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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February 2021
Volume 10, Issue 2

ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

With all of the reduced activity for our Outreach Program it's nice to have several items to report this month. Lynne Dyer has recently worked with a group of ten involved with the Weblo Scouts. We have served Scouts for many years since starting our Outreach program. I also heard from Dr. Berry again thanking us for helping her with rock and mineral teaching kits for all of the teachers in her district. The kits are a hit with the many students interested in the hands-on experience.

I recently met with Lynne Wheeler in our ESM Workshop in Apache Junction and we discussed what the future of the Outreach Program might look like. We have a large supply of rock, mineral and fossil material on hand for the egg carton program. We also have many educational displays on a wide variety of geology topics with very nice samples and hands-on materials that we used at science fairs. We discussed needing to explore alternate ways of serving geology clubs at all grade levels with samples, and the possibility of creating smaller egg carton program materials to teachers. We will be using the Payson Club's efforts with a Student Geology Club as a probable exploratory effort as schools begin to reopen. The Corona Virus will be with us for awhile and ESM will be looking at both old and new ways of service delivery.

Hi Mardy,
I just wanted you to see what your efforts do for my students. The rock kits have been a high demand item since you donated them and we made them into kits. The students really love sorting them. These kids are in 4th grade. :)

LaFawn Berry, M.S., Ed.D.
District Science Coach K-12
Queen Creek Unified School District

Amethyst from Four Peaks
By Harvey Jong

February's birthstone is amethyst which suggests another timely topic for a newsletter article. Amethyst, the purple variety of quartz, is found throughout Arizona, and mindat.org currently lists 38 Arizona occurrences. The state's most famous locality is the Four Peaks Amethyst Mine in Maricopa County. The mine was accidentally discovered by gold prospector, Jim McDaniels, in the early 1900's and is named after the four prominent, steeply sloped mountains of the Mazatzal Mountain range.

Photo by Desertrat143 – CC-BY-SA-4.0, via Wikimedia Commons

Four Peaks as seen from McDowell Sonoran Preserve

The mine is located beneath the rightmost peak.

Access to the mine is limited by the area's rugged terrain and its location within a wilderness area of the Tonto National Forest. Hiking in by foot or flying in by helicopter are the only options for reaching the mine site.

The mine has been worked intermittently since 1942 and has produced limited amounts of amethyst. Although this material varies considerably in color and quality, the amethyst from Four Peaks has some unique mineralogical and gemological attributes.

Rob Lavinsky photo, iRocks.com – CC-BY-SA-3.0 via Wikimedia Commons

Quartz var. amethyst
Four Peaks Amethyst Mine, Maricopa County, Arizona
7.5 x 5.0 x 5.0 cm

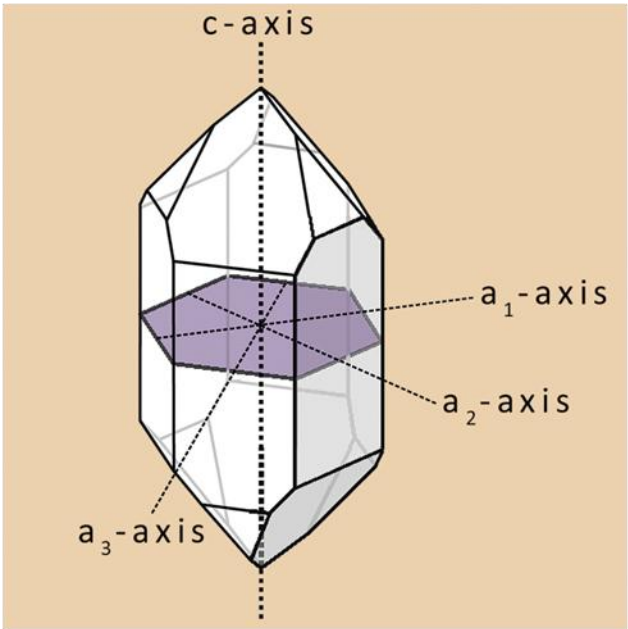
This doubly terminated specimen shows the characteristic color variations and highly etched prism faces of the crystals found at the Four Peaks Amethyst Mine.

C-face Crystals

Some Four Peaks amethyst exhibits an extremely rare crystal form for quartz. This form involves a crystal face termination called a c-face. To better understand the significance of c-face quartz crystals, we'll examine some basics of crystallography.

Quartz belongs to the hexagonal crystal system which is defined by four

crystallographic axes. Three axes are of equal length, separated by 120° from another, and are labeled a_1, a_2, and a_3. The fourth axis is perpendicular to the plane formed by the other three axes and is designated as c. (See the diagram below.)



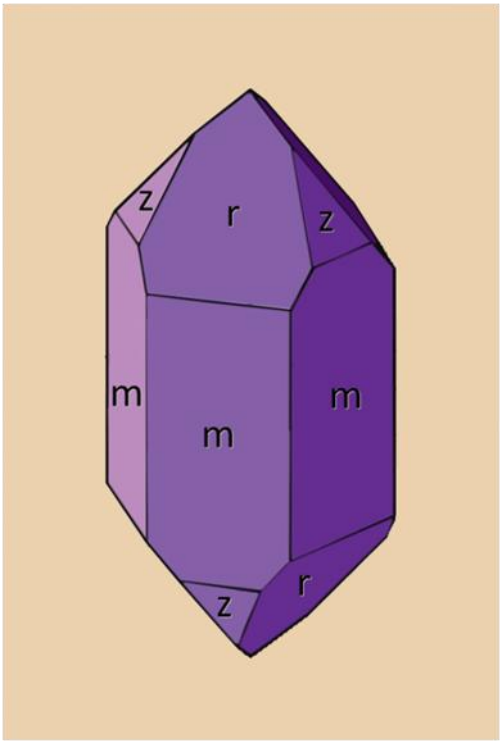
An idealized quartz crystal showing the four crystallographic axes

The different crystal faces, which comprise the overall shape of the crystal, are labeled with a single letter based on their orientation relative to the axes. The common crystal faces include:

m: six prism faces which nominally have a rectangular shape, are perpendicular to the a1, a2, and a3 axes, and form the main body of a crystal

r: three rhombohedral faces which nominally have a triangular shape and are located at the tip of a crystal.

z: three rhombohedral faces that are also at a crystal's tip and appear in between the r faces.



An idealized quartz crystal showing common crystal faces

The tip or termination of a quartz crystal typically comes to either point or edge depending on the relative shapes/sizes of the crystal faces. With Four Peaks amethyst, a crystal face may appear as the "tip" of some crystals. This face is perpendicular to the c-axis and is called a c-face. The formation of these flat crystal face terminations begins with crystals where the tips have been mechanically broken. Heavy dissolution and overgrowth follows resulting in the rare occurrence of a c-face.

Rob Lavinsky photo, iRocks.com – CC-BY-SA-3.0, via Wikimedia Commons

Quartz var. Amethyst
Four Peaks Amethyst Mine, Maricopa County, Arizona
9.7 x 6.7 x 4.8 cm
This crystal shows a c-face termination.

Siberian Connection

Since the 18th century, deposits in the Ural Mountains outside the town of Mursinsk have produced some very dark purple amethyst. The saturated color was recognized with a special name, Siberian amethyst. George F. Kunz, the American gemologist and mineralogist who worked for Tiffany and Co., described the color as "rich royal purple".

Marie-Lan Taÿ Pamart photo – CC-BY-4.0 International, via Wikimedia Commons

Amethyst from Siberia
Gallery of Mineralogy and Geology
French National Museum of Natural History, Paris
This specimen shows the incredible color of Siberian amethyst.

Although the Ural mines have been exhausted, the term continues to be used by the gem trade to refer to the finest color in amethyst regardless of origin. In addition to the dark color, Siberian amethyst is associated with reddish overtones and a much desired red flash in faceted gemstones. The Four Peaks Amethyst Mine is considered to be a source of Siberian amethyst.

Amethyst may be found in many different colors ranging from pale lilac (marketed as "Rose de France") to deep purple (Siberian amethyst) to almost black (smoky amethyst). But what accounts for this variability in color?

The cause of amethyst's color has been studied extensively. In the early 1800s, mineralogists, such as René Haüy, attributed the color to iron. Subsequent investigations,

however, revealed that the presence of iron represents only a partial explanation.

Iron impurities in amethyst can create color centers, crystal defects where color is produced by selective light absorption. Specifically, ferric iron (Fe^{3+}) ions replace some of the silicon (Si^{4+}) atoms in the amethyst. If the Fe^{3+} ions are irradiated with gamma rays from the radioactive decay in surrounding rocks, the impurities will change to Fe^{4+}, an uncommon valence state for iron. Charge transfer between oxygen (O^{2-}) and the Fe^{4+} ions will absorb light wavelengths around yellow-green (357 and 545 nm) resulting in a purple color. Light-colored amethyst has been reported to involve iron concentrations around 6 parts per million (ppm), while greater than 20 ppm is needed for darker material (Czaja et al., 2017).

Heating amethyst to around 300-400°C or prolonged exposure to ultraviolet light will result in the Fe^{4+} ions losing an electron and returning to the Fe^{3+} state. Depending on how long a sample is treated, the purple color may be altered to a lighter shade; changed to a yellow-brown color; or go completely colorless. (See the following web page for a cool example of these color changes on an amethyst geode: https://www.mindat.org/photo-700718.html. Be sure to click on the symbol to view the explanations of what was done to produce the different colors.) The original color can be restored with X-ray radiation.

References:

Czaja, M., M. Kądziołka-Gaweł, A. Konefał, R. ·Sitko, E. Teper, Z. Mazurak, and M. Sachanbiński (2017) The Mössbauer spectra of prasiolite and amethyst crystals from Poland. *Physics and Chemistry of Minerals* 44(5): 365-375.

Fritsch, E. and G.R. Rossman (1988) An update on color in gems. Part 2: colors involving multiple atoms and color centers. *Gem & Gemology* 24(1): 3-14.

Kawasaki, M., T. Nagase, K. Onuma, T. Katsumata, and I. Sunagawa (2006) Appearance of basal faces in natural amethyst crystals from Four Peaks, Arizona. *European Journal of Mineralogy* 18(2): 273-278.

Lehmann, G. and W.J. More (1966) Color center in amethyst quartz. *Science* 152: 1061-1062.

Lowell, J. and T. Rybicki (1976) Mineralization of the Four Peaks amethyst deposit, Maricopa County, Arizona. *Mineralogical Record* 7(2): 72-77.

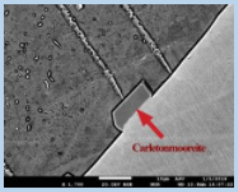
Lowell, J. and J.I. Koivula (2004) Amethyst from Four Peaks, Arizona. *Gems & Gemology* 40(3): 230-238.

Arizona State University

Center for Meteorite Studies

https://meteorites.asu.edu/news/carletonmooreite

Mineral 'carletonmooreite' named for founder of ASU Center for Meteorite Studies



This story originally appeared in ASU News. A new mineral has been named for Arizona State University Emeritus Regents Professor Carleton Moore, the founding director of ASU's Center for Meteorite Studies. The mineral, named "carletonmooreite," was found in a large, rare type of meteorite that fell in February 1948 in Norton County, Kansas. School of Earth and Space Exploration Research Professor ...

Arizona Rocks 93

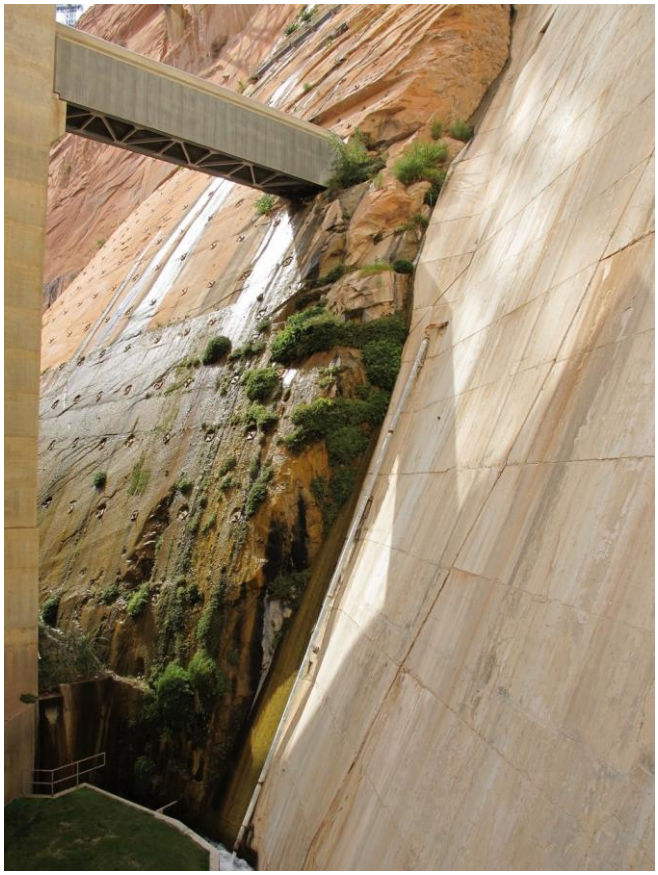
Text & photos by Ray Grant

Continuing with things to see and do in Paige, Arizona. In Arizona Rocks 91, I wrote about the Carl Hayden Visitor Center at Glen Canyon Dam. This visitor center is also where you can take tours down into the dam. The Glen Canyon Dam was built from 1956 to 1966 to control the flow of water downstream to Lake Mead, to generate electricity, and to store extra water in wet years. The building of the dam was quite a feat with long diversion tunnels and a cofferdam to route the river around the building site.

After the dam was completed, the lake was slow to fill and one of the reasons was the rock at the dam site is the Navajo Sandstone and it is porous with up to 24% porosity. I read that 655,000 acre-feet of water a year leaked into the sandstone; that is a lot of water. It took until June 1980 for the lake to fill. When the lake level is low some of the water will drain back into the lake as springs, and there are springs downstream from the dam from water that moves from the lake to the springs. Of course because of the drought, at present the lake is not full, down 127 feet.

(Note: many of the places especially U.S. Government facilities are closed now because of the virus.)

Glen Canyon Dam from Carl Hayden Visitor Center



Water seeping from springs in the Navajo Sandstone on the downstream side of the Dam. Notice all the rock bolts helping to hold the sandstone in place.

AZ Mining, Mineral & Natural Resources Education Museum Update February 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

Catie reports that she is currently in the planning stages with an exhibit consultant for a display at Phoenix city hall. The theme is 'From Mine to Medallion' and they are connecting copper mining with the copper medallions mounted along Central Ave. Catie will be supplying specimens and context for the labels and believes there will also be art.

In the meantime, please enjoy a photo from the museum collection.

Kunzite (synthetic)
Kunzite is an alternate February birthstone. It is a pink gem variety of spodumene which is named after George F. Kunz, the famous gemologist. Although spodumene is found in Arizona, there are no reported occurrences of kunzite.
S. Celestian photo

ALL ARIZONA GEM SHOWS MAY BE CANCELED DUE TO HEALTH CONCERNS!

Apache Junction Rock & Gem Club
ROCK SALE
2151 West Superstition Blvd.
Apache Junction, Az. 85120

March 6, 2021 - 9:00-4:00
March 7, 2021 - 9:00-3:00

Sale will be held outdoors in a covered area.
Observing social distancing guidelines and
Masks are required

If you have any questions please contact Teri Ritter at Tritterphoto@me.com

Tucson Show dates that have changed for 2021

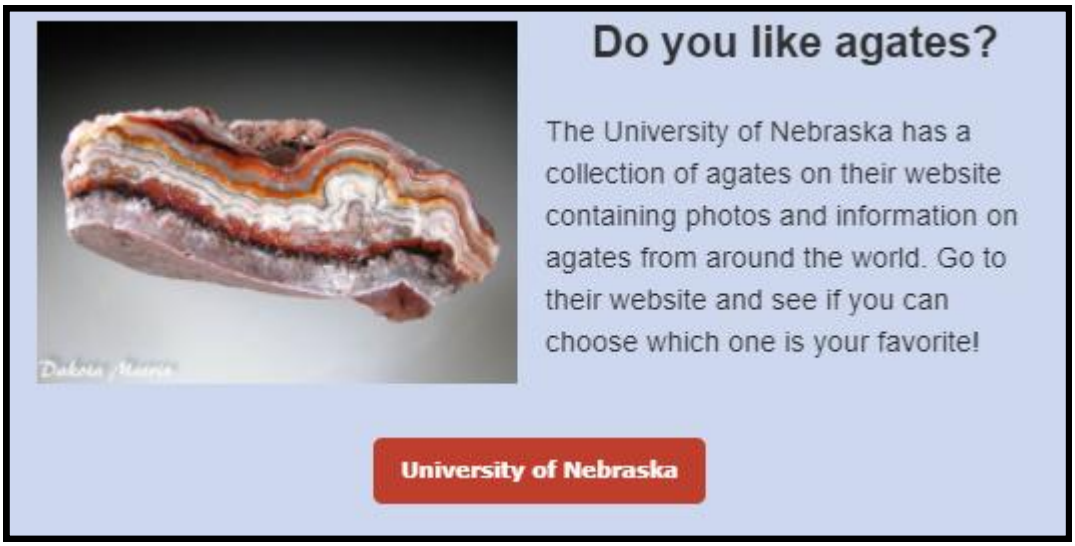
With the COVID-19 vaccine now being administered in the US and other countries, the decision was made to move some of the Tucson Shows from February to April, 2021. As the show gets closer, more shows will decide on their dates – but there will be shows taking place in April 2021. This change was brought with the anticipation of a lower infection rate, the lifting of some travel restrictions, and fewer restrictions for restaurants and lodging. However, still plan to practice social distancing, good personal hygiene, and wearing masks.

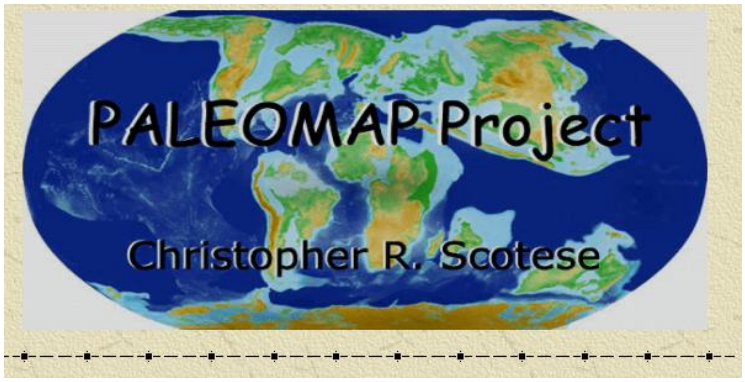
New Show Dates for Some Tucson Shows
April 7th - 25th, 2021

RockAndMineralShows.com - For updated Tucson Show Dates

Parent/Teacher Resource Page 1

http://snr.unl.edu/data/geologysoils/agates/agatesdatabase.aspx





http://www.scotese.com/

Teaching Material

The PALEOMAP Project publishes the results of its research in a variety of formats useful for teaching and research:

- Atlases & AnimationsAtlases & Animations showing the plate tectonic, paleogeographic, climatic, oceanographic, and biogeographic development of the earth during the last 1100 million years.
- Software (WIN & ArcView) that makes maps of the past, suitable for publication or for use in Earth Science labs and courses.
- Paleo-Globes (2", 4" & 6" diameter spheres) Hold the ancient world in your hands! FREE STUFF! (Free sample - Pangea Antenna Ball)
- ESH-GIS 2.0 ESH-GIS 2.0 (ArcView) 46 time slices with reconstructed shapefiles. FREE STUFF! (Free Sample ArcView Time Slice)
- Teaching materials for labs, textbooks, classroom instruction, and museum exhibits.
- Quick Time animations illustrating plate motions and changing paleogeography.
- CD-ROMs with digital image files, animations and laboratory exercises for Introductory Geology Classes.
- Special Discounts for High School, Middle School & Secondary Schools
- FREE STUFF! FREE STUFF! (More Free Stuff is on it's way. Send me an email (cscotese (at) gmail.com) and tell me what else you would like to be able to download for free from this site.)

Parent/Teacher Resource Page 2

EARTH SCIENCE WEEK UPDATE
American Geosciences Institute
Vol. 19, No. 2: February 2021

Webinar: Link Earth Science to NGSS With PBS

Join us on March 11, 2021, for a Next Generation Science Standards in Earth and Space Science (NGSS-ESS) Working Group webinar titled "Inspiring ALL Geoscience Learners Nationwide with PBS." Listen as Public Broadcasting Service stations from across the country talk about free, ready-to-use resources and services to inspire Earth science students.

With a focus on resources grounded in the science inquiry process, NGSS Science and Engineering Practices (SEPs), Cross Cutting Concepts (CCCs), and locally relevant and authentic phenomena, this session connects teachers with resources and strategies to ensure that these standards are accessible to all students. The webinar is free, but registration is required.

World Water Day Offers Resources Online

How can you celebrate the Earth Science Week 2021 theme of "Water Today and for the Future"? One way to start is by making connections around World Water Day, March 22, 2021.

Post on social media #Water2me with a note and a photo about how water is important to you. And build understanding of water science for World Water Day. Tap resources online.

What Do Geophysicists Do? Find Out With SEG

Geophysicists are making a difference in the world with innovations such as improving tsunami safety in Indonesia, revealing a forgotten tunnel dug by Jews trying to escape a Nazi camp in Lithuania, and discovering a gigantic freshwater aquifer just off the eastern coast of the United States.

These are just a few examples of the impact geophysicists are making on problems facing humanity, as illustrated on the "What Do Geophysicists Do?" website of the Society of Exploration Geophysicists (SEG), an Earth Science Week partner.

Today, geophysics has a major role to play in addressing three of the planet's most pressing challenges — energy, water, and climate. "The world needs more geophysicists," according to SEG. "Are you ready to help save the world?" Learn more online.

Pinal Museum and Club News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Gem and Mineral Club meeting

March 17, 2020, live on YouTube

www.pinalgeologymuseum.org

Ray Grant raycyn@cox.net.

Pinal Geology and Mineral Museum will be closed until further notice due to the health emergency.

Please enjoy our expanding website until we reopen.
www.pinalgeologymuseum.org
New content is being added weekly!

ALL ARIZONA CLUB MEETINGS ARE LIKELY C CANCELLED D
DUE TO HEALTH CONCERNS!

Apache Junction Rock & Gem Club
Meetings are on the 2nd Thursday
Next Meeting: 2021, 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: March 2, 2021, 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
Meetings are on the 1st Monday
(unless a Holiday then 2nd Monday)
Next Meeting: 2021, 7:00 pm
www.maricopalapidarysociety.com
@ North Mountain Visitor Center
12950 N. 7th St., Phoenix

Mineralogical Society of Arizona
Meetings are on the 2nd Thursday
(September meeting on the 3rd Thursday)
Next Meeting: March 11, 2021, 7:30 pm
www.msaaz.org
Zoom Meeting - Register on MSA website

Pinal Gem & Mineral Society
Meetings are on the 3rd Wednesday
Next Meeting: March 17, 2021, 7:00 pm on
YouTube go to their website for more info
www.pinalgemandmineralsociety.org
@ Artisan Village
351 N. Arizona Blvd., Coolidge

West Valley Rock & Mineral Club
Meetings are on the 2nd Tuesday
Next Meeting: March 9, 2021, 6:30 pm
On Line and in person
www.westvalleyrockandmineralclub.com
@ Painted Desert Academy
2400 S. 247th Ave., Buckeye, AZ

White Mountain Gem & Mineral Club
Meetings are on the 1st Sunday
(unless a Holiday then 2nd Sunday)
Next Meeting: 2021, 1:00 pm
www.whitemountain-azrockclub.org
@VFW Hall
381 N. Central, Show Low

Wickenburg Gem & Mineral Society
Meetings are on the 2nd Friday
(February & December on the 1st Friday)
Next Meeting: 2021, 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 2021, 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! ☺☺☺

_ _ _ _ _ _ _ _ _ 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.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

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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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 2021, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

Earth Science Museum
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