THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Next meeting: November 3 Time: 7:30 p.m. (doors open at 7 p.m.)

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

Hybrid Meeting With Zoom Option

Zoisite

Alchuri, Shugar Valley, Pakistan

Source: Wikipedia. Photo: Rob Lavinsky.

Volume 65, No. 9
November 2025
Explore our website!

November Meeting Program:

2025 Club Show

details on page 13

In this issue …

Mineral of the Month
Zoisite, part 1

by Sue Marcus

Zoisite is our mineral this month. I encourage all interested collectors to have a specimen in their collections. There are many forms to choose from—something for everyone, including gems. You can also choose from many different localities, so many that I am writing this month's column in two parts.

Type Localities

Two places share the title of type locality. The first samples came from mountains known as the Saualpe in Carinthia, Austria, and from "Baireuth." In 1797, the samples were brought to the attention of Sigmund Zois, possibly by mineral dealer Simon Prešern. Zois recognized them as something new and shared the specimens with the famous geologist Abraham Gottlob Werner. Werner's description, published by Robert Jameson, apparently missed the publication date for Jameson's *System of Mineralogy*, so Jameson added it later as "Appendix IV." I don't know how it was included in an already published book.

Werner placed the Saualpe in Carinthia but gave no further details about "Baireuth." It is almost certainly Bayreuth in Bavaria, Germany. (National boundaries and place name spellings have changed since the 18th century.) Although Werner included Baireuth as a source of his material, that seems to be the only mention of it as a co-type locality.

Conflicting information about the original material is provided by multiple sources. For example, the original name may have been saualpite after the Saualpe, where the material was first found. Wikipedia and Mindat both state that Simon Prešern provided the material used by Werner in his original description of zoisite. Yet Werner wrote that his material came from Sigmund Zois. Mindat reports that Prešern found the material in 1804, yet other sources state that Werner was given the specimens in 1797.

Geologic Environment

Zoisite forms in several ways, typically related to metamorphism. Usually, zoisite forms from the alteration of mafic (dark, quartz-poor) igneous rocks. It is often associated with eclogite, a mafic metamorphic rock formed under intense pressures like the conditions in subduction zones. Eclogite, or eclogite altered to serpentinite, hosts many zoisite occurrences. Another metamorphic origin of zoisite in rocks takes place after the peak of metamorphic events, when heat and pressure decline: this is called retrograde metamorphism.

Northern Virginia Mineral Club members,

Our next club meeting will be on November 3 at 7:30 p.m. at the Dunn Loring Fire Station in Fairfax. We will join our speaker, Maria Nopo, for dinner beforehand at 5:30 p.m. at:

Inca Social Club
Dunn Loring Metro Station complex
2670 Avenir Place, Vienna, VA
(for parking directions, see the program on page 13)

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

Zoisite, Prickler Halt, St. Oswald, Eberstein, Carinthia, Austria. Source: Mineralienatlas; photo: Hkern.

A third environment for zeolite occurs in anorthosite, an igneous rock primarily composed of plagioclase feldspar. Zoisite in Idaho is hosted by anorthite. Pegmatites are a silica-rich igneous rock, quite different from other geologic environments where zoisite forms. Most references to zoisite in pegmatites are from older sources, written prior to the knowledge or acceptance of plate tectonics. My hypothesis is that if zoisite has truly occurred in pegmatite, it is the result of alteration of feldspar, similar to the retrograde metamorphism resulting in zoisite in some metamorphic rocks.

Mineral collectors may be interested in all varieties of zoisite, while lapidarists and those who prefer the results of their arts may find certain varieties more to their tastes. The well-known blue, vanadium-rich variety is tanzanite. Pink zoisite, variety thulite, occurs in many places, including the United States. Opaque green zoisite with red corundum (ruby) is sometimes called anyolite (not an official name).

Zoisite can be confused with epidote, clinozoisite, and pargasite. All four can be green minerals that occur together.

Localities

United States

In 1942, W.T. Schaller and J.J. Glass published a report on thulite, the pink variety of zoisite, from 12 states. They examined occurrences in the field, analyzed specimens brought to them by others, and compiled information from prior sources. Their report is old but still the most comprehensive source for U.S. localities, especially for thulite. Mindat is the most comprehensive reference for worldwide localities. Images posted on Mindat are useful indicators of the quality and size of specimens. Unfortunately, zoisite and its varieties are often listed for a specific country or locality, with no additional information provided.

Zoisite occurs in scattered localities throughout the United States. Mindat and other sources note zoisite occurrences that I describe in this article. I have primarily focused descriptions on localities that produced more than a couple of specimens and where I have confidence in the identification. The images of some zoisite specimens show opaque, lathe-shaped, off-white to brown crystals. They may be zoisite, but unless I could find other sources mentioning the same locality as a zoisite occurrence, I have not included them. There are too many possibilities for unintentional misidentification.

Zoisite, Mineral Hill Mine, Carroll County, MD. Source: Mindat; photo: Bill Cordua.

Maryland. Zoisite has been reported from Bare Hills near Baltimore and from Carroll County, Maryland.

Virginia. The Wheatly (or Wheatley) Mine near Moneta in Bedford County exploited a feldspar in a pegmatite body. When W.T. Schaller visited the property, he collected a specimen containing thulite crystals "several centimeters [1+ in] long" and half a centimeter (0.2 in) thick, along with massive thulite. There seems to be no other information on this thulite locality.

California. Only one specimen from the Westgard prospect in Inyo County is shown on Mindat. It has lustrous crystals of thulite in jackstraw arrangements on a 9-centimeter (3.5-in) specimen. Individual thulite crystals grew up to about 3 centimeters (1 in) in open spaces, possibly in a pegmatite. Schaller and Glass (1942) mention a locality with euhedral thulite crystals on the east side of Saline Valley. If these two occurrences are not the same, their proximity suggests that thulite was probably found in the same rock type.

A large, isolated roadside outcrop near Longvale in Mendocino County is named Syke Rock. It consists of serpentinite and eclogite. Zoisite found in Syke Rock occurs in two distinct forms, as described by two sources. An image on Mindat shows opaque gray subhedral crystals(?), which the description reports as up to 30 centimeters (1 ft) long. It is difficult to confirm that these are zoisite. The other specimen exhibits transparent to translucent light brown terminated crystals in porous rock. The 10-centimeter-long (4-in-long) sample contains crystals up to 1.2 centimeters (0.5 in)

Zoisite with corundum, Buck Creek Mine, Clay County, NC. Source: Mindat; photo: Dan and Diana Weinrich Minerals.

in size. It would be interesting to know whether there is more of the of the well-crystallized material.

Garnet Hill, near Palm Springs, is the source of two small ventifacts (wind-polished rocks) containing thulite. The identification of thulite was verified by powdered x-ray diffraction. It is not known whether the specimens were found near their original source or outcrop.

Pink thulite crystals were reported from the famous Crestmore Quarry near Riverside by Schaller and Glass (1942).

Connecticut. The Gillette Quarry near Haddam was known for the elbaite crystals found there. Schaller and Glass (1942) quote other authors who reported a zone of thulite almost 0.3 meters (1 ft) thick in gneiss.

Massachusetts. Large gray-white crystals forming blocky groups and compact parallel sheaves are shown on two separate Mindat images from the Walnut Hill

Zoisite, Walnut Hill pegmatite prospect, Hampshire County, MA. Source: Mindat; photo: Harold Moritz.

pegmatite prospect near Huntington (formerly Norwich). These localities produced specimens more than a century ago, so they may no longer be accessible.

Rare specimens of crystallized zoisite, variety thulite, were recovered from Tyringham, although the identification of these samples should be verified.

North Carolina. Zoisite in colors from tan through bright green to pink (thulite) have been collected in North Carolina. Thulite, sometimes massive but also as small, gemmy crystals, occurs in the Spruce Pine area. Radiating crystals at least 4 centimeters (1.6 in) long have been reported from an unknown locality in the Spruce Pine area.

Schaller and Glass (1942) listed 12 thulite occurrences in Mitchell County, five in Yancy County, and one in Macon County. They provided specific locations but give no details about most of the thulite occurring in each place. In Mitchell County, they noted that coarse, granular thulite formed masses several centimeters (an inch or more) thick in association with oligoclase at the Putnam and Deer Flat Mines.

One very interesting specimen shown on Mindat from the Buck Creek Mine in Clay County exhibits broken white to green zoisite crystals partly rimmed with reddish corundum, looking similar to the much better ruby-and-zoisite specimens from Tanzania.

In Macon County, W.T. Schaller and fellow geologist C.S. Ross found aggregates of granular pink thulite forming lenses on altered oligoclase.

Montana. Disseminated fine-grained thulite was found in the Phillipsburg Mining District, according to

Schaller and Glass (1942). The metamorphic rock composed of thulite and epidote could make interesting lapidary material.

Idaho. A scientific paper on certain rocks near Boehls Butte reported zoisite in several places, usually hosted in metamorphosed anorthosite. Zoisite was locally abundant in metamorphosed igneous rocks. Zoisite, variety thulite, occurred with prehnite near a place named Stocking Meadows. Green zoisite was also found near Orphan Point, forming bands that contrasted with garnet-rich pink bands. Subhedral zoisite crystals were found south of Goat Mountain. Fine-grained zoisite occurred with tremolite, muscovite, and graphite near a place named Buzzard Roost. Randomly oriented lathe-shaped zoisite crystals in quartzite were found at Pinchot Butte and Getaway Point, with the quartzite associated with schist. There has been no known exploration of these localities by rockhounds.

Small veins and masses of thulite were found at the Helena Mine, and thulite was also found at the Arkansaw [sic] Mine. Since the authors also mentioned both mines in the same sentence, it is likely that the Helena Mine, like the Arkansaw Mine, was in Adams County. There was more than one Helena Mine in that state.

Nevada. Attractive microscopic pink zoisite (thulite) crystals grew in small vugs at what is now known as the Westgate Mine in Churchill County. The vugs are small, reaching only 1 centimeter (0.4 in) across. When they are filled with translucent to opaque thulite, enthusiasts have bright crystals for their micromount collections.

A single specimen of zoisite has been posted on Mindat from a locality in Pershing County. It is worth mentioning because the piece measures 13.1 centimeters (5.2 in) long and is covered with tiny sparkling yellow-green crystals. Mineral dealer John Betts has a specimen from Pershing County on his archive site. It is a splendidly crystalized specimen with a color similar to the specimen on Mindat. Betts's image shows partly translucent crystals on a specimen that sports individual crystals up to 2 centimeters (0.8 in) in size. More specimens are likely to have been collected.

USGS geologist Thomas Nolan collected thulite from a site described as Roger's Tunnel at Ruby Hill in Eureka County. Schaller and Glass (1942) reported that Nolan's specimens were dark pink to red, with deeper color saturation than most thulite. Lower iron in these samples may permit the manganese chromophore to show.

Zoisite, Westgate Mine, Churchill County, NV. Source: Mindat; photo: Douglas Merson.

Schaller and Glass (1942) cited V.T. Gianella when briefly mentioning thulite occurrences in the southern Pine Nut Mountains (Douglas County), in the Singatse Range (Lyon County), and in Ryan Canyon near Thorne (Mineral County). All of these occurrences were in metamorphosed calcic rocks. I was unable to find the original Gianella reference online.

New Mexico. The Picuris District in Taos County was particularly rich in zoisite, variety thulite. A 1935 report by Northrop describes the location as "just south of the Pilar Post Office (... formerly Cieneguilla …)" and northeast of the Picuris/Copper Hill district. Thulite at this locality was hosted in pegmatite, probably related to one exploited at the Harding Mine. Thulite mineralization extended from the pegmatite into and sometimes replacing the surrounding schist. Crystals are described as acicular and subtranslucent.

Samples of massive fine- to coarse-grained pink thulite in specimens up to 11.5 centimeters (4.5 in) in the greatest dimension have been collected in one or more unspecified parts of the Picuris District.

Macroscopic dark pink crystals also occurred in the district. The crystals formed in vuggy pegmatite veins that provided the open spaces necessary for euhedral crystallization.

Pennsylvania. In Pennsylvania, zoisite was sometimes called by the unofficial name unionite, apparently to distinguish it from the pink variety, thulite (also found there). Pennsylvanian thulite seems to be known only from lists and analyses by Gordon (1922), with nothing known about the crystallization or geologic context of the mineralization. Here is a slightly modified version of that list: Chester County: Corundum Hill (Newlin, unionite), Sylmar, French Creek mines, Pierce's Paper Mill (Kennett), and West Chester (Bath Springs); Delaware County: Avondale (thulite), and Leiperville (thulite, rose red to pale pink, with grossularite); Philadelphia: Fairmount Park, Germantown, and Prince's quarry. The Leiperville thulite locality was at a property known as Deshong's Quarry (now flooded beneath the Crum Creek Reservoir).

Tennessee. Ducktown is known among geologists for the copper and iron extracted there. Unfortunately, the high sulfur content of the ore resulted in sulfuric acid when the ore was processed, causing environmental devastation of land and water in the region, which was declared a superfund site. It was compared to Mars due to the lack of vegetation. The area has now been restored and is being used for recreation.

Zoisite was found in the Ducktown Mining District, but Mindat posters did not give a more precise location. Ducktown zoisite is opaque brown to green, forming subhedral crystals in quartz-orthoclase matrix or as matrix-free specimens. Of the two specimen photos posted on Mindat, one has crystals in matrix up to at least 2 centimeters (0.8 in) in size. The other specimen without matrix shows a partial crystal 1.5 centimeters (0.6 in) long.

Utah. Two forms of thulite were found at the Miller Mine near Beaver. Based on the images of specimens posted on Mindat, microscopic deep pink translucent crystals and massive thulite with an unidentified white mineral occurred there.

Vermont. Striated, opaque brown crystals were found near Wardsboro.

Washington. Massive pink thulite from Tunk Creek (or more likely Tunk Mountain) in Okanogan County is suitable for lapidary purposes. A YouTube video of the location shows blocky lenses of pink thulite that have been fractured. The outcrop is on a prominence referred to in the video as Tunk Mountain. One source states that it occurred in 0.9-meter (3-ft) lenses in hornblende gneiss. Some specimens were pure thulite. Others sported pink bands with green rims or occurred as pink grains disseminated in the dark hornblende gneiss. Tumbled thulite from this locality is pink and green, similar to Virginia unakite. A 2013 report indicated that the site was open to collecting for a fee, and the video shows collecting in 2020. This gives us information about a time of activity at this site, which is on private land.

Park and Cannon (1943) found thulite at three locations during their field studies of the Metaline Quadrangle of Pend Oreille County. Those results had not been published when Schaller and Glass (1942) published their report on thulite localities throughout the United States. The draft results of the Metaline mapping were used in the nationwide thulite report. The three thulite locations found by Park and Cannon (1943) are described below, with additional information from the Schaller and Glass (1942) report.

Near the peak of Timber Mountain, thulite crystals reached a maximum of about 0.6 centimeter (~0.25 in) and were disseminated in a chlorite/epidote-andesine matrix. Andesine is a variety of albite. Small veinlets of fine-grained thulite also cut the host rock, indicating that they formed later. This locality seems similar to the Tunk Mountain locality in Okanogan County, based on literature narratives. A complication is that no place or feature with the name "Timber Mountain" could be found. The other two occurrences are related to the Kaniksu batholith and were described as in "the west center of sec. 29, T. 36 N., R. 43 E., and in the south center of sec. 32, T. 36 N., R. 43 E."

Zoisite, variety thulite, with quartz, Waterloo Quarry, Dodge County, WI. Source: Mindat; photo: Bill Cordua.

Wisconsin. An observant collector found two specimens of zoisite at the Waterloo Quarry in Dodge County. Both specimens shown on Mindat exhibit opaque euhedral to subhedral crystals of thulite; one also has parallel beige crystals that are presumably also zoisite. The larger piece is 7.6 centimeters (3 in) long; the other has crystals up to 2 centimeters (0.8 in) long.

Canada

Canada has several zoisite localities, which is not surprising, given the vastness of the country and the diverse geologic environments found there.

The Jeffrey Mine near Val-des-Sources (formerly Asbestos) in Quebec is famous among mineral collectors, especially micromounters. Actually, the town was moved to make way for mining. As the former town name suggests, asbestos (primarily chrysotile) was the economic reason for production. Mining began in 1879, with major production and periods of inactivity throughout the 20th century. By the 1980s, carcinomic concerns about asbestos significantly decreased demand. The open pit operation formally ended in 2012, mostly for environmental reasons. By then, the pit had reached a depth of 350 meters (1,100 ft) and extended almost 6 square kilometers (2.3 mi^2). In 2013, collectors found a few specimens of massive zoisite, variety thulite, in matrix.

The Black Lake (or British Columbia) Mine is another chrysotile mine in Quebec where thulite occurred. A single specimen is shown on Mindat and usually wouldn't be worth mentioning. The poor-quality image appears to show a crystallized specimen and is labeled as being exhibited at the Thetford Mines Museum, so it is likely a verified identification. Oddly, zoisite is not mentioned on the list of species found there, as shown on the Mindat locality page as of this writing (September 30, 2025).

Lustrous though opaque sheafs of bright pink thulite were found in the Témiscamingue regional county municipality of Quebec. The site is called the Rémigny armenite occurrence on Mindat. It is likely a small roadside outcrop, based on Mindat locality photos. All thulite specimens are in a white matrix (quartz?), and some are associated with the rare mineral armenite. Since these are subeuhedral to euhedral, they are probably the best known Canadian zoisite specimens.

Zoisite, variety thulite, Rémigny armenite occurrence, Canada. Source: Mindat; photo: Maggie Wilson.

Mexico

In Mexico, Mindat shows two crystalized specimens from the Fenomeno Mine in Baja California. The reddish-brown crystals are possibly zoisite, although analysis of specimens would be useful to confirm it.

A single specimen, purportedly of zoisite, is shown on Mindat as coming from the Trace Mine, south of the previously mentioned Fenomeno Mine. The Trace Mine specimen consists of opaque, greenish-gray lathelike crystal clusters, unlike any other zoisite crystals I've seen (in person or online). As with the Fenomeno Mine specimens, verification is needed to confirm that the crystals are zoisite.

Peru

Zoisite is probably found in Peru, although I have been unsuccessful in confirming reports of specific localities. Zoisite has been reported from the Raúl-Condestable Mine near Bujama in Cañete Province. Online images from dealers' websites show brownish-green crystals with epidote and clinozoisite. The euhedral, partly translucent crystals appear to be in a granular matrix of similar material. I could not distinguish zoisite from clinozoisite on the specimens, nor could I

identify epidote; there were no detailed descriptions. Mindat lists zoisite from this mine, but there are no images of it posted on the Mindat site.

An even more confounding situation concerns a beautiful salmon-colored euhedral crystal group from an unspecified part of the mineral-rich Huancavelica region. Mindat links information on mineral species with the localities where each species is found. There are locality-specific pages and mineral-species-specific pages that are supposed to cross-link. The photo can be accessed on the zoisite species part of the Mindat website but does not show up on the separate Huancavelica locality pages, nor is zoisite listed as occurring in that locality.

France

Lovely transparent euhedral pink microscopic crystals were found near Petches, which is near Ax-les-Thermes in the French region of Occitanie. Many of the crystals shown on Mindat for this locality have a disclaimer stating that they could be zoisite or clinozoisite, a separate mineral. Evidently, none of the specimens in the posted photos has been analyzed. If they are zoisite, they are probably variety thulite. The Gerbaudière quarry, west of Montaigu, is a crushed stone quarry where opaque gray zoisite crystals up to about 4 centimeters (~1.6 in) in size have been collected. Zoisite crystals occur in quartz matrix.

Czech Republic

Sparse thulite was found in two sites in the Czech Republic. The Markovice quarry is the source of two specimens consisting of transparent to opaque sprays of pink thulite crystals up to 2 centimeters (0.79 in) in size. The quarry was reportedly still active in 2025.

A single specimen of bright pink grains of thulite disseminated in matrix is shown on the homepage of the Dlouhá Ves locality; no other information is readily available.

Austria

Diverse forms of zoisite occur in scattered parts of Austria. A digital German mineral atlas describes a specific type locality for the Saualpe occurrence, Prickler Halt near Eberstein in Carinthia (although Prickler Halt is not mentioned in the description by Werner (1805)). The mineral atlas includes an image of a yellow-brown, highly fractured prismatic crystal on a group of parallel, less euhedral zoisite crystals. Zoisite fills the 1.35-centimeter (0.5-in) image.

Zoisite with quartz in banded gneiss, Zillertal, Tyrol, Austria. Source: Mindat; photo: Rob Lavinsky.

Well-formed brown crystals up to 3 centimeters (1.2 in) long in matrix were found on a peak named Gösleswand in Tyrol. Mindat informs us that the collecting area has been exhausted.

At Zillertal, a specimen of bicolored (deep pink-green) zoisite that is partly transparent and 3.5 centimeters (1.4 in) long was found. Austria's Salzburg region has also produced a few zoisite crystals, including some lovely euhedral microcrystals.

From the Fürpaß quarry in Styria came a large sample of opaque white to pale pink zoisite crystals, apparently greater than 20 centimeters (7.9 in) in size, indicating that the piece was part of a larger zoisite occurrence.

Kleinitz Alp in the Prägraten am Großvenediger municipality was a source of zoisite in the late 19th century. It was apparently a common mineral, forming elongated light green crystals that were more attractive than zoisite from the Gorner Glacier in Switzerland. German mineralogist Ernst Weinschenk analyzed samples from Gorner and Kleinitz. His analyses indicated that the Kleinitz samples contained lower amounts of iron than the Gorner samples.

Greece

I thought I had described all the notable localities and was concluding my research by finding prices for zoisite specimens. While checking online dealer sites, I found that Spirifer Minerals was offering a specimen of massive green zoisite with rubies from Paranesti in the Greek prefecture of Drama. The specimen looks like the Tanzanian material. On Mindat, rubies from Paranesti are said to be hosted in amphibolite or pargasite. Verification of the zoisite identification would be useful.

Italy

Italy's Aosta Valley is in the far north of the country, on the Alpine boundary with France and Switzerland. At a site called Iveri near the city of Pont-St-Martin, zoisite crystals up to 3.4 centimeters (1.3 in) in size were found. The opaque brown zoisite is subhedral, showing some but never all crystal faces. Zoisite was hosted in quartz matrix. A few zoisite specimens are reported on Mindat from other Italian localities, but none are worth further mention.

Norway

Thulite was first identified from Norwegian samples from the Øvstebø farm near Kleppan. It was initially identified as a new mineral in 1823 and was more thoroughly described in 1879. Cyprine, a lovely blue mineral related to vesuvianite, also occurs here. Rare specimens bearing crystals of both minerals make attractive blue and pink specimens. Thulite occurs in quartz veins that are cut by later pegmatites. The bedrock is epidotized agglomerate (a coarse-grained pyroclastic rock blasted from a volcano). In the Øvstebø deposit, the rock has been metamorphosed. In their 1955 paper, Neumann and Svinndal discussed several geologic models to explain the deposits, and they explained why some of them, though theoretically possible, are geologically impossible at this site.

Thulite is often found with cyprine. The most common associated minerals are combinations of quartz, fluorite, grossular, or calcite. In one part of the deposit, thulite is disseminated throughout the agglomerate. Most thulite is massive and suitable for lapidary purposes. Crystals are uncommon, although an image on Mindat shows glassy, internally fractured though partly translucent thulite crystals. The raspberry pink thulite crystals grew only up to 0.5 centimeter (0.2 in) in size; however, with the contrasting blue cyprine crystals, the specimen is an exquisite micromount.

Zoisite with cyprine, Øvstebø, Kleppan, Telemark, Norway. Source: Mindat; photo: OT. Ljøstad.

In January 2019, construction of the Mjønes Tunnel near Mjønes exposed thousands of cubic meters (more than 35,000 ft^3) of thulite. Most of the material was massive. Occasional cavities revealed lustrous translucent thulite and calcite specimens, with thulite crystals reportedly growing up to 3 centimeters (1.2 in) in size. Massive quartz and blue-green apatite were associated with massive to granular thulite.

The Leksvik Thulite Quarry, a former thulite quarry now on private property, was a source of thulite for lapidary purposes. Massive thulite has also been found in other places in Norway, including the Søre Lia Quarry and a roadcut near Tjostolvflaten.

Spain

Zoisite, variety thulite, has been found along the Somosierra mountain pass near the hamlet of the same name. Verification of the mineral is needed to confirm visual identification.

Sweden

Images posted on Mindat portray microscopic reddish crystals from two localities, including Frosvidal and the Långban Mine. The color of the crystals is odd and the validity of the species should be confirmed. A polished section shows a single crystal of zoisite in calcite, with a pink rim around the approximately 0.02-

millimeter (0.008-in) brown crystal. Polished thin sections are an optical analytical technique. Additional analyses using spectral or chemical methods should be used to confirm the validity of these unusual reddish crystals.

On Mindat, a single zoisite specimen from the Gåsgruvan Quarry near Filipstad is captioned "zoisite crystals in calcite." The image appears to be green on green; the zoisite is unimpressive.

Switzerland

The alpine Swiss canton of Valais is home to the Matterhorn, but zoisite from this region can also be alluring, particularly to micromounters. Specimens seem scarce, based on the numbers of photos posted on Mindat. Most specimens show microscopic crystals, but other specimens may have been overlooked. In the 1980s-90s, collectors found several zoisite microcrystals on the northern slope of Wasenhorn. One is a perfect 2-millimeter (0.08-in) doubly terminated crystal that looks like the skewer through a white unspecified mineral. This apparently small site is also the type locality for two minerals: ganterite, named after a nearby valley; and martinandresite, named for a local collector who found the mineralized site.

Macroscopic translucent green zoisite crystals up to almost 3 centimeters (1.2 in) in size were found in a dark green matrix of metamorphic rock near Zermatt.

Dark olive-green zoisite crystals were found on the southeastern slope of the Holzerspitz. The attractive crystals contrast with the hosting white to colorless quartz.

Another Valais zoisite locality close to Zermatt was reported near the Gorner Glacier on the western slopes of the Monte Rosa massif. Columnar to radiating zoisite crystals were found in amphibolite with quartz and calcite. Weinschenk (1896) described these as ranging from colorless or light green and transparent in places to gray-green and "cloudy." The glacial ice has retreated about half a mile since then, so collectors may find additional specimens.

Russia

On Khit Island (Khit Ostrov), parallel opaque olive green zoisite crystals formed specimens up to 9 centimeters (3.5 in) in size, with individual crystals at least 2 centimeters (0.8 in) long. It is doubtful that many specimens have been collected from the locality due to its remoteness. Khit Ostrov is part of Russia's Republic of Karelia. A specimen of sparkling, tiny, light mint green transparent crystals on matrix was offered on eBay from this locality on September 8, 2025, but confirmation of the species would be advisable. It does not look like other zoisite specimens from this locality.

Zoisite on calcite, Långban Mine, Värmland County, Sweden. Source: Mindat; photo: Kjell Gatedal.

Other Russian zoisite localities are mentioned in one source or another, although descriptions of the zoisite found there could not be readily located. Reported localities, according to one source, include the following Russian regions or areas: the Ulankhodinskoye nephrite deposit in the Buryatia; the Urals; Altai; Transbaikalia; and Kemerovo.

A zoisite deposit on the island of Novaya Zemlya is mentioned in one source, but the island may be a nuclear test site. Collecting and removing minerals in Russia may be difficult, and this place would be particularly risky.

Zoisite was found with garnet (unspecified species) in eclogite xenoliths in the Obnazhennaya kimberlite in the Siberian region of Sakha. Eclogite is formed in Earth's mantle. Xenoliths are exotic rocks (meaning out of place or out of their customary geologic context) ripped up and included as chunks in igneous rocks. Eclogite xenoliths were ripped up and included in the kimberlite pipes as those pipes forced their way into Earth's crust. ⛏

Next: *The December issue of this newsletter concludes the article with spectacular zoisite specimens from Tanzania, along with zoisite prices, technical information, and more.*

President's Message

by Jason Zeibel

Greetings, NVMC brethren, to another November! As the days get shorter and the nights colder, we start to think about preparing for the upcoming Thanksgiving and Christmas seasons.

For the NVMC, we turn our attention to preparing for another one of our amazing annual shows. Our show is an opportunity to give folks a truly positive, outward-facing impression of our organization and our hobby in general. I look forward to it every year and know that we'll pull together to get all the work done to make it a wonderful event.

This year's show comes with some changes from those of the past decade or so. We are still at the same venue (George Mason University), but we have a new faculty sponsor, some new procedures to follow, and—my personal favorite—some expanded exhibit space! I know that change brings uncertainty, but I think all these tweaks are going to be small and beneficial to us in the long term. So be sure to put the dates on your schedule, and please volunteer to help out!

At our November meeting, we will devote some time to going through the logistics of what is needed and the various roles that we need filled by club volunteers. In anticipation, there is already a Signup Genius site on which you can volunteer! Please click on the link to see the opportunities for volunteering, then go ahead and sign up.

For yours truly, it has been an interesting few weeks. As I write this, we are moving towards a third week of the federal government shut down. As a federal employee, I have therefore been gifted with some time off to experience what retirement will be like some day.

My first thought was that I was going to have all this free time to lounge around and enjoy myself. It took less than a day for all those projects that I have been putting off to announce that their time had come. As I slowly got through some of them, but others were added, often faster than the ones happily ticked off. By now, I am beginning to realize that there is no end in sight, and I'm busier than I was before I was furloughed.

Although my professional self is quite ready for this congressional silliness to come to a quick end, the rest of me is trying to figure out how to keep working on all of those projects and to-do items when the eventual return-to-work notice comes. Stay tuned to see how it turns out!

Figure 1—*Driving west from Salt Lake City on I-80, you see the tilted sedimentary layering in the mountains of western Utah. All photos: Jason Zeibel.*

Just before the government shut down, I spent a week in the Utah desert doing some equipment testing. This is a truly magnificent part of the country from a geological perspective (I wrote about it briefly after my last trip there last year).

The mountains around me exhibited layers tilted about 30 degrees downward from horizontal (fig. 1). Most of the tilted sedimentary layers formed during the late Permian or Triassic Period from inland seas that were then covering what is now the western United States. The Thaynes limestone was then uplifted and at times covered by inland seas. Then, at the end of the Oligocene Epoch (about 25 million years ago), a rift formed between two plates, fracturing the area of what is now western Utah, Nevada, and eastern California. Parts were uplifted and tilted, while others sank and were ultimately covered by sediments from Lake Bonneville over the last few million years. Hobbyists and trained

Figure 2—*NVMC President Jason Zeibel self-collecting in the Utah desert.*

geologists now come to this area as a place to see hundreds of millions of years of history laid out right before their eyes.

While I was there, I did a little self-collecting (fig. 2). I was there in daytime, so I couldn't judge whether any of the specimens I found were fluorescing. I tried to collect a mix of what were obviously sedimentary limestone examples as well as igneous intrusions or aqueously deposited crack-fillers (fig. 3). To my delight, many of the samples fluoresced a bright pale orange. I think these might be calcite—but I welcome other opinions! I was especially enamored of a specimen with a streak of brightly fluorescing material right through the host sedimentary limestone.

Speaking of fluorescing minerals, our field trip team has set up a wonderful opportunity to experience one of the world's most important fluorescent mineral outcrops. In early November, the club is headed up to Franklin, NJ, to take part in a night dig for fluorescent minerals. That is on my personal bucket list of collecting trips. Alas, our family will be at multiple marching band activities that day. Nevertheless, you should all join Katy and likely Ken Reynolds as the club heads up to visit one of our area's truly exceptional mineral locations. This will be our final club-sponsored field collection opportunity of the year, so don't miss out! If you need to track down a shortwave UV light before heading out, then feel free to ask Ken or me for some recommendations.

We had a great club auction in October, with lots of minerals and fossils finding homes with new owners. Participation was great, and we had five new people

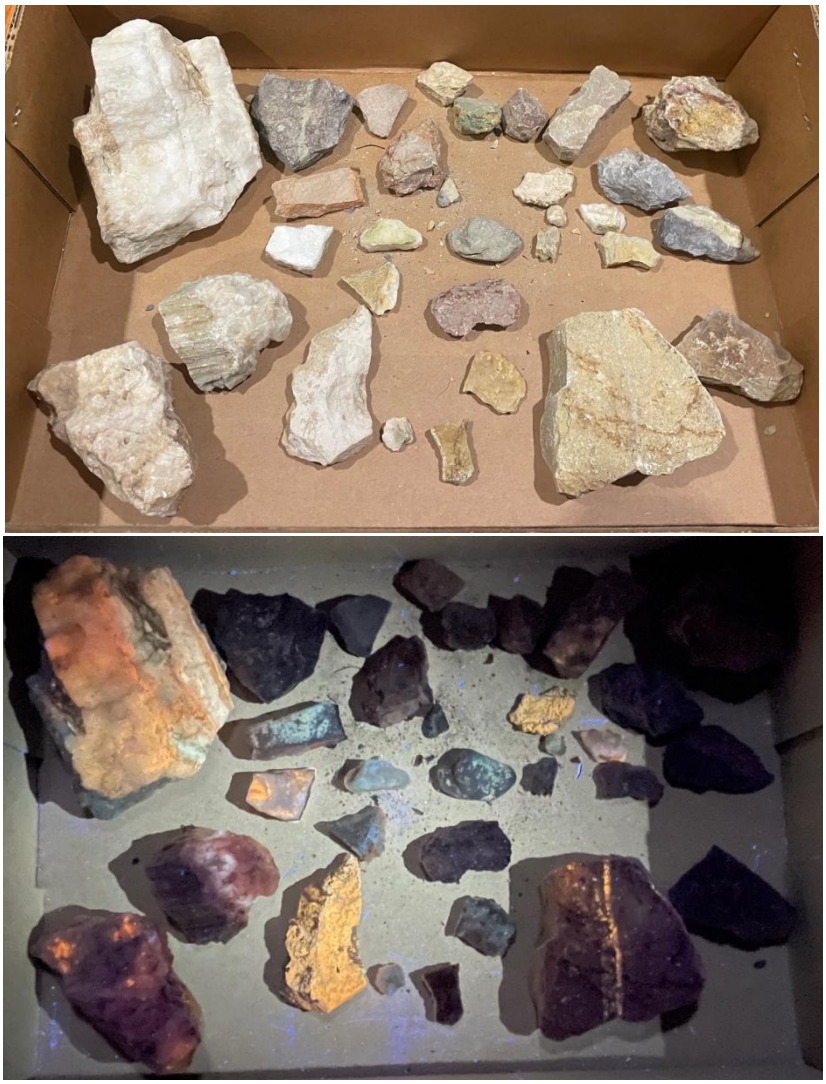


Figure 3—*Self-collected mineral specimens from the western Utah mountains. The upper image is in visible light and the lower image in MWIR UV. Several minerals fluoresce a pale orange, likely from calcite. I especially liked the one in the lower right with the stripe of orange cutting through the sedimentary layers.*

come, with several joining the club that night! These are all signs of a vibrant and healthy club, and I hope you enjoy seeing all this energy as much as I do.

In November, besides the discussion about show logistics, we are welcoming our own Maria Nopo to talk about minerals of Peru. I'm looking forward to that and must admit that Peru is on my bucket list of places to visit before I get too old or lazy to make it. Maybe this will be an inspiration to get something on the calendar. We plan to go out to dinner ahead of November's meeting to share a meal with Maria and begin the early. Look for details elsewhere in this newsletter.

NVMC club members checking out the auction lots at the October 2025 NVMC Club Auction.

This is the busiest month of the year for the club, with a field trip coming up, a great November program, and our annual show. Try to make as much as you can and enjoy all that the NVMC has to offer. In the meantime, be thankful for all the opportunities we have to gather together and talk about rocks and minerals!

Jason

Order Your Club Name Tag

by Jason Zeibel, NVMC President

I am placing another order for NVMC name tags to arrive in time for our upcoming club show on November 22-23. If you're unfamiliar with our name tag, the photo at right shows an example. The cost is $15, payable to NVMC on delivery. I will take orders via email and up to and at the next club meeting on November 3. I will put in the order the day after the November meeting and hopefully have them at the show.

Just to make sure that I have not missed anyone who asked previously for a name tag, please assume that I lost your previous request and send me an e-mail at president@novamineralclub.org. Include the exact spelling of your name and what you want for your location (such as Clifton, VA). Alternatively, you can sign up on the name tag order sheet at our November club meeting.

Mineral Show Coming Up
November 3 Program

For our NVMC meeting on **November 3, 7:30 p.m.**, we will meet at the Dunn Loring Fire Station, 2148 Gallows Road, Dunn Loring, VA. You can also join us on Zoom at https://tinyurl.com/ycx7tf8j.

We will meet for dinner beforehand at 5:30 p.m. at the Inca Social Club in the Dunn Loring Metro complex. The Metro parking garage costs $5 and is a bit of a walk, but limited street parking with parking meters is nearby, as is 2-hour free parking at the Harris Teeter parking lot across the street. If you are joining us, please let Vice President Craig Moore know at vicepresident@novamineralclub.org.

We will discuss the upcoming club show on November 23-24. Show Chair Tom Taaffe will lead the discussion. Please volunteer by clicking here.

In addition, our own Maria Nopo, a junior club member, will give a presentation on the mines and minerals of Peru. Maria, a high school sophomore in Maryland, has been interested in minerals since kindergarten and is considering studying geology in college. She will give a general overview of the geology and history of mining in Peru, then delve deeper into popular mines and mineral samples that are unique to the country. She hopes to show samples.

Club Show Coming Up!

November 22-23, 2025

by Tom Taaffe, Show Chair

The NVMC is holding our 33rd Annual Gem, Mineral, and Fossil Show this fall at George Mason University (GMU) in Fairfax, VA. The show will be on November 22-23 and take place in Dewberry Hall, Johnson Center Building, on GMU's Fairfax campus. This event has ongoing sponsorship by GMU's Department of Atmospheric, Oceanic and Earth Sciences; we introduce a new GMU liaison in the person of Dr. Jules Goldspiel, an assistant professor in the department.

Show hours will be from 10 a.m. to 6 p.m. on Saturday, November 22, and from 10 a.m. to 4 p.m. on Sunday, November 23. Admission will be $6 for adults, $4 for seniors (65-plus years old), and $3 for teens (13-17 years old). Admission is free for children 12 and under who are accompanied by a parent. Admission is free for GMU students, faculty, and staff with ID. Scouts in uniform get free admission as well.

Show volunteers needed!!

Staffing the Show

We will use **Signup Genius** to recruit volunteers and assign show tasks. Please click on the link for our Signup Genius site and sign up! What follows are ways that NVMC members can help with this year's show.

First, we need more than four club volunteers to help with **Friday night setup** on November 21. It starts with volunteers bringing items from the club's storage unit to GMU's Johnson Center. Volunteers help set up the Kids' Activity Room and perform other tasks, such as helping to assemble exhibit cases. Volunteers are also needed to put directional signs around campus to point showgoers to designated show parking in GMU's Lot A. Other volunteers help dealers at the loading dock unload their goods, a process that needs to go smoothly.

You can also volunteer to help during actual show hours on **Saturday and Sunday**. For example, we always need volunteers for the **Kids' Activity Room**. This job entails administering quizzes and rock-related puzzles, and awarding free specimens to kids who earn them. It also includes fielding questions and helping with mineral and fossil identification. The Kids' Activity Room can get a little crazy at times, but it's lots of fun and very worthwhile. Feel free to contact John Weidner at jfweidner@gmail.com if you have questions.

Scenes from our annual club show in November 2023. Photos: Tom Taaffe.

We always need volunteer help at the **admissions table**. If several club members take a shift or two, it makes the process less chaotic and more efficient. If you are interested in helping and have questions, please let Roger Haskins know at treasurer@novamineral.club.

When the show ends on Sunday, we will need volunteers to help with **teardown**. We need volunteers to help pack up the Kids' Activity Room and gather all

the club equipment and gear. This includes disassembling exhibit cases and club banners and retrieving campus directional signs. We will need many helping hands and several vehicles to bring it all back to our nearby storage unit.

Campus Parking Directions

If you are coming to help out on Friday, please use this link (https://www.offstreet.io/events/R5I4CJWH) to park in campus lot A. If you need to unload on Friday, then use the left two bays before parking in lot A. A campus event on Friday night starts at 5:30 p.m., so please arrive before then to avoid complications. There will be no shuttle from the parking lot on Friday.

If you are coming on Saturday/Sunday, please use this link (https://www.offstreet.io/events/CFO0UQPD) to register your car. You can park in lot A, and you only need to register once for both days. A shuttle will run from the parking lot during the hours when the show is open to the public.

Donating Specimens for Kids

You can further contribute to the show by donating mineral and fossil specimens for our kids' mines in the Kids' Activity Room. The specimens should be suitable for children, nothing too big or small (1-3 inches in size and about 1-4 ounces in weight). The specimens should be somewhat interesting and somewhat attractive and hopefully have some educational value. No junk please.

Donated specimens should not be toxic, sharp, splintery, or otherwise dangerous. They would also be best in their natural unpolished state. Specimens from nearby localities are great choices, such as prehnite, amazonite, amethyst, and garnet.

Specimens for Door Prizes/Silent Auction

We typically announce and award door prizes to both kids and adults every hour of the show on Saturday and twice more early on Sunday morning. (Door prize drawings end after Sunday's Silent Auction begins.) We depend on club member contributions for both door prizes and the Silent Auction.

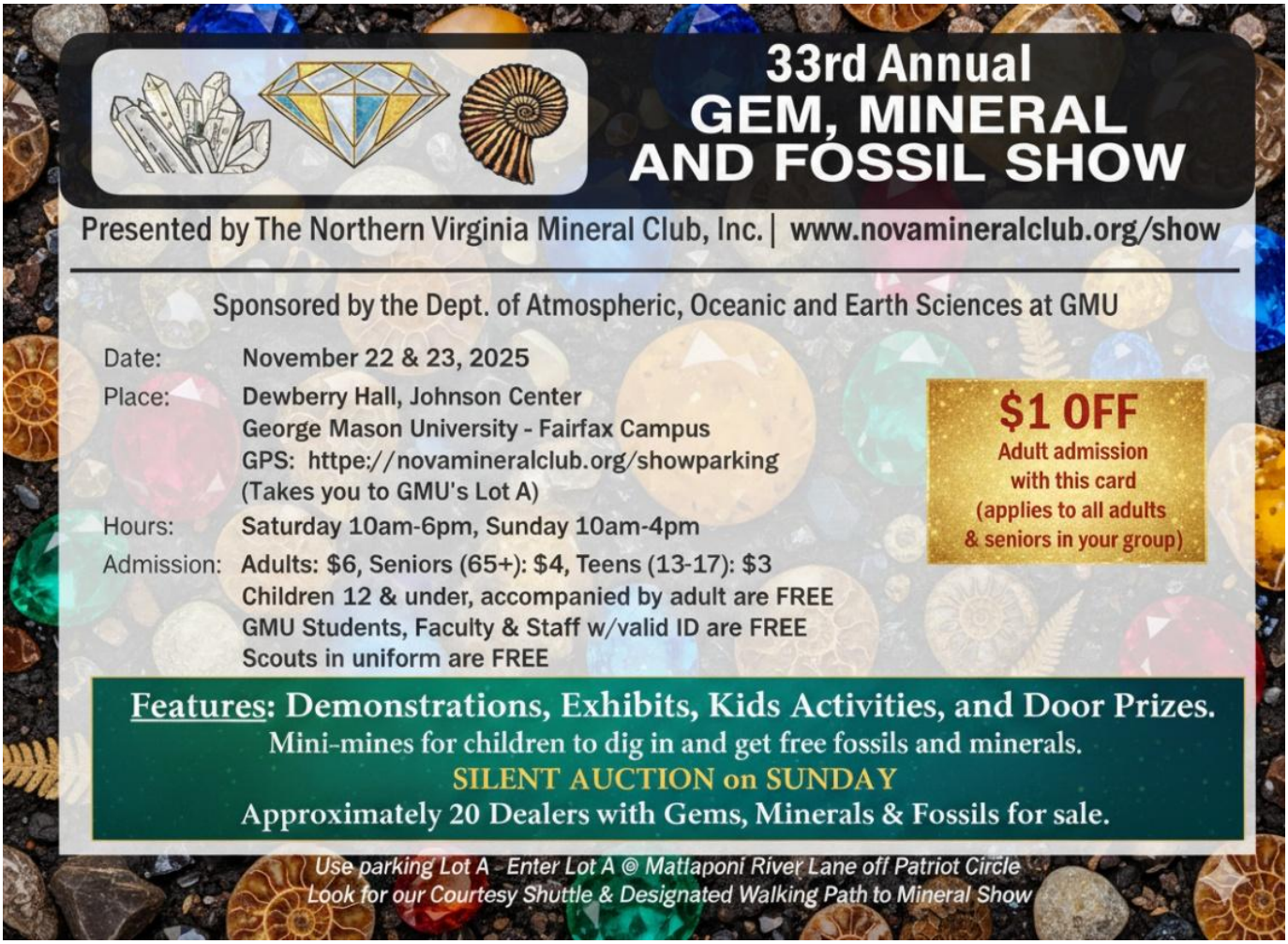
If you have specimens to donate that are suitable for either purpose, please bring them to an in-person club meeting (at the Dunn Loring Fire Station) and hand them directly to a club officer. If that is impractical, please contact one of the two club members who will be organizing the Silent Auction and door prizes, Craig Moore at crrocks77@icloud.com or Jeff Guerber at jeff@guerber.net. You can also contact Show Chair Tom Taaffe at rockcllctr@gmail.com.

2025 Gem, Mineral, and Fossil Show: Participating Dealers

- R and L Minerals, Ron & Linda Tonucci, Waldorf, MD
- Jon Feigin, Old Bridge, NJ
- Crystal Luxe Lighting, Aldeane Josephs, Bethesda, MD
- Arrowwood Minerals, Dick & Mary Ertel, Lexington, VA
- Bob Farrar, Bowie, MD
- Alan's Quality Minerals, Mount Laurel, NJ
- The Garnet Group, Casper Voogt, Sterling, VA
- Geosol Imports, Rob Evans, Hawley, PA
- Hartstein Fossils, Gene Hartstein, Newark, DE
- Dave Hennessey, Woodbridge, VA
- Ken Reynolds, Herndon, VA
- KBT Minerals & Fossils, Tom Taaffe, Vienna, VA
- The Mineral House, Tom & Pam Kottyan, Bucyrus, OH
- Broken Back Minerals, Eric Meier, Wilmington, DE
- Andy Dietz, Ashland, VA
- Stone Soul Crystals, Jere Myers & Lee Anne Myers, Queenstown, MD
- Ken Rock, Rock's Rocks & Minerals, Oakton, VA

Exhibit Cases

Club President Jason Zeibel is hoping that our 2025 show can accommodate a few more exhibits. If you are interested in designing and providing an exhibit, please contact Jason at president@novamineralclub.org or Tom Taaffe at rockcllctr@gmail.com and let us know



of your interest and what your subject matter would be.

Getting the Word Out

You can volunteer to help promote our annual show and really get the word out. We always need help with show advertising and promotion. We will, of course, mail postcards to previous attendees, and we do post our show on some rockhound show calendars; but we really could use much more help.

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

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

GeoWord of the Day

(from the American Geoscience Institute)

mechanical weathering

The process of weathering by which frost action, salt crystal growth, absorption of water, and other physical processes involving no chemical change break down a rock into fragments. Cf.: chemical weathering. Syn.: physical weathering.

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

The Rocks Beneath Our Feet

Geology of Holmes Run Gorge, Part 2: The Tectonic Backstory

by Hutch Brown

On August 30, about a dozen NVMC members joined a geology walk in the gorge formed by Holmes Run in Alexandria (fig. 1). I helped lead the group and wrote an article in the October 2025 issue of this newsletter describing the rocks we saw in the gorge.

We saw two main bedrock types (fig. 2), one metamorphic (Indian Run sedimentary melange) and the other igneous (Occoquan granite). In addition, the gorge has two smaller bedrock types, both igneous (Falls Church tonalite and muscovite monzogranite). The rocks are all roughly the same age, originating at about the same time under similar circumstances.

So what's their geologic backstory?

Plate Tectonics

A fundamental process of geology is called plate tectonics, from Latin *tectonicus*, "pertaining to building." It's based on the theory of continental drift, according to which Earth's crust is made up of rocky continental and oceanic plates (the lithosphere) overlying a zone of viscous magma (the asthenosphere) (fig. 3). Convection currents in the magma drive the overlying plates into, past, and away from each other over geologic time. Colliding plates form mountains: a classic example is the Himalayas, formed by a head-on collision between the Indian and Eurasian Plates.

When an ocean closes and tectonic plates collide, one plate slides under the other in a process called subduction (fig. 3). Friction produces heat that melts the subducting (diving) plate as it descends into the asthenosphere, sending up plumes of magma. Erupting on the seafloor, the lava forms an arc (curved line) of volcanic islands. Ahead of the islands, the colliding plates form a marine basin and a deep-sea trench (such as the Marianas Trench in the Pacific Ocean today). Sediments scraped up from the seafloor and eroded from the islands accumulate in the trench and basin, hardening over time into sedimentary seafloor rock. As the collision continues, the advancing plate pushes up the seafloor rock, thrusting it onto the continental plate. Under tremendous pressure from the colliding land masses, the rock buckles, folds, melts, and metamorphoses, ultimately forming mountains.

Figure 1—*Holmes Run Gorge at Dora Kelley Nature Park in Alexandria. All photos: Hutch Brown.*

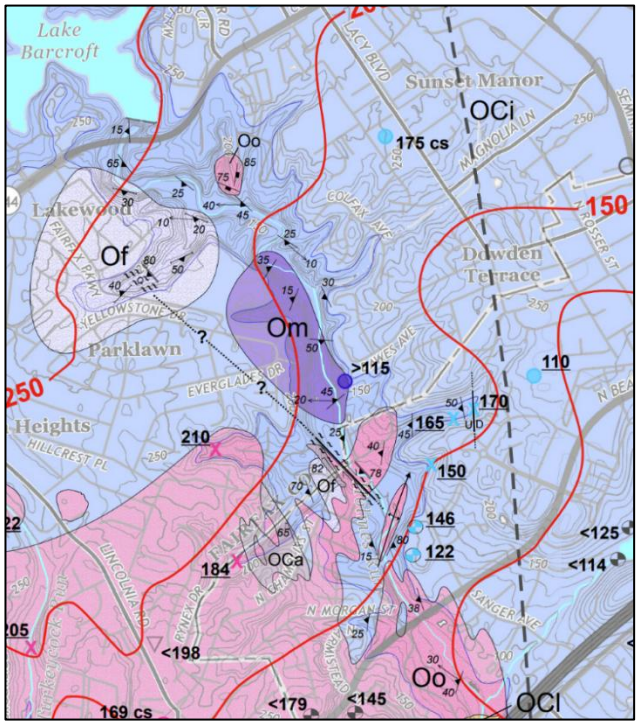


Figure 2—*Detail of a geologic map showing Holmes Run Gorge (along the blue line of Holmes Run) from Lake Barcroft (upper left) to I-395 (dark diagonal, lower right).* **OCi** *(blue) = Indian Run sedimentary melange;* **Oo** *(pink) = Occoquan granite;* **Of** *(mauve) = Falls Church tonalite;* **Om** *(purple) = muscovite monzogranite;* **OCa** *(light gray) = Accotink schist. Source: Fleming (2015).*

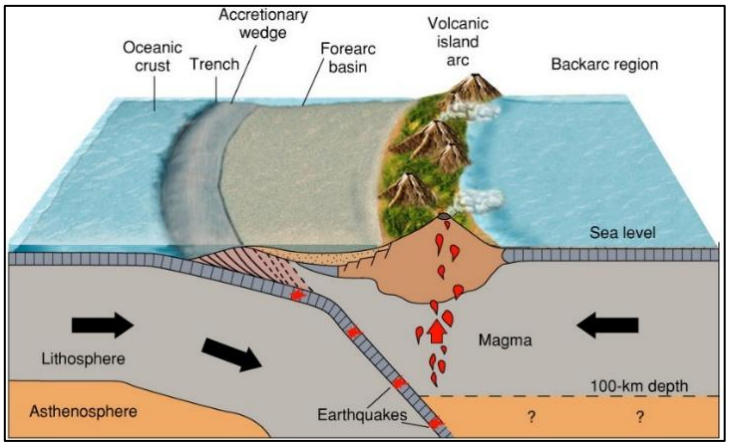


Figure 3—*Tectonic plate subduction. When plates collide head-on, one dives under the other in a subduction zone. As the subducting plate melts into the asthenosphere, it sends plumes of magma up to the surface, where lava erupts in volcanoes, creating a volcanic island arc. Where the plates converge, they form a trench and forearc basin; both gradually fill with materials scraped up from the plates and emitted or eroded from the islands. Source: Herman (2013).*

Figure 4—*About 490 million years ago, the southern part (the Taconian Terrane) of a tectonic plate approaches proto-North America (red arrow), closing the remnant Iapetus Ocean. Source: Herman (2013).*

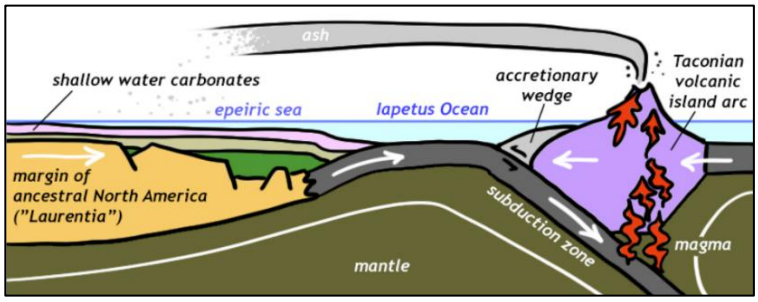


Figure 5—*Formation of the Taconian volcanic island arc and forearc basin. As the advancing Taconian Terrane slid over the continental margin, the subducting continental crust dove into the asthenosphere and melted, sending plumes of magma rising to the surface and erupting to form a volcanic island arc. Marine sediments accumulated in the deep-sea trench ahead of the arc (the accretionary wedge), hardening over time into sedimentary seafloor rock. Some magma bodies never reached the surface but cooled and hardened deep underground into plutonic igneous rock. Source: Bentley (2020).*

Taconian Orogeny

About half a billion years ago, Earth's continental plates were slowly converging into a single supercontinent called Pangaea (pronounced pan-JEE-uh). A plate edged by a line of islands, known as the Taconian (or Taconic) Terrane, was slowly approaching proto-North America (fig. 4, red arrow), closing the Iapetus Ocean, predecessor of the Atlantic.

The advancing terrane slid over the continental margin (fig. 5), which subducted and melted into the asthenosphere. The melting rock sent up bodies of magma that reached the surface and erupted to form the Taconian volcanic island arc. The advancing plate scraped up sediments from the subducting continental plate; augmented by volcanic ash and material from the eroding volcanic islands, the sediments thickened and hardened into sedimentary seafloor rock.

In the process, some of the rising bodies of magma intruded the seafloor rock deep underground, then cooled to form igneous rocks like granite and tonalite. As the Taconian Terrane continued to advance, it uplifted the seafloor rocks in the trench and marine basin, along with the associated igneous rocks, and pushed them onto the continent, followed by the Taconian islands with their own igneous intrusions (fig. 6).

The tremendous heat and pressure from the colliding plates folded, buckled, and fractured the rock, partially melting some of it and raising a mountain chain rivaling the Alps today (fig. 6). The Taconian Orogeny (mountain-building event) lasted for about 25 million years, from about 474 million to about 450 million years ago. The tremendous heat and pressure metamorphosed the sedimentary seafloor rock, producing the major metamorphic rock types we have in northern Virginia today, including the Indian Run sedimentary melange of Holmes Run Gorge.

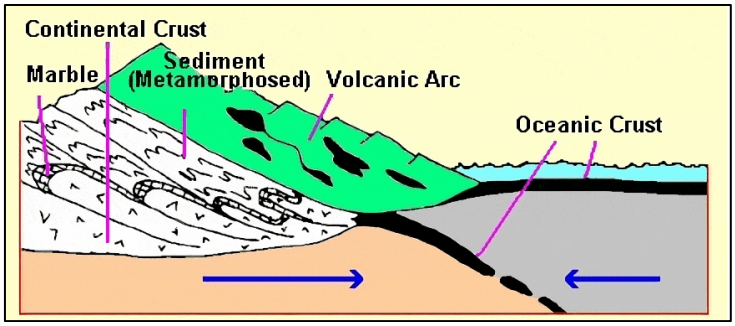


Figure 6—*The Taconian Orogeny (474-450 million years ago) raised a great mountain chain across our area. The orogeny uplifted and metamorphosed sedimentary seafloor rock and left buried chambers of igneous rock (black). Source: Wikipedia.*

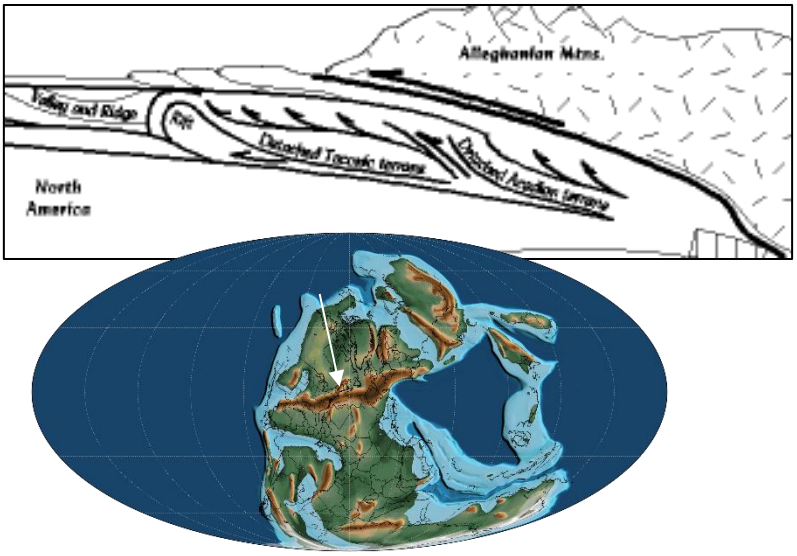


Figure 7—*During the Alleghanian Orogeny (320-280 million years ago) (top), proto-Africa slid over proto-North America, creating a huge mountain range (bottom, arrow). In the process, the orogeny broke off Taconian bedrock pieces and moved them inland (top, center arrows), emplacing them in the Piedmont as we know it today. Sources: Fichter and Baedke (1999), top; Wikipedia, bottom.*

In effect, the Taconian Orogeny emplaced ancient island and seafloor rock, both igneous and metamorphic, on the proto-North-American continent under a huge mountain range, forming the basis for the Piedmont Province. The deeply buried bedrock included not only the Indian Run sedimentary melange shown on the geologic map in figure 2 (**OCi**, blue) but also the Occoquan granite (**Oo**, pink), Falls Church tonalite (**Of**, mauve), and muscovite monzogranite (**Om**, purple).

Mountain chains weather away within a few tens of millions of years, leaving behind their buried roots. By about 420 million years ago, the Taconian Mountains were gone. In carving its gorge over the last few million years, Holmes Run has exposed some of the igneous and metamorphic roots of the ancient Taconian mountain chain in the Piedmont.

But the tectonic backstory of Holmes Run Gorge doesn't end there.

Alleghanian Orogeny

About 320 million years ago, proto-Africa collided with proto-North America to complete the formation of the supercontinent Pangaea (fig. 7). What geologists call the Alleghanian Orogeny raised mountains as high as the Himalayas today. The tremendous pressure caused by the collision broke off pieces of the underlying bedrock and pushed them dozens of miles inland on great, nearly horizontal thrust faults (fig. 7, top). The Alleghanian Orogeny thus shaped the Piedmont Province by emplacing the Taconian bedrock types where we see them today.

In the process, the transported rocks came under enormous pressure, in some cases initiating metamorphism. Some metamorphic rock types in the Piedmont have undergone multiple episodes of metamorphism: Accotink schist (fig. 2, **OCa**, light gray), for example, derived from shale, a sedimentary rock; under great heat and pressure, the shale metamorphosed first into slate, then into phyllite, and finally into schist.

Geologists believe that Indian Run sedimentary melange has undergone only a single episode of metamorphism, so it was presumably transported by the Alleghanian Orogeny more or less intact. The Alleghanian Orogeny metamorphosed much of the granitic rock in the Blue Ridge Province into gneiss, yet most Occoquan granite seems to have been unaffected by Alleghanian transport. Still, some of both the Indian Run rock and the Occoquan granite shows signs of intense tectonic pressure.

Signs of Metamorphism

Curiously, the nature trail guide for Dora Kelley Nature Park identifies an outcrop of bedrock as schist and metagraywacke, even though the geologic map and pieces broken off with a rock hammer suggest that it is all Indian Run sedimentary melange (figs. 2; 8, top). The typical Indian Run rock has none of the characteristics of schist, such as a mica sheen and foliation (reorientation of the crystals into parallel planes).

Figure 8—*Examples of Indian Run sedimentary melange in Holmes Run Gorge.* ***Top:*** *A typical Indian Run specimen shows none of the characteristics of schist, such as foliation and a mica sheen.* ***Bottom:*** *A less usual Indian Run rock shows a sheen from tiny muscovite crystals and signs of foliation, such as flaking in parallel sheets.*

But not all Indian Run sedimentary melange is typical. In the alluvium along Holmes Run, I found multiple samples of Indian Run rock with both foliation and a mica sheen (fig. 8, bottom). In fact, the geologic map for the Annandale Quadrangle (which contains Holmes Run Gorge) describes Indian Run sedimentary melange as "poorly to well foliated." I saw relatively little foliation; in any case, the map classifies the Indian Run rock as sedimentary melange (not schist), and it makes no mention of either schist or metagraywacke anywhere in Holmes Run Gorge.

Some Occoquan granite shows similar signs of metamorphism. On a nature walk last spring in Fairfax's Accotink Gorge, Sue Marcus pointed out lineation in the gorge's Occoquan granite due to incipient metamorphism (see the May 2025 issue of this newsletter). Some Occoquan granite in Holmes Run Gorge has the same lineation—or "quartz-rodding," as the geologic map for the Annandale Quadrangle calls it.

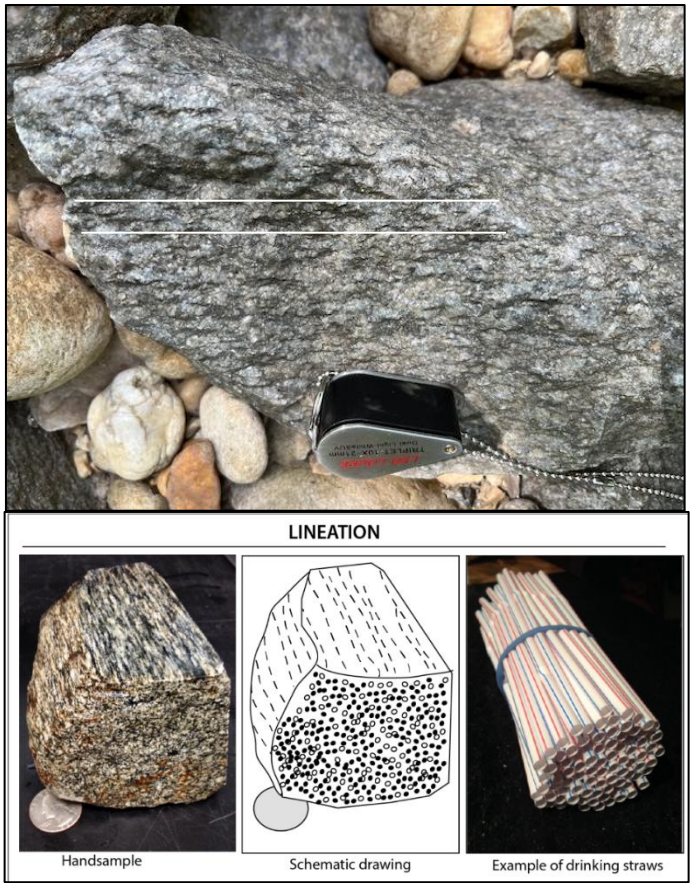


Figure 9—*Lineation in granite.* ***Top:*** *Occoquan granite in Holmes Run Gorge shows horizontal lines in the rock (white lines for illustration) where tectonic pressure reoriented the minerals in the same direction.* ***Bottom:*** *Images showing lineation ("quartz-rodding") in granite, resembling a bundle of straws. Source (bottom): Johnson et al. (2017).*

Figure 9 (top) shows lineation (quartz-rodding) in Occoquan granite along Holmes Run. Tectonic pressure has realigned the granite components into parallel rods stacked like straws in a bundle (fig. 9, bottom). The pressure might have come from the Taconian Orogeny or from transport during the Alleghanian Orogeny. For whatever reason, the pressure eased, keeping Occoquan granite from metamorphosing into gneiss—and Indian Run sedimentary melange from becoming a higher grade of metamorphic rock (such as phyllite).

Complex Story

Unlike Accotink Gorge, which has a single bedrock type (Occoquan granite), Holmes Run Gorge has multiple types, both igneous and metamorphic. The Taconian Orogeny, a mountain-building event that took place 474-450 million years ago, accounts for them all. The metamorphic rocks in the Virginia Piedmont—schists, phyllites, and more—originated in seafloor rock adjacent to the Taconian volcanic island arc, and the igneous intrusions came from rising magma, some of which erupted to create the volcanic islands.

Although the Taconian Orogeny accounts for the bedrock, it doesn't explain its placement. Our area's bedrock types are typically upturned along thrust faults (fig. 10), suggesting that they were originally flat layers later upturned by tectonic forces. The Alleghanian Orogeny (320-280 million years ago), when proto-Africa collided with proto-North America, had the necessary tectonic force to fracture, transport, and emplace the upturned Taconian bedrock (figs. 7, top; 10). The orogeny broke off chunks of bedrock and moved them dozens of miles inland along thrust faults, pushing them up to where we find them in the Piedmont today.

So that's why Indian Run sedimentary melange and Occoquan granite are the two main bedrock types in Holmes Run Gorge today. But why do they make up so little of the alluvium? Why is the Holmes Run alluvium mainly quartz and sedimentary rock?

Part of the answer is that igneous and metamorphic rocks in the alluvium weather away so quickly—but that's not all. By about 230 million years ago, Pangaea was breaking apart as Africa pulled away from North America, forming the Atlantic Ocean. Continental rifting along Bull Run Mountain created a great rift valley in Culpeper Basin, which filled with sediments that hardened into rock. The subsequent lack of tectonic activity allowed our area to erode into a flat and featureless plain drained by meandering rivers.

Beginning about 140 million years ago, the rivers brought sediments from as far away as the Blue Ridge Province. The sediments contain pebbles and rounded river rocks, mostly quartz and sedimentary rocks from Culpeper Basin. The rocks have eroded out of the sediments and washed into the Holmes Run alluvium, forming a rich compendium of sandstones, siltstones, quartzites, quartzes, and other rocks from far across our area. The alluvium also contains a lesser component of local igneous and metamorphic rocks.

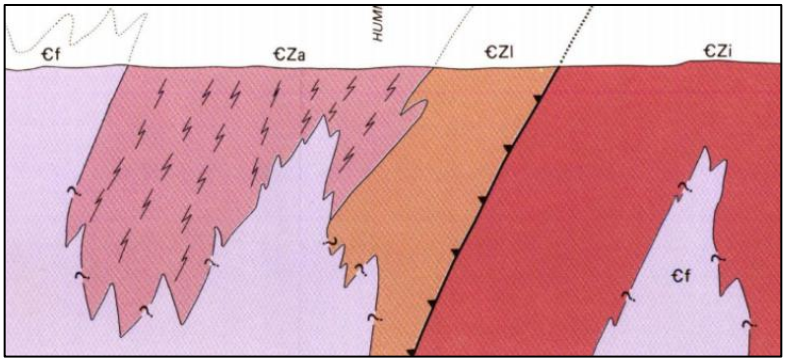


Figure 10—*Upturned layers of metamorphic rock in the Annandale Quadrangle.* **Cf** *= Falls Church tonalite;* **CZa** *= Accotink schist;* **CZl** *= Lake Barcroft metasandstone;* **CZi** *= Indian Run sedimentary melange. Source: Drake and Froehlich (1986).*

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

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 Show: Oaks, PA
2 Show: Oaks, PA	3 NVMC mtg	4 Election Day	5 MSDC mtg	6	7	8 Show: Richmond, VA; Symp: W Chester, PA
9 Symposium: W Chester, PA	10 GLMSMC mtg	11 Veterans Day	12	13	14 Shows: Raleigh, NC; Lebanon, PA	15 Shows: Raleigh, NC; Lebanon, PA
16 Shows: Raleigh, NC; Lebanon, PA	20	21	19	20	21 NVMC show (setup)	22 NVMC show
23 NVMC show	24	25	26 MNCA mtg	27 Thanksgiving	28	29

Event Details

1-2: Oaks, PA—Annual show, Tuscarora Lapidary Society; Greater Philadelphia EXPO Ctr, 100 Station Ave; Sat 10-6, Sun 10-5; adults $11, kids under 12 $1, Scouts in uniform with Scoutmaster free; info: Linda Green, tuscaroralapidary@gmail.com, www.lapidary.org.

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

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

8: Mechanicsville, VA—Annual Rock Sale and Swap; Richmond Gem & Mineral Society; St. Paul Lutheran Church, 8100 Shady Grove Rd; 9 a.m.-3 p.m.; free.

8-9: West Chester, PA—Symposium for Mineral Collectors; Friends of Mineralogy, PA Chapter; Merion Sci Ctr, W Chester Univ; Sat: talks, auction; giveaway table; Sun: field trip to Phoenixville area sites; $20 registration, kids free; info, reg https://www.rasloto.com/FM/category/whats-new/.

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

14-16: Raleigh, NC—Show, Treasures of the Earth, Inc; North Carolina State Fairgrounds, 4285 Trinity Rd; Fri 12-6, Sat 10-5, Sun 10-5; adults $8, 16 and under free; info: Ellen White, 804-642-2011, Ellen.White@TreasuresOfTheEarth.com, www.TreasuresOfTheEarth.com.

14-16: Lebanon, PA—Show, Mid-Atlantic Gem and Mineral Ass'n; Expo and Fairgrounds, 80 Rocherty Rd; Fri 12-6, Sat 10-5, Sun 11-4; adults $6, kids under 12 free; info: Teresa Schwab, 301-807-97, eventcoordinator@gem-show.com, www.gem-show.com.

22-23: Fairfax, VA—NVMC/GMU Club Show (details on page 14).

26: Burke, VA—Micromineralogists of the National Capital Area; http://www.dcmicrominerals.org/.

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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Arlington, VA 22203
hutchbrown41@gmail.com

RENEW YOUR MEMBERSHIP!

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

OR

Bring your dues to the next meeting.

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

2025 Club Officers

President: Jason Zeibel
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Webmaster: Casper Voogt
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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.*