



EARTHQUAKE

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

Earth Science Museum, 3215 W. Bethany Home Rd., Phoenix, AZ 85017
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October 2023
Volume 12, Issue 10

ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

Lynne and Terry Dyer began their fall outreach by teaching 11 boys and 4 adults at a church in Mesa on Sept. 20th and then on October 2nd, they taught 68 cub scouts and their parents and leaders at a church in Phoenix.

Geology Day at North Mountain Visitor Center

By Harvey Jong and Shirley Coté

Several ESM members participated in the Save Our Mountains Foundation's *Geology Day at the North Mountain Visitor Center* held on Saturday, October 14, 2023. Here are some of the activities that our members were involved with.



Bob Holmes displayed meteorites and meteor "wrongs" and answered attendee's questions about them.



Pallasite from Sericho, Kenya

Bob Holmes collection

Photo by S. Coté

Pallasites are a class of stony-iron meteorite. They are relatively rare, and can be distinguished by the presence of large olivine crystal inclusions in the ferro-nickel matrix.



Murnpeowie meteorite, an iron meteorite with regmaglypts resembling thumbprints.

Photo by James St. John - CC BY 2.0 via Wikipedia

This spectacular, 2,520 pound iron meteorite was found in the South Australian Outback in 1909. The mass has a well-preserved, dark-colored outer surface with nice regmaglypts.

Quiz

What are regmaglypts? Keep reading.

Iron meteorites exposed at Earth's surface oxidize & rust relatively quickly. Given the fresh nature of Murnpeowie, it's been estimated that it fell to Earth within five years of it being found.



Shirley Coté displayed her Rock Cycle posters and specimens and talked with guests about them.



Doug Duffy demonstrated chain making and answered questions from visitors.

Volcanic Activities

The Geology Day celebration included two volcanic activities - the ESM's Volcanic Rocks & Mineral Display and a special presentation by Harvey Jong on *Volcanoes in the News, in History, and in Arizona*. The event

represented the first public showing of the volcanic display since the pandemic.



Main Table Area of the ESM Volcanic Rocks & Minerals Display

These tables featured three themes:

1. "It All Starts with Magma"
This theme included a poster and rock samples of the four "flavors" of magma - basalt, andesite, dacite, and rhyolite.
2. "Where on Earth Are Volcanoes Found?"
A poster showing tectonic plate boundaries and mantle hotspots along with a case of specimens representing a volcano on each continent were featured for this theme.
3. "Big Bangs in History"
Historic volcanic eruptions were compared in a poster that provided information on the size and explosivity of several famous eruptions. This was accompanied by an assortment of samples highlighting the different textures and forms of lava.



Side Table of the ESM Volcanic Rocks & Minerals Display

This table included the “Four Ways to Spew” poster which described the major types of above ground volcanoes, a volcano model that is on loan from the UA AMMNRE Museum, a pumice boulder from the Mount Mazama area in Oregon, and a box of free volcanic samples.

Geology Day marked the “world premiere” of several specimens that have been added to the collection.

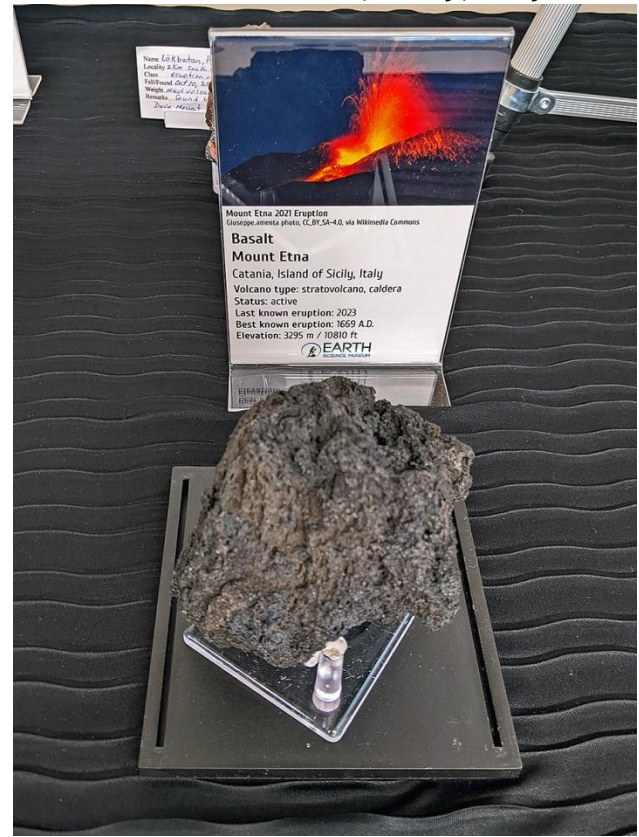
Reticulite, Hilo area, Hawai’i



Dimensions: 3x3 cm

The “Heart of Reticulite” debuted as a part of the case which featured specimens from a volcano on each continent. See the [February 2023 newsletter](#) for the story behind this unique volcanic sample.

Basalt from Mount Etna, Sicily, Italy



Dimensions: 9.5x8.5x8.5 cm

Mount Etna is Europe’s most active volcano. The composite volcano has one of the world’s longest historical records of volcanic activity, dating back to 1500 BCE. The most recent eruptive period started in 2022 and continues to the present day.

Although the volcano is located on the continental crust, its volcanic materials do not have the usual indicators associated with magmas produced by subduction. Instead, the basalts have isotope ratios of helium and carbon that are similar to basalts found at mid-ocean ridges. This has led to some interesting theories on how Mount Etna might have formed. One possible scenario suggests that as the African plate descends under the Eurasian plate it produces slab “rollback” where low-pressure regions suck molten material from the asthenosphere (Gvitzman and Nur, 1999).

Dacite from Mount Pinatubo, Central Luzon, Philippines



Dimensions: 13x10.5x5.0 cm

This relatively large sample was originally a souvenir candle holder, but now it has been repurposed to provide a hands-on way of recalling the second-largest volcanic eruption of the 20th century. Mount Pinatubo erupted in 1991 sending an ash cloud up to 40 km (25 mi) into the air. Huge pyroclastic flows covered the Central Luzon region where some areas were buried with deposits as much as 200 m (600 ft) deep. Overall, the eruption ejected about 10 km³ (2.4 mi³) of material and has been rated a 6 on the Volcanic Explosivity Index (VEI). (Note VEI is a relative logarithmic scale of 0-8 that is used to compare volcanic eruptions and is similar to the Richter scale for earthquakes.)

In addition to the display's regular samples, Bob Holmes presented a special guest specimen of a mud volcano breccia from Azerbaijan.



Mud Volcano Breccia

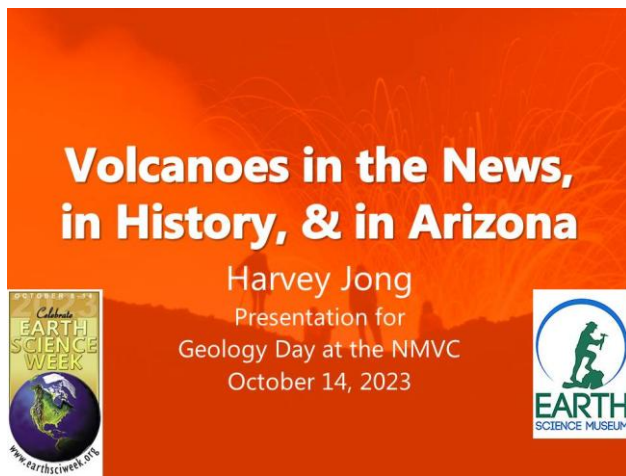
Lökbatan, Azerbaijan

Size: specimen is on a 2 in. peg stand

Azerbaijan hosts about a third of the world's mud volcanoes. These mud volcanoes (also known as sedimentary volcanoes) formed about 25 million years ago due to hydrocarbon seepage. They provide indicators of the location of potential natural gas and oil deposits. While no magma is involved, eruptions may be associated with gas flames that shoot several hundred meters high and mud flows that deposit tons of gooey material.



Mud Volcano in Gobustan, Azerbaijan
Zigtywidty photo, - CC_BY_SA-4.0
International, via Wikimedia Commons



Title Slide of the Volcanoes Presentation
A special presentation on volcanoes was created for the Geology Day celebration. Several weeks of research were involved in compiling a set of compelling images, videos, and facts about recent and historic eruptions. A fun trivia quiz about volcanoes

in the movies was also prepared to engage visitors.

Overall, eight visitors attended the presentation, while 15 bags of volcanic samples were given away.



Nelson Duarte (left) and Don Richardson (far right), Maricopa Lapidary Society members, demonstrated cabochon making and faceting and answered questions from visitors about lapidary arts.



During Geology Day, the Maricopa Lapidary Society celebrated its 75th Anniversary with cake and drinks. Society members Greg Roe, Bob Holm, Sue Bartz, Ford Doran and Loretta Meador conducted several silent auctions and members Rebecca Noel and Michael Ford demonstrated wire wrapping for visitors.

References

Gvirtzman, Z. and A. Nur (1999) The formation of Mount Etna as the consequence of slab rollback. *Nature* 401: 782-785.

◇ ◇ ◇

The Return and Quick-look Analysis of the OSIRIS-REx Sample of Asteroid Benu

By Harvey Jong

This article follows up on an earlier report on the OSIRIS-REx mission to collect a sample from the near-Earth asteroid Benu. (See [June 2022 Newsletter](#).) Previously, we described the incredible technical feat that spacecraft performed in October 2020. It touched down on Benu's surface using an articulated arm called the TAGSAM (Touch And Go Sampling Acquisition Mechanism). The regolith was stirred up by a burst of nitrogen gas, and material was collected in a cylindrical sample container.



Sample Collection Event on Benu's Surface, October 20, 2020

NASA/Goddard/University of Arizona image, - PD, via nasa.gov

On May 2021, OSIRIS-REx departed Benu for the long 1.2 billion mile journey back to Earth. When the spacecraft was 63,000 miles from Earth, the sample capsule was released. Traveling at 27,650 mph, the capsule entered the atmosphere and landed on September 24, 2023 in the Department of Defense's Utah Test and Training Range west of Salt Lake City.



Sample Capsule Enters the Atmosphere

Screen shot from NASA Scientific Visualization Studios animation, NASA Goddard Space Flight Center/Conceptual Image Lab, - PD, via gsfc.nasa.gov



Sample Capsule Descending to the Ground

NASA/Keegan Barber photo, - PD, via nasa.gov/flickr.com



Sample Capsule Shortly After Touching Down

NASA/Keegan Barber photo, - PD, via nasa.gov/flickr.com



Sample Capsule Flown to a Cleanroom Hanger

NASA/Keegan Barber photo, - PD, via [nasa.gov/flickr.com](https://www.nasa.gov/flickr.com)



Safe, Secure, & Ready for the Flight to Houston

NASA/Keegan Barber photo, - PD, via [nasa.gov/flickr.com](https://www.nasa.gov/flickr.com)

The capsule housed a science canister with the asteroid sample. The canister was carefully removed and securely stored in this flight container.



All Aboard for the Flight to Houston

NASA/Keegan Barber photo, - PD, via [nasa.gov/flickr.com](https://www.nasa.gov/flickr.com)

The recovery and curation teams accompanied the science canister on the flight to the Johnson Space Center in Houston.

The Johnson Space Center is the home of NASA's Astromaterials Research and Exploration Science (ARES) Division. It curates the world's largest collection of extraterrestrial materials which includes samples from:

- Apollo lunar missions
- Antarctic meteorites
- Cosmic dust
- Genesis solar wind mission
- Hayabusa/Hayabusa2 asteroid missions
- Stardust comet mission

And now ARES will handle the OSIRIS-REx sample using a special ISO Class 5 cleanroom to preserve the pristine condition of the material. (Note: This cleanroom classification specifies that the concentration of airborne particles must be less than 3,250 particles $\geq 0.5 \mu\text{m}$ per cubic meter. The extreme level of cleanliness is typically used in manufacturing semiconductors and biopharmaceuticals.)



The New OSIRIS-REx Sample Cleanroom

NASA/James Blair photo, - PD, via [nasa.gov](https://www.nasa.gov)
Work on the sample is performed in a specialized glovebox where an active flow of nitrogen is used to keep the material from being exposed to Earth's atmosphere.

Customized tools and handling procedures have been designed to ensure safe collection of the sample.



Removing the Science Canister Lid

NASA/Robert Markowitz photo, - PD, via nasa.gov

NASA curation team members along with Lockheed Martin engineers carefully remove the lid of the science canister. They were pleasantly surprised to find a large amount of dark particles inside the lid and on the base of the TAGSAM head.



“Bonus” Material on the TAGSAM Head

NASA/Erika Blumenfeld & Joseph Aebersold photo, - PD, via nasa.gov

This view outside of the sample collector shows the “bonus” material which is near the middle right of the image. The bulk of the sample, which is estimated to be around 250 g, is still inside.



Stereoscopic Close-up Images of the “Bonus” Material

Original images: NASA / Erika Blumenfeld & Joseph Aebersold photo, - PD, via nasa.gov

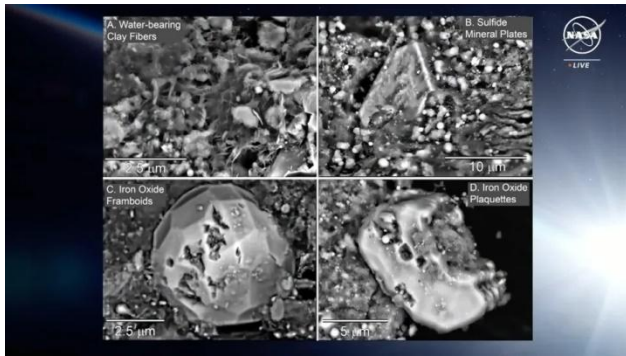
Stereoscopic images: processed by Brian May & Claudia Manzoni, - PD, via nasa.gov

The largest fragments in the image pair are about 1 cm across. The two overlapping fragments near the center of the photo are noteworthy for their contrast between darker and lighter colors. This variation was observed on the surface of Bennu and seems to extend down to a small scale.

Live Sample Reveal Broadcast

A small portion of the bonus material was examined for a “quick-look” analysis. A scanning electron microscope (SEM), infrared measurements, and X-ray diffraction (XRD) were used to gain a preliminary understanding of the sample’s composition and structure. Some initial findings were presented on October 11, 2023 at NASA’s Sample Reveal broadcast.

The sample reveal event included the following group of SEM images which shows some of the different types of minerals that have been identified so far.



Scanning Electron Microscope Images of Different Benu Minerals

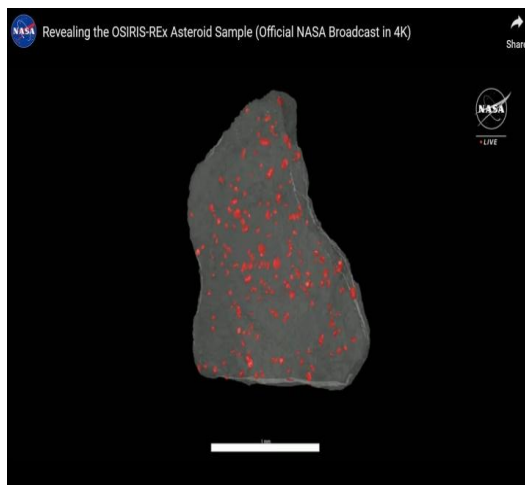
Screen shot of NASA Sample Reveal Conference, live broadcast on October 11, 2023, - PD, via nasa.gov

Hydrated Minerals

One noteworthy finding involves the presence of water in the form of hydrated minerals. Serpentine, a fibrous hydrated clay mineral, appears in the upper left photo. It indicates that water played a role in the formation of Benu and raises an interesting hypothesis that asteroids like Benu may have been involved in introducing water during the Earth's formation. In fact, serpentine has been proposed as one of the six "must-have" materials for life's emergence (Russell and Ponce, 2020).

Sulfide Minerals

The SEM micrograph in the upper right shows a sulfide mineral with platy hexagonal crystals. Sulfides were also detected by the X-ray computed tomography used in producing a 3D computer model of one of the particles.



3D Computer Model of a Sample Particle

Screen shot of NASA Sample Reveal Conference, live broadcast on October 11, 2023, - PD, via nasa.gov

This image presents a 3D model cross section. The red dots and patches correspond to sulfide minerals.

Sulfur is considered a critical element not only for planetary evolution but also for its role in shaping the 3D structure of proteins through disulfide bonds.

Iron Oxide

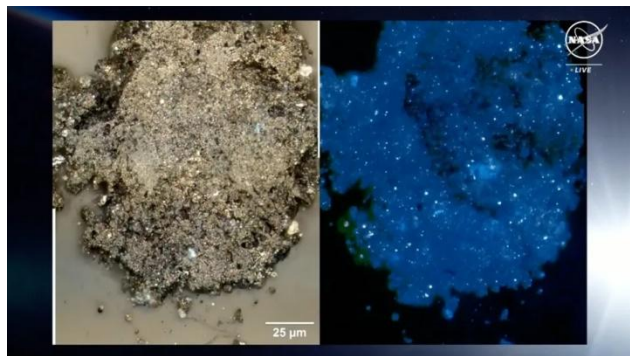
The lower two SEM images depict different forms of the iron oxide mineral, magnetite. Magnetite may be an important factor in the origin of life since it can serve as a catalyst for organic reactions.

Carbon

Benu is a carbonaceous or "C-type" asteroid, so carbon was expected in the sample. The amount of carbon was measured at 4.7% by weight which represents one of the highest carbon concentrations detected in an extraterrestrial sample. Some of this carbon appears to be bound as unspecified carbonate minerals.

Organic Compounds

Much of the carbon appears as blob-like organic globules. The organic compounds fluoresced under ultraviolet light, but their exact composition couldn't be determined with the non-destructive scans used in the quick-look analysis. This finding, however, suggests the possibility that asteroids might have "seeded" the basic building blocks of life on Earth and other planets.



Screen shot of NASA Sample Reveal Conference, live broadcast on October 11, 2023, - PD, via [nasa.gov](https://www.nasa.gov)

This tiny globule was examined under white and ultraviolet (UV) light. The bright specks in the UV image indicate the presence of organic compounds.

Sample Mass Milestone and Future Work

The retrieval and analysis of the OSIRIS-REx sample is just beginning. On October 20, 2023, NASA announced that its curation team has successfully removed and collected 70.3 g (2.48 oz) of rocks and dust. This amount includes the bonus material found outside the TAGSAM head and a portion of the bulk sample inside the canister. It represents a sample mass milestone that exceeds NASA's goal of bringing back at least 60 g of asteroid material to Earth.

Extracting the bulk sample has been hampered by two of the TAGSAM head's 35 fasteners. These fasteners could not be removed with the tools approved for use in the OSIRIS-REx glovebox. So, the team had to hold down the head's mylar flap and use tweezers or scoops to carefully remove material inside the canister. Additional material still remains in the head, and the team is developing some new extraction procedures.

Over the next two years, the curation team will characterize and catalog the sample. NASA plans to preserve at least 70% of the material for further research, including future generations of scientists. More than 200 investigators from the U.S.; NASA

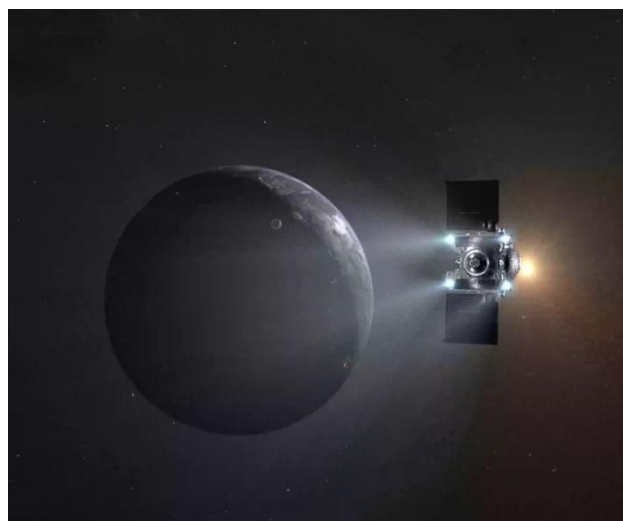
partners Japan Aerospace Exploration Agency (JAXA) and Canadian Space Agency (CSA); and other countries are scheduled to receive specimens for in-depth study. Additional samples will also be loaned to the Smithsonian Institution, Space Center Houston, and the University of Arizona for public display.

References

Russell, M.J. and A. Ponce (2020) Six 'must-have' materials for life's emergence: olivine, pyrrhotite, bridgmanite, serpentine, fougérite, and mackinawite. *Life* 10(11): 291.



After making the special delivery of the sample capsule, OSIRIS-REx fired its engines to start its new mission to asteroid Apophis. The spacecraft has been renamed OSIRIS-APEX, short for OSIRIS-APophis EXplorer. It will enter orbit around Apophis shortly after the asteroid's close approach to Earth on April 13, 2029. The probe will conduct an 18-month study which includes detailed mapping and firing its thrusters to stir up loose surface material.



OSIRIS-REx Starts Its New Mission

Screen shot from NASA Scientific Visualization Studios animation, NASA Goddard Space Flight Center/Conceptual Image Lab, - PD, via [gsfc.nasa.gov](https://www.gsfc.nasa.gov)



AZ Mining, Mineral & Natural Resources Education Museum Update October 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>

In last month's ESM newsletter we mentioned that we were finalizing a guest exhibit at the Sun City Rockhounds Museum. The display is now complete and open for viewing at their location in the Sun Dial Recreation Center. "Rocks and Minerals of Arizona and the Southwest: a selection of collector's pieces, mining ores, industrial minerals and lapidary art" is showcased at the entrance of the museum and includes over 30 rock and mineral specimens on loan from our museum. Highlights include a large chrysocolla specimen from the Tyrone Mine in New Mexico, which is a new acquisition for the museum, a beautiful green fluorite specimen from the Homestake Mine, spheres and carved material fashioned at the Arizona Mining and Mineral Museum's lapidary shop, and several other historic, beautiful specimens. We've enjoyed working with the Sun City Rockhounds Club and meeting several of their members. The museum is located in the Sun Dial Recreation Center at 14801 N. 103rd Ave., Sun City. From October through April, it is open to the public from 10am-1pm on Mondays, Tuesdays, Wednesdays, Fridays and Saturdays. As always, thank you all for your continued support!



Entrance to the Sun City Rockhounds Mineral Museum in Sun City, AZ. Our exhibit is showcased at the entrance of the museum.



Chrysocolla from the Tyrone Mine, Tyrone, Grant Co., New Mexico. This is a new acquisition from donor Dennis Bartlett.

Carved turquoise leaf from the Sleeping Beauty Mine, Gila Co. AZ.



Fluorite from the Homestake Mine, Oatman, Mohave Co., AZ.



Arizona Rocks 125

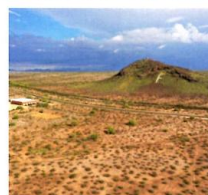
Text by Ray Grant

Looking for an interesting short hike near Phoenix? Poston Butte, also called F Mountain because of the large F built on the side by Florence High School students, is in Florence and has a one-mile round trip hike to the top of the Butte. An overview of the geology and history of the Butte has been made by Florence Copper, the Pinal County Historical Museum and the Pinal Geology and Mineral Museum. You can pick up a copy at either Museum.

The Butte is made up of two major rock units. The lower part of the Butte is composed of granite that is Precambrian, 1.4 billion years old. The upper unit is basalt that is 6 million years old. The basalt erupted some miles away and flowed over the granite. That is a large time gap between the two rock units, all the intermediate age rocks were eroded away before the basalt flows.

You can also hike around the Butte and on the west side are some copper prospects with chrysocolla. This was the discovery site for the Florence Copper Mine that is across the highway from the Butte.

Charles Poston was active in Arizona in mining projects and then Arizona politics. He is called the "Father of Arizona" because he was instrumental in the creation of the Arizona Territory from the New Mexico Territory. In travels to Asia he became interested in Zoroastrianism and wanted to build a Temple to the Sun on the Butte. He did not do it, but after his death, Arizona Governor Hunt had a pyramid built on the Butte and Poston is buried there.



Florence Copper

On the west side of Poston Butte ("the Butte"), there are small prospect pits with copper minerals. This is where geologists got the idea to look for a possible economic copper deposit.

In 1969, extensive drilling in the area located a large copper deposit south of the Butte. Due to the unique features of the orebody, this copper deposit could not be recovered using traditional mining methods.

Now, Florence Copper recovers the mineral using advanced technology called in-situ copper recovery (ISCR) that has an extremely small environmental footprint. A solution (similar in pH to common household vinegar) is pumped under low pressure to dissolve the copper within the copper oxide zone. Copper-rich solution is then pumped to the surface through recovery wells for processing into LME grade "A" pure copper cathode sheets using an electro-chemical process that separates the copper from the solution. The solution is recycled into the deposit, and the process repeats. Florence Copper already has recovered over 1 million pounds of copper using this innovative and proven process.



Florence Copper wellfield

Overview of Poston Butte available at the Pinal County Historical Museum and the Pinal Geology and Mineral Museum



Rocks found at Poston Butte



Pyramid on Poston Butte where Charles Poston is buried



Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society next meeting

November 15, 2023

Meetings are the third Wednesday at 7pm, doors open at 6:30.

www.pinalgeologymuseum.org

Ray Grant ray@pinalgeologymuseum.org

Through next May, we will have our hours of 10 to 4 Wednesday through Saturday, admission is free.

Pinal Geology and Mineral Society and Museum schedule of events

November 15 - Meeting "Geology and History in the Casa Grande Valley" by Bob Hole

December 20 - Meeting Pot-Luck Geology Cookie PARTY! Fun, activities, cookies, and more

January 13 - GIANT BOOK GIVEAWAY, 10-4 at the museum. Check it out! Geology related books on all sorts of topics. Bring Your Own Bag.

January 17 - Meeting - Paul Marsh, Arizona State Mine Inspector

March 2, 2024 - PGMS Annual Mineral Show in Coolidge

New exhibit of Arizona type minerals



SUN CITY ROCKHOUND MINERAL MUSEUM
SUNDIAL RECREATION CENTER
14801 N. 103RD AVE.
SUN CITY, AZ 85351
scrockmuseum@gmail.com
623-428-6442

The Sun City Rockhound Mineral Museum has a fluorescent room with over 130 specimens on display. The room utilizes both short and long-wave ultra violet (UV) lighting. This spectacular exhibit of rocks and minerals takes on vibrant colors in the dark under the UV lights. This colorful collection is the highlight for many museum visitors and is one of the largest public collections in the southwest. (The preceding from SCRMM brochure)



C. Sandoval photo

WINTER HOURS
OCTOBER – APRIL
MON., TUES., WED., FRI., SAT.
10 AM TO 1 PM
CLOSED THURS., & SUNDAY



Doug and Shirley's view at the beginning of the fluorescent display. . .



Continuing down the short hall. . .



And continuing. . .



View as we continue to the right. . .



As we take a right turn, we still are not at the end!

Doug and Shirley highly recommend seeing this fabulous display!

Arizona Rock and Gem Shows

Lake Havasu Gem & Mineral Society
53rd Annual Lake Havasu Gem & Mineral Show
November 11-12, 2023
Sat. 9-5, Sun. 9-4
 Adults \$2
 Children 12 and under free
 Aquatic Center
 100 Park Avenue
 Lake Havasu, AZ

Flagg Mineral Foundation
51st Annual
Flagg Gem and Mineral Show
January 5-7, 2024
Fri., Sat., Sun. 9-5
 Free Admission and parking
 Mesa Community College
 1833 W. Southern Ave.
 Corner of Dobson Rd. and US60
 Mesa, AZ

Wickenburg Gem & Mineral Society
Wickenburg Gem & Mineral Show
November 25 & 26, 2023
Sat. 9-5, Sun. 10-4
 Free Admission
 Hassayampa Elem. School
 251 S. Tegner
 Wickenburg, AZ

Gila County Gem and Mineral Society
Gila County Gem & Mineral Show
January 12-14, 2024
Fri. & Sat. 9-5, Sun. 10-4
 \$3 Adults, Students and Kids Free
 Gila County Fairgrounds
 3 miles northeast of Jct. US 60-70
 Globe, AZ

Wickenburg Gem and Mineral Show
Nov 25 & 26, 2023

Free Admission
gemclub.info

Jewelry
Fossils
Minerals




Over 40 Vendors **Best Rock Contest** **Raffle**
Door Prizes **Kid's Area** **Silent Auction**

Hassayampa Elementary School
 251 South Tegner Street Wickenburg, AZ
 9am - 5pm Saturday • 10am - 4pm Sunday

66th Annual **GILA COUNTY**
2024
GEM & MINERAL SHOW

JANUARY 12TH, 13TH, & 14TH 2024
FRI & SAT. 9 AM - 5 PM & SUN 10 AM - 4 PM

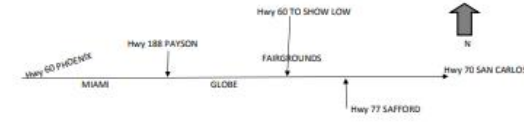


DEALERS * DISPLAYS
DEMONSTRATORS * ACTIVITIES

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

OPENING CEREMONY PROVIDED BY THE GLOBE JROTC
 SNACK BAR PROVIDED BY THE PINAL MOUNTAIN ELKS LODGE # 489
 COME AND CHECK OUT OUR EXCITING ACTIVITY ROOM WITH HANDS ON LEARNING
 WIRE WRAPPING, LAPIDARY, SILVER SMITHING AND STONE CARVING WITH JADE
 Special guest: Fossil Presentation for all ages @ 1:00pm all three days by John O'Brien

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



DONATION
 \$3.00 ADULTS
 AND
 STUDENTS AND KIDS FREE

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 VENDOR CHAIRMAN
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51ST ANNUAL FLAGG GEM & MINERAL SHOW



PYRITE 6TH LEVEL, 79 MINE, ARIZONA
JOHN CALLEMAN COLLECTION
PHOTO CREDIT: JEFF SCOVIL
4CM HIGH



SPHALERITE ON GALENA
FLIX MINE, SANTA CRUZ COUNTY, ARIZONA
LES AND PAULA PRESMYH COLLECTION
PHOTO CREDIT: JEFF SCOVIL
2.8CM HIGH



GALENA AND QUARTZ
IBRE CAP MINE, GRAHAM CO., ARIZONA
MARK HAY COLLECTION
PHOTO CREDIT: JEFF SCOVIL
8.4CM WIDE

JAN 5 to 7 2024

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

www.Flaggshow.info

FREE Parking
FREE Admission
FREE Samples for Kids

The Tradition Continues!



FLAGG
MINERAL
FOUNDATION



Apache Junction Rock & Gem Club

Meetings are on the 2nd Thursday
 Next Meeting: November 9, 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: November 7, 2023, 6:30 p.m.
Please go to their website for more info
www.dmrmc.com
 @ Anthem Civic Building
 3701 W. Anthem Way, Anthem, AZ



Maricopa Lapidary Society, Inc

Note: Change of meeting day
 Meetings are on the 3rd Tuesday
 Next Meeting: November 21, 2023, 7:00 pm
www.maricopalapidarysociety.com
 @ North Mountain Visitor Center
 12950 N. 7th St., Phoenix, AZ



Mineralogical Society of Arizona

Meetings are on the 3rd Thursday
 (Except December & June)
 Next Meeting: November 16, 2023,
 7:30 pm
 Franciscan Renewal Center, (Piper Hall),
 8502 E. Lincoln Drive, Scottsdale, AZ
**Please go to their website for more
 information**
www.msaz.org



Pinal Geology & Mineral Society

Meetings are on the 3rd Wednesday
 Next Meeting: November 15, 2023, 7:00 pm
In person meeting
www.pinalgeologymuseum.org
 351 N. Arizona Blvd., Coolidge



West Valley Rock & Mineral Club

Meetings are on the 2nd Tuesday
 Next Meeting: November 14, 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: November 2, 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: November 10, 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.

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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.

We're on the Web!

Visit us at:

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THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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