Mapping the Ocean Floor

Name: _____

Instructions and data sheet

Background:

The surface of the oceans covers an area of more than 12 million square km! Did you ever wonder what was below the surface of all that water? Many early explorers did, and they used several methods to try to determine the shape of the ocean floor. At one time, sailors tied weights to the end of ropes and lowered them to the ocean floor, marked the distance when the rope hit bottom, and then measured that distance. You can imagine what a slow process this was!

In the early 1900s, sonar was invented by a French scientist. He used this technology to get sound wave readings of the ocean floor. This was a great discovery because it allowed scientists to get faster and more accurate readings. A device called an "echo sounder" is simply aimed downward, at which point it gives off a sound signal. The sound signal travels to the ocean floor and bounces, or "echoes", off the surface. The device picks up the echo and then computes the ocean depth at that point. To do this calculation yourself, all you need to know is the speed of sound in water (1,500 m/s), and the time it took for the sound signal to echo.

During this activity, you will use this method to construct a map for two different regions of the ocean floor.

Procedures:

Part 1: Atlantic Profile

1. Compute the *Total Distance Traveled* by multiplying the *Time for the Signal to Return* by the speed of sound (1,500 m/s), and record this distance on the data table on the back of this sheet.
2. Divide your *Total Distance Traveled* by 2 to get your *Ocean Depth* in meters. Record this depth on the data table. This *Ocean Depth* data is what you will be graphing.
3. Along the bottom of the graph, label the x-axis as "**Distance from Beach (km)**", and set up the scale, counting by 100's.
4. On the "Mapping the Ocean Floor Lab" handout, plot the *Distance from Beach* (x-axis) vs. *Ocean Depth* (y-axis) for the Atlantic Profile graph. **Sea level (0 meters) is the line already shown on the graph.**
5. Once the points are plotted, connect the points and shade in the profile of the ocean floor.
6. **Label the following ocean floor features on your graph.** Use page 48 and 49 as a reference.

Continental Shelf, Continental Slope, Continental Rise, Island, Mid-ocean ridge, Abyssal Plain

Part 2: Pacific Profile

1. Label the x-axis as "**Distance from Beach (km)**", and set up the scale, this time counting by 8.
2. On the "Mapping the Ocean Floor Lab" handout, plot the *Distance from Beach* (x-axis) vs. *Ocean Depth* (y-axis) for the Pacific Profile graph. **For this set of data, the depth has already been calculated for you.**
3. Once the points are plotted, connect the points and shade in the profile of the ocean floor.
4. **Label the following ocean floor features on your graph.** Use page 48 and 49 as a reference.

Continental Slope [directly next to shore], Seamounts [next to the subduction zone], Trench [the deep one]

Part 3: Labeling

1. The Pacific Profile shows the Pacific Plate subducting beneath the Philippine Plate. Beneath the ocean floor on this profile, **sketch what you think the subduction zone would look like** (*HINT → Show one plate going under the other*). **Label these two plates; then draw in the rising magma that is leading to the creation of the seamounts.**

2. In this activity you created two different ocean floor profiles. One major difference between the two profiles is the scale of the distance from the shore. Even though both of your profile pictures cover the width of your paper, they do NOT represent the same distance. You need to get a sense of how each of the two profiles compare to each other.
    a. **First determine how wide the entire Pacific Profile is (in km): _____**
    b. **Now take that number and find where that same distance would be along the Atlantic Profile. Draw a vertical dotted line at this point.**
    c. **Use a colored pencil (any color) to lightly shade in everything to the left of this dotted line.**
    d. **Using the same colored pencil, write "Width of Pacific Profile" under this shaded section.**

*** When finished with Parts 1 – 3, answer all discussion questions in complete sentences. ***

Data for Atlantic Profile

This column is what you're graphing on the Y-axis for the Atlantic Profile.

Distance from Beach (km)	Time for Signal to Return (seconds)	Total Distance Traveled (meters) (Time x 1500 m/s)	Ocean Depth (meters) (Total Distance ÷ 2)
50	0.4		
100	0.5		
150	0.6		
200	0.7		
250	1.1		
300	1.4		
350	2.1		
400	3.2		
450	3.7		
500	4.3		
550	4.9	7350	***3675***
600	5.4	8100	***4050***
650	5.4	8100	***4050***
700	5.7	8550	***4275***
750	5.7	8550	***4275***
800	5.6	8400	***4200***
850	5.7	8550	***4275***
900	5.7	8550	***4275***
950	5.7	8550	***4275***
1000	5.7	8550	***4275***
1050	5.4	8100	***4050***
1100	5.4	8100	***4050***
1150	4.3	6450	***3225***
1200	3.2	4800	***2400***
1250	0.7	1050	***525***
1300	N/A	N/A	***- 500 (above sea level)***
1350	1.4	2100	***1050***
1400	4.3	6450	***3225***
1450	4.9	7350	***3675***
1500	4.9	7350	***3675***
1550	5.4	8100	***4050***
1600	5.7	8550	***4275***
1650	5.7	8550	***4275***
1700	5.6	8400	***4200***
1750	5.7	8550	***4275***
1800	5.4	8100	***4050***
1850	5.4	8100	***4050***
1900	4.9	7350	***3675***
1950	4	6000	***3000***
2000	3.7	5550	***2775***
2050	4.6	6900	***3450***
2100	6	9000	***4500***
2150	4.3	6450	***3225***
2200	3.2	4800	***2400***
2250	4.3	6450	***3225***
2300	5.4	8100	***4050***
2350	6	9000	***4500***
2400	6	9000	***4500***

Data for Pacific Profile

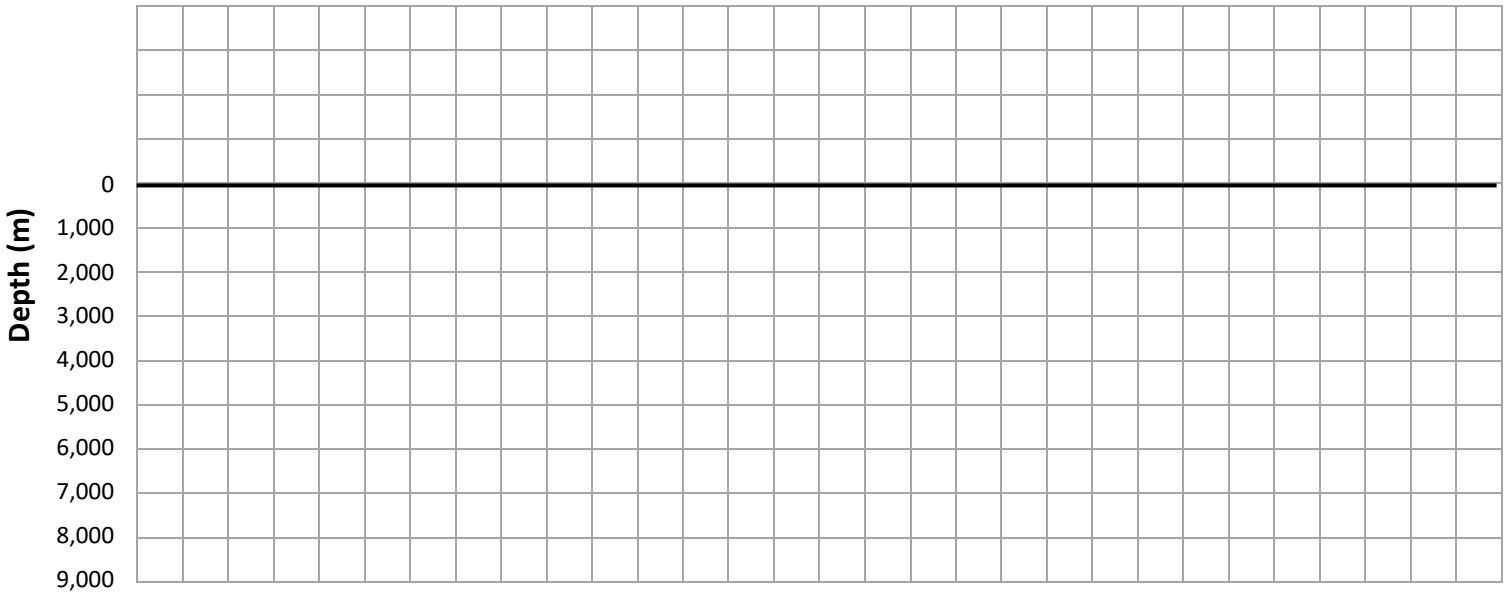
Distance from Beach (km)	Ocean Depth (meters)
0	- 400 (above sea level)
8	1300
16	1000
24	30
32	1000
40	3000
48	4000
56	4500
64	3000
72	2800
80	3000
88	2800
96	3700
104	3000
112	3200
120	2500
128	3100
136	4200
144	7100
152	8200
160	11000
168	10000
176	9000
184	8000
192	7000
200	6000
208	5100
216	4500
224	4200
232	3840
240	3800

Rip this instruction sheet off of the graph and analysis questions page. When you turn it in, you will **submit only that page!**

Name: _____ Period: _____ Date: _____

Mapping the Ocean floor lab

Atlantic Profile:



Pacific Profile:

Discussion Questions:

Answer in complete sentences.

Atlantic Profile

1. What two pieces of information are needed to determine ocean depth through echo-sounding?
   (*HINT → Distance from the shore is NOT one of them.*)

   _____ and _____

2. Describe how a volcanic seamount could become an island. **ALSO,** describe how an island could become a seamount.

3. The island on your graph for the **Atlantic Profile** is part of a chain of islands located near 26°W and 38°N latitude. Use a globe or world map to locate and identify this island chain:

   _____

4. For the first data table, once you have found the total distance traveled by the sound wave, why is it necessary to divide it by 2? (*HINT → Think about where the sound signal has to travel.*)

Pacific Profile

5. This profile shows the seafloor at the Marianas Trench, the deepest known point in any of the world's oceans. **Please write the name of this trench <u>on your profile</u>.** What is the name of the process that's occurring here?

   Process name: _____

6. Explain how the seamounts (between 72 km and 128 km from the shore) probably formed near this trench.

Comparing the two profiles:

7. Besides the scale, how do the two profiles differ from one another? What are the main differences between the seafloor features in either place?

8. In oceanography, the edges of the continents are referred to as "margins". Depending on what type of plate activity is occurring, a margin may be considered an active margin or a passive margin. Based on your knowledge of plate tectonics, which of the two profiles would you consider to be "active", and which would be "passive". Explain your reasoning **in detail**, referring to each profile. **Then, label each profile as either "passive" or "active" on each graph**.