Deep Earth Academy
CONSORTIUM FOR OCEAN LEADERSHIP

Activity of the Month – June, 2008
Plate Tectonics and Contributions from Scientific Ocean Drilling

Summary

In this activity. students will use actual data from historic oceanographic cruises to examine sea floor spreading. They will also model sea floor spreading at a spreading center such as the Mid-Atlantic Ridge.

Learning Objectives

Students will be able to:

- Plot data on a diagram.
- Draw conclusions from the data.
- Make predictions about future events related to this data.

National Science Education Standards

- Content Standard A: Science as Inquiry; Students in grades 5-8 can begin to recognize the relationship between explanation and evidence.
- Content Standard D: Earth and Space Science; Student's study of earth's history provides some evidence of the distribution of land and sea and features of the crust.

Target Age: Grades 5-8

Time Estimate: 2 to 3 class periods

Materials

- PowerPoint "Stories From the Sea Floor," available on-line at *www.deepearthacademy.org*
- Student Handout
- Posterboard / cardstock
- Paper
- Scissors

Background

Using actual data from the *Glomar Challenger* cruises will allow student to see a real-world connection between classroom science and "real" science. Also, creating a model for sea floor spreading will allow students to see a hands-on example of this phenomenon.

Activity of the Month

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What To Do

Part 1

1. Students will need to cover basic information on sea floor spreading and the movement of tectonic plates. Some great sources for information are http://library.thinkquest.org/17457/platetectonics/1.php and *http://www.ucmp.berkeley.edu/fosrec/Metzger3.html*
2. Be sure to discuss how our planet has changed over geologic time. (For re-creations of the movement of the plates, go to *http://www.ucmp.berkeley.edu/geology/anim1.html*
3. Present the PowerPoint "Stories from the Ocean Floor." Students will follow along with the Student Materials, filling in words that are underlined in the PowerPoint.

Part 2

1. To create a working model of sea floor spreading, follow the model seen below. The base is best if made from poster board or card stock. The width and length of the base are not critical, as long as they are at least 12 cm wide and 30 cm long. Cut 3 slits, each slightly more than 8 cm wide. One slit needs to be in the center, and the other two at either end of the base, at least 4 cm in from the ends. (You can cut the slits ahead of time using an Exacto knife.) Label the slits A and B at either end.
2. For the models of the plates, print out the templates (Page 3).

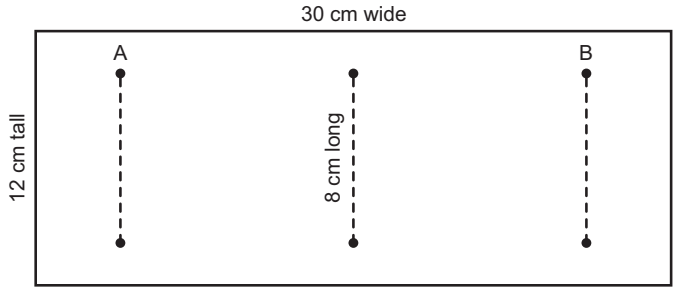


Figure 1.

3. Cut out the plate strips and place them back to back (marked sides together with number 1 at the top) and tape the end as indicated (at the end nearest number 7.
4. Put the two strips up through the bottom slit and then off to the slits at either end of the base. (Figure 2.)

Procedure for students

5. Thread the two strips through the center slit of the base, keeping the taped edge at the bottom. Pull the "North American Plate" strip down through slit "A" and the "Eurasian Plate" strip through slit "B".
6. Push the strips up from below until you can see numbers 3, 4, and 5 on top of the base.
7. Hand out the student pages. When students have all completed their models and analysis, lead a discussion about their answers and observations.

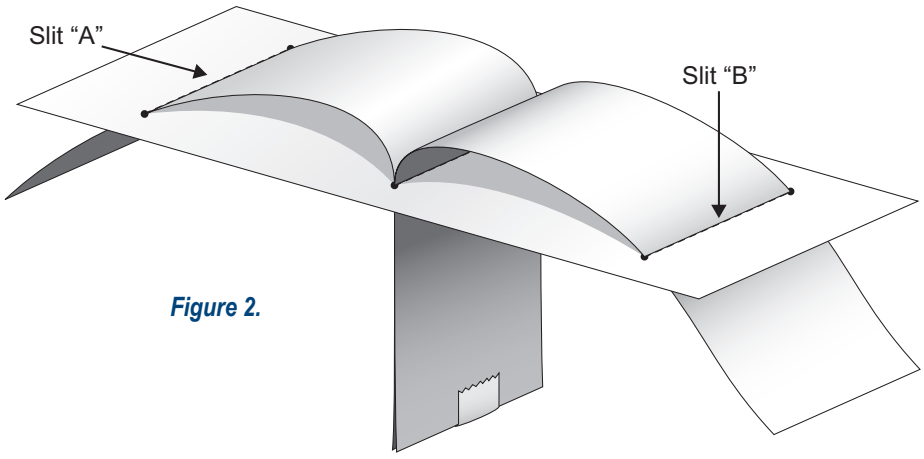


Figure 2.

Submitted by: Jan Fechhelm, College Station, Texas, School of Rock 2007

North American Plate North American Plate

1 2 3 4 5 6 7

1 2 3 4 5 6 7

Eurasian Plate Eurasian Plate Eurasian Plate

Student Page

Name_____ Class_____

1. The _____ _____ _____ _____ was begun in 1964 and was designed to investigate the evolution of ocean basins by core drilling of ocean sediments and underlying oceanic crusts.

2. The data used in this exercise were taken from cores collected by the drill ship_____ on a cruise in _____. The Deep Sea Drilling Project was the first of 3 international ocean drilling programs that have continued right up to today.

3. Remember that the _____ on the surface of the Earth have _____ _____ throughout the Earth's history.
   These diagrams show what the Earth looked like _____ _____ _____ _____

4. When scientists drill into the sea floor, the _____ _____ are at the _____, and the _____ _____, those that are just settling to the bottom of the ocean, are ____ _____ _____.

5. On the third expedition of the ship (Leg 3) the crew drilled 17 holes at 17 different sites along an _____ between _____ and _____

6. What they found astonished many around the world and opened up a whole new area of scientific investigation.

7. When ocean cores are drilled, scientists can then look at the _____ of ancient organisms found in the sediments.

8. From years of study, scientists can tell the _____ of sediments by looking at the fossils.

9. Some organisms (or their fossils) are used as _____ _____

10. This means that if those organisms are found, scientists can tell the age of the sediments, or when they were _____ on the _____.

11. There are 3 main groups of microscopic organisms that scientists use.

    (1) _____

    • _____ (0.2 to 2 microns!) *1 micron (or micrometer) = 1 X 10-6 or 1/1,000,000*

    Often occur in massive "blooms" in the ocean (so large they can be seen in satellite pictures).

    (2) _____

    • _____ up to the size of a grain of sand.

    Also can occur in massive "blooms" in the oceans.

    (3) _____

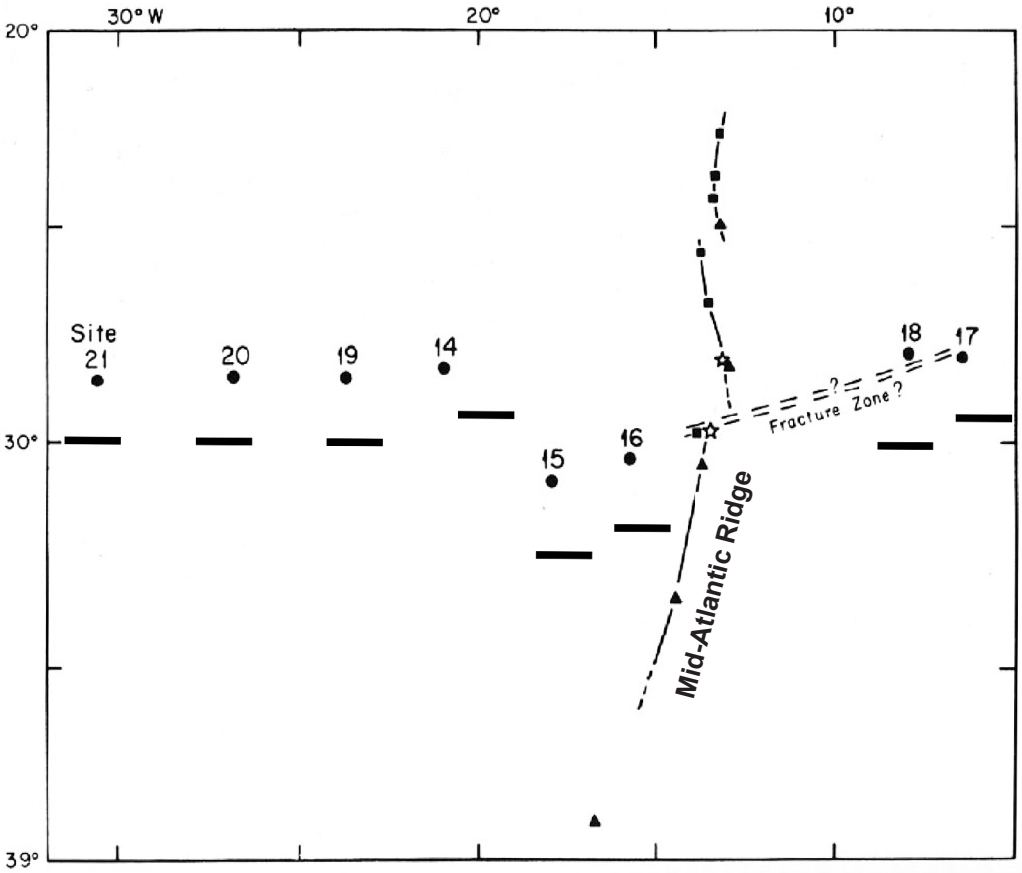
    • _____

    Very important in the dating of ancient deep sea sediments.

Part 1: Just the Facts!

Use the data below and write the age of the sediments found at each site on the map below. (Write the age on the line by each site.) Then answer the questions on the next page.

Site	Age of Sediments (in millions of years)	Distance from Ridge (in km)
14	40	745
15	24	422
16	11	221
17	33	718
18	26	506
19	49	1010
20	67	1303
21	>76	1686



From Fig. 7 in the Initial Reports of the Deep Sea Drilling Project, Volume III. p.460

Conclusions: *(Please write in complete sentences!)*

1. Where are the youngest sediments found, compared to the Mid-Atlantic Ridge? _____

   _____

2. Where are the oldest sediments found?_____

   _____

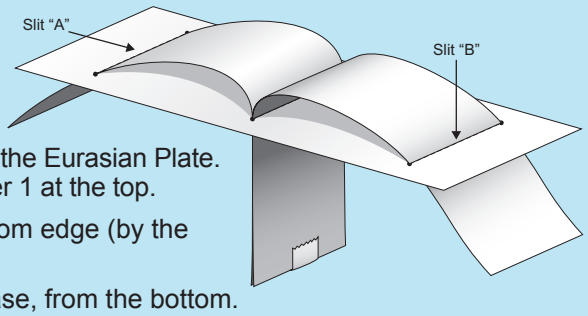
3. Does the data support the theory of sea floor spreading? How? _____

   _____

Part 2. A Model for Movement.

Materials

Base, Templates for plates, Scissors, Tape



Directions

1. Cut out the strips representing the North American Plate and the Eurasian Plate. Place them face to face (letters on the inside) with the number 1 at the top.
2. Use a small piece of tape to attach the two strips at the bottom edge (by the number 7).
3. Insert the attached strips into the slot in the middle of the base, from the bottom.
4. Feed one strip into slot A and the other into slot B. (See diagram)
5. Push the strips up from below the base until you can see the numbers 3, 4 and 5 on the top.

Analysis and Conclusions *(Complete sentences, please!)*

4. What are you modeling by pushing the strips up through the base?_____

   _____

5. What is being modeled at slits A and B as you push the strips up through the base?_____

   _____

6. This model shows what happens at sea floor spreading centers, such as the mid-Atlantic Ridge. List at least 2 good points of this model. _____

   _____

7. What are at least 2 reasons why this model is not a good model? _____

   _____

8. Seafloor spreading is continuing today along mid-ocean ridges such as the Mid-Atlantic Ridge. Predict what effect this will have on the size of the ocean basin: _____

   _____

   _____

   _____

BONUS (10 points!): Using the data, calculate the speed of the movement of the plates, in centimeters per year. (*Show your work!*)

The North American Plate and the Eurasian Plate are moving apart at approximately

_____ cm per year.