Modeling Seafloor Spreading

Overview

Students create models which show the formation of new oceanic crust through seafloor spreading and its destruction in subduction zones. They incorporate the concept of magnetic polarity reversal evident in the seafloor, one of many important pieces of evidence supporting the theory of plate tectonics. Extend / enrich activities are listed at the end of the lesson, including potential connections to life and physical science concepts and ways to incorporate current research on the possible links between seafloor spreading and climate change.

Subjects: Science, Writing, Speaking & Listening, Art, Environmental Education

Grades: 5 – 12

Duration: 40 – 75 minutes

Vocabulary
- Asthenosphere
- Lithosphere
- Magma
- Mid-ocean ridges (aka spreading centers and divergent plate boundaries)
- Subduction zones (aka convergent plate boundaries and deep-sea trenches)
- Tectonic plates
- Polarity

Guiding Questions

- What are some ways that the Earth is always changing?
- How is new seafloor created?
- How can seafloor provide evidence that the polarity of Earth's magnetic field has reversed periodically through time?
- Can changes in the climate affect the seafloor and vice versa?

Objectives

- Students will create models of ocean spreading centers and subduction zones.
- Students will demonstrate understanding of the following scientific principles through writing and discussion:
  - Seafloor spreading and how new seafloor is created and destroyed
  - How seafloor provides evidence that the polarity of Earth's magnetic field has reversed periodically through time
- *Optional:* Students will read about current research into the possible connections between seafloor changes and the climate, then form hypotheses to predict the possible connections between the seafloor and climate change.

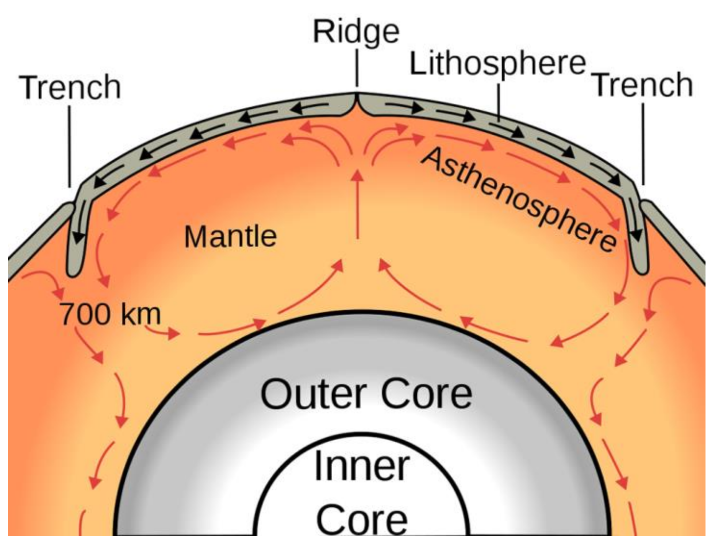


Illustration showing seafloor spreading at ridges and subduction at trenches
commons.wikimedia.org/wiki/File:Oceanic_spreading.svg

Next Generation Science Standards + Common Core State Standards		
NEXT GENERATION SCIENCE STANDARDS	**Performance Expectations**	**5-ESS2-1.** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **MS-PS1-4.** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. **HS-ESS2-3.** Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
	Crosscutting Concepts	• Cause and Effect • Energy and Matter • Stability and Change • Systems and System Models
	Science & Engineering Practices	• Developing and Using Models • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information
	Disciplinary Core Ideas	**ESS2.A: Earth's Materials and Systems** **ESS2.B: Plate Tectonics and Large-Scale System Interactions** **ESS2.D: Weather and Climate** **ESS3.C: Human Impacts on Earth Systems** **ESS3.D: Global Climate Change**
COMMON CORE STATE STANDARDS INITIATIVE PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER **ELA**	**Writing**	4, 10
	Speaking & Listening	1, 2
	Language Standards	1, 2, 3, 6
	Writing Standards Science & Technical Subjects	4, 7, 10
California's Environmental Principles and Concepts	**Principle III** **Natural Systems Change in Ways that People Benefit from and Can Influence** Natural systems proceed through cycles that humans depend upon, benefit from, and can alter. **Concept A.** Natural systems proceed through cycles and processes that are required for their functioning. **Concept B.** Human practices depend upon and benefit from the cycles and processes that operate within natural systems.	

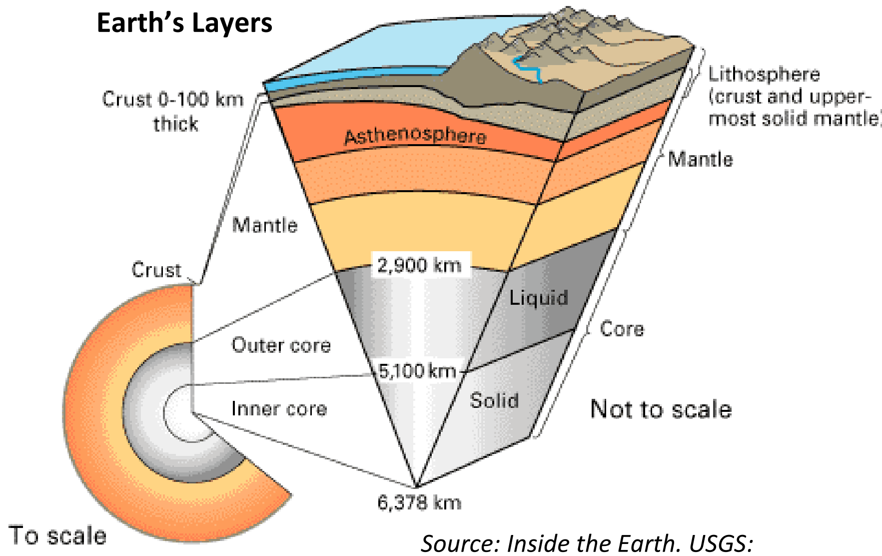
Teacher Background

Before creating their seafloor models, students should be familiar with these concepts:

- Types of boundaries between plates of the Earth's lithosphere
- Features of the ocean floor
- Seafloor spreading
- Earth's magnetic field and the principle that it has reversed its polarity many times in the past.

Earth consists of 3 main layers: the **crust**, the **mantle**, and the **core**. The outer 100 km or so is a rigid layer called the **lithosphere**, which is made up of the crust and uppermost mantle. The lithosphere is broken into **tectonic plates** that move over the **asthenosphere**, a plastic layer in the upper mantle. Earthquakes and volcanoes are concentrated at the boundaries between plates. It is thought that plate movement is caused by convection currents in the mantle, although the exact mechanism is not known. Plates are moving at rates of a few cm per year.

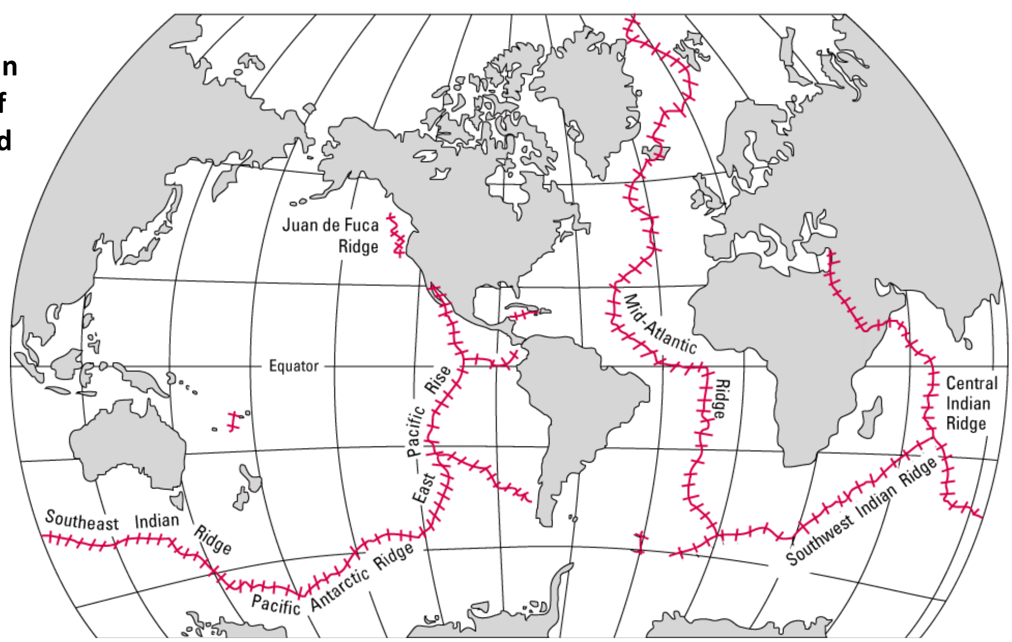
Earth's Layers



Source: Inside the Earth. USGS: pubs.usgs.gov/gip/dynamic/inside.html

The creation of new seafloor at **mid-ocean ridges** (aka spreading centers) is one of many cycles that cause the Earth to experience constant change. Spreading centers occur where two **tectonic plates** of the Earth's crust are moving away from each other. For this reason, they are also known as **divergent plate boundaries**, and they result in deep cracks in the crust. Mid-ocean ridges are found in all of the planet's ocean and on a map resemble the seams of a baseball.

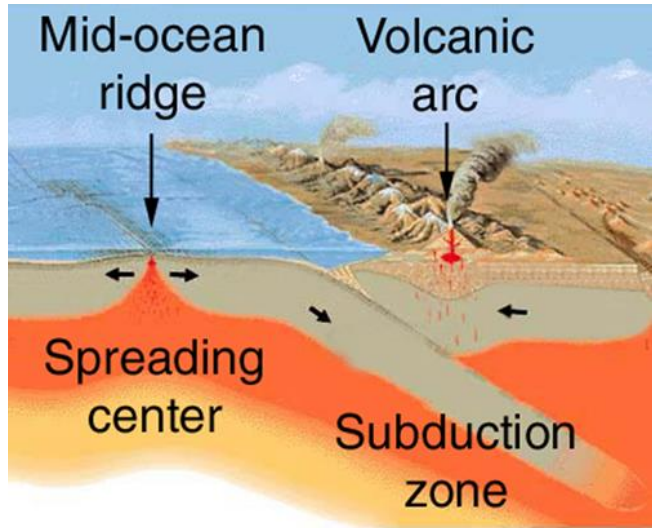
Mid-Ocean Ridges of the World



USGS: pubs.usgs.gov/gip/dynamic/graphics/Fig5.gif

Seafloor is constantly destroyed in **subduction zones** (aka **convergent plate boundaries**). New seafloor is made from **magma** (liquid rock) that rises from the mantle and cools to form solid **igneous** rocks.

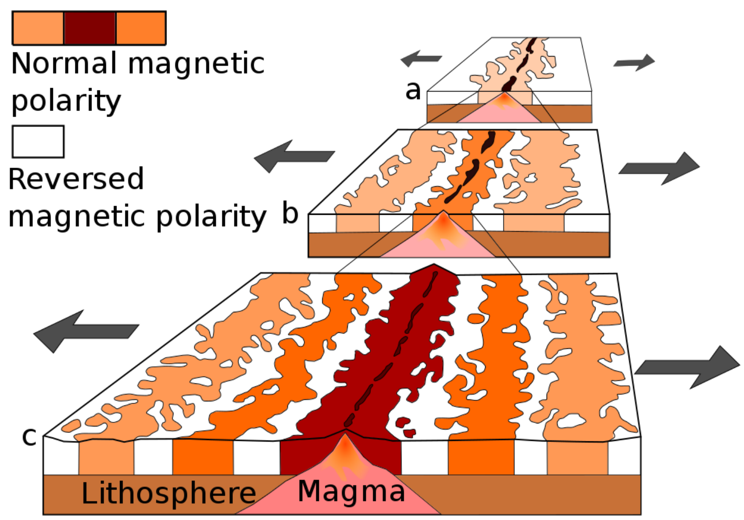
Creation and Destruction of Seafloor



NOAA: pmel.noaa.gov/eoi/nemo/education/curr_p1_09.html

The Earth has a **magnetic field**, which is thought to arise from the movement of liquid iron in the outer core of the planet as it rotates. The field behaves as if a magnet were located near the center of the Earth. Igneous rocks contain magnetic minerals, which align with the Earth's magnetic field. The magnetic minerals are like compasses in the magma, swiveling to point north, but they can no longer do so when the rock becomes solid. In this way, the geologic memory of the direction of magnetic north is forever locked in that rock.

All of the recently formed seafloor has magnetic minerals pointing toward the North Pole (**normal polarity**). But the magnetic minerals of older seafloor point toward the South Pole (**reversed polarity**). Amazingly, the magnetic minerals of even older seafloor point back toward the North Pole, and still older seafloor points back toward the South Pole! This alternating pattern of magnetic "stripes" continues on and on, and is found in all seafloor on Earth.



Wikipedia: en.wikipedia.org/wiki/Plate_tectonics

At first, this puzzled scientists, but now they think that Earth's magnetic field has reversed about once every 250,000 years. Thus, a compass would have pointed in the opposite direction during times of reversed polarity; the north magnetic pole would be what is today the south magnetic pole and vice-versa. The evidence for this is the magnetic memory of the magnetic minerals in the rocks of the seafloor.

Glossary

asthenosphere — a portion of the mantle which underlies the lithosphere. This zone consists of easily deformed rock and is about 180 km thick.

continental drift — The first hypothesis proposing large horizontal motions of continents. This idea has been replaced by the theory of plate tectonics.

convergent plate boundary (subduction zone) — a boundary between two lithospheric plates that move towards each other, with one plate subducting (diving) beneath the other. Such boundaries are marked by subduction, earthquakes, volcanoes, and mountain-building.

Curie point — the temperature (about 580˚ C) above which a rock loses its magnetism

deep-sea trenches — long, narrow, and very deep (up to 11 km) depressions oriented parallel to continents and associated with subduction of oceanic lithosphere

divergent plate boundary — a boundary between two plates that move away from one another; new lithosphere is created between spreading plates

hydrothermal vent communities (black and white smokers) —vents found at ocean spreading centers that are the sites of mineral deposits and unique ecosystems that exist in total darkness

lithosphere — the rigid, outermost layer of the Earth; includes crust and uppermost mantle and has an average thickness of about 100 km thick. Oceanic lithosphere is thinner and denser than continental lithosphere.

mid-ocean ridge — a continuous mountain chain on the floor of all major ocean basins which marks the site where new ocean floor is created as two lithospheric plates move away from one another

normal polarity — a magnetic field that has the same direction as the Earth's present one

paleomagnetism — the permanent magnetization recorded in rocks that allows reconstruction of the Earth's ancient magnetic field

Pangaea (Pangea) — the proposed "supercontinent" began to break apart about 200 million years ago to form the present continents

plate tectonics — the theory that proposes that the Earth's lithosphere is broken into plates that move over a plastic layer in the mantle. Plate interactions produce earthquakes, volcanoes, and mountains.

reversed polarity — a magnetic field with direction opposite to that of the Earth's present field

transform plate boundary — a boundary between lithosphere plates that slide past one another

sea-floor spreading — a hypothesis, proposed in the early 1960s, that new ocean floor is created where two plates move away from one another at mid-ocean ridges

subduction zone — a long, narrow zone where one lithospheric plate descends beneath another; synonym for convergent plate boundary described above

Materials + Preparation

- For each student:
    - "Modeling Seafloor Spreading" handout (found at end of lesson)
    - Two sheets of 8.5" X 11" paper; consider reusing printer paper ready to be recycled
    - Scissors; ideally with points to more easily cut in the middle of the paper sheets
    - Ruler
    - Tape (transparent or masking)
    - Colored pencils
- Draw a simple labeled model of a divergent plate boundary with a spreading center on the board, or prepare to show one with a data projector, such as:
    - gotbooks.miracosta.edu/oceans/images/spreading_center.jpg
    - oceanexplorer.noaa.gov/facts/plate-boundaries.html
- Make your own model ahead of time to show students before they make their models.
- ***Optional:*** Prepare to show other diagrams to help explain the concepts presented in the lesson, such as those shown in the "Teacher Background" section.
- ***Optional:*** Watch the videos below as additional background. You could also share one or more of them with your students and discuss them.
    - Sea Floor Spreading with Bill Nye and TEDEd lesson: ed.ted.com/on/rvOfVY7Q#watch
    - Magnetic Field Reversal youtube.com/watch?v=igGsuDYxhEA
    - Sea Floor Spreading Lecture by Renee Schreindl: youtube.com/watch?v=DZL5GWaLviY
    - Plate Tectonics Theory Lesson: youtube.com/watch?v=zbtAXW-2nz0

Teaching Suggestions in the 5E Model

Engage

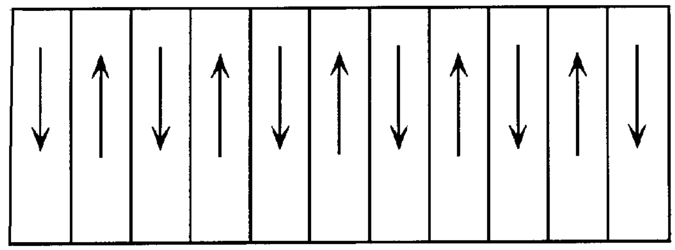
1. Ask students an essential question to engage them and prime them for the lesson, such as "What are some pieces of evidence that suggest the Earth changes over time?" Direct them to do a "Think, Pair, Share" in which they think about the question for a moment, jotting down their ideas on a piece of paper, then discuss the question with a neighbor.
2. Circulate to answer any questions. After a couple of minutes, ask for a few volunteers to share their thoughts, which might include canyons and how they were carved out by flowing water, or how volcanoes erupt and create new land, like what is often happening on the Big Island of Hawaii. You might share photos and/or videos of phenomenon such as these and discuss how the planet is ALWAYS changing, including at the very bottom of the oceans. Part of how that happens—and what it means for our planet and us—is what they will be investigating today.

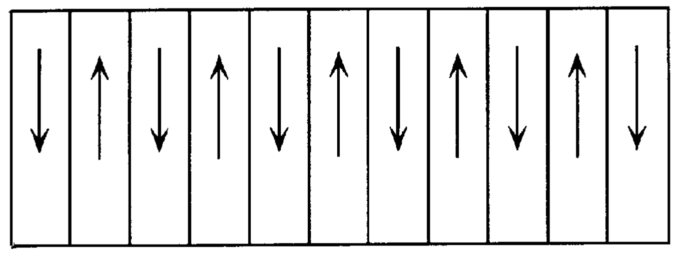
Explore

3. *Optional:* Before or after the students develop their models , ask them to view (or show the whole class) one or more visuals or videos to help explain the concepts presented in the lesson, such as:
    - Sea Floor Spreading with Bill Nye and TEDEd lesson: ed.ted.com/on/rvOfVY7Q#watch
    - Magnetic Field Reversal: youtube.com/watch?v=igGsuDYxhEA
4. Have students form groups of 2-4 while you pass out printer paper to them. Ask them to use the paper to create a model showing how the sea floor spreads away from a mid-ocean ridge, creating new seafloor.

Explain

5. After a couple minutes, ask one or two volunteers who have a good start on their models to explain them to the class. Tell the students that they have the option to be creative with their seafloor spreading models and continue creating them their own way, but first ask them to watch you demonstrate the following method that they can use or adapt:





a. Place one sheet of printer paper so that the long side is toward you.

b. Fold the paper in half, being careful to make the corners line up so the fold is exactly in the center.

c. Along the fold, draw a vertical line in the middle of the paper with a height of 11.5 cm, leaving 5 cm above and below the line. Explain that this line represents a mid-ocean spreading center, so label it "Mid-ocean ridge."

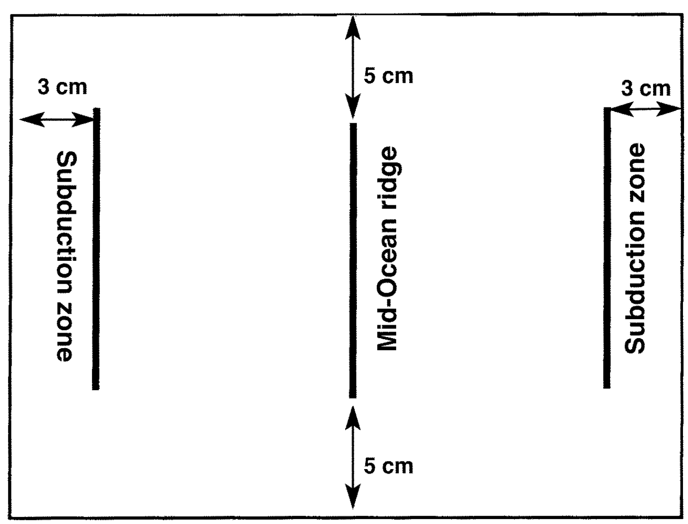
d. Draw a second vertical line 3 cm from the right edge of the paper; it should also be 11.5 cm, leaving 5 cm above and below the line. Explain that his line represents a subduction zone, so label it, as well.

e. Draw another 11.5 cm vertical line 3 cm from the left edge of the paper. Ask students what they think it represents, and someone should guess another subduction zone. Label it.

f. With a pair of scissors, cut slits in the paper along the 3 lines. (They should all be the same length and parallel to each other).

g. Demonstrate how to reinforce the slits: place tape over each and re-cut them.

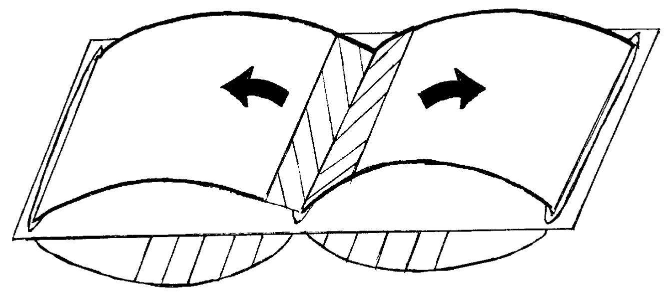
6. Demonstrate how students can create the rest of the seafloor model on the second sheet of paper:



a. Use the ruler to measure 2.54 cm (or 1 inch, just a hair over 2.5 cm) from the short edge of the paper. Continue making marks every 2.54 cm (1 in.) across the paper. Draw parallel lines from the edges of the paper through the marks to create 11 bands of the same width perpendicular to the long edge of the paper.

b. Choose one color pencil to represent normal polarity and a second to represent reversed polarity. Use them to color alternate bands representing periods of normal and reversed polarity. Color the band on the far left as reversed polarity.

c. Cut the paper in half parallel to the long edge to get two strips of paper as shown in the image to the right. Mark the bands on each strip with arrows to indicate alternating periods of normal (up arrow) and reversed (down arrow) polarity.



d. Insert an end of one of the strips of paper up through the spreading center line on your first piece of paper. Pull the strip towards one of the slits representing a subduction zones with the color bands showing. Insert the other end of the strip up through the slit representing the subduction zone and tape the two ends of the strip together to make a loop. Repeat the process with the other strip to make a second loop, as shown in the diagram above.

e. Circulate the ribbons of paper (which represent oceanic crust) to simulate the movement of ocean floor from the mid-ocean spreading center to the subduction zones. Start the movement of the ribbons with bands representing normal polarity, since that would be the polarity of new seafloor emerging at present.

7. Pass out copies of the handout "Modeling Seafloor Spreading" found at the end of the lesson. Explain that students can use it to help them remember the steps in the method of creating a seafloor model that you demonstrated, or they can create the model in another way. Students can borrow the other materials they need to complete the activity, such as scissors and a ruler.

8. Circulate through the room, answering questions—and asking them—to help students complete the project and better understand the process of seafloor spreading. They can then can clean up and complete the questions on the handout.

9. Give students a warning five minutes before they will have to start working. At that time, direct them to finish cleaning up and answering the questions.

10. Close by having students do a "Think, Pair, Share" about what they learned about how new seafloor is created and why scientists believe that the Earth's polarity has been switching roughly every 250,000 years (although the length of time between reversals has not been constant).

Extend / Enrich

- Explore the possible links between seafloor spreading and the Earth's climate with students. Ask them to read and discuss one or more articles about the topic, such as:
    - "Reading the Ridges: Are Climate and the Seafloor Connected?" Earth Magazine: earthmagazine.org/article/reading-ridges-are-climate-and-seafloor-connected
    - "Control of CO2 by Seafloor Spreading." Climate Policy Watcher: climate-policy-watcher.org/earth-surface-2/control-of-co2-by-seafloor-spreading.html
    - "New Seafloor Sponges Up Carbon to Stabilize the Climate." Deep Carbon Observatory: deepcarbon.net/feature/new-seafloor-sponges-carbon-stabilize-climate
    - "Climate Change Leaves Its Mark on the Sea Floor? Maybe Not." State of the Planet. Earth Institute, Columbia University: blogs.ei.columbia.edu/2015/10/15/climate-change-leaves-its-mark-on-the-sea-floor-maybe-not-study-says

You might also explore other possible connections between the seafloor and climate change and/or ask students to form hypotheses to predict the possible connections between the seafloor and climate change. Interesting articles highlighting different phenomenon being observed include:

- "Alterations to seabed raise fears for future." McGill University. Phys.org, Science X: phys.org/news/2018-10-seabed-future.html
- Sulpis, O. et al. "Current CaCO3 dissolution at the Seafloor Caused by Anthropogenic CO2." PNAS: pnas.org/content/115/46/11700
- "Undersea Gases Could Superheat the Planet." University of Southern California. ScienceDaily: sciencedaily.com/releases/2019/02/190213090812.htm

- For younger or less advanced students, omit the explanation of magnetic stripes and reversals of polarity. Use the model to show them the creation of new sea floor at spreading centers and the disappearance of old sea-floor at subduction zones. You may wish to cut the paper model pieces for the students ahead of time, or use a model you have made as a demonstration for the class.
- Have students draw diagrams of one or more of the processes discussed during the lesson. They can use colored pencils, crayons, and/or markers to color the illustrations—or computers with illustration software, if available. Have volunteers share their illustrations with the class.
- Have students reflect on why earthquakes and volcanoes occur at spreading centers and subduction zones. They can research the topics more fully and add details to their models.
- Share one or more books about the ocean floor with younger students, such as *The Magic School Bus on the Ocean Floor*: goodreads.com/book/show/110962.On_the_Ocean_Floor
- Integrate a unit on seafloor spreading and ocean floor topography with biology by having students research the unique creatures associated with **hydrothermal vent communities**, one of the most exciting discoveries made during recent decades of marine exploration. Also called **black and white smokers**, these vents are found at ocean spreading centers and are the sites of mineral deposits and unique ecosystems that exist in total darkness. Some suggested resources are listed below.
  - Hydrothermal Vent Communities, Radford University: php.radford.edu/~swoodwar/biomes/?page_id=1027
  - Hydrothermal Vent Communities lesson for grades 7-10: botos.com/marine/vents01.html
  - Barone, J. "In Search of Life's Smoking Gun." Nautilus: nautil.us/issue/25/Water/in-search-of-lifes-smoking-gun
  - Scearce, C. "Hydrothermal Vent Communities." CSA Discovery Guides: jvarekamp.web.wesleyan.edu/Vents.pdf

Evaluate

11. Ask students to explain what their models show (in writing in their science notebooks and/or orally), including how they relate to changes in the seafloor. You might also ask:

- "Based on observations of your sea-floor spreading model, why do you think that the oldest ocean floor is only about 200 million years old, even though the Earth is about 4.6 billion years old?"
- "On the real ocean floor, alternating stripes of normal and reversed polarity are not all of equal width. What does this tell you about the lengths of time represented by normal and reversed polarity?"

12. Review completed student models and/or written reflections, completed handouts, or other projects.

13. Lead a discussion about the guiding questions of the lesson and record student participation students could also reflect upon these questions in writing:

- What are some ways that the Earth is always changing?
- How s new seafloor created?
- How can seafloor provide evidence that the polarity of Earth's magnetic field has reversed periodically through time?
- Could changes in the seafloor affect the climate and vice versa?

Expand Knowledge + Skills

Seafloor Spreading

- Encyclopædia Britannica article about Seafloor Spreading: britannica.com/science/seafloor-spreading-hypothesis
- "Earth's Inconstant Magnetic Field" from NASA: science.nasa.gov/science-news/science-at-nasa/2003/29dec_magneticfield
- "Earth's Magnetic Field" diagram from NASA: nasa.gov/sites/default/files/images/607968main_geomagnetic-field-orig_full.jpg
- Oceanography 101, a free online textbook with excellent visuals from MiraCosta College: gotbooks.miracosta.edu/oceans/index.html
  - Plate Tectonics: gotbooks.miracosta.edu/oceans/chapter4.html
  - Much of the site's content provided by "Geology Café," an excellent natural resources website: geologycafe.com
- Wikipedia article about Plate Tectonics: en.wikipedia.org/wiki/Plate_tectonics
  - Original magnetic striping image: en.wikipedia.org/wiki/Plate_tectonics#/media/File:Oceanic.Stripe.Magnetic.Anomalies.Scheme.svg

Lessons / Units

- NeMO education activities/resources from NOAA: pmel.noaa.gov/eoi/nemo/education.html
- "Submarine Mountains," related lesson from Dr. Ellen Metzger: ucmp.berkeley.edu/fosrec/Metzger3.html
- "Think, Pair, Share" cooperative learning strategy details: teachervision.com/group-work/think-pair-share-cooperative-learning-strategy
- Video of a teacher showing a different model of seafloor spreading: youtube.com/watch?v=V0h8v2w3LGU
- Visual showing age of Earth's crust from NOAA: ngdc.noaa.gov/mgg/image/images/AtlanticAge.jpg
- California Education and the Environment Initiative curriculum: californiaeei.org/curriculum

Standards

- More examples of what NGSS looks like for high school students can be found in Chapter 7 of the *2016 Science Framework for California Public Schools:* cde.ca.gov/ci/sc/cf/documents/scifwchapter7.pdf
- More information about the Next Generation Science Standards, including a link to the *Framework for K-12 Science Education* to which this lesson was aligned, can be found at nextgenscience.org/framework-k%E2%80%9312-science-education.
- More information about the Common Core State Standards and links to the complete documents: corestandards.org

Appreciation + Thanks

Thank you for using Bay Area E-STEM Institute resources and helping to inspire the next generation of thinkers and scientists! We also greatly appreciate the support of the National Science Foundation, San José State University, and NASA.

We welcome your questions or comments.

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Bay Area E-STEM Institute
San José State University

Name: ______________________________ Period: ____ Date: ______________________

Modeling Seafloor Spreading

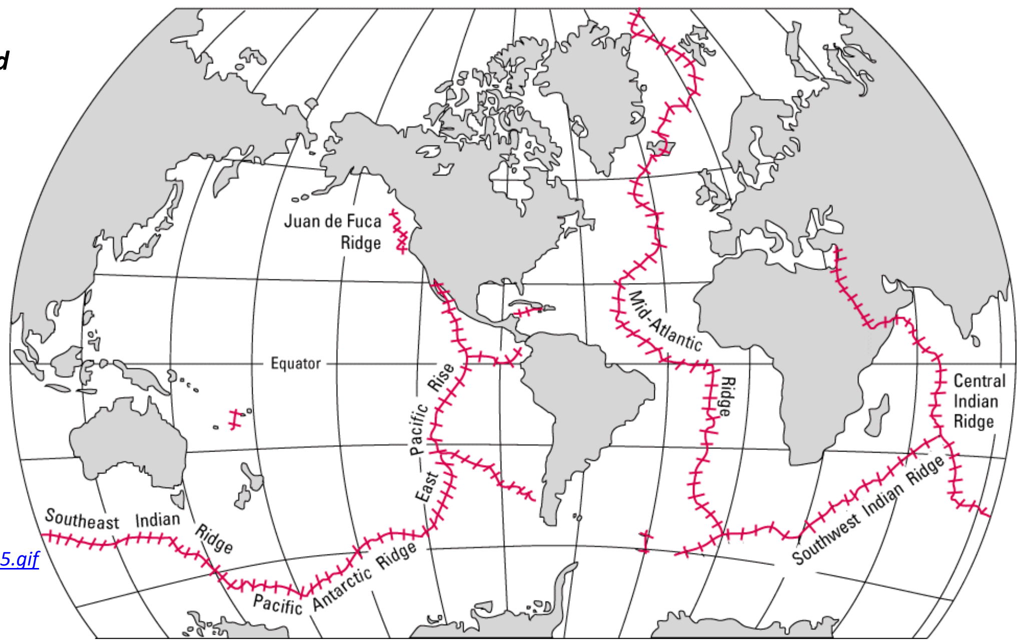
Your Challenge

1. Create a model of seafloor spreading and subduction zones using the steps below or your own method.
2. Use it and the information below to help you answer the questions at the end of the handout.

Background

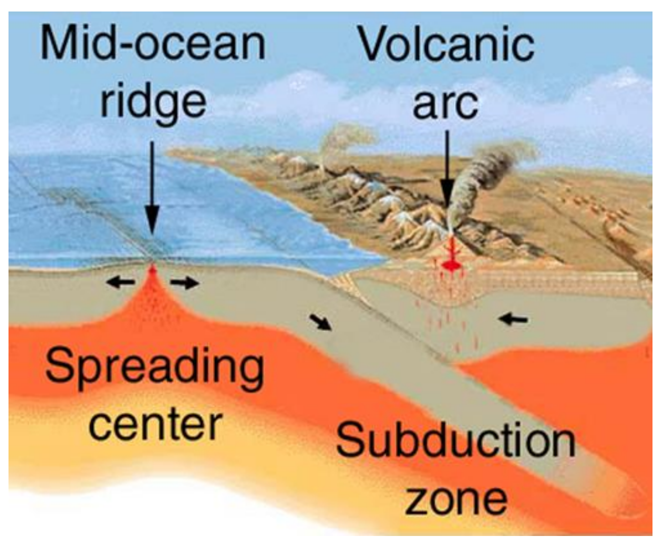
The creation of new seafloor at **mid-ocean ridges** (spreading centers) is one of many cycles that cause the Earth to experience constant change. They occur where two **tectonic plates** of the Earth's crust are moving away from each other. For this reason, they are also known as **divergent plate boundaries**, and they result in deep cracks in the crust.

Mid-Ocean Ridges of the World



Source: USGS: pubs.usgs.gov/gip/dynamic/graphics/Fig5.gif

Seafloor is constantly destroyed in **subduction zones** (also known as **convergent**—meaning coming together—**plate boundaries**). New seafloor is made from rising **magma** (liquid rock), that cools to form solid **igneous** rocks.



NOAA: pmel.noaa.gov/eoi/nemo/education/curr_p1_09.html

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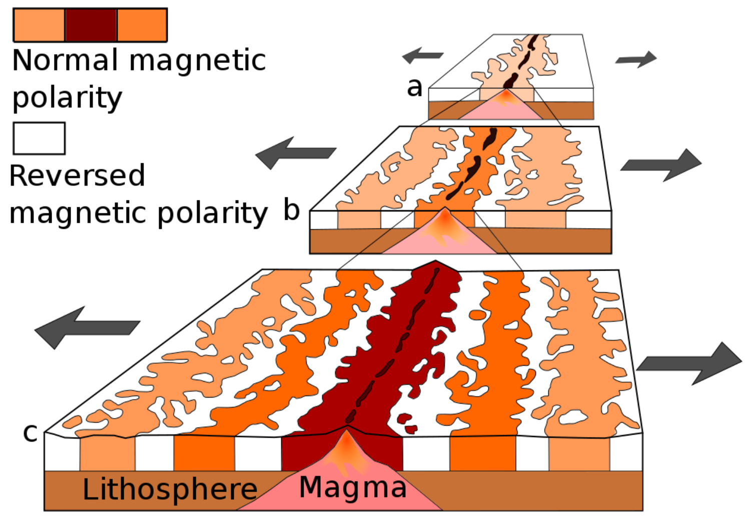
All of the seafloor formed recently has magnetic minerals pointing toward the North Pole (**normal polarity**). But the magnetic minerals of older seafloor point toward the South Pole (**reversed polarity**). Amazingly, the magnetic minerals of even older seafloor point back toward the North Pole, and still older seafloor points back toward the South Pole! This alternating pattern continues on and on, and is found in all seafloor on Earth.

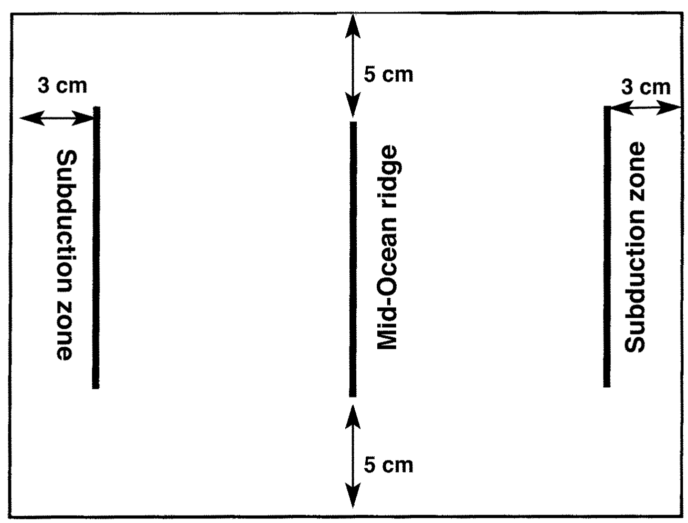
At first, this puzzled scientists, but now they think that Earth's magnetic field has flipped about once every 250,000 years. Thus, a compass would have pointed in the opposite direction during times of reversed polarity; the north magnetic pole would be what is today the south magnetic pole and vice-versa. The evidence for this is the magnetic memory of the magnetic minerals in the rocks of the seafloor.



Wikipedia: [*en.wikipedia.org/wiki/Plate_tectonics*](en.wikipedia.org/wiki/Plate_tectonics)

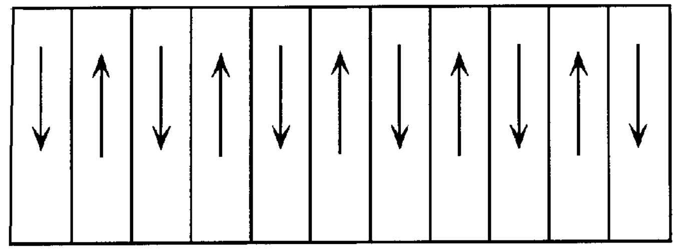
One Method of Creating a Seafloor Model

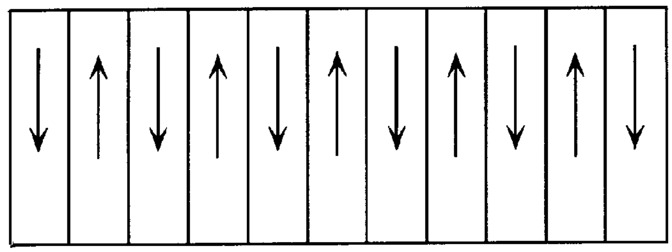
1. Place a sheet of paper in front of you with the long side toward you.
2. Fold the paper in half, being careful to line up the edges exactly. Then open the paper back up.
3. Draw a vertical line along the fold with a height of 11.5 cm, leaving 5 cm above and below the line. Label it "Mid-ocean ridge."
4. Draw a vertical line 3 cm from the right edge of the paper; it should also be 11.5 cm, with 5 cm above and below the line. Label it "Subduction zone."
5. Draw a matching "subduction zone" 3 cm from the left edge of the paper and label it.
6. With a pair of scissors, cut slits in the paper along the 3 lines.



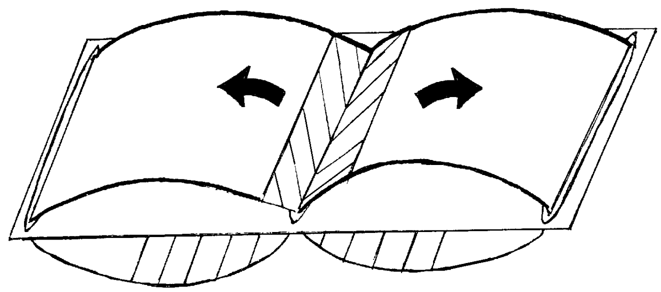
7. *Optional:* Reinforce the slits by placing tape over each and re-cutting them.
8. On a second sheet of paper, use the ruler to measure 2.54 cm (or 1 inch, just a hair over 2.5 cm) from the short edge of the paper. Continue making marks every 2.54 cm (1 inch) across the paper. Draw parallel lines from the edges of the paper through the marks to create 11 bands of the same width perpendicular to the long edge of the paper.
9. Choose one color pencil to represent normal polarity and a second to represent reversed polarity. Use them to color alternate bands representing periods of normal and reversed polarity. Color the band on the far left as reversed polarity.

10. Cut the paper in half parallel to the long edge to get two strips of paper as shown in the image to the right. Mark the bands on each strip with arrows to indicate alternating periods of normal (up arrow) and reversed (down arrow) polarity.





11. Insert an end of one of the strips of paper up through the spreading center line on your first piece of paper. Pull the strip towards one of the slits representing a subduction zones with the color bands showing. Insert the other end of the strip up through the slit representing the subduction zone and tape the two ends of the strip together to make a loop. Repeat the process with the other strip to make a second loop, as shown in the diagram to the right.



12. Circulate the ribbons of paper (which represent oceanic crust) to simulate the movement of ocean floor from the mid-ocean spreading center to the subduction zones. Start the movement of the ribbons with bands representing normal polarity, since that would be the polarity of new seafloor emerging in our geologic era.

Think About It!

1. What does your model show? Why are those processes important for Earth?

2. Earth is about 4.6 billion years old. Based on observations of your model, why do you think that the oldest ocean floor is only about 200 million years old?

3. On real seafloor, alternating stripes of polarity are not all of equal width. What does this tell you about the lengths of time represented by normal and reversed polarity?

4. Illustrate how the Mid-Atlantic Ridge emerges and changes the seafloor. Use arrows to show movement.