



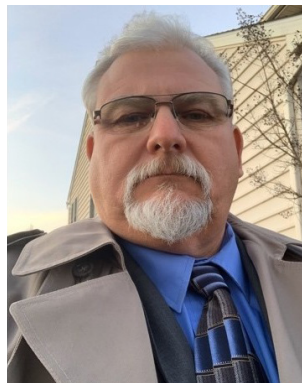
*to promote, support, protect and expand the collection of mineral specimens and to further the recognition of the scientific, economic and aesthetic value of minerals and collecting mineral specimens*

# BULLETIN OF FRIENDS OF MINERALOGY

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## PRESIDENT'S MESSAGE

by Bill Stephens

Hello everyone!

We are now rapidly approaching the 2026 FM National Symposium to be held at the Tucson Gem and Mineral Show in the Convention Center, Saturday February 14, 2026. Symposium Chair Mark Jacobson has assembled a slate of 8 great speakers and talks on a wide variety of subjects, and we hope you can attend in person, but if not, The symposium

will be hybrid this year for the first time ever! The theme for this year is "Red, White and Blue Minerals" in honor of our country's 250th anniversary. Registration will be online soon. Remote attendance via zoom will have a small charge to cover our costs to connect to the Convention Center's system and required IT support. Don't forget, if you need credits for your professional geologist (PG) license requirements, you can get 6 credits for full attendance whether in person or online.

Also, this year we will have a table in the Galleria for the duration of the Main TGMS Show and I'm working with my Board to select some things to sell and information to distribute at the table.

The Pacific Northwest and Pennsylvania Chapters have held their respective Symposia this fall. PNW was not hybrid this year, so I did not get to attend but I hear it was fantastic. FMPA was back at its original venue, West Chester University (WCU), for its annual symposium. We have been hybrid since 2019, and this year was an exceptional year for attendance, including 17 PGs from as far away as Kansas. Returning to our core membership region in southeastern Pennsylvania and our social media campaign brought in more than usual, and our field trip to the Phoenixville mines, with some excavation work ahead of the trip bolstered our field trip attendance to 40. As usual, New Jersey and Midwest Chapters had many great field trips throughout the year.

The General Membership meeting will be held at Mineral Nexus Friday, February 13 in the morning as usual. I trust all of my board members will be able to attend in person, but for those that cannot, it will be hybrid as it has been the last few years. Each year we vote on 4 of the 12 director/officer positions that rotate on a 3 year cycle. The entire board includes the National at-large directors and the chapter Presidents or their designated representatives. This year the four at-large directors and the secretary are up for election. The Vice President executive position will be open as well. The results of the voting will be announced at the Board meeting. Meanwhile, our affiliate periodicals are being judged by our team for best article from each, the results to be announced at the gala at TGMS after the Symposium.

As I have reported, the Board has been exceptionally busy this year, having completed major revisions to the Operating Regulations, minor revision to the bylaws, removing references to California and its State

(continued on page 3)

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## NATIONAL OFFICERS

### PRESIDENT:

Bill Stephens, PG • [bstephens@stephensenv.com](mailto:bstephens@stephensenv.com)

### VICE PRESIDENT:

Nicole Childs • [nchilds@amnh.org](mailto:nchilds@amnh.org)

### SECRETARY:

Jeanine Mielecki • [jaynine9@aol.com](mailto:jaynine9@aol.com)

### TREASURER:

William Besse • [wwbesse@gmail.com](mailto:wwbesse@gmail.com)

### WEBMASTER:

Sean Stimac • [seanstimac@gmail.com](mailto:seanstimac@gmail.com)

### PUBLICITY CHAIRPERSON:

Jessica Robertson • [jar7709@hotmail.com](mailto:jar7709@hotmail.com)

### BULLETIN EDITOR:

Sean Stimac • [seanstimac@gmail.com](mailto:seanstimac@gmail.com)

## NATIONAL BOARD OF DIRECTORS

Terms expire before the annual general meeting in February

### TERMS EXPIRE IN 2026:

Matt McGill • [matt@i rocks.com](mailto:matt@i rocks.com)

Jessica Robertson • [jar7709@hotmail.com](mailto:jar7709@hotmail.com)

Jeanine Mielecki • [jaynine9@aol.com](mailto:jaynine9@aol.com)

William Besse • [wwbesse@gmail.com](mailto:wwbesse@gmail.com)

### TERMS EXPIRE IN 2027:

Nicole Childs • [nchilds@amnh.org](mailto:nchilds@amnh.org)

Alfredo Petrov • [alfredo@mindat.org](mailto:alfredo@mindat.org)

Ashley Palafox • [ashleyrowepalafox@gmail.com](mailto:ashleyrowepalafox@gmail.com)

Alex Venzke • [alex.venzke27@gmail.com](mailto:alex.venzke27@gmail.com)

### TERMS EXPIRE IN 2028:

Sean Price • [blackpinesgeology@gmail.com](mailto:blackpinesgeology@gmail.com)

Tomer Shapira • [tomert@tomertline.com](mailto:tomert@tomertline.com)

Thea Stender • [theasmineralworld@hotmail.com](mailto:theasmineralworld@hotmail.com)

Sean Stimac • [seanstimac@gmail.com](mailto:seanstimac@gmail.com)

## CHAPTER REPRESENTATIVES

### COLORADO CHAPTER:

Ben Murphy • [bscott.murphy@gmail.com](mailto:bscott.murphy@gmail.com)

### MIDWEST CHAPTER:

Randy Marsh • [marsh.rg@pg.com](mailto:marsh.rg@pg.com)

### MISSISSIPPI VALLEY CHAPTER:

Larry Nuelle • [lnuelle@gmail.com](mailto:lnuelle@gmail.com)

### NEW JERSEY CHAPTER:

Dave Shapiro • [dshapiro33@gmail.com](mailto:dshapiro33@gmail.com)

### PACIFIC NORTHWEST CHAPTER:

Jessica Robertson • [jar7709@hotmail.com](mailto:jar7709@hotmail.com)

### PENNSYLVANIA CHAPTER:

Bill Stephens, PG • [bstephens@stephensenv.com](mailto:bstephens@stephensenv.com)

### SOUTHERN CALIFORNIA CHAPTER:

Dr. Don Buchanan • [dbuch7326@aol.com](mailto:dbuch7326@aol.com)

\*Chapter representatives also have a board position

## EX-OFFICIO BOARD MEMBERS

### ROCKS & MINERALS:

Marie Huizing • [rocksandminerals@fuse.net](mailto:rocksandminerals@fuse.net)

### THE MINERALOGICAL RECORD:

Wendell Wilson • [minirecord@comcast.net](mailto:minirecord@comcast.net)

### MINERALOGICAL SOCIETY OF AMERICA:

Alex Speer • [jaspeer@minsocam.org](mailto:jaspeer@minsocam.org)

### MINDAT.ORG:

Jolyon Ralph • [jolyon@mindat.org](mailto:jolyon@mindat.org)

### MINERALOGICAL ASSOCIATION OF CANADA:

Paula Piilonen • [ppiilonen@mus-nature.ca](mailto:ppiilonen@mus-nature.ca)

### MINERAL NEWS:

Tony Nikischer • [tony@excaliburmineral.com](mailto:tony@excaliburmineral.com)

## ONLINE RESOURCES



### WEBSITE:

[friendsofmineralogy.org](http://friendsofmineralogy.org)



### CALENDAR OF EVENTS:

[friendsofmineralogy.org/calendar-of-events](http://friendsofmineralogy.org/calendar-of-events)



### FACEBOOK:

Page: [@FriendsofMineralogy](https://www.facebook.com/FriendsofMineralogy)

Group: [www.facebook.com/friendsofmineralogy](https://www.facebook.com/friendsofmineralogy)



### INSTAGRAM:

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(President's Message, continued from page 1)

Seal, creating and adopting a new logo thanks to Tama Higuchi for her assistance and mad skills, voting and beginning the arduous task of moving the corporation to Arizona, developing a social media campaign for membership and symposium attendance, and updating the website to name a few. We voted to add the Young Mineral Collectors (YMC) and Minerals in Context (MIC) to our roster of affiliates and I am actively engaged with YMC as a mentor. YMC officers have joined our Board of Directors and bring some much needed skills and energy to our organization. We changed banks and moved our accounts to the new bank and cleared up issues with our California non-profit status. See more detailed explanations of each accomplishment and goal in the newsletters from the last 12 months.

We have several significant goals for the coming year. First, we are planning field trips to various locations around the country throughout the coming year including a machine dig at the Hogg Mine in Lagrange GA for rose quartz and beryl/aquamarine, and a trip to Treasure Mountain in Little Falls New York for Herkimer diamonds, including scepters and other unique quartz specimens. We are also instituting a social media campaign which along with the field trips and hybrid symposia, will keep us engaged with our members and followers throughout the year, and we anticipate these efforts will bring in new members and keep us engaged with YMC and other active affiliates. Third, we will be reinforcing our educational mission with enhanced outreach techniques and broad in-person and social media presence. We will be coordinating with our chapters to help enhance their presence and draw members as well.

I'm very excited to announce the formation of the Herkimer Diamond Research Institute (HDRI), recently formed and already active as a research team dedicated to understanding all aspects of the formation of "diamond" quartz in the Herkimer District of New York, the host rock and its implications for our understanding of the geology and mineralogy of these deposits, and other similar deposits. I'm pleased to be a Board of Directors member of this newly formed research organization which currently consists of myself, Bob Borofsky, several professors at Rutgers and Rensselaer Polytechnic Institute, well known Herkimer authors and PhD candidate David Tibbitts who many of us know. I'll be asking our Board to recognize HDRI as an affiliate at our annual meeting.

Happy Hunting, Stay Tuned and hope to see you in Tucson!

## BULLETIN EDITOR

Dear Reader,

This issue of the Bulletin is heavily focused on our annual symposium at the Tucson Gem and Mineral Show in February. As no content was submitted by members or chapters for this issue, I elected to include the abstracts from all symposium speakers. The abstract prepared by Mark Ivan Jacobson served as the template for this section and was replicated throughout the issue. I did, however, take editorial liberties with formatting to ensure clarity, structure, and overall readability. A PDF copy of Mark's original abstract is available for download [here](#).

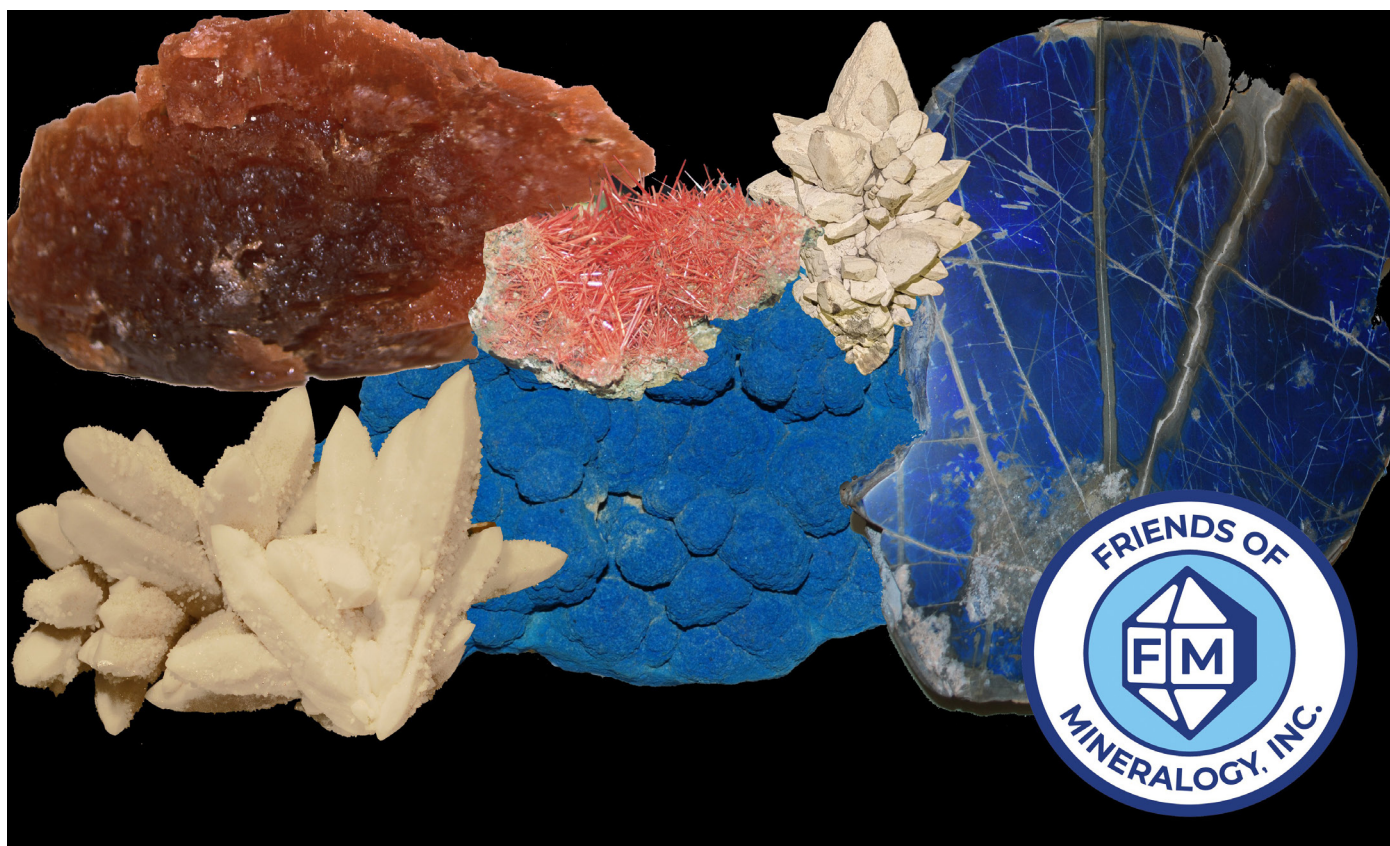
With respect to the symposium itself, we are currently developing an online registration form for those wishing to attend. This year, we will also be offering a virtual attendance option for individuals unable to participate in person. Providing this option requires the purchase of additional services, including internet access and dedicated IT support. As a result, a \$15 registration fee will apply to virtual attendance via Zoom. This fee will be collected through the online registration form.

Additionally, I have assumed the role of webmaster from Bill Besse. I have been working behind the scenes on the website for a short time and look forward to taking a more active role going forward. In conjunction with our recent rebranding, I plan to refresh the visual design of our digital presence and significantly strengthen site security. After implementing traffic-reporting metrics, we identified activity that appears consistent with attempts leading to spoofing and phishing emails. Accordingly, I will be hardening the website to better protect against these threats.

Finally, I have been elected by the Midwest Chapter to serve as Chapter Liaison beginning January 1st. This position became vacant following the passing of Randy Marsh this past fall. I am honored to follow in Randy's footsteps and look forward to serving in this role, recognizing that he left very big shoes to fill.

Sean Stimac, FM National Bulletin Editor





**In conjunction with the Mineralogical Society of America and the Tucson Gem & Minerals Society®, Friends of Mineralogy is pleased to announce the 44th Annual Tucson Mineral Symposium**

*Red, White, and Blue: Celebrate the Spirit of Minerals!*

Saturday, February 14, 2026  
from 10am to 3:30pm

## **The 44th Tucson Mineral Symposium**

West Meeting Rooms 102/103  
Tucson Convention Center, Tucson, AZ



## AGENDA

Theme “ Red, White, and Blue minerals: Let us Celebrate”  
Saturday, February 14, 2026,

West Meeting Rooms 102/103  
Tucson Convention Center, Tucson, Arizona

10:00 AM	Opening of symposium
10:00-10:15 AM	Introduction by symposium chair, Mark Jacobson
10:15 – 10:45 AM	John Stuart McCloy, Cuprorivaite: Egyptian Blue, humanity's first inorganic pigment.
10:45 - 10:55 AM	break
10:55 - 11:55 AM	Johan Maertens, Heaven and Hell in Ohio [about Celestine].
11:55 - 1:00 PM	Lunch
1:00 – 1:40 PM	Donald A. Dallaire, New Hampshire's Red, White & Blue Minerals .
1:40 – 1:45 PM	break
1:45 - 2:15 PM	John Rakovan, Pleochroism in minerals.
2:15 - 2:20 PM	break
2:20 – 2:50 PM	Markus Raschke, An ocean within – new insights into structure and phases of water in minerals.
2:50 – 2:55 PM	break
2:55 – 3:25 PM	Bruce Kelley, Finding Art in Minerals: How an interest in color and form ignited my passion for minerals.
3:30 PM	close of symposium

## ACKNOWLEDGMENTS

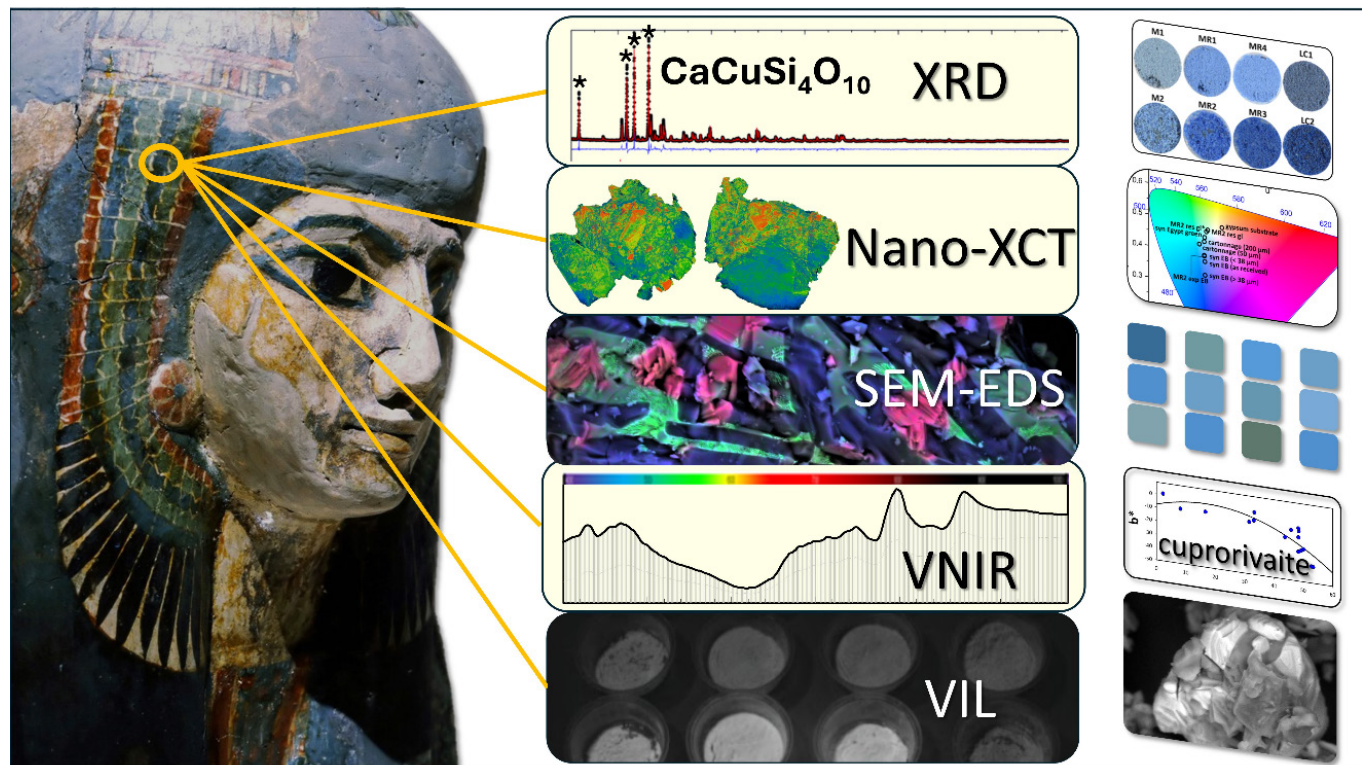
The Friends of Mineralogy executive board, Bill Stephens PG, Nicole Childs, Jeanine Mielecki, and Bill Besse, has been very supportive of proceeding with this symposium as well as our co-sponsors, the Mineralogical Society of America represented by J. Alex Speer and Ann Benbow, and the Tucson Gem and Mineral Society, represented by Pat McClain. Mineral News, managed by Tony Nikischer, Rocks & Minerals, managed by Marie Huizing, and the Mineralogical Record, managed by Wendell Wilson all helped with providing publicity for the symposium. The abstract booklet was edited and assembled by Mark Ivan Jacobson.

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## ABSTRACTS



### CUPRORIVAITE: EGYPTIAN BLUE, HUMANITY'S FIRST IN-ORGANIC PIGMENT

John S. McCloy,  
School of Mechanical & Materials Engineering,  
Washington State University

Egyptian Blue (EB), first made over 5,000 years ago, is the world's earliest synthetic pigment. It is based on the blue mineral cuprorivaite ( $\text{CaCuSi}_4\text{O}_{10}$ ), related to barium copper silicates (effengerite, colinowensite) also known from antiquity as Chinese blue and purple.

To fabricate EB, artisans heated sand, lime, copper minerals, and alkali to create a brilliant blue thought to symbolize eternity and the heavens, adorning tomb walls, statues, and pottery. Later, Romans used it in mosaics, frescos, and buildings. Its use declined after 600 CE but survived into the Renaissance. Rediscovered in the 19th–20th centuries, cuprorivaite was shown

to have unique optical and magnetic properties, making it promising for modern applications in biomedicine, telecommunications, lasers, and security inks.

Recently, our group at Washington State University, with the Carnegie Museum of Natural History and the Smithsonian Museum Conservation Institute, recreated EB to uncover the science behind its color, ranging from gray or green to deep blue. We produced 12 versions of EB and compared them with artifacts, using advanced X-ray techniques, spectroscopy, and quantitative color measurements. We found EB is a complex mixture of phases, with hue controlled by particle size, glass content, and cuprorivaite–silica ratios. Even small changes in materials or heating could dramatically shift its color.

These findings reveal ancient craftspeople as skilled materials scientists. Beyond cultural insights and conservation, Egyptian blue's infrared glow continues to inspire modern technologies, linking past creativity with future innovation.

## JOHN S. MCCLOY, SPEAKER BIOGRAPHY



Dr. John S. McCloy is Professor and Director (Department Head) of the School of Mechanical & Materials Engineering and Lindholm Endowed Chair in Materials Engineering at Washington State University (WSU), and a joint appointee at Pacific Northwest National Laboratory (PNNL). His professional career includes academia (WSU, 12 y), national

laboratory (PNNL, 5 y), and industry (Raytheon, etc., 10 y). At WSU, he leads the Nuclear, Optical, Magnetic, & Electronic (NOME) Materials Lab and the Crystals and SemiConductors (CASC) group, both within the Institute of Materials Research (IMR). These groups develop materials solutions for energy, environment, and security applications. Over his career, he has worked on diverse engineering problems, including cryogenics, composite structures, telescopes, optical ceramics, magnetic nanoparticles, ancient materials technologies, nuclear fuels, single crystal growth, and glass development for optics and immobilization of radioactive waste. He holds degrees in Materials Science & Engineering (MSE) from the Massachusetts Institute of Technology (BS) and the University of Arizona (MS, PhD), as well as an MA in Anthropology from Arizona. He is co-author of over 300 journal articles, book chapters, conference proceedings, public reports, and patents. He is a Fellow of the American Ceramic Society, a Fellow of SPIE the optics and photonics society, an elected member of the Washington State Academy of Sciences, and a Fulbright Scholar. In whatever spare time there is left, he enjoys reading, hiking, music, mineralogy, foreign languages, and board games with his family.

## HEAVEN AND HELL IN OHIO

Johan Maertens

Ohio

Mr.Calcite@live.com

Attendees get to enjoy an audio-visual lecture about one of Ohio's common minerals. Celestine or celestite, is a mineral, the (anhydrous) sulfate salt of strontium. The mineral derives its name – for its occasional delicate blue color – from the Latin word *caelestis* meaning celestial, which in turn is derived from the Latin word *caelum* meaning sky or heaven. Celestine occurs as crystals, and also in compact massive and fibrous forms. It is mostly found in sedimentary rocks, often associated with the minerals gypsum, anhydrite, and halite. The mineral is found worldwide, usually in small quantities. Pale blue crystal specimens are found in Madagascar and in the Midwest USA.

Did you know that the bodies of Acantharea - a group of radiolarian protozoa - are made of strontium sulfate crystals, unlike those of other radiolarians which are made of silica. Celestine and the carbonate mineral strontianite are the principal sources of the element strontium, commonly used in fireworks and in various metal alloys. We descend from heaven and go underground to the largest known celestine geode located near the village of Put-In-Bay, Ohio on South Bass Island in Lake Erie.

Note: While the lecturer prefers the name celestite, celestine is the approved name for this mineral by the International Mineralogical Association Commission on New Minerals and Mineral Names (CNMMN). Although celestite finds frequent usage in some mineralogical texts, the name has been discredited as a valid mineral name by this organization.

## NEW HAMPSHIRE'S RED, WHITE & BLUE MINERALS

Donald A. Dallaire  
829 Candia Rd.  
Chester, NH 03036  
dadallaire@hotmail.com

New Hampshire is a small state but has 367+ confirmed mineral species (Mindat accessed 2025) placing it as the 33rd state with the most mineral species in the United States. The abundance of species can be attributed to past geological events including the formation of the super continent Pangea approximately 300Ma and subsequently as it broke up approximately 200Ma. The coalescence of Pangea was responsible for a number of orogenic granites and LCT (Lithium, Cesium, Titanium) class pegmatites and the subsequent breakup resulted in anorogenic granites and NYF (Niobium, Yttrium, Fluorine) class pegmatites as described in Černý and Ecrít's (2005) revision of pegmatite classification. Most of New Hampshire rocks are metamorphic and there are a few hydrothermal veins that contain sulfide minerals, but pegmatites are the host of most mineral species. Consequently, in this review, the majority of the minerals presented are from pegmatites.



## JOHAN MAERTENS, SPEAKER BIOGRAPHY

A lifelong naturalist and passionate collector, Johan Maertens is a citizen-scientist mineralogist based in Ohio, USA, best known for his specialization in calcite. His fascination with the natural world began in childhood and evolved to a focused interest in minerals, culminating in decades of collecting and studying calcite in all its diverse forms and crystal habits.

He is a dedicated member of the international mineral community since the late 1970s. His calcite inventory, ranging from micromounts to large cabinet specimens, reflects a lifelong pursuit of both beauty and crystallographic precision. Now in the "senior citizen" phase of collecting, he dedicates much of his time to curating the inventory to a collection and studying crystal forms, building 3D models, and applying a system he calls the "5 Ds" to responsibly downsize and refocus his extensive holdings. Beyond minerals, he is an active volunteer in several mineralogical and community organizations, a committed hiker, and a family cook.

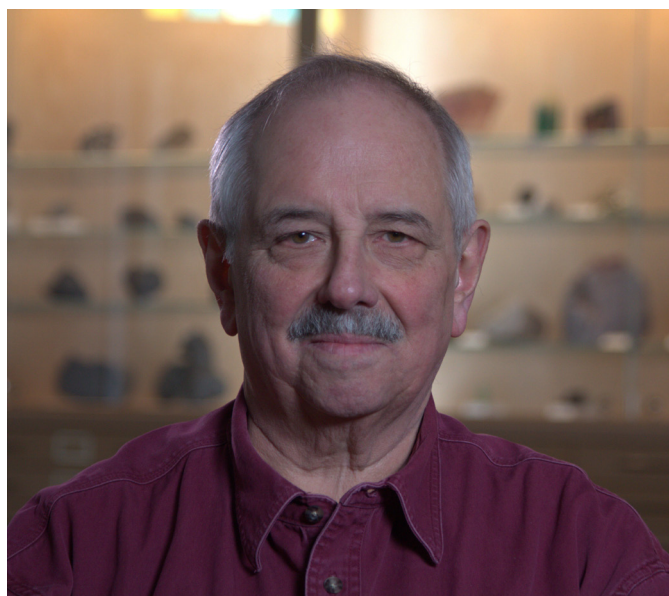
## NOMINATIONS NEEDED

The Friends of Mineralogy is currently seeking nominations for three At-Large Director positions on the Board. At-Large Directors play an important role in guiding the organization's mission, supporting chapters, and contributing to strategic planning and governance at the national level. Members in good standing are encouraged to nominate qualified individuals, including self-nominations who demonstrate a commitment to mineralogy, organizational service, and the long-term health of the Society. Please email Bill Stephens, PG with your nominations.



## DON DALLAIRE, SPEAKER BIOGRAPHY

Don Dallaire was born in Manchester, New Hampshire and has lived in Chester, New Hampshire since 1971. He received a BA from St. Anselm's college in 1967 and an MBA degree from the University of New Hampshire in 1970. He had a career in banking for 38 years, retiring in 2008 giving more time to devote to his interest in minerals. His mineral collecting began in 1971 when a coworker showed him pictures of a recent vacation with a mine in the background. When told the vacation included collecting minerals at old mines his curiosity led him to join in on the next collecting trip. That began 55 years of collecting minerals. He has specialized in apatite and New Hampshire minerals. His current collection of 5600+ catalogued specimens includes approximately 1000 apatites. Don has field collected in New England, New York, Michigan, California, Arizona, and Eastern Canada. He has written several articles for Rocks & Minerals maga-



zine as well as other publications and has given many talks to mineral clubs in New England. Don is a member of the MP2 Research Group at the Maine Mineral & Gem Museum in Bethel, Maine.



## PLEOCHROISM IN MINERALS

John Rakovan,  
New Mexico Mineral Museum,  
New Mexico Bureau of Geology and Mineral  
Resources,  
801 Leroy Place Socorro, New Mexico 87801.  
[john.rakovan@NMT.edu](mailto:john.rakovan@NMT.edu)

Pleo (many) chroic (colors), could be used to describe several phenomena mineralogy, however, the term pleochroic is used very specifically in mineralogy to describe the variation in color observed in a mineral when it is viewed along different crystallographic directions. Many minerals show pleochroism, and an excellent example is seen in the tanzanite variety of zoisite (Fig. 1). If one searches for a definition to the term pleochroism, however, they will find two related but distinctly different definitions among reliable sources. The first is the definition given above. The second is the property of a crystal of showing different colors when viewed by light polarized in different directions (or something similar).

Figure 1. Tanzanite crystal (variety of zoisite), from the Merelani Hills, Tanzania; 3.8cm high. In this composite image, the crystal is seen along three different directions, all illuminated with unpolarized white light. In the upper left, you are looking along the a crystallographic axis, and the color is purple. In the

middle right, you are looking along the b-axis, and it is distinctly blue. When looking down the c-axis, lower left, it appears red. This is an example of trichroic pleochroism, or simply trichroism. Mike Keim specimen. Jeff Scovil photo.

The term “pleochroism” was coined by the German mineralogist Wilhelm Haidinger (1795-1871) in his article “Ueber den Pleochroismus der Krystalle” (On the Pleochroism of Crystals) published in *Annalen der Physik und Chemie* in 1845. Haidinger therein introduces the term pleochroism for the first time, but in German, pleochroismus. In that paper Haidinger discusses pleochroism as the variation in a crystal's color when viewed along different crystallographic directions, and in unpolarized light.

Pleochroism, however, can be enhanced if polarized light is used in the observation of a crystal. In polarized light microscopy, especially using a polarizing light microscope, pleochroism is also used to describe a related, but subtly different, observation than the variation in the color of a crystal with varying directions of observation. When observing pleochroism in polarized light, especially in a thin section on a petrographic microscope, one is typically looking in only one direction relative to a crystal in the section. One then rotates the crystal relative to the fixed plane of polarization of the light source. In this context, we see a change in color as a function of polarization direction, not the direction of light propagation

## JOHN RAKOVAN, SPEAKER BIOGRAPHY



Dr. John Rakovan is a mineralogist and the Senior Mineral Museum Curator at the New Mexico Bureau of Geology and Mineral Resources, Socorro, NM, and an Adjunct Professor in the Department of Geology and Environmental Earth Science, Miami University, Ohio. John has been a mineral collector for more than fifty years, and it was collecting that opened

his eyes to the science of mineralogy. His current collecting interests are heavily influenced by his research, much of which focuses on apatite and apatite supergroup minerals. John has been an executive editor of and regular contributor to *Rocks & Minerals* magazine since 2001. He is a fellow of the Mineralogical Society of America (MSA), a recipient of the Carnegie Mineralogical Award, and the eponym of the decavanadate mineral rakovanite

## AN OCEAN WITHIN – NEW INSIGHTS INTO STRUCTURE AND PHASES OF WATER IN MINERALS

Markus B. Raschke  
University of Colorado, Boulder, Colorado,  
80309, USA  
Email: markus.raschke@colorado.edu  
http: <https://nano-optics.colorado.edu>

We live in a water world. Seventy-one percent of the earth is covered by water. We humans are composed of approximately 60% water. When it rains, or snows, or does neither, a prominently visible hydrological cycle of surface and atmospheric water unfolds in front of our eyes every day. However, yet less visible, there is another oceans'-worth of water that lies beneath our feet. From the crust to the core the earth hosts

an abundance of water. This deep water cycle controls from subduction and plate tectonics, to magmas and volcanism, and metamorphism. And with hydrothermal circulation giving rise to the formation of ore deposits, water plays a critical role in mineral formation, not only as a solvent, but also as agent controlling crystal growth, habit, and chemistry.

An associated process is mineral hydration which describes the incorporation of water into the crystal structure, either as OH<sup>-</sup> anions by, e.g., conversion of an oxide into a double hydroxide, or the incorporation of molecular water directly into the crystal lattice, either as integral part of the structure, or occupying vacancy sites. These processes control the formation, structure,

composition, stability, and other properties of many mineral species.

Upon crystallization from a hydrous fluid, many minerals incorporate water into their crystal structure and typically in a well-defined stoichiometric ratio. Prominent examples are gypsum  $\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$ , epsomite  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , or borax  $\text{Na}_2[\text{B}_4\text{O}_5(\text{OH})_4] \cdot 7\text{H}_2\text{O}$ . Also, talc, zeolites, chlorite, muscovite, serpentine, and a range of biominerals contain variable amounts of water. Of technological importance is the hydration reaction giving cement its strength, and its intriguing ability to harden even when submerged in water.

However, many of the underlying processes of water in mineral formation are yet poorly understood [1]. This is associated with the yet poorly understood properties of water itself. This is exemplified by its many unusual properties that are fundamentally distinct from most other substances: Upon freezing water expands, rather than contracts. It has a very high heat capacity. It is one of the strongest polar liquids; for the molecular size it has a very high melting temperature; nearly universal solubility; and an exceptionally complex variety of thermodynamic phases.

These anomalies of water make water different from any other molecular substance. They result from its unique inter-molecular hydrogen bonded network. Conversely this highly fluctuating network and associated variations of local structure, make the study of elementary properties of water very difficult.

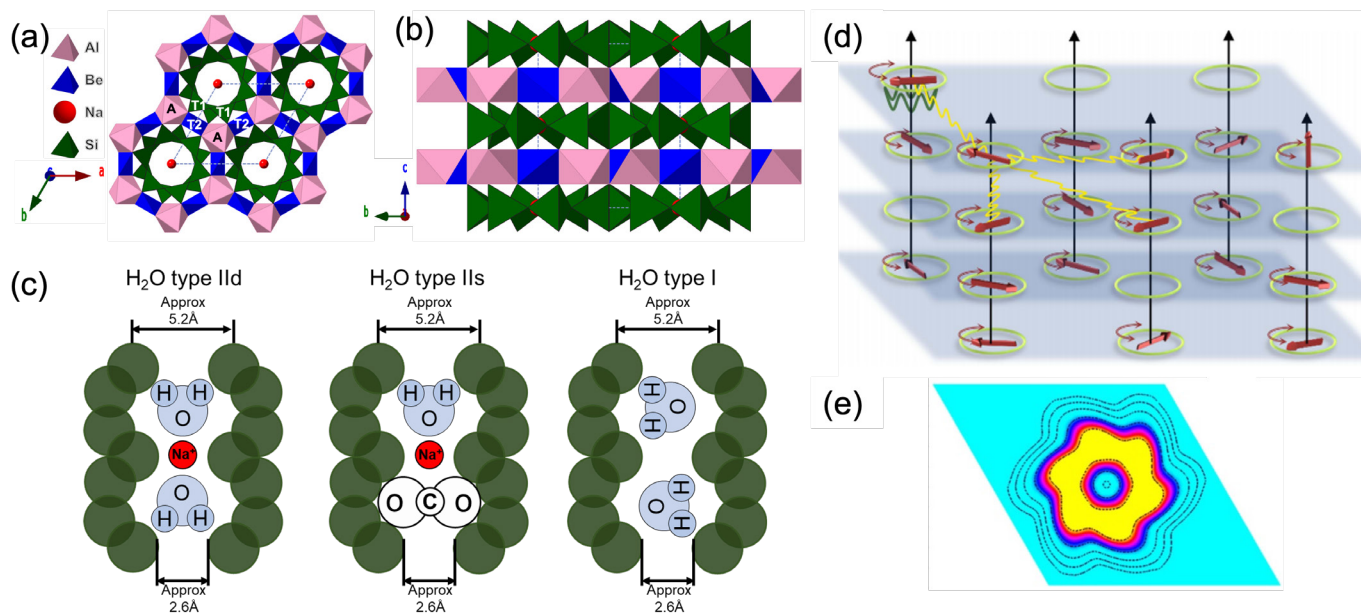
In this talk, I will provide both an overview



**Fig. 1. Beryl (var. aquamarine) with cassiterite. Xuebaoding, 21.0 x 13.0 x 10.0 cm. Collection MIM museum. Photo James Elliott. The blue color is associated with  $\text{Fe}^{2+}$  substitution. Beryl can contain several weight % water in its structure.**

of the field of water in mineral structures and discuss results from our studies of water in beryl  $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$  (Fig. 1). In beryl six-membered rings of Si tetrahedra form channels parallel with respect to the crystallographic c-axis (Fig. 2a,b). This open cyclosilicate framework of just the

**Fig. 2. Crystal structure of beryl, (a) parallel, and (b) perpendicular with respect to c-axis, with octahedral A (Al), tetrahedral T2 (Be), Si (T1) and two channel sites at the 2a ( $\text{H}_2\text{O}$ , large alkali) and 2b (Na) position. (c)  $\text{CO}_2$  and type I, IIa and IIb  $\text{H}_2\text{O}$  water configuration, with Na, on channel sites [2,3]. Coupling of dipole moments of type I (d) can give rise to ferroelectric order of the water molecules [4]. Charge density proton map in the ab plane, suggesting quantum tunneling and hydrogen atom delocalization [5].**





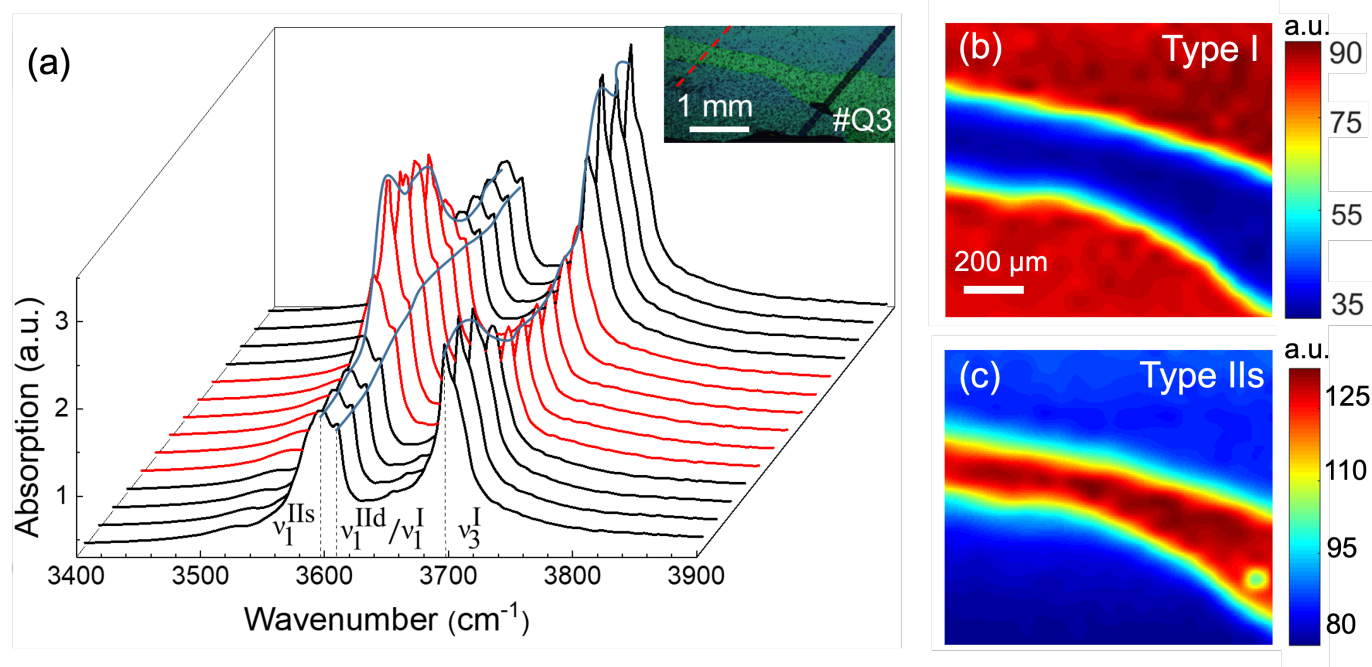
right dimensions provides for weakly bonded yet defined lattice sites for water molecules, thus prevented from hydrogen bonding in contrast to liquid water or ice. As shown in Fig. 2c water on the C1/2a sites has been defined as type I or type II with its molecular dipole moment oriented perpendicular or parallel with respect to the c-axis, respectively. The preference for each type, specifically, the amount of type II water is controlled by doping, where the oxygen ions of the silica tetrahedra bind, e.g., an alkali ion, which in turn defines the water molecular orientation by electrostatic interaction.

Providing a lattice of isolated water molecules, beryl has attracted considerable recent attention with the discovery of several exotic properties. In the absence of hydrogen bonding, yet with defined dipole interaction of the water molecules, a low-temperature ferroelectric ordering of crystal water was discovered based on the electric dipole-dipole interaction [4] (Fig. 2d). Even more unusual was the discovery that the hydrogen atoms of the water molecules do not behave classically as illustrated in Fig. 2c having defined spatial positions. Instead, quantum tunneling leads to a delocalization of the protons in the ab-plane over all six symmetrically equivalent channel positions around the c-axis (Fig. 2e).

I will discuss how we use this system of isolated water molecules both as a laboratory to study elementary properties of water itself, as well as to advance our understanding of beryl

hydration and hydrated minerals in general. In this work we apply a combination of conventional vibrational infrared (IR) and Raman micro-spectroscopy and -imaging, with new nonlinear and coherent spectroscopy techniques. Probing the vibrational response of molecular vibrations of water, and using the symmetry selectivity of the IR and Raman response (similar to birefringence and dichroism in optical microscopy) we can determine molecular orientation and zoning in natural samples of beryl. As example Fig. 3a-c shows results from micro-IR spatio-spectral imaging of natural beryl from Xuebaoding. Based on IR absorption cross section and XRD a C1 site water content of 0.4–0.5 apfu is derived, i.e., close to 50% site occupancy. Secondary crystal phases with a decrease in Fe and Mg, yet increase in Na, suggest early crystallization of aquamarine, with goshenite being late [2].

**Fig. 3. IR point spectra and micro-IR transect of beryl (Xuebaoding, sample #Q3-2 [2]). (a) IR spectral transect with spectra centered on the water stretch region crossing a secondary beryl zone (red) with primary beryl on either side (black) (inset: optical micrograph, with IR transect indicated in red and LA-ICP-MS track in black). The larger type II signal for secondary beryl corresponds to a large Na<sup>+</sup> content as determined by LA-ICP-MS. (b,c) Micro-IR imaging shows anticorrelation of type I and type II, controlled by Na<sup>+</sup>, yet with overall small variation of total water content (ca. 0.4 to 0.5 apfu) [2].**



In ongoing work, we combine electron microprobe analyses (EMP) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) with single-crystal X-ray diffraction (XRD), correlated with Raman and micro-infrared (IR) spectroscopy and imaging, to further quantify lattice position, molecular orientation, bonding state, and dynamics behavior of water in different natural and synthetic beryl crystals. For this work we introduce the application of the novel technique of infrared (IR) scattering scanning near-field microscopy (s-SNOM) for the study of water in mineral structures. IR s-SNOM extends spatial resolution of micro-IR spectroscopy and -imaging from the 10's micrometer to the 10's nanometer, resolving spatial heterogeneities of water type and content on the nanoscale [6]. Nano-IR spectroscopy using s-SNOM further extend selection rules and symmetry selectivity of IR spectroscopy with respect to the different crystallographic phases of water, and with femtosecond (10<sup>-15</sup> seconds) laser excitation, we demonstrate active control of the molecular orientation through optical alignment.

In summary, this talk provides a tour about water from its fundamental properties in common mineral systems to the forefront of the field of mineral and nano-analytical instrumentation science.

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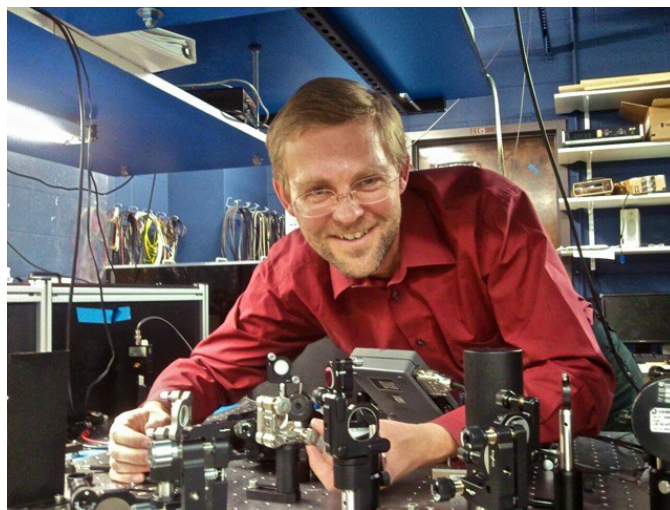


## MARKUS RASCHKE, SPEAKER BIOGRAPHY



Markus Raschke is professor at the Department of Physics at the University of Colorado at Boulder. His research is on the development of novel nano-optical spectroscopy and microscopy techniques with applications to single molecules, quantum materials, and fundamental control of light matter interaction.

Based on a long personal interest in field collecting minerals his research also ventured into geology and mineralogy, with projects in Washington, Colorado, and the Sichuan Mountains in Tibet/China. He received his PhD in 2000 from the Max-Planck Institute of Quantum Optics and the Technical University in Munich, Germany. Following research positions at the University



of California at Berkeley, and the Max-Born-Institute in Berlin, he became faculty member at the University of Washington, followed by his appointment in Boulder in 2010. He is fellow of the Optical Society of America, the American Physical Society, the American Association for the Advancement of Science, and The Explorers Club

## FINDING ART IN MINERALS: HOW AN INTEREST IN COLOR AND FORM IGNITED MY PASSION FOR MINERALS.

Bruce Kelley  
bruce.kelley@gmail.com

Objective: Illustrate how the fields of mineralogy and art overlap in the aesthetic space.

Outline:

### 1. Introduction

- a. Why minerals?
- b. My background
  - i. Science and technology
  - ii. Art study

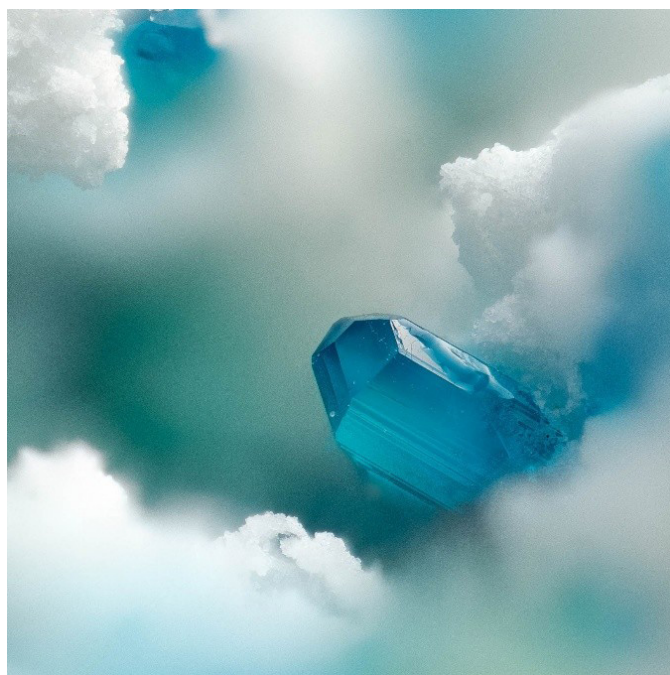
### 2. Form

- a. Form in art vs. form in mineralogy
- b. Examples of interesting forms

### 3. Color

- a. Slide show of colorful minerals with discussion of artistic considerations including depth of focus, composition, color, etc.

Conclusion: This is not a typical scientific talk, but more of an artistic appreciation of science. Expect eye candy!



**Fig. 1. Caledonite from the Rowley Mine, Painted Rock District, Maricopa Co., AZ  
FOV: 1.4 mm**



## BRUCE KELLEY, SPEAKER BIOGRAPHY



Bruce Kelley is passionate about sharing his love of art and science. A retired software engineer, he has been exploring the micro-landscapes of tiny mineral crystals since 2008 and enjoys developing methods for photographing them. Bruce is a board member for the Pacific Northwest chapter of Friends of Mineralogy. He is also a classical musician, playing French horn in the Port Angeles Symphony and Port Townsend Symphony and was one of the founders of the Northwest Mahler Festival. When those avocations aren't enough, Bruce works for the non-profit poetry publisher Copper Canyon Press. He is living his ideal "renaissance guy" life on Marrowstone Island in Washington State. You can see more of Bruce's photos at [LithoCat.com](http://LithoCat.com)

## FRIENDS OF MINERALOGY

The Friends of Mineralogy is a national, nonprofit corporation founded in 1970 with members who share a common passion for minerals, mineral collecting, and mineralogical knowledge. The organization's mission is "to promote, support, protect, and expand the collecting of mineral specimens, while furthering the recognition of the scientific, economic, and aesthetic value of minerals and mineral collecting." Through this mission, FM serves as a vital bridge between professional mineralogists, museum curators, researchers, educators, and enthusiastic collectors across the United States and beyond.

To fulfill its objectives, FM supports both national and regional efforts that encourage regular engagement among members. Nationally and through its local chapters, the organization promotes collecting trips, symposia, and other educational activities that foster interaction and learning at all experience levels. These initiatives help sustain a community where collectors can share knowledge, develop friendships, and contribute to the broader appreciation of mineralogy.

One of the hallmark activities of the Friends of Mineralogy is its active sponsorship of symposia, including the annual session at the Tucson Gem and Mineral Show. In addition to in-person presentations, FM has expanded its

outreach through hybrid and virtual formats, furthering access to mineralogical scholarship for members who are unable to attend physically. These events underscore the organization's commitment to both education and inclusivity within the mineral community.

FM also collaborates with affiliated mineralogical societies and publications, providing support for best-article awards, educational display recognitions, and opportunities for continuing education. These partnerships amplify FM's impact, creating avenues for collectors and professionals alike to engage with high-quality research and exhibition. By working with museums, academic institutions, and preservation efforts, FM contributes to the stewardship of important mineralogical resources and public collections.

Serving as a director with the Friends of Mineralogy is a meaningful way to help guide these efforts into the future. At-large Directors play an important role in shaping how the organization meets its mission supporting chapters, fostering community engagement, and ensuring that FM's programs continue to benefit both current and future generations of mineral enthusiasts. Elections for these positions provide an opportunity for members to participate directly in the governance and strategic direction of the Society.

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Editor-in-Chief: Marie Huizing  
5341 Thrasher Drive, Cincinnati, OH 45247  
Phone: (513) 574-7142  
[rocksandminerals@fuse.net](mailto:rocksandminerals@fuse.net)



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*Understanding the material  
needs of our energy future...*

Minerals in Context (MiC) is a new grassroots 501(c)(3) civil-society organization dedicated to education and raising public awareness about minerals and their importance to society.



The Mineralogical Society of America  
Resources and Coming Attractions  
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The Mineralogical Society of America (MSA) was founded in 1919 to advance mineralogy, crystallography, geochemistry, and petrology, and to promote their uses in other sciences, industry, and the arts. MSA encourages fundamental research about natural materials; supports the teaching of mineralogical concepts and procedures; and raises the scientific literacy of society on issues involving mineralogy in the widest sense. MSA encourages the preservation of mineral collections, displays, mineral localities, type minerals, and scientific data. MSA publishes the journal *American Mineralogist*, *Elements* magazine, the book series *Reviews in Mineralogy & Geochemistry*, textbooks, and monographs.

Anyone with an interest in mineralogy/petrology is eligible to join MSA. Information about membership is on the MSA home page: [minsocam.org](http://minsocam.org)



Young Mineral Collectors  
[youngmineralcollectors.org](http://youngmineralcollectors.org)

The Young Mineral Collectors group is an online, global mineral collecting community, in which over 1700 members from 50+ countries have come together to celebrate mineralogy, share knowledge, and create a positive environment for the newest generations of collectors. We welcome all collectors under 40 years of age.

The Friends of Mineralogy National Newsletter is issued quarterly, near the change in the four seasons – March, June, September and December. The Midwest Chapter distributes the Friends of Mineralogy National newsletter via an email notice from Google Groups that the newsletter is available. It is up to each member to download their own copy. The Pennsylvania Chapter sends the National newsletter out as an internet link. The Virginia Chapter sends the National newsletter out both as an internet link and attachment to the email. The New Jersey Chapter forwards the actual National newsletter via email. The Colorado Chapter has the National organization deliver the newsletter directly to its members. The Mississippi Valley Chapter has National organization send the newsletter directly to its members. The Pacific Northwest Chapter forwards the actual National newsletter via email. The Southern California Chapter President receives the National newsletter and emails the pdf copy directly to the chapter members. National only members receive their National newsletter as an attachment to their email. All Chapter presidents, at-large board members, and affiliated societies also receive the National newsletter directly by email. The National newsletter is also available directly from the National Friends of Mineralogy Website at: <https://www.friendsofmineralogy.org/newsletters-2/>