

Volcanoes and Plate Tectonics

Reading Preview

Key Concepts

- Where are most of Earth's volcanoes found?
- How do hot spot volcanoes form?

Key Terms

- volcano • magma • lava
- Ring of Fire • island arc
- hot spot



Target Reading Skill

Asking Questions Before you read, preview the red headings. In a graphic organizer like the one below, ask a *where*, *what*, or *how* question for each heading. As you read, write the answers to your questions.

Volcanoes and Plate Tectonics

Question	Answer
Where are volcanoes found?	Most volcanoes are found along plate boundaries.

Lab zone

Discover Activity

Where Are Volcanoes Found on Earth's Surface?

1. Look at the map of Earth's Active Volcanoes in Figure 2. What symbols are used to represent volcanoes? What other symbols are shown on the map?
2. Do the locations of the volcanoes form a pattern? Do the volcanoes seem related to any other features on Earth's surface?

Think About It

Developing Hypotheses Develop a hypothesis to explain where Earth's volcanoes are located.

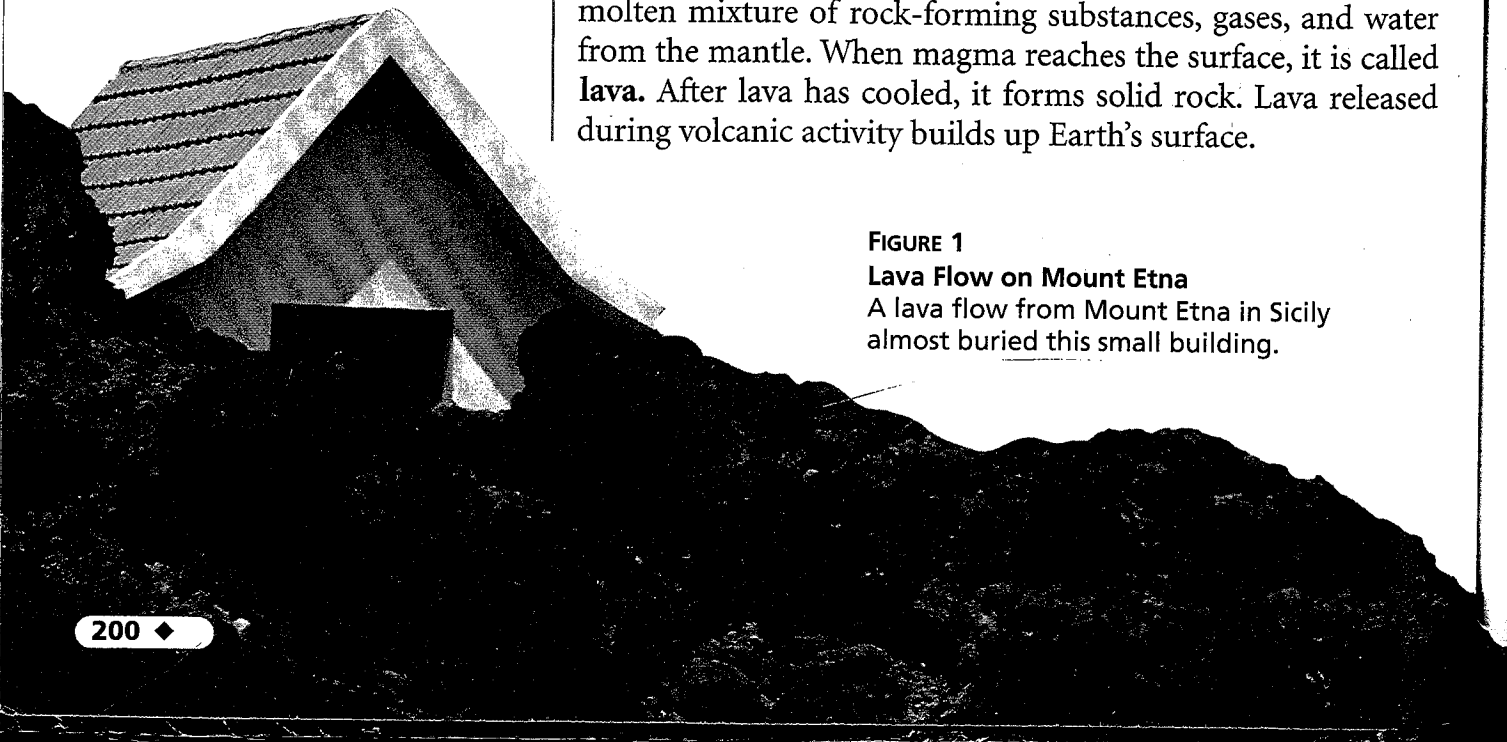
In 2002, Mount Etna erupted in glowing fountains and rivers of molten rock. Located on the island of Sicily in the Mediterranean Sea, Mount Etna is Europe's largest volcano. Over the last 2,500 years, it has erupted often. The ancient Greeks believed that Mount Etna was one home of Hephaestus, the Greek god of fire. Beneath the volcano was the forge where Hephaestus made beautiful metal objects for the other Greek gods.

The eruption of a volcano is among the most awe-inspiring events on Earth. A **volcano** is a weak spot in the crust where molten material, or magma, comes to the surface. **Magma** is a molten mixture of rock-forming substances, gases, and water from the mantle. When magma reaches the surface, it is called **lava**. After lava has cooled, it forms solid rock. Lava released during volcanic activity builds up Earth's surface.

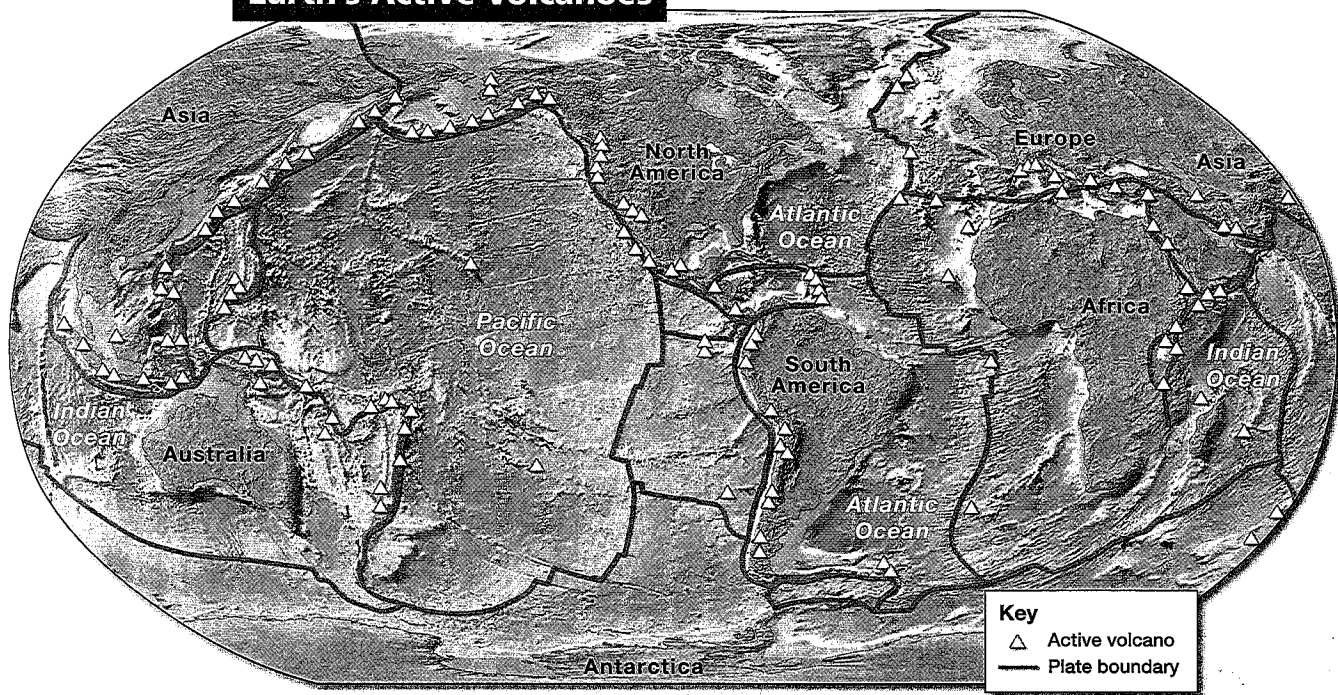
FIGURE 1

Lava Flow on Mount Etna

A lava flow from Mount Etna in Sicily almost buried this small building.



Earth's Active Volcanoes



Volcanoes and Plate Boundaries

There are about 600 active volcanoes on land. Many more lie beneath the sea, where it is difficult for scientists to observe and map them. Figure 2 shows the location of some of Earth's major volcanoes. Notice how volcanoes occur in belts that extend across continents and oceans. One major volcanic belt is the **Ring of Fire**, formed by the many volcanoes that rim the Pacific Ocean.

Volcanic belts form along the boundaries of Earth's plates. At plate boundaries, huge pieces of the crust diverge (pull apart) or converge (push together). As a result, the crust often fractures, allowing magma to reach the surface. Most volcanoes form along diverging plate boundaries such as mid-ocean ridges and along converging plate boundaries where subduction takes place. For example, Mount Etna formed near the boundary of the Eurasian and African plates.

Diverging Boundaries Volcanoes form along the mid-ocean ridges, which mark diverging plate boundaries. Recall that ridges are long, underwater mountain ranges that sometimes have a rift valley down their center. Along the rift valley, lava pours out of cracks in the ocean floor, gradually building new mountains. Volcanoes also form along diverging plate boundaries on land. For example, there are several large volcanoes along the Great Rift Valley in East Africa.

FIGURE 2

Many of Earth's volcanoes are located along the boundaries of tectonic plates. The Ring of Fire is a belt of volcanoes that circles the Pacific Ocean. **Observing** *What other regions have a large number of volcanoes?*

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Converging Boundaries Many volcanoes form near converging plate boundaries where oceanic plates return to the mantle. Volcanoes may form where two oceanic plates collide or where an oceanic plate collides with a continental plate. Figure 3 shows how converging plates produce volcanoes.

Many volcanoes occur near boundaries where two oceanic plates collide. Through subduction, the older, denser plate sinks beneath a deep-ocean trench into the mantle. Some of the rock above the subducting plate melts and forms magma. Because the magma is less dense than the surrounding rock, it rises toward the surface. Eventually, the magma breaks through the ocean floor, creating volcanoes.

The resulting volcanoes create a string of islands called an **island arc**. The curve of an island arc echoes the curve of its deep-ocean trench. Major island arcs include Japan, New Zealand, Indonesia, the Philippines, the Aleutians, and the Caribbean islands.

Volcanoes also occur where an oceanic plate is subducted beneath a continental plate. Collisions of this type produced the volcanoes of the Andes Mountains in South America and the volcanoes of the Pacific Northwest in the United States.

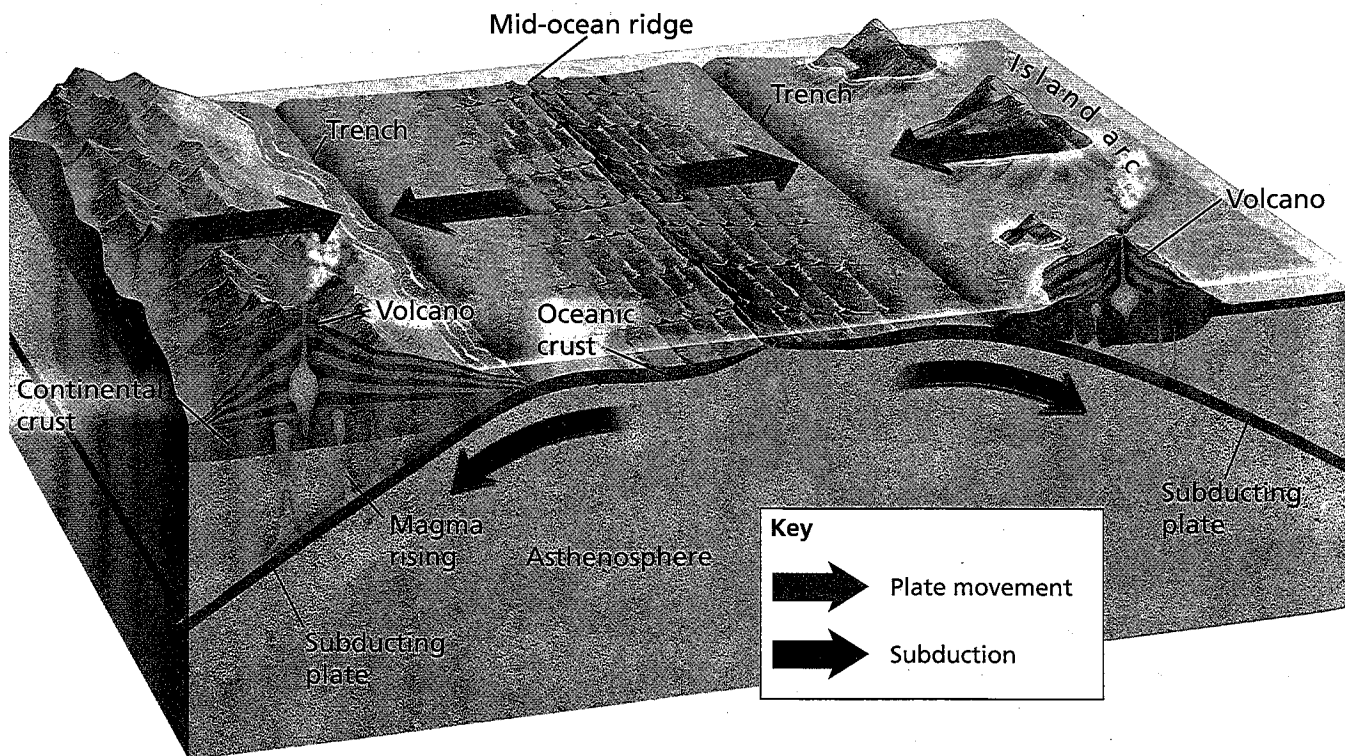
FIGURE 3
Volcanoes at Converging Boundaries

Volcanoes often form where two oceanic plates collide or where an oceanic plate collides with a continental plate. In both situations, an oceanic plate sinks beneath a trench. Rock above the plate melts to form magma, which then erupts to the surface as lava.



Reading
Checkpoint

How did the volcanoes in the Andes Mountains form?



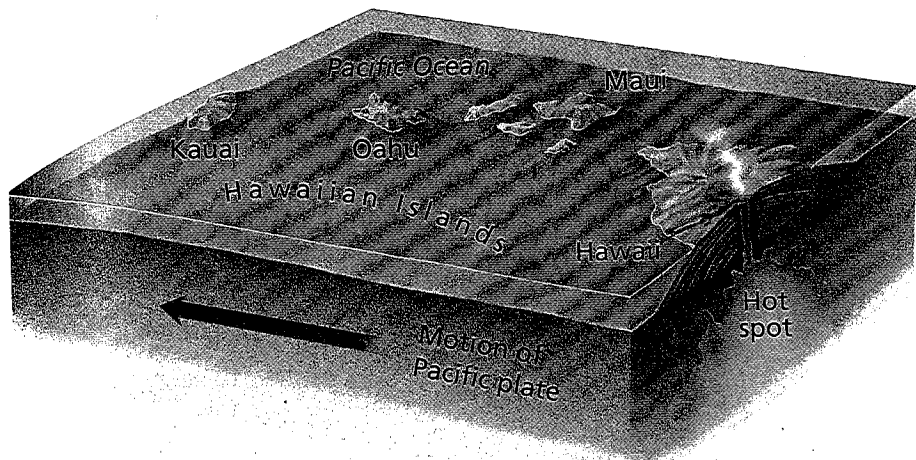


FIGURE 4
Hot Spot Volcanoes
 Eventually, the Pacific plate's movement will carry the island of Hawaii away from the hot spot.
Inferring Which island on the map formed first?

Hot Spot Volcanoes

Some volcanoes result from “hot spots” in Earth’s mantle. A **hot spot** is an area where material from deep within the mantle rises and then melts, forming magma. A **volcano forms above a hot spot when magma erupts through the crust and reaches the surface**. Some hot spot volcanoes lie in the middle of plates far from any plate boundaries. Other hot spots occur on or near plate boundaries.

A hot spot in the ocean floor can gradually form a series of volcanic mountains. For example, the Hawaiian Islands formed one by one over millions of years as the Pacific plate drifted over a hot spot. Hot spots can also form under the continents. Yellowstone National Park in Wyoming marks a hot spot under the North American plate.

Lab zone Try This Activity

Hot Spot in a Box

1. Fill a plastic box half full of cold water. This represents the mantle.
2. Mix red food coloring with hot water in a small, narrow-necked bottle to represent magma.
3. Hold your finger over the mouth of the bottle as you place the bottle in the center of the box. The mouth of the bottle must be under water.
4. Float a flat piece of plastic foam on the water above the bottle to model a tectonic plate.
5. Take your finger off the bottle and observe what happens to the “magma.”

Making Models Move the plastic foam slowly along. Where does the magma touch the “plate”? How does this model a hot spot volcano?

Section 1 Assessment

Target Reading Skill Asking Questions Work with a partner to check the answers in your graphic organizer.

Reviewing Key Concepts

1. **a. Defining** What is a volcano?
b. Reviewing Where are most volcanoes located?
c. Relating Cause and Effect What causes volcanoes to form at a diverging plate boundary?
2. **a. Defining** What is a hot spot?
b. Summarizing How does a hot spot volcano form?
c. Predicting What features form as an oceanic plate moves across a hot spot?

Writing in Science

Travel Brochure As a travel agent, you are planning a Pacific Ocean cruise that will visit volcanoes in the Ring of Fire and Hawaii. Write a travel brochure describing the types of volcanoes the group will see and explaining why the volcanoes formed where they did.