THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: May 23   Time: 7:30 p.m.

The meeting will be in person. Details on page 8.

Hübnerite

Pasto Bueno, Ancash, Peru

Source: Wikipedia.   Photo: Ivar Leidus.

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May Meeting Program:

Spring Club Auction

Details on page 8

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Mineral of the Month
Hübnerite

by Sue Marcus

Mineral classification evolves as new technologies are developed and applied to minerals. Using newer techniques, experts describe new minerals and discredit old ones. Our May Mineral of the Month is hübnerite, the manganese-rich end member of the wolframite series: so if you think about the chemistry of hübnerite ($MnWO_4$) on one end of a straight line, then the other end is the mineral ferberite ($FeWO_4$).

Chemical analysis is necessary to distinguish between hübnerite and ferberite; the distinction cannot accurately be made by visual identification. Between hübnerite and ferberite are chemical mixtures containing some manganese and iron, and the whole series—that straight line—is called the wolframite series.

There used to be a mineral species named wolframite—until scientists realized that all the specimens called wolframite were combinations of hübnerite and ferberite, with some as the end members of that changeable chemistry. Though the wolframite name has been discredited for individual mineral species, it is still accurate for the *series* (any mineral from pure $MnWO_4$ through the various admixtures to pure $FeWO_4$). Dealers, including some high-end ones who should be able to have their specimens analyzed, might label a specimen wolframite because the specimen has not been tested to identify the correct species.

Clever collectors may be able to make an educated guess about whether a “wolframite” specimen should be labeled hübnerite or ferberite based on the chemistry of the deposit in which it was found. Was the deposit more iron rich or more manganese rich? Although darker, blacker specimens are more likely to be hübnerite, remember that color is not a reliable indicator. Only analytical techniques seldom available to collectors can quantifiably determine the correct species. Many of us make educated guesses.

Hübnerite forms in high-temperature environments. The wolframite series (ferberite to hübnerite), along with scheelite, is the main source of tungsten ore. Though not rare, hübnerite is uncommon, but good crystals of hübnerite are rare. In the tungsten deposits where it is found, hübnerite is usually not interesting to mineral collectors.

Happy Memorial Day!

Northern Virginia Mineral Club members,

The November club meeting will be a hybrid meeting, both in person and via Zoom, on **May 23, 7:30 p.m.** Tom Kim has graciously permitted us to use his home for the meeting. The program will be on chemical zonation in tourmaline. See details on page 7.

Hübnerite (red in transmitted light) with quartz, Huayllapon Mine, Pasto Bueno, Ancash, Peru. Source: Wikipedia; photo: Rob Lavinsky.

The type locality of hübnerite is the Ellsworth Mine in the Mammoth Mining District, Nye County, NV. Mining Engineer Dr. Justus Adelberg found the material in 1865 in the Erie and Enterprise veins together with scheelite, apatite, and fluorite, with shale hosting the mineralized veins. He apparently brought samples to Dr. Eugene Riotte, a German-born mining engineer who worked in Nevada. Riotte's official description of the new mineral was published in the *Reese River Reveille,* a mining newspaper. Riotte named the new species for Friedrich Adolf Hübner, a German mining engineer and metallurgist who worked on the description with him. Dr. Herman Credner picked up information about the new mineral and published Riotte's report in German in 1865.

There were earlier reports of the mineral that came to be called hübnerite from other localities, but the name hübnerite stuck, and those earlier reports—and perhaps even descriptions—were not generally acknowledged. Ignoring or discounting the earlier reports, the International Mineralogical Association (IMA) gives the official name of the mineral as hübnerite, with the umlaut over the u. I have been unable to find a copy of Riotte's original description in the *Reese River Reveille* to determine whether it used the umlaut.

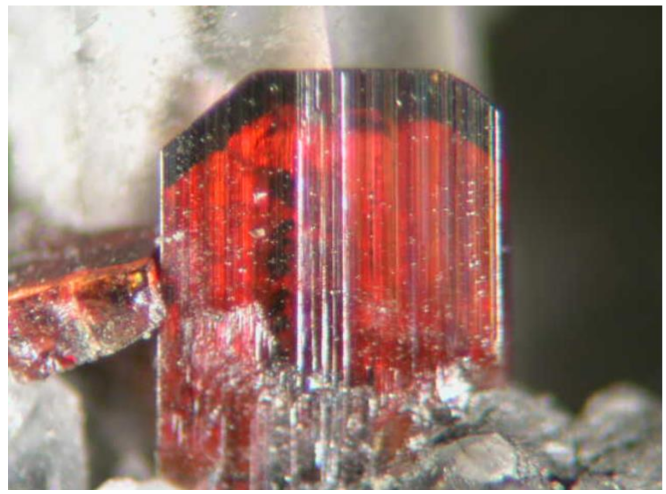
Another oddity for this mineral name is that the IMA does not use the source of Riotte's original description in English as the primary (first) source. Instead, it uses Credner's German translation. The reason could be that finding the exact edition of the *Reese River Reveille* is difficult, even though the publication has been scanned.

Crystals are typically striated, elongated, and tabular. Stubby hübnerite may be more manganese rich than the more elongated crystal forms, at least in some Peruvian deposits. The stubby and elongated crystal forms are both reported from localities in other countries, though I could not find readily available references to their respective manganese contents.

Hübnerite has variations on its name, so if you look for information or for a specimen online, the name could depend on the font you are using or a particular writer's usage. You might see "hubnerite" (no umlaut) or "huebnerite" (with a variation on the umlaut).

Mindat shows no photos of Nevada hübnerite, even though Nevada is where hübnerite was originally described and where a separate Nevada locality reported large crystals from a producing mine. I could find no images of hübnerite from Nevada anywhere, so if anyone knows of a Nevada specimen or has a photo of visible crystals, please let me know. Or, better yet, post it on Mindat.

Hübnerite was an early-forming mineral in quartz veins that were part of plutonic events about 80 million years ago east and south of Round Mountain, NV. Faulting sheared the veins, and fluids later emplaced additional minerals. Weathering added to the complexity, although it exposed the deeply buried hübnerite-bearing veins. Analysis proved this hübnerite to be manganese rich and iron poor, making it clearly hübnerite rather than ferberite.



Top: *Hübnerite, Adams Mine, Silverton, Colorado. Source: Wikimedia; photo: Rob Lavinsky.*
Bottom: *Hübnerite (red in transmitted light), Black Pine Mine, Phillipsburg Mining District, Montana. Source: Mindat; photo: Brent Thorne.*

The hübnerite in this area was a source of small tonnages of tungsten production. Crystals reached up to 5 centimeters (2 in) long; most were 1 centimeter (0.4 in) or less. In the schistose host rock, elongated euhedral hübnerite crystals were found, and the centers of some quartz veins hosted hübnerite crystals within the quartz matrix. Some hübnerite crystals contained muscovite inclusions. Microscopic studies have shown that some hübnerite crystals were zoned, indi-

Hübnerite with quartz, Black Pine Mine, Phillipsburg Mining District, Montana. Source: Wikimedia; photo: Rob Lavinsky.

cating changes in the chemistry and probably the discontinuity of the mineralizing fluids.

In Colorado, well-formed hübnerite crystals were found in quartz at the Adams Mine in San Juan County, primarily in the 1950s. Collectors etched away the quartz using hydrofluoric acid to expose the hübnerite. These hübnerite crystals were usually brown to black and were reported to be up to 5 centimeters (2 in) in size. Microcrystals that transmit light better are more likely to appear reddish. The Sweet Home Mine, famous for rhodochrosite, and several other deposits throughout the state produced a few nice specimens.

Many other localities in the United States are reported to have hübnerite, but few are interesting to collectors. An unusual color of hübnerite was found in Alpine, County, CA. Specimens from this locality are light brown to yellow-brown, with small crystals on sucrose quartz. Crystal sizes will be of greatest interest to micromounters. The huge mixed metal deposits in the Butte, MT, mining district produced rare euhedral crystals up to at least 4.5 centimeters (1.8 in) in size. Also in Montana, the Black Pine Mine in the Phillipsburg District was the source of scare though attractive macro- and microspecimens.

Pasto Bueno, in Peru's Ancash Region, is the source of what may be the world's finest showy, aesthetic hübnerite crystals. At their best, these are lustrous and striated, showing blood-red areas when backlit by strong light. In some specimens, the silvery black of the hübnerite contrasts with thin euhedral quartz crystals that are clear or white. Stocky, more equant crystals also came from this locality.

Specimens were extracted from several mines, most notably the Huayllapon Mine (Huallapon Mine) in the Peruvian Department of Ancash. Hübnerite crystals reaching 25 centimeters (9.8 in) were extracted in the collecting heydays of the 1970s-80s. Tungsten ore occurs in quartz veins emplaced relatively recently (7 to 9 million years ago), probably related to igneous intrusions.

Geologic studies by Landis and others have indicated two phases of tungsten-containing fluids that resulted in hübnerite crystallization. The earlier one produced stockier hübnerite crystals, whereas the second phase resulted in the more stunning prismatic crystals that are reddish in transmitted light. Most beautiful hübnerite specimens came from vugs in the Chabuca and Santa Isabel veins. These veins were as large as 2 meters (6.6 ft) across.

Another hübnerite crystal source was the Magistral deposit, about 10 kilometers (6.2 mi) southwest of Pasto Bueno. This latter deposit formed in skarn, where hydrothermal fluids from igneous plutonic rock mixed with surface waters and altered the surrounding sedimentary or metasedimentary rocks.

Still in Peru, though farther northwest, the Sánchez Carrión Province in the La Libertad Region produced

Hübnerite with quartz, Huayllapon Mine, Pasto Bueno, Ancash, Peru. Source: Wikimedia; photo: Rob Lavinsky.

Hübnerite with quartz, Nuevo Mundo Mine, Pasto Bueno, Ancash, Peru. Source: Wikimedia; photo: Rob Lavinsky.

both the stocky and the lustrous elongated types on hübnerite, particularly from the La Victoria Mine and the [Mundo Nuevo Mine](). These may be the same mine; the location of La Victoria is imprecise on Mindat, its generalized location overlapping with that of the Mundo Nuevo Mine. American dealers who visited these mines in the 1970s purchased specimens from mine employees for less than $1 to $15 for specimens that were later sold for thousands of dollars. This cheap source of specimens ended when miners and other local people learned how much others were making off their finds.

The Mundo Nuevo Mine produced beautiful, well-crystallized hübnerite and quartz specimens. Some specimens from this mine may have been attributed to the Pasto Bueno Region due to ill-defined boundaries of the two nearby districts. Like the Pasto Bueno specimens, those from Mundo Nuevo can be gemmy and, rarely, doubly terminated. They can be stubby, though most are elongated. Specimens reportedly came out in the 1960s, 1985, and 2008, possibly indicating intermittent tungsten ore mining at the site. One lustrous group of terminated hübnerite crystals with minimal matrix weighed 800 grams (more than 2 lb); the estimated length of the largest crystal is 7 centimeters (~3 in).

The [Siglo Veinte]() tin mine in Llallagua, Bolivia, is another, less productive South American hübnerite source. At this locality, like at the Peruvian ones, hübnerite occurs together with clear quartz needles; unlike the Peruvian specimens, monazite-(Ce) is

Hübnerite with quartz, Huayllapon Mine, Pasto Bueno, Ancash, Peru. Source: Wikimedia; photo: Rob Lavinsky.

sometimes a well-crystalized accessory mineral. Mining may still be active here, though it is intermittent and locally run on a small scale.

Hübnerite is the primary ore mineral in the Dzhida W-Mo orefield in Russia's Southwestern Transbaikalia region. Oddly, no crystalized specimens are shown on Mindat from the Inkur and the Kholtoson deposits within that field, despite extensive mining. Hübnerite occurs in quartz and quartz-muscovite veins. Both deposits were likely to have been formed during the same events, with fluids from the same source. One reference shows hübnerite crystals estimated to be up to 2 centimeters (0.8 in) long growing from the vein walls into the vein centers and frozen in the surrounding quartz. This may be due to the lack of open spaces (vugs) in the orebodies.

Massive or poorly crystalized specimens from this locality could presumably be offered for sale. Hydrofluoric acid freed hübnerite crystals from similar

Top: *Hübnerite with monazite-(Ce) and quartz, Siglo Veinte Mine, Llallagua, Potosí, Bolivia. Source: Wikimedia; photo: Rob Lavinsky.*
Bottom: *Hübnerite, Yaogangxian Mine, Chenzhou, Hunan, China. Source: Mindat; photo: Javier Taguas.*

quartz surroundings in Colorado; the technique could probably be used on these Russian specimens—if they could be obtained. The crystals from these deposits are elongated and reddish-brown. Since all images show hübnerite encased in quartz, it is impossible to tell whether any specimens would be redder in transmitted light.

China hosts most of the world's tungsten resources and reserves. It also produces fine hübnerite specimens, though not in great numbers. The Yaogangxian Mine, near Chenzhou in China's Hunan Province is a major tin and tungsten ore producer. The ores come from two geologic deposit types, and that distinction is relevant here.

Four groups of zoned quartz veins in at least three separate orebodies host tin and tungsten minerals, including cassiterite, stannite, scheelite, and hübnerite. Bismuth minerals, along with others containing copper, silver, and lead, are also found in these veins. Some of these minerals are rare. "Bismuthinite" specimens from this deposit have been analyzed and found to be other mineral species, although authentic bismuthinite is also found here.

Skarns are the other deposit type at the Yaogangxian Mine. The skarns are more silver rich, though they are much less likely to contain hübnerite. Once again, what you see may not be what you get, meaning that specimens from this part of the mine are more likely to be ferberite upon analysis—though only analysis can distinguish between the two forms of wolframite. Handsome, gleaming hübnerite crystals with quartz from this locality reach up to at least 6.7 centimeters (2.6 in) in size.

China is both the world's largest tungsten producer and its largest consumer. Hübnerite is a major tungsten ore in some deposits, though ferberite and scheelite are at least as significant in abundance and economic value as tungsten ore. China has more the 14 times the tungsten production of the next largest producer (Vietnam). China's tungsten reserves are 4.75 times larger than the next most tungsten-rich country (Russia). The United States has not produced tungsten since 2015. Tungsten is mostly used in tungsten carbide products such as cutting tools, durable parts for metal crafts, steel, and alloys for critical applications like propeller blades.

If there is a possibility of creating a gemstone from a rough piece of rock or mineral, some lapidary expert will always be up to the challenge. However, hübnerite is more of a novelty than a pleasing gemstone. The gemdat.org website claims that hübnerite has "deep blood-red internal reflections … [that] make this gem very attractive." Given its good cleavage and usually small crystal sizes, this is surprising.

Gemdat displays three photos of hübnerite. One, faceted in a teardrop cut, appears (oddly) blue-green, probably due to reflections from the lighting rather than the actual color. This is also the heaviest faceted hübnerite I could find, weighing 12.65 carats.

The classicgems.net website shows two images of one rectangular cut stone from Pasto Bueno, Peru. The cut hübnerite is described as opaque, weighing 4.1795 carats, and having the dimensions of 7.49 by 6.70 by 4.34 millimeters (0.29 × 0.26 × 0.17 in). That is relatively large for gem-quality hübnerite.

Collectors may spend $6,000 for a 1.8-kilogram (4-lb) Peruvian hübnerite specimen that is 25.4 centimeters (10 in) long. You could also pay $20 for a small, much less attractive specimen. Miniature specimens are available for about $150 and up; miniatures are about 5 centimeters (2 in) square. When I checked on April 21, 2022, several faceted hübnerite stones were for sale for less than $100. I don't find them attractive, but someone thinks they are marketable.

Technical Details

Chemical formula ......$MnWO_4$
Crystal form ....Monoclinic
Hardness 4-4.5
Specific gravity 7.12-7.18
Color ....Black, brown, red, mixed shades of those colors. Red in strong transmitted light.
Streak ....Gray, light brown
Cleavage ....1 good, 1 poor (sources vary)
Fracture ....Uneven
Luster ....Submetallic, adamantine

Sources

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Hübnerite gemstone, Peru, 5.67 carats, 10.4 × 10.2 mm. Source: Etsy.

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How to Write Good

Don't be redundant; don't use more words than necessary; it's highly superfluous.

It behooves you to avoid archaic expressions. Avoid archaeic spellings too, especially in archaeology.

(From plainlanguage.gov, a federal website about plain writing.)

Club Member Rocks and Minerals Auction Coming Up!

May 23 Program

by Tom Kim

We're having a club meeting on **May 23, 7:30 p.m., at my home, 2301 Stokes Lane in Alexandria, VA.** For the benefit of all, we ask you to come only if you are vaccinated against COVID and are in good health.

Our May meeting will feature our Spring Club Auction! Proceeds from the auction go into the Fred Schaefermeyer Scholarship Fund, which supports students in the field of geology. 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 XX for the form—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;
- from (locality); and
- starting bid amount (the lowest bid you will accept for sale—if not stated, the minimum bid is $2).

Also, use the summary sheet on page XX to list all of your items for sale so that the 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 rocks 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 finish up 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 Collected Thoughts

by Tom Kim

The very first NVMC meeting I attended with my son was an auction. That was it. That sealed the deal. We walked out of that meeting with my son insisting that we had to attend every month.

From that first meeting, we could immediately tell that most members of the club were serious collectors. It was evident not only that there was an impressive depth and breadth of knowledge but also that there was still a high degree of enthusiasm. No one seemed beneath occasionally ooh-ing and aah-ing.

We could also tell that there was quite a lot of generosity. Sure, the bidding sometimes got a little competitive, but often people graciously bowed out to newer—and younger—collectors. People auctioned off things of actual value and interest not to make a profit but to share their love and history with this avocation. We could immediately sense this was a special community.

I hope we can revive some of that old magic in this month's meeting. It's been a while since we've held a club auction, and I think more than a few people are looking forward to this one. If you're new to this kind of event, you'll see our general guidelines and protocols on this page. If you have some thing(s) you're willing to sell, please do. And even if you don't, come by and bring cash! You won't regret it.

Tom

Bench Tip

Sheet Wax With Adhesive

Brad Smith

While shopping in the Los Angeles jewelry district for supplies for our class, I found a new product that may interest some of you. Often before casting, I want to increase the thickness of a model by adding a layer of wax on the back side. For instance, models like a leaf or a flower petal do not cast well unless you add a little extra thickness. The problem is trying to apply a coating of wax that's smooth and even.

The new product I found is an easily moldable sheet wax with an adhesive coating. This lets me easily add thickness to a very thin model. With a leaf, just press it onto the wax, trim excess wax around the outer edges, and then gently bend the sandwich to the contour you would like. The wax is available in a number of different thicknesses from about 26 ga to 14 ga.

If interested, my supplier is Jewelry Tools & Supplies, 412 W. 6th Street #1011, Los Angeles, CA 90014, 213-624-8224, jtstech@sbcglobal.net

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

Gold, the Rich Element

by James Horton

Editor's note: *The article is in* LiveScience *(November 30, 2021).*

Gold represents a tiny fraction of the elements in the known universe. The reason for its rarity is owed to the incomprehensible amount of energy needed for its formation. Gold is formed in stars, but only in those that are exploding in giant supernovae or incredibly dense ones that have come together in monstrously powerful collisions, according to the journal PNAS .

Stars, such as our sun, generate energy through the power of fusion, where smaller elements are fused, or combined, together into heavier elements. To start with, a star may be mostly hydrogen, the smallest element. The process of fusion under immense pressure and heat in the star's core will generate helium. When hydrogen runs low and the star begins to reach the next phase of its life cycle, it will fuse helium into the next heavier element, and so on.

This process continues until the element of iron, where the balance suddenly shifts because fusing iron consumes energy rather than creating it. With no means of generating internal energy to counteract its own immense pressure and gravity, the star begins to collapse onto itself. If the star is large enough, the result is a supernova—a massive star explosion. Heavier elements are formed during the incredible energy generated during this process, including gold. ... *Read more*.

Field Trip: James Madison University Mineral Museum

by Sue Marcus

Drs. Lance and Cynthia Kearns treated NVMC members to a private showing of the James Madison University Mineral Museum. About eight club members ventured to the JMU campus for the magnificent collection developed by the Kearns.

The newly reopened displays included cases devoted to categories of minerals (sulphides, oxides, carbonates, and so forth) along with special cases of minerals from Elmwood, TN, and, of course, Virginia. A separate room shows off the fluorescent collection, which includes many specimens collected by Lance and Cindy.

Both new and old localities are represented in the collection. A zoned octahedral fluorite from China, rhodochrosites from N'Chwaning and Colorado, and tourmalines from Brazil were among the many highlights we saw. Cindy and Lance also laid out boxes of specimens and books for us, available for donation or for free.

We are grateful for this opportunity to learn by seeing minerals, enjoying their aesthetic properties, and having good fun with nice people. ⚒

Navigating Maps

Using Topographic Maps to Your Best Advantage

by Roger Haskins

A topographic map is a display of the Earth's surface for a given area. The map is presented in contour lines that connect points of equal elevation at a specified spacing of elevations (10 feet, 20 feet, 50 feet, and so on) between each contour line. The closer together the contour lines, the steeper the hillside or valley wall. All elevations are given as feet above sea level. The top of the map is always north. In the United States, topographic maps are mostly produced by the U.S. Geological Survey, although some state surveys have issued their own versions.

Map Scales

For topographic maps, the common standard projections are 7.5-minute square (1:24000, 1 inch = 2,000 feet) and 15-minute square (1:62,500, 1 inch = 5,208 feet). The term "minute" refers to the fact that these maps cover 7.5 or 15 minutes of one degree of latitude and longitude per map. Regional maps at scales of 1:250,000 (1 inch = 20,833 feet or 3.946 miles) and 1:500,000 (1 inch = 41,667 feet or 7.89 miles) are also available.

A new metric series has been issued in scales of 1:10,000 (10 centimeters = 100 meters); 1:20,000; 1:50,000; and 1:100,000 (10 centimeters = 1,000 meters). The 1:50,000 and 1:100,000 are the most common scales issued. Fairfax County has been mapped at both the 1:24,000 and the 1:100,000 scales (fig. 1).

If you are going to take a hike or long-distance bike ride, you will want to figure out the terrain you will pass over. The location of hills and valleys along your route may require some advance planning, so you can create a topographic profile.

Creating a Topographic Profile

I have used the Manassas 7.5-minute quadrangle for this exercise (fig. 1). The scale is 1:24,000 and the contour interval is 10 feet.

The profile line is a dark pencil line, labeled A-A′. Using a blank sheet of graph paper, lay it along the profile line and tape it to the horizontal profile line. Use blue painter's tape, which is a low-tack tape and

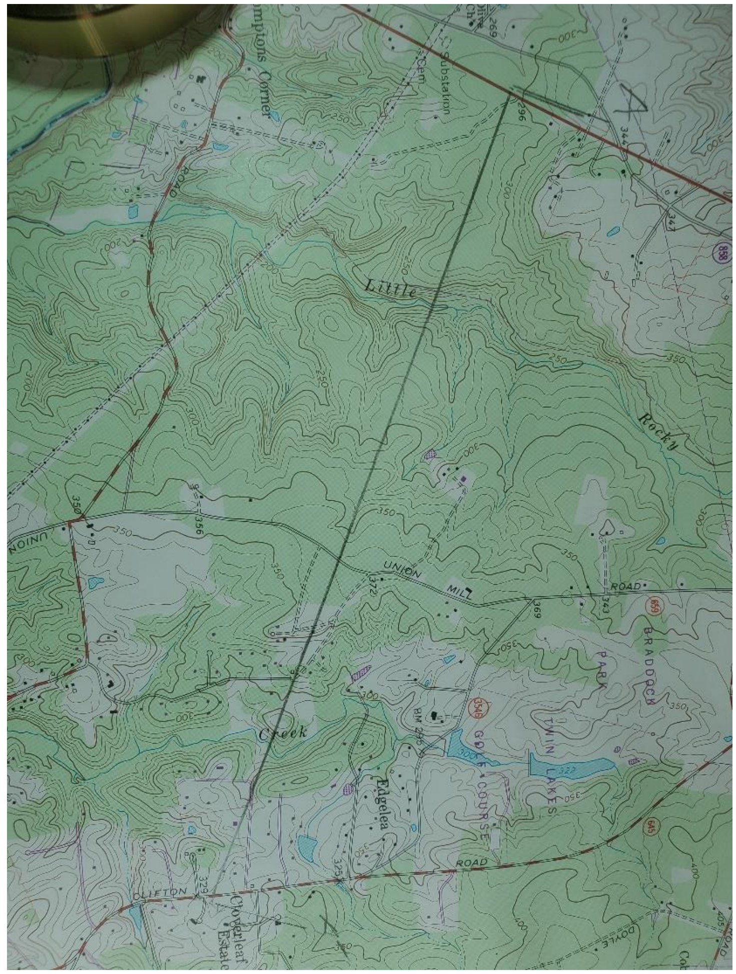


Figure 1—*Manassas quadrangle above Manassas Park USGS 7.5-minute series.*

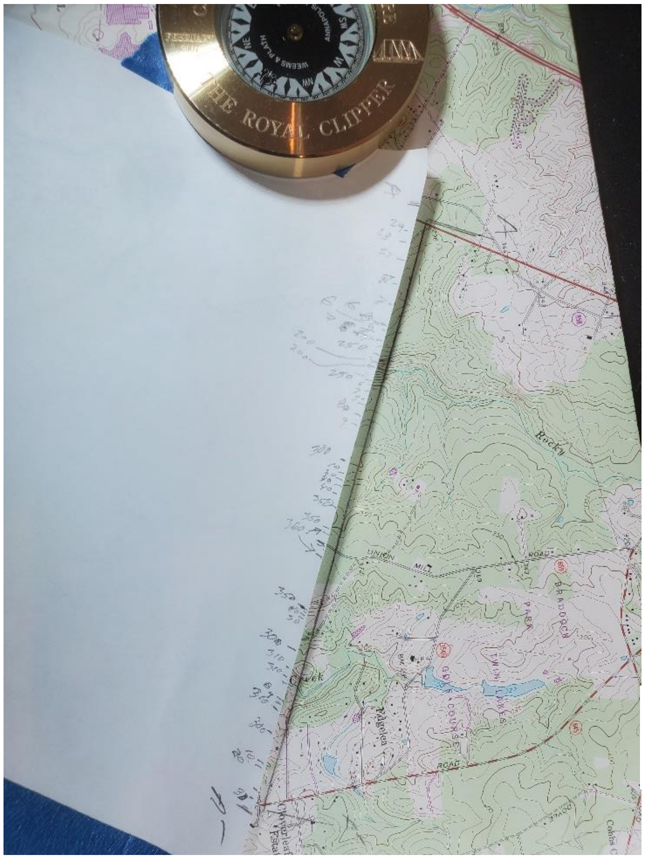
prevents the map face from being removed when you remove the tape.

Mark the ends A-A′ (fig. 2). Then project each elevation point onto the graph using a soft lead pencil. Once all the points are in place, connect the dots using smooth curves. (Mother Nature does not like straight lines except in fault zones.) Add road, powerline, railroad, and water intersections, labeled accordingly.

You now have your topographic profile (fig. 3)!

Terrain Analysis From the Profile

From Centerville Road (A) on figure 3, the land slopes eastwards down into the valley of Little Rocky Run Creek, a difference of 40 feet. About halfway down, the slope of the land flattens and then continues downwards to the creek.



The entire flat area on both sides of the creek is its floodplain. Do not build a house there!

Continuing eastwards and upwards, the first notch is the other side of the creek's floodplain. The creekbed's channel is 20 feet deep and about 900 feet wide; the flood plain is about 3,500 feet wide.

When you reach near the top of the slope at an elevation of 350 feet, you have reached Union Mill Road. Proceeding eastwards, you descend downwards to a major roadcut and then up to Clifton Road (A′).

Your total distance traveled is 14,000 feet horizontally; your actual walking distance is about 20,300 feet.

Figure 2—*Tick strip in place along profile section line.*

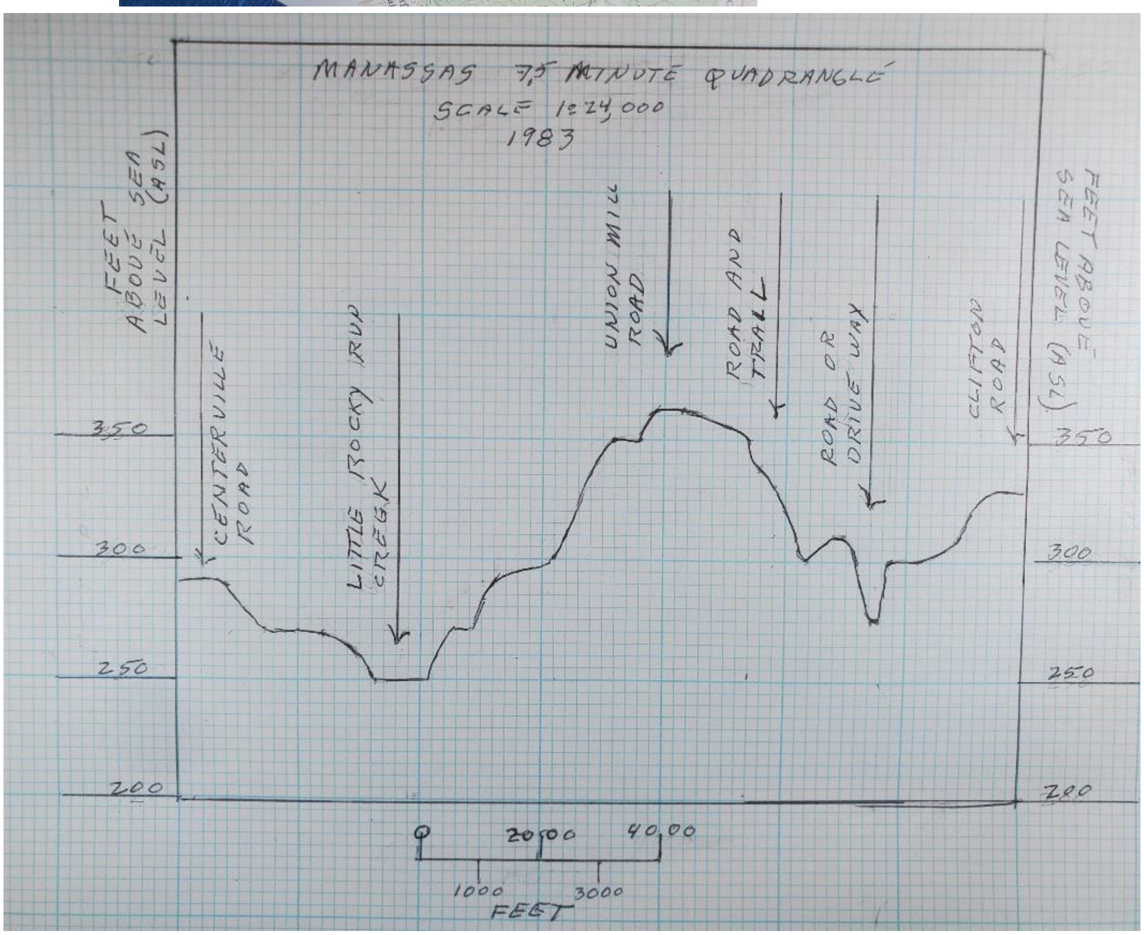


Figure 3—*Topographic profile along line A-A′. Vertical exaggeration is 20x.*

Physical Properties of Gems and Minerals

Color

Editor's note: *Ever wonder that the "technical details" for a mineral are? This article, based on an [online course on gemology] by Barbara Smigel, outlines some basic aspects of color in gems and minerals.*

The color of a gem or mineral is determined by the way it absorbs light. White light is actually made up of various colors. The diagram at right shows the relative distance from crest to crest (wavelength) of the various components of white light.

Selective Absorption

The color of most objects, minerals included, is a result of a process called selective absorption. For example, suppose you have on a yellow shirt. Why is it yellow? The fibers and dyes in it absorb wavelengths of white light in the red, orange, green, blue, and violet bands. The yellow wavelengths are reflected back to the eye of the observer, who sees the shirt as yellow. The shirt could be greenish yellow or yellowish orange if wavelengths slightly shorter or longer than yellow were also reflected.

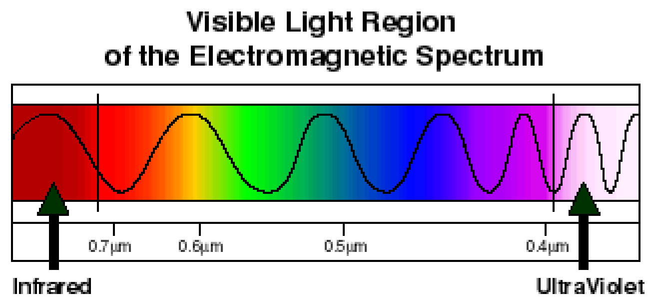
The color of a gem or mineral will depend on what is reflected after selective absorption has removed part of the spectrum.

- If none of the wavelengths are absorbed, the gem will be colorless if it is transparent or white if opaque.
- If equal amounts of each wavelength are absorbed, the gem will be gray.
- If all wavelengths are absorbed equally and completely, the gem will be black.

If selective absorption determines color, what determines selective absorption? Why do rubies look red and sapphires blue?

The basic answer is simple: selective absorption in gems results from the interplay between their chemical makeup and their three-dimensional structure.

The atoms that create color in a gemstone are called chromophores. The most common chromophores in minerals include titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, nitrogen, and boron, along with their various ions. (Ions are atoms with unequal numbers of protons and electrons,

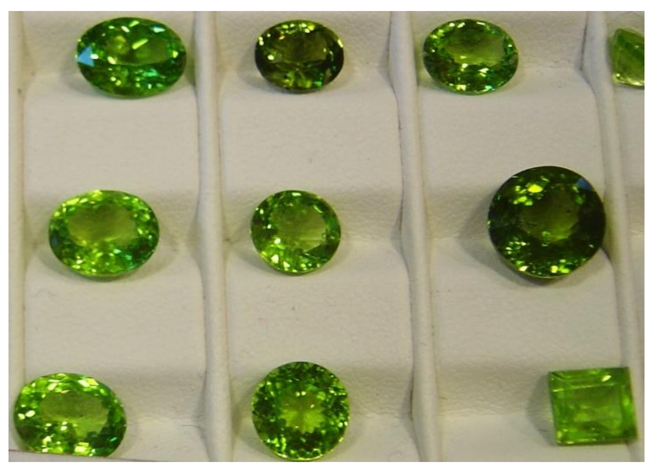


making them positively or negatively charged.) Both particular atoms and ions and specific crystal "defects" (such as missing or extra atoms or areas of compression or strain within the crystal structure) can act as coloring agents in gems.

Basic Color Determinants

With respect to color, gems fall into two categories: idiochromatic and allochromatic. Idiochromatic gems derive their color from the chemistry of their basic formulas (such as Fe_2SiO_4 for peridot, with the iron ion (Fe^{+2}) making the gem appear green). Therefore, ideochromatic gems are always in shades of the same basic color.

Allochromatic gems are more common. The chemistry of their basic formula does not cause any selective absorption; in a "pure" state, they are white or colorless. Trace amounts of impurities act as the chromophores. Such gems occur in colorless forms as well as in a variety of other colors, depending on the nature and amount of their impurities.



Peridot gemstones in shades of the same basic green. The coloring agent is the iron ion (Fe^{+2}) in its chemical makeup (Fe_2SiO_4). Source: Wikipedia.

Cuprite with malachite. Copper ions (Cu^{+1} and Cu^{+2}, respectively) are the coloring agents for both (red and green, respectively).
Source: Wikipedia; photo: Didier Descouens.

Idiochromatic Gems

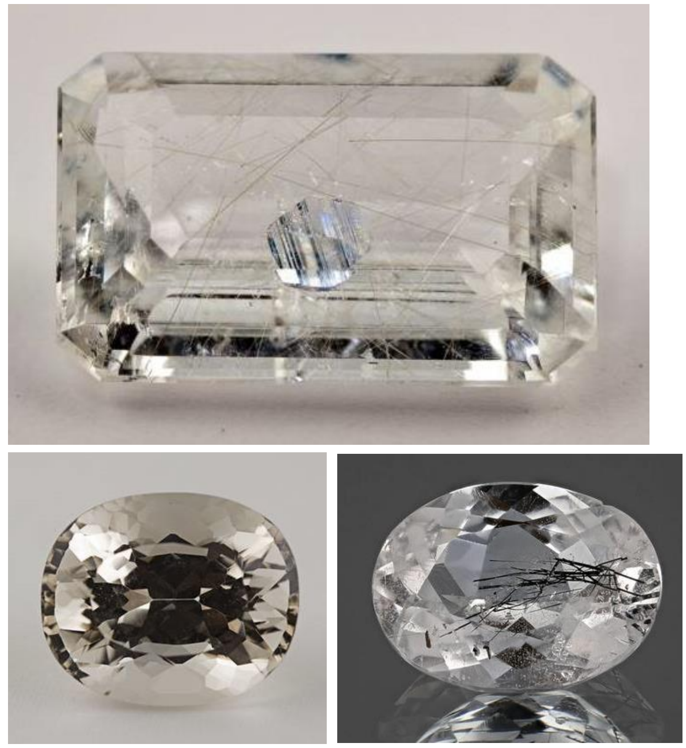
Idiochromatic gems include cuprite (Cu_2O) and malachite ($CU_2CO_3(OH)_2$), both containing copper. But cuprite is red and malachite is green, so how can that be?

Welcome to the wonderful world of gem color!

A particular element does not always make a gem or mineral a particular color. Each gem's color is determined by the interplay between its chemical makeup and its physical structure.

To complicate matters, some emeralds are green due to their chromium content, whereas others get their green from vanadium. In fact, iron (as in peridot), copper, chromium, and vanadium can each make a gemstone look green.

Yet chromium in corundum makes rubies red; iron gives chalcedony an orange color and makes sapphires appear yellow. Green zircons and green diamonds both get their color not from chromophores but from crystal defects.



Allochromatic gems (pure state): **Top**—*Rock crystal (quartz);* **bottom left:** *danburite;* **bottom right:** *topaz. Source: Smithsonian Gem Collection.*

Allochromatic gems (and coloring agents). Beryl—emerald (chromium or vanadium); zoisite—tanzanite (vanadium); quartz—carnelian (iron). Sources: Wikipedia; Smithsonian Gem Collection.

Allochromatic corundum gems in various hues, including pure white sapphire (colorless); corundum with iron (yellow/orange sapphire); with iron and titanium (blue/green/purple sapphire); and with chromium (pink sapphire). Enough chromium in the corundum to turn it red makes it a ruby. Source: Smithsonian Gem Collection; photo: Chip Clark.

Allochromatic Gems

Allochromatic gems include beryl, corundum, quartz, grossular garnet, tourmaline, topaz, spinel, and nephrite jade. In some cases, the "pure" material is the most common and therefore the lowest in value; corundum, quartz, beryl, and topaz are in this category. In other cases, the pure form is so rare as to be a high-value collector's item, especially for grossular garnet, tourmaline, and nephrite jade. Colorless spinel is so rare that it literally has not been found in nature; we know it only from labs.

A good example of an allochromatic gem species is corundum (Al_2O_3). Pure corundum is colorless (as in white sapphire), but if we add just a tiny bit of iron to the mix, then we get yellow or orange sapphire; pair the iron with a bit of titanium and the gem becomes the familiar blue. And if chromium is the chromophore, then the corundum is red and called ruby.

Some gems get their color from inclusions of other minerals. One of the most beautiful of all the chalcedonies, often called "gem silica" but more properly termed chrysocolla chalcedony, has a vivid blue-green color. The minute quartz crystals are actually colorless, but among them are tiny crystals of the blue-green (and very soft) mineral chrysocolla. The overall result, in the best specimens, is a translucent chrysocolla-colored gem or mineral with the durability of quartz.

Chrysocolla quartz (top) and strawberry quartz (bottom). Source: Wikipedia; photos: Rob Lavinsky.

In the varieties known variously as strawberry and raspberry quartz, particles of red or red-orange hematite, depending on their size and number, create a pink, orange, red, or polkadot-looking appearance in the colorless quartz.

Multiple Colors

One of the most common features of some gemstones is patterning. Since gems form from very tiny single crystals, we can easily envision conditions where differently colored pools or batches of tiny crystals mix and intermesh, creating bands, dots, or other patterns. Agates and jaspers are the most common minerals with strong patterns.

Single-crystal gems subjected to changing conditions during their growth can show bands or zones of different colors or shades of the same color. When these are dramatic and attractive, they are desirable; but far more commonly, gems of this type have nondescript, patchy, or zoned coloration and are considered inferior to more evenly colored pieces.

Source

Smigel, B. 2012. [Introduction to gemology: Optical properties of gems]().

Gems with color zoning. Watermelon tourmaline (top) and ametrine (bottom). Sources: Smithsonian Mineral Gallery; Wikipedia.

Minerals with patterns. Clockwise from top: ocean jasper, red-green-yellow jasper, Tabu jasper, mookaite chert, bloodstone, polkadot jasper. Source: Wikipedia.

AUCTION BID SLIP

ITEM # ________________________________

DESCRIPTION__________________________

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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AUCTION BID SLIP

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FROM _________________________________

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Bidders: You need to bid on this item if you want it to be auctioned! Place bid below.

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Bidders: You need to bid on this item if you want it to be auctioned! Place bid below.

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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
	1			
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	28			

May 2022—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4 MSDC mtg	5 Cinco de Mayo	6	7
8 Mother's Day	9 GLMSMC mtg	10	11	12	13	14
15	16	17	18	19	20	21
22	23 NVMC mtg	24	25 MNCA mtg	26	27	28
29	30 Memorial Day	31				

Event Details

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

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

23: Arlington, VA—Northern Virginia Mineral Club; info: https://www.novamineralclub.org/.

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

Disclaimer

All meetings/shows are tentative during the coronavirus pandemic, and club meetings might well be remote. Check the website for each organization for more information.

2022 Club Officers

President: Tom Kim
president@novamineral.club
Vice President: Sue Marcus
vicepresident@novamineral.club
Secretary: David MacLean
secretary@novamineral.club
Treasurer: Roger Haskins
treasurer@novamineral.club
Communication: Vacant
Editor: Hutch Brown
editor@novamineral.club
Field Trip Chair: Vacant
Greeter/Door Prizes: Vacant
Historian: Kathy Hrechka
historian@novamineral.club
Show Chair: Tom Taaffe
show@novamineral.club
Tech Support: Tom Burke
tech@novamineral.club
Webmaster: Casper Voogt
webmaster@novamineral.club

The Northern Virginia Mineral Club

Visitors are always welcome at our club meetings!

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

Please send your newsletter articles to:
Hutch Brown, editor
4814 3rd Street North
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 member).

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 fourth Monday of each month (except May and December).* (No meeting in July or August.)

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