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

The Mineral Minutes

Volume 76-07
September 2018

In this Issue:

September Program

"The Sculptural Evolution and Predicted Future of Bermuda's Geologic Landscape"

Presented by Amanda Parker

Our September presentation will be made by one of our own members, Amanda Parker. Amanda is a Fairfax, Virginia artist, mineral collector, and the newest member of our MSDC board of directors. She has a strong interest in the geology of tropic locations, the surrounding sea life, and how historic climate changes affect Earth's landscape. She is especially fond of the island of Bermuda, having traveled there twice during the past year.

In addition to working on her tan, Amanda visited the famous pink beaches and the attractive caverns (stalactites/stalagmites!) that draw many tourists to this island, 600 miles off the coast of North Carolina. Her talk will explain how Bermuda was formed, including the volcanic activity that sculpted the island and historic elevation changes. In addition, she will cover the current cave structure, how the population utilizes the limestone, and the Bermudian solution to hurricanes and tidal waves. She will explain a bit about the coral reefs near the island, how the famous pink sand forms, and how the island is currently evolving geologically and its predicted future. Although glaciers were not present in Bermuda, Amanda will explain how they affected the island and its history.

Please join us in taking Amanda to dinner on September 5th before the club meeting. We will be meeting at 6:00 pm at Elephant & Castle Restaurant, 1201 Pennsylvania Ave, NW, Washington, DC, about 2 blocks from the Smithsonian Institution National Museum of Natural History (NMNH) where our club

Prez Says...

by Dave Nanney
MSDC President

Summer is almost over. Despite another heat wave of three or more 90+ degree days, the evening temperatures "should" start dropping soon. (Please God!).

The parking next to the museum will remain open in September. It closes 1 October. That will be a difficult challenge so I am planning to host a discussion at the business meeting, and if it gets too lengthy, combine the discussion with our upcoming (not scheduled yet) board meeting.

So for this month, we are having the usual dinner with our speaker before the meeting at the Elephant and Castle at 6PM followed by normal free parking next to the museum. We will move up to the meeting room shortly after 7:45. Please drop Dave Hennessey a note to insure a seat, or arrive and we will borrow a seat from another table.

Our current crazy project is to install a 1,600 foot deer fence around our property. Of course the "to be assembled, sure it's easy, DIY project, arrived right in the middle of the hottest part of the summer. This has been a dream for over five years so several more weeks of effort should yield a significantly better blooming season for our azalea collection.

Leslie and I attended the West Springfield (hey, that's where I live) Massachusetts (oh, yeah) Mineral Show early in August. It was HUGE. One location, much larger than the GMU show, with several dealers we have seen in our area, and many more from up there. We only brought back 13 pieces so we on moderately good behavior. Thanks to encouragement from Ken and Dan, we stopped at Franklin NJ to visit their museum

June Business Meeting Synopsis

By Andy Thompson, Secretary

President Dave Nanney welcomed the relatively large gathering of attendees, including three MSDC past presidents and several first-time visitors. The latter ranged from veteran Dave Line who has been the long-time Chairman and coordinator of field trips for the Southern Maryland Rock and Mineral Club as well as novice collectors interested in lapidary and gem stones (including Alyson Smith), and Gary Christmas, visiting from Texas. A special warm welcome was extended to visiting Dr. Cindy Kearns, an instructor at James Madison University who recently received her Ph.D. in geology from is and spouse of the evening's presenter Dr. Lance Kearns.

Dave called for approval of the Minutes of the May meeting as published in the June edition of Mineral Minutes. Noting no editorial changes requested, the minutes were unanimously accepted. The only "Old Business" was the issue of where to park our cars come September or October, when construction equipment will occupy the Natural History museum's parking lot. On-street parking along Constitution Ave seems to be the best solution. There was no "New Business" cited, including no available information on upcoming mineral shows, so Dave called for and received a vote to close the business meeting. He turned the podium over to V.P. for Programs, Dave Hennessey, to introduce the evening's speaker.

To be perfectly clear:

The usual parking is available to us for our September meeting but NOT for our October meeting.

and tour the mine. Simply breathtaking! We will not become fluorescent collectors, but we do plan to get a medium quality UV light to play with our existing collection.

I hope you have been well since our last meeting in June, and I look forward to seeing everyone this Wednesday, September 5, to hear our own Amanda Parker, share her adventures in Bermuda. Leslie and I celebrated our honeymoon there a very long time ago so it will be fun to revisit a place in our dreams.

CLUB INFO

MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

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/MineralogicalSociety-OfTheDistrictOfColumbia

2018 Officers & Directors

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	Ken Reynolds
Editor	Steve Johnson
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meeting is held. If you plan to come to dinner, please send an e-mail to me (davidhennessey@comcast.net) and let me know so I can try to get the number right for the reservation - but do not hesitate to come to dinner if you forget to e-mail. We can always make room for more around the table. If you cannot make it to dinner, we will meet in the NMNH lobby at 7:30 pm and head up to the Cathy Kerby Room for Amanda's presentation.

June Program: "The History of the James Madison University Mineral Museum"

Presented by Dr. Lance Kerns

By Andy Thompson, Secretary

MSDC's V.P. for Programs, Dave Hennessey, introduced Dr. Kearns, founder and curator of the James Madison University Mineral Museum. Lance been well known to our club due in part to his having been a long-time supporter of MSDC and numerous local mineral clubs. In particular, he hosted MSDC's annual winter visit to the JMU Mineral Sciences labs where Lance helped members identify unknown mineral specimens and provided a wide range of books for our personal libraries. In turn, members donated funds to support student participation in mineralogical events such as the Rochester Mineralogical Symposium.

Lance's objective for the evening was to tell the story of the birth and growth of the JMU Mineral Museum. It was also interesting to learn the origins of his passion for minerals and geology. As the Museum's founder and chief proponent, Lance shared that his personal immersion in minerals began when he was a 5-year old and a gentleman gave him 5 mineral samples. His family vacations thereafter became collecting field trips. This culminated at the University of Delaware with his Ph.D. research into the mineralogy of the Franklin Marble, Orange County, New York. That unique deposit of mineral-rich exposed marble stretches about 20 miles long and 2 miles wide, between western NY and the Highlands of NJ, including Franklin, NJ, well-known for its fluorescent minerals.

Lance's teaching career at JMU extended from his arrival in August of 1976 until his retirement in September of 2017, after 41 years of service. Today he serves as Emeritus Professor, and Curator of the JMU Mineral Museum, and so is the perfect person to explain the past, present and bright future of the JMU Museum. Lance's story was less about the collection's individual minerals and more about the determination, luck, resources, and, most importantly, the trusting individuals and organizations that brought the Museum into existence.

(Steve: photo #1 about here: Lance overlooking the Geology Department's initial micro-mount mineral collection)

The story of the Museum began in 1976. Imagine being assigned to teach an undergraduate course in mineralogy without the geology department having any significant collection of minerals for students to study. They did have a relatively small collection of micro-mount specimens and that constituted the Museum's initial holdings. Fortunately, his mentor at the University of Delaware soon came to their recent graduate's aid by providing JMU's mineral laboratory with larger specimens. At the time JMU was called Madison College. In those early years, there were at least seven major donors of minerals, including Dr. Peter Leavens of the University of Delaware and the Crawfords of Bryn Mawr College who made substantial contributions to the teaching collection.

One of the factors supporting the trust relationship of donors to the school's Museum was respect for the law that any minerals donated to the University belong to the State, in perpetuity, and not to the Geology Department or to its individual professors. Accordingly, Lance frequently donated to the JMU Museum the minerals he himself had collected on field trips.

(second photo about here: Lance, in 1983, exploring an excavation pit with owner Don Richardson at the Herbb II pegmatite of Powhattan, VA.)

(3rd photo about here – cassiterite specimen from Don Richardson)

Pictured here is a large cassiterite specimen which Don Richardson found at the Herbb II pegmatite and is now part of the JMU collection. "It's almost as heavy as galena and weighs about two pounds," stands about 3.5 inches, making it one of the largest ever discovered in North America.

Along with contributions by individuals and other universities, another interesting source of "donations" came by way of what Lance called "wheeling and dealing." He described one example of visiting a mining region where the employees were forbidden to pocket any minerals that caught their eye. A mysterious phone call had urged him to visit that rural area in the dead of night. Because Lance and others arrived in a University-marked vehicle, that instilled enough confidence in a very cautious unidentified local gentleman, that some interesting minerals then became available for purchase at a second remote site from unnamed individuals on behalf of the University's growing collection.

Increased security was another variable that helped the Museum's collection of Virginia and out-of-state minerals to grow. When one wealthy donor called to explore making a donation, Lance had to tell him a strong security system was not in place. So the would-be donor simply hung up the phone. Years later, when the University had provided adequate security for the Museum's specimens, the donor came forward saying he felt comfortable giving the University substantial minerals. By the Summer of 2019, Lance hopes that a new, larger display facility will be built in the JMU Festival Building.

Over decades, based on the trusting relationships Lance had developed among geologists and collectors, mineral donations continued to flow to JMU. Jerome Ulinski donated 22,000 micro-mounts, including many Herkimer "diamonds." Jim Farraiola provided an extensive collection of micro phosphates. By 2006 the collection had outgrown its original display area in Miller Hall and necessitated a larger display area.

That second Museum opened in October of 2007 and several members of MSDC were present for the festivities. From 2007 through 2018, the Mineral Museum collection was housed in JMU's Memorial Hall. Here again, trusting relationships came to the rescue when the University's budget covered the Hall's construction, heating and cooling costs but ended up short of funding for purchasing display cases. Lance made the need known that each of the display cabinets would cost $2,000 and several mineral clubs and individuals responded with financial contributions to complete the endeavor.

(4th photo about here: in foreground, Virginia specimen case, additional cases in background)

Having shared some of the highlights of the past and present of the Museum, Lance spoke of his optimism for the bright future he sees for the JMU museum. The Mitchel Fund, for example, has established a solid base for expanding the University's excellent collection of Virginia minerals. Additional donors' contributions continue to support the collection's growth, which for the first time has a full-time curator, namely himself. Recent geology Ph.D. recipient Cynthia Kearns, spouse of Dr. Kearns, shared her first-hand experience as a faculty member that today's and tomorrow's students now have an excellent collection of mineral specimens for their on-going study and research.

(5th photo about here: Drs. Lance and Cynthia Kearns)

Although Lance's presentation focused on the history of the Museum's collection as a whole, he did include in his presentation a photo of one large, orange calcite crystal, a scalenohedron, seated upon a mound of sphalerite, with barite and fluorite, which was discovered in the Cumberland Mine at Elmwood, Tennessee. As a doubly terminated, six-sided polyhedron, it is similar to a bipyramidal hexagon and definitely a show-stopper.

(6th photo about here: large orange calcite from Elmwood, TN)

President Dave Nanney thanked Lance for his excellent presentation and the attending audience signaled their approval with sustained applause.

The Show and Tell segment included Dan providing hints and specimens as clues to the locale of his recent field trip, which turned out to be to Mt. Ida and the Crater of Diamonds area of Arkansas. Kenny brought in specimens of zincite and willamite and Steve brought in a large calcite whose vug contained a delicate feathery millerite.

From Magnet Cove, AR. To Memphis, TN to Spruce Pine, N.C. to Franklin, N.J. and Back

by George Loud

Karen and I had planned to attend gem and mineral shows in Spruce Pine at the beginning of August but, unfortunately, had to cancel out at the last minute because of a health problem. However, mere mention of "Spruce Pine" brings to mind a story which starts in Franklin, N.J.

Many years ago, in the process of going through offerings of outdoor vendors at the "Pond" in Franklin, N.J., I came across some strange looking pyrite. The locality given for this strange "titaniferous pyrite" was Magnet Cove, Arkansas. I had collected in Magnet Cove many times, starting when I was a kid, but had never seen such material before. Because I regarded it as unusual for the locality and because it was priced cheap, I purchased a piece. My inquiries of the vendor revealed only that he had purchased the material from a vendor at a show in Spruce Pine, N.C.

Fast forward about one year to Memphis, TN. and one of my periodic trips there to visit my mother. As usual on such trips I also visited my good friend Dr. Jim Cole who also lived in Memphis. Dr. Cole was one of the most enthusiastic "rockhounds" I have ever met. I collected with him in Magnet Cove on several occasions. He owned a cabin near Mount Ida, Arkansas and we used it as our base of operations. His home in Memphis had a very large basement full of minerals. Likewise, his large back yard was full of crates and buckets of self-collected minerals. During this particular visit I noticed a container full of pyrite that looked very similar to my specimen of "titaniferous pyrite." Question: "Jim, what is this stuff?"

Answer: "Oh, we found that if we soak in bleach pyrite from Cove Creek it turns to that color.

I call it 'titaniferous pyrite' but that is just a guess on my part." Knowing that Dr. Jim was a frequent vendor at the Spruce Pine shows, those comments put it all together for me.

I collect mainly minerals from classic U.S. localities and tend to jump at anything I see for sale that appears to be unusual for such a locality. Lesson learned and frequently forgotten: if it appears to be unusual for the attributed location, (1) the label may be wrong or (2) the specimen may be faked in some manner. To illustrate the point, at the Tucson Show I once purchased an apophyllite specimen labelled "Centreville, Virginia" because it seemed to be an unusual habit of apophyllite for the locality. Upon returning home and unwrapping the specimen, I turned it over and, upon seeing the matrix, I knew immediately that it was from India. I should have turned it over to better see the matrix before I purchased it. Hate to admit that I was so stupid.

Iron-silica particles unlock part of the mystery of Earth's oxygenation

The original sunscreen:mParticles in ancient seawater helped cyanobacteria to oxygenate Earth's oceans billions of years ago

From ScienceNews.com

Banded ironstone boulder in front of the Smithsonian Natural History museum

The oxygenation of Earth's atmosphere was thanks, in part, to iron and silica particles in ancient seawater, according to a new study by geomicrobiologists at the University of Alberta. But these results solve only part of this ancient mystery.

Early organisms called cyanobacteria produced oxygen through oxygenic photosynthesis, resulting in the oxygenation of Earth's atmosphere. But cyanobacteria needed protection from the sun's UV radiation in order to evolve. That's where iron and silica particles in ancient seawater come in, according to Aleksandra Mloszewska, a former PhD student who conducted this research under the supervision of Kurt Konhauser, professor in the Department of Earth and Atmospheric Sciences, and George Owttrim, professor in the Department of Biological Sciences.

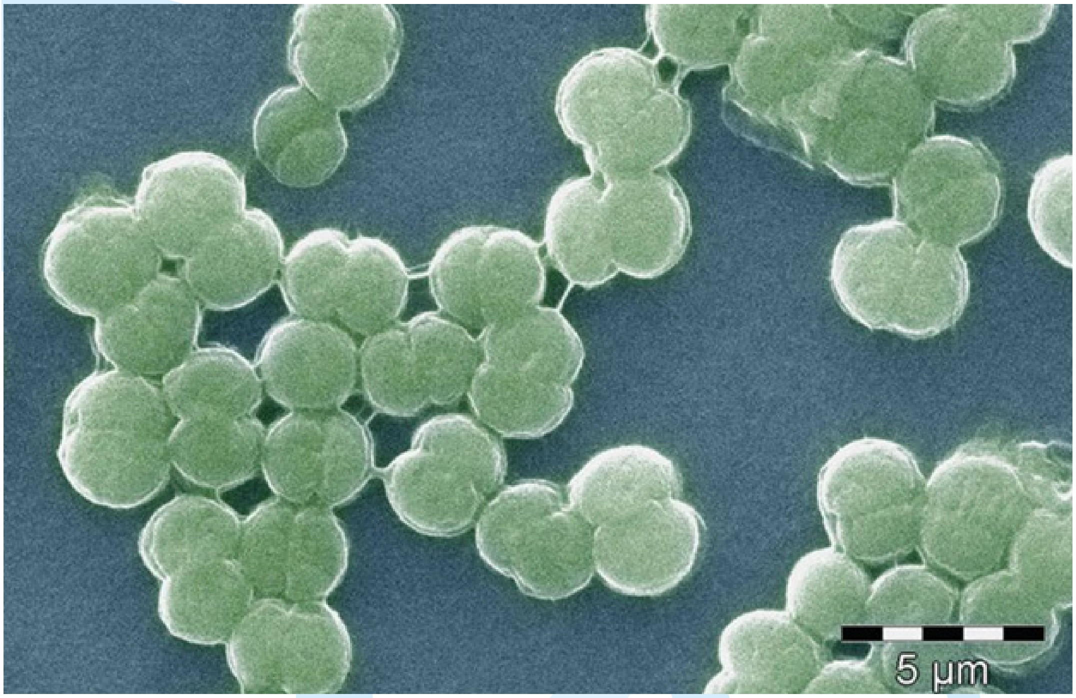
The research team characterized the effect of UV stress on cyanobacteria and the degree of radiation through the seawater medium through a combination of microbiological, spectroscopic, geochemical and modelling techniques. Their results show that the presence of high silica and iron concentrations in early sea water allowed for the formation of iron-silica precipitates that remained suspended in the ocean for extended periods of time.

"In effect, the iron-silica particles acted as an ancient 'sunscreen' for the cyanobacteria, protecting them from the lethal effects of direct UV exposure," said Konhauser, the senior author from UAlberta. "This was critical on the early Earth before a sufficiently thick ozone layer was established that could enable marine plankton to spread across the globe, as is the case today."

More missing pieces

But, the researchers explain, the iron-silica rich precipitates tell only part of the story.

"The accumulation of atmospheric oxygen from cyanobacterial facilitated the evolution of oxygen-based respiration and multicellular organisms," says Owttrim. But the reason for the large amount of time that it took for free



Iron-silica particles helped shield cyanobacteria like these, which played a key role in the oxygenation of Earth's atmosphere according to new research from UAlberta. Credit: George Owttrim

oxygen to accumulate permanently in the atmosphere after the initial evolution of cyanobacteria remains a mystery.

While iron-silica precipitates would have allowed early cyanobacteria to survive, UV radiation would still have prevented their widespread growth.

"It is likely that early cyanobacteria would not have been as productive as they are today because of the effects of UV stress. Until the accumulation of sufficient cyanobacteria-derived oxygen allowed a more permanent means of protection to develop, such as an ozone layer, UV stress may have played an even more important role in shaping the structure of the earliest ecosystems," explained Mloszewska.

These new findings are helping researchers to understand not only how early cyanobacteria were affected by the high level of radiation on the early Earth but also the environmental dynamics that affected the oxygenation history of our atmosphere.

"These findings could also be used as a case study to help us understand the potential for the emergence of life on other planets that are affected by elevated UV radiation levels, for example Earth-sized rocky planets within the habitable zones of nearby M-dwarf star systems like TRAPPIST-1, Proxima Centauri, LHS 1140 and Ross 128 among others," said Mloszewska.

The research was conducted in collaboration with colleagues at the University of Tuebingen and Yale University and was supported by the National Science and Research Council of Canada, and by the NASA Alternative Earths Astrobiology Institute. The paper, "UV radiation limited the expansion of cyanobacteria in early marine photic environments" is published in Nature Communications.

Story Source: Materials provided by University of Alberta. Original written by Katie Willis. Note: Content may be edited for style and length.

Journal Reference: Aleksandra M. Mloszewska, Devon B. Cole, Noah J. Planavsky, Andreas Kappler, Denise S. Whitford, George W. Owttrim, Kurt. O Konhauser. UV radiation limited the expansion of cyanobacteria in early marine photic environments. Nature Communications, 2018; 9 (1) DOI: 10.1038/s41467-018-05520-x

University of Alberta. "Iron-silica particles unlock part of the mystery of Earth's oxygenation: The original sunscreen:mParticles in ancient seawater helped cyanobacteria to oxygenate Earth's oceans billions of years ago." ScienceDaily. ScienceDaily, 7 August 2018.

www.sciencedaily.com/releases/2018/08/180807103659.htm.

Scientists trace atmospheric rise in CO2 during deglaciation to deep Pacific Ocean

Long before humans started injecting carbon dioxide into the atmosphere by burning fossil fuels like oil, gas, and coal, the level of atmospheric CO2 rose significantly as the Earth came out of its last ice age. Many scientists have long suspected that the source of that carbon was from the deep sea.

But researchers haven't been able to document just how the carbon made it out of the ocean and into the atmosphere. It has remained one of the most important mysteries of science.

A new study, published today in the journal Nature Geoscience, provides some of the most compelling evidence for how it happened -- a "flushing" of the deep Pacific Ocean caused by the acceleration of water circulation patterns that begin around Antarctica.

The concern, researchers say, is that it could happen again, potentially magnifying and accelerating human-caused climate change.

"The Pacific Ocean is big and you can store a lot of stuff down there -- it's kind of like Grandma's root cellar -- stuff accumulates there and sometimes doesn't get cleaned out," said Alan Mix, an Oregon State University oceanographer and co-author on the study. "We've known that CO2 in the atmosphere went up and down in the past, we know that it was part of big climate changes, and we thought it came out of the deep ocean.

"But it has not been clear how the carbon actually got out of the ocean to cause the CO2 rise."

Lead author Jianghui Du, a doctoral student in oceanography at Oregon State, said there is a circulation pattern in the Pacific that begins with water around Antarctica sinking and moving northward at great depth a few miles below the surface. It continues all the way to Alaska, where it rises, turns back southward, and flows back to Antarctica where it mixes back up to the sea surface.

It takes a long time for the water's round trip journey in the abyss -- almost 1,000 years, Du said. Along with the rest of the OSU team, Du found that flow slowed down during glacial maximums but sped up during deglaciation, as the Earth warmed. This faster flow flushed the carbon from the deep Pacific Ocean -- "cleaning out Grandma's root cellar" -- and brought the CO2 to the surface near Antarctica. There it was released into the atmosphere.

"It happened roughly in two steps during the last deglaciation -- an initial phase from 18,000 to 15,000 years ago, when CO2 rose by about 50 parts per million, and a second pulse later added another 30 parts per million," Du said. That total is just a bit less than the amount CO2 has risen since the industrial revolution. So the ocean can be a powerful source of carbon.

Brian Haley, also an Oregon State University oceanographer and co-author on the study, noted that carbon is always falling down into the deep ocean. Up near the surface, plankton grow, but when they die they sink and decompose. That is a biological pump that is always sending carbon to the bottom. "The slower the circulation," Haley said, "the more time the water spends down there, and carbon can build up."

Du said that during a glacial maximum, the water slows down and accumulates lots of carbon. "When the Earth began warming, the water movement sped up by about a factor of three," he noted, "and that carbon came back to the surface."

The key to the researchers' discovery is the analysis of neodymium isotopes in North Pacific sediment cores. Haley noted that the isotopes are "like a return address label on a letter from the deep ocean." When the ratio of isotope 143 to 144 is higher in the sediments, the water movement during that period was slower. When water movement speeds up during warming events, the ratio of neodymium isotopes reflects that too.

"This finding that the deep circulation sped up is the smoking gun in this mystery story about how CO2 got out to the deep sea," Mix said. "We now know how it happened, and the deep Pacific is the culprit -- a partner in crime with Antarctica."

What concerns the researchers is that it could happen again as the climate continues to warm.

"We don't know that the circulation will speed up and bring that carbon to the surface, but it seems like a reasonable thing to think about," Du said. "Our evidence that this actually happened in the past will help the people who run climate models figure out whether it is a real risk for the future."

The researchers say their findings should be considered from a policy perspective.

"So far the ocean has absorbed about a third of the total carbon emitted from fossil fuels," Mix said. "That has helped slow down warming. The Paris Climate Agreement has set goals of containing warming to 1.5 to 2 degrees (Celsius) and we know pretty well how much carbon can be released to the atmosphere while keeping to that level.

"But if the ocean stops absorbing the excess CO2, and instead releases more from the deep sea, that spells trouble. Ocean release would subtract from our remaining emissions budget and that means we're going to have to get our emissions down a heck of a lot faster. We need to figure out how much."

The authors are from College of Earth, Ocean, and Atmospheric Sciences at Oregon State, and from United States Geological Survey. The study was supported by the National Science Foundation.

Story Source:

Materials provided by Oregon State University. Note: Content may be edited for style and length.

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Journal Reference:

1. Jianghui Du, Brian A. Haley, Alan C. Mix, Maureen H. Walczak, Summer K. Praetorius. Flushing of the deep Pacific Ocean and the deglacial rise of atmospheric CO2 concentrations. Nature Geoscience, 2018; DOI: 10.1038/s41561-018-0205-6

Oregon State University. "Scientists trace atmospheric rise in CO2 during deglaciation to deep Pacific Ocean." ScienceDaily. ScienceDaily, 13 August 2018. <www.sciencedaily.com/releases/2018/08/180813113338.htm>.

Napoleon's defeat at Waterloo caused in part by Indonesian volcanic eruption

Electrically charged volcanic ash short-circuited Earth's atmosphere in 1815, causing global poor weather and Napoleon's defeat, says new research.

Historians know that rainy and muddy conditions helped the Allied army defeat the French Emperor Napoleon Bonaparte at the Battle of Waterloo. The June 1815 event changed the course of European history.

Two months prior, a volcano named Mount Tambora erupted on the Indonesian island of Sumbawa, killing 100,000 people and plunging the Earth into a 'year without a summer' in 1816.

Now, Dr Matthew Genge from Imperial College London has discovered that electrified volcanic ash from eruptions can 'short-circuit' the electrical current of the ionosphere -- the upper level of the atmosphere that is responsible for cloud formation.

The findings, published today in Geology, could confirm the suggested link between the eruption and Napoleon's defeat.

Dr Genge, from Imperial's Department of Earth Science and Engineering, suggests that the Tambora eruption short-circuited the ionosphere, ultimately leading to a pulse of cloud formation. This brought heavy rain across Europe that contributed to Napoleon Bonaparte's defeat.

The paper shows that eruptions can hurl ash much higher than previously thought into the atmosphere -- up to 100 kilometres above ground.

Dr Genge said: "Previously, geologists thought that volcanic ash gets trapped in the lower atmosphere, because volcanic plumes rise buoyantly. My research, however, shows that ash can be shot into the upper atmosphere by electrical forces."

A series of experiments showed that that electrostatic forces could lift ash far higher than by buoyancy alone. Dr

Genge created a model to calculate how far charged volcanic ash could levitate, and found that particles smaller than 0.2 millionths of a metre in diameter could reach the ionosphere during large eruptions.

He said: "Volcanic plumes and ash both can have negative electrical charges and thus the plume repels the ash, propelling it high in the atmosphere. The effect works very much like the way two magnets are pushed away from each other if their poles match."

The experimental results are consistent with historical records from other eruptions.

Weather records are sparse for 1815, so to test his theory, Dr Genge examined weather records following the 1883 eruption of another Indonesian volcano, Krakatau.

The data showed lower average temperatures and reduced rainfall almost immediately after the eruption began, and global rainfall was lower during the eruption than either period before or after.

He also found reports of ionosphere disturbance after the 1991 eruption of Mount Pinatubo, Philippines, which could have been caused by charged ash in the ionosphere from the volcano plume.

In addition, a special cloud type appeared more frequently than usual following the Krakatau eruption. Noctilucent clouds are rare and luminous, and form in the ionosphere. Dr Genge suggests these clouds therefore provide evidence for the electrostatic levitation of ash from large volcanic eruptions.

Dr Genge said: "Victor Hugo in the novel Les Miserables said of the Battle of Waterloo: 'an unseasonably clouded sky sufficed to bring about the collapse of a World.' Now we are a step closer to understanding Tambora's part in the Battle from half a world away."

Story Source:

Materials provided by Imperial College London. Original written by Caroline Brogan. Note: Content may be edited for style and length.

Journal Reference:

1. Matthew J. Genge. Electrostatic levitation of volcanic ash into the ionosphere and its abrupt effect on climate. Geology, 2018; DOI: 10.1130/G45092.1

Imperial College London. "Napoleon's defeat at Waterloo caused in part by Indonesian volcanic eruption." ScienceDaily. ScienceDaily, 22 August 2018. <www.sciencedaily.com/releases/2018/08/180822101037.htm>.

Meteorite bombardment likely to have created the Earth's oldest rocks

Scientists have found that 4.02-billion-year-old silica-rich felsic rocks from the Acasta River, Canada -- the oldest rock formation known on Earth -- probably formed at high temperatures and at a surprisingly shallow depth of the planet's nascent crust. The high temperatures needed to melt the shallow crust were likely caused by a meteorite bombardment around half a billion years after the planet formed. This melted the iron-rich crust and formed the granites we see today. These results are presented for the first time at the Goldschmidt conference in Boston (14 August), following publication in the peer-reviewed journal Nature Geoscience.

The felsic rocks (rocks rich in silica/quartz) found at the Acasta River in Canada, are the Earth's oldest rocks, although there are older mineral crystals*. Scientists have long known that the Acasta rocks are different to the majority of felsic rocks we see today, such as the granites widely used as a building or decorative material. Now a group of scientists from Australia and China have modelled the formation of the oldest Acasta felsic rocks and found that they could only have been formed at low pressures and very high temperatures.

Scientists believe that the primitive crust largely comprised dark, silica-poor mafic rocks, so there has been a question over how the Acasta River felsic rocks could have formed.

"Our modelling shows that the Acasta River rocks derived from the melting of pre-existing iron-rich basaltic rock, which formed the uppermost layers of crust on the primitive Earth," said team leader Tim Johnson, from Curtin University, Perth.

"We used phase equilibria and trace element modelling to show that the Acasta River rocks were produced by partial melting of the original mafic rocks at very low pressures. It would have needed something special to produce the 900°C temperatures needed to generate these early felsic rocks at such low pressures, and that probably means a drastic event, most likely the intense heating caused by meteorite bombardment.

We estimate that rocks within the uppermost 3km of mafic crust would have been melted in producing the rocks we see today. We think that these ancient felsic rocks would have been very common, but the passage of 4 billion years, and the development of plate tectonics, means that almost nothing remains.

We believe that these rocks may be the only surviving remnants of a barrage of extraterrestial impacts which characterized the first 600 million years of Earth History."

The Acasta River is part of the Slave Craton formation in Northern Canada, north of Yellowknife and the Great Slave Lake. The area is the homeland of the Tlicho people, which led to the geologists who discovered the rocks giving them the name "Idiwhaa," derived from the Tlicho word for ancient.

Commenting, Dr Balz Kamber (Trinity College Dublin) said: "The idea of making felsic melts by large or giant impacts seems plausible considering the high-energy nature of these events and the pockmarked ancient surfaces of other inner Solar System planets and moons. However, the implied pressure-temperature regime might also permit melting of shallow crust below a super-heated impact melt sea. In other words, an indirect consequence of the impact itself."

* Rocks from Jack Hills in Australia contain zircon crystals from up to 4.4 billion years ago, embedded in younger rocks.

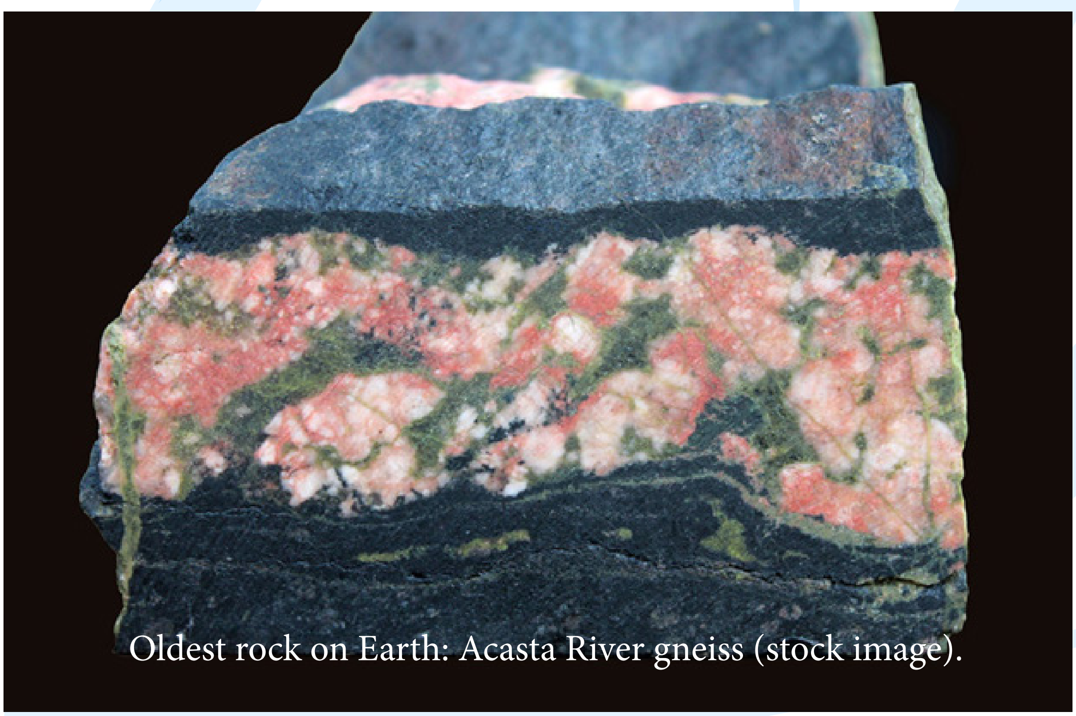
Story Source:

Materials provided by Goldschmidt Conference. Note: Content may be edited for style and length.

Journal Reference:

Tim E. Johnson, Nicholas J. Gardiner, Katarina Miljković, Christopher J. Spencer, Christopher L. Kirkland, Phil A. Bland, Hugh Smithies. An impact melt origin for Earth's oldest known evolved rocks. Nature Geoscience, 2018; DOI: 10.1038/s41561-018-0206-5

Goldschmidt Conference. "Meteorite bombardment likely to have created the Earth's oldest rocks." ScienceDaily. ScienceDaily, 14 August 2018. <www.sciencedaily.com/releases/2018/08/180813113334.htm>.



Oldest rock on Earth: Acasta River gneiss (stock image).

NASA Scientists Discover Unexpected Mineral on Mars

Scientists have discovered an unexpected mineral in a rock sample at Gale Crater on Mars, a finding that may alter our understanding of how the planet evolved.

Looking Up at Mars Rover Curiosity in 'Buckskin' Selfie – This low-angle self-portrait of NASA's Curiosity Mars rover shows the vehicle at the site from which it reached down to drill into a rock target called "Buckskin." Bright powder from that July 30, 2015, drilling is visible in the foreground. Credit: NASA/JPL-Caltech/MSSS

NASA's Mars Science Laboratory rover, Curiosity, has been exploring sedimentary rocks within Gale Crater since landing in August 2012. In July 2015, on Sol 1060 (the number of Martian days since landing), the rover collected powder drilled from rock at a location named "Buckskin." Analyzing data from an X-ray diffraction instrument on the rover that identifies minerals, scientists detected significant amounts of a silica mineral called tridymite.

This detection was a surprise to the scientists, because tridymite is generally associated with silicic volcanism, which is known on Earth but was not thought to be important or even present on Mars.

The discovery of tridymite might induce scientists to rethink the volcanic history of Mars, suggesting that the planet once had explosive volcanoes that led to the presence of the mineral.

Scientists in the Astromaterials Research and Exploration Science (ARES) Division at NASA's Johnson Space Center in Houston led the study. A paper on the team's findings has been published in the Proceedings of the National Academy of Sciences.

"On Earth, tridymite is formed at high temperatures in an explosive process called silicic volcanism. Mount St. Helens, the active volcano in Washington State, and the Satsuma-Iwojima volcano in Japan are examples of such volcanoes. The combination of high silica content and extremely high temperatures in the volcanoes creates tridymite," said Richard Morris, NASA planetary scientist at Johnson and lead author of the paper. "The tridymite was incorporated into 'Lake Gale' mudstone at Buckskin as sediment from erosion of silicic volcanic rocks."

The paper also will stimulate scientists to re-examine the way tridymite forms. The authors examined terrestrial evidence that tridymite could form at low temperatures from geologically reasonable processes and not imply silicic volcanism. They found none. Researchers will need to look for ways that it could form at lower temperatures.

"I always tell fellow planetary scientists to expect the unexpected on Mars," said Doug Ming, ARES chief scientist at Johnson and co-author of the paper. "The discovery of tridymite was completely unexpected. This discovery now begs the question of whether Mars experienced a much more violent and explosive volcanic history during the early evolution of the planet than previously thought."

To view the paper, go to: http://www.pnas.org/content/early/2016/06/07/1607098113.full

To learn more about the ARES Division, go to:

http://ares.jsc.nasa.gov/aboutares/index.cfm

NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, California, built the rover and manages the Curiosity mission for NASA's Science Mission Directorate, Washington. For more about Curiosity, visit: http://mars.nasa.gov/msl/

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 2018 issues of the American Mineralogist: Journal of Earth and Planetary Materials.

http://www.minsocam.org

The future of Mineralogy

On page 1173 of the August issue, Nobuyoshi Miyajima gives an overview of advances in electron channeling spectroscopy from TEM. The key data from the technique are site occupancies, especially in minerals that are texturally complex, as illustrated in the subject article, Igami et al. (2018). This is an effectively untapped area of rock-forming minerals, and perhaps it is only the technical challenge that prevents the technique from being more widely used. The level of precision in our modeling efforts, from phase transitions to thermometry or hygrometry could potentially increase by orders of magnitude if we better understood intra-crystalline partitioning in natural and experimental systems. And when we greatly increase precision in measuring –- well, pretty much anything –- we often discover very new and exciting things.

Transporting H2Or across the Transition Zone

On page 1221 of the August issue, Kakizawa et al. present new experiments on the stability of superhydrous phase B at mantle transition zone P-T conditions. They find that up to 1600oC, Al2O3 and H2O contents in superhydrous phase B increase, at the expense of MgO and SiO2, but above such temperatures, MgO and Al2O3 increase at the expense of SiO2 and H2O. The authors suggest that Al contents are a key factor in affecting the stability of superhydrous phase B, and it may be stable more so within Al-rich subducted crust rather than peridotite, perhaps providing a mechanism for keeping H2O dissolved within crystalline phases during subduction.

Where did all the Beryllium come from?

On page 1228 of the August issue, Dailey et al. examine the petrology and geochemistry of the extraordinarily Be-rich rhyolites of Spor Mountian, western Utah. They find that the host rhyolitic magmas erupted at relatively low temperatures of 682-718oC and that these low-T conditions were accompanied by high F and elevated water that depolymerized the melt. In concert, these conditions led to especially low mineral/melt partition coefficients for a range of trace elements, including Be. The authors posit that mafic magmas mixed with a 25% partial melt of ambient crust, that the product magma was later 75% crystallized -- and that later hydrothermal alteration would complete the Be-enrichment process.

A New Age For the Inner Core

On page 1271 of the August issue, Gomi et al. examine equations of state for FeHx compounds that are thought to represent the mechanisms by which H is incorporated into the solid core. They find that both magnetism and the solution of H into the core affect electrical resistivity and thermal conductivity. From the latter, and using phase solution models in the Fe-Si-H system to estimate temperatures of the inner core/outer core and core/mantle boundaries, they calculate that for a core. For a core of composition Fe1-ySiyHx, the inner core age is between 0.49 and 0.86 Ga, as H contents respectively vary from x = 0 to x = 0.7.

Highlights & Breakthroughs

On page 1009 of the July issue, Konstantinos Demadis provides an overview of Wysokowski et al. (on page 665 of the May issue). The contribution is as much as anything, a look forward, posing fascinating and still unanswered questions about biominerals. For example, biosilicifiers are not uncommon, and yet why is it that some organisms choose (let alone are even able) to concentrate molecules that occur at remarkably low concentrations? And how are they able to do so at efficiencies that exceed anything we have created in the lab?

Fe-oxide reaction controls on groundwater contaminants

On page 1021 of the July issue, Voelz et al. examine the surface area-normalized reactivities of hematite as iron (II) bound on the mineral surface reacts with fluids containing chloronitrobenzene, a model for several pollutant classes like pesticides, dyes, and munitions. Their experiments indicate that reactive sites on hematite change as a function time, pH, and extent of reaction. Additionally, reaction conditions influence whether the concurrent oxidative mineral growth results in hematite particle growth, nucleation of goethite on the hematite mineral surface, or a mix of both. These factors must be quantitatively modeled to understand the fate of contaminants in Fe-oxide bearing groundwater systems.

New Minerals, Anyone?

On page 1080 of the July issue, Liu et al. present the latest installment of predictions of mineral diversity, in this case involving V as an essential structural constituent. Applying the novel Large Number of Rare Events model, the authors suggest that Earth's crust should contain 307±30 vanadium minerals, and hence that 88 species are yet to be discovered, most of which are expected to have formed in sedimentary or hydrothermal environments, rather than in high T igneous or metamorphic systems. The Editors anxiously await manuscripts from mineralogists specializing in new mineral discoveries that test the hypothesis.

Limits on Si in the Core

On page 1161 of the July issue, Helffrich et al. (in an Open Access paper) examine the simultaneous solubility of both O and Si in Earth's core. They illustrate how O and Si solubilities are negatively correlated, at least at the pressure-temperature conditions of core formation, and find that Si in the core must fall between 0.4 and 3.1 wt%. They also show how their analysis of core-derived Si affect estimates of core Si isotope ratios, which could be constrained, might be used to detect core-mantle interaction in the highly uncertain (and unlikely?) case that the bulk Earth is chondritic, if carbonaceous chondrites represent bulk Earth Si isotopically.

Crystallography on Mars

On page 837 of this issue, Michael Velbel provides an overview (in a Highlights and Breakthrough paper) of two papers that appear in this issue, Morrison et al. (2018) on pages 848 and 857 of this issue. It will be no surprise to readers of this journal that analyses of crystal structures would be an essential component to the exploration of a new planet; Morrison et al. present the results of such, making use of the CheMin XRD on the Mars rover, Curiosity. Their crystallographic data and unit-cell calibrations are revising our understanding of mineral compositions on the Martian surface, with the potential of adding much precision to ideas of Martian sedimentary provenance, stratigraphy, diagenesis, and ultimate magmatic origin of individual mineral grains.

You can Rely on Al in Qz

On page 839 of this issue, Tailby et al present new experimental results that show very slow diffusion rates of Al in quartz—slow enough that Al contents obtained during crystal growth will be almost invariably preserved above the tens-of-micrometers scale, irrespective of time. Diffusivities of Ti are similarly low, which means that zoning patterns of either element are quite likely to preserve the conditions of crystallization. If these elements preserve temperatures and cooling rates, they might also allow us to estimate crystal growth rates for quartz in natural systems, perhaps with a precision that is lacking for other minerals.

Mineral Chemistry from Crystallography

On page 848 of this issue, Morrison et al. present sets of equations that provide stunningly precise estimates of mineral compositions as calculated from X-ray diffraction data. As noted in Velbel's Highlights and Breakthroughs article (p. 837, see above), this work was an important step in adding considerable precision to estimates of mineral compositions on Mars. But of course, there is nothing special about a martian origin, and these equations can and should be applied to terrestrial systems as well. This study may allow for much more cost-effective estimates of rock-forming mineral compositions compared to use of the electron microprobe, with the added benefit of having crystallographic information in the process.

A One-Mineral Tour of Arc Magmatism

On page 899 of this issue, Tecchiato et al. use the major and trace element contents and isotope ratios of clinopyroxene to trace magmatic transport and storage at the Capo Maragiu Volcanic District in Sardinia. The authors identify three types of clinopyroxenes, based on texture and composition, that track magma compositional evolution from Mg#(liq) 70 to Mg#(liq) 40. Especially intriguing are isotopic patterns with respect to Cpx Mg#, which allow the authors to show that, at least in this system, only the most mafic magmas are affected by assimilation of crustal components and that extensive and subsequent cooling and crystallization occurs as nearly a closed system.

Accelerating Supereruptions

On page 952 of this issue, Myers et al. obtain ascent rates for three different supereruptions from measurements of H2O and CO2 in re-entrants (melt inclusions that connect to enclosing glass) in quartz. Their case studies are from eastern California (Bishop Tuff), Yellowstone (Huckleberry Ridge Tuff), and New Zealand (Oruanui), and the ascent rates vary from 0.06 to 13 m/s with the lowest rates correlating to field relationships that indicate pauses in eruptive output. They find lower re-entrant H2O and CO2 contents compared to that of melt inclusions and model the contrasts as representing an accelerating of the magma during decompression, as magmas migrate from a storage chamber to an active conduit (on the order of hours to days).

Eckermannite replaces Glaucophane at High P

On page 989 of this issue, Howe et al. present the results of new experiments that indicate that above 40 kbar, glaucophane is likely to breakdown into an amphibole that is a solid solution mix of eckermannite (80%) + ktaophorite (15%) + Mg-winchite (5%). The authors show at least two different pathways by which the new amphibole may be formed, the most likely of which may involve the breakdown of jadeite + talc, with the consequent production of eckermannite, pyrope, coesite, and water. Because of the high Na/Al ratio of eckermannite, this phase is possibly stable in any system where jadeite and talc occur as precursors and should replace glaucophane in metabasite systems above 40 kbar.

High-Pressure Humites

On page 1002 of this issue, Luoni et al. make use of thermodynamic models and recent experiments to quantify the otherwise ultra-high pressure (UHP) metamorphic paths of humite-bearing serpentinites. In the process, the authors show that UHP metamorphism in the western Alps was both polybaric and diachronous. This would appear to require a "mosaic of tectonometamorphic units" that accreted over a range of depths and times and suggests that similarly dismembered ophiolites in other parts of the globe may represent composites of multiple slices of lithosphere, rather than coherent lithospheric sections.

Useful Mineral Links:

AFMS	American Federation of Mineralogical Societies (AFMS)	www.amfed.org
EASTERN FEDERATION MINERALOGICAL & LAPIDARY SOC'S, INC.	Eastern Federation of Mineralogical and Lapidary Societies (EFMLS)	www.amfed.org/efmls
mindat.org	MINDAT	www.mindat.org
MINERALOGICAL SOCIETY of AMERICA 1916 2016 American Mineralogist Centennial	Mineralogical Society of America (MSA)	www.minoscam.org
FRIENDS OF MINERALOGY	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)	scovilphotography.com/
USGS science for a changing world	United States Geological Survey (USGS)	www.usgs.gov
The Geological Society of Washington founded 1893	The Geological Society of Washington (GSW)	http://www.gswweb.org/

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

October

19-21: 62nd Annual Desautels Micromount Symposium, The Friends School of Baltimore, 5114 North Charles St; Baltimore, MD 21210. Info: www.baltimoremineralsociety.org/desautels-symposium.html

Registration: BMS, PO Box 302; Glyndon, MD 21071.

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

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