



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

December 2022
Volume 11, Issue 12

ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

On December 8th Lynne & Terry Dyer taught three third grade classes for a total of 68 students and 5 teachers at Phoenix Central BASIS charter school.



A Few Notable Volcanic Eruptions of 2022

By Harvey Jong

2022 has been a relatively active year in terms of volcanic eruptions. So, in case you missed some of these explosive events, this article will provide a quick look at a few notable eruptions.

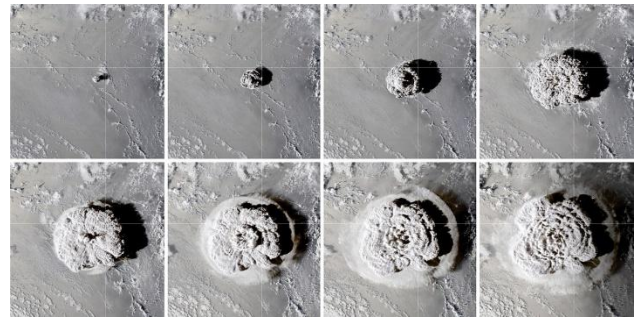
Hunga Tonga-Hunga Ha'apai

The year started out with a huge bang involving the underwater volcano in the South Pacific near Hunga Tonga-Hunga Ha'apai. On January 15, 2022, an explosive eruption blasted steam and ash to a record height of 58 kilometers (38 miles) reaching the mesosphere. The plume went two and a half times higher than any observed thunderstorm and was associated with about 400,000 lightning strikes (Gramling, 2022). Some lightning can be seen in the following dramatic eruption video captured by the Tonga Geological Services:

<https://www.youtube.com/watch?v=Y4NpOldV8To>

Aerial drone footage provided by the Tonga Geological Services

The eruption was also observed by the National Oceanic and Atmospheric Administration's GOES-17 satellite which produced this amazing sequence of still images of the rising ash plume:



NASA Earth Observatory images by Joshua Stevens - PD, via Wikimedia Commons

The island of Hunga Tonga-Hunga Ha'apai was formed in late December 2014 when a series of volcanic eruptions joined two separate islets into a single landmass.



Satellite Image of Hunga Tonga-Hunga Ha'apai

NASA/ESRI image - PD, via nationsonline.org

The powerful January eruption obliterated the uninhabited island.



Remnants of Hunga Tonga-Hunga Ha'apai After the January 2022 Eruption

ESA/Copernicus Sentinel-2 L2A image - CC_BY_SA-3.0, via Wikimedia Commons

The resulting tsunami destroyed many homes of the nearby islands of Tonga and crossed the Pacific reaching the coasts of Japan, North and South America. In addition, shock waves traveled and reverberated around the planet.

Fagradalsfjall

Fagradalsfjall is a volcanic system on Iceland's Reykjanes Peninsula. This field remained dormant for about 6000 years until March 19, 2021 with the appearance of a fissure vent in the Geldingadalur Valley. Lava was sporadically emitted until September 18, 2021.

On August 3, 2022, a new eruption similar to the 2021 eruption occurred in the Meradalir Valley. Lava spewed from a narrow fissure until August 21, 2022. The fissure, estimated to be 360 meters (1181 ft) in length, was located closed to Reykjavik (60 km/37.3 mi) and popular tourist sites. It attracted around 10,000 visitors on the first day of the eruption.



Meradalir Eruption on August 4, 2022

Drumstick21 photo - CC_BY_SA-4.0 International, via Wikimedia Commons



Meradalir Eruption, August 11, 2022

Berserkur photo - CC_BY_SA-4.0 international, via Wikimedia Commons

Mount Semeru

Mount Semeru is the highest volcano on the island of Java with an elevation of 3,676 meters (12,060 ft). It started erupting on December 4, 2022 which is the same day that last year's eruption began. Both events involved large pyroclastic flows triggered by monsoon rain that eroded and collapsed a lava dome.



Screencapture of Pyroclastic Flow from a Bystander Video of the 2021 Semeru Eruption
 Indonesian National Board of Disaster Mangement image - PD, via Wikimedia Commons



Satellite Image of 2022 Semeru Eruption Showing Pyroclastic Flows
 ESA photo, modified Copernicus Sentinel data (2022) - CC_BY_SA-3.0 IGO, via esa.int

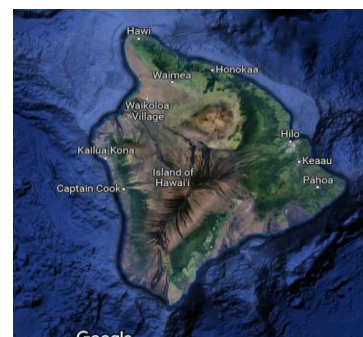
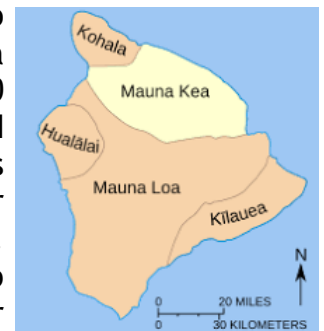


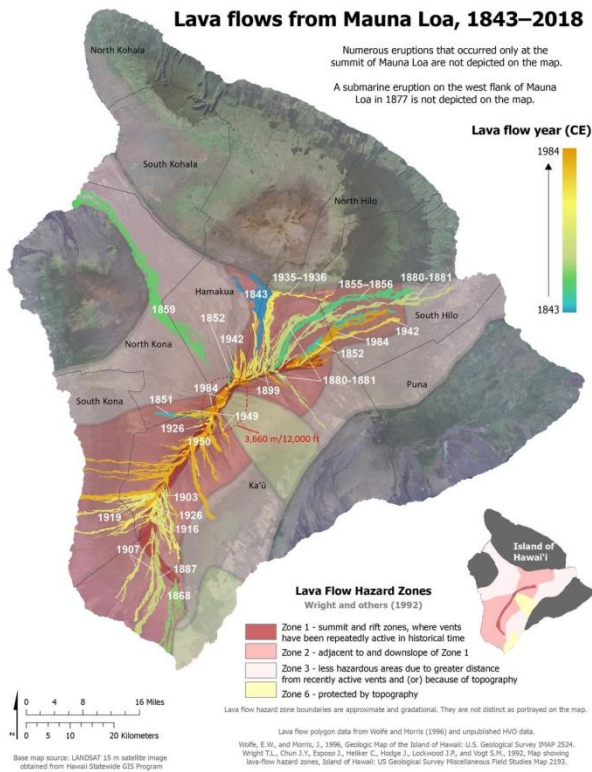
Aerial View of Damage Caused by the 2021 Semeru Eruption
 Indonesian National Board of Disaster Mangement image - PD, via Wikimedia Commons

As reported by the Smithsonian Institution’s Global Volcanism Program, the 2022 Semeru eruption produced an ash plume that rose about 700 m (2297 ft) above the summit. Four pyroclastic flows moved down the southeast flank as far as 19 km (11.8 mi) prompting a Level 4 alert (highest level on a scale of 1-4) and the evacuation of nearby villages.

Mauna Loa

Mauna Loa is the Earth’s largest active volcano and covers over half of the Island of Hawai’i. The volcano emerged above sea level about 300,000 years ago, and hundreds of eruptions have occurred over the past 4,000 years. The following map shows lava flows over the past 200 years which includes the last eruption that happened 38 years ago in 1984.





K. Mulliken map, Hawaiian Volcano Observatory - PD, via usgs.gov

A new brief, but spectacular eruption started on November 27, 2022 and ended on December 13, 2022. No injuries or major property damage occurred, but the eruption did threaten the Mauna Loa Observatory and Saddle Road.



Lava Flows of Mauna Loa's Northeast Rift Zone, Nov. 28, 2022
N. Deligne photo, USGS - PD, via Wikimedia Commons



Aerial View of Fissure 3 of Mauna Loa's Northeast Rift Zone, Nov. 29, 2022
M. Patrick photo, USGS - PD, via Wikimedia Commons



Satellite View of Fissure 3 Lava Flow, Dec. 2, 2022
NASA photo, Landsat 9 Operational Land Imager-2 - PD, via earthobservatory.nasa.gov



Aerial Drone View of the Mauna Loa Eruption from the Hawai'i Space Exploration Analog and Simulation (HI-SEAS) Habitat, Dec. 3, 2022

J. Lerma photo - PD, via earthobservatory.nasa.gov

The USGS' Hawaiian Volcano Observatory closely monitored the eruption and captured the following dramatic lava flow videos:

[Mauna Loa Fissure 3 Overflight](#), Dec. 7, 2022

M. Patrick video, USGS - PD, via usgs.gov

[Mauna Loa Fissure 3 Lava Channel](#), Dec. 7, 2022

M. Patrick video, USGS - PD, via usgs.gov

[Mauna Loa Fissure 3](#), Dec. 8, 2022

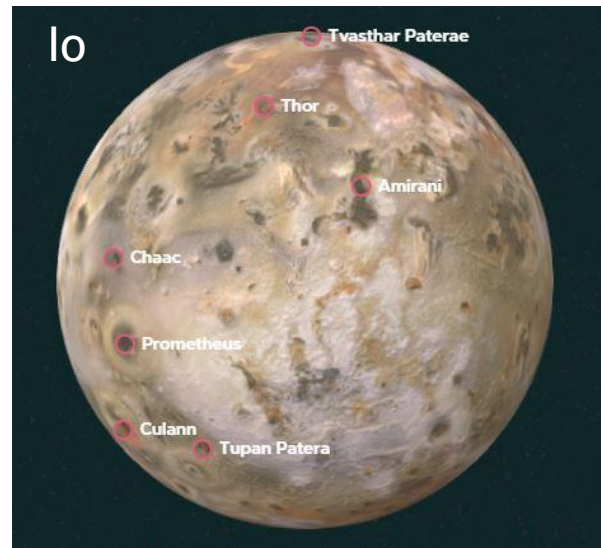
M. Patrick video, USGS - PD, via usgs.gov

References

Gramling, C. (2022) The Hunga Tonga volcano eruption touched space and spawned a lightning blitz. *Science News*: 12/13/22.

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Io, Jupiter's volcanically active, rocky moon



<https://solarsystem.nasa.gov/moons/jupiter-moons/io/in-depth/>

Jupiter's rocky moon Io is the most volcanically active world in the solar system, with hundreds of volcanoes, some erupting lava fountains dozens of miles high. Io's remarkable activity is the result of a tug-of-war between Jupiter's powerful gravity and smaller but precisely timed pulls from two neighboring moons that orbit farther from Jupiter - Europa and Ganymede.

A bit larger than Earth's Moon, Io is the third largest of Jupiter's moons, and the fifth one in distance from the planet.

Io was discovered on Jan. 8, 1610 by Galileo Galilei. The discovery, along with three other Jovian moons, was the first time a moon was discovered orbiting a planet other than Earth. The discovery of the four Galilean satellites eventually led to the understanding that planets in our solar system orbit the Sun, instead of our solar system revolving around Earth. Galileo apparently had observed Io on Jan. 7, 1610, but had been unable to differentiate between Io and Europa until the next night.

Galileo originally called Jupiter's moons the Medicean planets, after the powerful Italian Medici family and referred to the individual moons numerically as I, II, III, and IV. Galileo's naming system would be used for a couple of centuries.

It wouldn't be until the mid-1800s that the names of the Galilean moons, Io, Europa, Ganymede, and Callisto, would be officially adopted, and only after it became apparent that naming moons by number would be very confusing as new additional moons were being discovered.

Although Io always points the same side toward Jupiter in its orbit around the giant planet, the large moons Europa and Ganymede perturb Io's orbit into an irregularly elliptical one. Thus, in its widely varying distances from Jupiter, Io is subjected to tremendous tidal forces.

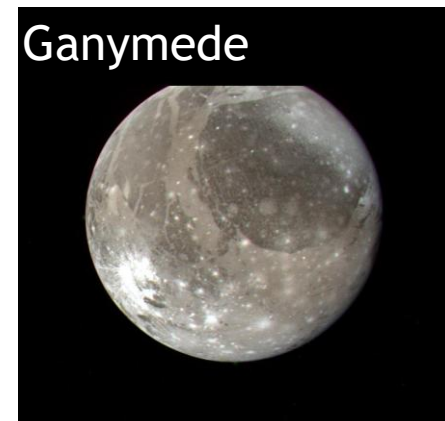
These forces cause Io's surface to bulge up and down (or in and out) by as much as 330 feet. Compare these tides on Io's solid surface to the tides on Earth's oceans. On Earth, in the place where tides are highest, the difference between low and high tides is only 60 feet (18 meters), and this is for water, not solid ground.

Io's orbit, keeping it at more or less a cozy 262,000 miles from Jupiter, cuts across the planet's powerful magnetic lines of force, thus turning Io into an electric generator. Io can develop 400,000 volts across itself and create an electric current of 3 million amperes. This current takes the path of least resistance along Jupiter's magnetic field lines to the planet's surface, creating lightning in Jupiter's upper atmosphere.

Callisto's surface is extremely heavily cratered and ancient—a visible record of events from the early history of the solar system. However, the very few small craters on Callisto indicate a small degree of current surface activity.



Europa's surface is mostly water ice, and there is evidence that it may be covering an ocean of water or slushy ice beneath. Europa is thought to have twice as much water as Earth does. This moon intrigues astrobiologists because of its potential for having a "habitable zone." Life forms have been found thriving near subterranean volcanoes on Earth and in other extreme locations that may be analogues to what may exist on Europa.



Ganymede is the largest moon in the solar system (larger than the planet Mercury), and is the only moon known to have its own internally generated magnetic field.





AZ Mining, Mineral & Natural Resources Education Museum Update December 2022

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

Catie Carter Sandoval
cscarter@email.arizona.edu
703.577.6449

Help support the museum at:

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

Merry Christmas and Happy New Year from the AMMNRE Museum! We are gearing up for a busy and exciting 2023. In the coming year we will start working with a design-build company to begin renovations on our 100 year old building at 1502 W. Washington Street. We have been communicating with Representative Gail Griffin (LD-14) to further develop the vision for our museum and we look forward to continuing that relationship in the New Year. In the meantime, we plan to showcase an exhibit at the Tucson Gem and Mineral Show at the Tucson Convention Center in February. This year's theme is "SILICA! Agates and Opals and Quartz, Oh My!" and our exhibit will include museum specimens of SiO₂ specifically from Arizona. This will include smoky quartz crystals, fire agate, petrified wood, and more. We are also making plans with educators for various school and community outreach events, some of which will include egg carton minerals for elementary-aged kids.

Thank you for all your support over the past year. Enjoy some holiday and winter-themed photos of mineral specimens from our collection. Happy Holidays!

Tin of "Christmas cookies"
from the Banquet of Rocks!
Specimens include chert,
quartz, granite, and
sandstone concretion.



"Bisbee Ice" calcite from the Southwest Mine, Bisbee, Cochise Co., AZ



Coal from the Black Mesa Coal Mine, Black Mesa, Navajo Co., AZ





Arizona Rocks 115

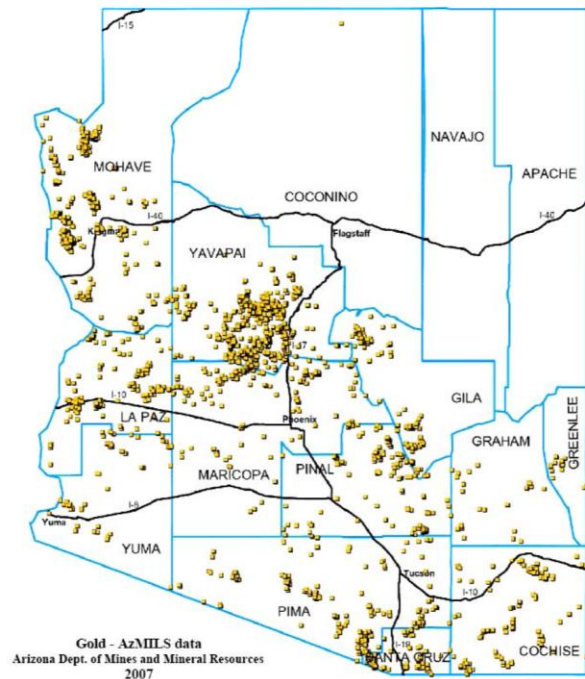
Text and photos by Ray Grant

There are two types of gold deposits lode and placer. Lode gold is gold that is found where it was deposited, and placer gold has been weathered out of the rock and often transported to streams. The old saying is “gold is where you find it”. Is there gold in Arizona? This month we will look at lode gold in Arizona and next month placer gold.

Gold production in Arizona is over 16 million ounces and most of this gold is from lode deposits. Much of the gold mined in Arizona is not visible; it is recovered as a byproduct of copper mining. But some spectacular gold specimens have been found. Good information about lode gold localities is in Bulletin 137, Arizona Lode Gold Mines and Gold Mining, available on the Arizona Geological Survey website.

In the Phoenix area, there are three historical mining districts that produced gold. The Cave Creek district had limited production. The Winfield District in the Phoenix Mountains also had a small production. The Salt River District in the South Mountains with the Max Delta Mine produced about 7,000 ounces of gold between 1913 and 1942.

More recently, gold was found north of the Blackstone Country Club at the north of Surprise. The Fischer Watt Gold Company started a mine (Mystic Mine). Production began in 1991 and only lasted a year (about a hundred high-grade specimens were recovered). No need to rush out as the mine has been reclaimed and is under one of the holes of a golf course. But if you are out in the hills look for quartz veins; there is still gold to find.



Map of AZ Gold Mines from AZ Geological Survey



Gold, Mystic Mine,
Maricopa County,
Arizona, Jeff Scovil
photograph



Gold, Sunshine
Mine, Yavapai
County, Arizona,
Jeff Scovil
photograph



Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society meeting

January 18, 2023

www.pinalgeologymuseum.org

Ray Grant 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.

The Museum will be closed Saturday, New Year's Eve

In Pinal County we're getting ready for some great things in the next few months.

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.

January 18th we'll have David Tews of Tucson talking about trail side geology in southern Arizona, and on February 15th Mike Henry will be talking on Mining Operations.

On Saturday, March 11, our annual show returns. Vendor information can be gotten from Richard Sichling, or email info@pinalgeologymuseum.org. Richard will be representing us at the Flagg show in Mesa.

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

You can find our calendar at pinalgeologymuseum.org

50TH ANNUAL **FLAGG GEM & MINERAL SHOW**



GOLD - QUARTZSITE, LA PAZ COUNTY, ARIZONA
U OF A MINERAL MUSEUM COLLECTION
PHOTO CREDIT: JEFF SOOVL
2.2CM HIGH

JAN 6 to 8
2023



MESA COMMUNITY COLLEGE
NE CORNER OF US 60 AND
DOBSON ROAD | 9AM - 5PM



The Tailgate Show
Tradition Continues!

FREE Parking
FREE Admission
FREE Samples for Kids
www.Flaggshow.info



2023
65th ANNUAL
GILA COUNTY
GEM & MINERAL SHOW

JANUARY 13th, 14th & 15th 2023
FRI & SAT. 9 AM - 5 PM & SUN 10 AM - 4 PM

DEALERS * DISPLAYS
DEMONSTRATORS * ACTIVITIES

LOTS OF CHILDREN'S ACTIVITIES ** DEMONSTRATORS AND VENDORS
LAPIDARY EQUIPMENT/TOOLS **40+ SPECIMEN DISPLAYS
HOURLY DOOR PRIZES ** AND MUCH, MUCH MORE!!

OPENING CEREMONY PRESENTATION OF COLORS PROVIDED BY THE GLOBE JRPTC

SNACK BAR PROVIDED BY THE GLOBE/MIAMI ELKS LODGE # 489

WITH HANDS ON LEARNING

PRESENTATION FOR ALL AGES

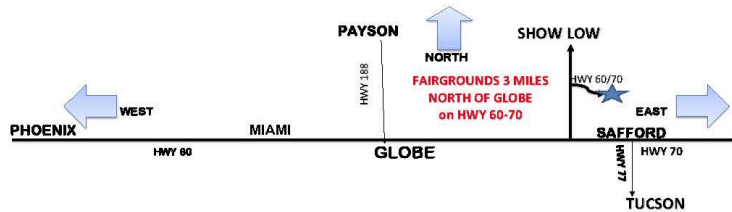
JOHN O'BRIEN - WHAT IS A FOSSIL @ 1PM FRIDAY, SATURDAY & SUNDAY

DEMONSTRATION FOR ALL AGES

GILA COUNTY COLLEGE - LAPIDARY - ALL DAY FRI, SAT & SUN
WIRE WRAPPING JEWELRY WITH POLYMER CLAY- CINDY KOONTZ - ALL DAY FRI, SAT & SUN
WIRE WRAPPING ART - HALEY WILLIAMS - ALL DAY FRI, SAT & SUN
NATHAN SCHOLTEND - STONE CARVING WITH JADE - ALL DAY SATURDAY

JOIN US @ GILA COUNTY FAIRGROUNDS
GLOBE, ARIZONA
3 MILES NORTHEAST OF JUNCTION U.S. 60-70

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OR
\$5 COUPLE
STUDENTS AND KIDS FREE

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President
(623) 810-9780

JERRY KASTNER
Vendor Chair
(520) 401-6715



PRESS RELEASE

A DAY AT THE ALFIE: ALFIE NORVILLE GEM AND MINERAL MUSEUM
LAUNCHES EVENT DURING TUCSON GEM SHOW SEASON

A Day at the Alfie

Saturday February 4th 9:30am-10pm

Spend the day listening to expert guest speaker presentations, networking with industry professionals, and enjoying the newest exhibit installations in our galleries!

Food and beverage will be included at each portion of the day.

Purchase tickets for each separate event or an all-day pass!

9:30am-2:45pm Brunch Presentations

10am Wim Vertriest, Gemological Institute of America
Mozambique Field Exposition
Mozambican Rubies: News from the Field

11am Bruce Bridges, Bridges Tavorite
The Discovery and Faceting
of The Lion of Merelani Tavorite

12pm David Smith, Faceters Paradise
The United States Faceters Guild

1pm Les Presmyk, Chairman, Flagg Mineral Foundation
Underground Collecting:
Adventures in Arizona and Mexico

2pm Aaron Palke, Gemological Institute of America
Sapphires from Montana:
Gemology, Geology, and History

3-6:45pm Afternoon Presentations

3pm Jeff Morrison, Havey Quarry
Mining the Havey Tourmaline Quarry

4pm Robert Weldon, Gemological Institute
of America
Peter Rainier and the Chivor Mine
Colombian Emeralds in 1920s

5pm Jesse Fisher
Fluorite from the Weardale Region,
Northern England

6pm Justin Prim, Faceting Apprentice
Early History of American Gem Cutting &
Early History of Mixed Drinks

QR Code to book tickets
or Search "A Day at the
Alfie" on Eventbrite for
Tickets





SHOW HOURS

Thursday, February 9 - 10:00 am to 6:00 pm

Friday, February 10 - 10:00 am to 6:00 pm

Saturday, February 11 - 10:00 am to 6:00 pm

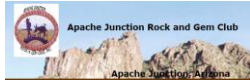
Sunday, February 12- - 10:00 am to 4:00 pm

Tickets are \$12.00 with a \$1.00 TCC ticket tax

Children 14 and under are free with a paying adult

OPEN TO THE PUBLIC!! COME JOIN THE FUN!!

At the Tucson Convention Center - 260 S. Church Avenue



Apache Junction Rock & Gem Club

Meetings are on the 2nd Thursday
 Next Meeting: January 12, 2023, 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: January 3, 2023, 6:30 p.m.
Please go to their website for more info
www.dmrnc.com
 @ Anthem Civic Building
 3701 W. Anthem Way, Anthem, AZ



Maricopa Lapidary Society, Inc

Meetings are on the 1st Monday
 (unless a Holiday then 2nd Monday)
 Next Meeting: **January 2, 2023**, 7:00 pm
www.maricopalapidarysociety.com
 @ North Mountain Visitor Center
 12950 N. 7th St., Phoenix



Mineralogical Society of Arizona

Meetings are on the 3rd Thursday
 (Except December)
 Next Meeting: January 19, 2023, 5:00 pm
Please go to their website for more information
www.msaaaz.org
 @ Franciscan Renewal Center
 Room: Padre Serra
 5802 E. Lincoln Dr., Scottsdale



Pinal Geology & Mineral Society

Meetings are on the 3rd Wednesday
 Next Meeting: January 18, 2023, 7:00 pm
In person meeting
www.pinalgeologymuseum.org
 @ Artisan Village
 351 N. Arizona Blvd., Coolidge



West Valley Rock & Mineral Club

Meetings are on the 2nd Tuesday
 Next Meeting: January 10, 2023, 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: January 5, 2023, 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: January 13, 2023, 7:00 pm
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. 7th 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! 😊😊😊

----- 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
- West Valley Rock and Mineral Club
<http://www.westvalleyrockandmineralclub.com/>
- Staples Foundation
www.staplesfoundation.org
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
- Will & Carol McDonald
- Debbie Michalowski
- Janet Stoeppelmann
- Dennis & Georgia Zeutenhorst

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Phone:
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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.

We're on the Web!

Visit us at:

www.earthsciencemuseum.org

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

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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