
Some Processes that Change the Earth's Surface

SCIENCE STANDARDS

To prepare students to understand the Essential Academic Learning Requirements (EALRs) introduced 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.

BACKGROUND

The Earth's surface (crust and mantle) is in constant motion. This motion causes crustal plates to move. (Note: The concept of crustal plates is a 6th – 12th grade Science Standard and therefore not addressed in this lesson.) 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 CLASS:

- Question Quilt
- Earth Changes PowerPoint
- 3" x 5" Index Cards or Post-it Notes
- *Earthquakes!* by *Time for Kids* with Barbara Collier

PREPARATIONS

Set up PowerPoint or use colored transparencies on overhead projector.
Allow approximately 45 minutes for this lesson.

PROCEDURE

1. PREASSESSMENT

- 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 or transparencies of the PowerPoint slides. 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

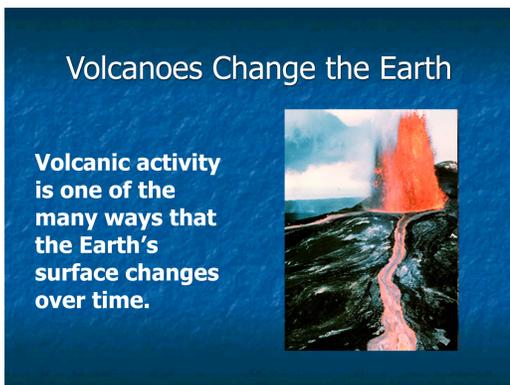


NOTE—

Please pause to show the dramatic effects of the changes which happened when Mt. St. Helens erupted May 18, 1980. This slide is composed of two photos, which show before and after the eruption. The animation settings are set to change with your mouse click.

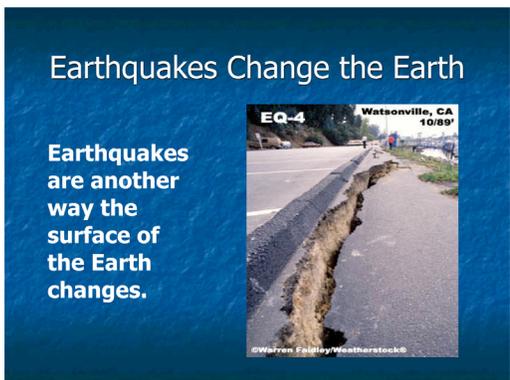


You may have written different changes on your Concept Map but we are focusing on these processes that change the earth quickly.



Volcanoes change the surface of the earth by erupting out matter.

(Note to Teacher: You may read these slides to your students, especially to second language learners. Use the pictures to help these students connect to the vocabulary.)



In this picture, your students will be able to observe damage to the Earth as well as to man-made structures covering the Earth.

Landslides Change the Earth

Landslides make changes to the Earth, too.



Earth Changes Can Look Different



Change caused by lava flow.



Change caused by cinder, pumice, ash explosions.



Change caused by lava flow with steam, cinder, pumice and ash.

Volcanoes produce gasses, liquids and solids released from inside the Earth.

Different types of volcanoes emit different types of material. Some volcanoes erupt with slow and continuous lava flows, some explode sending cinder, pumice, and ash into the air to fall to the earth and some volcanoes have lava flows along with a release of cinder, pumice and ash.

Earth Changes Can Look Different



These pictures show the same road. What earth changes do you observe in each picture?

What inferences can you make about the causes of each change?

These are pictures of the road leading to Mt. Kilauea. The picture on the left shows evidence of an earthquake. The picture on the right shows a lava flow which is continually adding new rock.

(Note: The observations are based on what you actually see or observe whereas inferences are things you reason from those known facts.)

Earth Changes Can Look Different



Earthquakes can cause damage in populated areas.



Earthquakes can leave a scarp, a visible cut in the earth.

Earthquakes cause the Earth's surface to shake, roll, and heave.



Earthquakes under the ocean can cause tsunamis.

Earthquakes are caused by the constant motion of the Earth's surface. This motion creates build up and release of energy stored in rocks at and near the Earth's surface. Earthquakes are the sudden rapid shaking of the earth as this energy is released.

A tsunami is a very large ocean wave caused by an underwater earthquake or volcanic eruption.

Earth Changes Can Look Different

Landslides cause rocks, soil and debris to suddenly slide down a slope.



Rock breaking away from a hillside.



Landslide caused by water-soaked soil.



Earthquakes cause some landslides.

A landslide is a mass of rocks, soil and debris that suddenly slides down a slope. A landslide can be caused by rocks breaking from an outcrop and tumbling down a cliff, heavy rains soaking the ground causing mud to flow down a hillside, or an earthquake shaking the ground causing it to move down a steep slope.

Use this slide as an opportunity to tie into regional events.

What three processes change the Earth's surface?



Volcano



Landslide



Earthquake

As each picture appears, briefly review to check for student understanding.

Changing the Earth's Surface

While in most places the Earth changes very, very slowly, this change can happen rapidly and violently.



USGS

There are forces deep underground and on the surface that are always changing the Earth.

Photograph Sources

- United States Geological Survey
- United States Forest Service
- Georgia Boatman
- Neptune.Com

Credits

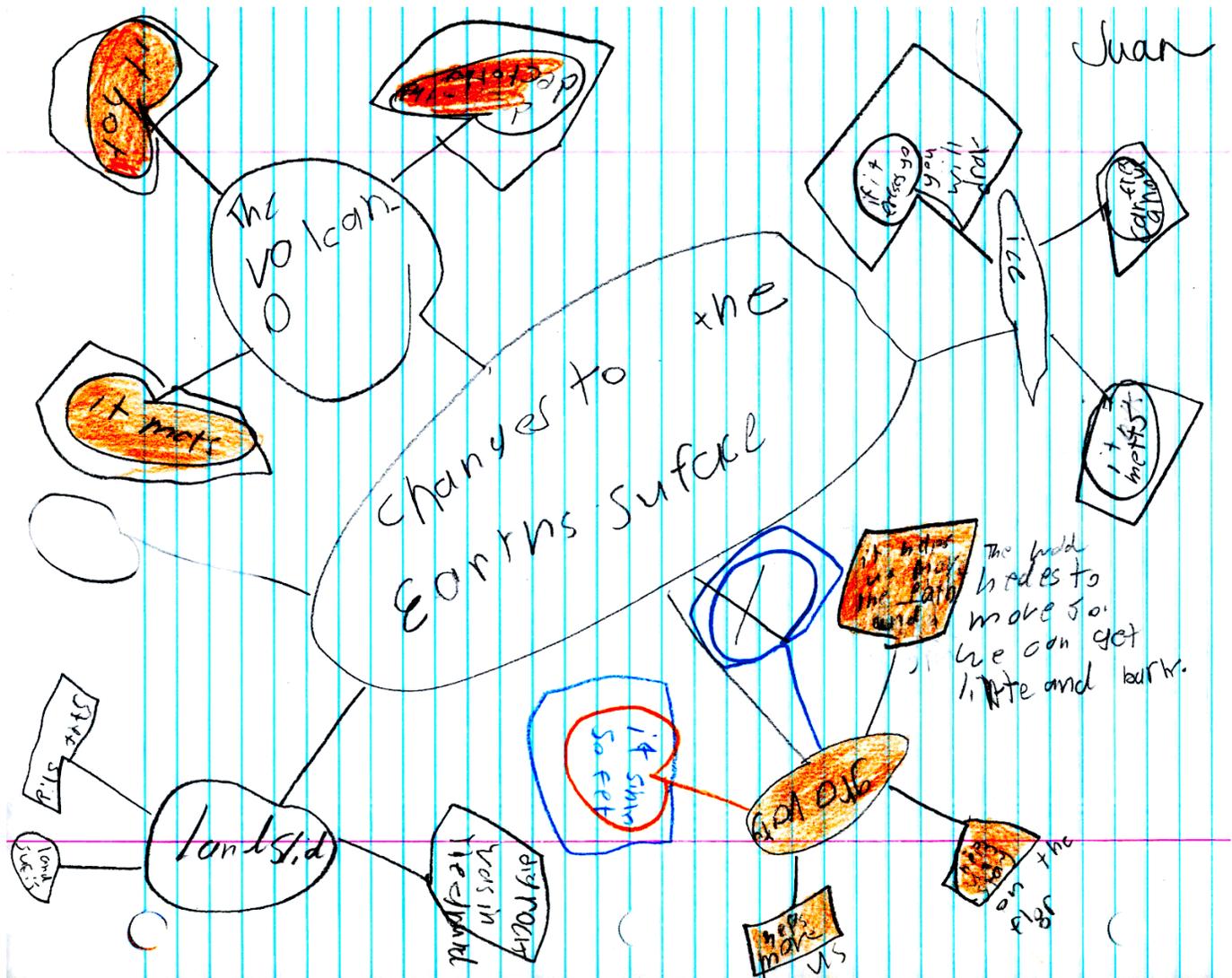
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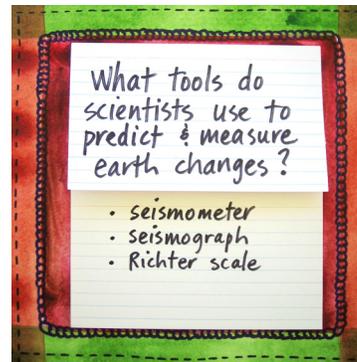
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- Think-pair-share: Ask students to think quietly for a minute about what they noticed. Next have them turn to a partner and share what changes they observed. Finally have partner groups share with the whole group what they noticed about changes to:
 - Land
 - Man-made structures
 - Vegetation
- Have students turn back to their concept map and add any new information about processes 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 the 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 the Earth's surface.
8. Visit the Question Quilt – have all of the questions been answered? Are there any new questions? Attach answers below the associated question.

