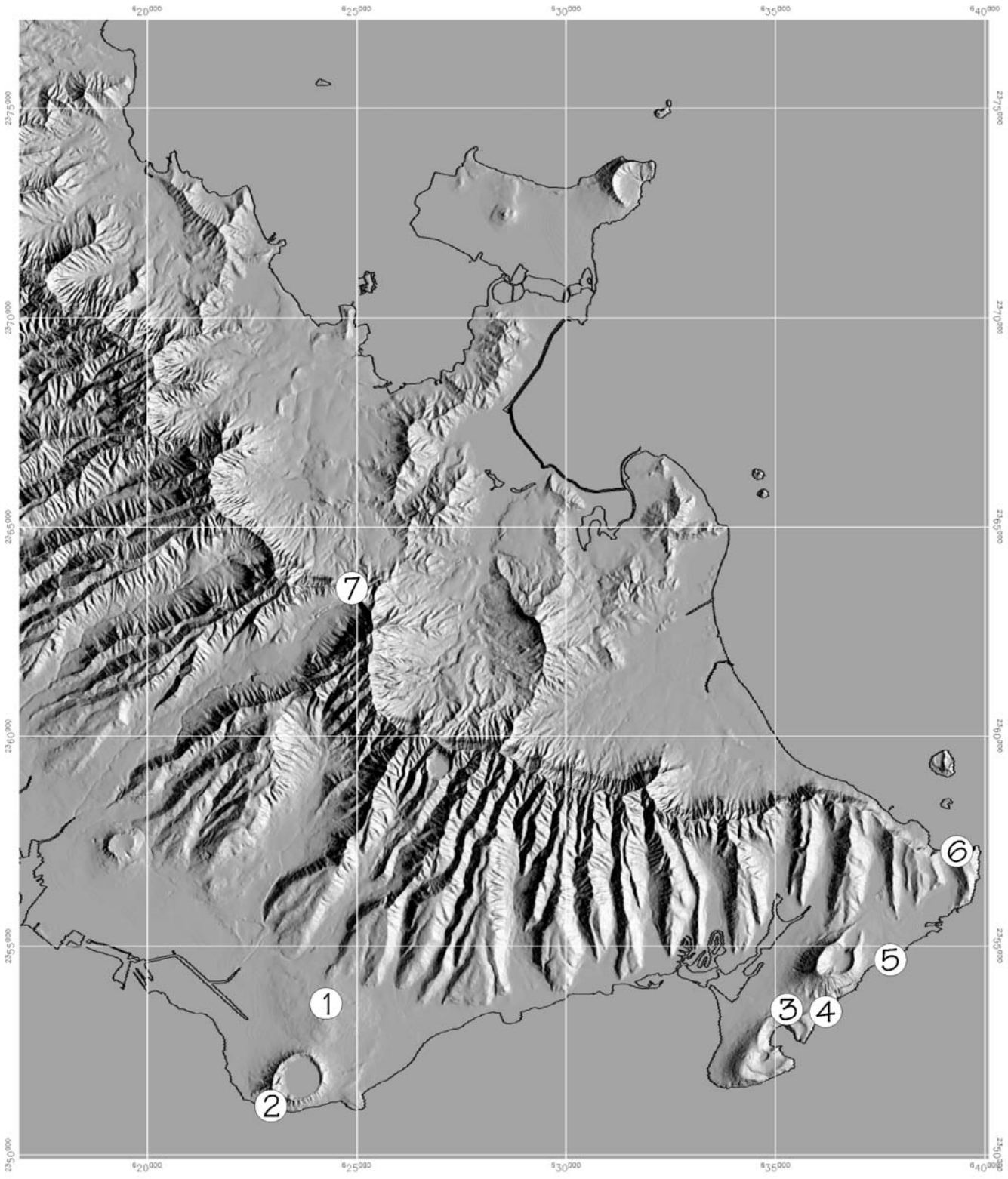
NAME_____ COURSE _____ INSTRUCTOR _____

Southeast O‘ahu Field Trip
University of Hawai‘i at Mānoa Geology & Geophysics Dept.



➢ ***Stop 1: Puʻu o Kaimukī:***

1. Puʻu o Kaimukī (*the hill where ti (ki) roots were cooked in ovens (imu)*) is one of the Rejuvenation stage vents of Koʻolau (*windward*) volcano (Figure 1). Figure 1 also indicates that Puʻu o Kaimukī consists of lava. What style of eruption formed Puʻu o Kaimukī? How do you know?

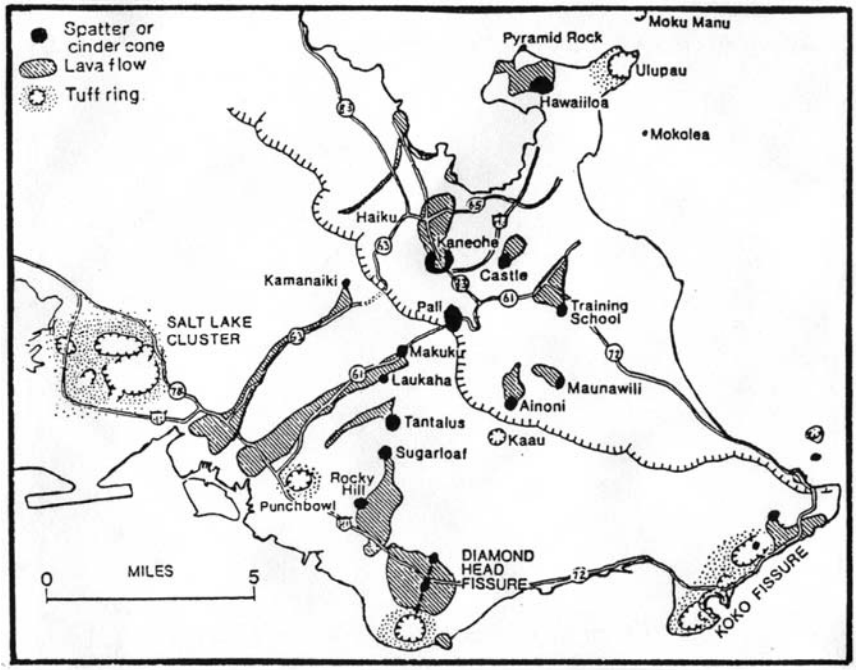


Figure 1: Sketch map of most of the vents of the Honolulu Volcanic Series (by George P.L. Walker)

2. How do the slopes of Lēʻahi (*the brow of an ahi*), also known as Diamond Head, compare to those of Puʻu o Kaimukī?

3. What style of eruption formed Lēʻahi? How do you know?

4. Figure 2 shows stages in the erosion of all or parts of a typical Hawaiian volcano surface. As you look māuka from Puʻu o Kaimukī, which stage corresponds to the nearby slopes of Koʻolau volcano?

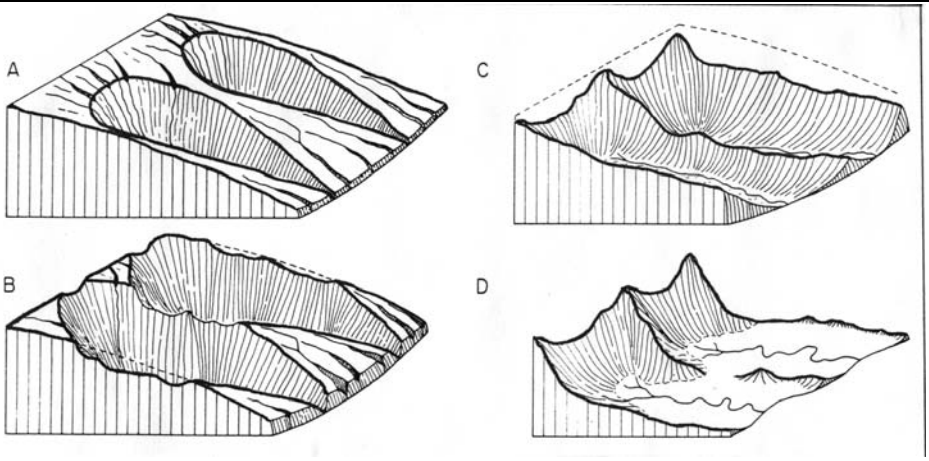
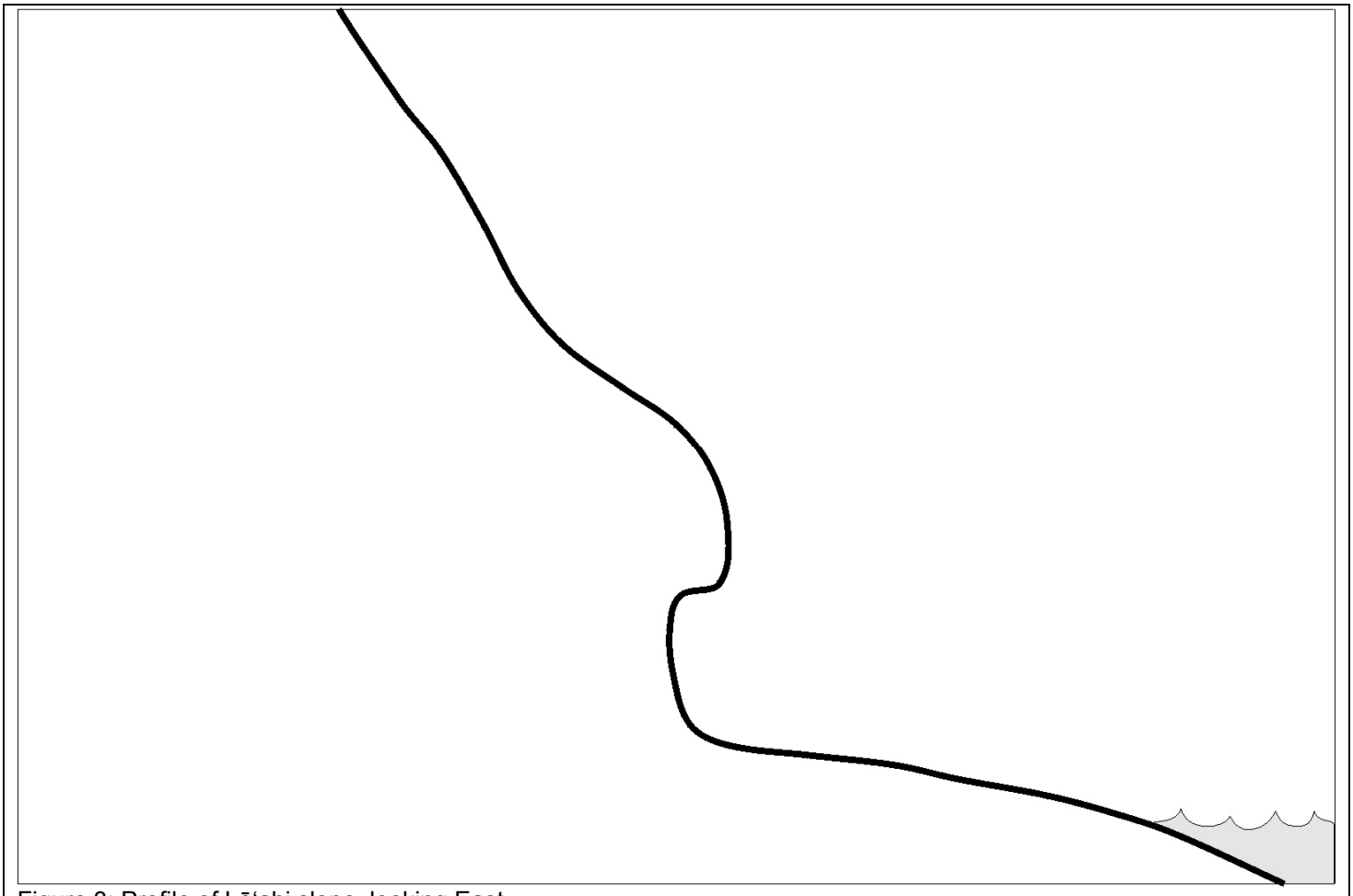


Figure 2: Stages in Hawaiian volcano erosion (from Volcanoes in the Sea).

➢ ***Stop 2: The coast along Beach Rd.:***


Figure 3: Profile of Lēʻahi slope, looking East.

5. Figure 3 shows the profile of the ground slope as you look East from the bottom of Beach Rd. Complete this diagram by adding in the geologic layers. That is, make it a cross-section (cut-away view) by extending the layers into the slope. Use a different symbol or pattern for each layer.

6. Describe each of your layers.

7. What was the order of geologic events here?

8. Does the sand that you see in the cliff have the same composition as the sand that makes up the modern-day beach? If not, how are they different?

➢ ***Stop 3:Koko District Park:***

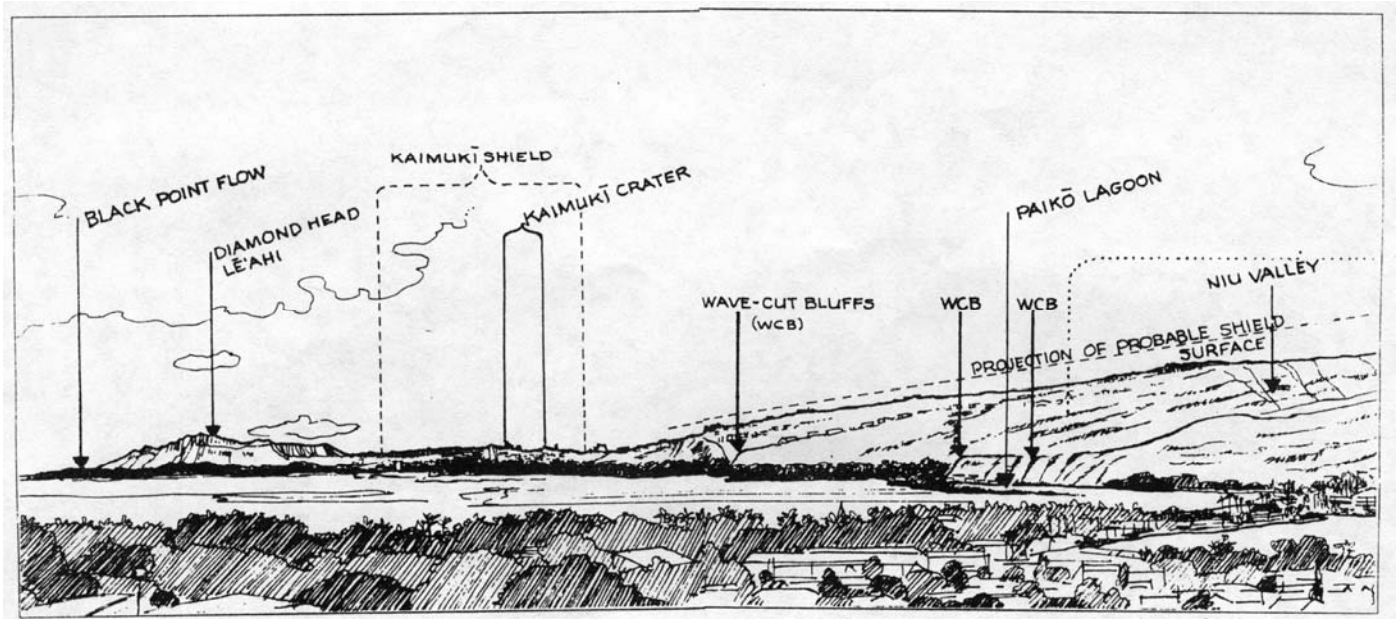


Figure 4: View plane drawing from Hawai' Kai, looking West (By Lorin T. Gill)

Figure 4 shows the view back towards Honolulu from the Hawai'i Kai/Koko Head area. *The name "Koko" (blood) refers to the blood of a man who was bitten by a shark near here. The Kai part of Hawai'i Kai does double duty as the ocean and the first part of Henry Kaiser's name - he developed Hawai'i Kai).*

9. There is some disagreement among geologists regarding whether or not the current profile of the ridges is the old shield surface, or, as Figure 4 suggests, the old shield surface was once higher. The lava flows exposed in the walls of the valleys had to at one time define the surface of the volcano, and one consideration would be to ask if the current topographic profile is parallel to these lava flows. Is it? (hint: you can measure the slopes of the flows and the ridge profiles using the simple clinometer)

10. There are wave-cut bluffs at the downslope-ends of all the ridges. Are they actively being cut by waves now days?

11. (hint, the answer to Question 10 is no) So then, how did these wave-cut bluffs form?

12. What other evidence would you look for to support your answer to Question 11?

➢ ***Stop 4: Lāna'i lookout:***

Even though this place is called Lāna'i Lookout, It is usually a lot easier to see Moloka'i from here. Be very careful of slippery slopes and of large waves! *Lāna'i is an old word that can be translated literally to "day of conquest". Whether that is the true meaning for this particular island is not known. The meaning of Moloka'i is not known.*

13. Are the individual layers normally graded or reverse graded?

14. How many layers are there?
    - ☐ few
    - ☐ kind of plenty
    - ☐ lots
    - ☐ super lots

15. What does the number of layers tell you about the eruption (for example, was there a constant fountain or multiple explosions)?

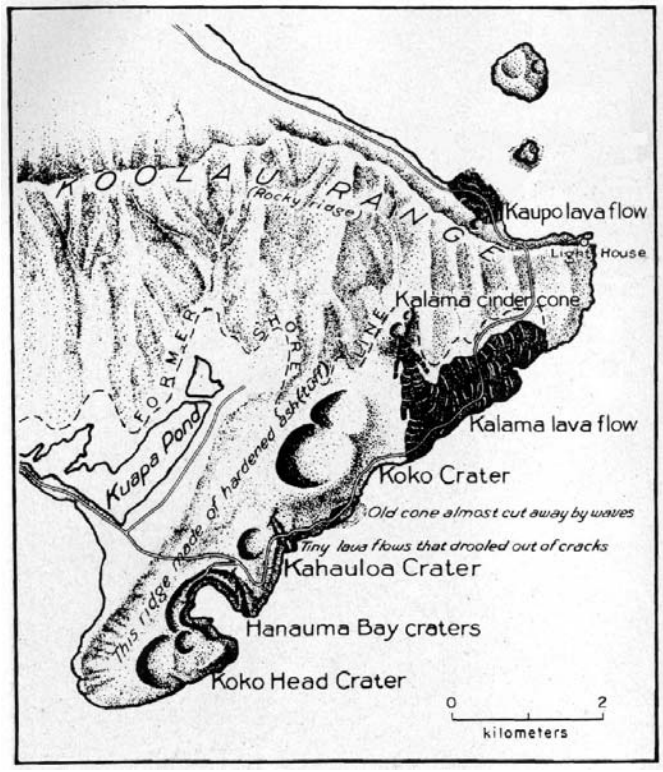


Figure 5: Sketch map of the Koko Rift (from Volcanoes in the Sea).

16. Is the big chunk of limestone in its natural place or was it blown out and dumped here by the eruptions? How would you tell?

17. In Figure 5, Lāna'i lookout is right by the word "Tiny", just above "Kahauloa". Kahauloa, by the way, means the tall hau tree. According to Figure 5, this location was offshore from the island of O'ahu at the time of the Koko rift eruptions, which occurred 40,000 years ago (notice where it says "FORMER SHORELINE"). There is one bit of geological evidence that supports this idea, and another (see question 16) that doesn't. What are they?

➢ ***Stop 5: Kalama lava flow near Sandy Beach:***

Not all of the Koko rift rejuvenation stage activity was hydromagmatic. The Kalama lava flow is the product of a dry eruption up near the mouth of Kalama valley. *Kalama means "the lama" - lama is a type of ebony tree.*

18. Is the Kalama lava flow ʻaʻā or pāhoehoe? What is your evidence?

From here you can also see Koko Crater, a very steep-sided (and therefore somewhat unusual) hydromagmatic vent. *The old name for Koko Crater was Kohelepelepe, which literally means the rim of a vagina. This comes from the story of Pele's sister Kapo luring Kamapuaʻa off of Pele with a flying vagina that landed briefly here. You can decide whether or not the name is appropriate.*



Figure 6: Photo of Koko Crater from the northeast.

19. Notice that Koko Crater is very asymmetric. In fact, you can actually walk into the crater from the northeast (there is a City and County of Honolulu botanical garden in there with all kinds of weird dryland plants). Why do you think the crater is so asymmetric? (Lēʻahi shows the same asymmetry, although not as dramatically)

➢ ***Stop 6: Makapu‘u lookout:***

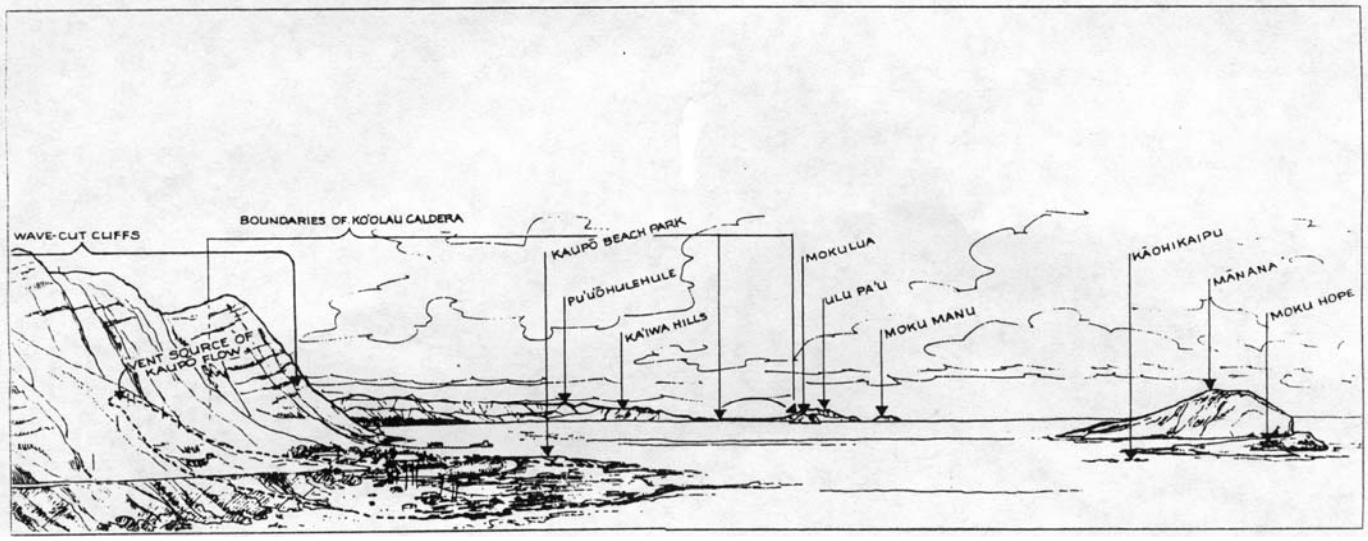


Figure 7: View plane diagram of Kaupō, Mānana, and other Ko‘olau features, as seen from Makapu‘u lookout. The Dept. of Transportation made a fancy new parking area up at the lookout, but buses are not allowed there. Diagram by Lorin T. Gill.

Makapu‘u means bulging eyes (literally, eyes like hills), and refers either to an image in a cave nearby, or to a woman who longed for her home in Kahiki (Tahiti) and said she was able to see it from here, with what must have been really good eyesight!

20. The big ol’ boulders lying around here are part of a geological puzzle (some are in place, others were put back sort-of in place after construction of the lookout). Think about where in Hawai‘i you typically find large boulders, and based on this, explain how these particular boulders got here.

From the lookout, you can see the products of three more Koko Rift rejuvenation eruptions, Mānana, Moku Hope, and the Kaupō lava flow. The Kaupō flow is the product of another “dry” eruption along the Koko Rift. The vents for this flow are uphill from the green-roofed wedding chapel that Sea Life Park built (against community wishes) a few years ago. *Kaupō means to land a canoe at night.*

21. Notice from Figures 5 and 7 (and with your <u>own</u> two maka) that the Kaupō lava flow is banked up against some pretty dramatic pali (cliffs). What does this tell you about the relative ages of the pali and the Kaupō flow?

22. Notice also all the lava flow layers exposed in these pali. Where are/were the vents that produced these lava flows?

23. How do you think this pali formed?

24. Notice the two islands offshore, Mānana (*buoyant*; the higher, lighter-toned one that is farther offshore) and Moku Hope (*island behind*; the lower, darker-toned one that is closer to shore). Mānana is a tuff cone, formed by hydromagmatic eruptions, whereas Moku Hope is a scoria cone, formed by dry, high-fountaining eruptions. Assuming that they formed at the same time, do their eruption types and relative locations make sense geologically? Explain.

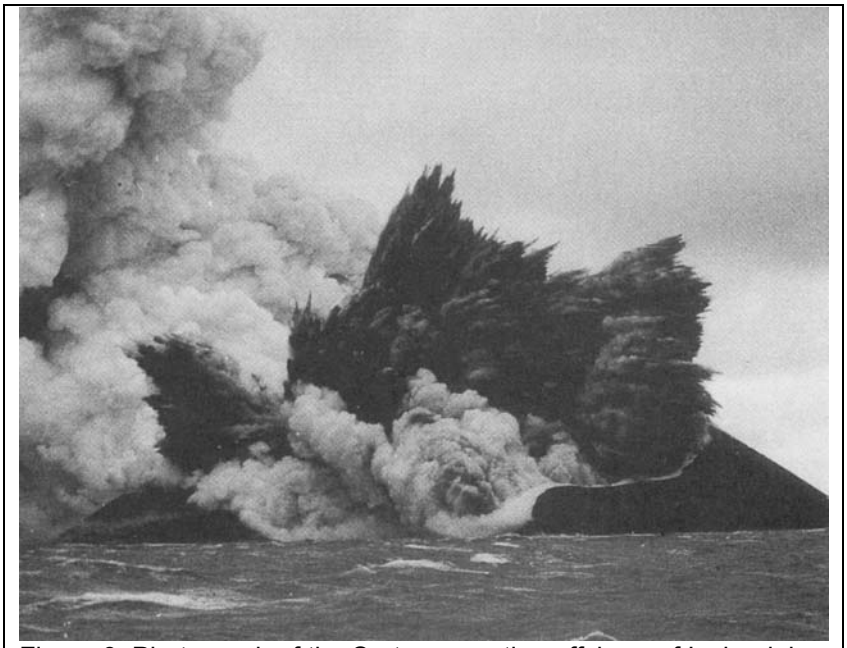


Figure 8. Photograph of the Surtsey eruption offshore of Iceland, in 1963. This is a classic example of a hydromagmatic eruption, and if you had been in Hawai‘i about 40,000 years ago, this is probably what Mānana would have looked like.

➢ ***Stop 7: the Pali lookout:***



Figure 9: Oblique air photo looking town-ward over the pali (from Volcanoes in the Sea).

The Nu'uanu Pali lookout is located at a very significant historic place, an interesting geologic place, a touristic place, and often a very windy place. Historically, this is where Kamehameha I defeated Kalanikūpule, and thereby added O'ahu to his empire. Because this place is popular with tourists and rental cars, make sure you don't leave any valuables unattended.

25. Notice in Figure 9 that the Pali and Wilson tunnels are located at similar places topographically. What has happened geologically to make these places so similar and so ideal for building cross-Ko'olau roads and tunnels?

26. Draw a cross-section of the roadcut just down the old road from the lookout (spend at least a minute on it). Label each unit. What was the order of their emplacement?

27. Many people say that the Nu‘uanu Pali, right where we’re standing, is the scar from the giant avalanche that carried away the northeast half of Ko‘olau volcano (Figure 10). Can you see anything that might indicate problems with this idea? Hint: the following features in Figure 7 are parts of the old Ko‘olau volcano (i.e., they are not rejuvenation-stage features): Mokulua (*two islands*), Ka‘iwa (*the frigate bird*) Hills. Other features that are also parts of the old volcano are the Kapa‘a hills (*the solid - appropriate for a quarry, or the closing*), and Olomana (*forked hill*), which is not in Figure 7 but which we were able to see from Kaupō.

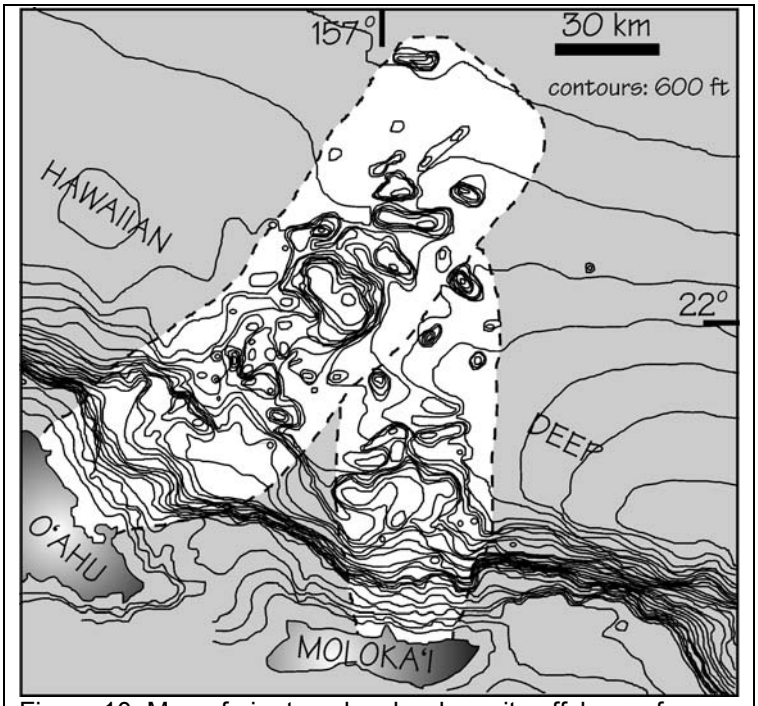


Figure 10: Map of giant avalanche deposits offshore of Ko‘olau and E. Moloka‘i volcanoes (from Volcanoes in the Sea).

28. Finally, here is a place where you can put your finger on a contact that represents a time break of perhaps 1.5 million years! To the right (south) are lava flows of the main Ko‘olau shield volcano. To the left (north) are scoria layers of a rejuvenation-stage vent upslope from us. List 3 ways in which the cinder layers differ visually from the lava flows.

