

Bulletin of the Mineralogical Society of Southern California

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July 2009

The 856th Meeting of The Mineralogical Society of Southern California

How Gemology is Different than Mineralogy

By

Dr. Mary Johnson

Friday, July 10, 2009 at 7:30 p.m.

Geology Department, E-Building, Room 220

Pasadena City College

1570 E. Colorado Blvd., Pasadena

Featuring:

- Field collecting at Grenville province Canada**
 - Vivianite as absorber of evil energy**
 - Lapis lazuli crystal**
-

July Program

Date: July 10, 2009

Same time Same place

How Gemology is Different than Mineralogy

By Bruce Carter

As mineral collectors, we are used to examining specimens based on their mineralogy and the aesthetics of their association. People in the gem trade, however, regard minerals as raw material, so their "ideal mineral specimen" may be matrix-free, unterminated, and covered with fracture surfaces. How is gemology a different way of looking at minerals? We will explore this in a short chat, then introduce Dr. Johnson's new book, *Gemstones*, co-written by British writer Karen Hurrell.

Gemstones is a convenient pocket-sized book that introduces the reader to the concepts of mineralogy, gemology, identification, and collection, and lists properties for 150 varieties of gemstones. Dr. Johnson will bring copies with her in case anyone wishes a signed copy.

Mary Johnson, Ph.D. is past president of the MSSC. She earned degrees in geochemistry from Caltech and mineralogy/crystallography from Harvard University, and was Director of Research at the GIA in Carlsbad, CA. She has performed research on sulfide minerals, high pressure chemistry and physics, outer solar system processes, meteorites and the early solar system, and gemstones and their cuts and treatments. An award-winning writer, her latest work includes the "Dear-Abby-like" column "Gemological Answers" for the trade magazine *National Jeweler*. She has a consulting firm in San Diego (www.maryjohnsonconsulting.com).

Minutes of the June 12, 2009 Meeting

The 855th meeting of The Mineralogical Society of Southern California was held on Friday, June 12, 2009, at Pasadena City College, Pasadena, CA. Vice President Bruce Carter brought the meeting to order at 7:30 p.m. He then introduced the speaker of the evening, Paul Adams, who gave a presentation entitled: Mineral Collecting in the Grenville Province, Ontario Canada."

Mr. Adams, who has both MS and BS degrees in geology, has been an avid mineral collector since his junior high school days. His talk centered around fifteen 5-day trips he made in and about the Grenville province, near Bancroft, Ontario.

Calcite veins, thought to have been formed from molten calcite, are among the mineral formations in the province. The mineralogy of vein wall crystals is controlled by host rock composition. Floater crystals in the calcite veins are common. Further, accessory minerals

will often reach large sizes in the vein dikes. Among the minerals found in the province, especially the Bear Lake Diggings, are mica, feldspars, hornblende series minerals, apatite, titanite, and biotite. Mr. Adams collected a 9" hornblende crystal and a 5" apatite crystal, in addition to his other finds. He also managed to locate a titanite crystal, one of the more elusive and sought after prizes at Bear Lake. Visits to the Faraday Mine and the Silver Crater Mine were also discussed. Mr. Adams accompanied his presentation with numerous maps and slides, and provided detailed descriptions of the digging sites' respective histories and working conditions.

(The Bear Lake Diggings and its minerals are also described by Michael Walter in an article entitled: "The Minerals of Bear Lake, Ontario" (see the July 2001 issue of Rock & Gem)).

Shou-Lin Lee brought reservation forms and related information she received from Carolyn Seitz, regarding the Gem and Mineral Council field trip on June 20th to explore the earthquake faults in the Los Angeles basin. We thank Carolyn for keeping us informed of events of interest to MSSC members.

Vice President Carter brought the meeting to a close at 8:55 p.m.

Respectfully submitted, Pat Caplette, Secretary

**A Thank You Note from
Megan Shadrick,
Speaker of May Program**

To the members of the M.S.S.C.: I would like to thank all of you, for allowing me to come present my work to you. I had a really nice time. Thanks. Megan Shadrick.

You are invited to join

Fallbrook Gem and Mineral Society's Annual Pot Luck and Swap Meet

When: Saturday, August 22, 2009

11:00 am – 12:45 PM, Potluck Lunch

1:00 PM - 4:00 PM, "Tailgate" in meeting room

Where: Fallbrook Gem and Mineral Museum, 123 W. Alvarado Street, Fallbrook, CA 92028.

Food: Bring something yummy to share for the potluck. FGMS will supply plates, cups, utensils and napkins! It will be indoors!

Minerals Sale: 3 ft. table space available on a first-come, first-serve basis. FGMS asks that

the sellers limit items to things that relate to minerals, fossils, gems and jewelry, and a 10% donation of all sales. The donation will be used towards the mortgage of the Fallbrook Gem and Mineral Society's building and Museum that is open to the public.

A Scientific Study of the Absorption of Evil

by Vivianite

by Alfredo Petrov

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<http://www.petrovrareminerals.com/articles03.html>

Every mineral collector has at one time or another probably drooled over a gemmy green vivianite from Morococala, Huanuni, Llallagua or Tomokoni in Bolivia, or Trepca in Serbia, or the Blackbird mines in Idaho, but hesitated to buy it because they had heard that vivianite crystals are unstable and will eventually turn black and fall apart, especially when exposed to bright light.; or perhaps they went ahead and purchased a fine crystal anyway because some reputable high-end dealer (undoubtedly a highly successful used car salesman in a previous life) assured them that this particular extremely fine and important specimen came from a locality which produces stable vivianite – stable because of some magical ingredient in the matrix, or absence of something in the matrix, or lack of oxygen at the high elevations the crystal grew in, or lack of bacteria at the high elevation..... You get the picture. Or perhaps the dealer convinced the customer that he wouldn't have a problem with vivianites because he lived in a sufficiently dry region (or a sufficiently humid one), or at a high Rocky Mountain altitude with low atmospheric oxygen.... All of this nonsense comes from statements I personally heard while wandering around mineral shows, or read in dealer advertizing; I promise I didn't make any of them up. Unfortunately, the bad news is that ALL vivianite suffers from the same type of instability; the good news is that its decomposition can be easily prevented. But before we discuss how to preserve vivianite specimens we need to understand the chemical mechanism involved in its self-destruction.

My favorite explanation for the instability of vivianite came from a couple of lovable young mystical counterculture types I met at the Tucson gem and mineral show. They had bought several Bolivian vivianites from me at Tucson 2003 and came back for more in 2004. "The last ones we got turned black already", they told me with a happy - even gleeful - expression. "Did you leave them in a sunny window?", I asked, "You mustn't expose them to bright light". Turns out they wanted their vivianites to turn black and were delighted when the hoped-for phenomenon really happened. Apparently, vivianite gradually gets darker and darker by absorbing "evil energies" from its surroundings. After it gets black one has to throw it away and go buy a fresh one. I hadn't known this before but, as an occasional exporter of Bolivian vivianite, I thought it was a wonderful discovery! This unexpected and valuable property of vivianite will surely expand the market for it, and Bolivia will finally have a near monopoly on a natural resource the rest of the world will be standing in line to buy (especially considering the amount of evil our current administration has discovered lurking in evolutionary biology textbooks, sex education classes, Palestinian charities, the Iranian government, gay weddings).

Probably not a whole lot of mystics read my website, so I sort of feel an obligation to come up with an explanation that involves more physical chemistry and fewer supernatural powers: The vivianite molecule is a phosphate of divalent iron, with a lot of water – $\text{Fe}^{2+}_3(\text{PO}_4)_2(\text{H}_2\text{O})_8$. It crystallizes in several types of environment, and we ought to describe these before we get into the crystal chemistry:

One environment is mud and other low-oxygen sedimentary rocks, usually in the reducing environment associated with fossil organic matter – Such localities include the world's largest vivianite crystals (more than a meter long) from mud in Cameroon, the aesthetic crystal sprays in fossil shells from the Kerch peninsula on the Black Sea, the concretions from lake bed and seafloor muds at several localities in Japan, and those from various U.S. localities including Florida, New Jersey, and Contra Costa county, California. Bones and teeth buried in peat bogs are sometimes replaced by vivianite.

Another type of environment is hydrothermal sulphide ore veins, including all the localities already mentioned in the first paragraph above, along with the Ashio mine in Japan, and other mines in Peru, Cornwall, Colorado and elsewhere. It is this latter environment, the hydrothermal veins, that produces the most splendid crystal specimens with the classic gemmy green color. While on the subject of hydrothermal ore vein vivianite, we should kill another myth that occasionally shows up in print, written by people who ought to know better (eg: Bideaux, et al. Handbook of Mineralogy): Yes, a lot of colorful phosphates may be characteristic of the oxide zone of ore deposits, but vivianite is not one of them! You hardly ever find it in limonitic vugs in gossan. It occurs associated with siderite and unoxidized pyrite and other sulphides in deep unoxidized levels of ore deposits; if your specimen appears to be sitting on limonite, check more carefully – the “limonite” will generally turn out to be hisingerite or some other brown iron silicate or phosphate.

Phosphate-rich pegmatites, like the ones in the Black Hills (South Dakota), provide another, although relatively minor, source of vivianite, most recently some fairly large crystals perched on muscovite from Brazil. Other vivianite environments, of no importance to collectors, include rocks altered by coal mine fires, and smelter slags.

The late Dr. Fred Pough observed that sedimentary vivianite changed color and flaked apart faster than hydrothermal vivianite. I haven't ever timed the decomposition, but subjectively I tend to agree with him. If this is indeed true, the increased instability may be caused by other elements substituting for Fe or P in the crystal lattice. Sedimentary vivianite from lake bed muds, for instance, can contain several weight percent manganese substituting for iron, whereas hydrothermal vivianites (at least those from the Siglo XX and Ashio mines) contain only negligible traces of Mn and Mg replacing Fe.

Now let's look at the self-destruction mechanism: Some people think vivianite darkens by oxidation – absorbing oxygen from the atmosphere – and then flakes apart along the cleavages by “drying out”, i.e. losing some of its 8 waters. They optimistically hope that both of these processes can be hindered by a thin coating of lacquer (which is why some specimens in old collections were varnished), or by dipping in oil, or sealing it in a glass jar. They are correct that both oxidation and water loss are taking place, but not in the way they imagine and not in any way that could be prevented by a coating of lacquer no matter how thick! To somewhat oversimplify and paraphrase the process, when photons (particles of

light energy) enter a transparent vivianite crystal, they can knock a proton (a hydrogen nucleus) out of one of the 8 water molecules, which converts the water into a hydroxyl ion (OH) which has a negative charge. This extra negative charge is balanced by oxidation of one iron atom, whose valence state changes from 2+ (ferrous) to 3+ (ferric). Notice that no interaction with the atmosphere was involved – No oxygen entered the structure from outside, and no water molecule escaped to the outside; we are dealing with a completely internal reaction. The liberated hydrogen (the proton) can migrate easily through the crystal lattice, as in all the other species of proton-conducting crystals (which are currently undergoing intense study for potential industrial uses like fuel cells). No coat of lacquer is going to prevent the hydrogen from diffusing out.

The end result is that the vivianite changes into another mineral species, kertschenite (also known as metavivianite), $\text{Fe}^{2+} 2 \text{Fe}^{3+} (\text{PO}_4)_2 (\text{OH}) (\text{H}_2\text{O})_7$. This alteration is accompanied by a progressive color change. Absolutely pure fresh vivianite is colorless! A minor amount of light-induced oxidation rapidly changes the color to a brilliant transparent green – We are talking here in terms of a few minutes rather than weeks. Further oxidation changes the color to a deeper emerald green and a strong pleochroism sets in, with the color in transmitted light becoming a cobalt blue when the crystal is rotated to a certain angle. The mystical crowd gets quite excited by this “blue flash” and believe such vivianite crystals to be special; it is, alas, just one stage on the timeline to self-destruction. Eventually the whole crystal turns an opaque deep blue and finally bluish black. As a historical aside, powdered vivianite used to be used in blue oil paint, with the blue color becoming more intense as time went on, as opposed to powdered azurite paint which tends to slowly alter into malachite, resulting in the greenish skies of some old paintings.

Theoretically, if another proton gets knocked out of the molecule, we get the mineral ferrostrunzite, $\text{Fe}^{2+} \text{Fe}^{3+} 2 (\text{PO}_4)_2 (\text{OH})_2 (\text{H}_2\text{O})_6$, but this does not happen as easily as the change from vivianite to kertschenite. The reason is that the iron in vivianite actually occupies two different types of sites (the formula as usually written is oversimplified and doesn't reflect the structure very well), and one of these structural sites is easier to oxidize than the other. By the time kertschenite is formed, most of the more easily oxidized Fe has already been used up.

Knocking out yet one more proton would leave us with $\text{Fe}^{3+} 3 (\text{PO}_4)_2 (\text{OH})_3 (\text{H}_2\text{O})_5$, which corresponds to the species ferristrunzite and santabarbaraite. No further reaction can take place because at this point there is no more divalent iron left to oxidize. Since santabarbaraite occurs as pseudomorphs after vivianite, it would seem that these reactions really do happen in nature, although light may not play a role in the later stages.

A similar oxidation process also happens to paravauxite, $\text{Fe}^{2+} \text{Al}_2 (\text{PO}_4)_2 (\text{OH})_2 (\text{H}_2\text{O})_8$, which alters to sigloite, $\text{Fe}^{3+} \text{Al}_2 (\text{PO}_4)_2 (\text{OH})_3 (\text{H}_2\text{O})_7$, after a few hours in proximity to a hot incandescent light bulb; perhaps heat is the culprit here rather than light. Some other species of hydrous ferrous phosphates, for example ludlamite and vauxite, seem to be stable and remain unaffected under these conditions, in spite of their chemical similarity to vivianite and paravauxite.

Another factor that remains to be tested is which wavelengths of light are responsible for the reaction in vivianite. Many people assume that blue and ultraviolet light, the more

energetic wavelengths, must be responsible, but this is not necessarily the case and I have a hunch that yellow, red or infrared might be responsible. (In the case of another light-sensitive mineral, realgar, it has already been determined that green light is the violent destructive agent, not blue or ultraviolet.)

The practical application of these theories is that we can suggest two alternative courses of action for preserving the transparency and color of pristine vivianite crystals:

1) Keep them in the dark. That doesn't mean "shade"; it means in a closed cotton-lined box in a drawer, not in a glass case. Let the great unwashed public ooh and aah over your green tourmaline, emerald and forsterite; they don't need to see your vivianites. Reserve the vivianite for short-term viewing by your connoisseur friends – A few minutes exposure indoors once in a while isn't going to noticeably hurt it.

2) Keep all evil out of the house. Meditate. Burn incense. Avoid nasty thoughts about your ex-spouse and mother-in-law. Don't be jealous of your neighbor's new boat. For your next cocktail party, remove from the guest list any dope dealers, terrorists, politicians and lawyers.

Personally, I think the first method is more likely to be reliably effective.



Vivianite from Bolivia, photo by Shou-Lin Lee

What can you find in Glendora or La Habra?

How about lapis lazuli crystals?

Now I got your attention, haven't I?

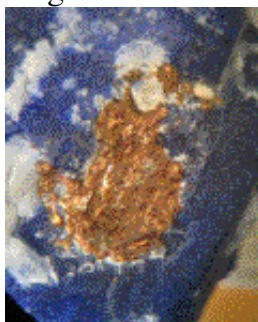
By Shou-Lin Lee



Ever drive through Glendora? It has quite a few interesting old houses and a quaint downtown. But of course, I did not go there for old house sight-seeing. Glendora Gems was the show that brought me to Glendora. The interesting part about Glendora Gems was the large number of sphere displays. One of our MSSC members, Jo Anna Ritchey, had two display cases of spheres cut from various kinds of rocks and minerals. I thought maybe the theme of the show was spheres. But Ms. Ritchey told me that the club just has several sphere making machines. This encouraged members to make spheres and may account for the large number of sphere displays.

The show had quiet a few rock and mineral dealers. One of the dealers had some very large ruby crystals that caught my attention. As I picked up the ruby, I noticed unusual dark blue crystals in marble looking matrix. The dealer told me that those were lapis lazuli crystals. The lapis lazuli I know is a rock composed of mainly lazurite, calcite, and pyrite. It may also contain some other minerals but by definition, rock does not crystallize. I was skeptical about the dealer's claim. Besides, he called his sphere crystal, spinel.

I was ready to leave. But then he picked up one of the blue crystals and called my attention to the metallic inclusion in the center. He told me excitedly that the yellow metallic spot was gold (see photo to the right). I was not convinced either. "How can you be sure that it is not pyrite?" I asked. No. It was gold. He was very sure. He said that he did not



know the existence of the gold inclusion until after he cleaned the crystal with bleach. I doubted his ability of identifying minerals correctly, but still shelled out a considerable amount for the piece because it looked different. Besides, I didn't have crystal lapis lazuli in my collection.

Later in talking to Fred Elsnau about my new find, he told me that when lapis lazuli crystals first came to the market some years ago, a micro-mount specimen would cost more than a hundred dollars. Wow, I think I got a good deal, gold or no gold.



A week later, at the La Habra show held by the North Orange County Gem and Mineral Society, I spotted some more lapis lazuli crystals for sale. This time the crystals had no

metallic inclusion but the shapes were well defined (see photo to the left). And this dealer's prices were much better. So I added some more crystals to my collection.

Both crystals were said to be from Badakhshan, Afganistan. As to the metallic inclusion in the first crystal, I thought about using the karat gold testing acid on it but was unable to find a safe spot to test on. Several MSSC members suggested that I do the needle test. If the surface can be scratched by the needle, it is gold. Pyrite would crumble. A longtime mineral dealer told me that it is most likely chalcopyrite. Chalcopyrite is copper sulfide (CuFeS₂). Sometime small amount of gold and silver may substitute copper in the structure.

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2009 Calendar of Events

July 11-12 2009, Culver City, Culver City Rock and Mineral Club Veterans Memorial Auditorium and Rotunda 4117 Culver Blvd Hours: Sat. 10-6, Sun. 10-5

CulverCityRocks.org/fiesta.htm

July 30-August 2 2009, Billings, Montana, Northwest Federation/AFMS combined show Hosted by Billings Gem & Mineral Club Holiday Inn Grand Montana 5500 Midland Rd, Billings, MT. Hours: 10-5 daily Website: www.amfed.org/nfms/nfmsshow.htm

August 1-2 2009, San Francisco, San Francisco Gem & Mineral Society San Francisco County Fair Building Ninth Ave. at Lincoln Way Hours: Sat. 10-6, Sun. 10-5 Website:

www.sfgms.org