THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: October 26 Time: 7:45–9:00 p.m.

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

Source: http://www.reddit.com/user/Jarl_of_Michigan

Happy Halloween!

Volume 56, No. 8
October 2015
You can explore our club website:
http://www.novamineralclub.org/

Northern Virginia Mineral Club members,

Please join our October speaker, Bob Cooke, for dinner at the Olive Garden on October 26 at 6 p.m.

Olive Garden, Baileys Cross Roads (across from Skyline Towers), 3548 South Jefferson St. (intersecting Leesburg Pike), Falls Church, VA
Phone: 703-671-7507

Reservations are under Kathy Hrechka, Vice-President, NVMC. Please RSVP to Kathy at 703-407-5393 or kshrechka@msn.com.

October 26 Program

Bob Cooke: Micromineralogist Extraordinaire

by Kathy Hrechka, Vice-President

Bob Cooke will present his recently acquired perspectives on microminerals. He is a member of the Micromineralogists of the National Capital Area, a club that views minerals under microscopes.

Opal
October birthstone

Fire opals from Queretaro, Mexico, in the Smithsonian National Gem Collection. Photo: Chip Clark.

Pyromorphite wulfenite (micromineral). Photo: Bob Cooke.

Bob has an academic background in chemical engineering and physics, but he acknowledges that 20 years in the Army might have "flushed away" the greater part of that knowledge. As a Chemical Corps officer, Bob specialized in nuclear and chemical weapons. Upon retiring from the Army, he spent another 20 years supporting nuclear programs at the U.S. Department of Energy (DOE) in Germantown, MD, both as a contractor and as a federal employee.

While stationed in Germany in 1975, Bob was introduced to thumbnail minerals by a fellow Army officer with a geology background. A few years later, Bob and his wife Carolyn attended a mineral show in California, got hooked, and have been collecting thumbnails ever since.

In 2012, Bob retired from DOE. To support his interest in mineral crystals and geology, he took advantage of Virginia's senior citizen program to audit several geology classes at Northern Virginia Community College (NOVA). He has been volunteering in the NOVA Geology Department ever since.

Club Member Social: After Bob speaks, club members are invited to share their hobby interests. Refreshments will be served. ⛏

The Prez Sez

by Wayne Sukow

We need members to volunteer to serve our club as an officer for next year!

I have found a candidate for NVMC President. Now we need candidates for Vice-President, Treasurer, and Secretary.

It's our club. Let's keep it! ⛏

In this issue …

Deadline for Submissions

November 1

So we can send out the newsletter on time, please make your submission by the 1st of the month! Submissions received later might go into a later newsletter.

Previous Meeting Minutes
September 28, 2015

by Ti Meredith, on behalf of Secretary David MacLean

President Wayne Sukow called the meeting to order at 7:50 p.m.

Wayne recognized past presidents in attendance, including Sue Marcus, Rick Reiber, Barry Remer, Rob Robinson, and Wayne Sukow himself.

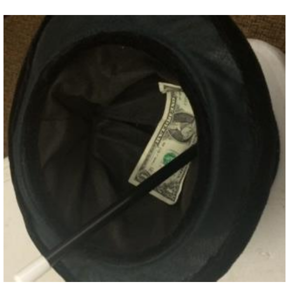
Jim Kostka reminded everyone of the GMU club show coming up on November 21–22. He asked members to take show cards with coupons and pass them out everywhere. (Print out the card on page 18 and bring it with you to the show for a discount!) We need more volunteers so sign up as soon as possible. The November club meeting will be in the third instead of the fourth week of the month. Further discussion will happen at the October club meeting.

Vice-President Kathy Hrechka reported that Alex Brenner, three-time recipient of a grant from the club's Fred C. Schaefermeyer Scholarship Fund, is doing well at Cal Tech. He will submit a series of articles on his experiences at school, the first of which appears in this newsletter beginning on page 9. He thanks the club for supporting him.

Conrad Smith, according to his mom, is also doing well in school. He is another recipient of the club's scholarship fund. He also sends his thanks for the club's support.

Morefield Mine is open again on Saturdays to the general public. It will be open from October 10 to December 5. Opening time is 9:30 a.m. Look for more information at http://www.morefieldmine.com/.

The business meeting adjourned at 8 p.m. and the club auction began. Fifteen percent of the proceeds went to the Fred C. Schaefermeyer Scholarship Fund, and we also passed around the money magic hat for the scholarship fund.



The auctioneers were Matt Charskey, Sheryl Sims, and Tom Taaffe. The auction went well and lots of minerals were sold.

The Great Mass Extinctions

by Bonnie Berkowitz and Alberto Cuadra

Editor's note: *The article is from* The Washington Post, *June 29, 2015. Thanks to Sue Marcus for the reference!*

Extinct Pyrenean ibex. Source: Wikipedia.

Scientists have spotted five times when a huge portion of Earth's species died out relatively rapidly. Each time, something created an upheaval that altered the planet faster than those species could adapt. A growing number of scientists think we are a few hundred years into a sixth mass extinction, possibly the fastest one yet. And the cause of the upheaval, they say, is human activity.

To see a chart with the timeline of the six mass extinctions, along with their extent and causes, go to: https://www.washingtonpost.com/apps/g/page/multimedia/the-great-mass-extinctions/1745/

Dazzled by Australia's Precious Opals

by Jonathan Amos

Editor's note: *The article is from* Science and Environment, *May 8, 2015. Thanks to Sue Marcus for the reference!*

It's exactly 100 years since the teenage Willie Hutchinson stumbled across a few pieces of opal while walking in the Australian Outback.

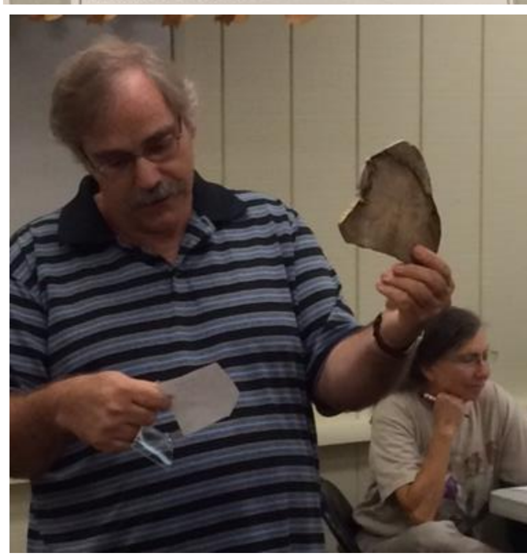
There with his father to prospect for gold, the youngster's chance find led to a gemstone mining boom and the establishment of the town of Coober Pedy.

Today, the settlement even refers to itself as the "opal capital of the world," with the wider Australian deposits producing more than 80 percent of the world's precious opals. …

Read more at: http://www.bbc.com/news/science-environment-32665035

Scenes from the September NVMC meeting and club auction …

thanks to Sheryl Sims for all the great photos!



Mineral of the Month

Opulent Opals

by Sheryl E. Sims

Deriving its name from the Greek word *Opallos* (meaning "to see a change of color"), opal has always been one of my favorite gemstones. With colors ranging from a milky white to even black (the most rare), opals are also found with flashes of red, yellow, blue, and green, which only enhance their beauty. White and green opals are the most common.

Opals are the hydrated amorphous form of silica, with a water content that ranges from 3 to 21 percent but is usually about 6 to 10 percent. Therefore, opals are also very fragile.

Did you know that almost 97 percent of the world's supply of opals comes from South Australia? However, Ethiopia also has a large supply of opals.

Opals are classified as a mineraloid because of their amorphous character. Opals are a noncrystalline silica gel that seeps into crevices in the sedimentary strata. Due to heat and molding, the gel hardens, which forms the opals. Tightly compressed particles arranged in a spherical shape create the three-dimensional array of spaces that gives opals their radiance.

The internal structure of the opal causes it to diffract light, which lends to its beauty. Opals can be found in areas with sandstone, limonite, rhyolite, and basalt.

The general characteristics of opal include the following:

Category ....Mineraloid

Formula .... Hydrated silica ($SiO_2 \cdot nH_2O$)

Color ....Colorless, white, yellow, red, orange, green, brown, black, blue

Crystal habit .....Irregular veins, in masses, in nodules

Crystal system ....Amorphous

Fracture .... Conchoidal to uneven

Mohs hardness.. 5.5–6

Luster ....Subvitreous to waxy

Streak ....White

Density 2.9

The "Rainbow Shield," an opal pendant made with Australian gem opal. Source: Wikipedia.

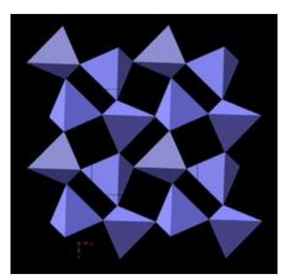
Polish luster .... Vitreous to resinous

Optical properties ......Single refractive, often anomalous double refractive due to strain

Refractive index.........1.450 (+.020, –.080) Mexican opal may read as low as 1.37, but typically reads 1.42–1.43

Fluorescence .... *Black or white body color:* inert, to white, to moderate light blue, green, or yellow in long and short wave; may also phosphoresce. *Common opal:* inert to strong green or yellowish green in long and short wave; may phosphoresce. *Fire opal:* inert to moderate greenish brown in long and short wave; may phosphoresce.

My favorite variety of opals is the fire opal. Perhaps its beauty is one of the reasons that it is Australia's national gemstone!



Crystal structure of opal. Source: Wikipedia.

It's hard to ignore the volcanic glow of a fire opal, which is mined in Mexico. It's said that fire opals were born in the fire in the ancient volcanoes of Mexico, forming when water seeped into the silica-rich lava.

The American Federation of Mineral Societies has a wonderful DVD on fire opals. I

Multicolored black opal cabochon from Lightning Ridge, New South Wales, Australia. Source: Wikipedia.

An opal "triplet" from Andamooka, South Australia, showing blue and green fire. Source: Wikipedia.

saw it a couple of years ago during one of our club meetings. It shows a vast landscape with mounds of rocks where individuals had staked their claims to certain areas.

It also showed the interior of houses that miners had built in the mines. Digging out for those houses alone unearthed small fortunes in opals. While digging out a bathroom, one homeowner found $70,000 worth of opals; another, in digging out for a kitchen, netted $50,000 worth of opals.

Opals are not just opulent, colorful, and desirable; they are amazing! ⛏

Sources

American Gem Society. 2015. Why the American Gem Society.

Boyle, J. 2011. Mexican fire opal.

No author. 2015. Opal. Wikipedia.

AFMS News
Fossil Collecting in the National Forests

by John Martin, AFMS Conservation & Legislation

Editor's note: *The article is adapted from* A.F.M.S. News *(June 2015), pp. 5–6.*

A final ruling of interest to rockhounds has been released by the U.S. Forest Service. Included in the final rule are definitions important to collectors of fossils on lands managed by the Forest Service—the national forests and grasslands.

One definition is of particular interest: "The term casual collecting restates the definition contained in 16 U.S.C. 470. To be considered casual collecting, the activity means all of the following: Collecting of a reasonable amount of common invertebrate or plant paleontological resources for noncommercial personal use, either by surface collection or the use of non-powered hand tools, resulting in only negligible disturbance to the Earth's surface and other resources."

Other parts of the final rule are also of interest. For example, casual collecting requires no permit and is generally allowed on national forest land except in areas specifically closed to casual collecting.

Each casual collector may take no more than 25 pounds of material per day and no more than 100 pounds per year. Minimal surface disturbance using hand tools is allowed; when finished, collectors must fill in any holes. Material collected is for personal use only and may not be sold.

For the full report, go to the AFMS website at http://www.amfed.org/news/n2015_06.pdf. ⛏

Rock collecting on the Chattahoochee–Oconee National Forests in Georgia. Photo: U.S. Forest Service.

GeoWord of the Day

(from the American Geoscience Institute)

plateau mountain

A pseudomountain produced by the dissection of a plateau; e.g., the Allegheny Mountains of West Virginia or the Catskill Mountains of New York.

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

EFMLS News

Our Code of Ethics: Safety Aspects

by Ellery Borow, EFMLS Safety Chair

***Editor's note:** The article is adapted from* EFMLS News *(October–November 2013), p. 3.*

Seems as though there are safety instruction manuals for everything. Safety goggles, rock picks, hardhats, and lapidary equipment of all sorts have their manuals or instructions. In our litigious society, companies are bound by their insurers and volumes of government regulations to ensure your safety. Their manuals are there, in part, for your protection and safety. The instructions in most manuals ask the user something to the effect of, "Please read and follow these instructions." Those instructions are there for a reason!

Just the other day, I assembled a tiny portable charcoal grill. The grill had all of four parts for assembly. I read all three pages of the assembly instructions (except for those in French, German, and Portuguese) twice! The directions were so simple I could have assembled the grill with one screwdriver tied behind my back. Even though simple, I still read the directions.

Our EFMLS and AFMS both abide by a set of safety instructions—you may know them as the Code of Ethics. I hope you keep a copy of the code with you. *[Editor's note: You can find the code on the following page.]*

The code's safety aspects are summarized below:

1. "I will respect both private and public property …" This is the ethical thing to do and also the safe thing to do.

2. "I will keep informed on all laws …" Also for your protection. Knowledge is indeed power.

3. "I will, to the best of my ability, ascertain the boundary lines …" Very much a safety issue as well.

4. "I will use no firearms or blasting material …" No more need be said.

5. "I will cause no willful damage …" A safety issue for both you and the property owner.

6. "I will leave all gates as found." Safety for your fellow creatures!

7. "I will build fires only in designated …" Smokey Bear, I'm sure, will thank you for being safe.

8. "I will discard no burning material …" Ditto.

9. "I will fill all excavation holes …" Could this be any more clearly a safety issue?

10. "I will not contaminate …" Safety, safety, safety!!!

11. "I will cause no willful damage to collecting material …" Not specifically a safety matter but the right and ethical thing to do.

12. "I will practice conservation …" Perhaps an indirect reference to the safety and protection of our hobby?

13. "I will support the rockhound project HELP (Help Eliminate Litter Please) …" Most certainly a health and safety issue as well.

14. "I will cooperate with field trip leaders ..." Our field trip leaders are there, in part, to keep us safe.

15. "I will report to my club or federation officers … any deposit of petrified wood or other materials … that should be protected …" Similar to number 12.

16. "I will appreciate and protect our heritage of natural resources." Again, similar to number 12.

17. "I will observe the Golden Rule …" No doubt about it, another matter that involves safety.

These 17 items not only constitute the AFMS Code of Ethics but also underpin our safety guidelines. Please be ethical and please be safe. It is in our hobby's instruction manual—and you do read instruction and safety manuals, don't you?

AFMS Code of Ethics

A large measure of the enjoyment of our hobby consists of collecting in the field. For that reason, the members are proud to endorse the following:

1. I will respect both private and public property and will do no collecting on privately owned land without permission from the owner.
2. I will keep informed of all laws, regulations, or rules governing collecting on public lands and will observe them.
3. I will, to the best of my ability, ascertain the boundary lines of property on which I plan to collect.
4. I will use no firearms or blasting material in collecting areas.
5. I will cause no willful damage to property of any kind, such as fences, signs, buildings, etc.
6. I will leave all gates as found.
7. I will build fires only in designated or safe places and will be certain they are completely extinguished before leaving the area.
8. I will discard no burning material—matches, cigarettes, etc.
9. I will fill all excavation holes that might be dangerous to livestock.
10. I will not contaminate wells, creeks, or other water supplies.
11. I will cause no willful damage to collecting material and will take home only what I can reasonably use.
12. I will practice conservation and undertake to utilize fully and well the materials I have collected and will recycle my surplus for the pleasure and benefit of others.
13. I will support the rockhound project H.E.L.P. (Help Eliminate Litter Please) and will leave all collecting areas devoid of litter, regardless of how found.
14. I will cooperate with field trip leaders and those in designated authority in all collecting areas.
15. I will report to my club or federation officers, the Bureau of Land Management, or other authorities any deposit of petrified wood or other materials on public lands that should be protected for the enjoyment of future generations or for public educational and scientific purposes.
16. I will appreciate and protect our heritage of natural resources.
17. I will observe the Golden Rule, will use good outdoor manners, and will at all times conduct myself in a manner that will add to the stature and public image of rockhounds everywhere.

Lab Notes
Mineral Identification (the Cool Way)

by Alec Brenner

Author's note: *For 2 years now, I've been an undergraduate student at the California Institute of Technology (Caltech), where I'm working towards a degree in geology. The NVMC has supported my studies from the beginning, thanks to three scholarships from the Fred C. Schaefermeyer Scholarship Fund, gifts for which I am extremely grateful. To show some appreciation for the club, I thought it might be fun to write a series of articles about my research at Caltech. In this* ***Lab Notes*** *series, I intend to cover some of the interesting, curious, or otherwise neat experiences I've had with two major lab groups (paleomagnetism last summer and mineralogy this summer). In this first article, I examine one of the professional "tools of the trade" used for identifying minerals.*

I was recently reminded of how I came to work in the Caltech mineralogy lab while browsing through my old phone photos. I came across one I took at the September 2014 NVMC auction. It showed an opaque, ruddy brown specimen about the size of a fist, with no easily discernable crystals and with no locality or collector information. In short, a mystery specimen.

Tom Taaffe was the lucky winner of the odd lump of something-ite, and I asked him whether I could chip off a tiny piece so I could try to identify it using Caltech's instruments. He was just as intrigued as I was, and he happily let me fracture off a few pieces the size of peppercorns.

In October 2014, midway through fall term at Caltech, I still hadn't formally taken mineralogy. But I knew the name of the professor who taught it, Dr. George R. Rossman. I wandered up to his office to meet him and ask about NVMC's mystery lump.

Not knowing what to expect, I couldn't help but gawk at his office as he invited me in. Professor Rossman had been a professional mineral spectroscopist and geochemist and an avid mineral collector for some 40 years, and his walls and shelves were accordingly decorated with some of the most spectacular mineral specimens I'd ever seen. For instance:

- Scattered throughout the room were gleaming boules (artificial crystals) of pure silicon the size of melons.

NVMC's mystery mineral. Tom Taaffe received it during the September 2014 club auction and graciously allowed the author to take a small sample for study. Photo: Alec Brenner.

- Under a bunch of books was a sheet of synthetic sapphire over a foot long.
- On top of a filing cabinet were bookends made of purple rose quartz—that's right, not amethyst, but purple rose quartz! I didn't know there was even a difference.
- In a display cabinet were several hand specimens of rossmanite, the tourmaline species *named after him*.
- To the left of the rossmanite was much of the world's supply of painite, once the world's rarest mineral.
- Stored in drawers were several new minerals that were even rarer, the details of which I can't even divulge until he publishes something about their discovery.

Professor George R. Rossman, the working head of the Caltech mineralogy laboratory and my current research mentor. Source: [University of Wisconsin at Eau Claire](#).

- On top of a bookshelf were the flags of the 18 countries he'd traveled to on mineralogy business.

I guess I shouldn't have been surprised, but he had an incredible workspace!

At some point, I showed him the specks of NVMC's mystery rock. I asked him naïvely, "Do you have any instrumentation to identify this? Maybe an X-ray diffractometer?" Somewhere in the back of my mind, I half expected him to hand me a streak plate and a Mohs hardness scratch-testing kit.

He chuckled and replied, "Of course we do—although we wouldn't use an X-ray diffractometer, that's over in the chemistry division. We can actually do it a lot more easily with our spectrometers. Why don't we take it over to the IR spectrometer right now and take an ATR on it? That'll tell you whether it's got sulfates or carbonates or silicates or if it's organic."

I was amazed at how readily he turned his full scientific attention to my ornery specimen. Heck, compared to the stuff just lying around in his office, it could just as easily have been dirt off the floor. But no, in this lab, even the dirt was interesting!

I asked another naïve question: "Okay, how long will this ATR take? Because I have a class to go to at 2:30." I had no idea what an ATR even was, so I expected something like an hour. I was again pleasantly surprised.

"Ten minutes," Professor Rossman said, "start to finish."

So into the lab we went. On the main table were a pair of boxlike instruments encased in off-white plastic, somewhat yellowed with age, as well as a gigantic microscope. I could only assume that these were spectrometers. Gesturing towards the nearest one, Professor Rossman said, "Have a seat—that's the IR ATR machine. How much experience do you have with IR spectroscopy?"

"None in practice, and not a lot in theory either," I admitted. In my high school organic chemistry class, I had learned some of the basics of reading IR spectra, but not much else.

Rossman's eyes lit up: He was about to turn this into a teachable moment. He set about explaining the machine, filling the main gaps in my knowledge.

"This is an attenuated total reflectance (ATR) infrared (IR) spectrometer," he said. "'Infrared' just means that the spectrometer measures infrared light. 'ATR' is a bit more subtle, and we'll get to that. But first, we need to start it up."

Before I confuse anyone, a bit of context is warranted, and it goes all the way back to high school physics (and not the part where you pretended that throwing paper planes was an aerodynamic experiment; believe me, that was my favorite part). I was taught that light was a wave, with oscillating electric and magnetic fields, and that the distance between a pair of crests on a light wave was called the light's wavelength. For instance, the wavelength of purple light is about 0.4 microns. A micron is a unit of length exactly a millionth of a meter long, and inconveniently abbreviated with the Greek lowercase letter "μ." (Sometimes, the more formal "μm" is used, which doesn't help either.)

Likewise, the wavelength of red light, on the other end of the visible rainbow, is about 0.7 μ, or 0.7 millionths of a meter. Thus, the range of light wavelengths that we can see is from 0.4 μ to 0.7 μ.

Infrared light—the invisible kind of light that comes out of heat lamps, the kind that thermal imaging cameras see—covers the much larger range of wavelengths from 0.7 μ to 1,000 μ. In fact, 1,000 μ is the same as a millimeter—so you can imagine how small 0.7 μ is.

Additionally, a spectrometer is an instrument that produces spectra (the singular form of the word is spectrum). Spectra are plots of how a measurable property of light (usually)—such as intensity, absorbance, transmittance, reflectance, and energy flux—changes, depending on the wavelength of light in question. Spectrometers aren't always based on measuring light—some measure other forms of radiation—but the vast majority are light based, including all of the ones in Caltech's mineralogy lab.

Spectrometers are used by scientists like Professor Rossman to quickly assess the optical and chemical properties of their samples. In Professor Rossman's case, the samples are mineral specimens—sometimes real, sometimes artificial, and sometimes a mix of both. The properties he's interested in include the chemical causes of colors in his minerals, their water content, or possibly just their crystalline structures. He's also interested in how these properties change, depending on from what angle you look at a crystal, a strange but useful concept called anisotropy. But I'll deal with that in a later article.

Nearly everyone is familiar with at least one spectrometer. You might see it just after a storm rolls through. It's the rainbow, where small water droplets refract and disperse sunlight into an intensity spectrum. The colors correlate with the wavelengths of sunlight, and the brighter the color appears, the more intensely the sun emits it. The sun is brightest in the green, the center of the visible spectrum. The colors we see represent only a fraction of the full spectrum, which includes ultraviolet light past the purple part of the rainbow and infrared beyond the red part. The fact remains that a rainbow is a very simple spectrometer.

Modern scientific spectrometers are a different story. These are almost universally made of four basic parts: a *source* to produce light; *optics* to direct that light (including a spot for a sample of interest); a *detector* to see the light; and *computers* to control everything.

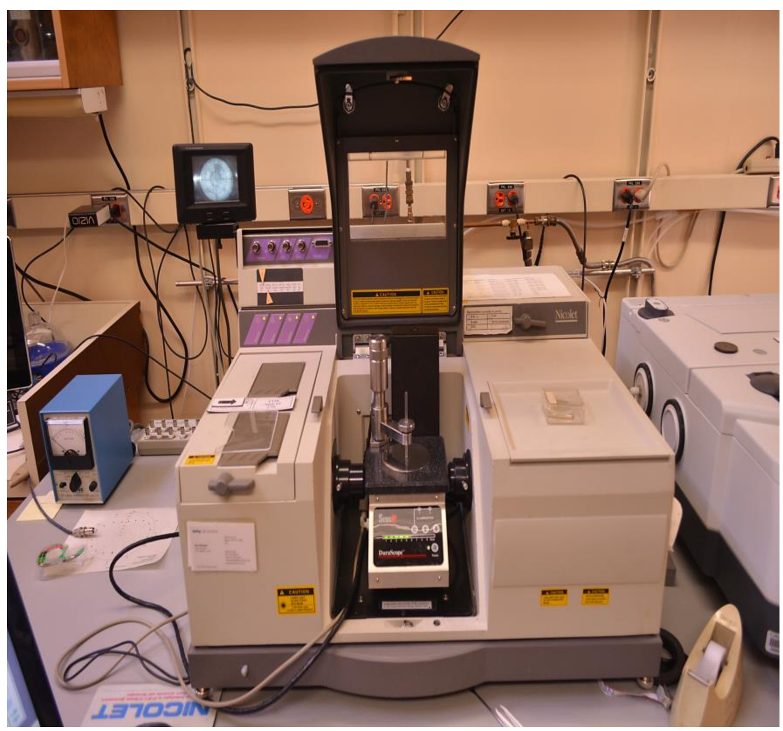
In this spectrometer, Professor Rossman told me, the *source* was a red-hot filament of silicon nitride that shone brightly with infrared light. The *optics* were, among other things, a bunch of precisely aligned mirrors that focused the light onto the sample area and then from the sample area to the detector. The *detector* was a tiny chip of deuterated triglycine sulfate, designed to detect light in the mid-infrared. The *computer* that controlled everything was a Windows 98 desktop—one of the many fossils that Professor Rossman kept around.

As I turned the spectrometer on, Professor Rossman posed a question: "This spectrometer measures the intensity of light coming from the sample, and it does that for light of many wavelengths. It uses that intensity spectrum to figure out at what wavelengths the sample absorbs light. But to do that we need more information—we need to know what that intensity spectrum looks like *without* a sample. What do we need to do first?"

I guessed the obvious. "Do we take a reference spectrum without the sample?"

"Yes," he replied, "but we call that a background. By doing some basic math and comparing the intensity spectra with and without your sample, the spectrometer will figure out how much light your sample absorbs over a range of wavelengths in the infrared. So let's take a background!"

I clicked the "collect background" icon on the control computer and watched as it produced a spectrum. The spectrum started out noisy, but it got better and better



The ATR spectrometer referred to in this article. The sample compartment is in the center of the photo. Photo: Alec Brenner.

as the machine took the same spectrum over and over again and averaged the trials.

At this point, Rossman did some more explaining. “This machine is designed off the concept of ATR,” he said. “Attenuated total reflectance—let’s think about what that means. ‘Attenuated’ is just a fancy way of saying ‘dimmed.’ So this machine measures the dimming of a reflection. The ‘total reflection’ is the background spectrum you’re looking at. The surface it’s reflecting off of is a small facet on a diamond, which is right here.”

He pointed at a small round spot in the sample area. I looked closer, and there was indeed a small, flat, clear object—the diamond—about a millimeter across, emitting a dim red light.

“Looking at your background spectrum, we can see a few dips in intensity,” he went on. “These are caused by nitrogen impurities in the diamond that absorb some light. That’s okay, though, this is a good background. What we’re going to do next is put your sample on the surface of the diamond.”

“But first,” he said, pointing at my sample, “we’ll need to turn that into a powder.”

Startled, I said “Excuse me? How destructive will this be?”

Professor Rossman reassured me that I wouldn’t need much powder at all. “Pick the smallest piece of your sample and powder it—that’ll be more than enough. All you need to do is get the powder to cover the tiny diamond surface. We regularly work with only a few milligrams of material, and you have a lot more than that.”

I selected a small grain of the sample and powdered it with a small mortar and pestle. As I carefully spread the powder over the diamond facet, Professor Rossman said, “Now we need to press that powder firmly onto the diamond. Just rotate that knob.”

I obliged, and as I rotated the knob, a stiff plastic rod pressed down on the sample. When it was pressed at the correct pressure, a little light came on.

“Okay, so now you need to know how light gets into your sample. This is what makes ATR work. When the light reflects off the diamond’s surface, a little will leak off the facet of the diamond and into your sample as an evanescent wave. The rest of the light travels back through the diamond. We’re going to detect that light.”

Cooool! But who on Earth could have come up with such a crazy instrument?

“This all seems pretty complex,” I said. “If you don’t mind my asking, how much does one of these instruments retail for?”

Professor Rossman grinned. “The one you’re using is an old but equivalent version of that one over there.”

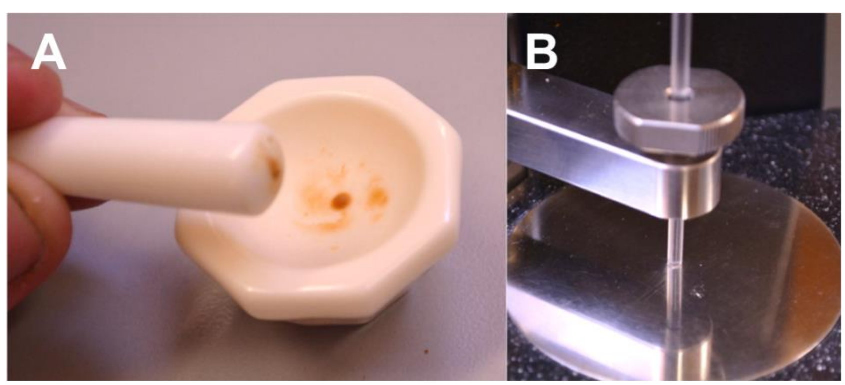
He pointed to the other big plastic box on the table, slightly less yellowed.

“That one cost me $37,000 for the instrument alone, and different detectors and sample modules cost up to $10,000 apiece on top of that.”

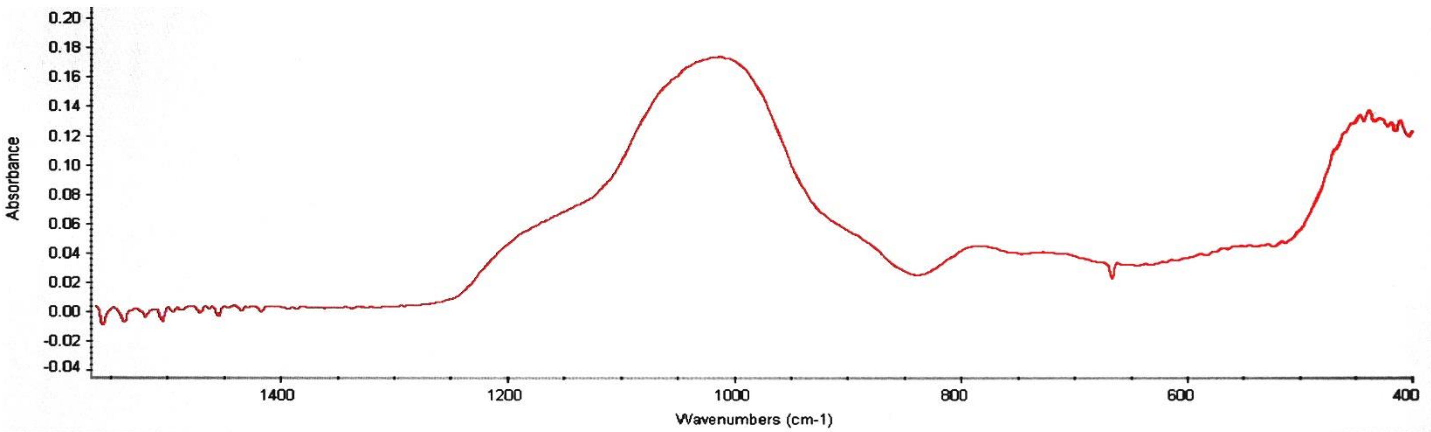
I immediately backed away from the spectrometer we were using. “Then why the heck are you even letting me near these things?” I said, raising my hands.

Professor Rossman kept on grinning. “It’s my toy,” he said. “A very expensive toy. I like having fun with my toys and showing other people how much fun they are. Now let’s do some science! Hit the ‘collect sample’ icon on the computer.”

I did so, and a second or two later, a spectrum appeared on the screen. Professor Rossman immediately started pointing out features in the spectrum, but he had one major initial impression: “Your sample does not look crystalline, because these absorbance features are way broader than most mineral specimens. This may be in a gel phase.”



The NVMC mystery specimen, first powdered (A) and then pressed firmly against the diamond window (B). Photos: Alec Brenner.



The ATR absorbance spectrum of the NVMC mystery specimen. On the y-axis is absorbance, and on the x-axis is wavenumbers (1 divided by the number of centimeters), a way of expressing the wavelength of light. (In simple terms, the larger the wavenumber, the smaller the wavelength.) Although there are some peaks—indicating the presence of multiple chemical groups in the mineral's structure—the peaks are muddled rather than sharply defined, meaning that the sample is not entirely crystalline. This spectrum is not useful for identification, so based on this alone, the mineral is still just something-ite.

In simple English, this meant the sample was going to be tricky to identify.

I asked if there was a library of mineral ATR spectra that the machine could search. Professor Rossman replied that there was but we probably wouldn't learn much if we searched it—this specimen's spectrum was just too fuzzy. We tried it, but to no avail—the only matches looked nothing like the spectrum we had.

"Well, this is a puzzle," Professor Rossman said, staring analytically at the computer screen. "Oh, and it's almost 2:30—we could save this spectrum and run your sample through other instruments later. Does that sound good?"

"If it's not too much of a time drain for you, that'd be great!"

Professor Rossman smiled. "Hey, this is science, man! You've got an unknown, and as far as I'm concerned, if I'm supervising, these instruments are at your disposal to identify it. I'm curious too, and mineral forensics is my job—I get requests like this all the time from professional gemologists, but rarely undergrads in person. That's my other job, teaching—I am a professor, after all. Just stop by whenever, and if I'm not tied up with someone else I'd be happy to help!"

So we shook hands and I left to go to class.

Two weeks later, I got an e-mail from Professor John Eiler, another geochemist at Caltech. At the time, he taught a class I was in, so I wondered if I had missed an assignment.

Imagine my surprise when I read that he had talked about me with Professor Rossman! Professor Eiler had seen me doing photography on a field trip, and because Professor Rossman's research was on the interactions of minerals and light, my interests in imaging seemed right up his alley. Professor Eiler had gone so far as to recommend that Professor Rossman bring me into his lab to do formal, paid mineralogical research over the summer!

So I wandered back into Professor Rossman's mineral-adorned office and told him about the e-mail from Professor Eiler. Sheepishly, I asked if I could do summer research with him.

"Absolutely!" Professor Rossman said. "I think we could both get something good out of some research—you'd get lab experience, and I'd get some good science out of you. I look forward to it!"

In brief, my curiosity over NVMC's mystery rock had landed me a summer research fellowship. My summer was excellent, and I've done some neat work on the spectroscopy of meteorites.

Incidentally, I was able to identify the NVMC mystery rock—sturtite. But all of those are stories for later articles. In my next article, I plan to discuss a very different kind of spectrometer called a Raman microscope, which nailed down the mystery mineral's identity.

If you're interested in more technical information as well as some of the mineralogy work performed in Professor Rossman's lab, you can visit the website of mineralogy at Caltech at minerals.gps.caltech.edu. ⛏

Acknowledgments

I thank Professor George R. Rossman, the working head of the Caltech Mineralogy Research Group, and Dr. Chi Ma, the technical head of the Caltech GPS Analytical Facilities, for providing me with access, training, and funding for using the equipment described above. My research in the mineralogy lab has also been funded through the Caltech SURF program by Mr. and Mrs. Sam Vodopia on behalf of the late Mr. G. Edward Bryan and his family, to whom I am also very grateful. Of course, I also must thank Mr. Fred Schaefermeyer and the Northern Virginia Mineral Club for encouraging my geology education through three scholarships from the Fred C. Schaefermeyer Scholarship Fund. Finally, I want to thank Tom Taaffe, who generously allowed me to sample the mystery specimen that made all this possible.

Mineralogy Is a Stitch!

by Sheryl E. Sims

The author displaying her mineral quilt.
Photo: Sheryl Sims.

Over the past couple of years, I've had a burning desire to own a mineral quilt. The thought kept popping up, and I discussed how great it would be to have one with several mineral club friends—combining my love of minerals with my love of quilts.

I've had the pleasure of visiting a number of quilt shows. Quilts are amazing; they tell the creator's stories in myriad ways. Each time I attend a show, I'm blown away by the variety and quality of the quilts that I see. I've seen nature quilts, portrait quilts, grief quilts, and even political quilts.

What I've never seen, however, is a mineral quilt! Wait for it! An idea is brewing! I waited and thought; and thought and waited, but nothing materialized.

However, several of my friends are quilters, so I dropped a few not-so-subtle hints that I wanted a mineral quilt. "Great idea!" they said. "Oh, how clever!" It was my hope that they'd make me one and surprise me!

That didn't happen. The more quilts I saw, the more I wanted a mineral quilt. Let's face it! We rockhounds know the beauty that a mineral contains. We capture this beauty in our collecting, through photography, and through lapidary arts. So I could easily envision the beauty of minerals artfully displayed in a quilt. But how could I accomplish this task?

My first thought was to "piece and appliqué" a variety of minerals—sewing pieces of fabric into a quilt to form pictures. My second thought was that doing so would be entirely too hard and time consuming.

My third thought was the charm! I decided to print photos of the minerals out on canvas paper. This proved to be ideal, because canvas paper feeds through an inkjet printer.

Once the photos were printed and laid out on my carefully selected fabric, I felt that the viewer needed to see actual mineral specimens. I wanted people to be able to remove the mineral, examine it, and then, most importantly, put it back!

Mineral pictures on canvas paper, along with specimens in bags.
Photos: Sheryl Sims.

Together with a couple of my quilter friends, I pondered about just how this could be done. I spoke with a quilt store owner, and she suggested using silk or net bags.

Great idea! Narrowing my mineral selection down to seven, I played with the layout, stitched them down, arranged the minerals bags around them, and attached the mineral names and chemical formulas.

Since the minerals that I used came out of my collection, which isn't organized at all, I didn't know the sites from where my minerals came. Therefore, I took my quilt to the Micromounters club meeting, where Dave Frayuff, Dave Hennessey, and Bob Cooke identified the locations for me!

Pebble fabric for the border of the quilt.
Photo: Sheryl Sims.

That's the beauty of being part of a mineral club! Even though you may not have the needed expertise, plenty of other people do; and, they are very generous with their knowledge and experience.

I searched for the perfect backing for my quilt and found some pebble fabric. It was perfect! Another quilter friend put me in touch with someone who had a long-arm quilting machine and could make the circular quilting pattern for me. I wanted a pattern that mimicked the shape of the pebble border and backing.

In the end, the satisfaction and fun that I had in making my own mineral quilt were beyond measure! It was better than buying one that someone else made. It was better than walking around dreaming of a mineral quilt but never owning one. And it was great fun showing it to everyone and and telling them about it.

Mind you, my quilting skills are lacking, but that doesn't bother me. I love my hobby/novice-level quilting ability, and I think that it's perfectly adequate for the vugs, varieties, and textures of the many minerals that I've come across, thanks to my being a rockhound and mineral club member.

I knew that I had hit upon something unique when my daughter, Amber (who usually turns a deaf ear to my rocky stories), was extremely surprised by and complimentary of my end result. I couldn't have been happier had I found a pink diamond in a pile of rocks under the hot Arkansas sun!

Story of Geology

Beyond Genesis: Kant and Buffon

by Hutch Brown

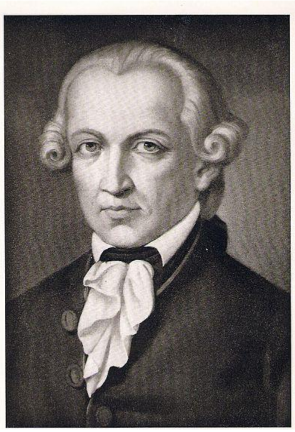
Editor's note: *The author is solely responsible for the views expressed here, which do not necessarily conform to those of other NVMC members. If you would like to comment or contribute to our newsletter, please contact me at hutchbrown41@gmail.com.*

In early modern Europe (from about 1500 to 1800), scholars generally believed that the Bible explained the landforms around them. They saw the story of Genesis inscribed in the face of the Earth, from the Creation to the Great Flood. By adding up the ages of the patriarchs listed in Genesis (Noah himself is said to have been 950 years old when he died), they dated the origins of the Earth to 4004 BC.

Kant Rejects "Immediate Creation"

By the mid-18th century, however, influential scholars were recognizing natural processes that did not seem to fit the story of Genesis. One of the skeptics was the German philosopher Immanuel Kant (1724–1804), who published his *Universal Natural History and Theory of the Heavens* in 1755. Kant ranks with Aristotle as one of the greatest philosophers of all time. He exercised enormous influence on contemporary thinking, with lasting impacts to this day.

Based on Newtonian physics and his own study of astronomy, Kant concluded that "Creation is not the work of a moment." Kant rejected the notion of "immediate Creation" (the Genesis account of divine creation of the world in 6 days). For Kant, the laws of nature alone sufficed to explain the origins and workings of the world. From the order and beauty he saw in nature, Kant inferred an "Infinite Being" who created a "great chain of nature" without limits in time and space. In effect, he espoused the notion of a *deus ex machina*—a "God beyond the mechanism," one who set loose mechanical forces governed by the laws of nature, forming the Earth and other heavenly bodies. It was a wonderful world, inspired by divine perfection, but it was not the story of Genesis.



Immanuel Kant. Source: Wikipedia.

An image of the Earth's creation based on the story of Genesis. Source: Martin 2014.

Buffon Embraces Natural Causes

In his work, Kant cited the French naturalist Georges-Louis Leclerc, Count of Buffon (1707–88). Like Kant, Buffon attributed the origins of the Earth to natural causes rather than to an act of divine creation. In *The Epochs of Nature*, published in 1778, Buffon discussed the origins of the solar system, speculating that the planets resulted from a comet's collision with the sun.

Buffon claimed that the Earth was far older than a literal reading of the Bible might suggest. If the Earth sprang from the sun after a collision with a comet, then like the sun it was extremely hot—composed of molten material, especially iron. (Good, no?) Based on the cooling rate of iron, Buffon calculated the age of the Earth as 75,000 years. Building on the Danish naturalist Nicolas Steno's work, he suggested that the Earth had undergone geological stages—the modern notion of a geologic time scale.

Late in Kant's life, the Lutheran authorities in his native Prussia censored him for religious reasons, but not for his views on the origins of the solar system. Buffon, who lived in Catholic France, was not so lucky. The Faculty of Theology at the Sorbonne in Paris condemned his writings on the origins of the Earth, forcing Buffon to print a retraction. However, he contin-

Georges-Louis Leclerc, Count of Buffon. Source: Wikipedia.

ued to publish his work without revising it to reflect the views of his religious censors.

Natural Origins of the Earth

As later scientists discovered more about geology and astronomy, they discounted many of Buffon's hypotheses about the solar system, certainly about the comet colliding with the sun and about the age of the Earth, which they realized was much older. And Kant's writings were highly abstract—more about philosophy than about physics and astronomy. But both scholars were indicative of a trend in thinking about the origins of the Earth that came to underpin modern science in the 19th century.

By the mid-18th century, naturalists and natural philosophers like Buffon and Kant knew so much about physics and astronomy that they no longer needed supernatural explanations for the origins of the Earth. By replacing the biblical story of Creation with natural explanations based on empirical observation, they paved the way for the modern science of geology. ⛏

Next issue: In defense of the biblical account of Creation, the German geologist Abraham Gottlob Werner adduced empirical evidence to support the view that a global flood shaped the Earth.

Sources

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Martin, R. 2014. Creation and the image of God: A biblical view of technology. Blog. September 8.

Piveteau, J. 2015. Georges-Louis Leclerc, Count de Buffon. Encyclopaedia Britannica.

Earth's Mineral Total Passes 5,000!

Editor's note: *The article is adapted from* M.R.News *(news and notes from the editors of the* Mineralogical Record*, August 2015). Thanks to Sue Marcus for submitting the piece!*

After more than 2 centuries of investigation by mineralogists worldwide, the total number of discrete, currently accepted mineral species has passed the 5,000 mark.

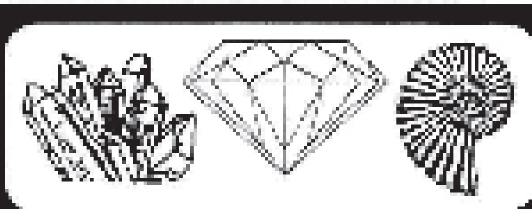
When the German mineralogist Abraham Gottlob Werner (1749–1817) published his *Last Mineral System* in 1817, he listed just 317 different mineral species. Over the following years, some were discarded or refined and new ones added. By January 1969, Michael Fleischer of USGS (original author of the *Glossary of Mineral Species*, now in its 11th edition) estimated the total at 1,950. As of January 2014, the official count by the International Mineralogical Association (IMA) had grown to 4,684.

Since that time, 136 new species have been identified in the peer-reviewed literature. If another 226 accepted but "questionable" species are included in the list, the total reaches 5,046 (rruff.info/ima). Because the IMA chooses to count them, *Glossary* author Malcolm Back will include the "questionable" species in the 12th edition, scheduled for 2018.

Are there likely to be very many more minerals discovered? Definitely. Robert Hazen, in a forthcoming article in the *Mineralogical Record*, uses complex statistical analyses to estimate that roughly 1,500 more unknown species are waiting to be discovered.

And that number might increase if new and more sophisticated analytical instruments are developed in the future. So at this point in history, we are in no danger of running out of new minerals! ⛏

Hyalophane on matrix. A barium-rich potassium feldspar, hyalophane is classified as a "questionable" mineral. Source: Wikipedia.



24th Annual
GEM, MINERAL AND FOSSIL SHOW

Presented by The Northern Virginia Club, Inc. www.novamineralclub.org
Sponsored by the Dept. of Atmospheric, Oceanic and Earth Sciences at GMU

Date: November 21 & 22, 2015

Place: The Hub Ballroom (Student Union II Bldg)
George Mason University Campus
Braddock Rd. & Route 123, Fairfax, VA

Hours: Saturday 10am-6pm, Sunday 10am-4pm

Admission: Adults: $6, Seniors: $4, Teens (13-17): $3
Children 12 & under, Scouts in uniform, and GMU Students w/valid ID are FREE.

$1 OFF
1 Adult admission with this card (applies to all adults + seniors in your group)

Demonstrations, Exhibits, and Door Prizes. Mini-mines for children to dig in and get free fossils and minerals.

Over 20 Dealers with Fossils, Minerals, Crystals and Gems for sale.

Use Parking lot A, enter Lot A from Nottaway River Lane.
Look for our Courtesy Shuttle to Mineral Show

Note: ***Print out this page and bring it with you to the show for the discount!***

Participating Dealers

Arrowwood Minerals—Richard and Mary Ann Ertel, Lexington, VA

Alan's Quality Minerals—Alan Benson, Mt. Laurel, NJ

John Culberson—Minerals, Arlington, VA

Jon Ertman—Minerals, Rockville, MD

Bob Farrar—Minerals and fossils, Bowie, MD

Geosol Imports—Rob Evans, Hawley, PA

Harsteins Fossils—Gene Hartstein, Newark, DE

David Hennessey—Minerals, Woodbridge, VA

George Loud—Minerals, Hilton Head, SC

Jan Minerals—Jehan Sher, Stafford, VA

KBT Minerals & Fossils—Tom Taaffe, Vienna, VA

John Kress—Minerals, Falls Church, VA

The Mineral House—Tom and Pam Kottyan, Bucyrus, OH

The Prospector Shop—Marrianne Cannon, Ligonier, PA

Barry Remer—Minerals, Reston, VA

Mike Shoemaker—Minerals, Manassas, VA

Wayne Sukow—Minerals, Fairfax, VA

Yinan Wang—Fossils, Meteorites, Arlington, VA

Williams Minerals—Keith Williams, Rio, WV

Zembla Minerals—Casper Voogt, Sterling, VA

Upcoming Events
(of interest in the mid-Atlantic region)

October

23–25: Austin, TX—Gem Capers; AFMS/South Central Federation of Mineral Societies; Convention: Double Tree Inn, 6505 North Interstate Hwy 35, 512-454-3737; Show: Palmer Events Ctr, 900 Barton Springs Rd, 512-472-5111.

24: Albany, NY—Gem, Mineral & Jewelry Festival & Auction; Saco Valley Gem & Mineral Club; 9–5; Albany town hall, Albany, NY; info: jherndon1@roadrunner.com.

24: Fairless Hills, PA—Ultraviolation: Fluorescent Mineral Show; Rock and Mineral Club of Lower Bucks County, PA; First United Methodist Church, 840 Trenton Road, Fairless Hills, PA; 9–5; adults $2, children under 13 free; info: Chuck O'Loughlin, 856-663-1383; ultraviolation@yahoo.com.

November

7–8: Oaks, PA—Gemarama 2015: Rocks in the USA; Tuscarora Lapidary Society; Sat 10–6, Sun 10−5; Hall C, Greater Philadelphia EXPO Center; info: www.lapidary.org.

7–8: Lancaster, PA—Symposium and field trip; Friends of Mineralogy—Pennsylvania Chapter; Hackman Physical Sciences Bldg, Franklin and Marshall College; Saturday symposium on recent advances in mineralogy, five presentations; Sunday field trip, details to follow; registration: nonmembers $25, members $15, students w/ID free; register in advance at http://www.rasloto.com/FM/; info: Joe Marchesani, 609-433-5129, Jmarch06@comcast.net.

21–22: Fairfax, VA—24th Annual Gem, Mineral, and Fossil Show; cosponsors: Northern Virginia Mineral Club & George Mason University's Department of Atmospheric, Oceanic, and Earth Sciences; George Mason University, The Hub Ballroom, Rte 123 & Braddock Rd, Fairfax, VA; Sat 10–6, Sun 10–4; adults $6, seniors $4, teens (13–17) $3, 12 and under free, Scouts in uniform & students w/ID free; info: http://www.novamineralclub.org/events/2015-show.

21–22: West Palm Beach, FL—49th Annual Gem, Mineral, Jewelry, Bead and Fossil Show; Gem & Mineral Society of the Palm Beaches; South Florida Fairgrounds Expo Center East, 9067 Southern Blvd., West Palm Beach, FL; Sat 9–6, Sun 10–5; adults $9, children under 12 free, free parking; info: Jeff Slutzky, 560-585-2080, show@gemandmineral.cc.

27–29: Salem, VA—36th Annual Roanoke Valley Mineral & Gem Society Show; Salem Civic Center, 1001 Boulevard, Salem, VA; Fri 2–7, Sat 10–6, Sun 12–5; 3-day ticket $4, under 16 free, free parking; info: CKWLT@aol.com.

December

5–6: Miami, FL— Gem, Jewelry, Mineral, and Fossil Show; Miami Mineralogical and Lapidary Guild; Evelyn Greer Park, 8200 SW 124 Street, Pinecrest, FL, just one block off US 1; Sat/Sun 10–5; adults $4, children under 12 free, free parking; info: www.miamigemandmineral.com.

February

19–21: Indianapolis, IN—GeoFest: 14th Annual Indiana State Museum Fossil, Gem and Mineral Show; Fri/Sat 10–5, Sun 11–4; museum admission: adults $13, seniors $12, children $8.50; info: Peggy Fisherkeller, 650 West Washington Street, Indianapolis, IN 46204; 317-232-7172; pfisherkeller@indianamuseum.org; Website: www.indianamuseum.org.

March

5–6: Newark, DE—53rd Annual Earth Science Gem and Mineral Show; Delaware Mineralogical Society, Inc.; Delaware Technical and Community College, 400 Stanton-Christiana Road, Newark, DE (I-95 Exit 4B); Sat 10–6, Sun 11–5; adults $6, seniors $5, kids 12–16 $4, 11 and under free; info: www.delminsociety.org or contact gene@fossilnut.com or call Wayne Urion at 302-998-0686.

19–20: Sayre, PA—47th Annual Che-Hanna Rock & Mineral Club show; Athens Twp. Volunteer Fire Hall, 211 Herrick Ave; Sat 9–5, Sun 10–4;. info: Bob McGuire at 570-928-9238 or uvbob@epix.net.

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news.nvmc@gmail.com

Visitors are always welcome at our club meetings!

RENEW YOUR MEMBERSHIP!

SEND YOUR DUES TO:
Kenny Loveless, Treasurer, NVMC
PO Box 10085, Manassas, VA 20108

OR

Bring your dues to the next meeting.

Purpose: To promote and 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, http://www.amfed.org/efmls) and the American Federation of Mineralogical Societies (AFMS—at http://www. amfed. org).

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

Meetings: At 7:45 p.m. on the fourth Monday of each month (except May, November, and December)* at **Long Branch Nature Center**, 625 Carlin Springs Road, Arlington, VA 22204. (No meeting in July or August.)

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