



*The Mineralogical Society of the
District of Columbia*



THE MINERAL MINUTES

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- December's Meeting is Saturday, 10 December. We will be meeting at Susan and Ed Fischer's house for our Holiday Party.

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Prez Says...

By David Nanney,
MSDC President



I hope everyone had a wonderful Thanksgiving holiday. Leslie and I got to pick up our almost seven year old granddaughter in Seattle, fly with her to Los Angeles for three days in Disneyland. We then land at our daughter's house in LA for Thanksgiving dinner before returning to Seattle. We are completely in awe of just how much a first grader knows, and how much fun (and tiring) it can be to share their lives. We did experience a rare event for LA - it rained.... Won't say people were dancing in the streets, but it definitely rained. Really good napping weather.

I want to take a minute to thank everyone for your support and interest during 2016. I was very uncomfortable becoming the president of MSDC while we have so many much more mineralogically knowledgeable people in our club. You have certainly enjoyed a great year of programs thanks to Dave Hennessey, our intrepid VP. The newsletter has been outstanding, and is growing as Steve Johnson, past

November Program – “Holiday Party at the Fisher’s – including Election”

Presented by Susan and Ed Fisher

The Fishers are hosting the club's annual party on 10 December 2016, starting at 7 p.m. All members and their families are invited to attend. Please RSVP to Susan and Ed by 1 December via email: novaya2@cox.net. Those willing to help with the preparations or post-party clean up can contact Susan at the same email address. Flyers will be distributed electronically as well indicating driving directions. Their address is 14981 Gold Post Ct.,

President and Newsletter Editor, gets more and more engaged in new themes. Thanks to Betty Thompson and Casper Voogt for our website, recently in recovery. Thanks also to Andy Thompson, our secretary, who has the incredible ability to take chaos and make it sound organized. Ed and Susan Fisher have done the heavy lifting this year, bringing the projector to every meeting so we can enjoy these programs. And finally thanks to everyone who comes to our meetings, bringing treasures to show (Ken, Steve), or simply bringing your interest and friendship. We had a great year which, as I wipe my forehead in relief, will only have to be better next year, our 75th anniversary.

Details for the Christmas party will be listed elsewhere in the newsletter. I want to thank the Fisher's in advance for being willing to allow the MSDC hoard to descend on their home for our Holiday party on 10 December. Celebrating with friends makes the season fun, but celebrating in the location of a world class mineral collection, with friends, that's simply a mineral club nirvana. Please join us. And please offer to help with whatever the Fisher's ask to make this as easy on them as possible.

A final reminder that we will NOT host a meeting in December as it will be replaced by our Christmas Party. See you on the 10th!

Centreville, VA 20121. Parking is available at the entrance to their cul-de-sac, near the basketball standard. Then walk the short distance to their house.

In addition to the party, members will have an opportunity to see Susan's fine collection. I was drooling over some of her stibnites the last time I was there. In addition to all the frivolity and merry-making, we will also be conducting elections for next year's slate of officers, presenting scholarship money to one of Dr. Tollo's GWU students to support their research efforts and we will also be making our annual

donation to the Smithsonian Institute. Hope to see everyone there.

Directions from beltway in Virginia:

Take I-66 WEST for 12 miles past the beltway. Take EXIT 52 onto US 29. RIGHT at bottom of ramp. Go one mile (through two traffic lights after the one at the bottom of the ramp). Cross Cub Run (a stream). Halfway up the hill from Cub Run, there's a left-turn lane (but no

traffic light). Get into that left-turn lane. Turn left onto **WHITE POST ROAD** into Gate Post Estates. Second left (.4 mile) to **GOLD POST COURT**. If possible, please park on the circle and walk back to the final house on the pipe stem (14981). There will be a lighted snow flake in tree in yard. If you have problems, please call Ed at 703-830-9733 or cell phone 703-209-6121.

Business Meeting Report November 2016

Andy Thompson, Secretary

President David Nanney welcomed and thanked everyone for coming to the November meeting, especially Susan and Ed Fisher who have been so generous in bringing their projection equipment. He also expressed appreciation to the club's past presidents in attendance.

Geology in the News – Members cited three events, the first being the recent earth quakes in central Italy which destroyed several towns. The second was an article in the Washington Post (2 Nov 2016, A2) which described planetary physicists' reinterpretation of the moon-earth collision which took place 4.5 billion years ago. The article said the previously widely held giant impact theory did not adequately address the problems of accounting for the similar chemistry of the earth and moon, nor did it explain why the moon did not revolve about the earth's equator. The scientists' new theory suggests not a glancing but a direct impact which provides a better account of those unresolved issues.

Dave also called attention to a third news event, the discovery of a previously unknown mineral, Merelaniite, discovered by Robert Simonoff, a friend, a former full time member,

and sometimes current visitor or presenter at our monthly meetings. He brought his unusual specimen to the S.I. Mineral Department's Dr. Mike Wise who in turn worked with an international team of geologists to authenticate the mineral composition of this new find. Congratulations to Bob for his sleuth expertise. The mineral was named for the nearby town of Merelani, near the Lelatema Mountains, and the Simanjiro District of Tanzania. For more information see the article in Minerals, 2016: <http://www.mdpi.com/2075-163X/6/4/115>.

Local Mineral Show – MSDC member Bob Cooke, President of the Northern Virginia Mineral Club encouraged everyone to come to his club's annual mineral show held at the George Mason University campus on November 19 and 20.

MSDC Holiday Party – Susan Fisher announced that the Fishers were hosting the club's annual party on 10 December 2016, starting at 7 p.m. She invited all members and their families to attend and asked all to reply by 1 December via email: novaya2@cox.net. Those willing to help with the preparations or post-party clean up can contact Susan as above. She distributed flyers indicating driving directions will be emailed to all members and guests. Their address is 14981 Gold Post Ct., Centreville, VA 20121. Parking is available at the entrance to

their cul-de-sac, near the basketball standard. Then walk the short distance to their house.

Volunteer Recruitment for Club's Monthly Snack Brigade – Dave Nanney announced a new approach to soliciting volunteers to bring goodies for our monthly post-program socializing. Rather than lean on the group until three volunteers agree to take responsibility for bringing food, Dave will now put a sign-up sheet on the back counter. If that does not work, he said the group could fall back to having a slimmed-down and simple menu of cookies and drinks. This new approach began at the November for signing up folks for the January 2017 meeting.

Dave thanked Steve Johnson for his particularly fine editing of the November Mineral Minutes.

Dave informed the attendees that the club's board of directors, at their 20 October meeting,

November Program Synopsis: “Some History and Minerals of Franklin and Sterling Hill, New Jersey”

Presented by Mark Dahlman
Synopsis by Andy Thompson, Secretary

Mark Dahlman, well known and respected by Washington, DC area mineral collectors, is highly qualified to speak on this topic given his interest in and collecting at this site. He currently also serves as President of the Franklin-Ogdensburg Mineralogical Society (FOMS) and as a director of the Franklin Mineral Museum. For tonight's presentation, he supplemented his personal knowledge with a collection of historical photos of the mine sites, and drawings of the mine's east and west veins and shafts. The photos of the diverse fluorescent minerals were spectacular. Mark thanked Dr. Earl Verbeek, the resident curator at the Franklin Mineral Museum, for kindly sharing these materials

voted to continue contributing funds to the Smithsonian's Dept. of Mineralogy as well as to an undergraduate geology student at George Washington University. Accordingly a proposal was made and seconded and attendees approved the board's decision. The group also approved the board's decision to underwrite a small amount of funds to pay for some of the expenses of the 10 December Holiday Party.

With the discussion of the business of the MSDC Society concluded, Dave called for and received a motion to close the business meeting. It was seconded and unanimously approved. So the President then requested our V.P. for Programs, Dave Hennessey, to introduce the evening's presenter, Mark Dahlman.

The Sterling Hill and Franklin mining area has been renowned throughout the world for collecting fluorescent minerals. Of those attending the evening's presentation, eight had visited and collected there. Mark began by providing some historical background, starting with the 17th century Dutch efforts to mine for copper. At that time, mineral identification was not yet an exact science. For many decades, the earlier miners, seeking copper for commercial use, without knowing the difference, mistakenly mined zinc ore instead. Consistent with this mineral confusion, legal difficulties soon followed.

The legal confusion originated in part because several small mining companies were given the right to mine for one of several minerals as though they weren't intermixed. For example, one company was authorized to mine franklinite (a zinc-iron-oxide) and a second company was permitted to mine for zincite (a zinc oxide). This arrangement would have worked if the minerals were located in separate and distinct veins. However, because they intimately intermixed

throughout the Franklin and Sterling Hill deposits, the confusion persisted.

Sterling Hill, one of the oldest productive mines in the nation, finally found a resolution of this problem through the Sussex County 1897 court decision that set a precedent for subsequent U.S. mining law. The courts encouraged the feuding mining companies to merge into one company, thereby settling the issue.

For today's mineral collectors, whenever possible, it is important to correctly identify the source of the mineral. Mark cautioned collectors not to take literally the source designations they find on the labels of minerals for sale. He referred in particular to some minerals collected from the separate locations within the Franklin mine. He gave as an example that a mineral specimen may be labeled as having been originally collected from the Parker Shaft. But actually, he said, these minerals often have come from other areas of the Franklin mine and were simply evacuated from underground via the Parker Shaft. This awareness has practical implications. It speaks not only to the correct identification of the minerals' site of origin, but also, if you as a collector at the site know what minerals you can expect from a particular tailings pile, you have a better chance of successfully finding them. Important examples are the expensive and highly sought roebblingite, margarosanite and lead siliconite minerals. Despite their being excavated through the Parker shaft, they actually originated near the Palmer mine.

So why is this Franklin and Sterling Hill mining area so unique, having more than 365 distinct minerals and 99 being known fluorescent species? Mark explained that about 1.3 billion years ago, the continental and oceanic plates crashed together with the latter subducting beneath the former. That caused heating and melting of the more dense oceanic plate minerals which subsequently rose through the crust via hydrothermal fluids and were deposited into a surface-level cooler body of water named a back-arc basin. The recurring plate movements

resulted in multiple folding and concentration of the metallic-laden and non-metallic layers of minerals, resulting in a rich mélange heavy in zinc, iron and manganese which delights today's collectors. The manganese in particular is responsible for producing fluorescence and so has helped make this mining area world famous.

Mark's stated primary focus for the presentation was discussion of the ore minerals. But throughout the evening's presentation, he described the mineral content of the site by speaking alternatively, like the layered mine site itself, of the metallic and then the non-metallic minerals. So after showing photos of several of the beautiful metallic minerals, such as the franklinite (zinc-iron-oxide), spinels (magnesium-aluminum-oxide), willemite (zinc silicate), sphalerite (zinc-sulfide), tephronite (manganese-silicate) or zincite (zinc-oxide), he mixed in pictures of non-metals such as the many forms of calcium carbonate, calcite and limestone. Often the photos of the minerals, taken with ultraviolet light, showed layering, like pieces of cake, of the metallic and non-metallic minerals sandwiched within one rock. Of all these minerals, he said his favorite is the "peaches and cream calcite", plain looking in sun light, which becomes a riot of diverse fluorescing colors under various ultra violet wavelengths.

In conclusion, Mark encouraged all interested persons to visit and become members of the Franklin Mineral Museum and the Sterling Hill Mining Museum, some of whose mineral displays and memorabilia he included in his presentation. Aesthetically the evening's program was an extraordinarily beautiful presentation of fluorescent minerals. Dave Nanney and the attendees applauded Mark's thoughtful presentation and attendees expressed their appreciation for Mark having marshalled so much interesting historical and present day mineralogical information pertaining to this unique area.

Dave then asked Ken Reynolds to do a short show-and-tell of his display of about 20 rocks which fluoresced beautifully when hit with UV

light. Similarly, Steve Johnson showed half a dozen mineral samples which included a large beautiful blue beryl (aquamarine) from Afghanistan and a large brown stalagmite from an

“In Praise of Special Tufa”

By Andy Thompson

Imagine you were a contestant representing your local club at an Eastern Federation Mineralogical Quiz Show.

Announcer: Here’s the final question for the winner-take-all finale: What little-known mineral was most responsible for the rise of the Roman Empire?

Tick tock, tick tock . . . and your answer is?

You: “Tufa”?

The buzzer sounds. The announcer says: “You were so close and on the right track. Volcanic tufa indeed made their concrete so strong that its endurance has yet to be surpassed. Just think of the Pantheon, Colosseum, aqueducts, amphitheatres, fortifications, entire cities. They have lasted for these two thousand years. But our judges ruled that ‘tufa’ technically is a rock and not a mineral. Yet, because you were so close, they recommend you be given a second chance: So listen carefully. What little known “mineral” was responsible for the rise of the Roman Empire? Tick tock, tick tock . . . and your answer is?



unknown cave. Dave then concluded the evening by encouraging people to stay and socialize around the goodies brought by Ken, John Weidner and Susan Fisher.

Let’s see. What was the name of that Scottish seaside town . . .? Tobermore? Is the mineral torbermorite?

Announcer: Yes. (Bells and whistles sound. Balloons fall from the ceiling. There is much jubilation.) You have triumphed. Congratulations. Our Tweet-O-Sphere is lighting up with questions. Our audience wants to know: How could you have possibly known about torbermorite? I agree with them. I have never heard of it.



The

Pantheon in Rome. Completed by the emperor Hadrian and probably dedicated about 126 AD, it is crowned by a coffered concrete dome with a central opening to the sky – an oculus. To this day it is the world’s largest unreinforced concrete dome.

Well, our club celebrated its 75th anniversary with members taking an arm-chair field trip to Scotland, the birthplace of so many breakthrough geological discoveries. Torbermore was

one of the towns we visited and that was where tobermorite was first identified in 1820 by Professor Heddle, one of the earliest geologists.

Announcer: But didn't the Romans know about it back in their day in order for them to put it into their concrete mix?

Well, yes, they certainly knew enough to add very fine volcanic ash they called pozzolana or porcelana or pozzolaic ash (pulvis puteolanus in Latin) which they brought from areas like Mt. Vesuvius and from quarries just outside Rome. They combined it with the quick lime, small nuggets of tufa aggregate and as little water as possible. They knew it worked and even the contemporary writer Pliny, and earlier, the architect Vitruvius, wrote about where Romans mined the particularly fine volcanic ash. But back then they did not know about the chemical elements, the calcium, silicate and hydroxide that was in the volcanic ash. And the Romans certainly did not name that mineral after the Scottish town where it was first identified in the 1820s. When they mixed in their secret pozzolana, they were in fact using what today we call tobermorite.

It was only in 2013 that the researchers at Lawrence Lab at Berkeley University identified a super-secret ingredient, aluminum, which, it turned out, was actually part of that special volcanic ash which made their underwater concrete for ports and sewage systems so incredibly strong and long-lasting. The Lawrence lab international team referred to this variation of the mineral as CASH, for its calcium, aluminum, silicate and hydroxide and named this mineral "Al-tobermorite." Regular tobermorite is called CSH, without the Al, for aluminum. So the Romans used fine ash, CSH for above ground buildings and the special ash with aluminum for underwater projects.

What is so unique about this special ash is it has an internal chemical reaction while allows it to dry and set up internally, without needing to dry in the open air which is how regular concrete dries. The CASH even dries when completely under water and is not weakened by the

surrounding water. The Romans' extensive use of the special ash is what enabled them to build magnificent sea ports throughout the Mediterranean world for transporting the food and materials needed to sustain their rapidly expanding empire. So that mineral, in both its CSH and CASH forms was a very big deal and helped build their empire.



Announcer: That's all very interesting indeed and congratulations again on your victory. Perhaps we will see you at our contest next year. And to our audience, we wish you good bye for now, happy holidays and "Keep on Collecting."

P.S. Interested readers can learn more about this recent discovery which appeared in the October 2013 issue of *American Mineralogist*. Dr. Paulo Monteiro was the lead researcher and the entire article, somewhat technical in nature, is available at:

http://www.minsocam.org/msa/ammin/toc/Abstracts/2013_Abstracts/OCT13_Abstracts/Jackson_p1669_13.pdf

A shorter and more reader friendly story describing their findings is available at: <http://news.berkeley.edu/2013/06/04/roman-concrete/>

Also of possible interest are a few short videos which tell how Rome's extraordinary concrete "changed the world":

<http://www.sciencechannel.com/tv-shows/romes-buried-secrets/> (Rome's recipe for concrete, length: 3 minutes)

MSDC Board of Directors Minutes

Submitted by Andy Thompson

Attendees: Dave and Leslie Nanney, Dave Hennessey, John Weidner, Yury Kalish, Betty and Andy Thompson and Tom Tucker. Guests: Ken Reynolds. Absent: Susan Fisher and Steve Johnson.

Prior to the meeting, President Dave Nanney solicited ideas and distributed the agenda to the Board members.

1. Goals and Objectives Review – Having called the meeting to order Dave Nanney began with the first item, namely an invitation to discuss MSDC's goals and objectives. The discussion which followed served to focus the club's purpose, especially for new board members. Board members said they felt the club differed from other local clubs in part because of the club's sharp focus on minerals (as distinct from jewelry, lapidary or bead work), strong interest in geology, emphasis on helping collectors, an openness to programs discussing in depth mineralogy, offering support for students' mineral education, links with the Smithsonian NMNH Dept. of Mineral Sciences and our unique location in DC. Yury encouraged the group to think about additional possible links with embassies, universities, government agencies, perhaps expanding beyond current links with GWU, NVCC, USGS, Carnegie Institution, all of which are local to our area and with whom we have some associations.

2. Monthly Program Review – As part of our standard review, the group discussed the solid quality of our more recent monthly programs and expressed appreciation to Dave Hennessey for lining up diverse and interesting presentations. The point was made that each member needs to help find possible speakers.

<http://www.sciencechannel.com/tv-shows/romes-buried-secrets/romes-buried-secrets-videos/what-makes-roman-concrete-so-special/>

3. Newsletter Review – Also as part of our standard review, the group discussed its pleasure with the high quality of the Mineral Minutes newsletter and thanked Steve Johnson, its editor, in absentia, for a job well done. There was a request that it would help members if it were published a bit earlier so members would have more time to read it prior to the monthly meeting. Given it is essentially electronic in nature, one suggestion was that it include more links and videos. It was noted that the slimmed – down email list now has 80 recipients of which 30 are paying club members. Those present believed there were no or very few mailed hard copies.

4. Financial Update – Included in Treasurer John Weidner's four-page report is that MSDC has sufficient cash in its checking account to handle its expenses for the next two years. In addition, it presently has a 30-day CD which is projected to allow MSDC to make contributions for several years. Beyond these funds, there currently is no other source of significant income to enable the club to make such contributions into the future. The club does own a small amount of minerals which, if successfully sold, could net a few hundred dollars. John noted there has been a significant increase in membership.

He proposed and the Board voted to authorize transferring the majority of the CD funds to seek a higher interest rate. The board members thanked John for his extraordinary work in clarifying membership and financial reports. The tax status and DC charter must be refilled every two years. He will address these needs in the spring of 2017.

Yury recommended the club promote membership and monthly attendance by using a free website which promotes meetings in the DC area. The board affirmed the merit of this

suggestion. No decision was made as to who would follow up on it. A guest asked if MSDC board members follow up with first time visitors to our monthly meeting and was assured we do follow up and perhaps this is reflected in the recent increase in club membership. Ed Fisher was widely praised for his hospitality and follow through with visitors. Ed gives the email addresses to John who also follows up.

The question was also raised about the possible value of publishing in our newsletter the club's finances. One member noted the Eastern Federation recommended its member clubs not do so because several clubs that did and then experienced negative consequences.

5. The topic of "Trends in Mineralogy" was not addressed as such. But there was a recommendation that MSDC start a trend in having more frequent board meetings.

6. Review of MSDC's Website and Facebook pages – Betty Thompson reported that thanks to Casper the website is now on a new platform. The club owes a debt of gratitude to Susan Fisher for providing a wealth of photos that will be used as the site is improved. Both sites are updated roughly every 10 days. Betty welcomes any feedback on either site. It was recommended that the monthly newsletter include information encouraging members to visit both sites. Dave Nanney asked that when possible, Alyssa review the website (and/or the FB page) and provide any suggestions that come to mind.

9. The slate of officers for 2017 will be proposed by the Election Committee and will include the continuation of current officers, with the addition of Ken Reynolds for a 3 year directorship to replace Susan Fisher who has completed her term. Yury has 2 years remaining and Leslie has one year.

10. December's grants to the S.I. Mineral Department and to a student for a 2017 research project was approved at the same level as for 2016. This topic of a student research grant and a host of related considerations will be revisited with further discussion at an upcoming board meeting in 2017.

11. By-Laws Committee plans and actions soon will be addressed down the road starting in email. Stay tuned.

12. The 2016 Holiday Party in December will take place at the home of Susan and Ed Fisher in Centreville, VA. The board expressed its profound appreciation to the Fishers for their generosity in taking on this event which will constitute the December club meeting but will be on a weekend rather than on December's first Wednesday. The board members pledged to work on the plans and arrangements, so the Fishers are not overburdened with the considerable preparations and with supplying the food and drink.

Given that the December party will be in a private home, rather than a large public venue, the board recommended MSDC invite and welcome any interested Montgomery County Club members to attend. And given the space limitations of the private home, the board agreed this holiday party, unlike last year's held in a community center, in honor of Andy Muir, would not be a combined holiday party of both entire clubs' membership

13. The 75th Anniversary – 2017 marks the MSDC's 75th anniversary of the club. MSDC was founded in 1942 and Dave Nanney emphasized the importance of honoring the members who came before us and labored to build the heritage we continue today. Discussion pursued how to best accomplish this and some of the possible options included: a) a festive event at the Smithsonian; b) with a high profile speaker, dinner; c) special guests; d) Dave Nanney's and Ed Fisher's suggestion of having a mineral auction; e) and/or having a one day conference. Members initially suggested an auction might best be accomplished at a monthly meeting.

Board members were intrigued with Yury's idea of having a conference, perhaps inviting 3 or 4 speakers and perhaps getting a large auditorium within the Natural History Museum. Dave noted that his preference was to aim for an October 2017 celebration because he believed the club was founded in October of 1942. The

consideration of a conference was new and deserves more substantial consideration. So it will be on the agenda for our first board meeting in 2017.

14. "Other topics" generated discussion of alternate approaches for members providing snacks for post-presentation socializing. There seemed to be consensus that this social time is valued and important for the club. There was some discomfort with soliciting volunteers for next month's meeting. There was some support for making it more simple, perhaps having only cookies and lemonade, vs. having the typical wide range or mix of snacks such as fruit, cheese & crackers, sausage-type meats and/or baked goods. There was also discussion of possibly making it a budget item and/or having one board member responsible for each of the club's 9 meetings per year. No definitive solution was reached.

It was decided that as an interim step, Dave Nanney will announce at the November 2nd meeting that there is a sign-up sheet for next monthly meeting, namely for January 2017, near

each meeting's refreshments, and encourage a simple cookies-and-lemonade approach

A second topic discussed was the frustration members experienced with the broken ceiling projector in the Cathy Kerby room and with continuing to burden the Fishers with their bringing their equipment. Several suggestions were proposed. It was speculated that a large LED screen might be installed which would negate the value of having a new projection system. Dave agreed to speak with Tim Rose.

Having addressed most of the items on the lengthy agenda, except for By-Laws revisions and Trends in Mineralogy, Dave Nanney called for and received a motion which was seconded to conclude the board meeting. The vote was unanimous. Dave thanked all for attending.

P.S. At the end of the evening John Weidner announced the NVCC-Annandale campus would be hosting another Thin Section lab in the January-February time-frame, and there would also be a "Kids Day" that would draw on the three local mineral clubs.

EXCLUSIVE PREVIEW: NATIONAL FOSSIL HALL WITH KIRK JOHNSON, MODERATED BY DAVID M. RUBENSTEIN



Tuesday, December 6, 2016 / 6:30 PM - 8:10 PM / Baird Auditorium, Ground Floor, National Museum of Natural History at 10th St. and Constitution Ave. N.W. Washington, DC 20013

Join the Smithsonian Institute as Kirk Johnson, paleontologist, Museum Director, and the moderator of "An Evening With..." series, takes attendees behind the scenes and explores the massive undertaking of redoing the National Fossil Hall. In a conversation with philanthropist David M. Rubenstein, Johnson will illuminate current trends in paleontology, unveil new fossil discoveries featured in the National Fossil Hall, and explore why studying the past matters as we contemplate our planet's future. Get a sneak peek at plans for the new exhibition, and learn more about the role of conserving and displaying dinosaurs at a national museum.

The SI is giving away a behind-the-scenes tour of its fossils collections at this After Hours program.

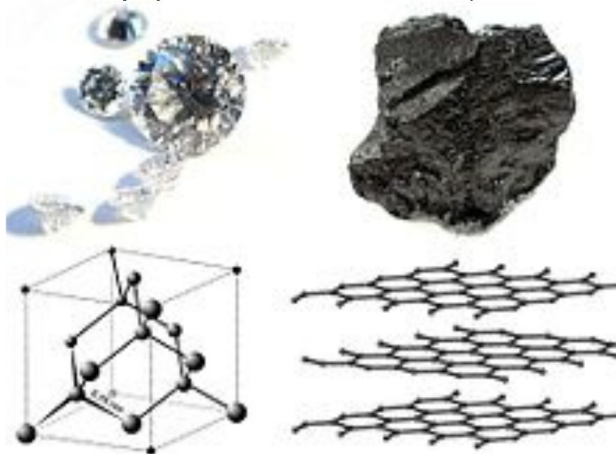
"Ancient Wyoming" will be available for purchase and signing after the program. This

evening is made possible through the generous support of David M. Rubenstein.

This program is part of the “An Evening With...” signature series featuring thought leaders

Mineral of the Month Native Carbon

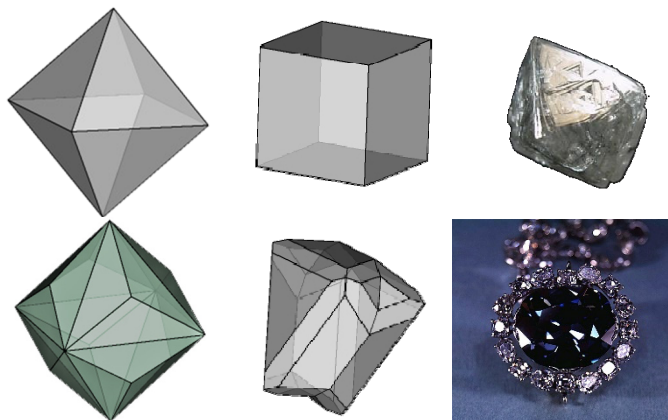
Since I have been thinking about starting a “Mineral of the Month” addition to the Mineral Minutes ever this since I began as editor, I finally am getting around to it. It took me a year, but here it is. To start things off, I’ve decided to initially cover the native elements. This month’s selection includes two minerals – Graphite and Diamond. Both are native forms of the 6th element on the periodic table – Carbon. They are the most common forms of native carbon. There are three other minerals that are native carbon – Chaoite, Fullerite, and Lonsdaleite, but they are much rarer. Over the next few months we will cover Sulfur, Gold, Silver, Copper, Tin, Lead, Tellurium, Platinum, Zinc and Arsenic. And upfront, I’m going to acknowledge that much of my information is going to come from either Wikipedia or from Mindat.org (a great website if you have any questions about minerals).



Diamond and graphite are two allotropes of carbon: pure forms of the same element that differ in structure.

in conversation with paleontologist and Sant Director of the National Museum of Natural History, Kirk Johnson.

REGISTRATION REQUIRED.



| Diamond | |
|-----------------------|---|
| Category | Native Minerals |
| Formula | C |
| Strunz Classification | 1.CB.10a |
| Crystal System | Cubic |
| Crystal Class | Hexoctahedral (m3m) H-M symbol (4/m 3 2/m) |
| Formula Mass | 12.01 g/mol |
| Color | Typically yellow, brown, or gray to colorless. Less often blue, green, black, translucent white, pink, violet, orange, purple and red |
| Crystal Habit | Octahedral |
| Twinning | Spinel law common (yielding “macle”) |
| Cleavage | 111 (perfect in four directions) |
| Fracture | Conchoidal |
| Mohs Scale | 10 (defining mineral) |
| Luster | Adamantine |
| Streak | Colorless |
| Specific Gravity | 3.52 ± 0.01 |
| Refractive Index | 2.418 (at 500 nm) |
| Melting Point | Pressure dependent |

From Wikipedia - **D**iamond is a metastable allotrope of carbon, where the carbon atoms are arranged in a variation of the face-centered cubic crystal structure called a diamond lattice. Diamond is less stable than graphite, but the conversion rate from diamond to graphite is negligible at standard conditions. Diamond is renowned as a material with superlative physical qualities, most of which originate from the strong covalent bonding between its atoms. In particular, diamond has the highest hardness and thermal

conductivity of any bulk material. Those properties determine the major industrial application of diamond in cutting and polishing tools and the scientific applications in diamond knives and diamond anvil cells.

Because of its extremely rigid lattice, it can be contaminated by very few types of impurities, such as boron and nitrogen. Small amounts of defects or impurities (about one per million of lattice atoms) color diamond blue (boron), yellow (nitrogen), brown (lattice defects), green (radiation exposure), purple, pink, orange or red. Diamond also has relatively high optical dispersion (ability to disperse light of different colors).

Most natural diamonds are formed at high temperature and pressure at depths of 140 to 190 kilometers (87 to 118 mi) in the Earth's mantle. Carbon-containing minerals provide the carbon source, and the growth occurs over periods from 1 billion to 3.3 billion years (25% to 75% of the age of the Earth). Diamonds are brought close to the Earth's surface through deep volcanic eruptions by magma, which cools into igneous rocks known as kimberlites and lamproites. Diamonds can also be produced synthetically in a HPHT method which approximately simulates the conditions in the Earth's mantle. An alternative, and completely different growth technique is chemical vapor deposition (CVD). The word is from the ancient Greek ἀδάμας – *adámas* – "unbreakable".

HISTORY

The name is derived from the ancient Greek ἀδάμας (*adámas*), "proper", "unalterable", "unbreakable", "untamed", from ἀ- (*a-*), "un-" + μάω (*ō*), "I overpower", "I tame". Diamonds are thought to have been first recognized and mined in India, where significant alluvial deposits of the stone could be found many centuries ago along the rivers Penner, Krishna and Godavari. Diamonds have been known in India for at least 3,000 years but most likely 6,000 years.

Diamonds have been treasured as gemstones since their use as religious icons in ancient India. Their usage in engraving tools also dates to early

human history. The popularity of diamonds has risen since the 19th century because of increased supply, improved cutting and polishing techniques, growth in the world economy, and innovative and successful advertising campaigns.

In 1772, Antoine Lavoisier (the discoverer of oxygen) used a lens to concentrate the rays of the sun on a diamond in an atmosphere of oxygen, and showed that the only product of the combustion was carbon dioxide, proving that diamond is composed of carbon. Later in 1797, Smithson Tennant repeated and expanded that experiment. By demonstrating that burning diamond and graphite releases the same amount of gas, he established the chemical equivalence of these substances.

The most familiar uses of diamonds today are as gemstones used for adornment, a use which dates back into antiquity, and as industrial abrasives for cutting hard materials. The dispersion of white light into spectral colors is the primary gemological characteristic of gem diamonds. In the 20th century, experts in gemology developed methods of grading diamonds and other gemstones based on the characteristics most important to their value as a gem. Four characteristics, known informally as the four Cs, are now commonly used as the basic descriptors of diamonds: these are carat (its weight), cut (quality of the cut is graded according to proportions, symmetry and polish), color (how close to white or colorless; for fancy diamonds how intense is its hue), and clarity (how free is it from inclusions). A large, flawless diamond is known as a paragon.

NATURAL HISTORY

The formation of natural diamond requires very specific conditions exposure of carbon-bearing materials to high pressure, ranging approximately between 45 and 60 kilobars (4.5 and 6 GPa), but at a comparatively low temperature range between approximately 900 and 1,300 C (1,650 and 2,370 F). These conditions are met in two places on Earth; in the lithospheric mantle below relatively stable

continental plates, and at the site of a meteorite strike.

Formation in cratons

The conditions for diamond formation to happen in the lithospheric mantle occur at considerable depth corresponding to the requirements of temperature and pressure. These depths are estimated between 140 and 190 kilometers (87 and 118 mi) though occasionally diamonds have crystallized at depths about 300 km (190 mi).[13] The rate at which temperature changes with increasing depth into the Earth varies greatly in different parts of the Earth. In particular, under oceanic plates the temperature rises more quickly with depth, beyond the range required for diamond formation at the depth required. The correct combination of temperature and pressure is only found in the thick, ancient, and stable parts of continental plates where regions of lithosphere known cratons as exist. Long residence in the cratonic lithosphere allows diamond crystals to grow larger.

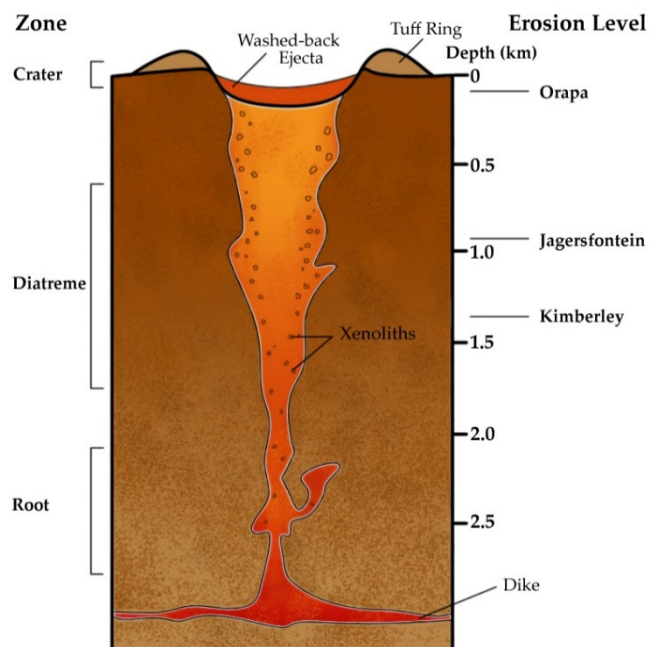
Through studies of carbon isotope ratios (similar to the methodology used in carbon dating, except with the stable isotopes C-12 and C-13), it has been shown that the carbon found in diamonds comes from both inorganic and organic sources. Some diamonds, known as, are formed from inorganic carbon originally found deep in the Earth's mantle. In contrast, diamonds contain organic carbon from organic detritus that has been pushed down from the surface of the Earth's crust through subduction before transforming into diamond. These two different source of carbon have measurably different $^{13}\text{C}:^{12}\text{C}$ ratios. Diamonds that have come to the Earth's surface are generally quite old, ranging from under 1 billion to 3.3 billion years old. This is 22% to 73% of the age of the Earth.

Diamonds occur most often as euhedral or rounded octahedral and twinned octahedral known as macles. As diamond's crystal structure has a cubic arrangement of the atoms, they have many facets that belong to a cube, octahedron, rhombicosidodecahedron, tetrakis hexahedron

or disdyakis dodecahedron. The crystals can have rounded off and unexpressive edges and can be elongated. Sometimes they are found grown together or form "twinned" crystals at the surfaces of the octahedron. These different shapes and habits of some diamonds result from differing external circumstances. Diamonds (especially those with rounded crystal faces)

Schematic diagram of a volcanic pipe are commonly found coated in nyf, an opaque gum-like skin.

Transport from mantle



Schematic diagram of a volcanic pipe – Wikipedia

Diamond-bearing rock is carried from the mantle to the Earth's surface by deep-origin volcanic eruptions. The magma for such a volcano must originate at a depth where diamonds can be formed 150 km (93 mi) or more (three times or more the depth of source magma for most volcanoes). This is a relatively rare occurrence. These typically small surface volcanic craters extend downward in formations known as volcanic pipes. The pipes contain material that was transported toward the surface by volcanic action, but was not ejected before the volcanic activity ceased. During eruption these pipes are open to the surface, resulting in open circulation;

many xenoliths of surface rock and even wood and fossils are found in volcanic pipes. Diamond-bearing volcanic pipes are closely related to the oldest, coolest regions of continental crust (cratons). This is because cratons are very thick, and their lithospheric mantle extends to great enough depth that diamonds are stable. Not all pipes contain diamonds, and even fewer contain enough diamonds to make mining economically viable.

The magma in volcanic pipes is usually one of two characteristic types, which cool into igneous rock known as either kimberlite or lamproite. The magma itself does not contain diamond; instead, it acts as an elevator that carries deep-formed rocks (xenoliths), minerals (xenocrysts), and fluids upward. These rocks are characteristically rich in magnesium-bearing olivine, pyroxene, and amphibole minerals which are often altered to serpentine by heat and fluids during and after eruption. Certain typically occur within diamantiferous kimberlites and are used as mineralogical tracers by prospectors, who follow the indicator trail back to the volcanic pipe which may contain diamonds. These minerals are rich in chromium (Cr) or titanium (Ti), elements which impart bright colors to the minerals. The most common indicator minerals are chromium garnets (usually bright red chromium-pyrope, and occasionally green ugrandite-series garnets), eclogitic garnets, orange titanium-pyrope, red high-chromium spinels, dark chromite, bright green chromium-diopside, glassy green olivine, black picroilmenite, and magnetite. Kimberlite deposits are known as for the deeper serpentinized part of the deposits, or as for the near surface smectite clay and carbonate weathered and oxidized portion.

Once diamonds have been transported to the surface by magma in a volcanic pipe, they may erode out and be distributed over a large area. A volcanic pipe containing diamonds is known as a primary source of diamonds. Secondary sources of diamonds include all areas where a significant number of diamonds have been eroded out of their kimberlite or lamproite matrix, and

accumulated because of water or wind action. These include alluvial deposits and deposits along existing and ancient shorelines, where loose diamonds tend to accumulate because of their size and density. Diamonds have also rarely been found in deposits left behind by glaciers (notably in Wisconsin and Indiana); in contrast to alluvial deposits, glacial deposits are minor and are therefore not viable commercial sources of diamond.

Space diamonds

Not all diamonds found on Earth originated on Earth. Primitive interstellar meteorites were found to contain carbon possibly in the form of diamond. A type of diamond called carbonado that is found in South America and Africa may have been deposited there via an asteroid impact (not formed from the impact) about 3 billion years ago. These diamonds may have formed in the intrastellar environment, but as of 2008, there was no scientific consensus on how carbonado diamonds originated.

Diamonds can also form under other naturally occurring high-pressure conditions. Very small diamonds of micrometer and nanometer sizes, known as or respectively, have been found in meteorite impact craters. Such impact events create shock zones of high pressure and temperature suitable for diamond formation. Impact-type microdiamonds can be used as an indicator of ancient impact craters. Popigai crater in Russia may have the world's largest diamond deposit, estimated at trillions of carats, and formed by an asteroid impact.

Scientific evidence indicates that white dwarf stars have a core of crystallized carbon and oxygen nuclei. The largest of these found in the universe so far, BPM 37093, is located 50 light-years (4.7×10^{14} km) away in the constellation Centaurus. A news release from the Harvard-Smithsonian Center for Astrophysics described the 2,500-mile (4,000 km)-wide stellar core as a diamond.

Mining

Approximately 130,000,000 carats (26,000 kg) of diamonds are mined annually, with a total value of nearly US\$9 billion, and about 100,000 kg (220,000 lb) are synthesized annually.

Roughly 49% of diamonds originate from Central and Southern Africa, although significant sources of the mineral have been discovered in Canada, India, Russia, Brazil, and Australia. They are mined from kimberlite and lamproite volcanic pipes, which can bring diamond crystals, originating from deep within the Earth where high pressures and temperatures enable them to form, to the surface. The mining and distribution of natural diamonds are subjects of frequent controversy such as concerns over the sale of blood diamonds or conflict diamonds by African paramilitary groups. The diamond supply chain is controlled by a limited number of powerful businesses, and is also highly concentrated in a small number of locations around the world.



Siberia's Udachnaya diamond mine - Wikipedia

Only a very small fraction of the diamond ore consists of actual diamonds. The ore is crushed, during which care is required not to destroy larger diamonds, and then sorted by density. Today, diamonds are located in the diamond-rich density fraction with the help of X-ray fluorescence, after which the final sorting steps are done by hand. Before the use of X-rays became commonplace, the separation was done

with grease belts; diamonds have a stronger tendency to stick to grease than the other minerals in the ore.

Historically, diamonds were found only in alluvial deposits in Guntur and Krishna district of the Krishna River delta in Southern India. India led the world in diamond production from the time of their discovery in approximately the 9th century BC to the mid-18th century AD, but the commercial potential of these sources had been exhausted by the late 18th century and at that time India was eclipsed by Brazil where the first non-Indian diamonds were found in 1725. Currently, one of the most prominent Indian mines is located at Panna.

Diamond extraction from primary deposits (kimberlites and lamproites) started in the 1870s after the discovery of the Diamond Fields in South Africa. Production has increased over time and now an accumulated total of 4,500,000,000 carats (900,000 kg) have been mined since that date. Twenty percent of that amount has been mined in the last five years, and during the last 10 years, nine new mines have started production; four more are waiting to be opened soon. Most of these mines are located in Canada, Zimbabwe, Angola, and one in Russia.

In the U.S., diamonds have been found in Arkansas, Colorado, Wyoming, and Montana. In 2004, the discovery of a microscopic diamond in the U.S. led to the January 2008 bulk-sampling of kimberlite pipes in a remote part of Montana. The Crater of Diamonds State Park in Arkansas is open to the public, and is the only mine in the world where members of the public can dig for diamonds.

Today, most commercially viable diamond deposits are in Russia (mostly in Sakha Republic, for example Mir pipe and Udachnaya pipe), Botswana, Australia (Northern and Western Australia) and the Democratic Republic of the Congo. In 2005, Russia produced almost one-fifth of the global diamond output, according to the British Geological Survey. Australia boasts the richest diamantiferous pipe, with production from the Argyle diamond mine reaching peak

levels of 42 metric tons per year in the 1990s. There are also commercial deposits being actively mined in the Northwest Territories of Canada and Brazil. Diamond prospectors continue to search the globe for diamond-bearing kimberlite and lamproite pipes.

GRAPHITE

| Diamond | |
|-----------------------|--|
| Category | Native Minerals |
| Formula | C |
| Strunz Classification | I.CB.05a |
| Crystal System | Hexagonal |
| Crystal Class | Dihexagonal dipyramidal (6mmm) H-M symbol: (6/m 2/m 2/m) |
| Formula Mass | 12.01 g/mol |
| Color | Iron-black to steel-gray; deep blue in transmitted light |
| Crystal Habit | Tabular, six-sided foliated masses, granular to compact masses |
| Twinning | Present |
| Cleavage | Basal – perfect on {0001} |
| Fracture | Flaky, otherwise rough when not on cleavage |
| Mohs Scale | 1-2 |
| Luster | Metallic, earthy |
| Streak | Black |
| Specific Gravity | 2.09-2.23 |
| Pleochroism | Strong |
| Other Characteristics | Strongly anisotropic, conducts electricity, greasy feel, readily marks |



Graphite Crystals from Warwick, NY – Glen Rhein photo

Graphite, archaically referred to as plumbago, is a crystalline form of carbon, a semimetal, a native element mineral, and one of the allotropes of carbon. Graphite is the most

stable form of carbon under standard conditions. Therefore, it is used in thermochemistry as the standard state for defining the heat of formation of carbon compounds. Graphite may be considered the highest grade of coal, just above anthracite and alternatively called meta-anthracite, although it is not normally used as fuel because it is difficult to ignite.

History Of Natural Graphite Use

In the 4th millennium B.C., during the Neolithic Age in southeastern Europe, the Mari a culture used graphite in a ceramic paint for decorating pottery.

Some time before 1565 (some sources say as early as 1500), an enormous deposit of graphite was discovered on the approach to Grey Knotts from the hamlet of Seathwaite in Borrowdale parish, Cumbria, England, which the locals found very useful for marking sheep. During the reign of Elizabeth I (1533–1603), Borrowdale graphite was used as a refractory material to line moulds for cannonballs, resulting in rounder, smoother balls that could be fired farther, contributing to the strength of the English navy. This particular deposit of graphite was extremely pure and soft, and could easily be broken into sticks. Because of its military importance, this unique mine and its production were strictly controlled by the Crown.

Historically, graphite was called black lead or plumbago. Plumbago was commonly used in its massive mineral form. Both of these names arise from confusion with the similar-appearing lead ores, particularly galena. The Latin word for lead, plumbum, gave its name to the English term for this grey metallic-sheened mineral and even to the leadworts or plumbagos, plants with flowers that resemble this colour.

The term black lead usually refers to a powdered or processed graphite, matte black in color.

Abraham Gottlob Werner coined the name graphite ("writing stone") in 1789. He attempted to clear up the confusion between molybdena, plumbago and blacklead after Carl Wilhelm Scheele in 1778 proved that there are at least

three different minerals. Scheele's analysis showed that the chemical compounds molybdenum sulfide (molybdenite), lead(II) sulfide (galena) and graphite were three different soft black minerals.

Geologist of the Month – William Barton Rogers

I have also decided to include articles on famous geologists/mineralogists. It's important to know the history and how we got to the understanding we have today. In addition to William Barton Rogers I will also cover Lyell, Hutton, Dana, Paracelsus, Agricola, Steno, Wegener, Agassiz, Mohs and Kunz. I suspect that I will run out of famous these superlative scientists well before I run out of minerals.

The bulk of the material for this month's selection comes almost entirely from Wikipedia. I have made some additions and edits as I deemed necessary.

I first heard about William Barton Rogers from my Structural Geology professor, Dr. Ken Bick during his "Geology of the United States" class while attending William and Mary. In fact, one of the buildings at W&M is named after Rogers to this day – unfortunately it is the Chemistry building (Rogers Hall) but I guess you can't everything, particularly since the Geology Department didn't really have its own building (or at least a large percentage of one) until after my departure.

From Wikipedia – William Barton Rogers (December 7, 1804 – May 30, 1882) was a geologist, physicist, and educator at The College of William and Mary from 1828 until 1835 and at the University of Virginia from 1835 to 1853. In

Uses Of Natural Graphite

Natural graphite is mostly consumed for refractories, batteries, steelmaking, expanded graphite, brake linings, foundry facings and lubricants.

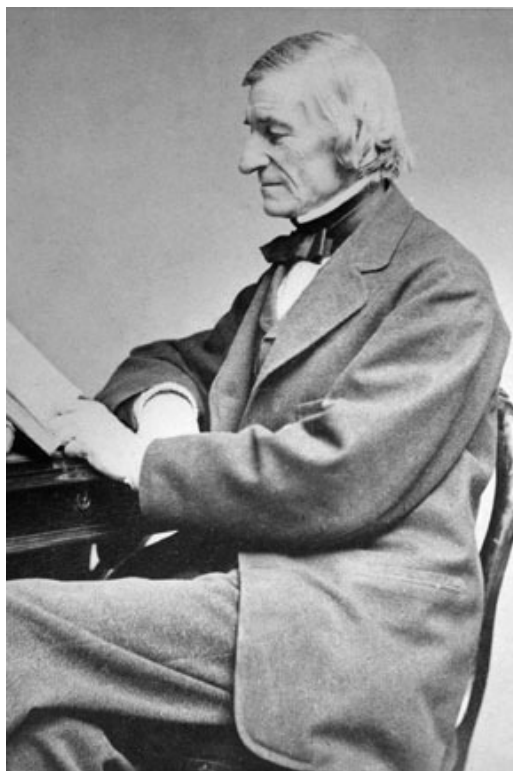
1861, Rogers founded the Massachusetts Institute of Technology (MIT). The university opened in 1865 after the American Civil War. Because of his affiliation with Virginia, Mount Rogers, the highest peak in the state, is named after him.

Rogers was born on December 7, 1804, in Philadelphia, Pennsylvania. He was the second son of Patrick Kerr Rogers and Hannah Blythe and was of Irish, Scottish, and English extraction. Patrick Rogers was born in Ireland and had immigrated at the end of the 18th century to America, where he graduated from the University of Pennsylvania and practiced medicine. When William Barton was born, Patrick Rogers was a tutor at Penn. In 1819 Patrick Rogers became professor of natural philosophy and mathematics at the College of

William and Mary, where he remained until his death in 1828.

William Barton Rogers had three brothers: James Blythe Rogers (1802–1852), Henry Darwin Rogers (1808–1866), and Robert Empie Rogers (1813–1884). The Rogers brothers would each grow up to be distinguished scientists.

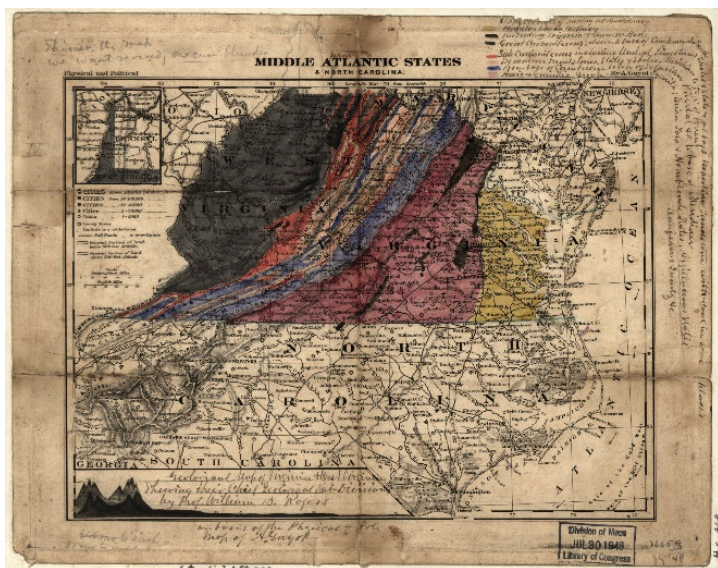
Rogers was educated by his father, attended the public schools of Baltimore, Maryland, and also graduated from the College of William and Mary. He delivered a series of lectures on science before the Maryland Institute in 1827, and succeeded his father as professor of natural philosophy and chemistry at William and Mary in 1828, where he remained until 1835. During this time, he carried on investigations on dew and on



the voltaic battery, and prepared a series of papers on the greensand and calcareous marl minerals of eastern Virginia and their value as fertilizers.

In 1833, his brother Henry had returned from England filled with enthusiasm for geology, and this prompted Rogers to begin studies in the field. The practical value of his article on greensand caught the eye of the Virginia legislature. Rogers took this opportunity to lobby for a geological survey of Virginia, and he was called upon to organize it in 1835.

By 1835, his brother Henry was state geologist of Pennsylvania, and together the brothers unfolded the historical geology of the Appalachian chain. Among their joint special investigations were the study of the solvent action of water on various minerals and rocks, and the demonstration that "coal beds stand in close genetic relation to the amount of disturbance to which the inclosing strata have been submitted, the coal becoming harder and containing less volatile matter as the evidence of the disturbance increases". In modern terms, this was the realization that the geological process of metamorphism had gradually transformed softer grades of coal, such as lignite, into harder grades, such as anthracite.



Together, the brothers published a paper on "The Laws of Structure of the more Disturbed

Zones of the Earth's Crust", in which the wave theory of mountain chains was first announced. This was followed later by William Rogers' statement of the law of distribution of geological faults. These pioneering works contributed to a better understanding of the vast coal beds underlying some parts of the Appalachian region, and helped pave the way for the Industrial Revolution in the United States. In 1842 the work of the survey closed. State revenues had shrunk beginning in 1837, and the funding for the survey had been cut back. Meanwhile, Rogers had published six "Reports of the Geological Survey of the State of Virginia" (Richmond, 1836–40), though there were few copies, and recognition of their significance was slow to develop. They were later compiled by Jed Hotchkiss and issued in one volume with a map as Papers on the Geology of Virginia (New York, 1884).

In 1835 Rogers also began serving as professor of "natural philosophy" at the University of Virginia (UVA). There he added mineralogy and geology to the curriculum, and did original research in geology, chemistry and physics. While he was chair of the department of philosophy at UVA, he vigorously defended to the Virginia State Legislature the University's refusal to award honorary degrees, a policy which continues today. (Later, MIT would adopt a similar policy from its beginning, and continuing to the present).

In 1849, he married Emma Savage of Boston. Then in 1853, he resigned from UVA, moving to Boston for two principal reasons. First, he wanted to increase his activity in scientific movements under the auspices of the Boston Society of Natural History and the American Academy of Arts and Sciences, in whose proceedings and in the American Journal of Science his papers had been published while at UVA. Second, and more important (because the University of Virginia was not a technology specialty institution), Rogers wanted to implement his innovative scheme for technical education, in which he desired to have associated, on one side, scientific research and

investigation on the largest scale and, on the other side, agencies for the popular diffusion of useful knowledge. [Editor's Note: Dr. Bick's comments back in the day were that the climate in Virginia weren't good for Roger's health and that another reason he moved to Boston was for medical reasons.] This project continued to occupy his attention until it culminated in the chartering of the Massachusetts Institute of Technology (1861), of which he became first president.

To raise funds and public awareness of his new Institute, Rogers delivered a course of lectures before the Lowell Institute on "The Application of Science to the Arts" in 1862. In 1861, he was appointed inspector of gas and gas meters for the state of Massachusetts, a post he accepted reluctantly. During his service, he improved the standards of measurement.

An act of the Massachusetts State Legislature incorporated MIT in 1861, and Rogers became its first president in 1862. He served as president of MIT until 1870, when he stood down because of declining health. By necessity, he returned to office in 1878 and continued to 1881, when he was made professor emeritus of physics and geology, which position he had held while he was president.

He died after collapsing during a speech at MIT's 1882 commencement exercises. His last words were "bituminous coal".

MSDC History – A selection from the Mineral Minutes of April 1964

DR MICHAEL FLEISCHER OF
GEOLOGICAL SURVEY TO SPEAK AT
ANNUAL BANQUET
April, 1964

Our speaker at the Annual Banquet on Saturday, April 25, will be Dr. Michael Fleischer noted geochemist and mineralogist of the U. S. Geological Survey and currently President of the Geochemical Society. Dr. Fleischer is a native of Connecticut, and received his education at Yale University, winning his Ph. D. in Chemistry there in 1933. For a while after that he assisted in the

Rogers was chairman of the Association of American Geologists and Naturalists (AAGN; organized 1840) in 1845 and again in 1847, and contributed important memoirs to its Transactions, including observations on the temperature of coal mines in eastern Virginia. In 1847 he also called to order the first meeting of the American Association for the Advancement of Science (AAAS), an enlargement of the AAGN. He was president of the AAAS in 1875, and elected its first honorary fellow in 1881, as a special mark of distinction. He was active in founding the American Social Science Association and its first president; also he was one of the corporate members of the National Academy of Sciences, and its president from 1878 until his death. In 1866, Harvard gave him the degree of LL.D.

Besides numerous papers on geology, chemistry, and physics, contributed to the proceedings of societies and technical journals, he was the author of:

- Strength of Materials (Charlottesville, 1838)
- Elements of Mechanical Philosophy (Boston, 1852)
- Papers on the Geology of Virginia (New York, 1884)

editing of Dam's System of Mineralogy, but in 1936 came to Washington as a Physical Chemist for the Carnegie Institution's Geophysical Laboratory. In 1939, he joined the Survey. His interest in the field of scientific literature and information dissemination came to the fore as early as 1940, when he became an Assistant Editor of Chemical Abstracts, a position he holds to this day. He has gained mineralogical friends throughout the world, attested by his memberships in the Mineralogical Societies of Canada, Great Britain and Ireland, France, Italy and Switzerland, and by his service as Vice President and President of the Committee on

Geochemistry of the International Union of Chemistry. At home, he belongs to the American Chemical Society, and is a Fellow of the Mineralogical Society of America (serving as its President in 1952), a Fellow of the Geological Society of America (Vice-President, 1953), and a Fellow of the Society of Economic Geologists. Presently he is Chairman of the Committee on New Minerals and Mineral Names of the International Mineralogical Association. From time to time he serves as a Guest Lecturer at George Washington University.

Since his days at Yale, Dr. Fleischer has published nearly 25 scientific papers, singly or in collaboration with such scientists as J. J. Fahey, C. P. Ross, Earl Ingerson, J. W. Frondel, G. S. Switzer, F. S. Grimaldi and E. C. T. Chao. He has worked on aenigmatite, the garnets, pollucite, the manganese oxide minerals, belyunkite/creedite, bavenite, and others, but his major interest has been in chemical mineralogy and the geochemical abundance and distribution of the elements.

Specifically, Dr. Fleischer has studied the occurrence of tungsten and vanadium in manganese oxide ores and minerals, the

geochemistry of quicksilver deposits, niobium and titanium, hafnium and zirconium, rhenium, and many others. He is regarded as one of the world's greatest authorities on the abundance of the elements in the Earth's crust. It is a distinct honor to have Dr. and Mrs. Fleischer as our guests at the Banquet.

The Society's Annual Banquet for 1964 will be held on Saturday, April 25, in the Embassy Room of the Officer's Club in the Washington Navy Yard Annex, 8th and M Streets, S. E., Washington, D. C. there will be a cocktail hour at 6:30 P. M., followed by an excellent buffet dinner at 7:30 P. M. Tickets are available at \$5.00 (not including drinks) per person, from Miss Mary Mrose, 114 N. Wayne St. Apt 2,

Arlington 1, Va. Please make your check or money order payable to: Mineralogical Society of D. C. A self-addressed envelope will help. There is space for only 75 persons, but as of this writing a number of tickets are available. For further information, call Helene Haliday (EM 3-7561) or Mary Mrose (JA 8-6448).

The Rocks Beneath Our Feet

Theodore Roosevelt Island: The Bedrock

by Hutch Brown



Theodore Roosevelt Island in 1950, from the north looking south. Today, a footbridge leads to the island from the Virginia side of the Potomac (on the right), across a channel known colloquially as Little River. Source: National Park Service.

MSDC Editor's note: This is an excellent article by Hutch Brown, the editor for the Northern Virginia Mineral Club's newsletter – The Mineral Newsletter. This article is from their November edition. Since it is about a very local site and Hutch does such a nice job with the article, I decided it was worth including, particularly for those that might be looking for a quick field trip in our own back yard.

Original Editor's note: This is the first in a three-part series on the geology of Theodore Roosevelt Island. The second and third parts, respectively, are on the river and its sedimentary deposits.

A jewel in the National Park System it might never be, but Theodore Roosevelt Island is well worth a visit, if you haven't been there already. It is centrally located in our area and easily accessible, with well-groomed trails and boardwalks leading through an array of local ecosystems within short distances—mature upland forest as well as swamp and marsh.

(In case you ever wondered, a swamp is a flooded forest, whereas a marsh is a flooded grassland—an easy way to remember.)

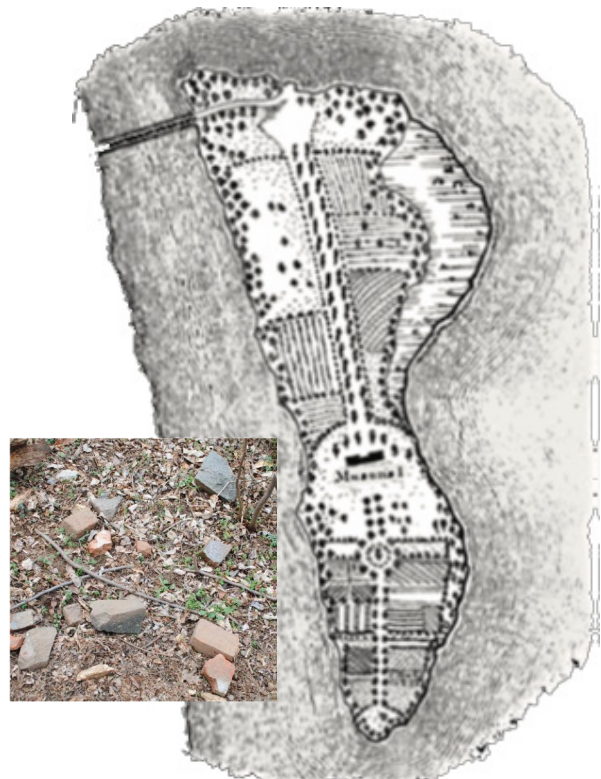


Figure 1—Analostan Island in about 1800, when it was owned by the Georgetown businessman John Mason, who farmed the island and had a summer home at its highest point (circled). All that remains of the house are a few bricks and building stones (left). The island had a swamp on its north-eastern side (arrow) but lacked today's marsh, tidal creek, and additional island at the southern tip. Source: Gunston Hall (n.d.); photo: Hutch Brown.

The island has a rich history. The Nacotchtank people, who called the island Analostan, had at least one village there. 1). Mason built a causeway from the Virginia side of the Potomac River to the north-eastern point of the island; a tree-lined road led from north to south down the middle of the upland plateau to the house at the island's highest point (44 feet) and then down to its southern tip. Well-heeled visitors raved about the verdant settings, sweeping river views, and decorous parties thrown by the Masons.

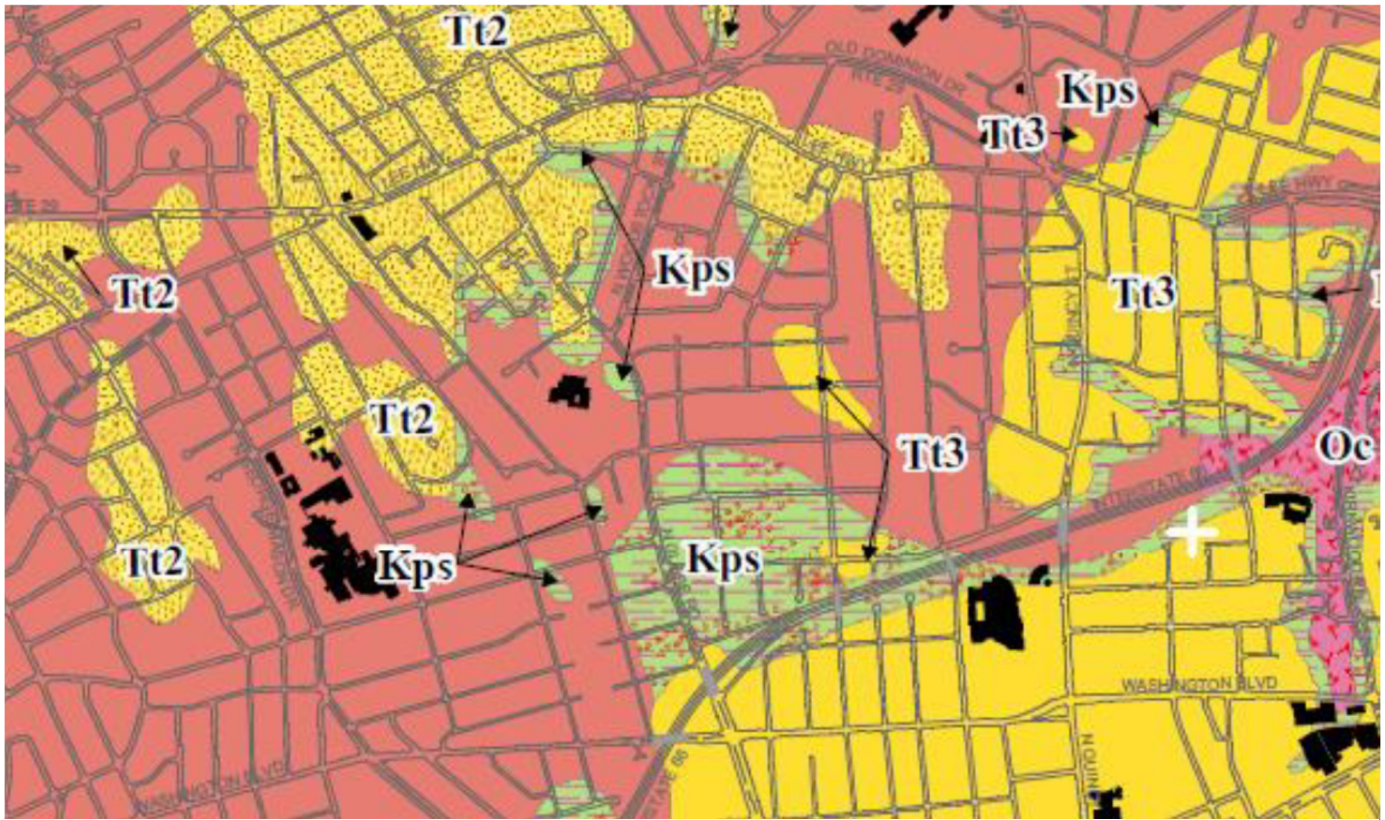


Figure 2—Map detail showing the geology of central Arlington County in Virginia. Dark pink = Cambrian bedrock (Sykesville Formation, Cs); pink w/gray flecks (lower left corner) = Cambrian/Proterozoic bedrock (Indian Run sedimentary melange, CZi); green = Cretaceous sediments (Potomac Formation, Kpu/Kps); deep yellows/light pink = Tertiary terrace deposits (Tt2/3/4/5); buff/light yellows = Quaternary deposits (Qal/Qcl/Qt1/2); brown = artificial fill (af); black = structures. Source: Frost and Ernest (1999).

Today, much of the island is wetland; the idea of farming it seems strange. But the island was originally smaller and drier than today, underlain by the same crystalline bedrock that underlies much of Arlington County in Virginia (fig. 2).

Where did the bedrock come from?

Buried Fault Line

The core of the island is metamorphic rock classified as Sykesville Formation, thought to have originated in the Cambrian Period (from about 545 million to 505 million years ago). The Sykesville is a metasedimentary melange (metamorphosed mixture of sediments) similar to the Indian Run sedimentary melange exposed by Four Mile Run near the nature center where our club meets. In fact, the two formations were originally thought to be the same (Drake 1985).

A geologic map of Arlington County shows

Theodore Roosevelt Island at the southern edge of the Sykesville Formation, which underlies most of North Arlington (the dark pink in figure 2). The map reflects disparate geologic events separated by hundreds of millions of years.

The Indian Run sedimentary melange (the grayflecked pink in figure 2, CZi) is separated from the Sykesville Formation (Cs) by the Burke Fault. The two formations, each half a billion years or more in age, were put in place during the Alleghanian Orogeny, a mountain-building event resulting from the collision of proto-Africa with proto-North America about 320 million years ago. The Sykesville slightly overlies the Indian Run, as we shall see.

Overlying both Cambrian formations in turn are sediments from the Cretaceous Period (from about 144 million to 66 million years ago) and the

Tertiary Period (from about 66 million to 1.6 million years ago)—respectively, green and yellow on the map. The sediments cover most of South Arlington.

About 230 million years ago, as Africa broke away from North America, the bedrock dipped toward the widening Atlantic Ocean. Where east-flowing rivers in North America reached the tidal zone, they slowed and released their sediments, creating a widening and deepening coastal plain. You can see the process in miniature today along the Potomac River, from Great Falls to Theodore Roosevelt Island.

The sediments demarcate the Fall Line zone and the beginning of the Coastal Plain; Interstate Highway 66 roughly follows the Coastal Plain's northern edge in Arlington County (fig. 2). On the Coastal Plain, younger Tertiary sediments (yellow) overlie older Cretaceous sediments (green).

Except where exposed by erosion, the sediments now cover the Cambrian bedrock, obscuring most of the boundary between the Sykesville and Indian Run formations (fig. 2). Hence so much yellow and green on the geologic map of central Arlington—and hence the truncated Burke Fault line on the map.

The Sykesville Formation

The Sykesville rock is medium in grain size and medium gray in color. The matrix is mostly quartz, muscovite, feldspar, and biotite, with a much higher proportion of quartz than in the Indian Run rock (Drake 1985). Fisher (2010) has identified parts of it as a garnet-bearing schist, and you can find garnetiferous rock on the island (though no schist that I have seen except for rock brought in for building).

The Sykesville contains large pieces of quartz and other rocks (what geologists call olistoliths—from ancient Greek words meaning “slip stones”). Some of the olistoliths (though not on Roosevelt



Sykesville exposures on Theodore Roosevelt Island. Note the embedded rocks (olistoliths) in the photo at top and the granularity of the quartz-rich matrix around the quartz olistolith (bottom left) and around the tiny garnet crystal (bottom right), both circled. In places, bedding is visible (top). Photos: Hutch Brown.

Island) are big enough to appear on geologic maps. They include migmatite, phyllonite, metagraywacke, and other rocks from the adjacent Mather Gorge Formation to the northwest. Large olistolith exposures are mainly upriver near Mather Gorge; the olistoliths on Roosevelt Island, though common, are small.

The olistoliths prove that the Sykesville is younger than the Mather Gorge Formation. The Mather Gorge, like the Indian Run rock, is thought to be early Cambrian or Proterozoic in age; accordingly, both formations usually show up on geologic maps as CZ (“C” for Cambrian and “Z” for Proterozoic, reflecting the uncertainty).

Though widely considered to be Cambrian in age, the Sykesville could be older. A huge intrusion into the Sykesville called the Occoquan granite has a known age—about 472 million years—so the Sykesville has to be at least that old. Recent research suggests a maximum age of from 600

million to 1 billion years (Fisher 2010). Accordingly, Callan (2015) describes the Sykesville’s depositional age as unknown.

So how did the Sykesville form?

Terranes

The Sykesville rock is part of three formations that make up the Potomac Terrane (fig. 3). The other two are the Mather Gorge and Laurel Formations; the Laurel, like the Sykesville, is a metasedimentary melange. It is mapped only north of the Potomac River (in Maryland and beyond), although it might also be buried under Coastal Plain sediments to the south (Johnston 1964). In

Virginia, the Mather Gorge lies to the west and the Sykesville to the east, bordered by the Indian Run sedimentary melange and other formations even farther east (Drake 1985).

By “terrane,” geologists usually mean blocks of rock bounded by faults; the blocks can include multiple formations. The three formations in the Potomac Terrane (Sykesville, Laurel, and Mather Gorge) were probably emplaced on the proto-North American continent at about the same time, though in different geo-logic environments.

And that gets to another meaning of the term “terrane”: The Potomac Terrane originated in a much larger piece of the Earth’s crust that geologists also call a terrane.

Such terranes are free-floating pieces of the Earth’s crust, just like continents. Picture the Earth as a raw egg, with its liquid interior. Now imagine that the shell has cracked; pieces of various sizes are floating around on the liquid interior, some of them tiny.

These “shell bits,” even the tiny ones, are propelled by enormous heat and energy from within the Earth’s interior. When they collide, the bits of crust are large enough to generate tremendous force. They form ramps in subduction zones that dive into the Earth’s interior. The ramps let one crustal mass slide up over the other

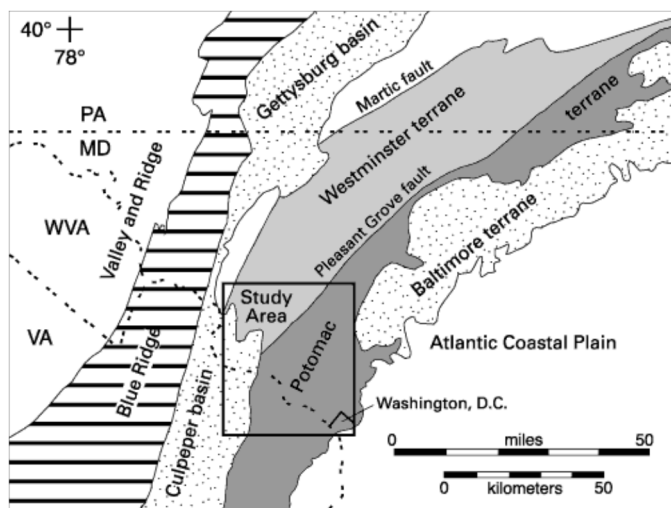


Figure 3—Map of the Piedmont terranes in our area, including the Potomac Terrane (dark gray). These terranes abut the Triassic basins at the foot of the Blue Ridge. Note the location of Washington, DC, on the eastern edge of the Potomac Terrane. Source: Kunk and others (2014).

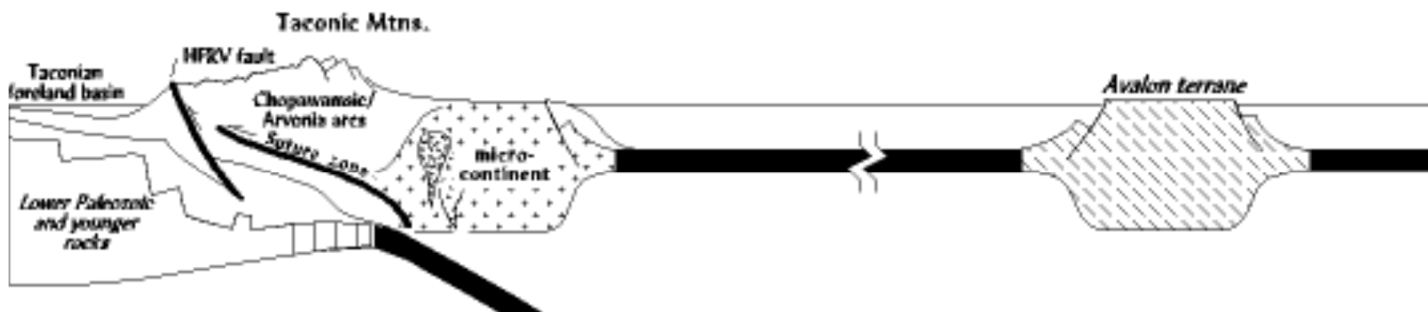


Figure 4—The Taconic Orogeny, about 450–435 million years ago. The Taconic Terrane slams into proto-North America (far left), which forms a subduction zone (black bar) that acts as a ramp, letting the terrane slide up over the continent. Remnants of the Chopawamsic/Arvonis arcs (which collided with each other long before to form the leading edge of the Taconic Terrane) are pushed up into the Taconic Mountains along the Haysville-Fries-Rockfish Valley (HFRV) thrust fault, creating a foreland basin ahead of the rising mountain range. The collision establishes a suture zone between the terrane and the underlying continental rock. A second terrane, the Avalon, follows behind the Taconic Terrane, colliding with proto-North America tens of millions of years later. (The black bands represent ocean crust.) Source: Fichter and Baedke (1999).

as they collide. The tremendous heat and pressure caused by the collision deforms the materials caught in between, sometimes raising newly formed metamorphic rock onto dry land and covering it with overlying rock layers that form mountains.

The entire Piedmont bedrock in our area is made up of the ancient Taconic Terrane, which collided with proto-North America, riding up over the continental bedrock and lodging there (fig. 4). The collision formed mountains that are long since

The Taconic Terrane has a complex history; it formed from separate oceanic plates that collided in the pro-to-Atlantic Ocean long before reaching proto-North America. A microcontinent slammed into one or more lines of volcanic islands; the combined land mass then proceeded toward



Figure 6—Sykesville rock on Theodore Roosevelt Island. Note the bedding planes from lower left to upper right, parallel with the dark flat olistoliths. Photo: Hutch Brown.

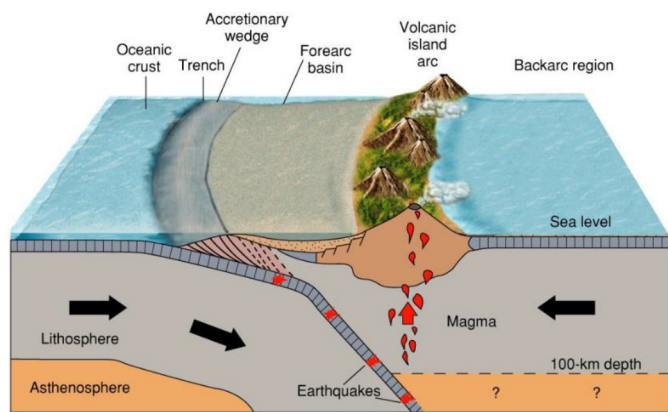


Figure 5—Formation of a volcanic island arc. Where oceanic plates collide, one dives under the other in a subduction zone. The tremendous heat and friction cause earthquakes and melt the lithosphere, sending plumes of magma up to the surface, where they erupt in volcanoes. Where the plates converge, they form a trench that gradually fills with materials scraped from the plates and eroded from the island arc. Source: A.M. (2013).

gone, although their sediment caps are still with us. For example, the tough sandstone that caps Massanutten Mountain in the Shenandoah Valley derived from the last remnants of the Taconic Mountains that formed beginning about 450 million years ago when the Taconic Terrane collided with proto-North America (fig. 4). The terrane also laid down the underlying bands of rock that make up the Piedmont today, including the Potomac Terrane and its Sykesville component.

Watery Origins

So the Sykesville Formation originated on another continent of sorts, albeit a much smaller one.

proto-North America, ultimately colliding with the continent (fig. 4).

Geologists are reasonably certain that the Sykesville rock formed in an undersea trench associated with the Taconic Terrane or its antecedents (fig. 4). Where oceanic plates converge, one plate dives under the other in a subduction zone (fig. 5). The resulting heat and friction melt the lithosphere, sending plumes of magma to the surface, where they form a line of volcanic islands in the shape of an arc. The converging plates form an oceanic trench that gradually fills with materials accreted from the plunging plate and eroded from the volcanic islands.

Most of the materials accumulating in the trench are sand and silt, although earthquakes can send sizable rocks and boulders plunging into the trench in under-sea landslides. Over time, the materials thicken and harden into sedimentary rock. Granular layering in the Sykesville Formation



Figure 7—The Alleghanian Orogeny, about 320–280 million years ago. As proto-Africa rides up over proto-North America, massive thrust faulting pushes the underlying bedrock westward. Flat sedimentary rocks are pushed and folded in the Valley and Ridge; the Blue Ridge granitoids and associated metamorphic rocks emerge in a massive upfold behind the Bull Run Fault; and great sheets from the Taconic and Avalon Terranes move in a series of thrust faults to where they are today in the Piedmont and beneath the Coastal Plain. The overlying Alleghanian Mountains were as high as the Himalayas today. Source: Fichter and Baedke (1999).

(fig. 6) suggests that it originally formed in this way—in a deep-sea trench.

So how did the Sykesville turn into metamorphic rock? And how did it get to where it is today—more than a hundred miles inland?

Landfall and Uplift

Metamorphism resulted from the mountain-building event known as the Taconic Orogeny (fig. 4). Half a billion years ago, our area was covered by shallow seas, and the continental bedrock in our area was the Grenville granite now exposed only in the Blue Ridge. The Piedmont and Coastal Plain did not exist.

The first sign of the Taconic Terrane approaching from the east would have been plumes of ash rising from volcanoes. Ahead of the volcanoes was the oceanic trench, the leading edge of the terrane (fig. 5). The trench might have contained the Sykesville sedimentary rock, although the Sykesville might have already been lifted onto dry land as part of an earlier collision between components of the Taconic Terrane (fig. 4). But if the Sykesville was in the oceanic trench, then the colliding land masses would have pushed it, together with other pieces of the Potomac Terrane, up the ramplike continental subduction

zone onto the proto-North American continent (fig. 4).

In any case, the Sykesville and associated rocks were then buried under the mountains that formed over the continental basement rock. Had the Sykesville not underlain the Taconic Mountains, it would have weathered away and disappeared long ago, together with the mountains.

The tremendous friction of the colliding land masses and the enormous pressure of the overlying rock would have superheated and melted the Sykesville Formation, transforming it into the metasedimentary melange we see today. In the process, the Sykesville might have absorbed pieces of the older Mather Gorge rock, just as intrusive dikes of basalt often contain pieces of the older rock they intrude. Or the

Mather Gorge olistoliths might have weathered away and fallen into the oceanic trench long before, to be buried in the Sykesville sediments.

The Taconic Orogeny carried enough force to graft the terrane onto the proto-North American continent. A second terrane, the Avalon, arrived about 380 million years ago, adding another wedge of metamorphic rock to the proto-North American continent, sutured onto the Taconic bedrock.

But the biggest mountain-building event was yet to come.

The Great Rock Train

About 320 million years ago, the proto-Atlantic Ocean completely closed as the proto-African continent slammed into proto-North America (fig. 7). The collision formed mountains as high as the Himalayas today. The proto-African continent rode up over proto-North America, stripping off layers of underlying rock and pushing them on great, nearly horizontal thrust faults to the west.

A great rock train resulted as rock layers peeled off from the continental bedrock, one by one, and moved westward. At the head of the train were sedimentary rocks that came to rest in the Valley and Ridge Province, forming a series of folds that geologists call synclines and anticlines; picture a rug being pushed together. The Valley and Ridge rocks included remnants of the Taconic Mountains, partly in the form of the massive syncline (a fold with upturned edges) of Massanutten Mountain in the Shenandoah Valley.

Following right behind were detached sheets of rock from the original continental bedrock, the Grenville granite, more than a billion years old. Partially altered by tremendous heat and stress, these granitoids and their associated basalts and overlying sediments were thrust to the west and ultimately upward behind the Bull Run Fault (where Bull Run Mountain lies today in Virginia).

The rocks formed a giant anticline (a fold with down-turned edges). Breached at the top by erosion and weathered away, the anticline became today's Blue Ridge Mountains. The Blue Ridge rocks have metamorphic layers on their eastern and western edges, including Catoclin greenstone, Weverton quartzite, Harpers phyllite, and Antietam quartzite.

Coming behind the Blue Ridge rocks were great sheets of terrane rock. First came the

Taconic, trans-ported behind the Blue Ridge upthrust and coming to rest in what we now call the Piedmont (fig. 7). Next came sheets from the Avalon (or Acadian) Terrane, which today underlie the Coastal Plain. In figure 7, the curved fault lines with arrows demarcate sheets of metamorphic rock detached and pushed up over other sheets in a series of sharply angled upthrusts. In figure 8, for example, note how the Sykesville "over-lies" the Indian Run sedimentary melange along the nearly vertical Burke Fault in Falls Church, VA.

Island Bedrock

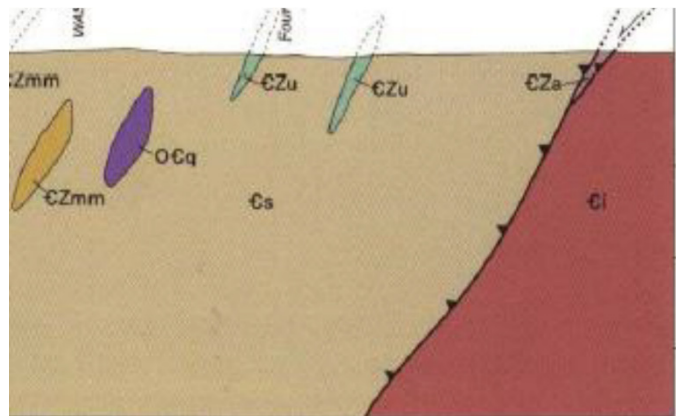


Figure 8—Map detail of the Sykesville Formation (gray-brown, Cs) and Indian Run sedimentary melange (burgundy, Ci) divided by the Burke Fault (line with saw teeth) in Falls Church, VA. The line indicates the sharply angled thrust fault where the Sykesville rode up over the Indian Run rock during the Alleghanian Orogeny. Note the olistoliths, large enough to map. Source: Drake and Froelich (1997).

And so the Sykesville came to rest in our area, together with the other rocks of the Potomac Terrane. Tectonic forces associated with the Alleghanian mountain-building event moved the entire Potomac Terrane tremendous distances (fig. 9). The Sykesville might have started near the same longitude as what is now Virginia Beach, only to end up on the edge of Washington, DC—dozens of miles to the west.

For tens of millions of years, the Potomac Terrane was covered by enormous mountains made up of rock from Africa. Gradually, the mountains weathered away; their sediments

*Approximate locations of modern geographic features
on the Pre-Alleghenian Mid-Atlantic Region*

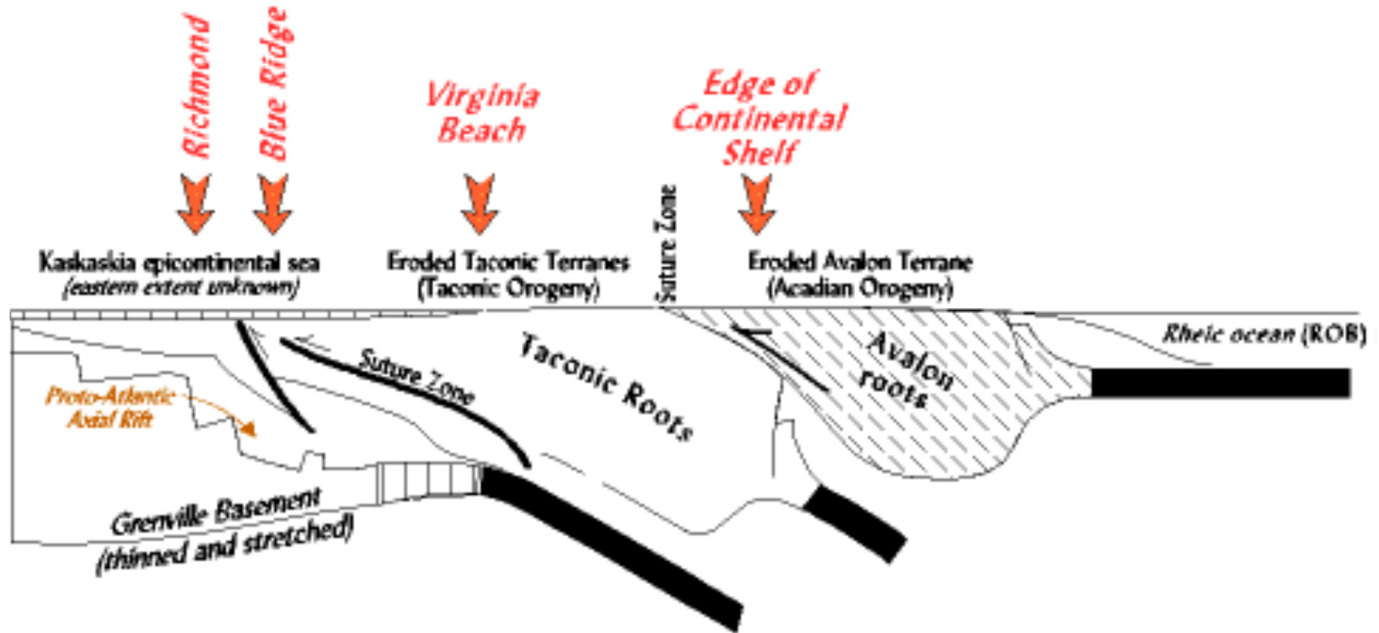


Figure 9—A period of tectonic calm followed the Taconic and Avalonian mountain building events. Both terranes were sutured onto the continent; the mountains eroded away, leaving a plain gently draining into an inland sea (the Kaskasia, upper left). The subsequent Alleghenian Orogeny compressed and folded the terranes and jumbled their formations, pushing them

washed to the west, filling the great inland seas.

Weathering eventually exposed the Taconic roots of the Piedmont, leaving no trace of Africa. As the continents separated again, forming the Atlantic Ocean, rivers began flowing eastward. The rivers etched patterns in the Sykesville bedrock, including the low spine of what is now Theodore Roosevelt Island.

But that is another story.

Next issue: How did bedrock lying in the middle of a supercontinent draining to the west become an island in a river flowing to the east?

Acknowledgment

The author thanks NVMC member Sue Marcus for reviewing and improving the article. Any errors are the author's alone.

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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 July 2016 issue of the *American Mineralogist: Journal of Earth and Planetary Materials*. <http://www.minsocam.org>

Melts, Mush, and More...

On pages 2365-2366 of this issue, Erik Klemetti provides an overview of Paterson et al. (pages 2176-2198 of the October issue), first by outlining the growing consensus that large liquid magma bodies are rare and that long-lived bodies spend most of their time as crystalline mush. Paterson et al., in their study of the Tuolumne Intrusive Complex (TIC), show evidence of massive erosion and re-deposition of early magmatic materials by later magma intrusions. Their field and geochemical evidence indicate that as much as half of an original magma mush may be eroded and either incorporated into a later intrusion, or erupted (if thermally rejuvenated) or

migrate downwards, being replaced by more buoyant magmas. This presents challenges for interpreting everything from emplacement dates (if most zircon crystals are recycled from earlier magma batches) to pluton volume growth rates. Klemetti end by noting that at least some numerical models apparently indicate that massive mush erosion and mixing are unlikely; field evidence shows that the unlikely is possible.

Rhyolite Emplacement from Spherulites

On page 2367 of this issue, Gardner et al. examine geochemical gradients in glass adjoining spherulites in rhyolitic obsidian, to estimate spherulite saturation conditions and growth

rates, and by extension, the nucleation rates of spherulites and cooling rates of rhyolite flows. Their modeling of spherulites indicates that nearly anhydrous Yellowstone Plateau rhyolite lavas exhibit post-emplacement (sub-solidus) cooling rates of 0.3 to 1.2 C/day, in the temperature ranges of 710 to 430 C. This work interestingly complements a paper we highlighted earlier, by Seaman (2013; page 304, v. 98), who examined spherulites in hydrous systems, and showed that they exhibit either blade-like or needle shapes that vary as a function of cooling rate. Together, these studies provide means to evaluate rhyolite cooling rates from spherulite growth ranging from slightly above-solidus to sub-solidus conditions.

A Comprehensive Mush Model for Silicic Systems

On page 2377 of this issue (open access), Bachmann and Huber review the genesis of silicic magma bodies. These authors develop a "mush model" to explain silicic systems, both plutonic and volcanic. The model embodies a counterintuitive view that crystal-liquid separation can be more effective at intermediate crystallinities (~50-70% crystals). This is a foreign concept to those studying basaltic systems, as olivine crystals, for example, readily separate from parent liquids at even the smallest of crystal fractions. But these authors argue that for silicic systems, intermediate to high crystallinities (>40-70%) inhibit convective stirring and small pockets of liquid contained within a larger crystal-rich mush can segregate to form eruptible cupolas. A driving force for this model is its apparent ability to simultaneously explain geophysical observations and the incremental growth of large magma reservoirs.

A Plagioclase Geobarometer, and Arc Magma Storage Depths

On page 2405 of this issue, Zellmer et al. apply MELTS to calculate maximum An [Anorthosite] contents of plagioclase for nominally aphyric lavas from the Trans-Mexican Volcanic Belt. They find that for water saturated mafic melts, An contents (predicted by MELTS) first increase with increasing pressure, to about 1.0 kbar, decreasing thereafter as pressure increases (to at least 9 kbar). The authors suggest that maximum An contents reflect the depths at which magmas stall prior to eruption. In their model, nearly aphyric magmas leave their mantle source region with varying amounts of dissolved water. Those liquids with the greatest water contents reach vapor saturation at the greatest depths and partially crystallize as the magma dehydrates. Both crystallization and dehydration serve to increase viscosity, causing magmas to stall and cool further, reaching plagioclase saturation. From this outlook, maximum An contents are a proxy for depths of vapor saturation and pre-eruption staging depths, or the final depths of crystallization for un-erupted fractions.

A Volatile-Depleted Chondritic Earth?

On page 2452 of this issue, Jones et al. examine the water and halogen contents of merrillite and apatite crystals from various chondritic meteorites. They find that while volatile contents vary across meteorite sub-types, and even within individual samples, they do not vary systematically with metamorphic grade. It would seem, then, that fluid evolution on chondrites can be quite localized, and that phosphate compositions record a range of processes related to regolith development. One hypothesis is that F-rich apatite grains form within a regolith by interaction with F-rich vapors

released from impact-degassed melts near the chondrite parent body surface. To the extent that regolith development is an early solar system process, this mode of genesis implies that chondrites might be strongly degassed prior to

their accretion into planet-sized objects. In such a case, Earth's inventory of volatiles may be less than inferred from the compositions of non-brecciated chondrite fractions.

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.org

MINDAT

www.mindat.org



WebMineral

webmineral.com



Mineralogical Society of America

www.minsocam.org



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Upcoming Local (or mostly local) Geology Events:

December:

- 3 NERF Ball 2016 - The FMS Northeast Region Fluoresophiles (NERF) Ball will be held on Saturday, 12/3/16 at the GeoTech Center of the Sterling Hill Mining Museum in Ogdensburg, NJ. The meeting runs from 9 AM until 4 PM. All FMS members are invited, as are prospective FMS members and members of other rock clubs. As usual, an enjoyable and informative program is scheduled:
- Donna Beaton, G.G., Colored Stones Technical Advisor and Director of Gemology Content/Education at the Gemological Institute of America, will lead a discussion of Determinants of Color in Natural and Treated Tanzanite. A presentation and show-and-tell on Fluorescent Minerals from the Merelani Hills will accompany her talk.
 - Andrea Cavagna, Ph D., of the Institute for Complex Systems (ISC-CNR) and of the University Sapienza, Rome, will tell us how theoretical physics informs the understanding of collective behavior in biological systems in Particles, Waves, and Starlings.
 - Howie Green, FMS VP, will continue on the theme of understanding the collective behavior of less complex biological systems by dancing on the tightrope that is The Perception of the Fluorescent Mineral Enthusiast in the Eyes of the Great and Powerful. Dick Bostwick will expand upon the topic and try and help Howie keep his balance.
 - Mark Cole, Chief Cook and Bottle Washer at MinerShop, and the manager of the FMS Facebook Group, will demonstrate the latest techniques in photography of Fluorescent Minerals; for the Beginner and the Expert.
- We'll have a display and discussion in which Alkaline Intrusion Complexes Bring leucophanite to New Jersey. The Mineral Sell/Trade-a-Thon Extravaganza will continue during the entire course of the meeting. Last year's turnout was widely held to be the most productive and active exchange of local and worldwide fluorescent minerals EVER. In any event, BRING TONS OF ROCKS TO SHOW, SWAP OR SELL! The infamous NERF Lunch Players will be up to their usual culinary tricks, and new food donors will be rewarded. Bring \$10 to cover food expenses. As always, BYOBeer!
- It is ESSENTIAL that each attendee RSVP to Howie Green at howie@uvminerals.org for meeting attendance, menu coordination and participation, and to suggest or present topics at the meeting. As always, and most importantly, please tell your friends (if you have any).**
- 5 – 6 47th Annual Fine Gem, Jewelry & Mineral Show – Gemarama 2016 sponsored by the Tuscarora Lapidary Society. Greater Philadelphia EXPO Center at Oaks, Hall C. Contact: Amy Karash <amy.karash@gmail.com>.
- 10 MSDC December Holiday Party and Meeting - Elections
- 19-20 25th Annual Gem, Mineral & Fossil Show sponsored by the Northern Virginia Mineral Club. The Hub Ballroom at George Mason University. Braddock Rd & Rt. 123, Fairfax, VA. Contact: <novamineralclub.org>
- 26 NVMC December Meeting (may be adjusted to accommodate holidays)
- 28 Micromounters December Meeting

January:

- 4 MSDC January Meeting

23 NVMC January Meeting
25 Micromounters January Meeting

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>
22 Sterling Hill Super Dig
22-23 Annual Spring Franklin Gem & Mineral Show & Swap, Franklin Elementary School, Washington Ave. Franklin, NJ
22-23 Ogdensburg, NJ – Annual Sterling Hill Garage Sale
22-23 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

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| Robert W. Dunning | 1969 | | |

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? _____

MINERALOGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

(2015 Officers & Board Members)

President: Dave Nanney, dnanney@cox.net

Vice President & Program Chair: Dave Hennessey, davidhennessey@comcast.net

Secretary: Andy Thompson, thompson01@starpower.net

Treasurer: John Weidner, (mail: 7099 Game Lord Dr, Springfield, VA 22153-1312)

Directors:

Editor: Steve Johnson

Co-Web Masters: Betty Thompson & Casper Voogt, <http://mineralogicalsocietyofdc.org/>

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

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Newsletter of the Mineralogical Society of the District of Columbia

Mineralogical Society of DC

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