

SECTION 1 Volcanic Eruptions

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are two kinds of volcanic eruptions?
- How does the composition of magma affect eruptions?
- What are two ways that magma can erupt from a volcano?

National Science Education Standards
ES 1c

What Is a Volcano?

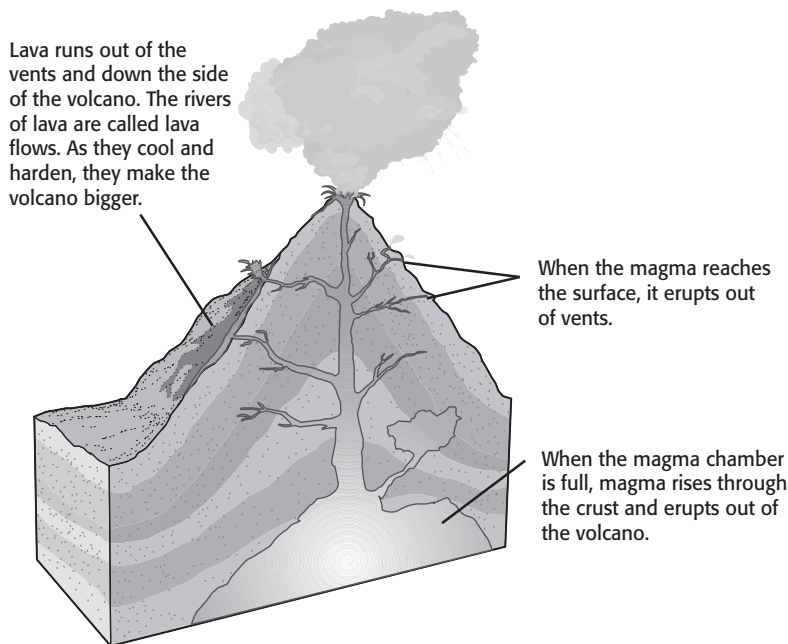
When you think of a volcano, what comes into your mind? Most people think of a steep mountain with smoke coming out. In fact, a **volcano** is any place where gases and *magma*, or melted rock, come out of the ground. A volcano can be a tall mountain or a small hole in the ground.

STUDY TIP

Compare After you read this section, make a chart that describes the features of each kind of lava and pyroclastic material.

THE PARTS OF A VOLCANO

If you could look inside an erupting volcano, it would look similar to the figure below. Below the volcano is a body of magma called a **magma chamber**. The magma from the magma chamber rises to the surface and erupts at the volcano. Magma escapes from the volcano through openings in the Earth's crust called **vents**. When magma flows onto the Earth's surface, it is called *lava*. ✓



READING CHECK

1. Define What is a magma chamber?

TAKE A LOOK

2. Describe What makes volcanoes grow larger?

SECTION 1 Volcanic Eruptions *continued*

What Happens When Volcanoes Erupt?

Many people think that all volcanic eruptions are alike. However, this is not the case. Scientists put volcanic eruptions into two groups: nonexplosive eruptions and explosive eruptions.

NONEXPLOSIVE ERUPTIONS

Nonexplosive volcanic eruptions are the most common type of eruption. These eruptions produce fairly calm flows of lava. The lava flows over the Earth's surface. Nonexplosive eruptions do not produce very much ash or dust, but they can release huge amounts of lava. For example, most of the rock of the ocean floor was produced by nonexplosive eruptions. ✓

READING CHECK

3. Identify What is the most common type of volcanic eruption?

Critical Thinking

4. Compare How are nonexplosive eruptions different from explosive eruptions? Give two ways.

EXPLOSIVE ERUPTIONS

Explosive eruptions are much less common than nonexplosive eruptions. However, explosive eruptions can be more destructive than nonexplosive eruptions. During an explosive eruption, clouds of hot ash, gas, and rock fragments shoot rapidly out of a volcano.

Most explosive eruptions do not produce lava flows. Instead of flowing calmly over the Earth's surface, magma sprays into the air in tiny droplets. The droplets harden to form particles called *ash*. The ash from an explosive eruption can reach the upper parts of the Earth's atmosphere. It can stay there for years, blocking sunlight and causing the climate to get cooler.

An explosive eruption can blast millions of tons of material from a volcano. The explosive eruption of Mount St. Helens in 1980 caused an entire side of a mountain to collapse. The blast from the eruption flattened 600 km² of forest.



The eruption of Mount St. Helens in 1980 was an explosive eruption. It was very destructive.

Say It

Investigate Find out more information about the eruptions of Mount St. Helens. Share your findings with a small group.

SECTION 1 Volcanic Eruptions *continued*

Why Do Volcanoes Erupt?

By comparing magma from different eruptions, scientists have been able to figure out why volcanoes erupt in different ways. The main factor affecting an eruption is the composition of the magma. The amounts of water, silica, and gas in the magma determine the type of eruption. ✓

WATER CONTENT

If magma contains a lot of water, an explosive eruption is more likely. Beneath the surface, magma is under high pressure. The high pressure allows water to dissolve into the magma. If the magma rises quickly, the pressure suddenly decreases and the water turns to bubbles of gas. As the gases expand, they cause an explosion.

This is similar to what happens when you shake a can of soda and open it. When you shake the can, the gas dissolved in the soda forms bubbles. Pressure builds up inside the can. When you open the can, the pressure causes the soda to shoot out.

SILICA AND GAS CONTENT

The amount of silica in magma also affects how explosive an eruption is. *Silica* is a compound made of the elements silicon and oxygen. Magma that contains a lot of silica is very thick and stiff. It flows slowly and may harden inside a volcano's vents, blocking them. As more magma pushes up from below, the pressure increases. If enough pressure builds up, the volcano can explode. ✓

Silica-rich magma may be so stiff that water vapor and other gases cannot move out of the magma. Trapped bubbles of gas may expand until they explode. When they explode, the magma shatters and ash is blasted from the vent. Magma with less silica is thinner and runnier. Therefore, gases can move out of the magma easily, and explosive eruptions are less likely.

Material	How it affects eruptions
Water	
Silica	

 **READING CHECK**

5. Identify What is the main factor that determines how a volcano erupts?

 **READING CHECK**

6. Describe How can magma that contains a lot of silica cause an explosive eruption?

TAKE A LOOK

7. Identify Relationships Fill in the blank spaces in the table.

SECTION 1 Volcanic Eruptions *continued*

How Can Magma Erupt from a Volcano?

There are two main ways that magma can erupt from a volcano: as lava or as pyroclastic material. *Pyroclastic material* is hardened magma that is blasted into the air. Nonexplosive eruptions produce mostly lava. Explosive eruptions produce mostly pyroclastic material. ✓

READING CHECK

8. Define What is pyroclastic material?

Most eruptions produce either lava or pyroclastic material, but not both. However, a single volcano may erupt many times. It may produce lava during some eruptions and pyroclastic material during others.

TYPES OF LAVA

Geologists classify lava by the shapes it forms when it cools. Some kinds of lava form smooth surfaces. Others form sharp, jagged edges as they cool. The figure below shows four kinds of lava flows.



Aa is lava that forms a thick, brittle crust as it cools. The crust is torn into sharp pieces as lava moves underneath it.

Pahoehoe is lava that forms a thin, flexible crust as it cools. The crust wrinkles as the lava moves underneath it.

Blocky lava is cool, stiff lava that does not travel very far from the volcano. Blocky lava usually oozes from a volcano and forms piles of rocks with sharp edges.

Pillow lava is lava that erupts under water. As it cools, it forms rounded lumps that look like pillows.

TAKE A LOOK

9. Compare How are aa and blocky lava similar?

TYPES OF PYROCLASTIC MATERIAL

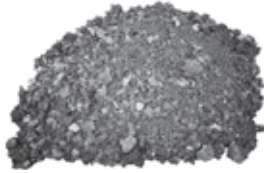
Pyroclastic material forms when magma explodes from a volcano. The magma solidifies in the air. Pyroclastic material also forms when powerful eruptions shatter existing rock.

Geologists classify pyroclastic material by the size of its pieces. Pieces of pyroclastic material can be the size of houses or as small as dust particles. The figure on the top of the next page shows four kinds of pyroclastic materials.

SECTION 1 Volcanic Eruptions *continued*



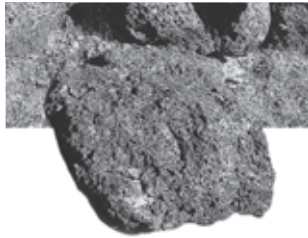
Volcanic bombs are large blobs of lava that harden in the air.



Lapilli are small bits of lava that harden before they hit the ground. Lapilli are usually about the size of pebbles.”



Volcanic ash forms when gases trapped in magma or lava form bubbles. When the bubbles explode, they create millions of tiny pieces.



Volcanic blocks are large pieces of solid rock that come out of a volcano.

TAKE A LOOK

10. Describe How do lapilli form?

PYROCLASTIC FLOWS

A *pyroclastic flow* is a dangerous type of volcanic flow. Pyroclastic flows form when ash and dust race down the side of a volcano like a river. Pyroclastic flows are very dangerous. They can be as hot as 700°C and can move at 200 km/h. A pyroclastic flow can bury or destroy everything in its path. A pyroclastic flow from the eruption of Mount Pinatubo is shown in the figure below.

Math Focus

11. Convert How fast can pyroclastic flows move? Give your answer in miles per hour.

1 km = 0.62 mi



This pyroclastic flow formed during the 1991 eruption of Mount Pinatubo, in the Philippines.

Section 1 Review

SECTION VOCABULARY

magma chamber the body of molten rock that feeds a volcano

vent an opening at the surface of the Earth through which volcanic material passes

volcano a vent or fissure in the Earth's surface through which magma and gases are expelled

1. Compare How is lava different from magma?

2. Identify What are the two kinds of volcanic eruptions?

3. Explain How does the amount of water in magma affect how a volcano erupts?

4. Explain Why is magma that contains little silica less likely to erupt explosively?

5. Compare How is pahoehoe lava different from pillow lava? How are they similar?

6. Describe How do volcanic bombs form?

7. Describe How does volcanic ash form?

8. Define What is a pyroclastic flow?

9. Infer Do pyroclastic flows form during explosive or nonexplosive eruptions?
