Nannofossils Reveal Seafloor Spreading Truth

Summary

Students interpret data from an early leg of the scientific ocean drilling program to determine how scientists solidified their understanding of seafloor spreading.

Background

The goal of the Deep Sea Drilling Project (DSDP) was to investigate the sediments and rocks beneath the deep oceans by drilling and coring. The data featured in this exercise were taken from cores collected by the *Glomar Challenger* drill ship, at seven sites east and west of the Mid-Atlantic Ridge during DSDP Leg 3, in late 1968 (see Figure 2). The holes were drilled in the South Atlantic between Rio de Janeiro, Brazil and Dakar, Senegal. The age of the contact between the sediment and the basalt of the ocean floor was determined by identifying the nannofossils found at each contact.

Objectives

Learning students will be able to:

- analyze real data collected from the Deep Sea Drilling Project to discover evidence of seafloor spreading.
- graph and use slope analysis to determine the relationship between distance from the spreading center and age of the sediments.

National Science Education Standards

A. Science as Inquiry

D. Earth and Space Science

E. Science and Technology

Ocean Literacy Principles

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
7. The ocean is largely unexplored.

Alfred Wegener first proposed the theory of continental drift but could not explain how it happened. (photo from USGS, http://pubs.usgs.gov/publicatios/text/wegener.html)

Target Grade: 5-8

Time: One class period

Vocabulary

basement rock
core sample
Deep Sea Drilling Program
nannofossil
ocean sediment

Materials

1. Graph Paper
2. Pencil

Methods

1. Using data from Table 1 (from DSDP Initial Reports, Vol. 3), plot coordinates representing the age and distance from the ridge at each site. For time values, use the column labeled Paleontological Age of Sediment (in millions of years). For distance use the column labeled Distance from Ridge Axis. Choose a scale that allows you to plot distance on the Y-axis and age on the X- axis. Label each coordinate with the site number.
2. Locate the position of the core samples relative to the Mid-Atlantic Ridge by looking at Figure 2 (also from Initial Reports of DSDP, Volume 3). (Hint - they are not in order.)

Analysis

(Answer these questions on your own paper.)

1. These DSDP Leg 3 observations were the ground truth needed to test the seafloor spreading hypothesis. Where are the youngest samples? Where are the oldest samples? What do you think might have caused this relationship? Does this relationship support the theory of seafloor spreading? Why?
2. These data show a straight-line relationship between age and distance. What does this tell us about the rate of seafloor spreading?
3. Should your lines of best fit pass through (0, 0)? What does this mean?
4. Calculate the rate of seafloor spreading west of the Mid-Atlantic Ridge in km/m.y., then convert your answer to cm/year. Be sure to show your work!
5. Calculate the rate of seafloor spreading east of the Mid-Atlantic Ridge in km/m.y., then convert your answer to cm/year. Don't forget to show your work!
6. If you could acquire data of a different type from these same sites, what other data might be used to study seafloor spreading? Explain how this data would be useful.

Table 1
Distances and Ages of Mid-Atlantic Ridge Sites from the Axis

Site Number	Paleontological Age of Sediment (m.y.)	Distance From Ridge Axis (km)
16	11	221
15	24	422
18	26	506
17	33	718
14	40	745
19	49	1010
20	67	1303
21	76	1686

Adapted from Table 5[a], from Initial Reports of DSDP, Volume 3

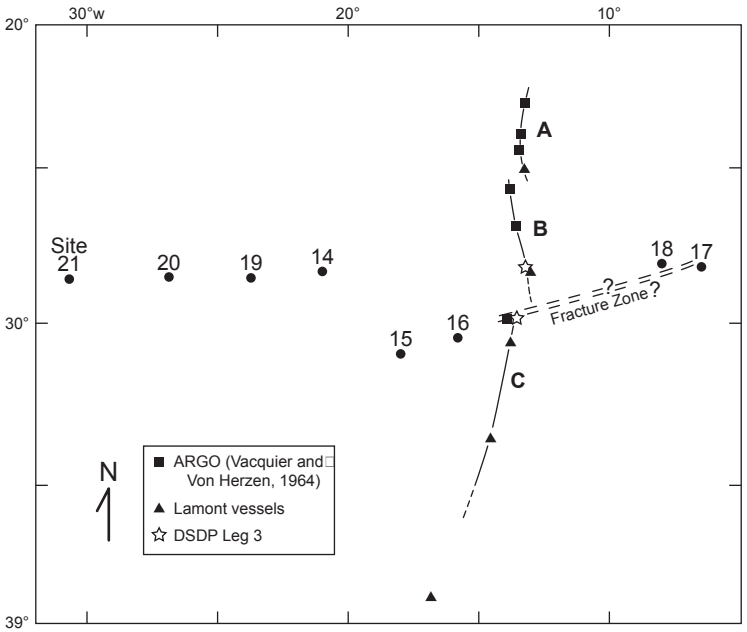

Figure 2. *Location of DSDP Leg 3 drillsites relative to the axis of the Mid-Atlantic Ridge in the South Atlantic. Lines of latitude are in degrees South (i.e., 20° to 39°S)*

Extensions

1. To learn more about the *Glomar Challenger*, read the article found on the following web page: *iodp.tamu.edu/publicinfo/glomar_challenger.html*
2. Locate the DSDP Leg 3 drill sites on the DSDP drill site map at: *iodp.tamu.edu/scienceops/maps/dsdpmap.gif* Using a map of the seafloor, locate the Mid-Atlantic Ridge.
3. Find out how core samples are drilled and processed by reading blogs and watching videos at *www.joidesresolution.org*.

Nannofossils Reveal Seafloor Spreading Truth! was adapted by School of Rock Expedition participants Jerry Cook and Virginia Jones from "Plate Tectonics and Contributions from Scientific Ocean Drilling" (www.oceanleadership.org/classroom/plate_tectonics_DSDP3) an undergraduate-level activity written by Dr. Kristen St. John and Dr. Mark Leckie, 11/2005 (learning@oceanleadership.org)