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 9 **OCTOBER 2021**

This is an emerald with the characteristic bluish-green color

Photo by Stan Celestian with permission of the Natural History Museum of Los Angeles County Gem & Mineral Hall Collection.

"THE SKY IS FALLING"

By Susan Celestian

The weather is cooling and it is getting more comfortable to get out in the field. With your eyes on the ground, you might spot something from out of this world; you might even go out with a metal detector or magnet and look for alien rocks on purpose. Those alien rocks?.....Meteorites.

- It is estimated that annually 20,000 meteorites, over 3.5 ounces each, land on Earth (most into the ocean).
- Of these, only 6-8 landings are witnessed or cause property damage.
- 100 tons of meteoritic material enters Earth's atmosphere each day (most is vaporized as it travels through the atmosphere -- including cometary dust, interplanetary dust, planet/planetoid fragments from asteroids, the Moon, and Mars).
- Meteorites and micrometeorites add up to 30,000 tons of material each year to the Earth's mass.
- On average, every year an automobile-sized asteroid enters Earth's atmosphere and vaporizes, creating a large fireball. (*jpl.nasa.gov*)
- On average, every 2000 years a football field-sized meteorite hits Earth. (*jpl.nasa.gov*)

Keep in mind that, besides a meteor's size, survival in our atmosphere is also dependent on composition, angle of entry & speed

Terminology:

- Asteroid - rocky body orbiting the Sun (known from 33' to 329 miles)
- Comet - icy/rocky body orbiting the Sun
- Meteoroid - rocky body broken from asteroid or comet and orbiting the Sun
- Meteor aka "shooting star" - rocky body in Earth's atmosphere
- Meteorite - rocky body that strikes Earth's surface
- Meteor Shower - a stream of dust particles left by the trailing tail of a comet and entering Earth's atmosphere
- Fall - meteorite recovered from a witnessed landing
- Find - meteorite recovered from an unwitnessed landing
- Strewn Field - zones where fragments from a meteorite were dispersed upon broke up during its journey through the atmosphere.

Meteorites continued on page 10…..

BERYL

By Susan Celestian

Chemical Formula - $Be_3Al_2(Si_6O_{18})$
Crystal System - *Hexagonal (3 horizontal axes of equal length, 120° from each other; a fourth perpendicular to those 3). Go to https://www.mindat.org/min-819.html And scroll down to an interactive crystal form.*
Growth Forms/Habits - *Crystalline: prismatic, tabular*
Hardness - *7.5-8*
Luster - *Vitreous, waxy, greasy*
Streak - *White*
Color - *Colorless, blue, green, yellow, pink, white*
Diaphaneity - *Transparent to sub-translucent*
Specific Gravity - *2.63-2.92*
Cleavage - *Imperfect-fair in one direction*
Fractures - *conchoidal*
Occurrence - *Occurs in granitic pegmatites, mica schist, and limestone.*

A source of beryllium, varieties of Beryl are also outstanding gemstones.

- *Aquamarine* - blue to greenish blue
- *Red Beryl (Bixbite)* - red
- *Emerald* - green, bluish green, yellowish green
- *Golden Beryl* - yellow, golden yellow
- *Goshenite* - clear
- *Heliodor* - greenish yellow
- *Morganite* - light pink to orangish

Aquamarine is generally a pale blue color (a deep blue variety is called mixixe, whose color -- that fades quickly in sunlight -- is probably due to natural radiation). Aquamarine's color is due to the presence of iron (Fe^{2+} or Fe^{3+}) -- the darker color of mixixe is due to the presence of both iron ions. However, most aquamarine gemstones have been either irradiated or heat treated. Irradiation will deepen the blue color, but the stone will fade over time; heat will change the color from greenish to blue -- and that change is permanent.

Beryl continued on page 21….

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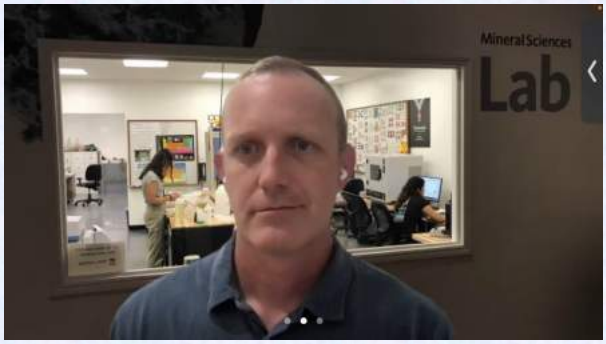
Each item is now hyperlinked to the page on which it is found



OCTOBER SPEAKER - Aaron Celestian

Curator of the Natural History Museum of Los Angeles County -- and genius son of DMRMC members, Sue and Stan Celestian -- Aaron addressed the sourcing of lithium, an element in great demand for batteries. He told us that projections predict that by 2025, the sales of electric cars will outpace the supply of lithium. So it is important to find a ready supply!

- Uses of lithium:
  - Batteries
  - Antiviral for Covid 19 treatment
  - Antidepressant/Mood Stabilizer
    - Editor's note: Between 1928 and 1948 7 Up (or 7 Up Lithiated Lemon Soda, as it was called) contained lithium citrate (mood stabilizer)
  - Fireworks (reds & others)
- South America and Australia are currently the primary sources of lithium
  - Greenbushes Mine in Australia currently supplies 1/3 of the world's lithium
- The element Lithium is created in supernova
- Sources of Lithium:
  - It is concentrated in ***Pegmatites***, as the minerals spodumene, hiddenite, tryphane, lepidolite, tourmaline, petalite, eucryptite, lithiophilite, triphylite, and others. SPODUMENE is the primary ore mineral for lithium.
    - Mining and recovery of lithium from rocks uses aqua regia (= nitric and hydrochloric acid) or hydrofluoric acid = caustic substances; and recovery processes are complex, requires a lot of land, is water intensive, and expensive.
  - ***Sedimentary sources*** are also important: hectorite (a clay alteration from ash) and jadarite
    - Jadarite is a newly discovered mineral -- with the same composition of the made-for-comics kryptonite (how weird is that?!)
    - Thacker Pass Mine at Nevada/Oregon border is slated to be a major open pit mine
    - Mining and recovery has same drawbacks as above
  - ***Brines*** in geothermal fields and those associated with oil are potentially the easiest and most cost-effective source of lithium.
    - Recovery from geothermal sources uses little water and requires very little land
    - Brines in Argentina have a huge footprint for evaporation and stockpiles
    - U.S. brines at geothermal plants could provide lithium for the United States, by driving out lithium from hot water brought up to drive power plants.
      - ⇒ The molecular retrieval accomplished by manganese oxides -- most of which currently degrade quickly, have low lithium capacity, use highly acidic conditions to regenerate, and take a long time to absorb lithium
        - ◊ But scientists are literally creating compounds in their kitchens, that are highly selective for lithium, have long-term durability, regenerate under mild acidic conditions, and quickly conduct ions -- quick, efficient, inexpensive, less pollution/hazard

Zoom Board Meeting Minutes
October 4, 2021

- In Attendance: Bill F., Bob E., Bob S., Claudia M., Cynthia B., Deanne G., Don R., Ed W., Nancy G., Rebecca S., and Stan C.
- Meeting called to order by Bill F.
- September minutes approved
- Cynthia B. discussed the financials
  - ◊ Scholarship was paid out to the winner's school account
  - ◊ Civic building rooms are paid for through the end of the year
  - ◊ $40 for 2020-2021 Arizona Corporation filing
    - * For 501(c)3 organization status
  - ◊ Positive net income because of raffle sales
  - ◊ Amendment will be made to by-laws to include those allowed to possess club credit cards
    - * No specific mention of who has access at this moment
- Membership, run by Tiffany P., was mentioned
  - ◊ The website and online forms are working as intended
- Stan C. talked about the claim's committee
  - ◊ Dave Haneline Mine
    - * Name has not yet changed with Yavapai Co
      - ⇒ Ed W. will follow up next month
  - ◊ Email was sent to BLM to discuss mine rights
  - ◊ If anyone would like to visit the mine, please email Stan C. with name, date, and have $10/member fee: stancelestian@gmail.com
  - ◊ Next area of interest is near the Mushroom Rhyolite site
    - * Will check on area soon
- Jennifer G. will continue wire wrapping classes
  - ◊ 4:30–6:30 pm first Tuesday of the month
  - ◊ At the Civic building
  - ◊ Bring materials and supplies if you can
  - ◊ Jennifer is a volunteer, so tips for material/time is appreciated
- Bill F. discussed the field trips
  - ◊ Mingus mountain trip had a great turnout including other clubs' members
  - ◊ Always check your emails for updates
- Please follow proper etiquette when on the field trips
  - ◊ Please stay together on backroads when following the group
  - ◊ Communication is essential
    - * The leader always brings walkie-talkies for other drivers so that no one gets lost
- Ed W. updated us on the March 2022 show
  - ◊ Application was sent to Boulder Creek H.S.
    - * For March 18-20th
    - * Email with specifics was sent to the principal
      - ⇒ School can be difficult to work with
  - ◊ Jim Reed sent letter to vendors
- October general meeting was discussed
  - ◊ Bill F. went to civic building to confirm that the Zoom setup will work
  - ◊ New manager at the building knows of our time arrangement
    - * We will be able to stay until 8:30pm moving forward
- Christmas party will be discussed at the general meeting
- Office elections will be decided in December
  - ◊ Nominations will be November
  - ◊ Treasurer is available
  - ◊ President is available
- A silent auction will be added to the raffle while supplies available
  - ◊ These are more expensive items that were donated
  - ◊ Bring your checkbook if you would like to bid on items
  - ◊ Items will be listed before each meeting
- Club dues are coming up
  - ◊ Look out for email with square payment option
  - ◊ Deadline for club dues – December 1st
  - ◊ Can always give cash, check, or money order at meetings
  - ◊ Can send to club's mailing address
    - * DMRMC P.O. Box 74215 Phoenix, AZ 85087

Respectfully submitted, Rebecca Slosarik, secretary

General Meeting Minutes
October 5, 2021

- Open attendance: about 47 members present
- Ed W. called the meeting to order
  - ◊ This will be Ed's last year as President
    - * Thank you so much for your years of service to the club!
- Cynthia B. talked about the financials
  - ◊ Club in good standing
  - ◊ Deadline for club dues – December 1st
  - ◊ This will be Cynthia's last year as treasurer
    - * Thank you so much for your years of service to the club!
- Tiffany P. discussed membership
  - ◊ Currently ~175 members (+3 from meeting)
  - ◊ The club grew during the pandemic
    - * Thank you everyone for your continued support of the club's mission

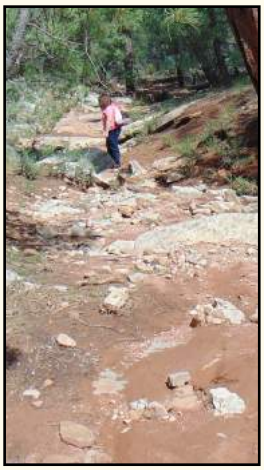
Minutes continued on page 20…..

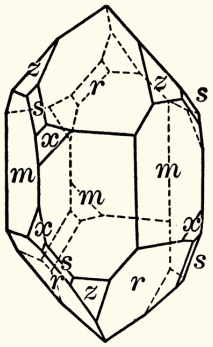
FIELD TRIP FOR QUARTZ CRYSTALS

Saturday, October 2, 2021

Photos & Text by Bill Freese

These are the pics I have from the Diamond Point trip. I don't have that many pictures as people were scattered all over the forest. As far as I can guess, we had around 40 people from the DMRMC & MSA. The weather was absolutely beautiful -- in the 60's. I believe everyone found at least one good piece, and some found many big crystals.





Field Trips continued on page 6…..

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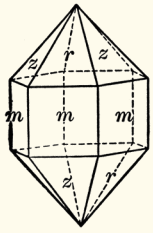
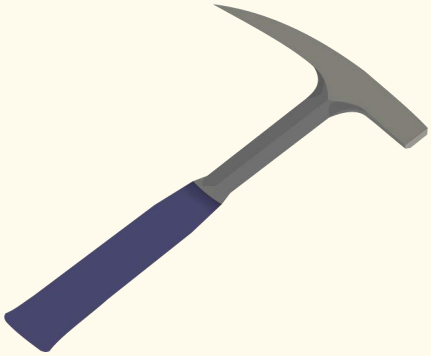


DIAMOND POINT



Field Trips continued on page 7…..

...Field Trips continued from page 6

FIELD TRIP TO PARKS FOR OBSIDIAN

Wednesday, October 6, 2021

Photos & Text by Bill Freese

Our Parks-Obsidian trip was awesome. We only had four people on the trip but it was a great day. The area where we were looking for the obsidian was over 7400 feet in elevation, and so when we arrived, it was in the low 50's, and even by the time we left, it had only gotten up to 60 degrees. We hiked around the mountain looking for the best pieces and the elusive mahogany specimens. It was a workout, but fun nonetheless. Another fun and beautiful trip.

Lobster Mushroom
Hypomyces lactifluorum

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FIELD TRIP TO PAYSON FOR SHOOFLY AGATE

Saturday, October 23, 2021

Photos & Text by Bill Freese

Our field trips are doing very well and this was no exception. We ended up with 14 people including me. We started our beautiful cool day in the pines at a geode site north of Whispering Pines (N of Payson) and everyone found plenty to take home. While we were getting close to leaving, one of the newbies found a crystal (like Diamond Point) by the area where we were parked. We looked around and found several more. Who knew! We all headed to the second 4x4 trail to Shoofly agate and found tons of great agate. I filled a 1/4 bucket of tumble size in 10 minutes. Lots of interesting colors and a fun 4x4 trip. Thank you all for the tips in the tip jar. On to the next!

GEODES UNDERFOOT!

QUARTZ CRYSTALS

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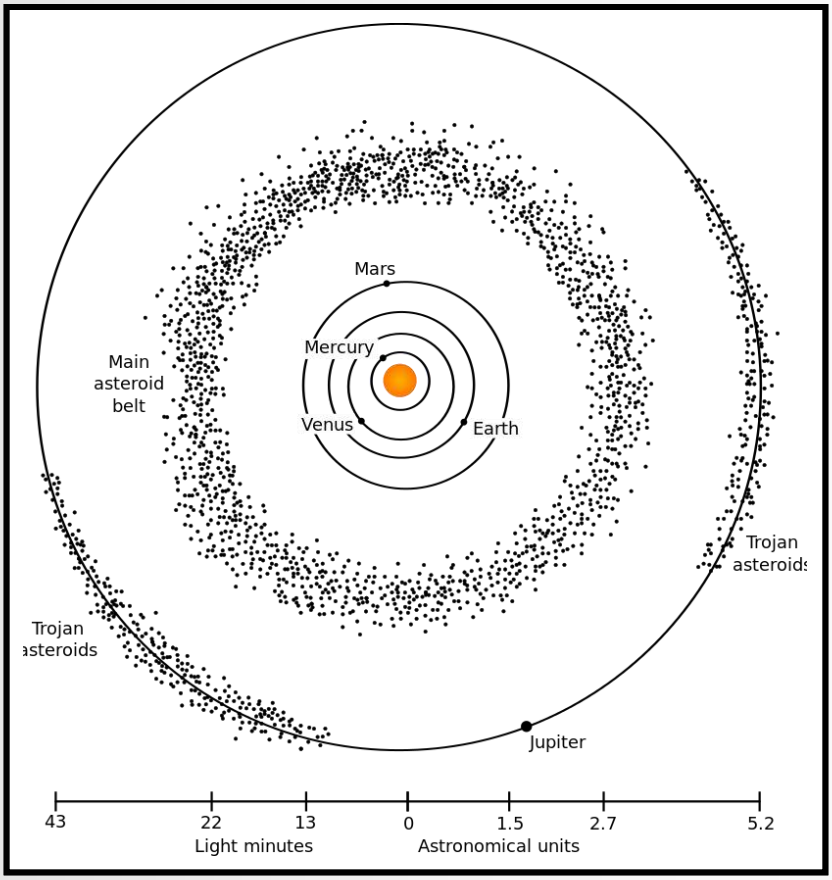
Now, from where do these meteoroids come? Nearly all of the 50,000 recovered meteorites (99.8%) come from the Asteroid Belt between Mars and Jupiter, or from the Oort and Kuiper Belts of comets. See Figures 1-2.

FIGURE 1 THE ASTEROID BELT The Asteroid Belt (or Main Asteroid Belt) between Mars and Jupiter is probably the source of most meteorites. The total mass of the particles in that orbit equal about 3-4% of the mass of the Moon; Although half of the mass is contained in 4 large asteroids (Ceres, Vesta, Pallas, and Hygiea)[1] Most of the material is much smaller than those 4 bodies, ranging down to dust-sized.

- Over 200 are over 62 miles diameter
- 700,000-1.7 million have a diameter exceeding 2/3 mile

[1] Ceres is about 590 miles in diameter (a dwarf planet), and Vesta, Pallas and Hygiea are all under 375 miles in diameter.

Illustration source: Public Domain: my own work derived from NASA's image



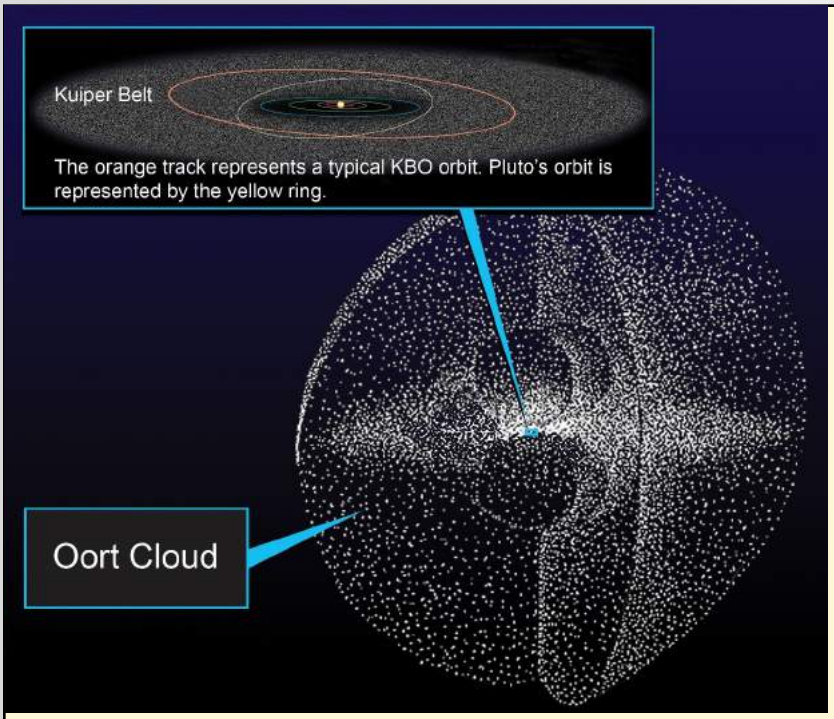


Illustration source: Public Domain: *William Crochot* - https://herschel.jpl.nasa.gov/solarSystem.shtml

FIGURE 2 THE KUIPER BELT AND OORT CLOUD The Kuiper Belt is a donut-shaped belt of relatively small comets (smaller than our Moon) found beyond the orbit of Neptune, out to about 55 AU[2].

The Solar System and Kuiper Belt is surrounded by the Oort Cloud. The latter is a large-comet filled bubble extending from 2000 -5000 AU out to 10,000-100,000 AU, from the Sun. Although we have observed no objects in the far Oort Cloud, it is thought to be the source of long-period comets (comets whose orbits bring them into the inner solar system only after very long periods of time -- for example C/2013 A1 (Siding Spring) approached Mars in 2014, but will not return for 740,000 years).

[2] An Astronomical Unit (AU) is equal to the distance between the center of the Earth and the Sun -- about 93,000,000 miles.

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Mars (60 known) and the Moon (80 known) are additional sources for some less-usual meteorites. Impacts of large meteoroids may break off chunks of the planetary bodies, and send them into orbits that may intersect those of Earth, where they are caught in Earth's gravitational pull. Identification of these meteorites is made by comparing their composition to that we know of rocks and the atmospheres of Mars and the Moon.

What happens when a meteoroid enters Earth's atmosphere?

- 60-75 miles up: frictional/ramming pressure causes heating to produce a flare or *FIREBALL*.
  - Very small ones burn up (although the tiniest may survive as they radiate heat away from themselves rapidly)
  - Friable ones (like stony meteorites) will break up at 50-55 miles up
  - Tough ones (like metallic meteorites) will break up at 6-18 miles up, unless they are large enough to survive all the way down
  - A meteorite less than 3' in diameter can produce a fireball 600' in diameter!
  - At lower altitudes and denser air, meteorites slow, and fireballs are extinguished when 15-20 miles up.
- Most visible meteors are the size of dust (1 micron across = 1/1000 mm, and there are 25 mm in an inch).
- Most (not all) meteors smaller than 82' will burn up in the atmosphere. (*NASA.gov*)
- Meteorites travel at 4-44+ miles per second (32,000-150,000 MPH!!!)

"I saw a fireball and it landed just down the road!" Meteorites appear to be closer than they really are, due to the distances involved and the curvature of the Earth. In fact, most fireballs are produced by objects that burn up and never reach the Earth's surface.

- If it appears to reach the horizon, it is probably 300 miles away
- If it appears to go behind a hill or some trees, it is probably over 50 miles away
- As stated above, fireballs burn out at 15-20 miles up. After burnout, it may take 5 minutes for a meteorite to hit the Earth -- IF it even does.

REPORT A FIREBALL SIGHTING: Should you see a fireball (either daytime or nighttime), you can report it HERE. You can also see a chart of reports from around the U.S. and the world. It is surprising how many there are some days!

> *Editor's Note: During a golf game on Saturday, October 16, 2021, at about 6:23am, Stan Celestian looked up and saw a fireball streaking across the sky. It had a bright whitish green vapor trail, lasted about 3 seconds, and broke up into at least 3 fiery fragments toward the end.*

> *Editor's Note: On August 10, 1972 at about 4:30pm, I (Susan Celestian) witnessed the Great Daylight Fireball. I was at field camp in Montana, looked up as I trudged up a ridge, and was rewarded with a spectacular sight. My eyewitness was shared by many people throughout the western U.S. and Canada. It was a huge bright fiery ball, with a reddish vapor trail, and lasted about 1.5 minutes, as it streaked across the horizon. Apparently, it was at least 25 miles from Earth, entered the atmosphere over Utah, and skipped back out into space over Alberta, Canada. It was AWESOME!*

Witness to meteorite falls report hearing crackling or hissing, sonic booms, a hot blast of air, and of course fireballs. Everyone expects a meteorite to be hot, if picked up shortly after landing; but remember that they are icy cold, from their tenure in deep space, and ablation carries heat away from its surface. So, while they flare and ablate during their journey through Earth's atmosphere, they are probably frosty -- or slightly warm -- upon impact.

> *Editor's Note: One evening, during an astronomy observing session at Buckeye Hills, southwest of Phoenix, a meteorite flared, casting a shadow on those of us in the park. And remember, the meteorite was probably at least 60 miles up, and who knows how far away horizontally!*

What would happen if a meteorite the size of _____ hit the Earth's surface? Of course, the effects will vary with the diameter and density of the meteorite, velocity, the angle of impact, the rock type at the impact site, or whether the impact occurs in the ocean, but… Here are some possible estimates:

- 25' diameter (1 per 10 years) - usually burn up in the atmosphere; enter the atmosphere

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about 1/year; energy of Little Boy, the atomic bomb dropped on Hiroshima

- 50' diameter - destroy an area the size of a large urban area, like New York City
- 120' diameter - destroy an area the size of a small state; mild tsunamis
- 164' diameter - (1 per 400,000 years) - comparable to Tunguska impact in Russia
- 250' diameter - destroy area the size of a moderate state (ex: Virginia); large tsunamis; if in seismic zone, then trigger M7.5+ quakes
- 550' diameter (>300-1 per 5000 years) - raise dust with global implications; destroy area the size of a large state or small country (ex: California, France); tsunami 600' high
- 1/2 mile diameter (1 per 300,000-500,000 years) - global dust, no crops for a year
- >3 miles diameter (1 per 10-30 million years) - flames, dust, cold, extinctions…… *See one proposed impact scenario on pages 20-21.*
- 60 miles diameter - wipe out all life on Earth
- KNOWN: Tunguska Event (June 30, 1908 over Siberia)
  - fireball;
  - explosion heard for 500 mile radius;
  - hot, hurricane-force winds - knocked people, who were 36 miles away, 20+ feet and unconscious;
  - flattened and burned forest for 10 mile radius
  - body estimated to be 300-500' diameter AND it exploded/disintegrated 5 miles above the surface!!
- KNOWN: Chelyabinsk Meteorite (February 13, 2013 over Chelyabinsk, Russia)
  - 65.6' diameter, 10,000 tons
  - travelling 40,000-42,900 MPH
  - Shattered 18-32 miles above the surface (4-6 tons reached the ground)
  - 20-30x the energy of atomic bomb at Hiroshima
  - shockwave damaged 55 miles on either side of the trajectory
  - so bright it caused skin and retinal burns (1 person 18 miles away lost facial skin to radiation)
  - broke windows, damaged 7,200 buildings,

For fun go to HERE, and click on the link to an interactive page, where you can create the specifications of a meteorite impact, and see the resultant effects.

Near Misses emphasize the potential risk of a meteorite hitting Earth. NASA's JPL manages a Center for Near-Earth Object Studies, that tracks comets and asteroids. The goal is to be able to anticipate a potential strike -- however, what we could do to prevent it or to prepare for it is another matter. There have been a number of "near" misses in recent years -- and many of them we didn't see until they had passed by (the sun is often in our eyes)….oops. Some examples are:

- April 12, 2021 - a 16,000' diameter asteroid missed by 12,000 miles
- August 18, 2020 - a car-sized asteroid missed by 1,830 miles (and we didn't see it coming)
- June 5, 2020 - a football field-sized asteroid missed by over 190,000 miles. That sounds like a lot, but it is still within the distance between the Earth and the Moon. We spotted it 2 days after it had passed.
- September 24, 2020 - a bus-sized asteroid passed within 13,700 miles of Earth -- that is within the orbit of geostationary satellites encircling our planet. Of course, it was small and probably would've broken up and vaporized had it entered the atmosphere.
- November 13, 2020 - a 16-33' diameter asteroid passed within 230 miles of Earth (closest passby ever recorded).
- September 8, 2021 - a car-sized asteroid passed within 9,532 miles of Earth. Per The Watchers website, this asteroid (discovered by Arizona astronomers at Mt Lemmon) was the 81st asteroid to fly within the Earth/Moon orbit -- and the closest -- in 2021.

A lot of asteroids zoom by pretty close, although fortunately most are relatively small and pose little risk, even if they entered our atmosphere.

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TYPES OF METEORITES

There are 3 basic types of meteorites: stony, iron, and stony-iron. These are all, of course, further divided into sub-groups; however, I'll leave that to your curiosity to further research those

STONY METEORITES are thought to have originated as fragments of planet/planetoid crustal material.

Stony meteorites account for 95% of all falls and 80% of all finds (by the number of specimens). They:

- are smooth with a gently undulating surface
- generally are light to dark gray in their interior, where you can see minerals, crystals, chondrules (small spheres)
- usually have a thin glassy to black fusion crust (about 1mm thick) -- this may weather away over time
- can be up to 23% metal, and therefore are usually magnetic

See Figures 3-4.

FIGURE 3 STONY METEORITE Stony meteorites often resemble Earth rocks, with visible minerals and crystals. However, their metallic content makes them somewhat heavier than Earth rocks, and magnetic. Locality: NW Africa *Photo by Stan Celestian.*

FIGURE 4 FUSION CRUST As meteorites race through our atmosphere, friction causes the surface to heat up and melt. This alters the minerals and creates a very thin (normally no more than 1mm thick), black *fusion crust*. *Photo by Stan Celestian.*

EVIDENCE OF METEORITE IMPACT

- **IMPACT CRATER**
- **IMPACT BRECCIA:** deposits of angular rock
- **TSUNAMI DEPOSITS:** mixed shallow-deep marine & terrestrial sediments
- **SHOCK METAMORPHISM:** melted rocks, shocked quartz/feldspar, shatter cones, hi-pressure quartz
- **IRIDIUM ANOMALY:** rare in Earth's crust, but may be enriched in dust created by impact

Meteorites continued on page 14.....

...Meteorites continued from page 13

IRON METEORITES are thought to have originated as fragments of planet/planetoid core material.

Iron meteorites account for 4% of all falls and 18+% of all finds, by the number of specimens; however 96% by weight. They:

- are angular
- often have thumbprint-like depressions or regmaglypts
- usually have a black to blue-black fusion crust (less than 1mm thick) -- this may weather away over time, to a rusty surface
- often composed of 5-50% nickel (Ni), which can be a very diagnostic feature
- are strongly magnetic
- sometimes will display Widmanstatten Pattern (revealed after polishing and treatment with acids): low nickel content (7.5-12.7%)
- Sometimes will display Newmann Lines, caused by impact deformation
- May display no internal crystal structure: ataxite with hi nickel content (>16%)

See Figures 5-12.

FIGURE 5 IRON METEORITE This is a photo of the 2520 pound Murnpeowie Meteorite, from South Australis, and discovered in 1909. It exhibits classic regmaglypt formation -- those thumbprint-like depressions that cover the surface. These form from melting and abrasion of the surface as it descends through Earth's atmosphere *Photo by John St. John and licensed by* CC BY 2.0

FIGURE 6 IRON METEORITE This is a small piece of Arizona's Canyon Diablo Meteorite (from Meteor Crater). Note its angularity and rusty spots (white is caliche). This meteorite landed about 50,000 years ago. *Photo by Stan Celestian.*

FIGURE 7 IRON METEORITE This is a fist-sized fragment of the Canyon Diablo Meteorite. It has been wire-brushed to remove rust. It is generally angular with modified regmaglypts. *Photo by Stan Celestian.*

FIGURE 8 IRON METEORITE This fragment of the Campo del Cielo Meteorite, of Argentina, is quite rusty. It is estimated that it has resided on Earth for 4-5,000 years. *Photo by Stan Celestian.*

Meteorites continued on page 15…..

...Meteorites continued from page 14

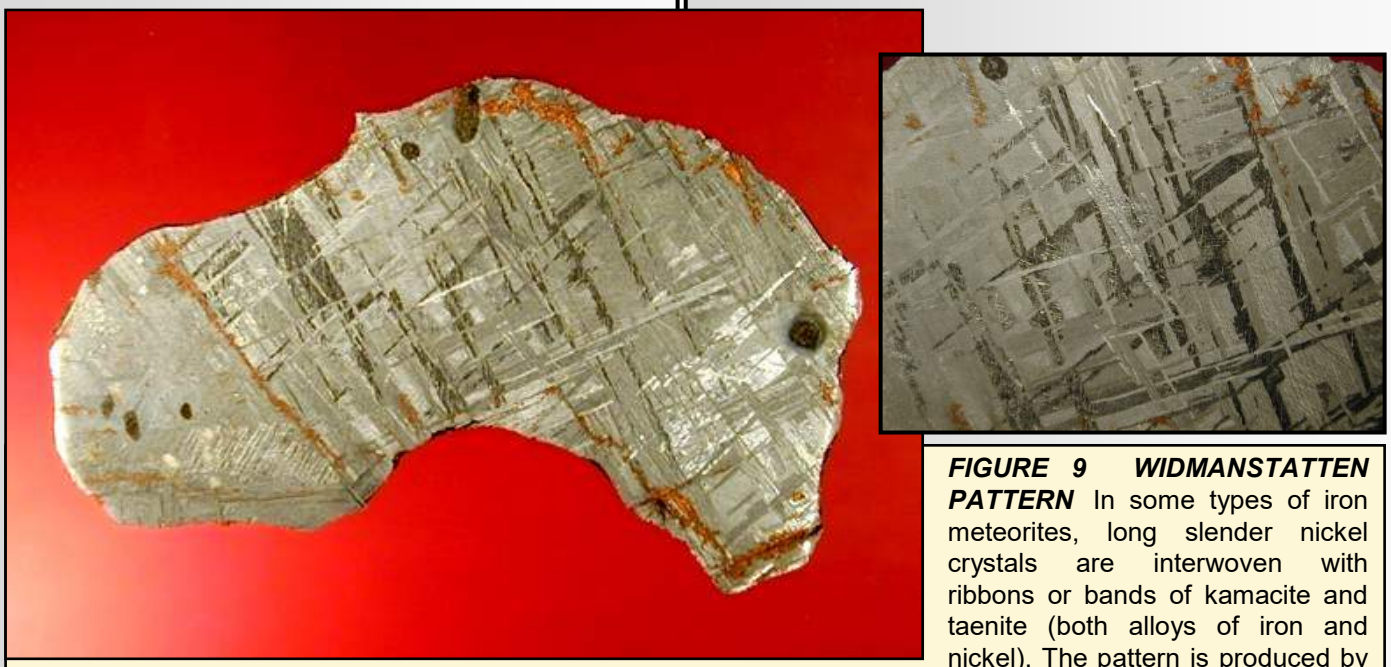


FIGURE 9 WIDMANSTATTEN PATTERN In some types of iron meteorites, long slender nickel crystals are interwoven with ribbons or bands of kamacite and taenite (both alloys of iron and nickel). The pattern is produced by the metal cooling over a period of millions of years. The pattern is revealed after the meteorite is sliced, polished, and etched with nitric acid or ferric chloride. This is the Gibeon Meteorite from Namibia. *Photos by Stan Celestian.*

FIGURE 10 WIDMANSTATTEN PATTERN This is the Odessa Meteorite, from Odessa, Texas. Note that the Widmanstatten Pattern is coarser than that of the Gibeon in Figure 9. The black areas are graphite nodules. *Photo by Stan Celestian.*

FIGURE 11 IRON METEORITE This is the Chinga Meteorite, from Russia. It is very high in Nickel (16%), so displays no Widmanstatten structure, and polished to a high sheen.
Photo by Stan Celestian.

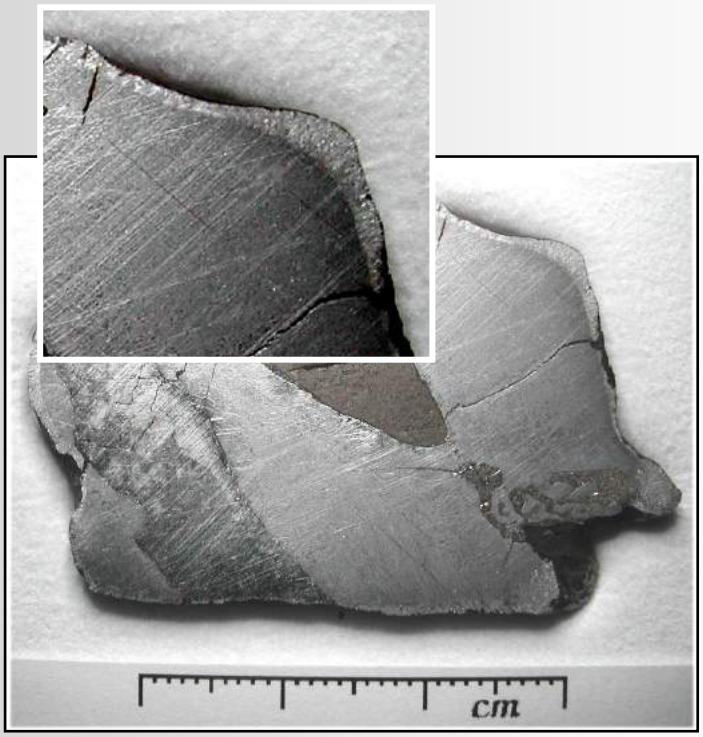


FIGURE 12 NEUMANN LINES This is a cut, polished, and acid etched slice of the Sikhote-Alin Meteorite, from Siberia. It is an iron meteorite that exhibits Neumann Lines or Bands, that result from deformation of kamacite (nickel iron alloy) crystals, resulting from the shock of an impact event on the parent meteorite. *Photo by* André Knöfel *and licensed by* CC BY-SA 3.0 de

Meteorites continued on page 16…..

...Meteorites continued from page 15

STONY-IRON METEORITES are thought to have originated as fragments of planet/planetoid core/mantle boundary material.

Stony-iron meteorites account for 1% of all falls and 1.6% of all finds. They:

- are a mixture of about equal parts of stony and iron elements. There are 2 types:
  - ◊ Pallasite: iron plus olivine
  - ◊ Mesosiderite: brecciated (mix of metal veins, glass, and stony fragments)

- Pallasites are composed of metallic NI/Fe and large crystals of olivine. There are two hypotheses on their origin: 1) they formed at the boundary of the core and mantle of an asteroid that has differentiated into core/mantle/crust, similar to the Earth; and 2) they formed at an impact hat caused the mixing of core and mantle material. See Figure 13.

  There are only 61 known pallasites, to date.

- Mesosiderites are composed of metallic Ni/Fe and brecciated rocky fragments (pyroxene-rich, olivine-rich, and Ca-plagioclase-rich rocks). They are thought to have formed in asteroid collisions (between one stripped of core and mantle and one with crustal rocks), with the resulting mixture of core, mantle, and crustal material. See Figure 14.

  There are only 150 known mesosiderites,

FIGURE 13 STONY-IRON METEORITE - PALLASITE The large greenish and golden crystals are olivine. Locality: Brenham Meteorite, Kansas. *Photo by Stan Celestian.*

FIGURE 14 STONY-IRON METEORITE -- MESOSIDERITE Relatively equal parts of metal and stony (fragmental silicates) material, this is the Estherville Meteorite from Iowa.
Photo by James St. John and licensed by CC BY 2.0.

If you go HERE you will find an interactive map of Terrestrial Impact Craters. Lots of interesting Information.

AND if you go HERE, you will find an interactive map of Arizona with some of the known meteorite sites marked. A complete list of known meteorites can be found HERE.

FINDING A METEORITE -- AND HOW TO TELL A METEORITE FROM A METEOR-WRONG

SO, you want to go out and try to find a meteorite! A good place to start is where meteorites have been found already -- you can use the list mentioned above for places to start. Other criteria that will increase your chances of success are:

- Areas where weathering is minimal
  - ⇒ playas (desert dry lakes)
  - ⇒ dune fields
  - ⇒ Glaciers
- Areas where rocks/vegetation are scarce; OR rocks are sedimentary (i.e. not "hot")
  - ⇒ dune fields
  - ⇒ playas (desert dry lakes)
  - ⇒ glaciers
  - ⇒ Midwest U.S. (lots sedimentary rocks)
- Areas where ground is repeated overturned, such as farmland.

Meteorites continued on page 17…..

...Meteorites continued from page 16

There are some basic and inexpensive tools, with which you should arm yourself. See Figures 15-20.

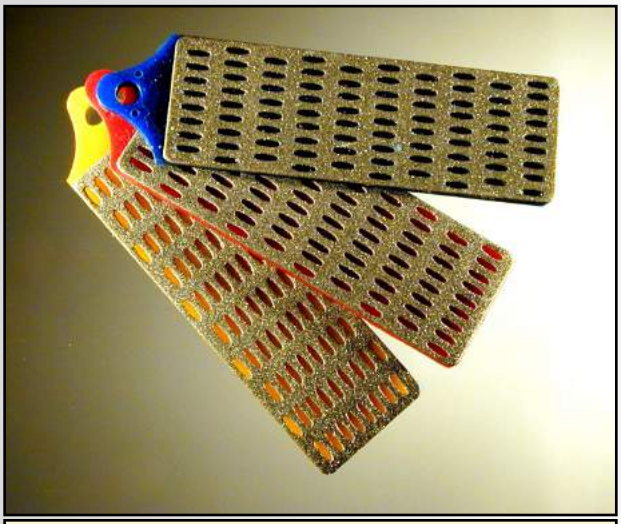


FIGURE 15 DIAMOND FILES These are used to abrade a meteorite, to reveal the interior. Pick an inconspicuous spot.
Photo by Stan Celestian

FIGURE 16 STRONG MAGNET As mentioned previously, most meteorites include some iron minerals, and that makes them magnetic (attracted to a magnet). Tool picker-uppers, with strong magnets have a handle and make it easy to sweep the ground for magnetic rocks. Be sure to cover the magnet with a plastic bag, so you don't have to spend hours clearing fine magnetite bits (abundant in Arizona soils) from it. *Photo by Stan Celestian*

FIGURE 17 GEOPICK This is a tool you can use to pry rocks out of soil, or dig down to them. Never leave home without one.
Photo by Stan Celestian

FIGURE 18 MAGNIFIER Looking closely for inclusions of metal bits is easier with a magnifier of some kind. *Photo by Stan Celestian*

FIGURE 19 METAL DETECTOR This piece of equipment can be pricey, and believe me it is unlikely that it will "pay for itself". However, it can be quite useful for detecting rocks that go *BEEP*.
Photo by Stan

FIGURE 20 GPS/TOPO MAPS Locating previous finds is easier when you can accurately determine your location -- and you for sure want to be able to get back to the same spot, if your hunt is successful! *Photo by Stan Celestian*

Meteorites continued on page 18.....

...Meteorites continued from page 17

NOW, how do you separate the ordinary rocks from potential meteorites? There are some pretty easy ways to begin to do this. Should you find a rock that you really think MIGHT be a meteorite, you can visit the Center for Meteorite Studies at ASU, for ID help.

QUESTIONS TO ASK

- ⇒ Is it heavier than normal Earth rocks? This can be quite subjective, but still could be useful -- compare the target rock with other rocks nearby.
  - stonys are 30-50% heavier; irons much more
- ⇒ Is there a fusion crust? Don't confuse desert varnish with a fusion crust!
- ⇒ Are there regmaglypts?
- ⇒ Is there a rusty scale?
- ⇒ Is it magnetic? (99+% of all meteorites are!)
- ⇒ Are there chondrules? You would probably have to saw the rock in half, but some stony meteorites have round structures, called chondrules.
- ⇒ Does it leave a STREAK? Meteorites leave little or no streak; Hematite's is reddish brown; Magnetite's is black. See Figure 21.

FIGURE 21 STREAK TEST You might want to add a streak plate to that list of equipment (these can be purchased online, or use the unglazed side of a tile). Rubbing a *fresh surface* of the rock firmly across the plate will powder it. The color of the powder is a strong clue. A strong reddish-brown or black streak will eliminate the rock as a meteorite. *Photo by Stan Celestian*

- ⇒ Does it contain nickel? It isn't a hard test, but it does require some chemicals that you don't have around the house. HERE is the process. I also noticed that you can buy a kit on Amazon. Almost no Earth rocks contain nickel, so this can be quit diagnostic (and it is the test that ASU will perform IF they think your rock might be a meteorite).

EXAMPLES OF METEOR-WRONGS

Figures 22-27

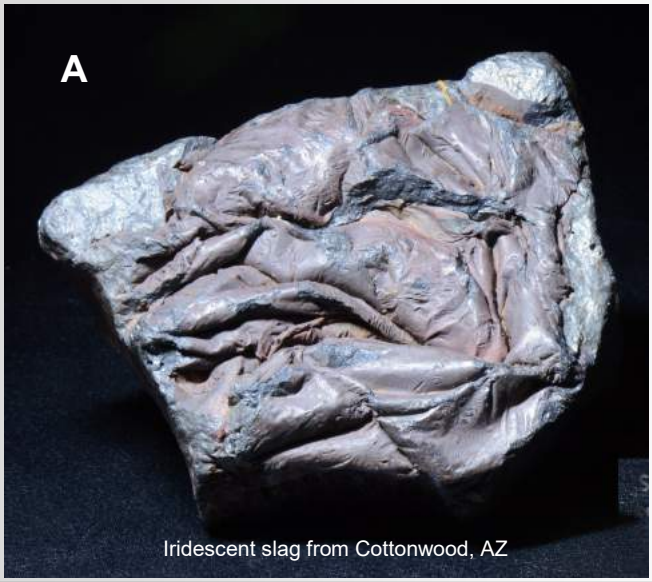
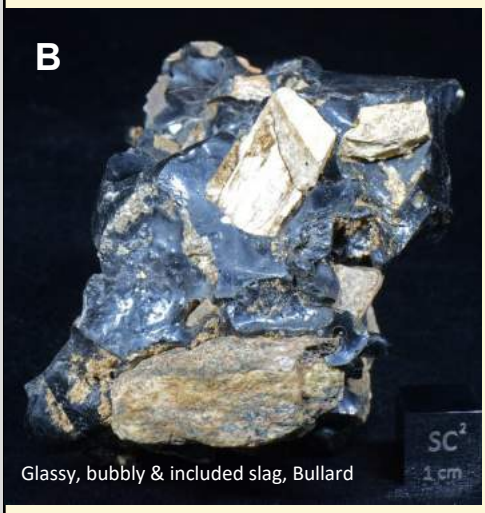


FIGURE 22 SLAG Material VERY commonly mistaken for a meteorite is slag -- a byproduct of mining. Especially in Arizona, it is commonly found, due to all the historical copper mining and smelting. Here slag is high in iron, which makes it very heavy, and it may be slightly magnetic.



However, features that may be present and that visually eliminate it as a meteorite are: a) iridescence, b) bubbly (as a rule, meteorites do not get all molten and bubbly); c) gas bubble holes (typically meteorites don't have vesicles -- though some do, however their interiors are solid rock without porosity; d) inclusions of other rock; and e) glassiness. *Photos by Stan Celestian*

Meteorites continued on page 19…..

...Meteorites continued from page 18

FIGURE 23 MAGNETITE Another rock common to Arizona is magnetite -- a rock that is iron-rich, so heavy and strongly magnetic. However, it will leave a very black streak on a streak plate. *Photo by Stan Celestian*

FIGURE 24 HEMATITE A partner of magnetite, and very common in Arizona, is hematite -- another iron oxide. It is heavy and often dark-colored. However, it is not normally magnetic (but associated magnetite may make it magnetic). And remember -- it has a reddish-brown streak.

Photo by Stan Celestian

FIGURE 25 BASALT Basalt is an iron-rich igneous rock -- and quite common in Arizona. It is heavy, and MAY be slightly magnetic. However, you usually can see some crystals, and may see gas bubble holes (vesicles).

Photo by Stan Celestian

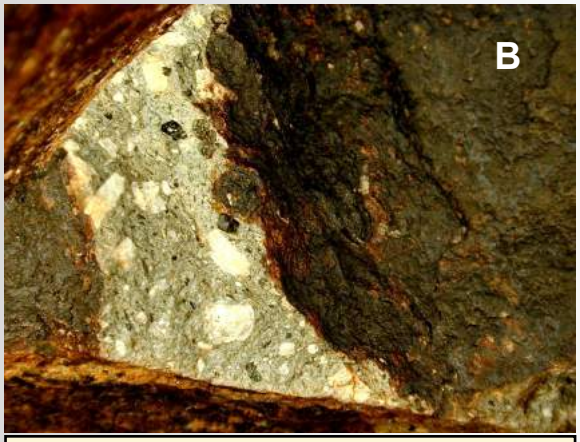


FIGURE 26 DESERT VARNISH Especially in arid climates (like Arizona), rocks take on a thin coating of manganese and iron oxides, called *desert varnish*.. This does resemble the fusion crust found on many meteorites. However, fusion crust tends to display contraction cracking, that will not be present in desert varnish. And you won't find any metal inclusions, common to even stony meteorites, in Earth rocks. *Photo by Stan Celestian*

FIGURE 27 SLAG GLASS Chunks of slag glass, initially a byproduct of iron smelting (and later produced intentionally), is used as a decorative item, and can be found in the most unlikely places "out in the wild". Contrary to common belief, meteorites do not melt and cool to glass, as they move through the atmosphere. And they definitely are not colorful red, blues, yellow, and so on. *Photo by Stan Celestian*

Meteorites continued on page 20…..

...Meteorites continued from page 19

JUST FOR FUN: A POSSIBLE CHICXULUB CRATER IMPACT SCENARIO

At the end of the Cretaceous, a 6-9 (or more) MILES in diameter asteroid slammed into the Earth in the vicinity of the present-day Yucatan Peninsula. The consequences of that impact caused the extinction of 75% of all life on Earth. There have been many descriptions of those consequences -- and many variables will determine these, including the size of the asteroid, the angle at which it impacted Earth, and whether the ocean at the impact site was shallow or deep. Years ago, I found one very specifically described scenario (and can't find the source). Some of the projected consequences may have been tempered by more recent research and simulation capabilities; however I find it an interesting scenario -- and certainly all components were instrumental in the extinction process, even if the absolute impact may prove different. Here goes:

DURING FREE FALL

- *heat the atmosphere to 50,000°F, stripping molecules of electrons (visible, ultraviolet, and infrared radiation)*
- *red/brown smog of nitrogen oxides (acrid smell)*
- *upon hitting ocean, water temperature raised to 100,000°F, flash boiling 8 trillion tons of water and rocketing vast jets of vapor skyward*

UPON IMPACT (100 million megatons of energy released)

- *100 trillion tons of bedrock and vaporized meteorite + 130 billion trillion gallons of seawater SHOOT UPWARD at 25,000 mph*
- *in 3 minutes, everything within 1200 miles leveled and scoured*
- *initial crater 16 miles deep and 200 miles wide (impact drilled through ocean sediments into the granite basement rock)*
- *shock waves heat air to more than 3000°F, followed by hurricane winds for 15-20 hours*
- *earthquakes with 100 billion times the energy of the 1905 San Francisco earthquake*
- *tsunami as high as the Rocky Mts and 3-4 miles wide (from Gulf of Mexico, 1500' high wave moving 450 mps hits Kansas City). This hypothesis may be excessive -- go HERE for a very recent simulation by Steve Ward, research geophysicist at UC Santa Cruz*
- *secondary waves for hours; churn oceans, mix warm and cold water killing sea life; aftershocks and disrupted wave patterns for decades or centuries*

DARKNESS

- *dust thrown 30 miles above clouds -- create violent air currents; dust/atmospheric particles collide = energy of and equal mass of TNT, therefore the air temperature 40 miles up rose to 1800°F, ground temperature 600°F, and 90% of worlds forests and grasslands burn*
- *soot + nitrogen oxide smog + dust created a shroud 17 miles thick -- within 24 hours, no sunlight penetration anywhere on Earth, that persists for as long as 6 months*

ACID RAIN

- *nitrogen oxide + water creates precipitation as corrosive as battery acid, resulting in defoliation; acidified lakes; poisonous metals leached out of soil and into waterways; ocean acidity rises, and upper 300 feet decalcified, releasing carbon dioxide into the atmosphere (will take ocean 50,000 years to recover)*

COLD

- *no sunlight, therefore cold, despite high carbon dioxide: within 10 days, it was 22°F, and it persisted for 6 month; 20' of snow in 3 months*

LIGHT RETURN

- *in about a year, dust and soot settle, allowing sunlight in*
- *Greenhouse effect: water vapor, nitrogen oxide, carbon dioxide = moist and steamy for 2000 years*

LIFE RETURNS

- *but with ozone disrupted; mutation, cataracts, cancers, etc.*

Meteorites continued on page 22.....

...Meteorites continued from page 20

GENERAL RESOURCES FOR METEORITES

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

https://www.nasa.gov/mission_pages/asteroids/overview/fastfacts.html

https://solarsystem.nasa.gov/solar-system/kuiper-belt/overview/

https://solarsystem.nasa.gov/asteroids-comets-and-meteors/meteors-and-meteorites/in-depth/

https://www.space.com/meteor-showers-shooting-stars.html

https://www.space.com/meteor-showers-shooting-stars.html

https://futurism.com/19943

http://curious.astro.cornell.edu/our-solar-system/75-our-solar-system/comets-meteors-and-asteroids/meteorites/314-are-meteorites-hot-or-cold-when-they-hit-earth-intermediate

https://www.businessinsider.com/asteroid-sizes-that-can-damage-cities-states-planet-2018-6#a-london-sized-asteroid-would-be-more-than-just-a-major-extinction-level-event-its-impact-would-slow-down-earths-rotation-enough-to-make-its-day-last-almost-half-a-second-longer-18

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

https://www.spacecampturkey.com/what-happens-if-an-asteroid-hits-earth

https://www.jpl.nasa.gov/asteroid-watch

https://earthsky.org/space/small-asteroid-skimmed-close-to-earth-sept-7-2021/

https://www.mlive.com/weather/2021/04/earth-expects-near-miss-of-an-asteroid-today-heres-why-we-care.html#:~:text=A%20relatively%20small%20asteroid%20is,miss%20compared%20to%20most%20asteroids.&text=While%20Asteroid%202021GW4%20is%20going,a%20crater%2060%20feet%20across.

https://www.bbc.co.uk/newsround/53823795

https://globalnews.ca/news/7067086/asteroid-near-miss-earth/

https://newatlas.com/space/earths-nearest-miss-record-asteroid-iss/

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

https://en.wikipedia.org/wiki/Widmanst%C3%A4tten_pattern

https://www.arizonaskiesmeteorites.com/Widmanstatten/

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

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

https://en.wikipedia.org/wiki/Stony-iron_meteorite

https://geology.com/meteorites/stony-iron-meteorites.shtml

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

https://geology.com/meteorites/stony-iron-meteorites.shtml

http://www.jsjgeology.net/Mesosiderite.htm

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

https://www.nytimes.com/2016/11/18/science/chicxulub-crater-dinosaur-extinction.html?.?mc=aud_dev&ad-key-words=auddevgate&gclid=CjwKCAjwn8SLBhAyEiwAHNTJbTdzg7lFg6kCAymf8fr2STqT4JhA7wRLt4-4OrnxvwBIF0DpzZE-yRoClDgQAvD_BwE&gclsrc=aw.ds

https://eos.org/articles/new-simulation-supports-chicxulub-impact-scenario

...Minutes continued from page 4

- Jennifer G. talked about the wire wrapping class
  - ◊ There is a different project each month, so keep coming back
  - ◊ Email with instructions will be sent before each meeting
- Stan C. discussed the claim's committee
  - ◊ Dave Haneline Mine
    - * Purchased for $5000
    - * In Wickenburg area
    - * Cerussite, barite, calcite, fluorite, quartz can all be found on the claim
  - ◊ Mushroom Rhyolite area is being investigated
    - * Desert rose, fluorescents found in the area
  - ◊ Any suggestions for other claim locations?
    - * Email Stan: stancelestian@gmail.com
  - ◊ The club wants to save claim's from further urban development
- The Christmas Party location was announced
  - ◊ Will be at the Dave Haneline Mine
    - * 2-wheel drive accessible
  - ◊ Date will be decided next month
- Bill F. talked about the field trips
  - ◊ Full calendar: Check emails regularly for updates and specifics
  - ◊ Sedona Rock Show on October 16th
- Ed W. discussed the 2022 show
  - ◊ Applied for March 18-20 at Boulder Creek H.S.
    - * Other school locations possible if need be
      - ⇒ Chorus Academy
      - ⇒ Diamond Canyon School
    - * During spring break for students
    - * Date coincides with Albuquerque show though
- Aaron Celestian did a wonderful presentation on Lithium
  - ◊ Thank you to everyone for your patience with the technical issues
  - ◊ Aaron is the curator for the Mineral Sciences at Natural History Museum of Los Angeles
    - * Shortened presentation, but still amazing
- Robin S. and Deanne G. announced the raffle prizes
  - ◊ Brought in $234 for club
    - * Most thus far from a single meeting raffle!
- Thank you, Nancy G., for your continued excellence on the award-winning website
  - ◊ Check it out! dmrmc.com
- We need a volunteer to bring water and snacks for each general meeting
  - ◊ Please contact the club if you would like to volunteer: dmrmclub@gmail.com

Respectfully submitted, Rebecca Slosarik, secretary

...Beryl continued from page 2

Many mines around the world produce aquamarine -- in Brazil, Pakistan, Namibia, Afghanistan, Colombia, and others. U.S. localities occur in California, Maine, Idaho, Georgia, Connecticut, New Mexico, North Carolina, and Utah. Arizona has produced some; however, almost no gem quality stones. We may very likely find some low-grade beryl crystals on a field trip or other foray into the White Picacho District pegmatites (fingers crossed for something better!). Go here for a YouTube video of a gold prospector finding a pretty nice crystal (if it is true).

Another notable location is atop **Mt. Antero**, in Colorado -- where small mines at over 14,000' are worked for gemstones.

See Figures A-E.

FIGURE A BERYL var. AQUAMARINE Gemmy crystals from the Murdock claim in Centerville, Boise Co., Idaho. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Hall Collection.*

FIGURE B BERYL var. AQUAMARINE This bight blue crystal is from Kala, Darrah Pech, Kunar Province, Afghanistan. Crystal is 1.1" tall. Accessory minerals are Albite and Schorl. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Hall Collection.*

FIGURE C BERYL var. AQUAMARINE These pale blue, tabular crystals are from Sichuan, China. *Photo by Stan Celestian*

FIGURE D BERYL var. AQUAMARINE with MUSCOVITE This lovely specimen is from Skardi, Pakistan. *Photo by Stan Celestian*

Beryl continued on page 23…..

...Beryl continued from page 22

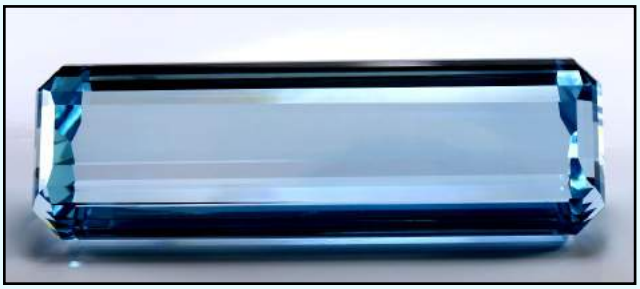


FIGURE E FACETED BERYL var. AQUAMARINE This is the world's second largest faceted aquamarine, at 2594 carats. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Hall Collection.*

Red Beryl, formerly called Bixbite, is a rare variety, whose type locality is the Maynard Claim in the Thomas Range, Juab Co., Utah. Its color is due to manganese (Mn^{3+}). It has been reported only from Utah and New Mexico. See Figure F.

FIGURE F RED BERYL A rare gemmy red beryl crystal in rhyolite, from the Wah Wah Mts, Beaver Co., Utah. *Photo by Rob Lavinsky (iRocks.com) and licensed by Creative Commons BY-SA 3.0.*

Emerald another rare beryl variety, and one highly prized as a valuable gemstone -- only diamonds have more value. It is the birthstone for May.

Emeralds tend to be highly fractured and included, so clear, gemmy ones are special -- and often they are from Colombia. In fact, many emeralds on the market have been soaked in oil, resin, or glass filler to mask defects -- you may notice how greasy a mineral specimen looks. Lab-created emeralds (common in modern jewelry) are generally very clear and free of defects. However, the manner of its growth leaves telltale chevron features visible at 10x-40x magnification.

The ionic green color is due to chromium (Cr3+), and occasionally vanadium. Many crystals occur in schist. See Figure G-K.

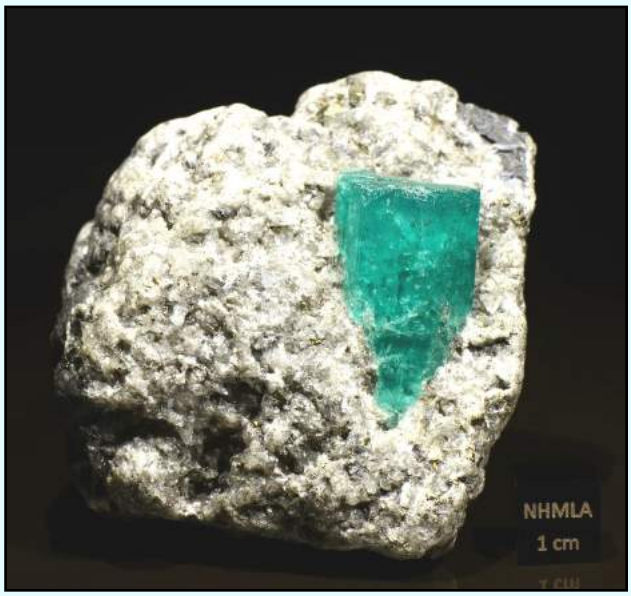


FIGURE G BERYL var. EMERALD Rare, clear, and a distinctive green color, this emerald occurs within a granitic rock. Locality is unknown. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Hall Collection.*

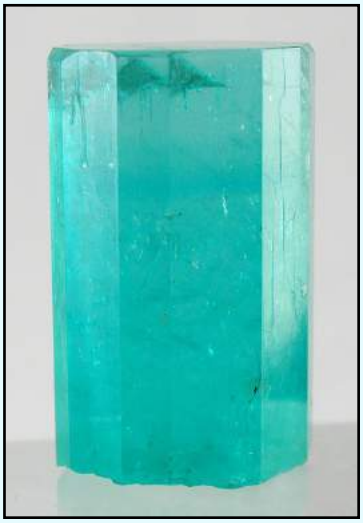


FIGURE H BERYL var. EMERALD This is an outstanding natural crystal of emerald! *Photo by Rob Lavinsky (iRocks.com) and licensed by Creative Commons BY-SA 3.0.*

Beryl continued on page 24…..

...Beryl continued from page 23

FIGURE I TRAPICHE. EMERALD This is a rare trapiche emerald, known only from mines in Colombia. Carbon inclusions create a radial six-spoked "star" pattern. See Figure 9 for a crisply starred example. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Collection.*

FIGURE J TRAPICHE EMERALD This trapiche emerald, from the Muzo Mine in Colombia, has an exquisitely developed radial pattern. *Photo by Luciana Barbosa and used with permission via Creative Commons BY-SA 3.0*

FIGURE K FACETED EMERALD This is part of a very fancy necklace designed by Cartier in 1931, and now housed in the Smithsonian (Mackay Emerald and Diamond Necklace). Note how many fractures are present in this Colombian stone -- and still it is quite valuable! *Photo by thisisbossi and licensed by CC BY-SA 2.0*

Golden Beryl is pale yellow to golden, whose color is attributed to iron (Fe^{3+}). See Figure L.

FIGURE L GOLDEN BERYL This variety of beryl is a cheerful, sunny color. *Photo by DonGuennie (G-Empire The World Of Gems) - Own work http://www.g-empire.de, licensed by Creative Commons BY-SA 4.0*

Beryl continued on page 25…..

...Beryl continued from page 24

Heliodor is often confused with golden beryl, but it is a more greenish-yellow color, also attributed to iron (Fe^{3+}). See Figure M-N.

FIGURE M BERYL var HELIODOR The color of this variety is a greenish-yellow, distinguishing it from the purer yellow of golden beryl. This specimen is from Afghanistan. *Photo by Orbital Joe and licensed by Creative Commons BY-NA-ND 2.0.*

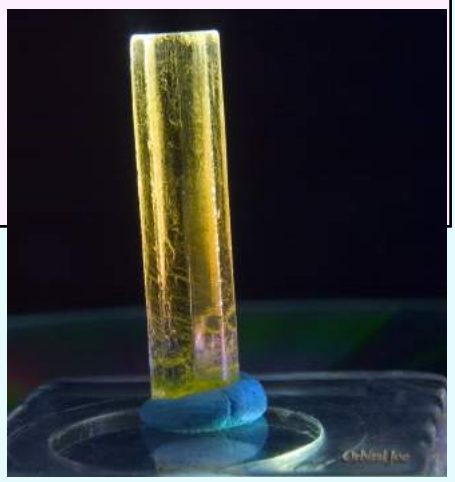


FIGURE N BERYL var HELIODOR Here are two views of the same crystal, from Volodarsk-Volynskii, Zitomir, Ukraine. The greenish cast to the color is quite evident. Up close you can see many imperfections in the crystal -- a common feature of beryl crystals. *Photos by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Collection.*

Goshenite has no color. Originally discovered in Goshen, Massachusetts, it was used in the 13th century as the glass in magnifiers, telescopes, and eyeglasses (it was difficult to produce really clear glass, at that time). In its natural state, it is a low-value gemstone; however irradiation can produce a rainbow of colors, (depending on the impurities in the target stones), and may increase its appeal to consumers. See Figures O-Q.

FIGURE O BERYL var GOSHENITE This specimen is from the Tourmaline Queen Mine, in Pala, San Diego Co., CA. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Collection.*

FIGURE P BERYL var GOSHENITE This is a well-developed crystal of very clear goshenite (locality unknown). *Photo by dnh_macro and licensed by CC BY-NC-SA 2.0*

Beryl continued on page 26…..

...Beryl continued from page 25

FIGURE Q FACETED GOSHENITE Goshenite is quite colorless -- unless it is a diamond (or even clear sapphire) colorless stones are not real popular in jewelry. *Photo by DonGuennie (G-Empire The World Of Gems) - Own work http://www.g-empire.de, licensed by Creative Commons BY-SA 4.0*

Morganite is a light pink or rose-colored variety of beryl. The color is due to manganese (Mn^{2+}). But the natural color tends to be light in intensity. Many stones are heated to intensify the pink, and removes yellow, to change orange stones to pink. See Figure R-S.

FIGURE R BERYL var MORGANITE Here is a very hexagonal crystal of morganite. Recall that previously it was stated that beryl is often highly included -- look at all the inclusions in this crystal. This specimen is from Helikon and Rubicon Mine, Karibib, Erongo, Namibia. *Photo by Stan Celestian with permission of Natural History Museum of Los Angeles County Gem and Mineral Collection.*

FIGURE S FACETED MORGANITE A beautiful rosy-colored morganite gemstone pendant. *Photos by Stan Celestian*

INTERESTING FACTS:

♦ **Many large crystals of beryl occur in the world**

- 200 TON crystal found in Brazil (*Britannica*)
- Crystal 19' long and 5' diameter found in Black Hills, South Dakota (*Britannica*)
- One crystal 26 tons, 27' long in the Bumpas Quarry in Albany, Maine (*Wikipedia*)
- Largest crystal (of anything) in world - 59 feet long, 11.5' diameter, 440 TONS in Malakialina, Madagascar (*Wikipedia*)

♦ **Beryl is the state mineral of New Hampshire**

♦ **Beryl can be black**

GENERAL RESOURCES FOR BERYL

https://en.wikipedia.org/wiki/Beryl#Varieties
https://en.wikipedia.org/wiki/Bumpus_Quarry
https://geology.com/minerals/beryl.shtml
https://www.mindat.org/min-819.html
https://www.britannica.com/science/beryl

GEO MINI

OBSIDIAN

By Susan Celestian

I never really wrote much about obsidian; however, since this month there was a field trip to Parks, AZ for obsidian, I thought it would make a good topic.

OBSIDIAN is an extrusive igneous rock, that has no crystalline structure, i.e. it is amorphous -- a volcanic glass. There are few or no crystals because it forms from the very rapid cooling of lava. It is basically a super-cooled liquid, as is window glass. Due to its uniformity, it exhibits excellent conchoidal fracture.

The parent lava is felsic (high in silica, low in ferromagnesians). Felsic lavas are very viscous (thick, tendency not to flow), and it is this viscosity that inhibits the movement of atoms, necessary to build minerals. Alternatively, quenching in water will accelerate the cooling of lava, and obsidian will form.

Obsidian is not very stable at Earth's surface. Exposure to the elements or groundwater (or hydrothermal water, associated with volcanism) it will de-vitrify. The end result of devitrification is *Perlite* -- a gray, vitreous, hydrous glass (that expands upon heating to produce a porous material used as filtering medium and water retentive soil additive). Alteration is fairly rapid, and obsidians older than 5 million years are very rare.

Despite its relationship to light-colored igneous rocks, such as granite and rhyolite, obsidian is usually dark-colored (black, rusty-brown, dark green).

- *Snowflake Obsidian* -- obsidian included by white spherules of cristobalite (high temperature form of SiO_2), possible centers of devitrification
- *Mahogany Obsidian* -- obsidian with a mix of black and reddish-brown obsidian. The color differences are probably due to compositional differences.
- *Sheen Obsidian* -- obsidian with a golden shimmer, resulting from the alignment (along flow lines) of tiny gas bubbles
- *Fire Obsidian* -- obsidian with iridescence caused by the interference with light by thin layers of nanocrystals of magnetite.
- *Rainbow Obsidian* -- similar to fire obsidian, but nanocrystals of hedenbergite (a pyroxene) occur in thicker volume
- *Pele's Hair* -- fibers or strands of golden glass created when wind-blown droplets of lava are stretched out and cool rapidly
- *Apache Tears* -- un-hydrated centers of obsidian in a bed of perlite

See Figures AA-EE.

FIGURE AA OBSIDIAN CLIFFS Between Mammoth and Norris, WY (Yellowstone NP) is this 180,000 year old obsidian flow. It is a very lustrous black with centers of crystallization.

Photos by Stan Celestian

Obsidian continued on page 28…..

...Obsidian continued from page 27

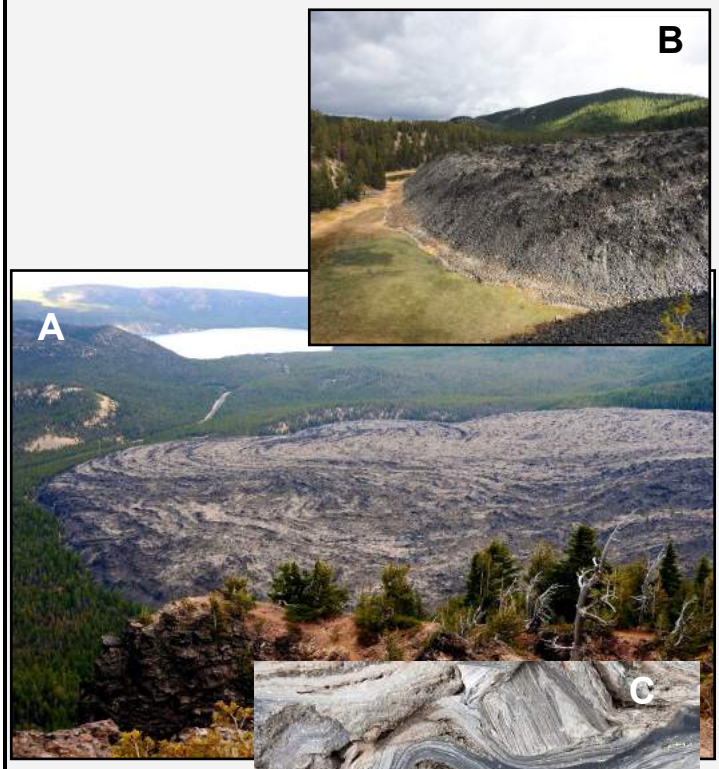


FIGURE BB BIG OBSIDIAN FLOW This amazing deposit is a thick deposit of obsidian, formed when a de-gassed lava flowed in the area of Newberry Crater National Park, Oregon, 1300 years ago.

Note the flow banding in photo C. That is caused by layers contorted during flow. The layers are defined by crystallinity or vesicularity variations.

Photos by Stan Celestian

FIGURE DD CONCHOIDAL FRACTURE This glassy, black obsidian is part of the Big Obsidian Flow at Newberry Crater National Park. It exhibits very well developed conchoidal fracture -- a very diagnostic feature.

Photo by Stan Celestian

FIGURE CC OBSIDIAN BETWEEN RHYOLITE BEDS In southeast Nevada, along Rte. 93, the highway goes through a narrow pass through rhyolite flows bracketing a black obsidian flow.

Photos by Stan Celestian

Obsidian continued on page 29…..

...Uinkaret continued from page 28

FIGURE EE VARIETIES OF OBSIDIAN Following are images of different varieties of obsidian.

Photos by Stan Celestian, unless otherwise indicated.

MAHOGANY OBSIDIAN
Near Delta, Millard Co., Utah

FIRE OBSIDIAN
Photo by Different Seasons Jewelry . Licensed by CC BY 2.0

VELVET RAINBOW OBSIDIAN
Jalisco State, Mexico
Photo by James St John, licensed by CC BY 2.0

APACHE TEAR IN PERLITE
Superior, AZ

PELE'S HAIR
Big Island, Hawaii

RAINBOW OBSIDIAN
Mexico

SHEEN OBSIDIAN

SNOWFLAKE OBSIDIAN

GENERAL RESOURCES FOR OBSIDIAN

https://www.mindat.org/min-27158.html
https://www.mindat.org/min-27236.html
https://en.wikipedia.org/wiki/Obsidian
https://www.usgs.gov/volcanoes/newberry/big-obsidian-flow

UPCOMING FIELD TRIPS

WHERE: Payson Area
WHEN: Saturday, October 23 2021
WHAT: Fossils, Geodes, Shoofly Agate
MEET: 8:50 at McDonald's in Payson

WHERE: Bronzesmith (Prescott Valley)
WHEN: Thursday, October 28, 2021
WHAT: Bronze foundry tour

WHERE: Purple Passion Mine
WHEN: Wednesday, November 10, 2021 (EVENING)
WHAT: Fluorescents
MEET: 4:20 McDonalds in Wickenburg
OTHER: High clearance, 4WD required

WHERE: Chilito Mine
WHEN: Saturday, November 13, 2021
WHAT: Copper Minerals
MEET: 9:30 AM at the turn off for the site on AZ-177 just south of mile marker 140
(coordinates = 33.01108, -110.82079)
OTHER: Joint trip with Verde Valley Rockhounds & MSA
High clearance at least; 4WD preferable

WHERE: Tucson Area
WHEN: TBA November

WHERE: Red Cloud Mine (Yuma)
WHEN: Friday/Saturday, December 3-4, 2021
WHAT: Wulfenite, fluorescent fluorite
OTHER: Joint trip with MSA & Verde Valley Rockhounds

WHERE: Dave Haneline Mine
WHEN: Wednesday, December 8, 2021
WHAT: Cerussite, other rocks

WHERE: Blue Cube/Spectrum/Prism Mines
WHEN: Saturday, December 18, 2021
WHAT: Fluorite, Amethyst, Barite

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

March will be here before we know it! Keep you calendar open for the DAISY MOUNTAIN GEM & MINERAL SHOW 2022

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……. stancelestian@gmail.com
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Don R	Howard R
Jessica C.	Rebecca S
Johnaton M	Joe G
Clark L	Bob S.
	Nancy G

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

Wire Wrapping

has resumed!

Jennifer Gecho is graciously teaching a wire wrapping class that meets prior to the general meeting. November's project will be making LEAVES.

Photo by Jennifer Gecho

- **First Tuesday of the month**
- **4:30-6:15**
- **Anthem Civic Building, 3701 W Anthem Way, Anthem, AZ 85086**

Please bring a cabochon, 20 and 26 gauge copper-based wire. Round nose pliers and flush cutters. Extra tools, wire, and cabochons will be available for use

LOOKING FOR A REFRESHER, OR NEW GUIDANCE, ON THE IDENTIFICATION OF MINERALS AND ROCKS?

Check out Shirley Cote's *FREE* presentation on Rock and Mineral Identification

WHEN: Saturday, December 11, 2021

WHERE: North Mountain Visitor Center

REGISTRATION limited to 15 people

DONATIONS to Save Our Mountains Foundation much appreciated

RSVP: Register by December 9 by emailing Shirley at crystalc17@gmailcom

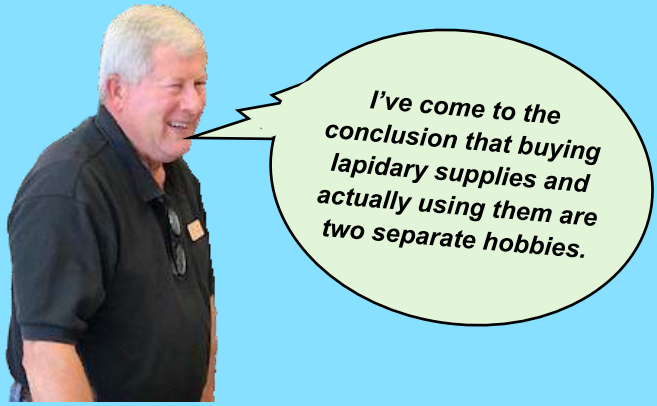
Participate and learn about elements, minerals, and rocks. Shirley will be presenting a Hands-on Rock and Mineral Identification and Uses Program. Each participant will be given an informational handout and a special mineral to take home. Enjoy a wonderful display of minerals!

"Come learn and enjoy the wonderful world of minerals!"

Words of Wisdom

passed along by our own

Bob Evans



UPCOMING AZ MINERAL SHOWS

October 8-10 - Buckeye, AZ West Valley Rock & Mineral Club; 902 N 1st St (Miller Rd); Fri-Sat 9-5, Sun 9-2; Admission: $3, under 13 free.

October 9-10 - Sierra Vista, AZ Huachuca Mineral & Gem Club; The Mall, 2200 El Mercado Loop; Sat 9-5, Sun 10-4; Admission: Free.

October 16-17 - Sedona, AZ Sedona Gem & Mineral Club; Sedona Red Rock High School, 995 Upper Red Rock Loop Rd; Sat 10-5, Sun 10-4; Admission: ?.

November 13-14 - Lake Havasu, AZ Lake Havasu Gem & Mineral Society; Aquatic Center, 100 Park Ave; Sat 9-5, Sun 9-4; Admission: $2.

November 20-21 - Mesa, AZ Apache Junction Gem & Mineral Club; Skyline High School, 845 S Crimson; Sat 9-5, Sun 10-4; Admission: Adults $3, Students w/ID $1; under 12 free.

November 27-28 - Wickenburg, AZ Wickenburg Gem & Mineral Society; Hassayampa School, Wrangler Event Center, 251 S Tegner St; Sat 9-5, Sun 10-4; Admission: Free. See poster on 3.

January 7-9 - Mesa, AZ Flagg Mineral Foundation; Mesa Community College, 1833 W Southern; Daily 9-5: Admission: Free.

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

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 EDITOR

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

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 - NOVEMBER

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

November – Thursday's dates are 4, 11, 18, 25
November – Saturday's dates are 6, 20

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

November - Monday's dates are 1, 8, 15, 22, 29

Wickenburg Gem and Mineral Show

Nov 27 & 28, 2021

Free Admission

Jewelry

Fossils

Minerals

Gems

Over 40 Vendors Best Rock Contest Raffle

Door Prizes Kid's Area Silent Auction

Hassayampa Elementary School

251 South Tegner Street Wickenburg, AZ

9am - 5pm Saturday • 10am - 4pm Sunday