# Determining How Fast Some Crustal Plates Move

Most scientists believe that the Earth's crust is broken into pieces, much like the cracked shell of a hard-cooked egg. These pieces are called crustal plates and are thought to be moving across the mantle. The mantle is the layer of the Earth located directly under the crust.

The diagram illustrates how some scientists believe lines of volcanic islands are produced, as superheated molten material rises upward from deep within the mantle. The molten material breaks through weak places in the crustal plate as the plate moves over the stationary hot spot in the mantle. In the diagram, the first volcano is the oldest while the second and third get progressively younger. The fourth volcano is the youngest because it is still located over the hot spot in the mantle. Because volcanoes are formed in the ocean, they form what is referred to as a chain of volcanic islands, as their tops reach above the ocean surface.
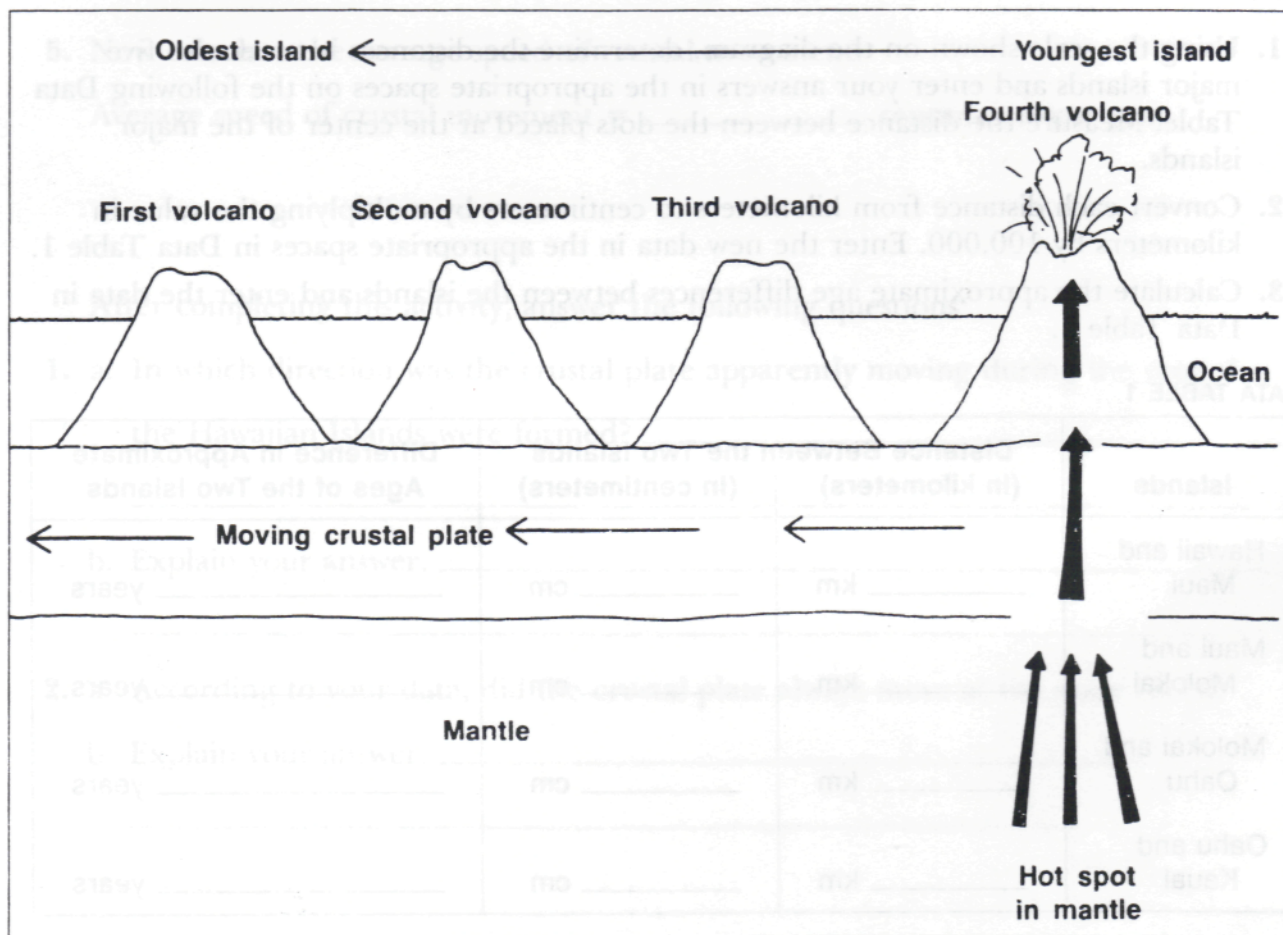
Using the idea that chains of volcanic islands are formed as a crustal plate moves over a hot spot in the mantle, it is possible to calculate the average speed at which the crustal plate is moving. The following diagram illustrates the eight main islands of the Hawaiian chain. The approximate age is given for the larger islands.
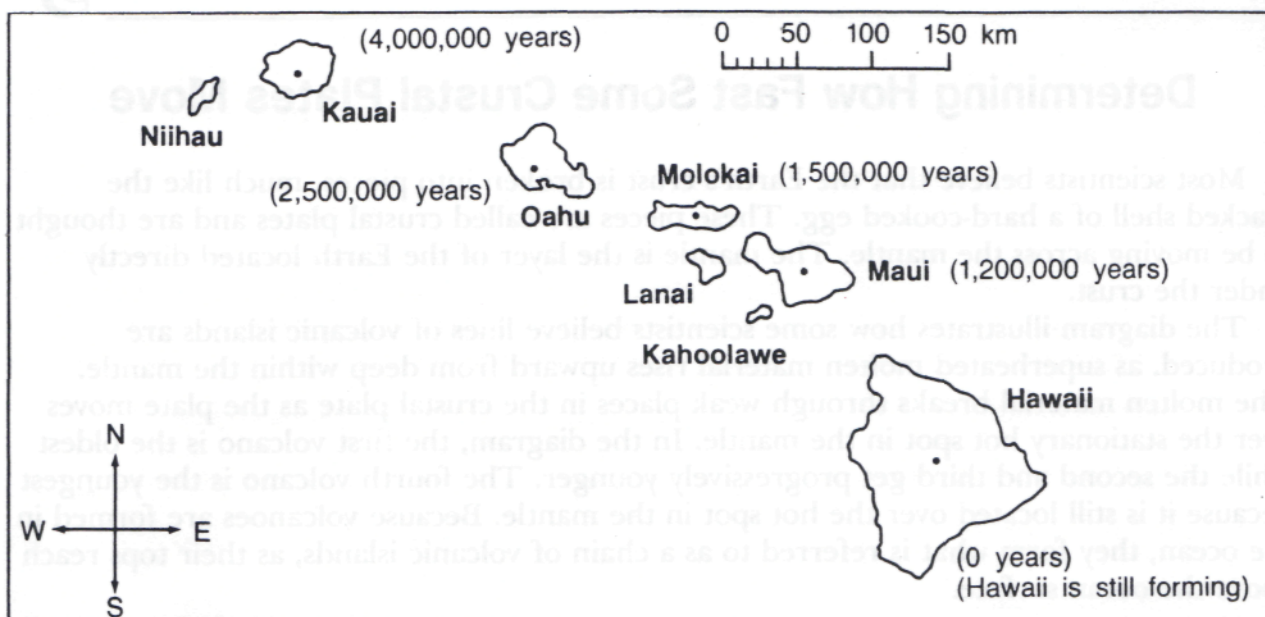
1. Using the scale shown on the diagram, determine the distances between the five major islands and enter your answers in the appropriate spaces on the following Data Table. Measure the distance between the dots placed at the center of the major islands.

2. Convert each distance from kilometers to centimeters by multiplying the value in kilometers by 100,000. Enter the new data in the appropriate spaces in Data Table 1.

3. Calculate the approximate age differences between the islands and enter the data in Data Table 1.

DATA TABLE 1

Islands	Distance Between the Two Islands (In kilometers)	(In centimeters)	Difference in Approximate Ages of the Two Islands
Hawaii and Maui	_____ km	_____ cm	_____ years
Maui and Molokai	_____ km	_____ cm	_____ years
Molokai and Oahu	_____ km	_____ cm	_____ years
Oahu and Kauai	_____ km	_____ cm	_____ years

4. Using the following formula, calculate the approximate speed at which the crustal plate was moving between the times that each of the islands formed. Enter your data in Data Table 2.

$$\text{Speed of crustal movement (cm/yr)} = \frac{\text{Distance between the two islands (in centimeters)}}{\text{Difference in approximate ages of the two islands (in years)}}$$

DATA TABLE 2

Islands	Approximate Speed of Crustal Movement Between the Times That the Two Islands Formed (cm/yr)
Hawaii and Maui	_____ centimeters per year
Maui and Molokai	_____ centimeters per year
Molokai and Oahu	_____ centimeters per year
Oahu and Kauai	_____ centimeters per year

5. Now calculate the average speed of crustal movement.

Average speed of crustal movement = _____ centimeters per year.

After completing this activity, answer the following questions:

1. a. In which direction was the crustal plate apparently moving during the time that the Hawaiian Islands were formed? _____

_____

b. Explain your answer. _____

_____

2. a. According to your data, did the crustal plate always move at the same speed? _____

b. Explain your answer. _____

_____