Seafloor Magnetic Stripes Lesson Plan

By Ashlee Henig, Scripps Classroom Connection, 2011-2012
& Stephen Halpern, San Diego High School
Adapted from Leah Ziegler, Scripps Classroom Connection, 2010-2011
& Dave van Dusen, San Diego School of Creative and Performing Arts

(1) 90 min period

Summary:
The discovery of a pattern of rock magnetization directions (polarity) locked within the rocks of the seafloor was an important piece of evidence used by scientists in the discovery of seafloor spreading and the development of the theory of plate tectonics. In this lesson, Earth's magnetic field and its reversals are reviewed and used to explain the magnetic stripes observed in oceanic crust.

Special Note: This lesson is adapted from Scripps Classroom Connection 2010 activity: Solid Earth and Plate Tectonics "Day 4", by Leah Ziegler and Dave van Dusen. It will be helpful to download the Solid Earth & Plate Tectonics Day 4 lesson plan for reference. This adaptation directs focus toward the symmetry of magnetic stripes on the seafloor as evidence for Seafloor Spreading. Materials from the SCC Solid Earth and Plate Tectonics lesson will be noted by an asterisk.

Prior Knowledge Required: This lesson is best used as part of the SCC Mid-Ocean Ridges Unit. The following lesson on the ages and age distribution of the seafloor will build upon this lesson. Understanding the symmetric magnetic stripe pattern is key for the subsequent lessons in this unit.

Materials:
*SCC Solid Earth and Plate Tectonics Day 4 lesson plan (optional - for teacher)
Lecture_SF_MagneticStripes.ppt Lecture Slides (including presenters notes contained within the powerpoint)
Bar Magnet
Iron Filings (check the local auto/brake repair center)
Transparency Paper (1 sheet for demonstration)
Rocks (hand-sized; 1 per student)
**GPTS Activity Details, GPTS Data, GPTS Labels (All included in document Activity_GeomagPolarityTimeScale.pdf)*
Black and White Construction Paper
Worksheet_SF_MagneticStipes.pdf (1 per student)

Documents:
*Activity_GeomagPolarityTimeScale.pdf** (contains SCC Solid Earth and Plate Tectonics Files)*
Lecture_SF_MagneticStripes.pdf
Lesson_Plan_SF_MagneticStripes.doc
Worksheet_SF_MagneticStripes.pdf

Worksheet_SF_MagneticStripes_key.pdf

Prep: Have the rocks (1 per student) labeled with the filled out GPTS activity labels. Prepare the bar magnet, transparency sheet, and iron filings for the dipole field demonstration. This should be projected onto the white board so all students can see the demonstration.

Lesson Plan & Instructions:

1. Discuss why the students believe a compass points North as an introduction to the slides.
2. Present the Lecture Slides (annotated in detail on each slide). Have students take notes if you wish.
3. Demonstrate a magnetic dipole field by sprinkling magnetic filings onto a transparency sheet overlying a bar magnet. Project this onto the board for the class to observe.
4. Distribute pre-labeled rocks for the GPTS activity*. Have students form a line in order of the age of their rock sample. Pass out black paper to the students with Normal polarity rocks (positive VPG latitude) and white paper to the students with Reverse polarity rocks (negative VPG latitude). Ask students to hold their paper out in front of them and observe the pattern of magnetic polarity reversals (that look like a barcode). Alternatively, provide each student with a piece of tape and ask them to turn around and tape their paper to the wall. They can then step back and see the “barcode” stripe distribution.
5. Students then complete the Seafloor Magnetic Stripes Worksheet and answer the questions.
6. Present the remainder of the lecture, including the conclusions.

Seafloor Magnetic Stripes Plotting Exercise

Name KEY

Procedure:

1. In the lower grid, plot the 20 points listed in the Data Table on the right.
2. In the box above the grid, draw a Geomagnetic Reversal Timescale from the data plotted on the grid. To do this, use the data plotted on the grid to estimate the distances where the magnetic field switched its polarity (hint: every time the VGP latitude crosses 0 is a change in polarity). Shade in periods of Normal Polarity black, and let periods of Reverse Polarity be white. (Note: in the next lecture we will learn that distance corresponds to seafloor age).

Questions:

1. If magnetic reversals are recorded in the seafloor, what kind of rock must the seafloor be made of?

   The seafloor is made of volcanic rock that solidified from magma and/or lava.

2. What do you notice about the magnetic stripe pattern on each side of the Oceanic Ridge?

   The stripes are symmetric across the Oceanic Ridge. They create a mirror image.

3. What does this pattern suggest about how the seafloor forms?

   It suggests that new seafloor is formed in the middle (at the Ridge) and some of the new seafloor moves to each side of the Ridge forming a symmetric pattern.

Data Table

Distance from Oceanic Ridge (km)	VGP Latitude (deg.)
-156	82.9
-133	-88.5
-125	-80.5
-109	71.1
-85	-82.9
-76	12.7
-52	38.8
-39	86.9
-19	82.2
-8	60.4
10	58.4
21	84.0
38	87.4
60	40.2
76	9.6
87	-83.2
111	69.7
128	-78.8
136	-87.8
159	81.3