

Master Teacher Name: Tamar Burris

Lesson: Under My Feet

Grade Level: 5

Time Allotment: 1 hour



Overview: In this lesson students will discuss the layers of the earth and discover that over 200 million years ago all the continents were grouped in one large land mass. They will then watch a video that explains the origin of tectonic plates and describes what happens when plates collide and shift. After watching the video they will participate in an interactive Web activity that will explain the different types of plate movements and then will use clay in a hands-on culminating activity that will further explain these different types of movements.

Subject Matter: Science

Learning Objectives:

Students will be able to:

- Identify the parts of the earth (crust, mantle, and core);
- Describe how the earth's continents were formed;
- Explain the differences between divergent, convergent, collisional, and transform boundaries; and
- Demonstrate the actions of divergent, convergent, collisional, and transform boundaries

Standards:

The following standards were taken from the State of Montana Office of Public Instruction Web site at <http://www.opi.state.mt.us/>

State of Montana Science Content Standard 2: Students demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.

Benchmark – *Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound, and mechanical waves.*

Science Content Standard 4: Students demonstrate knowledge of the composition, structures, processes, and interactions of the Earth's systems and other objects in space.

Benchmark – *Describe and give examples of Earth's changing surface; Model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics*

Media Components:

Video

Discovery Channel School: TLC Elementary: Understanding Geography

Web Site

A Science Odyssey: Mountain Maker, Earth Shaker

<http://www.pbs.org/wgbh/aso/tryit/tectonics/#>

This interactive PBS Web site teaches students about the theory of plate tectonics as well as the differences between divergent, convergent, collisional, and transform boundaries.

Materials:

Per Class:

- Apple
- Large world map

Per Student Group:

- Drop cloth or newspaper to cover group table
- Baking pan or cardboard box (about 9" by 12")
- 3-4 cups of sand
- 2 colors of modeling clay (enough to roll into slabs, each about ½" thick, 6" wide and 12" long)
- Rolling pin

Prep for Teachers:

- Load video and cue to the audio cue of "Scientists believe that more than 200 million years..." and a visual cue of earth's plates pulling apart.
- Bookmark <http://www.pbs.org/wgbh/aso/tryit/tectonics/#>

When using media, provide students with a Focus for Media Interaction, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

Introductory Activity:

1. Show an apple to the class and ask students to describe some similarities between the apple and the earth. Cut the apple in half and show one half of the apple to your students. Explain that, like an apple, the earth has several different layers, the crust, the mantle, and the core. The top layer of the earth is called the crust. This outer shell is similar to the skin on an apple. (*Point to the apple skin*) Underneath the crust is the mantle; this is where many rich minerals can be found, similar to the vitamins found in the flesh of an apple. (*Point to the apple flesh*) And at the very center of the earth is the core. (*Point to the apple core*) The core is filled with hot, molten lava.

2. Show students a large map of the earth and point out the different continents and oceans that are found on earth's crust. Tell your students that scientists believe that at one point in history, all of the earth's continents were joined together in a large land mass. According to scientific theory, about 200 million years ago the land mass began to break apart. Ask students why they think this land mass broke apart. Ask your students if they think that the earth's crust is continuing to shift and change. If they do, ask them for examples of the changes that are taking place.

Learning Activities:

1. Explain to the class that they will be watching a video about the movements of the earth. Set the Focus for Media Interaction: After watching this video I want you to answer the following questions. What is Pangaea? How did tectonic plates form? Why do earthquakes and volcanoes occur? PLAY the tape starting with an audio cue of "Scientists believe that more than 200 million years..." and a visual cue of earth's plates pulling apart. END the tape with an audio cue of "We're just along for the ride" and a visual cue of an image of a long fault line.

2. Ask students to answer your focus questions. "What is Pangaea?" (*The giant land mass scientists believe existed more than 200 million years ago*) "How did the tectonic plates form?" (*Many years ago, the movement of the molten rock below the lithosphere caused the lithosphere to break into pieces called tectonic plates*) "Why do earthquakes and volcanoes occur?" (*Scientists believe that earthquakes and volcanoes occur when tectonic plates collide or slip past one another*)

3. Talk about the tectonic plates with your students. Explain that the earth's plates are constantly at motion. Even though this motion is too small for normal people to detect on a given day, we can feel and see indicators of when the tectonic plates meet. Explain that tectonic plates move in different ways and that the different interactions of the tectonic plates create different geographic formations, such as mountains or valleys. Divide students into groups of 3-5 and have these groups log on to <http://www.pbs.org/wgbh/aso/tryit/tectonics/#> Before allowing them to click on the "Plate Tectonics Activity," Set the Focus for Media Interaction: Tell students that after completing the Plate Tectonics Activity they will need to explain where divergent, convergent, collisional, and transform boundaries occur.

4. Have students click on "Plate Tectonics Activity." Give them about 15 minutes to complete the whole activity and explore the four different ways tectonic plates meet. If any groups finish early encourage them to read the other sections of the Web site on plate tectonics. Once students have completed the activity, ask them to answer your focus questions. "Where do divergent boundaries occur?" (*Also called spreading boundaries, divergent boundaries occur where two tectonic plates move apart, opening up a gap that is filled in by molten lava*) "Where do convergent boundaries occur?" (*Convergent boundaries occur where two plates are pushed together and one plate slides under the other. This process is also called subduction.*) "Where do collisional boundaries occur?" (*Collisional boundaries occur where two plates are pushed together. Because they are both trying to occupy the same space, the plates buckle and fold, creating mountains.*) "Where do transform boundaries occur?" (*Transform boundaries occur where the edges of two plates slide against one another. Instead of sliding smoothly, the plates build up tension and slide in bursts and spurts, creating earthquakes*) Ask students such questions as "Why do you think divergent boundaries are also called spreading boundaries?" (*Because the plates spread apart*)

Culminating Activity:

1. Keeping students in their groups of 3-5, have them move to a workspace and cover the table with a drop cloth or newspaper. Give each group a baking dish or cardboard box and sand and have them pour the sand into their container. Pass out the rolling pin and the clay and have the groups roll their clay into slabs about ½" thick, 6" wide and 12" long. Make sure all student groups have two different colors of clay and have made 1 slab from each color.

3. Tell students that these slabs of clay represent tectonic plates and the sand in the box represents molten lava. Have students place these "plates" in their containers full of sand and tell them that they will be demonstrating the different plate movements in their containers. Have students arrange their two "plates" so that the edges touch one another and instruct them to slowly push the slabs into each other. "What happens to the plates when you slowly push them into each other?" (*They buckle and fold*) "What kind of land formation does this look like?" (*Mountains*) "What is this type of tectonic plate movement called?" (*Collisional, or folding*)

4. Have students remove their plates from the container and reform them. Ask them to again place their plates in the container in such a way that the edges of the plates are touching. This time, instead of pushing the plates together, have the students try to carefully and slowly slide them past each other, being sure to keep the edges touching. "Do the plates slide smoothly?" (*No*) "What happens?" (*The plates bump and jerk past one another, the edges of the plates become misshapen and torn*) "What kind of natural disaster does this remind you of?" (*An earthquake*) "What is this kind of tectonic plate movement called?" (*Transform boundaries*)

5. Have the students again remove their slabs of clay from the containers and reshape them. This time when putting the clay back in the containers instruct students to place one edge of a plate underneath the edge of the other one. Have students slowly push the slabs toward one another. "What happens to the plates?" (*One slides below the other one*) "What is this process called?" (*Convergence or subduction*)

6. Have students again remove their clay from the containers and reshape them. Ask them to again place their reformed plates back in the container with the edges touching. Ask them to slowly pull the two plates apart. "What happens?" (*The sand, or molten lava, fills in between the plates*) Explain that this is like seafloor spreading; molten lava comes in and fills in the gaps between the tectonic plates. "What is this process called?" (*Divergent or spreading boundaries*)

7. Have students clean up their materials and allow them to talk about some examples of tectonic movements they have seen (*Perhaps the San Andreas fault, Rocky Mountains, cracks in the pavement outside, etc.*)

Cross-Curricular Extensions:

Science/Art

Build model volcanoes

Science/Social Studies

Research the formation of the Ring of Fire and other major volcanoes around the world

Science/Math

Research the distance the plates have shifted each year for the past 100 years and have students graph the changes

Science/Language Arts

Write creative essays about life on Pangaea

Community Connections:

- Invite a geologist to the classroom to discuss plate tectonics and the layers of the Earth
- Invite a seismologist to the classroom to talk about earthquakes and earthquake prediction
- Invite a scuba diver or marine biologist to the classroom to talk about the geological formations found on the seafloor
- Visit a museum or Exploratorium with an exhibit on the Earth