still be open to collecting. It is best known for epidote and quartz.

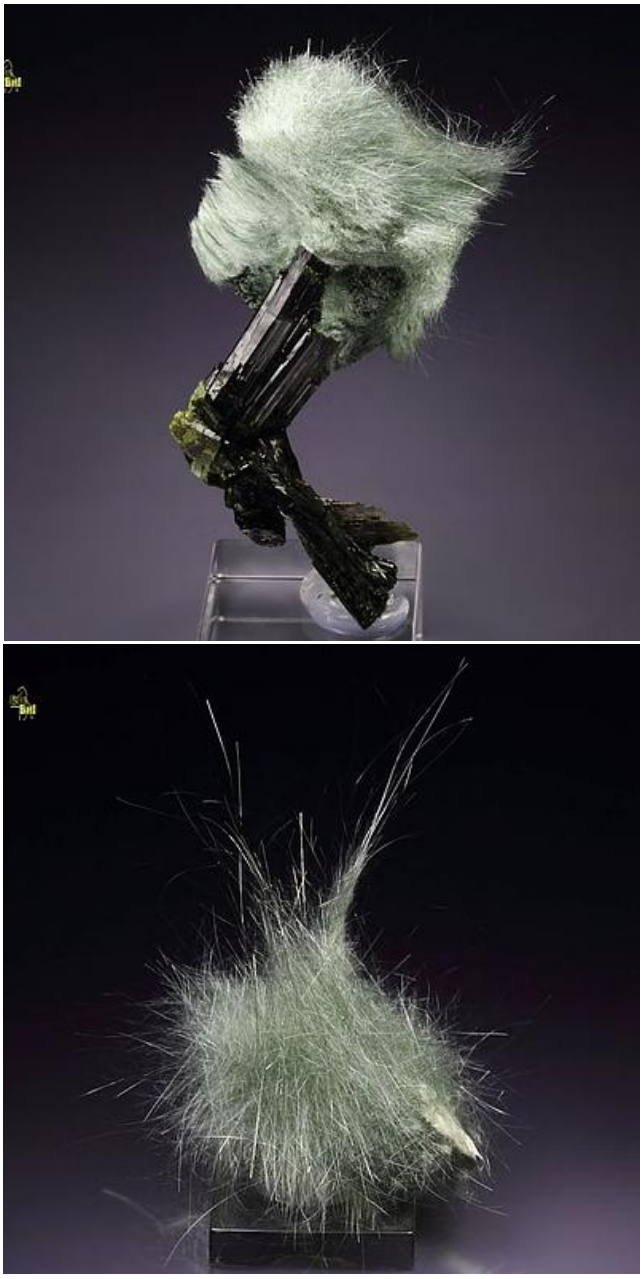
Austria. Austria is one of the preeminent countries for byssolite. It could be that the geologic environment is more widespread in Austria or that collectors are more avid and observant.

Alpine clefts are a primary environment for byssolite formation. The Alps transect Austria—and byssolite has been found in numerous clefts, especially in the Knappenwand area, a notable mineral locality associated with a syncline (*Mulde* in German) near a mountain peak called Großvenediger. The syncline rocks were the subject of a detailed 1990 study published in proceedings from a conference in Austria.

The Knappenwand syncline has long been explored through adits and extensive excavations. Imagine a locality at which mineral specimen extraction began in 1865! Knappenwand probably produced more high-quality byssolite specimens than any other place in the world.

Although metallic ores brought initial prospecting to the area, mineral specimens have always been the most economically valuable resource there. Epidote is the most abundant and collectible mineral from the area. The epidote crystals from Knappenwand can be transparent and beautifully lustrous. Some even form doubly terminated fadenlike sets of parallel crystals. The epidote crystals are flattened, aligned, and adjacent to one another, although they don't have a central "thread" like quartz fadens do.

Matrix specimens of byssolite, up to at least 5 centimeters (2 in) in size, are covered with bright gray-green hairlike byssolite needles growing in all directions, some with attractively contrasting albite crystals. A huge 12-centimeter (4.7-in) matrix specimen shown on Mindat is covered with upright fibers of byssolite up to 7 centimeters (2.6 in) long on amphi-



Amphibole Supergroup (var. byssolite), with epidote (top). Knappenwand, Zell am See District, Salzburg, Austria. Source: Mindat; photos: Nadya Georgieva.

bolite. Even larger specimens exist, although the byssolite fibers may be matted or felted.

On some specimens, lovely crystals of colorless apatite are shot through with green needles of byssolite. Other apatite crystals are perfectly formed but are opaque forest green due to byssolite inclusions. Apatite is classified as both a group and a supergroup of mineral species. In image descriptions of byssolite



Amphibole Supergroup (var. byssolite), Seekar, Zell am See District, Salzburg, Austria. Source: Mindat; photo: Peter Neschen.

from Knappenwand posted on Mindat, when apatite is an associated mineral, the apatite species is not identified. It is probably fluorapatite because that is the species occurring at this locality shown on other parts of the Mindat Knappenwand locality site.

The byssolite and apatite specimens from Knappenwand are intriguing. The byssolite needles, sometimes identified as amphibolite on Mindat photo captions for fluorapatite, occur as inclusions in colorless apatite crystals and with apatite perched delicately on the byssolite. Inclusions indicate that byssolite formed first, then fluorapatite later enclosed them. Fluorapatite on top of byssolite also indicates that fluorapatite formed first, yet without including byssolite. Perhaps the fluids occurred in pulses over geologic time during tectonic strain.

Macro- and microscopic byssolite specimens were extracted at another locality in the Knappenwand syncline rocks and in the same district. At Söllnkar, some wispy byssolite fibers grew long enough to curve, with specimens at least as long as 5.6 centimeters (2.2 in) on amphibolite matrix.

Other Austrian localities with minor byssolite include St. Johann (near Großheinrichschlag) near Seebach Lake; the Gudenus Cave (near Hartenstein Castle);



Amphibole Supergroup (var. byssolite), Miage Glacier, Courmayeur, Aosta Valley, Italy. Source: Mindat; photo: Nadya Georgieva.

Hocheck, the S35 motorway tunnel near Kirchdorf; and Loja (across the Danube River to the west of Diedersdorf). At an active quarry near Loja, lovely white tufts of byssolite occur with white calcite.

Italy. Italy's northern area shares the Alps with other countries. Again, alpine clefts with their fissures and pockets are good geologic environments for byssolite formation, but Italian alpine localities have not been as productive of byssolite as some Austrian sites, and byssolite found there has not been as attractive.

Byssolite was found on Monte Cervandone, where white fibers have been called actinolite, although there is no indication that they have been analyzed. Matrix specimens up to 9 centimeters (3.5 in) in size were found, and the locality might still be open to collectors.

A few byssolite specimens have been found at Mühlwald (Selva dei Molini), with greenish and white byssolite fibers growing up to 4.2 centimeters (1.7 in) long, according to a Mindat caption. Byssolite was also found in boulders in Rondanera (Rondinera) Brook, near the town of Marsaglia.

Azerbaijan. For those unfamiliar with Mindat, it has separate, usually linked pages for localities and mineral species. Sometimes it also has separate pages for nondistinct species like byssolite. On the byssolite page, users can search for localities by country.

Photos of beautiful byssolite specimens from the Dashkesan Co-Fe (cobalt-iron) deposit in Azerbaijan are shown on the Mindat pages for byssolite. Oddly, the Amphibole Supergroup (var. byssolite) is not listed as one of the minerals on the Dashkesan Co-Fe deposit page. I don't know why different search strategies fail to produce the same information. Mindat is run by volunteers (thank you, Mindat volunteers!).

The three images of byssolite from Azerbaijan shown on Mindat were all posted by the same person. Each shows a different lovely specimen. Tiny colorless calcite crystals decorate byssolite, like glitter adhering to hair. In one image, deep red andradite crystals nestle among byssolite fibers. The lengths of the fibers reportedly extend to 5 centimeters (~2 in).

All three specimens were found at the Dashkesan (also written as Dashkasan) Mine. The deposit exploited several orebodies; exactly where byssolite was found within the larger deposit is unknown. The mine was actively producing iron in 2023, so perhaps more byssolite will be found, along with other collectible minerals.

New Zealand. The New Zealand specimens are attractive transparent, cream-colored microcrystals in xenoliths (altered older rocks) in the Ngatutura Vol-



Amphibole Supergroup (var. byssolite), Dashkesan Co-Fe deposit, Dashkesan District, Azerbaijan. Source: Mindat; photo: Boris Z. Kantor.

canics. These rocks, less than 2 million years old, can be found 60 miles south of Auckland. Given their relatively recent emplacement and accessibility, there may be byssolite specimens yet to be discovered in them.

Other Countries. Fibrous forms of actinolite and tremolite that we are calling byssolite occur in many places where those minerals occur. The geologic environment needs to be exactly right, not only conducive of those specific minerals, but also allowing the thin needles of byssolite to grow.

That environment is right in many places, including Imilchil, Morocco; Russia, in the Ural Mountains and elsewhere; Gilgit-Baltistan, Pakistan, where byssolite needles are included in quartz crystals; and the Huanggang Fe-Sn deposit, inner Mongolia, China, where pink fluorite crystals include byssolite. Other unpublicized byssolite occurrences are likely.

Some countries have a specimen or two of byssolite reported on Mindat. Photos show attractive specimens from localities that are unavailable now, including byssolite specimens from France (Saint-Véran and Le Queyron); Ecuador; the Czech Republic (a lovely micro specimen); and Greece (inclusions in quartz crystals).

Economic Uses

Byssolite has no economic value, other than as mineral specimens for collectors. Actinolite and tremolite (of which, as we have seen, byssolite can be a form) are heat resistant, and heat- and fire-resistant clothing can be made from asbestiform amphibolite or tremolite. However, concerns about harm to humans caused by asbestos has severely diminished or halted the commercial use of asbestos.

Gems

Byssolite needles are not appropriate for lapidary crafts. Inclusion of byssolite in other minerals could form potential material for faceting or cabochoning, although byssolite in calcite would not make a durable gemstone.

Prices (2025)

As of May 15, 2025, a specimen of byssolite needles with chalcopyrite from French Creek, PA, was posted on Etsy for $65. A nice but small specimen displaying upright byssolite needles covering the top of a piece from Cornog, PA, was priced at $251.50 or best offer.



Amphibole Supergroup (var. byssolite), Le Queyron, Hautes-Alpes, Provence-Alpes-Côte-d'Azur, France. Source: Mindat; photo: José Dehove.

An Italian specimen with sharp arsenopyrite crystals sold recently for 27€ ($30.22) on the I-rocks website. If you want to pay $9,500 for a terrific specimen of octahedral pink fluorite from Inner Mongolia (China) that has minor byssolite inclusions, buy it for the fluorite, not the byssolite. Another dealer was offering byssolite needles in colorless calcite from Pakistan for about $26 or best offer.

I was dismayed by the relatively high prices of "stand-alone" byssolite (not included in another mineral). The steep prices are probably due to most U.S. specimens being found many years ago, when quarries in our area were still open to collectors. Austrian specimens are most likely to be sold in Europe. The delicate nature of free-standing byssolite crystals may prevent the seller from taking them for long distances.

Technical Details

Chemical formula ..... Based on actinolite, $Ca_2(Mg_{4.5\text{-}2.5}Fe^{2+}_{0.5\text{-}2.5})Si_8O_{22}(OH)_2$; based on tremolite, $Ca_2(Mg_{5.0\text{-}4.5}Fe^{2+}_{0.0\text{-}0.5})Si_8O_{22}(OH)_2$



Amphibole Supergroup (var. byssolite) with epidote, Knappenwand, Zell am See District, Salzburg, Austria. Source: Mindat; photo: Andreas Wallisch.

Crystal form.....Monoclinic, based on actinolite and tremolite

Hardness.....5-6, based on actinolite and tremolite; byssolite needles cannot readily be tested for hardness

Specific gravity.....~3, based on actinolite and tremolite

Color.....Colorless, white, cream, pale green through forest green

Streak .....White; byssolite needles cannot readily be tested for streak

Fracture .....Brittle

Luster .....Silky, vitreous

Sources

Burgsteiner, E. 2024. A world-famous discovery site: epidotes of the Knappenwand. Mineralica.

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Mining Journal. 2024. Breathing new life into Dashkasan: from historic mine to integrated hbi production hub.

National Library of Medicine. N.d. Asbestos: selected cancers.

No author. N.d. Minerals from Cabezo Negro in Albatera. Serranos Quarry.

Powell, D. N.d. A dictionary of mineral names.

Virginia Department of Energy. N.d. Asbestos.

Wikipedia. N.d. Actinolite.

Wikipedia. N.d. Tremolite.



Casper Voogt: Trilobites
June 2 Program

Our June meeting will feature Casper Voogt discussing trilobites before our field trip with Casper on the following Saturday to collect trilobite fossils in West Virginia. Casper will present an overview of trilobites, their morphology, and some well-known trilobite collecting localities. He will also cover spots where he himself has collected, and he will bring specimens for people to see.

Casper, an active NVMC member for many years, is our webmaster; he also manages the websites for other clubs. Casper has traveled the world for minerals, and he is a mineral dealer who routinely has a table at our annual club show.



President's Message

by Jason Zeibel

Welcome to June! What a wonderful time to go outside and enjoy the weather and sunshine.

While you're out there, you will hopefully pause for a minute to take in the geology around you. If you have been fortunate enough to take in one of our club's geology walks, then you might have learned a bit about what to look for in our region. We are in an area rich in metamorphic and igneous rocks, so there are outcrops of both in many places around us!

I'm not sure I realized how prevalent the signs of this were until walking along Accotink Creek with a few geologists. Hopefully, this will inspire you to come out to our next geology walks or on one of the nature walks hosted by the Virginia Master Naturalists. The only true danger is that your walks might take longer as you unconsciously stop to admire an outcrop or five along your way.

What a wonderful meeting we had in May! Dr. Mike Wise from the Smithsonian came to talk to the club about the institution's recent acquisitions from both purchases and donations. Many new treasures were acquired at or because of the February Tucson Gem and Mineral Show. Having been once to the annual Tucson show, I completely understand why attending is so critical for Dr. Wise. The level of newly discovered and amazing specimens on display there is truly unequaled. Dr. Wise showed slides of several dozen



Recent Smithsonian Institution acquisitions include a specimen of elbaite with quartz and albite and a collection of butterflies featuring gems and minerals.

new acquisitions. If you missed the meeting, fear not—we have the recording here.

As a thank you for coming to speak to us, I had the honor on behalf of our club of presenting Dr. Wise with a check for $500 to put towards additional treas-



Many club members turned out for the May NVMC meeting to hear Dr. Mike Wise speak about the Smithsonian Institution's recent acquisitions of gems and minerals. All photos: Jason Zeibel.




President Jason Zeibel (left) presenting Dr. Mike Wise with a check from the NVMC for further gem and mineral acquisitions by the Smithsonian Institution in appreciation for Dr. Wise's presentation at our May meeting, which drew a large NVMC turnout.

ures as he sees fit. I'm sure that all the wonderful things that he showed us cost way more than that, but I'm happy that we can do a small part towards securing and expanding the nation's mineral collection for future generations of mineralogists and geologists.

The club meeting sported a large turnout for Dr. Wise's presentation—52 attendees, including 4 who were either visiting for the first time or had just joined. All in all, we have over 100 paid members for 2025, a peak for the post-COVID years. I am thrilled to see all the excitement at our meetings, on our field trips, and at other club events. As Sue Marcus remarked, the club is clearly doing something right because there was a palpable energy in the room.

I hope everyone will join us on our upcoming field trips to West Virginia on June 7 to look for trilobites and to Franklin, NJ, in July to look for fluorescent minerals. And, of course, don't forget our club picnic and rock swap coming up on August 10! That will be a fun day of relaxation and geology. Come with a side dish or dessert and some rocks to share. The club will provide burgers, hot dogs, and nonalcoholic beverages—as well as some shade for displaying rocks. Look for additional details in your email or on our Facebook page this summer.

The club officers have approved a new program to sponsor members who are enrolled in an educational program (from elementary through graduate school) by providing up to $400 towards travel and/or registration for a national-level seminar or show related to our hobby. The event could include, for example, Wildacres or a national show like the one in Tucson. Applicants must write a paragraph on why they want to go and submit it to club officers. If approved, the student would give a presentation to the club on the event. This is an amazing opportunity to help defray the costs of engaging in one of our hobby's best experiences.

During the first couple of years of writing these articles, I could showcase geologically themed experiences from my travels as an executive with the U.S. Army. Because the new administration has not permitted any official travel, I have not been traveling nearly as much and have had to resort to other ways of acquiring nuggets (get it?) of personal geological wisdom and storytelling.

This month, I am introducing you to one of my other hobbies to show how mixing hobbies can lead to new areas of study. Sometimes this can inspire others to learn new and interesting things.

I belong to the Fairfax Coin Club and am a lifelong numismatist (coin collector). A few years ago, I told one of my coin collecting friends about rocks and the NVMC, and I happened to mention that there are even coins featuring rocks. He asked me to prove it.

So, with help from Google, I showed that there have been rocks and minerals on coins for over 2,000 years. If you recall my article on Athens and the Acropolis from last fall, you might surmise that I have always been fascinated by ancient Greece and the advances then made in mathematics and philosophy. Well, the Greeks were also among the first to honor a rock by putting it on a coin!



Figure 1—*A Greek coin from the Seleucid Empire (312-63 BC), with a quarter for scale. On one coin (top), Apollo sits on the famous Omphalos Stone. The obverse (bottom) shows Emperor Antiochus III.*

The rock in question is known as the Omphalos Stone. The Omphalos myth comes from the very origin of the Greek gods. Legend has it that when Zeus was born to the Titans Rhea and Cronos, Cronos was unhappy about it, so Rhea presented him with a rock wrapped up like a baby. Cronos then ate the rock thinking it was Zeus, and Zeus escaped certain death.

Later, Zeus led his siblings in the defeat of the Titans, earning the title King of the Gods. He then sent two eagles out from opposite ends of Earth, telling them to meet in the middle. They met at the Temple of Delphi, where Zeus placed the rock that Rhea had used to trick Cronos—the Omphalos, meaning "navel" in Greek (that is, the navel of Earth). Later, Apollo slayed the great serpent Python on the Omphalos Stone to honor Zeus. At the Temple of Delphi, the Omphalos Stone was greatly revered and became the very stone upon which the Oracle of Delphi would sit to receive visions.

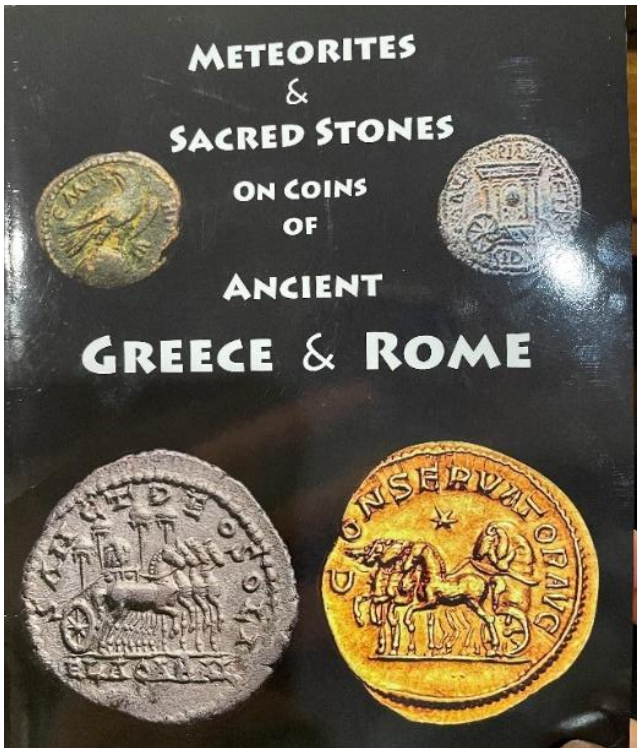


Figure 2—*A book by Michael Blood on the sacred stones and meteorites that appear on ancient coins.*

During the Seleucid Empire (312-63 BC), Emperor Antiochus III chose to honor the Omphalos Stone by putting it on his coinage, from small copper coins up to the large silver tetradrachm (fig. 1). A very interesting book by Michael Blood explains the role of the Omphalos and other stones and meteorites in ancient numismatic history (fig. 2).

Although the Omphalos Stone supposedly enabled direct communication with the gods, it is a pretty ordinary rock, geologically speaking. Other stones in ancient Greece and Rome are more geologically interesting, such as the large meteorite Elegabal (the Stone of Emesa), which also appears on coins, but from several hundred years later. Today, the Omphalos Stone—or maybe a 2,000-year-old copy—can be seen in the Museum of Delphi in Greece.

Maybe some of my geologically themed numismatics will inspire you to think about other hobbies and activities in your personal and professional lives to see how they might intersect in some way. You never know how the results will inspire others on both sides of the intersection. I myself have had fun seeing how both organizations overlap. Who knows, maybe next time I'll stray into more modern examples of coins that rock!

I encourage you to seriously consider volunteering for club officer positions in 2026. We definitely need to spread out duties among more members as we move forward. At our May meeting, the club welcomed our new A/V coordinator, Jake Broughton. Given the success of both the Zoom livestream and the subsequent recording, he is a welcome addition!

Please come talk to me or send me an email if you are at all interested in becoming an elected or unelected club officer in 2026.

A few business items of note. If you haven't picked up your name tag yet, please bring a check or cash for $15 to the June meeting and we will trade. The June meeting will feature the always-entertaining Casper Voogt talking about some amazing trilobites as we all prepare for our June field trip. We will continue with our zoom/hybrid meetings for those of you who can't make an in-person meeting. As usual, I will send out a Zoom link a couple of days ahead of time. We are planning on having dinner before the meeting as well—see page 2 for details.

In the meantime, go out for a (geologically themed) walk. Maybe walk down to the Smithsonian Institution's National Museum of Natural History and see if you can spot the Lion of Merelani tsavorite or the Winston Red Diamond!

Jason

Geology Links

The Fairfax chapter of the Virginia Master Naturalists (VMN) has posted a blog on the geologic history of Mather Gorge over the past 1.3 billion years; thanks to Kathleen Luisa for the link! You can find more geology-related blogs based on past articles in our own newsletter that were posted by the Arlington chapter of the VMN here.

The Rocks Beneath Our Feet

Geologic Folds: Synclines and Anticlines



by Hutch Brown

Editor's note: *The article is adapted from a section on geologic structures in Callan Bentley's Historical geology: A free online textbook for historical geology courses.*

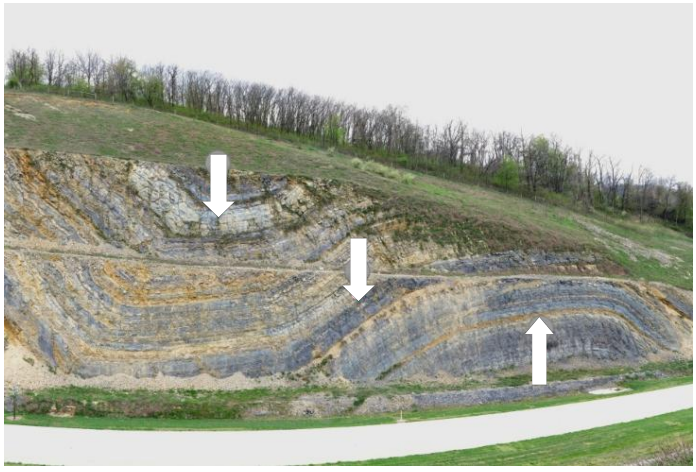
Synclines (downfolds) and anticlines (upfolds) are common geologic structures that form in pairs in response to compression and folding caused by tectonic events such as mountain building. Synclines and anticlines, common in our area, share a limb of a fold.

Below, the gigapixel image of a roadcut in Patterson Creek Mountain in eastern West Virginia shows a typical syncline-anticline pair, with the arrows indicating the syncline on the left, the anticline on the right, and a shared limb of folded rock.

The author John McPhee offered a simple yet elegant analogue for synclines and anticlines in his book *In Suspect Terrain* (1983):

> When rock is compressed and folded, the folds are anticlines and synclines. They are much like the components of the letter S. Roll an S forward on its nose and you have to the left a syncline and to the right an anticline. Each is a part of the other.

In the image below, can you see the S rolled forward on its nose?





Meeting Notes
May 6

by Almas Eftekhari, Secretary

President Jason Zeibel opened the meeting by announcing name tags for pickup and asking visitors to introduce themselves. Four did.

Field Trip Co-Coordinator Katy Johnson discussed the field trip to the National Limestone Quarry on May 17 and the upcoming trip on June 7 to collect West Virginia trilobite fossils with Casper Voogt. In preparation, Casper will give the program at the June meeting (see page 9).

Jason announced a summer club picnic and rock swap on August 10. The club will provide hamburgers and hotdogs; members should bring a dish to share and specimens to swap. Jason also announced that Jake Broughton is our new AV coordinator, thanking him for taking on the role.

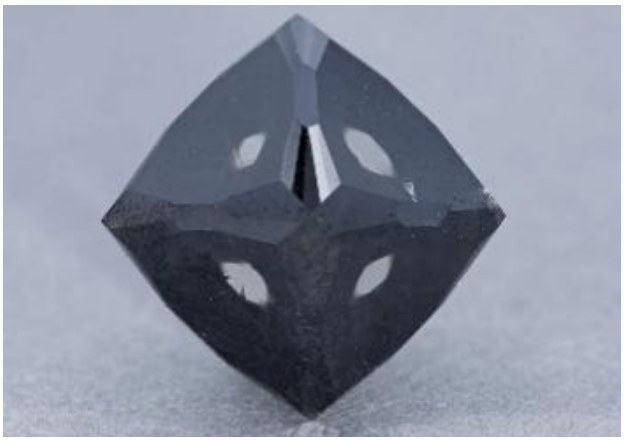
Club members who are in school at any level can now apply for a stipend of up to $400 to travel to any event related to our hobby. Applicants must write a paragraph on why they want to go and what they'll do, then give a club presentation when they return.

Jason reminded members to pay their club dues and that our annual club show is coming up in November. We need volunteers to make it possible.

Sue Marcus introduced Dr. Michael Wise from the Smithsonian Institution's Department of Mineral Sciences. He's a mineralogist who is world-renowned for his work on pegmatites and has been a friend to our club and the entire collecting community for decades. Mike started as a research scientist but now does a lot of education and outreach. His presentation was on recent acquisitions for the Smithsonian gem and mineral collection from shows and donations.

Mike showed us beautiful specimens, including beryl carved into cockatiels, unusual diamonds from Zimbabwe (including a black diamond), a bicolored zoisite from Tanzania, a brilliant spessartine from Nigeria, barite from China, celestine from Afghanistan, and a stunning rhodochrosite crystal from the Montreal Mine in Wisconsin. Mike's favorite acquisition was a honey-colored celestine specimen from Poland.

Mike noted that, 10 years ago, painite was the rarest mineral from Myanmar. It's not the rarest anymore,



A 13.9-carat black diamond from Merange, Zimbabwe, acquired by the Smithsonian Institution. Photo: Greg Polley.

and the Smithsonian acquired a nice specimen on matrix, along with forsterite specimens from various localities. Another of Mike's favorites is tantalite from Mozambique. The Smithsonian also acquired a nice red apatite specimen and a very rare laurentthomasite, along with an orange sodalite (variety hackmanite) that darkens when you shine light on it and takes a few seconds to return to its normal color.

Mike said that the Smithsonian has over 400,000 specimens, with only 1 percent on display. When researching a mineral, researchers might break off a small, unnoticeable piece of a specimen, if necessary. The collection sometimes loans specimens to affiliates for a few years, but they never sell a specimen, even if it is never displayed. If it acquires a better specimen, it swap it out and stores the inferior piece.

Mike showed slides of gold from the Fire Creek Mine in Nevada that tarnished within 6 months, so it clearly wasn't pure. He is trying to identify the impurities, possibly through chemical analysis or X-ray; the specimen seems to contain silver selenite crystals.

Other acquisitions include a Brazilian rhodonite gem better than the collection's other rhodonites, a deep-red sunstone gem from Oregon, and a breathtaking tricolor elbaite specimen with quartz and albite. Mike also showed a collection of butterflies with gems making up the wings, eyes, bodies, and so forth.

Mike ended his slides with an elbaite (variety Paraiba) ring, noting that he hopes to acquire a raw Paraiba crystal that isn't cut up before he retires. At the very end, he showed the Winston Red Diamond, part of a collection of multicolored diamonds that just went on display.

National Limestone Quarry

Good Rocks, Good People, Good Time!

by Mickey Johnson, Field Trip Co-Chair

The NVMC field trip on May 17 to Pennsylvania's National Limestone Quarry (two quarries, one in Middleburg and the other in Mt. Pleasant) was a great opportunity for both young and old members of this amazing club to collect specimens from one of our area's best quarries, this one with a devout Christian owner who shared his faith with us.

This trip was a perfect opportunity to collect fluorite, strontianite, wavellite, calcite, and many other outstanding minerals and fossils. This trip allowed us to find specimens that were plentiful and beautiful in terms of both shape and features.

The first quarry was an amazing aggregate pit where the owner had only recently excavated. As a result, we were able to find marvelous specimens with little or no light exposure or damage. It was exactly the type of quarry best suited for rockhounds to find fluorite, calcite, and more.

The second quarry produces mainly limestone. It was the perfect place to find wavellite veins, strontianite cavities, and fossils. Club members collected excellent specimens in the walls and in cavities within a recently demolished wall; the rain exposed even more specimens that had been previously discarded.

Thank you so much to the 11 club members who joined us, including 3 enthusiastic junior members! And thank you to our club officers for organizing the trip!

















Upcoming Field Trips

by Katy Johnson, Field Trip Co-Chair

Stay tuned for details on our trip to West Virginia to look for trilobites June 7. I am currently working with park naturalists to coordinate a date for a summer program on fossils at Flag Pond Park. We are also hoping to make a trip to New Jersey to visit the Franklin Mineral Museum and Sterling Hill Mining Museum.

In the fall, we are looking to return to Willis Mountain (for kyanite) and Odessa, DE (for petrified wood). We will also have another local field trip, this one on the geology of the Holmes Run watershed in Alexandria.

All trips will be coordinated through Google Forms, and each trip will have its own RSVP. Some field trips will be limited in number of participants; once we have reached that number, I will close the form. Final details of trips will be sent only to those who have filled out the form.

GeoWord of the Day

(from the American Geoscience Institute)

hairstone

A variety of clear crystalline quartz thickly penetrated by fibrous, threadlike, or acicular inclusions of other minerals, usually crystals of rutile or actinolite; esp. sagenitic quartz. See also: Venus hairstone; Thetis hairstone. Also spelled: hair stone. Syn.: needle stone.

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



Bench Tip
Transparent Cabs

Brad Smith

When bezel setting a transparent cabochon in silver, I usually cut out the back of the bezel to allow background light to show off the colors and patterns in the stone. If this is not possible or appropriate, I worry that the silver bezel will tarnish under the stone and will ruin its brilliance.

My solution is to take one extra step before setting the stone. I place a piece of thin silver Mylar plastic under the stone to act as a mirror that will never tarnish. Mylar is readily available in craft and gift wrap stores or in a pinch from a party balloon supplier. You might even want to experiment with using colored or patterned Mylar (that is, a diffraction pattern) under some stones.



Smart Solutions for Your Jewelry Making Problems
amazon.com/author/bradfordsmith



Educators Thank NVMC

Part of our purpose as a club is educational, and several NVMC members have been teaching kids in various ways about rocks, minerals, and fossils. Recently, several elementary schools (Providence, Braddock, Laurel Ridge, and Marshall Road Elementary Schools) thanked Roger Haskins for featuring displays related to STEAM (science, technology, engineering, arts, and math) in support of Family STEAM Night in February-April. Some reached out with messages of appreciation, reprinted below.

Congratulations, Roger—and thanks! The entire club owes you a debt of gratitude!

"Dear NOVA Minerals Club,

We are writing to express our sincere gratitude for your participation in Providence's Family STEAM Night. It was an incredibly engaging experience for our students and families, and we are grateful for the time and effort that you and the rest of your club members dedicated to making it such a success.

The evening provided a wonderful platform for students to come together, engage in meaningful STEAM activities, and partake in various activities that fostered the growth of 21st-century skills. Our students were so excited by the rocks and minerals you shared—they couldn't stop talking about them and were eager to explore the rocks and minerals in their own neighborhoods!

Once again, thank you for participating in this memorable evening. We look forward to working with you for future events!

Warmest regards,

Providence Elementary STEAM Planning Team"



"Subject: Thank You for Your Participation in STEAM Night at Laurel Ridge!

Thank you so much for hosting a table at STEAM Night last week!

The creative displays, hands-on experiences, and valuable insights shared with the students sparked curiosity and excitement about STEAM. We are so grateful for the time, effort, and resources you dedicated to making the event a huge success!

We will be posting about the event using your organization's name and a link to your website to continue supporting your club throughout our community! If you have any pictures from that night that you would feel comfortable sharing, please send them to us.

We hope to have the opportunity to collaborate again in the future, and continue inspiring the next generation of innovators and problem solvers.

Thank you once again for your generosity and support!

Warm regards,

The STEAM Night Committee"

September Meeting Zoom Only!

Our first meeting after summer break falls on Labor Day (Monday, September 2), when our meeting place at the Dunn Loring Fire Station will be closed. Our meeting will therefore be Zoom only.

Pacific Northwest Fault Zone Could Trigger Catastrophic Quake

by Evan Bush

Editor's note: *The piece is adapted from NBC News, 28 April 2025. Thanks to Sue Marcus for the reference!*

When an earthquake rips along the Cascadia Subduction Zone Fault, much of the West Coast could shake violently for 5 minutes and tsunami waves as tall as 100 feet could barrel toward shore. But that's just the start of the expected horrors.

Even if coastal towns withstand the seismic onslaught, floodwaters could seep into many communities for good. That's because entire coastal shorelines are expected to drop by as much as 6-½ feet when the earthquake strikes, according to new research published Monday in the Proceedings of the National Academy of Sciences.

Researchers analyzed seismic and flood modeling to produce some of the most detailed estimates of how the Cascadia earthquake would drop coastal shorelines and found that it could affect more than double the number of people, structures, and roads currently at risk. The effect will also worsen over time as intensifying climate change raises sea levels.

"This less-talked-about hazard is going to persist for decades or centuries after the earthquake," said Tina Dura, the study's lead author. "The tsunami will […] have big impacts, don't get me wrong, but the lasting change of the frequency of flooding—that's going to have to be dealt with."

Dura said geologic fossil evidence shows that previous Cascadia earthquakes immediately dropped the land level and turned dry ground into tidal mudflats in estuaries along the Pacific Northwest coast.

"That's going to happen again and we've built up a lot of those areas," said Dura, an assistant professor of geosciences at Virginia Tech University. "That's how we have ports there ... and that's where we built towns, and all that area is gonna drop down maybe over a meter, up to 2 meters."

The Cascadia Subduction Zone Fault, which runs offshore along the West Coast from northern California to northern Vancouver Island, represents a looming threat. The fault has the capability to produce a magnitude-9.0 earthquake, and a large temblor is expected there at least once every 450-500 years, on average. The last major quake occurred in 1700.



Researchers sampling sediments in the Salmon River estuary in Oregon in 2023 to document land-level changes following past earthquakes and tsunamis.

The National Seismic Hazard Model suggests a 15-percent chance of a magnitude-8.0-plus earthquake along the zone's margin within the next 50 years. When the fault rips, it will precipitate the worst natural disaster in the nation's history. A 2022 state and federal planning exercise for a Cascadia earthquake predicted about 14,000 fatalities, more than 100,000 injuries, and the collapse of about 620,000 buildings, including 100 hospitals and 2,000 schools. Coastal planners must reckon not only with the threat of intense shaking and tsunamis, but also for the long-term reshaping and rapid sinking of the coastline itself.

"There's the flood itself and then there's the basically permanent change to land level at the coast, and that has a big impact for what those communities have to plan for," said Harold Tobin, director of the Pacific Northwest Seismic Network and a professor at the University of Washington. "Where are you going to put your school or hospital? Where are you going to build your transportation network? I think it's important to take the long view."

After the earthquake, Dura's research suggests, large portions of towns along the Pacific Northwest coastline would be expected to flood at least once every 100 years, if not more often.

The study also points out that sea level rise is accelerating as climate change intensifies, and the effects of post-earthquake flooding could worsen in the future. … *Read more*.

Pangaea: Ancient Supercontinent

by Tia Ghose and Laura Geggel

Editor's note: *The article is adapted from* LiveScience, *15 November 2024.*

Pangaea was a massive supercontinent that formed between 320 million and 195 million years ago, surrounded by a single ocean called Panthalassa. The explanation for Pangaea's formation ushered in the modern theory of plate tectonics, which posits that Earth's outer shell is broken up into plates that slide over Earth's viscous interior, the mantle.

Over the course of the planet's 4.5-billion-year history, several supercontinents have formed and broken up, a result of churning and circulation in Earth's mantle, which makes up 84 percent of the planet's volume. The breakup and formation of supercontinents has dramatically altered the planet's history.

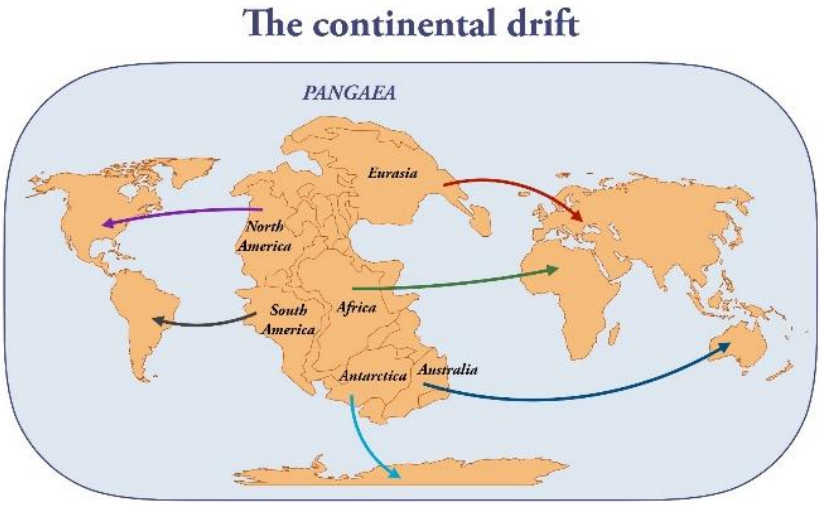
"This is what's driven the entire evolution of the planet through time. This is the major backbeat of the planet," said Brendan Murphy, a geology professor at St. Francis Xavier University in Nova Scotia.

Pangaea is the most recent supercontinent, with Rodinia and Columbia (also known as Nuna) coming before it. A huge landmass called Gondwana also existed before becoming part of Pangaea.

More than a century ago, the German scientist Alfred Wegener proposed an ancient supercontinent, which he named Pangaea. The name comes from Greek *pan* (all) and *gaia* (Earth).

An obvious clue to Pangaea's existence was that the "continents fit together like a tongue and groove," Murphy said. Another telltale hint comes from the geologic record. Coal deposits in Pennsylvania have a similar composition to those in Poland, Great Britain, and Germany from the same period, so North America and Eurasia must have been a single landmass. And the orientation of magnetic minerals in geologic sediments reveals how Earth's magnetic poles migrated over time, Murphy said.

In the fossil record, identical plants, such as the extinct seed fern Glossopteris, are found on multiple continents. And mountain chains on different continents, such as the Appalachians in the United States and the Atlas Mountains in North Africa, were all part of the Central Pangaea Mountains, which formed through the collision of the supercontinents Gondwana and Laurussia.



Graphic created by Dimitrios Karamitros.

Tectonic plate movement is why Pangaea formed and broke up and why continents still move today. Earth's outermost layer comprises multiple tectonic plates driven by convection currents in Earth's mantle. As the plates move, they push land masses together, break them apart, and transform them.

The Pangaea timeline spans hundreds of millions of years. In the early Phanerozoic Eon (which has lasted from 541 million years ago to now), almost all of the continents were in the Southern Hemisphere, with Gondwana, the largest continent, reaching from the South Pole to the equator. The Northern Hemisphere was largely covered by the Panthalassic Ocean.

Another ocean—the Iapetus, named after a mythical Greek Titan—separated the paleo-continents Laurentia, Baltica, and Gondwana. It began to close during the Ordovician Period (485-444 million years ago) and then disappeared during the Silurian Period (444-419 million years ago), when Baltica and Avalonia collided with Laurentia to form Laurussia.

Finally, about 320 million years ago, there was a major geologic collision as Gondwana, Laurussia, and other nearby landmasses smashed together and created Pangaea. … *Read more*.

The Rocks Beneath Our Feet

Fossils Along Our Local Creeks

by Hutch Brown

Editor's note: *This is a revised version of an article that appeared in* The Mineral Newsletter *in January 2019.*

I found the rock shown in figure 1 in October 2018 on a gravel bar in Arlington, VA. The lines in it are traces of wormlike marine animals that lived more than half a billion years ago. Most of the lines (except the leftmost one, which appears to hold an actual wormlike fossil) are tracks—signatures left by ancient animals, like dinosaur footprints. They are known as trace fossils.

You can easily find trace fossils like this in our area. It took me 20 minutes to find this particular specimen on a gravel bar along Four Mile Run near the Barcroft Sports and Fitness Center in Arlington. I've found others like it on gravel bars along streams in both Arlington and Alexandria as well as on hillsides in Arlington's Glencarlyn and Lubber Run Parks.

All it takes is knowing what to look for—and where.



Figure 1—*Antietam quartzite with marine trace fossils, found along Four Mile Run near the Barcroft recreation center in Arlington, VA. The trace on the left appears to contain an actual wormlike fossil. Photo: Hutch Brown.*

Local Geology

The USGS geologic map for Arlington County can help (fig. 2).

The map shows mostly sediments from the Neogene Period (about 24-2.6 million years ago) in yellow and (on the right) pale pink. Suburban homes are built on these so-called Tertiary terraces, which formed at a time when our area was a flat and featureless plain, with the Atlantic Ocean occasionally intruding far inland. Some deposits from the Miocene Epoch (about 24-5 million years ago) are estuarine in origin, but most Neogene deposits in Arlington are fluvial (from ancient rivers, predecessors of the Potomac).

About 5 million years ago, gentle uplift began across our area as Earth's mantle started pushing up the crust from the Piedmont in the east to the Allegheny Plateau in the west. In response, rivers and streams began shaping the landscapes we know today. The map in figure 2 shows part of Arlington's main stream system: Four Mile Run and its tributaries, shaded in buff and marked **Qal** (**Q** for the current Quaternary Period and **al** for alluvium).

In carving its valley, Four Mile Run wore away the overlying sediments down to the metamorphic bed-

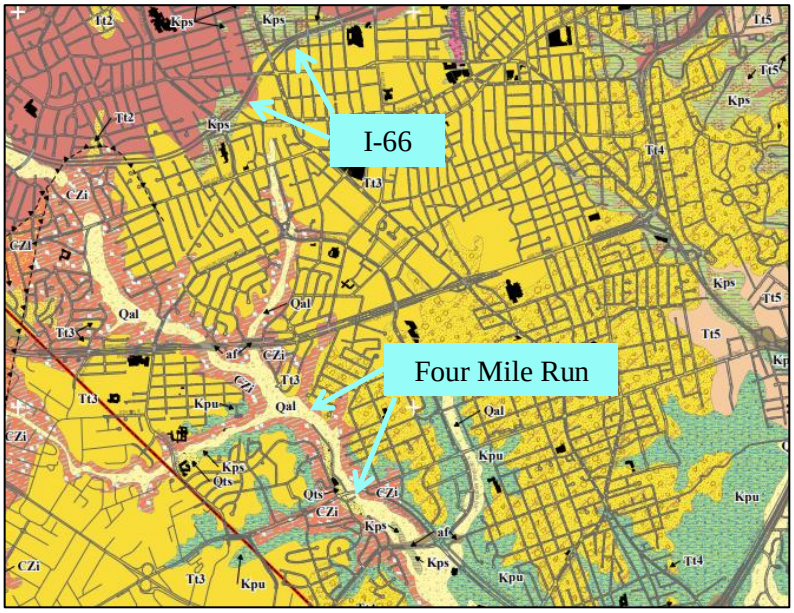


Figure 2—*Detail of a geologic map for Arlington County showing bedrock and overlying sediments. Yellow/light pink = Tertiary terraces (e.g.,* **Tt3**, **Tt5***); buff = alluvium (***Qal***) in creek beds; dark pink = metamorphic bedrock (Sykesville Formation in upper left and Indian Run sedimentary melange (***CZi***) along Four Mile Run); green = Potomac Formation (***Kpu***/***Kps***). Source: Frost and Ernest (1999).*

rock, shown on the map in dark shades of pink. The bedrock to the south is Indian Run sedimentary melange (**CZi**); to the north (upper left on the map, dark pink) is the overlying Sykesville Formation, with I-66 following the approximate Sykesville boundary line.

Immediately over the Indian Run bedrock (and under the Tertiary sediments) is a layer of fluvial sediments known as the Potomac Formation (fig. 3). Shown on the map in shades of green, the sediments were deposited by rivers during the early Cretaceous Period (about 140-100 million years ago). Most of the formation is marked as **Kpu** (**K** for Cretaceous; **p** for Potomac; and **u** for undivided, meaning a sedimentary mixture ranging from cobble to clay (fig. 3, top)).

Potomac Formation

Some Neogene sediments in Arlington are contemporaneous with Calvert Cliffs in Maryland, famous for Miocene marine fossils about 10-20 million years in age. Sea levels were higher then, and the ocean sometimes reached into the Fall Line zone, so you might think that any marine fossils found in Arlington are also Miocene in origin—but they are not. The trace fossils I found came from far inland, deposited by ancient rivers up to 140 million years ago.

The Potomac Formation is dense and hard to pick apart (fig. 3, top), but it is not solid rock. It contains well-rounded river rocks in various sizes, some from scores of miles inland. The specimens with trace fossils are Antietam quartzite (fig. 3, bottom), a metamorphic rock named for a Maryland creek of Civil War fame, where the Battle of Antietam was fought in September 1862. Antietam Creek joins the Potomac River upstream from Harpers Ferry, WV.

In addition to quartzite, gravel bars in Arlington contain sandstones in various hues, including the red variety quarried for the stones used to build the Smithsonian Castle in Washington, DC. That sandstone, quarried near Seneca Creek in Maryland, also lies well upstream from Arlington County.

The quartzite and sandstones in our local creeks came from bedrock sources up to 50 miles away. The rocks are worn and rounded from many miles and millions of years of rolling down ancient rivers, predecessors of the Potomac. Loosened by erosion, the rounded river rocks fell out of stream banks into Four Mile Run and other local creeks. The streams then carried the rocks a few miles—or just a few yards—to whatever gravel bars you can find them on today. You can also find them exposed in the Tertiary terraces on eroding hillsides above Arlington's creeks.



Figure 3—*Potomac Formation sediments.* ***Top:*** *Exposure on an eroding slope above Long Branch, a tributary of Four Mile Run in Arlington, VA. The sediments are a hard-packed blend of clay, silt, sand, and river rocks of various sizes.* ***Bottom:*** *Trace fossil in Antietam quartzite from a Long Branch gravel bar. Photos: Hutch Brown.*

Antietam Quartzite

Quartzite forms from sandstone under intense heat and pressure, and (like other metamorphic rocks) it has various grades, depending on the amount of heat and pressure. Antietam quartzite is so poorly consolidated that much of it resembles sandstone; in fact, some sources call it "quartzose sandstone" rather than quartzite.

But the trace fossils are a dead giveaway—Antietam quartzite is known for them. This particular type of 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 the Greek words *skolex*, "worm," and *lithos*, "rock," combined with Latin *linearis*, "consisting of lines").

The lines in the rock are from burrows in the sand left by wormlike creatures possibly related to a marine animal alive today. Today's wormlike phoronids live in shallow marine environments just offshore. They burrow into the sands and use tiny tentacles to filter food from currents flowing overhead.

Antietam quartzite originated in a similar offshore marine environment. How did it happen?

Continental Rifting

About a billion years ago, our area was located in the middle of a supercontinent known as Rodinia. We still have some of the ancient bedrock, known as the Grenville granitoids, in our area. You can see Grenville granite in igneous outcrops in the Blue Ridge Mountains, such as Old Rag.

Supercontinents eventually break up. Rifting began in earnest about 570 million years ago along old suture lines as the continents (proto-Africa and proto-North America) pulled apart. Figure 4 shows the sequence of rock formation as the Iapetus Ocean, precursor of the Atlantic, began to form beaches and lagoons.

Rifting began near the edges of the granitic basement rock in today's Blue Ridge geologic province. As the rock thinned and stretched, it formed basins eroded by streams, covering the granitic rock with a thin layer of sands and gravels known as the Swift Run Formation.

Magma welled up through the thinning crust, causing lava flows that hardened into basalt, which later metamorphosed into Catoctin greenstone. As the new ocean formed over the thinning crust, 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 turned into Harpers phyllite, which in turn gave way to more sands, the origins of Antietam quartzite (fig. 4, light gray).

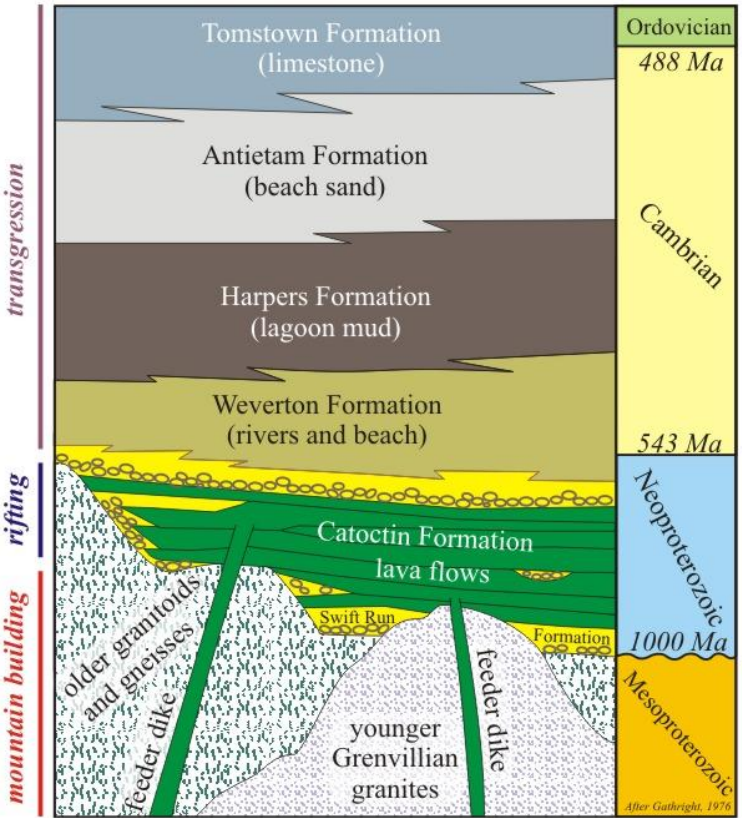


Figure 4—*Rock formations of the Blue Ridge Province. The formations overlying the granitoids are tied to rifting as the supercontinent Rodinia broke up beginning about 570 million years ago, forming the Iapetus Ocean. Source: Bentley (2014).*

The offshore Antietam sands were a perfect environment for creatures like phoronids, which burrowed into the sands by the billions and left us the trace fossils we find today. Subsequent tectonic events raised mountains in our area, laying the foundations for the Piedmont and Coastal Plain and metamorphosing the Weverton, Harpers, and Antietam sedimentary rocks into the quartzites and phyllites in today's Blue Ridge Province.

Alleghanian Mountain Building

Geologists call the Antietam, Harpers, and Weverton Formations the Chilhowee Group because they make up a related sequence of rock layers overlying the Catoctin greenstone and granitic basement rock of the Blue Ridge Province (fig. 4). Together with the underlying rocks, they formed the great anticline (upfold) of the Blue Ridge (fig. 5), which took shape when proto-Africa closed the ancient Iapetus Ocean

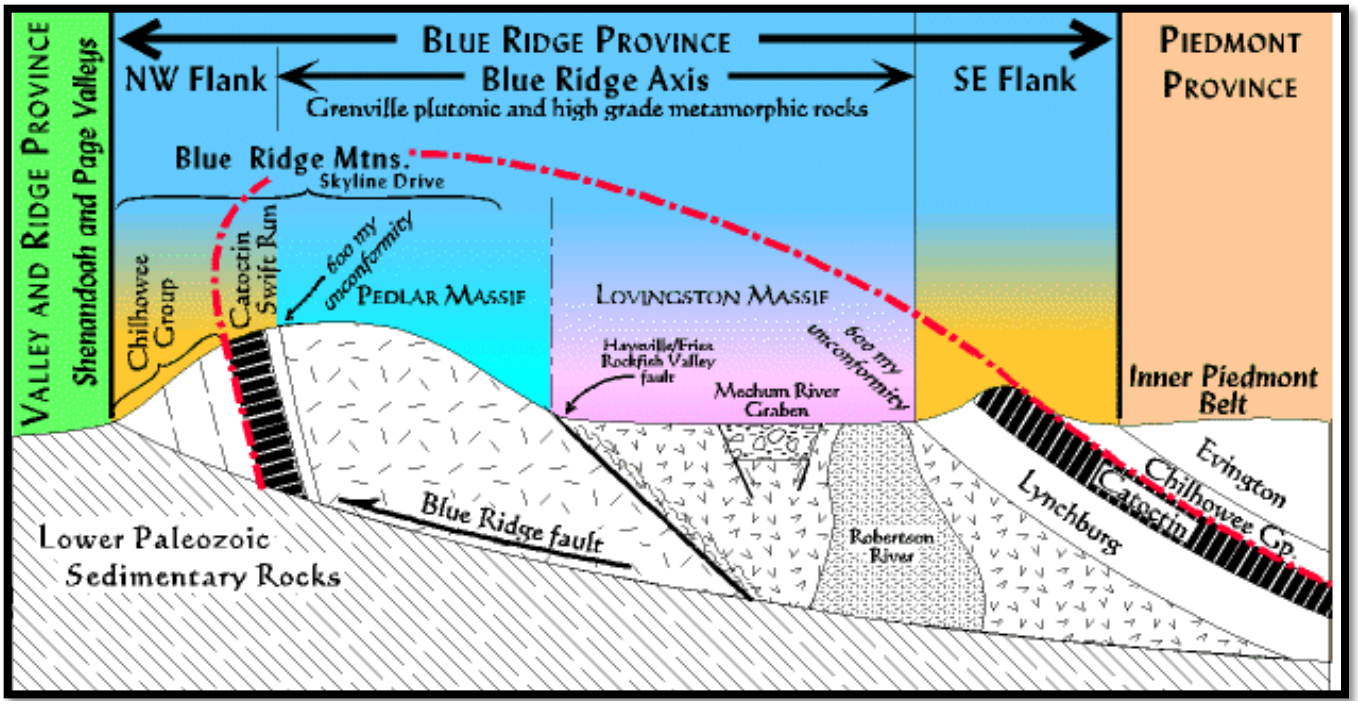


Figure 5—*The Blue Ridge thrust fault and anticline. The Blue Ridge Province includes a suite of associated rocks upthrust during the Alleghanian Orogeny, which started about 320 million years ago. The Chilhowee group, including Antietam quartzite, forms the two flanks. Source: Fichter and Baedke (1999).*

and collided with proto-North America beginning about 320 million years ago. As figure 5 shows, the Chilhowee Group still comprises the two flanks of the anticline. It originally covered the entire anticline, which was long ago breached by erosion and worn away.

In any case, all of the Blue Ridge rocks, including Antietam quartzite, are linked by Iapetus rifting about 570 million years ago (fig. 4) and by the Blue Ridge thrust fault and anticline associated with mountain building beginning some 320 million years ago (fig. 5), what geologists call the Alleghanian Orogeny.

Long Geologic Record

Gravel bars along some local creeks contain a geologic record going back for more than half a billion years. The record spans two geologic provinces (Blue Ridge and Piedmont) and covers at least 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 Antietam quartzite, derived from ancient offshore sands. They were deposited in the Piedmont up to 140 million years ago by rivers long since gone. They contain unmistakable traces of ancient sealife, and they are not that hard to find. Just look for rounded river rocks, buff in color and tinged reddish-brown, with distinctive parallel grooves.

So next time you're on a gravel bar along a creek flowing through Potomac Formation or Tertiary terrace sediments—typically green or yellow on geologic maps (fig. 2)—why not give it a try? Finding fossils is always a thrill!

Sources

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June 2025—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2 **NVMC mtg**	3	4 MSDC mtg	5	6	7 **NVMC field trip** Shows: PA, NC
8 Show: Raleigh, NC	9 GLMSMC mtg	10	11	12	13 Show: W Friendship, MD	14 **Flag Day** Shows: MD, NJ
15 **Father's Day** Shows: MD, NJ	16	17	18	19 **Juneteenth**	20 **Summer begins** Show: Swannanoa, NC	21 Show, Swannanoa, NC
22 Show, Swannanoa, NC	23	24	25 MNCA mtg	26	27 Show: Concord, NC	28 Show: Concord, NC
29 Show: Concord, NC	30					

Event Details

2: Dunn Loring, VA—Northern Virginia Mineral Club; info: https://www.novamineralclub.org/.

4: Washington, DC—Mineralogical Society of the District of Columbia; info: http://www.mineralogicalsocietyofdc.org/.

7: West Virginia—NVMC collecting trip for trilobite fossils; details on page XX; info: Katy Johnson, fieldtrips@novamineral.club.

7: Macungie, PA—Annual show, Pennsylvania Earth Sciences Association; Macungie Memorial Park, 50 Poplar St; Sat 8:30-3; free; info: Mandy Apgar, pesanewsletter@yahoo.com.

7-8: Raleigh, NC—Retail show; NC State Fairground (Kerr Scott Bldg), 4285 Trinity Rd; Sat 10-6, Sun 10-5; free; info: Ash, 919-257-8915, Jewelpassageshows@gmail.com.

8-9: Gastonia, NC—Annual show; Gaston Gem and Mineral Club; Johan Newcombe Event Center/Habitat for Humanity, 1840 E Franklin Blvd; Sat 10-6, Sun 10-4; free; info: Eric Clymer; Email: clymeric@protonmail.com.

9: Rockville, MD—Gem, Lapidary, and Mineral Society of Montgomery County; info: https://www.glmsmc.com/.

13-15: W Friendship, MD—Annual show; Mid-Atlantic Gem and Mineral Association, LLC; Howard County Fairgrounds, 2210 Fairgrounds Rd; Fri 12-6, Sat 10-5, Sun 11-4; $6, kids under 12 free; info: Teresa Schwab, 301-807-9745, eventcoordinator@gemshow.com.

14-15: E Cherry Hill, NJ—Annual South Jersey Gem, Jewelry, Mineral and Fossil Show; 499 Rte 70; Sat 10-6, Sun 11-5; info: www.sjmineralshow.com.

20-22: Swannanoa, NC—Show; Mountain Area Gem and Mineral Ass'n; Land of the Sky Shrine Club, 39 Spring Cove Rd; Fri 9-6, Sat 9-6, Sun 10-4; free; info: Richard Jacquot, 828-779-4501, rickjacquot@gmail.com.

25: Arlington, VA—Micromineralogists of the National Capital Area; info: http://www.dcmicrominerals.org/.

27-29: Concord, NC—Annual show; Southeastern Mineral Specimens; Cabarras Arena & Events Ctr, 4751 State Hwy 49, Gold Hall 1; Fri 10-6, Sat 10-6, Sun 11-5; $10 adults, kids 12 and under free; info: Mark Woods, 706-296-9467, imineral@bellsouth.net.

The Northern Virginia Mineral Club, Inc.

Visitors are always welcome at our club meetings!

EXPLORE OUR WEBSITE! FIND US ON FACEBOOK!

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

Please send your newsletter articles to:
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RENEW YOUR MEMBERSHIP!

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

OR

Bring your dues to the next meeting.

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

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Meetings: At 7:30 p.m. on the first Monday of each month at the Dunn Loring Fire Station, 2148 Gallows Rd., Dunn Loring, VA.* (No meeting in July or August.) September meeting (Labor Day) is Zoom only.

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

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