

The Mineralogical Cabinet

The Newsletter for the Friends of the New Mexico Bureau of Geology & Mineral Resources - Mineral Museum

Volume 7, No. 2, Nov. 2022

From the Director's Desk

Dear Friends,

This is my first message from the “Director’s Desk” as the new director of the NMBGMR Mineral Museum, and I would like to start by introducing myself. My interest in minerals started at a young age and it was mineral collecting that turned me on to science. This personal experience, shared by so many, supports my conviction that mineral museums can be significant gateways to interest in STEM disciplines (science, technology, engineering and math); plus, they are just beautiful, and so enjoyable to visit. That interest in science became focused on mineralogy and I consider a passion for minerals one of the greatest gifts I have been given in life. I am also very fortunate to have had the opportunities to pursue this passion in my education and career. I spent the last 25 years as a professor of mineralogy at Miami University in Oxford, OH. Miami was a delightful institution to work for and I have many wonderful colleagues there, especially in my home department – Geology and Environmental Earth Science. The main responsibilities for most university faculty are teaching, research and service. Much of my service has been to the broader mineralogical community, both professional and amateur. This has included many activities for the Mineralogical Society of America, such as outreach at the Tucson show (please come see us on the mezzanine level of the convention center during the TGMS show), and as an executive editor for *Rocks & Minerals* magazine (since 2001). A considerable amount of my research is based in specimen mineralogy and I have tried to share as much of it as possible with the mineral collecting community through publications written for a broad audience.

One of my friends and mentors, Carl Francis (you will see him at the New Mexico Mineral Symposium this year), convinced me that specialization in collecting was a worthwhile endeavor. Once I got into research I decided that I would focus my collection on minerals that I worked with, and this has led to a specializa-



tion in apatite. In exploring the connections between its structure and chemistry I have realized that trying to answer seemingly simple questions common to mineral enthusiasts, like “what causes this color or that crystal shape” have deep implications for our understanding of matter, and potential unexpected applications in our lives. Thus, collecting has strongly influenced my research and vice versa.

Though I had many wonderful years at Miami I am sincerely looking forward to the new opportunities ahead of me at the Bureau and in the museum. I look forward to continuing my research, with some new directions pertinent to New Mexico, and having more time to work with the mineral enthusiast fraternité. I am so impressed by the work of my colleagues Kelsey McNamara — our Museum Curator & X-ray Diffraction Lab Manager, Cynthia Connolly — our Education Outreach



John Rakovan in front of a new guest exhibitor display at the NMBGMR mineral museum.

Manager, and Amy Trivitt — our Geological Archives Coordinator; what a great team! It has been a pleasure working with them these last two months and I look forward to a fun and productive future. I am also grateful to my friend and colleague Virgil Lueth who is still working at the Museum as we get ready for the 2022 New Mexico Mineral Symposium, and I am looking forward continuing our collaborations as he continues on at the Bureau as a mineralogist emeritus.

As we gear up for this year's New Mexico Mineral Symposium I have been reflecting on some of my goals for the museum in the short and long term. Each year the Friends of the Museum (please consider becoming a member if you are not already; <https://geoinfo.nmt.edu/museum/donations/home.cfml>) help us raise money for a specified acquisition or project for the museum. This year our goal is to fund a new display case for creation of a "Best of New Mexico" display. Many of our best and most iconic New Mexico minerals are scattered among displays throughout the museum. We want to greet every visitor from the uninitiated to seasoned collector with a celebration of the best of our State's mineral heritage. If you would like to help us achieve this goal, please consider contributing to the cause. For the long term, I can't help but to put at the very top of my priority list the endowment to fully fund our curator position. This would be the most concrete way to secure the longevity and continued success of the mineral museum and its activities.

Although I have only been here for two months as I am writing this, we have been very busy in the museum with many visitors and events. I want to thank everyone who I have met since arriving for the very warm



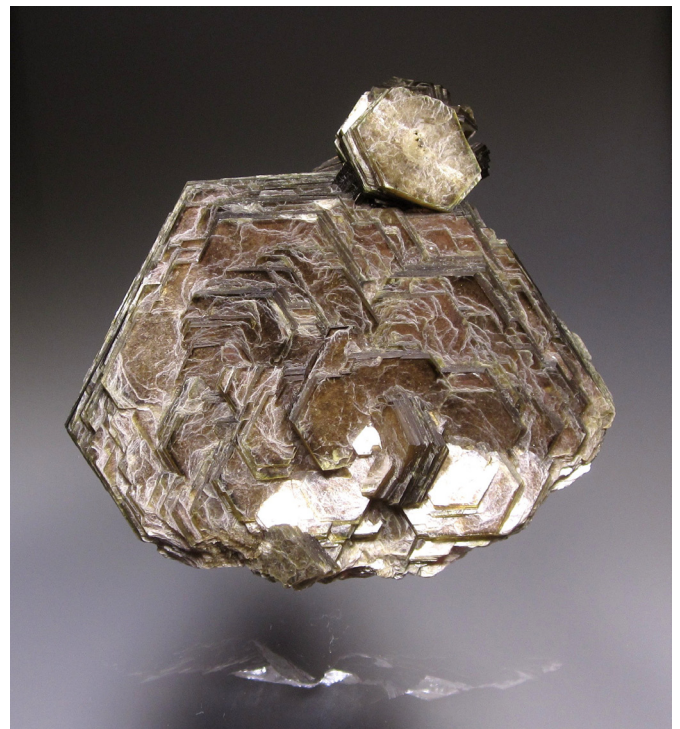
Brunch at Bingham: from left to right - John Rakovan, Mike Sanders, Ray DeMark and Virgil Lueth outside the Sunshine #3 mine, Hansonburg Mining District, Bingham New Mexico.

welcome and support. During my first week of work I attended the Denver Mineral Show and HardRock Summit where we put on displays of Colorado Minerals and Coronado's Treasure Chest – New Mexico Minerals. It was also a pleasure to visit the collections of several museum friends and benefactors. Another, very special, event was a "Hail and Farewell – Picnic" held for me and Virgil at the Blanchard Mine hosted by Mike Sanders and Ray DeMark (thank you both!). Three of my first graduate advisees (Stephanie Bosze, Carrie Wright, and Fred Partey) did their thesis work in the Hansonburg Mining District, in collaboration with Virgil, and it was particularly fitting to celebrate this transition in our old stomping grounds.

John Rakovan

Director's Choice

Rather than choose apatite as the topic of my first "Director's choice", a mineral that many may presume I would pick, I want to fall back on the group of minerals that started my career in research; layer silicates. Often overlooked as collectable minerals of any stature, the layer silicates can be very aesthetic, and important associated minerals. For some their favorite specimen may be a tourmaline with associated lepidolite; I often look at such specimens as lepidolite with associated tourmaline.



Muscovite: Xanda mine, Virgem da Lapa, Minas Gerais, Brazil. 8 cm.

Most significant as specimens among layer silicates are the micas. It is difficult to resist the temptation to peel the layers when holding a specimen of mica. This modest action gives a tactile observation of the very uncommon combination of properties found in mica. The perfect cleavage, flexibility, and elasticity as well as the strength within a layer of mica are all physical properties that allow its crystals to be peeled apart, like pages in a book. These same properties (and others) lead to myriad technological applications from windows in blast furnaces, to dielectrics in microwave ovens, to woofers in stereo speakers.



Lepidolite: Taquaral, Itinga, Minas Gerais, Brazil. 5.1 cm

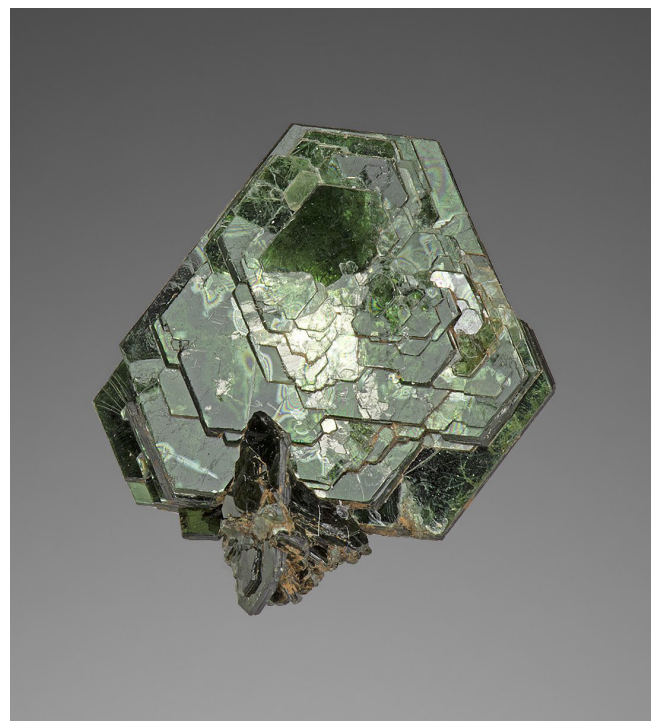
The structure of and bonding in mica are what give it these properties. Mica is a group of minerals. All are silicates; composed of oxygen (O), silicon (Si), aluminum (Al) and varied combinations of K, Na, Ca, Fe, Mg, Li, Mn, Cr, and Ti. The arrangement of these elements is in the form of layers. Thus, mica is considered a layer silicate (a.k.a. phyllosilicate). Somewhat weaker bonding between the layers and strong bonding within them lead to many of mica's unusual properties.

The mica group of minerals includes species such as muscovite, $\text{KA}_2(\text{AlSi}_3\text{O}_{10})(\text{F,OH})_2$, and phlogopite,

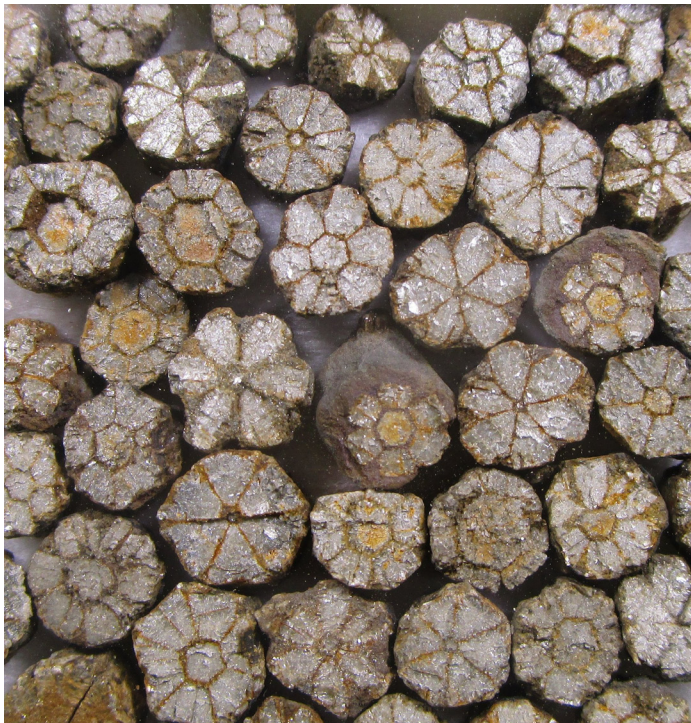


Biotite, diopside, quartz: St. Lawrence Co., New York. 5.7 cm

$\text{KMg}_3\text{AlSi}_3\text{O}_{10}(\text{F,OH})_2$ and solid solution series including lepidolite (a series between endmember compositions of polyolithionite, $\text{KLi}_2\text{Al}(\text{Si}_4\text{O}_{10})(\text{F,OH})_2$, and trilithionite, $\text{K}(\text{Li}_{1.5}\text{A}_{11.5})(\text{AlSi}_3\text{O}_{10})(\text{F,OH})_2$), and biotite



Clintonite (a brittle mica): Green Monster Mountain, Prince of Wales Island, Alaska. 1.5 cm.



Muscovite pseudomorphs after cordierite/indialite (known as sakura ishi): Kameoka-Shi, Yunohana, Kyoto Prefecture, Japan. 5 mm

(the IMA recommends that the name biotite be used for any minerals in the “series” between the species annite-phlogopite and siderophyllite-eastonite. But it is most commonly used for any dark-colored (Fe-rich) mica whose species is unknown). There are over 60 different mineral species that constitute the mica group because of the wide variety of chemistries that this one structure type can accommodate.



Clinocllore on magnetite: Imilchil Cercle, Midelt Province, Drâa-Tafilalet Region, Morocco. 2.5 cm rosette.

Other layer silicates include the serpentine polymorphs (lizardite, antigorite, and chrysotile), the kaolinite group (found almost exclusively as clay minerals), talc, pyrophyllite, the smectite group (expandable clay minerals; think toothpaste when wet), vermiculite, illite, the brittle mica group, modulated layer silicates like palygorskite and sepiolite (a.k.a. meerschaum, of tobacco pipe renowned), and the chlorite group. Like the micas, the chlorites can have many varied compositions and numerous species exist. The most common chlorite minerals include clinocllore, $Mg_5Al(AlSi_3O_{10})(OH)_8$, and chamosite, $(Fe^{2+},Mg,Al,Fe^{3+})_6(Si,Al)_4O_{10}(OH)_8$. They are also found in beautiful crystals, often with rich colors such as the red-purple of k ammererite, a Cr-bearing variety of clinocllore.

Curator’s Corner

Greetings friends!

The museum has been busier than ever, with visitor numbers soaring and donations rolling in. I can’t complain! In August I spent 16 days on a raft in the Grand Canyon, and I returned to a new boss! John joined the museum team on the first of September and it’s been a pleasure working with him.

The Denver show moved up a weekend, putting it back-to-back with Silver City. We were able to divide and conquer, as I went to Silver and John put in two displays at the HardRock Summit /Club Show. I lost my photos of the Silver City display, but you can check out some photos from the Grant County Rolling Stones Facebook page here: <https://rollingstonesgms.blogspot.com/>



A nice display of colorful Colorado minerals for the Denver club show.



John set up a nice exhibit featuring “Coronado’s Treasure Chest,” highlighting some of the best New Mexico minerals for the HardRock Summit.

NEW DISPLAYS

The Black Hawk Mining District (aka Bullard’s Peak) Display

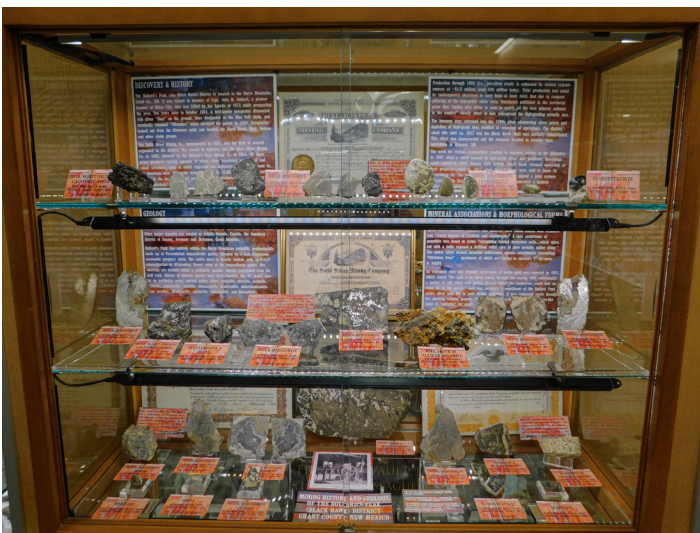
The Black Hawk District display was a true tag-team effort. Don Musser of Silver City provided many of the slabbed and rough silver in dolomite specimens. Bob Eveleth supplied four stock certificates from the Bureau Mining Archives and gave an in-depth write-up on the mining history, general geology, and mineral associations of the district. I arranged it all into a Waddell three shelf display, and the silver pops under the LED lights.



A close-up view of both slabbed and rough specimens, most on loan from Don Musser.

From the Vault: The Joan Massagué Collection Display

The sad reality is that the museum only has so much space. This means that only a small percentage of minerals go on display, while the rest occupy a dark space in the reference collection cabinets. We decided to bring some of those beauties out into the light again, in our “From the Vault” series. For this display, worldwide minerals from Joan Massagué are highlighted. Joan has gifted the museum over 250 minerals since 2013, and we really appreciate his support! Feast your eyes on a few shots of this new exhibit.



Overall view of the Black Hawk District display, complete with stock certificates and text by everyone’s favorite, Bob Eveleth.



View of the “From the Vault: The Joan Massagué Collection” case. Apologies for all of the reflections!

Claire Schaeffer. It was nice to hear collecting stories told by Claire and to see the actual minerals collected during those special times.

I’d also like to add that the money donated by the Friends of the Museum last year was put towards a fresnoite specimen from Clear Creek San Benito Co., California. This piece shows marvelously large yellow tetragonal fresnoites on gray analcime, which is on display in our “New Acquisitions” case. I hope you all get to check it out during Symposium. We are still in search of a nice Québécois cubanite and Sweet Home rhodo to grace our museum shelves.

Please enjoy some of the minerals added to the collection since our last newsletter.



A zoom-in of a nice Mexican silver and other worldwide pieces, all gifted from Joan Massagué.



Azurite, Tsumeb Mine, Tsumeb, Oshikoto Region, Namibia. Gift of Dr. Emily Laws Stoudt.

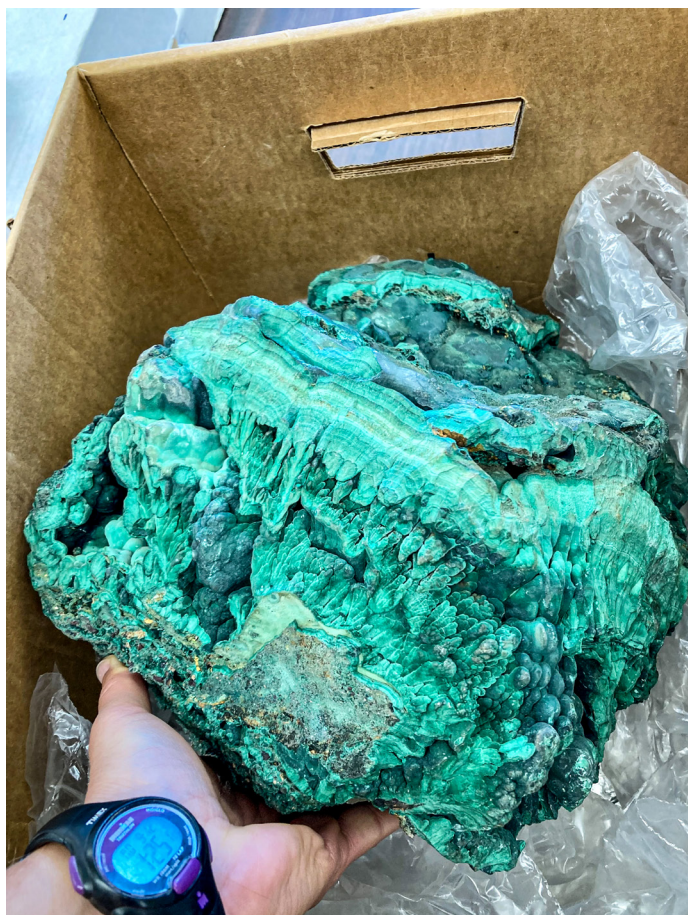
NEW ACQUISITIONS

So far this year, we have received 10 donations of mineral specimens, but there is still time if you’d like to make it on the donor list for 2022 (i.e. I’m really good at getting paperwork done quickly and I do make house calls!). In July, I drove to Mountain Home, AR to pick up the collection of a lifelong collector named Edward Hakesley. Most items were self-collected from Canada as well as the northeast and Midwest US. Unfortunately, I came down with COVID during my time there, which made for a rough drive back to New Mexico. I’m happy to report that the minerals and myself made it in one piece! An early October trip to Denver was arranged to receive part of the Bill & Christopher Hayward Collection, generously gifted by

OUTREACH NEWS

New Mexico Geological Society Fall Field Conference

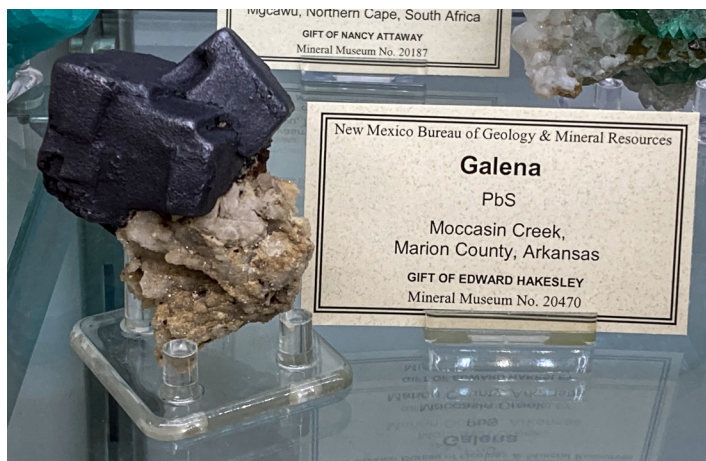
The geology of the Socorro region is so outstanding that a third (yes you read that right) fall field confer-



A large malachite from the Lavender Open Pit Mine, Bisbee, Cochise Co., Arizona. Gift of David Stoudt & Susan Hoffman.



Fluorite, Cave-in-Rock Sub-District, Hardin Co., Illinois. Gift of Scott Werschky.



Galena, Moccasin Creek, Marion Co., Arkansas. Gift of Edward Hakesley.



Two beautiful (and hefty!) Peruvian pyrite specimens. Gift of Douglas Flax.



A delightful iron-stained amazonite from Crystal Peak, Teller Co., Colorado. Gift of Claire Schaeffer, in memory of Christopher Hayward.

ence was held in and around Socorro from September 29th to October 2nd. Over 100 people attended the trip, which included stops in the Little San Pascual Mountains, the Quebradas, and Box, Nogal, and San Lorenzo Canyons. Next year's fall field conference will be held in southeast New Mexico around the Carlsbad area. If you are interested in learning more, please visit: nmgs.nmt.edu/ffc/home.html



Dan Cadol discussed precipitation events and sediment transport in the Arroyo de los Pinos, an ephemeral tributary to the Rio Grande.



Fresnoite on analcime, Clear Creek, San Benito Co., California. Gift of the 2022 Friends of the Museum!

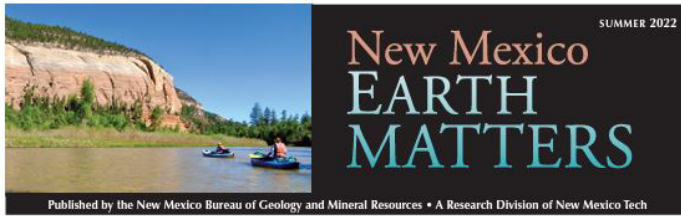


Fall field conference attendees poking around manganese deposits of the Gloryana Mine, near Box Canyon.

Bureau Periodicals

Are you interested in cave formation (in particular, caves formed by rising groundwater carrying dissolved hydrogen sulfide)? The most recent Earth Mat-

ters publication focuses on New Mexico's fabulous cave systems and the role of hydrogen sulfide-rich groundwater in cave formation.



New Mexico's Sulfuric Acid Caves

New Mexico has some of the world's most spectacular caves. Each year, roughly half a million visitors flock to southeastern New Mexico to experience the underground splendor of Carlsbad Caverns National Park and hike in the rugged terrain of the Guadalupe Mountains. The area attracts more than just tourists. Scientists from all over the world study Carlsbad Cavern, Lechuguilla Cave, and other beautiful and enigmatic caves in the Guadalupe Mountains. These caves contain strange mineral deposits and large chambers that puzzled scientists and explorers for many years. We now know that these once-mysterious features are the result of an unusual cave-formation process known as *sulfuric acid speleogenesis* (cave formation by sulfuric acid).



Speleothems in Carlsbad Cavern. Photo by Peter Jones

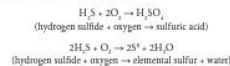
What Are Sulfuric Acid Caves?

Caves can form in many ways. Lava tubes form as molten rock drains from inside cooling basaltic lava flows, sea caves form where waves erode into cliffs, and glacier caves form as streams cut through or under glacial ice. But the most common caves are solution caves, which form as water dissolves soluble rocks such as limestone or gypsum.

Most limestone caves result from carbonic acid, the weak acid formed when carbon dioxide (CO₂) gas dissolves in water. It is slightly corrosive to limestone and, with time, can form caves such as the extensive Mammoth Cave in Kentucky and Fort Stanton Cave in New Mexico. Most of these caves are *epigenic* caves, which are formed by carbonic acid produced in CO₂-rich overlying soils and other surface sources. Epigenic limestone caves tend to be connected to the surface through sinkholes and sinking streams. Landscapes that contain these features are known as *karst*.

Most of New Mexico's largest caves are a little different. Carlsbad Cavern, Lechuguilla Cave, and most other large caves in the Guadalupe Mountains are karstic, but they were formed by sulfuric acid. This strong acid is responsible for their unusual mineralogy and morphology. Unlike epigenic caves, sulfuric acid caves are a type of *hypogenic* cave, which means that the acidic waters, or the ingredients that produce the acid, come from below Earth's surface. When they form, sulfuric acid caves are fed by rising groundwater that carries dissolved hydrogen sulfide (H₂S). Many hypogenic caves are not directly connected to the surface, and the overlying land lacks the characteristic karst topography associated with epigenic caves. Surface erosion exposed most sulfuric acid caves in the Guadalupe Mountains when they were intersected by downcutting canyons.

Hydrogen sulfide, the gas that gives rotten eggs their distinctive odor, is especially abundant in deep, oxygen-free environments associated with petroleum deposits or magmatic activity. Hydrogen sulfide is unstable in the presence of oxygen, so when rising groundwater is exposed to oxygen, it reacts to form sulfuric acid and elemental sulfur:



This usually happens at or near the water table, where oxygen is plentiful in cave air and fresh water from the surface. Sulfuric acid can form below the water table if sulfidic groundwaters mix with oxygenated waters or when sulfidic streams pick up oxygen from the cave air. Sulfuric acid can also

continued on next page

In this edition of Earth Matters, Dr. Dan Jones et al. discuss the spectacular caves of New Mexico and the role of sulfuric acid speleogenesis (aka cave formation by sulfuric acid).

The newest Lite Geology issue touches on fieldwork performed by many Bureau geoscientists, a nice companion edition to the former issue on Bureau laboratories. If either of these topics appeal to you, free publications are available for free download from this website: <https://geoinfo.nmt.edu/publications/periodicals/home.cfml>

PUBLICATIONS STORE NEWS

Bookstore Staff

I'd like to introduce Brenda Whitt to you! She is now managing the bookstore and you will definitely see her (and her students) during Mineral Symposium.



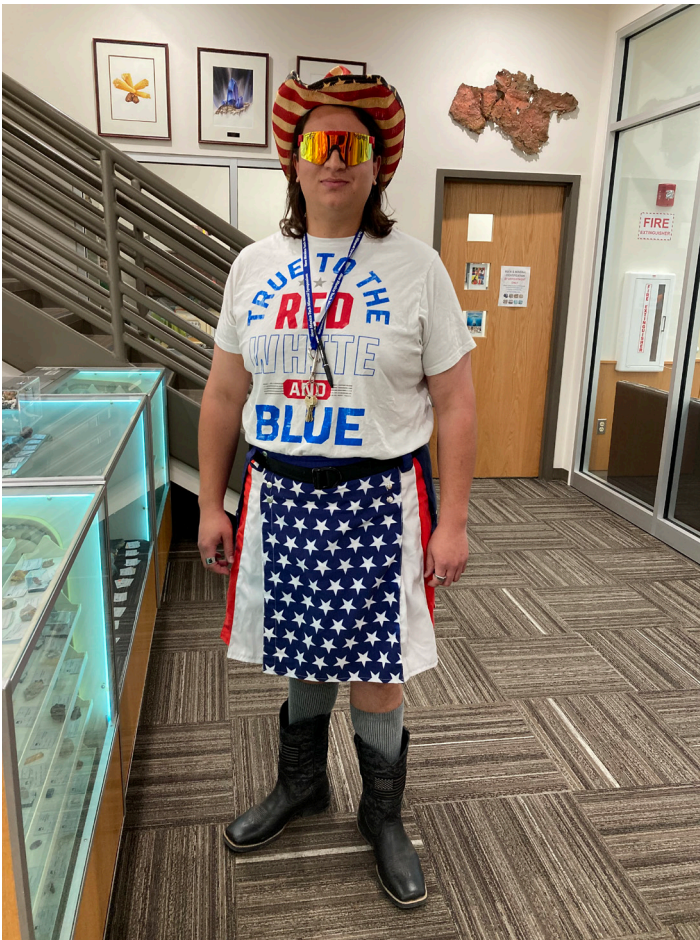
This issue of Lite Geology is focused on Bureau fieldwork. Bureau scientists from a variety of geology disciplines reveal what is in their backpacks for field excursions, and many of the articles focus on fieldwork performed by these particular geoscientists.



This is Brenda! She will gladly take your "Friends of the Museum" dues during Symposium!

Many of you might remember Michael Carroll, who managed the bookstore during the last Mineral Symposium. Michael recently moved to the Albuquerque area. We wish him the best!

Kelsey McNamara



My favorite picture of Michael flashing his pit viper glasses and patriotic kilt.

Explaining Our Newsletters Name... “The Mineralogical Cabinet”

New Mexico Tech (originally New Mexico School of Mines) was established by the territorial legislature in 1889 (23 yrs before statehood) and in its charter is the mission to “provide mineral and geological cabinets [collections]”



New (and improved) publications at the NMBG Bookstore make great holiday gifts!

“Friendly Reminder”

Annual Dues for the Friends of the Museum expire on the weekend of the Mineral Symposium.

You can pay dues on site or remit payment to:
NMT - Mineral Museum Gift Fund
and send it to:

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