

Dawson-Bryant Middle School Blizzard Bag

Teacher Name	Sanders
Blizzard Bag #	1, 2, 3
Class	7 th grade science
Directions	Complete 1 packet for every snow day.
Grading	
Points assigned	30 per bag

Earth's Changing Surface

Earthquakes and Volcanoes

..... Before You Read

Key Concepts

- What causes earthquakes?
- What causes volcanoes to form?
- How do earthquakes and volcanoes change Earth's surface?

What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.

Before	Statement	After
	3. Earthquakes occur and volcanoes erupt only near plate boundaries.	
	4. Volcanoes erupt melted rock.	

Mark the Text

Identify the Main Ideas

Write a phrase beside each paragraph that summarizes the main point of the paragraph. Use the phrases to review the lesson.

..... Read to Learn


Earthquakes

Because tectonic plates move very slowly, most changes to Earth's surface take a long time. But some changes occur quickly and violently. An **earthquake** is the rupture and sudden movement of rocks along a break or a crack in Earth's crust. An earthquake can change Earth's surface quickly and dramatically.

Causes of Earthquakes

Slide your textbook across your desk. To make it move, you must push hard enough to overcome the force of friction that keeps your book from sliding. Earth's crust is similar. The forces acting on tectonic plates must be large enough to make blocks of crust move. When these blocks move, earthquakes occur.

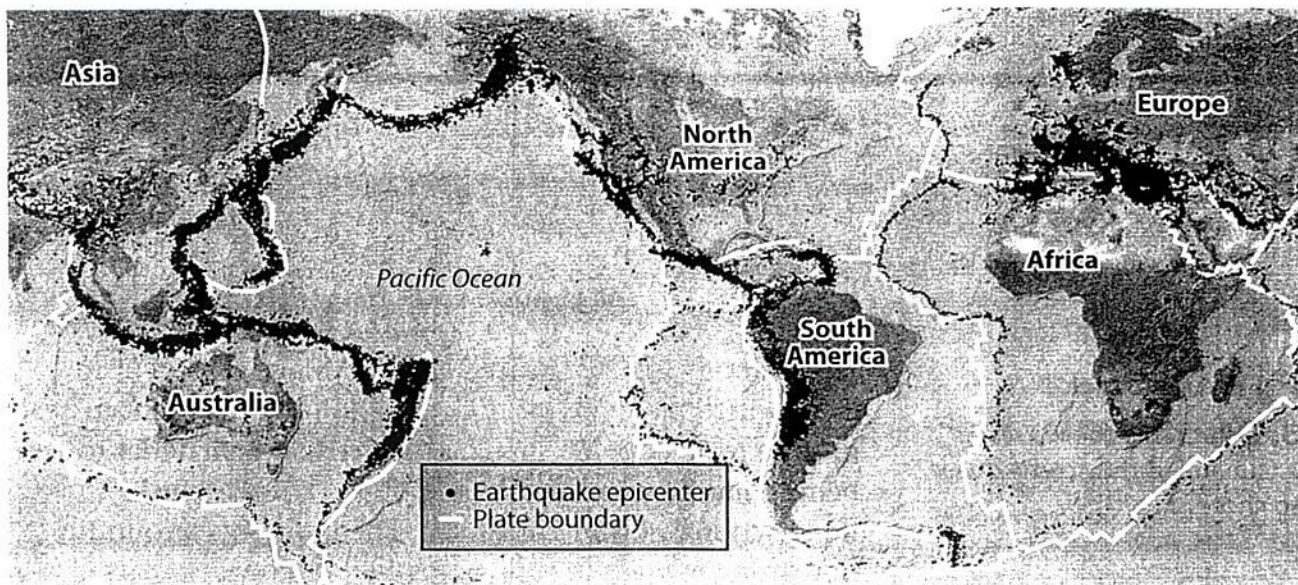
*The surface along which the crust moves is called a **fault**.* Movement along faults occurs when the forces pushing on the rock layers become large enough to cause movement along the fault.

Recall that compression and tension cause vertical motion on a fault, and shear forces cause horizontal motion. When pieces of crust slide past each other, energy is released, causing the ground to shake. 

Key Concept Check

1. Explain What causes earthquakes?

Earthquake Locations



Where do earthquakes occur?

Most earthquakes occur near plate boundaries, as shown in the figure above. However, some of the largest earthquakes in the United States occurred far from plate boundaries. For example, in the winter of 1811–1812, three large earthquakes occurred in Missouri. An explanation of these earthquakes might be their nearness to an old fault system, the New Madrid fault system. This fault system is part of the beginning of a rift valley on the North American Plate.

Changing Earth's Surface

You might be familiar with the damage earthquakes can cause. But earthquakes also can create landforms. Faults associated with earthquakes can be visible at Earth's surface. Some faults, such as the San Andreas Fault in California, are more than 1,000 km long. During the massive Sichuan (SI chwan), China, earthquake in 2008, blocks of crust moved as much as 9 m along a fault 240 km long and 20 km deep. Earthquakes also form mountains and change Earth's surface in other ways.

Mountains Every time blocks of crust slide past each other along a fault, an earthquake occurs. Blocks might move only 1–2 m. But after hundreds or thousands of earthquakes, blocks of crust will have moved a long distance. Compression and tension forces produce ridges and mountains as crust moves vertically.

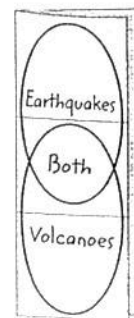
Visual Check

2. Locate Most earthquakes occur _____. (Circle the correct answer.)

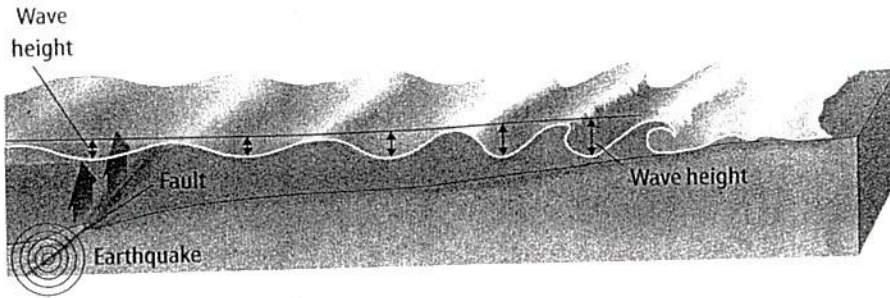
- a. far from plate boundaries
- b. near plate boundaries
- c. only on plate boundaries

FOLDABLES

Make a three-tab Venn book to compare the causes and effects of volcanoes and earthquakes.



Tsunami



Visual Check

3. Describe the waves of a tsunami as they come closer to shore.

Reading Check

4. Define What is liquefaction?

Key Concept Check

5. Summarize How do earthquakes change Earth's surface?

Liquefaction and Landslides Great damage can occur in areas where the ground is made up of loose sediment instead of solid rock. Extreme shaking can cause this material to behave more like a liquid than a solid. This is called liquefaction (li kwuh FAK shun). The liquid-like ground is not strong enough to support heavy buildings. So part of a building can sink into the ground, causing the building to collapse. ✓

Liquefaction is responsible for most of the damage to buildings after an earthquake occurs. Shaking caused by earthquakes also can trigger landslides. Landslides bring rocks and soil from the tops of mountains into valleys.

Tsunamis Earthquakes that happen underwater can cause tsunamis (soo NAH meez), as shown in the figure above. Upward movement at a fault pushes the water up and creates huge ocean waves. These waves become taller as they reach shallower water near a shore. Tsunamis also can be caused by part of the ocean floor dropping down or by an underwater volcanic eruption. ✓

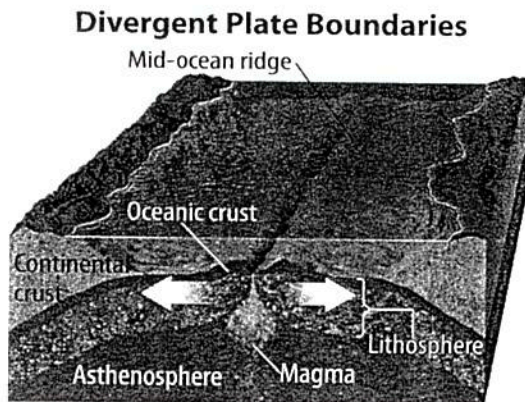
Volcanoes

Recall that molten rock below Earth's surface is called magma. Because magma is hot, it is less dense than the surrounding rock and rises, or moves upward. Volcanoes are landforms that form when magma erupts onto Earth's surface as lava.

Volcanoes are common on Earth. Each year about 50–60 different volcanoes erupt somewhere on Earth. There are approximately 1,500 active volcanoes on Earth. Volcanoes can be destructive, but they also make new landforms.

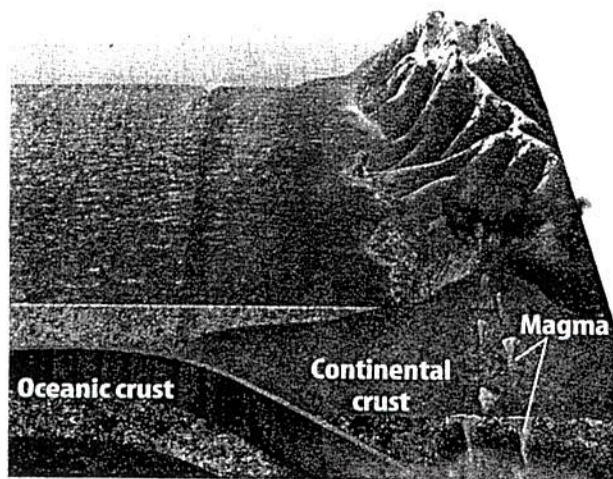
Where Volcanoes Form

Volcanoes can occur at divergent plate boundaries, at convergent plate boundaries, and at hot spots. At a divergent boundary, lava flows into the rift formed by the separating plates, as shown in the figure below. New crust is made of the rocks that form as this lava cools. *The mountains that form as this lava builds up and cools are called **mid-ocean ridges**.*



At some convergent boundaries, one tectonic plate sinks into the mantle. The sinking plate also carries water into the mantle. This causes the mantle to melt and form magma. The magma rises and erupts onto the plate that does not sink, as shown in the figure below. ✓

Convergent Plate Boundaries



Hot Spots Not all volcanoes are near plate boundaries. In a few places, large volcanoes form near the center of a tectonic plate. These volcanoes form at **hot spots**, *locations where volcanoes form far from plate boundaries*. The Hawaiian Islands in the middle of the Pacific Ocean and Yellowstone National Park in Wyoming are hot spots.

✓ Visual Check

6. Draw a circle around the landforms that are created as the lava cools.

✓ Reading Check

7. Summarize How do volcanoes form at convergent boundaries?

✓ Visual Check

8. Identify Highlight the path of the rising magma.

 **Reading Check**


9. State a hypothesis to explain why hot spots exist.

 **Reading Check**

10. Summarize Why does rock melt more easily near Earth's surface?

 **Key Concept Check**


11. Explain What causes volcanoes to form?

Why Hot Spots Exist Scientists do not fully understand the reason hot spots exist. One hypothesis is that hot spots occur above places where the mantle melts. The magma then rises toward the surface and eventually erupts through the crust. 


Causes of Volcanic Eruptions

In order for magma to form, the crust and the mantle must become hot enough to melt. Rocks melt more easily when pressure is low. Pressure results from the weight of overlying rock, so pressure is lowest at Earth's surface. When hot rocks from deep inside Earth move toward Earth's surface, the decrease in pressure allows these hot rocks to melt.

The temperature at which rocks melt depends on the makeup of the rock and the presence or absence of water. If the melting temperature of rock is lowered, the rocks melt more easily.

Water enters the mantle at convergent boundaries. This allows the mantle to melt at a lower temperature. This is similar to adding salt to ice. If you put salt on ice, the ice melts at a lower, or colder, temperature. 

Because magma is hot, it is less dense than the rock material around it. It moves upward and causes cracks to form in the solid rock.

Magma also contains dissolved gases. The rising magma plus the gases cause pressure to build up. Eventually, the magma erupts through cracks in Earth's surface and a volcano forms. Most of Earth's largest volcanoes are located at convergent plate boundaries. 

Changing Earth's Surface

Volcanoes can be as small as a car. They also can be more than 10 km high. The shapes of volcanoes and the way lava erupts depend on where volcanoes form. What comes out of volcanoes, and how do volcanoes change Earth's surface?

Lava Flows Melted mantle material flows easily. When it erupts, it flows over Earth's surface. This creates *long streams of molten rock called lava flows.*

Lava eventually cools and solidifies, forming solid rock. Lava flows can be more than 10 km long. Over time and after repeated eruptions, lava flows build up as flat layers.

Explosive Eruptions At convergent plate boundaries, part of the continental crust can become mixed with magma from the mantle. When this mixture of molten materials erupts, it does not flow as easily as lava made only of melted mantle. Instead of forming lava flows, it often solidifies in the atmosphere, where it breaks into *small pieces of lava called volcanic ash*.

Ash can reach heights greater than 20 km. The ash eventually falls back to Earth's surface. Thick layers of these small pieces of lava can cover large areas that extend more than 100 km from the volcano. Eruptions that eject ash high into the atmosphere are called explosive eruptions. Lava is also produced during these eruptions.


Types of Volcanoes

Lava flows can build up and form large volcanoes. Shield volcanoes form after lava flows have occurred over time. Shield volcanoes tend to be large with gentle slopes, such as Mauna Loa in Hawaii.

Composite volcanoes also can form as lava flows and ash layers deposited by explosive eruptions build up. These types of volcanoes often have steep sides and are cone-shaped, such as Mount Adams in Washington. They are most common at convergent boundaries.

Before a volcano erupts, magma builds up in the crust in a reservoir called a magma chamber. What happens when large amounts of magma are removed from this chamber? Sometimes the surface above the chamber collapses. This creates *a large depression in the center of the volcano called a caldera* (kal DER uh). Some calderas can be more than 70 km wide.

Effects on the Atmosphere

Volcanoes also change Earth's atmosphere and climate. Volcanic ash and gases from explosive eruptions can blow high into the atmosphere. Some volcanic material remains in the atmosphere for years. This material can block sunlight. This can cause the temperature of the atmosphere near Earth's surface to decrease. 

Math Skills

Geologists estimate the volume of a lava flow from a volcano by measuring the average depth and the radius of the hardened lava field. The volume of a cylinder is the area of the base times the height (h). The base of a cylinder is a circle with an area equal to the square of the radius (r^2) times π (3.14). Therefore, $V = \pi \times r^2 \times h$. For example, what is the volume of lava needed to produce a lava field with a radius of 100.0 m and an average depth of 20.0 m?

- a. The formula for volume is

$$V = \pi \times r^2 \times h$$

- b. Replace the values in the formula with the given values and calculate.

$$V = 3.14 \times (100 \text{ m})^2 \times 20.0 \text{ m}$$

$$V = 3.14 \times 10,000 \text{ m}^2 \times 20.0 \text{ m}$$

$$V = 628,000 \text{ m}^3$$

12. Use Geometry

What is the volume of lava in a field with a radius of 90 m and an average thickness of 10.0 m?

Key Concept Check

13. Describe How do volcanoes change Earth's surface?

After You Read

Mini Glossary

caldera (kal DER uh): a large depression in the center of a volcano

earthquake: the rupture and sudden movement of rocks along a break or a crack in Earth's crust

fault: the surface along which Earth's crust moves

hot spot: a location where a volcano forms far from plate boundaries

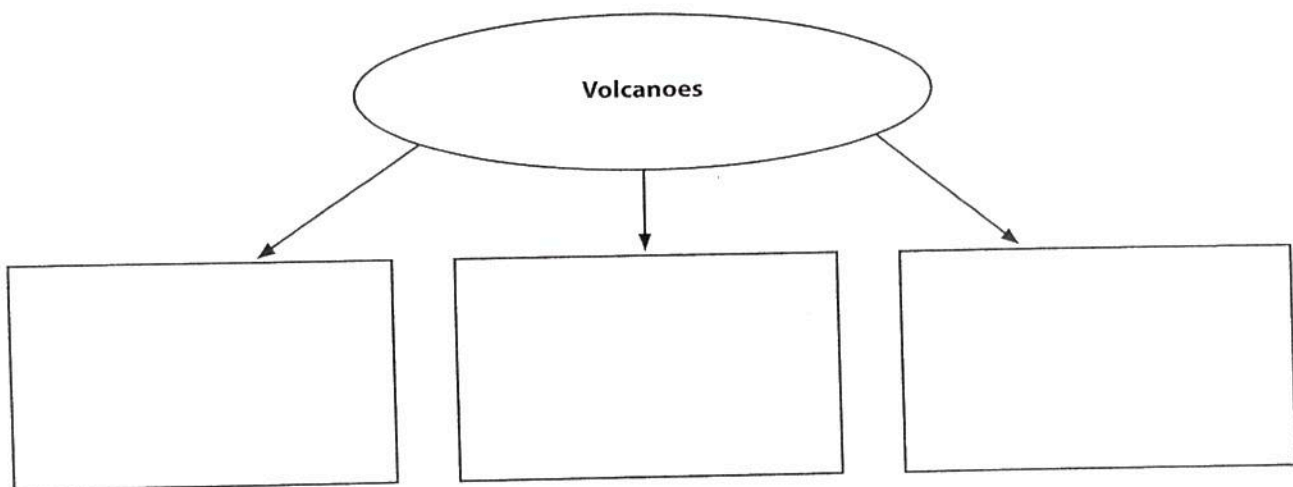
lava flow: a long stream of molten rock that erupts from a volcano

mid-ocean ridge: an undersea mountain that forms as lava builds up and cools on oceanic crust

volcanic ash: small pieces of lava

1. Review the terms and their definitions in the Mini Glossary. Write a sentence explaining the relationship between a fault and an earthquake.

2. Use the graphic organizer below to show three changes volcanoes make to Earth's surface, atmosphere, and/or climate.



3. In the early 1800s, three large earthquakes occurred in Missouri. Do you think any of them caused a tsunami? Explain.

What do you think NOW?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



Log on to ConnectED.mcgraw-hill.com and access your textbook to find this lesson's resources.

END OF LESSON

