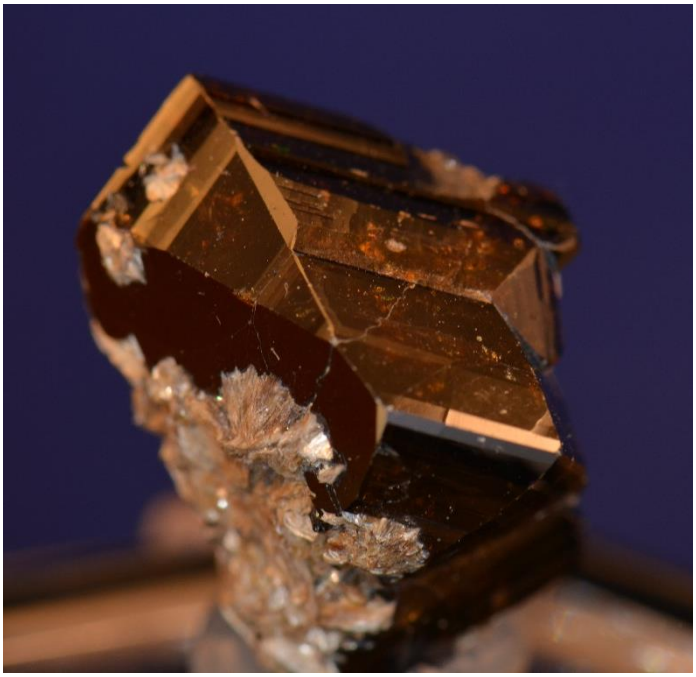
THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: April 22 Time: 7:45 p.m.

Long Branch Nature Center, 625 S. Carlin Springs Rd., Arlington, VA



Cassiterite

Elsmore, New South Wales, Australia

Photo: Bob Cooke.

Volume 60, No. 4
April 2019
Explore our website!

April Meeting Program:

Estate planning for your collection

Details on page 5

In this issue …

Deadline for Submissions

April 20

Please make your submission by the 20th of the month! Submissions received later might go into a later newsletter.

Mineral of the Month
Cassiterite

by Sue Marcus

Cassiterite is a simple mineral, isn't it—simply tin and oxygen, SnO_2? I usually learn something while researching these articles. I hope that we can learn about this Mineral of the Month together.

Name Origin

The first rocky problem comes from the derivation of the name. Various sources offer *kassiteros* (Greek for tin) or *Cassiterid* (Phoenician for the British Isles, a likely early source of tin). There are ancient tin mines in Cornwall, England, but some references indicate that islands off Spain gave cassiterite its name. (What islands? Anyway, none have tin!) Another source suggests that the mineral was named for the people and region of Kassites in Iran.

Copper and tin are required to make bronze, one of the earliest multiple-use metals, so I tend to believe the Cornish reference.

Mining History

Tin, probably in the form of cassiterite, has been mined since about 2500 BCE. The earliest known mines were in southwestern England, roughly contemporaneous with mines in the German *Erzgebirge* (literally, "Ore Mountains"), which now straddle the border between Germany and the Czech Republic. Through trade, cassiterite deposits in these locations were exploited by the Phoenicians and Greeks, followed by the Romans (through conquest in addition to trade). Other ancient sources of cassiterite were mined in Brittany, the Iberian Peninsula, and the Balkans.

In Asia, few cassiterite deposits were known to early miners. Excavations began during the early Bronze Age at a large surface and underground mine in Kestel, Turkey. The deposit was relatively low grade but worth mining since the commodity was relatively rare and very useful. Small cassiterite deposits were also mined along the Yellow River during the Chinese Bronze Age.

So you see, cassiterite isn't so simple after all, at least not in terms of its history.

Cassiterite, as the primary early tin ore, drove early world trade. Copper was useful but soft; adding tin made it harder. Arsenic could also be used as an alloy to harden copper, but arsenic's toxicity was obvious to users—or to their surviving colleagues and heirs. Extremely early bronze objects are reported from Pločnik, Serbia, dating from 4500 BCE. Bronze, the copper–tin alloy, was the hardest metal known to the ancients. Tin, as a principle ingredient, was therefore a prized commodity.

Happy Easter!

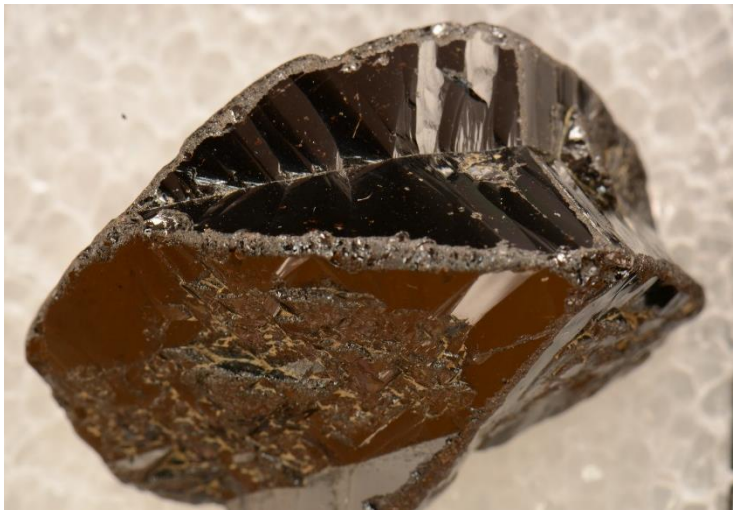
Northern Virginia Mineral Club members,

Please join our speaker, Germaine Broussard, for dinner at the Olive Garden on April 22 at 6 p.m.

Olive Garden, Baileys Cross Roads (across from Skyline Towers), 3548 South Jefferson St. (intersecting Leesburg Pike), Falls Church, VA
Phone: 703-671-7507

Reservations are under Ti Meredith, Vice-President, NVMC. Please RSVP to me at ti.meredith@aol.com.

Cassiterite and siderite on quartz, from the Panasqueira Mines, Covilhã, Castelo Branco District, Portugal. Photo: Bob Cooke.



Cassiterite from Minas Gerais, Brazil. Photo: Bob Cooke.

Tin was probably shipped from small deposits in central Asia over the Silk Road or sent from the European or Asian mines to foreign processing facilities. Tin ore could remain closer to its source when copper was imported for bronze manufacturing. Ancient Mediterranean shipwrecks have been found carrying copper ingots, probably on their way to becoming bronze objects, indicating that copper may have been transported to tin-bearing sites.

Tin mining is part of the history of Cornwall. Many rare minerals were found in the Cornish tin mines, and the region was recognized in 2006 as a UNESCO World Heritage Site for its mining history. The last mines closed in 1998, following a price crash a decade earlier. None of the mines could survive the struggle to remain economically viable.

Specimens and Sources

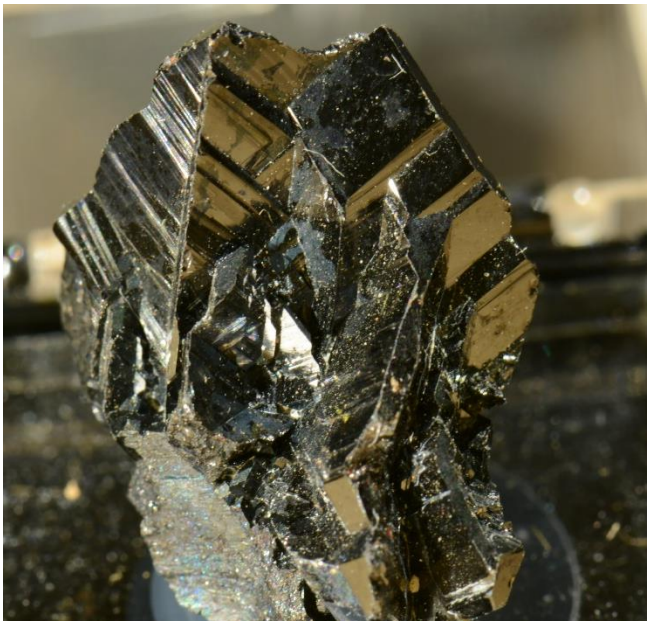
Cassiterite can form in several ways. "Wood tin" forms in low-temperature surficial hydrothermal systems, with matrix-based, radiating crystals that have alternating bands of color, roughly resembling wood. Cornwall, England, and the Malyi Khingan Range, Russia, are among the sources of wood tin. Placer cassiterite deposits are currently mined using hydraulic methods in Malaysia, Thailand, Indonesia, Somalia, and Russia. Hydraulic mining is environmentally destructive, using large quantities of water and adding sediment to the waterways.

Cassiterite is hosted in stanniferous (tin-bearing) granites, some of which may have hydrothermal veins richer in cassiterite. The Cornish mines extracted tin from these enriched veins, and Bolivia continues mining similar tin-bearing geologic systems.

Bolivia is also known for the lustrous, classic cassiterite mineral specimens, usually from the Departments of Oruro or Potosí. Crystals are deep brown, often on matrix. The Brazilian pegmatites have also been a minor source of cassiterite crystals.

China has been exporting an abundance of collectable minerals, and cassiterite is part of this cornucopia. Mt. Xuebaoding in Sichuan Province and the Yaogangxian in Hunan Province are tungsten–tin mines that have produced nice cassiterite specimens, along with other mineral species. The show stoppers, which I'd never seen until I looked for them for this article, are the transparent to translucent specimens from Ximeng, Yunnan Province, China. They can be huge—and still be transparent! I could not find any images for the white cassiterite, reportedly from China, nor any images of what I would consider white cassiterite at all, other than bands in massive, wood-tin-type material.

Khabarovsk Krai, Russia, has produced attractive wood tin and cassiterite crystal specimens reminiscent of the Bolivian ones. Moving to Europe, Bohemia (Czech Republic) and Saxony (Germany) were some of the original specimen producers. Nice, classic specimens, though never plentiful, have also come from France and Spain.



Cassiterite twin from the Erongo Mountains, Erongo Region, Namibia. Photo: Bob Cooke.

Australia's Elsmore Mine in New South Wales was active in the late 19th century, when lustrous, fine cassiterite specimens were extracted. Apparently, an Australian mineral club had (but lost) a lease on the property in the late 20th century. Perhaps less well known, the Aberfoyle Mine in Tasmania was worked until the 1970s, with cassiterite crystals found—and possibly later found on the dumps. If you are going to Tasmania, collecting on those dumps may still be possible.

The Morefield Mine in Amelia County, VA, has produced cassiterite, though not of the spectacular quality—or quantities—found elsewhere. Other U.S. deposits are similarly limited, with rare specimens found in Maine and New Mexico.

Commercial Production

China is the world's largest tin producer, with Indonesia not far behind. Indonesia is the primary source of tin for the United States. The U.S. Geological Survey notes that U.S. tin resources, mostly in Alaska, are insignificant.

Tin is used in this country for tinplate—steel coated with a thin layer of tin for corrosion resistance, ease of welding, and luster (as in "tin" cans). Tin is also used in chemicals, solder, alloys, and other manufactures.

Lapidary Use

Wood tin may be cut into lovely, unusual cabochons. Most cassiterite is opaque and would not make an attractive faceted gem. When it is faceted, it is mostly as a novelty. It is quite brittle. "Andean diamond" is a name for faceted Bolivian cassiterite!

Technical Details

Chemical formula .....SnO_2

Crystal form .....Tetragonal

Hardness 6–7

Specific gravity 6.8–7.1

Color .....Brown to black; extremely rarely red, yellow, or colorless

Streak .....Light brown to white

Cleavage .....Imperfect; indistinct, poor

Fracture .....Uneven to subconchoidal

Luster .....Adamantine in best crystals, dull in wood tin

Cassiterite from the Inverell District, New South Wales, Australia. Photo: Bob Cooke.

Acknowledgments

I would like to acknowledge the helpful review and additions provided by my husband, Roger Haskins, and editor Hutch Brown for his skillful editing.

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Germaine Broussard

Life 101: What Do You Have? Where Is It? Who Knows About It?

April 22 Program

Germaine Broussard will be presenting a program that will challenge you to think about your collection. What are your plans for it? Yes, we know you plan to live forever, but what happens after that? Or if life doesn't go as planned?

Did you start collecting when you were given a hand-me-down collection from someone else? Are you downsizing your collection by generously giving away or donating or by cleverly selling parts of it? What are your plans for what's left? Who knows—literally—what you have and where it is?

Germaine's interest in rocks and minerals is consistent with her lifelong quest for knowledge and for preserving our heritage for the next generation, in this case by teaching the next generation about ROOOOCKS!!! She has worked with children of various ages to spark their interest in geology, mineralogy, gemology, and paleontology. From dinosaurs to diamonds lies a broad range of information that appeals to various ages and genders. It may not be cool for a teenage girl to discuss dinosaurs, but a necklace of coprolite that gets compliments and matches emojis is cool. Worth more than any rock, mineral, or fossil is the reward of seeing a 4-year-old wanting to go to Hawaii because volcanoes are making new igneous rocks to collect—or watching a shy, insecure teenage girl correct her science teacher by explaining that granite is a composite rock made up of minerals and not a mineral itself!

Germaine is an Arete Wealth management financial advisor, financial planning specialist, and portfolio manager. Focusing on life planning for people in and near retirement, Germaine has worked in the financial securities industry since 1993 and has lived in Northern Virginia for over 20 years. Germaine is the founder/president of TroopTreats, a 501(c)3 nonprofit charity. She started by baking cookies for troops stationed in harm's way, earning her the name "The Cookie Lady" among troops stationed around the world. Since 2003, Trooptreats.com has provided packages of necessities to our military personnel in war zones and motorized wheelchairs to veterans in need here at home. Germaine is regional vice-president of the American Political Items Collectors (APIC) and is also the graphics editor for *The Keynoter*, APIC's quarterly journal of political history.

For her volunteer service, Germaine has received recognition and numerous awards over the years. In 2011, she received the Investment News/Invest in Others national Volunteer of the Year Award. She also received the 2011 Fairfax County Providence District Volunteer of the Year Award and the Fairfax County Lady Fairfax for Providence District.

Items at the NVMC's 2018 spring auction included this magnificent quartz crystal from the estate of longstanding club member Gerry Cox. In a classic case of estate planning, Gerry asked that half the proceeds from her sales go to the club's Fred Schaefermeyer Scholarship Fund. Photo: Hutch Brown.

Writing Tip of the Month

God only exhibits his thunder and lightning at intervals, and so they always command attention. These are God's adjectives. You thunder and lightning too much; the reader ceases to get under the bed, by and by.

Mark Twain

President's Collected Thoughts

by Sue Marcus, President

Collecting Season Is Open!

Collecting season is starting, whether by having fun in the mud or by using the silverpick (money!).

The Montgomery County show is recently past, and our show isn't until November. But other opportunities are coming up—check the calendar on the second-to-last page below for details.

You spent the winter organizing and cataloging your collection, right? So now it is time to have more fun by seeing what you can find to add to it.

Did I hear someone mutter that they *intended* to do a lot a cataloging, but didn't get a roundtuit? Maybe I'll order some online (you can buy them there—and everything else, including minerals).

Maybe you prefer to see what you are getting by picking a treasure from the quarry pile or grabbing that fossil before the wave pulls it away, or maybe you prefer to support one of our member dealers.

While you are thinking about what makes you happy about our hobby, please share ideas for possible speakers or topics for presenters at our monthly meetings. Ti (our vice-president and program chair) and I would like to hear from you! If you have specific contacts, we can pursue them if you would rather not do so. Or, if you have a topic in mind, we'll try to find a good speaker for it. We only know what interests you if you tell us!

On a final note for now, have a look at the options for club T-shirts, and we'll vote on them at our April meeting. If you can't attend (we'd like to see you!), please contact me with your vote. A final decision, which may include variations of the designs presented here, will be made by those who attend the meeting.

Sue

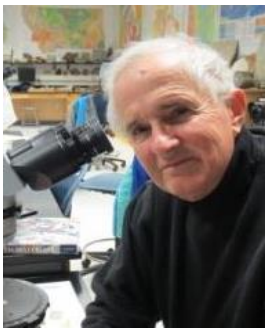
Club T-Shirts?

Wouldn't it be great to have a T-shirt with our club name on it? Something cool that shows us off and is distinctive—like we are! The club would buy them at wholesale and sell them for a small profit; the cost to members would be on the order of $10–12 each. Pat Flavin and Sue Marcus have come up with the options below. We will vote on a design at the April meeting. If you can't be present, let Pat or Sue know your preference.

Option 1 = black shirt with minerals-related images and the name of our club (for more information, click here)

Option 2 (not shown) = plain white shirt with club logo (below)

THE NORTHERN VIRGINIA MINERAL CLUB INC



Meeting Minutes
March 25, 2019

by David MacLean, Secretary

President Sue Marcus called the meeting to order at 7:35 p.m. at the Long Branch Nature Center in Arlington, VA.

The minutes of the February 25 meeting were approved as shown in *The Mineral Newsletter*.

The treasurer reported that 20 club members have submitted survey forms on their interests in our hobby. He urged other members to do so.

The president recognized past President Barry Remer in attendance, along with guests Marnie Dollinger, Bob and Mary Otte, Gary and Carol Rekes, Ben Sand, Yoli Webster, and Audra Zeibel.

The president said that NVMC is now supporting a Mindat page for $100 per year, as approved by the club members earlier this year.

The upcoming Annual Midatlantic Micromounters' Conference was announced (see page 11 for details). The conference is hosted by the Micromineralogists of the National Capital Area, who meet on the fourth Wednesday of each month at the Long Branch Nature Center.

There will be a field trip to Manassas Quarry in Manassas, VA, to collect diabase minerals on Saturday, March 30, from 7:30 a.m. to noon. Full safety equipment is required, including hard-toe shoes, a hardhat, safety glasses, and perhaps an iridescent vest.

NVMC is also a cosponsor of the Super Diggg on Saturday, April 27, from 9 a.m. to 11 p.m. in Franklin and Sterling Hill, NJ (see page 12 for details).

The spring club auction followed. Photos are on the next page!

Bench Tip: Burnishing Bezels

Brad Smith

A dapping ball can sometimes be used to burnish a bezel. I noticed this when setting some 10-millimeter cabs on a piece of filigree. It was difficult to get enough pressure with a pusher or a regular burnisher, so I tried a dapping ball and found it much easier. Make sure the ball is well polished (hit it with the Zam wheel) and let it ride along the base of your piece. Select a ball big enough so its curvature hits the top of the bezel at the best angle to burnish it down onto the stone.

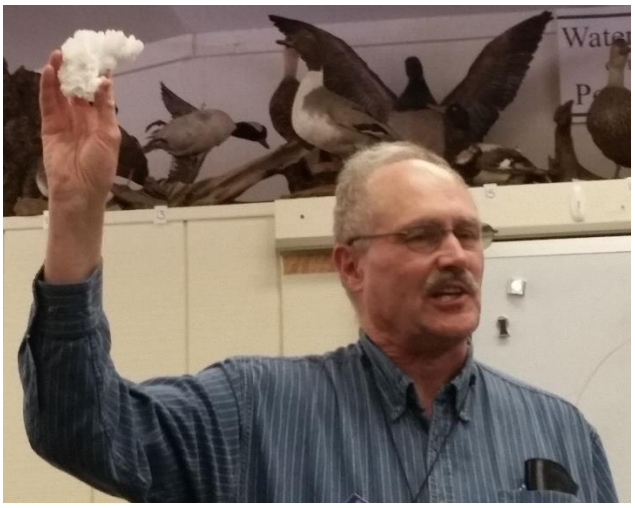
See Brad's jewelry books at
amazon.com/author/bradfordsmith

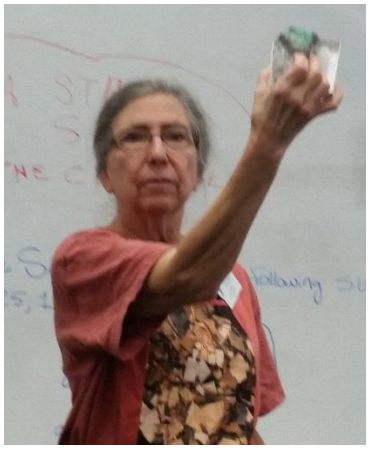
Dinosaur Tracks Make Fresh Impression at Valley Forge National Historic Park

by Mark Scolforo

Editor's note: *The source is the Associated Press (March 6, 2019). Thanks to Sue Marcus for the reference!*

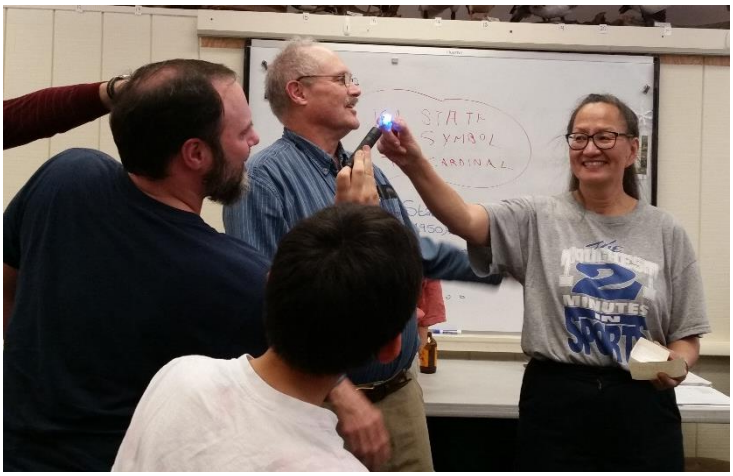
The national park on the site where George Washington and the struggling Continental Army endured a tough winter during the American Revolution boasts a new feature that's a couple of hundred million years old — dozens of fossilized dinosaur footprints discovered on rocks used to pave a section of hiking trail. … *Read more*.





Scenes from the spring club auction

(photos: Pat Flavin)



Rock and Gem Buying Techniques

Buying Lapidary Materials—Rough

by Joe Iannucci

Editor's note: *This series of articles from 1989–90 is reprinted in the* Livermore Lithogram *(newsletter of the Livermore Lithophiles, Livermore, CA). This article is adapted from the November 2018 issue.*

Other than finding your own in the field, the least expensive way to get good lapidary materials is to buy them in rough chunk form. Of course, you'll have to slab it yourself, but that's a big part of the fun; think of it as a field trip to the interior of the stone!

With some materials, the outside of the rock is an excellent indication of the quality and color of the interior; examples include blue lace agate, rhodochrosite, most jaspers, jade, and some obsidians. But in many cases you're flying blind, for example with thundereggs, geodes, Brazilian agate, and weathered material of any type.

One of the most difficult materials to "read" from the outside is rhodonite. It is almost always black on all sides, and it dramatically changes color and pattern from slice to slice.

Cracks are an ever-present danger in rough. Even careful inspection will not divulge them in most cases.

Of course, you should consider the size of the stones you are planning to make from the material. Consider the saw you will use too: the stone may be too large for your blade or vise, or it may be in a shape that cannot be accommodated.

I have a slab grabber on my vise, which allowed me to buy and slab some fantastic Graveyard Point agate for next to nothing: the dealer didn't have a grabber and didn't want to mess with other techniques. I got 10 slabs worth at least $5 each for a total of $3 for the rough!

I think that buying rough material is definitely the way to go if you will be needing several slabs of the material—or if you enjoy gambling, adventure, and great bargains.

The quality of jade is relatively easy to assess from the rough. Source: Wikipedia; photo—Immanuel Giel.

Humor

Pigeonite-Bearing Traprock

Editor's note: *The piece is adapted from Mindat Adventures: Humorous Mineral Stories. Thanks to Sue Marcus for the reference!*

When I was too young to drive, my mother would take me along on field trips of the Mineralogical Society of the District of Columbia. I recall visiting one of the traprock quarries near Leesburg, VA. Mom overheard some of the experienced collectors talking about the rocks being pigeonite bearing.

That cracked her up. She thought they were referring to the purple bird droppings on the rocks. I could never convince her otherwise.

–Bill Cordua

Save the Dates!

The Next 100 Years of Mineral Sciences

June 20–21

The Mineralogical Society of America (MSA) will hold a celebratory Centennial Symposium on June 20–21 at the Carnegie Institution for Science Building (pictured), located at 1530 P Street NW, Washington, DC.

Fourteen theme colloquia will offer a vision for exciting new directions in mineralogy, geochemistry, and petrology as MSA begins its second century. Each theme colloquium will include two 20-minute presentations by invited speakers, followed by 15 minutes of moderated audience discussion. Lunches will be included with your registration fee, and attendees are invited for a private evening reception in the Janet Anneberg Hooker Hall of Geology, Gems, and Minerals in the National Museum of Natural History, Smithsonian Institution. We thank the Gemological Institute of America for sponsoring this evening reception.

Please join us for this once-in-a-century event! For more information and registration, go to: http://www.minsocam.org/MSA/Centennial/MSA_Centennial_events.html#symposium.

Elegy for a Vent in a Hawaiian Volcano

by Lawrence Downes

Editor's note: *The source is* The Washington Post *(February 8, 2019). Thanks to Sue Marcus for the reference!*

Scientists who study Kilauea volcano in Hawaii are saying goodbye to an old friend, an eruption that many of them have known for all or most of their professional lives. The eruption was at Pu'u 'O'o, a vent on the volcano's eastern flank, which had been spewing lava, thrilling tourists, now and then burying forests and subdivisions, and slowly making the island bigger since 1983. … *Read more.*

Sad News …

Dear EFMLS Rockhound Family,

It is with great sadness that I inform you that our "Queen of the EFMLS," Carolyn Weinberger, has passed away.

Carolyn finally succumbed to her multiyear battle with her disease. She went to join our fellow Rockhounds in that great collecting field in the sky on early Monday morning, 3/25/19.

Carolyn's passion for most—and especially the latter part of her life—was running our Federation. She truly gave us her full-time effort.

A giant hole now looms in our extended Rockhound Family, including the American Federation of Mineralogical Societies. Carolyn was the foremost advocate of our hobby and was our EFMLS newsletter editor for I don't know how many years. A lot of years!

Always Sincerely,

David Nock

EFMLS President

Save the Dates!

Annual Atlantic Micromounters' Conference Coming Up

The Micromineralogists of the National Capital Area are holding their 46th Annual Atlantic Micromounters' Conference on April 5–6. Come enjoy mineral dealers, a micromineral auction, mineral giveaways, and more!

The featured speaker is Dr. Robert J. Lauf, whose three presentations are titled:

1. "Electron Microscopy: The Final Frontier of Magnification,"
2. "Mineralogy of Uranium and Thorium," and
3. "Orthosilicates."

Dr. Lauf holds a Ph.D. in Metallurgical Engineering from the University of Illinois. His scientific career includes over 20 years at Oak Ridge National Laboratory, where he conducted research on topics ranging from nuclear fuel, coal byproducts, materials synthesis, microwave processing, sensors, optical materials, and biomineralization. He has been granted 50 U.S. patents for his inventions, many of which have become successful industrial products. He is now a registered patent agent and technology consultant. He has published numerous books on mineralogy.

Dr. Michael Pabst will also speak on "Rare Earth Minerals." Mike is a retired professor of biochemistry who has collected minerals all his life. He is treasurer of the Micromineralogists of the National Capital Area and president of the Shenandoah Valley Gem and Mineral Society. He writes a monthly column on microminerals for *The Mineral Mite*, newsletter of MNCA. His mineral photography has gradually improved over the years, allowing the creation of PowerPoint talks with some pretty photos. He has a long-term interest in minerals containing rare-earth elements, like cerium and lanthanum and their neighboring elements on the periodic table, including scandium, yttrium, and uranium.

The conference will be at the Holiday Inn, 6055 Richmond Highway, Alexandria, VA. Details are posted on the club website at http://www.dcmicrominerals.org/.

Mindat Urals Adventure!

Editor's note: *Thanks to Casper Voogt for the reference!*

Sign up soon! ***Spaces fill up fast!*** Here's the link: https://adventures.mindat.org.

Save the dates!

Field Trip Opportunities

Super Diggg 2019

This year, the NVMC is cosponsoring the annual Super Diggg for fluorescent rocks in the old mine dumps near Franklin and Sterling Hill, NJ. The event is on April 27 from 9 a.m. to 11 p.m. (see the flyer). To attend, you must contact Field Trip Chair Steven Parker at stevenlparker@gmail.com.

Northern Virginia Community College

NOVA's Annandale campus offers 1-day weekend courses—essentially, field trips—related to our hobby. You can get more information at the Field Studies in Geology—GOL 135 website.

Thoroughfare Gap, Virginia

April 6, 9 a.m.–5 p.m. Led by Dr. Callan Bentley. The area where Broad Run transects the Bull Run Mountains west of Haymarket, VA, showcases rocks of the Blue Ridge geologic province, in particular the metamorphosed Cambrian-aged Chilhowee Group sedimentary package. The trip will involve rigorous hiking, with students providing their own transportation to the site.

Paleozoic Geology of Virginia/West Virginia

April 13, 9 a.m.–7 p.m. Led by Dr. Ken Rasmussen. This field trip will let you explore the geology of western Virginia and West Virginia, considering ancient depositional settings (tropical marine reefs, lagoons, shelves, deep basins, and terrestrial flood plains) and fossils, as well as later deformation (faulting and folding) associated with the Valley and Ridge Province.

Audubon Naturalist Society

The ANS offers classes and nature programs, including short field trips. You can get more information and register at the ANS website.

Geology Hike at Soldiers Delight

April 7, 1–4 p.m. The cost of this field trip, led by Joe Marx, is $36 for nonmembers. The Soldiers Delight Natural Environment Area, near Owings Mill, MD, preserves one of the largest patches of igneous bedrock that was lifted from beneath the seafloor and stranded in patches amidst the continental rock of the Piedmont. Soils here are thin, dry, and nutrient poor, producing a landscape observably different from most of the mid-Atlantic. We'll hike around 3 miles on park trails (parts will be steep and possibly muddy), studying the bedrock, soil, and plant communities. Note: Our geology hikes move farther and at a faster pace than our usual naturalists' shuffle.

Safety Matters

State of the Economy

by Ellery Borow, EFMLS Safety Chair

Editor's note: *The article is adapted from* EFMLS Newsletter *(April 2013), p. 1.*

The state of the economy is a hot topic in many conversations. So it may come as no surprise to many that I would like to put in my two cents worth.

The economy I'd like to mention is not the one of national concern but of a more personal interest. Being safe often incurs spending hard-earned money.

Many of our favorite rockhound tasks involve safety gear such as dust masks, eye protection, good solid footwear, gloves, hardhats, and ear protection. We often need to be wary of inhaling soldering fumes and careful to wear UV protective glasses for any length of ultraviolet work as well as properly labeling mineral cleaning solutions. We need to have first aid kits in our cars and on field trips. We need to wear the proper attire, such as kneeling pads, aprons, long-sleeve shirts, and so on. Indeed, it is a mighty long list of safety items for the well-equipped rock hobbyist.

All that safety stuff costs money. Yes, safety matters cost money, but what is the cost of not spending the money on proper safety gear? What is the cost of visiting an eye doctor to remove a foreign body from your eye? What is the cost of an emergency room visit to x-ray, set, and obtain therapy for a broken wrist? What is the cost of treating a severe torch burn? What is the cost of your rescue when lost in the woods? (Some places do actually charge for rescues if the situation warrants.)

We generally have insurance to help us in the event of a big loss; however, deductibles, copays, and other restrictions still hit us where it hurts—in the wallet.

The economics of safety suggest spending a little to save a lot. The cost of all of the safety gear mentioned above could be far less than the deductible amount for a single injury. Where is your money best spent? In a word, prevention.

Please be safe! Prevent injuries from happening by having and using the proper safety measures and gear. Your wallet and I thank will you.

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 of all laws and regulations 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, 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 excavated holes that may be dangerous to livestock.

I will not contaminate wells, creeks, or other water supplies.

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 those in designated authority in all collecting areas.

I will report to my club or Federation officers, the 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, use "Good Outdoor Manners," and conduct myself in a manner that will add to the stature and public image of rockhounds everywhere.

Wildacres in Fall

by Hutch Brown, Editor

Wildacres is a retreat located on Pompey's Knob just off the Blue Ridge Parkway about an hour north of Asheville, NC. Signing up for the September 2–8 session will give you the opportunity to take one or two classes; hear excellent talks from guest speaker Elise Skalwald (an accredited senior gemologist); and participate in a variety of other activities.

Registration is open! You can find a registration form on the Wildacres website. Some classes fill quickly, so register early! You can choose from the courses listed below.

Coming to Wildacres in September 2019

Intarsia *(John Miller):* Intarsia is the making of a geometric design using a variety of stones cut to precision and fitted together to form a pattern while leaving no gaps between the pieces. Learn the beginning skills by melding together stones of various colors and patterns to form a finished cabochon. Bring an optivisor. Prerequisite: cabbing experience. 2-day class, both semesters.*

Viking Knit *(Valerie Johnson):* Learn a technique used nearly 1,300 years ago to weave a silver rope. Also called trichinopoly chain, viking knit was used to make bracelets, trim on clothing, and many other decorative objects. Once you learn the skill, it is very easy and uses few tools and supplies to create stunning chains. 2-day class, 1st semester.*

Wire Works (*Valerie Johnson*): Learn how to work with various tools to create sterling silver wire-wrapped jewelry. Become familiar with the techniques needed to bend and twist wire to make a bracelet and a pendant. No experience needed. Hazard: Wire wrapping can damage acrylic or long fingernails. 2-day class, 2nd semester.*

Tab Setting (*Linda Searcy*): We will fabricate a pendant using odd-shaped stones, such as river rocks or nonflat-backed cabochons, using tab settings where no soldering will be required. 2-day class, 1st semester.*

Prong Setting (*Linda Searcy*): We will take setting to the next level, fabricating prongs in sterling silver. 2-day class, 2nd semester.*

Cold Connections/Etching (*Arlene Lazaro*): Etch copper, brass, and nickel silver with ferric chloride. Choose from a selection of copper shapes or cut your own shapes. Make components to later rivet together and patina. You may choose to complete a pendant and earrings or bracelet and earrings and will also complete several components to later make into other pieces. No experience needed. 2-day class, 1st semester.*

Cold Connections II/Etching & Setting Stone (*Arlene Lazaro*): Etch copper, brass, and nickel silver with ferric chloride. Design a pendant or bracelet around an ammonite. Learn to use a jeweler saw to cut prongs for setting the ammonite in the pendant or bracelet and complete earrings to match. Make cold connections using rivets to create layers of different metals. You will also learn patina and complete several components to later make into other pieces. No experience needed. 2-day class, 2nd semester.*

Enamel Stone Pendant, Wire Inlay Pendant, and Earrings (*Samantha Lazzaro*): Learn kiln/tool safety plus how to anneal, shape, and clean copper before enameling; begin the basic enameling techniques. Complete a pendant with a stone set in the middle, a wire inlay pendant, and a pair of earrings. Lab fee includes use of tools, copper, findings, and enamel needed to complete the three projects. Additional copper will be available for purchase if you finish all projects early and would like to make another. No experience needed. 2-day class, 1st semester.*

Crackle Enamel Pendant, Separation Enamel Pendant, and Ring (*Samantha Lazzaro*): Learn kiln/tool safety plus how to anneal, shape, and clean copper before enameling; begin the basic enameling techniques. Complete a crackle enamel pendant, a separation enamel pendant, and a ring. Lab fee includes use of tools, copper, findings and enamel needed to complete the three projects. Additional copper will be available for purchase if you finish all projects early and would like to make another. No experience needed. 2-day class, 2nd semester.*

*1st semester = Monday/Tuesday; 2nd semester = Thursday/Friday. (Wednesday is free.)

The Rocks Beneath Our Feet

Santorini, Greece: Ancient Atlantis?

by Hutch Brown

Editor's note: *This is the third in a series of articles on Santorini. The first is in the February 2019 issue, the second in the March 2019 issue.*

"But afterwards there occurred violent earthquakes and floods; and in a single day and night of misfortune all your warlike men in a body sank into the earth, and the island of Atlantis in like manner disappeared in the depths of the sea." –Plato, *Critias*

So concludes Plato's account of the island of Atlantis. Supposedly, an ancient island empire tried to force the city state of Athens into submission. The gods intervened through the tectonic activity familiar to ancient Greeks, and Atlantis disappeared into the sea.

For Plato, it was an allegory to make a moral point (explained below). But did he make the story up? Or did it come from stories passed down for more than a thousand years—stories of an ancient island empire destroyed by earthquakes and swallowed up by the sea?

The story of Atlantis, though shrouded in the mists of time, might well be grounded in historical fact. A natural disaster did befall an ancient military power in the Aegean Sea, and it began on the island of Santorini.

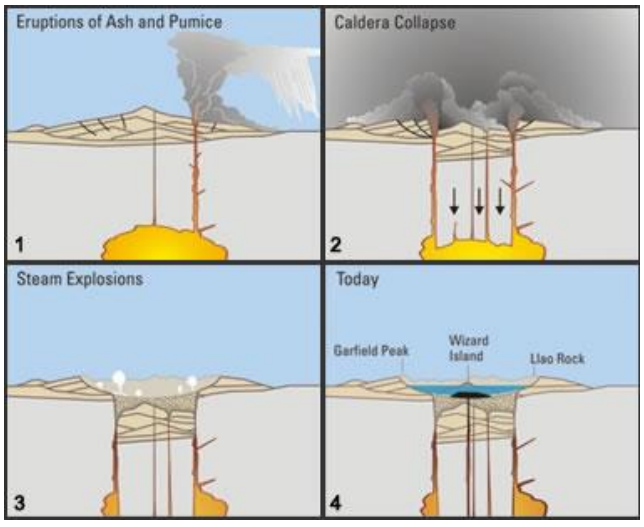


Figure 1—*Formation of Crater Lake in Oregon. A magma chamber domed the area, and pyroclastic eruptions spewed ash and lava, gradually building a volcano. The magma chamber subsided, perhaps in tandem with a volcanic super-eruption. The overlying volcano collapsed and sank, leaving a caldera that became a lake. Source: USGS, via King (2018).*

The town of Oia (pronounced "EE-uh," right foreground), looking east across the caldera toward the island of Therasia. Looming over the caldera are the ruins of a Venetian fortress (center foreground); in the background are the light-colored ash deposits from the great Minoan eruption in about 1645 BC. The eruption and caldera collapse destroyed the land bridge that once connected the island of Santorini with Therasia. Photo: Hutch Brown.

What is that story?

Caldera Collapse

The story revolves around a great volcanic eruption and caldera collapse. What *is* caldera collapse?

Take Crater Lake in Oregon, for example (fig. 1). Rising plumes of magma from the mantle formed lava chambers deep underground, causing swelling or uplift on the Earth's surface—the formation of a dome.

Doming rifted the rock, creating dikes that carried lava to the Earth's surface. Pyroclastic explosions followed, sending gases and hot ash into the atmosphere. Pyroclastic eruptions and lava flows together formed what geologists call a composite volcano.

An unusually powerful eruption was accompanied by emptying (or subsidence) of the magma chamber underlying the volcano. As the magma chamber subsided, the overlying structure of the remaining volcano collapsed downward into the Earth's crust.

Caldera collapse left a huge depression surrounded by vestiges of the former lava cone, which now make up the caldera rim. The caldera then filled with water, creating Crater Lake (fig. 1). In the case of Santorini, the caldera filled with seawater surrounded by the volcanic remnants of three islands (fig. 2).

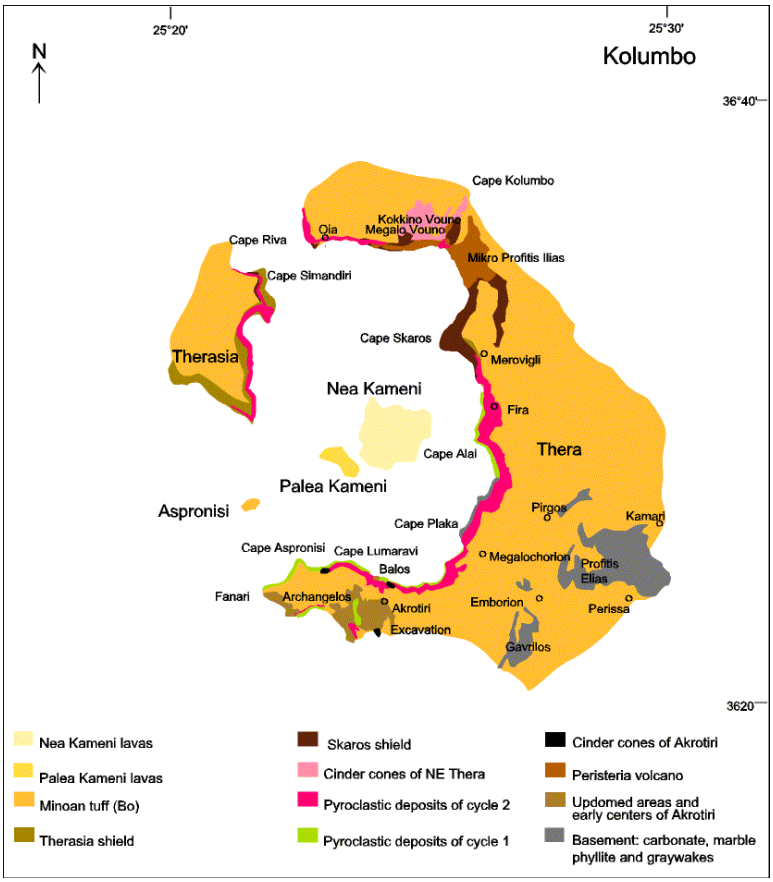


Figure 2—*A simplified geologic map of the Santorini caldera shows three remnant islands following the Minoan eruption in about 1645 BC (Santorini, Therasia, and tiny Aspronisi). Since 197 BC, volcanic activity inside the caldera has created two new islands, Nea Kameni and Palea Kameni. Source: Pfeiffer (2004).*

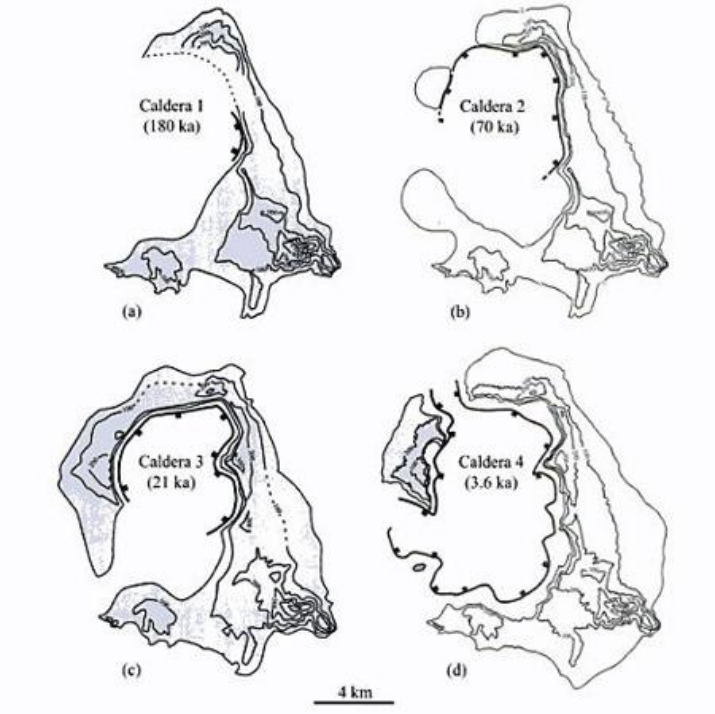


Figure 3—*In the last 180,000 years, lava dome growth and subsequent caldera collapse have led to four separate incarnations of the Santorini caldera: (a) 180,000 years ago, following the final eruption of the Thera volcano; (b, c) multiple caldera collapses until the Minoan eruption in about 1645 BC; (d) following the Minoan eruption. Source: Pfeiffer (2004).*

Today, the islands of Santorini and Therasia ring the caldera on four sides (fig. 2), with a gap in the northwest and a much larger gap in the southwest. Tiny Aspronisi is the sole remnant of the southwestern rim.

A new lava dome is forming in the center of the caldera. Palea Kameni, first reported emerging from the sea in 197 BC, now appears to be dormant. But the larger island of Nea Kameni has been rapidly growing since it first emerged from the sea in 1707.

The geologic record over the past 2 million years shows multiple cycles of lava dome growth within the caldera, followed by major eruptions and caldera collapse. Within the last 180,000 years, at least three separate calderas have formed (fig. 3(b)–(d)).

About 180,000 years ago, a first set of pyroclastic eruptions (fig. 2) ended with the caldera approximately as shown in figure 3(a). A second set of pyroclastic eruptions formed the caldera as shown in figure 3(b). The cycle continued until historical times, with the caldera more or less as shown in figure 3(c). The Minoan eruption in about 1645 BC left the caldera as we see it today (fig. 3(d)), minus today's growing lava dome (fig. 2). Most of the island complex is covered by ash deposits called Minoan tuff (the orange in figure 2).

Each pyroclastic cycle occurred in stages:

1. A lava dome built up on the caldera floor, gradually covering part of the caldera, much like Nea Kameni is doing today.
2. A huge eruption occurred, far more powerful than the smaller eruptions and lava flows that created the lava dome in the first place.
3. The caldera collapsed and filled with seawater. A partial rim remained, along with steep caldera walls, today about 1,000 feet high.

The Minoan eruption and caldera collapse initiated the latest pyroclastic cycle. What led up to it?

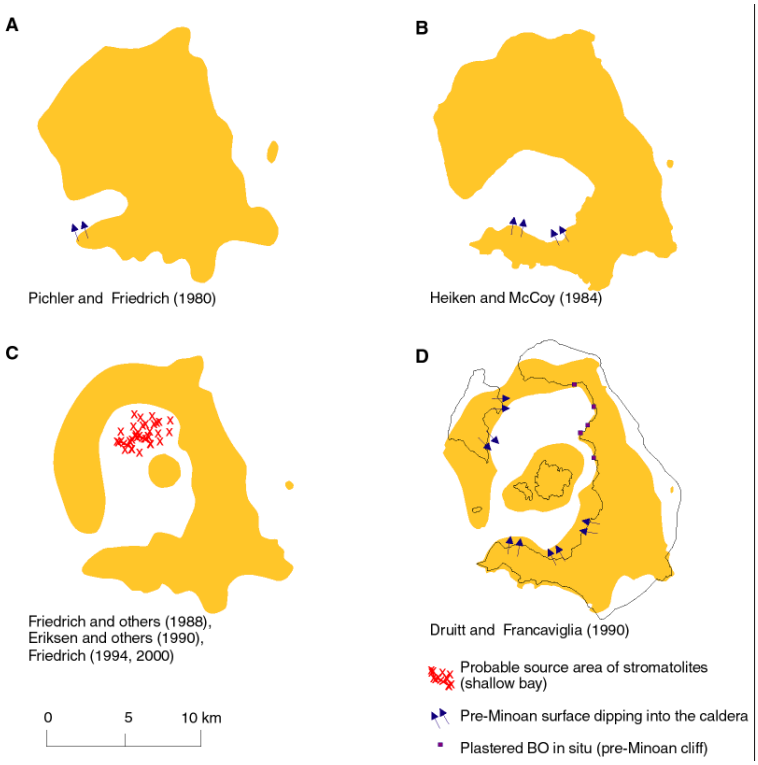


Figure 4—*In the 1980s–90s, geological discoveries in Santorini led to changing theories about lava dome development in the caldera preceding the Minoan eruption. The original theory of a caldera nearly filled in by a lava dome (a) gradually gave way to the theory of a flooded caldera much like today's (d). Source: Pfeiffer (2004).*

Lava Dome Formation

What follows is mostly based on Pfeiffer (2004). (I found nothing more recent to contradict his summary of previous research.)

As recently as 1980, geologists believed that a growing lava dome had filled most of the caldera by the time of the Minoan eruption. Santorini, they theorized, had grown into a huge volcanic dome with no more than a small bay left in the southwestern corner (fig. 4(a)). A large volcano was in the middle.

Then geologists punched several holes in the theory:

- The amount of material ejected by the Minoan eruption was smaller than figure 4(a) would suggest.
- Geologists found Minoan tuff dipping into the caldera or plastered onto older caldera walls (figs. 4(b), 4(d), arrows), which could only have happened if the caldera had existed and the walls had been exposed at the time of the Minoan eruption.
- The Minoan tuff contained stromatolites formed by cyanobacteria living in shallow lagoons, proving that parts of the caldera were still undersea (fig. 4(c)).

Figure 4 shows the progression in scientific thinking in the 1980s–90s about the extent of caldera closure by the time of the Minoan eruption. Scientists now agree that the sunken caldera just before the Minoan eruption was almost as big as today, but with a much larger lava dome growing in the middle (fig. 4(d)).

Interesting, no? And maybe a little alarming?

Conditions today—or, given the rapid growth of Nea Kameni in the last 3 centuries, not all that far in the future—could resemble those at the time of one of the greatest volcanic eruptions in recent millennia!

The Minoan Eruption

The Minoan eruption in about 1645 BC was one of the few supervolcanic eruptions in the last 2,000 years. Geologists measure eruptions in terms of the Volcanic Explosivity Index based on such factors as the volume of ejected matter and the height of the volcanic plume. The index is on a scale of 0 to 8, with each number representing a tenfold increase in the volume of ejected materials.

The Minoan eruption is one of only five eruptions in the last 2,000 years classified as a 7. (There are no 8s.) By comparison, the eruptions of Mount Vesuvius in 79 AD and of Mount St. Helens in 1980 were both classified as 5s, so the Minoan eruption was 100 times greater.

Scientists now believe that the volume of ejected material was about 24 cubic miles. The height of the eruption column was also about 24 miles, reaching into the stratosphere above the highest levels that aircraft can fly. The eruption would have been visible and even audible across much of the Aegean Sea.

The Minoan eruption left a layer of ash across islands to the west as well as across all of Asia Minor. The ashfall was 8 inches thick on islands immediately to the west, such as Rhodes, although it was negligible on islands to the north and south, such as Crete. No ashfall at all reached mainland Greece, which is not in the Santorini airshed.

The eruption included five separate events. First, earthquakes shook Santorini, followed by a relatively

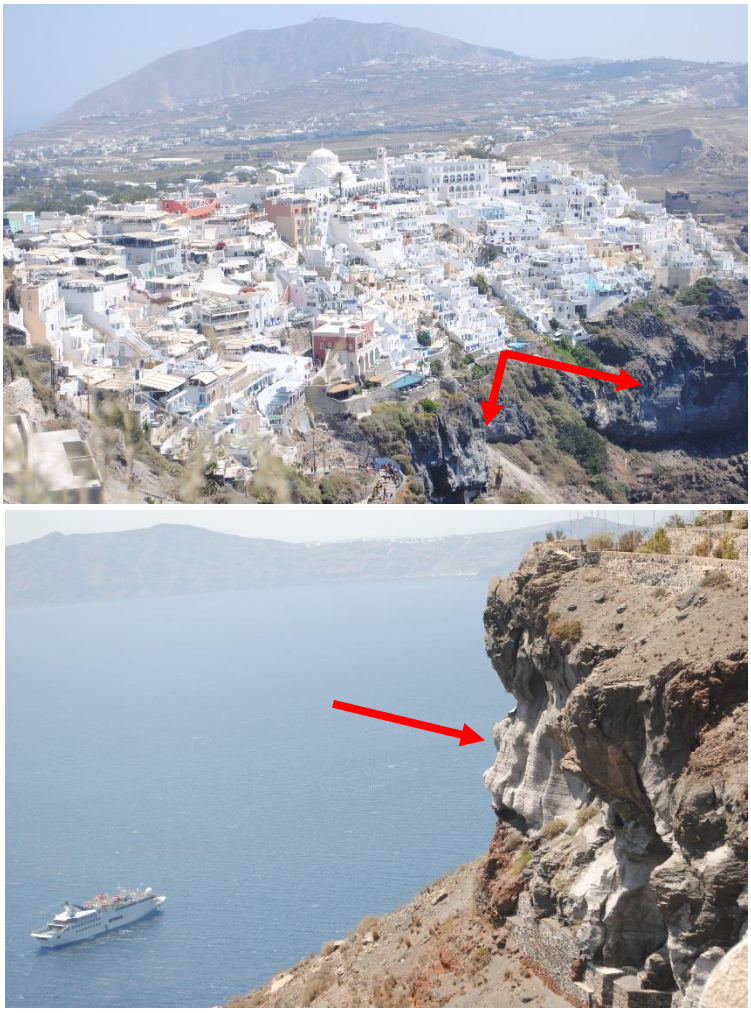


Figure 5—*Top:* *The town of Fira, with Profitis Ilias in the background. The mountain, with its metamorphic bedrock, is the highest point on Santorini. The light-colored layer in the cliffs below town (see the arrows) is made up of "rhyodacitic" pyroclastic deposits from the Minoan eruptions.* ***Bottom:*** *The same cliffs as top, with the same white Minoan tuff. Photos: Hutch Brown.*

minor eruption that left a thin layer of yellow ash. The earthquakes gave the island's inhabitants plenty of warning, and they managed to completely evacuate, leaving by ship for other islands.

Four major eruptions followed, each including lava fountains and major explosions. The main vent seems to have been near what is now the administrative center and port of Fira, in the west-central part of Santorini. It was also near the current vents on Nea Kameni.

The eruptions left the remnant islands covered with a thick layer of light-colored ash and pumice. The layer of deposits, up to 200 feet thick, is clearly visible along

Figure 6—*White Minoan tuff with embedded rocks—including huge lava bombs (black basalt). Photos: Hutch Brown.*

the top of the island's caldera rim near Fira and elsewhere (fig. 5).

The ash layer ranges from white to cream in color, reflecting its chemical makeup. Geologists describe it as

Figure 7—Top: *The loose Minoan tuff is highly susceptible to erosion by wind and water.* ***Bottom:*** *A lava bomb (basalt or andesite) from the Minoan eruption, more than 8 feet tall. The huge boulder lies on the Oia peninsula near the top of Megalo Vouno, several miles north of the vent that ejected it. Megalo Vouno, one of the high points on the island, features the exposed remnants of the Peristeria volcano, active about 430,000 years ago. The overlying Minoan tuff has completely eroded away, leaving the Minoan lava bomb perched on much older Peristeria lava (red scoria). Photos: Hutch Brown.*

"rhyodacitic," meaning high in quartz and feldspar and low in mafic minerals such as calcium, iron, and magnesium oxides (which make up darker volcanic rock).

In some places, the ash is laced with gray or black rocks and boulders, some of them huge. The boulders are lava bombs ejected during pyroclastic explosions from the erupting volcano. They are typically either andesite or black basalt (fig. 6), rich in mafic minerals.

The Minoan ash formed a loose tuff prone to erosion (fig. 7, top). It soon blew or washed away from higher elevations, such as Megalo Vouno on the Oia peninsula (fig. 7, bottom), leaving much older volcanic rock completely exposed. Erosion has deposited thick layers of Minoan ash on the gentle coastal plains of eastern Santorini, where landowners grow grapes and other crops in the fertile volcanic soils.

The final phase of the Minoan eruption was accompanied by caldera collapse, leaving the island remnants we see today. Caldera collapse weakened parts of the rim around the caldera, which gave way to landslides. Most of the southwestern rim vanished under the sea, as did the land bridge between Santorini and the island of Therasia.

Impact on the Minoan Civilization

The Minoan eruption is named for the ancient Greek civilization that flourished in Crete and on other Aegean islands from 2700 to 1600 BC. ("Minoan" comes from the name of the mythical first king of Crete, Minos.) The Minoans lived from farming and fishing as well as from shipping and trading in the eastern Mediterranean region. A seafaring nation, they were the leading sea power in the region.

Santorini had at least one major Minoan settlement on the island's southern Akrotiri peninsula. Alarmed by weeks or months of earthquakes that preceded the first minor eruption, the Minoans evacuated Akrotiri before the major eruptions began.

The Minoan town near Akrotiri was buried by Minoan tuff. When archeologists began excavating the community in the 1960s, they found neither corpses nor artifacts of value other than a gold figurine of an ibex, hidden beneath a floor and apparently forgotten. They concluded that everyone had left the island.

But the danger was not over. The effects of the Minoan eruptions included a huge tsunami that must have devastated nearby islands, including communities on the northern coast of Crete.

The seafaring Minoan nation would have lost much of its fleet, the cornerstone of its naval power and of its ability to control sea lanes. The effects might have weakened Minoan power enough to allow Mycenaeans on the Greek mainland to invade the Aegean islands. The Minoan culture never recovered.

Ancient Atlantis?

Plato's tale of Atlantis made a philosophical point: moral degradation of the ancient island empire of Atlantis undermined its military power, leading to its defeat by morally superior Athens. The angry gods then eradicated Atlantis through earthquakes and subsidence into the sea. That is plainly not what happened. The Minoan civilization predated classical Athens by more than a thousand years, but the analogies are clear.

Like Atlantis, the Minoan civilization was an island empire of sorts. Minoan Crete eventually succumbed to the mainland Mycenaeans whom Athenians regarded as their forefathers. And the decline of Minoan civilization might have been linked to the Minoan eruptions along with the associated earthquakes, tsunami, and caldera collapse on Santorini in about 1645 BC.

Next: Santorini's occupants have long used volcanic rock for buildings, but they have also carved dwellings straight into the tuff—perfect for a vacation stay!

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The Minoan community of Akrotiri on Santorini, buried by ash from the Minoan eruption in about 1645 BC. **Top:** *Intact buildings excavated by archeologists.* **Center:** *A gold figurine of an ibex, found hidden in Akrotiri.* **Bottom:** *Mural of a teenage girl on an interior wall. Source: Wikipedia.*

April 2019—Upcoming Events in Our Area/Region (see details below)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3 MSDC mtg, Washington, DC	4	5 MNCA Conf, Alexandria, VA	6 MNCA Conf, Alexandria, VA; NOVA field trip
7 ANS field trip	8 GLMSC mtg, Rockville, MD	9	10	11	12	13 NOVA field trip
14	15	16	17	18	19	20
21 Easter	22 NVMC mtg, Arl, VA Earth Day	23	24 MNCA mtg, Arlington, VA	25	26	27 Show, PA
28 Show, PA	29	30				

Event Details

3: Washington, DC—Monthly mtg; Mineralogical Society of the Dist of Columbia; 7:45–10; Smithsonian Natural Hist Mus, Constitution Ave lobby.

5–6: Alexandria, VA—45th Annual Atlantic Micromounters' Conference; Micromineralogists of the National Capital Area; Holiday Inn, 6055 Richmond Hwy; info: http://www.dcmicrominerals.org/.

6: Thoroughfare Gap, VA—NOVA field trip; 9–5; info, reg: GOL 135 Website.

7: Geology at Soldiers Delight, MD—Audubon Naturalist Society field trip; 1–4; info, reg: ANS website.

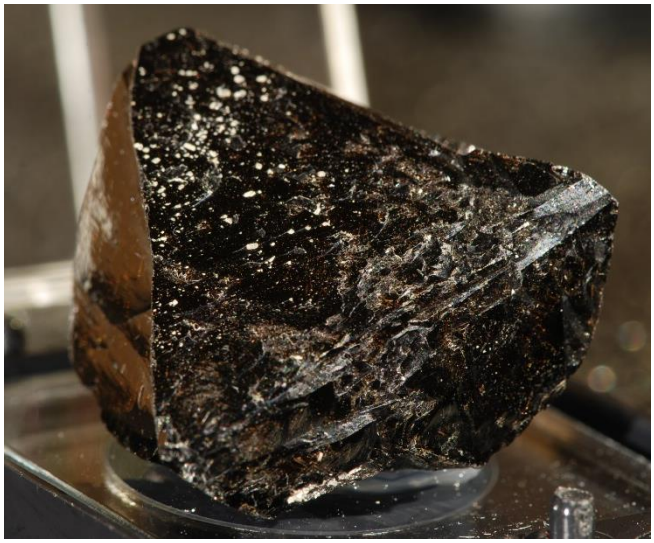
8: Rockville, MD—Monthly meeting; GLMSMC; 7:30–10; Rockville Senior Ctr, 1150 Carnation Dr.

13: Paleozoic Geology of VA/WV—NOVA field trip; 9–7; info, reg: GOL 135 Website.

22: Arlington, VA—Monthly meeting; Northern Virginia Mineral Club; 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.

24: Arlington, VA—Monthly meeting; Micromineralogists of the National Capital Area; 7:45–10; Long Branch Nature Center, 625 S Carlin Springs Rd.

27–28: West Mifflin (Pittsburgh), PA—Monongahela Rockhounds Gem, Mineral and Fossil Show; Sat 10–6, Sun 10–4; West Mifflin Volunteer Fire Co. #4 Skyview Hall, 660 Noble Drive; admission free; info: show@monongahelarockhounds.org.



Cassiterite from Taquaral, Minas Gerais, Brazil. Photo: Bob Cooke.

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THE NORTHERN VIRGINIA MINERAL CLUB INC
Crystals are the flowers of the Mineral Kingdom

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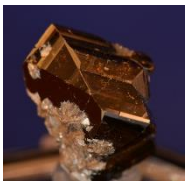

Mineral of the Month: Cassiterite

PLEASE VISIT OUR WEBSITE AT:
http://www.novamineralclub

The Northern Virginia Mineral Club

Visitors are always welcome at our club meetings!

Please send your newsletter articles to:
hutchbrown41@gmail.com

RENEW YOUR MEMBERSHIP!

SEND YOUR DUES TO:
Roger Haskins, Treasurer, NVMC
4411 Marsala Glen Way, Fairfax, VA 22033-3136

OR

Bring your dues to the next meeting. **Dues:** Due by January 1 of each year;
$15 individual, $20 family, $6 junior (under 16, sponsored by an adult member).

Purpose: To encourage interest in and learning about geology, mineralogy, lapidary arts, and related sciences. The club is a member of the Eastern Federation of Mineralogical and Lapidary Societies (EFMLS—at http://www.amfed.org/efmls) and the American Federation of Mineralogical Societies (AFMS—at http://www. amfed.org).

You may reprint NVMC materials in this newsletter.
Meetings: At 7:45 p.m. on the fourth Monday of each month (except May and December)* at **Long Branch Nature Center**, 625 Carlin Springs Road, Arlington, VA 22204. (No meeting in July or August.)

**Changes are announced in the newsletter; we follow the snow schedule of Arlington County schools.*