

NAME: _____ PERIOD: _____ DATE: _____

LAB PARTNERS: _____ LAB #16

SUBDUCTION BOUNDARIES*

INTRODUCTION

The vast majority of earthquakes occur at plate boundaries. The deepest earthquakes occur at subduction boundaries where lithosphere is plunging down into the mantle. Deep focus earthquakes are defined as those with foci (plural of focus) occurring deeper than 300 kilometers. Shallow earthquakes have foci less than 70 kilometers deep, while intermediate focus earthquakes occur at depths between 70 and 300 kilometers.

The behavior of the subducting plate is determined by the age of the rocks comprising the plate. Older crust is cooler, and therefore denser, than younger crust. Older, cooler, denser crust subducts faster and at a steeper angle than younger, warmer, less dense crust.

OBJECTIVES

In this lab activity you will:

1. Plot and compare actual earthquake foci data from two areas where subduction is currently occurring.
2. Compare the characteristics of subduction plates at two different locations.

PROCEDURE

1. Look at the Earthquake Depth Data Table (next page). Determine the number of shallow (<70), intermediate (70 – 300) and deep (>300) earthquakes and record them all on the summary table, for both the Tonga and Chile Trench.
2. Add the number in both columns of Summary Table. The total should equal the *Total number of Quakes*

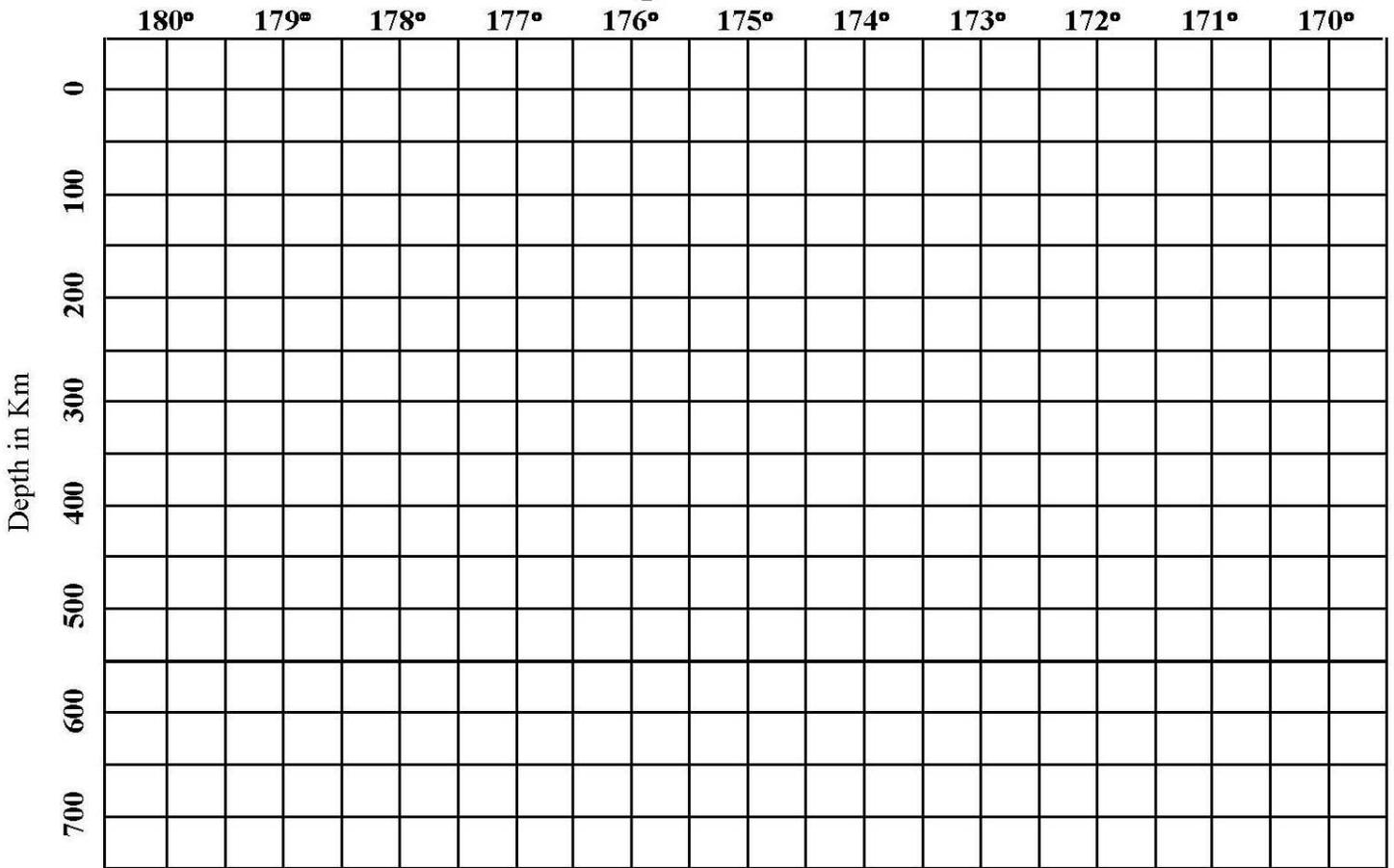
SUMMARY TABLE			
Earthquake Type	Focus Depth	Tonga	Chile
Shallow	Less than 70 km		
Intermediate	70 km – 300 km		
Deep	More than 300 km		
Total number of Earthquakes			

*Credit for lab given to Namowitz and Spaulding, Earth Science. Boston: McDougal Littell, 1994. Osmun, Vorwald & Wegner. Explorations in Earth Science. Albany: United Publishing Co., 1995

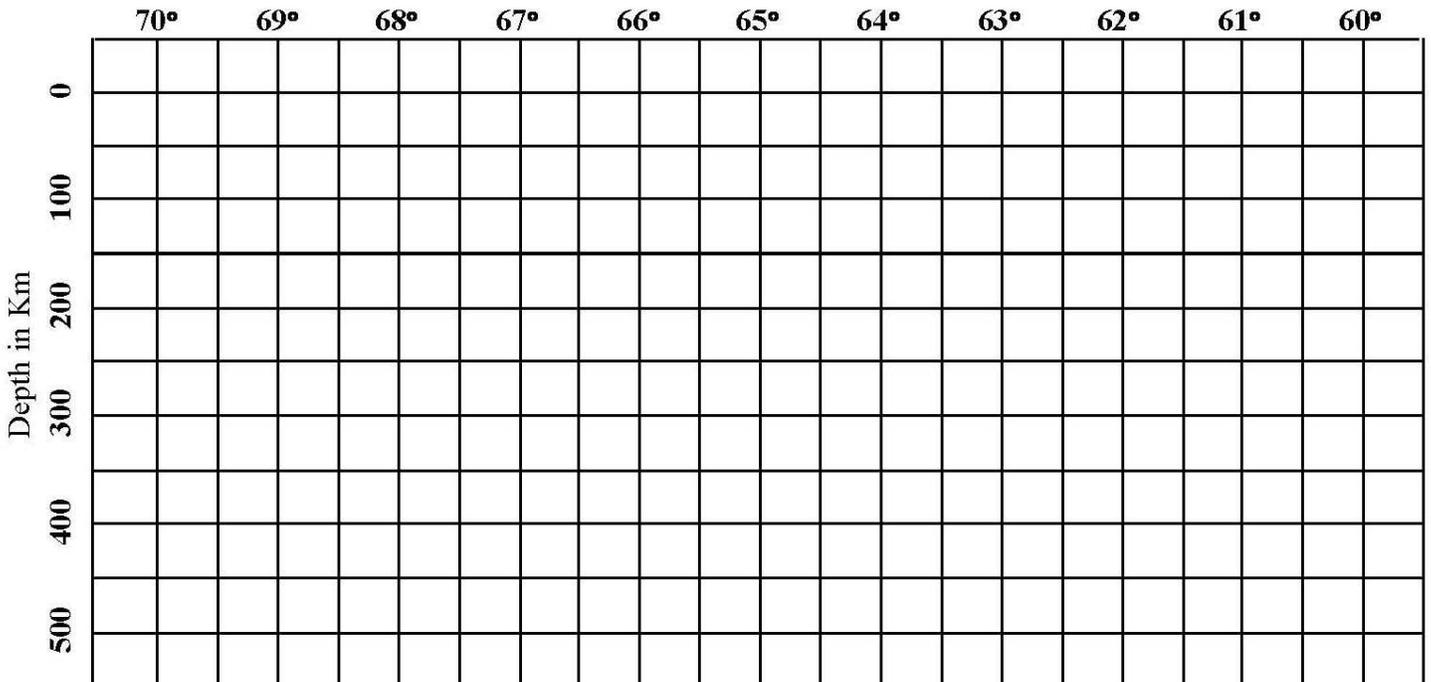
3. On the graph plot the data for the Tonga trench from the table. DO NOT CONNECT THE DOTS. Instead draw a *best-fit line* for the points. A best – fit line is a line that does not go through the points but shows a trend of data.
- Assume the line is the upper surface of a subducting plate.
 - Label the approximate location of the Tonga trench on the graph.
 - Using your Reference Tables, indicate the name of the two converging plate.
 - Using your Reference Tables, indicate the relative movement of each using arrows.
 - Using your Reference Tables, indicate the type of crust that makes up each plate.
4. Make a second graph for the Chile trench. Plot the Chile data... and again draw your best fit line.
- Assume the line is the upper surface of a subducting plate.
 - Label the approximate location the Chile trench on the graph.
 - Using your Reference Tables, indicate the name of the two converging plates.
 - Using your Reference Tables, indicate the relative movement of each plate using arrows.
 - Using your Reference Tables, indicate the type of crust that makes up each plate.

Earthquake Depth Data			
Tonga Trench		Chile Trench	
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		

Tonga Trench



Chile trench



LABORATORY QUESTIONS

1. Using the Reference Tables identify the following as a **convergent, divergent, or transform** boundary:

a. Mid Atlantic ridge _____

b. Tonga trench _____

c. Aleutian trench _____

d. East Pacific ridge _____

e. East African Rift Valley _____

f. San Andreas Fault _____

2. Which tectonic plate is being subducted at the Tonga trench? _____

The Chile Trench? _____

3. Compare the distances of the Tonga and Chile trench from the East Pacific Ridge, which is closer and which is farther?

If the East Pacific Ridge is the source of new rock, which trench would contain the oldest rock?

_____ Why? _____

4. Look at the summary data and compare the depth of the majority of the earthquakes at the Tonga trench and the Chile trench.

5. Collision of which two **types** of plates create the deepest earthquakes? _____

6. Which plate is subducting at a steeper angle? _____

7. How does the angle at which a plate subducts relate to the type of plate under which it subducts?

8. Which geographic feature is associated with subduction zones? _____

9. What is the relative movement of the plates along the San Andreas Fault? _____

10. As distance from the trench increases what happens to the depth of the earthquake foci?

11. What surface feature on the west coast of South America has apparently formed as a result of the collision of two crustal plates at the Peru Chile trench? _____

12. (Optional) For the Chilean data, the deepest earthquakes occurred at longitude 61.7°W and at a depth of 540 kilometers. If the rocks started subducting (left the surface) 10 million years ago and the distance down the subducting plate to the present location is 1000 kilometers, what is the plate's rate of descent, in centimeters per year? (Show all work)

13. (Optional) Describe what you learned about the differences between the two subduction plates. Compare the age of the subducting plates, distance from source, angle of descent, and number of deep focus earthquakes.

