



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
www.earthsciencemuseum.org, scote@earthsciencemuseum.org, 602-973-4291

July 2019
Volume 8, Issue 7

ESM Outreach Update:

By Mardy Zimmermann, Outreach and Education Coordinator

July was one of our slower months for ESM Outreach. However, there are several noteworthy items. The project to have 50 specimens for each future teacher kit items is completed.

We received a donation of minerals, fossils, rocks, meteorites and shells from Janet Stoeppelmann's teaching collection. Shirley, Doug and I have gone through the collection and have it sorted and most everything labeled. We are grateful for this donation and remember Janet's hard work toward getting the Mining and Mineral Museum back for students.

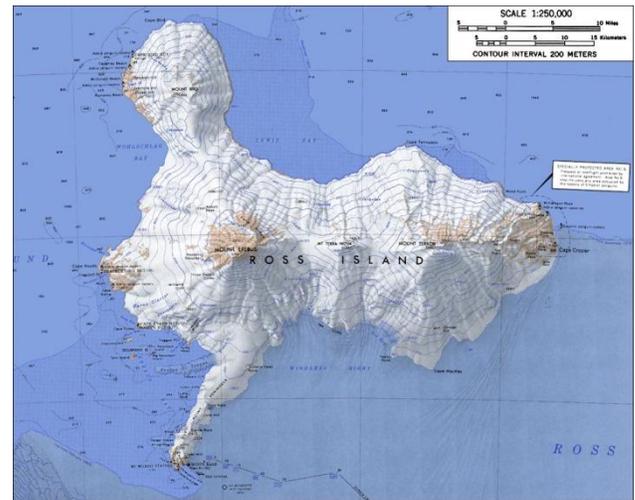
We have started crushing some of the material stored in buckets in Forest Lakes. The chalcopyrite we moved up from Queen Creek in spring netted some very beautiful multi-colored specimens. We also crushed larger pieces of obsidian and granite. Both used for teacher kits and the egg carton program. I also had a group of kids camping at Woods Canyon Lake participate in the egg carton program and crush sandstone into sand. The next months will hopefully give us direction for the new museum and the future of our outreach efforts.

An Amazing Antarctic "Anorthoclase" Addition

By Harvey Jong

The on-going search for new, interesting items for the Earth Science Museum's *Volcanic Rocks and Minerals* display has yielded another unique specimen. Our latest addition is an "anorthoclase" crystal from the Mount Erebus volcano in Antarctica!

Mount Erebus was discovered in 1841 and is one of the four volcanoes on Ross Island in eastern Antarctica and was named by Sir James Clark Ross after one of the ships in his expedition. Mount Erebus is the most active volcano in Antarctica as well as the southernmost active volcano on Earth.



Topographic Map of Ross Island

Mount Erebus is on the west side of the island.

USGS map, from *USGS Atlas of Antarctic Research* - PD - , via Wikimedia Commons

The volcano is also the site of an air disaster that happened on Nov. 28, 1979. Air New Zealand Flight 901, a scheduled Antarctic sightseeing flight, crashed into the side of Mount Erebus killing all 237 passengers and 20 crew members. The cause of the accident was attributed to errors involving flight navigation data changes made by the ground crew who did not inform the pilots about the modifications.

“Anorthoclase” appears in quotes since it is no longer recognized by the International Mineralogical Association (IMA) as a valid mineral species. Instead, it is now considered to be an intermediate member of an alkali feldspar series with the sodium feldspar, albite ($\text{NaAlSi}_3\text{O}_8$), at one end and the potassium feldspar, sanidine (KAlSi_3O_8), at the other end. The composition of this feldspar member involves a higher proportion of albite (around 64 to 90 percent) vs. sanidine (10 to 36 percent). (Note that although the IMA may object the obsolete name “anorthoclase” will continue to be used in this article.) Due to the high albite content, “anorthoclase” exhibits a triclinic crystal structure, and crystals may be prismatic, tabular, or rhombic.

The “anorthoclase” from Mount Erebus occurs in a lava lake located in the main summit crater.



Craters at the Summit of the Mount Erebus Volcano
Photo by Bill Rose, 1983, Michigan Technological University, via Global Volcanism Program, Smithsonian Institution

The lake, where continuous activity has been observed since 1972, measures up to 160 meters in diameter, has a depth of up to 100 meters, and a temperature around 1000° Celsius. It is one of the few permanent lava lakes in the world and is constantly monitored by researchers of the Mount Erebus Volcano Observatory.



Mount Erebus Lava Lake in 1983
Photo courtesy of Mount Erebus Volcano Observatory, via ehe.osu.edu

Up to six eruptions may happen each day as large gas bubbles rise and burst at the lake surface. The eruptions often eject glassy lava bombs onto the crater rim. The bombs range from 30 cm to 2 m in diameter and provide samples for analyzing the composition of the lake lava. Studies indicate that the overall composition is phonolitic (a rare type of high viscosity lava which is relatively low in silica and falls between felsic and mafic compositions; the same type occurs at Mount Vesuvius) and has essentially remained unchanged for the past 17,000 years.



Checking a Recently Ejected Lava Bomb
Clive Oppenheimer photo, University of Cambridge,
via sciencenews.org

Most of the lava bombs contain “anorthoclase” phenocrysts which can grow up to 10 cm in length. The large size may be due to shallow convection in the lava lake which helps promote crystallization. The crystals are randomly deposited on the ground as the glassy matrix of the bombs weather away.



Ground Littered with “Anorthoclase” Crystals
Rich Esser photo, NMT, via livescience.com

Below are some photos of the “anorthoclase” specimen that has been added to the ESM display.



ESM “Anorthoclase” Crystal - Front View



ESM “Anorthoclase” Crystal - Back View



ESM “Anorthoclase” Crystal - Side View

The crystal is 2.5 cm wide, 3.8 cm high, has a thickness of 1.6 cm, and weighs 14.1 grams. Note that most crystals found in erupting lava tend to be less than a centimeter in size, so the Mount Erebus “anorthoclases” have been called “megacrysts”. The size of our sample, however, is not exceptional by Mount Erebus standards.

The specimen is coated with a basalt ash which is somewhat different from other samples. As seen in the earlier ground photo, most of the “anorthoclase” crystals are gray to tan in color and have a somewhat dull, earthy luster.

Another interesting aspect of the new sample involves an unexpected Arizona connection. The “anorthoclase” crystal was part of the William “Jim” Thomas collection. Thomas worked as a mining engineer at the New Cornelia Mine at Ajo, Arizona and was an avid mineral collector. He amassed thousands of specimens which were mainly from the New Cornelia Mine area. But he also collected many other locations that produced unusual or rare minerals, and one of these sites was Mount Erebus.

Although we may have reached the ends of the Earth with the new Mount Erebus specimen, the search for samples for the ESM volcanic display has not ended. One of our goals is to feature a noteworthy specimen from a volcano from each of the seven continents. Currently, South America

is still not represented. So, if you happen to have something that might be suitable for the exhibit or know someone who does please let us know. Thank you!!

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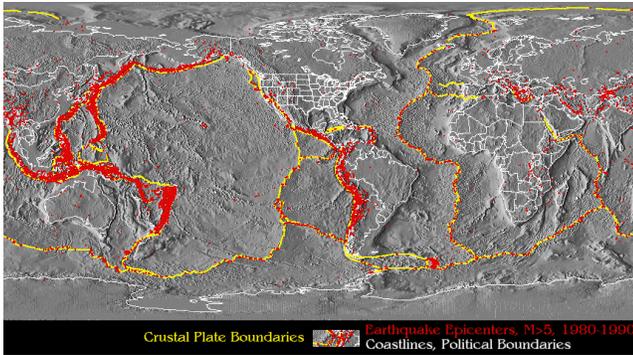
Lava Lakes and Plate Tectonics



What is really cool about this picture is what is going on at the lakes surface.

The uppermost layer of lava in a lava lake cools and solidifies, forming a thin crust on top of the molten lava beneath. This surface rind has the same composition, but different mechanical properties, than the fluid it covers, much like ice on a winter lake. The churning of the convecting lava beneath has broken apart the crust into a number of different slabs; in the picture above, the boundaries are marked by the lines of bright molten lava, creating a dramatic natural jigsaw puzzle. The same convection currents jostle the slabs against each other, moving them apart in some places, with new upwelling lava cooling and solidifying in the gap, and in other places pushing them back into the depths of the lake to be remelted.

Did you know that a lava lake is comparable to Earth’s tectonic plates?



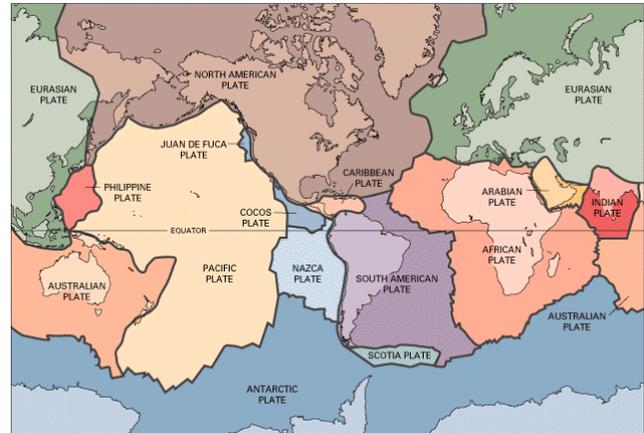
This image shows coastlines and political boundaries, along with crustal plate boundaries defined by earthquake epicenters of magnitude greater than five from 1980-1990. The images of the ocean floor in the above image were provided by the [World Data Center A](#) of the National Geophysical Data Center/ NOAA. Image: ucmp.berkeley.edu

Although the Earth's mantle is not molten, it is divided mechanically in the same way as a lava lake.

The crust and the upper layer of the mantle together make up a zone of rigid, brittle rock called the Lithosphere. The layer below the rigid lithosphere is a zone of asphalt-like consistency called the Asthenosphere. The asthenosphere is the part of the mantle that flows and moves the plates of the Earth.

Convection currents in the asthenosphere move heat from the Earth's interior towards the surface, and in the process also drives the motion of the overlying lithospheric plates. So a lava lake is in fact a fabulous natural analogue for plate tectonics, and because in this case the convecting medium *is* molten, moving at centimeters per second rather than centimeters per year, we can see processes that take tens of millions of years on a global scale happening in just a few hours.

Adapted from <https://all-geo.org/highlyallochthonous/2010/05/lava-lake-tectonics/>



The Earth's tectonic plates courtesy of the U.S. Geological Survey

Plate Boundaries

[This Dynamic Earth, USGS]

Scientists now have a fairly good understanding of how the plates move and how such movements relate to earthquake activity. Most movement occurs along narrow zones between plates where the results of plate-tectonic forces are most evident.

There are four types of plate boundaries:

- Divergent boundaries -- where new crust is generated as the plates pull away from each other.
- Convergent boundaries -- where crust is destroyed as one plate dives under another.
- Transform boundaries -- where crust is neither produced nor destroyed as the plates slide horizontally past each other.
- Plate boundary zones -- broad belts in which boundaries are not well defined and the effects of plate interaction are unclear. (E.g. almost all of New Zealand is in the deforming plate boundary zone, where reasonably steady deformation is occurring all the time).





Arizona Rocks 74

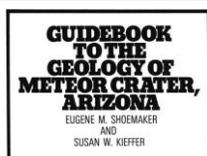
Text and photos by Ray Grant

The 50-year anniversary of the Apollo Moon landing on July 20, 1969 has put Meteor Crater in the news. The Apollo astronauts came to Arizona for training and one of the reasons was that the moon has many meteor craters and Meteor or Barringer Crater in northern Arizona is one of the best examples in the world.

The Earthquake newsletter for October 2013 has an article on Meteor Crater and you can go to earthsciencemuseum.org, click on newsletters and the October 2013 issue to learn more about the geology of Meteor Crater.

Another great resource on the geology of meteor crater is the *Guidebook to the Geology of Meteor Crater, Arizona* by Shoemaker and Kieffer.

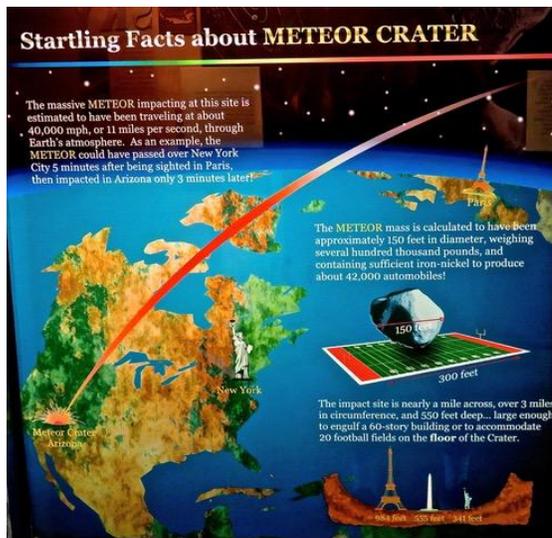
https://www.lpi.usra.edu/publications/book/s/barringer_crater_guidebook/shoemaker-kieffer/Shoemaker_Kieffer_Guidebook.pdf



Meteor Crater is about 45 miles from Flagstaff and I think a really great place to visit. You get to see the crater, and the Visitors Center on the rim is excellent. There are tours along the crater rim, there are many educational and interactive exhibits, there is a theater with a good film, there are exhibits about the Apollo program and astronaut training, and there is a large gift and rock shop. You will need a few hours to do it all. Go to meteorcrater.com for hours, admission fees, and other information. Here are a few photographs from the Visitors Center.



Explore Arizona in the Arizona Republic on Saturday, July 13, 2019



One of many informational exhibits at the Center



Part of a meteorite identification exhibit, here you can test the magnetism of the meteorites



AZ Mining, Mineral & Natural Resources Educational Museum Update July 2019

<https://ammnre.arizona.edu/>
<http://tinyurl.com/SupportMM-NREMuseum>

By Catie Carter Sandoval
cscarter@email.arizona.edu
 703.577.6449

Last month we began the process of interviewing potential candidates for the Museum Director position. After conducting video interviews with several applicants in June, we invited four people to Phoenix in mid-July. Their schedule included an on-site visit to the building and interviews with both the search committee and the museum's Advisory Council. The Advisory Council members who attended included; State Geologist Phil Pearthree, Pam Wilkinson, Les Presmyk, Steve Trussell, Nyal Niemuth, and Ben Stewart, representing AZ Office of Tourism Director Debbie Johnson. Brooks then met with the Advisory Council members to get their input about the different candidates and their ability to connect with the different natural resource industries. Since we are still in negotiations, we do not yet have a name to announce, but stay tuned.



Les Presmyk, Pam Wilkinson, Ben Stewart (AZ Office of Tourism), and Phil Pearthree (AZGS)

In other news, we're continuing building renovations, including installation of four new A/C units on the roof. The A/C units will provide cold air to the classroom in the NE corner, the Copper Gallery, and the mineral storage area, so that we can begin moving material back this fall. Other improvements scheduled for August include roof repair, an upgraded security system with keypad access, and environmental abatement. Once a new director is in place, he or she will continue to work with UA Facilities to determine next steps for renovation.



Out with the old, in with the new!



Monday Crew: Keep on the lookout for an email with our next volunteer activities! We will be moving the AZGS material out of the classroom and preparing for the mineral collection move. We also still hope to hold a public event this fall showcasing the stamp mill and outdoor equipment. Thank you all for your continued support.



Pinal Museum and Club News

351 N. Arizona Blvd., Coolidge, AZ

Next Pinal Gem and Mineral Club meeting

Wednesday, September 18, 2019

Museum opens at 6:30, meeting starts at 7p.m.

www.pinalgemandmineralsociety.org

We are going to have volunteer days at the Pinal Geology Museum (Artisan Village in Coolidge) every Thursday, July 25, August 1, 8, 15, 22, and 29. The Museum will be open at 9:30 and we can work as long as people can stay.

We will finish up a number of projects that have been started. Collection work is a long-term project and we have some additional projects to start.

We need to make more treasure bags to give kids who do the search for things in the museum. We need apache tears (hundreds given away over the last few years), or any small specimens if there are at least a 100 of them, and we have given tumble polished stones if we can get them. If you have any of these that you can donate please email me at raycyn@cox.net.

Our next club meeting is Wednesday, September 18, watch for program.



Registration: Registration is required for this event.

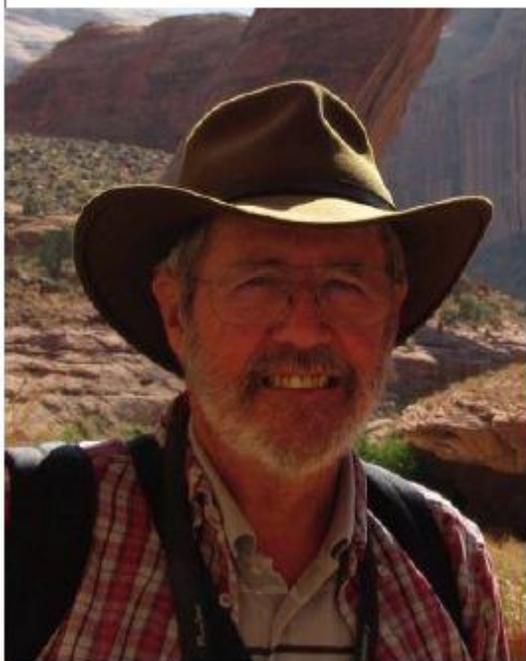
<https://azsos.libcal.com/event/5377114?hs=a>

<https://azlibrary.gov/starl>

2019 ARIZONA AUTHOR SERIES

Raymond Grant

Minerals and Gems of Arizona



Thursday, August 29, 2019, at 1 p.m.

State of Arizona Research Library
Polly Rosenbaum State Archives and History Building
1901 W. Madison St., Phoenix
(near the State Capitol, with free parking and convenient bus access)

Need special accommodations? Please contact us at 602-926-3870

FREE LECTURE * OPEN TO PUBLIC

This program is funded by a Library Services and Technology Act grant from the Institute of Museum and Library Services to the Arizona State Library, Archives and Public Records, a division of the Secretary of State.



KATIE HOBBS
SECRETARY OF STATE



Arizona Gem Shows



Prescott Gem and Mineral Club
 15th Annual Show & Sale
 August 2-4, 2019
 Adults \$5.00
 Seniors 65+, Vets, Students \$4.00
 Children under 12 FREE w/paid Adult
 Findlay Toyota Center
 3201 N. Main St.
 Glassford Hill & Florentine
 Prescott Valley, AZ

Payson Rimstones Rock Club Inc.
 Annual show
 September 20-22, 2019
 Fri. 4-8, Sat. 9-5, Sun. 10-4
 Admission \$3
 Free for children 12 and under
 Event Center at Mazatzal Hotel & Casino
 Highway 87, Mile Marker 251
 Payson, AZ

Mingus Gem and Mineral Club
 Annual Show & Sale
 September 27-29, 2019
 Fri. 9-5, Sat. 9-5, Sun. 10-4
 Free admission
 Clark Memorial Clubhouse Auditorium
 19 N. Ninth Street
 Clarkdale, AZ



Huachuca Mineral and Gem Club
 Annual show
 October 12-13, 2019
 Sat. 9-5, Sun. 10-4
 Free Admission
 Cochise College, 901 N. Colombo Ave
 Sierra Vista, AZ
http://huachucamineralandgemclub.info/Gem_Show.html



Sedona Gem and Mineral Club
 Show and Sale
 October 19-20, 2019
 Sat. 10-5, Sun. 10-4;
 Adults \$3
 Free admission for children under 12
 Sedona Red Rock High School,
 Hwy. 89A and Upper Red Rock Loop Road
 Sedona, AZ
<http://sedonagemandmineral.org>

Rock-A-Rama Gem & Mineral Show
 November 1-3, 2019
 Fri 9-4, Sat 9-5, Sun 9-4
 High Desert Park
 19001 E. Jacie Lane
 Black Canyon City, AZ

Rock & Gem Clubs



Apache Junction Rock & Gem Club

Meetings are on the 2nd Thursday
 Next Meeting: September 12, 2019, 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: September 3, 2019, 6:30 p.m.
www.dmrmc.com
 @ Anthem Civic Building
 3701 W. Anthem Way, Anthem



Maricopa Lapidary Society, Inc

Meetings are on the 1st Monday
 (unless a Holiday then 2nd Monday)
 Next Meeting: August 5, 2019, 7:00 pm
www.maricopalapidarysociety.com
 @ North Mountain Visitor Center
 12950 N. 7th St., Phoenix



Mineralogical Society of Arizona

Meetings are on the 2nd Thursday
 (February meeting on the 3rd Thursday)
 Next Meeting: September 12, 2019, 7:00 pm
www.msaz.org
 @ Franciscan Renewal Center,
 5802 E. Lincoln Dr., Scottsdale

Next Meeting



Pinal Gem & Mineral Society

Meetings are on the 3rd Wednesday
 Next Meeting: September 18, 2019, 7:00 pm
www.pinalgemandmineralsociety.org
 @ Artisan Village
 351 N. Arizona Blvd., Coolidge



West Valley Rock & Mineral Club

Meetings are on the 2nd Tuesday
 Next Meeting: August 13, 2019, 6:30 pm
www.westvalleyrockandmineralclub.com
 @ Painted Desert Academy
 2400 S. 247th Ave., Buckeye, AZ



White Mountain Gem & Mineral Club

Meetings are on the 1st Sunday
 (unless a Holiday then 2nd Sunday)
 Next Meeting: August 4, 2019, 1:00 pm
www.whitemountain-azrockclub.org
 @ VFW Hall
 381 N. Central, Show Low



Wickenburg Gem & Mineral Society

Meetings are on the 2nd Friday
 (February & December on the 1st Friday)
 Next Meeting: October 11, 2019, 7:00 pm
www.wickenburggms.org
 @ Coffinger Park Banquet Room
 175 E. Swilling St., Wickenburg

Prescott Gem & Mineral Club
 Invites you to the
16th Annual Prescott Gem and Mineral Show
 And the
2019 RMFMS Convention



63 retail Gem, Mineral, Fossil, Meteorite, Beads, and Jewelry Dealers
 Exhibition Cases
 Geode Cracking & Fluorescent Box
 Fluorescent Tent, Kid's Activities
 Demos, Raffle
 Specimen Identification Table
 Gold Panning
 Competitive Case Exhibits

Show Location:
 Findlay Toyota Center
 (Event Center)
 3201 N. Main St
 Prescott Valley, AZ 86323

August 2-4, 2019
 Friday 9am-5pm
 Saturday 9am-5pm
 Sunday 9am-4pm

Admission:
 \$5 Adults
 \$4 Seniors, Vets, Students
 Children under 12 Free with paid Adult
 (Cash only for Admission. ATM Available)

Convention Headquarters:
 Prescott Resort & Conference Center
 1500 AZ-69
 Prescott, AZ 86301

Visitor Information:
<http://www.prescottgemmineral.org/shows/>
<http://www.visit-prescott.com/>

Convention Information:
 Colleen Denton - PGMC
 928-308-3986

**ANNOUNCING THE ARIZONA (PRE-DENVER) { SUPER SECRET }
PREVIEW SALE OF THE**

VICTOR J HOFFMANN MINERAL COLLECTION

AUGUST 10TH 2019 @ 4:15 pm at the GILBERT MUSEUM

[ELLIOT @ GILBERT RD]

The 12th annual Gilbert show will be held in the morning 10AM - 2PM.

The Gilbert Show Vendors will close down at 2pm, pack out & the Shannon crew will set up for a 4:15 re-open in the same venue.

(I know this date conflicts with the Springfield show, and who in their right mind would come to the Valley of the Sun in August, but I could not help but tease all you back East dealers & collectors!) { See you in Denver for what the locals missed!?? }

We have the privilege of offering the widely encompassing mineral collection of this UofA Alum.

Vic wrote his thesis on the mineralogy of the Ojuela mine in 1967!
It has been a 3 month odyssey cleaning, sorting, prepping & labeling the collection for sale.

I've seen so many old classics & things I've only heard of, from locales I've only read about!

Everyone will find *something* they just got to have!

Tons of specimens with old labels:

Scott Williams, Southwest Scientific, Wards, John White, US National Museum, Roebling collection & so forth.

What you're going to see

The collection is about 200 flats of

Common to Rare species,

Ore samples to Display specimens, Classic European;

Classic Arizona (including Tiger, Bisbee, Sleeping Beauty etc.);

Gem Crystals from Pala to Brazil {from the 1960s-80s};

Tsumeb - common to rare;

Classic crystallized Gold & Silver from Mexico to Canada, Colorado to California, and Hungary to Romania!

TNs to Museum sizes, something for every collector!

Food and Beverages will be available.

For those of you that will be coming to the Morning Edition of the Gilbert Show, we will have gift certificates to some of the fine food/beverage venues in downtown Gilbert to enjoy close by, while you wait for us to open up at 4:15!

The "Ugly" Details!

**The collection is a consignment offering and ALL PRICES WILL BE NET!
SORRY, for this sneak preview the marked price is THE price.**

No haggling, no volume discounts.

Tax (7.8%) will be charged to retail customers.

Resellers please bring a copy of your AZ 2019 TPT license

Cash or check preferred but we will be able to take credit (Visa, MC, AMEX etc)

Hoping to see you there;

Please come to the morning show also, as the Weaver collection is also one you do not want to miss.

All the best,

Michael Shannon

12th Annual Gilbert Mineral Sale 2019

This intimate venue is an opportunity for collectors to see Arizona dealers' newest acquisitions before Denver Gem & Mineral Show® in September.

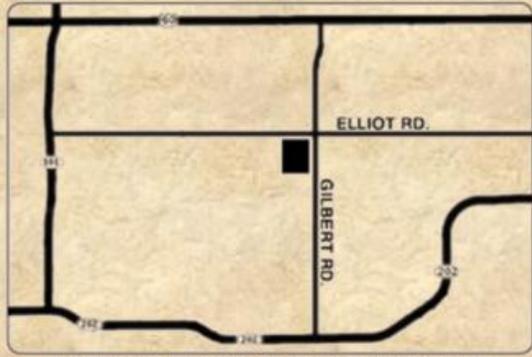
WHEN:
Saturday, August 10, 2019
10:00AM - 2:00PM
4:15PM - 8:00PM *Shannon Minerals: Vic Hoffman Coll.*

WHERE:
Gilbert Historical Society Museum
10 S Gilbert Rd
Gilbert, AZ 85296
(Southwest corner of Gilbert and Elliott Roads)

PARKING:
Parking is available at **Gilbert Elementary School**
West parking lot off (Gilbert and Elliott Roads) intersection.
Take 2nd driveway on Elliott Road, **NOT** the 1st driveway.

COST:
Free Admission

Gilbert Historical Museum
10 South Gilbert Rd., Gilbert, AZ 85296



**ADDITIONAL PARKING AT GILBERT ELEMENTARY
JUST WEST OF THE MUSEUM (FOLLOW SIGNS)**

ESM's Meeting Notice

ESM's next meeting will be at North Mountain Visitor Center, 12950 N. 7th St., Phoenix, on Tuesday, August 27, 2019, at 6:30 p.m.

BECOME A MEMBER!
Join the Earth Science Museum's



IS IT TIME TO RENEW YOUR MEMBERSHIP?
Please renew today! 😊😊😊

----- cut here -----
**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.

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.msaz.org
- Payson Rimstones Rock Club
- Sossaman Middle School
- White Mountain Gem & Mineral Club
www.whitemountain-azrockclub.org
- Wickenburg Gem & Mineral Society
<http://www.wickenburggms.org>
www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438
- Staples Foundation
www.staplesfoundation.org
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
- Will & Carol McDonald
- Debbie Michalowski
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- Dennis & Georgia Zeutenhorst

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602-973-4291

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We're on the Web!

Visit us on  and 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.

NOTICE:

ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7th St, Phoenix, on Tuesday, August 27, 2019, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

**EARTH SCIENCE MUSEUM
NON-PROFIT BOARD OF DIRECTORS**

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Mardy Zimmermann	VP Outreach
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Earth Science Museum

3215 W. Bethany Home Rd.
Phoenix, AZ 85017

