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AUGUST 2015

# GNEISS TIMES

*Wickenburg Gem & Mineral Society, Inc.*
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*The purpose of this organization shall be to educate and to provide fellowship for people interested in rocks and minerals; to foster love and appreciation of minerals, rocks, gems, and the Earth. Membership shall be open to all interested people.*

## FROM THE PRESIDENT

**UPCOMING GEM AND MINERAL SHOW** — Club president, Craig Jones, has a few comments/thoughts regarding the upcoming November club Gem and Mineral Show:

**Silent Auction**: He would like to see a Silent Auction become a part of the show, with proceeds used to increase advertising of the show. To that end, the club is soliciting member donations of rocks, slabs, display item, and so on. He has already donated 60 pounds of slabs and rocks. Time to clean up the yard!!

**Hourly Drawings**: In addition, donations of member-made jewelry for the hourly drawings would increase the appeal (and frequency!) of the drawings.

**Children's Table**: The Roes are unable to continue manning the children's table. This is a very popular stop for families attending the show, and it is an important component of the club's educational and recreational outreach. PLEASE consider volunteering for at least part of the show!

**FIELD TRIPS**: MAKE A LIST! Please come to the September meeting armed with ideas about where you would like to venture this year, in *passionate pursuit of pretty pebbles*. It would be great to be able to establish a trip calendar early in the season!

Additionally, there is a need for a field trip coordinator. This person need not lead every trip, but would manage the details of directions and communication with members.

## STRAWBERRY CRATER

*By Susan Celestian*

Last summer I wrote about Sunset Crater. In this issue, I will take a look at Strawberry Crater.

**WHAT**: Cinder Cone and Lava Flow — part of the San Francisco Volcanic Field. See Figures 1-3.

**WHEN**: It has been hard to establish a firm and reliable date on the crater's rocks. 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).

Another of the nearly 600 cinder cones identified in the San Francisco Volcanic Field, Strawberry Crater is about 1000 feet high, and one half mile in diameter. The name derives from the reddish color and the strawberry-like profile (Figure 4). The basaltic andesite (black volcanic rock, about 55% silica) cinders and debris were produced in mildly explosive eruptions (*strombolian*). During the later stages, with the loss of volatiles (water, carbon dioxide, hydrogen sulfide, sulfur dioxide), the eruption style switched to quieter lava flows, alternating with sputtering that dropped hot plastic (deformable) bombs near the rim, where they welded to each other to form a resistant cover (Figure 5).

INSIDE THIS ISSUE

## Meeting Minutes — May 8, 2015

The meeting was called to order at 7 pm by VP Marty Hagan. Guest Madison Mueller was introduced, with a total of 21 people in attendance. There were no minutes available from the April meeting. The treasurer's report was given by Debbie Keiser and approved.

The Arizona Corporation papers and fees need to be updated. Helen Dudley was the club's representative. With her recent death the papers have been sent in with Dale Keiser as the clubs contact person.

The meeting room contract has been signed and paid for 2015-16 Friday night meetings.

Field trips: Places to go, and ways to make future trips more successful was discussed, including an attendance sign in paper for all people participating on an outing. Mel Canter brought a sample of a First Aid Bag to take out on future outings. A soft bag runs between $100 and $200, and a smaller metal box is $150. No decision was made at this time.

2015 WGMS Show: Nov. 28 and 29th:

80 tables and one table cart have been delivered and donated to the Hassayampa Elementary School, with the understanding that the School will furnish 120 tables for us to use for our show. Club members are asked to bring gently-used items and prizes to be used for door prizes during the show.

The WGMS board awarded the 2015 $3,000 Scholarship to Larken Vargus, from Bagdad High School. He will be attending NAU in Flagstaff, studying mechanical engineering. He wants to work on ways to extract copper and ways to help with the mining industry. There were 2 scholarship applications from Bagdad High School and 2 from Wickenburg.

Old Business: A $50 donation will be sent to the Friends of the Library in memory of Helen Dudley. Dale Keiser had a thank you note and picture from the 15 West Valley Explorers 4H group that he had taught a rock class to in April. The 4H kids had shown Dale their Mineral Story Boards, that they were entering in the County Fair. Debbie will ask if they want to show the boards at our next Gem Show. Dale has also volunteered to work on the new (3 fold) membership application.

New business: The club will be needing a secretary and program chair next year. Jim Koning volunteered to do the September program, Mel Canter October, Joyce

*Continued…….*

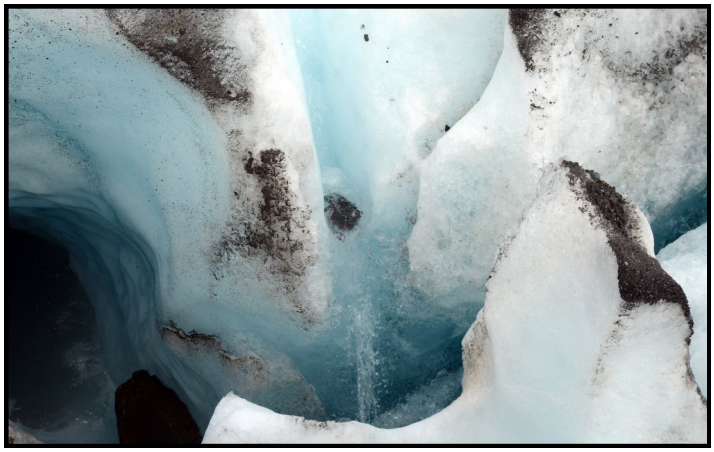
Ramage November and the Christmas party for December.

Show and tell: Prize went to Mel Canter.

Door prize: Won by Erma and Al Roe.

Next meeting will be September 11th. Desserts and snacks at 6:30 with the business meeting at 7pm.

Respectfully submitted,
Debbie Keiser, Substitute Secretary



Opposite of the fire that generates Basalt, this blue ice is the foundation of the Matanushka Glacier, in Alaska. Dense, bubble-less or bubble-poor glacial ice strongly absorbs red; plus included debris, and any bubbles, will scatter blue light multiple times, thus enhancing the blue color. Photo by Stan Celestian

## NOTES FROM THE EDITOR

Have a geological interest? Been somewhere interesting? Have pictures from a club trip? Collected some great material? Write a short story (pictures would be great). I'd like topic suggestions also.

Deadline for the newsletter is the end of the month.

Mail or Email submissions to:
Susan Celestian, editor
6415 N 183rd Av
Waddell, AZ 85355
azrocklady@gmail.com

**http://www.wickenburggms.org/**

If you ever have photos from a club field trip, send a couple to Dale, for posting on the website.

## UPCOMING AZ MINERAL SHOWS

**October 2-4 - Clarkdale, AZ** Elks Club Lodge; 100 S Broadway; Fri-Sat 9-5, Sun 10-4; Admission $2, children free with adult. www.mingusclub.org

**October 9-11 - Buckeye, AZ** Helzarockin' Rodeo Arena ; 802 N 1st St & Miller Rd; Fri-Sun 9-4, Admission $3, children under 12 free; Snacks and beverages available. www.westvalleyrockandmineralclub.com

**October 10-11 - Sierra Vista, AZ** Cochise College; 901 N Columbo; Sat 9-5, Sun 10-4, Admission free. huachucamineralandgemclub.info

**October 17-18 - Sedona, AZ** Sedona Red Rock High School; 995 Upper Red Rock Loop Rd; Sat 10-5, Sun 10-4, Admission $3, children under 12 free. www.sedonagemandmineral.org

**October 30-November 1 - Black Canyon City, AZ** High Desert Park; 19001 Jacie Lane; Fri-Sun 9-4; Admission Free; Food and beverages available. hgihdeserthelpers.org

**November 21-22 - Payson, AZ** Longhorn Gymnasium, Payson High School; Corner of W Longhorn Rd & S McLane Rd; Sat 9-5, Sun 10-4, Admission $2, children under 12 free.

**November 21-22 - Apache Junction, AZ** Apache Junction High School cafeteria; 2525 S Ironwood Dr; Sat 9-5, Sun 10-4, Admission: Adults/Seniors $3, Students $1, children free.

If you are travelling, a good source for out-of-state (or in-state) gem and mineral shows AND clubs is http://www.the-vug.com/vug/vugshows.html or http://www.rockngem.com/ShowDatesFiles/ShowDatesDisplayAll.php?ShowState=AZ

For out-of-the-country shows: http://www.mindat.org/eventlist.php\

A good source for a list of Arizona Mineral Clubs and contact information is http://whitemountain-azrockclub.org/Public_AZ_Clubs_Links.html

## UPCOMING WGMS FIELD TRIPS

NO FIELD TRIPS ARE SCHEDULED, DUE TO SUMMER BREAK

*DATES SUBJECT TO CHANGE*

**CONSIDER VOLUNTEERING TO PLAN OR HELP PLAN TRIPS. YOU WOULD NOT NEED TO LEAD EVERY TRIP, BUT KEEP THINGS ON TRACK.**

**If you all have some place that you would like to go, let Bob Bartlett 623-388-0749, Marty Hagan 602-469-7770, or Craig Jones 208-681-4770 know. We have some dates to fill in. This is your club. Let's go out and have some fun.**

***Check the website for field trip announcements, especially if you don't have email!***

## Officers and Chairpersons

**President**: Craig Jones ……..……....208-523-9355
**Vice President**: Martin Hagan ..…... 602-469-7770
**Secretary**: Sue Jones ……..…….. 208-523-9355
**Treasurer**: Debra Keiser …….. 928-684-1013
**Program Director**: Dale Keiser …… 928-684-1013
**Publicity**: currently open position
**Membership**: Roma Hagan …….. 602-469-7662
**Editor**: Susan Celestian …….. 602-361-0739
**Field Trip**: Craig Jones, Bob Bartlett, Marty Hagan
**Show Chair**: Beth Myerson ……..... 480-540-2318
**Scholarship Chair**: Steve Hill ……. 928-533-3825
**Historian**: Jeanine Brown ……..…… 928-684-0489

Meetings are held the **2nd Friday most months** at **Coffinger Park banquet room.** Potluck dessert at 6:30 pm. Business meeting at 7:00 pm. **Exceptions: February and December** meetings are held on the **first Friday of the month.** We do not meet in the summer — **no meetings in June, July or August**.

**Membership Dues: $15.00 Adults per Person**
**$ 5.00 Juniors and Students**

**Meeting Dates for 2015/2016**

**Wickenburg**: Jan 9, Feb 6, Mar 13, Apr 10, May 8, Sept 11, Oct 9, Nov 13, Dec 4, Jan 8, Feb 5, Mar 11, Apr 8, May 13

**Stanton meets** Thursday after the Wickenburg meetings. Apr 16, May 14, Sept 17, Oct 15, Nov 19, Dec 10, Jan 14, Feb 11, Mar 17, Apr 14, May 19 (subject to change)

…...Strawberry Crater continued from page 1

*FIGURE 1 — Topographic map of Strawberry Crater, Coconino County, Arizona*

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: Either hit Ctrl +, or go to the top of the page and use the +, -, or drop down menu.)

*Image courtesy of the USGS*

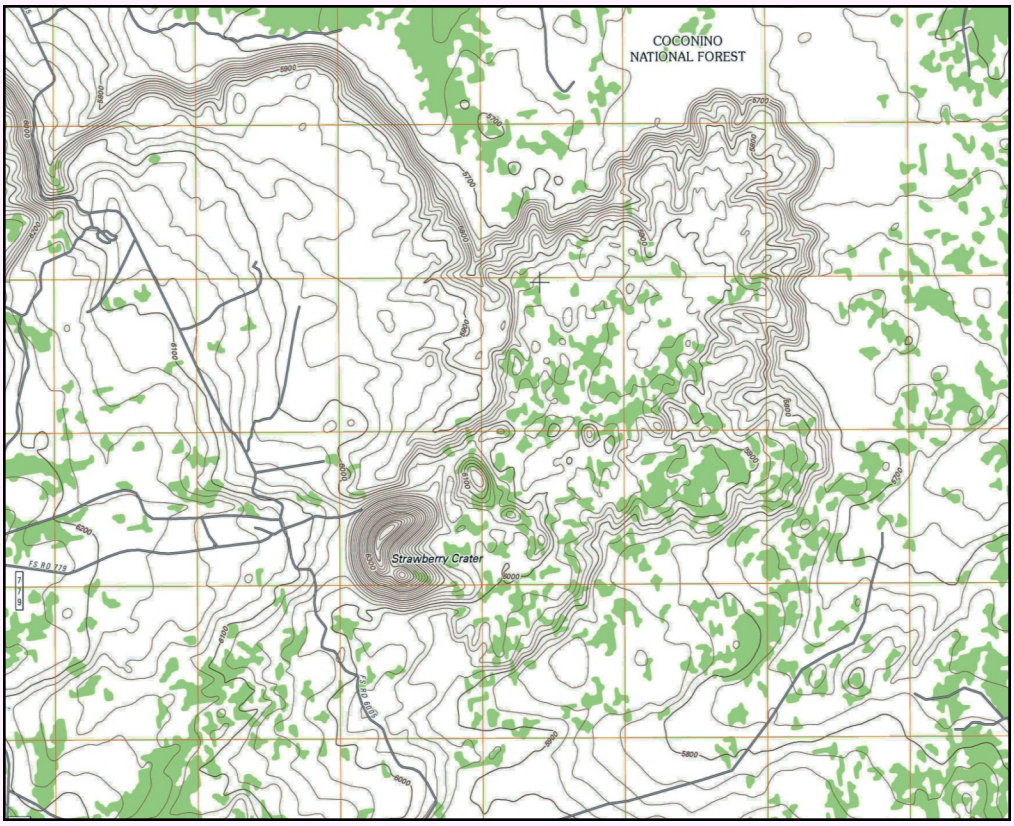



*FIGURE 3 — Aerial view of Strawberry Crater, Coconino County, Arizona* Photo by Stan Celestian

*Strawberry Crater continued on page 5….*

…...Strawberry Crater continued from page 4

The flows breached the eastern side of the cone, carrying away large and small rafts of cone material, and causing the current C-shape of the cone. Flows turned to the northeast, and continued for about 2.39 miles. Eventually, there was a small breach on the southwest side, which can be seen as a small saddle along that slope (Figure 6).

In 1984, the cone and surrounding area was designated a wilderness area, with a total of 10,141 acres. As a result, you can no longer drive up to the base of the cone. The road dead-ends at a small parking area, and from there a 0.3 mile walk gets you to the base. There is a 1.1 mile trail around the cone, and it apparently passes some archaeological sites, where gardens with cinder mulch have been found. However if you climb the slopes of the crater, you may discover some very interesting features — *volcanic bombs.* The debris comprising Strawberry Crater's slopes contain a lot of these.

*FIGURE 4 Profile view of Strawberry Crater*, highlighting the color and shape, that lend the cone its name. Photo by Stan Celestian

*FIGURE 5 A view of the rim around Strawberry Crater.* Note how the rampart of welded spatter protects the integrity of the narrow rim. Weathering and erosion will impact unprotected slopes more quickly than shielded rim. (Although both will proceed very slowly, as cinders and other volcanic debris is typically full of gas holes (*vesicular*), and precipitation does not flow, so much as soak into the slopes. *Photo by Stan Celestian*

*FIGURE 6 A view of the small breach of the southwest-facing slope of Strawberry Crater.* There a small flow ripped away the cone's wall. *Photo by Stan Celestian*

*Strawberry Crater continued on page 6……..*

…...*Strawberry Crater continued from page 5*

**VOLCANIC BOMBS** are small-to-large bits (technically larger than 2.5 inches diameter) of once-hot and plastic volcanic debris (ejecta) that are thrown into the air, during an eruption. During their flight, they cool, and are generally solid rock by the time they land. Often, they are shaped by rotation, before they cool — and that creates the novel shapes, that I will now describe. Based on their characteristics, there are: fusiform, squeeze-out, ribbon, inclusion, bread crust, explosion, and cow pie bombs. See Figures 7-15.

*FIGURE 7 FUSIFORM (aka SPINDLE or ALMOND) BOMB* This is a fusiform, or spindle-shaped, bombs — a very recognizable form, with spindling at opposite ends. As a hot, plastic blob of lava rotates through the air it becomes shaped aerodynamically — fatter in the middle, tapering toward the ends. Probably the spindles are originally very long; however, they are very thin and glassy (the latter due to speedy cooling), and easily break off upon landing. *Photo by Stan Celestian*

*FIGURE 8* This Fusiform Bomb must have experienced an extra twist. *Photo by Stan Celestian*

*FIGURE 9* This Fusiform Bomb was still hot and gooey when it landed, and it became fused, or welded, to cinders. *Photo by Stan Celestian*

*FIGURE 10 SQUEEZE-OUT BOMB* Sometimes the crust of a bomb cools, leaving the inside soft and plastic. Expanding gases may cause the crust to crack, allowing some lava to ooze out. Note the 'ooze' on the left end of this bomb. *Photo by Stan Celestian*

*FIGURE 11 RIBBON (aka CYLINDRICAL) BOMB* Very fluid lava will form as strings, or flattened ribbons, as they soar on high. These will fragment in the air, or upon landing. The ribbon shown here welded to cinders on impact.

*Photo by Stan Celestian*

*Strawberry Crater continued on page 7…….*

…...Strawberry Crater continued from page 6

*FIGURE 12 INCLUSION (aka CORE) BOMB* Often a volcanic bomb will encase a fragment of previously erupted basalt, or a fragment of the country rock (previously existing rock, through which the volcano is erupting). If broken, a bomb's innards are revealed. The bomb, in the upper photo, includes both a fragment of basalt (denser, rectangular bit), and of the country rock (dark gray granite — or other coarse-grained igneous rock, probably from relatively great depth). The one in the lower photo holds a fragment of the Coconino Sandstone, found closer to the surface.

*FIGURE 13 BREAD CRUST BOMB* Similar to explosion bombs, bread crust bombs form when the cooled-and-rigid outer shell of a bomb is cracked by the pressures of expanding gases.

*Photo by Stan Celestian*

*FIGURE 14 EXPLOSION BOMB* The upper photo is a classic explosion bomb. As gas bubbles expand in the still soft interior, they may break through the harder crust. Pfffffft — and with a pop, explode out of the bomb. The lower photo is a combination of inclusion bomb and explosion bomb — and that one must have been very gassy, as it is nearly hollow!

Photos by Stan Celestian

*FIGURE 15 COW PIE BOMB* Cow pie bombs form when globs of lava ejected to low heights, and are still liquid when they impact the ground. Upon impact they splash, to form flattened disks. The above photo is of the underside of a "cow pie" — fragments of volcanic debris have embedded and fused into the bomb, as it cooled on the ground (enlarge the view for a closer look.

*Photo by Stan Celestian*

# WHAT ARE IGNEOUS ROCKS??

Volcanoes are a good segue into the topic of Igneous Rocks. All igneous rocks originate as molten rock, or *magma*. As magma cools, crystals form sequentially, and ultimately a solid crystalline rock is formed.

There are two types of igneous rocks:

Intrusive (or Plutonic) - form at depth, beneath Earth's surface

Extrusive (Volcanic) - form at the Earth's surface (magma at the surface is called *lava*)

Intrusive rocks cool very slowly, giving ions enough time to link up, and build visible crystals. These rocks will be coarse-grained — comprised of interlocking crystals of various minerals.

On the other hand, volcanic igneous rocks are obviously extrusive. Extrusive rocks cool fairly quickly, and there is little time for crystals to form, so they tend to be very small; and as a result, extrusive rocks are fine-grained. They generally exhibit as one color (black, red, brown…), with few or no visible crystals.

Commonly, in both intrusive and extrusive igneous rocks, there may be distinctive crystals, called *phenocrysts.* Phenocrysts are crystals that form in a period of time during which a magma cools very slowly. Subsequently, the magma cools more quickly. The result, in intrusive igneous rocks, is a rock with very large crystals "floating" among smaller, yet still visible, crystals. In the case of extrusive igneous rocks, visible crystals "floating" throughout the fine-grained background. Igneous rocks that exhibit these two stages of cooling are called *porphyritic*. See Figures 16 and 17.

*Igneous rocks continued on page 9…….*

*FIGURE 16 Porphyritic Granite* In this intrusive rock you can see extra-large rectangular crystals of pink feldspar, surrounded by visible black and white crystals (quartz, feldspar, biotite). *Photo by Stan Celestian*

*FIGURE 17 Porphyritic Basalt* In this extrusive rock, you can see large rectangular crystals of white feldspar, surrounded by a fine-grained black background. *Photo by Stan Celestian*

……..*Igneous rocks continued from page 8*

The minerals within a cooling magma crystallize out in a specific order. This order is depicted by Bowen's Reaction Series (Figure 18). While the composition of magmas differ, the first crystals to form are found toward the top of the diagram. And it is those crystals that are found as phenocrysts. See Figure 18.

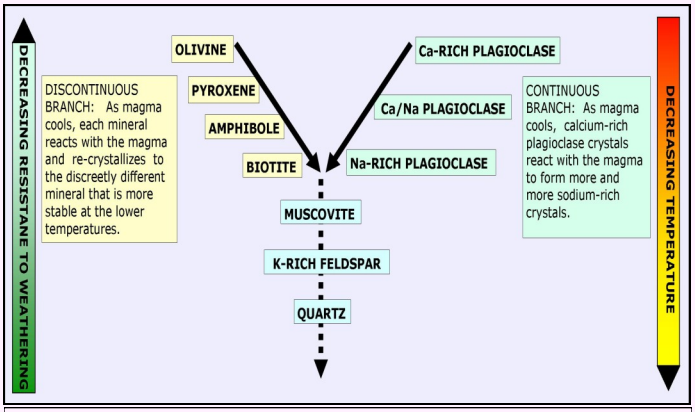



*FIGURE 18 Bowen's Reaction Series* This diagram depicts the order in which minerals crystallize in a cooling magma. (Enlarge for better view.) *Diagram by Susan Celestian*

Basic extrusive rock types include rhyolite, andesite, and basalt — plus obsidian and pumice. The latter two are more distinctions based on texture, rather than composition, but we will eventually look at them a separate rock types. See diagram below.

| Light color | Intermediate | Dark color |
|---|---|---|
| **RHYOLITE** | **ANDESITE** | **BASALT** |
| *white, lt gray, pinks | *med-dk gray | *black-dk gray, rust-red |
| * very viscous lava | *black phenocrysts common | *gas bubbles common |
| | * very viscous lava | * very fluid lava |

**OBSIDIAN** →
*glassy, black, rust-red, greenish,

**PUMICE** →
*glassy froth: white, yellow, brown, black

**Decreasing % Silica** →

**Increasing % Iron and Magnesium** →

# BASALT
## (the stuff of cinder cones)

► Basalt is generally dense and fine-grained, because it cools relatively quickly at the Earth's surface. Cooling occurs on the order of minutes to weeks; one can usually walk on a lava flow within 10-15 minutes! See Figure 19.

► It will be black to charcoal gray, or rust-red.

*FIGURE 19* This is a close-up view of a Hawaiian basalt (porphyritic). Note that you cannot see any crystals in the black, fine-grained rock. The green crystals are olivine phenocrysts. *Photo by Stan Celestian*

► Other textures often seen are (See Figures 20-23.).

- *'a'a* - the surface of the lava flow is jagged and irregular. This occurs when the lava is cooled to the point that it breaks up into blocks, as it flows. Can occur with pahoehoe.
- *pahoehoe* - the surface of the lava flow is smooth and ropy. This forms when the lava is very hot, and smoothly-flowing. Can occur with 'a'a.
- *vesicular* - the rock is full of gas bubble holes
- *amygdaloidal* - gas bubble holes have been filled in with other minerals, long after the rock was formed


*FIGURE 20 'A'a lavas are jagged and blocky.* Left: Blocky Kana 'a Flow at Sunset Crater; right: same flow in profile. *Photos by Stan Celestian*

*FIGURE 21 Pahoehoe surface texture on a Hawaiian basalt.* When a flowing lava is very hot, the surface cools to form a 'skin', that wrinkles and folds.

Go to https://www.youtube.com/watch?v=IRfZ2q4Jvmo for Stan's first-hand view of flowing lava.
*Photo by Stan Celestian*

*FIGURE 22 Vesicular basalt from northern Arizona* As gases in lava come out of solution, they form bubbles that are trapped in the cooling lava. *Photo by Stan Celestian*

*FIGURE 23 Amygdaloidal Basalt* The gas bubble holes have been filled in by chalcedony (quartz). — these are amygdules.

*Photo by Stan Celestian*

►Often, there are phenocrysts of plagioclase feldspar and/or olivine. Both of those minerals form at high temperatures, so are the first to form in a slowly-cooling magma chamber, below Earth's surface. When lava erupts, those crystals are "frozen" within the fine-grained rock (refer back to Figure 17). For a look at the beautiful result of a lot of olivine phenocrysts, go to https://www.youtube.com/watch?v=xA-6TtxyBfk .

► Being deficient in low-density silica, and enriched in high-density iron and magnesium, basalt is a relatively heavy rock.

► The hottest of the lavas, basaltic lavas extrude onto the surface at about 1100-1200°F, and are very fluid — flowing like rivers of hot tar for distances up to tens of miles, at velocities exceeding 6 mph.

► Because basaltic lava is so fluid (non-viscous), the eruptions tend to be quiet; and the volcanoes built up are large with shallow slopes (*shield volcanoes*). These mountains can be very large (Mauna Loa is 60 miles wide at its base), and have very low profiles, with slopes of 1°-2° at their bases, steepening to 10° toward the peak.

► Besides shield volcanoes, another topographic feature associated with the gassy late-stages of basaltic eruptions is the *cinder cone*. Cinder cones are composed of volcanic fragments — cinders and other debris — that are thrown into the air, and accumulate around the vent. They are irregular and rough, so can pile up at steeper angles than in shield volcanoes. Cinder cones tend to be roughly circular, no more than about 1000 feet tall, with slopes of about 30°-40°, and with a central crater.

► Basaltic volcanoes are found at hot spots (stationary mantle plumes of rising magma, such as below Hawaii), and at spreading centers (such as the mid-ocean rifts, and continental Basin and Range faulting). In Arizona, basaltic volcanoes occur on the Colorado Plateau (San Francisco, Springerville (White Mts), and Uinkaret (NW corner of Arizona) Volcanic Fields, and throughout southern Arizona's Basin and Range Province (Sentinel, San Bernadino, Pinacate, and San Carlos). The Plateau volcanoes are thought to be associated with a hot spot, across which Arizona moved, creating volcanoes that, in each field, decrease in age to the east. The southern volcanoes are probably largely associated with Basin and Range faulting. ***

*** Why is basalt generated under these circumstances? Earth's mantle material is very high in iron and magnesium (higher than basalt), and is under such high pressure that it remains solid, at temperatures exceeding its melting point. Once the crust is fractured — by faults associated with mantle plumes or mountain-building — the pressure is released, the rock partially melts, and basaltic magma flows.

# BASALT in our Everyday Lives

Basalt is used “as is” — slabbed or shaped, as a powder, and can be melted and blown into fibers that may be woven into fabric. It is heavy, hard, heat/cold resistant, radiation resistant, UV resistant, electrically resistance, acid/alkaline resistant, rust resistant, low water absorption, easily recyclable, high wet-ability. I think you will find some of the applications surprising!

- Cobblestones, building blocks
- Asphalt pavement aggregate; concrete aggregate
- Flooring tiles — either residential, or in industrial situations (such as foundry floors, where molten metal or slag may ‘hit the floor’)
- Railroad ballast
- Filter stone in drain fields
- Stone (or rock) wool (fibers may be woven into fabric): —
  - Car and motorcycle exhaust systems
  - Oven insulation
  - Heat insulation of gas turbines (inc. those of nuclear power plants)
  - Insulation of liquid nitrogen tanks and pipes
  - Components of composite materials: tripods, fishing poles — fiber rein forced plastic **rebar** is 25% lighter, and has over twice the tensile strength, than steel
  - Fabric used as reinforcement in concrete, allows for thin walls
  - Fabric bound with resins can make a very light-weight, but flexible, strong, and resistant yacht, canoe, snowboard, skis, or other similar vehicle
- Statuary
- Countertops
- Ground up basalt is bound by various products and used as a substitute for concrete
- Sound-proofing
- Filtering material
- Rip rap
- Soil/hydroponic additive: crushed or coarse to serve as root support and slow-release nutrient source

Susan Celestian, editor
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