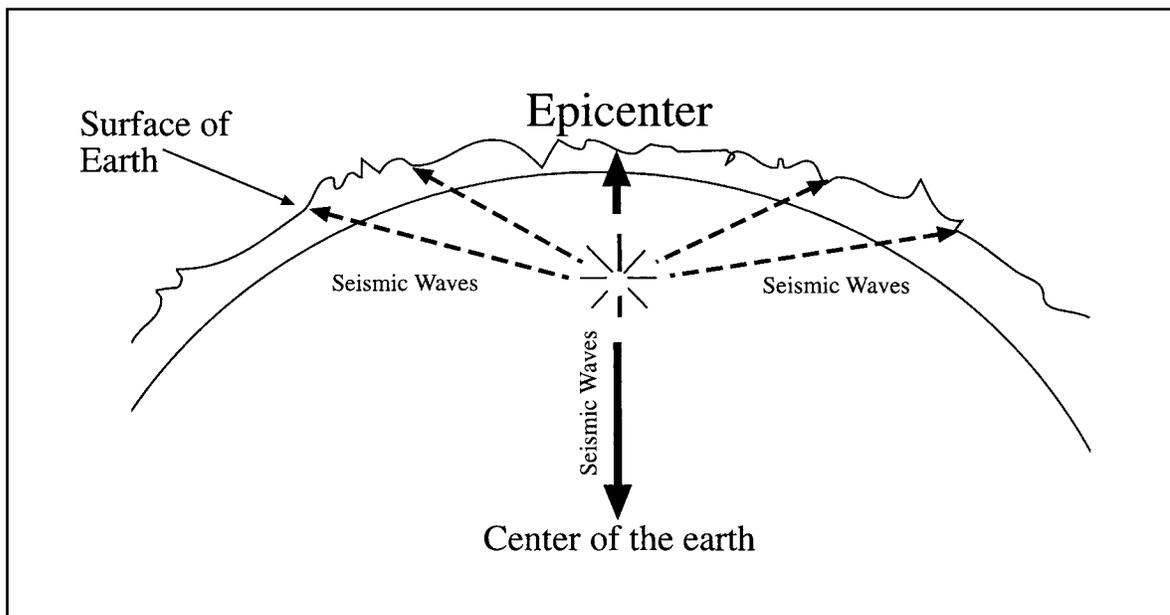


Locating the Epicenter

Overview:

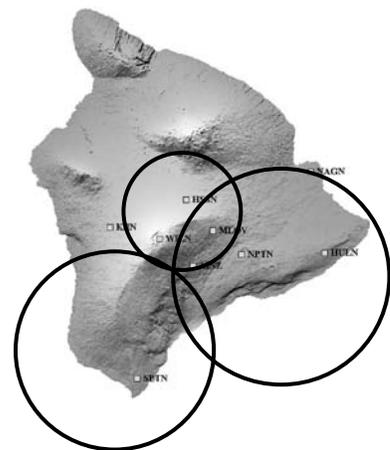
The movement of magma within a volcano causes earthquakes. Earthquakes occur below Earth's surface. Scientists can locate the epicenter of an earthquake by finding the distance between the epicenter and at least three seismometers. The epicenter is the place on the surface of Earth directly above where the earthquake occurred (see diagram below). In this lesson students use information from seismographs in Hawai'i to find the epicenter of an earthquake near Mauna Loa Volcano.



Objectives:

The student will:

- locate seismographs on a map;
- understand that three seismographs are needed to locate the epicenter of an earthquake;
- read and use a map scale; and
- use a compass and seismograph information to locate the epicenter of an earthquake.



Answers to Student Worksheet:

Analysis of Data: 1. AINZ Seismometer near Mauna Loa Volcano

Conclusion: If the three seismographs in the chart recorded accurate data, then the epicenter of the earthquake is at the AINZ seismometer near Mauna Loa Volcano. Other answers will vary.

- Further Questions:
1. d) the place on Earth's surface directly above where an earthquake occurred
 2. Three or more.
 3. No. Explanations will vary.

Locating the Epicenter

Materials:

- Drawing compasses (one per student)
- Student Worksheet: “Locating the Epicenter”

Activity Procedure:

1. Begin this activity by explaining that as the magma chamber within a volcano inflates, it cracks the earth around it, creating vibrations called earthquakes. These earthquakes can shake the ground, causing structures to collapse, and can trigger other hazards such as landslides, tsunamis and avalanches. Scientists use information recorded by seismometers to find the epicenter of an earthquake. The epicenter is the place on the surface of Earth directly above where the earthquake occurred.
2. Distribute compasses, and the Student Worksheets: “Locating the Epicenter.” Ask students to read and discuss the testable question and background information. Ask students to complete the hypothesis portion of the worksheet before using their compass. Review procedure with students and demonstrate how to set the radius of a compass by adjusting the distance between the pencil and the pointer.
3. Ask students to complete the Student Worksheets: “Locating the Epicenter.” Remind them to answer the questions on the final page.
4. After all students have completed the activity ask where they found the epicenter.
5. All students should indicate that the epicenter was right next to the AINZ Seismometer.



Cultural Tie

‘Ope‘ape‘a, or the Hawaiian bat, is the only terrestrial mammal native to Hawai‘i. Bats, as well as dolphins and whales, use echo location to navigate and find food. They send out high-pitched sounds that bounce off objects, creating an echo that returns to the bat. Bats can detect the shape, size and location of objects with great accuracy.

Locating the Epicenter

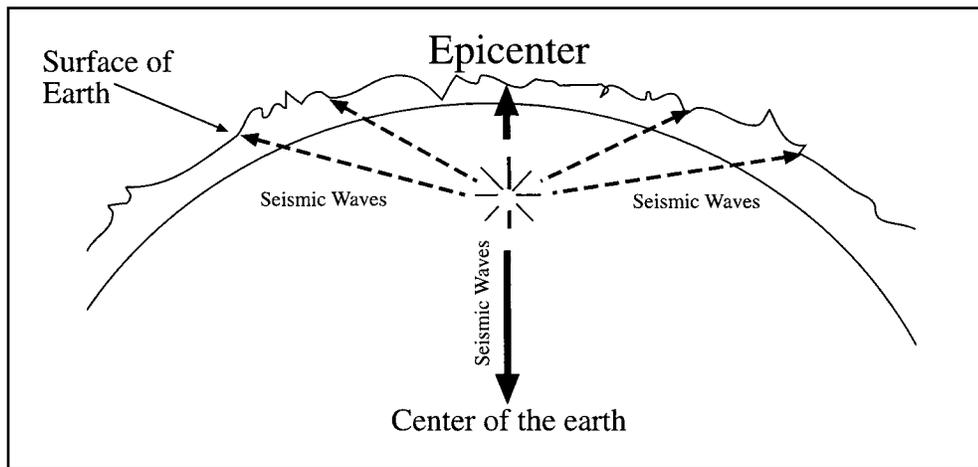
Testable Question:

Given the following seismic data, where is the epicenter of the earthquake?

Seismograph Site in Hawai'i	Distance from seismograph site to epicenter
Humu'ula Sheep Station (HSSN)	26 km
South Point (SPTN)	47 km
Heiheiahula (HULN)	53 km

Background Information:

Scientists can use P-waves and S-waves to figure out the distance to the epicenter of an earthquake. The epicenter is the place on the surface of Earth directly above where an earthquake occurred, as shown in the diagram below.



To find the epicenter of an earthquake, scientists must figure out where the origin of P-waves and S-waves recorded on a seismograph. The table above shows the epicenter distances recorded by three seismometers in Hawai'i.

Hypothesis:

1. Complete the hypothesis below.

If the three seismographs in the data chart recorded accurate data, then the epicenter of the earthquake is _____.

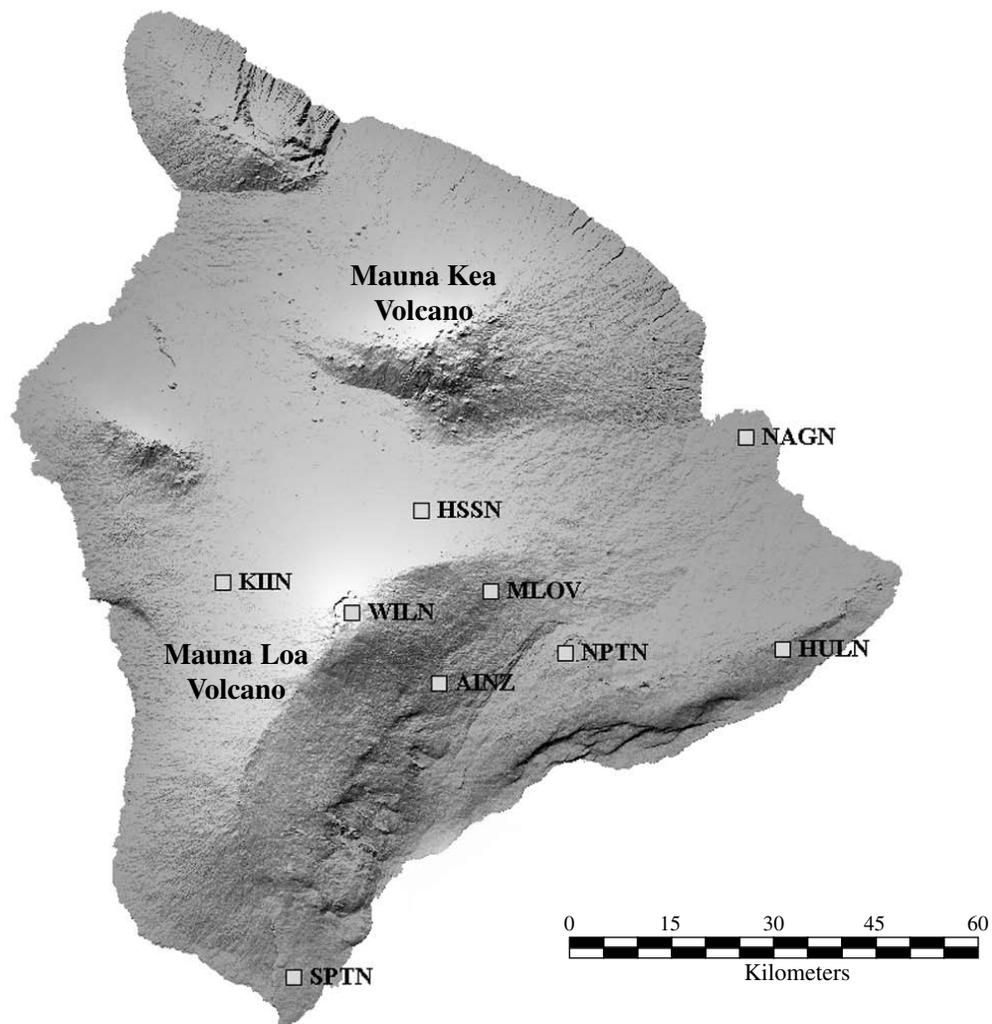
Locating the Epicenter

Materials:

Drawing Compass

Procedure:

1. Use the scale on the map to set the radius of your compass. Match the distance from the HSSN Seismometer to the epicenter. This distance is given in the table on the previous page.
2. After you set the radius of your compass, put the compass pointer on the square that shows the location of the HSSN Seismometer. Draw a circle around the HSSN Seismometer.
3. Repeat steps 1 and 2 for the SPTN Seismometer and the HULN Seismometer.
4. When you finish, three circles should be drawn on your map, one around each seismometer. The point at which these three circles meet is the epicenter of the earthquake.



Locating the Epicenter

Analysis of Data:

1. Where do the three circles you drew on the map meet?

Conclusion:

Write your conclusion as a complete sentence on the lines below.

Was your hypothesis proved or disproved? Explain your answer.

Further Questions:

1. What is the epicenter of an earthquake?
 - a) The location of the seismometer to first record the earthquake's P-waves.
 - b) The location of the seismometer to first record the earthquake's S-waves.
 - c) The place deep in Earth's crust where the earthquake began.
 - d) The place on Earth's surface directly above where the earthquake occurred.
2. How many seismometers and their epicenter distances are needed to locate the epicenter of an earthquake? _____
3. Are earthquakes always caused by volcanoes? How do you know?
