



DAISY MOUNTAIN ROCKCHIPS

The purpose of Daisy Mountain Rock & Mineral Club is to promote and further an interest in geology, mineralogy, and lapidary arts, through education, field experiences, public service, and friendship.

VOLUME 6, ISSUE 3

MARCH 2021



Some of the 600 cinder cones within the San Francisco Volcanic Field.

Image Source: Google Earth 2021



THÉNARDITE

By Susan Celestian

Chemical Formula - Na₂SO₄

Crystal System - Orthorhombic (3 axes, of unequal length, and at 90° to each other).

Growth Forms/Habits - Crystals, massive, encrusting

Hardness - 2.5-3

Luster - Vitreous

Streak - White

Colors - Colorless, white, light gray, yellowish

Diaphaneity - Transparent to translucent

Specific Gravity - 2.7 (2.664)

Cleavage - one perfect, 2 less than perfect

Fracture - Splintery (similar to hornblende)

Occurrence - Evaporating saline lakes & playas; also as a crust around fumaroles and in old mines

Other - weak somewhat salty taste

- soluble in water

- fluorescent: SW white; LW yellow-green

Uses - Source of sodium (Na),

- Source of sodium sulfate

- **Glass industry:** helps remove small bubbles from molten glass, prevents the formation of scum on molten glass, flux;
- **Paper industry:** Kraft process in wood pulping;
- **Detergent:** The biggest use is as a bulking agent in powdered clothes detergent.

Named after French chemist and professor, Louis Jacques Thénard, thénardite is not extremely common as a collectable mineral, but in Arizona there is a unique and now-inaccessible occurrence. The Salt Mine at Camp Verde was mined for halite by Native Americans. Later, chemical companies mined the sediments for sodium sulfate - halite, mirabilite, glauberite, thénardite -- for use in the chemical industry. The salts were mined by underground tunneling. Subsequent to the abandonment of the tunnels, groundwater dissolved minerals, and thénardite was precipitated as speleothems. These were frosty, snow white, and knobby stalactites. See Figures A-E.

[Thénardite](#) continued on page 22...

VOLCANICS OF NORTHERN ARIZONA

PART III: Cinder Cones & Spatter Cones

By Susan Celestian

Cinder Cones are literally loose piles of pyroclastic debris. During an explosive eruption, lava is thrown into the air, it breaks up into small to large bits, cools, and falls very close to the vent. The debris tends to be scoriaceous, because gases continue to be released during the cooling period, leaving lots of gas bubble holes in the rock. For the most part, the cinders, bombs, and so on are cooled enough, that upon landing, they do not weld to adjacent particles. Thus, the pile of cinders is loose, and unconsolidated.

They are cone-shaped hills with relatively steep sides (slopes of 30°-40°), and are composed of scoriaceous cinders, bombs, ash, and lapilli that fall around the usually-circular vent (marked by a crater).¹

¹Various pyroclastic fragments found in a cinder cone are:

Cinder: Pyroclastic debris with lots of small gas bubble holes (scoriaceous); between .08"-2.5".

Bomb: Scoriaceous pyroclastic debris greater than 2.5"; may be streamlined in flight (while molten and cooling).

Ash: Pyroclastic debris under .08" diameter. A minor component of cinder cones, as ash is easily carried far away by even light breezes.

Lapilli: Pyroclastic debris that is spherically, teardrop, or dumbbell-shaped; between .08"-2.5".

[Cinder Cones](#) continued on page 11...

ZOOM MEETING

April 6, 2021

BE SURE TO ATTEND

Our speaker will be Stan Celestian, whose talk is titled "Rock Candy". He will describe some of his favorite Rocks, and their geological significance.

There will be a **Show & Tell** segment, so be prepared to share with the group, any new or old rock finds. Let's stay involved!

MAY: Leslie Hale, Smithsonian

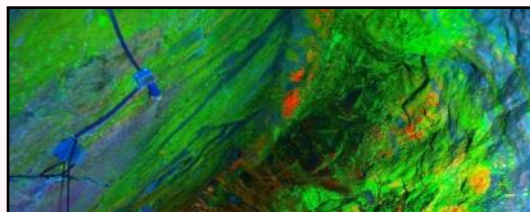
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MARCH SPEAKER
JEFF OSOWSKI
 VP Board of Trustees
 Sterling Hill Mining Museum



The blue color may or may not be hydrozincite. Photo Source: Sterling Hill Mining Museum

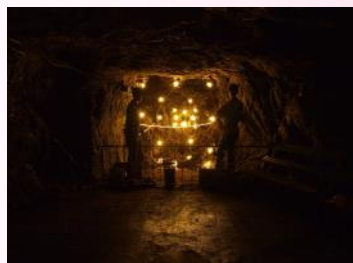
At March's Zoom meeting, Jeff Osowski presented a very interesting brief history of the Sterling Hill Mine, and of the recent upgrades to the museum.



The Sterling Hill Mine, in Ogdensburg, New Jersey, was operated from 1630 to 1986. It's mineralogy makes it an ore body unique in the world. The primary ore minerals -- franklinite, zincite, and willemite -- occur in an unusually high concentration, yielding ores with 22% zinc.

Almost 360 different minerals occur here, 35 of which are only found here, and 91 of which are fluorescent. The latter characteristic is what has made this site particularly famous. Zincite, willemite, hydrozincite, sphalerite, wollastonite, and other minerals occur embedded in the Franklin Marble, producing outstanding displays of bright green, orange, yellow, pink, white, and blue. In fact, a 44,000 pound slab of fluorescent rock has been cut and relocated to a new exhibit in the American Museum of Natural History in New York City.

Included on the museum grounds are: mine tour, Zobel Hall Museum (that includes the world-class Oreck - of vacuum cleaner fame -- mineral collection, Warren Museum of Fluorescence, Ellis Astronomical Observatory, and a restored vintage train caboose (highlighting the importance of the rail yard in the history of the mine), a stamp mill, headframe, and many original artifacts.



Diorama inside mine, demonstrating blasting pattern. Photo Source: Sterling Hill Museum



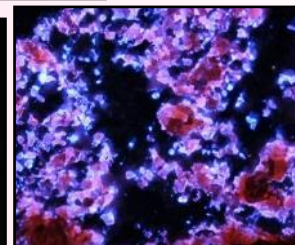
Man cage in which miners descend to lower levels. Photo source: [Vilskogen](#) is licensed under [CC BY-NC 2.0](#)



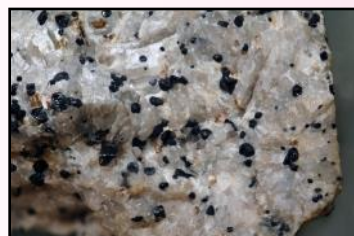
The walls inside the mine are ablaze with color when exposed to SW fluorescent lights.



Octahedral crystals of franklinite. Photo Source: Stan Celestian

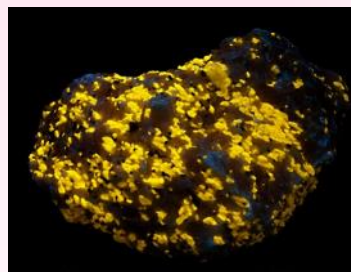


Sphalerite var cleiophane fluoresces shades of pink. Photo Source: Sterling Hill Museum

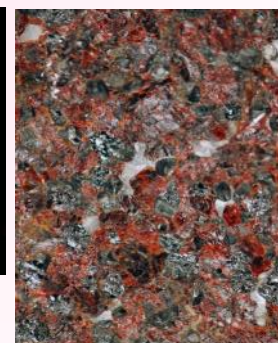


SW light causes calcite to fluoresce bright red-orange and willemite is green in this sample from Sterling Hill. Photo Source: [James St. John](#) is licensed under [CC BY 2.0](#)

Zn
Fe
Mn



White wollastonite fluoresces shades of pink. Photo Source: [Cran Cowan](#) licensed under [CC BY 2.0](#)



The red zincite, a zinc oxide, is a major ore mineral at Sterling Hill Mine. Photo Source: [James St. John](#) is licensed under [CC BY 2.0](#)

Go to [YouTube](#) for a nice preview of the museum's offerings.

Zoom Board Meeting Minutes March 1, 2021

Board Minutes not available

General Zoom Meeting Minutes March 2, 2021

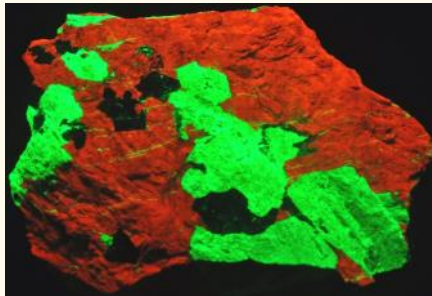
- Open attendance: 25 zoom participants
- Bill F. called the meeting to order
- We will continue with zoom meetings through the rest of the season
- Thank you to Jeff Osowski for his wonderful presentation on the Sterling Hill Mine in New Jersey
 - ◇ If you would like to visit one day:
 - Go to www.sterlinghillminingmuseum.org
 - Find Jeff's information on the website
 - Get ahold of Jeff for a special tour
- Cynthia B. discussed the financials
 - ◇ Revenue came from dues and t-shirt sales
 - ◇ Paid out for nametags and flowers for deceased member's family
 - Flowers expense approved by board
- Stan C. talked about the claims committee
 - ◇ Some members took advantage of the \$10 private visit to the mine
 - If you would like to visit: Please email Stan -- stancelastian@gmail.com
 - ◇ We are looking into acquiring a claim in the Mushroom Rhyolite area
 - Still investigating claims
- Bill F. updated us on the field trips
 - ◇ No overnights for the rest of the season
 - ◇ Watch emails for updates
 - He would like to add some weekday trips
- Tiffany P. discussed the membership
 - ◇ We currently have 141 members
 - ~ 60 did not renew
 - 25+ new members this year
 - ◇ Ed W. checks the mailbox at least every week
 - ◇ Nametags should be available now
 - ◇ Online membership signup will be available on the website soon

- Ed W. updated us on the show
 - ◇ The dates in question would be Nov 12, 13 & 14
 - ◇ Nothing has been setup yet
 - Wire wrapping with Jennifer G. was discussed
 - ◇ She would like to have a zoom call in April
 - ◇ Will send email with date and time
 - ◇ Jennifer is also looking into adding some YouTube videos
 - Show and Tell went well!
 - ◇ Do not forget to have your rockhounded specimens handy when on the general zoom meetings
 - We love to see what everyone is collecting
- ▶ Please wear your name tag when attending club events
- ▶ You are more than welcome to share our zoom general meeting link with any friends interested in rocks, or the club. It is an open meeting that we encourage to be shared with others.

Respectfully submitted, Rebecca Slosarik,
secretary



A specimen from the Sterling Hill Mine, Franklin, New Jersey. The white mineral is calcite, the brown is willemite, and the black is franklinite.



Under SW fluorescent light, the calcite fluoresces bright orange-red, and the willemite is bright green.

Photos by Stan Celestian



Octahedral Franklinite crystals in calcite from the Sterling Hill Mine, Franklin, New Jersey.

Photo by Stan Celestian and specimen from Natural History Museum of Los Angeles, Gem and Mineral Hall Collection

TRIP TO CHILITO MINE

Saturday, February 27, 2021

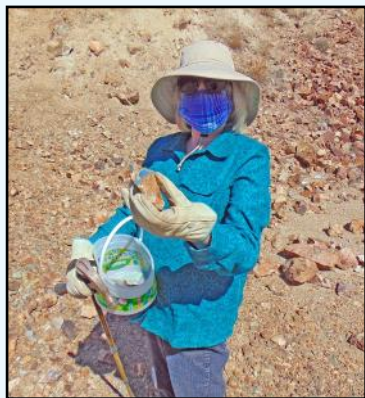
Photos by Bill Freese and Susan Celestian

Twenty-three people, in 11 vehicles, scoured the slopes for blue rocks -- with great success! Bill thinks there was an informal competition to see who could get the biggest rock. Several 100+ pounders hitched a ride back to The Valley.



**AND
THE
WINNER
IS.....
you
decide**

...Field trips continued from page 5



Another rockhound: *Bella*



Minerals du jour



Azurite: Azure blue, Copper carbonate - will fizz in acid



Malachite: Grass green, Copper carbonate - will fizz in acid



Chrysocolla: Turquoise blue-green, Copper silicate - will not fizz in acid; will stick to your tongue



BEFORE (mostly)



AFTER

JUST BEFORE "PRESS" Stan took some pix of rocks we collected on the MSA trip to Chilito. [GO TO PAGE 25.](#)

NOW RESIDING IN WADDELL

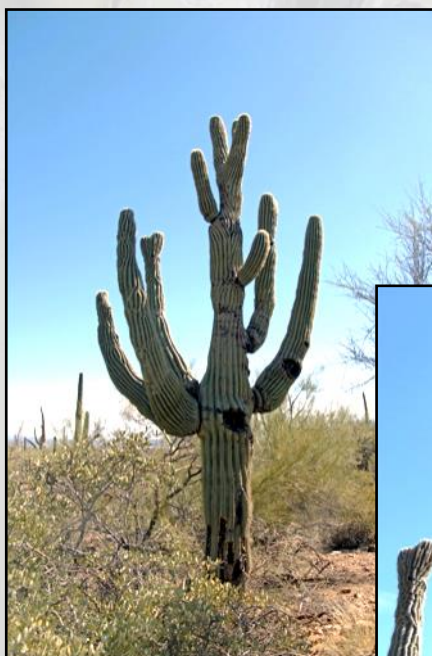


...Field trips continued from page 6



So Many Arms!!!!

The terrain around the Chilito Mine supports a saguaro forest!



This saguaro exhibits a form of cristation or cresting. Rather than a fan-like growth at the apex, several of the arms have forked. A couple are bifurcated; and the central pillar is trifurcated.



Spring is Springing



Desert Mistletoe (*Phoradendron californicum*)



Parry's Beardtongue (*Penstemon parryi*)



Spiny Goldenweed (*Xanthisma spinulosum*)



Desert Marigold (*Baileya multiradiata*)

Field Trips continued on page 7...

FIELD TRIP TO CONTACT MINE

Saturday, March 13, 2021

Photos by Bill Freese

Hammers raised, knees dirty, buckets full, cars riding low -- a nice day in pursuit of amethyst.



FIELD TRIP TO RYE CREEK

Saturday, March 24, 2021

Photos by Susan Celestian & Bill Freese

Eleven DMRMC members scoured Rye Creek for rocks to take home! Lots of cool rocks!!!



Epidote



Pretty blue-green metamorphic rock



Gooding's Verbena (*Glandularia good-*



Bright Red Jasper -- "Yes, Bill, this one went home with me"



This is a metamorphosed breccia



Metaconglomerate



Diorite with a big black xenolith (chunk of other rock incorporated, but not melted, into dioritic magma)



Quartzite with sedimentary crossbeds preserved



Clark's Spiny Lizard (*Sceloporus clarkia*)

Vibrant green fine-grained metamorphic rock



Petroglyphs -- a fun surprise!



Jasper with Quartz bands

FIELD TRIP TO BULLARD MINE

Wednesday, March 27, 2021

Photos by Bill Freese

Another beautiful day in the neighborhood! Clear blue skies and 70's, the weather was perfect. We had a total of 21 people plus me that went out to the Bullard mine. Plenty of new folks and veterans. All had a great time and found plenty of great copper minerals.



Chrysocolla



Cu

...Cinder Cones continued from page 2

The cones are rarely rise higher than 1000', however, can rise to over several thousand feet.

Cinder cones tend to persist as unaltered geomorphic features. The cones are quite porous, so precipitation soaks in rapidly, and does not form rivulets -- hence, no erosion.

Cinder cones are found on the flanks of larger volcanoes (shield and composite), or scattered throughout volcanic fields. See Figure 1'. They are the result of gassy phases that produce minor, short-lived, somewhat explosive eruptions.



FIGURE 1' CINDER CONES In this photo, several cinder cones can be seen decorating the flanks of Mauna Kea, in Hawaii. There are at least 100 cinder cones on the huge shield volcano's slopes.

Photo by Susan Celestian

The time it takes to build up a cinder cone is short, and they typically erupt only once. For example, Parícutin, in Mexico, grew to over 600' tall in the first four months, and to nearly 1100' tall in one year. It erupted over an unusually long 9-year period.

Spatter Cones (sometimes called hornitos) are included here, because they occur in association with cinder cones. They are very small (typically less than 20' tall) mounds built up by welded blobs of lava that spatter out of a central vent. See Figure 2'.



FIGURE 2' SPATTER CONE This small spatter cone, or hornito, is found along the trail around the base of Sunset Crater, in northern Arizona. Note that the structure looks lumpy, which is what you would expect when the walls are built by hot blobs of semi-cooled lava. *Photo by Stan Celestian*

There are over 600 cinder cones within the San Francisco Volcanic Field. See Figure 3' & 4'. This article will highlight 5 cinder cones², unique features:

- ▶ Sunset Crater (1085-1090 AD)
- ▶ SP Crater (55,000 years ago)
- ▶ cleft cone (undetermined age)
- ▶ Colton Crater (200,000-800,000 years ago)
- ▶ Strawberry Crater (50,000 years ago)
- ▶ Red Mountain (740,000 years ago)
- ▶ Merriam Crater (20,000 years)



FIGURE 3' CINDER CONES A view across the San Francisco Volcanic Field from The Peaks. Most of those bumps are cinder cones. *Photo by Stan Celestian*

²(In the March 2017 issue of *Rockchips*, I wrote a bit about Strawberry Crater; and in March 2019 about Merriam Crater & Grand Falls -- much of that information will be repeated here.)

...Cinder Cones continued from page 11

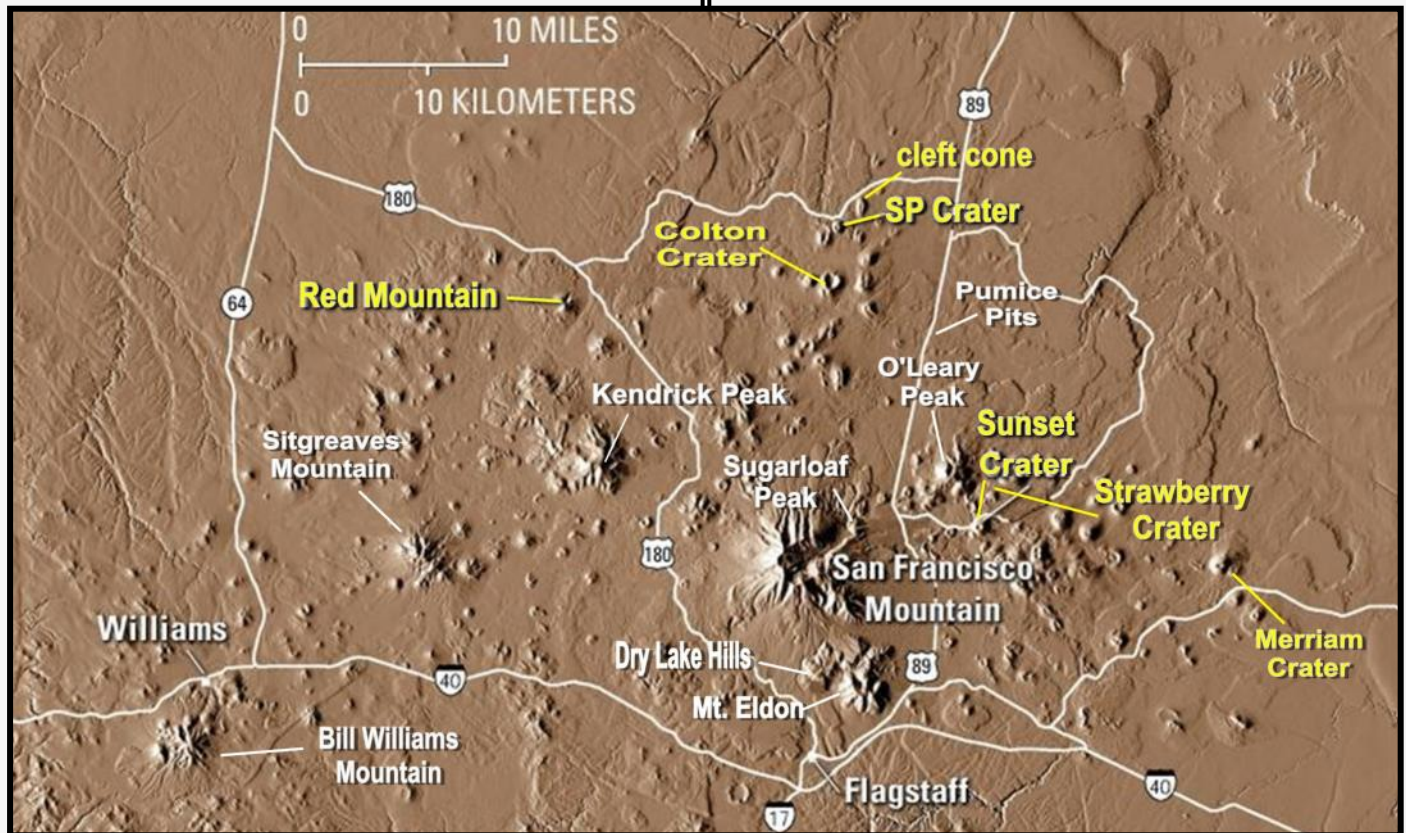


FIGURE 4' SAN FRANCISCO VOLCANIC FIELD You have seen (in the last 2 newsletters) this digital elevation model (DEM) of the San Francisco Volcanic Field, near Flagstaff, Arizona. In this version, the names of the highlighted cinder cones have been added and emphasized in yellow. Image courtesy of the USGS (some sites added by Susan Celestian)

SUNSET CRATER (1085-1090 AD): Until fairly recently, Sunset Crater was dated as 1064 AD, and thought to have erupted over a 200 year period. However, re-evaluation of the evidence has moved its eruption forward to 1085 AD or so, and compressed its eruptive period to only a month or two (or at most, a couple of years).

The youngest volcano in the San Francisco Volcanic Field, Sunset Crater is one of several cones that were built by eruptions along a 6-mile-long NE/SW fissure. Explosive eruptions created a curtain of fire (up to 850' tall), and a plume of steam and ash that could probably be seen for 250 miles. Ash and cinders blanketed the landscape forced local residents to escape to quieter areas. And two lava flows -- the Kan'a and Bonita Flows -- issued from the base of the cone. In the end, the cinder cone towered 1000' above the landscape. For a video tour of Sunset go to <https://www.youtube.com/watch?v=sjSUJLqxCZY> See Figures 5'-13'.

Sunset Crater Volcanoes National Monument was established in 1930, by President Hoover. The move was prompted by 1928 attempt of a movie company to blow up Sunset Crater.

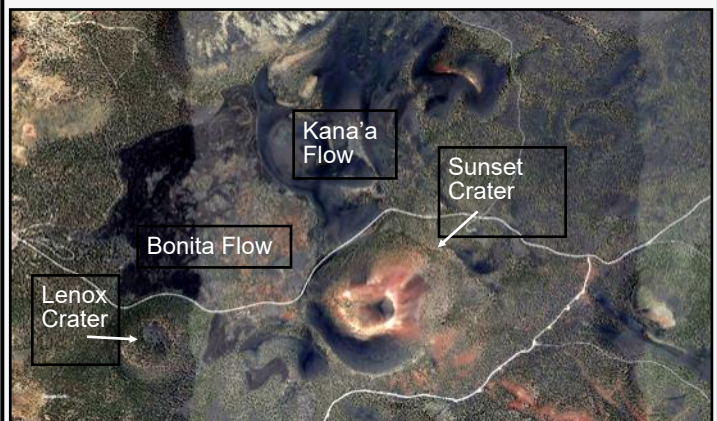


FIGURE 5' SUNSET CRATER This Google Earth image emphasizes the beautiful symmetrical cinder cone and central crater. (Lenox Crater is an older cone.) Photo courtesy of Google Earth © 2021 Google

...Cinder Cones continued from page 12



FIGURE 6' SUNSET CRATER The last gassy gases of the crater oxidized the iron in the cinders, creating the sunset red around the rim.

Look closely (even enlarge the page) and you will see dark streaks that are old trails, from pre-national monument days, when one could hike to the top. The lack of erosion and vegetation means that these are still visible - after over 90 years.

Photo by Stan Celestian



FIGURE 7' SUNSET CRATER Symmetry and snow -- a beautiful combination! Note again the old trails, visible on the far right. *Photo by Dale Nations and courtesy of the AZGS Earth Science Photo Gallery.*



FIGURE 8' SUNSET CRATER As eruptive activity waned, fumarolic activity oxidized the rim rocks to red, and deposited white gypsum crusts, with some sulfur and opal. It is this bright red and yellow crown that caused John Wesley Powell to dub the crater as perpetually in sunset -- Sunset Crater.

One unusual mineral present is terrohexahedrite, an antimony sulfide of copper, iron, zinc, and silver.

Photo by Stan Celestian



FIGURE 9' CINDER FIELD Scoriaceous cinders, lapilli, and ash blown out of Sunset Crater cover over 800 mi² -- up to 40' thick. Note the ripples in the cinders -- it gets really windy in northern Arizona!

Photo by Stan Celestian



...Cinder Cones continued from page 13



FIGURE 10' BONITA FLOW Also toward the end of Sunset Crater's active cycle, two lava flows issues out of the base of the cone. The 5-mile long Kana'a Flow to the northeast and the Bonita Flow to the northwest. The latter flow ended up ponding in a low area, with thickness up to 100' in the center. These photos are of the Bonita Flow, an a'a' flow. A'a' flows are blocky and jagged, the result of the crust cooling and subsequently being broken up into chunks rafted on the still flowing lava below. You don't want to trip and fall on these rock! *Photos by Stan Celestian*

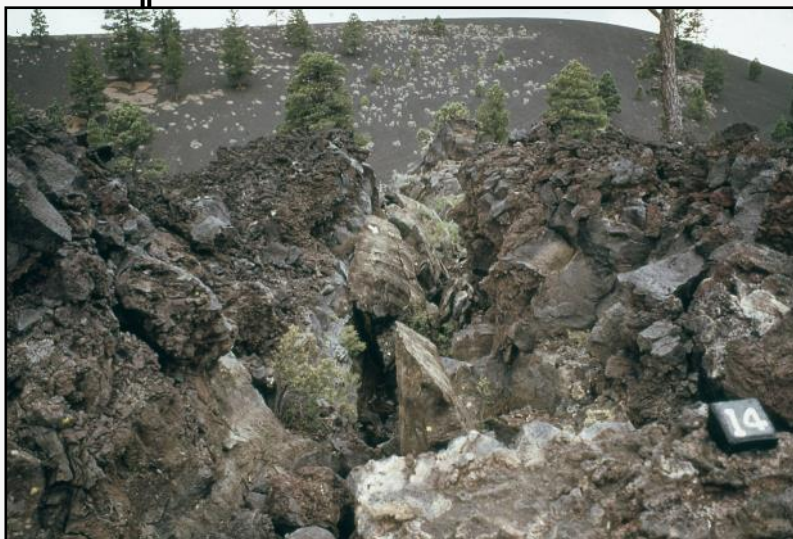
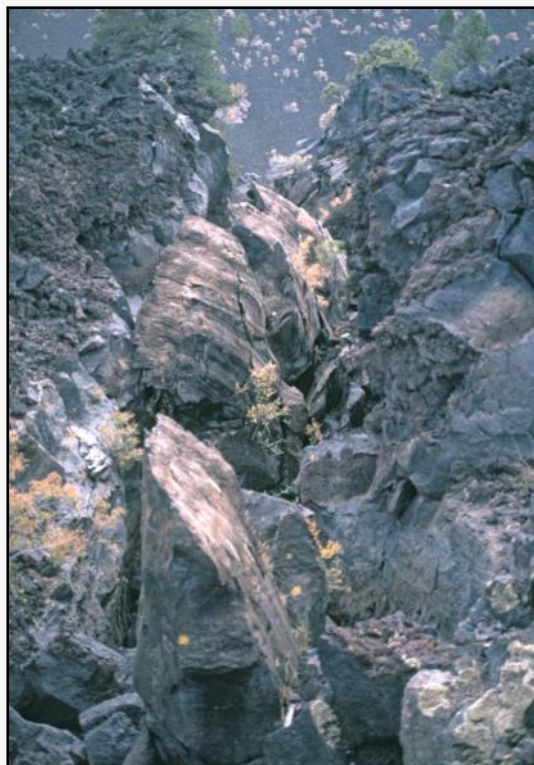


FIGURE 11' SQUEEZE UP Along the trail at Sunset Crater, one will see this squeeze up -- a striated mass of basalt, formed when partially-cooled magma bulged out of a fracture in cooled rock. *Photos by Sue and Stan Celestian*



FIGURE 12' XENOLITH

A xenolith is a chunk of country (or surrounding) rock, entrapped in a once-molten rock. In this case, it is a bit of the Coconino Sandstone, through which the basaltic lava of Sunset Crater moved. A piece was torn off and 'frozen' in place.



Photo by Stan Celestian



FIGURE 13' LAVA TUBE

When lava flows in narrow, channels, the sides will cool quickly, leaving a still-flowing river of lava. When that flow ceases, a hollow tube or cave is left. Sarah Celestian emerges

from one (now collapsed) here, a long time ago, at Sunset Crater. *Photo by Stan Celestian*

...Cinder Cones continued from page 14

SP CRATER (55,000 years OR 2000-4000¹ years): The age of SP Crater has not really been pinned down, but the Arizona Geological Survey accepts a ballpark age of 55,000 years (age estimates have ranged from 4000 to 70,000 years). It is a pristine conical hill, with a dark lava flow from its base. The flow extends about 5 miles, and is about 100 feet thick. The rim of the 820'-tall cone is fortified by welded spatter of cinders and bombs. Interestingly, in 1998 Conrad and others estimated a 13% chance of an eruption within the field in the next 1000 years -- could get exciting!²

In the surrounding field, are a couple of interesting cones -- a cleft cone, and Colton Crater, with a secondary central cinder cone. See Figures 14'-20'. For video tours of SP, go to <https://www.youtube.com/watch?v=2vjaf-SrSZQ> and <https://www.youtube.com/watch?v=sjSUJLqxCZY>

FIGURE 14' AERIAL VIEW SP CRATER

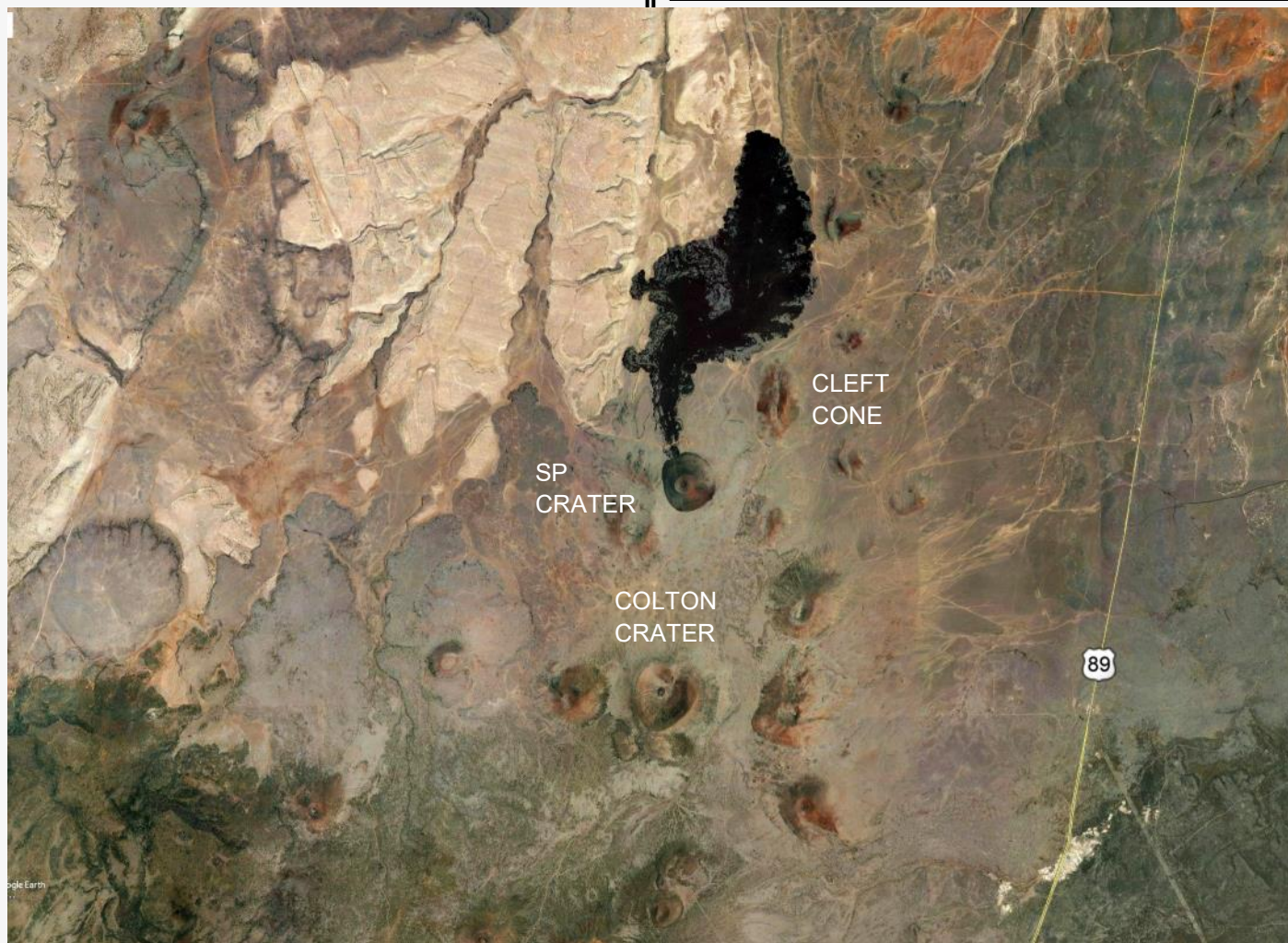
This high aerial view of SP Crater, highlights the pristine and beautiful nature of SP and its flow. The crispness of the rim is obvious; as is the flow issuing from the base.



Photo by Stan Celestian

FIGURE 15' SATELLITE VIEW SP CRATER This Google Earth image helps put SP Crater in special context. SP Crater and its lava flow stand out starkly against the background rocks. Lava breakouts are clearly visible, as is SP's beautiful symmetry.

Image source: Google Earth 2021



¹An undergraduate thesis by Laura Kennedy at NAU, concluded that the cone is only 200-2000 years old. https://azdailysun.com/news/cinder-cone-gets-younger/article_f3ac8cd9-f684-5cde-92c8-eea3afa716ec.html

²Conway, F. M.; Connor, Charles B.; Hill, B. E.; Condit, C. D.; Mullaney, K.; and Hall, C. M., "Recurrence Rates of Basaltic Volcanism in SP Cluster, San Francisco Volcanic Field, Arizona" (1998). *School of Geosciences Faculty and Staff Publications*. 166916 *Cinder Cones continued on page 20...*

...Cinder Cones continued from page 15

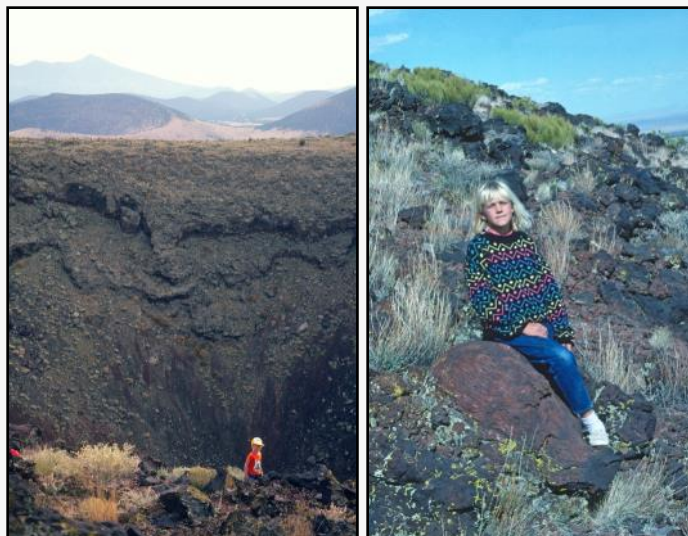


FIGURE 16' SP CRATER RIM After a strenuous hike, one gets a close view of the crater rim -- at the edge of which our much-younger son stands. The rampart is composed of welded cinders and bombs. In the photo on the right, our much-younger daughter sits on a volcanic bomb. It should be obvious why that projectile didn't go far. *Photos by Stan Celestian*



FIGURE 18' FUN IN THE CINDERS Part of the fun in hiking to the top of a cinder cone, is running down. In the right photo, a much younger Stan pours cinders out of his shoe, after leaping down the slopes of SP crater. His unshod foot is resting on a volcanic bomb he carried down. *Photos by Sue & Stan Celestian*

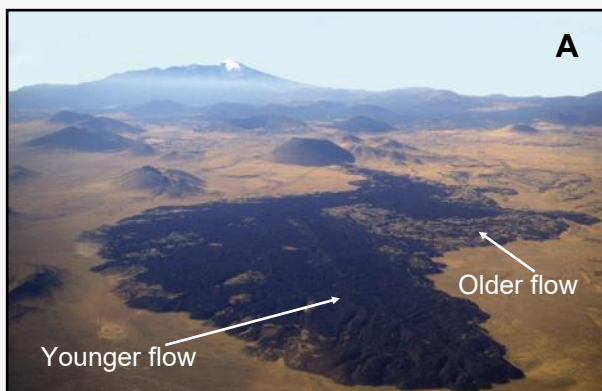


FIGURE 17' SP CRATER FLOW In these various views of the SP flow, there are a number of features to see. **First:** note that parts of the flow are black and others appear duller and vegetated. The blacker flow is younger and devoid of vegetation; while the other is older (weathering has produced a thin soil in which vegetation grows). **Second:** In views B & C, you can see that the edges of the flow are higher than the center. The raised edges are levees, produced when the edges cooled faster than the center, and where cooled sloshing built up the lava. These levees served to channelize the flow, not allowing it to spread out. **Third:** There are numerous breakouts, where lava broke through the levees, to form lobes. These are really obvious in the satellite view of Figure 14'. *Photos A & C by Stan Celestian; Photo B courtesy of AZGS Arizona's Earth Science Photo Gallery*

...Cinder Cones continued from page 16

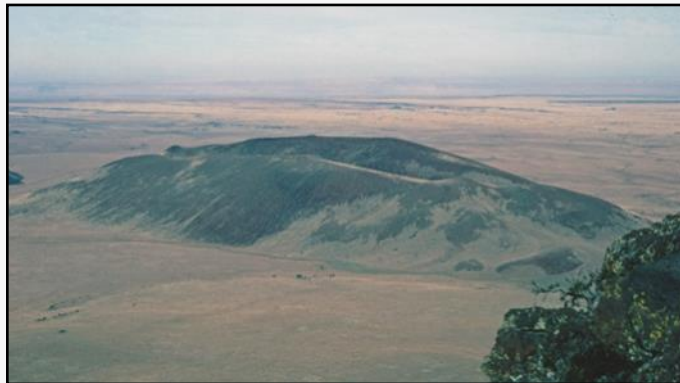


FIGURE 19' CLEFT CONE This cone, with the slit-shaped crater, formed along a fissure -- thus the elongate buildup of cinders. Photo by Stan Celestian

STRAWBERRY CRATER (50,000 years): The age of this crater is tentatively stated at 50,000 years; however estimated ages have ranged from 50,000 +/- 46,000 years (Damon et.al. 1974), to 3000 years (between 800 and 1604 BC), to 130,000 +/- 40,000 years (Morgan et. al. 2003). The asymmetric crater is about 1000' tall on the west; however the cone was breached by a lava flow, that rafted away the east wall of the cone. Lava flows extend to the east and northeast. See Figures 21'- 32'.



FIGURE 20' COLTON CRATER
Another of SP's neighbors, Colton Crater

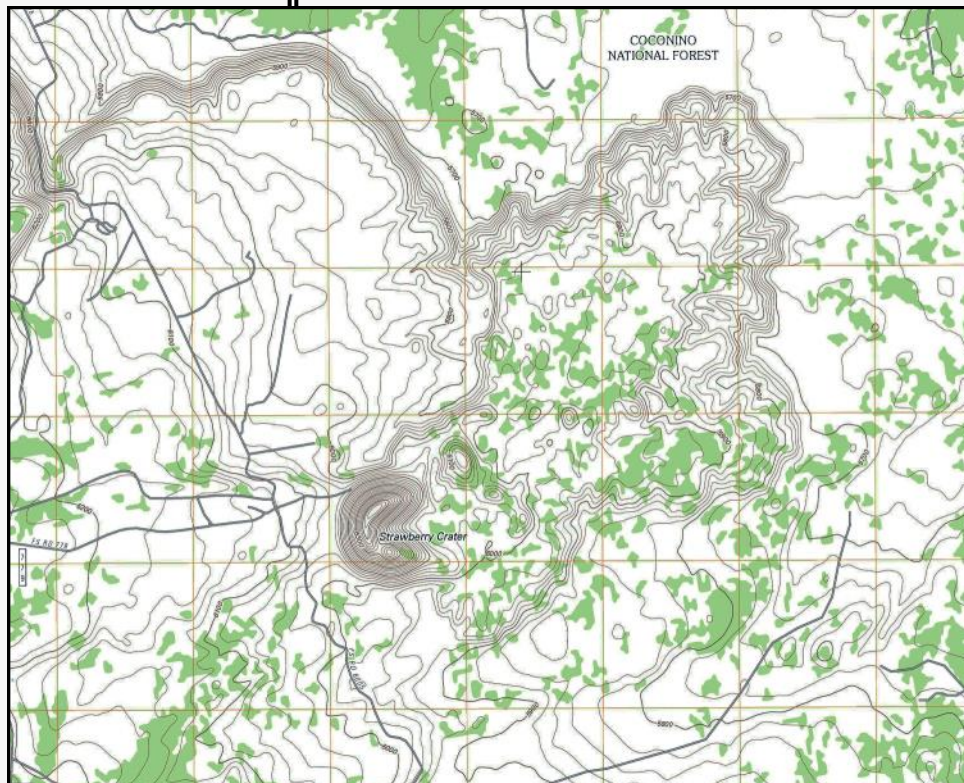
makes an interesting visit. Near the end of its eruptive cycle, the volcano experienced an explosive event, as magma interacted with ground water. Debris was blown to the north, where the crater rim is highest. Lots of interesting rocks can be found there -- some from the uppermost mantle of the Earth! The diameter of the crater is 0.7 miles, and sitting in the center is a smaller asymmetrical cinder cone that formed subsequent to the blast. Image B is a close view of the small cone.

Photos by Stan Celestian

FIGURE 21' TOPOGRAPHIC MAP OF STRAWBERRY CRATER This is a portion of the USGS Strawberry Crater, AZ 7.5' Quadrangle map. Note how close the lines are to each other around the crater — indicating very steep slopes. The lava flow is outlined by sinuous, closely-spaced lines.

This is a high resolution image, so you may zoom in to see a closer, clear, easily-read image. (TO ZOOM: Click the + or -, at the bottom of the page.)

Image courtesy of the USGS



...Cinder Cones continued from page 17



FIGURE 22' SATELLITE VIEW OF STRAWBERRY CRATER This view from Google Earth, further highlights the lava flows and the breached eastern wall. *Image from Google Earth 2017.*



FIGURE 23' APPROACHING STRAWBERRY Crater on FR 545, one sees the asymmetric profile. It now resides in the Strawberry Crater Wilderness, but you can get very close by car. *Photo by Stan Celestian*



FIGURE 24' VOLCANIC BOMBS Large volcanic ejecta are called *bombs*. One thing in abundance at Strawberry Crater are streamlined volcanic bombs, of all sizes. These were collected in the mid-1970s on a class field trip. *Photo by Stan Celestian*

...Cinder Cones continued from page 18



FIGURE 25' FUSIFORM BOMB Volcanic ejecta need not have this shape to be called a bomb; however, my favorites do. This shape results when a blob of lava spins in the air, causing the center to bulge and the ends stretching out into thin spindles (that easily break off on landing). Specimen is 4" long. *Photo by Stan Celestian*

FIGURE 26' FUSIFORM BOMB

This bomb was still hot and plastic when it landed back on the cinder cone. As a result, the bomb is welded to some cinders. *Photo by Stan Celestian*



FIGURE 27' RIBBON BOMB

This bomb formed as a stringer of lava that flattened, twisted, and broke up into pieces. Upon landing, this one welded to cinders, like the one in Figure 25'. *Photo by Stan Celestian*



FIGURE 28' INCLUSION BOMB Lava enclosed a piece of Coconino Sandstone (the inclusion)

as it moved through the country rock and was thrown into the air. *Photo by Stan Celestian*

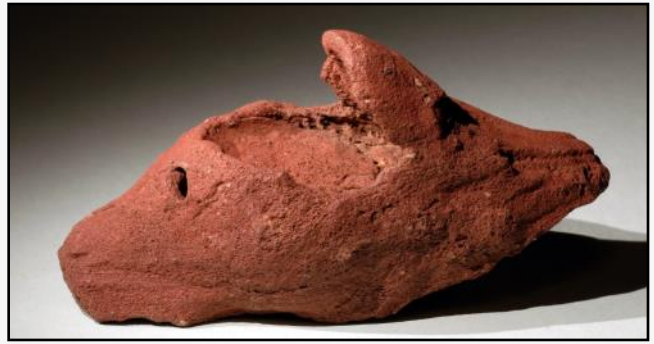


FIGURE 29' EXPLOSION BOMB Gas expanding in the bomb's interior erupted through the outer skin of this bomb. *Photo by Stan Celestian*



FIGURE 30' INCLUSION/EXPLOSION BOMB The inclusion in this bomb is a piece of basalt, and the cavity was created by explosive gases.

Photo by Stan Celestian



FIGURE 31' COW PIE BOMB

Sometimes a blob of lava goes "splat" upon hitting the ground, it flattens out and appears as might a

"cow pie" in a pasture. This one also has bits of cinder welded to the surface. Specimen is about 8" in diameter. *Photo by Stan Celestian*

FIGURE 32' BREADCRUST BOMB

As a bomb cools, it develops a hard "skin". Gases continue to expand in the plastic interior. That stretching



causes the exterior to crack, so it resembles a loaf of crusty bread. *Photo by Stan Celestian*

...Cinder Cones continued from page 19

RED MOUNTAIN (740,000 years): Red Mountain is unique in the San Francisco Field, in that it is missing a large portion of the cone, exposing the internal stratification. See Figure 33'.

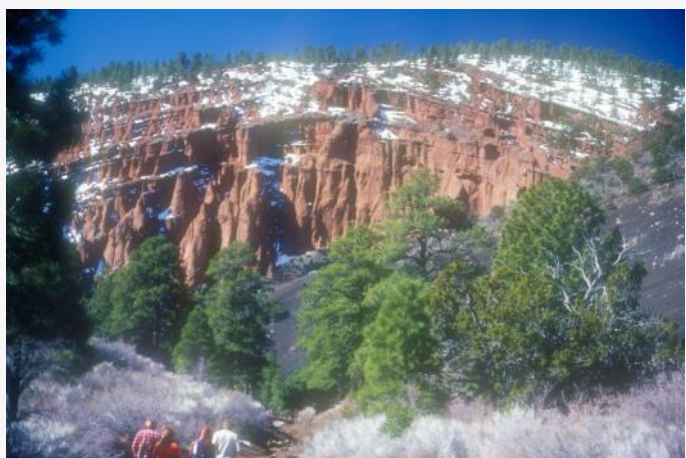


FIGURE 33' RED MOUNTAIN Here are two views of Red Mountain -- summer and winter. The exposed interior reveals layering, resulting from sorting that occurs, as pyroclastic debris settles out of air -- larger particles fall fastest, followed by smaller and smaller particles. Occasionally, a lava flow is revealed as a very resistant layer. *Photos by Stan Celestian*

Red Mountain is about 1000' tall at the highest point on the back wall. The cone is asymmetric, with more material to the northeast, presumably because during the eruption period there was a strong west to east wind. Additionally, sections of the cone appear to have been rafted away by lava flows.

Geologists are uncertain of the origin of the amphitheater, however the USGS has proposed a fairly spectacular scenario. With the cessation of

volcanic activity, rainwater seeping through still-hot cinders (about 600°F), caused the precipitation of minerals, that cemented the cinders together, sealing the hot cinders and groundwater below. As the water became superheated, pressure built up, and eventually steam explosions removed a large proportion of the cone.

Since then, erosion has sculpted the rocks of the amphitheater into a rather other worldly pocket. See Figures 34'-36'.

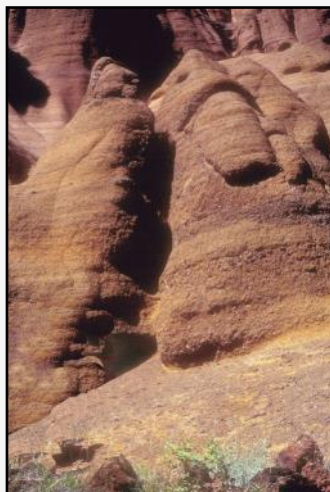


FIGURE 34' HOODOOS Erosion by water and wind has sculpted fins and towers of cinders, up to 20' tall. Rock caps protect the material below.

Photos by Stan Celestian



FIGURE 35' CRYSTALS

Embedded in the cinder walls are crystals of plagioclase feldspar (sunstone), pyroxenes, and amphiboles. They weather out and can be found in the sand of streams within the amphitheater.

Photo by Stan Celestian

FIGURE 36' XENOLITH

Look in all those cinders and you are likely to find a xenolith (chunk of country rock), embedded in cinder. Just one of those cool things out there!

Photo by Stan Celestian



...Cinder Cones continued from page 20

MERRIAM CRATER (20,000 years): Merriam Crater is one of the most beautiful cinder cones in the San Francisco Field -- over 1000' tall and 1 mile in diameter. It is quite symmetrical, with an elegant central crater. The lava flow associated with Merriam Crater flowed about 6 miles, spilled into the canyon of the Little Colorado River (LCR), and continued about 9 miles downstream. That flow obviously dammed the river, but eventually the LCR circumvented the flow and spilled back into its originally canyon at Grand Falls (A description of this was presented in the March 2019 DMRMC Rockchips newsletter.) See Figures 37'- 39'.

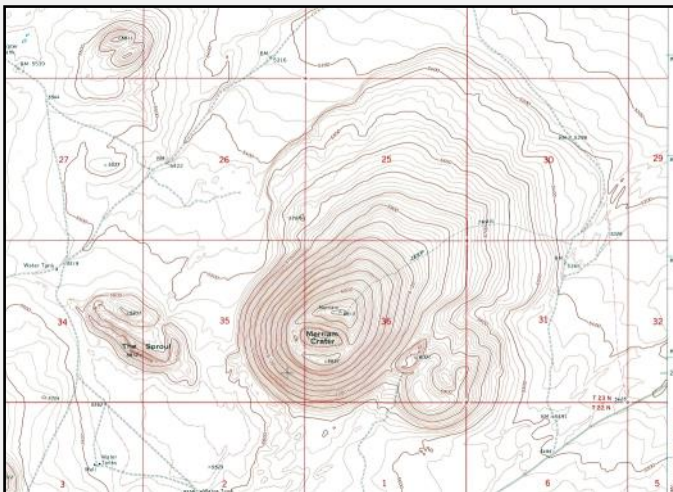


FIGURE 37' MERRIAM CRATER Topographic map view of Merriam Crater. To the west is The Sproul, and to the immediate east is Vent 130.

Source: USGS



FIGURE 38' MERRIAM CRATER & VENT 130 This aerial view is from the southeast, showing towering Merriam Crater and its adjacent partner, Vent 130. In between the two, you can see the basalt knob over the source of the lava flow. Photo by Dale Nations and courtesy of the AZGS Earth Science Photo Gallery.



FIGURE 39' MERRIAM CRATER & THE SPROUL This aerial view is from the northwest, showing The Sproul -- a large spatter cone, composed of spatter and welded pyroclastic debris. Photo by Dale Nations and courtesy of the AZGS Earth Science Photo Gallery.

GENERAL RESOURCES FOR CINDER CONES

COLTON CRATER

- https://www.lpi.usra.edu/science/kring/lunar_exploration/Colton-Crater-Lunar-Analogue-Site-Briefing.pdf
- <https://azgs.arizona.edu/photo/colton-crater-san-francisco-volcanic-field>
- <https://azgs.arizona.edu/photo/palagonitized-tuff-colton-crater-san-francisco-volcanic-field>
- <https://steemit.com/photography/@skypilot/the-psychotic-volcano-of-colton-crater-arizona>

MERRIAM CRATER

- <https://azgs.arizona.edu/azgs-photo-tags/merriam-crater>
- <https://www.wired.com/2017/03/exploring-mysterious-volcanoes-arizona-yes-arizona/>

RED MT

- <https://pubs.usgs.gov/fs/2002/fs024-02/#:~:text=The%20San%20Francisco%20Volcanic%20Field%20has%20been%20active%20for%20about,its%20internal%20structure%20is%20exposed.>
- <https://azgs.arizona.edu/photo/red-mountain-san-francisco-volcanic-field-summer-2018>

SP CRATER

- <https://earthobservatory.nasa.gov/images/49450/sp-crater-northern-arizona#:~:text=Different%20dating%20techniques%20have%20placed,the%20past%206%20million%20years.>
- <https://azgs.arizona.edu/photo/sp-crater-lava-flow-san-francisco-volcanic-field>
- <https://www.youtube.com/watch?v=2vjaf-SrSZQ>
- <https://www.youtube.com/watch?v=sjSULgxCZY>
- https://azdailysun.com/news/cinder-cone-gets-younger/article_f3ac8cd9-f684-5cde-92c8-eea3afa716ec.html
- <https://www.wired.com/2017/03/exploring-mysterious-volcanoes-arizona-yes-arizona/>

...Cinder Cones continued from page 21

GENERAL RESOURCES FOR CINDER CONES con.

STRAWBERRY CRATER

<https://azgs.arizona.edu/photo/strawberry-crater-cinder-cone-san-francisco-volcanic-field>
https://en.wikipedia.org/wiki/Strawberry_Crater

SUNSET CRATER

<https://www.nps.gov/sucr/learn/historyculture/people.htm#:~:text=The%20public%2C%20fearing%20irreversible%20damage,of%20volcanic%20and%20human%20history.>

<https://www.usgs.gov/volcanoes/san-francisco-volcanic-field/sunset-crater>

https://azgeology.azgs.arizona.edu/archived_issues/azgs.az.gov/arizona_geology/april09/article_sunsetcratervolcano.html

https://en.wikipedia.org/wiki/Sunset_Crater

<https://www.nps.gov/sucr/learn/nature/geology.htm>

Tom Gidwitz, March/April 2004, *Secrets in the Cinders in Archaeology* March/April 2004, pp 46-52.

Elson, Mark D., and Michael H. Ort 2012 *Fire in the Sky: The Eruption of Sunset Crater Volcano*. In *Hisat'sinom: Ancient Peoples in a Land without Water*. edited by C. E. Downum, pp. 27-33. School for Advanced Research Press, Santa Fe.

Elson, Mark D., editor, December 2007, *Anthropological Papers* No. 33, Center for Desert Archaeology, 238 pp.

<https://www.youtube.com/watch?v=sjSUJLgxCZY>



FIGURES B-D CAMP VERDE SALT MINE

Around 1985, Stan Celestian, and others, dug into the side of a hill at the Camp Verde salt mine site, and entered an old tunnel. As you can see from Figure B, it wasn't the safest place in the world. Salts crystallizing in the wood timbers had torn the wood apart, wet and weakened wood was failing -- and the air was very bad. However, note the white stalactites -- they are thénardite (probably with associated halite, mirabilite, and other minerals).
Photos by Stan Celestian



FIGURE A THÉNARDITE CRYSTALS These crisp diamond-shaped crystals (cluster 2" across) were collected from Soda Lake, Carrizo Plain, San Luis Obispo Co., California. For a description of the collecting area, go to [https://www.mindat.org/a/best thenardite](https://www.mindat.org/a/best_thenardite) and scroll to the bottom of the page. *Photo by John Sobolewski CC BY 3.0*

GENERAL RESOURCES FOR THENARDITE

- <https://www.somaiya.com/industries/personal-care-and-cosmetics/ingredient/sodium-sulfate#:~:text=Sodium%20sulphate%20is%20a%20simple,biggest%20users%20of%20the%20compound.>
- <http://www.galleries.com/thenardite#:~:text=Uses%3A%20As%20a%20source%20of,industries%20and%20as%20mineral%20specimens.>
- <https://www.minerals.net/mineral/thenardite.aspx>
- <http://webmineral.com/data/Thenardite.shtm#:.YELzYo5Kg2w>
- <https://www.mindat.org/min-3935.html>
- <https://en.wikipedia.org/wiki/Thenardite>
- <https://www.mindat.org/loc-45093.html>
- <https://commons.wikimedia.org/wiki/File:Thenardite-215859.jpg>

...Thénardite continued from page 2

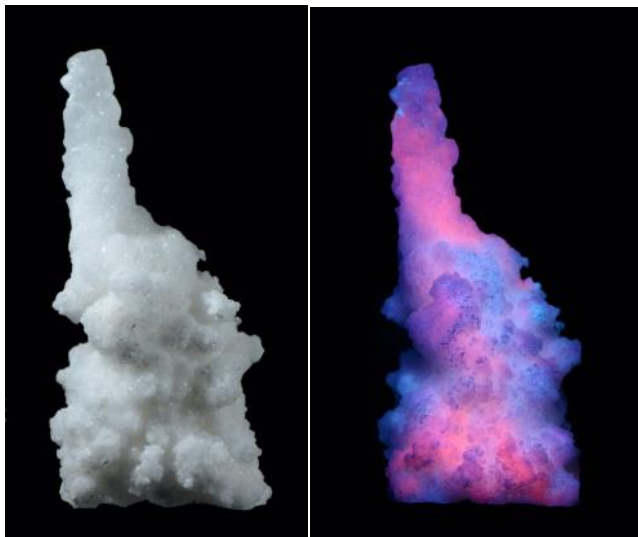


FIGURE E THÉNARDITE STALACTITE Stan collected this frosty white, 10" tall, stalactite from the underground tunnel at the Camp Verde Salt Mine, described in Figures B-D. The right-hand image was taken under UVc.

Photos by Stan Celestian

UPCOMING FIELD TRIPS & MEETINGS

WHERE: Contact Mine
WHEN: Saturday, March 13, 2021
WHAT: Amethyst

WHERE: Bullard Mine
WHEN: Saturday, March 27, 2021
WHAT: Copper Minerals, Slag

WHERE: Purple Passion Mine
WHEN: Thursday, April 8, 2021
WHAT: Fluorescents

MEET: McDonald's in Wickenburg at 5:45, LV at 6:00
OTHER: \$20 per 1/2 5-gallon bucket

WHERE: Date Creek
WHEN: Saturday, April 10, 2021
WHAT: Quartz Crystals, Hematite ps Pyrite
MEET: McDonald's in Wickenburg at 8:45 (LV at 9:00)

WHERE: Tucson mineral, fossil & jewelry shows
WHEN: Saturday, April 17, 2021
WHAT: If you don't want to venture into Tucson alone, sign up for this trip for guidance or possible carpool. Go to <https://tucsongemshow101.com/schedule-april-2021> to see what is available.

WHERE: Sycamore Creek
WHEN: Saturday, April 24, 2021
WHAT: Red Jasper

WHERE: Christopher Creek area & Fossil Site
WHEN: Saturday, May 15, 2021
WHAT: Zebra Chert, Naco Fm. Fossils

DATES SUBJECT TO CHANGE

Bill and the field trip committee will be actively looking for productive spots for field trips. If you have any suggestions, you are encouraged to contact him at bfreese77@cox.net



WIRE WRAPPING

Watch for an email announcing the resumption of the wire wrapping group

FACEBOOK



Visit and join the club page periodically. See what is happening, and boost our visibility on the web. Go to: [The Daisy Mountain Rock and Mineral Club](#). It is set up so you can post photos of outings or related items. Share with friends!

AWARD-WINNING WEBSITE

<http://www.dmrmc.com/>

If you have comments, contact Nancy Gallagher.

INSTAGRAM



Follow the club on Instagram. Go to <https://www.instagram.com/daisymountainrockclub/> and follow today. Share with friends!

Officers, Chairpersons, & Trustees

- President:** Ed Winbourne....ewinbourne@gmail.com
- Vice President:** Bill Freese..... bfreese77@cox.net
- Secretary:** Rebecca Slosarik .. rslosarik1@gmail.com
- Treasurer:** Cynthia Buckner....Cbuckrun1@q.com
- Publicity:** Jessie Redmond...
- Membership:** Tiffany Poetsch tnpoetsch@gmail.com
- Editors:** Susan & Stan Celestian.....
azrocklady@gmail.com
- Field Trip:** Bill Freese ... bfreese77@cox.net
- Mine Steward:** Stan Celestian.....
stancelastian@gmail.com
- Show Chair:** Ed Winbourne
- Trustees:**

Cynthia V	Claudia M
Susan C	Tiffany P
Bob E	Jim R
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Don R	Howard R
Jessica C.	Rebecca S
Johnaton M	Joe G
Clark L	Bob S.

Meetings are held the **1st Tuesday of the month** at the **Anthem Civic Building**, 3701 W Anthem Way, Anthem, AZ 85086. General meeting at 6:30 pm. We **do not meet in July or August.**

DMRMCLUB@GMAIL.COM

Membership Dues:
 First year \$30, then \$20.00 Adults per Person
 First year \$45, then \$25.00 Family (2 people)

Meeting Dates for 2021

Jan 5, Feb 2, Mar 2, Apr 6, May 4, June 1, Sept 7,
 Oct 5, Nov 2, Dec 7

MEETING VIA ZOOM ON TUESDAY, APRIL 6. Look for an email with the link.

Words of Wisdom

passed along by our own

Bob Evans



*When you let go,
you make room for
better things to
enter your life*

NEEDED: QUALITY MINERALS (or OTHER) DONATIONS WITH LABELS -- for monthly raffle prizes; and for raffle, door prizes, and sales tables at the annual show. If you have specimens to donate, please see Robin Shannon. The Daisy Mountain Rock and Mineral Club is a 501(c)(3) non-profit organization, and will gratefully acknowledge your donation with a Tax Deduction Letter. Thank You!

NOTE FROM THE EDITORS

Have a geological interest? Been somewhere interesting? Have pictures from a club trip? Collected some great material? Send us pictures -- or write a short story (pictures would be great).

Deadline for the newsletter is the 22nd of the month.

Mail or Email submissions to:

Susan Celestian
6415 N 183rd Av
Waddell, AZ 85355
azrocklady@gmail.com

UPCOMING AZ MINERAL SHOWS

April 9-24 - Tucson, AZ During this period, most of the shows normally held in February, will set up. More information closer to April.

For dates and locations of various shows go to <https://tucsongemshow101.com/schedule-april-2021>

April 24 - Miami, AZ Gila County Gem & Mineral Society; Oasis Insurance, 411 W Live Oak (Hwy 60); Sat 10-2; Outdoor show; Masks required.

If you are travelling, a good source of shows AND clubs is <http://the-vug.com/educate-and-inform/mineral-shows/> OR <http://www.rockngem.com/ShowDatesFiles/ShowDatesDisplayAll.php? ShowState=AZ> OR <https://www.rockandmineralshows.com/Location/?displayShows=true>



Polished surface of an amethyst nodule from the Prism Mine, Maricopa Co., AZ Photo by Stan Celestian



Visit <http://rmfms.org/> for news about conventions, events, and associated clubs. If you are travelling, you might want to contact a club local to your destination. Maybe they have a field trip you could join, while in town.

NORTH MT OPEN STUDIO - APRIL

You are invited to return to NMVC Open Studio. Lapidary & Silversmithing on Thursdays and the first, third and fifth Saturdays in a month, from 8:30 to noon with cleanup starting at 11:45.

NMVC requires that everyone wear a mask while in the building. (Other NMVC requirements will be sent in a later email or on premises.)

Only four people can sign up, and must do so for the full three hours that the shop will be open each day. First come, first served.

Please arrive no later than 8:45 a.m. The center may close to the public at 10.

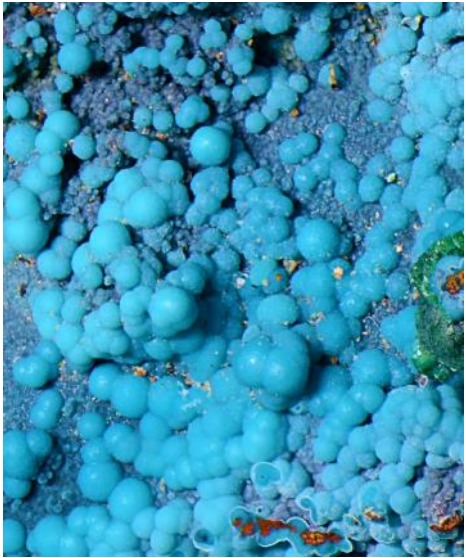
Email your request for the day(s) you are interested in participating ASAP. Email Shirley Cote at crystalc17@gmail.com

**April – Thursday's dates are 1, 8, 15, 22, 29
April – Saturday's dates are 3, 17**

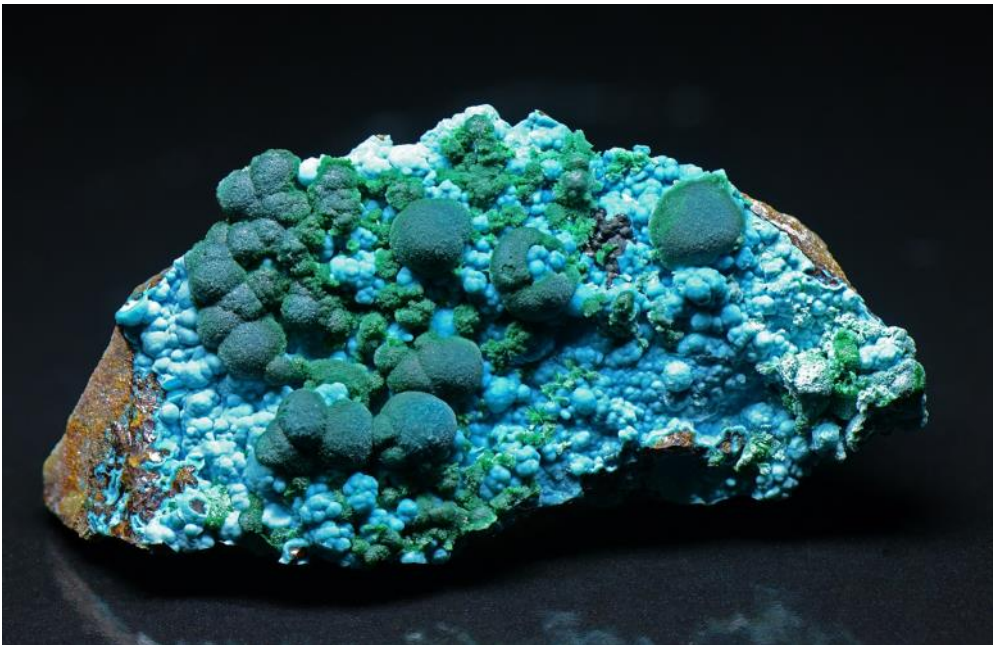
If more than four people wish to participate on the same day, please expect to be bumped or rotated to another day as efforts to accommodate everyone will be taken.

We would also like to inquire as to anyone wishing to come in for **Lapidary Only Open Studio on Mondays**. Email Shirley at crystalc17@gmail.com

April - Monday's dates are 5, 12, 19, 26



Balls of chrysocolla Photos by Stan Celestian

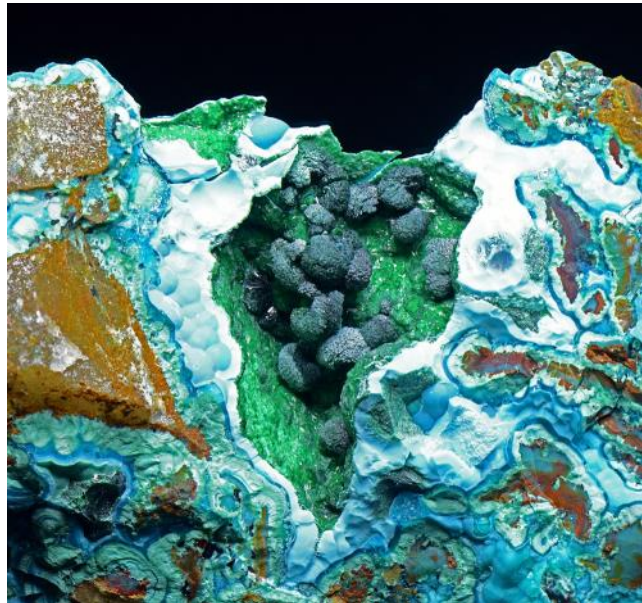
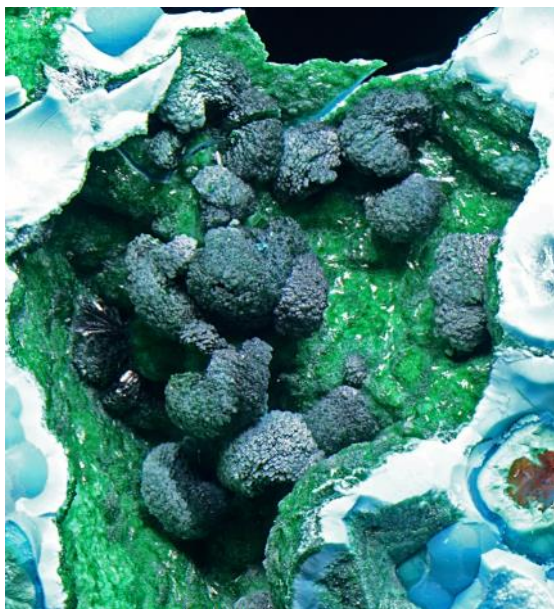


Balls of malachite and chrysocolla



Photos by Stan Celestian

Celestian's most recent acquisitions from the Chilito Mine



Balls of malachite on chrysocolla Photos by Stan Celestian