
GRACE Mission - Sea Floor Mapping

Background Information:

The GRACE Mission objective is to provide a new model of the Earth's gravity field with unprecedented accuracy every 30 days for five years. GRACE will unravel global climatic issues by measuring changes in sea-floor pressure. Scientists have been using sidescan sonar, which is like echo sounding to map more of the sea floor. We can now visualize how the sea floor looks in particular areas. Sidescan sonar is being used to map the coastal waters of the United States. It was used to find the Titanic.

Objectives:

At the end of the lesson, students will be able to:

- Use graphing skills to picture the sea floor.
- Identify seafloor features that are found throughout the world's oceans.

Standards:

Science: unifying concepts & processes; earth & space science
Math: measurement; computation & estimation

Vocabulary:

Sidescan sonar
Echo sounding
Nautical mile
Latitude
Continental shelf
Continental slope
Continental rise
Abyssal plain
Mid-ocean ridge.

Materials:

Ocean Depth Data [attached]	Pencil
Ruler	Markers
Graph Paper, 3 sheets [taped together lengthwise]	World atlas

Directions to the Teacher:

1. Ask the students: "What do you think the bottom of the ocean is like? Is it mountainous or flat? Does it gradually become deeper and deeper or does it suddenly become very deep? How deep is the ocean in miles? Has the ocean's bottom changed over the centuries?" Record the responses in their notebooks.
2. Distribute copies of the Ocean Depth Data. Tell the students this data was collected along approximately 38 degrees N latitude from the coast of the United States to the water just offshore Europe. Have the students use an atlas to locate where 38 degrees N intersects the US and Europe coastlines. Record this information on their Ocean Depth Data sheet. (Virginia and Portugal)
3. Pass out the materials to each student. Label the y-axis (vertical) "Depth in Feet" and mark it in 1000-foot intervals from 0 to 17,500. Make sure the students place 0 at the top of their y-axis since this is the location of the surface of the ocean's water. Next have them label the x-axis (horizontal) "Distance from the U.S. in Nautical Miles" and mark it in 100-mile intervals from 0 (United States) to 3400 (Portugal). A nautical mile is equal to approximately 1.15 statute miles - the miles we use on land. The students will use all three sheets of graph paper to include the distances. Entitle the graph "Depth of the Atlantic Ocean at 38 degrees N". Then plot the points and label any remarks.
4. As the students plot their coordinates, have them connect them with a ruler in the order listed. When students finish plotting the points and connecting them with their ruler, direct them to color the ocean floor bottom which is found below their plotted line segments. This will give them better ideas of what the bottom of the Atlantic looks like along this latitude.
5. Tell the students that what they have graphed depicts many of the sea-floor features that are found throughout the world's oceans. Discuss the terms located on their graphs. Point out to the students that water pressure increases with depth of the ocean and locate the areas that would contain the highest water pressure values.

Extensions:

1. Convert the shortest distance and deepest distance on your map to land miles. Explain these distances with two cities familiar to the student that have the same land miles.
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Ocean Depth Data		Ocean Depth Data		Ocean Depth Data	
Distance from U.S. (nautical miles)	Depth (feet)	Distance from U.S. (nautical miles)	Depth (feet)	Distance from U.S. (nautical miles)	Depth (feet)
10	60	10	60	10	60
50	240	50	240	50	240
100	7500	100	7500	100	7500
200	9600	200	9600	200	9600
300	12000	300	12000	300	12000
400	14850	400	14850	400	14850
500	16278	500	16278	500	16278
600	14706	600	14706	600	14706
700	16650	700	16650	700	16650
800	16830	800	16830	800	16830
900	17160	900	17160	900	17160
1000	17298	1000	17298	1000	17298
1100	16830	1100	16830	1100	16830
1200	17460	1200	17460	1200	17460
1300	17310	1300	17310	1300	17310
1400	17298	1400	17298	1400	17298
1500	16698	1500	16698	1500	16698
1600	16500	1600	16500	1600	16500
1700	15978	1700	15978	1700	15978
1800	12978	1800	12978	1800	12978
1900	14790	1900	14790	1900	14790
2000	9840	2000	9840	2000	9840
2100	3798	2100	3798	2100	3798
2200	5952	2200	5952	2200	5952
2300	4620	2300	4620	2300	4620
2400	6150	2400	6150	2400	6150
2500	11940	2500	11940	2500	11940
2600	14070	2600	14070	2600	14070
2700	14658	2700	14658	2700	14658
2800	14398	2800	14398	2800	14398
2900	17172	2900	17172	2900	17172
3000	14880	3000	14880	3000	14880
3100	15858	3100	15858	3100	15858
3200	15240	3200	15240	3200	15240
3300	2430	3300	2430	3300	2430
3350	1770	3350	1770	3350	1770
3400	978	3400	978	3400	978

Data Courtesy of Defense Mapping Agency, Hydrographic/Topographic Center
Washington, D.C.
