Investigation 9.2
Plate Tectonics and Crustal Features

What is plate tectonics?

Many of Earth’s crustal features can tell you a lot about the shape, size, and behavior of tectonic plates. In this investigation you will identify crustal features on your bathymetric map to identify different kinds of tectonic plate activity at plate boundaries.

1 Convection cells and moving tectonic plates

Earth’s tectonic plates are constantly moving. This motion is caused by convection cells in the mantle. Material in the mantle becomes heated close to the core, which causes it to rise. Newly heated material below it pushes it up toward the lithosphere and Earth’s tectonic plates.

The heated material moves under the plates in a zone called the asthenosphere and drags the plates along with it as it moves. The heated material eventually cools enough to begin sinking back toward the core, where the process repeats itself. Different convection cells circulate in different directions, and this is the key to what happens at tectonic plate boundaries.

The plates can move toward one another, causing a subduction zone, or they can move away from one another which produces a mid-ocean rise. These crustal features will appear at a plate boundaries and are an excellent way to identify the direction of motion of two plates at a boundary.

Mid-ocean ridges, deep-ocean trenches, and mountain ranges are great indicators of tectonic plate motion. You will be identifying these features on your bathymetric map in the following section.

2 Divergent plate boundaries

Mid-ocean ridges are crustal features that occur at a divergent plate boundary. A divergent plate boundary occurs when convection cells cause two adjacent plates to move in opposite directions away from
one another. When this happens material from the mantle comes to the surface to fill in the space left behind from the two plates moving apart, and can cause mid-ocean ridges, rises, island chains, and volcanoes to form.

1. Chose one color of pencil to indicate mid-ocean ridges on your bathymetric map.
2. Find examples of mid-ocean ridges on your bathymetric map and color those areas with the colored pencil you have selected. Include long mid-ocean rises as well. These are similar to ridges, just not quite as big.

### 3 Convergent plate boundaries

Converging plates produce mountain ranges, deep-ocean trenches, and even islands. These trenches indicate a subduction zone as one plate slides beneath another. See in the diagram below how this takes place.

1. Select a color to indicate deep-ocean trenches on your bathymetric map.
2. Find examples of deep-ocean trenches on your bathymetric map and color those areas with the colored pencil you have selected.

### 4 Thinking about what you have observed

a. Examine your marked map. Can you begin to see the boundaries of Earth’s seven major tectonic plates? Lightly sketch in pencil on your map where you think the boundaries are.

b. The Himalayan Mountains are a crustal feature that demonstrates a special case in convergent plate boundaries. Find them on your map and color them in a dark color. Does this help you in identifying tectonic plate boundaries?

c. Your teacher will show your class an image of the seven major tectonic plate boundaries. How did the boundaries you found on your map compare to the boundaries shown in this image?
d. Label on your map the obvious convergent and divergent plate boundaries. Label any areas you are not sure about “difficult” boundaries.

e. What made the difficult boundary areas challenging to label?

f. We have identified seven major tectonic plates based on obvious convergent and divergent plate boundaries. Would you be surprised to find out there are several smaller plates that are responsible for some of the most active geologic activity on Earth’s surface? Using your map predict the general location of these smaller and dynamic plates.

g. We discussed seven major tectonic plates in this investigation but a case made for eight major plates. If you had to predict where the boundary would be that creates the eighth major plate, where would you predict it to be?

h. There is a third type of boundary. Research the term transform fault boundary. Describe what it is, what makes it different from convergent and divergent boundaries, and give two examples of a transform fault boundary.