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 2022
Volume 11, Issue 2

ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

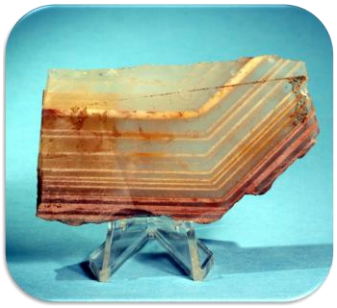
By Shirley Coté with most photos by Stan Celestian

On February 1st, Doug Duffy, ESM Board member, gave a lapidary presentation to the Daisy Mountain Rock and Mineral Club.

Doug showed how an ordinary looking rock, when cut open, can reveal something amazing inside.

Montana agate

When backlit, this Chevron agate from Africa, revealed this intriguing image!



Sometimes rocks even remind you of something to eat like this bacon agate from Burro Creek, or this petrified wood that may remind you of pork chops.

This picture jasper from Mexico may make your mouth water for a tray of spice cake or carrot cake with cream cheese frosting.

Sometimes the picture jasper reminds you of a scene at a lake in Arizona, but this jasper is from Idaho. This one, Doug calls "fishing on the lake". Can you find the "boat" and the "fish"? Amazing!

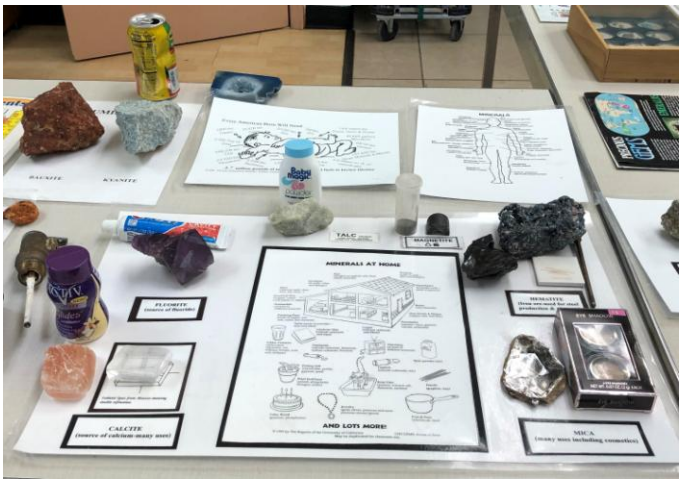
Does this picture jasper remind you of trees on a mesa as you drive north from Phoenix to Flagstaff?

Lapidary is the art of cutting and polishing rocks and is an incredibly interesting hobby. You never know what you'll find when you cut open a rock!

Outreach to schools back on track!

After about a two year hiatus because of Covid, Lynne and Terry Dyer are back. They set up their fabulous hands-on "Mini Museum" for the children of Dynamite Montessori School in Cave Creek.

20 students and two teachers learned about rocks and minerals and about the products we use every day derived from some of those rocks and minerals.



Igneous rocks display

Lynne and Terry also brought fossils and even a meteorite for the children to learn about and inspect.

After Lynne's presentation, the children enthusiastically inspected all the specimens!

Don't miss Lynne & Terry at the:
Pinal Gem and Mineral Show
Saturday, March 12, 2022
10 AM to 3 PM

There will be Meteorites and Dinosaurs and you will be able to see all of Lynne and Terry's "Mini Museum" for yourself.

The Mysteries of Black Diamonds
By Harvey Jong

Some recent news stories reported on the auction of one of the world's largest natural fancy black diamonds. This diamond weighs 555.55 carats and features a 55 facet free form design. It is named "The Enigma" and sold for $4.28 million! A short video of the unique gemstone can be viewed at the following web address: https://www.youtube.com/watch?v=RcT7eC9qcFc.

Enigma is an appropriate name given the unusual occurrence of black diamonds. The physical and optical properties of black diamonds are very different from other diamonds, while how they formed remains controversial nearly two centuries after their discovery. These mysteries will be the subject of this article.

Properties

Black diamonds are a rare form of polycrystalline diamond rock called diamondite. These irregularly-shaped diamonds vary in size (0.25-3,165 carats), but generally consist of small cubic diamond crystals ranging from 10-250 um cemented together by even smaller (<1 um) microdiamonds. This represents a key difference from white and other colored diamonds which are individual single crystals.

As microcrystalline aggregates, black diamonds are porous and have a lower specific gravity (2.8-3.45) compared to conventional diamonds (3.52). The porosity is a puzzling feature that seems inconsistent with diamond-forming environments in either the mantle or crust.

The polycrystalline texture also leads to another distinction involving toughness or durability. A black diamond has the same hardness as a conventional diamond, but the varied orientations of its microcrystals produce a much tougher material for industrial applications, such as cutting or drilling. While developing its South African diamond mines in the late 1800s, the De Beers Group recognized this characteristic and preferred using black diamonds over their own diamonds for diamond drilling.

The optical properties of black diamonds are very different from conventional diamonds. Black diamonds are usually opaque with black to dark grey colors due to inclusions of graphite and various metals, metal alloys and unusual minerals, such as titanium, iron-nickel, nickel-chromium, moissanite (silicon carbide) and osbornite (titanium nitride). In addition, microcrystalline structures or defects inhibit refraction and absorb light.

Black Diamond Known as the "Shaan-e-Kolkata"
Photo by Trishta- CC-BY-SA-4.0, via Wikimedia Commons
The round-cut diamond weighs 121.32 carats (24.264 g).

The age of black diamonds has been determined to be around 2.6 to 3.8 Ga, but the measurements are associated with large uncertainties (1.8 Ga). The diamonds also have carbon-13 isotope values which suggest that they may have originated from organic/recycled carbon from the Earth's surface vs. primordial carbon in the mantle.

Discovery and Mining

Black diamonds were first found in the Chapada Diamantina region of Bahia, Brazil. The exact year of discovery is uncertain since they were discarded as waste until

around 1850. These diamonds resemble pieces of charcoal, and Portuguese prospectors called the material "carbonado" which means burnt or carbonized in Portuguese. The carbonados occur primarily in alluvial deposits, and at the height of Brazil's mining activity from 1850-1870 some 70,000 carats were produced by an estimated 30,000 artisanal miners (Svisero, 1995).

The Sergio Carbonado – Largest Carbonado Ever Found
Photo from (Furnis, 1906), p. 274 – CC-BY-SA, via wikisource.org

This carbonado weighed 3,165 carats (1.4 pounds) and was found in Lençóis, Bahia, Brazil in 1895. It initially sold for $16,000, and was broken into small pieces for diamond drills (Furnis, 1906).

Many Brazilian deposits were depleted by the start of the 20th century. Carbonados, however, were later found in the Bangui region in southwest Central African Republic. Production started around 1925.

Brazil and the Central African Republic are the only two countries where black diamonds were mined, and their combined output has been estimated to be approximately 2 metric tons (Haggerty, 2014). [Note that total global production of diamonds as of 2005 was about 4.5 billion carats or 900 metric tons (Janse, 2007).]

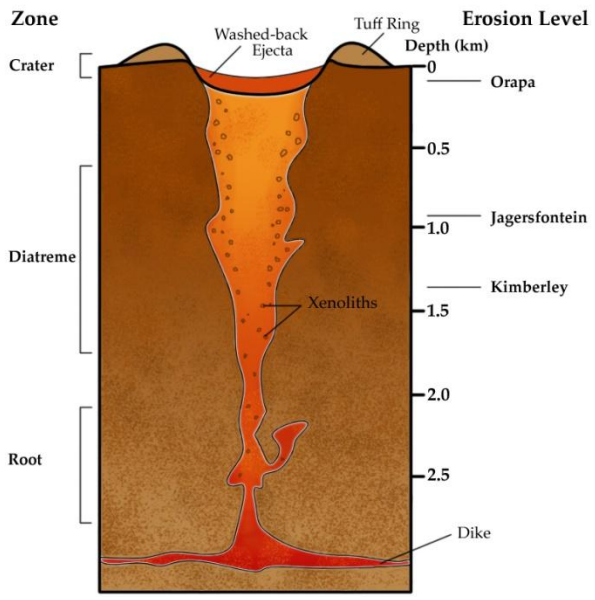
Carbonado Diamondites from Bangui Region, Central African Republic
Photo by James St. John – CC-BY-SA-2.0, via Wikimedia Commons
Top specimen is 4.05 carats, 9x9x6 mm,
Left specimen is 4.07 carats, 10x13x7 mm,
Right specimen is 5.09 carats, 12 x6x6 mm

Formation

To better understand the controversy behind how black diamonds form, we will first take a look at the natural processes involved in producing conventional diamonds. Monocrystalline diamonds may develop in the following environments:

1. In the Earth's mantle
2. In subduction zones
3. At impact sites

The Earth's mantle represents the main source of natural diamonds where they are believed to crystallize from carbon-bearing fluids or melts. The diamonds are associated with minerals, such as pyrope garnet, ilmenite, chromite, olivine, chrome diopside, and enstatite. Deep-sourced volcanic eruptions transported xenoliths containing the diamonds and minerals to the surface.

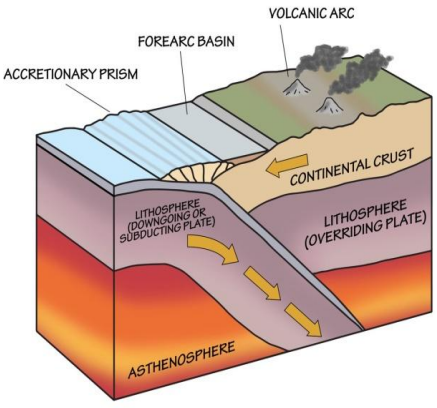


Cross Section of a Volcanic Pipe
Diagram by User: Asbestos – CC_BY_SA-3.0, via Wikimedia Commons

Volcanic pipes form when gas-filled magma erupts explosively from the mantle to the surface.

Black diamonds, however, do not have these mantle-related mineral associations.

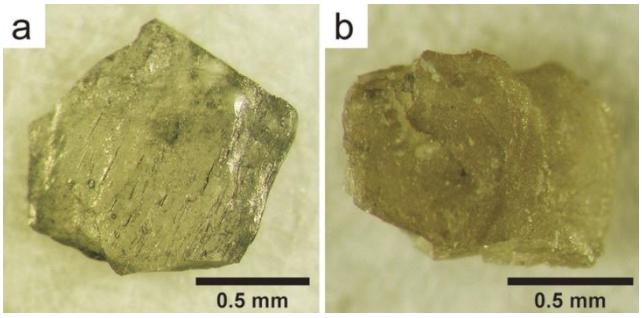
Subduction zones occur at convergent plate boundaries where one plate is forced down into the mantle. The temperature and pressure involved with the descending plate may transform oceanic crust into rocks containing small diamonds. These rocks were later returned to the surface.



Cross Section of a Subduction Zone
Diagram by Wade Greenberg-Brand/Paleontological Research Institution – CC_BY_SA-4.0, via Wikimedia Commons

Such rocks, however, are rare, and only a few diamond deposits, such as those of eastern New South Wales, Australia have been attributed to the subduction of ocean sediments (Barrows et al., 1996).

Impact sites were created when large space objects, such as asteroids, struck the Earth. The high temperature and pressure of such an impact may be sufficient for the shock formation of diamonds. Small impact diamonds ranging from a few microns to 1 mm have been found at the Popigai Crater in Yakutia, Siberia.



Popigai Impact Diamonds
Photo by Hiroaki Ohfuji et al. – CC_BY_SA-4.0, via Wikimedia Commons

One proposed theory on the formation of black diamonds involves a large meteor hitting the Earth around the Precambrian time when Brazil and the Central African Republic were part of the supercontinent known as Rodinia (Smith and Dawson, 1985). This event supposedly buried an iron meteorite that was detected as the Bangui magnetic anomaly in the Central African Republic. Black diamond deposits were created by the tremendous temperature and pressure of the impact.

Approximate Location of Mesoproterozoic (Older Than 1.3 Ga) Cratons in South America and Africa
Graphic by Woudloper – CC-BY-SA-3.0, via Wikimedia Commons

Black diamonds occur in the São Francisco craton in Brazil and in the Congo craton in the Central African Republic.

Some inconsistencies, however, detract from the impact theory. The magnetic anomaly may be related to a banded iron ore body. The age of black diamonds (~ 3.8 Ga) along with organic carbon playing a role in the diamond's composition suggests that cyanobacteria might have been a likely carbon source. But an extraordinary amount of the microorganisms would be required to produce 2 metric tons of carbonados. In addition, known occurrences of meteorite-impact diamonds, such as Arizona's Meteor Crater, consist of conventional microdiamonds rather than large black diamonds.

Another model of black diamond formation involves supersaturated carbon-bearing fluids in the crust or mantle (Ketcham and Koeberl, 2013). The diamonds crystallized from these fluids and were later metamorphosed producing their characteristic porosity and patina. The hydrothermal fluids, though, would have to be in an unlikely environment that drastically decreases the pressure and temperature needed for diamond crystallization while also avoiding the intense oxidation for the diamonds to survive.

Subduction of a slab containing organic sediments and followed by sintering has also been suggested as a possible process for producing black diamonds (De Carli, 1997). Conventional diamonds from subduction zones, however, are usually found with zircon, garnet, pyroxene, and amphibole which protect the diamonds as the host rocks move to the surface. These minerals have not been observed with black diamonds.

Another proposed mechanism for producing black diamonds is based on radioactive ion implantation which changes carbon into diamond (Ozima and Tatdumoto, 1997). But these radiation-induced diamonds are only a few nanometers in size. A natural occurrence involves a very rare uranium-rich hydrocarbon, carburanium, found in North Karelia, Russia (Daulton and Ozima, 1996). The investigators reported that the implantation process is not very efficient as evidenced by the low nano-diamond concentration of only 30 parts per million.

A last proposal maintains that black diamonds may have an extraterrestrial (ET) origin since other models fail to account for major diamond characteristics. Some black diamond attributes supporting the off-world theory include:

1. The surfaces have patinas that resemble the fusion crust of meteorites, while magnetic carriers are present only at the surface and not in the interior. These features suggest that the diamonds may

have been subjected to the ablation associated with entering the Earth's atmosphere.

2. The nitrogen and carbon isotope distribution is distinctly different where the amounts are significantly lower than other diamonds.
3. The fluorescence is very similar to synthetic diamonds created by chemical vapor deposition which requires a vacuum and plasma temperatures. These conditions do not occur naturally on Earth.
4. The presence of metal and metal-alloy inclusions instead of the usual garnet, pyroxene, olivine, or chromite impurities.

The ET theory suggests that carbonados may have formed in carbon-rich, diamond-bearing stellar bodies or disrupted carbon-bearing planets (Haggerty, 2014). This material was later transported to the Earth as either a large meteorite or possibly during the Late Heavy Bombardment period (3.8-4.2 Ga) where a large number of meteorites collided throughout the inner solar system. The widespread bombardment, however, seems inconsistent with black diamonds being limited to just Brazil and the Central African Republic.

Confirmation of the ET theory is still pending the discovery of black diamonds from a cosmic source, such as an asteroid probed by a spacecraft or a meteorite fall with direct, detailed observations.

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Highlights of the 2022 Tucson Gem and Mineral Show® Exhibits – Part 1 Fluorescent Displays

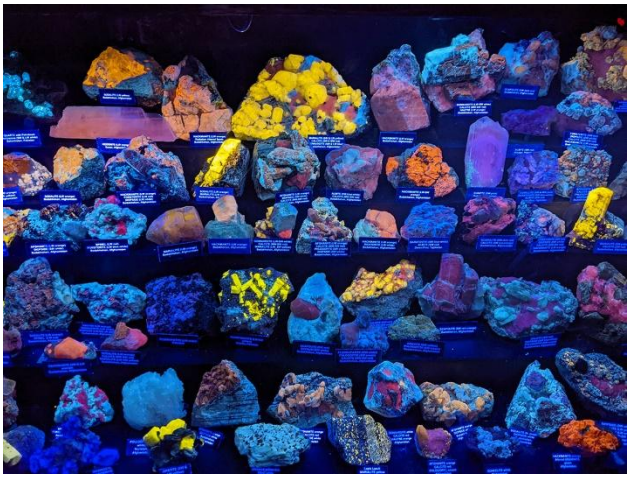
By Harvey Jong

The 67th Annual Tucson Gem and Mineral Show® was held on February 10-13 and billed as "The Show That Glows". Shows from previous years combined exhibits with dealers on the convention center floor, so one wondered if canopies would be used for the fluorescent displays.

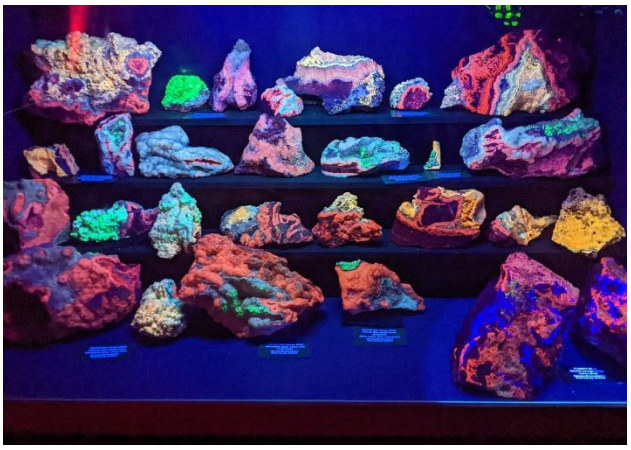
Fluorescent Minerals for the Show Quiz Were Enclosed in a Canopy

To provide a more conducive viewing environment, show organizers, instead, partitioned an area that was dedicated for the cases of glowing minerals. This darkened room was illuminated with only a number of red LED lights placed along the walls. The special pavilion featured 80 displays organized by the Fluorescent Mineral Society. Here are a few highlights.

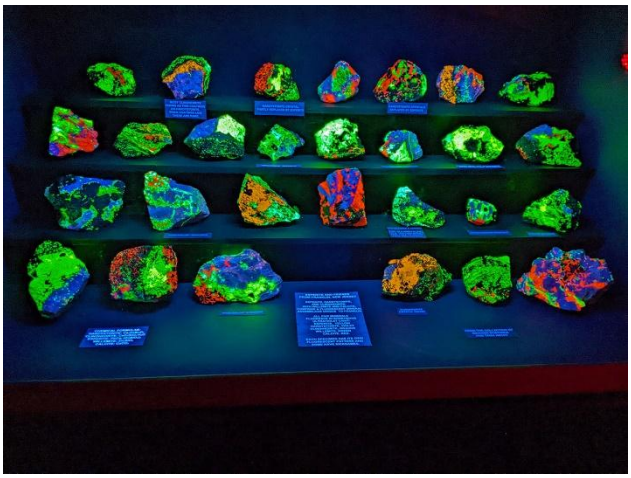
The cases involved a variety of different themes. Some exhibits focused on fluorescent minerals from a particular region.



Fluorescent Minerals Found in Afghanistan
This display included several minerals, such as fluorapatite, hackmanite, marialite, and sodalite, with bright longwave fluorescent responses.



Fluorescent Minerals Found in the Helvetia Mining District, Pima County, Arizona
An interesting assortment of minerals with different combinations of colors, patterns, and shapes was featured in this Southern Arizona case.

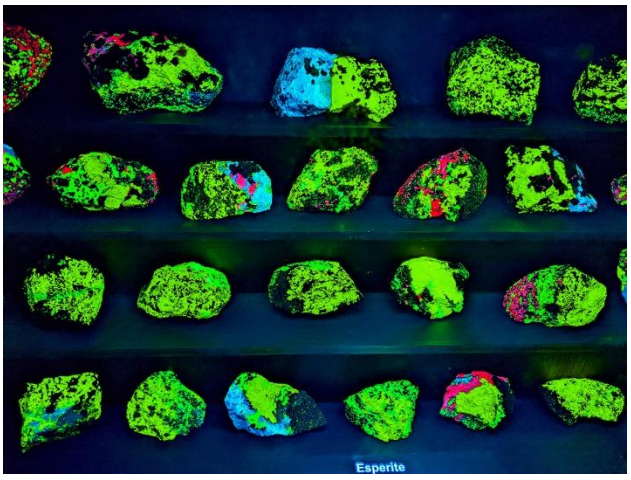


Display of Franklin Minerals
Fluorescent minerals from Franklin and Ogdensburg, New Jersey were well represented throughout the various exhibits.

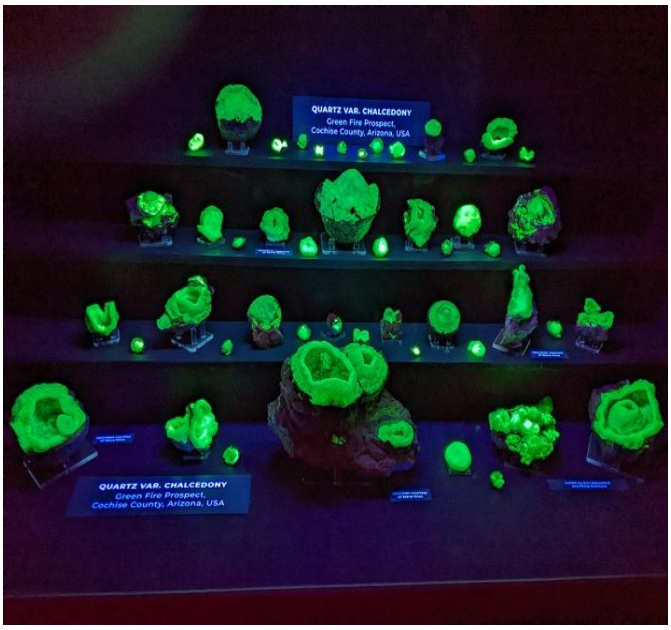
Fluorescent Minerals Found In Sweden
This display included minerals from several famous Swedish locations, such as Garpenberg, Jakobsberg, and Långban.

Other displays concentrated on a specific mineral or on fossils.

Display of Fluorescent Apatite
These apatite specimens from worldwide locations showed interesting zoning patterns under midrange ultraviolet light.



Case Featuring Esperite from Franklin
Esperite's super bright, distinctive yellow-green shortwave fluorescence makes it one of the most sought after minerals from Franklin, New Jersey.



Quartz var. Chalcedony Display
These chalcedony specimens are from the aptly named Green Fire Prospect in Cochise County.

Huge Display of Fluorescent Petrified Wood and Fossils

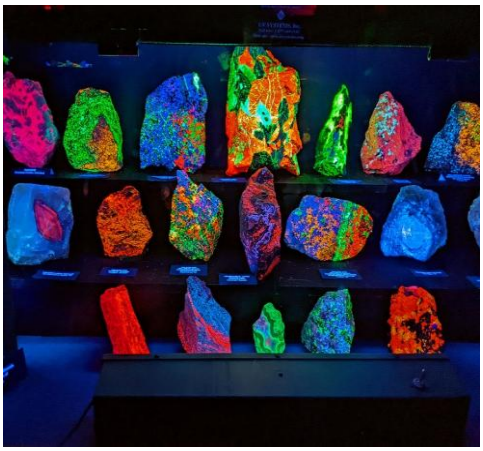
Close-up View of Fluorescent Fossils
This exhibit was packed with a wide variety of fossils which included ammonites, coral, dinosaur bone, and teeth from mastodons and sharks.

Some displays highlighted the range of different fluorescent colors.

Rainbow of Fluorescent Minerals
The "skies" over this rainbow were dark to view the vivid, glowing colors.

A few cases emphasized a particular wavelength of ultraviolet light.

Shortwave UV Minerals
This display featured super bright specimens from Greenland; Franklin, New Jersey; Sweden; and Terlingua, Texas.

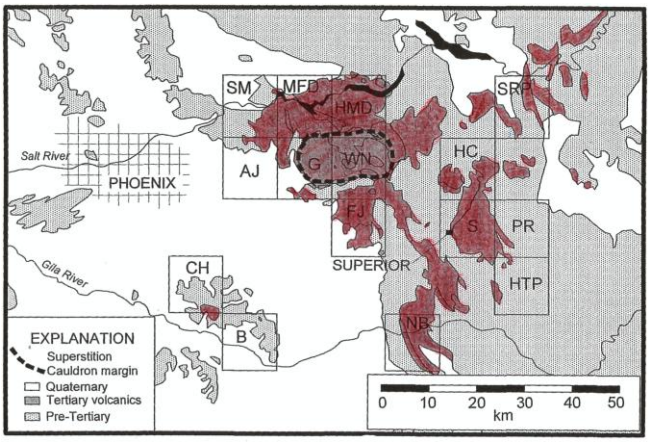


Arizona Rocks 105

Text and photos by Ray Grant

Want to see explosive volcanic rocks and erosion features that are a little closer to Phoenix? The Superstition Mountains have the same geologic history as the Chiricahua Mountains described in last month's Arizona Rocks. The Superstition Caldera (about 20 miles across) is larger than the Turkey Creek Caldera (12 miles across). The volcanic activity in the Superstitions started about 20 million years ago (20 Ma) so is younger than the Chiricahua activity (27 Ma). The major eruption of the caldera was 18.6 Ma and the Apache Leap Formation, a tuff or welded tuff, is the main result of that event. It would not have been good to be in the area at that time as these eruptions are explosive sending hot pyroclastic material over hundreds of square miles. The Superstition volcano was active from about 20 Ma to 15 Ma.

Erosion of the volcanic rocks results in buttes, columns, and pinnacles. Weavers Needle is one of the erosional remnants of a tuff layer and there many others in the Superstitions. You can see the geology from one of the many trails in the area. Lost Dutchman State Park is a good place or the Boyce Thompson Arboretum. The Arboretum has been having geology tours every month so check their website for the next one.



Map showing the Superstition volcanic rocks in red and the location of the caldera. The letters on the map are for quadrangle names. From Arizona Geological Survey Open File Report 98-27 by McIntosh and Ferguson, 1998.

Weavers Needle, a butte formed from eroded tuff layer

Superstition Mountains showing layers of explosive welded tuffs

Erosional formation of the Superstition volcanics at Boyce Thompson Arboretum

Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society meeting

March 16, 2022

www.pinalgeologymuseum.org

Ray Grant raycyn@cox.net.

The Museum will be open four days a week starting on January 6. It will open from Wednesday - Saturdays from 10 am to 3 pm. So more opportunities for people to visit! This will be the plan until we close for the summer.

Masks are required for all visitors and volunteers over five years old. We have taken this step to protect our volunteers so they can safely open the Museum for you. Please provide your own masks. We will have some on hand at the Museum, but cannot guarantee to provide them. If wearing a mask is a problem, please plan your visit for later.

Meteorites and Dinosaurs (Free Event)
Saturday, March 12, 2022 from 10 AM to 3 PM

You will be able to touch samples of meteorites and dinosaur fossils There are great activities for kids: the Traveling Museum of rocks, minerals and fossils with hands on lessons, the egg carton program where you can make your own rock/mineral collection for $1, a treasure hunt, after searching the Museum to answer questions kids get a treasure bag, and a fossil dig where every kid can find and take home a small fossil collection.

Information at website - pinalgeologymuseum.com

Pinal Geology and Mineral Museum
Artisan Village of Coolidge
351 N. Arizona Boulevard
Coolidge, Arizona

Parent/Teacher Resource Pages

HTTPS://WWW.EARTHSCIWEEK.ORG/NEWSLETTER

EARTH SCIENCE WEEK UPDATE

February 2022

DIG INTO ENVIRONMENTAL EDUCATION DURING EE WEEK

Few topics are more relevant to the Earth Science Week 2022 theme "Earth Science for a Sustainable World" than the environment. National Environmental Education Week (EE Week) provides science teachers and students with lesson plans, facts, quizzes, and other resources online.

"Instead of packing all of our educational resources and events into a handful of days in late April, we have decided to expand our EE offerings throughout the year," the National Environmental Education Foundation, which organizes EE Week, says on the program website. "We hope you are as excited as we are to begin this new era of year-round environmental education."

EE Week inspires environmental learning among K-12 students and connects educators with environmental resources. Register, find resources, and learn more online.

BOOST ENVIRONMENTAL, ENGINEERING GEOLOGY WITH AEG

The Association of Environmental and Engineering Geologists (AEG), an AGI member society, not only provides leadership, advocacy, and applied research in environmental and engineering geology, but also encourages educators to join and make use of its abundant resources.

Resources for members include technical publications, section and chapter meetings, and special educator sessions at the annual meeting. Opportunities for professional geologists to speak to classes are also available to members, as well as resume writing workshops and scholarships for students. To find out more about what AEG has to offer or become a member, visit AEG.

AMS TEACHER WORKSHOPS TAKING PLACE THIS SUMMER

The American Meteorological Society (AMS) is offering two hybrid (online & in-person) teacher professional development workshops this summer: Project Atmosphere and Project Ocean (formerly The Maury Project).

Project Atmosphere (July 24-29, 2022) is designed for K-12 teachers who teach science courses with atmospheric content. Participants will be required to engage online learning modules prior to the on-site portion of the course at the National Weather Service Training Center in Kansas City, Missouri.

Project Ocean (July 17-23, 2021) is designed for precollege teachers who teach science courses with oceanography content. Participants will be required to engage online learning modules prior to the on-site portion of the course at Washington College in Chestertown, Maryland.

At the conclusion of the on-site portion, participants are asked to complete work in the course management system in collaboration with California University of Pennsylvania. The application deadline for both workshops is March 25, 2022.

PROMOTE GROUNDWATER AWARENESS WITH NGWA

National Groundwater Awareness Week (March 6-12, 2022) will shed light on one of the world's most important resources: groundwater. Groundwater is essential to the health and wellbeing of humanity and the environment, according to the National Groundwater Association, an Earth Science Week partner.

Learn more about National Groundwater Awareness Week 2022 online, and visit Groundwater Fundamentals to learn more about the importance of groundwater.

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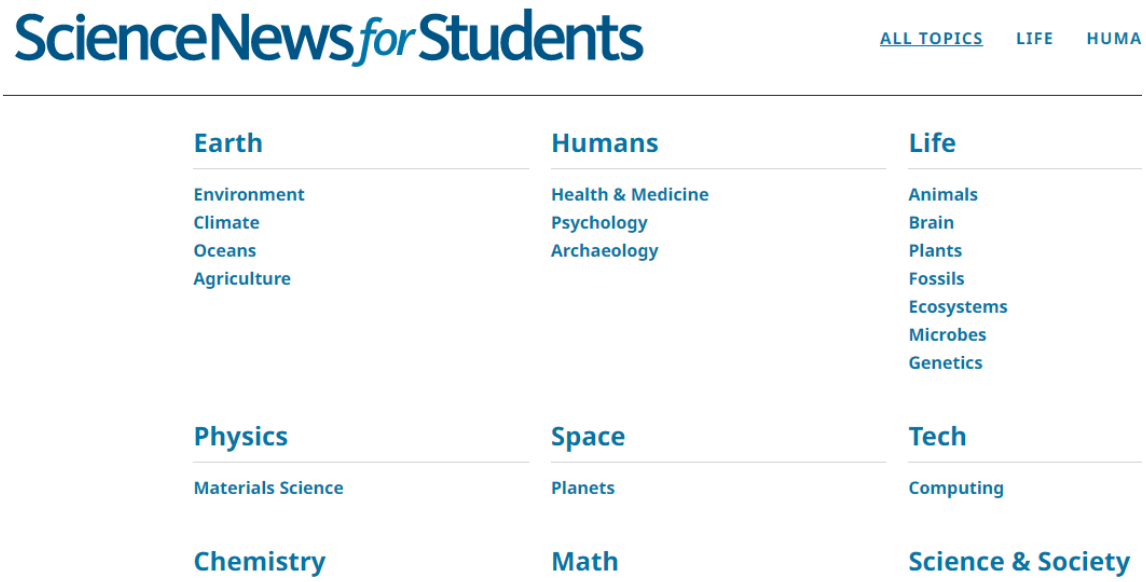
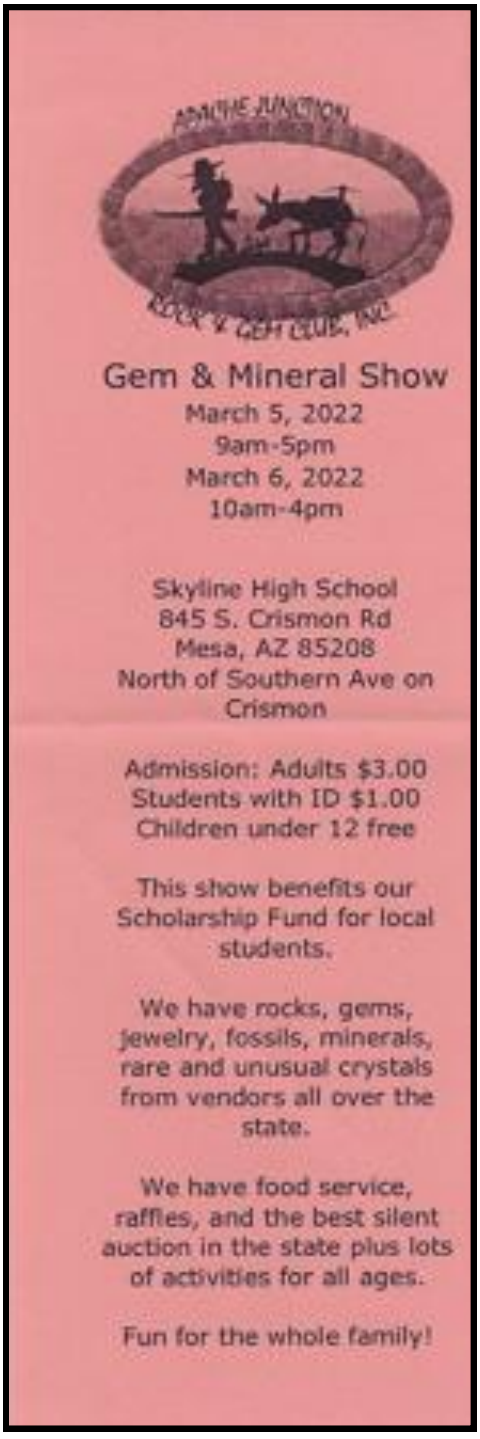
https://www.sciencenewsforstudents.org/





Pinal Gem and Mineral Show with Meteorites and Dinosaurs Saturday, March 12, 2022 from 10 AM to 3 PM

You will be able to touch meteorites and dinosaur fossils. There will be dealers set up selling minerals, meteorites, fossils, and lapidary material. Admission to the Event and Museum is free.

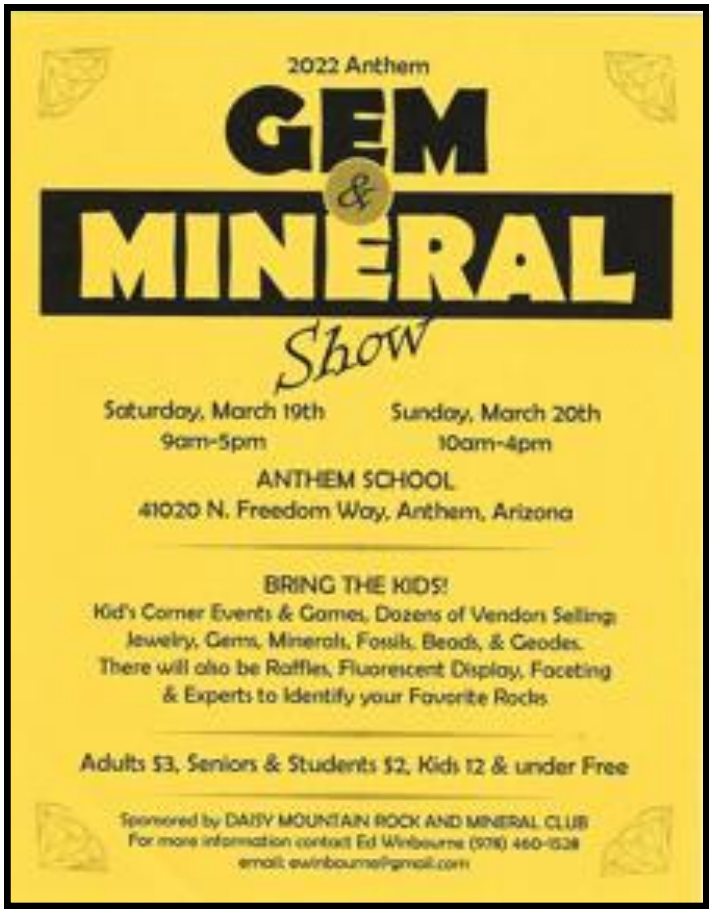
A lot of great activities for kids, a fossil dig where every kid can find and take home a small fossil collection, every kid will get a small dinosaur to take home, and many other activities.

The Pinal Geology and Mineral Museum

351 N. Arizona Boulevard
Coolidge, Arizona
next to the Coolidge
Chamber of Commerce

For information check our website
www.pinalgeologymuseum.org

Dealers contact Ray Grant for a space at
raycyn@cox.net



White Mountain Gem and Mineral Annual Show

July 9-10, 2022

Sat. 9-5, Sun. 10-

Adults $2.00

Juniors 18 and under with Student ID
Free when accompanied by an adult

Elks Lodge

805 E. Whipple Street

Show Low, Arizona

www.whitemountain-azrockclub.com

Mohave County Gemstoners
Annual Gem and Mineral Show

May 7-8, 2022

Sat. 9-5, Sun. 9-4

Kingman Academy of Learning
3420 N. Burbank St. 86409
Kingman, AZ
Free Admission
Plenty of Parking

Pinal Gem and Mineral Show

Saturday, March 12, 2022
10 AM to 3 PM

Pinal Geology and Mineral Museum
351 N. Arizona Boulevard
Coolidge, Arizona

Laurie Manifold has painted a new beautiful and exciting mural by the entrance to the Museum.

ALL ARIZONA CLUB MEETINGS MAY BE CANCELED DUE TO HEALTH CONCERNS!

Apache Junction Rock & Gem Club
Meetings are on the 2nd Thursday
Next Meeting: March 10, 2022, 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 1, 2022, 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: March 7, 2022, 7:00 pm
www.maricopalapidarysociety.com
@ North Mountain Visitor Center
12950 N. 7th St., Phoenix

Mineralogical Society of Arizona
Meetings are on the 3rd Thursday
Next Meeting: March 17, 2022, 7:30 pm
Please go to their website for more info
www.msaaz.org
@ Franciscan Renewal Center
Room: Padre Serra
5802 E. Lincoln Dr., Scottsdale

Pinal Geology & Mineral Society
Meetings are on the 3rd Wednesday
Next Meeting: March 16, 2022, 7:00 pm
On YouTube until further notice
www.pinalgeologymuseum.org
@ Artisan Village
351 N. Arizona Blvd., Coolidge

West Valley Rock & Mineral Club
Meetings are on the 2nd Tuesday
Next Meeting: March 8, 2022, 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: March 3, 2022, 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: March 11, 2022, 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 2022, at 6:30 p.m.

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www.flaggmineralfoundation.org

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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
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Visit us at:

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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.

NOTICE:
ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7th St, Phoenix, on Tuesday, TBA 2022, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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