

Chapter 10 Lab Activity

Earthquakes and Subduction Boundaries

Most earthquakes occur at plate boundaries. The deepest earthquakes occur at subduction boundaries. Deep-focus earthquakes are those with foci deeper than 300 kilometers. Shallow earthquakes have foci less than 70 kilometers deep, and intermediate-focus earthquakes occur in between.

Subducting plate behavior is determined by the age of a plate's rocks. Older crust is cooler, and therefore denser, than younger crust. Denser crust subducts faster and at a steeper angle than less-dense crust.

In this lab activity, you will plot and compare actual earthquake foci data from two areas where subduction is occurring currently. One of the areas includes the Tonga Islands in the southwestern Pacific Ocean. The other area is along the coastline of Chile.

Procedure

- From the earthquake data in Table 2, find the number of shallow focus earthquakes for both areas. Record your values in Table 1.
- Repeat Step 1 for intermediate-focus and deep-focus earthquakes.
- Add the numbers in each column of Table 1. Your totals should equal the Total Number of Quakes given for each column.
- On graph paper, draw a set of axes to plot longitude versus focal depth. Place focal depth on the vertical axis, with the surface (depth zero) at the top. Plot the data for Tonga from Table 2. Do not connect the dots. Instead draw a best-fit line for the points. Assume the line you have drawn is the upper surface of a subducting plate.
- Construct a second graph for the Chile data. You will want to change the values on the longitude axis to match the range of longitudes found in Table 2. Plot the Chile data and draw a best-fit line.

LAB SKILLS AND OBJECTIVES

- **Construct** profiles across two subduction zones.
- **Compare** and **contrast** the behavior of two subducting plates.

MATERIALS

- graph paper
- Appendix B: Plate Boundaries Map, pages 712–713 of your text.
- Appendix B: Physical World Map, pages 710–711 of your text.

Table 1

Earthquake Type	Focus Depth (km)	Tonga Total	Chile Total
Shallow	<70		
Intermediate	70–300		
Deep	>300		
Total Number of Quakes		41	35

Analysis and Conclusions

- Locate Tonga and Chile on the Plate Boundaries Map on pages 712–713 of your text. Identify the subducting plate and the overriding plate.

- 2** Locate the East Pacific Rise on the Physical World Map on pages 710–711 of your text. Compare the distances from the East Pacific Rise to the Tonga area and to the Chile area.
- _____

- 3** If the East Pacific Rise is the source of the subducting crust in both areas, how do the ages of the two subducting plates compare?
- _____

- 4** Compare the Tonga and Chile earthquake focus depths.
- _____

- 5** Look at the profile graphs you have drawn. At which location is the subducting plate moving westward? Which plate is subducting at a steeper angle? What can you conclude about the overriding plate at each location?
- _____
- _____
- _____

- 6** In Chile, the deepest earthquake occurred at 61.7° W longitude at a depth of 540 km. If the rocks at the focus began subducting 10 million years ago, and are now 1000 km from their original position, what is the average rate of subduction in cm/yr?
- _____
- _____

- 7** Would you expect the subduction rate at Tonga to be greater or smaller than the rate at Chile? Why?
- _____
- _____

- 8** Summarize the differences between the subducting plates at Tonga and at Chile by comparing their distances from the East Pacific Rise, ages, angles and rates of descent, and numbers of deep earthquakes.
- _____
- _____

Table 2

Tonga Data		Chile Data	
Longitude (°W)	Focus Depth (km)	Longitude (°W)	Focus Depth (km)
176.2	270	67.5	180
173.8	35	66.9	175
175.8	115	68.3	130
174.9	40	69.3	60
175.7	260	62.3	480
175.9	190	70.8	35
175.4	250	61.7	540
174.7	35	68.4	120
176.0	160	69.8	30
175.7	205	66.5	220
173.9	60	69.8	55
177.7	580	67.3	185
174.9	50	67.7	120
178.5	505	69.5	75
177.9	565	68.3	110
179.2	650	67.9	140
178.7	600	69.1	95
173.8	50	69.2	35
178.3	540	63.8	345
177.0	350	68.6	125
174.6	40	66.7	210
178.8	580	68.1	145
176.8	340	66.7	200
177.4	420	65.2	285
173.8	60	67.5	170
178.0	520	69.7	50
177.7	560	68.2	160
174.1	30	67.1	230
177.7	465	66.2	230
179.2	670	66.3	215
178.8	590	68.6	180
178.1	510	66.4	235
175.1	40	68.5	140
178.2	550	65.5	290
176.0	220	68.1	130
178.6	615		
174.8	35		
178.2	595		
179.1	675		
177.8	460		
177.0	380		