



# 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](http://www.earthsciencemuseum.org), [scote@earthsciencemuseum.org](mailto:scote@earthsciencemuseum.org), 602-973-4291

February 2023  
Volume 12, Issue 2

## ESM OUTREACH UPDATE

**Mardy Zimmermann, Outreach Coordinator**

Lynne Wheeler, ESM member and member of the Payson Rimstones Rock Club, made arrangements with a home school group in Pine, AZ, to give them three different presentations. Using ESM teaching materials, the first presentation was about minerals and their uses, the second about rocks and the third about fossils & fluorescents.



The evening after Lynne's presentation about minerals & their uses, the little girl at the end of the table (shown above) told her mom that she was surprised rocks helped her brush her teeth. She is only 3!

On February 21<sup>st</sup>, Richard Zimmermann and Bill Yedowitz worked with other Superstition Mountain Museum's stamp mill crew, to demonstrate their stamp mill and explain procedures in the assay office to a group of 3<sup>rd</sup> grade students.

While part of the 3<sup>rd</sup> grade group were waiting for their turn to visit the assay office, Mardy let the students examine and ask questions of the rocks, minerals and crystals she brought.



Mardy was very pleased with the students' response to touching the rocks and minerals. Both the boys and girls were excited to examine the crystals.

## A New Addition to the ESM Volcanic Rocks & Minerals Display - A Volcanic Valentine

By Harvey Jong

The ESM's Volcanic Rocks and Minerals display was last presented at the Pinal Gem and Mineral Show on March 14, 2020 just before such public events were shut down by the pandemic. Due to the uncertainty about how this hands-on activity might resume in the future, no new specimens have been added to the exhibit until now. The rather unusual nature and shape of this specimen suggested that it should be included in the display.

The new addition is a heart-shaped piece of reticulite from Hilo, Hawai`i. Reticulite is a type of tephra or lava fragment ejected by lava fountains.

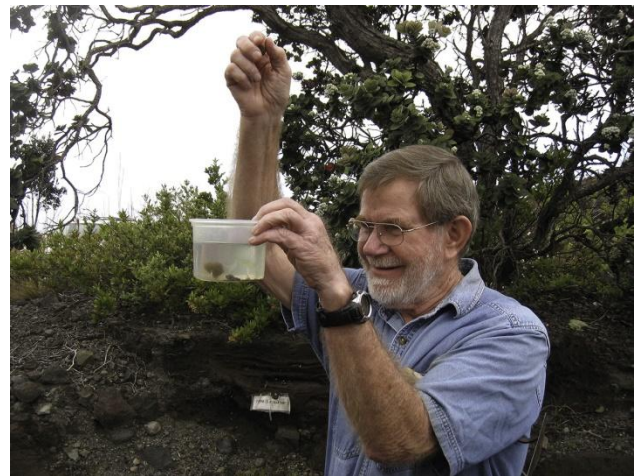


**Lava Fountain, Pu'u 'O'o Vent, East Rift Zone, Kilauea Volcano**

USGS photo, - PD - , via USGS.gov

The September 1984 eruption reached a height of 450 m (1,475 ft). Reticulite was produced by this lava fountain along with fountains in 1959 at Kilauea Iki and in 1969 at Mauna Ulu.

Reticulite is an extreme, delicate form of pumice and was called "thread-lace scoria" by the famous American mineralogist, James Dana<sup>1</sup>. It has a density less than pumice since its air bubbles have all burst, and the material is held together by glassy threads. Due to the resulting high porosity, it sinks in water.



**USGS Geologist, Don Swanson, Demonstrates That Reticulite Sinks, Rather Than Floats, In Water**

Stan Mertzman photo, - PD - , via USGS.gov

Reticulite is often associated with a fibrous form of basaltic glass, "Pele's Hair", which is named after Pele, the Hawaiian Goddess of Volcanoes. These pyroclastic materials are so light that they are often carried many miles downwind from an eruption site.

<sup>1</sup> James Dana was the geologist of the U.S. South Seas Exploring Expedition of 1838-1842. He observed active Hawaiian volcanoes and made pioneering contributions on their eruptive style and on the overall geology of the Hawaiian Islands. See Appleman (1987) for more information on Dana's involvement with the expedition.





### Annotated Map of Hawaiian Volcanoes

National Park Service map, - PD - , via Wikimedia Commons

The Kilauea volcanoes are located 30 km (19 mi.) from the town of Hilo. The collecting site of the new reticulite isn't known, but being around the vicinity of Hilo represents a rather remarkable travel distance.

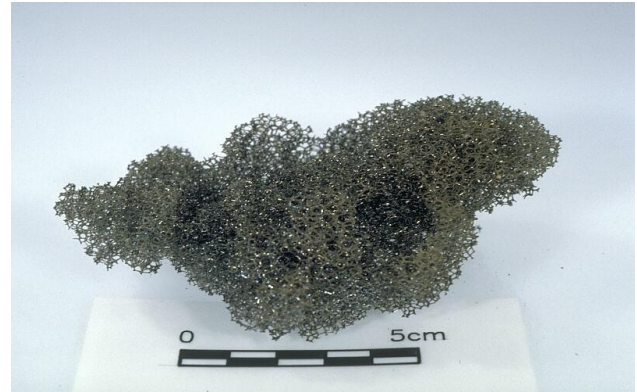


### Pele's Hair on the Curbs of the Halema'uma'u Crater Parking Lot

USGS photo, - PD - , via USGS.gov

The 2012 Kilauea eruption produced about a meter wide accumulation of Pele's Hair.

Vesicles are the small holes that develop when lava cools and forms volcanic rock. Their size, number, and distribution provide important information about the magma and eruption conditions of a volcano. In the case of reticulite, up to 98% of its total volume may be occupied by vesicles.

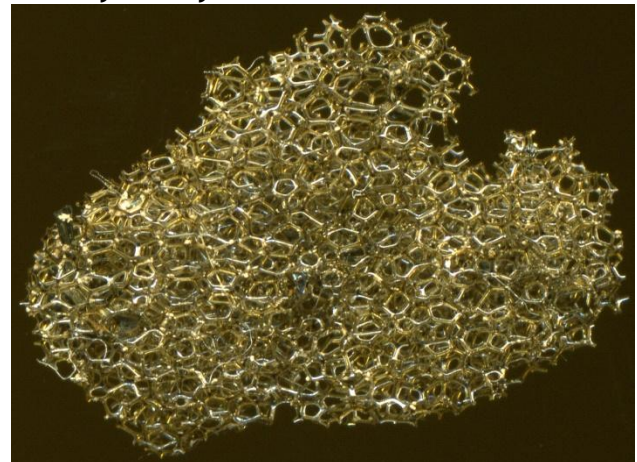


### Reticulite Sample

Photo by J. D. Griggs, USGS, - PD - , via Wikimedia Commons

Kilauea volcano, Hawai`i

Reticulite forms during vigorous lava fountaining and has the lowest average density of any rock.



### Close-up of Reticulite

James St. John photo, - CC\_BY\_SA-2.0 - , via Wikimedia Commons

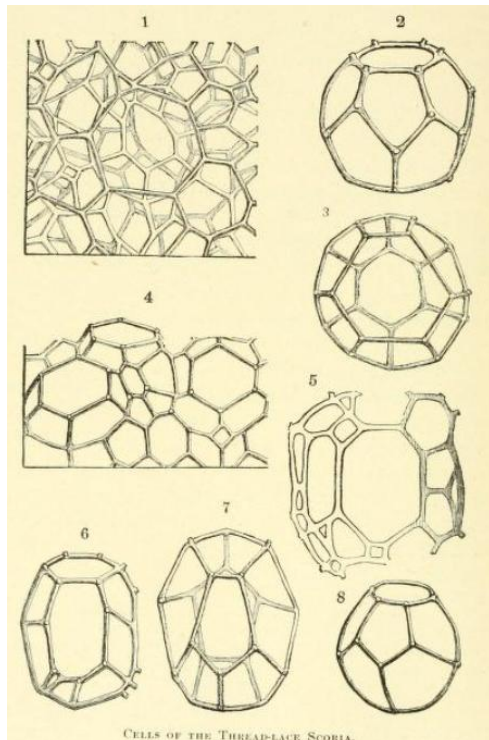
Kilauea volcano, Hawai`i

This sample, which is 18mm (0.71 in.) across, shows the complex three-dimensional honeycomb structure which results from the bursting of cell walls against one another.

The vesicles of reticulite samples from the 1984-1986 Kilauea eruptions have been reported to have diameters less than a few hundredths of a centimeter, while the number densities may be as high as  $10^5$  per cubic centimeter (Mangan and Cashman, 1996). The vesicle number density scales

with the height and intensity of lava fountains (Stovall et al., 2012).

The formation of reticulite has been suggested as being analogous to the popping of popcorn (Rust and Cashman, 2006). However, instead of happening in a microwave, the popping action may occur around a height of 400 m (1312 ft.) and at a temperature of 1200° C (2192° F). Bubbles start nucleating in magma in a near-instantaneous manner and rapidly expand to produce a foam phase. The foam ascends through a lava fountain and experiences a near-instantaneous rupture and quenching throughout the foam. The resulting structure consists of a network 12- to 14-sided polyhedral cells where the faces may be hexagonal, pentagonal, or quadrilateral. James Dana documented the shapes of these cells in his 1890 book *Characteristics of Volcanoes*.



CELLS OF THE THREAD-LACE SCORIA.

### Shape of Thread-Lace Scoria (Reticulite) Cells

James Dana drawing from Dana (1890) - PD - , via archive.org

Below are some photos of the reticulite specimen that has been added to the ESM display.



### ESM's "Heart of Reticulite" Specimen

Harvey Jong photo  
Hilo, Hawai i

The specimen is approximately 3 cm wide, 3 cm high, and weighs about 1 gram. The thickness is estimated to vary from 5 to 10 mm. (Note that due to its extremely fragile nature along with the unfortunate choice of cotton batting in the specimen box, no attempt was made to pick up the reticulite for a better measurement or to change the background for photography.)

The sample includes a few fibers of "Pele's hair", while "Pele's tears", black drops of lava, and are present on the upper left side and on the back.



Image: Pele's\_hair\_of\_Hawaii.jpg Cm3826 photo, - CC\_BY-SA-4.0 International - , via Wikimedia Commons





Image: PeleTears\_large.jpg

Jim D. Griggs, HVO (USGS) staff  
photographer, - PD - , via Wikimedia  
Commons

Kilauea volcano, Hawai`i

Collected a few kilometers downwind from  
Mauna Ulu, along the Hilina Pali Road



Close-up of the “Heart of Reticulite”  
Specimen

Harvey Jong photo, field of view: 13 mm  
Hilo, Hawai`i

This close-up view of the bottom portion of the specimen shows the intricate framework of polyhedral cells. The black areas indicate how some Pele’s tears are entangled with the reticulite.

## References

Appleman, D.E. (1987) James D. Dana and the origins of Hawaiian volcanology: the U.S. exploring expedition in Hawaii, 1840-41. *U.S. Geological Survey Professional Paper 1350: Chapter 60, 1607-1618.*

Dana, J.D. (1890) Characteristics of Volcanoes. Dodd, Mead, and Company, New York, NY. 399 p.

Mangan, M.T. and K.V. Cashman (1996) The structure of basaltic scoria and reticulite and inferences for vesiculation, foam formation, and fragmentation in lava fountains. *Journal of Volcanology and Geothermal Research: 73(1-2), 1-18.*

Rust, A.C. and K.V. Cashman (2006) Reticulite, scoria, and lava: foam formation in Hawaiian fire fountain eruptions. *American Geophysical Union, Fall Meeting 2006, abstract id. V43-1778.*

Stovall, W.K, B.F. Houghton, J.E. Hammer, S.A. Fagents, and D.A. Swanson (2012) Vesiculation of high fountaining Hawaiian eruptions: episodes 15 and 16 of 1959 Kilauea Iki. *Bulletin of Volcanology 74: 441-455.*

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## AZ Mining, Mineral & Natural Resources Education Museum Update February 2023

<https://ammnre.arizona.edu/>

Catie Carter Sandoval

cscarter@email.arizona.edu

703.577.6449

Help support the museum at:

<http://tinyurl.com/SupportMM-NREMuseum>

Gem and Mineral Show season is always our favorite time of year, and this past month was no exception. As we have done for the past few years, we participated as a Special Exhibitor for the Tucson Gem and Mineral Show at the Tucson Convention Center, which ran from Thursday February 9<sup>th</sup> to Sunday February 12<sup>th</sup>. The show theme was "SILICA - Agates and Opals and Quartz, Oh My!" Our case included beautiful specimens



of Arizona silica, including quartz and amethyst, agate cabochons, fire agate, petrified wood, and apache tears (>70% silica). We also contributed a piece of petrified wood to the shared Society of Mineral Museum Professionals case. At the show, we polled several visitors about their favorite specimen from the case and the overwhelming answer was the beautiful fire

agate from Mohave County (pictured). Fire



agate is iridescent rainbow red botryoidal chalcedony. It is associated with volcanic deposits and can be found in different locations across Arizona and the southwest. While it's not necessarily uncommon, this was an exceptional specimen with beautiful colors and shapes. It was originally donated by Don Schaefer.



Show visitor photographing the fire agate, one of our most popular specimens in the case.



University of Arizona mineral museum cases: Alfie Norville Gem and Mineral Museum (left) and AMMRE Museum (right)



Another thing we did in February was continue our educational outreach to elementary and high school-aged students in the Phoenix area. On February 8<sup>th</sup>, we participated in Science Night at a local charter school with our version of egg carton minerals, adapted from Marty Zimmermann and ESM's famous long-running activity. We provided kids with six-count egg cartons and twelve different specimens to choose from: quartz var. amethyst, quartz var. chalcedony, calcite, gypsum, mica, glauconite pseudomorph, azurite and chrysocolla (copper ore), pyrite, fossil coral, volcanic cinders, apache tears, and rhyolite. We received over 200 students at our station - a great turnout! We will certainly continue this activity in our future outreach. Thanks to Dick and Mardy for helping with the specimens and inspiring us.



Fossil coral, one of the options available at our egg carton setup.



Students and their families enjoying the egg carton activity at Science Night

Stay tuned for more news about our museum development and working with the new design-build team. Exciting updates to come! Thank you!



## Arizona Rocks 117

Text and photos by Ray Grant

Placer gold is gold that erodes from the lode deposits. Because gold is heavy and resistant to weathering, it is preserved and forms placer deposits. These deposits will be around the lode areas and eventually move to rivers. In the past there has been commercial placer mining at a number of places in the state; some with large gold dredges.



Commercial gold dredge placer mining gold on Big Bug Creek near Mayer, photograph from 1970s

Today placer gold recovery is mainly a hobby. When water is present, flakes and nuggets are recovered by sluicing and panning. If there is no water, dry washing is used. A dry washer blows air and vibrates the sediment over a set of riffles or by spinning the sediment separates the heavy gold from the lighter material. For larger nuggets, metal detectors are used and much of Arizona has been searched by metal detector.

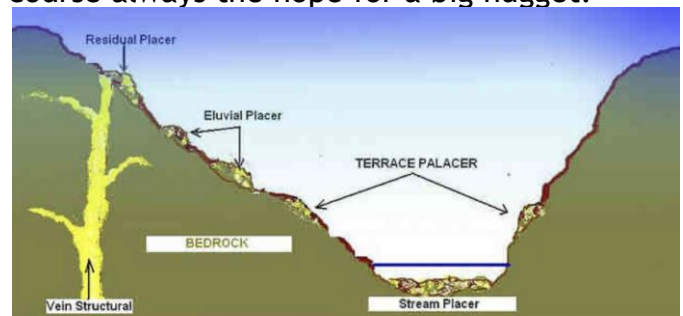


Mechanical sluice box to process faster, non-mechanical sluice boxes are also available

Gold panning is a recreational activity for many people, the equipment needed (a gold pan) is inexpensive and there are many places open to the public for panning. But be sure to check that an area is open as there are placer claims and trespassing is frowned upon. You can join a prospecting club as there are several gold prospecting clubs and groups in Arizona. I have gone gold panning and after driving a few hours and working many hours, I have a few small pieces of gold worth a couple of dollars. So I say, good for exercise and fresh air, and of course always the hope for a big nugget.



prospecting clubs and groups in Arizona. I have gone gold panning and after driving a few hours and working many hours, I have a few small pieces of gold worth a couple of dollars. So I say, good for exercise and fresh air, and of course always the hope for a big nugget.

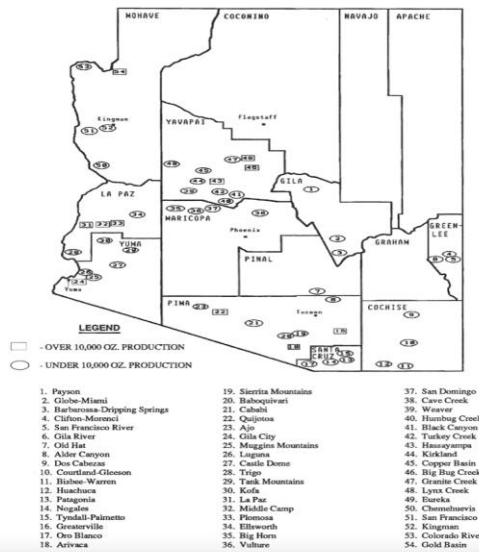


Formation of placer deposits from a lode gold deposit (Earth Science Australia)

There are three good publications about Arizona placers available on the Arizona Geological Survey website: *Gold Placers and Placering in Arizona*, Arizona Bureau of Geology Bulletin 168, reprinted in 1981; *Placer gold Deposits of Arizona*, USGS Bulletin 1355, 1972; and *Gold Panning in Arizona*, Mineral Report No. 7, 1990. These list hundreds of places where placer gold has been found.



Figure 6. Major Arizona Placer Gold Districts



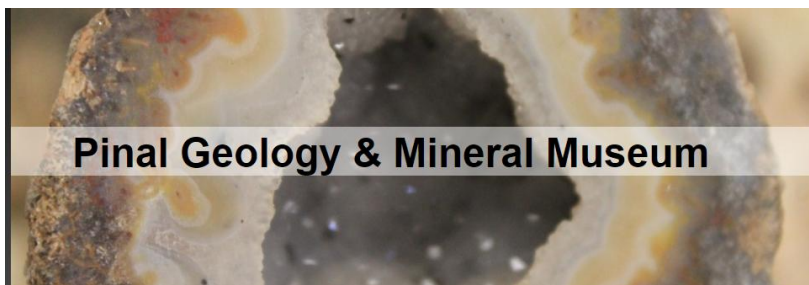
Gold nugget found recently at Rich Hill using a metal detector.

Map of commercial gold deposit areas in Arizona from Mineral Report 7 available at Arizona Geological Survey website

One of the most famous placer gold localities in Arizona is Rich Hill, Yavapai County. In May 1862, Pauline Weaver and Abraham Peeples with some other men were prospecting in the area near Rich Hill based on reports by some local Native Americans. After some days of searching a few of the party went searching for their horses that had strayed during the night. They found a hilltop covered with gold nuggets (Rich Hill). There were chunks of gold as big as potatoes all over the ground. In the weeks and months that followed there was a gold rush to the area. During this time Pauline Weaver was bringing in twenty-five pounds of gold a week. And in the first five years it is estimated that 25,000 ounces of gold were found in and around Rich Hill. In the last couple of years I have been shown some nice nuggets up to several inches that were found recently at Rich Hill. This is because better metal detectors that penetrate deeper are available now.

GOOD HUNTING!





## Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society meeting

**March 15, 2023**

[www.pinalgeologymuseum.org](http://www.pinalgeologymuseum.org)

Ray Grant [ray@pinalgeologymuseum.org](mailto:ray@pinalgeologymuseum.org)

The Museum is open from 11 to 4,

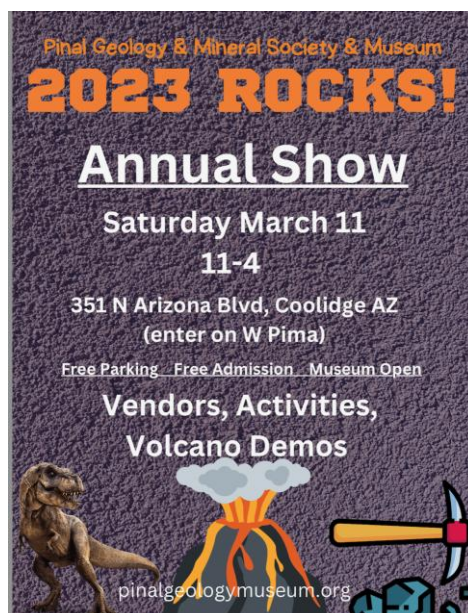
**Wednesday through Saturday**

Masks are now optional at the Museum. Please bring your own mask if you wish to wear one. We will have some masks on hand at the Museum, but cannot guarantee to provide them.

We've been holding in-person meetings since September, with a wide range of speakers. Meetings are the third Wednesday at 7pm, doors open at 6:30.

We're also hosting special days at the museum, running member-only field trips, and have greatly expanded our newsletter.

On Saturday, March 11, our annual show returns. Vendor information can be gotten from Richard Sichling, or email [info@pinalgeologymuseum.org](mailto:info@pinalgeologymuseum.org). Richard will be representing us at the Flaggs show in Mesa.





# 2023 DAISY MOUNTAIN GEM & MINERAL SHOW



**KIDS CORNER**  
Events & Games

**VENDORS**  
Jewelry, Gems,  
Minerals, Fossils,  
Beads, Geodes  
and More

**Saturday, March 11th**  
9am – 5pm  
**Sunday, March 12th**  
10am – 4pm

**ANTHEM SCHOOL**  
41020 N. Freedom Way  
Anthem, AZ 85086

**Adults \$3, Seniors & Students \$2**  
**Kids 12 & under Free**



**RAFFLES & DOOR PRIZES**

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**“DR. ROCK”**  
Identify your Favorite Rock



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For more information contact: Claudia Marek (623)640-8290

Email: [cmarek2@cox.net](mailto:cmarek2@cox.net)



**Apache Junction Rock and Gem Club**

**AJ ROCK & GEM SHOW**  
at Mesa Community College  
1401 S Dobson Rd, Mesa Show admission:  
March 4 & 5, 2023 \$3 adults  
Saturday 9am-5pm, Sunday 9am-4pm Children under 12 FREE \$1 students w/ID

Dog Friendly

## APACHE JUNCTION ROCK AND GEM CLUB

### SPRING 2023 JEWELRY, GEM, ROCK & MINERAL SHOW

Saturday, March 4 – 9am – 5pm

Sunday, March 5 – 9am – 4pm

#### LOCATION

Mesa Community College (Parking Lot)  
1401 S. Dobson Road  
Mesa, AZ. 85202

We have rocks, gems, jewelry, fossils, minerals, jewelry supplies, rare and unusual crystals from vendors throughout the state. Vendors will be set up under the solar panel covered area in the parking lot.

## 30th Annual Arizona Mineral Symposium Celebrating the Field Collector

**When:** March 31 & April 1, 2023

**Where:** Arizona Mining, Mineral & Natural  
Resources Education Museum  
1502 W. Washington  
Phoenix, Arizona

**Cost:** \$75.00 for members,  
\$85.00 for non-members.  
Includes symposium proceedings,  
snacks and lunch.

#### List of speakers and topics

- Gary Fleck** - The Grey Horse Vanadinite discovery  
**Graham Suttan** - Collecting adventures around the world  
**Tony Patucek** - San Pedro Mine, New Mexico  
**Jeff Smith** - The geode localities of Tancas and  
Las Choyas, Chihuahua, Mexico  
**Steve Scott** - Apex Mine, St. George, Utah  
**Jeff Scovil** - Quarries and Pegmatites of Connecticut  
**John Rakovan** - Rhode Island Amethyst  
and collecting in Japan  
**Barbara Munyan** - Duray, Colorado quartz localities  
**Jeff Langland** - Arizona Fossils  
**Stan Celestian** - Educational Kits for School Children,  
A Project of the Daisy Mountain Mineral Club

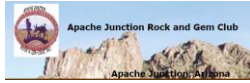
**We will have 4 to 6 dealers as well.**

**Friday afternoon** - We hope to have a series of short presentations by students from MCC, ASU and other colleges. Additional presentations and a possible Saturday night dinner and auction are also in the works.

Continue to check the website for updates and the final schedule.

**flaggmineralfoundation.org**





### Apache Junction Rock & Gem Club

Meetings are on the 2<sup>nd</sup> Thursday  
Next Meeting: March 9, 2023, 6:30 pm

[www.ajrockclub.com](http://www.ajrockclub.com)

@ Club Lapidary Shop

2151 W. Superstition Blvd., Apache Jct.



### Daisy Mountain Rock & Mineral Club

Meetings are on the 1<sup>st</sup> Tuesday  
(unless a Holiday then 2<sup>nd</sup> Tuesday)  
Next Meeting: March 7, 2023, 6:30 p.m.

**Please go to their website for more info**

[www.dmrnc.com](http://www.dmrnc.com)

@ Anthem Civic Building

3701 W. Anthem Way, Anthem, AZ



### Maricopa Lapidary Society, Inc

Meetings are on the 1<sup>st</sup> Monday  
(unless a Holiday then 2<sup>nd</sup> Monday)  
Next Meeting: March 6, 2023, 7:00 pm

[www.maricopalapidarysociety.com](http://www.maricopalapidarysociety.com)

@ North Mountain Visitor Center  
12950 N. 7<sup>th</sup> St., Phoenix



### Mineralogical Society of Arizona

Meetings are on the 3<sup>rd</sup> Thursday  
(Except December)  
Next Meeting: March 16, 2023, 5:00 pm

**Please go to their website for more information**

[www.msaaaz.org](http://www.msaaaz.org)

@ Franciscan Renewal Center  
Room: Padre Serra

5802 E. Lincoln Dr., Scottsdale



### Pinal Geology & Mineral Society

Meetings are on the 3<sup>rd</sup> Wednesday  
Next Meeting: March 15, 2023, 7:00 pm

**In person meeting**

[www.pinalgeologymuseum.org](http://www.pinalgeologymuseum.org)

@ Artisan Village

351 N. Arizona Blvd., Coolidge



### West Valley Rock & Mineral Club

Meetings are on the 2<sup>nd</sup> Tuesday  
Next Meeting: March 14, 2023, 6:30 pm

[www.westvalleyrockandmineralclub.com](http://www.westvalleyrockandmineralclub.com)

@ Buckeye Community Veterans Service  
Center

402 E. Narramore Avenue, Buckeye, AZ



### Gila County Gem & Mineral Society

Meetings are on the 1<sup>st</sup> Thursday  
(unless a Holiday then the next Thursday)  
Next Meeting: March 2, 2023, 6:30 pm

[www.gilagem.org](http://www.gilagem.org)

Club Building

413 Live Oak St, Miami, AZ



### Wickenburg Gem & Mineral Society

Meetings are on the 2<sup>nd</sup> Friday  
(February & December on the 1<sup>st</sup> Friday)  
Next Meeting: March 10, 2023, 7:00 pm

[www.wickenburggms.org](http://www.wickenburggms.org)

@ Coffinger Park Banquet Room  
175 E. Swilling St., Wickenburg

**ESM's Meeting Notice**

ESM's next meeting will be at North Mountain Visitor Center, 12950 N. 7<sup>th</sup> St., Phoenix, on Tuesday, TBA 2023, at 6:30 p.m.

**BECOME A MEMBER!**  
Join the Earth Science Museum's



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

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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.

**MANY THANKS TO OUR MAJOR DONORS!**

- AZ Leaverite Rock & Gem Society
- Flagg Mineral Foundation  
[www.flaggmineralfoundation.org](http://www.flaggmineralfoundation.org)
- Friends of the AZ Mining & Mineral Museum
- Maricopa Lapidary Society  
<http://maricopalapidarysociety.com/>
- Mineralogical Society of AZ  
[www.msaz.org](http://www.msaz.org)
- Payson Rimstones Rock Club
- Sossaman Middle School
- White Mountain Gem & Mineral Club  
[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)
- Wickenburg Gem & Mineral Society  
<http://www.wickenburggms.org>  
[www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438](https://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](http://www.staplesfoundation.org)
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**Editor E-Mail:**  
 scote@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](http://www.earthsciencemuseum.org).

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*We're on the Web!*

*Visit us at:*

[www.earthsciencemuseum.org](http://www.earthsciencemuseum.org)

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**NOTICE:**  
 ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7<sup>th</sup> St, Phoenix, on Tuesday, TBA 2023, at 6:30 p.m.

**THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!**

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