



The Mineral Minutes

In this Issue:

The Prez Says...	Page 1
April Program – “What’s New in Smithsonian Gems and Minerals”	Page 2
Flash!!! Sale of collection starting tomorrow	Page 3
Minutes of the March Business Meeting	Page 4
March 2017 Program “The Copper Silicates of Arizona”	Page 4
Mohs Scale of Hardness	Page 6
One of the Rarest Crystals on Earth Has Been Found in a Russian Meteorite	Page 7
Mineral of the Month – Native Gold	Page 8
Hammer on Hammer	Page 9
Geologists Find Remnants of Early Earth’s Crust in Canada	Page 12
Local Mineral Makes Good!!!	Page 13
Scientists Propose New Contributing Cause for ‘Great Oxidation Event’	Page 13
Prospecting With Fluorescence: Scheelite	Page 14
Geologist of the Month – George Fredrick Kunz	Page 15
Other Arizona Copper Silicate Photos by Mike Pabst	Page 18
Mineralogical Society of America Editors’ Picks	Page 19
Upcoming Geology Events	Page 20
Useful Mineral Links	Page 20
AFMS Code of Ethics	Page 21

Volume 75-04

April 2017

Prez

Says...

by **Dave Nanney**,
MSDC President



Looks like I was a week off. I had predicted that Mother Nature would punish us for our trip to Arizona by an early March snow storm. We got the snow, just two weeks after our return. Oh, well... Spring has officially arrived, our first flower blooms showed their color, only to be smacked by the cold.

Leslie and I attended the Montgomery Club’s mineral show and returned with a couple of more “treasures”. You might have thought we’d quenched our mineral thirst at Tucson, but we didn’t get past our MSDC VP before a new acquisition found its way home. There were a lot of cars in the parking lot and I had a report that Saturday’s attendance came within 3 of a record. This is contrasted with what we saw at Tucson, with higher prices and fewer attendees. I was impressed by the number of display boxes presenting a wide variety of mineral displays.

It will be interesting to see what our April speaker, Jeff Post, will report from Tucson. One of the displays at Montgomery showed a few new acquisitions for the Smithsonian from Denver and Tucson. Dave Hennessey continues to bring top flight speakers to our meetings.

On a personal note, we are again planning an open house on 30 April to highlight both our mineral collection and our 2,500 azaleas. We’re hoping it will be at full bloom and we will NOT ALLOW IT TO RAIN THIS YEAR!!! More to follow when we get close but we’d love to share both of our hobbies

April Program

“What’s New in Smithsonian Gems and Minerals”

Presented by **D. Jeffrey Post**, Curator-in-Charge of the National Gem and Mineral Collection”

by **Dave Hennessey**

We are pleased to once again welcome Dr. Jeffrey Post, curator-in-charge of the National Gem and Mineral Collection, U.S. National Museum of Natural History (Smithsonian Institution), as our presenter this month. Dr. Post majored in Geology and Chemistry at the University of Wisconsin – Platteville, earning a Bachelor of Science degree in 1976. He then earned a Ph.D. in Chemistry, with a specialty in Geochemistry, from Arizona State University in 1981. Prior to joining the Department of Mineral Sciences at the Smithsonian Institution in 1984, he was a Postdoctoral Research Fellow for three years in the Department of Geological Sciences at Harvard University.



From 1989 to 1994, and again from 2014 to the present, he served as the Chairman of the Department of Mineral Sciences, and in 1991 he became the Curator of the National Gem and Mineral Collection. In addition, Dr. Post served as the lead Curator for the Janet Annenberg Hooker Hall of Geology, Gems and Minerals that opened in 1997. His areas of research interest include mineralogy, gemology, geochemistry, crystallography, and electron microscopy. He has published nearly 100 articles in these fields. In 2011, the mineral Postite, a rare hydrous decavanadate, was named in his honor.

Dr. Post's presentation will take us on a journey of Smithsonian Institution Department of Mineral Sciences activities over the last year, including visits to and acquisitions at the Denver Mineral Show in September 2016 and the Tucson Mineral Show in February 2017. He will also tell us about field collecting activities undertaken by the Department of Mineral Sciences and other significant happenings (personnel changes; acquisition of new scientific equipment to facilitate research) that occurred during the past year.

Please join us in taking Dr. Post to dinner on April 5th before the club meeting. We will be meeting at 6:00 pm at Elephant & Castle Restaurant, 1201 Pennsylvania Ave, NW, Washington, DC, about 2 blocks from the Smithsonian Institution National Museum of Natural History (NMNH) where our club meeting is held. If you cannot make it to dinner, will meet in the NMNH lobby at 7:30 pm and head up to the Cathy Kerby Room for Dr. Post's presentation.

with you.

Of historical note, Tom Tucker has been retrieving copies of our newsletter from back in January, 1942 at the Natural History Museum. I've asked Tom to put in a note which may be in this newsletter.

I am finishing this from New Orleans, where it is 80 degrees, sunny and HUMID... Took a trip on the Mississippi on a paddle boat today. Reached out to the New Orleans mineral club and was suggested to visit a point bar in the Mississippi river two hours from here. The river cleans out the deposits after every rain, and delivers new agate, fossils, and Indian artifacts. We're thinking the next trip here will include that visit.

See everyone next Wednesday to hear Jeff Post describe the Smithsonian Institute's new acquisitions. Please consider joining us for dinner before as that's where you get to meet Dr. Post up close and personal.

Geological and Mineralogical Terms

Xenolith	A foreign inclusion in an igneous rock. Synonym of: inclusion, exogenous inclusion, accidental inclusion
Mafic	Describing dark colored rocks or minerals that are composed particularly of the elements magnesium and iron.
Felsic	Describing rock consisting mostly of silica (more than 65 percent), in the form of Quartz and Feldspar. Can also be applied in reference only to the Feldspars.
Botryoidal	Aggregate resembling a cluster of grapes with smooth rounded surfaces or bubbles. Also known as globular. Rounded agglomerations of botryoidal aggregates are smaller than reniform agglomerations and considerably smaller than mammillary agglomerations.w
Pegmatite	Type of intrusive igneous rock where the individual crystal grains are very coarse. Many minerals are specific to pegmatite environments.
Cataclastic	A type of metamorphic rock that has been wholly or partly formed by the progressive fracturing and comminution of existing rock, a process known as cataclasis, and is mainly found associated with fault zones. Mylonite was originally defined as a cataclastic rock but is now understood to have formed mainly by crystal-plastic processes.



Editor's Note: Crystal Shapes are from Goldschmidt's "Atlas der Krystallformen"

CLUB INFO

MINERALOGICAL SOCIETY OF
THE DISTRICT OF COLUMBIA

MEETINGS

Meetings are the First Wednesday of the Month (Jan-Jun and Sep-Dec). We meet in the lobby of the Smithsonian National Museum of Natural History at 7:45pm.

WEBSITE

<http://mineralogicalsocietyofdc.org/>

FACEBOOK

www.facebook.com/MineralogicalSocietyOfTheDistrictOfColumbia

2017 Officers & Directors

President	- Dave Nanney, dnanney@cox.net
Vice President	- David Hennessey, davidhennessey@com-cast.net
Secretary	- Andy Thompson, thompson01@starpower.net
Treasurer	- John Weidner, (mail: 7099 Game Lord Dr, Springfield, VA 22153-1312)
Directors	- Yuri Kalish - Leslie Nanney - Ken Reynolds
Newsletter Editor	- Steve Johnson
Webmaster	- Betty Thompson
Webmaster	- Casper Voegt

FLASH!!!

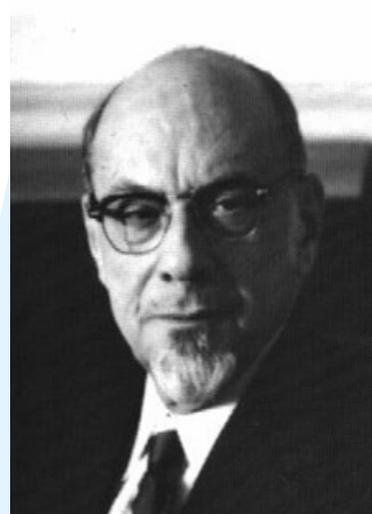
Members,

First, you're not going to get material like this included in the Mineral Minutes often, but it is time sensitive since the offerings start tomorrow!

Erich Grundel just got this email forwarded by Bob Cooke. It has been verified. One of Erich's observations to me in his email was that Tony Bonanno was a past president of MSDC - and sure enough he was in 1955.

Here is a brief bio of Mr. Bonanno from the Gemstone Press:

"Antonio C. Bonanno, F.G.A., A.S.A., M.G.A., noted gemologist and appraiser, was founder and president of National Gem Appraising Laboratory, and Director of Columbia School of Gemology near Washington, D.C. He held the coveted "Master Gemologist Appraiser" title (M.G.A.), the highest distinction awarded to gem and jewelry appraisers of the American Society of Appraisers. He worked with gems and minerals for over sixty years, specializing in forensic gemology, and was frequently called as an expert witness in a wide range of court cases. He was one of the first Americans to become a Fellow of the Gemmological Association of Great Britain With Distinction and was an Associate of the Alumni of the Gemological Institute of America. Highly esteemed in the field, he was past president of the Accredited Gemologists Association and a member of numerous gemological associations. Today, three daughters and one son, all registered gemologists, carry on his dedication to gemological research and educating professionals and consumers alike."



Here is the text of the email. As you can see this is the estate of his son, but his son kept quite a bit of his father's materials. You can contact me, Bob Cooke, Erich Grundel or Dave Nanney for phone numbers if you need them.

Dear Mineral Collector,

I would like to advise you and your membership of an exciting event in 2 days time - sorry that's not much advanced notice, but none of the family members live in the area, and we have only just organized a "tag/estate" sale for our deceased brother, Ken Bonanno, who also kept all of our father's minerals on his premises.

Our father, "Tony" Bonanno was an important gemologist and mineral collector; he passed away in 1996 but boxes of unopened minerals have been stored in Fredericksburg and these go back many decades since our father collected for approx. 70 years.

We are still gathering all of these boxes and will be offering their contents exclusively to gem and mineral collectors on Wednesday, March 29th, from 10 am to approx. 3 pm. This "private" sale will take place one day prior to the estate sale, which will offer antiques, saxophone and vinyl record collections, stereo equipment, art deco furniture, all types of tools, yard equipment, and much more, taking place on Thursday, March 30 through Saturday, April 1st.

The address for this event is: 1027 Julian Drive, Fredericksburg, Virginia, 22405. (approx. 10 minutes from I-95)

We don't know what treasures we are going to find, since we are still amassing boxes, but for the adventure seeker or collector, this could prove to be an exciting trip.

Thank you - I hope you will pass this on.

Respectfully,

Kathryn (Bonanno Patrizzi) Or Karen Bonanno DeHaas

March Business Meeting Synopsis

By Andy Thompson, Secretary

President Dave Nanney welcomed everyone to the evening's meeting, including a word of thanks to the MSDC past presidents in attendance for their service to the club. He then called for a Treasurer's report from John Weidner who indicated he had recently received 5 membership renewals, not counting his recruiting dues twice from one of the members (me). Dave thanked Mineral Minutes editor Steve Johnson for another fine edition including his own contributions to the content, which was applauded by the attendees.

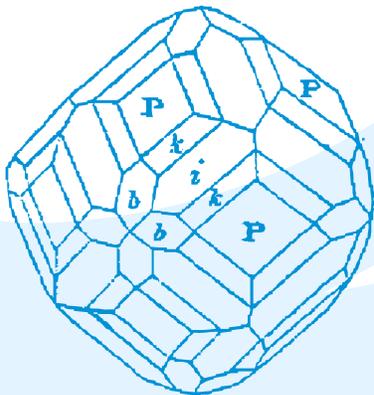
"Geology in the News" surfaced one global item, the report in Nature magazine (2 March 2017) of geologists finding what may turn out to be the oldest fossils yet discovered on earth, the 3.77 billion year old remnant of tiny structures which the reporting scientists said were made by micro-organisms. The location of the find was in the Hudson Bay area of northern Quebec, Canada. Other scientists reported they were slow to accept these structures a biological in origin and so resolution of this controversy awaits further research.

More current-day geological news included the members' reports of numerous upcoming meetings local to the DC area. Craig explained the benefits of attending the annual Delaware meeting. Bob, President of the Northern VA mineral club described not only his club's upcoming meeting, an auction, but also the 31 March – 1 April 44th Annual Atlantic Micromounters' Conference to be held in Alexandria VA. For further information see <http://dcmicrominerals.weebly.com/conferences.html>. Tim and Mark welcomed everyone to consider attending the upcoming Montgomery County mineral club's annual show, 18-19 March, with its extensive displays and activities. For more information go to: www.glmsmc.com/show.shtml.

Ed Fisher then requested approval of the February Business Meeting Minutes as they appeared in the March newsletter. The proposal was seconded and approved unanimously.

Dave then called for Old Business items. None were proposed for discussion. Ditto for New Business. He then noted that he would soon be convening a meeting of MSDC's board of directors. He also called for volunteers for bringing snacks to the April meeting. None stepped forward.

Next month's program? Club V.P. for Programs, Dave Hennessey said that Dr. Jeff Post will be presenting at our April meeting, highlighting some of the new acquisitions the Smithsonian brought back from this year's Tucson gem and mineral show. They, along with a selected few of last year's purchases, will be the focus of the April program. For May, Scott Southworth, of USGS fame, will give a presentation on some aspect of the geology local to DC, which topic will be clarified as we come closer to the May meeting.



"The Copper Silicates of Arizona"

Presented by Dr. Mike Pabst

By Andy Thompson, Secretary

Dave Hennessey introduced Dr. Mike Pabst as a Ph.D. biochemist who had published over 100 scholarly articles pertaining to various aspects of his expertise. Mike served and conducted research in medical centers associated with several universities. After retirement, he has continued to pursue his passion of collecting, photographing and writing articles about his study of micro minerals.

Perhaps there was a subtle influence in the air, it being Ash Wednesday. Dr. Mike Pabst said he loved coming to present to mineral clubs such as ours, and joked he wanted to lure us over to the "dark side" of collecting micro specimens. He recounted that he, like most collectors, had sought out larger rocks and minerals until one day when he first had the experience of viewing the stunning beauty of micro specimens. "I was hooked from then on." With a light evangelical touch, Mike said he hoped his presentation would open his listeners to a similar conversion experience. The photographs he shared certainly conveyed an aesthetically powerful message no one could deny.

The origin of tonight's presentation, he said, was his having noticed that nowhere could he find any scholarly articles on the beauty and range of copper silicates he himself had experienced from the bountiful Christmas Mine of Arizona. So, drawing on his own years of collecting and research, he put together and published an article in Mineral News celebrating those specimens, whose exquisitely detailed photos he then shared with the group.



Macquartite from Mammoth-St. Anthony Mine, Tiger, AZ. FOV 2 mm.

Photo: Mike Pabst

By way of an overview, he noted there are 39 known copper silicates that have been identified worldwide. Eighteen of those are found in 8 Arizona mines. Fourteen different copper silicates can be found in only three of those mines, namely 7 at Christmas Mine, 7 at the Mammoth-St. Anthony Mine, and 4 at the New Cornelia Mine. He used an alphabetical order for presenting about 45 slides of the 18 minerals. In one of his first slides, he presented an alphabetical list of all 18 mineral names, an Arizona mine where each could be found, the chemical formula and the crystal system or habit in which each presents itself. The chemical formulas ranged from Stringhamite, found in the Christmas Mine, with a simple formula of $\text{CaCu}(\text{SiO}_4)\cdot\text{H}_2\text{O}$, to Ashburtonite found in

the Rowley Mine, with the more complex formula, $Pb_4Cu_4(Si_4O_{12})(HCO_3)_4(OH)_3Cl \cdot H_2O$. Their crystal systems were monoclinic and tetragonal, respectively. Mike spent zero time explaining any of the chemical mysteries but the information was there for those who might want to explore those variables.

Instead, Mike used his time to share the aesthetic beauty of the micro minerals sometimes by showing an initial perfectly crisp photo of the specimen and then using an even higher magnification to surprisingly capture even greater delicate variations of the mineral.

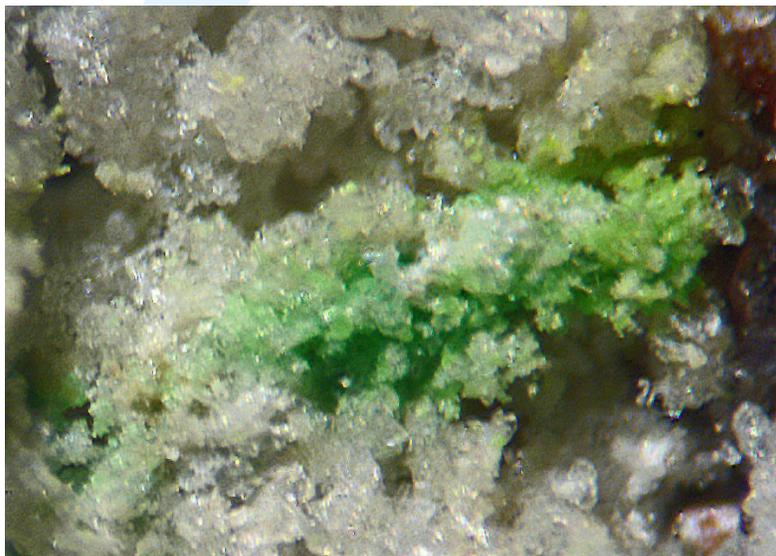
Using their alphabetical order as the organizing principle, Mike walked club members through the following copper silicate minerals: ajoite, apachite, ashburtonite, chrysocolla, creaseyite, diopside, gilarite, iranite, hemihedrite, kinoite, luddenite, macquartite, papagoite, plancheite, shattuckite, stringhamite, whelanite and wherryite.

There was a great deal of variety in the color and shape of the copper silicate specimens, although hues of green and blue prevailed. For example, shattuckite, pictured here, has the appearance of light blue fuzz balls atop dark green malachite crystals.

Here below are a few of the photos Michael shared with a very appreciative audience. Each of the photos features a copper silicate mineral, although sometimes, as with the following photo of gilarite (green), it is smaller than a non-copper-silicate, such as junite (violet).

Frequently the specimens are so small they challenge the skills of the photographer, such as with the tiny papagoite (blue) below, next to even smaller ajoite (green) crystals. Viewers see the photo as a finished product and may think it is a simple see-and-click picture taking process. But without going into detail, Mike hinted there is often an interesting story behind how micro-mount photographers have to be creative in order to capture their specimen.

Very commonly the copper silicate specimen, in the following photo, kinoite, has a crystal shape totally different from its neighboring crystals. The blue kinoite, with its straight cylindrical shape, is here nested within beautifully shaped orange fuzz balls of ruizite, a manganese silicate.

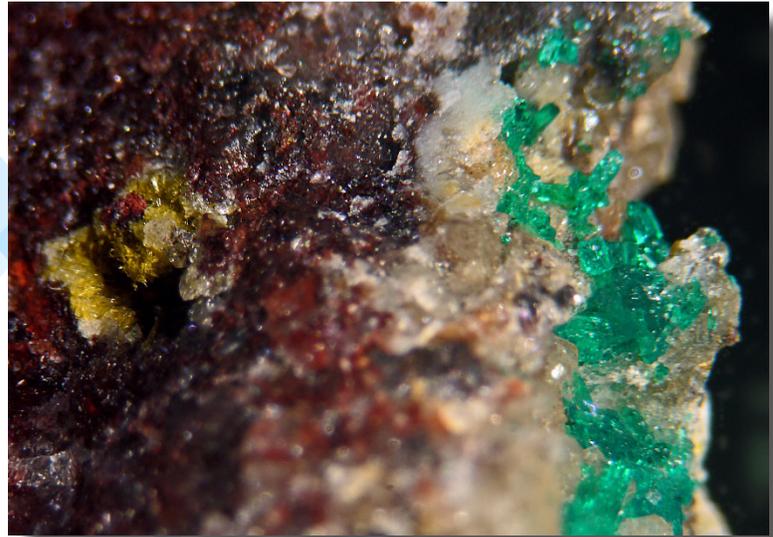


Macquartite (yellow) and Diopside (green) from Mammoth-St. Anthony Mine, Tiger, AZ. FOV 8 mm. Photo: Mike Pabst

But it was diopside that was the most frequently presented in photos, having 7 illustrating a wide range of greens, from deep to light. Here below it is pictured as green needle-like crystals

surrounding a larger, sharply terminated deep orange wulfenite crystal.

In the following photo, the blue-green diopside crystals have a rectangular shape and are adjacent to dark green malachite needles that appear to be exploding outward.



Macquartite (yellow) and Diopside (green) from Mammoth-St. Anthony Mine, Tiger, AZ. FOV 8 mm. Photo: Mike Pabst

One of the rarest minerals Mike showed was light green luddenite associated with a group of colorless wickenburgite crystals.

FOV, or Field of View, was one of the variables which the audience could not help but learn to appreciate. Most of the photos, of course, had a FOV which was microscopic. To capture a very tiny yellow macquartite, for example, he first showed an 8 mm FOV photo featuring green diopside but also showing very tiny yellow crystals.



Diopside (blue-green), Malachite (green) from Mammoth-St. Anthony Mine, Tiger, AZ. FOV 3 mm. Photo: Mike Pabst

But then, by using a greater magnification and reducing the FOV to 2 mm, he focused on the yellow crystals which showed tiny, delicate macquartite needle shaped crystals. (By way of a reminder, a millimeter equals .039 inches. So the entire FOV of the above photo is about only one twelfth of an inch.

All of the photos in this synopsis were taken by Mike and the evening's program appeared smooth, seamless and could give

viewers the mistaken impression it was put together easily and without much effort. But that is typical of fine art and science. To extend the pleasure of this viewing experience, visit his home page at <http://mindat.org/gallery-27958.html> which shows several of his additional photos, mostly of minerals other than copper silicates.

At the conclusion of his presentation, and after the applause, Dave Nanney asked if the audience had any questions. Typical of any strong aesthetic experience, there were no questions, but simply appreciation of the beauty which had been shared. Although the presentation was given on Ash Wednesday evening, attendees left with the sense they had just enjoyed a mineralogical Mardi Gras festival.

What is Mohs Hardness Scale?

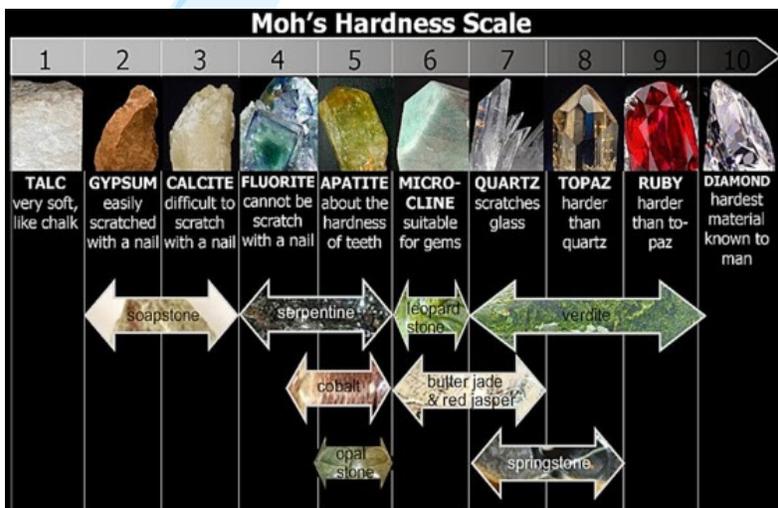
by Mary Harbison

(Originally from the January 2016 edition of the "Tar Heel Tailings" newsletter by the Tar Heel Gem & Mineral Club of Raleigh, NC)

The Mohs scale of mineral hardness characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material. It was created in 1812 by the German geologist and mineralogist Friedrich Mohs and is one of several definitions of hardness in materials science. The method of comparing hardness by seeing which minerals can scratch others, however, is of great antiquity, having been mentioned by Theophrastus in his treatise *On Stones*, c. 300 BC, followed by Pliny the Elder in his *Naturalis Historia*, c. 77 AD.



The Mohs scale of mineral hardness is based on the ability of one natural sample of matter to scratch another mineral. The samples of matter used by Mohs are all different minerals. Minerals are pure substances found in nature. Rocks are made up of one or more minerals.



Making Hardness Comparisons

"Hardness" is the resistance of a material to being scratched. The test is conducted by placing a sharp point of one specimen on an unmarked surface of another specimen and attempting to produce a scratch. Here are the four situations that you might observe when comparing the hardness of two specimens:

I. If Specimen A can scratch Specimen B, then Specimen A is

harder than Specimen B.

2. If Specimen A does not scratch Specimen B, then Specimen B is harder than Specimen A.

3. If the two specimens are equal in hardness then they will be relatively ineffective at scratching one another. Small scratches might be produced, or it might be difficult to determine if a scratch was produced.

4. If Specimen A can be scratched by Specimen B but it cannot be scratched by Specimen C, then the hardness of Specimen A is between the hardness of Specimen B and Specimen C.

Mohs Hardness Testing Tips

A list of minerals in order of hardness can be a handy reference. If you determine that a specimen has a hardness of Mohs 4 you can quickly get a list of potential minerals.

Practice and experience will improve your abilities when doing this test. You will become faster and more confident.

If the hardness of the unknown specimen is about 5 or less, you should be able to produce a scratch without much exertion. However, if the unknown specimen has a hardness of about 6 or greater, then producing a scratch will require some force. For those specimens, hold the unknown firmly against the table, place the standard specimen against it, press firmly with determination, then holding pressure slowly drag the standard specimen across the surface of the unknown.

Don't be fooled by a soft standard specimen producing a mark on a hard unknown. That mark is like what a piece of chalk produces on a blackboard. It will wipe off without leaving a scratch. Wipe your finger across the tested surface. If a scratch was produced there will be a visible groove. If marks wipe away then a scratch was not produced.

Some hard materials are also very brittle. If one of your specimens is breaking or crumbling rather than scratching, you will have to be very careful while conducting the test. Testing tiny or granular specimens can be difficult.

Some specimens contain impurities. If the results of your test are not visibly conclusive, or if the information from your test does not conform with other properties, do not hesitate to do the test again. It is possible that a small piece of quartz (or another impurity) was embedded in one of your specimens.

Don't be wimpy! This is a very common problem. Some people casually rub one specimen back and forth against another and then look for a mark. That is not how the test is done. It is done with a single, determined motion with the goal of cutting a scratch.

Be careful. When you hold the unknown specimen against the table, position it so that the known specimen will not be pulled across one of your fingers.

This test should be done on a lab table or work bench with a durable surface or a protective covering. Don't do this type of testing on fine furniture.

Test tiny particles or grains by placing them between two pieces of an index mineral and scraping them together. If the grains are harder than the index mineral scratches will be produced. If the grains are softer they will smear.

Hardness Variations in a Single Mineral

Most minerals have a fairly constant hardness. For example, the hardness of calcite is always about 3. However, some minerals have a range of hardness. Minerals that are part of a solid solution series can change in hardness as the composition varies.

Atomic bonds between some elements are stronger than others. An example is garnet which has a composition of $X_3Y_2(SiO_4)_3$ where X can be Ca, Mg or Fe and Y can be Al, Fe or Cr. Garnets with different compositions have different hardness. Garnets range in hardness from 6.5 to 8. Minerals such as kyanite have different hardness in different directions. Kyanite is a mineral that frequently occurs in blade-shaped crystals. These crystals have a hardness of about 5 if they are tested parallel to the long axis of the crystal and a hardness of about 7 if they are tested parallel to the short axis of a crystal.

Weathering can also influence the hardness of a mineral. Weathering usually changes a mineral's composition with the weathering product usually softer than the original material. When testing the hardness or streak or other property of a mineral, the best way to test is on a freshly broken surface that has not been exposed to weathering.

Some Notes on Spelling

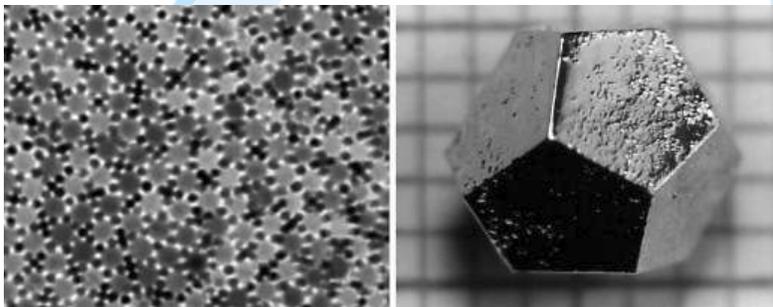
Mohs Hardness Scale is named after its inventor, Friedrich Mohs. This means that an apostrophe is not needed when typing the name of the test. "Moh's" and "Mohs'" are incorrect. Google is really smart about these names. You can even type "Moe's Hardness Scale" as a query and Google knows to return results for "Mohs Hardness Scale".

One of the Rarest Crystals on Earth Has Been Found in a Russian Meteorite

By ScienceAlert Staff

Physicists have uncovered an ultra-rare quasicrystal in a piece of Russian meteorite, and it's only the third time ever that we've seen one of these strange materials in nature.

Originating in outer space, these crystals aren't just incredible because of how rare they are – their atomic structure is so peculiar, for decades their existence was dismissed as "impossible", and they cost the scientist who first discovered them his job.



Quasicrystal atomic structure (L): Talapin et al; Synthetic quasicrystal (R): US Department of Energy

This new quasicrystal specimen was found by a team led by geologist Luca Bindi from the University of Florence in Italy. They'd been examining a tiny grain of meteorite that landed in the Khatyrka region of the Russian far east five years ago, and identified piece of quasicrystal inside, just a few micrometers wide.

This is the third quasicrystal found in grains of this particular meteorite so far, which suggests that there might be more out there, and with even stranger structures. "What is encouraging is that we have already found three different types of quasicrystals in the same meteorite, and this new one has a chemical composition that has never been seen for a quasicrystal," one of the team, Paul Steinhardt from Princeton University, told Becky Ferreira at

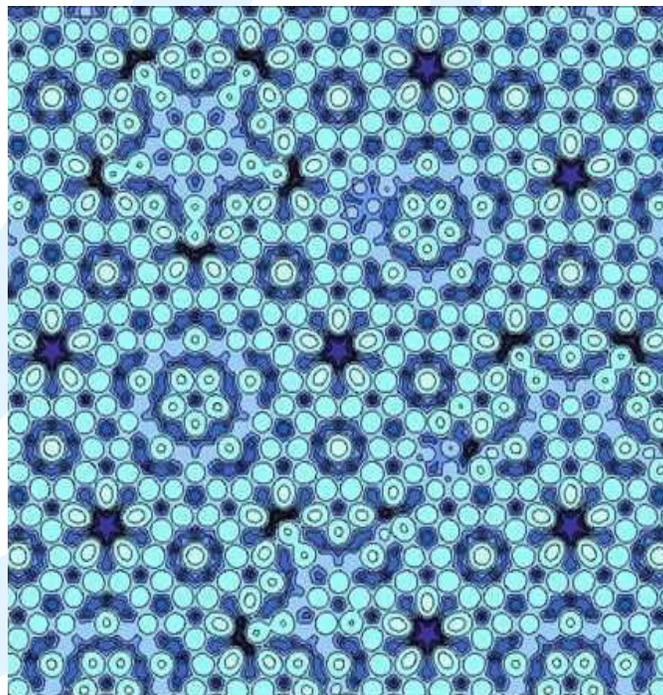
Motherboard. "That suggests there is more to be found, perhaps more quasicrystals that we did not know were possible before."

If you're wondering what the hell a quasicrystal is, they consist of an entirely unique atomic structure that basically combines the symmetrical properties of a crystal and the chaos of an amorphous solid. Regular crystals, such as snowflakes, diamonds, and table salt, are made up of atoms that are arranged in near-perfect symmetry.

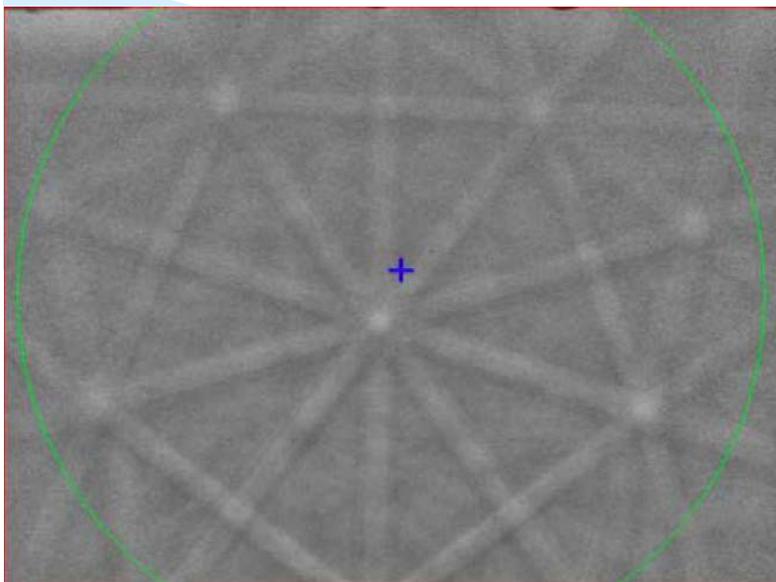
Polycrystals, including most metals, rocks, and ice, have more randomized and disordered structures, just like amorphous solids, such as glass, wax, and many plastics. Back in 1982, Israeli chemist Daniel Shechtman proposed that another type of atomic structure could exist in nature – a strange, semi-ordered form of matter, with an atomic structure that displays no repeating patterns anywhere you look. When he found some in a sample of synthetic material he created in the lab, he reportedly told himself, "Eyn chaya kao," which translates to "There can be no such creature," in Hebrew. Shechtman was awarded the 2011 Nobel Prize in Chemistry for his discovery, but not before being literally laughed out of his lab and ridiculed by his peers for decades for daring to suggest something so preposterous as a semi-ordered structure.

The reason quasicrystals are so unlikely is because for almost two centuries, perfect symmetry in atomic structures was believed to follow a very strict set of rules. Before the existence of quasicrystals was confirmed, scientists assumed that for a structure to grow with a repeating, symmetrical structure, it could exhibit one of four types of rotational symmetry: two-fold, three-fold, four-fold, or six-fold. Quasicrystals broke this rule, because they have crystal-like structure with a five-fold rotational symmetry. As Pat Theil, a senior scientist at the US Department of Energy's Ames Laboratory, explained to PBS, if you want to cover your bathroom floor in perfectly tessellating tiles, they can only be rectangles, triangles, squares or hexagons. Any other simple shape won't work, because it will leave a gap.

Quasicrystals are like pentagonal tiles – they can't tessellate like squares or triangles can, but other atomic shapes move in to fill in the gaps, like so:



You can also see an example of this in the image at the top of the page. And here's an actual image of the newly discovered quasicrystal with five-fold symmetry:



While quasicrystals appear to be incredibly rare in nature – or on Earth, at least – they’re actually really simple to make in the lab, and synthetic quasicrystals are now being built into everything from frying pans to LED lights. When the researchers examined the composition of the new quasicrystal, they confirmed that it was made from a combination of aluminum, copper, and iron atoms, all arranged like the pentagon-based pattern on a soccer ball. This is the first time this particular composition has ever been found in nature, suggesting that we’re still only on the very cusp of understanding this bizarre form of matter. The research has been described in Scientific Reports.

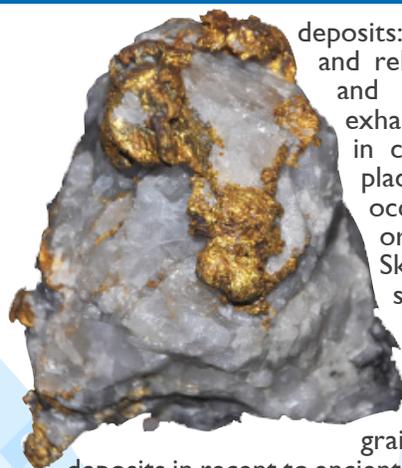
Source: ScienceAlert.com from December 10, 2016

Mineral of the Month – Native Gold – From Wikipedia and Mindat

A native element and precious metal, Gold has long been prized for its beauty, resistance to chemical attack and workability. Gold is a chemical element with symbol Au (from Latin: aurum) and atomic number 79. As it is found as a native element, has relatively low melting point (1064 degrees Celsius) and is malleable, it has been used by mankind for thousands of years. Gold’s atomic number makes it one of the higher numbered, naturally occurring elements. It is thought to have been produced in supernova nucleosynthesis, from the collision of neutron stars, and to have been present in the dust from which the Solar System formed. Because the Earth was molten when it was formed, almost all of the gold present in the early Earth probably sank into the planetary core. Therefore, most of the gold that is present today in the Earth’s crust and mantle is thought to have been delivered to Earth later, by asteroid impacts during the Late Heavy Bombardment, about 4 billion years ago.

Gold is used as a standard for international currency and is also widely used in jewelry, electronics (where its superb properties as a conductor help offset its tremendous cost), dentistry and in photographic processes.

Gold occurs in significant amounts in three main types of



deposits: hydrothermal quartz veins and related deposits in metamorphic and igneous rocks; in volcanic-exhalative sulphide deposits; and in consolidated to unconsolidated placer deposits. It may also occur in contact metamorphic or hypothermal deposits (eg. Skarns), or epithermal deposits such as volcanic fumaroles. It is most commonly found as disseminated grains in Quartz veins with Pyrite and other sulphides, or as rounded grains, flakes or nuggets in placer

deposits in recent to ancient stream and river deposits. Gold is often panned from such deposits by taking advantage of its high density to wash away the lighter sediments from a pan or sluice.

Nuggets are almost exclusively hypogene (produced or occurring under the surface of the earth) in origin, forming mostly in veins, but can be somewhat modified in form and chemistry by weathering, erosion and transport (Hough et al., 2007).

GOLD	
Category	Native Minerals
Formula	Au
Strunz Classification	1/A.01-40
Crystal System	Isometric
Crystal Class	m3m (4/m 3 2/m) - Hexoctahedral
Color	Rich yellow, paling to whitish-yellow with increasing silver; blue & green in transmitted light (only thinnest folia [gold leaf])
Cleavage	None Observed
Fracture	Hackly
Mohs Scale	2.5-3
Luster	Metallic
Tenacity	Malleable
Streak	Shining Yellow
Specific Gravity	19.309
Melting Point	1,948°F / 1064°C



Hammer on Hammer

by Clyde Spencer

This was originally published in the Bulletin of the Friends of Mineralogy, Vol. 47, No. 1 (Jan 2017)

At a recent MSHA safety training session conducted by Scott Kell, he showed the picture of me below as an example of someone well prepared. Afterwards, an individual in the class approached him and stated that a hammer to hammer blow is a violation of OSHA standards. He claimed that chisels are non-hardened steel and are designed purposely to mushroom rather than splinter. He claimed to have seen serious injuries caused by flying steel splinters from a hardened steel hammer striking a hardened steel wedge or hammer. Scott told him he was unaware of the claims, but would look into it. Scott told me that he has not found an applicable OSHA standard; however, a number of websites by hammer manufacturers advise against the practice.

Incidentally, in the photo of me, the rock had a large crack that went all the way through the boulder. I wasn't hitting my hammer as hard as I would a chisel because I was just trying to get the point in deep enough to use the curved point to pry the two pieces apart. Obviously, the design of the typical geologist's hammer is such that it is intended to be used to pry. Whether or not it can be hit on the face safely remains an open question unless we can learn more detail about how Estwing heat-treats their hammers.

I'm aware of the risk of hardened steel against hardened steel. That is part of the reason I wear eye protection, long-sleeve shirts, and gloves. Some of my chisels, but not all, are hardened throughout. Considering that geology hammers are intended for use on hard rocks, and observing the nature of the deformation on the heads, I had to question just how hard they are. What I observe when I dress them on a grinding wheel is that they are deforming and not spalling or splintering. Besides, there are different degrees of hardening. I imagine that the lawyers for Estwing and other geology-hammer manufacturers have advised them to use steel of a hardness that isn't highly prone to splintering.

The reason that some chisels are hardened is because the job they are required to do (such as cutting a bolt) couldn't be done with a soft chisel. One has to hit the hardened-steel chisel with a hammer to do the job! So, if such a claimed OSHA regulation exists, it was either created by a bureaucrat with no experience working on machinery, or, hopefully, recognizes that there are situations where one has to hit a hardened steel object with a hardened steel hammer. If there are indeed OSHA regulations about just what can be hit with a hammer, I would imagine that

would have to be very specific, such as specifying the Rockwell hardness, or malleability difference between the hammer and object being hit.

If you discover that such a regulation exists, I would like to know about it and I will certainly be careful to observe it while in a commercial operation under OSHA control. However, in something like 60 years of pounding on rocks, the only hazards I have personally experienced are from quartz or chert spalling and cutting me. Hopefully, OSHA won't tell us we can't hammer on siliceous rocks! I spent some more time investigating OSHA hand tool standards. The following are some things that I think are pertinent to concerns about the danger of hitting one hammer with another:

1915.133(c) Impact tools, such as drift pins, wedges, and chisels, shall be kept free of mushroomed heads.

1915.133(d) The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool.

1915.152(a) Provision and use of equipment. The employer shall provide and shall ensure that each affected employee uses the appropriate personal protective equipment (PPE) for the eyes, face, head, extremities, torso, and respiratory system, including protective clothing, protective shields, protective barriers, personal fall protection equipment, and life saving equipment, meeting the applicable provisions of this subpart, wherever employees are exposed to work activity hazards that require the use of PPE.

1915.153(a)(1) The employer shall ensure that each affected employee uses appropriate eye or face protection where there are exposures to eye or face hazards caused by flying particles, molten metal, liquid chemicals, acid or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

1915.155(a)(1) The employer shall ensure that each affected employee wears a protective helmet when working in areas where there is a potential for injury to the head from falling objects.

I did a search for "hammers" and "chisels" on the OSHA site. I found a slide-show where one of the slides was "Hammer Rules." [Note that they are not Regulations.]

- Make sure the handle of the hammer fits tightly on the head.
- Do not strike a hard steel surface with the steel hammer.
- Do not use the hammer handle for striking and never use it as a pry bar.
- Always strike the surface squarely - NO glancing blows.
- Always wear safety goggles.
- Never strike any hammer with or against another hammer.
- Discard a hammer with a chipped or mushroomed face.
- Do not use steel hammers on concrete, stone or hard metal objects.
- Replace loose or cracked handles.
- Discard hammers with cracked claws or eye sections.

Note that the third from the bottom advises against what we routinely do in collecting! I will conclude (this was for shipyard



workers) that they don't have experience with geologist's hammers. These rules are, again, probably most appropriate for machinist's and carpenter's hammers.

MythBusters: If two hammers strike each other, at least one of them will completely shatter with lethal force.

Busted

"Using a custom rig, the Myth Busters repeatedly struck pairs of hammers together, but none shattered. Hammers with wooden handles merely snapped in two and hammers with metal handles bent. The MythBusters then decided to make the steel hammers harder and more brittle by adding more carbon, and through heat treatment. In particular, they attempted to case harden the hammers, however it is questionable if this was done correctly. They heated the hammers to high temperatures and then coated the hammer heads in used engine oil. They also decided to have the hammers strike a more sturdy anvil instead of each other. However, during testing, the carbonized hammers merely bent at the handles without shattering. Furthermore, an anvil is generally not made of particularly hard steel, and so that test may have been doomed from the beginning. An anvil with a hardened tool steel insert would have been more appropriate. Though the myth was busted, some hammers come with warnings not to use them to strike another tool or hardened nail with excessive force; although no hammerhead shattered or chipped, high-speed footage showed particle dust flying in all directions, which presents an eye hazard." (This myth was revisited in episode 75 and it was re-busted.)

There is a tendency for people to get Urban Legends embedded in their minds and never question the origin, or circumstances under which there might be an element of truth. One rarely, if ever, sees a carpenter's hammer with a mushroomed face. From my reading, it is apparent that things like claw-hammers have differential heat-treating to make the face of the hammer and the V-groove harder than the body in between. That is probably why there is concern about hitting a hammer on a hammer. The face is very hard to keep it from getting indented. Most people only have experience with the kinds of hammers that carpenter's or machinists use. Rules of Thumb can be useful, but one should know when they can be broken safely.

I know someone, a man I used to work with, who's daughter and neighbor girl were breaking geodes with a carpenter's hammer. A metal splinter flew off the hammer and lodged in the neighbor girl's eye! While I have not heard of, or observed such things happening with geologist's hammers, it points out the necessity of always wearing eye protection. I'm concerned about getting this issue right, so I spent some more time looking for information on the internet. The other side of the argument is addressed pretty well here: <http://www.finewoodworking.com/item/17562/reader-saysmythbusters-missed-on-hammer-strikes> However, other than a lot of anecdotal stories about Murphy's Law in the comment section, I think that the best summary is the following:

"I am a retired metallurgical engineer with a lot of failure analysis experience. Those are my credentials for adding the following comment. There are a lot of valid comments about chips flying off the faces of hammers (and other heat-treated tools) in this string of postings. The technical reason for this is that high impact can cause some of the steel in the tool to transform to "martensite",



which is the hardest and most brittle form of steel. When you heat treat a tool to make it hard, you first quench it from an elevated temperature to transform all (or most) of the steel to martensite. In that condition it is hard, but it is too brittle to be useful. The next step is to heat the tool to a moderately high temperature to transform the martensite into something called "tempered martensite." The higher the tempering temperature, the lower the hardness and the less brittle the steel. OK. that's the end of the lecture- but I'll be happy to answer questions about steel heat treatment from interested folks.

The key is that hitting a hammer can transform some the head to brittle martensite, and that is where the danger lies. The next time you hit that spot a chip can break off- as was well attested in precious comments. Probably the most common occurrence is with wood-splitting wedges. They get pounded hard all the time, and they often produce flying chips. Always check your wedge heads before use and grind off any split or cracked areas.

Having said all that, I really doubt that hitting a ball-peen hammer to dimple a miter bar is going to cause a flying chip UNLESS the hammer head already has some martensite from previous abuse. It is just not a hard enough blow. Just be sure to check your hammer heads frequently for chipping and cracking and grind off the chipped area or get a new hammer."

Another poster wrote, "Steel is Steel. If you look up what the hardness is on a typical claw hammer, you'll find it to be Rockwell 50-60. A ball peen hammer may be hardened to 57R. Brick chisels are hardened to 60-61R. What do you hit a brick chisel with? A driving or mash hammer (also hardened to 57R). So what is the difference? I saw the Mythbusters program and they went far beyond the typical tapping. (typical, but that's what Myth busters does.) You should always wear safety goggles when hitting steel, but unless the hammer is defective. I don't see any difference in using the hammer instead of a drift, but my preference would be to use the correct tool. (the drift)" This may be getting to the essence of the problem: "Case hardened claw hammer heads are very wear resistant against relatively soft nails. BUT the process leaves a brittle layer that is prone to fracture by impact with a thoroughly hardened surface."

A couple of points to be made is that, again, these remarks are largely about claw-hammers and ball-peen hammers that probably start out a lot harder than a rock hammer. However, bear in mind that splitting wedges are intended to be struck by a mallet or sledge hammer. I'm reasonably sure that star drills are pretty hard or they wouldn't work. Although, they may be differentially heat-treated. There is always some risk when hitting something with great force, and that ranges from glancing blows that can hit the person swinging the hammer, to failure of the steel head even when hitting a rock. If we want to be totally safe. we should stay home and watch TV.



I wrote to Estwing for their official position. The following is what I received back: "Thank you for your email. The general safety rule is that you should never hit another object that is as hard as (or harder than) the steel tool itself. Some types of rock are softer than others. Nail hammers are engineered and designed specifically for hitting common, unhardened nails. Any other use could cause the steel to break which could result in injury. Rock picks are engineered a bit differently as you can tell by the solid rectangular structure. All of our tools use the same steel (1055 Special Bar Quality) and are heat treated to ASME Safety requirements of 45-60 Rockwell C Standard. The drilling hammers are much sturdier due to their size and weight, but should still not be used to strike hardened objects directly. The safe way to use these hammers would be in combination with a chisel or punch that has a struck face that is no more than half the diameter of the striking face of the drilling hammer [emphasis added: CHS] (such as our rock chisels). Rock picks are best used for prying rock from the ground. The hammer end can be used for light duty work, but again should not be used to strike any object that is harder than the steel itself."

My response to her was, "How is one supposed to know if a rock might be harder than the steel hammer before hitting it? If rock hammers can only be used for 'light duty work,' they would be practically useless for what a mineral or rock collector needs to break a rock. I'm a graduate geologist and I have been using Estwing (and Plumb) rock hammers since the 1960s and have never encountered a problem with a hammer despite hitting rocks with as much force as my six-foot frame will allow me. Yet, there numerous horror stories about people being seriously injured from nail hammers. You suggest that a nail hammer is engineered differently, but you don't provide specifics. As to being 'best used for prying rock from the ground,' it is obvious you have never personally used a geology hammer or observed the typical user of a geology hammer. The typical use by a geologist is to break off a sample from a large boulder or cliff face with multiple blows from the hammer face, and perhaps use the curved-pick end to widen a crack in an exposed outcrop."

I got a call from the Estwing VP of Engineering and we talked for about a half hour. He himself carries a piece of steel in his hand from a claw hammer! He assured me that all Estwing hammers are heat-treated and tempered the same, to ASME standards. What that means is that the bodies and shanks (if steel) are tempered to <40 HRC (Rockwell hardness, C-scale); the striking faces to low-50s HRC. Gad-pry bars, and typical chisels, such as mineral collectors might commonly use, are tempered to about 45 HRC on the striking surface. A brick-chisel cutting-edge is tempered in the range of 35-55 HRC Metal-cutting chisels, what are commonly called 'cold chisels,' are heat-treated and tempered to 48-60 HRC on the cutting edges, while the struck heads are tempered to <45 HRC. However, I own a Chinese-made cold chisel that I bought at Harbor Freight and Tools that I am certain is of the same hardness throughout! So, one has to take into consideration that not all chisels may be as safe as the Estwing products. Lastly, after the conversation with the Estwing VP of Engineering, I took a file to my Plumb nail hammer and could hardly touch the face! However, I was more successful in removing some of the burrs on my long-handled Estwing rock hammer. That may be in part because I have never dressed the face of the nail hammer after 30 years; however, I have dressed the face of my rock hammer on a grinding wheel several times and may have gotten down through a harder surface layer. Indeed, throughout my life, I have worn out several rock hammers; usually the pick end has become so short as to no longer be useful. We want to be safe, but we have to be practical in that our objectives are to turn big rocks into small rocks and no amount of chisel work is as effective as hitting a rock with a rock hammer! Being unnecessarily conservative or

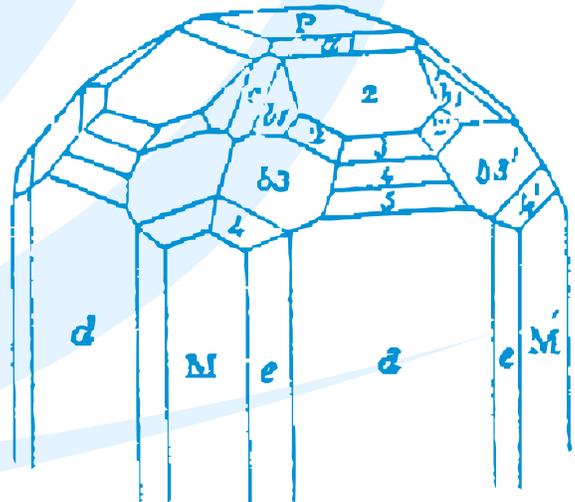
cautious defeats our purpose.

I'm at a loss to explain why nail hammers seem to be the implement commonly responsible for serious injuries from shrapnel, while I've never experienced the problem with a rock hammer, and don't know anyone who has experienced it. Perhaps it's just that there are far more people using (and misusing) nail hammers than rock hammers. Another consideration is that, except for quartz veins and chert boulders, there are very few rocks that are truly harder than heat-treated tool steel. Some rocks can be unbelievably tough and difficult to break with a large sledgehammer, but are not actually harder as measured by resistance to indentation. Also, polymineralic rocks and even monomineralic rocks with a "felted" texture (like jade) are less likely to fail by brittle breakage than are monomineralic rocks like quartz and chert.

Apparently, the key to safe use is to use a hammer and chisel combination where the chisel is much smaller than the striking face of the hammer. (Although, this isn't possible when hitting a gad-pry bar unless one uses a drilling or engineers hammer. And we don't always want to carry the extra weight when working our way over a blast pile.) This minimizes the chance of a flake coming off the edge of the hammer face and flying in the direction of the user if the blow is off-center. That is, it minimizes the chance of a glancing blow similar to what flint knappers try to achieve to make flint tools. From what I have read, I would strongly advise against using a nail hammer for mineral collecting!

While at the recent Denver mineral show, I noticed a new Estwing rock hammer that one of the dealers had on display. To my surprise, there was a warning in yellow letters, on the side of the head, not to strike anything with the pick end of the hammer. That is interesting because the recent Ward's Science catalog I received contains the following description of the long-handled Estwing rock hammer: "Pointed tip for hard-rock geology work."

Obviously, a corporation has to be careful as to what it publicly recommends out of concern that the kind of person who sues McDonalds for spilling hot coffee on themselves might sue them for not telling them to use caution in the use of hand tools. I think that the message in our safety classes should be to use common sense and try to use tools in the manner recommended by the manufacturer, which are probably conservative rules. Note that striking a nail hammer with another nail hammer violates the rule of having the striking head twice as large as the object being struck. [Note that in the photo above, the striking hammer has a face larger than the hammer I'm hitting.] Unfortunately, if the boulders we are commonly trying to reduce in size were smaller than the striking face of the hammer, we wouldn't need to hit them! So, sometimes we have to 'live on the edge.'



Geologists Find Remnants of Early Earth's Crust in Canada

Mar 17, 2017 by News Staff (www.sci-news.com)

An analysis of rock samples collected from the Superior Province, the region in Canada just north of the Great Lakes, suggests the samples contain components of ancient basaltic crust that existed more than 4.2 billion year ago (Hadean eon).

Recreating the nature of Earth's first crust is difficult because geologic activity has created turnover that drove most of it back into Earth's interior. While some slivers of 4-billion-year-old crust remain in the rock record, only isolated zircon mineral grains are dated to be older.

"Finding remnants of early Earth's crust has proven difficult, but a new approach offers the ability to detect the presence of truly ancient crust that has been reworked into 'merely' really old rocks," said study co-author Dr. Richard W. Carlson, Director of the Department of Terrestrial Magnetism at the Carnegie Institution for Science.

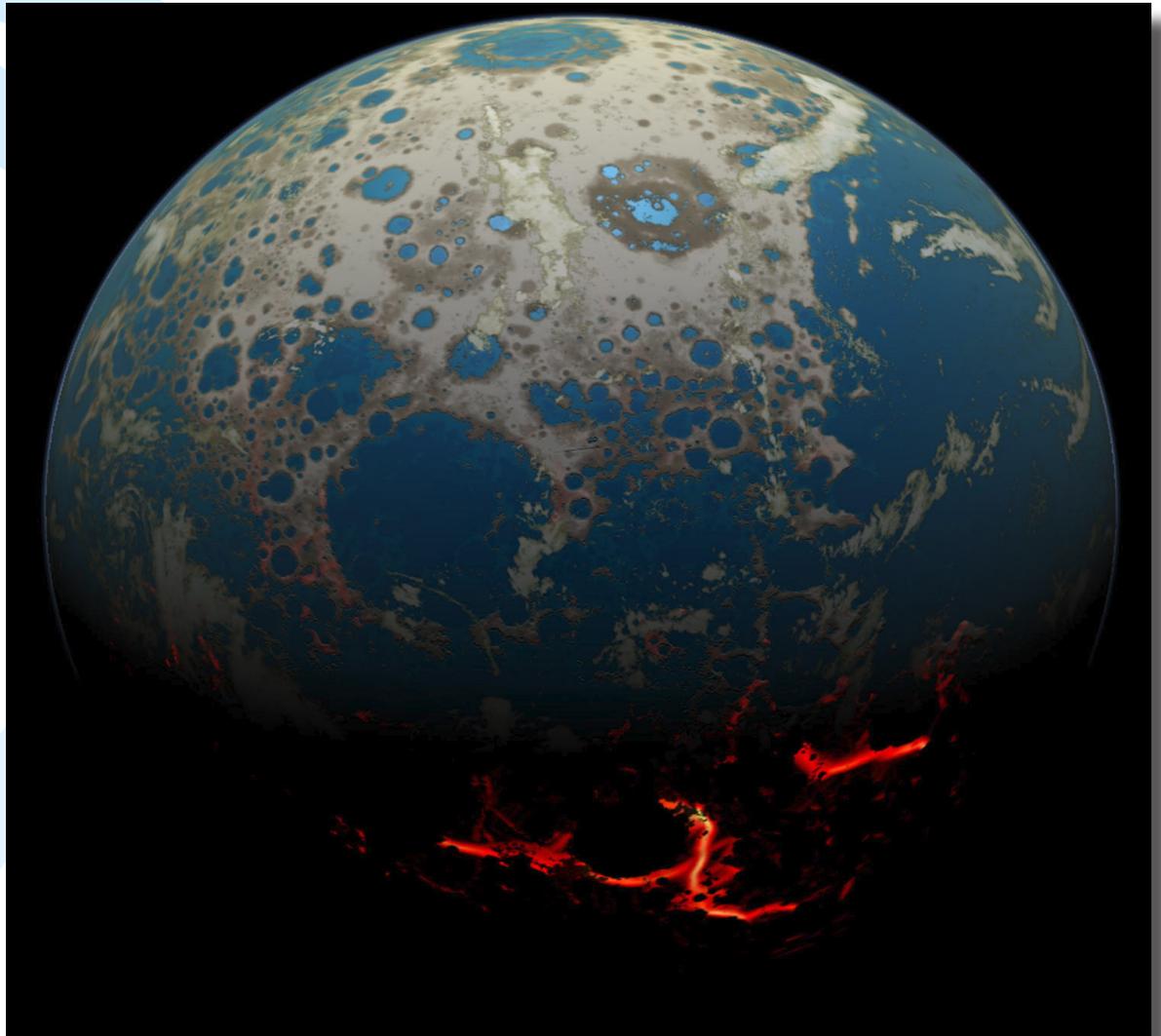
The novel approach examines variations in the abundance of an isotope of the element neodymium, which is created by the radioactive decay of a different element, samarium. The isotope of samarium with a mass of 146 (samarium-146) has a half-life of only 103 million years. It decays to the isotope of neodymium with a mass of 142. While samarium-146 was present when Earth formed, it became extinct very early in Earth's history.

Researchers know of its existence from the study of very ancient rocks, especially meteorites and samples from Mars and the Moon. Variations in the relative abundance of neodymium-142 compared to other isotopes of neodymium that didn't originate from decaying samarium reflect chemical processes that changed the ratio of samarium to neodymium in the rock while samarium-146 was still present—basically before about 4 billion years ago.

Dr. Carlson and his colleague, University of Ottawa researcher Dr. Jonathan O'Neil, studied 2.7 billion-year-old granitic rocks that make up a portion of the eastern shore of Hudson Bay.

The abundances of neodymium-142 in these granites indicates that they were derived from the re-melting of much older rocks — rocks that were more than 4.2 billion years old — and that these ancient rocks were compositionally similar to the abundant magnesium-rich rock type known as basalt, which makes up all of

the present day oceanic crust. In more-recent times in Earth's history, basaltic oceanic crust survives at Earth's surface for less than 200 million years before it sinks back into Earth's interior due to the action of plate tectonics.



An artistic conception of the early Earth. Image credit: Simone Marchi / NASA.

The team's findings, however, suggest that basaltic crust, which may have formed not long after Earth's formation, survived at Earth's surface for at least 1.5 billion years before later being re-melted into rocks that form a portion of the northernmost Superior craton, a geological formation that extends roughly from the Hudson Bay in Quebec to Lake Huron in Ontario.

"Whether this result implies that plate tectonics was not at work during the earliest part of Earth history can now be investigated using our tool of studying neodymium-142 variation to track the role of truly ancient crust in building up younger, but still old, sections of Earth's continental crust," Dr. Carlson said.

Details of the research were recently published in the journal *Science*. <http://www.sci-news.com/geology/early-earths-crust-04709.html>



Local Mineral Makes Good!!!

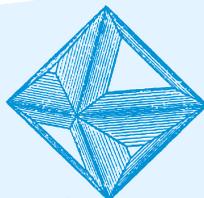
by Dave Hennessey

At my last high school reunion there were awards presented to the person who traveled the farthest and to the person who traveled least far to attend the reunion. The farthest traveler was a classmate who went to Australia after college graduation, married a local girl, and just stayed forever. The person who traveled least far still lived in the house they had grown up in. That got me thinking about minerals. How's that? Well, it got me wondering what mineral specimens in the Smithsonian Institution National Museum of Natural History (NMNH) display collection traveled least far to be there.



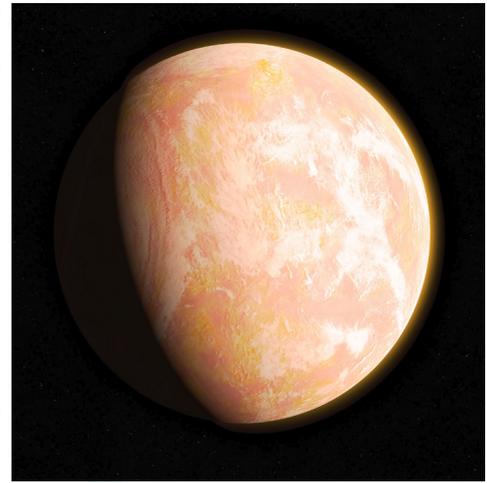
I think the answer is the remarkable apophyllite on prehnite specimen in the collection that came from what is now the Luck Stone Quarry in Centreville, Virginia. As the bird flies, the quarry that surrendered these pieces is about 24 miles from the Museum of Natural History. I was in the Northern Virginia Mineral Club at the time this specimen was found and I remember the buzz that collecting in the quarry was creating at the time. It was 1967 and I had joined the club a few years earlier. My parents did not have the slightest interest in minerals, but they were okay with dropping me off at and picking me up from the monthly club meetings. They were not okay with taking me on field trips so I never made it into the "Fairfax Quarry," as it was called in those days. At that time, collecting was allowed on Saturday mornings and for a few remarkable weeks in 1967 an area in the pit on the south side of Rt 29 was yielding remarkable specimens.

So, what is the specimen that has traveled the farthest to be in the Smithsonian's display collection? Since Washington is at roughly 38.9 degrees North Latitude and 77.0 degrees West Longitude, the opposite side of the world would be 51.1 degrees South Latitude and 103.0 degrees East Longitude. What's there? A lot of ocean (if you dig straight through the center of the earth you will not come out in China like they told you when you were a kid). The nearest land appears to be the southwestern corner of Australia. So, like my classmate who traveled furthest to come to the reunion, the mineral specimen that traveled furthest to be in the Smithsonian collection would be from that southwestern corner of Western Australia. I need to check it out, but I'm betting on a gold specimen from Kalgoorlie or Coolgardie, near Perth. I'll take a look next time I'm at the museum drooling on the cases.



Scientists Propose New Contributing Cause for 'Great Oxidation Event'

In the Archean Eon, more than 2.3 billion years ago, Earth's atmosphere spent about a million years filled with a methane-rich haze; and this haze drove a large amount of hydrogen out of the atmosphere, clearing the way for massive amounts of oxygen to fill the air, according to a University of St. Andrews-led research team.



Archean Earth. Image credit: Francis Reddy, NASA's Goddard Space Flight Center.

The scientists reconstructed atmospheric chemistry during the time period

immediately before the Great Oxidation Event (GOE), the singular event 2.3 billion years ago when oxygen concentrations in the Earth's atmosphere increased by over 10,000 times. "Reconstructing the evolution of atmospheric chemistry has long been the focus of geochemical research," said lead author Dr. Gareth Izon, who contributed to the research while a postdoctoral researcher at the University of St. Andrews and is now a postdoctoral researcher at MIT. "Our new data show that the chemical composition of the atmosphere was dynamic and, at least in the prelude to the GOE, hypersensitive to biological regulation." "The transformation of Earth's air from a toxic mix to a more welcoming, oxygen-rich atmosphere happened in a geological instant. With this study, we finally have the first complete picture of how methane haze made this happen," added co-author Prof. James Farquhar, from the University of Maryland.

The team's results suggest that ancient bacteria produced massive amounts of methane that reacted to fill the air with a thick haze, resembling the modern-day atmosphere of Saturn's moon Titan. Previous studies by many of the same researchers had identified several such haze events early in Earth's history. But the current study is the first to show how rapidly these events began and how long they lasted. "Our new dataset constitutes the highest resolution record of Archean atmospheric chemistry ever produced, and paints a dramatic picture of Earth surface conditions before the oxygenation of our planet," said co-author Dr. Aubrey Zerkle, from the University of St. Andrews. "These data show unequivocally that biology fuelled a methane-rich hydrocarbon atmosphere, similar to that of Saturn's moon Titan, for millions of years at a time. High methane levels meant that more hydrogen, the main gas preventing the build-up of oxygen, could escape into outer space, paving the way for global oxygenation."

The methane haze persisted for about a million years. After enough hydrogen left the atmosphere, the right chemical conditions took over and the oxygen boom got underway, enabling the evolution of all multicellular life. The key to the team's analysis was the discovery of anomalous patterns of sulfur isotopes in the geochemical records from this time. Sulfur isotopes are often used as a proxy to reconstruct ancient atmospheric conditions, but previous investigations into the time period in question had not revealed anything too unusual.

The team's results were published this week in the Proceedings of the National Academy of Sciences.

From <http://www.sci-news.com> 14 Mar 2017

Prospecting With Fluorescence: Scheelite

by Hans Adler

This article was originally published in THE TIDEWATER PROSPECTOR, the newsletter for the Tidewater Gem and Mineral Society, July 2016, Virginia Beach, VA. Some minor edits have been made.

Depending on what motivates you, prospecting in the field with an ultraviolet (UV) lamp can be both fun and exciting. Best done during the months when neither mosquitoes nor ticks are active, and there is little foliage to contend with, the most likely targets are the dumps in areas that were once mined. Although it's best to do your prospecting at night when fluorescence is most easily seen, the risks associated with picking your way around in the dark can be dissuasive. As an alternative, lamping can be done in daylight with the aid of an opaque blanket that covers you, the lamp, and the ground in darkness.

One of the easiest minerals to prospect for with the UV lamp, shortwave (SW) in this case, is scheelite, an ore of the chemical element tungsten. During World War II, the U.S. war industry was hard pressed for an adequate supply of tungsten which was needed to harden steel used in various armaments and weapons. Having been cut off from its foreign sources, and facing a crisis, the government offered prospectors numerous incentives to find deposits in the U.S. Thousands responded and, using UV lamps developed only a decade earlier, turned up large quantities in dumps and abandoned mines in places where its presence had not previously been suspected.

Many discoveries were made on the recognition that scheelite was almost unfailingly brightly fluorescent. With an adequately strong lamp it could be detected as far away as 60 feet. This was fortunate because scheelite is very similar in appearance to feldspar and quartz and, therefore, easily overlooked.

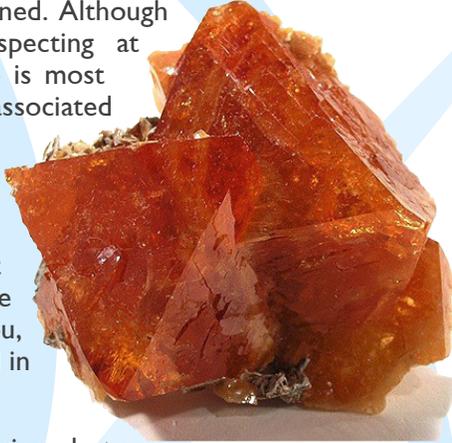
One of the simplest and most useful techniques for prospecting for scheelite is the panning of stream sediments. Because of its low solubility and high specific gravity, it tends to concentrate with other heavy chemically resistant minerals near the base of stream beds. Systematic sampling in this way can be used to determine whether or where an area may be favorable for further exploration.

Streams tend to collect minerals from broad areas within a drainage basin and can lead a prospector following a fluorescent trail to the point of its origin. With a mineral not easily recognized otherwise this may be the only way of finding tungsten deposits. Because scheelite is friable, its particles are usually not transported very far from its source before they are reduced to powdery grains. These can be carried for miles, so it's important to examine the tiny flecks in the stream's finer residues for indications of scheelite's tell-

tale blue fluorescence.

Scheelite is ordinarily accompanied in its ores by other tungsten minerals such as ferberite, wolframite, and huebnerite, the latter often being the most abundant. None of these fluoresces. Consequently, even a trace of a glow due to scheelite can be indicative of a rich deposit of tungsten.

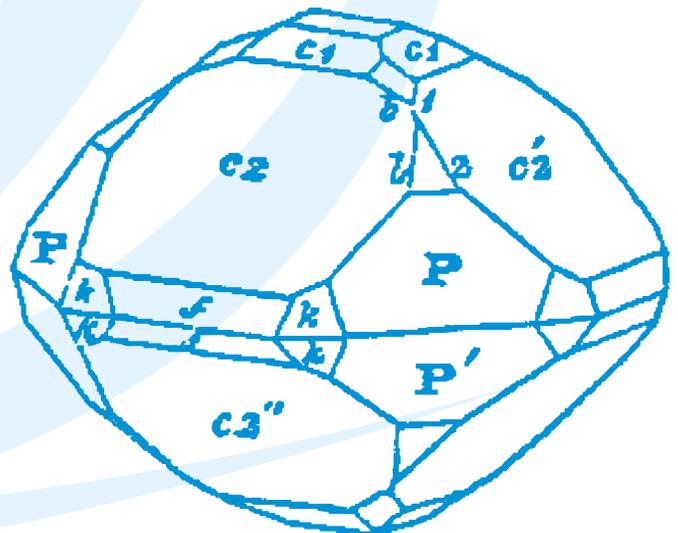
The most favorable area of Virginia for prospecting for scheelite is what is known as the Hamme District in southern Mecklenburg County. Most of the ore veins that were mined here are in North Carolina north of the town of Tungsten. The few deposits in Virginia are found just north of the Kerr Reservoir. The potentially favorable area for prospecting in Virginia lies between the reservoir and the town of Boydton. No other scheelite occurrences of any consequence are known to exist in Virginia.



The equipment mentioned in my June article would be very useful for this kind of exploration. *[Editor's note - the equipment discussion in the June article isn't particularly useful. He doesn't give any real equipment specifics and his prices for items such as battery packs are WAY off. Recommend talking with local fluorescent folks if you're really interested.]*

Reference:

"Geologic Setting of the Hamme Tungsten District North Carolina and Virginia" <https://pubs.usgs.gov/bul/1122g/report.pdf>



Geologist/Mineralogist of the Month George Frederick Kunz

Editor's Note: While reading up on Dr. Kunz, I found a wide variety of biographical information but probably the most thorough and heartfelt was the obituary written by Dr. Paul F. Kerr of Columbia University after Dr. Kunz's death. With only minor modification, I am using that as the basis for this article on Dr. Kunz. My edits and additions to Dr. Kerr's work are in blue italics.



“George Frederick Kunz,

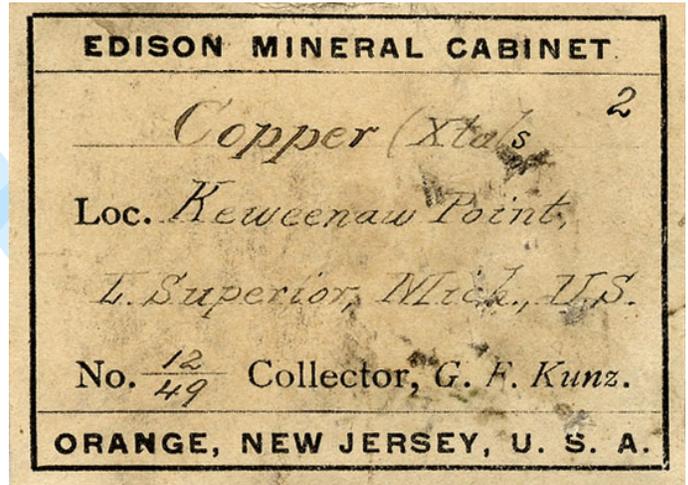
known and respected in mineralogical circles for almost sixty years, noted for his wide and extended knowledge of precious stones from all parts of the world, prominent in the affairs of his city, broadly acquainted and versed in the field of general science, unselfish in his service to his fellow men, passed away in New York City, June 29, 1932.

Dr. Kunz was born in New York City (*141 Duane Street in what is now Tribeca*) on September 29, 1856, the son of J. Gottlieb Kunz (*a baker from Germany*) and Marie Ida Widmar Kunz (*who was Swiss*). At the time of his death he was seventy-six years of age. The early boyhood of Dr. Kunz was spent in Hoboken where he became interested in collecting minerals from the trap rock ridges of the Palisades and the Watchung Mountains. It is reported that he started exchanging mineral specimens with collectors abroad at the age of fourteen. While still a boy he completed a collection of 4,000 specimens, weighing two tons, which was sold to the University of Minnesota for \$400. This was the forerunner of several important collections largely assembled through his efforts, the most outstanding being the famous Morgan-Tiffany collection of gems in the American Museum of Natural History. He was also instrumental in interesting the elder Mr. Morgan in the purchase of the Bement Collection for the Museum, and arranged the collection of elements for Morgan Hall.



At the early age of twenty-three Dr. Kunz was made vice-president of Tiffany and Company. *He was with the company for 53 years, ultimately becoming Vice President based on his knowledge and expertise.* His rapid rise in the field of applied mineralogy was accomplished through continuous and devoted effort. He was educated in the public schools and received his more advanced training at Cooper Union. He was a wide and

varied reader, however, and much of his practical education was acquired through his own efforts. *In the fields of mineralogy and gemology he was essentially self-taught.* As evidence of the success of his efforts, his scholarly achievements were recognized by honorary degrees from several institutions including Columbia University (A.M., 1898), University of Marburg (Ph.D., 1903), and Knox University (Sc.D., 1907).



He travelled extensively in his early years, and much of his knowledge was gained through first-hand contact with the leading mineral localities of the United States and Europe. Interest in minerals and gems was continued up to the very end, and many are the friends of the mineralogical clan who have had the pleasure, through his kindness, of holding the Tiffany diamond while visiting the famous store. Few men have had as wide an acquaintance with precious stones, and particularly their occurrence and distribution, as Dr. Kunz. In addition to his store of knowledge, he assembled one of the best libraries on precious stones in existence. Along Maiden Lane and Fifth Avenue there were few tradesmen who did not have the utmost respect for his judgment concerning the merits of cut stones, particularly of the rarer types.

The varied interests of Dr. Kunz kept him involved in a wide field of activities. He took active part in the entertainment of distinguished visitors to New York City, particularly scientists. Organizations claiming the honor of his membership included the Mineralogical Society of America, the Geological Society of America, the American Association for the Advancement of Science, New York Academy of Sciences, New York Mineralogical Club, the New York Bird and Tree Club, the American Scenic and Historic Preservation Society, the American Chemical Society, the American Institute of Mining and Metallurgical Engineers, Society de Chimie Industrielle de France (American section), Century Association, City History Club, and Pilgrims of the United States. In spite of membership in numerous organizations, he was particularly interested in the New York Mineralogical Club. Together with a small group of mineral collectors he organized the club in 1886 and served for many years as its president.



The Tiffany Diamond. Photo: Wikimedia

From the New York Mineralogical Club's website - "On September 21, 1886, in the home of Professor Daniel S. Martin at 236 West 4th Street, the New York Mineralogical Club was formed through the efforts of George F. Kunz, B.B. Chamberlin and Professor Martin. Monthly meetings followed at the homes of members, with hosts presiding. George F. Kunz was elected Secretary. At the sixth meeting in March 1887, the name "New York Mineralogical Club" was officially adopted. A constitution and by laws were approved at the eighth meeting. At the end of the club's first year, it had a membership of forty-six, including several notable mineralogists. Since no president was required by this constitution, none was elected until April 1895 when George F. Kunz became the club's first president, an office he held for many years." Editor's comment - the New York Mineralogical Club is the oldest mineral club in the United States.

Dr. Kunz was in charge of the department of mines at the Paris Exposition in 1889, the Kimberley (South Africa) exposition in 1892, and the Chicago exposition of 1893. He was honorary special agent of the department of mines at the Atlanta exposition of 1895 and the Omaha exposition of 1898. As a special investigator he served with the U. S. Fish Commission in its investigation of American pearls between 1892 and 1893. In 1900 he was sent to the Paris Exposition as an honorary special agent to the U. S. Commission General, and served also in that year as United States delegate to the Paris International Congress., He was radium commissioner to the St. Louis exposition of 1904, and had charge of precious stones for the twelfth census.

Foreign honors bestowed upon Dr. Kunz included being elected an officer of the Legion of Honor of France, Knight of the Order of St. Olaf of Norway, and an officer of the Rising Sun of Japan. He was an honorary member of the Chambre Syndicale Pierres Precieuses of Paris.

Dr. Kunz was one of the founders and president of the Museum of Peaceful Arts, former Vice-President of the New York Academy of Sciences and the American Institute of Mining and Metallurgical Engineers. He was a member of the North American Indian Memorial Commission. He served as special agent for the U. S. Geological Survey from 1883 to 1909, and continued to write annual reports on precious stones until the time of his death. From 1904 to 1918 he served as research curator of gems and precious stones for the Museum of Natural History, and later was made research associate of gems.

Dr. Kunz was president of the association to introduce the metric system into the United States (*too bad it hasn't taken*), and all jewellers owe him a debt of gratitude for his efforts in aiding the establishment of the international carat.

The gem kunzite found at Pala, San Diego County, California, and described by Professor Charles Baskerville in 1903 was named in his honor. He was instrumental in the naming of tiffanyite, moissanite, and morganite.

Dr. Kunz was a prolific writer. His contributions include a list of over three hundred articles on gems and minerals, aside from several well known books. Outstanding publications include "Gems and Precious Stones of North America," "The Book of the Pearl," "The Curious Lore of Precious Stones," "E. Roty and His Work," "Magic of Jewels," "Ivory and the Elephant," "Shakespeare and Precious Stones," and "The Ring."

Dr. Kunz married Miss Sophia Hanforth in 1879; she passed away in January 1912. He was married to Miss Opal Logan Giberson in May 1923. The marriage was later annulled, although Miss Giberson assisted in maintaining his household and helped

in entertaining up to the time of his death.

Dr. Kunz entered the hospital for medical examination early in June when his health began to fail. He maintained close contact with business interests until June 28. He was stricken with a cerebral hemorrhage, and passed away on the morning of the 29th. He is survived by a daughter, Mrs. Hans Zinsser, and by two sisters, Mrs. Millie Kunz Guttin and Mrs. fda Kunz Taggart. Among benefactions mentioned in the will of Dr. Kunz were gifts to the Mineralogical Society of America, the Mineralogical Collections of Columbia University, the New York Mineralogical Club, the American Scenic and Historic Preservation Society, the New York Academy of Sciences, and the United States Geological Survey. The gifts were directed essentially toward the collection and dissemination of scientific information.



Spodumene, var. Kunzite from Nuristan, Afghanistan.
Photo - John Betts

In concluding, it seems fitting to offer the final paragraph of an editorial printed July 2nd in the New York Times in tribute to Dr. Kunz. It cannot be irreverent to suggest that no one of all men of our day could be more interested in seeing the celestial city whose light is "like unto a very precious stone," or in inspecting the foundations of the wall of jasper adorned with all manner of precious stones: jasper, sapphire, chalcedony, emerald, sardonyx, sardius, chrysolite, beryl, topaz, chrysoptase, jacinth, and amethyst."

Lawrence Conklin, in his book "The Curious Lore of George Fredrick Kunz," writes that "after his death, his personal collection of several thousand rare books, pamphlets and articles on gems and precious stones were sold to the United States Geological Survey Library for one dollar. Acquired by the Library in 1933, the George F. Kunz Collection is a significant special collection on gems and minerals including rare books on gemology, the folklore of gemstones through history, lapidary arts and archival gem trade records important to the provenance of named stones such as the "Hope Diamond."

The gem kunzite found at Pala, San Diego County, California, and described by Professor Charles Baskerville in 1903 was named in his honor. He was instrumental in the naming of tiffanyite, moissanite, and morganite.

Conklin also reveals that "in December 2012, the discovery of a rare photographic album dated 1922 among the books from MrKunz's personal library was announced by the USGS. The album contained 81 photographs of the Russian Crown Jewels and pre-dates the official catalog by the Soviet government by three years. Researchers have identified four pieces of jewelry that were documented in 1922 that were not included in the later catalog and that are assumed missing today."

Additionally Conklin states that "Dr. Kunz was a prolific writer. His contributions include a list of over three hundred articles on gems and minerals, aside from several well known books. Outstanding publications include "Gems and Precious Stones of North America," "The Book of the Pearl," "The

Curious Lore of Precious Stones," "E. Roty and His Work," "Magic of Jewels," "Ivory and the Elephant," "Shakespeare and Precious Stones," and "The Ring." A selected bibliography of Dr.Kunz's work includes:

"The Book of the Pearl: The History, Art, Science and Industry of the Queen of Gems."

"Curious Lore of Precious Stones: Being a Description of their Sentiments and Folk Lore, Superstitions, Symbology, Mysticism, Use in Medicine, Protection, Prevention, Religion, and Divination, Crystal Gazing, Birth Stones, Lucky Stones and Talismans, Astral, Zodiacal and Planetary. "

"Diamonds in Meteorites". Science

Kunz, George Frederick (January–March 1891). "Exhibition of Gems Used as Amulets, etc.". The American Journal of Folklore. American Folklore Society.

"The Genesis of the Diamond" Science, pp. 450–456, 1897

"Kunzite and its unique properties" American Journal of Science, vol.18, no.103, pp. 25–28, July 1904

"The cause of the San Francisco earthquake" Annals of the New York Academy of Sciences, pp. 289–290, 1908

"Diamonds in North America" Geological Society of America Bulletin, vol.42, no.1, pp. 221–222, March 1931.

"Gems and Precious Stones of North America: A Popular Description of Their Occurrence, Value, History, Archaeology, and of the Collections in Which They Exist; Also a Chapter on Pearls, and on Remarkable Foreign Gems Owned in the United States."

Kunz, George Frederick, "History of the Gems Found in North Carolina."

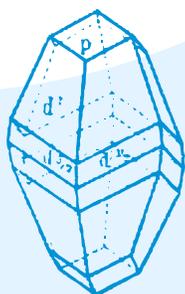
Kunz, George F., "The Magic of Jewels and Charms."

Kunz, George F., "Natal Stones; Sentiments and Superstitions Associated with Precious Stones."

Kunz, George F., "Rings for the Finger, from the Earliest Known Times to the Present, with Full Descriptions of the Origin, Early Making, Materials, the Archaeology, History, For Affection, For Love, For Engagement, For Wedding, Commemorative, Mourning, Etc."

Kunz, George F., "Shakespeare and Precious Stones, Treating of the Known References of Precious Stones in Shakespeare's Works, With Comments as to the Origin of his Material, the Knowledge of the Poet Concerning Precious Stones, and References to Where the Precious Stones of His Time Came From."

Kunz, Dr. George F. (1897). Kuna, Edward S., ed., "Sapphires From Montana, With Special Reference to Those From Yogo Gulch in Fergus County". American Journal of Science.



Morganite (pink variety of beryl, $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$ & named after the banker J.P. Morgan) with albite and quartz from the Smithsonian Collection.



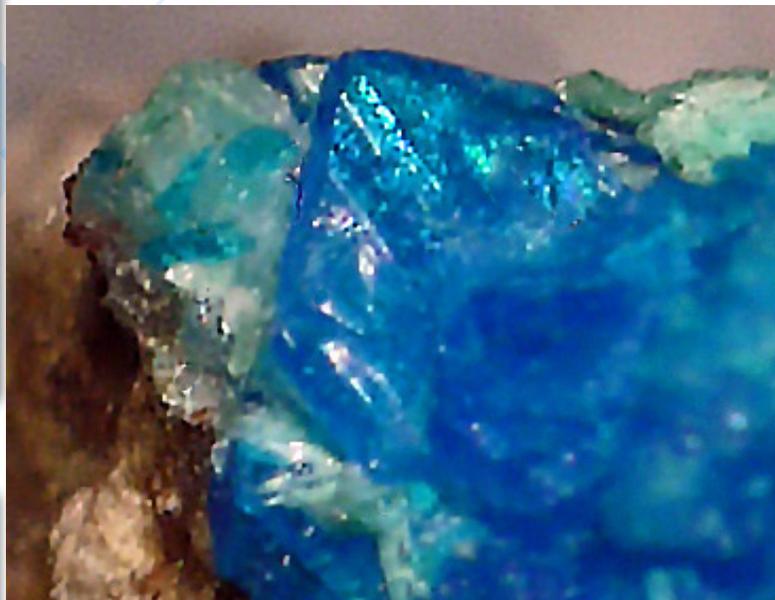
The original specimens of kunzite (spodumene, $\text{LiAlSi}_2\text{O}_6$) from the personal collection of the late Charles Baskerville.



Other Arizona Copper Silicate Photos by Mike Pabst



Junitoite (violet, $\text{CaZn}_2\text{Si}_2\text{O}_7 \cdot \text{H}_2\text{O}$), Gilalite (green, $\text{Cu}_5\text{Si}_6\text{O}_{17} \cdot 7\text{H}_2\text{O}$) from Christmas Mine, AZ. FOV 4 mm.
Photo: Mike Pabst



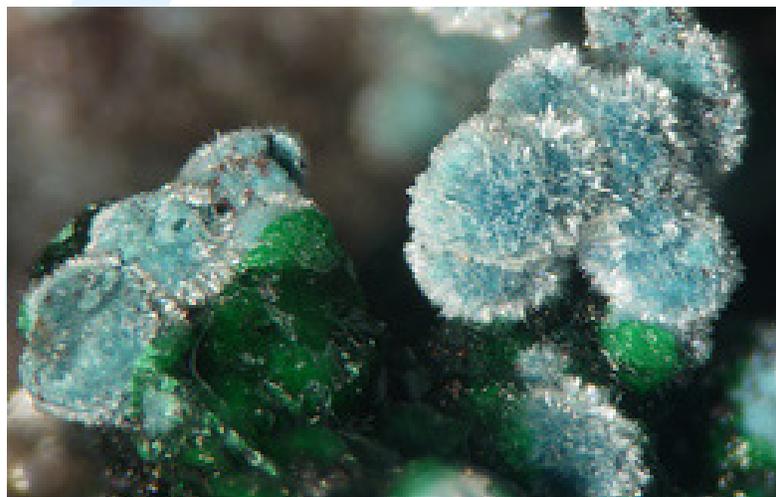
Papagoite (blue, $\text{CaCuAlSi}_2\text{O}_6(\text{OH})_3$), Ajoite (green, $\text{K}_3\text{Cu}_{20}^{2+}\text{Al}_3\text{Si}_{29}\text{O}_{76}(\text{OH})_{16} \cdot 8\text{H}_2\text{O}$) from New Cornelia Mine, Ajo, AZ.
FOV 3 mm. Photo: Mike Pabst



Ruizite (orange, $\text{Ca}_2\text{Mn}_2^{3+}\text{Si}_4\text{O}_{11}(\text{OH})_4 \cdot 2\text{H}_2\text{O}$), Kinoite (blue, $\text{Ca}_2\text{Cu}_2\text{Si}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$), Apophyllite (colorless,) from Christmas Mine, AZ. FOV 2 mm. Photo: Mike Pabst



Dioptase (green, $\text{CuSiO}_3 \cdot \text{H}_2\text{O}$), Wulfenite (orange, PbMoO_4), Fluorite (colorless, CaF_2) from Mammoth-St. Anthony Mine, Tiger, AZ. FOV 4 mm.
Photo: Mike Pabst



Shattuckite (blue, $\text{Cu}_5(\text{SiO}_3)_4(\text{OH})_2$), Malachite (green, $\text{Cu}_2\text{CO}_3(\text{OH})_2$) from Shattuck Mine, Bisbee, AZ. FOV 5 mm. Photo: Mike Pabst

Mineralogical Society of America Editors' Picks

With the permission of Keith Putirka, the following are the Editor's picks of Highlights and Breakthroughs & Invited Centennial Articles from the February 2017 issues of the American Mineralogist: Journal of Earth and Planetary Materials.

<http://www.minsocam.org>

Special Section: Olivine

Ni-in-Ol at Hawaii is Unrelated to Mantle Source

On page 507 of this issue Lynn et al. examine NiO contents of high forsterite (>Fo88) olivine crystals from various Hawaiian lavas (from Ko'olau, Kilauea, Loihi, Mauna Kea, and Mauna Loa). They find that over a 2.5X variation at individual volcanoes, Ni-in-Ol contents have no relationship to either host whole rock compositions, and that inter-island whole rock Ni contents strongly overlap and are not correlated to Ni contents in Ol. These authors show that variations in Ni-in-Ol at high Fo can be explained by very minor variations in the Ni contents of parental magmas (0.09-0.11 wt% NiO), and that observed ranges in Ni-in-Ol can be explained by a combination of fractional crystallization and magma mixing, and that to the extent that Ol may record mantle mineralogy, large, oriented crystals are needed to correct for intra-crystalline diffusion.

Special Section: Apatite: a Common Mineral, Uncommonly Versatile

A Potential Oxybarometer Based on Sulfur in Apatite

On page 548 of this issue, Konecke et al. examine the oxidation states of Sulfur in natural apatite and experimentally equilibrated apatite + liquid pairs. Their work reveals perhaps the first report of a mineral that can incorporate three oxidation states of S (S^{2-} , S^{4+} , and S^{6+}), which apply to experimental systems at oxygen fugacities ranging from FMQ to FMQ+3. These results show the potential for calibrating S^{6+}/S^{4+} and/or S^{4+}/S^{2-} ratios as oxybarometers for apatite saturated systems, although such a function is not calibrated, it probably can be from the data presented. The authors also note that the partitioning of various oxidation states of S may, in part, explain the non-Henrian behavior of Sulfur partitioning in apatite.

Outlooks in Earth and Planetary Minerals

Minerals Help to Define the Anthropocene

Most Am Min readers will know that some 400 news organizations have already covered the work of Hazen et al. (2017), which appears on page 595 of this issue. Hazen et al. show that >200 new minerals that occur exclusively or primarily because of human activities, may leave a decipherable stratigraphic signature, visible to future mineralogists. Some durable crystalline materials might not be classified as minerals today, as they are intentional products of engineering or social activities (Portland cement, semiconductors, various abrasives, etc.) rather than products of nature. Other substances at the boundary of natural and human activities occur because of human influences on near-surface conditions. Future mineralogists may be unable to decipher whether such substances were intentionally manufactured. Nevertheless, they are so ubiquitously distributed across Earth's surface that they will leave a robust mineral-like signature of what may be termed the Anthropocene.

Articles

Magnesioferrite Delimits Diamond P-T conditions

On page 632 of this issue Uenver-Thiele et al. present new experimental studies of the stability field and breakdown reactions of magnesioferrite ($MgFe_2O_4$). They find that above 8 GPa and 1000 C $MgFe_2O_4$ breaks down into $Fe_2O_3 + MgO$, and at yet higher temperatures, the reaction involves an unquenchable phase with an approximate stoichiometry of $Mg_5Fe_2O_8$ or $Mg_4Fe_2O_7$. Their results may shed light on magnesioferrite inclusions in diamond [often included in $(Mg,Fe)O$]. Either such inclusions formed within the upper mantle, or if a lower mantle genesis is inferred, say from other phases, then the magnesioferrite must have formed from some other precursor phase.

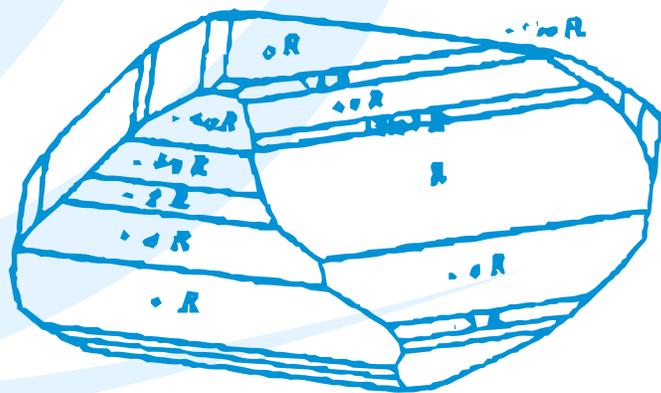
Letters

Melanophlogite: A New Target For Investigating Life on Mars

On page 686 of this issue, Lazzeri et al. study the isotopic ratios of N and C in the silica clathrate mineral, melanophlogite (from Italy and California). This mineral, which apparently likes Mediterranean climates, also appears to occur in organic-rich settings and may thus preserve records of the biogeochemical cycling of N and C at or near Earth's surface. In their samples, the authors find N isotope ratios influenced by isotopic exchange with organic matter, and so suggest that the N was previously biologically processed. They further suggest that, if melanophlogite or similar microporous phases were to be found on Mars, their N isotopic compositions could be valuable as tests for modern or ancient biological processes.

Alien Alloys

On page 690 of this issue, Ma et al. report three new minerals from the Khatyrka CV3 carbonaceous chondrite. These minerals are alloys in the system Al-Fe-Cu: hollisterite (IMA 2016-034; Al_3Fe), kryachkoite [IMA 2016-062; $(Al,Cu)_6(Fe,Cu)$], and stolperite (IMA 2016-033; AlCu). This meteorite continues to reveal new surprises, being the host of icosahedrite and decagonite, the first two quasicrystalline minerals.



Upcoming Local (or mostly local) Geology Events:

Useful Mineral Links:

April

- 1-2 Midland Park, NJ – 28th Annual North Jersey Gem, Mineral & Fossil Show
- 5 MSDC April Meeting
- 7-9 Edison, NJ - The Annual NY-NJ Mineral, Fossil, Gem & Jewelry Show <http://www.ny-nj-gemshow.com/index.php>
- 20-23 44th Rochester Mineralogical Symposium. Radisson Hotel Rochester Airport, 175 Jefferson Road, Rochester, NY 14623
- 29 Super Dig!!!, Sponsored by the Delaware Valley Earth Sciences Society and the Franklin Mineral Museum - **NEW LOCATION** - Franklin Mineral Museum, 32 Evans St., Franklin, NJ. Visit www.superdig.com for more information and updates! Special this year, material from the historic Mill Site area on the other side of the road opposite the Franklin Mineral Museum.
- 29-30 Annual Spring Franklin Gem & Mineral Show & Swap, Franklin Elementary School, Washington Ave. Franklin, NJ
- 29-30 Ogdensburg, NJ – Annual Sterling Hill Garage Sale, 30 Plant Street, Ogdensburg, NJ
- 29-30 Franklin, NJ - Annual NJ Earth Science Association Show at the Washington School

May

- 3 MSDC May Meeting
- 6-7 Topsfield, Mass. - Annual North Shore Gem & Mineral Show
- 6-7 Pittston, Pa. - 14th Annual Treasures of the Earth Gem & Mineral Show, St Joseph's Rt. 315 South, Pittston, PA. (Scranton Area)
- 13 Chesapeake Gem & Mineral Show 10am-4pm. Ruhl Armory, Towson, MD (Exit 26 - York Rd South off of I-695)
- 13-14 Hamilton, NJ - Annual Cape Atlantic Rockhounds Gem & Mineral Show

June

- 3 Spring Mineralfest - Macungie, Pennsylvania - 68th semi-annual Mineralfest
- 3-4 Monroe, NY - Annual Orange County Gem & Mineral Show, Museum Village, off Rt. 17, Monroe, NY
- 3-4 Canandigua, NY - Annual Wayne County Gem Fest - Canandigua Civic Center
- 7 MSDC June Meeting

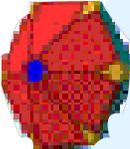
July

- 22-23 Frankfort, NY - **NEW LOCATION!!** - 3rd Annual Herkimer Diamond Festival and Gem Show, at the Herkimer County Fairgrounds, 135 Cemetary St., Frankfort, NY (Approx. 7 miles from Herkimer, on Rt. NY 5S, 1 mile West of Ilion.)



August

- 11-13 W. Springfield, Mass. - Annual East Coast Gem & Mineral Show
- 26-27 Canton, NY - Annual St. Lawrence County Gem & Mineral Show, Lincoln St. Park Pavillion

	American Federation of Mineralogical Societies (AFMS)	www.amfed.org
	Eastern Federation of Mineralogical and Lapidary Societies (EFMLS)	www.amfed.org/efmls
	MINDAT	www.mindat.org
	Mineralogical Society of America (MSA)	www.minoscam.org
	Friends of Mineralogy	www.friendsofmineralogy.org/
	WebMineral	webmineral.com
	The Geological Society of America (GSA)	www.geosociety.org/
	Jeff Scovil Mineral Photography (not advertising - just great photos)	scovilphotography.com/
	United States Geological Survey (USGS)	www.usgs.gov

AFMS Code of Ethics

- I will respect both private and public property and will do no collecting on privately owned land without the owner's permission.
- I will keep informed on all laws, regulations of rules governing collecting on public lands and will observe them.
- I will to the best of my ability, ascertain the boundary lines of property on which I plan to collect.
- I will use no firearms or blasting material in collecting areas.
- I will cause no willful damage to property of any kind - fences, signs, and buildings.
- I will leave all gates as found.
- I will build fires in designated or safe places only and will be certain they are completely extinguished before leaving the area.
- I will discard no burning material - matches, cigarettes, etc.
- I will fill all excavation holes which may be dangerous to livestock. [Editor's Note/Observation: I would also include wildlife as well as livestock.]
- I will not contaminate wells, creeks or other water supply.
- I will cause no willful damage to collecting material and will take home only what I can reasonably use.
- 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.
- 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.
- I will cooperate with field trip leaders and the se in designated authority in all collecting areas.
- I will report to my club or Federation officers, Bureau of Land management or other authorities, any deposit of petrified wood or other materials on public lands which should be protected for the enjoyment of future generations for public educational and scientific purposes.
- I will appreciate and protect our heritage of natural resources.
- I will observe the "Golden Rule", will use "Good Outdoor Manners" and will at all times conduct myself in a manner which will add to the stature and Public "image" of rockhounds everywhere.

MSDC Past Presidents

Name	Years served as President
Charles H. Robinson	1941-1945
James H. Benn	1946-1947
John J. Livingston	1948-1950
Phillip R. Cosminsky	1951
Benjamin J. Chromy	1952
John J. Livingston	1953-1954
Paul J. Rees	1954
Antonio C. Bonanno	1955
Paul E. Halter	1956-1957
John O. Griesback	1958
John Sinkankas	1959
William R. Smith	1960
Paul E. Desautels	1961
John R. Cranford	1962
Robert Highbarger	1963
Harry Van Tassel	1964
Grant C. Edwards	1965
Kenneth V. Zahn	1966
Douglas C. Alverson	1967-1968
Robert W. Dunning	1969
John W. Gruger	1970-1971
Angelo G. Cicolani	1972-1973
William H. Wilkinson	1974
Ellsworth E. Sinclair	1975-1976
Angelo Cicolani	1977-1978
	1979
Cynthia C. Payne	1980
Paul E. Smith	1981-1982
Fred C. Schaefermeyer	1983-1984
Erich Grundel	1985
James O'Connor	1986-1989
Erich Grundel	1990
Wilson (Ed) Fisher	1991-1996
Jennie Smith	1996-1997
Wilson (Ed) Fisher	1998-2003

Name	Years served as President
Andy Thompson	2004-2010
Tom Tucker	2011-2012
Stephen Johnson	2013-2015
David Nanney	2016-present

**MEMBERSHIP APPLICATION OR RENEWAL
THE MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA (MSDC)**

Family ~ \$25.00 per year. One address.

Individual ~ \$20.00 per year.

New * Renewal Dues are for Year _____ *

For new members who join in the last months of the year, membership will extend through the following year with no additional dues.

ANNUAL DUES – PLEASE PAY YOUR DUES PROMPTLY.

Pay at next meeting or mail to:

Mineralogical Society of DC
c/o John Weidner
7099 Game Lord Drive
Springfield, VA 22153-1312

Name(s) (First and Last) _____

Address _____

City _____ State _____ Zip: _____

Phone(s): Home/Work/Mobile _____

Email(s) _____

OK TO INCLUDE YOU ON CLUB MEMBERSHIP LIST?

Yes – Include name, address, phone, email.

If you want any information omitted from the membership list, please note:

Omit my: Email, Home phone, Work phone, Mobile phone, Address, Name

SPECIAL CLUB-RELATED INTERESTS? _____

Meeting Dates, Time, and Location: The first Wednesday of each month. (No meeting in July and August.) The National Museum of Natural History, Smithsonian Institution, 10th Street and Constitution Ave, Washington D.C. We will gather at the Constitution Avenue entrance at 7:45 PM to meet our guard who will escort us to the Cathy Kirby Room. Street parking: Parking is available in the Smithsonian Staff Parking – just tell the guard at the gate that you are attending the Mineral Club Meeting.



THE MINERAL MINUTES

Permission to copy material printed herein, except specifically copyrighted items, is granted, provided credit is given.

NEWSLETTER OF THE MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

Mineralogical Society of DC

Time Sensitive Dated Material
First-Class Mail