

# Ocean Bottom Profile

## Task Information

**Subject:** Earth Science

**Content:**

- N.Y.S. Earth Science Syllabus (1970 ed.) - Topic III A-3.2
- Earth Sci. Syllabus (Pro. Mod.)-Oceanography (optional) - A-3
- Framework-Standard 4 Science-Earth is governed by principles of relative motion and perspective.
- Middle Level Science - Block D - Section E2 - The Oceans

**Format:** Paper/pencil

**Purpose:** To interpret a graph of ocean depths and topographic features.

**Skills:**

**Primary:** Interpreting data, applying math  
**Secondary:** Generalizing and inferring

**Time:** 15-20 minutes

**Materials:**

**Teacher**  
none

**per Student**

- Ocean Bottom Profile (fig. 1)
- Calculator

**Preparation:** None

**Safety:** N/A

**Extensions/Modifications:**

Data could be given and graph plotted as assignment. Actual scale model could be determined by using data generated by small groups to make one large map.

## Ocean Bottom Profile

**Task:** In this activity, you will interpret a graph of ocean depths and topographic features.

### Materials:

- Ocean Bottom Profile (Figure 1)
- calculator

### Background:

The data for the graph in figure 1 (see attached) was obtained by a ship that sailed between North Carolina and Spain along approximately  $36^{\circ}\text{N}$  latitude. Thirty six stops were made to collect data. Figure 1 shows the seafloor depth at each location and identifies the seafloor region.

The map below shows the  $36^{\circ}\text{N}$  latitude line across the Atlantic Ocean. This is the approximate path traveled by the ship from North Carolina to Spain.



At  $36^{\circ}\text{N}$ , the horizontal distance represented by each degree of longitude is 90 kilometers.

To make the profile easier to plot, the vertical scale is not the same as the horizontal scale. The amount by which the vertical scale is greater than the horizontal scale is called the vertical exaggeration (VE). The value for VE is found by dividing the horizontal scale by the vertical scale. Note, both scales must be in the same units.

$$\text{VE} = \frac{\text{horizontal scale}}{\text{vertical scale}}$$

To answer the questions, remove the Ocean Bottom Profile (fig. 1) from your task packet and draw a line to represent the ocean bottom according to the plotted data.

## Answer Sheet Ocean Bottom Profile

1. According to the profile;
  - a. Which seafloor region is widest? \_\_\_\_\_
  - b. Which is narrowest? \_\_\_\_\_
2.
  - a. What is the ocean depth at 15°W? \_\_\_\_\_
  - b. What is the depth of the edge of the continental shelf?  
\_\_\_\_\_

3. Look at Figure 1. Note the seafloor regions listed in the first column and the 1° longitude ranges in the second column. Locate these same longitudes in Figure 1. Determine the change in depth that occurs between each pair of longitudes and record the value in the third column.

Seafloor Region	Longitude Range (°W)	Depth Change (m)
Continental Slope	74-73	
Continental Rise	72-71	
Abyssal Plain	63-62	

- a. Which seafloor region is steepest? \_\_\_\_\_
- b. Which seafloor region is most level? \_\_\_\_\_

4. Determine the vertical exaggeration (VE) of Figure 1. (Hint: Determine the number of meters in one horizontal square and the number of meters in one vertical square. Remember that 1 kilometer = 1000 meters.) For full credit, you must either explain your reasoning or show your work.

Vertical Exaggeration: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Please Continue on the Next Page**

### Answer Sheet Ocean Bottom Profile

5. Using complete sentences, compare the profile in Figure 1 to the appearance of a true scale profile of these ocean depths.

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6. The bedrock of the ocean floor is youngest at the mid-ocean ridges and is older as distance increases away from the ridges. Using one or more complete sentences and based on your knowledge of plate tectonics answer the following questions:

a. What crustal movement is most likely occurring beneath the mid-ocean ridge? (You may use a diagram with arrows to aid in your answer.)

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b. The mid-ocean ridges are primarily composed of what kind of bedrock?

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c. Using complete sentences, explain why hot water vents are often found in the rift valleys at the mid-ocean ridges?

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# Ocean Bottom Profile

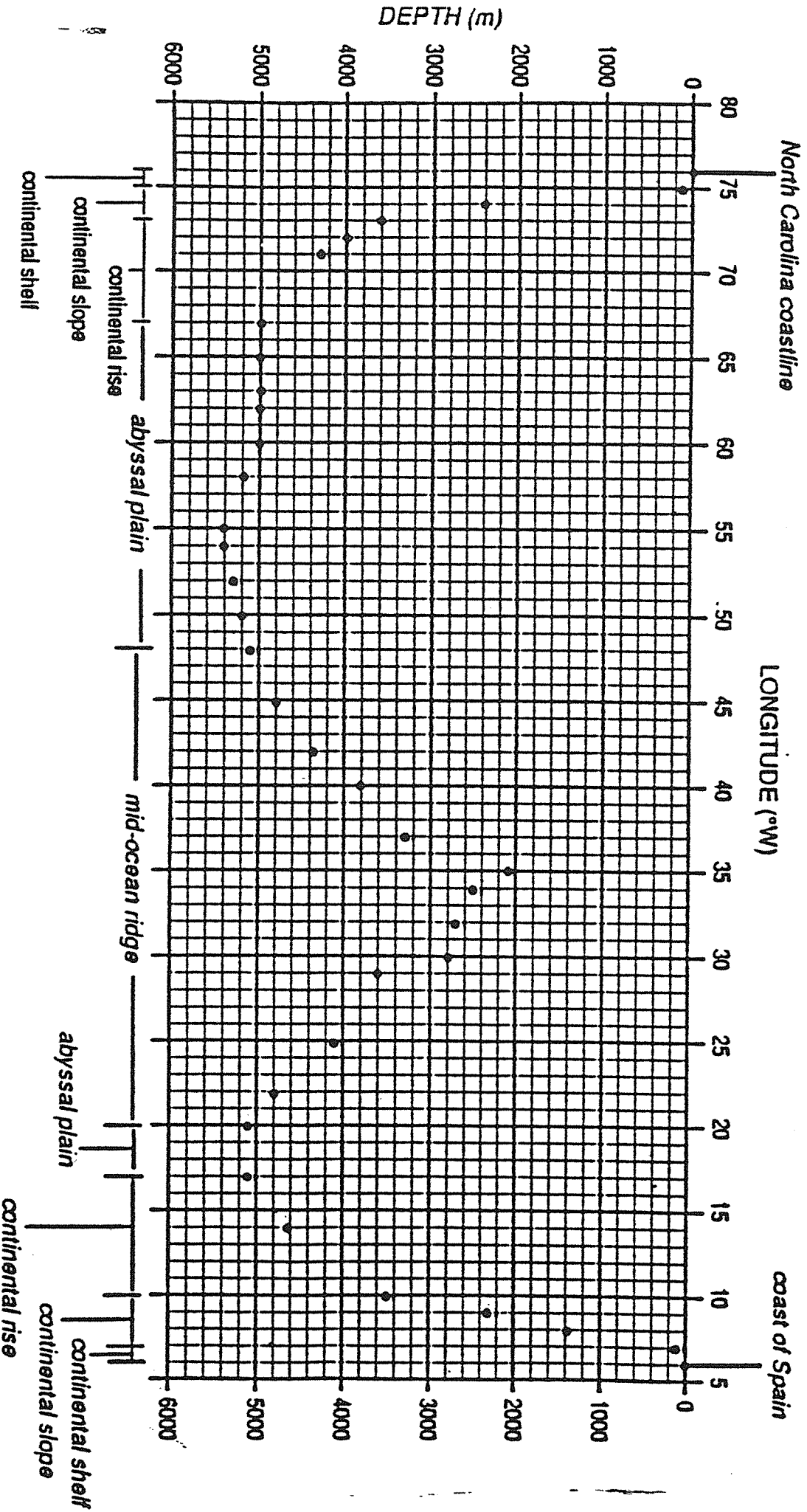


Figure 1

**Ocean Bottom - Scoring Rubric****Maximum score - 17 points****Task 1a & b** **2 points total**Standard: The student will correctly identify the regions based on the profile.Criteria:

- 1a. Allow 1 point for the mid ocean ridge.
- 1b. Allow 1 point for continental shelf.

**Task 2a & b** **2 points total**Standard: The student correctly reads ocean depth based on the profile.Criteria:

- 2a. Allow 1 point for  $4800\text{m} \pm 100\text{m}$ .
- 2b. Allow 1 point for  $140\text{m} \pm 100\text{m}$ .

**Task 3 - Depth changes - Data table** **5 points total**Standard: The student will determine depth change at different locations on the profile as shown below.Criteria:

- Allow 1 point for each correct depth change

	<u>depth change (m)</u>
Continental slope	= $1200\text{m} \pm 100\text{m}$
Continental rise	= $300\text{m} \pm 100\text{m}$
Abyssal plain	= $20\text{m} \pm 100\text{m}$

- 3a • Allow 1 point for continental slope  
 3b • Allow 1 point for abyssal plain

**Task 4 - Vertical exaggeration** **2 points total**Standard: The student will accurately determine or explain the vertical exaggeration in the profile.Criteria:

- Allow 1 point for proper substitution of values (including unit changes)
- Allow 1 point for calculation of VE

**Note:** Based on student data**OR**

- Allow 2 points if there is a clear explanation of the difference between both the horizontal and vertical axes of figure 1.
- Allow 1 point if the explanation shows a depth exaggeration but lacks a numerical explanation

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**Task 5 - Description****2 points total**

Standard: The student will apply the knowledge of scale to the profile.

Criteria:

- Allow 2 points for a correct statement implying the profile shows exaggerated depth. Answer should be in complete sentences.
- Allow 1 point for a correct statement, but not in complete sentences.
- Allow 0 points for an incorrect statement even if it is in complete sentences.

(We want students to know it's flatter than this picture.)

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**Task 6 - Application****4 points total**

Standard: The student will apply theories of ocean bottom features related to continental drift.

Criteria:

- 6a. • Allow 1 point for diagram or explanation showing accurate representation of sea floor spreading.
- Note:** Refer to double jeopardy
- 6b. • Allow 1 point for a correct statement identifying igneous, volcanic rock or Basalt
- 6c. • Allow 2 points for a statement relating vents to sea floor spreading or heat flow. Answer should be in complete sentences.
- Allow 0 points for an incorrect statement even if it is in complete sentences.
- 

**Highest possible score - 17 points**





Male or Female (circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

1. Identified regions

- a. Widest 0 (1)
- b. Narrowest 0 (1)

2. Depths

- a. 15° W 0 (1)
- b. Shelf edge 0 (1)

3. Depth change

- Continental slope 0 (1)
- Continental rise 0 (1)
- Abyssal plain 0 (1)
- a. Steepest 0 (1)
- b. Level 0 (1)

4. Vertical exaggeration (VE)

- Substitution 0 (1)
- Calculation 0 (1)

OR

- Clear explanation 0 1 2

5. Description

- 0 1 (2)

6. Application

- a. Crustal movement 0 (1)
- b. Bedrock 0 (1)
- c. Vents 0 1 (2)

Total Score 17

(Total Possible score - 17 points)

# Ocean Bottom Profile

**Task:** In this activity, you will interpret a graph of ocean depths and topographic features.

## MATERIALS:

- Ocean Bottom Profile (Figure 1)
- calculator

## BACKGROUND:

The data for the graph in figure 1 (see attached) was obtained by a ship that sailed between North Carolina and Spain along approximately  $36^{\circ}\text{N}$  latitude. Thirty six stops were made to collect data. Figure 1 shows the seafloor depth at each location and identifies the seafloor region.

The map shows the  $36^{\circ}\text{N}$  latitude line across the Atlantic Ocean. This is the approximate path traveled by the ship from North Carolina to Spain.



At  $36^{\circ}\text{N}$ , the horizontal distance represented by each degree of longitude is 90 kilometers.

To make the profile easier to plot, the vertical scale is not the same as the horizontal scale. The amount by which the vertical scale is greater than the horizontal scale is called the vertical exaggeration (VE). The value for VE is found by dividing the horizontal scale by the vertical scale. Note, both scales must be in the same units.


Answer Sheet  
Ocean Bottom Profile

5. Using complete sentences, compare the profile in Figure 1 to the appearance of a true scale profile of these ocean depths.

The change in the slope wouldn't be as drastic as this was a true scale profile. The length between meridians would have to be greater to become a true scale profile.

6. The bedrock of the ocean floor is youngest at the mid-ocean ridges and is older as distance increases away from the ridges. Using one or more complete sentences and based on your knowledge of plate tectonics answer the following questions:

- a. What crustal movement is most likely occurring beneath the mid-ocean ridge? (You may use a diagram with arrows to aid in your answer.)

Convection currents push the heated magma up to the surface.  as this continues the ocean floor spreads out as more magma is pushed up.

- b. The mid-ocean ridges are primarily composed of what kind of bedrock?

Mid-ocean ridges are primarily composed of igneous rock. Since a mid-ocean ridge is a plate boundary, volcanic rock is being constantly added creating an ocean surface that can be very thick.

- c. Using complete sentences, explain why hot water vents are often found in the rift valleys at the mid-ocean ridges?

Usually near rift valleys the pressure gets so intense that some of it has to be released. It is released through vents. This heats the water surrounding and provides a place for animals to live.

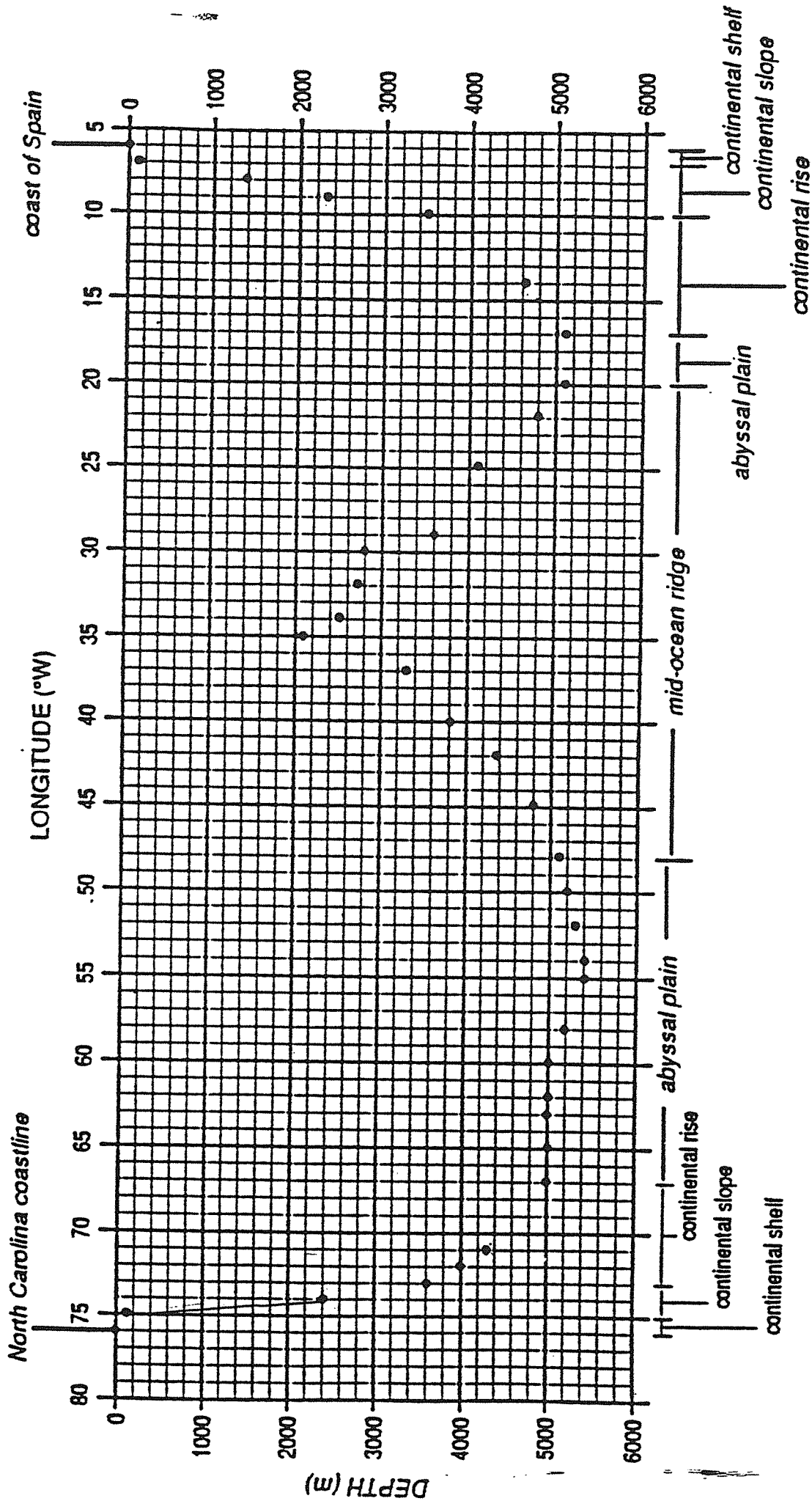


Figure 1

NYS Alternative Assessment in Science Project  
NSF Grant #MDR-9154506

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The State Education Department  
Albany, New York 12234

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

1. Identified regions

- a. Widest 0 (1)
- b. Narrowest 0 (1)

2. Depths

- a. 15° W (0) 1
- b. Shelf edge (0) 1

3. Depth change

- Continental slope 0 (1)
- Continental rise 0 (1)
- Abyssal plain 0 (1)
- a. Steepest 0 (1)
- b. Level 0 (1)

4. Vertical exaggeration (VE)

- Substitution 0 (1)
- Calculation 0 (1)

OR

- Clear explanation 0 1 2

5. Description

- 0 1 (2)

6. Application

- a. Crustal movement (0) 1
- b. Bedrock 0 (1)
- c. Vents (0) 1 2

**Total Score** 12

(Total Possible score - 17 points)

# Ocean Bottom Profile

**Task:** In this activity, you will interpret a graph of ocean depths and topographic features.

**MATERIALS:**

- Ocean Bottom Profile (Figure 1)
- calculator

11  
18

**BACKGROUND:**

The data for the graph in figure 1 (see attached) was obtained by a ship that sailed between North Carolina and Spain along approximately 36°N latitude. Thirty six stops were made to collect data. Figure 1 shows the seafloor depth at each location and identifies the seafloor region.

The map shows the 36°N latitude line across the Atlantic Ocean. This is the approximate path traveled by the ship from North Carolina to Spain.



At 36°N, the horizontal distance represented by each degree of longitude is 90 kilometers.

To make the profile easier to plot, the vertical scale is not the same as the horizontal scale. The amount by which the vertical scale is greater than the horizontal scale is called the vertical exaggeration (VE). The value for VE is found by dividing the horizontal scale by the vertical scale. Note, both scales must be in the same units.

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**Answer Sheet  
Ocean Bottom Profile**

1. According to the profile;
  - a. Which seafloor region is widest? mid ocean ridge
  - b. Which is narrowest? continental shelf
2.
  - a. What is the ocean depth at 15°W? 4800ft
  - b. What is the depth of the edge of the continental shelf? 150ft

3. Look at Figure 1. Note the seafloor regions listed in the first column and the 1° longitude ranges in the second column. Locate these same longitudes in Figure 1. Determine the change in depth that occurs between each pair of longitudes and record the value in the third column.

Seafloor Region	Longitude Range (°W)	Depth Change (m)
Continental Slope	74-73	1200m
Continental Rise	72-71	300m
Abyssal Plain	63-62	0m

- a. Which seafloor region is steepest? Continental Slope
  - b. Which seafloor region is most level? abyssal plain
4. Determine the vertical exaggeration (VE) of Figure 1. (Hint: Determine the number of meters in one horizontal square and the number of meters in one vertical square. Remember that 1 kilometer = 1000 meters.) For full credit, you must either explain your reasoning or show your work.
- Vertical Exaggeration:  $\frac{\text{horizontal}}{\text{vertical}} = \frac{7.200}{6} = 1200$
- The vertical exaggeration is 1200

**Please Continue on the Next Page**

# Answer Sheet Ocean Bottom Profile

1. According to the profile;
  - a. Which seafloor region is widest? Mid-Ocean Ridge
  - b. Which is narrowest? Continental Shelf
2.
  - a. What is the ocean depth at 15°W? 4800 meters
  - b. What is the depth of the edge of the continental shelf?  
100 meters

3. Look at Figure 1. Note the seafloor regions listed in the first column and the 1° longitude ranges in the second column. Locate these same longitudes in Figure 1. Determine the change in depth that occurs between each pair of longitudes and record the value in the third column.

Seafloor Region	Longitude Range (°W)	Depth Change (m)
Continental Slope	74-73	1,200 m
Continental Rise	72-71	300 m
Abyssal Plain	63-62	0

- a. Which seafloor region is steepest? continental slope
  - b. Which seafloor region is most level? abyssal plain
4. Determine the vertical exaggeration (VE) of Figure 1. (Hint: Determine the number of meters in one horizontal square and the number of meters in one vertical square. Remember that 1 kilometer = 1000 meters.) For full credit, you must either explain your reasoning or show your work.

Vertical Exaggeration: horizontal - 90000 meters      vertical : 200 meters  
90 km in a degree of longitude      There is 200 meters  
90,000 m.      to each square.

Please Continue on the Next Page




Answer Sheet  
Ocean Bottom Profile

5. Using complete sentences, compare the profile in Figure 1 to the appearance of a true scale profile of these ocean depths.

A true scale profile would be spread out greater and you would be able to see the dots to a more exact point.

6. The bedrock of the ocean floor is youngest at the mid-ocean ridges and is older as distance increases away from the ridges. Using one or more complete sentences and based on your knowledge of plate tectonics answer the following questions:

- a. What crustal movement is most likely occurring beneath the mid-ocean ridge? (You may use a diagram with arrows to aid in your answer.)

The plates are all pushing towards the center ~~colliding~~ <sup>colliding and converging</sup> ~~colliding~~  just the opposite

- b. The mid-ocean ridges are primarily composed of what kind of bedrock?

~~Basalt~~ Igneous

- c. Using complete sentences, explain why hot water vents are often found in the rift valleys at the mid-ocean ridges?

There are cracks in the ridges or plates ~~that~~. There are also underwater volcanoes. The lava and other things amount of these

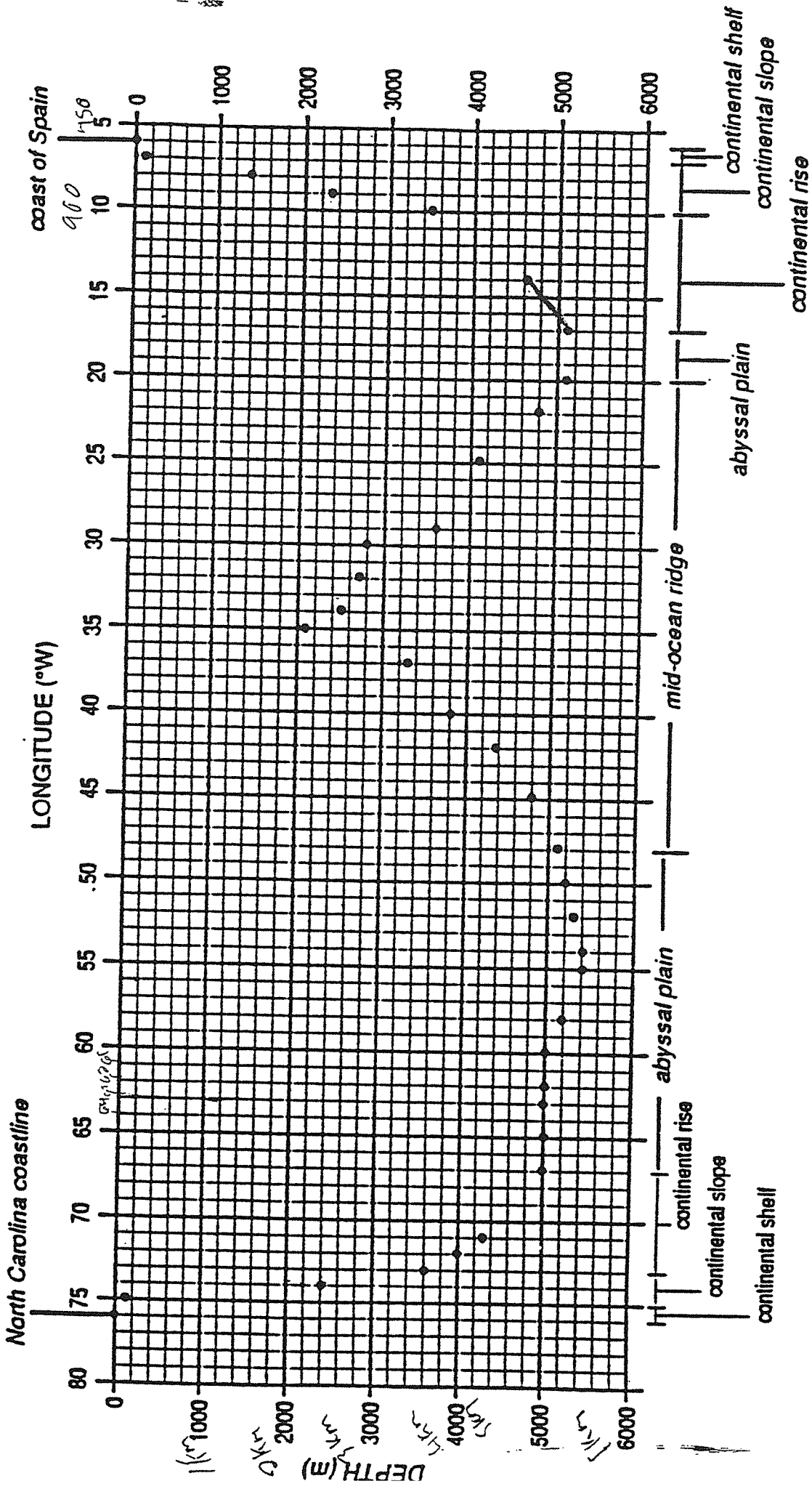


Figure 1

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Albany, New York 12234

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

1. Identified regions			
a. Widest	0	<u>1</u>	
b. Narrowest	0	<u>1</u>	
2. Depths			
a. 15° W	0	<u>1</u>	
b. Shelf edge	0	<u>1</u>	
3. Depth change			
Continental slope	<u>0</u>	1	
Continental rise	<u>0</u>	1	
Abyssal plain	<u>0</u>	1	
a. Steepest	<u>0</u>	1	
b. Level	<del>0</del>	<u>1</u>	
4. Vertical exaggeration (VE)			
Substitution	<u>0</u>	1	
Calculation	0	<u>1</u>	
<b><u>OR</u></b>			
Clear explanation	0	1	2
5. Description			
	<u>0</u>	1	2
6. Application			
a. Crustal movement	<u>0</u>	1	
b. Bedrock	<u>0</u>	1	
c. Vents	0	<u>1</u>	2
<b>Total Score</b>	<u>7</u>		

(Total Possible score - 17 points)

# Ocean Bottom Profile

**Task:** In this activity, you will interpret a graph of ocean depths and topographic features.

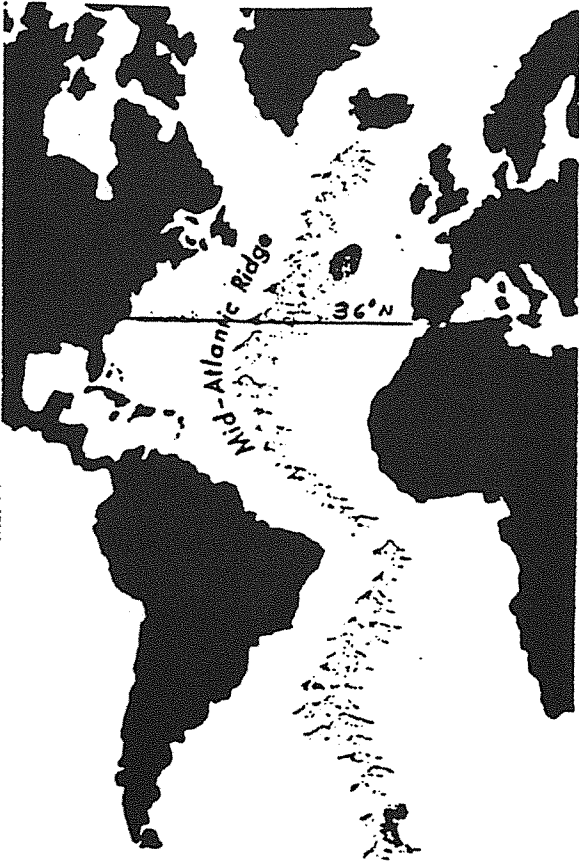
## MATERIALS:

- Ocean Bottom Profile (Figure 1)
- calculator

## BACKGROUND:

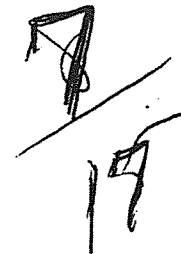
The data for the graph in figure 1 (see attached) was obtained by a ship that sailed between North Carolina and Spain along approximately  $36^{\circ}\text{N}$  latitude. Thirty six stops were made to collect data. Figure 1 shows the seafloor depth at each location and identifies the seafloor region.

The map shows the  $36^{\circ}\text{N}$  latitude line across the Atlantic Ocean. This is the approximate path traveled by the ship from North Carolina to Spain.



At  $36^{\circ}\text{N}$ , the horizontal distance represented by each degree of longitude is 90 kilometers.

To make the profile easier to plot, the vertical scale is not the same as the horizontal scale. The amount by which the vertical scale is greater than the horizontal scale is called the vertical exaggeration (VE). The value for VE is found by dividing the horizontal scale by the vertical scale. Note, both scales must be in the same units.



Answer Sheet  
Ocean Bottom Profile

1. According to the profile;

a. Which seafloor region is widest? mid-ocean ridge

b. Which is narrowest? continental shelf

2.

a. What is the ocean depth at 15°W? 4,800 meters

b. What is the depth of the edge of the continental shelf?

100 meters

3. Look at Figure 1. Note the seafloor regions listed in the first column and the 1° longitude ranges in the second column. Locate these same longitudes in Figure 1. Determine the change in depth that occurs between each pair of longitudes and record the value in the third column.

Seafloor Region	Longitude Range (°W)	Depth Change (m)
Continental Slope	74-73	<del>2326m.</del>
Continental Rise	72-71	<del>508m.</del>
Abyssal Plain	63-62	<del>5237m.</del>

a. Which seafloor region is steepest? mid-ocean ridge

b. Which seafloor region is most level? abyssal plain

4. Determine the vertical exaggeration (VE) of Figure 1. (Hint: Determine the number of meters in one horizontal square and the number of meters in one vertical square. Remember that 1 kilometer = 1000 meters.) For full credit, you must either explain your reasoning or show your work.

Vertical Exaggeration:  $\frac{90}{\times 5}$

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$450 \times 1,000 = 450,000 \leftarrow \text{vertical}$

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$1,000 \leftarrow \text{horizontal}$

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vertical exaggeration:  $0.002$

Please Continue on the Next Page

Answer Sheet  
Ocean Bottom Profile

5. Using complete sentences, compare the profile in Figure 1 to the appearance of a true scale profile of these ocean depths.

The appearance of a true scale profile would have more accurate readings and be clearer to read.

6. The bedrock of the ocean floor is youngest at the mid-ocean ridges and is older as distance increases away from the ridges. Using one or more complete sentences and based on your knowledge of plate tectonics answer the following questions:

- a. What crustal movement is most likely occurring beneath the mid-ocean ridge? (You may use a diagram with arrows to aid in your answer.)

There ~~is~~ are probably some convection currents and plates are subducting to form the ridge.

- b. The mid-ocean ridges are primarily composed of what kind of bedrock?

Granite

- c. Using complete sentences, explain why hot water vents are often found in the rift valleys at the mid-ocean ridges?

Heat from the lithosphere.

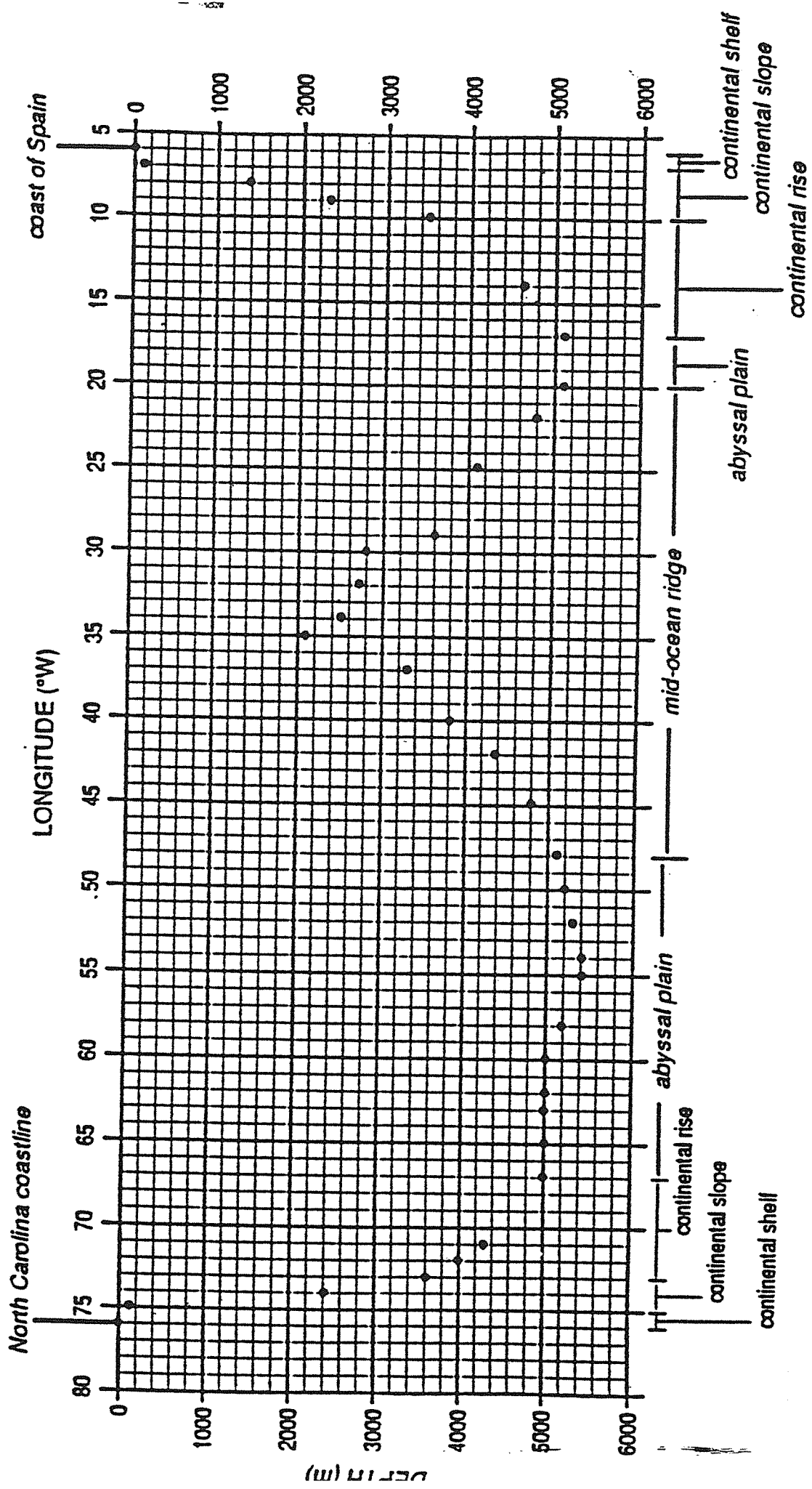


Figure 1

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