

Mapping the Ocean Floor

Part I: Finding Ocean Depth

Imagine you are an oceanographer traveling across the Atlantic along the 45° N latitude line. You and your crew are using sonar and radar to identify structures on the ocean floor. Data from these instruments are used to calculate the distance to the bottom. From this data, you will create a bottom profile of the Atlantic Ocean.

When oceanographers use sonar, they know how fast sound waves travel in water. Thus, they know how far the waves travel during their round trip to the ocean's floor and back to the surface. Half this distance is the depth of the ocean at that spot. The formula to find the ocean floor depth is

$$D = \frac{1}{2} t * v$$

In the formula, D stands for depth, t for time between sending and receiving, and v for the speed of sound in water. The speed of sound in water is 1,454 meters per second. The table below gives you some more sonar sounding data. Use the above formula to calculate the ocean floor depth for each sounding.

Sounding	Longitude (oW)	Time (s)	Depth (m)
1	64	0.00	
2	60	0.13	
3	55	0.18	
4	50	0.10	
5	48	4.83	
6	45	5.54	
7	40	5.23	
8	35	5.74	
9	33	4.73	
10	30	4.23	
11	28	2.42	
12	27	3.02	
13	25	4.33	
14	20	5.84	
15	15	6.34	
16	10	6.84	
17	5	5.94	
18	4	0.20	
19	1	0.00	

(Data are approximations)

Procedure:

Copy this chart into a spreadsheet program starting in the A1 cell. (Can be printed and done by hand and calculator.)

Click on the D2 cell (bold cell). Type “ $=-1/2*(C2*1454)$ ” – do not include quotation marks. Hit enter. A zero will appear in the cell if you have entered the above formula correctly.

Copy this formula for the remaining 18 cells. If you have entered it correctly the number “-94.51” should appear in the cell below. All numbers except zero should be negative to represent meters below sea level.

Copy column D into the table in your word processing document to complete the above table. **SAVE YOUR WORK!**

Part II: Mapping the Ocean Floor

Now that you have all of your data, you will plot these depths on a graph. Smoothly connect the points and you will have a cross-sectional map of the South Atlantic Ocean floor.

Procedure:

Examine the data in the table. The numbers in the Longitude column give the ship's location at 19 points in the Atlantic Ocean. The numbers in the Ocean Depth column give the depth measurements recorded at each location. Remember that the depths are represented on your graph as numbers below 0, or sea level.

To plot your graph, open the spreadsheet document and highlight the Longitude column and the Depth columns only. (You can do that one of two ways – highlight one column and while holding down the ctrl key, highlight the other – or – copy your new table and simply delete the middle column that has the time. Just make sure you don't lose your depth data!)

Click on the chart wizard button located in the toolbar. Choose the XY scatter graph with the curved lines. Click Next twice.

Now format your graph. Title your graph “Ocean Depth Sonar Data”. Label the horizontal axis Longitude. Label the vertical axis Ocean Depth. Click on the legend tab and uncheck the box that says show legend. Click Finish.

You should now have rough outline of your ocean profile. The last step is to format the axes of a graph. We need to mark the x-axis from 65° W to 0° from left to right. Right click on one of the numbers of the x-axis. A format axis window should pop up. Click there. Click on the scale tab. Change the maximum value to 65 instead of 70. And check the box that says values in reverse order. Click OK and you are finished. Feel free to format your graph as you like, as long as the rules and the values remain consistent. Copy and paste this graph into your word document in place of the sample graph below.

Analysis:

From what point do oceanographers measure depth?

On your graph, identify and label the continental shelf and continental slope.

At which station(s) is the ocean most shallow?

Label the abyssal plain on your graph. How would you expect the ocean floor to look there?

What large ocean floor feature is evident in the cross-sectional map? Label this feature on your graph. Describe the process that is occurring there?

What might the feature at 10° W be? Explain.

What information do you need to plot a point on the graph?

How do people know what the ocean floor looks like?

When a profile of a feature is drawn to scale, the horizontal and vertical scales must be the same. Does your profile give an accurate picture of the ocean floor? Explain.