

---

# Some Processes that Change the Earth's Surface

---

To prepare students to understand the standards introduced later, at middle school, this series of lessons, used in conjunction with the STC *Land and Water* Unit and/or the FOSS *Landforms* Unit, will acquaint students to the changes to the earth's surface caused by earthquakes, landslides, and volcanic eruptions. The **ESS2** Disciplinary Core Idea from the National Research Council's *Framework for K-12 Science Education* is broken down into five sub-ideas: Earth materials and systems, plate tectonics and large-scale system interactions, the roles of water in Earth's surface processes, weather and climate, and biogeology. This DCI points out that the locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.

The performance expectations in **ESS2: Earth's Systems**, help students formulate an answer to questions such as: "How do the materials in and on Earth's crust change over time, How does the movement of tectonic plates impact the surface of Earth, and How does water shape Earth's surface?" The specific Performance Expectations at the elementary level are:

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

## BACKGROUND:

The Earth's surface (crust and mantle) is in constant motion. The motion causes crustal plates to move. Plates can grind into each other, slide under and over each other, or even slide horizontally against each other. As this occurs, rock is squeezed, bent or stretched causing stress to build in the rocks. When this stress reaches a point where energy must be released, the rock breaks and the plates lurch into new positions. This sudden release of energy sends seismic (earthquake) waves rippling away from the breaking point in all directions. We see the results of earthquakes in landslides, tsunamis, faults and rifts.

An **earthquake** is a sudden, rapid shaking of the earth caused by a release of energy stored in rocks. Earthquakes are a natural phenomenon. They are happening all the time but are often not even noticed by people until they cause visible damage.

**Volcanoes** also can occur as a result of plate movement. A volcano is a vent in the surface of the Earth through which magma (molten rock called "lava" when it reaches the surface) and associated gases, erupt. Volcano is also the term used to describe the structure produced by material ejected through the vent. Materials ejected from the vent could include:

- Cinder- dark colored pieces of rock thrown from a volcano
- Pumice- bubbly, frothy rock that is hardened
- Ash- fine grained particles less than 2 mm across

Volcanoes can cause changes to the surface of the Earth in many ways. Of course lava flows and ejection of cinder, pumice and ash build up to create cones of volcanoes and volcanic mountains. In addition, volcanic activity such as basalt floods, lay thick, dense layers of rock on the landscape. Volcanoes also trigger mudflows, avalanches, and cracks or fissures in the Earth's surface.

There are excellent video clips of earthquakes, landslides and volcanoes found on the National Geographic website, <http://www.nationalgeographic.com>. They would make a powerful addition to this series of lessons; all are less than 4 minutes in length.

## MATERIALS:

## FOR EACH STUDENT:

- Science notebook

## FOR THE CLASS:

- Question Quilt (graphic available in this set of documents)
- 3" x 5" Index Cards or Post-it Notes
- Earth Changes PowerPoint (PowerPoint available in this set of documents)
- *Earthquakes!* by *Time for Kids* with Barbra Collier

## PREPARATIONS:

Set up PowerPoint. Allow approximately 45 minutes for this lesson.

## PROCEDURE:

### 1. PRE-ASSESSMENT

- a. Review with students the elements of a Concept Map (center concept, main ideas, and supporting details). Some students may not have worked with concept maps before and will need additional support.
- b. Ask students to create a concept map in their science notebook by starting with a large oval in the center of a two-page spread. Label the center oval: "Processes that Change the Earth's Surface." (Teacher models this)
- c. Remind students to create a new oval for each new main idea and rectangles for each new supporting detail.
- d. Ask students to think about what they have already learned in the *Land & Water* unit (STC) or *Landforms* unit (FOSS). Add that information to the concept map first, in words or pictures.
- e. Next, ask students to think of other ways (processes) that change the Earth's surface. Those main ideas need to be added as new ovals.
- f. Finally, students should add any supporting details they think they know in relation to each of the main ideas.

2. Show the “Earth Changes” PowerPoint.

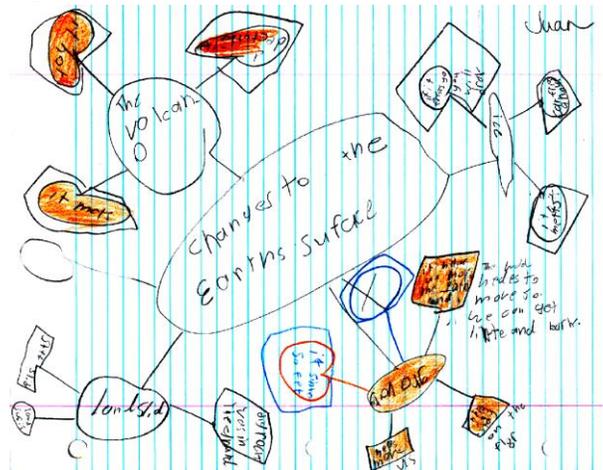
Discuss:

- Changes caused to the Earth’s surface by volcanoes
- Key vocabulary: magma, lava, cinder, pumice, ash, fault, landslide, earthquake, volcano, tsunamis
- Processes that change the Earth’s surface by earthquakes
- Changes caused to the Earth’s surface by landslides

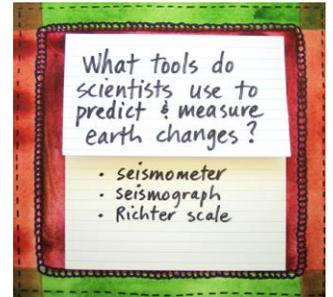
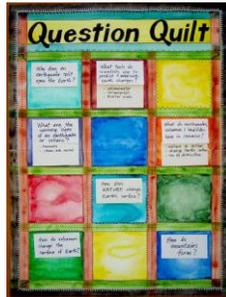
3. Think-pair-share: Ask students to think quietly for a minute about what they noticed. Next have them turn to a partner and share what changes they observed. Finally have partner groups share with the whole group what they noticed about changes to:

- Land
- Man-made structures
- Vegetation

4. Have students turn back to their concept map and add any new information about process that change the Earth’s surface. New information should be highlighted with a colored pencil. This is a good opportunity for the teacher to circulate, questioning students about elements of their concept map.



5. Invite students to record questions on Index Cards or Post-it Notes as they arise throughout the lesson (one question per card/post-it). These can be added to a Question Quilt which has been created for the classroom. Note: The Question Quilt is a living document that can be updated throughout the lessons. Periodically check for answers to posted questions, and gather any new questions from your students.



6. Read aloud and discuss the book *Earthquakes!*

- Focus students with the following questions which the teacher should have written and attached to the Question Quilt:
  - How do earthquakes change the surface of Earth?
  - What are ways people might know an earthquake is about to occur?
  - What tools do scientists use to predict and measure earthquakes?

7. Have Students turn back to their concept map and add any new information (highlight) about processes that change Earth's surface.

8. Visit the Question Quilt- have all the questions been answered? Are there new questions? Attach answers below the associated question.

