

## Mid-ocean Ridge Spreading Demonstration Model



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**DESCRIPTION:** Shoe box model plus foam pieces for demonstrating divergent plate boundaries and a mid-ocean ridge spreading center.

**TOPIC:** Earth Science – Plate Tectonics

**GRADE LEVEL:** 6, 7, 8

**CONTENT OBJECTIVE:**

The model is designed to help students understand the movement of the oceanic plates at the mid-ocean ridge. The foam board represents the oceanic lithosphere. Each strip represents 5 million years of extension at the ridge. As the blocks are pushed sideways, new magma is generated at the ridge and moves upward. The colors of the foam indicate periods of normal and reversed polarity. In the real world Earth, the time periods of normal (shaded) and reversed polarity would not be of equal duration (one million years in this simulation) and thus the widths of the stripes would vary. The student activity will allow students to create their own model of the mid-ocean ridge in order to simulate sea-floor spreading.

**CONTENT STANDARD:**

National Science Education Standard D (5-8) – Structure of the earth system. Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.

RESOURCE TYPE: Lesson Plan – Classroom Demonstration

TIME REQUIRED: 50 minutes

MATERIALS NEEDED:

Demonstration Model:

Shoe Box w/lid  
Closed Cell Foam (camping pad type)  
Permanent Markers  
Rubber Cement

Foam Core Board  
X-acto Knife  
Masking Tape

Student Activity:

Copy of “Mid-Ocean Ridge” Model  
Scissors  
Glue or tape  
Colored Pencils

Assembly:

1. Cut two pieces of foam core board (10 cm x 30 cm).
2. Cut two pieces of closed cell foam (10 cm x 20 cm). Glue to the ends of the foam core board.
3. Cut 12 strips of closed cell foam (2 cm x 10 cm). Color 6 strips with red permanent marker. Glue to the foam core board alternating colors.
4. Score the foam board with an X-acto knife between each piece of closed cell foam. Place masking tape on the back side of the foam board. This will allow the board to bend at each strip.
5. Cut an opening in the top of the shoe box (4.5 cm x 11 cm).
6. Label the box and the foam pieces.

The foam board represents the oceanic lithosphere. Each strip represents 5 million years of extension at the ridge. As the blocks are pushed sideways, new magma is generated at the ridge. In the real world Earth, the time periods of normal (shaded) and reversed polarity would not be of equal duration (one million years in this simulation) and thus the widths of the stripes would vary.

To demonstrate the concepts of divergent plate boundary and mid-ocean ridge spreading, insert the stripes of foam board into the hole in the top of the box. The oceanic lithosphere should be placed on the top of the box with the arrows on these pieces pointing outward. These pieces present oceanic lithosphere at a time six million years

ago and contain oceanic crust (the upper layer of the lithosphere) that is 6 million years old and older. Slowly slide the two foam pieces away from each other about 2 cm. This will represent the passage of time and will demonstrate how magma pushes up through the mid-ocean ridge creating new ocean floor. As the magma emerges, the old ocean floor is pushed aside.

In the real mid-ocean, there is not an opening between the plates. At slower spreading ridges, like the northern Mid-Atlantic Ridge, the seafloor behaves like nougat or cold chocolate bars – when it gets pulled enough it cracks and breaks. The ocean crust at slow spreading ridges breaks in to ridges and valleys as the seafloor gets pulled apart. Faster spreading ridges like the northern and southern East Pacific Rise are “hotter.” This means that the ridge spreads more like hot taffy being pulled apart. More magma is present beneath the ridge and more volcanic eruptions occur.

Because the oceanic crustal layer in this new lithosphere is formed from igneous processes, it cools from a liquid. The rocks acquire a magnetic direction which is the same as the Earth’s magnetic field direction at that time. Because the Earth’s magnetic field occasionally reverses its polarity, the lithosphere created at mid-ocean ridges has stripes of normal and reversed magnetic polarity parallel to the ridge. At the mid-ocean ridge spreading axis, these changes in the direction of the Earth’s magnetic field are recorded in the magnetization of the lava. This creates a symmetrical pattern of magnetic stripes of opposite polarity on either side of the mid-ocean ridges.

Continue to push the two plates away from each other at the ridge crest and reveal the new pieces of lithosphere. When you are finished, the stripes will represent the passage of time from 1 million to 5 million years. Note that the youngest rocks are in the center, along the ridge and the older rocks are farthest away from the ridge crest.

Student Activity:

1. Have students cut out the stripped pattern (Section A) around the outside edge and through the center so that they have two separate pieces.
2. Place the pieces together so that the printed sides are facing each other.
3. Tape or glue the end where it is marked.
4. Fold each side along the bold lines so that you can read the pattern.
5. Cut a slit in the center of the mid-ocean ridge base where marked.
6. Insert the stripped pieces “Section A” through the slit in the base. The printed sides should be facing inwards.
7. Open the stripped pieces so that you can see the Oceanic Lithosphere on either side of the slit. Pull the pieces slowly in the direction of the arrows.

EVALUATION:

1. As the magma comes up from the center, what happens to the Oceanic Lithosphere? (The plates are pushed away from the ridge.)

2. What type of formation is formed at the mid-ocean ridge? (Ridges and valleys are formed.)
3. Where is the youngest rock located on the ocean floor? (The youngest rock will be located closed to the mid-ocean ridge. The rock gets progressively older as you move farther from the ridge crest.)
4. Where does the magma come from? (Deep within the earth's crust where temperatures are hot enough to melt the rock.)
5. What so the stripes in the magma represent? (They represent the magnetic reversals. A polarity reversal means that the magnetic North flips to where we know the South Pole is.)

LESSON PLAN AUTHOR & CONTACT INFO:

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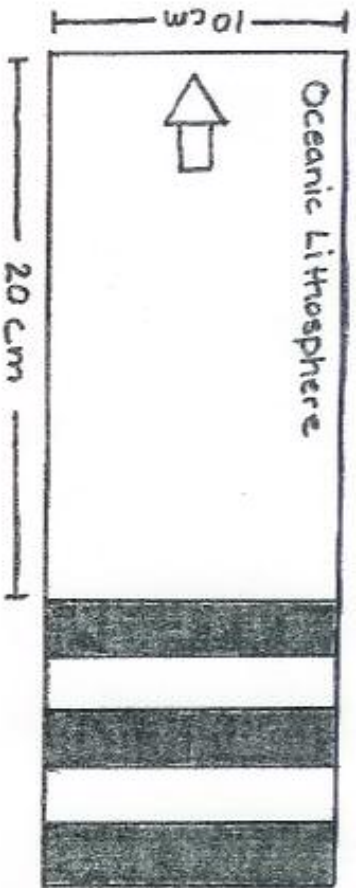
[msvoboda@comstock-park.k12.mi.us](mailto:msvoboda@comstock-park.k12.mi.us)

RESOURCES:

Braile, L.W. and S.J. Braile, Explorations in Earth Science –  
<http://www.eas.purdue.edu/~braile/educindex/educindex.htm>

FEMA/AGU *Seismic Sleuths – Earthquakes* – A Teachers Package on Earthquakes for  
Grades 7-12, American Geophysical Union, Washington, D.C., 367 pp., 1994

Kious, W. Jacquelyne and Tilling, Robert I., “This Dynamic Earth: The Story of Plate  
Tectonics” U.S. Geological Survey, 1996 (Online edition:  
<http://pubs.usgs.gov/publications/text/dynamic.html#anchor10790904>)



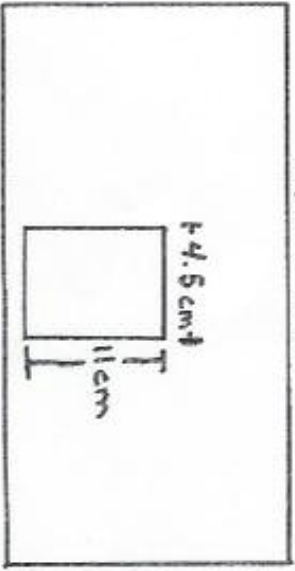
2 cm Wide Strips

Base - foam board  
10 cm x 30 cm

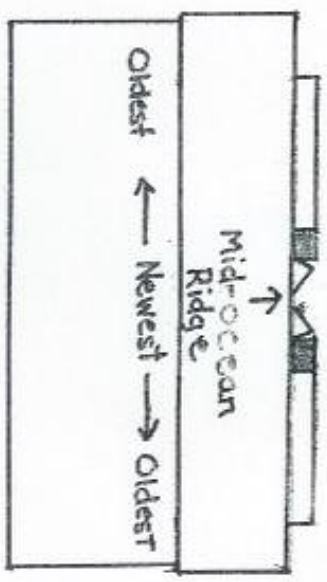


Side View

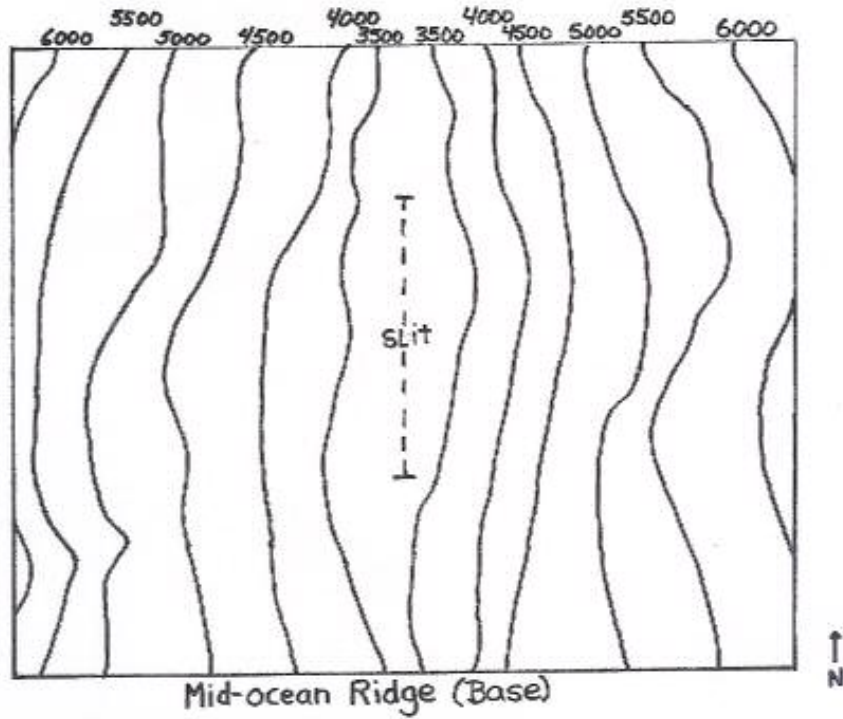
Top of Box



Front of Box



Mid-ocean ridge & divergent plate boundaries



Sounding in Meters - Interval 500m

← Oceanic Lithosphere	N	S	N	S	N	S	N	S	N	Tape IN
										Cut
← Oceanic Lithosphere	N	S	N	S	N	S	N	S	N	Tape IN

Section "A"