

## BACK TO THE BIG QUESTION INTRODUCTION

### Learning Set 3

□  $\frac{1}{2}$  class period\*

## Back to the Big Question

### Overview

Students revise their initial explanations of how the changes in the region of their Earth structure occur and update their class's *Project Board*.

\*A class period is considered to be one 40 to 50 minute class.

Targeted Concepts, Skills, and Nature of Science	Performance Expectations
Scientists often work together and then share their findings. Sharing findings makes new information available and helps scientists refine their ideas and build on others' ideas. When another person's or group's idea is used, credit needs to be given.	Students work in their groups to revise their explanations for how the changes at their Earth structure and their Earth structure's group occur.
Scientists must keep clear, accurate, and descriptive records of what they do so they can share their work with others and consider what they did, why they did it, and what they want to do next.	Students should use their records of data, and explanations to revise their initial explanation for how the changes at their Earth structure and their Earth structure's group occur.
Explanations are claims supported by evidence, accepted ideas, and facts.	Students should revise their explanations from <i>Learning Set 1</i> for how the changes at their Earth structure and their Earth structure's group occur.
Earthquake activity, volcanic activity, and topography are all evidence that Earth's crust is moving and changing.	Students' explanations should provide information about earthquakes being evidence for changes in Earth's crust.
Interactions between Earth's crustal plates can result in mountain-building, rift valleys, and geologic activity such as earthquakes and volcanoes. Underwater volcanic activity may form underwater mountains, which can thrust above the ocean's surface to become islands.	Students' explanations should provide information changes occurring along plate boundaries.

### Materials

- 1 per student     *Create Your Explanation* page
- 1 per student     *Project Board* page
- 1 per class        class *Project Board*

## Homework Options

### Preparation for Learning Set 4

- **Science Content:** What is occurring under Earth’s crust to cause its plates to move? *(The purpose of this is to elicit students’ initial ideas about what is occurring in the mantle to cause the tectonic plates to move. Students will learn about convective currents in the next Learning Set.)*

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## BACK TO THE BIG QUESTION IMPLEMENTATION

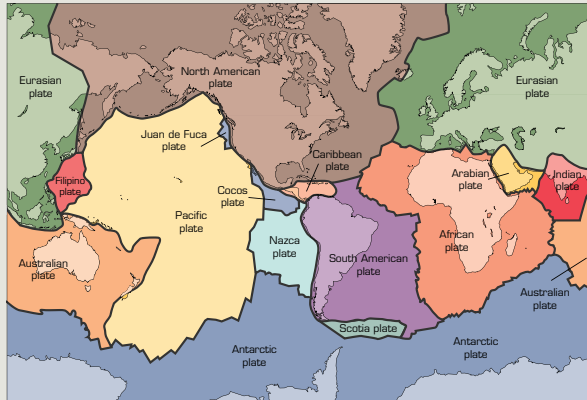


## Learning Set 3

## Back to the Big Question

The *Big Question* for this Unit is *How can you explain the changes happening around the regions of certain earth structures?* In *Learning Set 1*, you started to explain the changes that have occurred, or are continuing to occur, at your Earth structure to your pen pal. Since then you have learned so much about the Earth's crust and its interior, the plates that make up the crust, and what happens with these plates move.

One thing that commonly happens along plate boundaries is earthquakes. You have been using earthquakes data to identify the plate boundaries near your earth structures. Your Earth structure team collaborated with others to produce a world-wide map of Earth's crustal plates. Now you will revise and refine the explanation you started in *Learning Set 1*, using the new information and evidence you have gained.



ES 131

EARTH STRUCTURES AND PROCESSES

□  $\frac{1}{2}$  class period

## Learning Set 3

## Back to the Big Question

5 min.

*Introduce students to this section.*

### Engage

Remind students of the Unit's *Big Question*: *How can you explain the changes happening in the region of your Earth structure?* Then, ask groups their explanations from *Learning Set 1* for the changes occurring in the region of their Earth structure. Record some of the initial ideas for the class to see.

Ask students how their ideas have changed. Then, let them know that they will be revising their explanations and updating their class's *Project Board*.

Have the class's *Project Board* on display and point out where it is. Let students know they may want to refer to their *Project Board* as they are revising their explanations.

## Revise Your Explanation

10 min.

*Have groups revise their explanations of the changes occurring in the region around their Earth structure.*

### Revise Your Explanation

Using the plate boundary predictions agreed upon by your Earth structure team and the world-wide map of Earth's plates, revise the explanation you wrote to your pen pal in *Learning Set 1*. Include a description of your Earth structure in relation to the plate boundaries you identified that are close to it. You should also describe the pattern of earthquakes in the region. When you have completed that, compare your Earth structure to other Earth structures that share the same pattern of earthquake activity. Add any additional evidence from this comparison to your explanation.

Do not forget to support any new claims you make with evidence, including the science that you have learned about the plates making up Earth's crust and what happens when these plates meet. Your work with earthquakes, including all of your data collection, should provide you with ample evidence to support your claims. As with your first attempt at creating an explanation, use hints on the *Create Your Explanation* page. You will also have the opportunity to revise your explanation further as you continue to learn about the movements and changes that occur where Earth's plates come together.

### Update the Project Board

The *Project Board* will be a valuable tool to use as you revise your explanation. It is also a good time to update the information on the *Project Board* with new information and evidence. At this point, you most likely have some items to add to the column, *What does it mean for the challenge or question?*

How can you explain the changes happening around the regions of certain Earth structures?				
What do we think we know?	What do we need to investigate?	What are we learning?	What is our evidence?	What does it mean for the challenge or question?

### △ Guide

Let students know that they should include a description of their Earth structure in relation to the plate boundaries they identified that are close to it, a description of the pattern of earthquakes in the region, and a comparison between Earth structures that share the same pattern of earthquake activity.

Emphasize that they need to support their claims with evidence.

## Get Going

Distribute to students the *Create Your Explanation* pages and let groups know how much time they have to revise their explanations.

## Guide

When students have completed their explanations, have a brief class discussion on their explanations and use this discussion to transition to updating the class's *Project Board*.

Some may include in their explanations the following:

- What is a plate boundary? What happens at plate boundaries?

A plate boundary is the place where two plates meet. Earthquakes and volcanoes happen at these boundaries. Crust is added and crust is taken away at these boundaries.

- Where is your Earth structure in relation to your plate boundaries?

Most of the Earth structures are near or on a plate boundary. Some are not. Hawaii, for example, is not. Encourage the students to think about why. Ask students if they think the changes happening at Hawaii and Mt. Fuji, which is on the boundary, are happening in the same way. Students should be starting to see that there are different patterns of change at different Earth structures.

- How would you describe how and why there are earthquakes happening at or near your Earth structure?

In future *Learning Sets* students will start to categorize the different patterns in earthquakes and volcanoes that they are noticing at different Earth structures and plate boundaries. Different kinds of movement result in different patterns of earthquakes and volcanoes and therefore different Earth structures. Students may even be trying to describe some preliminary models, for example, one plate is sliding under another plate, or one plate is sliding past another plate.

You may want to remind students that in the Unit Introduction, the Alps were described as a great mountain range near the border between two colliding plates that are pushing up the mountains, and the Aleutian Range noted for volcanic activity that occurs near two colliding plates where one plate is diving under the other plate creating a deep trench.

### META NOTES

Students will learn more about plate interactions and zones in later *Learning Sets*.

## Update the Project Board

10 min.

Have the class update their Project Board.

**Update the Project Board**

The *Project Board* will be a valuable tool to use as you revise your explanation. It is also a good time to update the information on the *Project Board* with new information and evidence. At this point, you most likely have some items to add to the column, *What does it mean for the challenge or question?*

How can you explain the changes happening around the regions of certain Earth structures?				
What do we think we know?	What do we need to investigate?	What are we learning?	What is our evidence?	What does it mean for the challenge or question?

### △ Guide

Ask the class what claims and evidence from their explanations are not yet listed on their class's Project Board. Then update columns three (*What are we learning?*) and four (*What is our evidence?*) based on their responses.

Ask students what parts or whole explanations should they place in column 5 (*What does it mean for the challenge or question?*) and update this column of the class's Project Board.

Then ask students what questions they now have that they want to add to the second column (*What do we need to investigate?*).

### ◇ Evaluate

By this time students should have questions in column two about what is going on in the mantle to cause the plates to move, questions about the relationship between earthquake patterns and Earth structures, questions about how plates are interacting to cause types of Earth structures, and questions about the significance of volcanoes.

In columns three and four students should have their observations of earthquake patterns, information about what causes an earthquake, observations of earthquake patterns, determining plate boundaries, and how earthquakes are measured and described.

In column 5 students should list ideas from their explanations and their impact on the *Big Question*.

### Teacher Reflection Questions

- What difficulties did students have with interpreting and applying the Mercalli Scale.
- What pros and cons occurred with this independent activity?
- What management issues arose with this independent activity and what ideas do you have on how to address these next time?