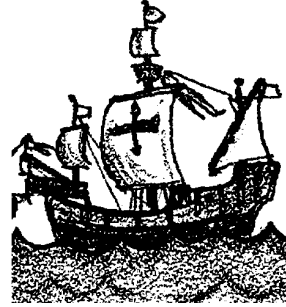


Retracing the Steps of Columbus

Key Concept

1. Information gathered from echo soundings can provide us with a picture of the ocean floor.



Background

“Deep Sounds” and “Sounds Good To Me” provided your students with an introduction to bottom topography and echo sounding. “Retracing the Steps of Columbus” provides the data necessary to construct a bottom profile of the Atlantic ocean basin from Cape Cod to Gibraltar. Although excessively exaggerated on the vertical scale, the profile reveals tectonic information and clearly shows the mid-Atlantic ridge, seamounts and other ocean features.

Materials

For each pair of students:

- data sheet
- graph paper
- pencil
- ruler or straight edge
- tape or glue

Teaching Hints

Duplicate the activity pages. One set is recommended per student. This activity is best accomplished in groups of two pairs. One pair plots the data from Cape Cod to mid-ocean while the second pair plots the data from mid-ocean to Gibraltar. It is imperative that both teams use the same horizontal and vertical scales. Demonstrate the technique and on the black board write the scales used (i.e. horizontal, one square = 100 kilometers; vertical one square = 300 meters). Have one member of each pair read off the data while the second member plots the points. In this manner, the plotter reduces the risk of mislocating points inherent in moving eyes from graph to data to graph etc. As always, provide your students with any assistance they may require during the activity. Allot time for a discussion of the activity and the questions in the “Analysis and Interpretation” section. Plan to post the finished bottom profiles on a classroom bulletin board so that the groups may have a chance to compare their results.

Key Words

bottom profile - one type of picture of the ocean floor

continental shelf - the submerged margin of the continent

echo sounding - method for locating objects by determining the time for a sound wave to travel to the object and for the echo to return

guyots - flat-topped volcanoes which have subsided beneath the water's surface

mid-Atlantic ridge - underwater mountain range which runs the length of the Atlantic Ocean

seamounts - underwater volcanoes which have not reached the water's surface

Extensions

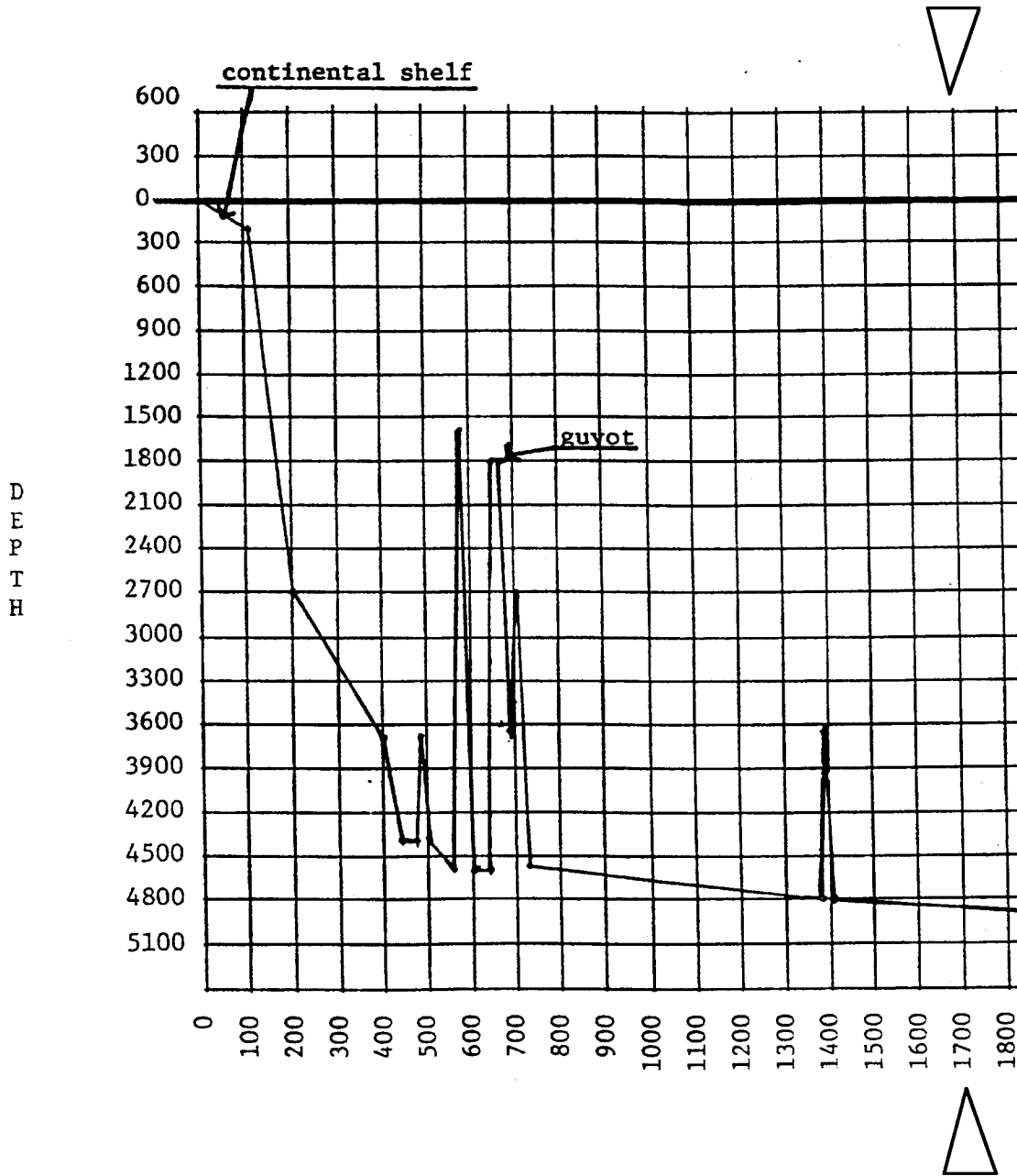
1. Have students research the voyages of Columbus, then write a ship's log outlining the highlights of the voyage.
2. Use bathymetric maps (*National Geographic* is a good source) to name the features seen in the completed bottom profiles.

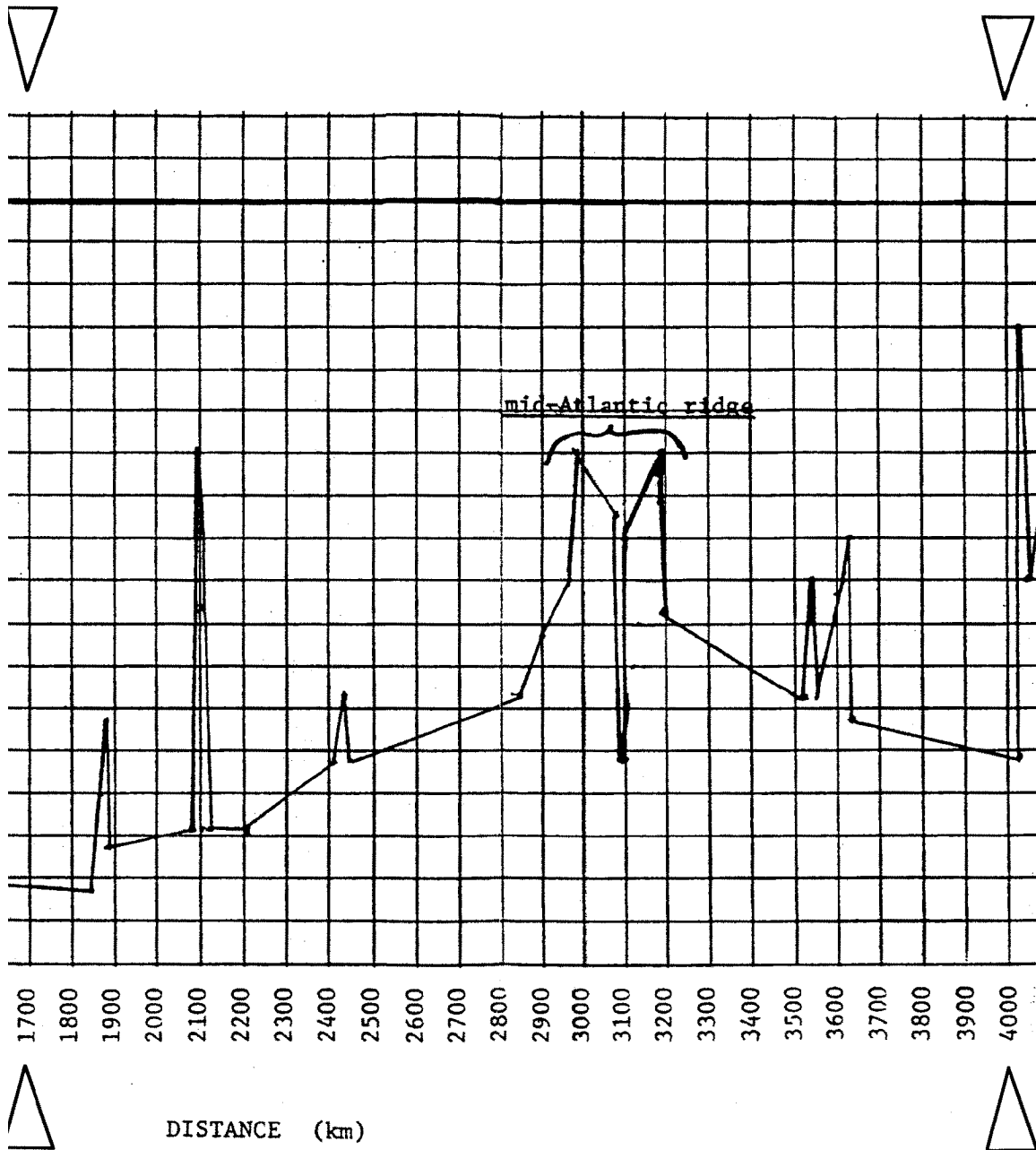
Answer Key

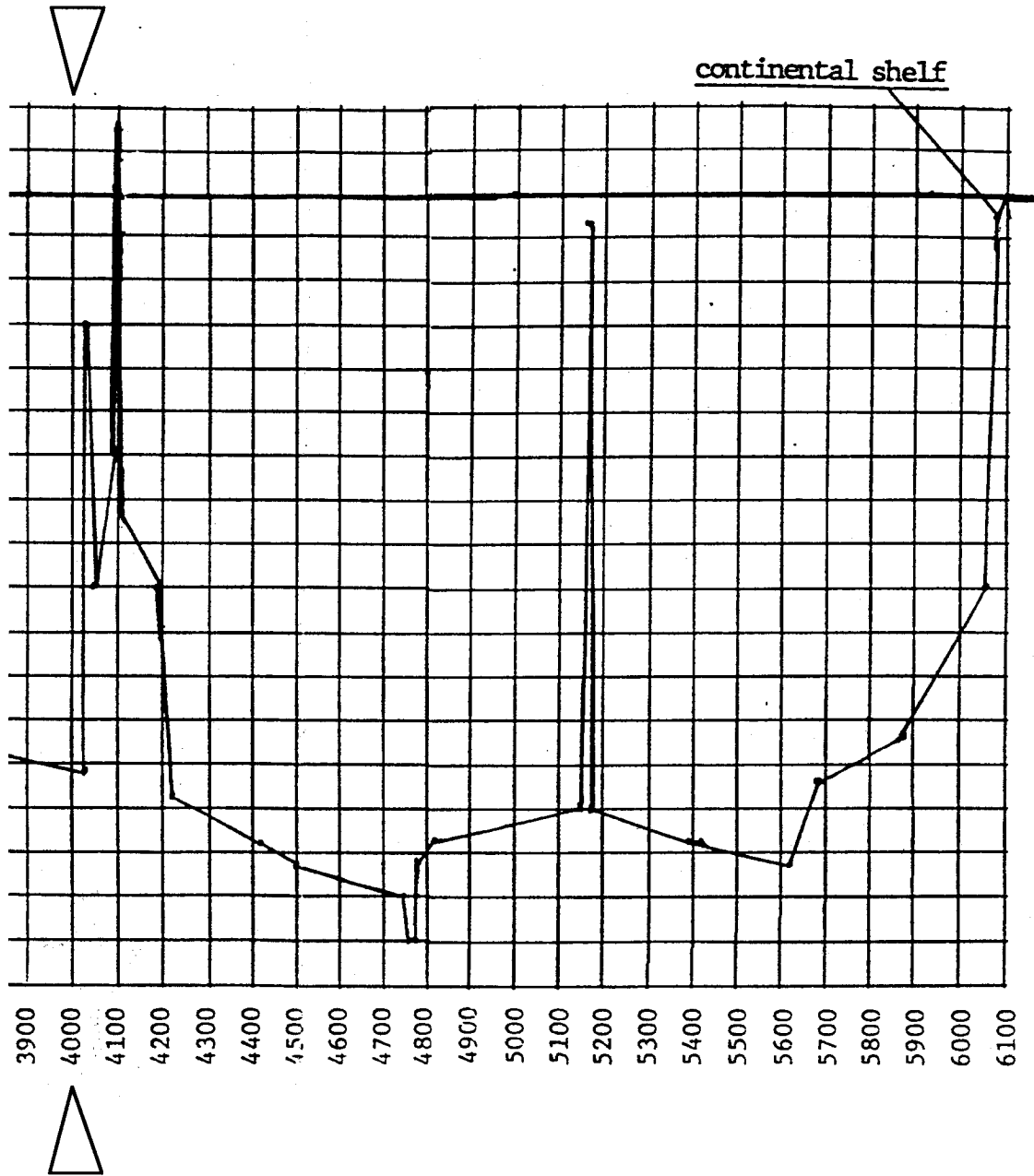
1. See completed bottom profile included below. The North American side has a wider continental shelf.
2. a. See completed bottom profile.
b. The youngest rocks would be found at the mid-Atlantic ridge, about 3075-3090 kilometers from North America.
3. a. A volcanic island is found about 1010 km east of the mid Atlantic ridge.
b. A seamount is found about the same distance (1010 km) west of the mid-Atlantic ridge.
4. a. The difference in height from the lowest point (5100 m) to the highest point (500 m) is 5600 m.
b. The horizontal distance between the highest and lowest points is 660 km. Essentially the highest point descends without interruption to the lowest point.
5. a. See completed bottom profile.
b. The suspected cause of the flat top is the planing action of ocean waves which occurred when the seamount protruded above sea level.
6. The simplest way to obtain a more detailed profile of the bottom would be to obtain and/or plot more data points.

Completed Bottom Profile

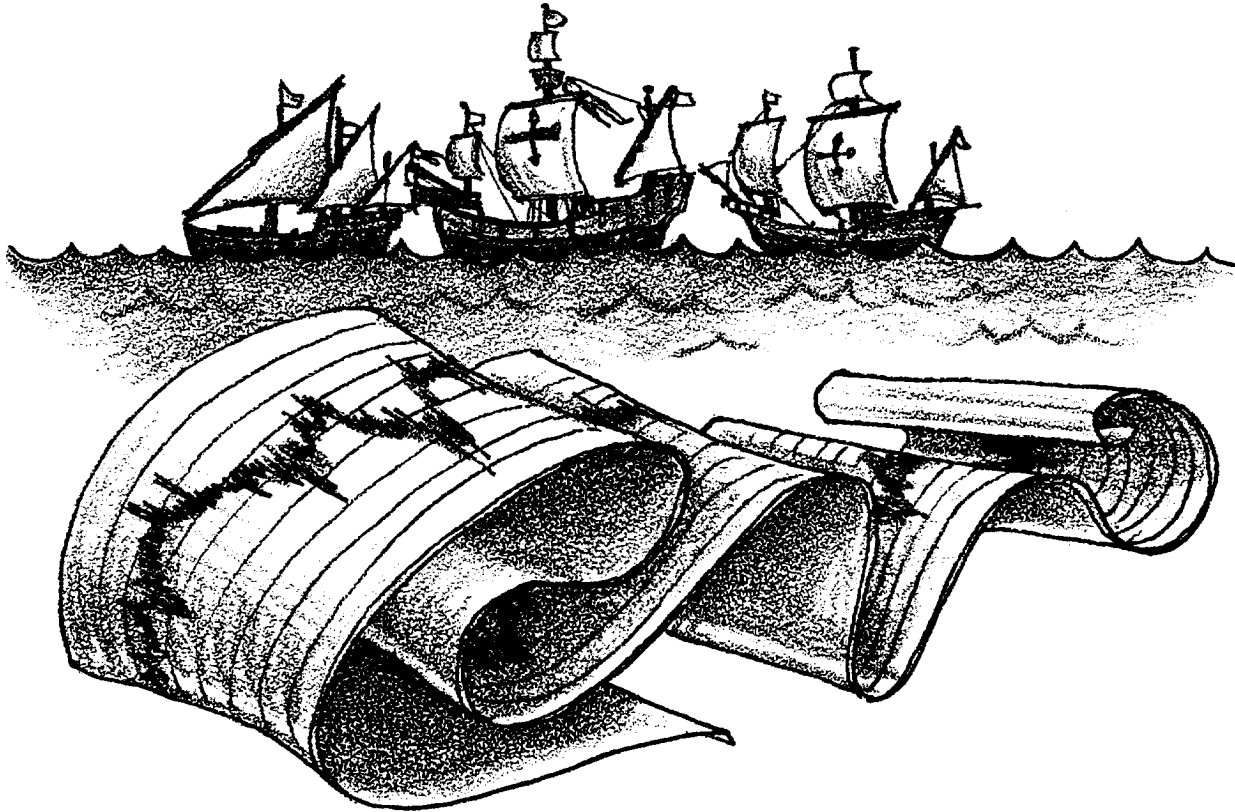
Overlap these three pages, connecting them at the triangles, to get complete data sheet.







Retracing the Steps of Columbus



What kinds of information can we obtain from echo soundings? The locations of the continental shelves are revealed by soundings. Geologists searching for oil and minerals are interested in locating these deposits on the shelves. Other geologists studying the forces that have shaped the face of the earth also use echo soundings to provide information to test their theories.

In the following activity you will use sounding data to construct a bottom profile for the Atlantic Ocean. Using this profile you will be able to answer questions of interest to research geologists.

Materials:

- data sheet
- graph paper
- pencil
- ruler or straight edge
- tape or glue

Procedure:

1. For this activity you will be working in groups of four. Divide your group into two pairs. One pair of students from your group will chart profile A. The other pair of students will chart profile B.
2. Obtain either Profile A or Profile B data sheet. The 40 data points on your profile represent soundings from a ship as it traverses half of the Atlantic Ocean.
3. Pair A will chart Profile A while Pair B will chart Profile B. Both teams **must** use the same horizontal and vertical scales. For the horizontal scale, one square will equal 100 kilometers (km). One vertical square will equal 300 meters.
4. Label the horizontal axis "Distance (km)". Pair A will label the vertical axis "Depth (m)" along the left paper margin. Pair B should label the vertical axis along the right paper margin.
5. Pair A will begin labeling the horizontal axis starting at 0 km and ending at 3300 km. Pair B begins at 2900 km and ends at 6100 km.
6. Plot points for your profile and connect them with a solid line as you proceed. (Use your ruler or straight edge).
7. After both pairs are finished, use tape or glue to join the two halves at the section where they overlap. (Hint: The maps overlap from 2900 km to 3300 km.)
8. Use your completed bottom profile to answer the questions in the "Analysis and Interpretation" section which follows.

Analysis and Interpretation:

1. Label the continental shelves. Which side of the Atlantic has a wider continental shelf?
2. a. The mid-Atlantic ridge is thought to be the location where new ocean floor is formed. The two sides of the ridge are slowly moving away from each other. The ocean floor to the east of the ridge is a rough mirror image of the ocean floor to the west of the ridge. On your profile mark the mid-Atlantic ridge with an arrow and label it with its name.

- b. At about what distance from North America would the youngest rocks be found on the ocean floor?
3. a. What geologic feature is found about 1010 km east of the mid-Atlantic ridge?
- b. What geologic feature is about the same distance west of the ridge?
4. a. What is the difference in height from the lowest to the highest points shown on your profile?
- b. What is the horizontal distance between the highest and lowest points?
5. a. A guyot (gee-oh) is a flat topped seamount. Label a guyot on your profile.
- b. What is the suspected cause of the flat top?
6. What would be one way in which you could obtain a more detailed profile of the bottom of the Atlantic Ocean?

Profile A: Cape Cod to Mid-Atlantic

POINT	DISTANCE (KM)	DEPTH (M)
1	0	0
2	120	200
3	200	2700
4	400	3700
5	440	4400
6	480	4400
7	490	3700
8	500	4400
9	560	4600
10	580	1600
11	600	4600
12	640	4600
13	660	1800
14	680	1800
15	690	3700
16	700	2700
17	725	4600
18	1375	4800
19	1390	3700
20	1400	4800

Profile A: Cape Cod to Mid-Atlantic - continued

POINT	DISTANCE (KM)	DEPTH (M)
21	1850	4900
22	1875	3700
23	1890	4600
24	2075	4400
25	2090	1800
26	2100	4400
27	2210	4400
28	2420	4000
29	2440	3500
30	2450	4000
31	2850	3500
32	2900	3100
33	2960	2700
34	2975	1800
35	3060	2200
36	3075	4000
37	3090	4000
38	3100	2400
39	3190	1800
40	3200	2900

Profile B: Mid-Atlantic to Gibraltar

POINT	DISTANCE (KM)	DEPTH (M)
1	2900	3100
2	2960	2700
3	2975	1800
4	3060	2200
5	3075	4000
6	3090	4000
7	3100	2400
8	3190	1800
9	3200	2900
10	3525	3500
11	3540	2700
12	3550	3500
13	3625	2700
14	3630	2400
15	3640	3700
16	4025	4000
17	4035	900
18	4050	2700
19	4090	1800
20	4100	+500

Profile B: Mid-Atlantic to Gibraltar - continued

POINT	DISTANCE (KM)	DEPTH (M)
21	4110	2200
22	4190	2700
23	4225	4100
24	4425	4400
25	4500	4600
26	4750	4800
27	4760	5100
28	4770	5100
29	4780	4600
30	4825	4400
31	5150	4200
32	5160	200
33	5170	4200
34	5390	4400
35	5625	4600
36	5675	4000
37	5875	3700
38	6050	2700
39	6075	200
40	6100	0

