EARTHQUAKE
e-Newsletter about what's movin' and shakin' at the Earth Science Museum

Earth Science Museum, 3215 W. Bethany Home Rd., Phoenix, AZ 85017
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Volume 15, Issue 4

Interesting Properties of the Perovskite Mineral Structure

By Harvey Jong

Perovskite is a calcium titanium oxide ($CaTiO_3$) mineral that was first discovered in the Ural Mountains of Russia by German mineralogist Gustav Rose (1798-1873) in 1839. Rose named the mineral in honor of Count Lev Alekseyevich Perovski (1792-1856) who was a Russian nobleman and mineralogist.

Count Lev Alekseyevich Perovski (1792-1856)
Portrait by Friedrich Jentzen (1804–1875), - PD, via Wikimedia Commons

Perovskite may vary from dark brown, black, or red-brown and has an orthorhombic crystal structure.

Perovskite
Rock Currier photo, British Museum of Natural History specimen #39111, - Copyright © Rock Currier, CC_BY_SA-3.0, via mindat.org
Akhmatov Mine, Magnitka, Kusinsky District, Chelyabinsk Oblast, Russia
Scale at the bottom is one inch long with a rule of one centimeter.
This specimen is from the type locality and features crystals with complex growth patterns that involve a combination of pseudo-cubic dodecahedral faces and repetitive twinning.

Perovskite

Rob Lavinsky, iRocks.com photo, - CC_BY_SA-3.0, via Wikimedia Commons

Magnet Cove, Hot Springs County, Arkansas

2.3 x 2.1 x 2.0 cm, crystals 6-7 mm

Ex. American Museum of Natural History, Clarence Bement collection specimen, donated in 1910.

Magnet Cove is an intrusive complex located southeast of Hot Springs, Arkansas. The site is known for vein deposits of unusual minerals, such as magnetite, rutile, anatase, brookite, and perovskite.

Perovskite (var. "Dysanalyte")

Kelly Nash specimen and photo, - CC_BY_SA-3.0, via Wikimedia Commons

Perovskite Hill, Magnet Cove, Hot Springs County, Arkansas

1.6 x 1.5 x 1.4 cm

Interpenetrating octahedral crystals of perovskite have been collected at Magnet Cove. Specimens may be labelled as dysanalyte to indicate their niobium-rich content (usually 5-10% Nb_2O_5).

Perovskite

Leon Huperrichs photo, - CC_BY_SA-3.0, via Wikimedia Commons

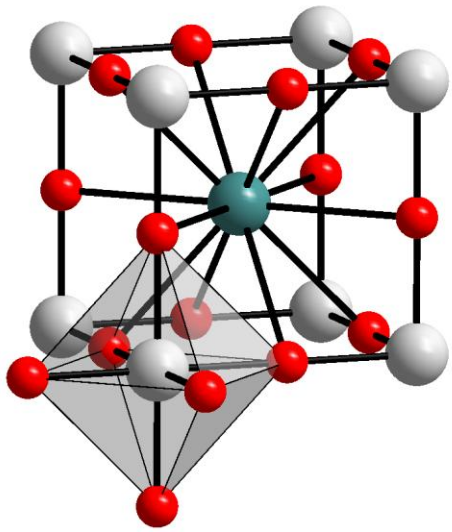
Rocca Sella dykes, Rubiana, Metropolitan City of Turin, Piedmont, Italy

Field of view: 7 mm

Lustrous red-brown pseudo-cubic crystals of perovskite occur in association with magnetite at Rocca Sella dykes near the city of Turin, Italy.

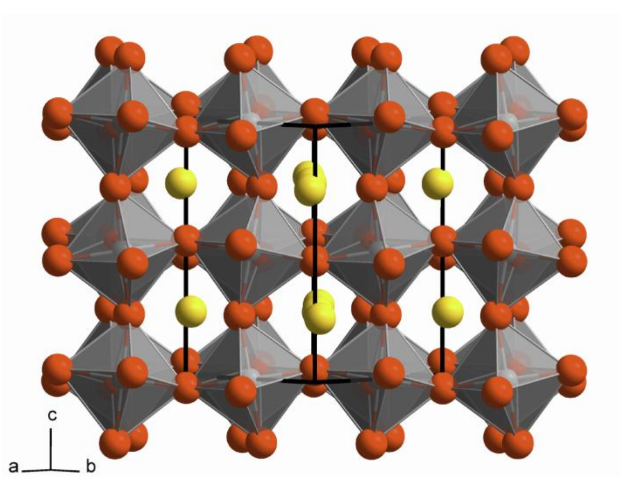
Crystal Chemistry

Perovskite is a member of the Perovskite Supergroup of minerals which was established and approved in 2016 (Mitchell et al., 2017). The supergroup involves a classification scheme based on crystal structure and chemical composition. The basic structure follows the general formula ABX_3 where A is a cation surrounded by 12 X anions and B is a cation shared by six X anions.



Ideal ABX_3 Crystal Structure
Orci diagram, - CC_BY_SA-3.0, via Wikimedia Commons

The teal sphere represents the A cation which occupies a body-centered site in the crystal lattice. This cation has 12 neighboring X anions which are shown as red spheres and is described as having cuboctahedral coordination. The gray spheres correspond to the B cations that are surrounded by six X anions. The diagram shows the octahedral coordination of these ions.



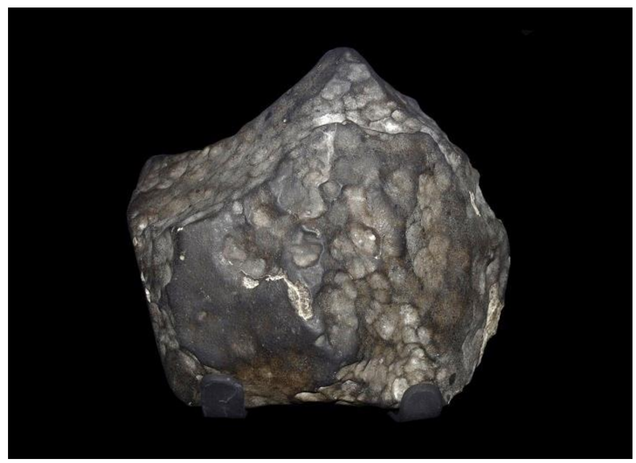
Perovskite Crystal Structure
Solid State diagram, - CC_BY_SA-3.0, via Wikimedia Commons

This diagram shows a network of octahedral groups for perovskite. Due to the smaller size of Ca^{2+} cations, the crystal structure exhibits a slight distortion that leads to the mineral assuming an overall orthorhombic symmetry.

Notable Minerals of the Perovskite Supergroup

Most Perovskite Supergroup minerals occur as either oxides or silicates, but they may also include fluorides, chlorides, hydroxides, arsenides, and intermetallic compounds. A few notable examples are presented below.

Bridgmanite [$(Mg,Fe)SiO_3$]



Tenham Meteorite
The paleobear photo, Natural History Museum, London specimen, - CC_BY_SA-2.0, via Wikimedia Commons
Tenham Station, Windorah, Barcoo Shire, Queensland, Australia
1879 fall

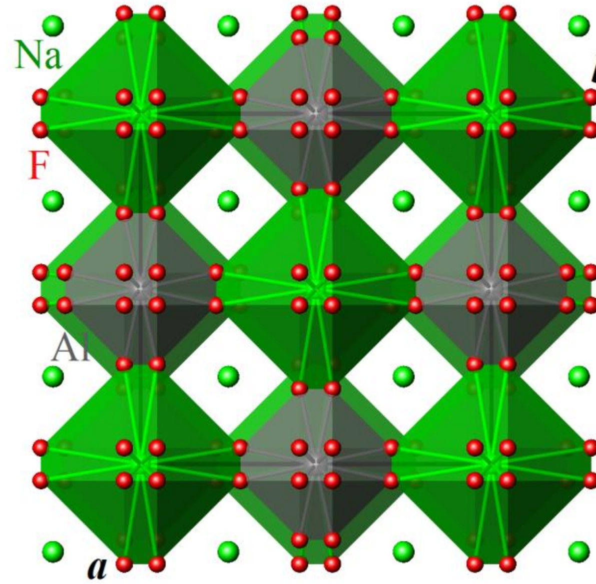
Although the existence of bridgmanite was predicted based on extreme temperature and pressure experiments, an occurrence of the magnesium iron silicate wasn't discovered until 2014 when samples of the Tenham meteorite were analyzed using X-rays. The mineral is named in honor of Percy Williams Bridgman (1882-1961), an American physicist who received the Nobel Prize in Physics in 1946 for his work in high pressure physics.

Bridgmanite is stable at pressures over 120 Gigapascals and temperatures above 3000 K (Ismailova et al.,2016). The mineral alters into enstatite under normal surface conditions, so detection involved searching within a shock melt vein embedded in the meteorite. Geoscientists believe that bridgmanite is the dominant phase of the Earth's lower mantle and comprises up to 38 percent of our planet's volume.

Cryolite (Na_2NaAlF_6)

Cryolite
Kelly Nash specimen and photo, - CC_BY_SA-3.0, via Wikimedia Commons
Ivittutt (Ivigtut) Mine, Ivittutt (Ivigtut), Arsuk, Sermersooq, Greenland
4.5 x 4.0 x 2.3 cm
Cryolite was first described in 1799 by Peter Christian Abildgaard (1740-1801), a Danish veterinarian and physician. The mineral name is based on the Greek words, *cryos* (ice), and *lithos* (stone). The Ivittutt Mine near the Arsuk Fjord, Sermersooq, Greenland is the type locality. Cryolite was initially considered as a source of aluminum, but it was later used in the processing of the aluminum ore bauxite.

Cryolite has a monoclinic crystal structure which reflects a double perovskite lattice arrangement. Double perovskite refers to a basic unit cell which is twice that of a standard perovskite. It includes the same A site cations coordinated with 12 X anions, but the B site has two different cations, each surrounded by six X anions.



Cryolite Crystal Structure
Perditax diagram, - CC0 1.0-UPD, via Wikimedia Commons
This diagrams shows cryolite's polyhedral lattice network of sodium B-site octahedra (in green) and aluminum B-site octadhedra (in gray).

Diaboleite [$CuPb_2Cl_2(OH)_4$]

Diaboleite
Rruff specimen and photo, - Copyright © 2026 RRUFF, via rruff.info
Tiger, Pinal County, Arizona
Diaboleite was first discovered in 1923 at the Higher Pitts Mine, Somerset, England by British geologist Leonard James Spencer

(1870-1959). The name is derived from the Greek word *dia* (apart or distinct from) and the mineral boleite to indicate its difference from boleite.

Diaboleite has a tetragonal crystal structure with an underlying lattice framework that consists of a double perovskite structure with a vacant B-site. An arrangement where cations do not occupy octahedra is referred to as a defect perovskite.

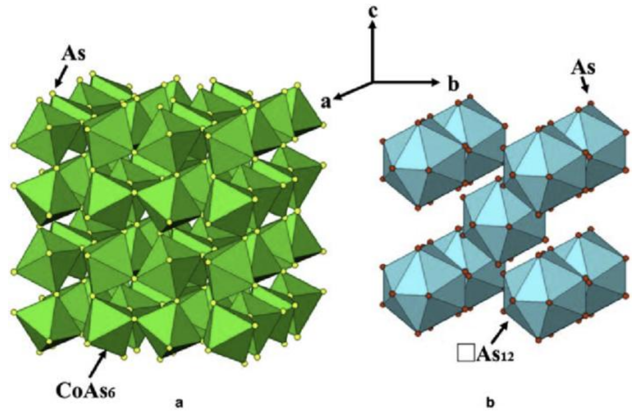
Skutterudite ($CoAs_3$)

Skutterudite

Bou Azzer, Bou Azzer District, Tazenakht, Morocco
6.5 x 6.3 x 4.2 cm

Skutterudite has been known since the Middle Ages as an ingredient used in producing cobalt glass. The cobalt arsenide was formally described in 1845 by Wilhelm Karl von Haidinger (1795-1871), an Austrian mineralogist, who named it after the type locality Skuterud Mines, Modum, Buskerud, Norway.

Skutterudite has an isometric crystal structure that is defined by a quadruple perovskite network of tilted $CoAs_6$ octahedra (shown in green below) and icosahedral polyhedral groups of arsenic anions surrounding vacant A lattice sites (in light blue) (Mitchell et al., 2017).



Crystal Structure of Skutterudite
Fig. 28 from (Mitchell et al., 2017)

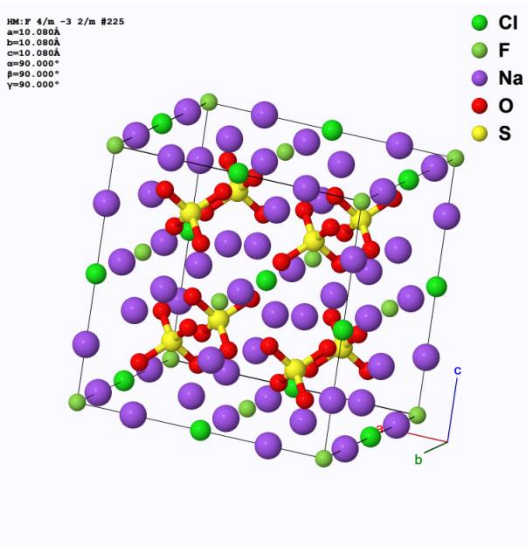
Sulphohalite [$Na_6(SO_4)_2FCl$]

Sulphohalite and Borax

Searles Lake, San Bernardino County, California
6.2 x 4.4 x 4.1 cm, crystal 1.5 cm

Sulphohalite was first described in 1888 by American mineralogist and geologist William E. Hidden (1853-1918) and American chemist James B. Macintosh (1877-1934) using samples collected at Searles Lake, San Bernardino County, California. The name refers to the mineral's composition - sulfur plus the Greek word *hals* (salt) for its halogen content.

Sulphohalite has an isometric crystal structure which involves a double antiperovskite arrangement. An antiperovskite represents a derivative of the ideal perovskite structure where the basic unit consists of an octahedral group of an X anion surrounded by 6 A cations (XA_6) instead of the usual BX_6 cation-centered octahedron. The X anions may include oxygen (O^{2-}), nitrogen (N^{3-}), phosphorus (P^{3-}), fluorine (F^-), or chlorine (Cl^-) and sometimes bromine (Br^-), sulfur (S^{2-}), or hydrogen (H^-).



Sulphohalite Crystal Structure
Diagram from online *Encyclopedia of Crystallographic Prototypes* (Hicks et al, 2021)

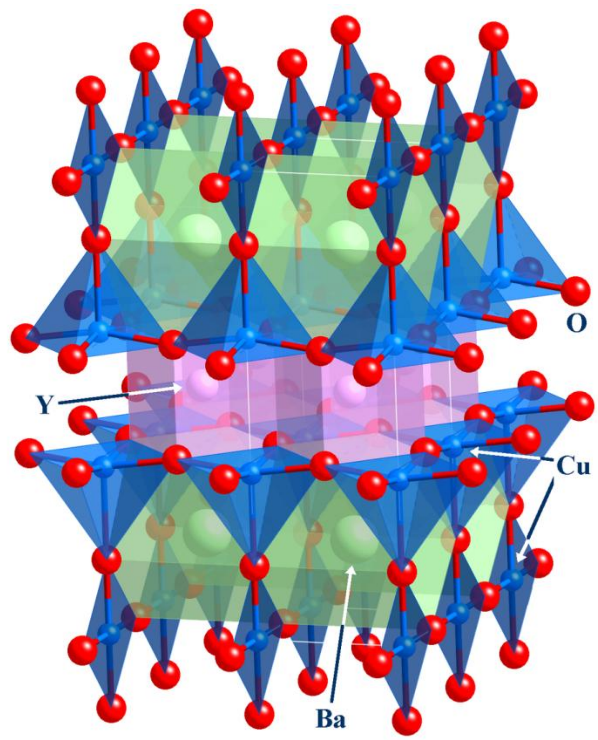
Properties of Synthetic Perovskite Compounds

As shown by the various mineral examples, the perovskite structure can accommodate a wide variety of cations along with vacancies of both cations and anions. This flexibility has generated considerable interest in developing new materials that take advantage of the unique properties arising from such arrangements. A few interesting properties and related synthetic compounds are presented below.

Superconductivity

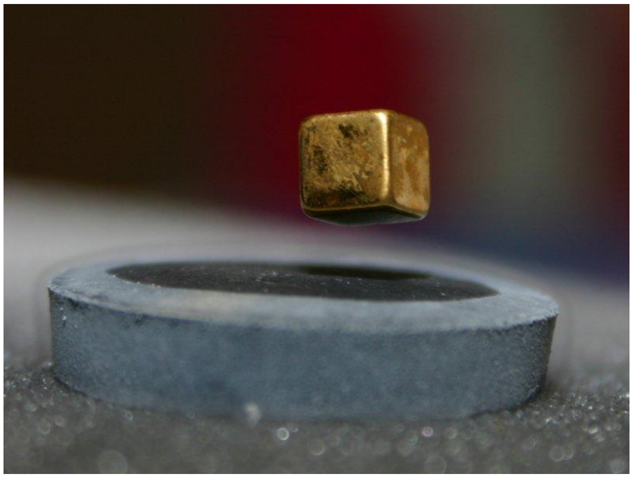
Superconductivity is a property where the electrical resistance of a substance decreases to zero and magnetic fields are expelled (known as the Meissner effect). Since the discovery of the phenomenon in 1911 by Dutch physicist Heike Kamerlingh Onnes (1853-1926), scientists have been investigating ways of achieving superconductivity at temperatures higher than 4.2 K. Room temperature (293 K) represents the ultimate goal.

A breakthrough occurred in 1986 when IBM researchers Georg Bednorz (1950-) and K. Alex Müller (1927-2023) developed a new class of high temperature superconductors based on a ceramic perovskite structure. These materials exhibit superconductivity above 77 K (-196.2 °C, -321.1 °F), the boiling point of liquid nitrogen. One of these compounds, yttrium barium copper oxide ($YBa_2Cu_3O_7$), has a superconductivity transition temperature above 90 K.



Crystal Structure of Cuprate Perovskite Superconductor ($YBa_2Cu_3O_7$)
Gadolinist diagram, - CC_BY_SA-3.0, via Wikimedia Commons

The superconductivity observed in cuprate perovskites is considered to be unconventional and beyond the explanation of accepted theories. The layered crystal structure made of copper oxide alternating with other oxides seems to form a charge reservoir. Paired electrons move through the copper-oxide layers, while charge carriers as either electrons or holes are supplied by the neighboring layers.



Magnet Suspended Over A High Temperature Superconductor
Peter Nussbaumer photo, - CC_BY_Sa-3.0, via Wikimedia Commons

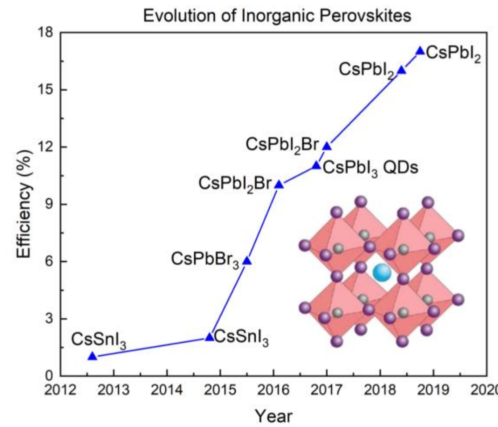
This magnet hovers over a perovskite superconductor cooled to the liquid nitrogen temperature of 77K. A potential application of high temperature superconductors involves magnetic levitation (maglev) trains.

Optoelectronic Properties

Materials with a perovskite structure exhibit a number of optical and electrical properties that are favorable for producing optoelectronic devices. By adjusting the composition, these properties can be tuned to match specific applications, such as solar cells, light emitting diodes, or photodetectors.

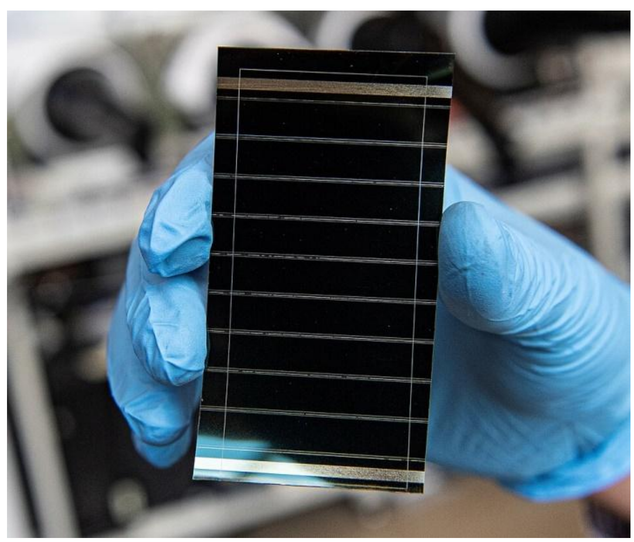
For example, one key characteristic of a material is the band gap, which is to the energy required to move an electron between energy bands. By changing crystal lattice relationships, such as the angles or distances between B cations and X anions, the band gap can be adjusted (from 1.5 eV to over 2.3 eV) which changes the absorption of different wavelengths of light and overall solar cell performance.

The ability to tune the properties of a perovskite structure has resulted in remarkable progress in solar cell efficiency. In 2009, the reported efficiency of prototype cells was 3.81%, and by 2026 the efficiency has increased to 26.1% (He et al.,2026).



Development Progress of Perovskite Solar Cells
Wikidave20 graph, - CC_BY_SA-4.0 International, via Wikimedia Commons

This graph shows increasing solar cell efficiency with different perovskite materials over time. Silicon-based solar cells required over 20 years to achieve similar improvements.



Perovskite Solar Cell
Dennis Schroeder/National Renewable Energy Laboratory photo, - PD, via Wikimedia Commons

Although perovskite solar cells appear promising due to their high efficiency and low production costs, the devices face significant challenges involving stability and degradation.

Moisture, oxygen interaction, and high temperature can lead to a rapid drop in performance.

Photostriction

A recently-published study by researchers at the University of California, Davis described halide perovskite crystals that exhibited photostriction, the ability to change shape when exposed to light. (Dubey et al., 2026). Single crystals of methylammonium lead tribromide ($MAPbBr_3$) were illuminated with a laser, and structural changes were monitored with an X-ray probe. Rapid, continuous, and reversible lattice distortions, up to a 0.3% change, were observed. The finding suggests the possibility of using halide perovskites for a new class of sensors or actuators that are tuned or switched by light.

Methylammonium Lead Tribromide ($MAPbBr_3$) Nanocrystals Under Ultraviolet Light

Jbeatley photo, - CC_BY_SA-4.0 International, via Wikimedia Commons

This photo shows methylammonium lead tribromide ($MAPbBr_3$) nanocrystals fluorescing under ultraviolet light. $MAPbBr_3$ exhibits an absence of grain boundaries in single crystals which makes it a material of interest for solar cells and other optoelectronic applications.

References

Dubey, M., B. Turedi, A. Kanak, M.V. Kovalenko, and M.S. Lette (2026) Reversible, Photo-Induced Lattice Distortions in Halide Perovskites. *Advanced Materials*: e21800, https://doi.org/10.1002/adma.202521800.

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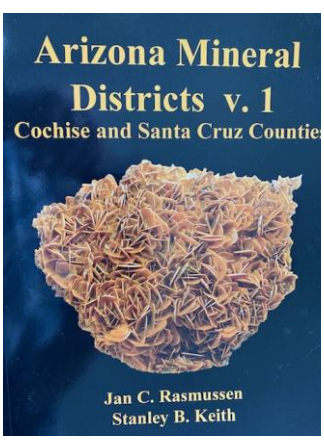
Mitchell, R.H., M.D. Welch, and A.R. Chakhmouradian (2017) Nomenclature of the perovskite supergroup: A hierarchical system of classification based on crystal structure and composition. *Mineralogical Magazine*, 81 (3) 411-461. ◊ ◊ ◊

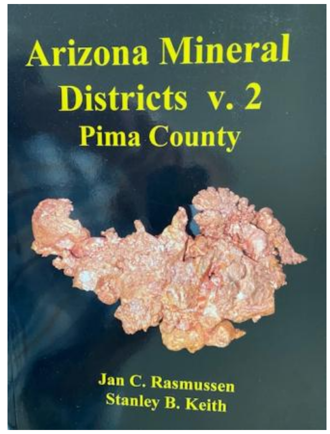
Arizona Rocks 155

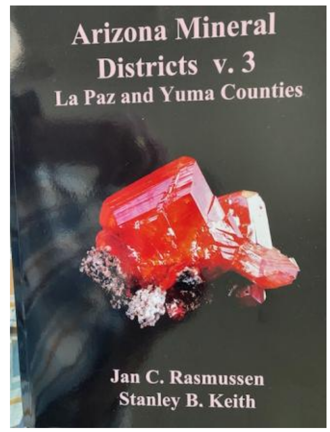
Text by Ray Grant
photographs

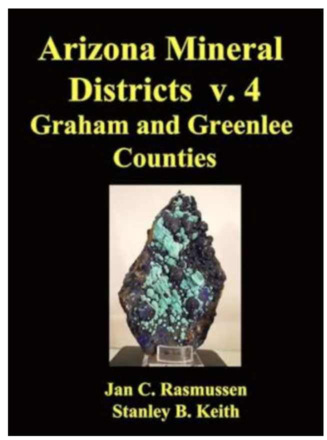
Jan Rasmussen and Stan Keith have started a massive project to describe all the mineral districts in Arizona by county. At present there are five volumes finished and can be found on Amazon by typing in Arizona Mineral Districts, the prices are for paper backs but hard covers are also available. The five volumes are v.1 Cochise and Santa Cruz Counties ($38.76), V.2 Pima County ($42.64), V.3 La Paz and Yuma Counties ($51.65), V.4 Graham and Greenlee Counties ($36.10) and V.5 Pinal County ($60.65). Each volume has geology, mineralogy, age dates, location, past production, maps, and many photographs for each district in the county. There is also a lot of information about the geology of the county and the geology of Arizona.

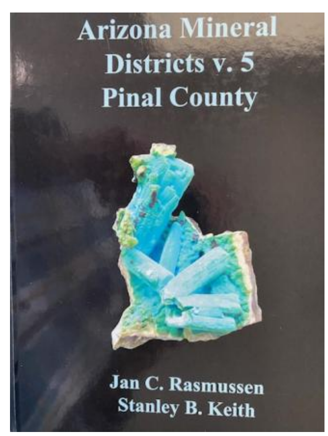
These volumes are valuable for mining companies, ore deposit exploration, and mineral collectors. For example, in volume 5, there are 88 districts and some sub districts described for Pinal County. “The book is profusely Illustrated with (435 figures) with 1:24,000 scale historic topographic maps that show mine names, mineral photographs from the now closed Arizona Mining and Mineral Museum, geologic maps, and diagrams of the mineral deposits.” - quote from a talk given by Jan Rasmussen at the Minerals of Arizona Symposium, March 26, 2026.











Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

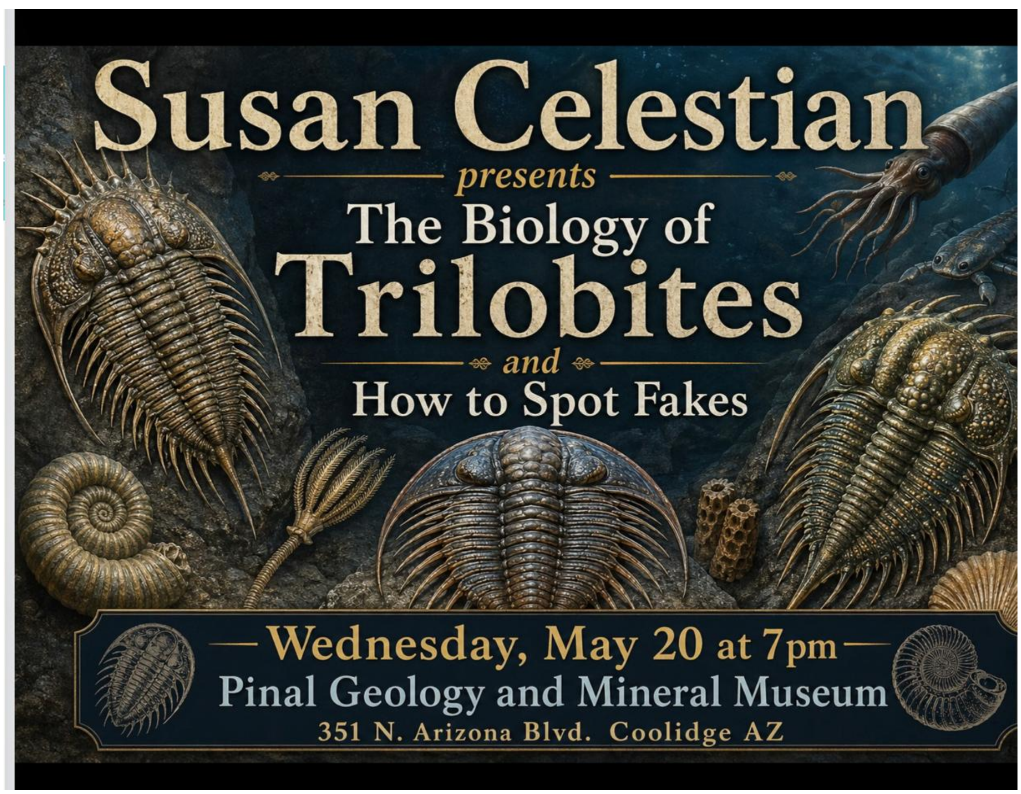
Pinal Geology and Mineral Society next meeting

May 20, 2026

Meetings are the third Wednesday at 7pm, doors open at 6:00 so stop in early to have a look around and see what is new--we have added new displays and will have new loaned specimens on display! www.pinalgeologymuseum.org

Ray Grant ray@pinalgeologymuseum.org

Pinal Geology and Mineral Museum
museum open Fridays & Saturdays from 10 - 4
admission is free.
Groups can arrange special visits please call 520-723-3009.



AZ Mining, Mineral & Natural Resources Education Museum Update April 2026

https://ammnre.arizona.edu/

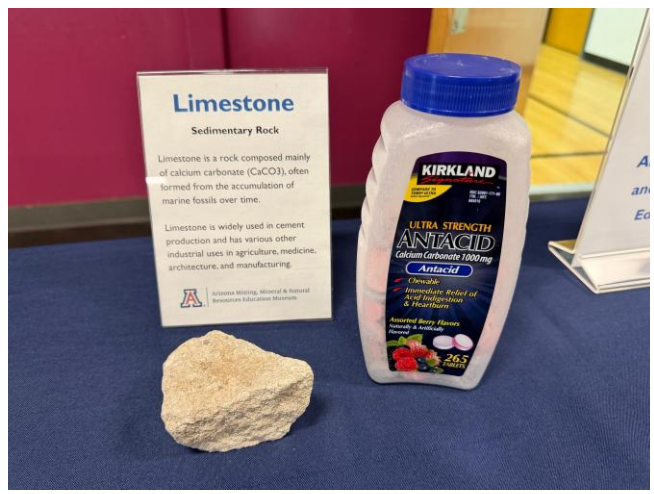
Catie Carter Sandoval
cscarter@email.arizona.edu
703.577.6449

Help support the museum at:
http://tinyurl.com/SupportMM-NREMuseum

This month we wrapped up our spring outreach efforts by participating in Science Night at a local BASIS charter school, and exhibiting at Galaxy STEM Fest at Heritage & Science Park in downtown Phoenix. For both events, we brought our industrial mineral activity, which features several rocks and minerals in their raw form along with the processed products. At Galaxy STEM Fest we also set up our popular sandbox mining activity, which allows participants to dig for (and take home) their own Arizona rock and mineral specimens. Outreach events are a great opportunity to engage students and get feedback from children and adults about museum experiences and expectations.

In museum development news, Marta continues to work with University of Arizona administration, our design-build team, and our Governor-appointed Advisory Council. We look forward to providing more update about movement on the building soon.

Industrial mineral display at a recent BASIS school event. Our table setup included chalcopyrite, malachite, perlite, peridot, scoria, and limestone.



Did you know that the calcium carbonate in TUMS and similar antacids is derived from limestone, a sedimentary rock? We need mining for more things than just building materials, including medicine.

Sandbox mining activity at the recent Galaxy STEM Fest, an Arizona Scitech Signature event in downtown Phoenix.

Sun City Rockhound Mineral Museum
Sundial Recreation Center
14801 N. 103rd Ave.
Sun City, AZ 85351

The museum offers private party tours for schools, clubs and individuals. We'd love to show off our museum to your club or private group. If you are interested, please contact the museum at scrockmuseum@gmail.com.

Please take a minute to check out our new website at scrockmuseum.com.

Summer Hours
May-September 10am-1pm
Saturdays only
Winter Hours
October – April
10 am to 1 pm
Closed Thurs., & Sunday

Unique Oil Geode Museum Specimens
By Carol Bankert-George
Museum Director Emeritus

Have you ever visited a museum you frequently visit and thought, *I've seen all this before*—only to be surprised by something entirely new?

That sense of discovery is one of the greatest joys of volunteering as a museum monitor. Every visit reveals something fresh: not just about minerals, but about the people who collected them and the stories that bring each specimen to life.

A Summer Tradition Worth Dusting Off

To a handful of club members, a favorite summer tradition is our annual deep cleaning of the museum displays. Case by case, we carefully remove each specimen, dust and polish the shelves, and gently refresh the entire exhibit. Some pieces are shifted to a better position so they can truly shine, and every label is checked to be straight, and facing just right.

It's slow, thoughtful work—and often full of surprises.

The Oil Geode Moment

During one of my first deep cleans, fellow rockhound club member, Karin Schardt was working on the quartz display when she suddenly gave a joyful little squeal. She had picked up one of the oil geode specimens and realized it was *still slowly draining oil*.

That's the kind of detail you may not genuinely appreciate through the plexiglass cabinet doors.

Holding a specimen in your hands can completely change how you understand it. That unexpected "oil drip" quickly became one of my favorite museum tour talking points, especially for children, whose faces light up the moment they see geology come alive. We even included it in our museum scavenger hunt.

Moments like these remind us that **every specimen has a story—and sometimes, a surprise—waiting to be discovered.**

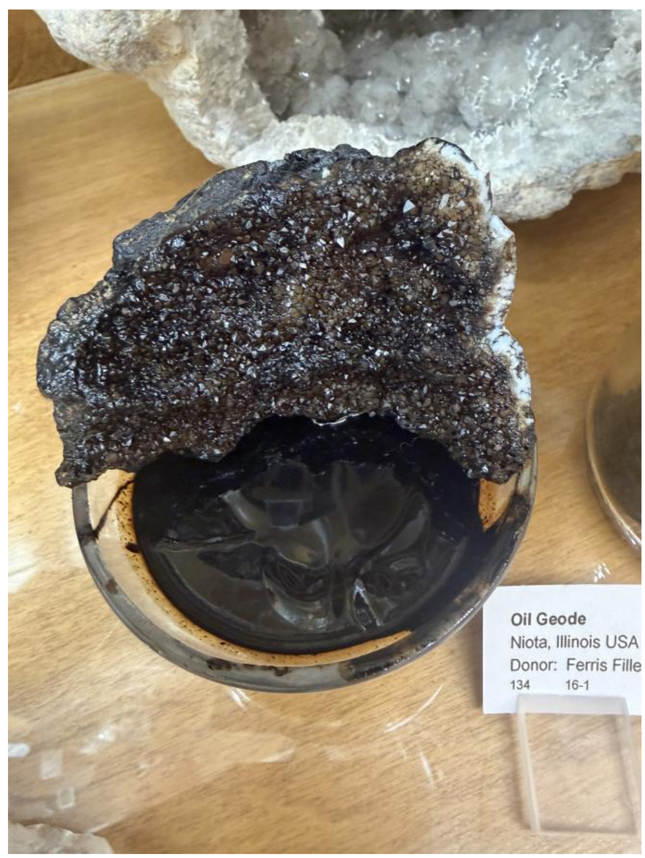
Geological Oil-Filled Geodes: These are natural rock formations that have been found to contain petroleum, oil, or bitumen inside them.

Geographic Distribution: They have been discovered in locations such as the **Warsaw Formation** in Illinois, specifically around Hancock County, as well as in eastern Iowa and parts of Kentucky (New Albany Shale).

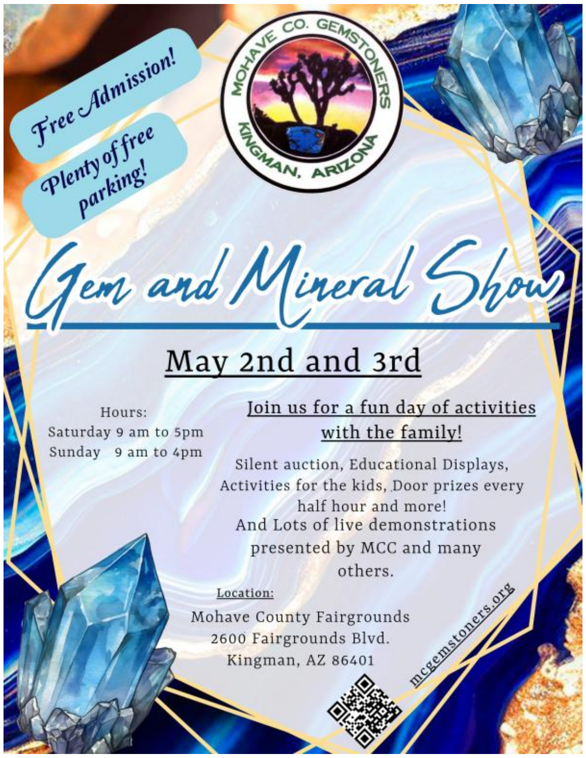
Origin: The oil often originates from surrounding rock formations, such as those from the Pennsylvanian age, which then infiltrated the forming geode.
Via Google

Oil Geodes

Oil Geode



Arizona Rock and Gem Shows



ANNUAL SHOW
White Mountain Gem and Mineral Club
July 10-12, 2026
Fri. 9-5, Sat. 9-5, Sun. 10-4
Adults $5, Kids 17 and under free
Elks Lodge
805 E. Whipple
Show Low, AZ
whitemountain-azrockclub.org

22nd Annual Prescott Gem & Mineral Show
Prescott Gem & Mineral Club
July 31,2026 - August 2,2026
Fri. 9-5, Sat. 9-5, Sun. 9-4
$5 Admission,
$4 Seniors, Vets and Students
Children Under 12 Free
Findlay Toyota Center
3201 N Main St
Prescott, AZ
https://www.prescottgemmineral.org/

The 2026 Sedona Gem and Mineral show will be held on October 3rd & 4th - start planning ahead. (We are breaking tradition from our normal 3rd week show!)

Annual Show
Sedona Gem and Mineral Club
October 3-4, 2016
Sat. 10-5, Sun. 10-4
Adults $5 Cash Only
Children 12 and under Free
Free Parking
Sedona Red Rock HS
995 Upper Red Rock Loop Rd

Arizona Rock and Gem Clubs

Apache Junction Rock & Gem Club
Meetings are on the 2nd Thursday
Next Meeting: May 14, 2026, 6:30 pm
www.ajrockclub.com
@ Club Lapidary Shop
2151 W. Superstition Blvd., Apache Jct.

Daisy Mountain Rock & Mineral Club
Meetings are on the 1st Tuesday
(unless a Holiday then 2nd Tuesday)
Next Meeting: May 5, 2026, 6:30 p.m.
www.dmrmc.com
@ Anthem Civic Building
3701 W. Anthem Way, Anthem, AZ

Maricopa Lapidary Society, Inc
Meetings are on the 3rd Tuesday
Next Meeting: May 19, 2026, 7:00 pm
www.maricopalapidarysociety.com
@ North Mountain Visitor Center
12950 N. 7th St., Phoenix, AZ

Mineralogical Society of Arizona
Meetings are usually on the 3rd Thursday
(Except June & December)
Next Meeting: May 21, 2026, 6:30 pm
@ Franciscan Renewal Center, (Piper Hall),
5802 E. Lincoln Drive, Scottsdale, AZ
www.msaaz.org

Pinal Geology & Mineral Society
Meetings are on the 3rd Wednesday
Next Meeting: May 20, 2026, 7:00 pm
www.pinalgeologymuseum.org
351 N. Arizona Blvd., Coolidge

West Valley Rock & Mineral Club
Meetings are on the 2nd Tuesday
Next Meeting: May 12, 2026, 6:30 pm
www.westvalleyrockandmineralclub.com
Buckeye Community Veterans Service Center
402 E. Narramore Avenue, Buckeye, AZ

Gila County Gem & Mineral Society
Meetings are on the 1st Thursday
(unless a Holiday then the next Thursday)
Next Meeting: May 7, 2026, 6:30 pm
www.gilagem.org
Club Building
413 Live Oak St, Miami, AZ

Wickenburg Gem & Mineral Society
Meetings are on the 2nd Friday
(February & December on the 1st Friday)
Next Meeting: May 8, 2026, 7:00 pm
www.wickenburggms.org
@ Coffinger Park Banquet Room
175 E. Swilling St., Wickenburg, AZ

ESM's Meeting Notice

ESM's next meeting will be at North Mountain Visitor Center, 12950 N. 7th St., Phoenix, on Tuesday, TBA 2026, at 6:30 p.m.

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MANY THANKS TO OUR MAJOR DONORS!

AZ Leaverite Rock & Gem Society

Flagg Mineral Foundation
www.flaggmineralfoundation.org

Friends of the AZ Mining & Mineral Museum

Maricopa Lapidary Society
http://maricopalapidarysociety.com/

Mineralogical Society of AZ
www.msaaz.org

Payson Rimstones Rock Club
https://www.rimstonesrockclub.org/

Sossaman Middle School

White Mountain Gem & Mineral Club
www.whitemountain-azrockclub.org

Sun City Rockhound Club & Mineral Museum
https://suncityaz.org/recreation/clubs/rockhound-club-mineral-museums/

Wickenburg Gem & Mineral Society
http://www.wickenburggms.org
www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438

West Valley Rock and Mineral Club
http://www.westvalleyrockandmineralclub.com/

Staples Foundation
www.staplesfoundation.org

Anita Aiston	Will & Carol McDonald
Peter & Judy Ambelang	Debbie Michalowski
Stan & Susan Celestian	Janet Stoeppelmann
Russ Hart	Dennis & Georgia Zeutenhorst

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ESM Earth Science Investigation Team Membership Form

_____ New Member _____ Renewal

Membership levels:

_____ ESI Family $20

_____ ESI Individual $10

Membership benefits:

- Monthly e-newsletter *Earthquake*
- Official team membership card
- Knowledge that your contribution is making a difference in earth science education.

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We're on the Web!

Visit us at:

www.earthsciencemuseum.org

Mission
Our Mission is to excite and inspire all generations about earth sciences through educational outreach.
Vision
We envision a community where students and the general public have curiosity about, passion for, and understanding of the underlying principles of earth sciences.

For more information about the ESM, how to become a member or how to arrange for a school visit or Community function, go to: www.earthsciencemuseum.org.

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THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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