SCIENCE

Lesson 4

Year 9

Topic: Investigating tectonic processes

Representing diverging plate boundaries

Today you will:

- ► explain events and processes occurring at divergent plate boundaries.

Resources

There are no additional resources required for this lesson.

Key terms

divergent plate boundaries, magma, mid-ocean ridge, rift valley, volcano

For definitions and explanations of terms, please see the Glossary.

Lesson

Model sea floor spreading

Recall from an earlier lesson that evidence of sea floor spreading was pivotal in changing scientific ideas about the movement of continents. If you have access to the required materials you can make the model shown below to demonstrate sea floor spreading. While the model will help you to see some aspects of what occurs at a diverging plate boundary, the questions related to the model and other items in the lesson do not require you to construct the model. Follow the instructions below if you are making the model. Otherwise continue the lesson from item 2 onwards.

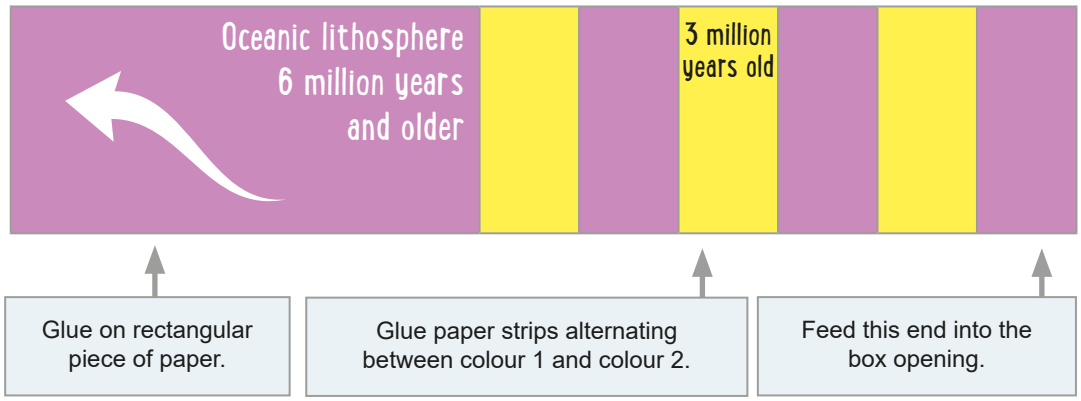


1. a. Collect your materials. You will need the following:
    - tissue box (or shoebox with lid)
    - 2 sheets of paper (different colours)
    - thick cardboard
    - scissors
    - glue

b. Construct the model using the instructions below.

Model instructions

1. Cut two 10 cm × 30 cm rectangular pieces of cardboard.
2. Cut two 10 cm × 20 cm rectangular pieces of coloured paper (colour 1).
3. Glue each rectangular paper piece onto the end of each piece of cardboard, as shown in the diagram below.
4. Cut six strips (1 cm × 10 cm) of coloured paper (colour 1).
5. Repeat step 4 for the other coloured paper (colour 2).
6. Glue the coloured pieces onto the cardboard as per the diagram below.



7. You should now have two cardboard rectangles that look like the above diagram. These represent the oceanic lithosphere (ocean crust plus upper part of the mantle forming a tectonic plate).
8. Using scissors or a craft knife, score the underlying cardboard between the thin paper strips so that it will bend.
9. Cut an opening if necessary in the top of the box. Make it big enough for both cardboard rectangles to fit into the box and feed out.
10. Slowly slide the two cardboard rectangles away from each other to demonstrate how convection currents push magma up through the mid-ocean ridge, forcing the plates apart and creating new ocean floor.

2. Answer the questions below about your model.

a. What does each part of the model represent?

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b. Why are the strips of paper on the model alternating colours?

c. Which strips on the model would represent the oldest rock?

Represent and explain events at divergent boundaries

Diverging plate boundaries

At the boundary between diverging plates, heated magma rises in a zone called the central plume. Convection currents move away on either side of this zone, pulling the plates apart and pushing magma towards the surface. Tectonic processes occurring at divergent boundaries form different geological features, depending on whether the lithosphere is continental or oceanic.

3. Go to the **Website — Plate tectonics (National Geographic)** https://www.nationalgeographic.org/media/plate-tectonics/ and view the first section of the video on diverging plates (up to 3:11).

4. Go to **Website — US Geological Survey 'Understanding plate motions'** https://pubs.usgs.gov/gip/dynamic/understanding.html. Read through the information which gives a more detailed explanation of the four different plate boundaries.

5. Use the information from the websites to answer the following questions.

	True	False
a. The mid-ocean ridge system occurs at divergent boundaries where tectonic plates are moving apart.	☐	☐
b. Divergent boundaries only occur between oceanic plates.	☐	☐

c. Where on land are scientists able to study the same processes occurring along the submerged parts of the mid-ocean ridge system?

d. Describe the tectonic processes occurring in Africa that will eventually lead to flooding of the Great Rift Valley, making the easternmost corner of Africa an island.



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Northern Tanzania, inside the Great Rift Valley.

6. Go to the **Website — Divergent plate boundaries (Geology.com)** https://geology.com/nsta/divergent-plate-boundaries.shtml. Read the text and play the animations to learn about the different geological features formed at diverging plate boundaries.

Remember, the terms magma and lava mean different things. **Magma** is semi-molten or 'plastic' rock in the inner mantle that is prevented from melting by the pressure of the upper mantle. **Lava** is melted or molten rock flowing on the surface of Earth.

7. Use the model of sea floor spreading from earlier in the lesson and/or the website information, to answer the following questions.

   a. In the model and/or animation on the website, the lithosphere at oceanic plate boundaries rises above the ocean floor, forming a ridge, before spreading out to either side. Explain what causes the mid-ocean ridge and sea floor spreading.

   b. What features are characteristic of diverging plate boundaries that occur:

      i. on land?

      ii. in the ocean?

   c. Explain why volcanic activity that may occur at divergent boundaries, is generally non-explosive.

Reflection

Divergent plate boundaries are places where two lithospheric plates are moving away from each other. Rifts, mid-ocean ridges, magnetic striping, non-explosive volcanoes and shallow earthquakes are common.