



# 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

December 2021  
Volume 10, Issue 12

## ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator



On Saturday, December 11<sup>th</sup>, twelve individuals attended Shirley Cote's mineral identification/mineral uses class at North Mountain Visitor Center. Participants included visitor center volunteers, Daisy Mountain Rock and Mineral Club members and interested local hikers.



Mineral specimens/products for the students to inspect and learn

After the class, participants were able to take several labeled mineral specimens including fluorite, magnetite, feldspar and quartz along with informational handouts. →



## “Christmas Comet” 2021

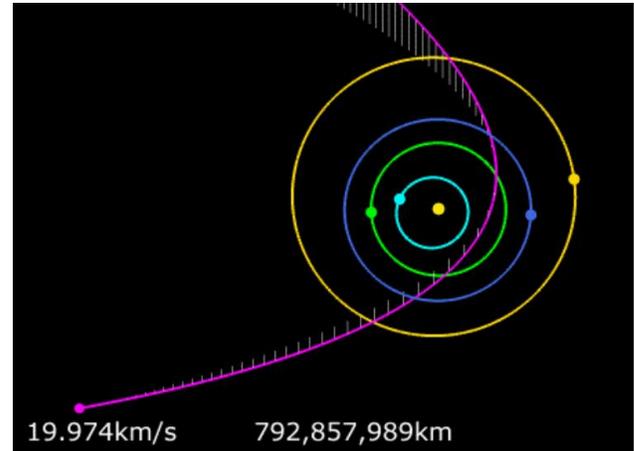
By Harvey Jong

For another Christmas theme article, we will focus our attention on the night sky. Specifically, the object of interest is Comet C/2021 A1 which is also known as Comet Leonard and has been dubbed the “Christmas comet” because of the timing of its appearance. The comet was discovered by astronomer Gregory Leonard on Jan. 3, 2021 at the Mount Lemmon Infrared Observatory near Tucson.

Since its discovery, the comet has been approaching the Earth and Sun, but has remained a very dim object. The brightness was an apparent magnitude of 19 when it was first detected. (Note: apparent magnitude is a reverse logarithmic scale where brighter objects have a lower magnitude.) On Dec. 12<sup>th</sup>, Comet Leonard reached its closest point to the Earth around 21.7 million miles (34.9 million kilometers), and according to the Comet Observation Database (<https://www.cobs.si/>) its brightness was about magnitude 5. Some unexpected brightening was, however, reported around Dec. 15<sup>th</sup> which may be due to forward scattering where ice and dust particles are backlit by the Sun. As the comet reaches its closest approach to the Sun on Jan. 3, 2022, it may perhaps reach a magnitude around 2.5 which would make it just visible to the naked-eye under city light conditions. (Note that predicting the brightness of a comet is a rather risky proposition. Recall that the 1986 apparition of Halley’s Comet was billed as the “Comet of the Century”, but it barely reached a magnitude of 2.)

Calculations of Comet Leonard’s elliptical orbit indicate a period of about 80,000 years. This analysis also shows that it is traveling at 158,084 miles per hour (254,412 kilometers per hour) relative to the Earth. Assuming the comet remains intact after its close encounter with the Sun (57.7 million

miles or 0.62 Astronomical Units), it will accelerate through a gravitational “slingshot” effect and be ejected from the solar system. So, Comet Leonard is truly another “once-in-a-lifetime” celestial event.



**C/2021 A1’s Orbit Around the Sun - 2021 Close Approach**

Screen capture of a gif animation by Phoenix7777 - CC-BY-SA\_4.0, via Wikimedia Commons

■ C/2021 A1 
 ■ Sun 
 ■ Mercury 
 ■ Venus 
 ■ Earth 
 ■ Mars

Around late November until Dec. 12<sup>th</sup>, Comet Leonard appeared in the early morning skies. It passed by several constellations (Boötes, Libra, Ophiuchus) and globular clusters (M3, M12, M10). From mid-December and possibly early January, the comet can be viewed low in the southwest horizon shortly after sunset. Venus and Saturn provide reference points as the comet appears below these planets.

Viewing of the comet from my home in Chandler was blocked by a neighbor’s house. So, on Dec. 19, I went to Chandler Veteran Oasis Park and schlepped my small telescope, tripod, and camera gear to the top of an overlook. While the 1311 ft. elevation of the viewing area provided an unobstructed view, the sky wasn’t very dark after sunset due to urban “light pollution”. By the time the sky was sufficiently dark,

the comet had already moved below the horizon. Oh well, I tried...

So, this time I will have to be an “armchair astrophotographer” and present some images from the Internet.



**Comet C/2021 A1 Leonard on November 28, 2021, Hertfordshire, United Kingdom**  
Photo by University of Hertfordshire Observatory - CC-BY-SA\_2.0, via Wikimedia Commons

The University of Hertfordshire’s Bayfordbury Observatory created this photo using a composite of thirteen 60 second images taken with RVB photometric filters. The total exposure time was 39 minutes.



**Comet Leonard Next to the Globular Cluster M3**

Photo by KSPFanatic102 - CC-BY-SA\_4.0, via Wikimedia Commons

This photo is by an amateur astronomer and involves a 30 minute stack exposure taken on Dec. 2, 2021 with a 135mm lens and a star tracker.

And for a truly out of this world perspective, the Origin Space Yangwang-1 Space Telescope, which orbits 500 km above the Earth, captured the comet appearing against the aurora with two satellites and a meteor! This photo was posted as a NASA Astronomy Picture of the Day at: <https://apod.nasa.gov/apod/ap211215.html>



### Another Special Christmas Space Event



### Successful Launch of the James Webb Space Telescope

Photo credit: NASA/Chris Gunn - CC-BY-SA\_2.0, via flickr.com

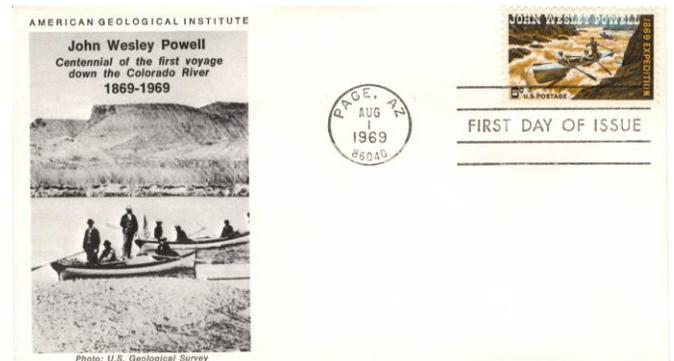
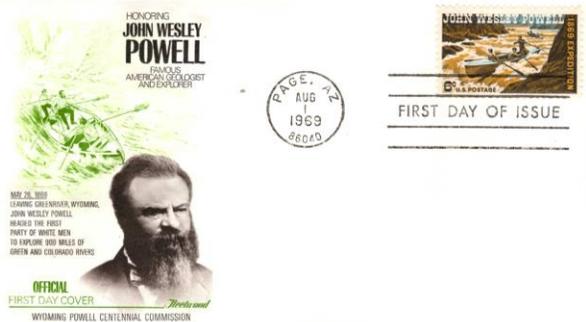


## Arizona Rocks 103

Text and photos by Ray Grant

This month a person associated with Arizona Rocks not a place. In going through some stamps from my father's collection, I found some first day covers for the 100<sup>th</sup> anniversary of John Wesley Powell's trip through the Grand Canyon in 1869. There are a number of different covers, all postmarked from Page, Arizona. One also has a medal with it. The front of the medal has Powell Expedition 100<sup>th</sup> Anniversary and the back the Great Seal of the State of Arizona. It is in a leather folder with 65<sup>th</sup> Anniversary Great Western Bank & Trust Founded in Prescott 1906 on the cover and says the medal was sculptured by Donald Dow of Phoenix, Arizona.

John Wesley Powell had a great interest in natural science and especially in geology. He studied at Illinois College, but mostly learned on his own. He fought in the Civil War and lost his right arm. After the war, he took the post of professor of geology at Illinois Wesleyan University. In 1867 he started expeditions exploring the west and in 1869 made his first trip by boat through the Grand Canyon. His is the first officially documented trip through the canyon, but there are stories of earlier people making it through. In 1871-72, he had another trip through the canyon resulting in a topographic map of the canyon and hundreds of photographs. He continued teaching and exploring the west and in 1881 he became the second Director of the United States Geological Survey. He was director until 1894 when he retired. John Wesley Powell made an important contribution to the study of the geology of Arizona.





## AZ Mining, Mineral & Natural Resources Education Museum Update December 2021

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

Catie Carter Sandoval

cscarter@email.arizona.edu

703.577.6449

Help support the museum at:

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

By Charlie Connell

On December 4<sup>th</sup> we had a special event at the museum that included access to the Copper Gallery displays and running of the outside mining equipment. We arrived at the museum at about 08:30 to get ready for the event that was to start at 10:00.

We had the following ten volunteers that supported the event including the outside equipment runs and activities in the Copper Gallery: George Busby, Roger Camplin, Charlie Connell, Shirley Cote, Doug Duffy, Rick Herrem, Bill Lytle, Jeremy Pettingill, Don Richardson, and, Bill Yedowitz. We conducted an initial safety stand down and went over what we were going to do to prepare for the event.

We worked on the following components to make sure we were ready for the equipment runs:

Cistern Checks We noticed that the cistern was filled to about 6" from the top. This restricted the flow of water flow out of the trough to the cistern. I brought a submersible pump and pumped about a foot of water out of the cistern to allow proper flow of water out of the trough. We tested the flow and the water drained quickly out of the trough to the cistern.

Primary Crusher We ran some quartz through the crusher and it worked fine, providing we

broke the pieces down to about no more than 3" in size. We will need to increase the speed of the crusher from its current speed of about 60 RPM to about 120 RPM in the future.

Mucker Operation We piled the muck up in front of the mucker and took a couple passes and it worked okay.

Mortar Box Levels The last time we ran the mill the mortar box was filled with fine sand and it washed it through in short order causing significant splashing and blasting of material above the screen and on to the table. We took material out of the ore bin that was greater than 2" in size and filled the mortar box to just below the stamps when they were on the jacks. We also adjusted the water flow to the box.

Lower Guides We noticed last week that the lower guide was moving during the mill operation. This meant that the guide needed to be tightened down. It did not need much, but just enough to stop its movement.

Feeder We noticed that the feeder actuator was not being hit by the collar on stem #3. We moved the collar about 2" down so that it would be hit by the actuator. We still need to move it slightly further, about 1" more in the future.

We got together about 10:00 and did a pre-job brief "dry run" for that team, making sure that everything would go smoothly. We focused on a couple weak areas and the most concern was the dumping of the skip into the ore bin on top of the stamp mill.

We had a successful run at 10:30 that lasted over an hour. We had about 40 guests at the first equipment run. Everything went smoothly and I think the visitors were impressed with the activity.



Shirley manned the two Earth Science activities:  
Conductivity  
Rock and Mineral Identification



Digging for Fossils  
A Family Activity



Mineral Displays



Cases containing mining Artifacts



**Presentation Discussion**  
Charlie Connell gave the group a quick history lesson on the mining components that were brought to the museum in the early 1990's.  
The restorations included the Boras Headframe and Hoist House, Swallow Mine 5-Stamp Mill & incline cart, Primary Jaw Crusher, Red Rover Mucker and a Gold Wheel. All of the restorations except the H&K Porter Steam Locomotive were completed by the Monday Crew.  
No small task!



**Boras Headframe**  
The Boras Headframe was the last of the wooden headframes built in the Warren Mining District near Bisbee, Arizona. Erected in 1917, it hoisted over 50,000 tons of copper ores by 1926 when the mine was closed during the Depression. Production resumed in 1938 and continued to 1941. In 1952 the headframe was reconditioned and some of its wood supports were replaced with steel. Until 1975 it served as a ventilation and escape shaft for the interconnecting underground workings of the Dallas and Cole mines.  
The relocation to Phoenix was completed in 1997.



**Swallow Mine 5-Stamp Mill History**  
This stamp mill was originally operated in the 1890's at a small town called Briggs near Castle Creek, approximately three miles from the Swallow Mine. In the beginning the ore was transferred from the Swallow Mine to the mill, but after a few years the mill was disassembled and taken directly to the Mine. There are only two years of documented operation of the stamp mill during its service at the Swallow Mine. The first 1000 tons of material through the mill ran about \$60.00 of gold per ton. (approx. 2 Ounces per ton)  
The stamp mill was donated to the Arizona Mining & Mineral Museum by the owner of the Swallow Mine, Charles W. Brown of Sun City.  
The stamp mill was disassembled at the mine and brought to the museum in 1996. The restoration was completed in 2003, and has been running since!

We had a second run for about 6 guests and it went very well. Overall the event was a success and we got to run the equipment for visitors.



**The Team!**  
(left to right):  
Doug Duffy, Shirley Cote, Chuck Messersmith, Mary Duer, Don Richardson, Rick Herren, Charlie Connell, George Busby, Bill Yedowitz, Bill Lytle, Roger Camplin, and Catie Sandoval.  
(Not in the picture)  
Jeremy Pettingill



Dessert anyone!



## Pinal Geology & Mineral Museum

### Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society meeting

January 19, 2022

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

Ray Grant [raycyn@cox.net](mailto:raycyn@cox.net).

The Museum will be open four days a week starting on January 6. It will open from Wednesday - Saturdays from 10 am to 3 pm. So more opportunities for people to visit! This will be the plan until we close for the summer.

Masks are required for all visitors and volunteers over five years old. We have taken this step to protect our volunteers so they can safely open the Museum for you. Please provide your own masks. We will have some on hand at the Museum, but cannot guarantee to provide them. If wearing a mask is a problem, please plan your visit for later.



Laurie  
Manifold has  
added to our  
dinosaur exhibit. Here she is painting and  
being carefully watched by her friends.



## Arizona Geological Survey

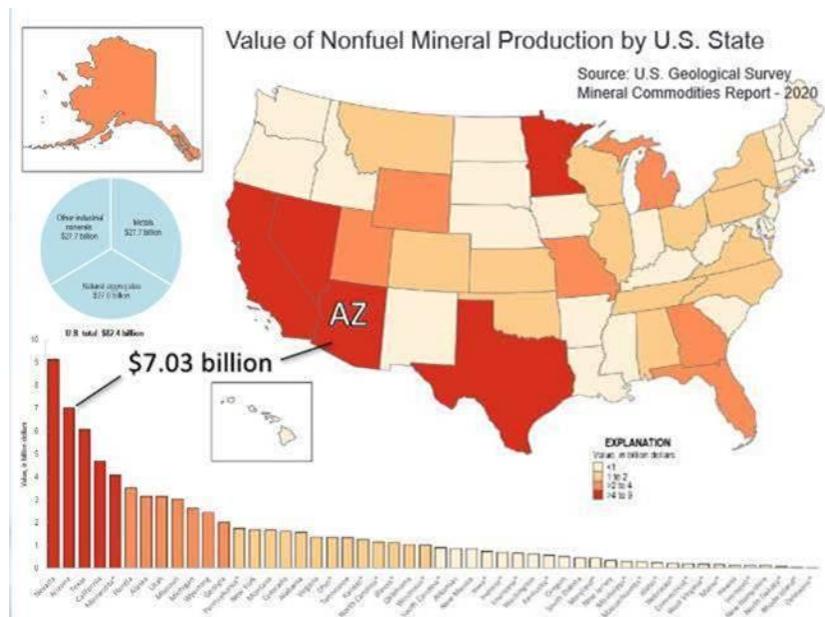
### Arizona Geology Newsletter v.43 #2 Winter 2021

#### Contents:

- Recent Earthquake Activity & Seismic Hazards in SE Arizona
  - Monsoon Rains & Earth Fissures in Cochise County
- Arizona Mining Production & Employment 2020 Infographic
  - New, Pending, and Revised Publications
  - Smiling faces of the AZGS Staff

Happy Holidays to all from the staff of the Arizona Geological Survey!

Direct link to newsletter: <https://tinyurl.com/AZGeol42-3>



From *Arizona Mining Production & Employment 2020 Infographic*

F. Michael Conway  
Sr. Research Scientist  
Arizona Geological Survey  
The University of Arizona  
1955 E 6<sup>th</sup> Street, PO Box 210184 Tucson, AZ 85721  
[fmconway@arizona.edu](mailto:fmconway@arizona.edu) cell: 520.971.3688

#### **AZGS Websites**

[AZGS Portal](#)  
[AZGS Mining Data](#)  
[AZGS Document Repository](#)

#### **AZGS Social Media**

Blog [Arizona Geology Blog](#)  
Facebook [AZ.Geological.Survey](#)  
Twitter [AZGeology](#)  
Instagram [azgeology](#)



## Parent/Teacher Resource Page 1

[HTTPS://WWW.EARTHSCIWEEK.ORG/NEWSLETTER](https://www.earthsciweek.org/newsletter)

### EARTH SCIENCE WEEK UPDATE

December 2021

#### **MORE CLASSROOM ACTIVITIES NOW SEARCHABLE ONLINE**

You can search online and find a classroom activity tailor-made to match the Earth science topic you're teaching. Just visit the Earth Science Week Classroom Activities page for more than 200 free learning activities, most contributed by the leading geoscience agencies and groups that are Earth Science Week partners.

Activities are organized and searchable by various criteria, including specific Earth science topics. To find the perfect activity for your lesson, just click on "Search Classroom Activities." Search by grade levels and Next Generation Science Standards. Maybe most useful, you also can search among 24 categories of Earth science topics, such as energy, environment, plate tectonics, and weathering.

Recently updated with activities focusing on the Earth Science Week 2021 theme of "Water Today and for the Future," this database-driven resource is ideal not only for supplementing a prepared curriculum, but also for generating activities that address in-the-news geoscience events. See Earth Science Week's [Classroom Activities](#).

#### **COOL ONLINE RESOURCE AVAILABLE FROM NASA**

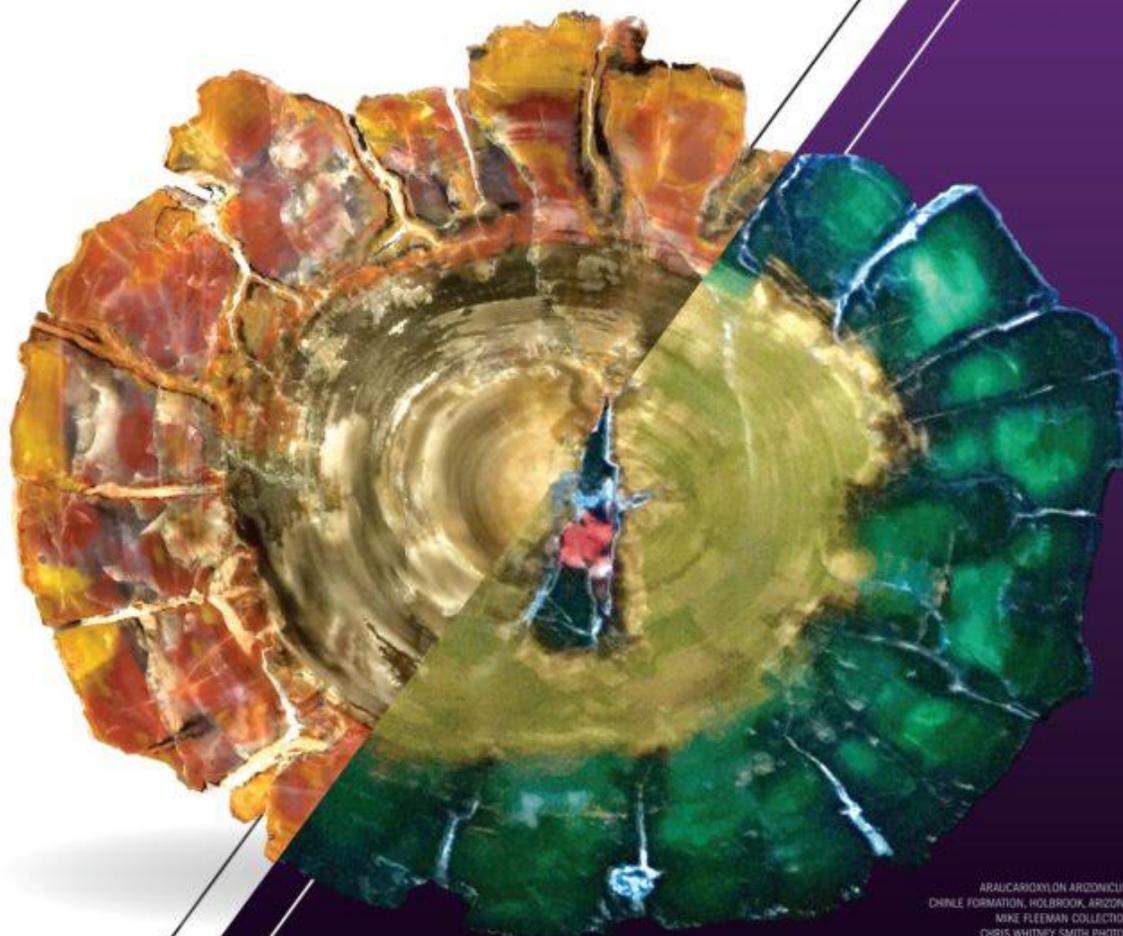
NASA has a new online science resource for teachers and students to help bring Earth, the solar system, and the universe into their schools and homes. Called NASA Wavelength, the site features hundreds of resources organized by topic and audience level from elementary to college, and out-of-school programs that span the extent of NASA science.

Educators at all levels can find educational resources through information on standards, subjects, keywords, and other details, such as learning time required to carry out a lesson or an activity, cost of materials and more.

Teachers can identify resources relevant to specific themes and current events, such as lessons dealing with NASA's Curiosity rover or using Earth science resources. Visit online for access to [NASA Wavelength](#). Learn more about education programs at [NASA STEM Engagement](#).

49<sup>TH</sup> ANNUAL

# FLAGG GEM and MINERAL SHOW



ARAUCARIDOLYON ARZONICUM  
CHINLE FORMATION, HOLBROOK, ARIZONA  
MIKE FLEEMAN COLLECTION  
CHRIS WHITNEY SMITH PHOTOS

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FREE ADMISSION & PARKING**

## FLUORESCENT MINERALS

**JANUARY 7<sup>TH</sup>/8<sup>TH</sup>/9<sup>TH</sup>, 2022**  
MESA COMMUNITY COLLEGE | 9am - 5pm  
NE CORNER OF US 60 & DOBSON ROAD

THE TAILGATE SHOW TRADITION CONTINUES!  
**WWW.FLAGGSHOW.INFO**

 DESERT GARDENS ROCK GEM & MINERAL SHOW 



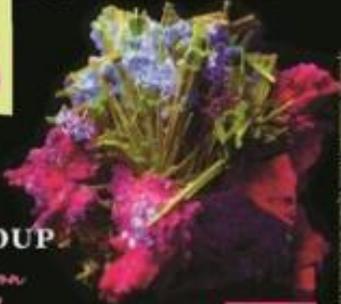
# DESERT GARDENS ANNUAL INTERNATIONAL ROCK, GEM AND MINERAL SHOW

January 1 – February 28  
9:00 am – 5:00 pm  
(Seven Days Weekly)

1055 Kuehn Street  
Quartzsite, AZ 85346

The Tucson Gem and Mineral Society Proudly Presents:

THE 67<sup>TH</sup> ANNUAL  
**Tucson Gem & Mineral Show<sup>®</sup>**  
February 10 - 13  
**The Show That Glows**  
2022  
featuring:  
**THE APATITE SUPERGROUP**  
and the *Fluorescent Mineral Pavilion*  
with over 80 Spectacular Displays by  
**The Fluorescent Mineral Society**



TUCSON CONVENTION CENTER  
For more information, visit: [www.tgms.org](http://www.tgms.org)

Scan QR code for  
more information on  
our Tucson Gem &  
Mineral Show!

Fluorescent Minerals & Gems Exhibit Area | Photo: Bruce Green

**ALL ARIZONA CLUB MEETINGS MAY BE CANCELED  
DUE TO HEALTH CONCERNS!**



**Apache Junction Rock & Gem Club**  
Meetings are on the 2<sup>nd</sup> Thursday  
Next Meeting: January 13, 2022, 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: January 4, 2022, 6:30 p.m.  
**Please go to their website for more info**  
[www.dmrmc.com](http://www.dmrmc.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: January 3, 2022, 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**  
January's meeting will be on the 2<sup>nd</sup> Thursday  
Thursday, January 13, 2022, 7:30 pm  
[www.msaaz.org](http://www.msaaz.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: January 19, 2022, 7:00 pm  
**On YouTube until further notice**  
[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: January 11, 2022, 6:30 pm  
[www.westvalleyrockandmineralclub.com](http://www.westvalleyrockandmineralclub.com)  
@ Buckeye Community Veterans Service  
Center  
402 E. Narramore Avenue, Buckeye, AZ



**White Mountain Gem & Mineral Club**  
Meetings are on the 1<sup>st</sup> Sunday  
(unless a Holiday then 2<sup>nd</sup> Sunday)  
Next Meeting: January 2, 2022, 1:00 pm  
[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)  
@ VFW Hall  
381 N. Central, Show Low



**Wickenburg Gem & Mineral Society**  
Meetings are on the 2<sup>nd</sup> Friday  
(February & December on the 1<sup>st</sup> Friday)  
Next Meeting: January 14, 2022, 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 2022, 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](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](http://www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438)
- Staples Foundation  
[www.staplesfoundation.org](http://www.staplesfoundation.org)
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
- Will & Carol McDonald
- Debbie Michalowski
- Janet Stoepplmann
- Dennis & Georgia Zeutenhorst

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**Earth Science Museum**

3215 W. Bethany Home Rd.  
Phoenix, AZ 85017

**Phone:**

602-973-4291

**Editor E-Mail:**

scote@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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**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).

**NOTICE:**

ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7<sup>th</sup> St, Phoenix, on Tuesday, TBA 2022, at 6:30 p.m.

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

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

Harvey Jong	President
Mardy Zimmermann	VP Outreach
Shirley Coté	Secretary/ Treasurer

Cindy Buckner, Doug Duffy, Ray Grant,  
Bob Holmes, Chris Whitney-Smith

**Earth Science Museum**

3215 W. Bethany Home Rd.  
Phoenix, AZ 85017

