THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Next meeting: October 7 Time: 7:30 p.m.

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



Cuprite

Tsumeb Mine, Tsumeb, Namibia

Source: Wikipedia *Photo: Rob Lavinsky*

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October Meeting Program:

Fall Club Auction

details on page 10

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Mineral of the Month
Cuprite

by Sue Marcus

For our October Mineral of the Month, let's examine cuprite. Cuprite presents a challenge for me because it is a relatively common mineral and lots has been written about it—so what can I add? I will try to hit some highlights and be relatively succinct. If you don't have a cuprite specimen in your collection, perhaps you will decide to add one—or more.

Cuprite is a copper oxide, Cu_2O. It has been known by many names reaching back into antiquity since it occurs in many copper deposits that were worked for thousands of years. The current moniker, cuprite, was bestowed by Wilhem Hardinger, who also described chalcotrichite and linked it to cuprite.

Deep red, especially when backlit, cuprite can look metallic silver to submetallic. The red color can change unless the mineral is protected from bright light, according to some sources. Color contrasts between red cuprite and green malachite, blue azurite, or white calcite create attractive specimens. Other specimens display cuprite and native copper or the thin, delicate fibrous crystals of cuprite called chalcotrichite. Some cuprite specimens display well in any orientation, having no ugly reverse side.

Localities

United States. Arizona's copper mines have provided the finest U.S. cuprite specimens, from micros to macros. Cuprite crystals ranging from chalcotrichite (the "hairy" or fibrous form of this mineral) to deep-red and silver-red microcrystals, to bright-red crystals on contrasting white calcite. Cuprite occasionally crystalized on native copper, usually forming arborescent specimens. Some cuprite crystals are coated with malachite. I'm not a micromounter, but micro cuprites from the Arizona deposits are beautiful and like nothing I've seen in other minerals. Many exhibit bright-red cubic (or modified cubic) crystals in groups that look like a creative Lego artist made them. Or maybe think of a geometric work of modern art composed of red blocks.

Two more areas where cuprite crystals were found in copper deposits are the Bisbee district and the Ray Mine. Both areas produced similar styles of specimens. People familiar with the localities can probably spot differences.

Happy Halloween!

Northern Virginia Mineral Club members:

Our next club meeting will be in person at the Dunn Loring Fire Station, 2148 Gallows Road, on **October 7, 7:30 p.m.** We will not meet for dinner beforehand but will offer pizza at our meeting place.

After a brief business meeting, we will hold our Fall Club Auction (see details on page 10), so we won't have a remote option for attendance through Zoom.



Cuprite with copper, Bisbee, Cochise County, AZ. Source: Mindat; photo: Rob Lavinsky.

Bisbee is a famous mining town southeast of Phoenix. Several mines produced fine cuprite specimens. The Copper Queen and Irish Mag Mines are best known for cuprite, although specimens were also collected from



Cuprite (var. chalcotrichite) on copper, Ray Mine, AZ. Source: Mindat; photo: Stephan Koch.

other Bisbee mines, including the Campbell, Cole, and Southwest Mines.

A 1-centimeter (0.4-in) crystal is unusually large for Arizona cuprite. A 35-centimeter (14-in) specimen of cuprite crystals on copper came from the Irish Mag. Despite mineralization, oxidation, and other geologic processes, some Bisbee specimens exhibit cuprite crystals and fossil crinoids or fossil bivalves.

Another Arizona cuprite source is the Ray Mine, southeast of Tucson near the Mexico border. The Ray Mine, currently owned and operated by ASARCO, started in 1880. It was an underground mine until 1955. After a period of dormancy, ASARCO purchased the mine from Kennicott and began developing an open-pit mine. The very large pit eventually required moving the town of Ray because mineral extraction followed the orebodies.

Mineralization along faults concentrated fluids and offered a particularly good geologic environment for cuprite crystals to grow. Arborescent forms pseudomorphing copper may be the most abundant type of Ray cuprite specimens. Some of these specimens are mostly copper, with cuprite later adorning them; others show tiny cuprite crystals overgrowing most of the copper. Cuprite has also been found as distinct euhedral translucent deep-red crystals up to about 1.5-centimeters (0.6 in) in size, silvery metallic crystals, and tiny (1- to 5-millimeter (0.04-0.2-in)) lattices.

At the New Cornelia Mine, near Ajo, alluring fiery red chalcotrichite specimens were found.

The Chino or Santa Rita Mine in Grant County, NM, produced lustrous cuprite crystals. Cuprite specimens do not seem to be abundant, although those pictured on Mindat include some beautiful, aesthetic examples. One example is a 10.5-centimeter (4-in) specimen of crystalized copper coated with drusy cuprite. Larger cuprite crystals have also been found at the mine, such as a 3.8-centimeter (1.5-in) piece completely covered with 0.2-centimeter (0.08-in) cuprite crystals. Arborescent copper and cuprite specimens are noteworthy from this locality. Small amounts of chalcotrichite were also recovered.

The copper deposit consists of a low-grade porphyry in which copper minerals are disseminated in granodiorite stocks. Enrichment of the copper occurred when the tops of the stocks weathered at or near the surface. Water mixed with pyrite, creating acidified fluids, came in contact with the water table, changing the fluid chemistry and forming economic—and sometimes collectible—minerals through a process known as supergene enrichment. Originally mined by Native Americans and then Spaniards, the deposit was developed on a larger scale by open-pit mining starting in 1910. Mining ceased by 2005 but was restarted in 2011. Mining has been active except for a halt from April 2020 to January 2021 due to the covid-19 pandemic. The Santa Rita Mine was named for a nearby town subsequently eliminated by the mine. Most specimens seem to have been found in the 1950s-60s.

Cuba. Few of us have mineral specimens, particularly crystals, from Cuba. The El Cobre Mine exploited a polymetallic deposit, primarily extracting copper. El Cobre was reported to be the first mine worked by Europeans in the so-called New World. Mining began in 1532 and ceased in 1988, presumably with extraction occurring intermittently between those dates. Few cuprite specimens are known, but a beautiful 3.1-centimeter (1-in) specimen with a euhedral cuprite crystal that appears to be 1 centimeter on an edge is pictured on Mindat.

Mexico. Many collectors get stars in their eyes when the Milpillas Mine is mentioned. The mine, located in

Sonora, has produced fabulous azurite crystals—easily among the best in the world.

It is not surprising that this copper mine would also have fine cuprite crystals. Individual lustrous metallic dark-red cuprite crystals on matrix extend to 2.4 centimeters (0.9 in) in size. An odd 18-centimeter (7-in) "lump" of massive cuprite studded with euhedral crystals is shown on Mindat, along with other examples of this style of crystallization, seemingly unique to the Milpillas deposit.

Another odd form, shown on Mindat, has flattened, stacked cuprite crystals. The crystals may have been partly dissolved by later fluids or may have formed this odd habit during original deposition. Some fine micromounts have also come from this locality. Most cuprite specimens were extracted in about 2012-16. At least some crystals were reported to have formed in fractures within the sulfide orebody.

The economic mineralization of the Milpillas deposit is similar to that of Arizona's Chino Mine, described above. Supergene enrichment altered and concentrated copper and other metals by leaching a low-grade porphyry deposit. At Milpillas, there were several supergene enrichment cycles.

Cuprite was uncommon in the Mapimí region of Durango, although the rare cuprite specimens can be attractive.

Bolivia. Bolivia is richly endowed with minerals, but cuprite is rare. Cuprite has been found mainly near the town of Coro in Pacajes Province. Specimen photos posted on Mindat show cuprite pseudomorphing copper.

Chile. Chile is a major copper producer. Many beautiful copper minerals occur there, buth cuprite is not abundant. The Manto Cuba Mine in the Atacama Desert produced some lovely micros and the occasional macro specimen of cuprite crystals. The Inca de Oro district, also in the Atacama Desert, was the source of rare but lovely cuprite and copper specimens.

England. Many English mines produced a few cuprite specimens. No mine was a prolific, although the Wheal Phoenix and the Wheal Gorland in Cornwall may have produced the most specimens. "Wheal" is Cornish for working, implying mines, usually for copper or tin.

Nice macro pieces came from the Wheal Phoenix at least as recently as 1978; the British Museum purchased a piece from this mine more than a century earlier, in 1862. Another British Museum specimen shows a 4.2-centimeter (1.7-in) crystal. According to Mindat photos, the Smithsonian Institution owns a specimen with a 1-centimeter (0.4-in) cuprite crystal from the Phoenix. The Wheal Phoenix is also known as the Phoenix United Mine. Massive cuprite was an ore at this mine.



Cuprite with goethite, Phoenix United Mine, Cornwall, UK. Source: Mindat; photo: Paul De Bondt.

A 7-centimeter (2.8-in) piece from the Wheal Gorland, with crystals up to 0.6 centimeter (0.02 in) in size, is more lustrous than many others from this locality, though other specimens of similar size exist. These specimens were probably found in the 1800s. Most specimens shown on Mindat occur with copper.

The Wheal Unity and South Caradon Mines have also produced cuprite specimens. Cuprite micros from all Cornish mines are attractive and have been found in old mine areas. Chalcotrichite, particularly from the Wheal Phoenix, makes lovely bright-red micromounts. Micromounters may also want to seek specimens from Ceredigion, Wales, which show attractive color contrasts.

The New Cliffe Hill Quarry, a road gravel quarry in Leistershire, blasted through a copper-rich zone containing cuprite. Lovely micros and a few macro specimens were recovered, along with massive cuprite.

France. Chessy-les-mines (or simply Chessy), located in the Rhône department of eastern France, is a world-



Cuprite coated by malachite, Chessy copper mines, Rhône, France. Source: Mindat; photo: Jean Marie Claude.

famous locality for copper minerals, including cuprite. Azurite was first described from these mines.

Mining was intermittent. The Romans started the first known copper extraction. After a pause, mining began again in the 14th and 15th centuries. The final period of mining ceased in the 1870s, when the deposits were considered mined out.

Four phases of the deposit were identified, each named as a mine by color (black mine, yellow mine, blue mine, and red mine). Specific ore and gangue minerals were associated with each phase. Cuprite was most abundant in the red mine, though also found in the blue mine.

The ores are hosted by soda-rich dacite from the Devonian Period. Later, hydrothermal fluids altered and concentrated the ore minerals. Oxidation of the sulfide ores, possibly during the Eocene Epoch, provided a rich suite of minerals that interest collectors.

Cuprite usually forms from the oxidation of sulfide minerals. Alteration processes continue, with cuprite easily being replaced (pseudomorphed) by malachite. Less frequently, azurite pseudomorphs cuprite.

Cuprite crystals are octahedral or modified octohedra. They are usually small, with micromounts that can be exquisite. Larger crystals, up to at least 2.5 centimeters (0.8 in) in size, have been recovered.

Hopper and skeletal crystals are particularly interesting. Hopper crystals form when atoms on the external edges of the crystal faces are laid down more quickly than on the surface of the face, resulting in stepped faces that become smaller towards the center of the crystal. Skeletal crystals are a more extreme form of hopper crystals, with many of the indented "steps" or even whole crystal faces missing.

Chalcotrichite, the fibrous form of cuprite, occurs in slag from Chessy.

Thanks to the L'Arbresle-Chessy Mineralogical Association, also known as the Geological Club of l'Arbresle, some mineral collecting still occurs at Chessy. The group bought the old mines and allows collecting, possibly only by members, on specific dates. They seem like an active club with interesting activities; definitely worth a visit if you are in the area.

The Le Moulinal Mine in Occitanie has been a source of lovely cuprite micromounts. Chalcotrichite and regular cuprite were both found.

Germany. I've come to know the Clara Mine in southwestern Germany as a source of crystals of many mineral species. Add cuprite to the list of fine micromounts from there. Chalcotrichite and regular cuprite crystals form bright small specimens.

Italy. Sardinia is a beautiful Mediterranean island that is part of Italy. Mining began in prehistoric times and continued intermittently through the 19th century. One of the important metals found here was copper. Sardinian cuprite specimens may appeal to micromounters; all the ones that I found online were micromounts.

Kazakhstan. Most U.S. collectors don't have a specimen from Kazakhstan, although reviewing images of cuprite crystals from the Itauz Mine can be an inspiration. These fine cuprites may not be abundant—or affordable, at least for me—but they can be stunning. A group of stacked red octahedral cuprite crystals with a slight metallic luster forms a lovely specimen reaching 2 centimeters (0.8 in) in size on Mindat and on the Arkenstone website. The piece has crystals up to 0.7 centimeter (0.3 in) long on an edge.

Itauz is part of the larger Zhelandy (also Zhilandy) area, which itself lies within the Dzhezkazgan orefield. Overlapping orebodies in the Dzhezkazgan region extend for about 193 square kilometers (120 mi^2). The huge copper deposits were initially exploited by the armies of Genghis Khan. Faulting and folding mobilized

and concentrated the mineralization within the host metasedimentary rocks, mostly sandstone. The major ore minerals are copper sulfides, including chalcocite, bornite, and chalcopyrite. The Dzhezkazgan deposits were actively mined in the mid-2010s, but I could not readily determine their current status.

Russia. The Rubtsovsk Mine in Russia's Altai Kraj (region) is part of a massive sulfide deposit containing copper/lead/zinc, along with gold and silver. The mine was a significant source of cuprite crystals, with world-class specimens produced mostly from 2008 to 2011.

The size and perfection of the cuprite crystals from this mine give it world-class status. A 22-centimeter-long (8.7-in-long) specimen of copper and microcrystalline cuprite is for sale on one website, while another offers a partial octahedral cuprite crystal completely pseudomorphed by copper. The latter is a rare example of copper after cuprite rather than cuprite after copper. Mindat images also include a 7-centimeter (2.6-in) native copper specimen studded with lustrous cuprite crystals up to 2 centimeters (0.8 in) in size. Geological conditions in this deposit seem to have produced a chronological sequence (over an unknown period of time) for cuprite formation, followed by copper pseudomorphing or perimorphing (encasing) the cuprite and cuprite then replacing copper.

Scanning through 11 pages of cuprite images from this mine on Mindat, specimens with individual cuprite crystals measuring 2 centimeters (0.8 in) or more abound. In *Rocks and Minerals*, Levitskiy reported specimens with clusters of cuprite crystals on specimens reaching 10 centimeters (4 in) in size. A single octahedron without matrix measures 5 centimeters (2 in)—for a single crystal!

Many cuprite crystals from this locality are floaters (unattached to host rocks) that are bright and shiny but dark. Deep-red, partly translucent crystals are rarer. Perhaps exposure to light has darkened these specimens. Accents of native copper or silver add to the attractiveness of some specimens.

The Rubtsovsk deposit includes about 50 economic orebodies in the Rudny Altai geologic province. Polymetallic mineralization at the Rubtsovsk deposit is hosted in Devonian tuffaceous sedimentary rocks. Faulting caused by volcanism and other tectonic forces formed conduits for ore-bearing fluids.



Cuprite, Rubtsovsk Mine, Altai Krai, Russia. Source: Mindat; photo: Quebul Fine Minerals.

The deposit was discovered in 1970. It took until 1990 to begin bringing the mine into operation. Sources differ, but it seems that financing issues halted work until about 2006. The mine produced from 2007 through 2015, when the deposit was depleted. The best specimens seem to have been extracted in or soon after 2007, when miners encountered clay-filled pockets that protected delicate crystalized cuprite and arborescent copper. Some copper remains, so collectors may have hope for future specimens.

Democratic Republic of Congo (DRC), formerly Zaire. Many cuprite specimens from the DRC are distinctive and beautiful. The Mashamba West Mine, in Lualaba Province (formerly Katanga region), has produced many colorful minerals. It may be the most well-known source of hot-pink cobalt-bearing calcite (often called cobaltian calcite). Beautiful malachite specimens also came from this deposit.

Cuprite is part of this mine's legacy with collectors. Colorful specimens of bright- to deep-red lustrous cuprite crystals contrast attractively with combinations of bright-green malachite, aqua chrysocolla, and white calcite. Euhedral crystals a bit more than 1 centimeter (0.4 in) in size were extracted in the 1970s-90s. A 5.9-centimeter (2.3-in) single crystal also came out then. A cuprite crystal that is 7 centimeters (2.8 in) on an edge and on calcite matrix is posted on Mindat. Other DRC



Cuprite with malachite, Mashamba West Mine, Lualaba, DRC. Source: Mindat; photo: Rob Lavinsky.



Cuprite, Onganja Mine, Khomas Region, Namibia. Source: Mindat; photo: Rudolf Watzl.

mines in the Katanga Copper Belt that have produced a few nice cuprite specimens include Dikuluwe, Musonoi, Kamoto Principal, and the Kamoto East open cut. All are in the DRC's Lualaba Province.

These mines exploited mineralization in the Kolwezi Klippe. Klippe (from German *Klippe*, "sharply protruding vertical rock") is the geologic term for a remnant area of rock that has been tectonically displaced (such as the Acropolis in Athens, Greece), often with older rocks pushed over younger rocks. The Kolwezi Klippe, composed of metasedimentary rocks, was thrust over younger rocks. Dolomite and dolomitic siltstone are the most common host rocks for the copper ores. Cuprite occurred in the central part of the mineralized belt in both the upper and the lower orebodies.

The Tenke Fungurume Mine, east of the Kolwezi Klippe, also produced collectible cuprite crystals under similar geologic circumstances, though not prolifically.

Namibia. The Onganja Mine, also known as the Emke or Helen Farm 235, located northeast of Windhoek, produced lovely cuprite crystals up to 4.6 centimeters (1.8 in) in size, usually coated by malachite. One Mindat image of a partial crystal is 8 centimeters (3.1 in) in size! Malachite has not totally replaced cuprite, nor has it altered the crystallographic cuprite form. Those crystal forms may be octagonal, which is most common at other localities, although modifications of the Onganja cuprites appear to be fairly common. Some crystals are translucent red and gemmy, becoming the source material for many faceted cuprites. Chalcotrichite, rarely as inclusions in calcite, also occurred at this mine.

Unlike most sources of cuprite, which are hosted in carbonate metasedimentary rocks, the Onganja deposit consists of iron/gold/copper-rich veins in schists. The mine was active, probably intermittently, for 120 years. It is currently being evaluated for renewed mining operations. Sorry, folks, but an October 2024 field trip to this property is fully booked. The Smithsonian Institution has several fine specimens from this locality, so maybe a field trip there is more manageable.

The Tsumeb Mine and area are famous for myriad mineral species. About 489 minerals have been identified in the Tsumeb deposit, the type locality for about 72 minerals. Cuprite has been found at the Tsumeb Mine, although it is not among the most prevalent minerals there, nor are cuprite crystals from Tsumeb the world's finest.

Cuprite crystals up to 4.2 centimeters (1.7 in) in size (for a partial crystal) have been recovered. Small cuprite crystals are scattered across an approximately 12-



Cuprite covered by malachite, Tsumeb Mine, Oshikoto Region, Namibia. Source: Mindat; photo: Matteo Chinellato.

centimeter (4.7-in) specimen shown on Mindat. A few specimens exhibit both regular cuprite crystals and chalcotrichite. Micromounters can find Tsumeb cuprite to enhance their collections. Among the associated minerals are limonite, calcite, rosasite, copper, duftite, and mimetite. Chalcotrichite included in quartz crystals or cerussite produced attractive rare orange specimens. Most cuprite specimens were found in the late 1960s-80s.

Indigenous San people mined copper from what became known as the Tsumeb deposit long before commercial mining began in 1907. Commercial mining continued until 1996. Copper was the most abundant economic metal recovered, although lead, zinc, silver, germanium, gallium, and cadmium were also extracted from the ore.

Neoproterozoic dolomite (formed about 1 billion to 542 million years ago) hosts the mineralized pipe that contains the ore. The pipe was emplaced about 530 million years ago. The upper part of the pipe has been oxidized, providing mineral collectors with a wealth of beautiful minerals.

Australia. Australia is a large, mineral-rich continent, so cuprite can be expected there. Some cuprite samples are stunning, though less well known than specimens from other localities.

Crimson single crystals and small groups came from the Red Dome Mine in Queensland, near Mungana. Backlighting always helps, although many Red Dome specimens are partly translucent and gemmy. Individual cuprite crystals grew to at least 3 centimeters (1 in) in size; many are floaters.

Some mineral specimens, including cuprite and other species, were saved during gold mining in the late 1980s-90s. Specimens came onto the mineral markets in the late 1990s and early 2000s.

Rhyolite dikes intruded along fault or shear zones in several phases. After the dikes were emplaced, regional tectonism brecciated and oxidized some of the hosting calcareous rocks. Gold and copper were deposited, then reworked during deformation (especially during faulting), with oxidized minerals like cuprite resulting (fortunately for collectors). The mine site seems to have been reclaimed, although economic development of the property remains a strong possibility.

Other Australian mines, including the Wallaroo Mine in South Australia and the famous Broken Hill district in New South Wales, have produced nice cuprite specimens. One twinned Wallaroo specimen with no matrix has crystals up to about 5 centimeters (2 in) long on an edge. On Mindat, the owner, Demetrius Pohl, says he found it "in a box [labeled] '$1 you pick' of cutting rough in J.S. Taylor's lapidary shop in Lane Cove, Sydney in June 1961 when I was still in high school."

The Sandy Flat Mine in the Northern Territories produced some lovely specimens of cuprite in the form of chalcotrichite.

China. China's Chengmenshan Mine near the city of Jiujiang was the source of lovely bright chalcotrichite and, more rarely for this locality, regular cuprite crystals. One 7-centimeter (2.6-in) piece shown on Mindat exhibits euhedral malachite-coated cuprite crystals on native copper. Specimens seem to have been extracted in 2007-18. The huge copper/molybdenum/gold deposit is worked in open pits. The deposit may still be actively mined, and therefore more specimens may be forthcoming if mining occurs in the oxide zone.

Economic uses

Cuprite is an ore of copper. It is less abundant than other copper ore minerals, but when found together with them, it can be mined economically. Copper uses are ubiquitous, including for electrical wiring and

components, transportation and industrial equipment, and even paints.

Gems

Though relatively soft, cuprite has been cabbed and faceted. I was surprised to see a 3- by 4-centimeter (1.2×1.6-in) cuprite and tenorite(?) cabochon posted on Mindat by Rolf Luetcke. Gemdat shows faceted cuprite in colors ranging from crimson to almost black, with the largest stone weighing 66.34 carats. Unfortunately, I received error messages when I tried to click on the images to learn what stone is the largest or the localities from which the stones came. The Gem Trader was offering a 40.7-carat stone for $814. Dr. Joel Arem, geologist and gemologist, mentions that the Smithsonian Institution is home to a 203.75-carat octagon-cut stone from Namibia. (I found all information online on September 3 and 14, 2024.)

Prices (2024)

I encourage you to add a cuprite specimen to your collection. As for most minerals, prices for cuprite depend on size, quality, and locality—and who is the seller. In 2024 (on August 27 and September 3), a nice 2-centimeter (0.79-in) crystal on attractively contrasting chrysocolla from the DRC was offered on an eBay auction with a bid of $2.75. For something grander, an aesthetic 8-centimeter-long (3.15-in-long) cuprite-on-copper specimen from the Irish Mag Mine, AZ, was offered by Weinrich Minerals for $6,000.

Technical Details

Chemical formula	Cu_2O
Crystal form	Isometric
Hardness	3.5-4
Specific gravity	6.14-6.15
Color	Red, from dark (almost black) through crimson
Streak	Metallic red-brown
Cleavage	Poor
Fracture	Conchoidal
Luster	Adamantine to submetallic

Sources

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Cuprite with malachite, Tsumeb Mine, Oshikoto Region, Namibia. Source: Mindat; photo: James K. Brizendine.

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Malachite acquired by a lucky buyer at a past NVMC club member auction. Photo: Sheryl Sims.

Club Member Auction Coming Up!
October 7 Program



Our October club meeting will feature our Fall Club Auction! Proceeds from the auction go into the Fred Schaefermeyer Scholarship Fund, which supports students in the field of geology. (Fred Schaefermeyer was a key figure in our area's mineral clubs in the 1980s-90s.)

Sellers should come early to set up. The meeting will start promptly at 7:30 p.m. We will quickly move through the business part of the meeting so we can get to the fun!

Sellers, come early to help set up the room and your items. Each auction item should be described on an individual bid slip (see page 29 for the forms—just print out as many pages as you need). Information on the bid slip should include:

- item number (your initials or other unique code followed by a sequence number);
- description;
- origin (locality); and
- starting bid amount (the lowest bid you will accept for sale—if not stated, the minimum bid is $2).

Also, you must use the summary sheet on page 30 to list all of your items for sale so that the club treasurer can record the final sales price and give you your money after the auction.

Bring guests or invite nonmembers who might be interested in gems, fossils, and minerals! Although only current club members are allowed to sell, the meeting and auction are open to all.

Please consider volunteering. The auctioneers, accountants, and runners are all volunteers—so help us out here, folks!

Bring small bills, bid early and often, and help us move on to the next item. We need to be out of our meeting room by about 10 p.m.

**** Note Current Club Auction Rules ****

- Any member may offer up to 20 specimens or up to 4 flats for auction.
- Each flat is one auctionable item.
- The club gets 15 percent of the purchase price; the remainder goes to the seller
- Anyone may donate items to the auction to fully benefit the club (no money goes back to the donor).
- The minimum bid is $2 on any item. The minimum increase is also $2. Bids higher than $20 increase by $5.
- We start with a silent auction to assess interest in each item for sale. So look carefully and start bidding. Items with multiple bids during the silent auction will be brought sooner to the actual (vocal) auction.

Winning bidders must pay for the item promptly with cash or check.



President's Message

by Jason Zeibel

Looking at our organization, I am pleased to see a vibrant and growing club. I am very happy to note all of the activities, from field trips and educational outreach to our beloved annual show.

We have a lot going on, in large part due to the work of our members and officers. Consider getting involved if you haven't already! Reach out to any club officers with suggestions or ideas, or simply ask where you can help. As the young folks say today … we appreciate you!

For me, the summer went by very quickly, and now it is October. I wanted to look back at a couple of events that I was fortunate enough to be involved in before turning to our club picnic this summer and our upcoming meetings this fall.

This summer, I was invited to give a paper at the 2024 International Geospatial & Remote Sensing Symposium in Athens, Greece. My wife Audra and I had the pleasure of honeymooning in Greece exactly 20 years ago this month, so I was thrilled to have a chance to go back. The conference was enjoyable, and many exciting topics were covered.

I also watched the sunset from the Acropolis on my second day there (fig. 1, top). When I think about some of the most famous rock outcrops in the world, certainly the rocky Acropolis is in a class by itself. From the Myceneans in the 13th century BC though over 30 centuries of Greek history, including the construction of the Parthenon, this hill has seen the birth of philosophy, democracy, mathematics, and much more.

One of the many neat things about the Acropolis is that it is a textbook example of a geologic anomaly—the perversion, due to thrust faulting, of the geologic principle of superposition (whereby older rock layers always underlie younger ones).

The limestone capping the Acropolis is part of the Upper Cretaceous Tourkovounia Formation laid down during the Cenomanian-Turonian Ages (about 100-90 million years ago). I did a little self-collecting of limestone there just to be able to say that I brought back part of the Acropolis (fig. 1, bottom).

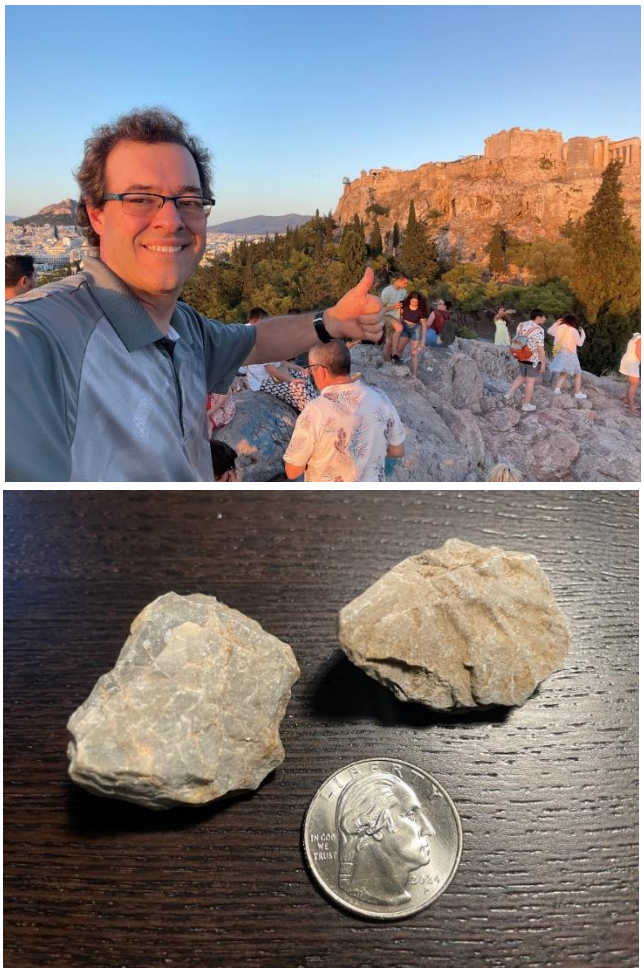


Figure 1—*Scenes from my trip to Athens this summer.* ***Top:*** *That's me with the Acropolis in the background, one of the historically most important rock outcrops in the Western world.* ***Bottom:*** *Self-collected Tourkovounia limestone from the Cenomanian Age of the Cretaceous Period (about 100 million years ago). The limestone overlies a younger sandstone known as Athens schist, which covers the valley where Athens stands today. All photos: Jason Zeibel.*

The rock layer under the limestone is known as Athens schist, which is not really schist but rather a mix of slightly metamorphosed sedimentary rocks (sandstone and marl, a blend of carbonate material with silt and clay). Athens schist is Cretaceous and later (Paleogene) in age; it formed during the Maastrichtian-Danian Ages (about 72-66 million years ago).

So the age difference between the older overlying Tourkovounia limestone and the younger underlying Athens schist is about 30 million years. In other words, the upper limestone layers are much older (and

harder—that is, more erosion-resistant) than the lower sandstone layers.

Therefore, the Acropolis did not originate where it is now, and the hill on which the Parthenon was built was once part of a much larger layer of limestone that was thrust on top of the sandstone valley where Athens is today.

Note: *Thanks to Professor Callan Bentley for explaining the Acropolis geology on his Mountain Beltway blog ("Geology of the Acropolis (Athens, Greece)," 17 January 2015).*

I did a little geologically related sightseeing on my free afternoon in Athens. I went by the marble stadium built for the first modern Olympic games in 1896 (figure 2, top). Known as the Panathenaic Stadium, it was built on the ruins of a 6th-century-BC racetrack and a Roman-era stadium commissioned by Herodes Atticus, a wealthy Greek philanthropist and Roman consul. It was rediscovered in 1836 and renovated with an enormous amount of Pentelic marble.

I also toured the amazing Acropolis Museum. Among the exhibits, the one that you might find most interesting is a description of all of the minerals and pigments that came from the Mines of Laurion. These are ancient mines in Attica (around 30 miles south of Athens) with mining activity that dates to at least 3200 BC.

The Laurion mines have been a source of copper and lead ore (such as galena) since antiquity. What was maybe more interesting to me was that the mines were also the source of all pigments used by the Greeks to paint their statues (fig. 2, bottom).

We tend to imagine the Parthenon and many buildings of antiquity as plain white marble buildings. However, in ancient times, all statuary was covered by striking and vibrant colors obtained through careful mining and mixing of minerals. Lead arsenate yielded a bright yellow; cinnabar resulted in a deep red; azurite and malachite were mined for blue and green; and so on. Pigment makers were elite and highly valued tradesmen.

The Acropolis Museum has several statues where traces of pigments have been recovered and analyzed via X-ray fluorescence and elemental analysis. A colorized recreation of the frieze surrounding the Parthenon is in the Acropolis Museum, where the carvings are displayed in the colors they would have had in the 5th century BC. The impact is strikingly different than imagining the frieze in blast-white marble.

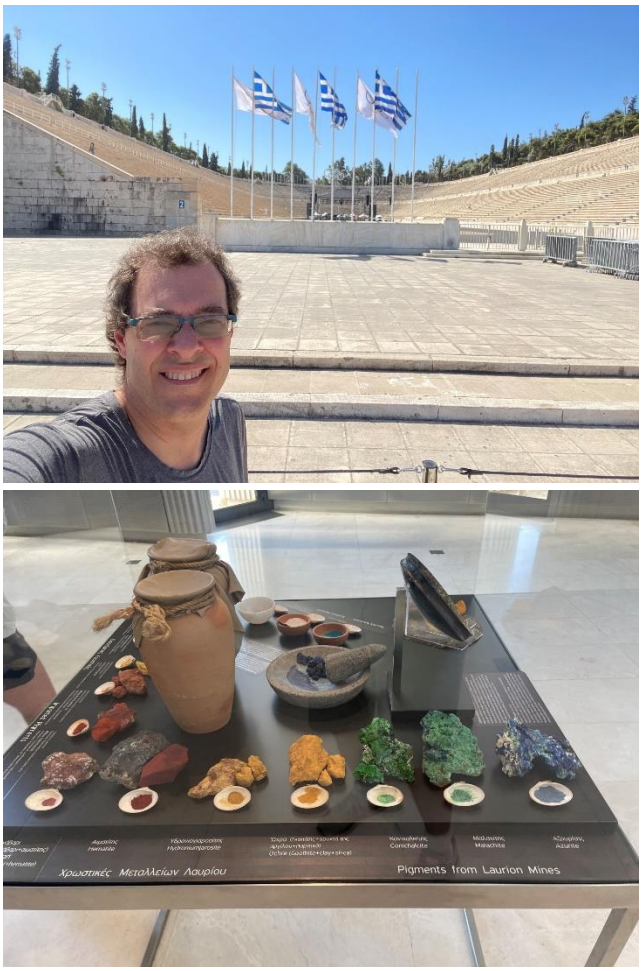


Figure 2—*More scenes from Athens.* ***Top:*** *The marble stadium for the first modern Olympics (in 1896), built on the site of a 6th-century-BC racetrack and 3rd-century-AD Roman stadium.* ***Bottom:*** *Pigments from the Laurion Mines in Greece displayed in the Acropolis Museum in Athens.*

Had I been a merchant during the Hellenistic period, I might have been a pigment-producing geologist!

My family and I were also happy to host the NVMC summer picnic this past August (fig. 3). We had gorgeous late August weather, which almost never happens where I live.

Several new members came to the picnic and were introduced to our longstanding members. One guest brought geologic maps of several counties and states, and we had fun looking at them. There was also quite a variety of rock, mineral, and fossil offerings for trading—so much that I had to break out my John Deere tractor to haul buckets over to the viewing area! I certainly hope that everyone went home with a full belly and some new geologic treasures.

Please continue to keep an eye out for good speakers and send a note to our club vice president, Craig Moore, who has the difficult job of coordinating speaker schedules. If you have a topic that you are excited about and feel motivated to present on it, let Craig know! We will likely try to go out to dinner before the club meeting whenever we have an in-person speaker.

However, for the auction night in October, I will instead try to bring pizza so we can snack while looking over all the beautiful offerings. That's right … we are super excited to have our twice-a-year club auction coming up this month. Please consider bringing specimens to sell, as well as a healthy wallet to help you take home some new treasures.

Because the auction is not well aligned with virtual attendance, we will forgo that aspect of the meeting for October. However, we will return to the virtual option in November for those unable to come in person. Please see the article on page 10 for instructions on our auction if you are not already familiar with them!

Jason











Figure 3—*Scenes from our annual club picnic at the Zeibel home, including a display of geologic maps brought by one club member and a photo of our rock swap table (left).*



Club Meeting Summary
September 2

by Almas Eftekhari, Secretary

We started our Zoom-only meeting on Labor Day by reviewing recent club activities. We had a great club picnic at the Zeibel family home on August 25; we also had a really fun field trip to the National Limestone Quarry in Pennsylvania on August 17 (see the article on page 15), and we have another one coming up to look for kyanite at Willis Mountain.

It was announced that the Southern Maryland Rock and Mineral Club is holding a 1-day rock show at Old Waldorf School in Maryland on Saturday, October 5, from 9 a.m. to 4 p.m. Dave Hennessy will be there, and there will be lots of raffles.

Vice President Craig Moore announced that our next meeting will feature our Fall Club Auction at the Dunn Loring Fire Station, with no Zoom option (see the program on page 10). We prefer cash but can also take checks and credit cards; Sue Marcus asked participants to bring small bills so we can make change.

Our November meeting will be hybrid (with a Zoom option), though we prefer that people come in person. The program will focus on the Crater of Diamonds in Arkansas, but we will also talk about our upcoming annual club show (see the article on page 17). Our annual holiday party will be on December 2.

Treasurer Roger Haskins reported that the club has $31,000 in the bank, and we would like to find a way to spend it well. Roger is reaching out to local schools to help teachers of the Earth sciences. We're now working with two elementary schools in northern Virginia, Providence and Braddock, which are struggling to find resources. We are looking for volunteers to speak at school meetings or back-to-school nights. We might set up a table to show specimens and talk to kids about minerals.

On an upcoming teacher workday, kids will have 3 hours before they can go home because their parents will be working. This is an opportunity for us to talk to kids about things related to the Earth sciences. We need volunteers, especially folks who are bilingual.

On March 13, Providence is having a STEM night, and we've been invited to have a table and to present there; Roger and Sue have volunteered. Providence has also requested some take-home materials for fifth graders,



Specimen from the National Limestone Quarry field trip.

and Roger is looking for mineral specimens to go into egg carton kits; the school has 150 fifth graders, so we need a lot of materials. Please contact Roger at the email shown on the last page of this newsletter if you can volunteer to help.

President Jason Zeibel gave a shoutout to Editor Hutch Brown for the September newsletter, a treasure trove of information related to our hobby. Jason has stopped sending out the newsletter as an email attachment be cause it keeps going into people's spam folders.

Field Trip Co-Chair Katy Johnson announced the upcoming field trip on September 21 to Willis Mountain, the world's largest producer of kyanite. Participants will meet there at 8:30 a.m. and collect until about 1 p.m. After getting more information about the field trip from the Lynchburg club, Katy will send it out to club members. We also need to reschedule the two local geology field trips rained out over the summer.

John Sanborn and Michelle Keeley came to the meeting as new club members. During Rock-n-Talk, John spoke about the August field trip to the Mt. Pleasant Mills Quarry, part of the National Limestone Quarry. Jason described his family trip to northern Italy to explore the Dolomite region.

In connection with the National Limestone Quarry field trip, EFMLS President Bill Stephens gave great advice on how to clean mineral specimens, especially wavellite. (Maybe we could ask him to contribute a corresponding piece for the newsletter or to give us a presentation.)

Sue Marcus spoke about the need to migrate to a new mail server for email. She asked whether anyone has experience doing email distributions. She will coordinate with Tom Burke, our Tech Support guru, when he comes back to town.

August Field Trip

National Limestone Quarry

by Katy Johnson, Field Trip Co-chair

On Saturday, August 17, 10 NVMC members set off on a dark, overcast day (while praying that the rain would stay away) into the National Limestone Quarry in Middleburg, PA. A couple of members had driven up the night before; the rest had made the drive—just over 3 hours long—earlier that morning.

A very punctual and excited group of us met at the quarry parking lot, took a few photos, and signed our waivers and a thank-you card. We then went into the office to meet with the owner, Eric Stahl, of what are actually two quarries—the Middleburg and Mt. Pleasant Mills Quarries. Eric shared some of his quarry stories and showed us the giant slab of beautiful blue celestite in the office. He then told us that the reason he invites rock clubs to rescue treasures from his quarries is also to share his passionate religious faith and to give testimony to being a born-again Christian.

In our briefing, we learned that the Middleburg Quarry had flooded and that we would instead visit the smaller Mt. Pleasant Mills Quarry. We were given directions to the quarry and the wavellite that lay waiting for us there.

Luckily, we were joined by a local EFMLS member who had been to the quarry before and was able to take us directly to the wavellite pits. We had also received specific instructions from Bill Stephens, the president of the EFMLS, about where to look for wavellite.

We spent about 3 hours searching for wavellite and were not disappointed; we also found fossils from the Devonian Period (about 419-359 million years ago). We then went down into the main quarry to search for dark-purple fluorite. The rain stayed away. Specimens found, in additon to fluorite and wavellite, included calcite crystals and strontianite.

As we were leaving, a wrong turn by one of our cars led to an additional adventure for a few of us. They met a quarry employee who took them to a vein of dark-purple fluorite, where they collected specimens and brought them to our club picnic to share with other members.

Overall, it was an amazing day, with amazing specimens, and we look forward to returning next year!

Please enjoy some photos of our adventure.








KCDEAN















Club Show Coming Up!

November 23-24, 2024

by Tom Taaffe, Show Chair

The NVMC is holding our 32nd Annual Gem, Mineral, and Fossil Show this fall at George Mason University (GMU) in Fairfax, VA.

The show will be on November 23-24 in Dewberry Hall, Johnson Center Building, on GMU's Fairfax campus. Show hours will be from 10 a.m. to 6 p.m. on Saturday, November 23, and from 10 a.m. to 4 p.m. on Sunday, November 24. 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 Scouts in uniform, children 12 and under who are accompanied by a parent, and GMU students and faculty with ID.

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

Show volunteers needed!!

Volunteers Staff the Show

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

We also need volunteers to help with **setting things up** on Friday night, November 22, from 4 to 9 p.m. The work begins at 4 p.m. with three to four volunteers bringing essential items from the club's storage unit to GMU. It's especially helpful if one or more volunteers can offer use of a vehicle. Additional Friday chores include building showcases and assembling the club's banner. Volunteers might be needed to help set up the Kids' Activity Room according to our floor plan.

Finally, incoming dealers (starting shortly after 5 p.m. until about 7:30 p.m. on Friday night) will greatly appreciate **help from volunteers at the loading dock**. It is very important for the process to go smoothly because we have only 4 loading bays for up to 20 incoming vehicles. We will assign arrival times for dealers to help make the process as efficient as possible.



Display tables at the annual club show in November 2023, with Dr. Julia Nord (left). Photo: Tom Taaffe.

This year, we are celebrating a remarkable **25 years of sponsorship** by Dr. Julia Nord and the Department of Atmospheric, Oceanic and Earth Sciences at GMU.

On Saturday and Sunday, during show hours, we will need volunteer help at the **admissions table**. The need is greatest on Saturday from 9:45 a.m. until about 2 p.m. and again on Sunday morning until about 2 p.m. More volunteers will make the admissions process smooth and efficient; we don't want to make people wait very long to enter the show.

When the show ends at 4 p.m. on Sunday, we will need numerous volunteers to help **take down the show**. Every task that went into setting up the show will go in reverse. Volunteers will need to carefully disassemble all club equipment and gather it up, then load everything into vehicles, transport it back to the club's storage unit, and put it away for next year.

Last year, we had success recruiting volunteers using "Signup Genius," and we will probably do so again.

Silent Auction and Door Prizes

Our club holds a Silent Auction on Sunday afternoon, usually between 1 and 2 p.m. On Saturday, we typically award hourly door prizes for both kids and adults. We invite club members to donate hobby-related items such as fossils and minerals for both the Silent Auction and as door prizes. Proceeds from the auction go to the club to help defray show expenses.

Donating Specimens for Kids

You can further contribute to the success of the show by donating mineral and fossil specimens for our Kids' Mines in the Kids' Activity Room. These should be specimens suitable for children, not too big or small (about 1-3 inches in size and weighing about 1-4 ounces). The specimens should be somewhat interesting and attractive, and they should hopefully have some educational value. Donated specimens should not be toxic, sharp, splintery, or otherwise dangerous. They would also be best in their natural unpolished state. Specimens from nearby localities are great choices, such as prehnite, amazonite, amethyst, and garnet.

Devising New Quizzes for Kids

You can help by designing or creating a new mineral challenge, puzzle, or identification quiz for the Kids' Activity Room. Your new mineral quiz should not be too easy or too difficult; we want children to get some of the answers right while still feeling challenged, and we want them to have learned something. If you have an idea and want feedback, please email me at rockcllctr@gmail.com.

For your newly designed quiz, you might want to use photos, line art, or even actual specimens. All of these ideas can work. Just remember that we want your quiz to be relatively uncomplicated and straightforward so that it is easy enough to take and easy to grade. It's been a long time since anyone other than me and John Weidner designed a new quiz for the Kids' Activity Room, so please give it a try!

Getting the Word Out

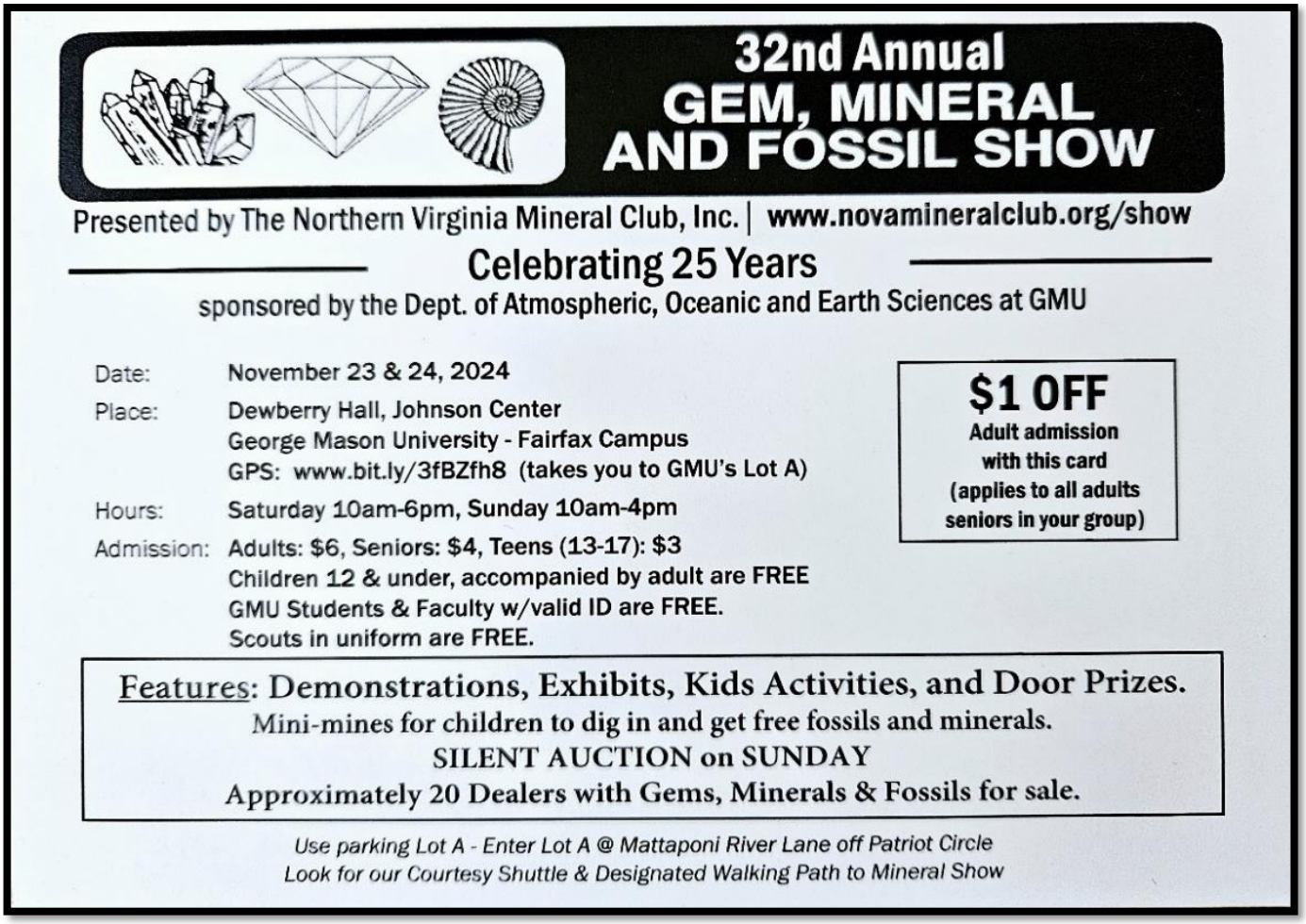
You can volunteer to help promote our annual show and really get the word out. We always need help with show advertising and promotion. We will, of course, mail postcards to previous attendees, and we do post our show on some rockhound show calendars; but we really could use much more help.

2024 Gem, Mineral, and Fossil Show: Participating Dealers

- R and L Minerals, Ron & Linda Tonucci, Waldorf, MD
- Jon Feigin, Glassboro, 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

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).



Scientists Find Seismic Role in Formation of Large Gold Nuggets

by Ian Sample

Editor's note: *The article is in* The Guardian, *2 September 2024. Thanks to Casper Voogt for the reference!*



Chunky gold nuggets tend to form far underground along fracture lines that run through quartz, but the reason why has never been nailed down.

Now, scientists have proposed an explanation for the effect: the immense forces unleashed by earthquakes squeeze quartz enough to generate electric fields, which in turn drive the formation of the precious deposits.

Lab experiments in Australia found that seismic waves from earthquakes produced strong enough electric voltages in quartz to extract dissolved gold from fluids infiltrating the mineral.

"This mechanism can help explain the creation of large nuggets and the commonly observed highly interconnected gold networks within quartz vein fractures," the researchers write in Nature Geoscience. *Read more*.

Club History

The George Loud Mineral Collection: You Can Now Own Part of It

by Sue Marcus and Hutch Brown

George Loud is familiar to longer-term (not older!) members of our club. Born in 1942, he's still alive and kicking, and we hope to see him at our November show. This news item is an alert that you can own part of the George Loud Mineral Collection if you act soon.

George served as NVMC president in 1991-92 and was instrumental in launching our annual club show in partnership with Dr. Julia Nord at George Mason University. He served as show chair in 1993-98, then together with current show chair Tom Taaffe in 1999. George is a lifetime club member and still regularly participates in our club shows.

George has collected minerals for most of his long life. A few of us were lucky enough to see and appreciate his superbly catalogued collection at his home in Hilton Head, SC, which he shared with his wife, Karen. George and Karen moved back to our area—and we hope to see him at our November show.

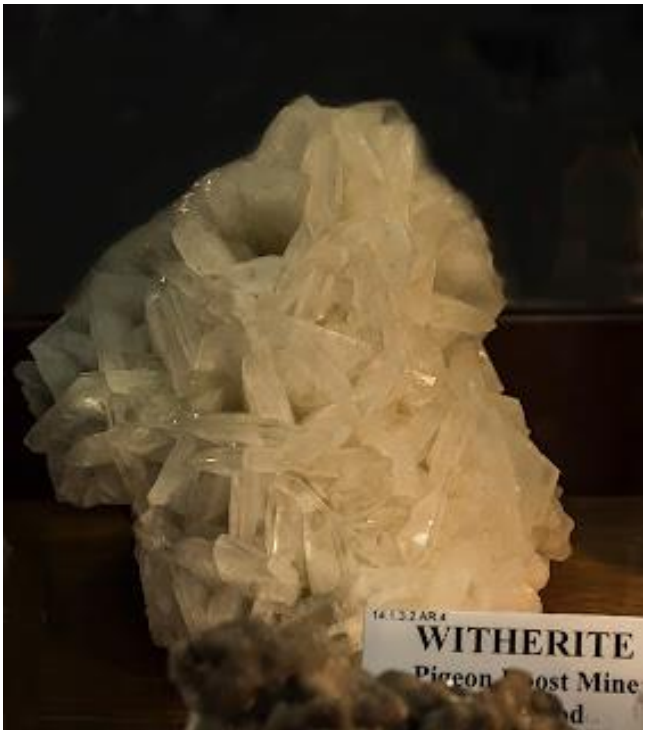
George's collection, partly self-collected, comprises 9,000-plus fine pieces from famous localities as well as obscure locations around the world, with a focus on specimens from the United States. George acquired a terrific collection of local minerals from no longer accessible quarries and mines. The collection includes well-crystalized specimens and perfectly fits the description of "classics" from our area.

Part of George's collection (featuring Colorado specimens) was offered for sale at the Hard Rock Summit, part of this year's Denver Mineral Showcase, which I recently attended. The Arkenstone, one of the world's premier fine-quality mineral dealers, had a case of his specimens for sale and another case of pieces up for auction. George's specimens occupied prime space, expensively displayed at a major show.

The Arkenstone has a full-page, prominently placed color ad in the September/October issue of *Rocks and Minerals* magazine. If you are interested in the collection, check out Jake Slagle's *Mineral Bliss* website. Contact The Arkenstone for potential purchases.







Local minerals from the George Loud Mineral Collection on display at his home, including witherite from Pennsylvania (bottom). See Jake Slagle's article for details.

Junior Geologists Lab at Kings Park Library in Burke, VA

by Kathy Hrechka

Local mineral club member John Weidner envisioned the Junior Geologists Lab as a way for members of the various clubs in our area to share our hobby with kids at the Kings Park library in Burke, VA. We are thereby following our clubs' mission of helping youth learn about fossils, minerals, and geology.

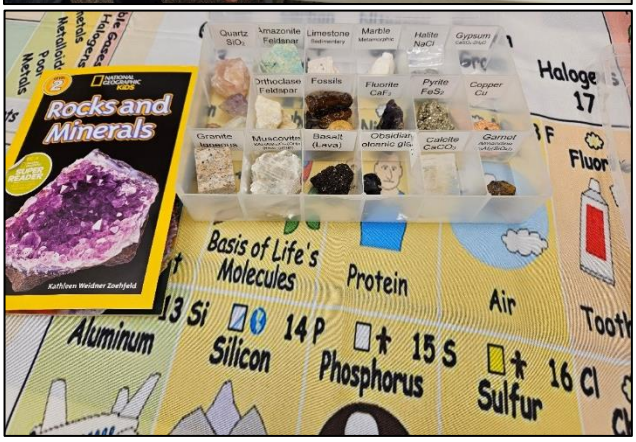
Once a month, we gather to "talk rocks" with kids in the community. Some kids bring rocks for us to identify; others come to learn from our activities. On August 22, for example, John Weidner, Kathy Hrechka, Ken Rock, and Tom Taaffe brought their own mini-exhibits to the library for kids to see. Family attendance during the summer ranged from 30 to 45 kids.

If you are interested in helping with our Junior Geologists Lab, contact NVMC Vice President Craig Moore at vicepresident@novamineral.club.









Scenes from the Junior Geologists Lab on August 22 featuring mini-exhibits related to our hobby. ***Top left:*** *John Weidner demonstrating his digital microscope.* ***Bottom left:*** *Kathy Hrechka's mineral study box and related materials.* ***Top right:*** *Tom Taaffe demonstrating fossils.* ***Bottom right:*** *Ken Rock teaching the three rock types.*

The Rocks Beneath Our Feet

A Quartz Outcrop in Annandale, VA

by Hutch Brown

Editor's note: *This is a revised version of an article that appeared in* The Mineral Newsletter *in November 2020.*

In 1963, when I was eleven, my family moved into an early subdevelopment near what is now the Annandale campus of Northern Virginia Community College (which didn't yet exist). The area was mostly woods and abandoned farmfields, with some of the last remaining habitat for bobcats and whippoorwills in Fairfax County (I remember both).

It was great country for outdoorsy kids. My friends and I would roam the woods and fish a local creek called Long Branch, the main tributary of Accotink Creek, one of the principal streams in Fairfax.

One of our discoveries was a mass of white boulders on a wooded slope overlooking Long Branch. We called it Rock Fort because it was huge—about the size of two suburban lots—and we used its walls and recesses to stage mock battles.

Today, despite the trash and graffiti, Rock Fort is still an impressive jumble of massive boulders up to about 14 feet in height. The boulders are pure white quartz with tinges of red, pink, and orange in places. Though neglected and abused, the outcrop is on county land, a greenway corridor called Long Branch Park.

Rock Fort is located in Virginia's Piedmont geologic province, where the predominate rock is metamorphic. So how did the quartz get there?

Geologic Environment

The outcrop shows up on a USGS geologic map for the Fairfax Quadrangle as an intrusion in the shape of an elongated lens (fig. 1). Such quartz lenses, typically mapped in shades of purple, are common in our area. Oddly, the map shows Rock Fort as lamprophyre, marked **Dl** (the "D" is for Devonian). Lamprophyre is a grayish-brown igneous rock that forms dikes in some of our area's metamorphic rock, notably at Great Falls; but Rock Fort is plainly quartz, not lamprophyre.

The geologic environment for Rock Fort is complex. Figure 1 shows, in addition to the quartz lens and the alluvium in Long Branch (yellow, **Qal**), four metamorphic rock formations and part of a massive igneous intrusion (the Falls Church Pluton).





A massive quartz outcrop on a wooded slope in Annandale, VA, up to an acre in size. **Top:** *View from below of a boulder about 14 feet in height (note the measuring tape for scale).* **Bottom:** *View from the top of the site, a massive jumble of white quartz boulders with shades of red, pink, and orange (the black is manganese oxide). Photos: Hutch Brown.*

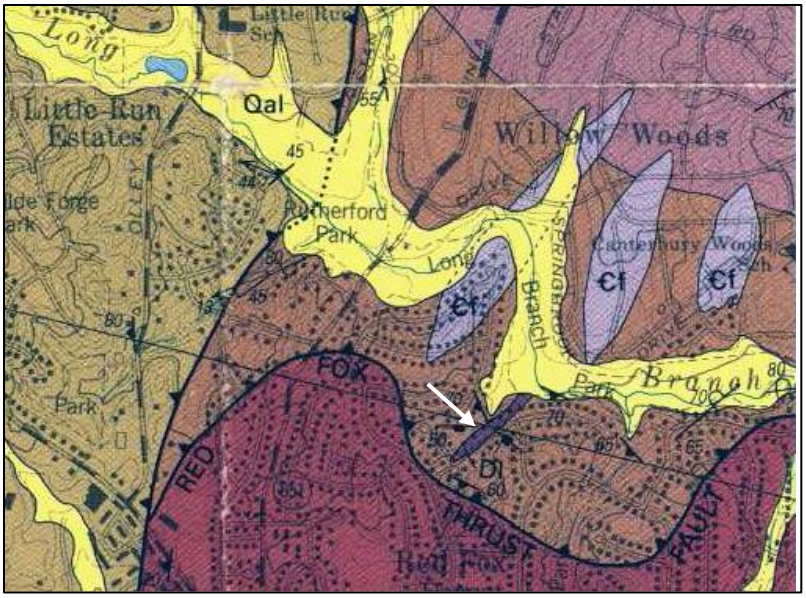


Figure 1—*Detail from a geologic map for the Fairfax Quadrangle. The arrow shows a quartz lens (purple) that crops out on a slope above Long Branch creek. From upper left to lower right, yellow = alluvium (***Qal***); beige = Sykesville Formation; brown = Lake Barcroft metasandstone; plum = Accotink schist; lilac = Falls Church tonalite (***Cf***); and burgundy = Indian Run sedimentary melange. Source: Drake (1986).*

The Rock Fort quartz is embedded in a dark-gray metamorphic rock called Lake Barcroft metasandstone (fig. 1, brown). Akin to quartzite, the metamorphosed sandstone ranges from a relatively coarse meta-arenite ("arenite" is derived from *arena*, the Latin word for sand) to a finer-grained metagraywacke (graywacke is an intermediate rock between sandstone and shale, richer than quartzose sandstone in feldspar and volcanic material such as ash). Both components formed from sediments laid down in the ancient Iapetus Ocean, forerunner of the Atlantic.

Geologists believe that Lake Barcroft metasandstone is early Cambrian or late Proterozoic in origin, making it more than half a billion years old. It started as sedimentary rock in a deep-sea trench at the edge of a volcanic island arc formed by an oceanic plate colliding with the proto-North-American continental plate (fig. 2). Island arc counterparts today include the Antilles Islands (such as Jamaica and Puerto Rico) on the outer edge of the Caribbean Sea. Geologists call ancient island arcs terranes, and this one is known as the Taconian (or Taconic) Terrane.

About 474-450 million years ago, the Taconian Terrane collided with proto-North America in a great

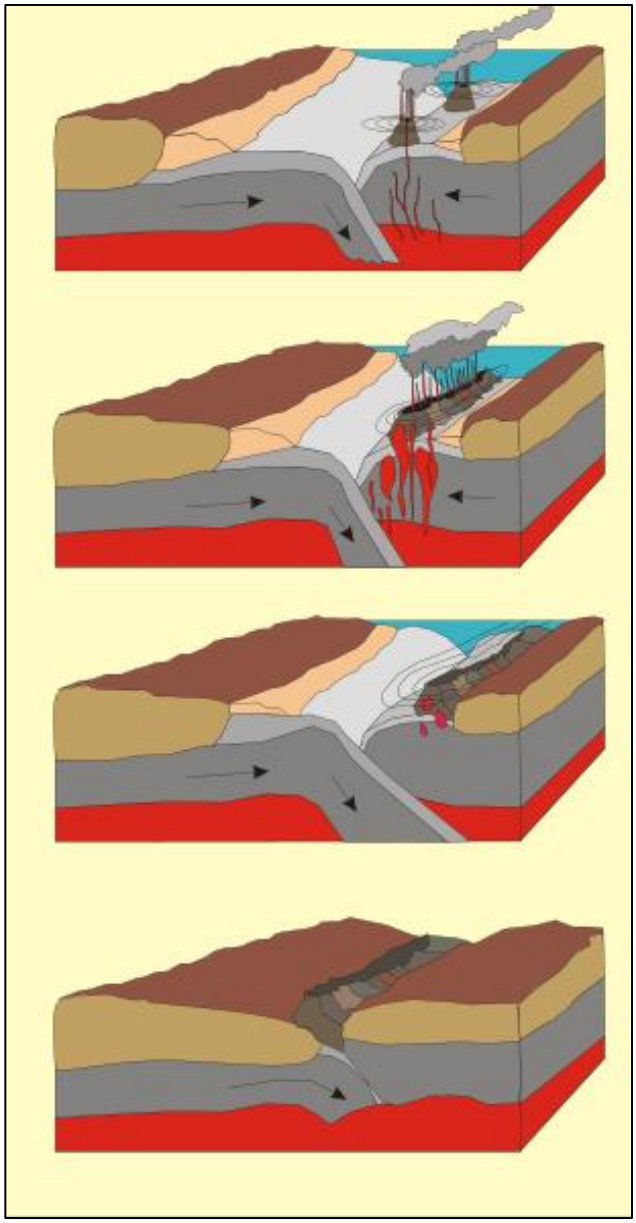


Figure 2—*Four phases in the collision of an island arc with a continent. (1) The continental crust dives into the mantle along the edge of an approaching oceanic plate (a terrane), forming a deep-sea trench and sending magma upwards as friction melts the crust, causing undersea volcanic eruptions. (2) The volcanoes emerge from the sea to form a line of volcanic islands. (3) The sea is gradually closed as the terrane slides up onto the continental margin. (4) As the collision continues, a mountain range forms over the suture zone between the terrane and the continent. Source: Wikipedia; artist: Ingwik.*

mountain-building event (fig. 2, phases 3-4). The Taconian Mountains have eroded away, but the underlying terrane, including the Lake Barcroft rock, is still attached to the continental plate. The tremendous heat and pressure of the colliding plates transformed the sedimentary rock layers into metamorphic rock. The relatively coarse Lake Barcroft metasandstone and the finer-grained Accotink schist (fig. 1, plum) comprise what geologists call the Annandale Group, which overlies the older Indian Run sedimentary melange (fig. 1, burgundy) and underlies the younger Sykesville Formation (fig. 1, beige). All four rock formations originated in the same deep-sea trench.

During the Taconian Orogeny, rising magma cooled underground into plutons exposed today as granitic intrusions. The Falls Church Pluton intrudes the Annandale Group; tonalite, a granitic rock, is now exposed in several places near Rock Fort (fig. 1, **Cf**).

About 320 million years ago, the proto-African continent closed the Iapetus Ocean, colliding with proto-North America and sliding over it to form a mountain chain as high as the Himalayas today. In the process, the collision broke off sheets of the underlying bedrock and transported them to the west on great thrust faults, folding and fracturing them and forming the Piedmont geologic province as we know it today.

The Alleghanian Orogeny finalized the complex pattern of folds and faults in our area's metamorphic rock. The thick black lines in figure 1 are thrust faults, with the black "teeth" on the younger rock: the Lake Barcroft metasandstone overlies the Indian Run sedimentary melange, and the Sykesville Formation overlies both. Figure 3 shows the relationships in cross-section.

So how did the Rock Fort quartz lens get into the Lake Barcroft bedrock?

Lens Formation

One possibility is a quartz intrusion. Surface water seeping through cracks in the rock percolates deep underground, and porous rock like sandstone can contain lots of groundwater. During orogenies, rising magma can heat the water underground, saturating it with silica and other minerals and forcing it up through cracks in the rock. Tectonic forces fold and fracture the overlying rock, creating fissures—some of them huge—for the superheated fluids to fill. As the silica-rich fluids cool, the minerals precipitate out in the fissures and cavities, forming veins and lenses of massive quartz.

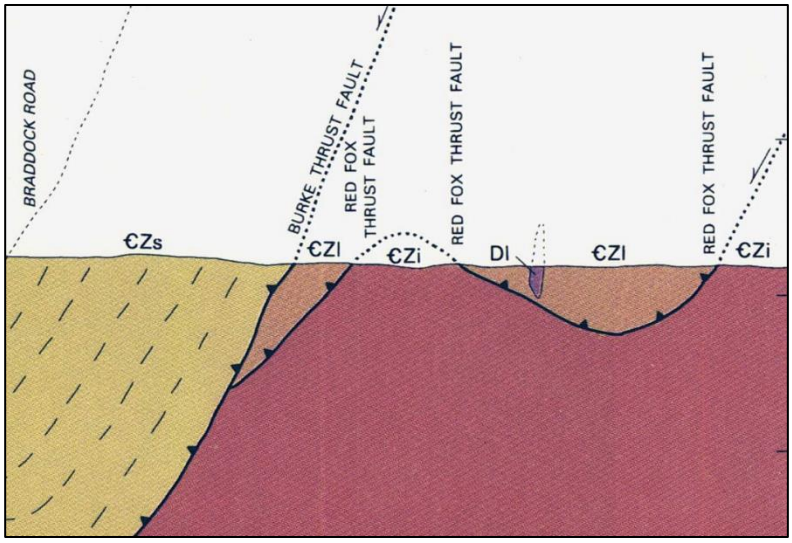


Figure 3—*Detail from a geologic map of the Fairfax Quadrangle showing thrust faults in Annandale, VA.* **CZs** *= Sykesville Formation;* **CZl** *= Lake Barcroft metasandstone;* **CZi** *= Indian Run sedimentary melange;* **Dl** *= lamprophyre from the Devonian Period (yet Rock Fort is quartz, not lamprophyre). Source: Drake (1986).*

Another possibility is that the bedrock itself—in this case, the Lake Barcroft metasandstone—secreted the silica. Quartz is one of the first minerals to melt, and mountain building would have placed the bedrock under enormous heat and pressure. The quartz-rich metasandstone would have secreted molten silica into cavities in the buckling rock, which then would have cooled to form quartz veins and lenses. Such quartz bodies, both large and small, are common in our area; the process is called lateral secretion, and the result is known as segregation quartz.

Some quartz veins contain minerals other than silica. Gold, like quartz, melts at relatively low temperatures, separating out from other minerals in the bedrock. Our area has a so-called Gold-Pyrite Belt, where massive quartz intrusions can contain both gold and pyrite; in the late 19th and early 20th centuries, the Gold-Pyrite Belt (for example, at Great Falls in Maryland and near Quantico, VA) produced both gold and iron-rich pyrite in sufficient quantities for economic mining. At Rock Fort, I was curious enough to check exposed rock surfaces, but I noticed nothing but quartz.

The Rock Fort quartz is mostly milky white, the cloudiness caused by minute bubbles in the rock, without which the quartz would be clear. In places, white quartz gives way to opaque hues of pink, orange, and reddish brown due to traces of iron, aluminum, and



Rock Fort quartz in various hues. Photo: Hutch Brown.

other elements replacing some of the silicon in the rock's mineral makeup. According to Joe Marx, a retired geology professor at Northern Virginia Community College, the black cracks and surfaces you often see in or on milky quartz are from manganese oxide (oxidation of manganese traces in the rock).

The great quartz blocks loom over the site of Rock Fort because the metamorphic bedrock is far more vulnerable to weathering. Crumbling metasandstone formed the red clay soil around Rock Fort, which owes its durability to the erosion resistance of quartz (7 of 10 on the Mohs scale of mineral hardness).

Other Quartz Outcrops

Arlington County has a celebrated quartz outcrop called Brandymore Castle (fig. 4, top), a landmark for surveyors during colonial times. The site is on public land well-maintained by the county, and it has a historical marker on the nearby W&OD Trail. Another quartz outcrop caps the highest hill in Roundtree Park on Annandale Road in Falls Church, VA (fig. 4, center). This outcrop, like Rock Fort, is badly defaced by paint. The Roundtree and Brandymore outcrops are much smaller in area than Rock Fort (fig. 4, bottom), and neither has a boulder more than 5 feet in height.

Like Rock Fort, the Roundtree and Brandymore outcrops are part of mapped quartz lenses embedded in the bedrock (which is, respectively, igneous tonalite from the Falls Church Pluton and metamorphic sedimentary melange from the Sykesville Formation). Why the Rock Fort outcrop is so much bigger is unclear to me, but it is by far the most impressive quartz outcrop I've ever seen.



Figure 4—*Quartz outcrops in northern Virginia. Brandymore Castle (top) and the outcrop in Roundtree Park (center) are shown almost in their entirety, whereas Rock Fort (bottom) is shown only in part. Photos: Hutch Brown.*

Visiting Rock Fort

Rock Fort has been neglected by both the county and the local community, given over to trash, graffiti, and invasive weeds like English ivy. When the leaves are off in winter, you can see the outcrop from the trail in the greenway corridor along Long Branch, but it is on

the opposite side of the creek; no marker announces it, and no bridge over the creek leads up to it.

Yet it is a striking geologic feature, and it is easily accessible, right off a quiet street with plenty of parking in the Annandale neighborhood of Canterbury Woods (fig. 5). Visitors need to bushwhack a bit down a moderately steep hill to get to it; the best time to go is from late fall to early spring, when the thorny greenbrier and the poison ivy aren't such an issue.

To get there, take Braddock Road toward Fairfax from I-495. Watch for Wakefield Chapel Road on the right. After the intersection, take the second right onto (aptly named) Stone Haven Drive and follow it to the end. Turn right onto English Drive and look for the gap between houses on the left.

The gap opens onto public land, part of Long Branch Park. Rock Fort begins just a few yards away from the sidewalk and reaches halfway down the ridge toward the creek.

Acknowledgments

Thanks to Roger Haskins and Sue Marcus for reviewing and improving earlier versions of this article!

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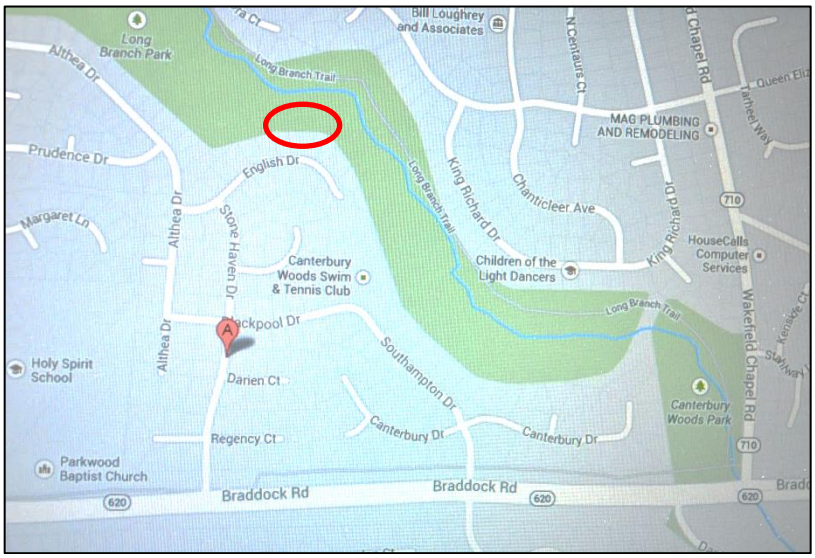


Figure 5—*Location of Rock Fort (circled) in Long Branch Park in Annandale. The main cross streets are Braddock Road (bottom) and Wakefield Chapel Road (right), which goes to Northern Virginia Community College. To get to Rock Fort, take Stone Haven Drive (A) and turn right on English Drive; park on English Drive.*



Rock Fort lies off the sidewalk next to a quiet suburban street in Annandale, at the top of a ridge overlooking Long Branch creek. Photo: Hutch Brown.

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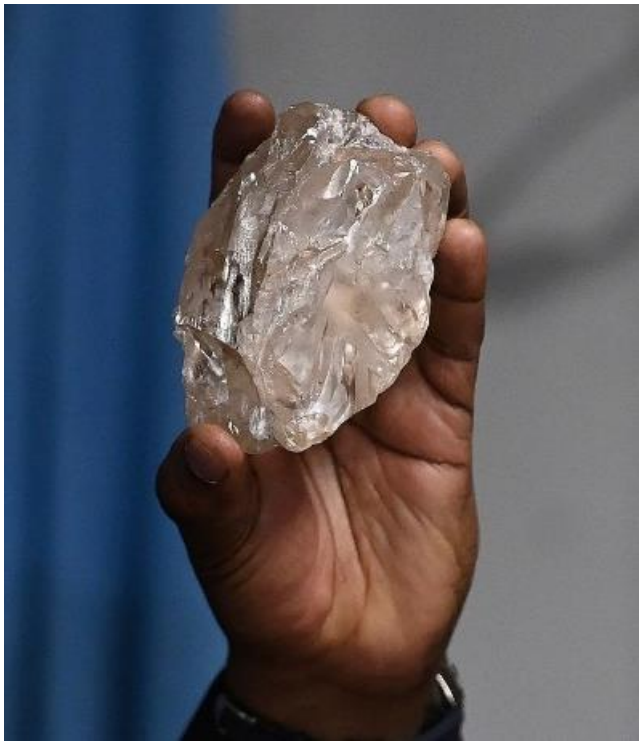
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Second-largest Diamond Ever Found—2,492 Carats

by Jennifer Hassan

Editor's note: *The piece is adapted from an article in* The Washington Post, *22 August 2024.*

A 2,492-carat stone unearthed in Botswana is the second-largest diamond ever found and the biggest ever recovered in the African nation, according to the Botswanan government.

Canadian mining company Lucara Diamond discovered the gemstone, hailing it as "exceptional" and "high-quality" in an official statement. The diamond came intact from the Karowe Mine, which is fully owned by the company, using X-ray technology employed since 2017.

The largest diamond ever found is the 3,106-carat Cullinan Diamond, discovered in South Africa in 1905. The stone was divided into nine large gems and nearly 100 smaller ones. Some of the gems are among the British crown jewels.

One of the gems, Cullinan I—also known as the "Great Star of Africa"—is described by Britain's Royal Collection Trust as the largest colorless cut diamond in the world. In 1911, it was mounted to the Sovereign's Scepter with Cross. The stone was so large that the scepter had to be reinforced to take its weight.

Some of the world's largest diamonds have been pulled from the Karowe Mine, including the Sewelo Diamond, a 1,758-carat stone that was discovered in 2019 and was, until now, the second-biggest diamond ever found.

In 2015, a 1,111-carat diamond was unearthed from the Karowe Mine, measuring the size of a human palm. The diamond, known as Lesedi La Rona, was bought by a British jeweler 2 years later for $53 million.

Southern Africa is one of the leading diamond producers in the world.

GeoWord of the Day

(from the American Geoscience Institute)

crystal sandstone

(a) A sandstone in which the quartz grains have been enlarged by deposition of silica so that the grains show regenerated crystal facets and sometimes nearly perfect quartz euhedra. Crystal sandstones of this nature sparkle in bright sunlight. (b) A sandstone in which calcite has been deposited in the pores in large patches or units having a single crystallographic orientation, resulting in a "poikiloblastic" or "luster-mottling" effect. In some rare sandstones with incomplete cementation, the carbonate occurs as sand-filled scalenohedra of calcite sand crystals.

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



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FROM _____
Starting bid amount:_____
Bidders: You need to bid on this item if you want it to be auctioned! Place bid below.
NAME/BID

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SUMMARY SHEET FOR AUCTION ITEMS SUBMITTED BY_____

Initials	Item #	Description	Minimum bid	Final sale price
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October 2024—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2 MSDC mtg, Washington, DC	3	4 Symposium, MD; show, VA	5 Symposium, MD; shows, MD, VA
6 Symposium, MD; show, VA	7 **NVMC mtg**	8	9	10	11	12
13	14 **Columbus Day** GLMSMC mtg	15	16 National Fossil Day, Smithsonian Institution	17	18 Show, Hickory, NC	19 Show, Hickory, NC
20 Show, Hickory, NC	21	24	25 MNCA mtg	26	27	26
27	28	29	30	31 **Halloween**		

Event Details

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

4-6: Baltimore, MD—68th Paul Desautels Memorial Micromount Symposium; Baltimore Mineral Society; Natural History Society of Maryland, 6908 Belair Rd; displays, presentations, slide shows, sales, trading, giveaways, silent auction; info/registration: Mike Seeds, mseeds@fandm.edu.

4-6: Virginia Beach, VA—Show, Treasures of the Earth, Inc; Virginia Beach Convention Ctr, 1000 19th St; Fri 12-6, Sat 10-5, Sun 10-5; adults $8,16 & under free; info: Ellen White, 804-642-2011, Ellen.White@TreasuresOfTheEarth.com.

5: Waldorf, MD—28th Annual Rock, Mineral & Fossil Show; Southern Maryland Rock and Mineral Club; Old Waldorf School, 3074 Crain Hwy; adults $5, 65+ $4, 13-17 $3, 12/under free; info: http://www.smrmc.org/rock-show-information.html.

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

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

16: Washington, DC—National Fossil Day; Smithsonian Natural History Museum; 10-2; activities for kids/families; info: https://naturalhistory.si.edu/events/family-programs/national-fossil-day.

18-20: Hickory, NC—Annual show; Catawba Valley Gem & Mineral Club, Inc; Hickory Metro Convention Ctr, 1960 13th Ave Dr SE; Fri 10-6, Sat 10-6, Sun. 10-5; adults $6, kids 12/under free; info: Dean Russell 828-303-1448, cvgmcsecretary@aol.com.

25: 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!

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

Please send your newsletter articles to:
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Bring your dues to the next meeting.

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

Meetings: At 7:30 p.m. on the first Monday of each month (except possibly January and September) at the Dunn Loring Fire Station, 2148 Gallows Road, Dunn Loring, VA.* (No meeting in July or August.)

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

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