



Name _____

Boundary lab

Per _____ Date _____

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.

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

Procedure:

1. **Look at Earthquake Depth Data Table (On 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 numbers 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			

3. On the graph below plot the data for 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.

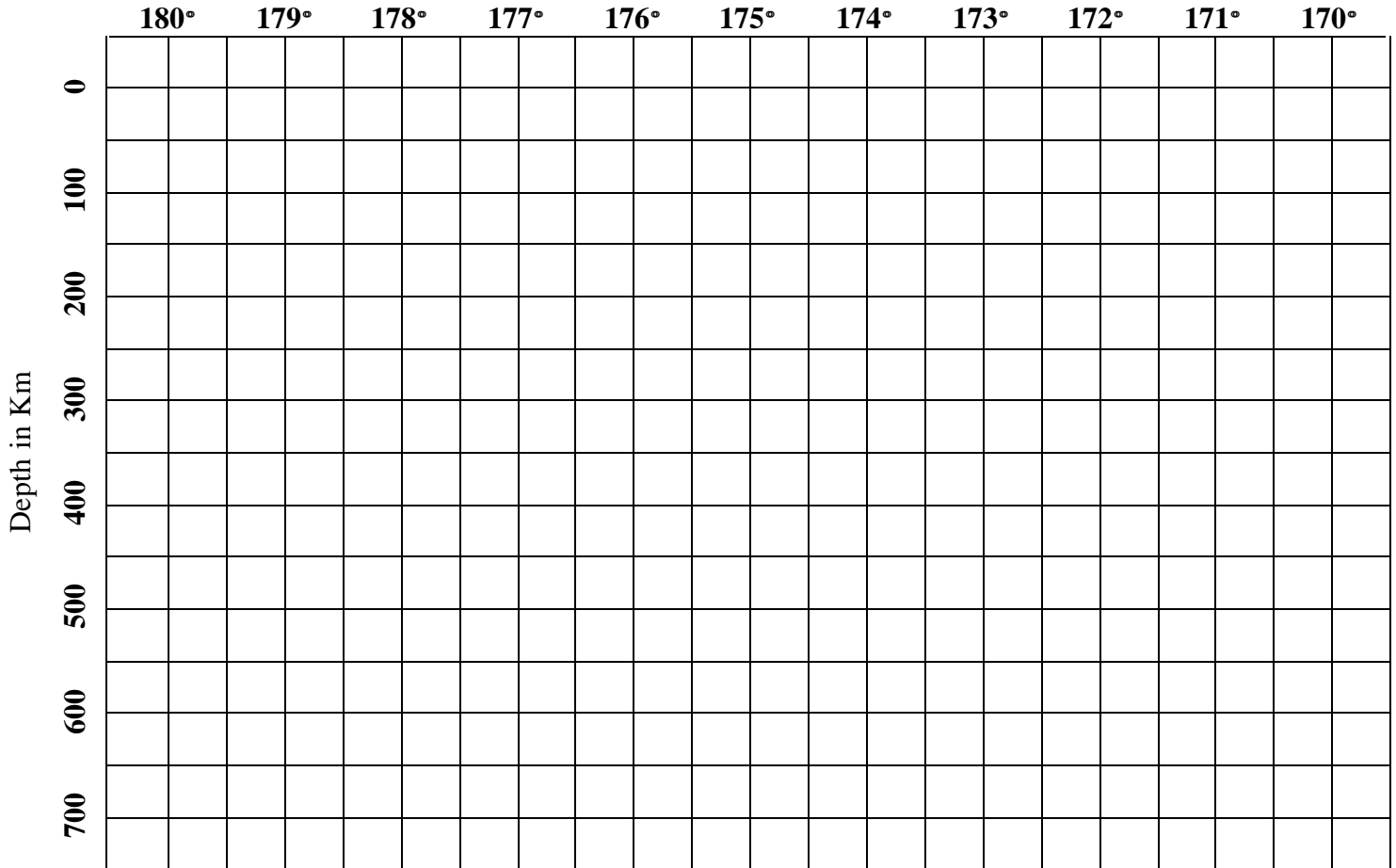
- ✓ Assume the line is the upper surface of a subducting plate.
- ✓ Label the approximate location of the Tonga trench on the graph
- ✓ Using your Reference tables, indicate the name of the two converging plate
- ✓ Using your Reference tables, indicate the relative movement of each plate using arrows
- ✓ Using your Reference tables, indicate the type of crust that makes up each plate.

4. Make a 2nd graph for the Chile trench. Plot the Chile data... and again draw your best-fit line.

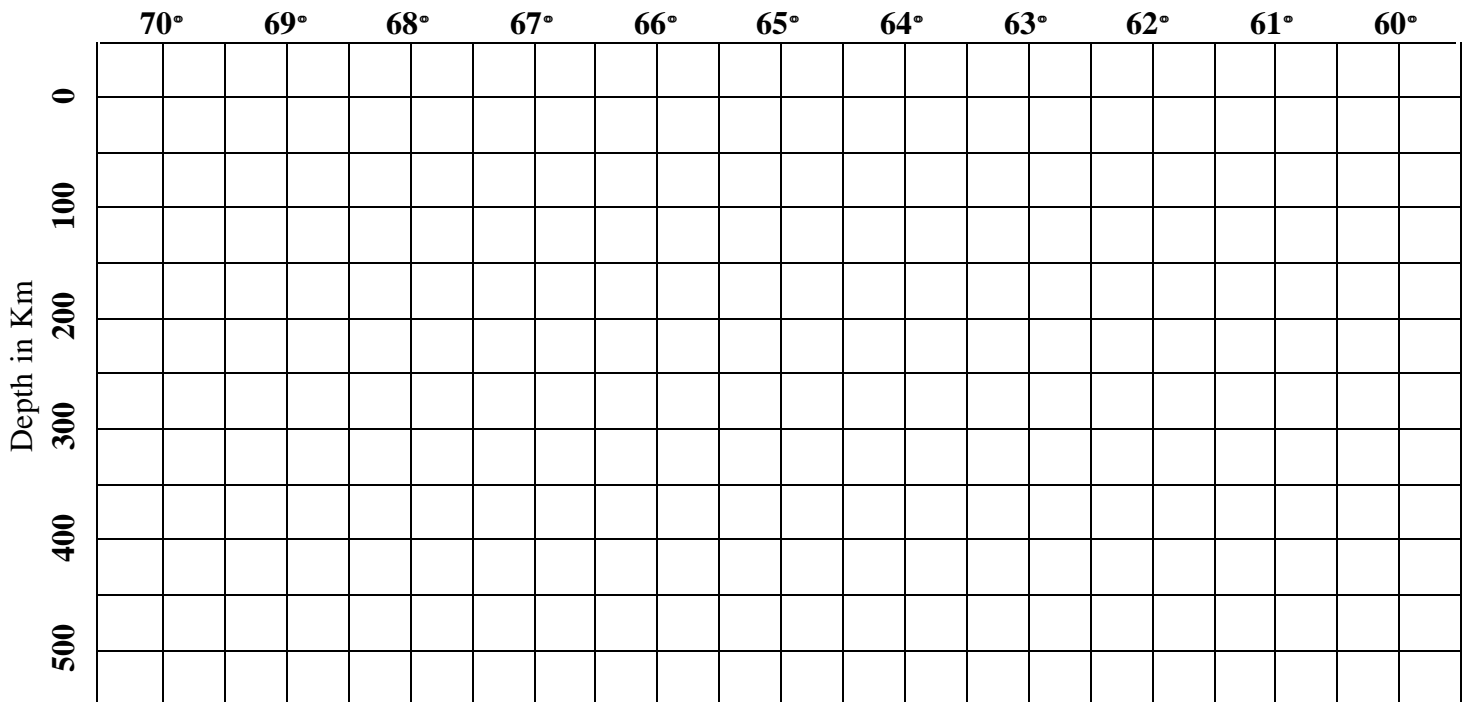
- ✓ Assume the line is the upper surface of a subducting plate.
- ✓ Label the approximate location of the Chile trench on the graph
- ✓ Using your Reference tables, indicate the name of the two converging plate
- ✓ Using your Reference tables, indicate the relative movement of each plate using arrows
- ✓ 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



Analysis and Conclusion

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 Rise _____
- e. Great Rift Valley _____
- f. San Andres Fault _____

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

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

If the East pacific rise is the source of new rock, which trench would contain the oldest rock? _____ Why? _____

4. Look at the summary data... 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 Quakes? _____

6. Which type of plate boundary creates new ocean crust? _____

7. From looking at your reference tables where do we usually find divergent boundaries?

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

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

Credits:

Namowitz and Spaulding. Earth Science. Boston: McDougal Littell, 1994.
Osmun, Vorwald & Wegner. Explorations in Earth Science. Albany: United Publishing Co., 1995