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 2023
Volume 12, Issue 12

ESM OUTREACH UPDATE

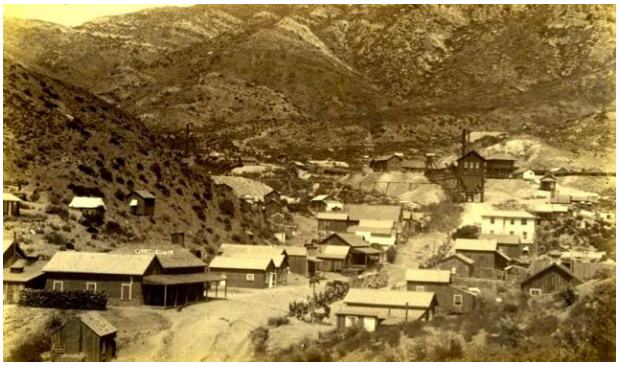
Mardy Zimmermann, Outreach Coordinator

December Outreach

There are no ESM outreach activities to report this month.

Silver King Mine

Please join Dr. Ray Grant for his presentation on the Silver King Mine at 10:00 a.m. on Friday, January 12, 2024, at the Viney Jones Library, 778 N.Main St., Florence, AZ.



Town of Silver King in 1880s, Arizona Geological Survey edited photograph

Wagons hauling ore from Silver King Mine to Pinal for smelting, AZ Geol. Survey photo

Ore wagon tracks just south of route 60

Ray Grant photo

Libyan Desert Glass

By Harvey Jong

Last month we explored trinitite, the glassy material produced by the first atomic bomb test. Continuing with a theme involving unusual occurrences of vitreous substances, this article focuses on Libyan Desert glass. The glass is found around eastern Libya and western Egypt and is believed to be an impactite (a metamorphic rock formed or modified by a meteorite impact). The origin of the material, however, remains a mystery.

Geologic Setting

Libyan Desert glass occurs within the Great Sand Sea which is one of the world's largest dune fields covering 72,000 square km (27,799 square mi). The Great Sand Sea is named for its landscape of megadunes that resembles ocean waves. The megadunes may reach heights of 100 m (328 ft) and lengths of 100 km (62 mi).

View from Space of the Great Sand Sea
ISS/NASA photo taken on May 11, 2012, - PD, via earthobservatory.nasa.gov
A distinguishing dimension of megadunes involves a wavelength (distance between each successive dune crest) that is greater than 1 km (0.62 mi). This image shows megadunes spaced at 1.5-2.5 km (0.92-1.55 mi) intervals.

The dunes are actually made up of a series of parallel ridges of Nubia Sandstone covered by a thin veneer of brownish to yellowish sand that resulted from the breakdown of the underlying sandstone (Ouda et al., 2012). The sand veneer has a nominal thickness of 3-5 cm (1.36-2.27 in), but it can sometimes reach up to 10-15 cm (4.54-6.81 in). The movement of vehicles is not hindered by the sand. In some areas, the ridges are intruded by old (Pleistocene) river systems.

Ground Level View of a Dune
Roland Unger photo, - CC_BY_SA-3.0, via Wikimedia Commons
Egyptian Sand Sea, Western Desert, Egypt
A pair of trucks traveling through the Great Sand Sea indicates the enormous size of the dunes.

The Nubia Sandstone was deposited between the Lower Paleozoic and Upper Cretaceous. It is composed of coarse-to-medium, rounded quartz grains cemented with microquartz. The sandstone includes a significant amount (3.5-10 wt%) of kaolinite group clay minerals, such as dickite and halloysite, but fossiliferous content is absent. Since Libyan Desert glass is near 100% silica, the Nubia Sandstone is unlikely to be the source of the glass.

Discovery of Libyan Desert Glass

Wind-eroded fragments of Libyan Desert glass were discovered in December 1932 during the Egyptian Desert Surveys. Various shapes and sizes of the glassy material was found lying on the silt-covered surface of the Nubia sandstone and scattered over an area

at least 80 by 25 km (49.7 by 15.5 mi) (Clayton, 1934). Some human-worked flakes of the silica glass were collected, and these artifacts were later dated to the late Neolithic or pre-dynastic period. It was also noted that clear material makes an effective gemstone when cut and polished.

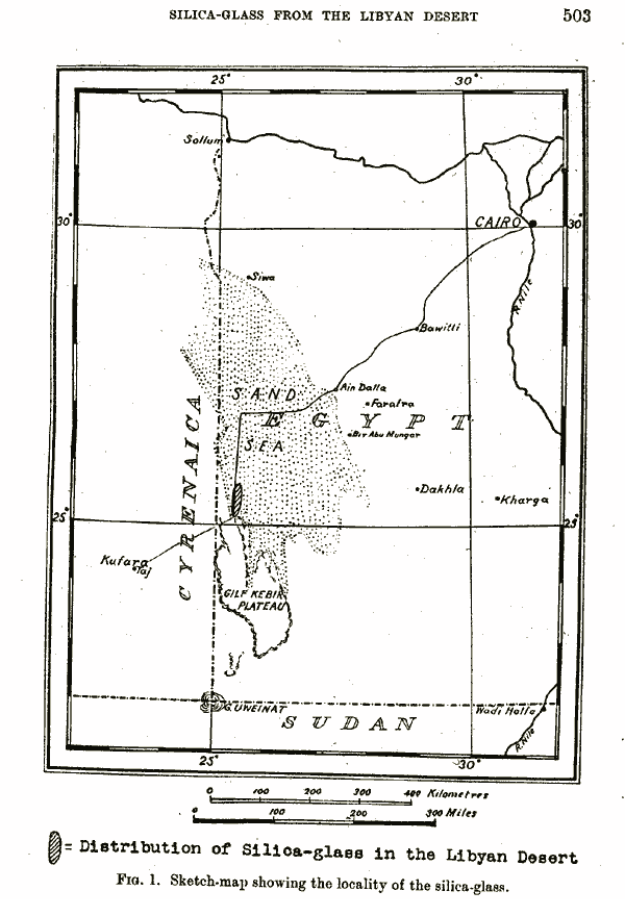


FIG. 1. Sketch-map showing the locality of the silica-glass.

Map of the Great Sand Sea Indicating the Location of the Libyan Desert Glass Field
From Clayton (1934), - PD, via Wikimedia Commons

A 1981 expedition estimated that the overall mass of glass at the time exceeds 1.4×10^9 g (1,543 tons), but the original mass may have been 10,000 times greater (Weeks et al., 1984). The material has been dispersed by natural erosional process as well as by human activities.

Libyan Desert Glass Field
Roland Unger photo, - CC_BY_SA-3.0, via Wikimedia Commons
Egyptian Sand Sea, Western Desert, Egypt

Composition and Properties

Libyan Desert glass has a relatively pure, homogeneous composition of 98 wt% silica (SiO_2). Colors vary from colorless, light-yellow, brown-green, or gray. Small specimens may be perfectly transparent, while others may be milky and opaque. Cloudy samples may involve tiny, closely spaced bubbles arranged in parallel arrays. Sometimes opaque dark bands may be associated with the bubble arrays. A microprobe analysis of these bands indicates a high concentration of iron. Minor inclusions of lechatelierite, cristobalite, zircon, baddeleyite, rutile, staurolite, tourmaline, cordierite, and kyanite may be present in the glassy material.

The index of refraction varies from 1.4600 to 1.4650, while the density ranges from 2.20 to 2.207 g/cm^3 (Weeks et al., 1984). (Note that pure fused silica glass has a refractive of index of 1.4585 and a density of 2.203 g/cm^3.)

Fission-track analysis has been used to determine the time since the fusion of Libyan Desert glass, and a range of ages has been reported that varies from 21.5 to 33.8 x 10^6 years. The mean around 28.5 x 10^6 years seems to be accepted as the best age value (Weeks et al., 1984).

Formation Theories

Since the discovery of Libyan Desert glass over 90 years ago, several theories have been proposed on how the large mass of glassy material was formed. Potential formation processes include lightning strike, meteorite impact, hydrothermal sol-gel, and welding of lunar volcanic glass particles. The exact scenario, however, remains controversial due to extreme assumptions or inconclusive evidence.

A lot of research has focused on the impact theory. It is supported by mineralogical evidence, such as the presence of lechatelierite, a high-temperature melt-product of quartz and baddeleyite, a high-temperature breakdown product of zircon. In addition, a recent nanostructural study identified inclusions of orthorhombic zirconia (ZrO_2), a rare high pressure polymorph, along with amorphous berlinite ($AlPO_4$), an ultrahigh temperature phosphate (Kovaleva et al., 2023).

Two competing impact-related hypotheses have been proposed:

1. Melting by low-altitude airburst
2. Melting by ground impact

Airburst Hypothesis

The airburst scenario reflects the growing interest in aerial bursts as an important class of geohazard events. Recent examples, such as the 2013 Chelyabinsk meteor and the 1908 Tunguska event, show that airbursts may involve a tremendous amount of energy (0.5 and 5 megatons, respectively). This hypothesis suggests that radiative melting occurred when a fireball of a vaporized object came into contact with the Libyan Desert – a situation analogous to the atomic thermal alteration of trinitite. One simulated finding indicates that an asteroid airburst with a kinetic energy of 108 Mt could result in the temperature and wind conditions needed for creating the Libyan Desert glass (Boslough and Crawford, 2007). Evidence of such massive energy events, however, doesn't seem to appear in the geologic record, while aerodynamically-shaped microtektites have not been found in the Libyan Desert glass.

Ground Impact Hypothesis

This theory maintains that a large meteorite impacting the Libyan Desert produced the high temperatures and pressures needed to form the glassy material. Some specific indicators of these conditions include:

- The occurrence of lechatelierite along with α- and ß-cristobalite indicates heating the original source rock to a temperature of at least 1550 °C.
- The breakdown of zircon to form baddeleyite involves temperatures above 1676 °C.
- The melting of zirconium oxide implies a temperature over 2750 °C, while the presence of orthorhombic ZrO_2 indicates a pressure greater than 13.5 GPa.

While the minerals establish a possible glass-forming environment, no evidence of an impact crater of a sufficient size has been found near the glass site. The crater, however, may be covered by sand or underwent extensive erosion. Another inconsistency involves the evidence that the glass cooled from its fusion temperature at a slower rate than the rate associated with the short duration of a meteorite impact.

Noteworthy Examples

We'll conclude with a quick look at some Libya Desert glass specimens.

Assortment of Libyan Desert Glass
Roland Unger photo, - CC_BY_SA-3.0, via Wikimedia Commons
Silica Glass Area, Great Sand Sea, Western Desert, Egypt
This collection of glass samples demonstrates the variety of colors, shapes, and sizes along with the contrast against the desert sand.

Libyan Desert Glass Samples
Roland Unger photo, - CC_BY_SA-3.0, via Wikimedia Commons
Silica Glass Area, Great Sand Sea, Western Desert, Egypt
This close-up shows the range in opacity from translucent to milky opaque.

Libyan Desert Glass
H. Raab photo, - CC_BY_SA-3.0, via Wikimedia Commons
Libyan-Egyptian border, Great Sand Sea
Dimensions: 55 mm wide
Weight: 22 grams
This translucent specimen exhibits a polished wind-blown texture.

Libyan Desert Glass
James St. John photo, - CC_BY_SA-2.0, via Wikimedia Commons
The sculpted appearance of this sample is due to sand abrasion of conchoidal fractures.

Libyan Desert Glass
Geolina163 photo, - CC_BY_SA-4.0 International, via Wikimedia Commons
Oasis Al Koufra, Gifl Kebir, Egypt
Technical Mineralogy Collection of TU Bergakademie Freiberg, Germany specimen
This sample features sharp conchoidal fractures that weren't subject to sand abrasion.

Libyan Desert Glass with Devitrification Spherulites
James St. John photo, - CC_BY_SA-2.0, via Wikimedia Commons
Egypt
Dimensions: 3.4 cm across
Devitrification or partial crystallization may occur in some glass samples depending upon the rate of cooling and presence of impurities. The resulting white spherulites may be a few millimeters in diameter and contain cristobalite along with aluminum, iron, or magnesium.

Libyan Desert Glass
Daderot photo, - CC0_1.0_UPD, via Wikimedia Commons
Egypt, UA Mineral Museum specimen
Dimensions: 4.5 x 4.1 x 3.3 cm
Weight: 59.18 g

Largest Known Libyan Desert Glass Sample
Eunostos photo, - CC_BY_SA-4.0 International, via Wikimedia Commons

Muséum national d'histoire naturelle, Paris, France specimen
Weight: 26 kg (57.3 lb)
This specimen is the largest known sample of Libyan Desert glass. It exhibits a flow band structure which has been interpreted as evidence of a downslope flow of a silica melt after a large aerial burst (Wasson, 2003).

Tutanhkamun Pendant
Jon Bodsworth photo, from Egypt Archive, - Copyright free, via Wikimedia Commons
From tomb of Tutankhamun, Valley of the Kings, West Thebes, Egypt
Egyptian Museum of Cairo artifact JE 61884
This elaborate winged scarab pendant was discovered among the treasures in King Tutankhamun's (ca. 1332-1323 BC) tomb. It features a canary-yellow piece of Libyan Desert glass as its central element.

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Wasson, J.T. (2003) Large aerial bursts: an important class of terrestrial accretionary events, *Astrobiology* 3(1): 163-179.

Weeks, R.A., J.R. Underwood, Jr., and R. Giegengack (1984) Libyan Desert glass: a review, *Journal of Non-Crystalline Solids* 67: 593-619.

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AZ Mining, Mineral & Natural Resources Education Museum Update December 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

Hi everyone,

I'm out of town for the holidays and will be back after the first of the year.

Please join me at the Flagg Gem and Mineral Show January 5-7, 2024.

Catie

Space Science Calendars for 2024

It's the start of a new year, and if you're looking for a calendar here are a couple downloadable versions that feature some spectacular images from the Hubble and James Webb Space Telescopes:

NASA graphic, - PD, via science.nasa.gov
This calendar celebrates the first anniversary of the James Webb Space Telescope and the NASA scientists, engineers, and technicians who continue to push the envelope of space exploration.

Click for the calendar download page

ESA/Hubble, ESA/Webb graphic, CC_BY_SA-4.0 International, via esawebb.org
The European Space Agency's calendar features the latest telescope images released in 2023.

Click for the calendar download page

Arizona Rocks 127

Text by Ray Grant
Photos by S. Coté

I am not sure who reads this column, so most of you may know what I am writing about this month. But I wanted to encourage you to go to the Flagg Gem and Mineral Show that is at Mesa Community College on January 5, 6, and 7 from 9 to 5. There will be over 135 dealers set up, a tent of exhibits, club booths, and more. Except for the Tucson shows, the Flagg Show is the biggest show in Arizona. There is free parking and free admission.

You don't need to buy anything just go and look. I always encouraged my students to go to mineral shows. You can just look and learn a lot. You will start to be able to identify different minerals and fossils because you have seen so many of them. You find out about new localities. My brain is overfilled after a few hours at a show. They are a real learning experience.

Want to be more involved? The Flagg Mineral Foundation who sponsors the shows always needs volunteers. The Foundation holds its annual meeting on Thursday night, information below.

Flagg Foundation annual meeting will be held at Mesa Community College, Physical Science Building (first building due north of the show area), Thursday, January 4, 2024, at 7pm.

Pre-show sale following the annual meeting will premiere portions of the A.L. Flagg thumbnail collection, specimens from the Richard Flagg and Bob Weaver collections. Only members in good standing (meaning those who have paid their dues for 2024) will be allowed to attend. Steve Kaminski will be available for 30 minutes prior to the start of the general meeting to accept dues. Payment can also be made by check or by Zelle to the Flagg Mineral Foundation.

Flagg Mineral Foundation sales tables at the Flagg Gem and Mineral Show

Free samples and kids activities

Educational exhibit from the 2020 Flagg Show

Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society next meeting

January 17, 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

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, the Arizona State Mine Inspector will be the speaker. The title of his talk will be "Arizona Mining and the role of the State Mine Inspector"**

March 2, 2024 – PGMS Annual Mineral Show in Coolidge

Geology and Mineral Book Bonanza!

A geological treasure trove! We're giving away an extensive collection of Geology and Mineral books that will leave you awestruck. Dive into a world of coffee table masterpieces, stunning fossil and minerals, how-to guides, government geological publications, textbooks, historical accounts, and a plethora of earth science wonders. **Bring your own bag.**

Mark your calendar:

Date: Saturday, January 13, 2024

Time: 10:00 AM - 4:00 PM

Location: Pinal Geology and Mineral Museum,

351 North Arizona Blvd., Coolidge, Arizona

Visit our website at pinalgeologymuseum.org for more details.

It's all free, though donations while you grab your favorite books would be welcome. No pressure!

Don't miss this golden opportunity to add to your library and explore the museum. Admission to the museum, the kids' fossil dig, Cullen's Rock and Mineral Dig for Kids, and field trips/tours are always free of charge. Join us for a great day of discovery!

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

C. Sandoval photo

WINTER HOURS
OCTOBER – APRIL
10 AM TO 1 PM
CLOSED THURS., & SUNDAY
SUMMER HOURS
MAY-SEPTEMBER 10AM-1PM
SATURDAYS ONLY

Sun City Mineral Museum update

Dave Balzer, Carol Bankert-George and with permission George Polman

The museum has recently added a new specimen of wickenburgite to the fluorescent room. Wickenburgite was discovered at the Potter-Cramer Mine outside of Wickenburg.

In 1967, Dr. Sidney A. Williams, a Phelps Dodge research geologist, was collecting information on the geology of the Potter-Cramer mine. Dr. Williams collected several specimens. One of the specimens collected contained a new mineral species. The new mineral was called wickenburgite and was approved by the International Mineralogical Association in 1968. Since the Potter-Cramer Mine was now the Type Locality for wickenburgite, samples were sent to the Smithsonian Institution for their vast collection.

Wickenburgite is a rare lead aluminum calcium silicate hydroxide. The molecular weight is composed of lead (41%), oxygen (33%), silicon (18%) with small amounts of calcium and aluminum.

Wickenburgite is usually white, colorless or in rare instances pink. It is well crystallized to granular with hexagonal crystals. Wickenburgite is the most abundant mineral present in a particular suite of oxide minerals found at the mine.

Several minerals have been found to fluoresce at the Potter-Cramer Mine. These minerals, in the order of observed abundance, include wickenburgite, fluorite, willemite, opal, quartz, cerussite and calcite. Wickenburgite fluoresces best under shortwave ultraviolet light, with a response ranging from Bazooka bubble gum pink to deep crimson red.

Wickenburgite from the Potter-Cramer Mine

The Sun City Mineral Museum is open to the public for free. The museum has a collection of over 1000 specimens in our main rooms and over 100 in our fluorescent room. Be sure and check out the new mineral, wickenburgite, in the fluorescent room.

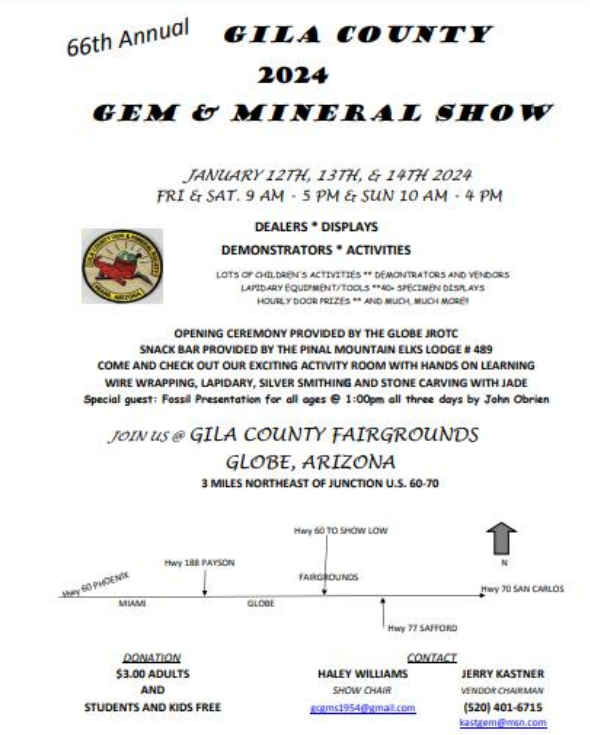
(Much of this article was quoted from an article written by George Polman, owner of Polman Minerals. The specimen in the museum was purchased from him. His article was used with permission.) His article can be found here: Polman, G.V. (2021) Potter-Cramer Mine, Maricopa County, Arizona, Rocks and Minerals 96(1): 24-37.

We hope to see you soon!
Find us on: Facebook: Sun City Rockhounds

Arizona Rock and Gem Shows

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

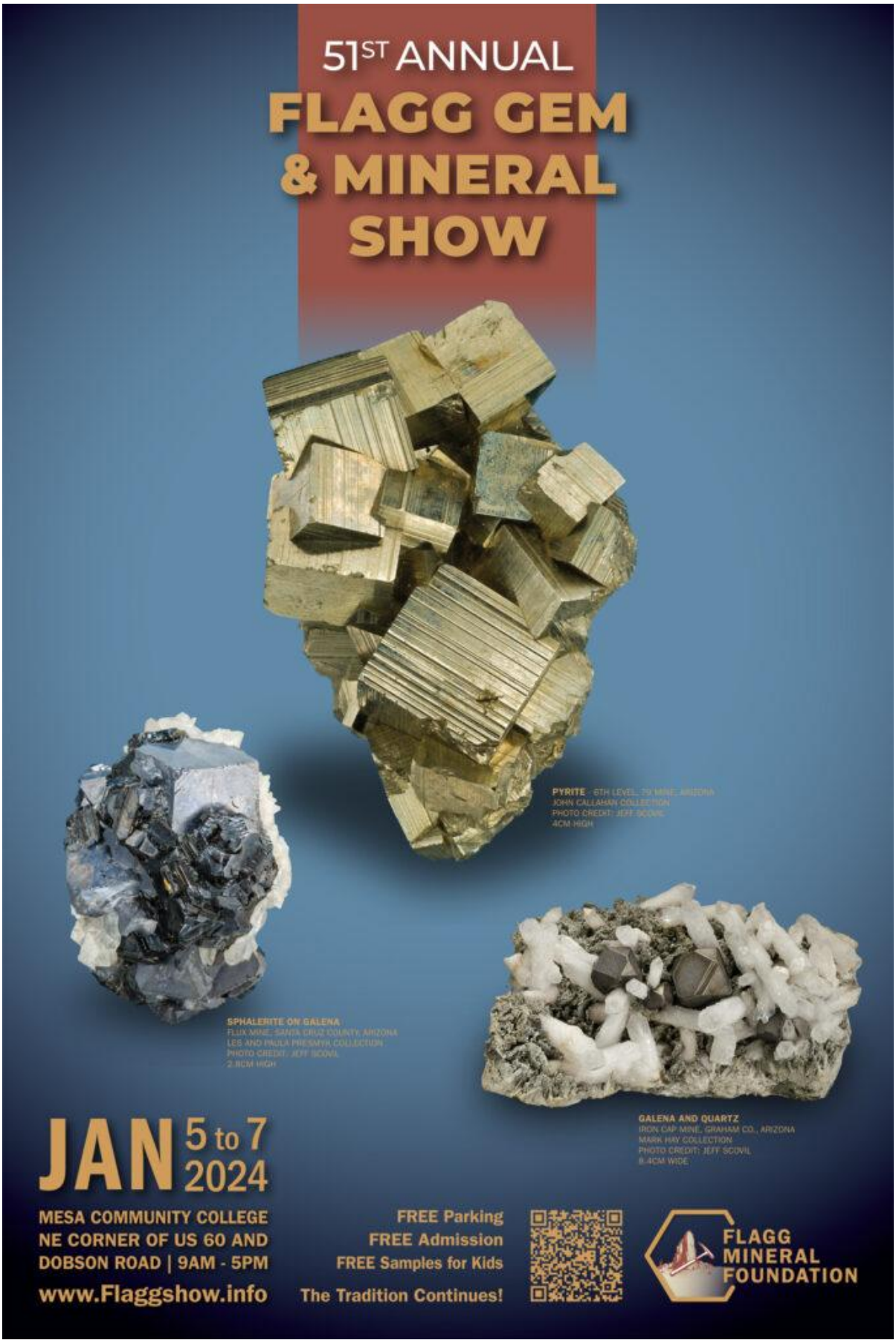
Gila County Gem and Mineral Society
Gila County Gem & Mineral Show
January 12-14, 2024
Fri. & Sat. 9-5, Sun. 10-4
$3 Adults, Students and Kids Free
Gila County Fairgrounds
3 miles northeast of Jct. US 60-70
Globe, AZ



Tucson Gem and Mineral Society
proudly presents the 69th
Tucson Gem and Mineral Show®
February 8-11, 2024
Thurs., Fri., Sat. 10 - 6
Sun. - 10 - 4
Tickets $12.00 with a $1.00 TCC ticket tax
Children 14 and under are free
with a paying adult
Tucson Convention Center
260 S. Church Avenue

Mingus Gem & Mineral Club
Annual show
February 23-25, 2024
Fri. 9-5, Sat. 9-5, Sun. 9-4
Free Admission
Clark Memorial Clubhouse Auditorium
19 N. Ninth Street
Clarkdale, AZ

Daisy Mountain Rock and Mineral Club
Daisy Mountain Rock and Mineral Show
March 2-3, 2024
Sat. 9-5, Sun. 10-4
Adults, $5,
Seniors, Vets, students $4
Children under 12 free with adult
Anthem School
41020 N. Freedom Way
Anthem, AZ


51ST ANNUAL
FLAGG GEM & MINERAL SHOW
PYRITE - 6TH LEVEL, 79 MINE, ARIZONA
JOHN CALLAHAN COLLECTION
PHOTO CREDIT: JEFF SCOVIL
4CM HIGH
SPHALERITE ON GALENA
FLUX MINE, SANTA CRUZ COUNTY, ARIZONA
LES AND PAULA PRESMYK COLLECTION
PHOTO CREDIT: JEFF SCOVIL
2.8CM HIGH
GALENA AND QUARTZ
IRON CAP MINE, GRAHAM CO., ARIZONA
MARK HAY COLLECTION
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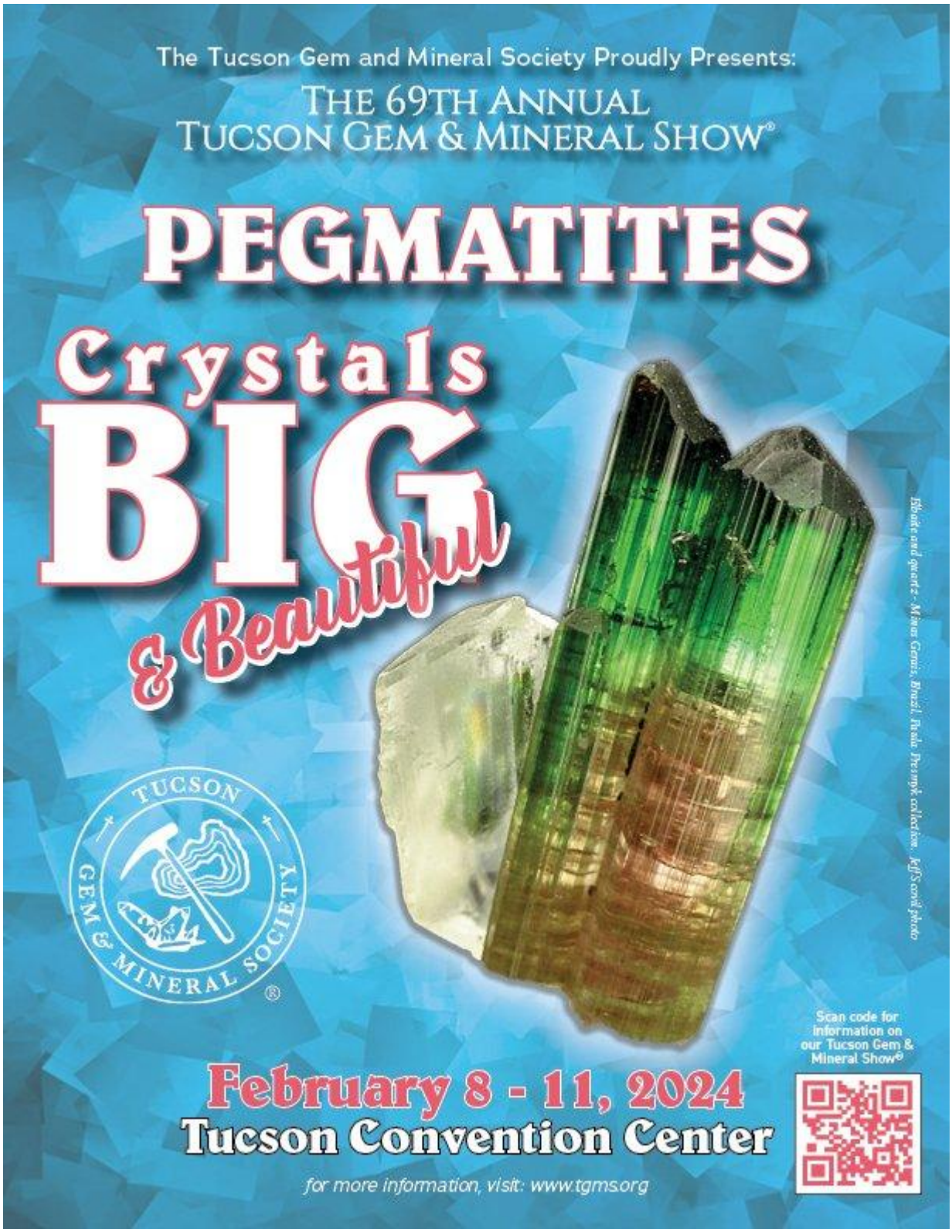
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February 8 - 11, 2024
Tucson Convention Center
for more information, visit: www.tgms.org

Apache Junction Rock & Gem Club
Meetings are on the 2nd Thursday
Next Meeting: January 11, 2024, 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 2, 2024, 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: January 16, 2024, 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)
January 18, 2024, 7:30 pm
Franciscan Renewal Center, (Piper Hall)
5802 E. Lincoln Drive, Scottsdale
www.msaaz.org

Pinal Geology & Mineral Society
Meetings are on the 3rd Wednesday
Next Meeting: January 17, 2024, 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: January 9, 2024, 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 4, 2024, 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: Janaury 12, 2024, 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 2024, at 6:30 p.m.

BECOME A MEMBER!

Join the Earth Science Museum's

esi: Earth Science Investigation team

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

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.msaaz.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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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.

_ _ _ _ _ _ _ _ cut here _ _ _ _ _ _ _ _ _

Name: _____

Address: _____

City, State, Zip: _____

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scote@earthsciencemuseum.org

We're on the Web!

Visit us at:

www.earthsciencemuseum.org

Mission
Our Mission is to excite and inspire all generations about earth sciences through educational outreach.

Vision
We envision a community where students and the general public have curiosity about, passion for, and understanding of the underlying principles of earth sciences.

For more information about the ESM, how to become a member or how to arrange for a school visit or Community function, go to: www.earthsciencemuseum.org.

NOTICE:
ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7th St, Phoenix, on Tuesday, TBA 2024, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

Earth Science Museum
3215 W. Bethany Home Rd.
Phoenix, AZ 85017