WHERE ARE YOU TRAVELING TODAY? PLATE TECTONICS

Subject Matter: Earth Science
Grade Level: 9
Time Allotment: Three 50-minute class sessions
Master Teacher: Susan Daugherty

Overview

Where are you traveling today? You live on a landmass that is moving very slowly. How do we know? Ocean fossils have been found on mountain peaks and tropical plant fossils have been found where temperatures rarely reach above freezing. In this lesson, students will learn more about plate tectonics using a number of interactive Web and video resources.

Learning Objectives

Students will be able to:

- Identify the evidence supporting the theory of plate tectonics.
- Explain and diagram the divergent, convergent and transform plate boundaries.
- Identify the direction of the movement of the major tectonic plates.

Oregon Standards Available at:

http://www.ode.state.or.us/cifs

Subject – Earth Science

Understand physical properties of the Earth, how those properties change and the Earth's relationship to other celestial bodies.

The Dynamic Earth

- Understand changes occurring within the lithosphere, hydrosphere and atmosphere of the Earth.

Media Components

Video

Check the link at http://www.opb.org/edmedia/trs/ to find access to the video(s) from unitedstreaming™ referenced in this lesson plan.

- "Continents Adrift: An Introduction to Continental Drift and Plate Tectonics" (26:05)

- **Clip:** "Pangaea: The History of the Continents" (02:23)
- **Clip:** "The Ocean Floor: Clues About Continental Drift on Earth" (02:40)
- **Clip:** "Plate Tectonics (01:21)
- **Clip:** "How the Inner Structure of Planet Earth Affects Plate Tectonics (05:43)

Web

- **The Earth 250 Million Years Ago**
  An interactive map game in which the continent name is displayed and the player must chose the correct continent.
  http://kids.earth.nasa.gov/archive/pangaea/Pangaea_game.html

- **The Breakup of Pangaea**
  An interactive Web site in which students drag their mice across the map of the world, moving the continents that make up Pangaea into their current world positions.
  http://www.scotese.com/pangeanim.htm

- **Mountain Maker, Earth Shaker**
  An animated Web site which includes text, images and animations. Students follow three links that show illustrations of the main tectonic plate interactions.
  http://www.pbs.org/wgbh/aso/tryit/tectonics/intro.html

- **abcteach**
  A printable outline map of the world.
  http://abcteach.com/directory/researchreports/maps/continents_and_world/

- **SAVAGE EARTH Animation**
  Animated links to follow that show a cross section of the Earth and the interactions that occur between tectonic plates.
  http://www.pbs.org/wnet/savageearth/animations/hellscrust/main.html

- **The World Quiz**
  An interactive quiz students take in which they name some of the major oceans and continents found around the world.
  http://www.lizardpoint.com/fun/geoquiz/worldquiz.html

Materials

Per Student:

- Printable world maps available from abcteach:
  http://abcteach.com/directory/researchreports/maps/continents_and_world/
- Scissors
- Glue stick, glue or tape

- Blank sheet of paper on which to glue the map

Per Class and/or Group:

- Blank drawing paper
- Colored pencils, crayons or chalk

Prep for Teachers

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, Web sites or other multimedia elements.

Prior to teaching this lesson, bookmark the Web sites used in the lesson on each computer or provide a list of URLs that students can type into the address bar. Make sure that each Web site is still available for use before bookmarking.

Download the video clips onto the computer that will be used for the classroom presentation. Be sure each video clip displays appropriately by using appropriate plug-ins and media players. Make sure the screensaver is turned off or is on a long delay.

Reserve the computer lab if one is available.

Introductory Activity

Day 1

Step 1: Review with students the oceans and continents by playing the interactive map game available at http://www.lizardpoint.com/fun/geoquiz/worldquiz.html.

Step 2: Provide students with a **Focus for Media Interaction** by having them write the major continent names down as they play the game. Review the list as a class. Continent names should include *North America, South America, Europe, Asia, Australia, Africa and Antarctica.*

Step 3: Provide students with a map of the world from http://abcteach.com/Maps/world.htm . Have them cut out the major landmasses, reassemble them into one major landmass and glue them onto another sheet of paper.

Step 4: Have students compare maps with the student beside them. *Students may see some variation in the way the maps were assembled. Australia would be misplaced because Antarctica was left off the map and Australia should connect with it.*

Step 5: Have students write the names of the landmasses on the newly created single landmass map using the list they created from their interactive game. *The students would use the names*

North America, South America, Europe, Asia, Australia, Africa and Antarctica. Antarctica would be left off and Greenland would be added.

Step 6: Ask students if they think it is possible for the continents to have been connected at one time. *Some students may already know that the continents were together and will respond with a "yes." Others may say "no" or that maybe some of the continents fit together.*

Step 7: Explain to students that they are going to play another interactive game (available at http://kids.earth.nasa.gov/archive/pangaea/Pangaea_game.html) that reviews the continents of the Earth 250 million years ago.

Step 8: Provide students with a **Focus for Media Interaction** by having them compare the map they just created with the map on the interactive Web site. Have students write the similarities and differences between their maps and the map on this Web site on the side of the maps they made. *Australia should be connected to Antarctica and the angles of the other continent connections may be slightly wrong*.

Step 9: Ask students what kind of evidence scientists might look for to prove the continents may have formed one large landmass in the past. *The shape of the continents match up; fossil evidence on each continent would be the same; rock type would be the same; tropical fossils found in areas too cold to grow plants; glacial evidence in countries without glaciers.*

Learning Activities

Day 2

Step 1: Explain to students that they are going to watch a short video clip on the history of the continents. Provide students with a **Focus for Media Interaction** by asking them to record important names that are mentioned, any examples of evidence that would support the theory of the continents having been one large landmass and where the evidence came from that proved continental drift occurs.

Step 2: Play the video clip, "Pangaea: The History of the Continents (02:23), from the video, "Continents Adrift: An Introduction to Continental Drift and Plate Tectonics" (26:05).

Step 3: At the end of the video, ask students to share the important names they recorded and evidence that would support the continents forming one large landmass. *Students' answers should include Alfred Wegener and Pangaea; evidence includes continental shapes matching like a jigsaw puzzle, fossils that were identical in both South America and Africa, and plant fossils in cold arctic regions; and the proof was in the mapping of the ocean floor.*

Step 4: Have students brainstorm a list of the possible evidence scientists found on the ocean floor that supports continental drift. *Possible answers might be the shape of the ocean floor and underwater mountains.*

Step 5: Explain to students that they are going to watch another video clip on the results of exploring the ocean floor. Provide students with a **Focus for Media Interaction** by asking them to record the clues that scientists found on the ocean floor that supported continental drift.

Step 6: Play the video clip, "The Ocean Floor: Clues About Continental Drift on Earth" (02:40), from the video, "Continents Adrift: An Introduction to Continental Drift and Plate Tectonics" (26:05).

Step 7: At the end of the video, ask students for the clues they recorded. *Information should include underwater mountain range in the middle of the Atlantic Ocean called the Mid-Atlantic Ridge; newly formed lava pushing up from the crack; geysers; life-forms in the heated water; the ocean floor being older the greater the distance from the crack as a result of sea-floor spreading*.

Step 8: Explain to students that they are going to watch another video clip about the drifting continents. Provide students with a **Focus for Media Interaction** by asking them to record the structures the Earth's crust is broken into and the name of the theory that explains the moving continents.

Step 9: Play the video clip, "Plate Tectonics" (01:21), from the video, "Continents Adrift: An Introduction to Continental Drift and Plate Tectonics" (26:05).

Step 10: At the end of the video, ask students for the name of the crust structures and the name of the theory. *Students should respond with tectonic plates and the Plate Tectonic Theory*.

Step 11: Explain to students that they are going to watch their final video clip. Provide students with a **Focus for Media Interaction** by asking them to record the mechanism that causes the tectonic plates to move and the three types of boundaries that are formed when the plates interact with each other.

Step 12: Play the video clip, "How the Inner Structure of Planet Earth Affects Plate Tectonics (05:43), from the video, "Continents Adrift: An Introduction to Continental Drift and Plate Tectonics" (26:05).

Step 13: At the completion of the video, have students work in pairs and use the information they recorded to diagram, label and describe the mechanism that causes the plates to move and the crustal interactions that take place between tectonic plate boundaries. Provide students with drawing paper and colored pencils, crayons or chalk to complete the activity.

Culminating Activity

Day 3

If a computer lab is available, have the students take the single landmass maps they created to the lab and use the interactive Web site at http://www.scotese.com/pangeanim.htm to draw arrows on the maps showing the direction of the movement of the tectonic plates when they separated from each other. If a computer lab is not available, complete the activity as a class using the classroom computer and projection device.

The next activity will also take place in the computer lab, or as a class if a computer lab is not available, and will involve students working with their partners to check the labeled diagram they created. Students will need to access two animated Web sites to correct the diagram or add information they left off of the diagram. The first Web site, called Mountain Maker, Earth Shaker, is found at http://www.pbs.org/wgbh/aso/tryit/tectonics/intro.html. The students will need to follow the three links at the bottom of the page to view the text, illustrations and animations showing results of the plate boundary interactions. The second Web site is found at http://www.pbs.org/wnet/savageearth/animations/hellscrust/main.html. Students will need to progress through the text and animations by following the continue button at the bottom of each window.

Finally, have the students work in pairs and explain their maps to the rest of the students in the class.

Cross-Curricular Extensions

Geography

- Use a world map with longitude and latitude lines to map earthquakes.

Engineering

- Research structural designs used to make buildings earthquake resistant.

Community Connections

- Contact the local United States or State Geological Office and invite a geologist in to talk and answer questions about plate tectonics and local geological formations that provide evidence for changes in landforms.