The Mineralogical Society of the District of Columbia

THE MINERAL MINUTES

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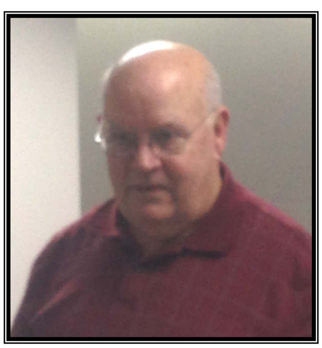
- February's Meeting is Wednesday, 1 February. We will be meeting at 7:45pm in the lobby of the Museum of Natural History. Dinner at the Elephant and Castle at 6pm for those interested in dining beforehand.

IN THIS ISSUE:

The Prez Says…

By David Nanney, MSDC President



Happy New Year. I want to start by congratulating January's speaker, Dr. Tim McCoy, first for his presentation to a very well attended talk on space exploration. But bigger, for his historical announcement that his team won a competitive decision to fund a mission to will design, build and launch a probe which is scheduled to rendezvous with asteroid Psyche 16, in the asteroid belt just beyond Mars, in the year 2030. This asteroid is totally metallic and should reveal some new information about the creation of planets. Thanks to Jeff for extending an invite to his astronomy club resulting in several very knowledgeable visitors.

While my geology professors at NOVA Community College will bust me for confusing (intentionally) weather (now) vs. global warming (trends over time), I really like our 60 degree weather. I have spent several days out in the garden, installing deer fencing, refreshing labels on our azalea collection, and picking up thousands of fallen sticks in our wooded lot. It looks like the polar vertex is holding with nasty cold up north where it belongs, one of my family members in Fairbanks Alaska experiencing -43 degree cold. I am all about 60 degree days in January, just saying…..

DUES – As your president has finally paid his dues, you are now officially late if you haven't paid yours. John Weidner, our treasurer, \is looking forward to quality time with each of you at this month's meeting.

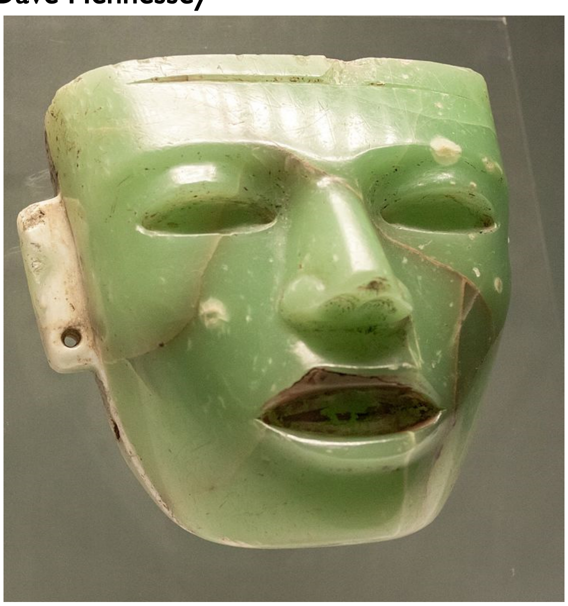
Right after our meeting on the 1st, Leslie and I are headed to Tucson for the Gem and Mineral Show. This has become a fabulous way to celebrate February, i.e. I HATE SNOW!!!! So we are headed to the high end show at the Westward Look Resort where many of the top dealers in the world show some of the best minerals in the world. Nope, we're not there to buy, only to worship. The next week is generally spent at the Tucson City Center (formally Inn Suites) where many of our favorite dealers have rooms. A week later, we will go to the Tucson Convention Center for at least one of the three day convention.

We are starting to look past the winter to think about our other hobby, azaleas. An average of 100 days into the New Year, around April 15, the first of the evergreen azaleas will start blooming. We have a collection of over 2,500 azaleas, including over 1,000 varieties. We plan to host an open house in late April, as rain is NOT ALLOWED to mess with our plans this year. So keep that weekend open and come see both our mineral collection, and our azaleas. Why am I saying this now? Because I don't even want to consider then next couple of cold months that are ahead.

Tim Rose is our speaker this month. Tim has spoken several times to our group and always provides an excellent presentation. He is our Smithsonian sponsor so please come join us in thanking both him and the Smithsonian for their long standing support.

February Program – "The Stone Faces of Teotihuacan"

Dave Hennessey



Rocks and Minerals make up much of what survives as relics of earlier civilizations. Over the centuries, organic materials tend to rot, desiccate, or otherwise decay, and are lost to us. But inorganic materials, in the forms of statuary, buildings, jewelry and carvings, often survive. Such is the case of the stone faces of Teotihuacan, Mexico. Our February presentation will take us on a journey to Teotihuacan and the many museum collection that house stone faces from Teotihuacan, to learn about the use, manufacture and sources for these remarkable stone faces.

Teotihuacan was an ancient Mesoamerican city located about 25 miles northeast of modern-day Mexico City and is well known for its Mesoamerican pyramids. The city is thought to have been established around 100 BC, with major monuments continuously under construction until about 250 AD. The city may have lasted


Temple of the Moon at Teotihuacan

until sometime between the 7th and 8th centuries AD, but its major monuments were sacked and systematically burned around 550 AD. Collection of the stone faces of Teotihuacan began in earnest in the late 18th century and intensified during the 19th and 20th century when the stone faces became a highly valued commodity sought after by collectors and museum curators.

Our presenters are Timothy Rose of the Smithsonian Institution's Mineral Sciences Department and Jane Walsh of the Smithsonian Institution's Anthropology Department. Tim is the Manager, Analytical Labs and knows his way around the big boy's toys – Scanning Electron Microscopes, Spectroscopes, and the like. Jane's principal research interest is the archaeology and ethnohistory of pre-Columbian Mexican cultures. One of her areas of specialty is pre-Columbian lapidary technology, which has included the debunking of alleged Pre-Columbian crystal skulls that appeared in the antiquities marketplace in the 19th century and found their way into collections including the British Museum. Together, they have brought their skills and experience to the examination of more than 100 stone faces attributed to Teotihuacan, housed in seven North American and European collections, to gain insights into their composition, manufacture and use. Their presentation will address the styles, materials, methods and tools used in the production of the Teotihuacan stone faces, including the 15 stone faces that are in the collections of the Smithsonian Institution's National Museum of Natural History (NMNH) and the National Museum of the American Indian (NMAI) here in Washington, D.C.

Please join us in taking Tim and Jane to dinner on February 1st 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, we will meet in the NMNH lobby at 7:30 pm (Constitution Avenue-side lobby) from which we will head up to the Cathy Kerby Room for Tim and Jane's presentation.

Business Meeting Report January 2017

Andy Thompson, Secretary

President Dave Nanney welcomed members and guests to the club's first monthly meeting of 2017.

With 27 attendees, we had a full house with a representative number from the Goddard Astronomy Club, all wanting to hear the evening's presentation on meteorites. Guests introduced themselves (Steve, Joyce, Dan and Rebecca, Charlie, Stephen and Janet). In addition, sisters Rachel and Rebecca were first time attendees with a general interest in minerals and identification of family specimens.

Mark Your Calendars: To provide everyone with future dates to enter into their calendars, Bob Cooke, President of the Northern Virginia Mineral Club invited everyone to their monthly programs that occur on the 4th Monday of each month, to the Micro club meetings on every fourth Thursday, and to the annual trip to James Madison University for later in January.

V.P. for Programs, Dave Hennessey listed the MSDC future presenters lined up as follows: 1 Feb Tim Rose presents on Mineral and Cultural Aspects of the Masks of Teotihuacan; 1 March Mike Pabst speaks on Silicates; 5 April Jeff Post shares recent Smithsonian acquisitions made at Tucson; and on 3 May, Scott Southworth presents a geological topic yet to be decided.

Dave Nanney noted that the field trip which George Washington University will sponsor this summer to Yellow Stone will include several MSDC members. That trip is now full, totally booked. Ed Fisher proposed the approval of the 2016 December Business Minutes, which was promptly seconded and unanimously accepted without amendments. Dave thanked Mineral Minutes editor Steve Johnson and all who contributed to making the newsletter the noteworthy publication it has proven to be.

With regard to the "Geology in the News," Jeff Guerber called attention to the recent edition of the American Geophysical Union journal (Eos, Volume 98, 15 December 2016) which detailed the official international acceptance of a new mineral, merelaniite, discovered by local collector Robert Simonoff. He first noticed the specimen's peculiar whiskered and spindle-like shape on a larger mineral sample taken from the famous tanzanite gem mines in northern Tanzania. He and daughter Jessica brought the mineral to the attention of Smithsonian's Dr. Michael Wise, who shared the finding with the wider mineralogical world.

Having completed discussion of the club's old and new business, members moved, seconded and approved the business meeting be closed. Nanney then called on V.P. Dave Hennessey to introduce the evening's speaker.

January 2017 Program Presentation "Four Cores and Thirty Years Ago" by Dr. Tim McCoy

Synopsis by Andy Thompson (MSDC Secretary) with editorial assistance of Tim McCoy

A Scientist's Dream Moving toward Fulfillment

Our mineral club's first meeting of 2017 was "historic" by several criteria. Readers may ask: Is it historic because 2017 marks the 100th anniversary of the National Museum of Natural History? Yes, this year does celebrate a century of increasing and diffusing scientific knowledge to the nation and the world. But there is more. Is it historic because 2017 is also the 75th anniversary of the founding of MSDC, one of the oldest mineral clubs in the nation? Yes, this is also correct. But the title of tonight's presentation by Dr. Tim McCoy, "Four Cores and Thirty Years Ago", points to one small step by the speaker, and one giant and historic step for humanity.

For three decades Tim has dreamed of and actually has participated in exploring space by building and guiding satellite fly-by probes and working with their findings. For five years, for example, he wrote computer programs that helped steer the daily movements of one of the rovers exploring Mars. But tonight he announced that his team of scientists across and beyond the U.S. this day learned that NASA has approved and will fund their proposal to send a probe to explore a unique distant metal asteroid. They will design, build and launch a probe which is scheduled to rendezvous with asteroid Psyche 16, in the asteroid belt just beyond Mars, in the year 2030. Psyche 16 is one of the largest asteroids that is nearly totally metallic. This $600 million grant will fund the probe's exploration of the core to help unlock the secrets of how our solar system's planets core interior originated.

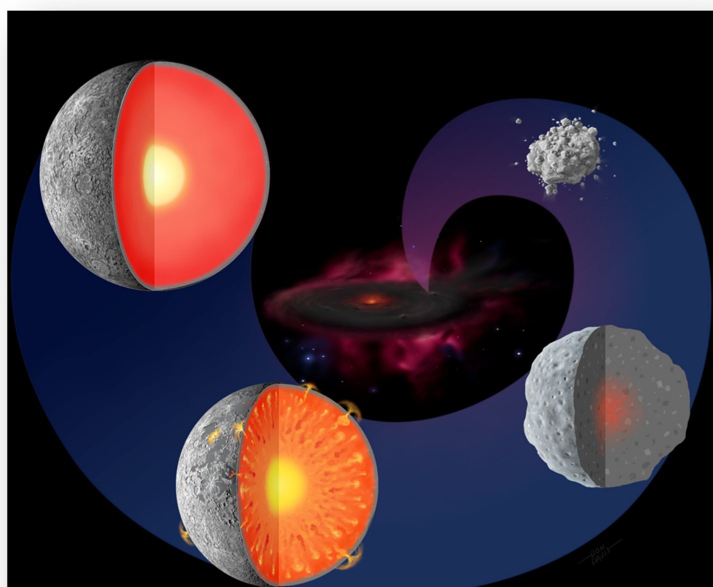
(Graphics courtesy of Tim McCoy)

When MSDC members and numerous guests heard this extraordinary news, they broke into applause. This competitive grant's approval not only promises to fulfill Tim's personal and professional dream. It also heralds an historic break-through in scientific exploratory endeavors. The current obstacle to learning more about the origins of planets is sizeable, namely the fact that the planets with solid metal cores are inaccessible because their cores are buried beneath thousands of miles of their respective crusts and mantles. But the Psyche asteroid, which has no mantle or crust, will allow for direct, high resolution, visual, magnetic, and other analyses that could unlock many of the secrets of our planets' origins.

The importance of this grant was profoundly appreciated by the evening's attendees, several of whom have worked at or are currently working at Goddard Space Flight Center. Everyone initially came to the meeting to listen to Tim's presentation on meteorites. But they left with a sense of buoyancy and hope for the future of scientific breakthroughs and science education. The evening's surprise announcement was clearly an important stepping stone for humanity's discovery of the origins of our solar system's planets.

The nature of the concepts Tim presented was complex and richly layered with mineralogical and astronomical information and illustrated charts. What follows is more of a layman's overview. To begin, the title of Tim's presentation, "Four Cores and Thirty Years Ago," was a tip-of-his-hat to Tim's native state of Illinois and his fellow native, President Abraham Lincoln, and the opening line of his Gettysburg Address.

The "four cores" refers to the four types of planetary and asteroidal cores that Tim has researched during his career. That career began some 30 years ago with a path through the Univ. of New Mexico, the Univ. of Hawaii, Houston's NASA Johnson Space Center, and finally to the National Museum of Natural History. During his 20 years at the Museum, he has classified more than 10,000



specimens from the Smithsonian's world-renowned meteorite collection. These specimens have posed the questions that guided his research.

The first type of core is typical of our own planet. The Earth's core likely formed during extensive melting of the planet, with all of the metal sinking to the center. However, other cores may have formed in very different ways.

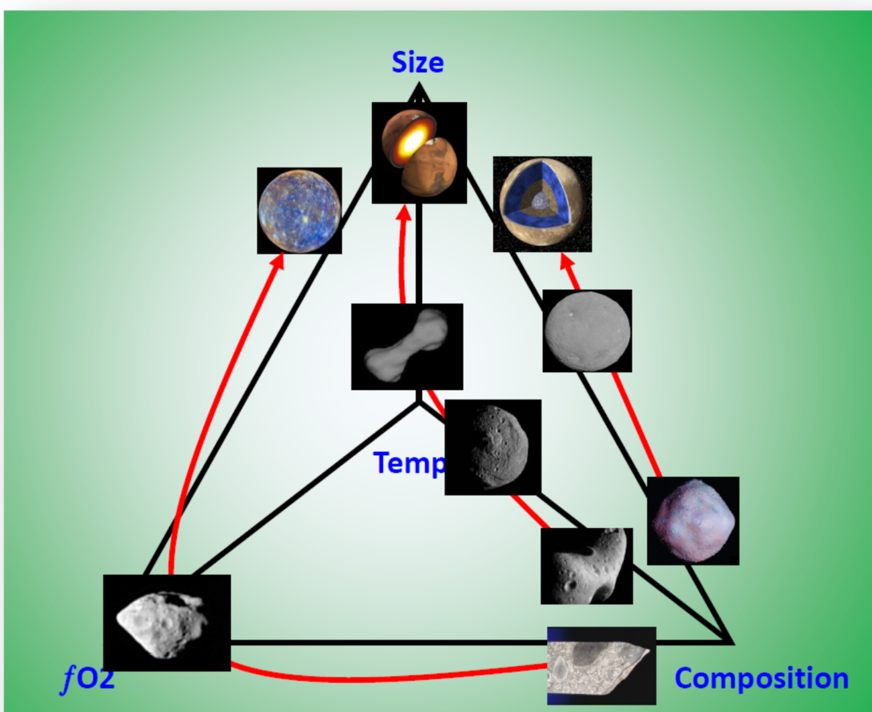
A second type of core formed in much smaller bodies that just started to melt, where sulfur was an important component. Indeed, some bodies may have been so small that the molten metal and sulfide erupted fast enough to escape the tiny gravitational field of the asteroid and were lost in space.

The third type of core is found in planets that are deprived of oxygen, like Mercury. While we are used to silicon combining with oxygen to make silicates on Earth, the oxygen-poor conditions on Mercury result in silicon metal dissolved in the core, while sulfur erupts in melts at the surface. You end up with what Tim calls a "geochemically inverted planet", quite unlike our own.

Tim doesn't even know if the fourth type of core exists, but models suggest that asteroids rich in oxygen may not have metal-sulfide cores, but magnetite-sulfide cores. He is just now doing the work to see if he can make such melts in the lab.

Tim illustrated the variety of cores with excellent slides. In describing the processes that produced these different types of cores, he showed how the different kinds of meteorites, asteroids, and planets related to the conditions that control melting – namely the amount of oxygen (fO_2), size of the asteroid or planet, composition, and temperature.

What follows is a synopsis of some of the key points he provided as an introduction to the current state of scientific understanding, along with responses to audience questions.



- First, what is a meteorite? Most people think of it as an ancient piece of metal or stone having originated beyond the earth, perhaps from the moon or planets, a relic of the solar system's origins. For most people, a meteorite summons an image of an iron meteorite, with its lab-prepared cross section showing a distinctive cross-hatched Widmanstatten pattern.
- Because we do not have direct access to the core of the Earth or of any other planet, metallic meteorites, as the core of proto-planets, give us a unique window into the origin of today's planets. That is why they are so important and need further study. "Meteorites are rocks without context." Tim and co-worker Cari Corrigan have together classified 15,000 samples. Among the Smithsonian's rich collection of iron meteorites, samples from

more than 60 different cores are now known. By gaining detailed information on Psyche 16, he and his mission team hope to provide a meaningful context for meteorites, namely, gaining insight into the major factors which have given birth to our solar system's planets.

- A common mistake, Tim reiterated, is to be too Earth-centric. Specifically, it is a mistake to believe that all planets are structured the same way as Earth, with iron as its core and sulfur primarily on the outer levels towards the crust. In this regard, Mercury and the Earth are definitely opposites.
- Given that the asteroid belt receives negligible sunlight, one listener asked what could have been the source of heat for those earliest meltings and related proto-planet building events? Tim said Aluminum 26, a radioactive isotope, had a strong effect in providing that high-temperature trigger mechanism. Given its half-life is so short, that isotope has long since degraded within the asteroid belt and so those heat-assisted, planet-building events did not continue without its presence.
- The beauty of this newly funded Psyche mission is that this asteroid is not only comparatively very large as indicated by its designation as 16, namely the 16th asteroid in history to be identified. But as a totally metallic and large structure, it can be inexpensively analyzed by a fly-along satellite, employing a three-part instrumentation payload. A multispectral imager consists of cameras that will provide high resolution pictures of the geology, composition and topology of Psyche. The gamma ray and neutron spectrometers will identify and map the elements present on the asteroid. Lastly, the magnetometer will map the gravitational field and, combined with the other instruments' findings, will help identify the structure of Psyche.

Conclusion: By way of wrapping up his presentation, Tim noted that no scientists have ever had the opportunity to study a relatively pure metal asteroid, that is, a proto-planetary core in-the-making. So these three types of instrumentation that will be on board the Psyche probe, employed over a 20 month observation period, will provide a treasure trove of new findings about this 200 kilometer (130 mile) diameter metal asteroid. One result will surely be, Tim offered, the rewriting of our science books based on these new findings.

He closed with words that inspired those present. He shared his personal passion for his work, his tremendous zest in doing it, and his enthusiasm for others to join in it, particularly younger people. "Did you ever want to be an explorer? Space is where today's great explorers are working. I drove a rover around Mars for 5 years! We tested the rocks -- on Mars! We get to see things no other human has ever seen. We are changing how we see other planets. Planets used to be specks of light in the sky. Now they are real places that we know about. This is the era to be a space systems explorer! [Speaking to a 15-year-old MSDC member:] I'll be doing this Psyche mission for the rest of my career. In 2029, I'll be looking for a post-doc to do the real work with me, and that person could carry on the work after I retire. You are at exactly the right age: that post-doc could be you. You have time to get the education and degrees and then come work for me. The National Museum of Natural History has the finest iron meteorite collection in the world, bar none. WE are the explorers. You can be, too."

Sharing in the group's heart-felt applause, Dave Nanney thanked Tim for his excellent presentation and making himself available to us on such an historic evening. Referring to the news of winning the NASA Discovery grant competition, Dave asked: "So how do you feel today, Tim?" "Great!" Tim responded, a feeling and vision of exploration he shared with all privileged to attend the gathering.

A brief Show-and-Tell then followed with mineral samples brought and displayed by Ken Reynolds, Steve, Rachel and Rebecca, which sharing was very much appreciated by members and visitors alike.

Mineralogical Snippets - Part I: The Steel Revolution

Andy Thompson, Secretary

Here's the first of several "mineralogical snippets" about how the introduction of steel in various industries transformed the U.S. economy. This article follows my interest in how the introduction of new minerals, such as iron replacing copper three thousand years ago, transformed warfare and nations' economies. This first snippet about steel begins with more recent history, the 1837 transformation of agriculture, the then-leading economic sector of the United States.

Most people know that the nation's eastern coastal plain is characterized by an abundance of sand. It was deposited by the long-term geologic decline of the Appalachian Mountains and the Atlantic Ocean's wave action eroding soil and building up islands from New York's Long Island to North Carolina's barrier reef and Florida's sandy beaches.

What may be less familiar is the fact that the soil of the Midwest states, enriched by the receding ice age depositions 10,000 years earlier, has less sand and more dense sticky clay soil. As a result, as the nation's early coastal farmers moved west, their standard wooden and iron plows failed to efficiently till the more dense Midwestern soil and required frequent work stoppages to clean off the clumps.

In the mid-1830s, John Deere, a young blacksmith from Vermont, had recently relocated to Illinois. He recognized the farmers' dilemma and remembered his earlier experience in Vermont when he used sand to provide a high polish to steel pins. Steel was hard to come by in 1837. So he adapted a broken steel saw from a lumber mill, made it into the shape of a plow, gave it a very high polish, and had his neighbor farmer try it out. The result was the steel cut through the soil like a hot knife thru butter.

There was no clumping and over the next few years the plough proved to be enduring. Additionally, its light weight allowed a farmer and team of oxen or horses to single-handedly manage the plow and complete the job in less than half the traditional time.

As a result, in 1842 Deere sold 100 steel plows. In 1843 he sold 400. In 1849 he sold 1,200. By 1855 he was selling 10,000 plows per year under the name "The Plow That Broke the Plains." By 1862, President Abraham Lincoln signed into law and established the Department of Agriculture as one of the first U.S. government executive departments. It was so central to the nation's economy, supporting farming, agriculture, forestry and food, that he named it "the People's Department." At that time, approximately one-half of the US population was directly engaged in agriculture and its products.

The reader may ask: How specifically did the steel plow impact the agricultural economy? Economic historians rightly tend to argue about the big picture, such as the impact of the Civil War and the end of slavery. But as one recent scholarly publication noted, during in the 1860s there was a "dramatically sharp and inexplicable increase in agricultural productivity…." Perhaps this revolutionary shift from iron to steel makes a small but explicit contribution to the discussion.

For example, one yardstick for productivity was the time the steel plough saved farmers. One report noted that a field which could be plowed in 24 hours using a standard wooden or iron plow, took only 5 to 8 hours using a steel plow. So it decreased the initial farming labor by a factor of more than three. Talk around the stable suggested that even the oxen and horses were keenly appreciative of this new technology which reduced their strain and increased their longevity.

So the consensus seems to be that farm productivity boomed and I propose the shift from iron to steel was central to this revolutionary agricultural transformation. What a difference a well-placed little carbon atom makes.

In future issues we will consider how the introduction of steel revolutionized bridge building, architecture and the airline industries.

An Amazing Limestone Quarry Field Trip

Tom Tucker, Past President

Last Spring, my daughter participated in the "5-K Crusher Run", along with 204 other hardy souls in a local limestone quarry. That's one heck of a field trip. There were an additional 50 or so spectators. It had originally been planned that there would be a rock and roll band stationed in the bowels of the quarry, to provide background music, but the misty foul weather prevented the band from preforming. Still, it was a great event. Shawn suggested I should sign up to run, and if I were really slow, I might find a chance to pick up some new minerals.   I didn't!

For shucks, this is not even a coveted Mindat locality!

Here's the webpage for this year's run, May 20, 2017: https://www.vamomentum.com/crusher-run-5k.html.   If you want to come down and run, you can stay with us.

Safety Matters: Seeing the Light?

Ellery Borow, AFMS Safety Chair
From the Feb 17 AFMS Newletter

If you are seeing the light, the ultra violet (UV) light that is, there may be a problem. Many of the shows I visit offer a display / exhibit / darkened booth highlighting the amazing effects of ultraviolet reactive minerals for show patrons to see. Such displays are really great to see at shows because they offer a view of minerals and rocks most folks never have the opportunity to see.

While many of the UV exhibits I have seen offer sufficient safe guards for the public, some could be better at protecting the club members working the display and the general public.

In your exhibit are folks provided with sufficient eye protection and bare skin protection? Is sufficient attention being paid to reflective surfaces? Are the lights angled sufficiently well to illuminate the minerals and rocks and keep the UV rays out of patron's eyes?

Even short term exposures to UV can have harmful effects. One of the examples I like to cite is about UV reflections. Take the story of a group of people out on a boat and enjoying some sport (catch and release) fishing. Imagine that all the folks are wearing baseball caps with visors to protect their heads and faces from harmful UV ray sunburn effects. At the end of the day there will be folks showing no signs of sunburn because they wore the proper amount of sun screen. There are also most likely going to be folks at the end of the day who are quite sunburned, right to the very underside edge of the baseball cap where its head band touches the forehead.

How might the sun's harmful UV rays have reached under the visor right to the person's forehead to create a sunburn in an area that should have been protected by the visor? In a word, the answer is – reflections. The surface of the ocean is not flat, it is covered by waves. Those waves act as curved reflectors to reflect the sun's harmful UV waves upward and right underneath a person's visor-covered forehead. The same can happen on a smaller scale in a show's UV mineral booth.

UV can be reflected by some mineral surfaces up onto the bare skin and unprotected eyes of show patrons and club members tending to the booth.

Under most circumstances the amount of exposure is relatively minimal, except for those who remain in the booth for extended periods of time - such as the folks tending to the booth and those curious show patrons who just can't get enough of the beauty and curiosity of UV illuminated minerals. Some suggested solutions to UV overexposure include:

- Wear eye protection for extended viewing or working in the vicinity of UV light.
- Wear sunscreen protection on exposed skin.
- Minimize reflections of UV light toward viewers - reflections may come from the display material and / or the minerals themselves.
- Angle the UV lights so no one, especially small children, can kneel down and look up into the UV lamp housing or bulbs.
- Offer protective eye-wear temporarily to patrons who wish to use it, even if for short exposure times.
- Take periodic breaks from being under strong UV illumination.

We encourage shows to offer exhibits of UV minerals and rocks because such displays always seem to be a great attraction. We also encourage sufficient protections and safeguards be utilized with such exhibits. As always, we hope you safely see the light because your safety matters.

Mineral of the Month – Copper

Native copper is an uncombined form of copper which occurs as a natural mineral. Copper is one of the few metallic elements to occur in native form, although it most commonly occurs in oxidized states and mixed with other elements. Native copper was an important ore of copper in historic times and was used by pre-historic peoples.

Native copper occurs rarely as isometric cubic and octahedral crystals, but more typically as irregular masses and fracture fillings. It has a reddish, orangish, and/or brownish color on fresh surfaces, but typically is weathered and coated with a green tarnish of copper(II) carbonate (also known as patina or verdigris). Its specific gravity is 8.9 and its hardness is 2.5–3.

"Halfbreed" copper-silver nugget, Keweenaw County, Michigan, US

The mines of the Keweenaw native copper deposits of Upper Michigan were major copper producers in the 19th and early 20th centuries, and are the largest deposits of native copper in the world. Native Americans mined copper on a small scale at this and several other locations, and .

evidence exists of copper trading routes throughout North America among native peoples, proven by isotopic analysis. The first commercial mines in the Keweenaw Peninsula (which is nicknamed the "Copper Country" and "Copper Island") opened in the 1840s. Isle Royale in western Lake Superior was also a site of many tons of native copper. Some of it was extracted by native peoples, but only one of several commercial attempts at mining turned a profit there.

Another major native copper deposit is in Coro Coro, Bolivia.

The name copper comes from the Greek kyprios, "of Cyprus", the location of copper mines since pre-historic times.

Diamond	
Category	Native Minerals
Formula	Cu
Strunz Classification	1/A.01-10
Crystal System	Isometric
Crystal Class	m3m (4/m 3 2/m) - Hexoctahedral
Color	Copper-red. Tarnishes to green
Cleavage	None Observed
Fracture	Hackly
Mohs Scale	2.5-3
Luster	Metallic
Streak	Copper-reds
Specific Gravity	8.94 - 8.95
Melting Point	1984.32 F

Geologist of the Month – Georgius Agricola – from Wikipedia

Georgius Agricola (24 March 1494 – 21 November 1555) was a German Catholic, scholar and scientist. Known as "the father of mineralogy", he was born at Glauchau in Saxony. His birth name was Georg Pawer (Bauer in modern German). Agricola is the Latinized version of his name, by which he was known his entire adult life; Agricola and Bauer mean "farmer" in their respective languages. He is best known for his book De Re Metallica (1556).

Gifted with a precocious intellect, Agricola early threw himself into the pursuit of the "new learning", with such effect that at the age of 20, he was appointed Rector extraordinarius of Greek at the so-called Great School of Zwickau, and made his appearance as a writer on philology. After two years, he gave up his appointment to pursue his studies at Leipzig, where, as rector, he received the support of the professor of classics, Peter Mosellanus (1493–1525), a celebrated humanist of the time, with whom he had already been in correspondence. Here, he also devoted himself to the study of medicine, physics, and chemistry. After the death of Mosellanus, he went to Italy from 1524 to 1526, where he took his doctor's degree.

He returned to Zwickau in 1527, and was chosen as town physician at Joachimsthal, a center of mining and smelting works, his object being partly "to fill in the gaps in the art of healing", and partly to test what had been written about mineralogy by careful observation of ores and the methods of their treatment. His thorough grounding in philology and philosophy had accustomed him to systematic thinking, and this enabled him to construct out of his studies and observations of minerals a logical system which he began to publish in 1528. Agricola's dialogue "Bermannus, sive de re metallica dialogus" [Bermannus; or a dialogue on metallurgy], (1530) the first attempt to reduce to scientific order the knowledge won by practical work, brought Agricola into notice; it contained an approving letter from Erasmus at the beginning of the book.

In 1530, Prince Maurice of Saxony appointed him historiographer with an annual allowance, and he migrated to Chemnitz, the center of the mining industry, to widen the range of his observations. The citizens showed their appreciation of his learning by appointing him town physician in 1533. In that year, he published a book about Greek and Roman weights and measures, "De Mensuis et Ponderibus".

He was also elected burgomaster of Chemnitz. His popularity was, however, short-lived. Chemnitz was a violent center of the Protestant movement, while Agricola never wavered in his allegiance to the Roman Catholic Church; he was forced to resign his office. He now lived apart from the contentious movements of the time, devoting himself wholly to learning. His chief interest was still in mineralogy, but he occupied himself also with medical, mathematical, theological and historical subjects, his chief historical work being the "Dominatores Saxonici a prima origine ad hanc aetatem", published at Freiberg. In 1544, he published the "De ortu et causis subterraneorum", in which he laid the first foundations of a physical geology, and criticized the theories of the ancients. However, he maintained that a certain 'materia pinguis' or 'fatty matter,' set into fermentation by heat, gave birth to fossil organic shapes, as opposed to fossil shells having belonged to living animals. In 1545, he followed with the "De natura eorum quae effluunt e terra"; in 1546 the "De veteribus et novis metallis", a comprehensive account of the discovery and occurrence of minerals and also more commonly known as De Natura Fossilium; in 1548, the De animantibus subterraneis; and in the two following years a number of smaller works on the metals.

Agricola's most famous work, the "De re metallica" libri xii was published the year after his death, in 1556; it was perhaps finished in 1550, since the dedication to the elector and his brother is dated to that year. The delay is thought to be due to the book's many woodcuts. The work is a systematic, illustrated treatise on mining and extractive metallurgy. It shows processes to extract ores from the ground, and metals from ore.

Until that time, Pliny the Elder's work "Historia Naturalis" was the main source of information on metals and mining techniques. Agricola acknowledged his debt to ancient authors, such as Pliny and Theophrastus, and made numerous references to Roman works. In geology, Agricola described and illustrated how ore veins occur in and on the ground. He described prospecting for ore veins and surveying in detail, as well as washing the ores to collect the heavier valuable minerals, such as gold and tin. The work shows water mills used in mining, such as the machine for lifting men and material into and out of a mine shaft. Water mills found application especially in crushing ores to release the fine particles of gold and other heavy minerals, as well as working giant bellows to force air into the confined spaces of underground workings.

Fire Setting

By Georgius Agricola - De re metallica, Public Domain

Agricola described mining methods which are now obsolete, such as fire-setting, which involved building fires against hard rock faces. The hot rock was quenched with water, and the thermal shock weakened it enough for easy removal. It was a dangerous method when used in underground, made redundant by explosives.

The work contains, in an appendix, the German equivalents for the technical terms used in the Latin text. Modern words that derive from the work include fluorspar (from which was later named fluorine) and bismuth. In another example, believing the black rock of the Schloßberg at Stolpen to be the same as Pliny the Elder's basalt, Agricola applied this name to it, and thus originated a petrological term.

In 1912, the Mining Magazine (London) published an English translation of "De re metallica". The translation was made by Herbert Hoover, the American mining engineer and his wife Lou Henry Hoover. Hoover was later President of the United States.

In spite of the early proof that Agricola had given of the tolerance of his own religious attitude, he was not suffered to end his days in peace. He remained to the end a staunch Catholic, though all Chemnitz had gone over to the Lutheran creed, and it is said that his life was ended by a fit of apoplexy brought on by a heated discussion with a Protestant divine. He died in Chemnitz on 21 November 1555; so violent was the theological feeling against him, he was not allowed to be buried in the town to which he had added such luster. Amidst hostile demonstrations, he was carried to Zeitz, some 50 kilometers away, and buried there.

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 December 2016 and January 2017 issues of the *American Mineralogist: Journal of Earth and Planetary Materials.* http://www.minsocam.org

Highlights and Breakthroughs

Predicting Trace Element Partitioning Behavior

On page 2577 of this issue, Sunichiro Karato provides a review of the physical basis for contrasts in partition coefficients. This review attempts to explain a suite of experimental observations, which include the now-familiar Onuma diagrams, so well developed by Blundy and Wood and others, which show how partition coefficients vary with an element's size and charge, but the physical reasons for the dependence of element partitioning on the size of element have been unclear particularly for noble gas elements. Karato developed new models of element partitioning using the models of point defects in minerals and the hard sphere model of silicate melts. Karato's model provides a physical explanation, for example, as to why some phases partition noble gases in proportion to their ionic radii (bridgemanite), while other silicate phases (Ol, Cpx) do not. Karato finds that his models may help better describe and predict partitioning behavior. But Karato also concludes that no physical model can yet satisfactorily predict P-T dependencies of trace element partitioning, and hence that there is still no substitute for a thermodynamic description of partitioning behavior.

Mineralogists at the Forefront of Human Health

On page 2594 of this issue, Jill Pasteris demonstrates why the demarcation between biogenic, synthetic, and inorganic phases is not a simple one, and may erect unfruitful barriers at least in some sub-disciplines of medicine, mineralogy, and materials science. Here, Pasteris examines apatitic "biomaterials", which are defined as the synthetic forms of hydroxylapatite (usually nanocrystalline, in some cases inter-bonded with organic molecules) that are used to replace natural bone and tooth materials. Her review illustrates the various ways in which biomaterials are structured and synthesized, with some fascinating insights into how subtle variations in synthesis conditions can tailor the required properties of a mineral to a given biologic function and determine how successfully such materials will operate when implanted in a human system. The take-home message of this review is that mineralogists have much to offer to such research, and argues that "biomaterials" should be pursued as a major sub-discipline of mineralogical research. As editors, we happily await the continued publication of papers in this field.

Immobilizing Radionuclides with Apatite

On page 2611 of this issue, Rigali et al. review the various ways in which apatite can be used to isolate a wide range of radionuclides from the near-surface environment. These means of radionuclide neutralization include the familiar modes of surface adsorption and partitioning of species into apatite structures. Rigali et al. also review what may be less familiar mechanisms, such as dissolution/(re-)precipitation reactions that are now being used to remediate contaminated groundwater or act as semi-permeable membranes. For example, some recent studies have shown that apatite can dissolve in the presence of U-bearing fluids to re-precipitate as U-phosphate or U-carbonate, and that the addition of hydroxyapatite to contaminated soils may reduce U concentrations in pore waters to levels deemed safe for drinking.

A Depth Continuum of Water Release During Subduction

On page 2645 of this issue Gemmi et al. employ cutting edge analytical techniques to determine the structures of two important candidates for carriers of water into the deep mantle: the "11.5 angstrom" phase, $Mg_6Al(OH)_7(SiO_4)_2$, and the HySo phase, $Mg_3Al(OH)_3(Si_2O_7)$. These phases can form by the breakdown of chlinochlore and so may carry water to depths beyond clinochlore and chlorite breakdown. These phases lack the H-bonded, infinite tetrahedral sheets structure of precursor silicates. The authors find structures with reduced Si-O-Si interconnections and much higher density. Thus, these high-density phases, which can contain between 8-13 wt% H2O, are expected to be stable to much greater depths.

Evidence for Mantle Global Warming?

On page 2768 of this issue, Ganne et al. present an analysis of global magmatic temperatures from published data that span the temporal range of 600 Ma to present. Their most dramatic finding is that magmatic temperatures, as measured from whole rock and mineral compositions, record a maximum that falls between 325-125 Ma; these ages are the bookends of the lifespan of Pangea. This time period also coincides with a peak in mantle potential temperature. The authors suggest that these findings support numerical models (e.g., Coltice et al. 2009; Van Avendonk et al. 2016) whereby supercontinent formation results in both thermal insulation, and a disruption of mantle convection, such that increased temperatures temporarily influence supercontinent volcanism. Coltice et al. predict that supercontinent-induced heating should be <100 C; Ganne et al. identify some key targets for high precision thermometry, as a test of the Coltice et al. model.

Predicting Mining Accidents, Building Collapse, Etc.

On page 2751 of this issue Jiang et al. provide an update of prior work that indicated that acoustic emissions presage mine collapse. In this new work, the authors present experimental results that confirm that acoustic emissions increase just prior to the collapse of cavities in sandstone and coal. The energy released by such acoustic emissions can be described by a power law, with slightly different exponents for different materials, but the exponents also change with time. A key result then is that collapse of a mine shaft, or bridge or building, may be presaged by both acoustic emissions and their energies. Another fascinating result is that cavity collapse yields a power law with an exponent greater than that associated with crack propagation, the latter being associated with micro-faults and earthquakes.

A New Hygrometer and Shallow Magma Accelerations at Etna

On page 2774 of this issue, in a Letter, Perinelli et al. re-calibrate their clinopyroxene-based hygrometer. The original, and new model, are applicable to trachyte or hawaiiite-type basalts. But while magmatically restrictive, the model predicts water contents without precise knowledge of liquid composition, relying on pyroxene components and the P-T conditions of crystallization. They find that at Mt Etna, magmas begin to dehydrate mostly at a <400 MPa and lose most of their water at pressure of <100 MPa. This result corroborates inferences form melt inclusions, and it indicates that eruption triggering, and magma transport acceleration due to dehydration, are mostly relatively shallow processes, at least in the Etnean plumbing system.

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- Page 2774 An improved clinopyroxene-based hygrometer for Etnean magmas and implications for eruption triggering mechanisms. Cristina Perinelli, Silvio Mollo, Silvio Mollo, Mario Gaeta, Serena Pia De Cristofaro, Danilo M. Palladino, Pietro Armienti, Piergiorgio Scarlato, and Keith D. Putirka
- Page 2778 New Mineral Names

Editors Selections, January, 2017 Highlights & Breakthroughs

Periodic Arcs

On page 1 of this issue, P.G. DeCelles reviews the new work of Kirsch et al., published on page 2133 in Am Min in 2016. DeCelles notes that while the rate at which magmas are produced in arcs is stubbornly uncorrelated with orthogonal convergence rates, Kirsch et al. provide an opening for a detectable tectonic control on magmatic addition rates at arcs. This results, in part, through the observations by Kirsch et al. of synchronicity of some (but not all) magmatic flare-ups throughout the Cordillera. As DeCelles notes, though, the mappable and datable effects of plate convergence are subject to many more factors than plate convergence rate. Implied is that convergence rates may provide an ultimate cause of magmatism and upper plate deformation, but are separated from intervening, and highly localized controls and conditions such that causative forces are well hidden—and may remain so absent detailed and comprehensive field and petrologic studies.

Invited Centennial Articles

Predicting Mining Accidents

On page 3 of this issue, Ulrich Bismayer provides an overview of a paper that we highlighted from last month's issue: Jiang et al.'s acoustic emission experiments on sandstone and coal lithologies. The larger sample size in these experiments allowed the investigators to detect a temporal transition. Early acoustic emissions are randomly scattered about the experimental volume and appear to be random with respect to both time and space. But later acoustic events cluster along what will prove to be collapse planes. And as noted earlier, the energy of these two event systems follow a power law, with a distinct exponent for the random and spatially correlated cases. These provide a means to predict failure events.

Why Arc Lavas Contain High LILE

On page 5 of this issue, Hans Keppler examines melt inclusion compositions from primitive arc lavas. His review reveals that fluid mobile elements in arc lavas are, perhaps unexpectedly, controlled by fluids. These elements, which include the large ion lithophile elements (LILE), light rare earth elements (LREE), and U, are correlated with Cl when both Cl and the element of interest are normalized to H2O. This correlation with Cl indicates that the classic enrichment of arc lavas in LILE, LREE, and U are not controlled by subducted sediment inputs or partial melting of subducted crust, since Cl does not affect mineral/melt partitioning. Keppler concludes that (Cl-bearing) fluids are the primary carriers of LILE, LREE, and U into arc magmatic systems, and that Ce/H2O ratios are a proxy for fluid inputs, not slab T.

Articles

Carbon in the Lunar Core

On page 92 of this issue, Steenstra et al. suggest that Carbon is the major light-alloying element in the lunar core. Like Earth's core, there is a recognition that the Moon's metallic portion has sufficiently low density to require an admixture of elements other than Fe and Ni. And like Earth, sulfur has been a leading candidate of a light-alloying element as it readily dissolves into metallic liquids. These authors use existing estimates of the bulk silicate Moon, and recent experimental work that describes metal/silicate partition, to show that C may compete successfully with S during lunar core formation. These authors contend that C is sufficiently siderophile to allow up to 4.8 wt% C in the lunar core. This work further indicates a close similarity between the bulk silicate portions of

Earth and its Moon, and a lack of devolatilization during the Moon's formation.

The Ecology of Cobalt

On page 108 of this issue Hazen et al. examine the temporal and spatial distributions of Co-bearing minerals (66 distinct species; >3000 species-locality pairs). Their work indicates that Co-bearing minerals follow a Large Number of Rare Events (LNRE) distribution, which is plotted as a ranking of minerals according to the numbers of localities at which they are found. At the top of such a list (if applied to all minerals), would be quartz, which is found at 45,000 localities; 22% of all minerals are found only at one locality. Hazen et al have previously shown that an LNRE distribution describes minerals as a whole, and minerals characterized by elements that are concentrated (e.g., C), rather than dispersed. Here, by examining Co, Hazen et al. now show that the LNRE distribution also applies to elements, even if they occur not just in concentrated form, but are also dispersed in wide ranging solid solutions. These authors thus show that LNRE distributions can be used to predict how many minerals are yet to be discovered; the editors of Am Min anxiously await the new mineral descriptions that test this hypothesis.

Apatite Mediates Body Fluid Compositions

On page 149 of this issue, Michael Fleet, as a perfect follow-up to Jills Pasteris' review in last months' issue, investigates the nature of Na and carbonate substitutions in hydroxylapatite; the author finds that these species substitute in a significant way within the hdyroxylapatite c-axis structural channel. A key implication of this finding is that the hydroxylapatite c-axis structural channel may be the key means by which body fluids interact with nanocrystalline bone materials, and so mediate acid-base reactions in biologic systems.

The State of Carbonates in the Deep Mantle

On page 210 of this issue, Solomatova and Asimow calculate crystal structures and relative enthalpies of high-pressure forms of dolomite. They find that a monoclinic dolomite phase has a lower energy compared to other candidate structures, at pressures ranging from 15 to 80 GPa. Their work does not delimit the conditions on which such a carbonate might decompose to other phases, but identifies a potentially important phase for understanding the global C cycle. Their study clearly points to the need for new experiments exploring the structural and phase equilibrium stabilities of comparable Fe- and Mn-bearing carbonate phases.

Ti in the Lower Mantle

On page 227 of this issue, Bindi et al. report a new Ti-bearing bridgmanite-type structure synthesized at transition zone P-T conditions (20 GPa, 1600 C). Their study indicates that Ti may stabilize bridgmanite-like structures at lower pressures and provide clues as to how Ti and other elements are housed within the lower mantle. As these authors note, natural Ti contents are too low to stabilize this new phase in the lower mantle, but it might be stable in certain localized Ti-rich environments. Although not highlighted by the authors, a yet more important implication is that such a component within bridgmanite may be important for explaining high Ti contents in many ocean island volcanic rocks thought to form as lower mantle thermal plumes. This new phase might either provide the source, or control the mineral melt partitioning of Ti and so may be central to understanding what appear to be lower mantle Ti enrichments.

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Useful Mineral Links:

Eastern Federation of Mineralogical and Lapidary Societies (EFMLS)	www.amfed.org/efmls
American Federation of Mineralogical Societies (AFMS)	www.amfed.org
MINDAT	www.mindat.org
WebMineral	webmineral.com
Mineralogical Society of America	www.minsocam.org
The Geological Society of America (GSA)	www.geosociety.org

Upcoming Local (or mostly local) Geology Events:

February:

1 MSDC February Meeting

9-12 2017 Tucson Gem and Mineral Show®, "Mineral Treasures of the Midwest", SMG-Tucson Convention Center. For days, times and discount ticket information: Click Here! Tickets available starting Thursday, January 12, 2017.

22 Micromounters February Meeting

27 NVMC February Meeting

March:

1	MSDC March Meeting
4-5	Wilmington, DE – 54th Annual Gem, Mineral & Fossil Show

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
29	Sterling Hill Super Dig
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
29-30	Franklin, NJ - Annual NJ Earth Science Association Show at the Washington School

May:

3	MSDC May Meeting
?	Ogdensburg, NJ – NoJMS Spring Swap & Sale at Sterling Hill Mining Museum

June

3	Spring Mineralfest - Macungie, Pennsylvania - 68th semi-annual Mineralfest
7	MSDC June 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? ____

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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

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