



# EARTHQUAKE

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

Earth Science Museum, 3215 W. Bethany Home Rd., Phoenix, AZ 85017  
[www.earthsciencemuseum.org](http://www.earthsciencemuseum.org), [scote@earthsciencemuseum.org](mailto:scote@earthsciencemuseum.org), 602-973-4291

July 2020  
Volume 9, Issue 7

## ESM Outreach Update:

By Shirley Coté

When Mardy Zimmermann, ESM Outreach Coordinator, moved a couple years ago, she had this large garage built on her new property specifically for the rocks and minerals she has accumulated for the ESM Outreach program.



This last spring when the pandemic precluded outreach activities, Mardy went to work moving many of the rocks and minerals that she has accumulated in buckets to the color coded, labeled bins in her garage.



This facilitates her being able to make kits and to bag samples for teachers and students.



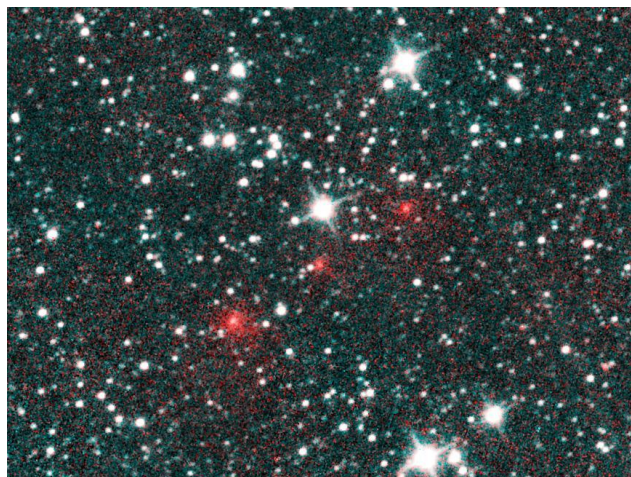
This spring, Mardy also had time to finally organize and label the contents of these flats of rocks, minerals and fossils.

Currently, Mardy and her husband Richard are in Forest Lakes where it is nice and cool. They are keeping busy crushing more rocks and minerals for the outreach program and to give to local rock clubs needing them for their outreach efforts and egg carton programs when this pandemic is over.

## A Once-in-Our-Lifetime Glimpse of Comet NEOWISE

By Harvey Jong

On March 27, 2020, instruments on the Near-Earth Object Wide-field Infrared Survey Explorer (NEOWISE) spacecraft detected an object about 250 million kilometers (169 million miles) away from Earth. This object was classified a new comet, C/2020 F3, and was later named Comet NEOWISE on April 1. (Note: comets are traditionally named after the person or persons who made the discovery, but in this case a spacecraft was honored.)

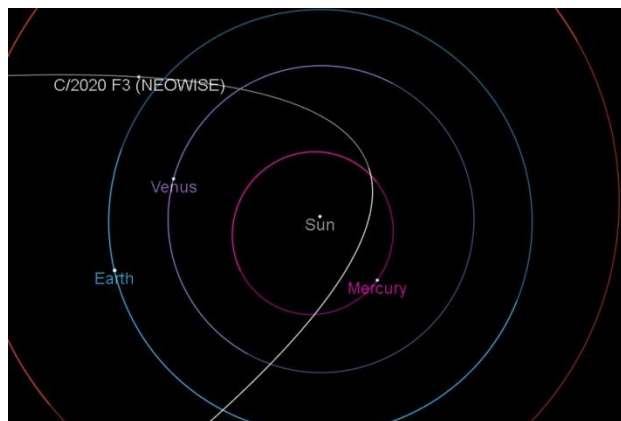


**Comet NEOWISE discovery image**

A composite of several infrared images where the red dots show the motion of the comet

Photo courtesy of NASA/JPL-Caltech

Following a near-parabolic orbit, the comet made its closest approach to the Sun on July 3 at a distance of 43 million kilometers (27 million miles). The orbital period is estimated to be around 6800 years which definitely qualifies its appearance as a once-in-our-lifetime event.



**Trajectory of Comet NEOWISE**

NASA diagram, PD via Wikimedia Commons

By July, the brightness of Comet NEOWISE had increased from its initial apparent magnitude of 18 to a peak value near 1. (Note: apparent magnitude is a reverse logarithmic scale where brighter objects have a lower magnitude) This was bright enough to be visible to the naked eye and made Comet NEOWISE one of the brightest comets in the northern hemisphere since Comet Hale-Bopp. Comet Hale-Bopp, which appeared in 1997, reached a maximum magnitude of 0. Halley's Comet is probably best known comet, but it attained a rather disappointing magnitude of 2 during its much-hyped 1986 apparition.

Due to its circumpolar position, Comet NEOWISE was visible in the morning just before sunrise and in the evening just after sunset. The evening view, however, proved to be more accessible with the comet appearing in the northwestern sky below the "Big Dipper" (part of the constellation Ursa Major).



### Location of Comet NEOWISE just after sunset, July 15-23

Diagram courtesy of NASA/JPL-Caltech

Although backyard astronomy may be convenient, it has some inherent disadvantages where city “light pollution” and the neighbor’s pesky palm trees invariably limit observation. These non-ideal conditions combined with annoying cloud cover make astrophotography particularly challenging. Nevertheless with some persistence, a bit of luck, and cooperative weather, it was possible to capture some images of Comet NEOWISE from my house in Chandler, AZ.



### Comet NEOWISE

Image detail is limited by the brightness of the Chandler night sky, but the photo provides a hint of the comet’s tail. Note that a faint “double” tail involving dust and ions has been reported, but much darker skies are needed to view this feature.



### Comet NEOWISE as seen from the street corner

This image attempts to convey a sense of the comet’s apparent brightness and relatively low position in the sky. However, detail is severely limited by an adjacent street light, while the depth of field of the lens (set to the widest aperture, f 2.8) impacted the focus.

◇ ◇ ◇

**Notice:** There will not be any lapidary, silversmithing classes or open studios at North Mountain Visitor Center in August due to the continued high incidences of COVID-19. - - Doug Duffy



## Arizona Rocks 86

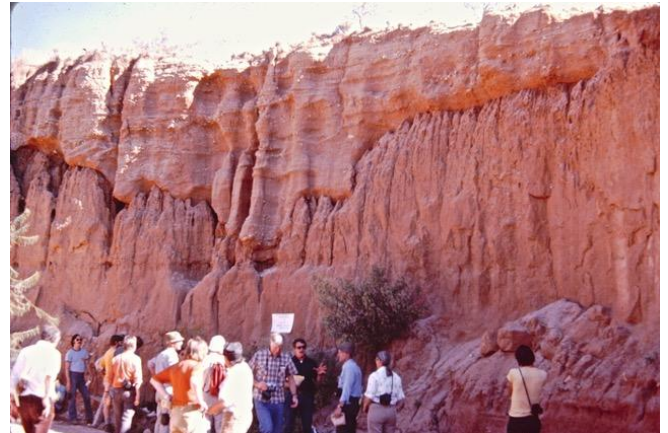
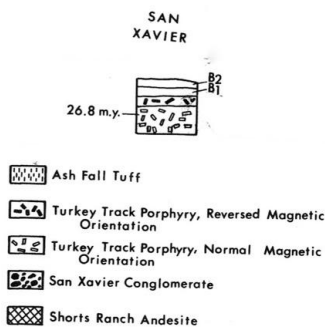
Text by Ray Grant

The University of Arizona had a paleomagnetic laboratory that was making the measurements and collecting data for the polar direction of rocks in Arizona. Here are a couple of examples from Arizona.

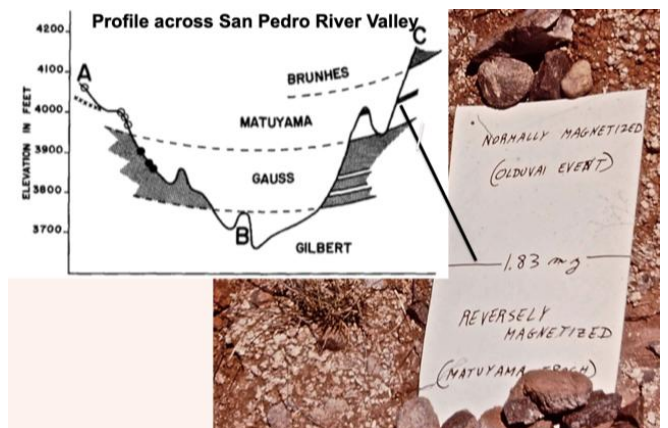
In the San Pedro River Valley hundreds of samples of the valley fill sediment were carefully sampled between Benson and the Mexican border. This study recognized eleven polar reversals in the sediments deposited in the valley during the last four million years. This data was used to help age date the fossil mammals that were found in the area. The reference for this information and the cross-section of the valley shown in the figure here are from the Geological Society of America Bulletin, 1975, v. 86, no. 1, p 5-12. The authors of the paper led a field trip that I attended to the San Pedro in 1978 and the photographs are from that trip.

Grotto Hill in front of the San Xavier Mission south of Tucson consists of several lava flows and between the times of the lower two flows the poles reversed. In the lower flow the minerals point to the north magnetic pole and in the upper flow they point to the south magnetic pole. The diagram here is from the Arizona Geological Society, Southern Arizona Guidebook III, 1968.

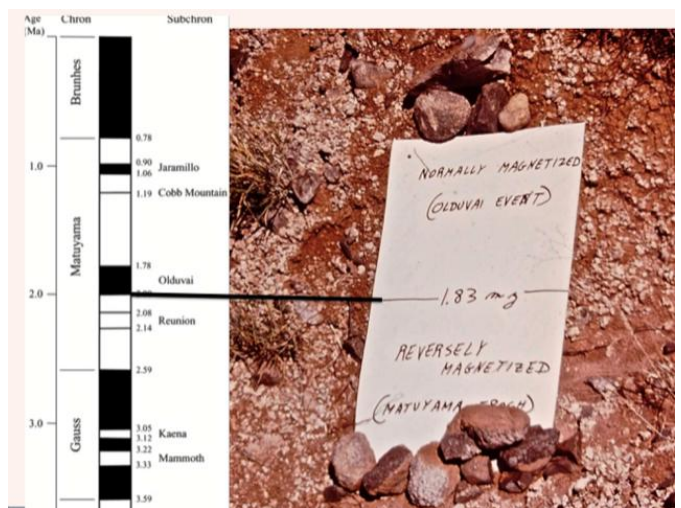
Keep an eye on your compass!



Geologists on a field trip to the San Pedro River to study magnetic reversals



Some of the magnetic reversals seen in the San Pedro Valley



Magnetic reversal time scale and location of one of the polar reversals in the San Pedro Valley (Black is present day magnetic field and white is reversed magnetic field)

Cross section of Grotto Hill with the two lava flows, one normal and one reversed.



**AZ Mining, Mineral & Natural Resources Education Museum Update April 2020**

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

Catie Carter Sandoval  
 cscarter@email.arizona.edu  
 703.577.6449

Help support the museum at:  
<http://tinyurl.com/SupportMM-NREMuseum>

With Catie currently on leave until September, Bill Yedowitz has followed Catie’s plan of organizing the collection from temporary shelving in the classroom to permanent storage cabinets and has almost completed this task.



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



Mingus Gem and Mineral Club  
 “Clarkdale Rocks!”  
 September 25-27, 2020  
 Fri. & Sat. 9-5, Sun. 10-5  
 Free Admission  
 Clark Memorial Clubhouse Auditorium  
 19 N. Ninth Street  
 Clarkdale, AZ

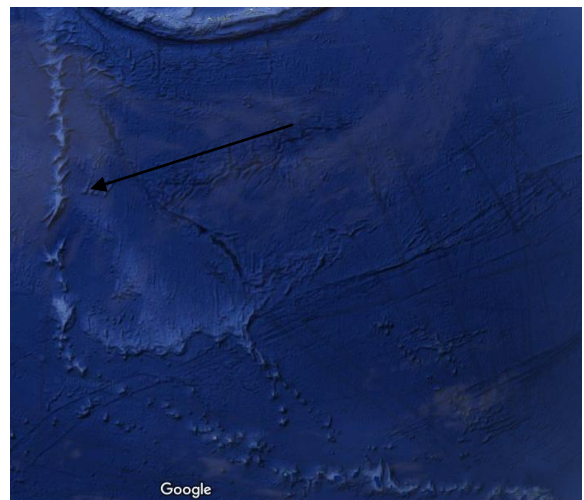
**Ocean glossary:**  
 Seamount - a submarine mountain  
 Guyot - a submarine mountain with a flat top



West Valley Rock & Mineral Club  
 Helzarockin’ Rock & Mineral Show  
 October 9-11, 2020  
 Friday & Saturday 9-5  
 Sunday 9-2  
 Admission \$5 Adults  
 Free - Children under 13  
 Buckeye Arena  
 802 N. 1<sup>st</sup> St.  
 Buckeye, AZ



Huachuca Mineral & Gem Club  
 Huachuca Gem, Mineral & Jewelry Show  
 October 10-11, 2020  
 Sat. 9-5, Sun. 10-4  
 Free Admission  
 Cochise College  
 901 N. Colombo Ave.  
 Sierra Vista, AZ



Which seamount chain is pictured here?  
 A. Louisville Seamount chain  
 B. Emperor Seamount chain  
 C. Kodiak-Bowie Seamount chain

## Parent/Teacher Resource Page 1

<https://geology.com/>



### Google Earth - Free



**Free Google Earth** software allows you to browse seamless world satellite images. Free.

### Fireworks & Minerals



**The Science of Fireworks** Learn how the colors and shapes are created.

### Tallest Waterfall



**Angel Falls** in Venezuela is the tallest waterfall in the world - it is 3212 feet tall.

### Grape Agate



**Grape Agate** is a popular mineral specimen with the color and the shape of a bunch of grapes.

### Gemstones



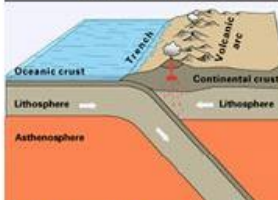
**Gemstones** - Colorful images and articles about diamonds and colored stones.

### Meteorites



**Meteorites** - Rocks that were once parts of planets or large asteroids.

### Plate Tectonics



**Plate Tectonics** - Articles and maps about plate tectonics and the interior of Earth.

### Wall Maps



**Wall Maps** - Wall maps of the world, continents, states and the USA.

<https://www.ptable.com/lessonplans/>

## Ptable | Periodic Table Lesson Plans



With help from the [American Association of Chemistry Teachers](#) and [American](#)






**ACS**  
Chemistry for Life®

[Chemical Society](#), Ptable has sponsored the creation of exciting new lesson plans developed by chemistry teachers which take advantage of the site's in-depth interactivity. Using these free lesson plans, you can engage with the periodic table in ways which were previously impossible.

## Parent/Teacher Resource Page 2

<https://www.mindat.org/>

 <p>mindat.org</p>		
<p><b>Welcome</b></p> <p>Mindat.org is the world's largest open database of minerals, rocks, meteorites and the localities they come from.</p> <p>Mindat.org is run by the not-for-profit Hudson Institute of Mineralogy.</p>	<p><b>Learn</b></p> <p>Learn more about rocks and minerals, their origins and their uses:</p> <ul style="list-style-type: none"> <li>▶ <a href="#">Enter our learning center</a></li> <li>▶ <a href="#">Search our archive of articles</a></li> </ul>	<p><b>Museums</b></p> <p>Our directory of mineral museums and public collections worldwide.</p> <ul style="list-style-type: none"> <li>▶ <a href="#">The Museum Directory</a></li> <li>▶ <a href="#">Forum on Minerals &amp; Museums</a></li> </ul>

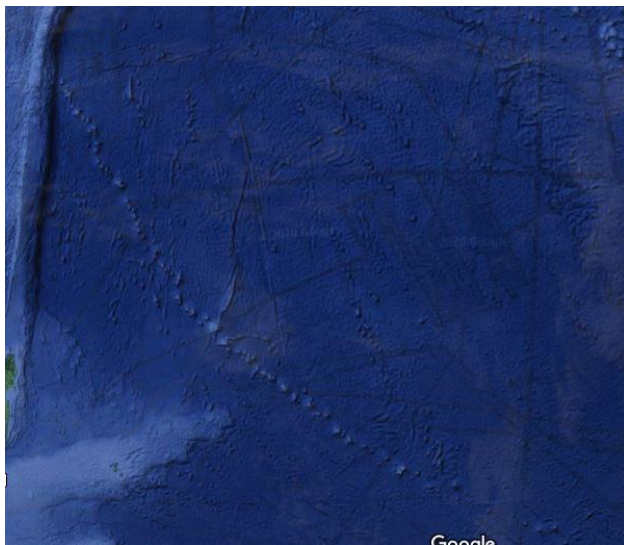
<https://www.gemdat.org/>

Gemdat.org 

[Gemdat Home](#)

**gemdat.org - the gemstone and gemology information website**

Current statistics: 624 gem names. 526 gemstone data pages. 3,153 total locality items listed from 1,476 sites worldwide. 8,182 photos.



Which seamount chain is pictured here?

- A. Kodiak-Bowie Seamount chain
- B. Louisville Seamount chain
- C. Emperor Seamount chain



## Pinal Geology & Mineral Museum

### Pinal Museum and Club News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Gem and Mineral Club meetings are

**CANCELED until at least September**

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

Ray Grant [raycyn@cox.net](mailto: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](http://www.pinalgeologymuseum.org)

New content is being added weekly!

<https://www.pinalgeologymuseum.org/index.php/learn-play/resourceslinks/geology-in-the-news-2>

Click on the above link to read about the following:

AMETRINE

CORONAVIRUS LOCKDOWNS CHANGE EARTH'S MOVEMENT

SHORTER DAY, LONGER YEAR

TRANSITIONAL FOSSIL FISH

ROCKS MAY BE THE REASON FOR LIFE

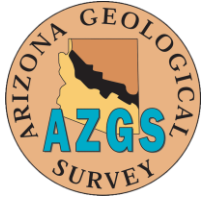
and many other interesting articles.

The answer to both seamount questions is B.

#### Trench Trivia

The Louisville Seamount Chain is located near the Tonga Trench in the South Pacific Ocean and is the second deepest trench on Earth with its deepest point - Horizon Deep at 35,433 feet. The deepest trench is the Mariana Trench (south and east of Japan) which is 36,037 feet at its deepest point - Challenger Deep.





**Mike Conway**  
Sr. Research Scientist,  
Arizona Geological Survey  
at the Univ. of Arizona

## Arizona Geology Blog: Review of [‘Helvetia-Rosemont: Arizona’s Hardscrabble Mining Camp’](#) by J. DuHamel

Retired exploration geologist Jonathan Du Hamel reviews David Briggs newest AZGS contributed report, 'Helvetia-Rosemont: Arizona’s Hardscrabble Mining Camp'.

From Jonathan's review, '... a compelling story of the Helvetia-Rosemont Mining District in the Santa Rita Mountains of southern Arizona from the 1690s to the present day. It is a well-told story of the people, conditions, conflicts, businesses, and development of transportation and mining technology...'.

The 65-page report includes 80 illustrations, including geologic and mine maps and historic photos of the mining camp.

Report citation: Briggs, D.F., 2020, [Helvetia-Rosemont: Arizona’s Hardscrabble Mining Camp](#). Arizona Geological Survey Contributed Report CR-20-A, 65 p.



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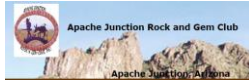
### AZGS Websites

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

### AZGS Social Media

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

**ALL ARIZONA CLUB MEETINGS ARE LIKELY CANCELED DUE TO HEALTH CONCERNS!**



### Apache Junction Rock & Gem Club

Meetings are on the 2<sup>nd</sup> Thursday  
Next Meeting: 2020, 6:30 pm

[www.ajrockclub.com](http://www.ajrockclub.com)

@ Club Lapidary Shop

2151 W. Superstition Blvd., Apache Jct.



### Daisy Mountain Rock & Mineral Club

Meetings are on the 1<sup>st</sup> Tuesday  
(unless a Holiday then 2<sup>nd</sup> Tuesday)  
Next Meeting: 2020, 6:30 p.m.

[www.dmrmc.com](http://www.dmrmc.com)

@ Anthem Civic Building

3701 W. Anthem Way, Anthem, AZ



### Maricopa Lapidary Society, Inc

Meetings are on the 1<sup>st</sup> Monday  
(unless a Holiday then 2<sup>nd</sup> Monday)  
Next Meeting: 2020, 7:00 pm

[www.maricopalapidarysociety.com](http://www.maricopalapidarysociety.com)

@ North Mountain Visitor Center

12950 N. 7<sup>th</sup> St., Phoenix



### Mineralogical Society of Arizona

Meetings are on the 2<sup>nd</sup> Thursday  
(February & September meeting on the 3<sup>rd</sup> Thursday)

Next Meeting: 2020, 7:30 pm

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

@ Franciscan Renewal Center,  
5802 E. Lincoln Dr., Scottsdale

**CANCELLED**



### Pinal Gem & Mineral Society

Meetings are on the 3<sup>rd</sup> Wednesday  
Next Meeting: 2020, 7:00 pm

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

@ Artisan Village

351 N. Arizona Blvd., Coolidge



### West Valley Rock & Mineral Club

Meetings are on the 2<sup>nd</sup> Tuesday  
Next Meeting: 2020, 6:30 pm

[www.westvalleyrockandmineralclub.com](http://www.westvalleyrockandmineralclub.com)

@ Painted Desert Academy

2400 S. 247<sup>th</sup> Ave., Buckeye, AZ



### White Mountain Gem & Mineral Club

Meetings are on the 1<sup>st</sup> Sunday  
(unless a Holiday then 2<sup>nd</sup> Sunday)

Next Meeting: 2020, 1:00 pm

[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)

@ VFW Hall

381 N. Central, Show Low



### Wickenburg Gem & Mineral Society

Meetings are on the 2<sup>nd</sup> Friday  
(February & December on the 1<sup>st</sup> Friday)  
Next Meeting: 2020, 7:00 pm

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

@ Coffinger Park Banquet Room  
175 E. Swilling St., Wickenburg

**ESM's Meeting Notice**

ESM's next meeting will be at North Mountain Visitor Center, 12950 N. 7<sup>th</sup> St., Phoenix, on Tuesday, TBA 2020, at 6:30 p.m.

**BECOME A MEMBER!**  
Join the Earth Science Museum's



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

----- cut here -----  
**ESM Earth Science Investigation  
 Team Membership Form**  
 \_\_\_\_\_ **New Member**      \_\_\_\_\_ **Renewal**

Membership levels:

\_\_\_\_\_ **ESI Family \$20**

\_\_\_\_\_ **ESI Individual \$10**

Membership benefits:

- ◆ Monthly e-newsletter *Earthquake*
- ◆ Official team membership card
- ◆ Knowledge that your contribution is making a difference in earth science education.

**MANY THANKS TO OUR MAJOR DONORS!**

- AZ Leaverite Rock & Gem Society
- Flagg Mineral Foundation  
[www.flaggmineralfoundation.org](http://www.flaggmineralfoundation.org)
- Friends of the AZ Mining & Mineral Museum
- Maricopa Lapidary Society  
<http://maricopalapidarysociety.com/>
- Mineralogical Society of AZ  
[www.msaz.org](http://www.msaz.org)
- Payson Rimstones Rock Club
- Sossaman Middle School
- White Mountain Gem & Mineral Club  
[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)
- Wickenburg Gem & Mineral Society  
<http://www.wickenburggms.org>  
[www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438](https://www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438)
- Staples Foundation  
[www.staplesfoundation.org](http://www.staplesfoundation.org)
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
- Will & Carol McDonald
- Debbie Michalowski
- Janet Stoepplmann
- Dennis & Georgia Zeutenhorst

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**Earth Science Museum**

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Phoenix, AZ 85017

**Phone:**

602-973-4291

**Editor E-Mail:**

scote@earthsciencemuseum.org

*We're on the Web!*

Visit us on  and at:  
[www.earthsciencemuseum.org](http://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](http://www.earthsciencemuseum.org).

**NOTICE:**

ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7<sup>th</sup> St, Phoenix, on Tuesday, TBA 2020, at 6:30 p.m.

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

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

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

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

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

