AMAZING LAVA PRODUCTS

Grade 5-12 **Meet at Mauna Ulu** **9:30-11:30**

Mauna Ulu "The Growing Mountain"

Introduction:

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.

Essential Question:

What kinds of formations and products do volcanoes produce and how are they vulnerable to change today?

Photo Analysis:

What's happening in this photo?

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

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 scientists to witness first-hand an underwater eruption showing how pillow lava, the oldest type of rock formation on earth is created.

Pillow Lava:

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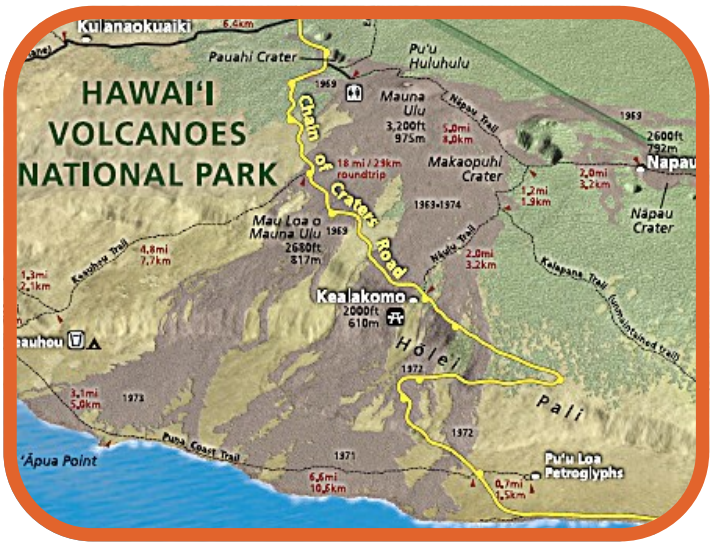
Photo by Richard D. Grigg

Locating the site:

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 ‘O‘ō

Directly north of ‘Āpua 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 m^3 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.

Metric Equivalents Chart for length, height and distance:

What you know	Multiply by:	Converted Answer
Feet	**0.31**	**Meters**
Inches	**2.54**	**Centimeters**
Miles	**1.61**	**Kilometers**

Visual Evidence-

Field and Group Activity Worksheet Students - 4-5 per group

Safety: This area is filled with many cracks, sharp lava and loose rocks. Stay on the trail and use your best behavior. Often vog from Puʻu ʻŌʻō comes through this area making breathing difficult, eyes and throat irritated, which can be hazardous to your health. If this occurs, 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 Worksheet, clip board, pen or pencil, measuring tape, calculator, Photo Glossary of Volcano Terms.

Questions and Locations:

Pāhoehoe/ʻAʻā 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. Look at the sign posting. When did the eruption that last changed this area occur?

_____

2. Which do you think is older, the pāhoehoe or the ʻaʻā?_____

Why? _____

3. Walk up closer to the ʻaʻā flow. Estimate its height. How high is it in feet?____

Meters?_____

Measure the thickness of a nearby pāhoehoe toe in inches and then convert this measurement into metric terms. _____inches = _____ centimeters

Kīpuka: 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!

Why is a *kīpuka* important to the re-vegetation of forested areas covered by lava flows?

A _____is usually the first plant type to experience re-growth on a new flow.

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.

List the 3 steps that take place in the creation of a lava tree mold:

A.

B.

C.

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

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 ʻaʻā 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.

Explain how this fissure formed.

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

How long do fissure eruptions usually last?

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

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 forces.)

2. Why are reticulite, Pele's Tears and Hair found on the leeward sides of formations?

Scientific Evidence – Photo Glossary of Volcano Terms

Fissure:

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 elongated 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.

(Photo by S. R. Brantley)

Kīpuka:

Kīpuka is a forested area surrounded 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.

Pele's Hair:

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 ʻaʻā 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:

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 ʻōhiʻa lehua, ʻōhelo and ʻamaʻu find their way onto the lava. Some seeds are carried by the wind from a nearby kīpuka and by birds.

Photo by JM Jarrell

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:

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.

(Photo by J. D. Griggs)

Spatter rampart:

Lava fountains that erupt from an elongated 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:

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, 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 away.

(Photo by JM Jarrell)

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 ʻaʻā 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)

In Closing:

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 and natural forces like new eruptions as well as wind, rain, and erosion.

Making the Climate Change Connection:

Lava flows can add to the problems of climate change because they destroy oxygen-making forests. Trees are our best natural defense against carbon-based global warming. They not only produce the oxygen we breathe, but also absorb huge amounts of carbon that cause global warming. In addition, the poisonous gases emitted during eruptions add to the processes that cause global warming.

What can you and your ʻohana (family) do to help ease the impact of climate change? Brainstorm ideas.