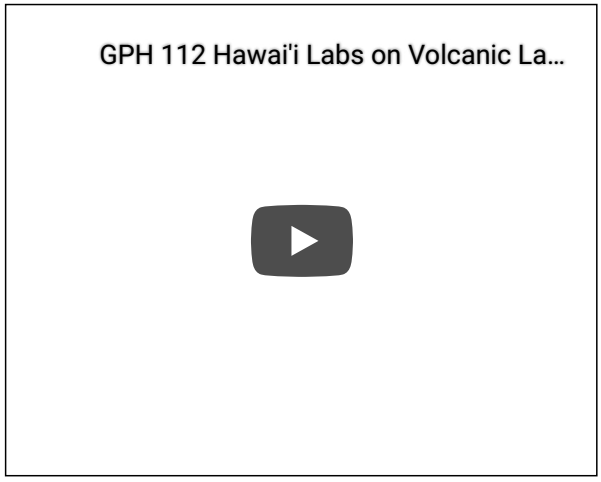
Hawai'i Physical Geography: Geomorphology - Volcanic Landforms

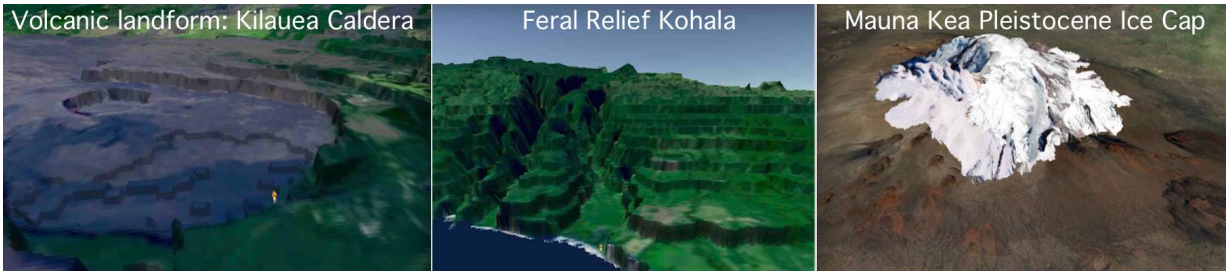
This is a preview of the published version of the quiz

Started: May 18 at 1:54pm

Quiz Instructions

You are welcome to watch this overview video about this volcanic landforms lab and the connected next lab about the creation of feral relief. The video does not explain how to do the problems, but explains how these different labs are connected to go from volcanoes to wild landscapes:





The landforms on the Big Island of Hawai'i are incredibly special to physical geographers who focuses on processes that generate landforms for several reasons:

- The rock type is almost all the same lava (basalt) derived from ocean crust.
- Related to this, the original slope of most of the Hawaiian volcano surfaces is remarkably similar, due to fluid basalt flows making the "shield volcano" (dome-like) shape for much of the island's surface.
- Hawaiian basalt is one of those rock types that can be "dated". Basalt older than about 50,000 years can be dated directly by measuring the decay of radioactive potassium. Basalt younger than about 40,000 years can be dated by measuring the radioactive carbon (radiocarbon) in trees that were swallowed up (run over) by lava flows.

All of these factors mean that the Big Island offers a wonderful laboratory to study how differences in climate influences the development of topography -- all while "controlling" rock type, original surface slope, and age of the original volcanic dome slope. The idea of this lab is for you to experience this research opportunity using real research data portrayed in geovisualization: digital elevation model data from the space shuttle; landsat data; and climate data.

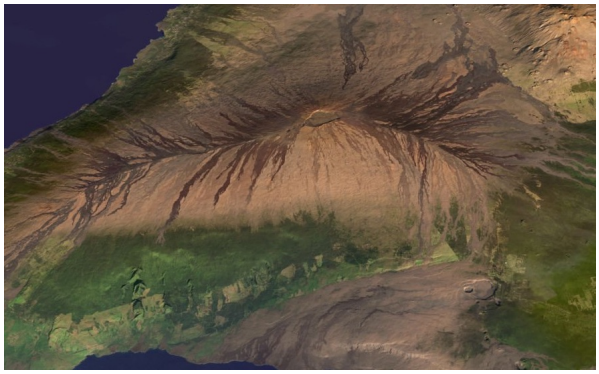
THIS LAB is really part 1 of a 2 part lab. You learn a bit about volcanoes and volcanic landforms. This "original volcano surface" then sets the stage for the next lab. The Part 2 (the next lab) is where you'll learn how climate plays an important role in eroding the Hawaiian volcanoes into feral (wild) landscapes like these:

Of course, there's a lot more to the Big Island geomorphology, including rock decay (weathering), soil

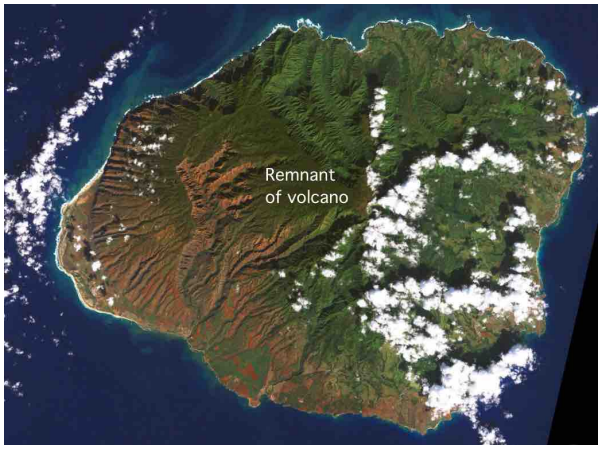
development, coastline erosional and depositional landforms, sand dunes, deposits of dust from Asian deserts, ice age glaciers, and much more. But this is just a 100-level course. So the focus here is on the "big picture" exciting geomorphology you will see when you (hopefully) visit the Big Island: volcanoes, deep spectacular valleys, and more.

This is the first of a two-part lab that starts with the geomorphology of a shield volcano (like Mauna Loa on the left) that then turns into the wild feral relief created by erosion of that volcanic surface (like Kauai on the right that has only a tiny bit of the original dome shape). This lab is about the original volcano geomorphology. The next one is about creating the feral relief.

Mauna Loa - what Kauai once looked like.



Kauai - little left of the original shield volcano



WHAT FOLLOWS IN THIS PRE-QUIZ INFORMATION is a tutorial on the questions you will see when you take THIS quiz. [*As always, don't hesitate to* ***ask for help*** *-- and taking screenshots of what has you stuck is great way to explain your question*.] This tutorial "walk through" presents the same order of questions you will encounter when you take the quiz.

VOLCANIC LANDFORMS. This section of the lab has two questions where you:

- **identify the volcanic landform** (and its relief or source) in a matching question
- **analyze a unique attribute of one of the big 5 shield volcanoes**

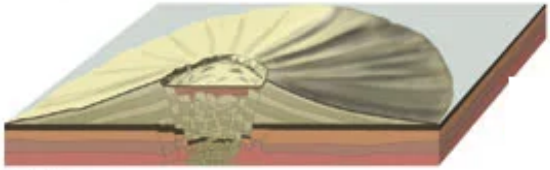
All the information you need is found below. But if you feel like you would like to review lecture content on basalt volcanic landforms. You can watch slide 5 through 30 in the **GPH 111 volcano lecture (https://www.asu.edu/courses/gph111/html5lectures/18Volcanoes/18PublishVolcanoes/)**. You will be asked a logon (gph111) and a password (gaia). If the lecture does not load, just refresh your browser.

QUESTION: The format is matching, where you select the best match between the location and the volcanic landform. In this question, you are given geographic coordinates scattered around the Island of Hawai'i. Within the geovisualization game, you enter the coordinates in Fast Travel and go to that location. Then, you find the best match between the location and the volcanic landform.

Your choices will be:

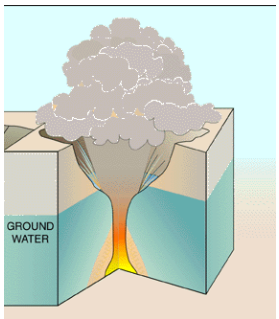
Caldera made by collapse of a volcano into an

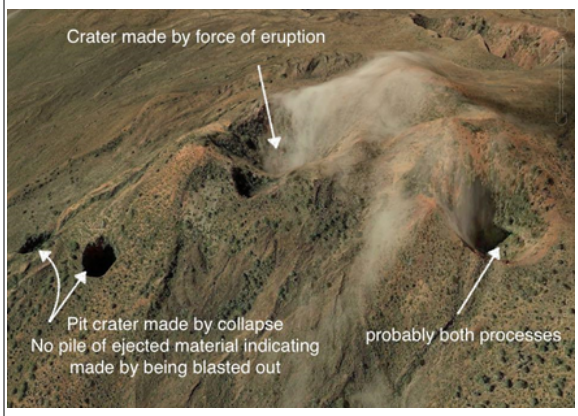
emptied magma chamber. **You will be asked the depth of the caldera**, that you determine by having your avatar stand on the rim (write down the elevation) and then jump down to the bottom of the caldera (write down the elevation). Just subtract the bottom from the top.



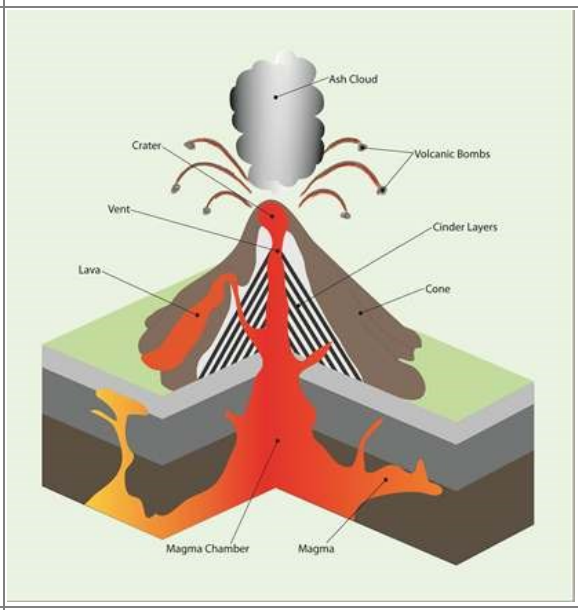
Crater made by the force of a volcanic eruption (or steam eruption). Craters can also be made by some collapse; but these craters are very different from the super big calderas made when the top of a volcano collapses into a void.

You may be asked the depth of the crater (determined the same way as a caldera)

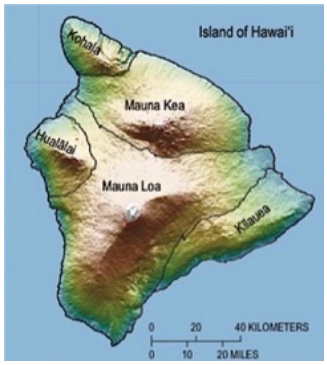




Cinder cone made by lava reaching the surface in the form of basalt pieces called cinder and dropping back down in the shape of a cone. **You may be asked the height of the cinder cone** (if so, write down the elevation at the base and at the top of the cinder con and subtract the two).



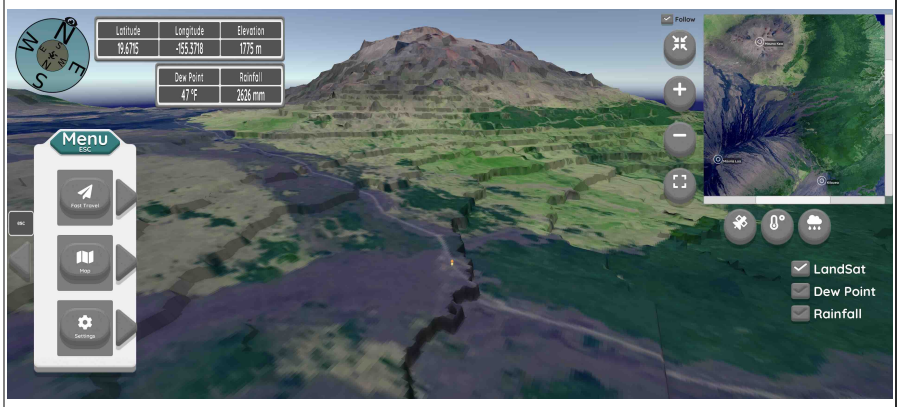
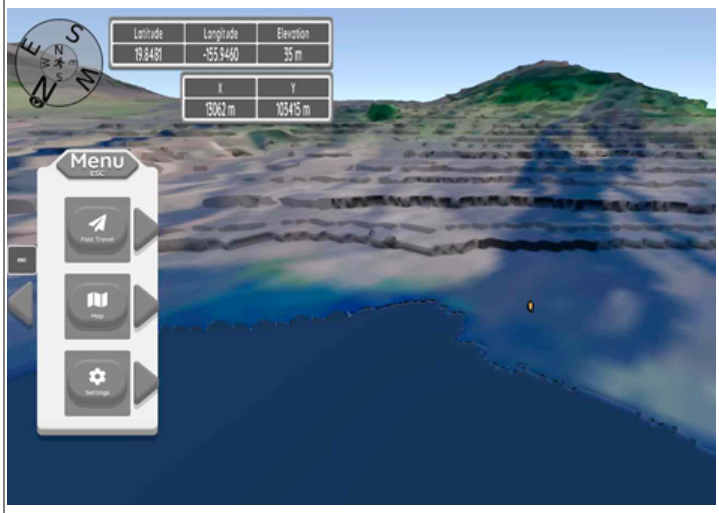
Basalt flow - that you will see as a strip of darker material flowing down the side of a shield volcano. In this question, you will be asked to find the volcano that is the source of the lava flow. Just follow the lava flow uphill and when you can't see it any more – that's the source. It will be one of the five big shield volcanoes seen to the right:

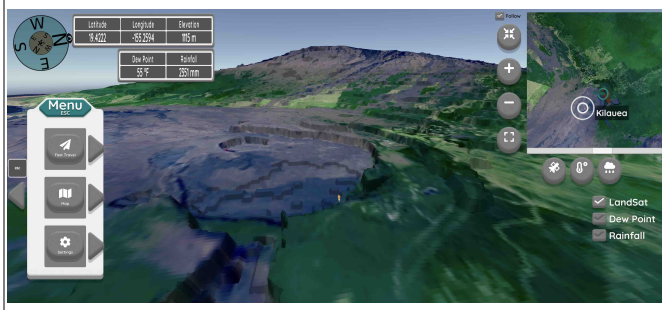
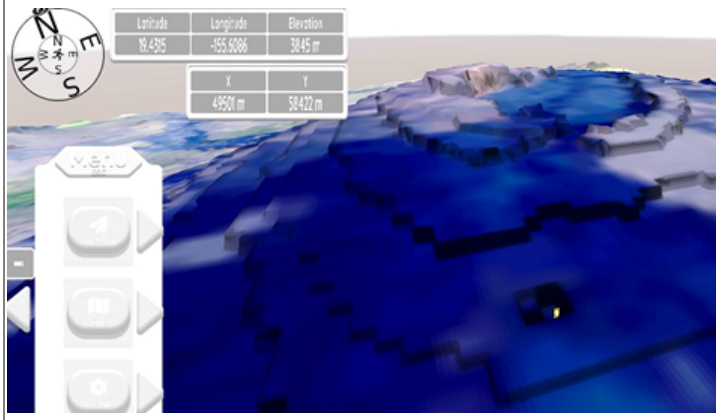


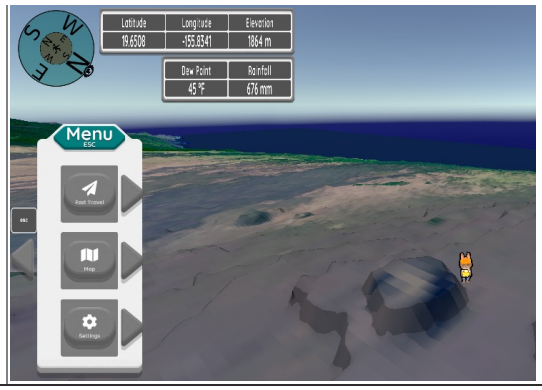
Below - you will find some examples of the matching you will do in the first question.

Note: Each student receives a randomized set of questions from the question pool. Thus, if you ask your instructor question in an email, please be sure to include a screenshot of the question you were given. Some students just write something like "I am confused about question 1, the first location ..." and then the instructor has no idea what question location you are writing about.

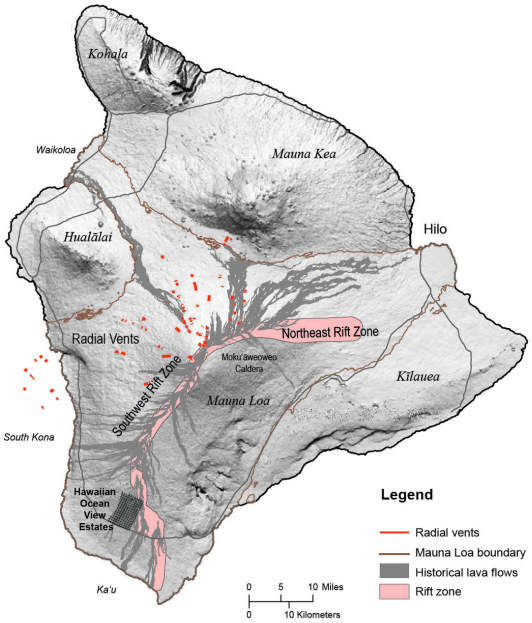
Note: If the feature has positive relief (goes up), then estimate its height using the highest elevation at the top and the lowest elevation around its base. If the feature is a negative relief (depression), then measure the highest location at the edge and the lowest education at the bottom to estimate the maximum depth.

Volcanic Landform Type and Fast Travel Coordinates	Annotated Geovisualization Screenshot example with the words you would see in the matching question
Basalt lava flow 19.6715 -155.3718	**Lava flow from Mauna Loa.** In this example, the avatar is in the middle of the screenshot. Mauna Loa is the volcano to the upper left, and the avatar "hopped" up hill following the basalt flow to a location high on Mauna Loa. 
Basalt lava flow 19.8481 -155.9460	**Hualalai Volcano lava flow** Hualalai Volcano erupted during 1800-1801 to produce the lava flow you investigated. It emerged from 5 fissures along the rift zone on the northwest side of this shield volcano. The lava flow made it to the ocean and buried Hawaiian villages along the way. 

Caldera 19.4222, -155.2494	**Caldera, around 100-200 m deep.** In this example, the avatar is in the middle of the screenshot standing on the edge of the Kilauea caldera. A caldera is made via the collapse of the surface, typically into a void left when lots of magma erupts on the side of a volcano. 
Caldera 19.4315 -155.6086	**Caldera, about 90 m deep** Lua Hou is a called a crater, but it's really a caldera made when the top of a volcano collapses. Craters are smaller, and they can be pit craters (made by collapse) or craters made by the force of an eruption.  Note: the avatar is standing in a caldera near the summit of Mauna Loa. The main caldera at the summit is in the background of the screenshot. The color of the lava is quite dark. Thus, the screenshot was brightened up a lot so that some of the features would show up better.
Crater 19.6760, -155.8256	**Crater, Rim 2136 m - Floor 2119 m or about 15 m deep** 
Cinder cone 19.6501, -155.8338	**Cinder Cone, Rim 1897 m - Base 1864 m or about 33 m tall**



There are five Big Island volcanoes. Can you tell them a part based on their volcanic features?



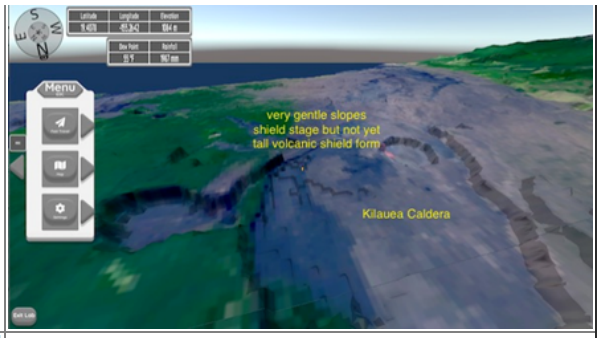
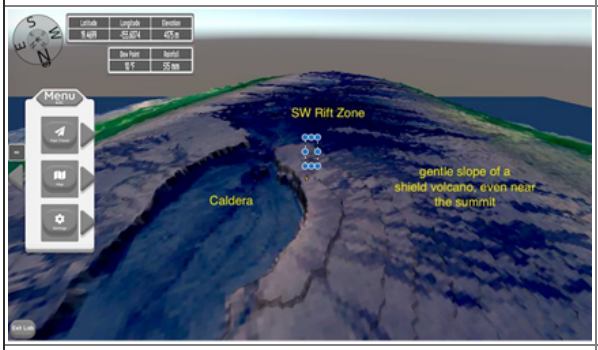
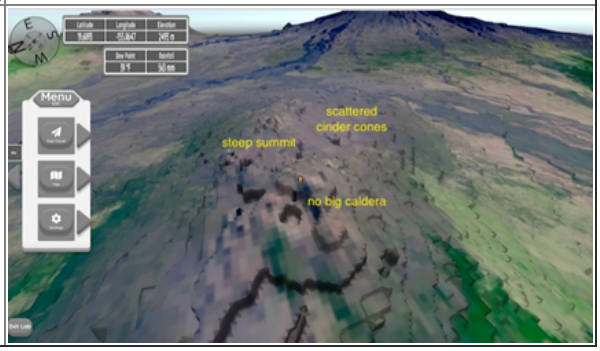
By now, you have been flying over and hopping around a lot of the volcanoes on the Big Island, and have gotten to know a few of their characteristics. This question tasks you with exploring these five volcanoes. You can fly over them via the Fast Travel helicopter (using the Fast Travel inset to start at one side and fly to the other). You can also use the Fast Travel buttons to jump to the top of each of the volcanoes and move the camera angle way up high and scan around.

This question pool has random questions that will ask you about one of these issues that helps distinguish the five Big Island volcanoes.

- volcano with the most surface area of dark (recent) lava flows
- volcano with the least surface of dark (recent) lava flows
- volcanoes with the most cinder cones and the least cinder cones
- volcanoes with summit calderas that show recent volcanic activity (e.g. dark lava)
- volcano with the lava flow that has the biggest elevation drop (from top to bottom
- volcano with the steepest slopes near the summit
- volcano dominated by recent lava emerging from multiple rift zones
- volcano old enough to have stream valley incision (eroding of stream valleys)

EXAMPLE QUESTION:

Look around the tops of the 5 big volcanoes. Identify the shield volcanoes, and determine which of the volcanoes has the lowest slopes (flattest terrain) around its summit?

Kilauea's summit is the flattest (lowest slopes). It does not even have the shape of a shield volcano, like Mauna Loa below	
	Mauna Loa has low slopes, but nowhere near as flat as Kilauea. If you look at Kohala, it has a shape with summit slopes similar to Mauna Loa.
Hualalai has a pretty steep summit, almost as steep as Mauna Kea.	

Question 1

2 pts

Matching – select the best match between the location and the volcanic feature (or the basalt flow source).

NOTE: There are a big pool of these questions, and so the instructions here apply for all of the potential questions.

You are given geographic coordinates scattered around the Island of Hawai'i. Use Fast Travel in the geovisualization to go to that location.

If the location is a volcanic feature that is not a lava flow (e.g. **caldera** made by collapse of a volcano into an emptied magma chamber, **crater** made by the force of a volcanic eruption (can also be made by collapse when there's no lava or cinder surrounding it), **cinder cone** made by lava reaching the surface in the form of pieces called cinder and dropping back down in the shape of a cone), then the correct match will be the correct name of the feature and an estimate of the height (e.g. of the cinder cone) or the depth (e.g. of the caldera) using the elevation data you see in the geovisualization.

If the location is a basalt lava flow, then the best match will be the volcano that is the source of the lava flow. Just follow the lava flow uphill and when you can't see it any more – that's the source. It will be one of the five big shield volcanoes.

19.41583 -155.25111 [Choose]

19.7787, -156.0432	[Choose]
19.4740, -155.5893	[Choose]
19.7669, -155.6357	[Choose]

Question 2

2 pts

Look around the tops of the 5 big volcanoes. Which of the listed volcanoes has the steepest slopes surrounding its summit?

- ◯ Mauna Kea
- ◯ Kohala
- ◯ Kilauea
- ◯ Mauna Loa

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