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

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ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

Guest article by Tony Occhiuzzi
Photos by Diana Occhiuzzi

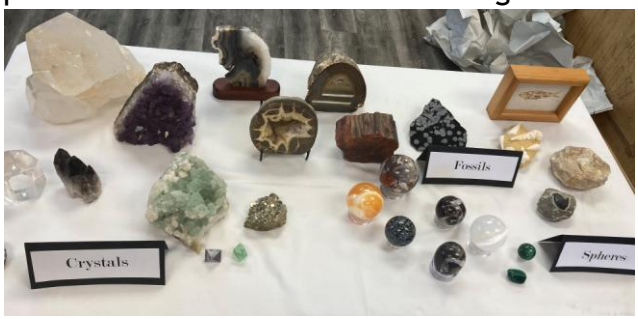
On June 29th, the preschoolers, kindergarten and first graders at Goddard School in Chandler, AZ, received a visit from Tony Occhiuzzi for two science lessons. Tony's first lesson was called "Sizes and Shapes". Using different household containers, common products the children's parents' use at home, Tony taught the students about pints, quarts, half gallons and gallons. Then to prepare the children for the next part on chemistry, Tony gave a brief lesson on solids, liquids, and gases.

Tony's Chemistry Demo's are called "Is It Science or Is It Magic?" Using a tea pot for "Aladdin's Lamp", Tony made "The Genie" "appear" in a foot tall cloud of oxygen gas.

Next he made "Elephant's Toothpaste" by mixing three chemicals to produce a nice tall column of soapy foam for the class to see.

Then, using household products like vinegar and ammonia in his last demo called "A Shot of Red Eye", which always produces a surprised look on the children's faces, when clear water changes into a strawberry color and then back to clear again.

On July 13th, the students at Goddard School were presented with another Science Day called Rocks, Minerals, and Fossils. Tony brought large specimens of same and definitions were provided for student understanding.



Then each student opened their own beautifully boxed samples of azurite, chalcopyrite, glauberite, obsidian, pyrite, quartz, plus petrified wood, coral, sharks teeth, and a trilobite. All samples were inside a white-labeled box for students to see, feel and touch. Kelli Wakefield and Catie Carter-Sandoval provided the six rocks and four fossil samples, white boxes were provided by Erin Hinds and Diana Occhiuzzi brought coloring pages for the 20 students.

The classroom teacher Ms. Maddi and the Director at Goddard School Mr. Todd Goldberg said the students were very thankful for the rock, mineral, and fossil samples and they were looking forward to the Flagg Gem and Mineral Show at Mesa Community College in January 2023.

Agate Deposits of the Fourth of July Butte

By Harvey Jong

Recent Fourth of July celebrations inspired this article which explores the area around the Fourth of July Butte. The butte is located in Maricopa County near Arlington and is named for its proximity to a wash by the same name. According to Barnes and Granger, 1960, a group in the 1890s went on a camping trip to the wash and had a memorable party on the Fourth of July. A member suggested naming the location for the holiday.

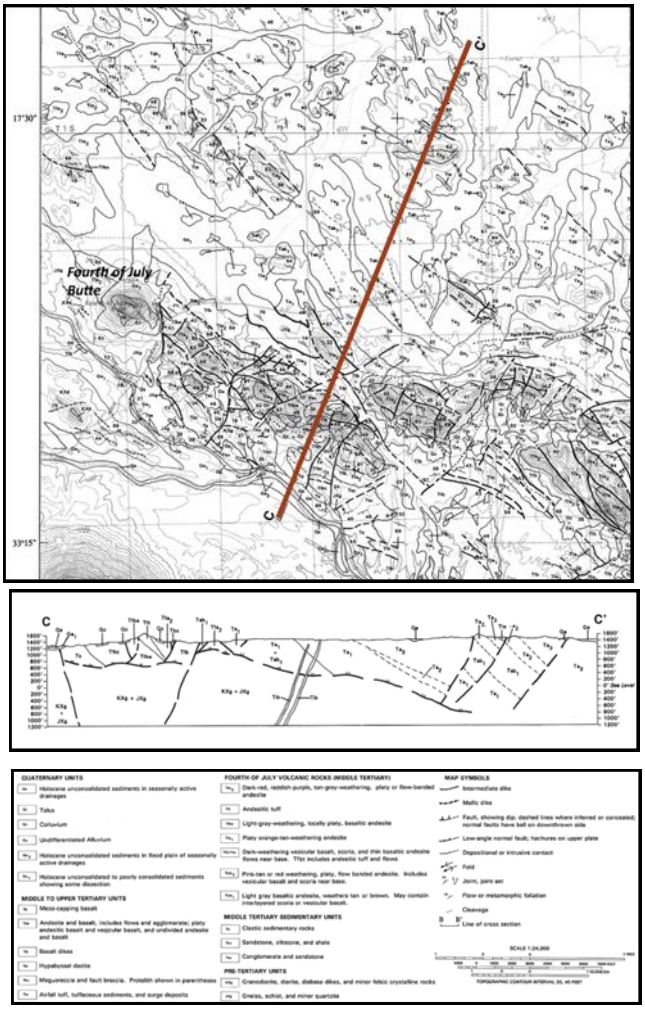
Google Earth View of the Fourth of July Butte Area

Geologic Setting

The butte has an elevation of 496 m (1,626 ft.) and is part of the Gila Bend Mountains which consists of a northwest-trending belt of low hills. The area is dissected by many washes that drain into the Gila River or Centennial Wash.

The Gila Bend Mountains consist of a metamorphic-plutonic base overlain by middle Tertiary sedimentary and volcanic rocks. The oldest rocks include gneiss, schist, and minor amounts of quartzite that date from the Proterozoic to possibly the Jurassic. Around the Late Cretaceous, these rocks were intruded by granite, pegmatite, and diabase dikes and were later overlain by a thick sequence of sedimentary rocks. This sequence includes conglomerate, arkosic sandstone, siltstone, and shale. Volcanic activity followed the deposition of the sedimentary rocks and produced mafic flows, tuff, and some pyroclastic material. The mafic flows may be divided into four sequences based on composition, distribution, and relative age. The oldest sequence involved andesite flows and tuff that formed the Fourth of July Butte (Scott, 1991).

The volcanism was accompanied and followed by faulting that cut and tilted the Tertiary and underlying rocks. The numerous northwest-trending faults set the stage for mineralization and agate formation.



Geologic Map and Cross Section of the Fourth of July Butte Area

Map excerpt from Scott (1991).
A full, detailed map can viewed at http://repository.azgs.az.gov/sites/default/files/dlio/files/nid905/ofr-91-07_gilabendmtns.pdf

Alteration and Mineralization

As a result of alkaline, saline waters circulating throughout the region, most of the volcanic rocks were altered in which their overall potassium content was enriched. Iron-bearing minerals were oxidized, while plagioclase was replaced with calcite, clay minerals, and sericite.

Hydrothermal alteration occurred in the Tertiary sedimentary and underlying rocks where mineralization formed along faults. Mineral deposits typically consist of quartz and calcite veins.

According to mindat.org, the minerals found at the Fourth of July Butte include only gold and quartz.

Agate Formation

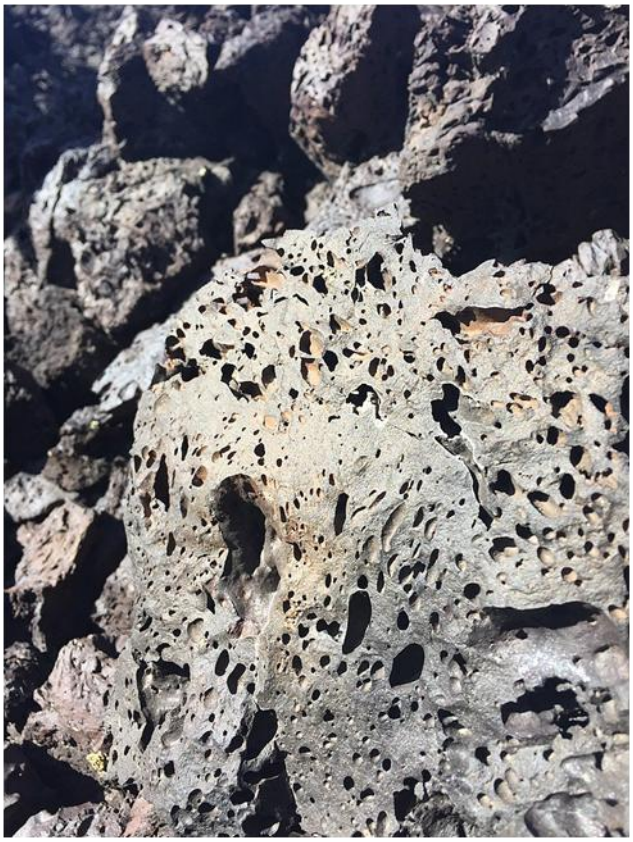
Agates may be regarded simply as translucent banded chalcedony intergrown with other minerals or silica phases. Their formation, however, involves complex processes and often multiple steps. They may occur in all rock types; develop in a variety of environments; and exhibit a multitude of different colors, patterns, and shapes.

Several hypotheses have been proposed on how agates form; however, none fully account for the diverse properties of agates. Various explanations are reviewed in Moxon and Palyanova, 2020 which points out the unknowns and inconsistencies that must be addressed. The inability to create a synthetic agate represents a major obstacle in validating these hypotheses.

Agates seem to form most frequently in volcanic rocks. Since the geology of the Fourth of July Butte involves volcanic activity, we will focus on the origin and characteristics of volcanic agates. Specifically, the sequence of macroscopic and microscopic events that may be involved in forming a fortification agate (the most common type of volcanic agate with angular banding patterns that resemble a medieval fortress) will be examined.

Macroscopic Events

The starting point for volcanic agates involves high viscosity lava flows with gaseous bubbles. The vesicles or amygdales (almond-shaped bubbles) provide the space which is later filled with silica.



Vesicles in Basaltic Lava
Tiffany A. Rivera photo – CC_BY_SA-4.0, via Wikimedia Commons

Supplying the cavities with silica-rich fluids represents the next key step, and different sourcing mechanisms have been proposed. One group of hypotheses involves secondary

deposits and maintains that this material arrived after the lava flows were in place. The vesicles were either empty or contained some precursor amorphous silica. The bulk of the formative silica along with coloring mineral impurities was produced by either weathering the surrounding host rock, direct contributions from hydrothermal solutions, or interactions with hydrothermal solutions and host rock that released silica.

Other hypotheses treat the silica and impurities as primary constituents that were already present in the lava. One proposed scenario involves magma surrounding globs of silica. Due to density differences (silica 2.3 g/cm^3, basaltic magma 2.6 g/cm^3 or andesitic magma 2.4 g/cm^3), this silica would come together and rise up to form agate nodules. These nodules would be held in place in the volcanic host rock as the lava cooled. This formation model, however, has a major inconsistency with the higher melting point of silica (1600 °C) vs basaltic magma (1100 °C) or andesitic magma (900 °C).

With secondary deposits, the next step in agate formation involves filling the vesicles with silica. Many hypotheses have been proposed about how silica is transported into cavities and transformed into banded structures. Initial proposals were generally based on observations of agate features and thick sections. An unusual feature in some, but not all, agates is an "infiltration" channel. Some investigators surmised that this channel may be a point of input for silica solutions, while others suggested that it is involved with the outflow of water from the agate.

Agate with an Infiltration Channel
Dirillo photo – CC_BY_SA-4.0, via Wikimedia Commons
San Rafael, Argentina

Later hypotheses involved experimental investigations, and one noteworthy study was conducted by Raphael Liesegang (1869-1947), a German chemist and photographer. Liesegang was able to synthesize various agate-like patterns by diffusing metal ions in silica gels.

Agate-like Banding Patterns with Silver and Chromate Ions
Photo from Liesegang (1915) – Not in Copyright, via archive.org

He published findings in his 1915 book, Die Achate, which had a major impact on the discussion of agate formation. However, since silica gel cannot diffuse through host rock, pores and cracks are needed, but not

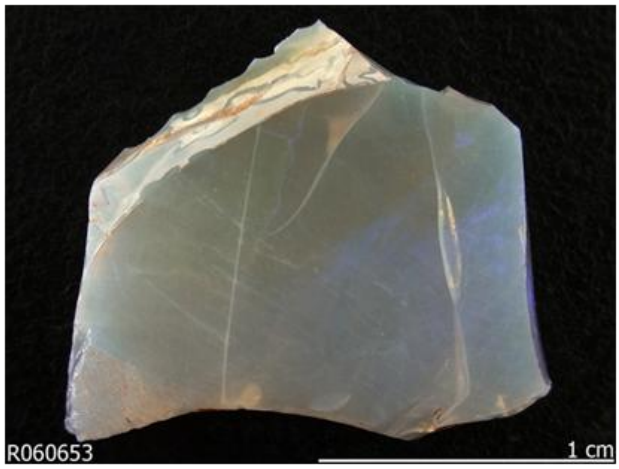
all vesicles may have these features. In addition, silica gel is prone to dehydration and may turn into silica powder.

Two different silica transport processes were described by Walger et al., 2009. These processes generate and maintain a silica concentration gradient from the agate's wall lining to its center. The very first silica layer along the wall lining has a special role in directing silica down the gradient by diffusion. This is called the direct process. If this initial layer, however, is disturbed by a fissure, an infiltration channel may form, and silica solution is carried into the cavity by a capillary injection process. Each silica layer involves a settling or relaxation time to reach an equilibrium state. This combined with the repeated start/stop process of filling a cavity leads to "rhythmic" agate banding patterns.

Microscopic Events

Silica concentration plays a key role in the crystallization of an agate. Silica denotes a substance with the chemical formula, SiO_2, and occasionally some water. It may assume different states or phases, and below is a sequence of phase transformations that may occur in agates:

- Silicic acid (H_4SiO_4) from weathering diffuses into host rock.
- Amorphous silica (Opal-A) forms as the silicic acid accumulates and produces a supersaturated silica solution. Silica particles condense and combine into chains and three-dimensional networks to create a gel.



Amorphous Fragment of Opal-A
RRUFF project specimen and photo
Brazil

- Opal-CT/cristobalite represents a metastable, intermediate stage with fine intergrown layers of cristobalite, tridymite, and opal-A. Note that cristobalite consists of silica tetrahedra packed in a three-layer structure, while tridymite involves a two-layer structure. Both phases become stable only at high temperature (tridymite >870 °C, cristobalite >1470 °C).

- Mogánite represents a transition to a more crystalline state from the preceding amorphous phases. It is a recently discovered monoclinic form of silica that was approved as a new mineral in 1999.

Mogánite
Joaquim Callen photo of Miguel Calvo specimen –CC_BY_SA-4.0, via Wikimedia Commons
Barranco del Medio Almud, Mogán (Gran Canaria), Spain
Height 5 cm

- Chalcedony, the common and dominant form of silica in agates, is a mixture of mogánite and α-quartz. It starts with spherulitic growth and continues into fibers with diameters of 0.1-1 μm and lengths up to several mm (Göetz et al., 2020).
- α-quartz is the familiar trigonal form of silica and may occur as macrocrystalline layers, particularly at the center of an agate, if the silica concentration is low.

Note that progression through this sequence involves the following changes:

- Decreasing silica concentration
- Increasing crystallinity
- Decreasing water content (may vary from 12% to 0%)
- Increasing density (may vary from 1.9 g/cm^3 to 2.65 g/cm^3). This leads to shrinkage in volume and creates space for additional silica solution.

The crystallization process may be initiated by environmental changes, such as temperature or pH, or reactions to certain compounds (e.g. iron or aluminum hydroxide).

Collecting History

Having explored how agates form, we will now focus on a brief history of agate collecting at the Fourth of July Butte. The site has been a long-standing rockhounding destination for lapidary and mineral clubs.

One early reference on collecting activity appeared in the March 1941 issue of *Rocks and Minerals* magazine in which A. L. Flagg (1883-1961), president of Mineralogical Society of Arizona, commented in the Club and Society Notes section:

"Field trips have been made to some of Arizona's little known agate fields. On the 5th, the Dixie and Fourth of July Butte fields were visited by a large group which included several visiting mineralogists who were spending the winter in the Valley of the Sun."

The site's popularity grew as it was included in many rockhound guidebooks. In the first edition of *Arizona Gem Fields* (1956), Alton Duke (1910-1982) provided the following description of some agate finds:

"We picked up many small, white thunder eggs, averaging the size of a thimble... There is blue and white vein agate and red moss agate. We have worked the red moss agate and found it to be excellent."

And he concluded:

"The potential of this area has hardly been touched and we believe it will last a long time... This is an excellent field and one you will want to visit time and again."

The Fourth of July Butte (Peak) was featured in the first edition of the *Gem Trails of Arizona* (1964). Author Bessie Simpson (1903-1986) mentioned two collecting sites – site "B" near the butte and site "A", 6.5 miles east of the butte. Site "A" was called the Chimney Beds due to its location near the ruins of an old chimney. She described collecting experiences in the following way:

"The agate is obtained by simply walking in any direction and keeping an eye out for the telltale little white stones. Most have a white opaque exterior and can be found in the flatlands, as well as in washes or other areas of erosion. Interiors tend to be light gray, with very delicate, fine, concentric white bands. One can also procure red, blue, and gray moss agate, but it isn't plentiful and takes some patient searching to find."

The location continued to be listed in later editions of these books as well as more recent publications such as *The Rockhound's Guide to Arizona* (1992). The site, however, was dropped after a series of lode claims were filed restricting public collecting.

Although the ownership has changed a few times, the status of these claims still seems to be active.

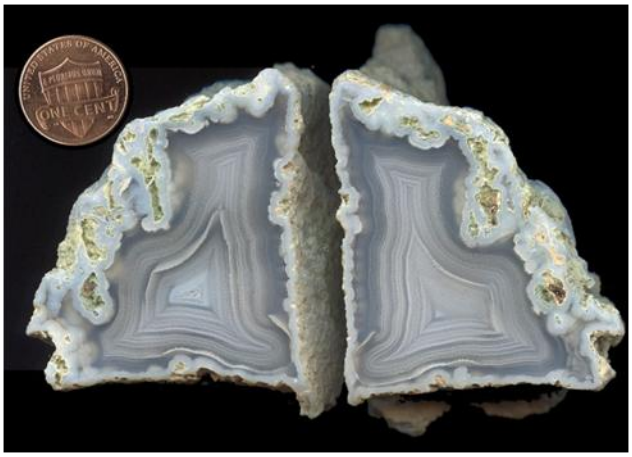
Some Common Agate Nodules

As mentioned earlier, Fourth of July Butte agates have a fortification type pattern with very dense banding. Some nodules may have bands with a speckled texture that creates a visual effect that has been described as "snowflakes". Viewing these bands under magnification reveals minute particles that have apparently precipitated near or onto these layers.

Close-up of Agate Bands
Harvey Jong specimen and photo
Chimney Beds
Field of view: 15 mm
This image shows some incredibly dense concentric bands in which bands are actually comprised of two or more separate layers. Tiny silica particles that cover these layers disperse light creating a sparkling "snowflake" effect.

Typical colors may vary from light gray to white as shown in the following photos:

Agate Nodule Extracted From Basalt Bedrock
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)



Gray-colored Agate
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)

Agate Collected from the Foot of the Fourth of July Peak
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)

Agate Nodule with Micro- and Macro-crystalline Banding
Stan Celestian specimen and photo - ©2005 via https://www.flickr.com/photos/usageology/50760582107/in/album-72157677965889184/ https://www.flickr.com/photos/usageology/50760581682/in/album-72157677965889184/ (reproduced with permission)
Chimney Beds
The nodule is avocado-shaped, 3.5 in. long, and 2.5 in. diameter.

Some Less Common Agate Nodules

Agates with different colors, inclusions, or interesting visual effects have been collected at the Fourth of July Butte area, but are less common. These nodules will be presented in alphabetical order starting with plume agates.

Plume Agates

Plume agates from the Fourth of July Butte have inclusions with a feathery or fluffy, cloud-like appearance that complement the typical gray and white bands. These inclusions may have a reddish color that may be due to iron oxide impurities; a greenish hue with chlorite coatings; or a black coloration which may be from manganese oxide.

Agate with Reddish-Purple Plumes and Black Calcite Crystals
Jeffrey Anderson specimen and photo - ©2005-2013, via

http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)

Agate with Chlorite Coated Plumes
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)

http://agateswithinclusions.com/wp-content/uploads/plume-ED-copy-9-797x1024.jpg

Agate with Black Plumes
Pat McMahan specimen and photo - ©2005-2016 Agates with Inclusions, via http://agateswithinclusions.com/arizona/
Chimney Beds
6 cm

Pseudomorphs

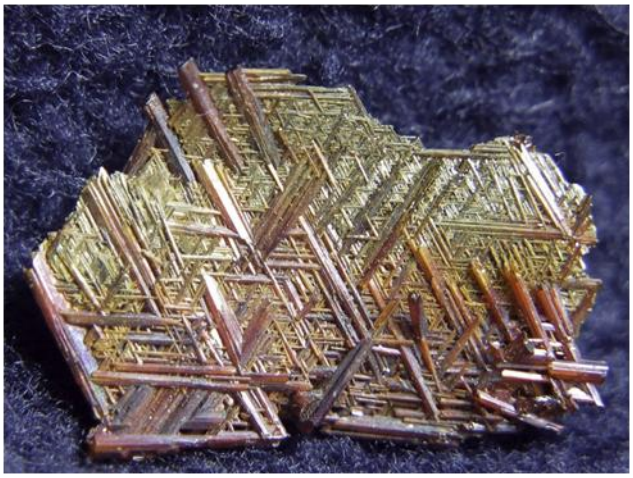
The replacement of pre-existing minerals in a cavity with chalcedony may occur in some agate nodules. Agates with pseudomorphs of calcite and other carbonate minerals have been found at the Fourth of July Butte.

Ivory-colored Agate with Pseudomorph After Calcite
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)
The pseudomorphs appear near the bottom of this heart-shaped agate.

Agate with Pseudomorphs
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)
Unspecified pseudomorphs (perhaps after aragonite?) appear throughout this agate.

Sagenite or Sagenitic Agates

Sagenite or sagenitic agate refers to an agate with acicular or needle-like inclusions. While describing agates with the term "sagenite" is common and accepted, it represents a use/misuse beyond the original name which is associated with a variety of rutile with a mesh-like network of twinned crystals. Sagenite is derived from the Greek and Latin word *sagena* for "net".



Sagenite - A Variety of Rutile
Lech Darski photo – PD, via Wikimedia Commons
Dolina Shigar, Skardu, Pakistan

Sagenitic agate occurs at the Fourth of July Butte, but appears to be limited like many other agate deposits. An early reported occurrence was made by Geo. G. McKhann, the Secretary-Treasurer of the Mineralogical Society of Arizona, in the May 1941 issue of *Rocks and Minerals* magazine:

"On March 23rd, a field trip was made to the Dixie Mine – Fourth of July Butte geode areas. Some very good specimens of clam shell geodes and sagenitic agate geodes were found."

Unfortunately, no further details were provided.

An example of a sagenitic agate with a prominent cluster of inclusions can be viewed via the following web link. The agate banding pattern flowed around these crystals.

http://agateswithinclusions.com/wp-content/uploads/sagenite7-ED-copy.jpg

Sagenitic Agate

Pat McMahan specimen and photo - ©2005-2016 Agates with Inclusions, via http://agateswithinclusions.com/arizona/
Fourth of July Butte
4.4 cm

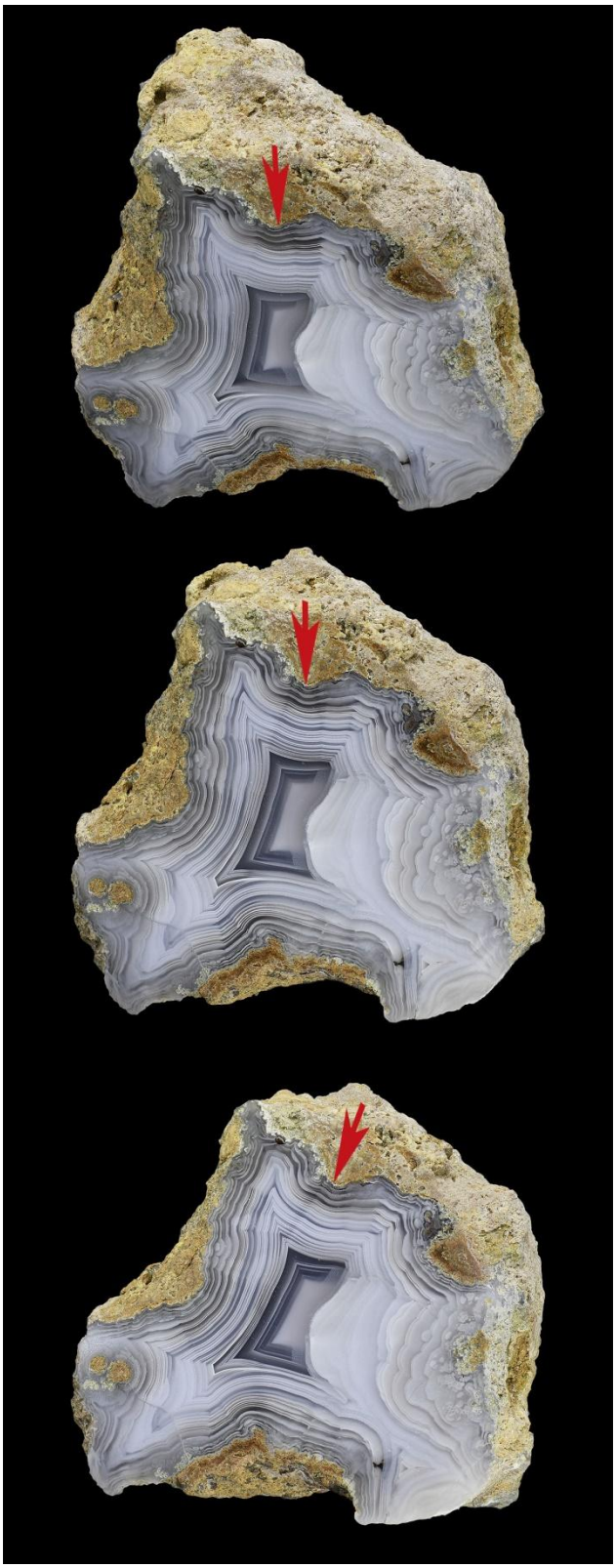
Shadow or Parallax Agates

Shadow or parallax agates display a shifting optical effect involving closely spaced, alternating opaque and transparent bands. Light entering the agate may cast a shadow from one opaque band onto the next opaque band. Changing the angle of the parallel bands relative to the light source casts longer shadows and creates an appearance of movement and increased depth. Dark lines are perceived to move across the agate until the shadows on the bands are no longer visible. Rotating an agate back and forth produces a "winking" effect.

The dense concentric bands of Fourth of July Butte agates provide an ideal situation for shadow/parallax effects. Some striking shadow lines can result with the proper spacing between bands and orientation to a bright light.

Agate Displaying the Shadow Effect
Jeffrey Anderson specimen and photo - ©2005-2013, via http://www.sailorenergy.net/Agates/AgatesArizonaJuly4th01.html (reproduced with permission)

The shadow/parallax effect can be seen as the slightly darker, radiating lines toward the corners of curved banding segments.



Shadow Effect Sequence
Harvey Jong specimen and photos
Chimney Beds
6.8 x 6.5 x 5 cm
This set of photos shows the shadow effect move as the viewing angle is changed.

References

Barnes, W.C., updated by B.H. Granger (1960) Arizona Place Names. University of Arizona Press, Tucson: 519 p.

Blair, G. (1992) The rockhound's guide to Arizona. Falcon Press, Helena, Montana: 165 p.

Duke, A. (1956) Arizona gem fields. Southwest Printers, Yuma, Arizona: 132 p.

Flagg, A.L. (1941) Club and society notes. *Rocks and Minerals* 16(3): p 97.

Götze, J., R. Möckel, and P. Yuanming (2020) Mineralogy, geochemistry and genesis of agate – a review. *Minerals* 10: article 1037.

Liesegang, R.E. (1915) Die achate. Dresden Leipzig Verlag von Theodor Steinkopff: 118 p.

McKhann, G.G. (1941) Club and society notes. *Rocks and Minerals* 16(5): p. 176.

Moxon T. and G. Palyanova (2020) Agate genesis: a continuing enigma. *Minerals* 10: article 953.

Scott, E.A. (1991) Geologic map of the central Gila Bend mountains, west-central Arizona. *Arizona Geological Survey* Open-File Report 91-7: 11 p.

Simpson, B.W. (1964) Gem trails of Arizona. Gem Trails Publishing Company, Grandbury, Texas: 88 p.

Walger, E., G. Mattheß, V. von Seckendorff, and F. Liebau (2009) The formation of agate structures: models for silica transport, agate layer accretion, and for flow patterns and flow regimes in infiltration channels. *Neues Jahrbuch für Mineralogie - Abhandlungen* 186(2): 113-152.

AZ Mining, Mineral & Natural Resources Education Museum Update July 2022

https://ammnre.arizona.edu/

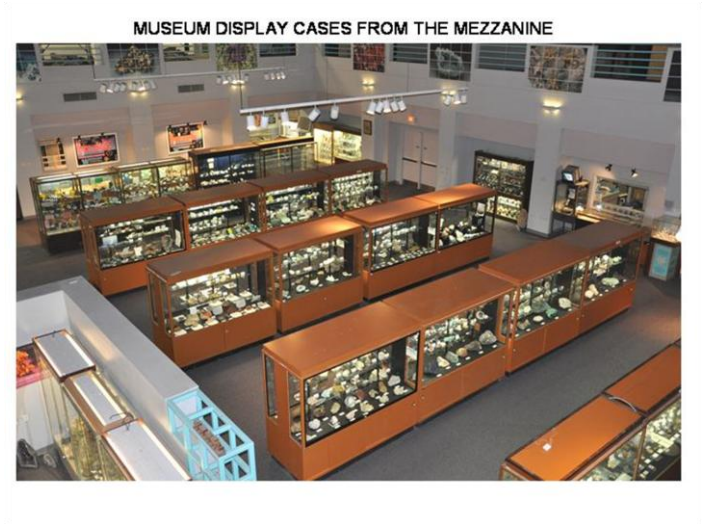
Catie Carter Sandoval
cscarter@email.arizona.edu
703.577.6449

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

Unfortunately I don't have a good update for the ESM newsletter this month. UA administration is starting to put together a strategy for renovations so no major updates yet – although I will definitely share when we get them. I should have an update for Augusts' newsletter.

A TRIP DOWN MEMORY LANE

In the meantime, please enjoy these photos from the AZ Mining and Mineral Museum before it closed in 2011.



The Main Gallery

The kid's corner

The Copper Gallery

The Banquet of Rocks

Arizona Rocks 110

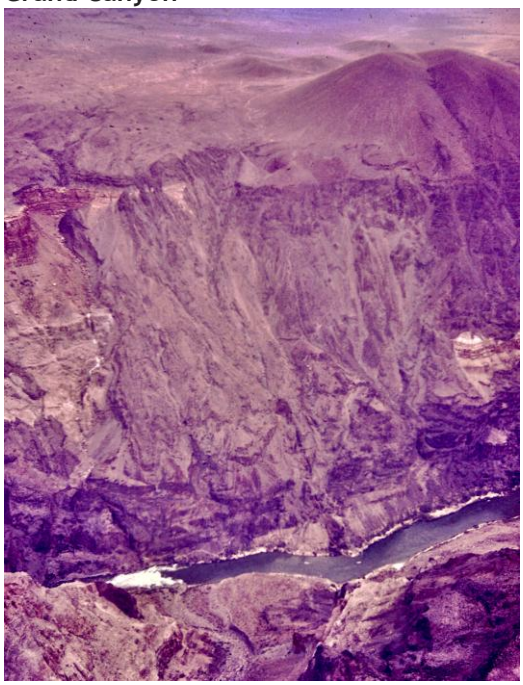
Text and photos by Ray Grant

Lake Mead and Lake Powell are making the news as they drop to historical low levels. They are not the first lakes in the Grand Canyon. Between 1.5 million years ago and 10,000 years ago there were at least 12 dams with lakes in the Grand Canyon. These lakes were formed by volcanic activity when lava flowed into the canyon about 90 miles downstream from Phantom Ranch and dammed up the river. Twelve dams that formed during this time are described by W. K. Hamblin in a chapter in Beus, S.S. and Morales, M., 2003. Grand Canyon Geology Oxford University Press, USA.

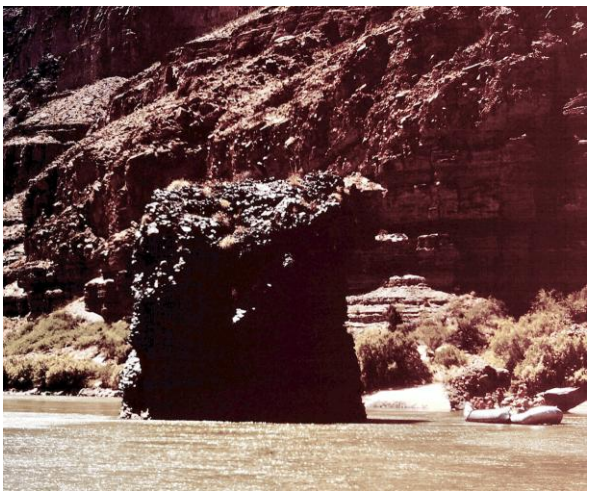
These lava dams would have been something to see. The largest was almost 2000 feet high, that is almost three times higher than Hoover Dam or Glen Canyon Dam, and it had a 200-mile-long lake that reached all the way to southern Utah. The evidence for these lakes is the remnants of the dams along the Colorado River and some of the lake deposits that are still present high above the river today. Using present day data for sediment carried by the river, the largest dam would have filled with sediment in a few hundred years and the river would have eroded down to its original level.

The best place to see this volcanic activity is at Toroweap Overlook on the north rim in the Grand Canyon National Park. There is a primitive campground a mile from the overlook, and it is a great place to visit. You need four-wheel drive and permits to visit, so check the park website if you are interested.

One of the basalt lava flows from the north rim into the Grand Canyon



Vulcan's Throne a cinder cone on the north rim and the lava flows into the canyon



Vulcan's Forge a mass of basalt in the Colorado River

Pinal Museum and Society News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Geology and Mineral Society meeting

September 21, 2022

www.pinalgeologymuseum.org

Ray Grant raycyn@cox.net.

The Pinal Geology & Mineral Museum will be open from 10 to 3 on Friday for July, and August.

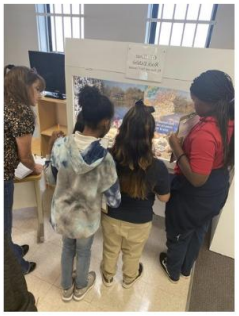
Masks are now optional at the Museum. Please bring your own mask if you wish to wear one. We will have some masks on hand at the Museum, but cannot guarantee to provide them.

In July, Museum volunteers Bob Hole and Christine New set up a table at the Coolidge School District Welcome Back Days for the new school year. There were samples of rocks, minerals, and fossils for the teachers to see. Flyers for the Museum were given out and for interested teachers a special flyer about possible field trips.

Pinal Geology Museum

351 N Arizona Blvd, Coolidge, AZ 85128 – pinalgeologymuseum.org
info@pinalgeologymuseum.org - 520-723-3009

Opened in 2016, the Pinal Geology and Mineral Museum is open 11-4 Wed-Sat September-May, and Fridays 10-3 during the summer. We have displays of minerals, rocks, and fossils from around the world with a focus on Pinal County, AZ. Admission is always free.



EDUCATOR RESOURCES AT NO COST

Field Trips,
Classroom Visits
Teacher Boxes,
Online Resources
and More

Parent/Teacher Resource Page

HTTPS://WWW.EARTHSCIWEEK.ORG/NEWSLETTER

EARTH SCIENCE WEEK UPDATE
July 2022

MINERALS DAY RETURNS ON MONDAY, OCTOBER 10

Since 2020, the Mineralogical Society of America (MSA) and AGI have been leading the celebration of Minerals Day, and this celebration of minerals is returning on Monday, October 10, during Earth Science Week 2022. Minerals Day raises awareness of and appreciation for minerals among the general public as well as students and teachers of all ages and at all levels.

AGI and MSA have developed materials and collaborated with geoscience partners in government agencies, professional associations, private corporations, and other groups — such as museums, libraries, and rock and mineral clubs, to name just a few — to make an impact with Minerals Day.

Offering educators and families with innovative ways of providing young people with the education tools they need to succeed, AGI and MSA are proud to join forces through Minerals Day in rallying the minerals, mining, and mineralogical studies communities to help meet this challenge. Look for relevant information and resources on AGI's Minerals Day page and MSA's Minerals Day page.

GUIDEBOOK PDF ENSURES 'NO CHILD LEFT INSIDE'

Wouldn't it be great to dedicate a day to "No Child Left Inside," a time for outdoor activities enabling young people to experience the inspiration of Earth science first-hand? To help you do just that, the NCLI Day Guide is available in both online and PDF format for easy printing, viewing on a smartphone, and using outdoors.

This free guide provides everything you need to start planning your own NCLI Day event, including any of 17 outdoor learning activities recommended for elementary, middle, and high school students. Begin now to plan your NCLI Day event for summer or fall, when young people can wade into ponds, climb hills, and search the skies to learn Earth science. And remember to include appropriate safety measures.

Find the NCLI Day Guide, including the PDF version, at No Child Left Inside Day. Have a great NCLI Day!

EXPLORE GEOPHYSICS DURING EARTH SCIENCE WEEK 2022

The Society of Exploration Geophysicists (SEG), an Earth Science Week partner and AGI member society, offers programs for educators and students. For example, a distinguished lecturer series and an honorary lecturer series both enable students to meet professional geophysicists, learn about groundbreaking research in the field of seismology, and obtain valuable career information.

Short courses offered through SEG not only enable seismologists to continue their education, but also help teachers to study seismology with introductory courses on seismic data processing. Meetings, forums, and workshops are also available. Check online for availability.

SEG members have access to journals, an online digital library, reference publications, meetings, workshops, networking, and employment referral. To learn more, visit SEG online.

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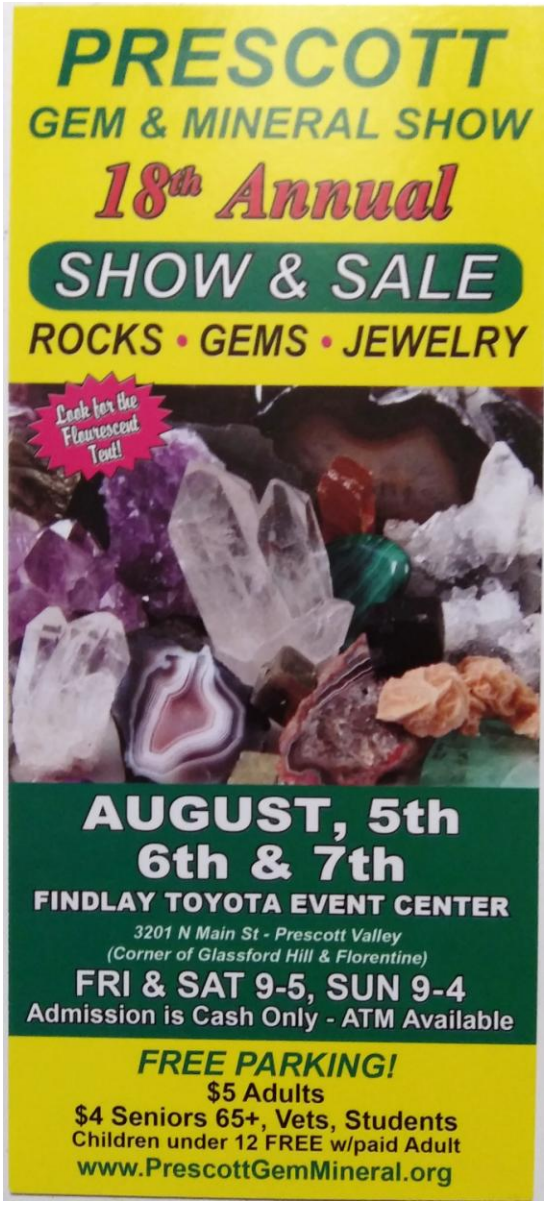
The Hubble Space Telescope

James Webb Space Telescope - Nasa.gov



48th ANNUAL HUACHUCA MINERAL, GEM, AND JEWELRY SHOW

8th AND 9th OCTOBER 2022
2200 EL MERCADO LOOP,
SIERRA VISTA, AZ
For Information;
Contact Maudie Bailey, gmbailey@msn.com,
520 249-1541

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

Apache Junction Rock & Gem Club
Meetings are on the 2nd Thursday
Next Meeting: September 8, 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: September 6, 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: August 1, 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: September 15, 2022, 7:30 pm
Please go to their website for more information
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: September 21, 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: August 9, 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: August 4, 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: October 14, 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.

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: _____

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Phone:
602-973-4291

Editor E-Mail:
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 2022, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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