

Amazing Lava Products and Forms

Grade 5



Mauna Ulu (Growing Mountain)

Photo by JM Jarrell

Mauna Ulu is located along the east rift zone of Kīlauea Volcano. It is an area of striking contrast and variety and landscapes ranging from newly formed lava flows to verdant rain forests. Dramatic features include the shield of Mauna Ulu, spatter ramparts, fissures, lava trees and molds, and an array of volcanic tephra.

Photo Analysis

What's happening in this photo?

What volcanic formations and products are possibly being created during this eruptive episode?



Photo by J.D. Griggs

Setting the Stage

Mauna Ulu was the longest eruptive phase in recorded history until the current Pu'u 'Ō'ō eruption began on January 3, 1983. The discovery and scientific research brought on by this event allowed scientist to witness first-hand an underwater eruption showing how pillow lava, the oldest type of rock formation on earth is created.



Photo by Richard D. Grigg

Pillow lava

When basalts erupt underwater, they commonly form pillow lavas, which are mounds of elongate lava "pillows" formed by repeated oozing and quenching of the hot basalt. First, a flexible glassy crust forms around the newly extruded lava, forming an expanded pillow. Next, pressure builds until the crust breaks and new basalt extrudes like toothpaste, forming another pillow. This sequence continues until a thick sequence may be deposited. When geologists find pillow basalts in ancient rock sequences, they may conclude that the area was once under water.

Diver examines a cooled pillow lava flow lobe off the coast of Kilauea volcano, Hawai'i.

Locating the Site: Map

From the Mauna Ulu parking lot, walk to the end of the paved road that has been covered by lava. Follow the pāhoehoe lava flow to the right and head toward the spatter rampart. This is where you will collect and record your data for this activity.



Where is Mauna Ulu on the map?

Southeast of Kīlauea Caldera
Southwest of Pu'u 'Ō'ō
Directly north of 'Apua Point

How far is it from the Mauna Ulu
Parking lot to Nāpau Crater? (Use the
arrows and mileage in red)

(7 miles, 11.2 kilometers)

Determining the Facts

The Mauna Ulu shield was built by many eruptive episodes during a five year period between 1969 and 1974. Until the eruption of Pu‘u ‘Ō‘ō, this was the greatest outpouring of lava from the east rift zone in recorded history—about 350 million m³ of lava erupted from the vent, enough to fill 46 million average dump trucks. Today, still free of vegetation and standing 120 m above the surrounding ground, the shield is one of the most visible features from the Chain of Craters Road. The eruption of Mauna Ulu made all of these amazing formations and lava products for us to see today. Geologists continue to study these features. They measure and analyze them to learn more about the many aspects of an eruption.

Scientists use the **Metric Measurement System** for their data recording and research calculations because it is the universal measurement system. Most people in the United States commonly use the **Imperial System** which consists of pounds and ounces; feet, inches, and yards; and cups, quarts and gallons.

The metric measurement is based on the decimal system, meaning it works in units of 10s. There are 3 basic units of the metric system:

- 1) **meters** which measures length
- 2) **grams** which measures weight
- 3) **liters** which measures liquid capacity.

So what do these numbers mean in more common measurements?

Let's practice converting metric and Imperial measurements. Using a calculator and the Metric Equivalents Chart below, calculate these conversions.

HINT: If converting from left to right on the chart, you will need to multiply. If converting from right to left on the chart, you must divide.

Be careful to input decimal points when using the calculator and transcribing answers!

1. Two yards (how many feet?) equals _____ meters.
2. A ruler is 12 inches or _____ centimeters long.
3. Hilo is approximately 28 miles or _____ kilometers from the park.
4. The average height of Mauna Ulu is 120 meters or _____ feet.
5. Mauna Loa is 13, 677 feet in elevation or _____ meters.

<u>Metric Equivalents Chart</u> for length, height and distance		
<u>What you know</u>	<u>Multiply by:</u>	<u>Converted Answer</u>
Feet	0.31	Meters
Inches	2.54	Centimeters
Miles	1.61	Kilometers

Student Names (4-5 per group): _____

Safety: This area is filled with many cracks, sharp lava and loose rocks. Stay on trails and refrain from inappropriate behavior. Often vog from Pu‘u ‘O‘ō comes through this area making breathing difficult, eyes and throat irritated, which can be hazardous to your health. If this occurs, you must leave the area immediately.

Instructions: Use the Photo Glossary of Volcano Terms to locate each volcanic landform or product in the field. At each location, research and answer a series of questions on the geology and natural history of this area. Then, convert measurements from Imperial to Metric equivalents where indicated.

Materials for each group: Group Activity Sheet, clip board, pen or pencil, measuring tape, calculator, Photo Glossary of Volcano Terms.

Questions and Locations:

Pāhoehoe/‘A‘ā Field: Head straight out from the end of the paved road and inspect the two kinds of flows you are looking at in this area.

1. According to a sign posting, when did the eruption that last changed this area occur? _____
2. Which do you think is older, the pāhoehoe or the ‘a‘ā? _____ Why? _____
3. Walk up closer to the ‘a‘ā flow. Estimate its height. How high is it in feet? _____ Meters? _____
4. Measure the thickness of a nearby pāhoehoe toe in inches and then convert this measurement into metric terms. _____ inches = _____ centimeters

Kipuka: Look back towards where you left the paved road. Look at the surface you are walking on and then notice the forested area near by. What a contrast!

1. Tell why you think a kipuka is important to the re-vegetation of forested areas that have been covered by lava flows: _____
2. A _____ is usually the first plant type to experience re-growth on a new flow.
3. Why do you think these are called “pioneer” plants? _____
What are two other examples of pioneer plants? _____

Tree Molds: Search around the pāhoehoe flows to find lava tree molds.

1. List the steps that take place in the creation of a lava tree mold:
 - a. _____
 - b. _____
 - c. _____
2. Measure the inside of a tree mold to predict the diameter of the tree that once stood here and then convert that number to metric: _____ inches = _____ centimeters
3. What three kinds of important scientific information can lava tree molds reveal to us long after a lava flow has moved through an area?
 - a. _____
 - b. _____
 - c. _____

Fissure: Continue along the a‘ā flow and head to the right until you come to a ridged lava formation (spatter rampart). There is an area that serves as a natural passage through the ridge up ahead. Find this passage and **carefully** proceed (single-file) across to the fissure (crack) area.

1. Explain how this fissure formed: _____

1. Name the process that occurs when lava flows back into a crack or fissure during an eruption. _____

2. How long do fissure eruptions usually last? _____

4. Describe what you think happened as this fissure was being formed:

5. What would you have seen, felt, or heard?

Spatter Rampart:

1. Study the characteristics of this spatter rampart to decide whether it was built all at once or over a period of time. Explain your answer. _____

2. Describe the colors that you see. _____

Tephra: All around this flat area fronting the fissure and the spatter rampart, you can find many different types of fragmented volcanic rocks. They were once blasted into the air by explosive forces or hot gases and carried some distance by the wind.

1. Name at least three examples of tephra: _____

2. Explain why the **smallest** size tephra is found the **farthest** away from the eruption site:

Reticulite, Pele’s Tears and Pele’s Hair:

1. There used to be lots examples of these rock formations all around this area. Why do you think it is getting harder to locate samples to examine? (Clue: one cause may have to do with humans and another with natural foprces.) _____

2. Why are reticulate, Pele’s Tears and Hair found on the leeward sides of formations? _____

Bonus Question

Find a lava formation near the spatter rampart that looks like the head of a Nēnē.

Explain who this formation was created. _____

HINT: The nēnē formation can be seen in your photo glossary.

Scientific Evidence – Photo Glossary of Volcano Terms

Fissure



Photo by S. R. Brantley

In geology, a fissure is a fracture or crack in rock along which there is a distinct separation; fissures are often filled with mineral-bearing materials. On volcanoes, a fissure is an elongate fracture or crack at the surface from which lava erupts. Fissure eruptions typically dwindle to a central vent after a period of a few hours or several days. Occasionally, lava will flow back into the ground by pouring into a crack or an open eruptive fissure, a process called drainback; sometimes lava will flow back into the same fissure from which it erupted.

Kipuka is a forested area surround by a lava flow. They are very important to the survival of native species because they provide a good source of seeds (seed bank). In this way, an area can naturally regenerate.

Kipuka



Photo by JM Jarrell

Pele's hair



Photo by D. W. Peterson

Thin strands of volcanic glass drawn out from molten lava have long been called Pele's hair, named for Pele, the Hawaiian goddess of volcanoes. A single strand, with a diameter of less than 0.5 mm, may be as long as 2 m. The strands are formed by the stretching or blowing-out of molten basaltic glass from lava, usually from lava fountains, lava cascades, and vigorous lava flows (for example, as pāhoehoe lava plunges over a small cliff and at the front of an 'a'ā flow). Pele's hair is often carried high into the air during fountaining, and wind can blow the glass threads several tens of kilometers from a vent.

Pele's tears

Small bits of molten lava in fountains can cool quickly and solidify into glass particles shaped like spheres or tear drops called Pele's tears, named after Pele, the Hawaiian goddess of volcanoes. They are usually jet black in color and are often found on one end of a strand of Pele's hair.



Photo by J. D. Griggs

Pioneer Plant



Photo by JM Jarrell

Tiny plants like the swordfern are the first to reestablish in an area after an eruption has cooled. Within a few years, other pioneer plants like 'ōhi'a lehua, 'ohelo and 'āma'u find their way onto the lava.

Some seeds are carried by the wind from a nearby kipuka and by birds.

Reticulite

Reticulite is basaltic pumice in which nearly all cell walls of gas bubbles have burst, leaving a light-weight, honeycomb-like or foam-like structure.

Even though it is less dense than pumice, reticulite does not float in water because of the open network of bubbles. The delicate glass threads between the bubbles are very fragile. Reticulite is often light brown in color and is found on the leeward side of cracks and crevices all around this area.



Photo by J. D. Griggs

Spatter

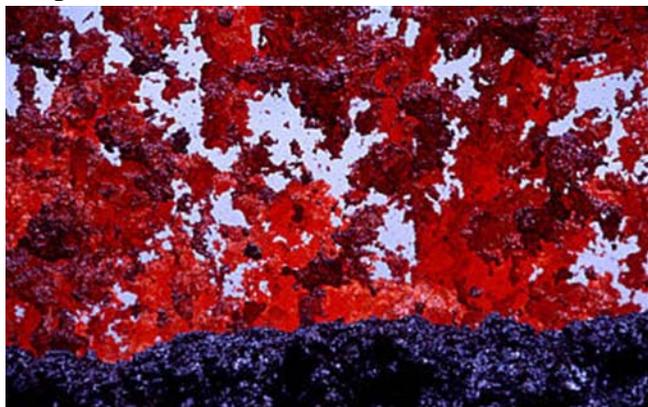


Photo by J. D. Griggs

Very fluid fragments of molten lava ejected from a vent that flatten and congeal on the ground are called spatter. Typically, spatter will build walls of solidified lava around a single vent to form a circular-shaped spatter cone or along both sides of a fissure to build a spatter rampart.

Clumps of molten lava (spatter) hurled above the rim of a spatter cone have already started to cool and develop a thin black skin on their surface. Width of the image is about 3 meters.

Close view of cooled, solidified spatter fragments hurled from an active littoral cone on the south shoreline of Kīlauea Volcano. The impact of the molten spatter hitting the ground flattened the fragments into roughly circular disks.



Photo by T. N. Mattox

Spatter rampart

Lava fountains that erupt from an elongate fissure will build broad embankments of spatter, called spatter ramparts, along one or both sides of the fissure. The spatter commonly sticks together, or agglutinates, when it lands and is buried by later spatter. In contrast to these low linear fortifications, spatter cones are more circular and cone shaped--the only real distinction between the two structures is their shape.



Photo by JM Jarrell

Tephra



Photo by JM Jarrell

Tephra is a general term for fragments of volcanic rock and lava regardless of size that are blasted into the air by explosions or carried upward by hot gases in eruption columns or lava fountains. Tephra includes large dense blocks and bombs, and small light rock debris such as scoria, pumice, reticulite, Pele's Tears and Hair and ash.

As tephra falls to the ground with increasing distance from a volcano, the average size of the individual rock particles becomes smaller and thickness of the resulting deposit becomes thinner. Small tephra stays aloft in the eruption cloud for longer periods of time, which allows wind to blow tiny particles farther from an erupting volcano.

Tree mold

Fluid basaltic lava may preserve the shapes of trees and other objects by solidifying around them. Tree molds are formed when lava surrounds a tree, chills against it, and then drains away. The standing structure left behind is often called a lava tree.

Tree trunks engulfed and incinerated by lava leave cylindrical hollows, or tree molds, where lava solidified against them; tree molds often preserve the original surface texture of the tree. Tree molds are found within standing lava trees and on the surfaces of lava flows. They are common pāhoehoe flows and occasionally found in 'a'ā flows.

Tree molds can tell scientists how high the lava flow was when it passed the area and the direction the flow traveled. Based on the charcoal residue left in the tree mold, they can also tell the age of the flow.



Photo by K. Schikman

Conclusion

Volcanoes produce amazing lava formations and products. The dramatic features of Mauna Ulu and the surrounding area are in danger of being lost by human impact or natural forces of nature like wind, rain, and erosion.