THE MONTHLY NEWSLETTER OF THE MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

The Mineral Minutes

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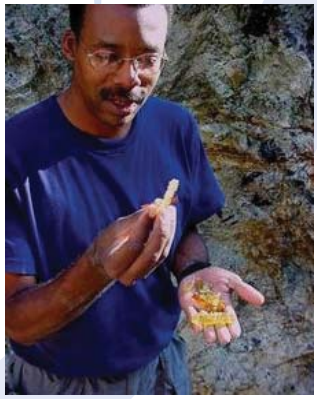
October Program

"Ameythst"

Presented by Dr. Michael Wise, Smithsonian Institution



Amethyst is the purple variety of quartz, February's birthstone, and supposedly if you put an amethyst in the bottom of your wine glass, it will prevent intoxication. Or so the ancient Greeks thought. I have tried it – it did not work. More research is indicated.

So why is amethyst purple? And where do you find it? What is the chemistry and crystal structure? Our presenter in November is the Smithsonian Institution's Dr. Michael Wise. He will tell us the answers to these and other questions about this popular and attractive semiprecious stone.

Dr. Wise is a native of Virginia, graduate of the University of Virginia and went on to earn his Ph.D. at the University of Manitoba in 1987. He is the Smithsonian's foremost authority and researcher on pegmatite minerals and mineralization. He was also a member of the team that discovered and described a new mineral from the Merelani Hills of Tanzania, subsequently named Merelaniite. More info on Dr. Wise's research interests and publications can be found on the Smithsonian Institution's "Mineral Science People" webpage at http://mineralsciences.si.edu/staff/pages/wise.htm .

Please join us in taking Dr. Wise's to dinner on Nov 1st before the meeting. We will be meeting at 6:00 pm at Elephant & Castle Restaurant, 1201 Pennsylvania Ave, NW, Washington, DC - near the Smithsonian. We will meet in the NMNH lobby at 7:30 pm and head up to the Cathy Kerby Rm. for Dr. Wise's presentation.

Prez Says...

by Dave Nanney,
MSDC President

Fall is finally here. In only a blink of the eye, we've moved from hot and humid to cool, occasionally rainy, sometimes low humidity days. My marker of the seasons is how quickly the sunsets are arriving. I am not ready….

But we have a major celebration in our future. You will see a signup sheet for our 75th anniversary of MSDC. We joined the Micromineralists of the National Capitol Area, (MNCA) for their 25th anniversary, and this year, we are joining them for their 50th anniversary. Please set aside Saturday, December 9, from 6-9 PM at the Holiday Inn Alexandria, for our celebration of . 75 years of MSDC, 50 years of MNCA and our annual Holiday party. The dinner will be a plated choice of three options, followed by a presentation by our own Tom Tucker on some of the early days of MSDC. Jeff Post of the Smithsonian Institute will be our featured speaker talking about the relationship of the Smithsonian with our club, and on the Collection at the Natural History Museum. We can guarantee a fabulous evening of dinner, friends and a great talk. There is free parking, and for out of town visitors, a $99 rate for the evening.

For the record, I have been worrying about this for months, but thanks to Susan Fisher (go figure that she played a major role), Kathy Hrechka (Helped us

October Business Meeting Synopsis

By Andy Thompson, Secretary

President Dave Nanney called the meeting to order and welcomed everyone, especially first-time guest Rick whose interest is in geological education, broadly understood and Angelo G. Cicolani who served as MSDC president during the years 1972, 1973, 1977 and 1978.

With no Old Business issues needing discussion, MSDC's most salient New Business is the club's upcoming 75th celebration, scheduled for 9 December. The 6 p.m. dinner at the Holiday Inn Express and Suites in Old Town Alexandria (6055 Richmond Highway) will be held in conjunction with a sister club, the Micromineralogists of the National Capital Area (MNCA) celebrating their 50th anniversary.

Attendees voted to authorize Dave to expend MSDC funds needed to satisfy contractual arrangements with the hotel. Thanks to Ed and Sue Fisher, the club raised a little over $1,300 from the recent sale of its books and minerals, which will help defray the expenses of the 75th celebration.

Treasurer John Weidner gave an update of the finances of the club (we continue to be solvent). He noted that although some costs for the celebration are fixed, such as for the rental space of the hotel dining room, local taxes and gratuities, other factors such as the number of invited guests is under review and so no final cost estimates were available at this time.

Representatives of neighboring clubs noted that the Montgomery County mineral club is having an auction on the 14th of October. Also, the Northern Virginia club is holding its annual mineral sale at George Mason's Johnson Center on the 18th and 19th of November.

While the MSDC ad hoc Program Committee worked to resolve and bypass the challenges of getting the presenter's Apple Computer to properly interface with the Kerby room projection system, Cindy graciously shared some of her adventures spending three weeks in an RV in May, exploring the geology of Yellow Stone National Park. Once the projection problems were resolved,

President Nanney thanked the Fishers, Weidners, Thompsons and Kalish family who brought snacks for sharing during the evening's social time together. He then turned the program over to Dave Hennessey to introduce the evening's presenter.

October Meeting Show and Tell

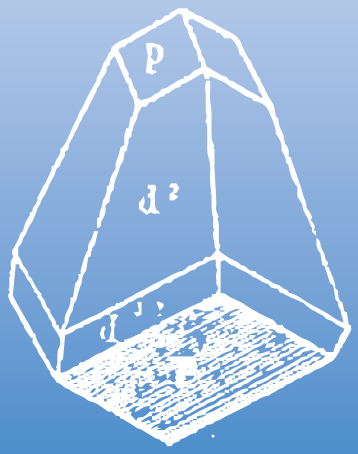
At the end of each monthly meeting, the MSDC president encourages members to bring any favorites or interesting minerals for informally showing other attendees.

Three members brought in interesting specimens which attendees examined after the meeting. Dan, who collects exclusively NJ minerals, brought in several items including a curious, relatively flat copper specimen which he noted, unlike most, was actually soft enough to bend. That, some speculated, might have been due to the fact that it was a mélange including other minerals as well. The specimen was collected on the site of the American Copper Mine near Rutgers University and Bridgewater.

Ken, knowing the evening's presentation featured minerals from Silverton, CO, including one silver specimen collected near Aspen and it featured tiny protruding silver fibers. A second piece was a rhodochrosite collected in Silverton, CO and a third piece was a doubly terminated calcite on quartz.

Don brought in a rose red rhodochrosite (manganese carbonate) from Argentina, a turquoise green deodorite (manganese oxide) in the form of a flattened, one inch diameter circle, a small bone of a dinosaur , a 7 inch diameter pillow starfish collected in Maine and other curious fossils including a cluster of salmon teeth and jawbone.

find the Holiday Inn as a site), we have a nice venue and a great evening ahead. I heard a rumor than Susan Fisher has done magic for door prizes, so you have to join us to gain a super addition to your collection. If you look to the names of the people who have served as Presidents of MSDC, it has been an incredible group of important people in Mineralogy and you can appreciate just how special this anniversary is. Please put it on your calendar to join us for our 75th/50th Anniversary/ Holiday party.. newsletters, stored at the USGS archives. Dinner will be a great place to hear about events and people from the past. Please mark your calendars, plan on attending and send Dave Hennessey a note so we can insure that we have enough seats.



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

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October Program: "Tom Tucker's Western Odyssey"

Presented by Tom Tucker

By Andy Thompson, Secretary

Can you imagine embarking on a nine thousand mile journey, driving cross country, visiting the nation's classic western silver and gold mines and related memorabilia? Through storytelling and a photo-packed power point presentation to club members, Tom shared some of his discoveries as he visited in selected mining-related sites in Colorado, Montana, Utah, Western Nebraska and Wyoming. It made for an enlightening and enjoyable tour of the history of western mining in the late 19th century, provided insights into the mining culture of the time and gave occasional glimpses into Tom's personal journey and geological career.

Whether you received an informal or formal education in geology, collectors often have clear memories of when and where they began learning about rocks and minerals. Tom's driving tour started in Virginia but one of his first personal stops along the way was at the campus of his alma mater, Missouri University of Science and Technology. Another was staying with friends in Creede, Colorado, which geologic neighborhood was historically a Mecca for precious metal mining, along with nearby Telluride, Ouray, Silverton and Howardsville, all also in Colorado.

One iconic mining site Tom visited and photographed was an ore processing silver mill, here pictured, still standing near Lake City, northeast of Creede. He encouraged MSDC members to imagine and think about the physical context experienced by the miners, working nine thousand feet above sea level, in an atmosphere with low levels of oxygen and winter's bitter cold. The weathered wooden structure here pictured is being protected and restored by the Hinsdale County Historical Society. The mine head frame, just across the road, once also yielded rhodochrosite specimens. But like most sites Tom visited, there were practically no mineral remains available for picking by the public. So his journey was characterized as getting a glimpse of the big picture, the mining cultural associated with these sites, rather than as a field trip for collecting specimens.

There were a few exceptions, however, one being a Bureau of Land Management (BLM) sponsored garnet collecting site located near Ely, Nevada. As may be hinted at from this photo, the site has been well picked over and several MSDC members who visited the site attested to finding no garnets. That illustrates, on a small scale, the history of boom-bust typical of previous metal mining sites in the western states. Mining towns sprung up overnight, became heavily populated, then became ghost towns once the mineral extraction completely exhausted the deposit.

Other exceptions to finding minerals included occasional backyard sales which visitors can typically come across, such as the enthusiastic children's wagon rock shop near Silverton, Co and the unattended geode-by-the-pound sale opportunity based on an honor system, located in Indiana. Tom warned that many such geodes were of very low quality given they were solid, what Tom called "ugly quartz," with no crystals or interesting mineral formations to be found on the inside.

Each of the mining sites Tom visited had its own interesting history, replete with stories and challenges. The Gold King Mine near Silverton, Colorado, for example, operated profitably from 1888 to 1907. The mine had been dug beneath a lake and over time, the lake broke through the mine ceiling and flooded the tunnels, prompting the close. So the mine entrance was sealed shut in an effort to promote safety and secure continued tourism to the area. In 2015, however, there was an effort to remediate the mine's polluted waters, but by accident, the result was an extensive release of toxic waste water into the surrounding waterways which then became off limits for local use. The cleanup efforts

continues to this day.

The Mayflower Mill, located 2 miles northeast of Silverton, CO is another very interesting story important for the understanding the history of mining. Owned by the Historic Society of Silverton, self-guided tours had been available for decades and allowed visitors to wander among the exhibits to understand, for example, how the large chunks of silver ore was crushed to smaller size by 3 inch diameter metals balls. The exhibits also contains 800 ton of ore in bins as well as examples of processed silver ingots. In the 1970s, $70,000 worth of ore was discovered to have been stolen and to this day no one has been arrested. Security at the Mill is now tighter.

Although Tom's presentation was replete with photos of sweeping geological vistas, recollections and personal stories from his prior visits to many of the sites, he also offered reflections on the big-picture cultural impact mining had on the western states. The arrival of trains, for example, was responsible for enabling the mining industry to thrive. Before the construction of those narrow-gage tracks and heavy duty steam engines, stage coaches could not handle the huge volume of ore needing to be transported. So trains bringing miners to the site and shipping out their extracted ore was essential to make the booming mining economy happen. Invisible to the casual visitor however was the price many mining families paid in the loss of life due to mine cave-ins and accidents.

The poignant photo of the tombstone of a 22 year old young man memorializes the dangers associated with mining, both historically and in modern times. He was the son of a local mine owner and he died in 1979 due to a rock fall just inside the portal of the family mine. Tom noted that today's U.S. Park Service rangers provide an important contribution to the public's safety, protecting visitors from rock falls and the dangers associated with hiking near unstable rock formations.

Tom concluded his presentation with a photo of the star studded Milky Way, a view he enjoyed camping outdoors overnight, far away from the intrusion of city lights. One night he awoke in the very early a.m. hours, while still pitch dark, to see mysterious lights flickering on nearby Devil's Tower, a site off limits to adventure seekers and rock climbers. He then realized the lights were the LED flashlights mounted on the helmets of rock climbers, enjoying the thrill of the forbidden climb enabled by the night time absence park rangers. Tom noted, such activities, akin to collecting petrified wood on protected government lands, is verboten to mineral collectors whose code of conduct places high priority on respecting nature's bounty, personal safety and preserving the rich history of mineral mining and collecting, he celebrated in his nine thousand mile odyssey.

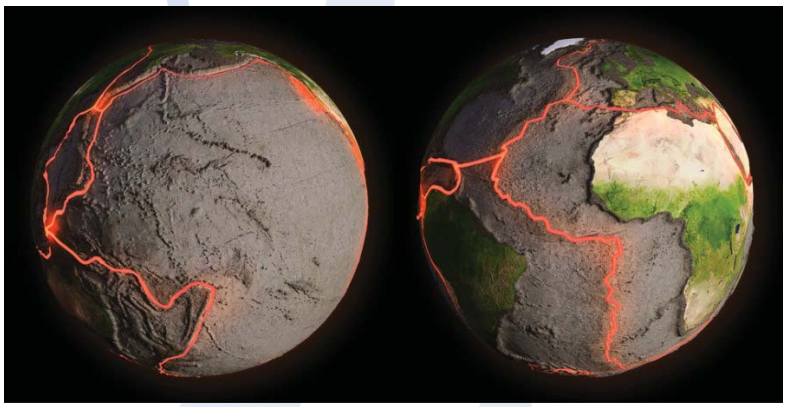
MSDC attendees applauded Tom's presentation and he then responded to their questions. Clearly he wet their appetite for learning more about the history of mining in the American west.

Earth's tectonic plates are weaker than once thought

from ScienceDaily.com

No one can travel inside Earth to study what happens there. So scientists must do their best to replicate real-world conditions inside the lab.

"We are interested in large-scale geophysical processes, like how plate tectonics initiates and how plates move underneath one another in subduction zones," said David Goldsby, an associate professor at the University of Pennsylvania. "To do that, we need to understand the mechanical behavior of olivine, which is the most common mineral in the upper mantle of Earth."



Earth's fault lines between tectonic plates. (Stock image) Credit: © Mopic / Fotolia

Goldsby, teaming with Christopher A. Thom, a doctoral student at Penn, as well as researchers from Stanford University, the University of Oxford and the University of Delaware, has now resolved a long-standing question in this area of research. While previous laboratory experiments resulted in widely disparate estimates of the strength of olivine in Earth's lithospheric mantle, the relatively cold and therefore strong part of Earth's uppermost mantle, the new work, published in the journal Science Advances, resolves the previous disparities by finding that, the smaller the grain size of the olivine being tested, the stronger it is.

Because olivine in Earth's mantle has a larger grain size than most olivine samples tested in labs, the results suggest that the mantle, which comprises up to 95 percent of the planet's tectonic plates, is in fact weaker than once believed. This more realistic picture of the interior may help researchers understand how tectonic plates form, how they deform when loaded with the weight of, for example, a volcanic island such as Hawaii, or even how earthquakes begin and propagate.

For more than 40 years, researchers have attempted to predict the strength of olivine in Earth's lithospheric mantle from the results of laboratory experiments. But tests in a lab are many layers removed from the conditions inside Earth,

where pressures are higher and deformation rates are much slower than in the lab. A further complication is that, at the relatively low temperatures of earth's lithosphere, the strength of olivine is so high that it is difficult to measure its plastic strength without fracturing the sample. The results of existing experiments have varied widely, and they don't align with predictions of olivine strength from geophysical models and observations.

In an attempt to resolve these discrepancies, the researchers employed a technique known as nanoindentation, which is used to measure the hardness of materials. Put simply, the researchers measure the hardness of a material, which is related to its strength, by applying a known load to a diamond indenter tip in contact with a mineral and then measuring how much the mineral deforms. While previous studies have employed various high-pressure deformation apparatuses to hold samples together and prevent them from fracturing, a complicated set-up that makes measurements of strength challenging, nanoindentation does not require such a complex apparatus.

"With nanoindentation," Goldsby said, "the sample in effect becomes its own pressure vessel. The hydrostatic pressure beneath the indenter tip keeps the sample confined when you press the tip into the sample's surface, allowing the sample to deform plastically without fracture, even at room temperature."

Performing 800 nanoindentation experiments in which they varied the size of the indentation by varying the load applied to the diamond tip pressed into the sample, the research team found that the smaller the size of the indent, the harder, and thus stronger, olivine became.

"This indentation size effect had been seen in many other materials, but we think this is the first time it's been shown in a geological material," Goldsby said.

Looking back at previously collected strength data for olivine, the researchers determined that the discrepancies in those data could be explained by invoking a related size effect, whereby the strength of olivine increases with decreasing grain size of the tested samples. When these previous strength data were plotted against the grain size in each study, all the data fit on a smooth trend which predicts lower-than-thought strengths in Earth's lithospheric mantle.

In a related paper by Thom, Goldsby and colleagues, published recently in the journal Geophysical Research Letters, the researchers examined patterns of roughness in faults that have become exposed at Earth's surface due to uplifted plates and erosion.

"Different faults have a similar roughness, and there's an idea published recently that says you might get those patterns because the strength of the materials on the fault surface increases with the decreasing scale of roughness," Thom said. "Those patterns and the frictional behavior they cause might be able to tell us something about how earthquakes nucleate and how they propagate."

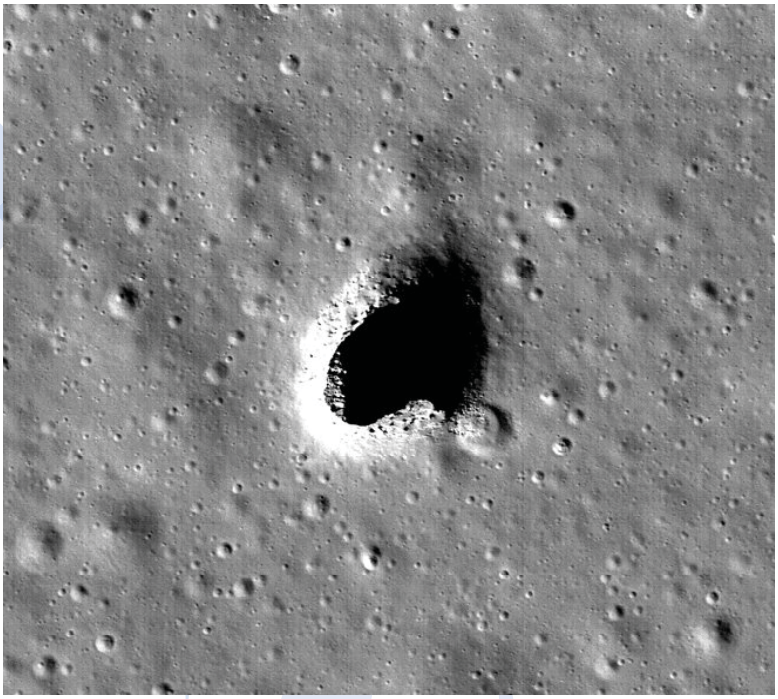
In future work, the Penn researchers and their team would like to study size-strength effects in other minerals and also to focus on the effect of increasing temperature on size effects in olivine.

https://www.sciencedaily.com/releases/2017/10/171003094005.htm

A newly discovered moon tunnel could be the perfect place for a colony, scientists say

By Avi Selk

from The Washington Post – 21 Oct 2017



A giant hole in the moon, which opens at the Marius Hills skylight (pictured here), was formed by an ancient lava tube. Credit: NASA/Goddard/Arizona State University

At the close of the Apollo age, a year before the final moonwalk in 1972, a NASA researcher argued that vast tunnels lie beneath the lunar surface.

There was good reason to think so. Lava from ancient volcanoes might have bored miles-long voids beneath the moon's surface, just as volcanoes carved out the Kaumana lava tubes in Hawaii.

What a sight a lunar lava cave would be. Protected from meteors and radiation that bombards the surface, the tunnels might preserve evidence from the moon's early history and clues to its mysterious origins. And many scientists have long dreamed of building bases inside natural moon caves, where lunar explorers might sleep safely in inflatable homes, protected from the storms above.

But the lava tunnels of the moon, like the mythical canals of Mars, proved elusive.

NASA's Ronald Greeley hypothesized in 1971 that one of the great channels in the moon's Marius Hills region might in fact be a collapsed tunnel. But he admitted that no mission had yet photographed a lunar cave entrance — and some doubted they even existed.

Half a century after Greeley's paper was published and NASA left the moon behind, in a paper published this week, Japanese researchers say they've found proof of the tunnels no one could see.

Japan calls its Kaguya orbiter the "largest lunar mission since the Apollo program." It was launched in 2007 with state-of-the-art instruments, deployable satellites and a mission to solve the great mysteries of the moon's origin.

In 2009, Kaguya drifted 60 miles above the Marius Hills and took a picture of a large, deep hole.

Holes aren't unusual on the moon's pockmarked surface, but a NASA Lunar Reconnaissance Orbiter managed to get a follow-up shot, closer to the ground, as a team of Japanese and American researchers recounted in Geophysical Research Letters last week.

"The floor of the hole extended at least several meters eastward and westward under a ceiling of two other holes," the researchers wrote — like the mouth of a tunnel.

But the murky picture revealed no more. Did the cave go on for miles, like the hypothetical lava tube, or dead-end just out of sight?

It took years to find out. The Japanese got another assist from the United States in 2011, when NASA put twin spacecraft — Gravity Recovery and Interior Laboratory, or GRAIL — in orbit around the moon.

GRAIL measured tiny fluctuations in the moon's gravity to map out mountains and subterranean features. When it flew over the Marius Hills, the researchers wrote, it detected something long and hollow beneath the surface — extending more than 30 miles from the hole Kaguya found.

So Kaguya swung back into action. The Japanese probe blasted radar waves down onto the suspected tunnel, listening for anomalies in the echoes that came back from underground.

[Why it matters that Japan is going to the moon]

Over and over, Kaguya heard a distinctive pattern of echoes. The researchers think it is either the floor or ceiling of a cave — the long-hoped-for lava tunnel.

Speaking of Science newsletter

The latest and greatest in science news.It is very long — 31 miles, according to Japan's Institute of Space and Astronautical Science.

It must be ancient, and may be buried more than 300 feet below the surface. It might even contain ice or water.

If the researchers are correct, it sounds just like what the old Apollo scientists and would-be colonists were looking for.

"Their existence has not been confirmed until now," Junichi Haruyama, one of the paper's authors, told Agence France-Presse. And now that he knows the tunnel exists, he said, he looks forward to finding out what's inside.

And on the same topic from ScienceDaily. Com

A city-size lava tube has been discovered on the moon, and researchers say it could serve as a shelter for lunar astronauts.

This lava tube could protect lunar-living astronauts from hazardous conditions on the moon's surface, the researchers said. Such a tube could even harbor a lunar colony, they added.

"It's important to know where and how big lunar lava tubes are if we're ever going to construct a lunar base," study co-researcher Junichi Haruyama, a senior researcher at JAXA, Japan's space agency, said in a statement. [How to Get to the Moon in 5 'Small' Steps]

Humans first landed on the moon more than 48 years ago, but no one has managed to stay there for longer than three days. That's because the moon is a perilous place. It has widely ranging temperatures, and unlike Earth, the moon does not have an atmosphere or magnetic field to protect life on its surface from harsh sun rays and radiation.

Spacesuits can't substantially shield astronauts from these dangers over long periods of time, but a lava tube could potentially help protect any space travelers, the researchers said. Lava tubes are channels that form when a lava flow cools and develops a hard crust; this crust then thickens and makes a roof over a still-flowing lava stream, they explained. Once the lava stops flowing, the channel sometimes drains, leaving behind an empty tube.

Researchers want to study this lava tube because they "might get new types of rock samples, heat flow data and lunar quake observation data," Haruyama said.

The tube was discovered when the Japanese lunar orbiter SELENE (Selenological and Engineering Explorer) — also known by its nickname, Kaguya — gathered data near the moon's Marius Hills skylight, which is the tube's entrance. When JAXA researchers later examined the data, they found a distinctive echo pattern: a decrease in echo intensity followed by a large second echo peak — signals that are largely suggestive of a hollow area, like a tube, they said.

The scientists also discovered comparable echo patterns at several places near the hole, indicating there may be more lunar tubes in the area.

However, SELENE wasn't designed to fly close to the moon, so JAXA partnered with NASA scientists working on the GRAIL (Gravity Recovery and Interior Laboratory) mission, a project that allows scientists to amass high-quality data on the moon's gravitational field. Areas of the moon with gravity deficits — that is, less mass — could help indicate hollow places underneath, they reasoned.

"They knew about the skylight in the Marius Hills, but they didn't have any idea how far that underground cavity might have gone," study co-researcher Jay Melosh, a GRAIL co-investigator and distinguished professor of Earth, atmospheric and planetary sciences at Purdue University, in Indiana, said in the statement. "Our group at Purdue used the gravity data over that area to infer that the opening was part of a larger system. By using this complementary technique of radar, they were able to figure out how deep and high the cavities are."

Earth also has lava tubes, but they're not nearly as large as the one discovered on the moon. If the scientists' gravity analyses are correct, the lava tube near Marius Hills could easily house a large U.S. city such as Philadelphia, they said.

The city of Philadelphia could easily fit inside a theoretical lunar lava tube.

Other scientists have speculated that the moon has lava tubes, but the new finding, which combines radar and gravity data, provides the best evidence and estimates of how big these tubes are, the researchers said.

This finding may go a long way: When meeting with the recently re-established National Space Council on Oct. 5, Vice President Mike Pencereiterated that the Trump administration will focus on sending astronauts to the moon rather than to Mars.

"The moon will be a stepping-stone, a training ground, a venue to strengthen our commercial and international partnerships as we refocus America's space program toward human space

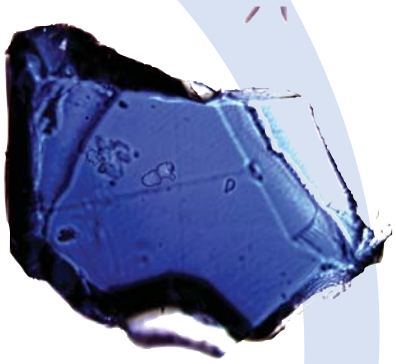
exploration," Pence said at the council meeting, according to a statement from the White House.

The study was published online Oct. 17 in the journal Geophysical Research Letters.

Mineral hints at bright blue rocks deep in the Earth

By Simon Redfern, BBC Science writer - 13 March 2014

Diamonds, brought to the Earth's surface in violent eruptions of deep volcanic rocks called kimberlites, provide a tantalising window into the deep Earth.



A research team led by Prof Graham Pearson of the University of Alberta, Canada, studied a diamond from a 100-million-year-old kimberlite found in Juina, Brazil, as part of a wider project.

They noticed that it contained a mineral, ringwoodite, that is only thought to form between 410km and 660km beneath the Earth's surface, showing just how deep some diamonds originate.

Buried oceans

While ringwoodite has previously been found in meteorites, this is the first time a terrestrial ringwoodite has been seen. But more extraordinarily, the researchers found that the mineral contains about 1% water.

While this sounds like very little, because ringwoodite makes up almost all of this immense portion of the deep Earth, it adds up to a huge amount of deep water.

Dr Sally Gibson from the University of Cambridge, who was not involved in the work, commented: "Finding water in such large concentrations is a hugely significant development in our understanding of the ultimate origin of water now present at Earth's surface."

Ringwoodite is thought to form between 410km and 660km beneath the Earth's surface

The observation is the first physical evidence that water can be stored in the deep interiors of planets and solves a 25-year-old controversy about whether the deep Earth is dry, wet, or wet in patches.

Discussing his findings, Prof Pearson told BBC News: "The discovery highlights the unique value of natural diamonds in trapping and preserving fragments of the deep Earth.

"It's incredible to think that, as you hold this sample in your hand, the residual pressure at the interface between the diamond and the inclusion is 20,000 atmospheres."

Describing his diamond sample, he said: "It looks like it's been to hell and back, which it has."

Blue planet

Prof Joseph Smyth of the University of Colorado has spent many years studying ringwoodite and similar minerals synthesised in his laboratory.

He said: "I think it's stunning! It implies that the interior may store several times the amount of water in the oceans. It tells us that hydrogen is an essential ingredient in the Earth and not added late from comets.

Image copyright Richard Siemens Image caption The Brazilian diamond was sculpted by corrosive fluids on its way up to the surface

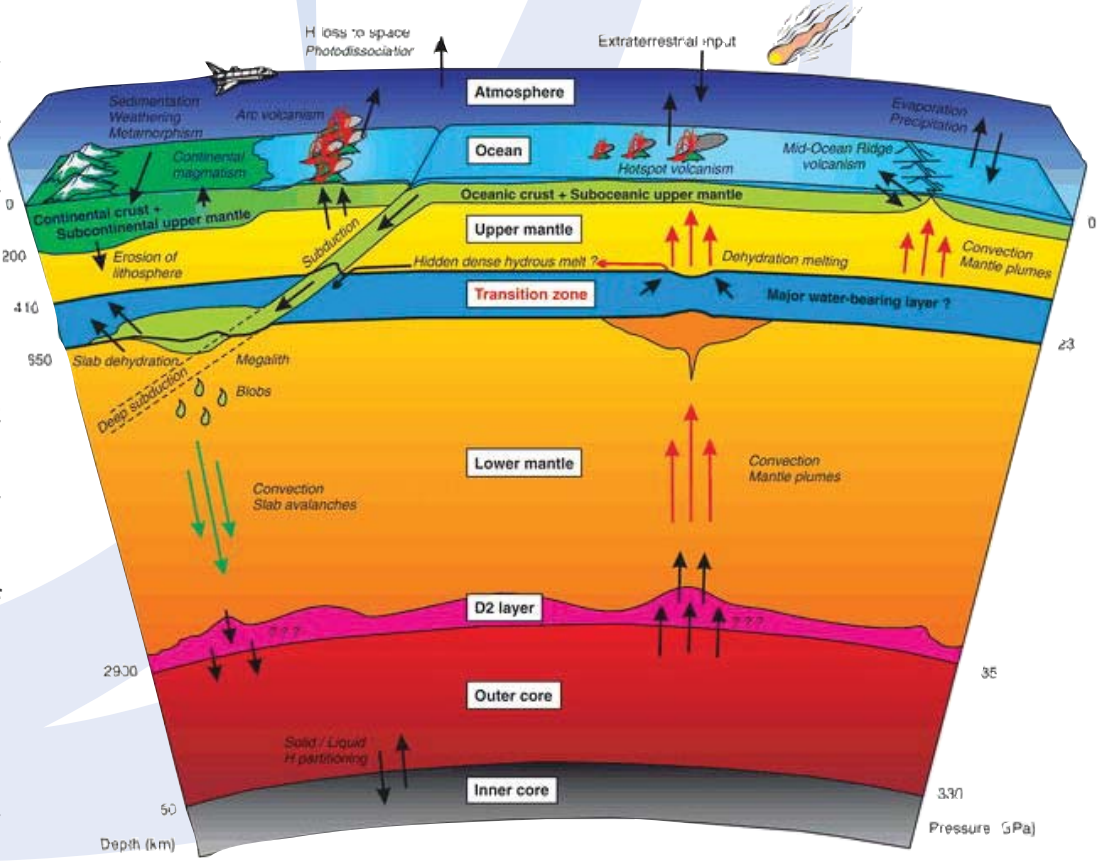
"This discovery implies that hydrogen may control the interior processes of the Earth just as it controls the surface processes, and that water planets, like Earth, may be common in our galaxy."

A key question posed by the observation is to understand the extent to which plate tectonics on Earth leads to oceans of water being recycled deep within our planet, and to predict the likely amounts of water trapped in other rocky planets.

Ringwoodite is expected to form deep in Mars as well, for example, where it sits against the metallic core.

Grains of the same mineral synthesised in Prof Smyth's laboratory shine bright blue under the microscope.

Given the new findings of ringwoodite's water-bearing capabilities, its abundance at depth, and its beautiful hue, the term "blue planet" seems even more appropriate for Earth.



Minerals of the Month – Calcocite and Bornite (from Wikipedia)

This month's minerals are Chalcocite and Bornite. These both should be in most collections. Chalcocite, (/ˈkælkəˌsaɪt/), copper(I) sulfide (Cu_2S), is an important copper ore mineral. It is opaque and dark-gray to black with a metallic luster. It has a hardness of 2½ - 3 on the Mohs scale. It is a sulfide with an orthorhombic crystal system.

The term chalcocite comes from the alteration of the obsolete name chalcosine, from the Greek khalkos, meaning copper. It is also known as redruthite, vitreous copper and copper-glance.[5]

Chalcocite is sometimes found as a primary vein mineral in hydrothermal veins. However, most chalcocite occurs in the supergene enriched environment below the oxidation zone of copper deposits as a result of the leaching of copper from the oxidized minerals. It is also often found in sedimentary rocks.

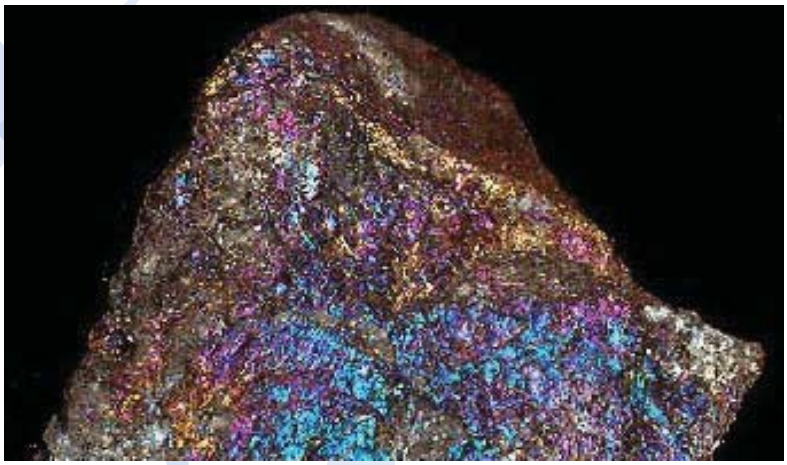
It has been mined for centuries and is one of the most profitable copper ores. The reasons for this is its high copper content (66.6% atomic ratio and nearly 80% by weight) and the ease at which copper can be separated from sulfur.

Chalcocite crystals from the Mammoth Mine, Mount Isa - Cloncurry area, Queensland, Australia (size: 3.0 x 2.9 x 2.4 cm)

Since chalcocite is a secondary mineral that forms from the alteration of other minerals, it has been known to form pseudomorphs of many different minerals. A pseudomorph is a mineral that has replaced another mineral atom by atom, but it leaves the original mineral's crystal shape intact. Chalcocite has been known to form pseudomorphs of the minerals bornite, covellite, chalcopyrite, pyrite, enargite, millerite, galena and sphalerite.

Calcocite	
Category	Sulfides
Formula	CuS
Strunz Classification	2.BA.05a
Crystal System	Monoclinic
Crystal Class	Prismatic
Color	Dark gray to black
Cleavage	Indistinct on {110}
Fracture	Conchoidal
Mohs Scale	2.5 - 3
Luster	Metallic
Tenacity	Brittle to sectile
Streak	Shiny black to lead gray
Specific Gravity	5.5 - 5.8

Bornite, also known as peacock ore, is a sulfide mineral with chemical composition Cu_5FeS_4 that crystallizes in the orthorhombic system (pseudo-cubic).



Bornite has a brown to copper-red color on fresh surfaces that tarnishes to various iridescent shades of blue to purple in places. Its striking iridescence gives it the nickname peacock copper or peacock ore.

Bornite is an important copper ore mineral and occurs widely in porphyry copper deposits along with the more common chalcopyrite. Chalcopyrite and bornite are both typically replaced by chalcocite and covellite in the supergene enrichment zone of copper deposits. Bornite is also found as disseminations in mafic igneous rocks, in contact metamorphic skarn deposits, in pegmatites and in sedimentary cupriferous shales. It is important as an ore for its copper content of about 63 percent by mass.

At temperatures above 228 °C (442 °F), the structure is isometric with a unit cell that is about 5.50Å on an edge. This structure is based on cubic close-packed sulfur atoms, with copper and iron atoms randomly distributed into six of the eight tetrahedral sites located in the octants of the cube. With cooling, the Fe and Cu become ordered, so that 5.5 Å subcells in which all eight tetrahedral sites are filled alternate with subcells in which only four of the tetrahedral sites are filled; symmetry is reduced to orthorhombic.

Substantial variation in the relative amounts of copper and iron is possible and solid solution extends towards chalcopyrite ($CuFeS_2$) and digenite (Cu_9S_5). Exsolution of blebs and lamellae of chalcopyrite, digenite, and chalcocite is common.

Rare crystals are approximately cubic, dodecahedral, or octahedral. Usually massive. Penetration twinning on the crystallographic direction, {111}.

It occurs globally in copper ores with notable crystal localities in Butte, Montana and at Bristol, Connecticut in the U.S. It is also collected from the Carn Brea mine, Illogan, and elsewhere in Cornwall, England. Large crystals are found from the Frossnitz Alps, eastern Tirol, Austria; the Mangula mine, Lomagundi district, Zimbabwe; from the N'ouva mine, Talate, Morocco, the West Coast of Tasmania and in Dzhezkazgan, Kazakhstan. There are also traces of it found amongst the hematite in the Pilbara region of Western Australia.

It was first described in 1725 for an occurrence in the Krušné Hory Mountains (Erzgebirge), Karlovy Vary Region, Bohemia in what is now the Czech Republic. It was named in 1845 for Austrian mineralogist Ignaz von Born (born as Born Ignác in a Hungarian family) (1742–1791).

Bornite	
Category	Sulfides
Formula	Cu_5FeS_4
Strunz Classification	2.BA.10
Crystal System	Orthrombic
Crystal Class	Dipyramidal
Color	Copper red, bronze brown, purple
Cleavage	Poor on [111]
Fracture	Uneven to subconchoidal; brittle
Mohs Scale	3 - 3.25
Luster	Metallic if fresh, iridescent tarnish
Tenacity	Brittle
Streak	Grayish black
Specific Gravity	8.176

Geologist of the Month – Nicolas Steno (from Wikipedia)

Nicolas Steno (Danish: Niels Steensen; Latinized to Nicolaus Stenonis or Nicolaus Stenonius, 1 January 1638 – 25 November 1686 was a Danish scientist, a pioneer in both anatomy and geology who became a Catholic bishop in his later years. Steno was trained in the classical texts on science; however, by 1659 he seriously questioned accepted knowledge of the natural world. Importantly he questioned explanations for tear production, the idea that fossils grew in the ground and explanations of rock formation. His investigations and his subsequent conclusions on fossils and rock formation have led scholars to consider him one of the founders of modern stratigraphy and modern geology.

Born to a Lutheran family, Steno converted to Catholicism in 1667. After his conversion, his interest for natural sciences rapidly waned giving way to his interest in theology. At the beginning of 1675, he decided to become a priest. Four months after, he was ordained in the Catholic clergy in Easter 1675. As a clergyman, he was later appointed Vicar Apostolic of Nordic Missions and Titular Bishop of Titopolis by Pope Innocent XI. Steno played an active role in the Counter-Reformation in Northern Germany. He was venerated as a saint after his death and the Roman Catholic canonization process was begun in 1938. Pope John Paul II beatified Steno in 1988.

Portrait of Nicolas Steno (1666–1677). Unsigned but attributed to court painter Justus Sustermans. (Uffizi Gallery, Florence, Italy)

Nicolas Steno was born in Copenhagen on New Year's Day 1638, the son of a Lutheran goldsmith who worked regularly for King Christian IV of Denmark. He became ill at age three, suffering from an unknown disease, and grew up in isolation during his childhood. In 1644 his father died, after which his mother married another goldsmith. In 1654–1655, 240 pupils of his school died due to the plague. Across the street lived Peder Schumacher (who would offer Steno a post as professor in Copenhagen in 1671). At the age of 19, Steno entered the University of Copenhagen to pursue medical studies. After completing his university education, Steno set out to travel through Europe; in fact, he would be on the move for the rest of his life. In the Netherlands, France, Italy and Germany he came into contact with prominent physicians and scientists. These influences led him to use his own powers of observation to make important scientific discoveries.

At the urging of Thomas Bartholin, Steno first travelled to Rostock, then to Amsterdam, where he studied anatomy under and lodged with Gerard Blasius, focusing on the lymphatic system. Within a few months Steno moved to Leiden, where he met the students Jan Swammerdam, Frederik Ruysch, Reinier de Graaf, Franciscus de le Boe Sylvius, a famous professor, and Baruch Spinoza. At the time Descartes was publishing on the working of the brain, and Steno doubted Descartes's explanation of the origin of tears as produced by the brain. Invited to Paris by Henri Louis Habert de Montmor and Pierre Bourdelot, he there met Ole Borch and Melchisédech Thévenot who were interested in new research and in demonstrations of his skills. In 1665 Steno travelled to Saumur, Bordeaux and Montpellier, where he met Martin Lister and William Croone, who introduced Steno's work to the Royal Society.

After travelling through France, he settled in Italy in 1666 - at first as professor of anatomy at the University of Padua and then in Florence as in-house physician of Grand Duke of Tuscany Ferdinando II de' Medici, who supported arts and science and whom Steno had met in Pisa. Steno was invited to live in the Palazzo Vecchio; in return he had to gather a cabinet of curiosities. Steno went to Rome and met Pope Alexander VII and Marcello Malpighi, whom he admired. On his way back he watched a Corpus Christi procession in Livorno and wondered if he had the right belief. In Florence Steno focused on the muscular system and the nature of muscle contraction. He became a member of Accademia del Cimento and had long discussions with Francesco Redi. Like Vincenzo Viviani, Steno proposed a geometrical model of muscles to show that a contracting muscle changes its shape but not its volume.

During his stay in Amsterdam, Steno discovered a previously undescribed structure, the "ductus stenonianus" (the duct of the parotid salivary gland) in sheep, dog and rabbit heads. A dispute with Blasius over credit for the discovery arose, but Steno's name remained associated with this structure known today as the Stensen's duct. In Leiden, Steno studied the boiled heart of a cow, and determined that it was an ordinary muscle and not the center of warmth as Galenus and Descartes believed.

In October 1666 two fishermen caught a huge female shark near the town of Livorno, and Ferdinando II de' Medici, Grand Duke of Tuscany, ordered its head to be sent to Steno. Steno dissected the head and published his findings in 1667. He noted that the shark's teeth bore a striking resemblance to certain stony objects, found embedded within rock formations, that his learned contemporaries were calling glossopetrae or "tongue stones". Ancient authorities, such as the Roman author Pliny the Elder, in his Naturalis Historia, had suggested that these stones fell from the sky or from the Moon. Others were of the opinion, also following ancient authors, that fossils naturally grew in the rocks. Steno's contemporary Athanasius Kircher, for example, attributed fossils to a "lapidifying virtue diffused through the whole body

of the geocosm", considered an inherent characteristic of the earth – an Aristotelian approach. Fabio Colonna, however, had already shown in a convincing way that glossopetrae are shark teeth, in his "*treatise De glossopetris dissertatio*" published in 1616. Steno added to Colonna's theory a discussion on the differences in composition between glossopetrae and living sharks' teeth, arguing that the chemical composition of fossils could be altered without changing their form, using the contemporary corpuscular theory of matter.

Steno's work on shark teeth led him to the question of how any solid object could come to be found inside another solid object, such as a rock or a layer of rock. The "solid bodies within solids" that attracted Steno's interest included not only fossils, as we would define them today, but minerals, crystals, encrustations, veins, and even entire rock layers or strata. He published his geologic studies in "*De solido intra solidum naturaliter contento dissertationis prodromus*", or Preliminary discourse to a dissertation on a solid body naturally contained within a solid in 1669. This book was his last scientific work of note. Steno was not the first to identify fossils as being from living organisms; his contemporaries Robert Hooke and John Ray, as well as Leonardo da Vinci a century earlier also argued that fossils were the remains of once-living organisms.

Steno, in his "*Dissertationis prodromus*" of 1669 is credited with four of the defining principles of the science of stratigraphy:

- the law of superposition: "... at the time when any given stratum was being formed, all the matter resting upon it was fluid, and, therefore, at the time when the lower stratum was being formed, none of the upper strata existed";
- the principle of original horizontality: "Strata either perpendicular to the horizon or inclined to the horizon were at one time parallel to the horizon";
- the principle of lateral continuity: "Material forming any stratum were continuous over the surface of the Earth unless some other solid bodies stood in the way"; and
- the principle of cross-cutting relationships: "If a body or discontinuity cuts across a stratum, it must have formed after that stratum."

These principles were applied and extended in 1772 by Jean-Baptiste L. Romé de l'Isle. Steno's ideas still form the basis of stratigraphy and were key in the development of James Hutton's theory of infinitely repeating cycles of seabed deposition, uplifting, erosion, and submersion.

Steno also gave the first accurate observations on a type of crystal in his 1669 book "*De solido intra solidum naturaliter contento*".

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 June, July and August 2017 issues of the American Mineralogist: Journal of Earth and Planetary Materials.

http://www.minsocam.org

Precipitation Conditions of Oxides in Diamonds

On page 1969 of this issue, Dongzhou Zhang provides an overview of Uenver-Thiele et al. (page 2054 of this issue) who explore the phase relationships of starting compositions having $MgFe_2O_4$ and $Mg0.5Fe^{2+}0.5Fe_2^{3+}O_4$ stoichiometries. These experiments help delimit the precipitation conditions of magnetite inclusions in diamonds, by taking advantage of textural clues that might indicate the presence of certain precursor phases, such as ferropericlase or one of a few "unconventional oxides" that may be stable at high pressure. Their experimental work also shows that otherwise simple oxides might exhibit rather great stoichiometric variety at elevated P and T.

10 Days for Pre-Eruption Magma Assembly at Laki

On page 2007 of this issue, Neave et al. use the textures and zoning patterns of plagioclase crystals to examine the disaggregation of a liquid-crystal mush prior to eruption. They find that most microcrysts grow just after macrocrysts of a mush are entrained on a final path to eruption. The result is that the seemingly homogeneously mixed magmas of the Laki eruptions are the result of multiple disaggregation and mixing events. The authors calculate, for example, that the 15 km3 of erupted material of the 1783-1784 extrusives were assembled in batches of eruptible magma no greater than about 1.5-2 km3, with magmas being assembled from mush systems about 10 days prior to eruption. These multiple mixing events also yielded similar magmas, perhaps indicating that the eruption triggering mechanisms are threshold dependent, although those thresholds remain undiscovered.

Making Bubbles

On page 2022 of this issue Masotta and Keppler present a new experimental assembly that allows bubble nucleation and growth experiments at elevated P-T conditions (up to 850°C and 2 kbar), along controlled P-T-time paths. Their preliminary experiments, on a haplogranite (or simple, synthetic granite) system appears to show that bubble nucleation in a closed system will end when the average distance between bubbles is equal or less than the mean diffusion distance of water molecules. (But then how does a water molecule at a distance greater than the mean know that system-wide the mean has been reached?) A potentially significant result is that magma fragmentation (e.g., vapor phases are >70% by volume) appears to occur at 0.2 kbar, regardless of decompression rate. In any case, their new experimental assembly should aid investigations of late-stage volcanic processes.

Does Anhydrous Phase B Exist in Earth's Mantle?

On page 2032 of this issue, Kojitani et al. experimentally investigate the stability of $Mg14Si_5O_{24}$, the so-called "anhydrous phase B" found in some high P experiments in simple silicate systems. In this work, Kojitani et al. suggest that this phase can form, by reaction of forsterite and periclase, at pressures that might explain the seismic X-discontinuity, which occurs at depths of 250-350 km. Their work confirms earlier suggestions that the reaction to form anhydrous phase B should only occur in the presence of fluids, when such fluids dissolve Si so as to leave a relatively Si depleted residue. Such conditions furthermore allow this phase to be stable at lower pressures. If this hypothesis is valid, anhydrous phase B might then affect the fluid-rock and melt-rock partitioning of trace elements in subduction zones.

More on Magma Fragmentation -- Lunar Eruptions

On page 2045 of this issue, Rutherford et al. use the volatile contents of lunar orange picritic glasses to reconstruct their eruption history. That history begins with melt segregation from a melt-rich mantle source at 500 km and vapor (CO-rich, but including S and H) saturation at somewhere between 4 and 50 km below the surface (or possibly as deep as 500 km in some scenarios), which then accelerates magma ascent. By the time these magmas reach depths of 300-600 m, the residual magmas have lost nearly all their volatiles to the gas phase, and in the new model, these depths would also represent the point at which the magmas became fragmented (having >70% bubbles by volume).

Hidden chromium

On page 2142 of this issue, Schindler et al. identify a potentially new source of Cr in rock samples: Chromium (IIII) occurs as inclusions of chromite nanoparticles within silicates rather than being incorporated into their structures. Transport models of Cr in the environment may need to take into account the release and transport of these nanoparticles during weathering rather than transport of chromium as aqueous species, which could have important implications for environmental modelling and risk assessments in chromium-rich regions.

Useful Mineral Links:

	American Federation of Mineralogical Societies (AFMS)	www.amfed.org
	Eastern Federation of Mineralogical and Lapidary Societies (EFMLS)	www.amfed.org/efmls
mindat.org	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	The Geological Society of America (GSA)	www.geosociety.org/
Scovil PHOTOGRAPHY	Jeff Scovil Mineral Photography (not advertising - just great photos)	scovil photography.com/
USGS science for a changing world	United States Geological Survey (USGS)	www.usgs.gov
The Geological Society of Washington	The Geological Society of Washington (GSW)	http://www.gswweb.org/

Upcoming Local (or mostly local) Geology and Mineral Events of Interest:

November

1 MSDC Meeting
8 GLMSMC Meeting
11-12 Fall New York City Gem & Mineral Show hosted by the New York Mineralogical Club. Watson Hotel (formerly Holiday Inn at 57th St), 440 West 57th St; New York, NY. Contact: Tony Nikischer: www.excaliburmineral.com
11-13 W. Springfield, Mass. - Annual East Coast Gem & Mineral Show
18-19 26th Annual Gem, Mineral & Fossil Show sponsored by the Northern Virginia Mineral Club. NEW LOCATION: George Mason University Dewberry Hall, Johnson Center, Braddock Rd & Rte 123; Fairfax, VA. Contact: www.novamineralclub.org
22 MNCA Meeting - depending on Thanksgiving
25-26 Rock and Mineral Weekend sponsored by the Morris Museum Mineralogical Society. Morris Museum, 6 Normany Heights Rd; Morristown, NJ. Info: kfrancis@morrismuseum.org
27 NVMC Meeting

December

8 GLMSMC Meeting
9 MSDC and MNCA 75th & 50th Anniverdary Dinner

January

3 MSDC Meeting
10 GLMSMC Meeting
22 NVMC Meeting
24 MNCA Meeting

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.

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

NEWSLETTER OF THE MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

Mineralogical Society of DC

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