

chapter 6 Volcanoes

section 2 Types of Volcanoes

● Before You Read

Imagine you have two balloons. One balloon is twice the size of the other. If you popped both balloons, which one would you expect to have the loudest bang?

What You'll Learn

- what determines the explosiveness of volcanoes
- about three types of volcanoes

● Read to Learn

What controls eruptions?

Some volcanic eruptions are explosive. These eruptions are rapid, powerful, and destructive, like the eruption that took place at the Soufrière Hills volcano. Other volcanic eruptions are quiet. The lava flows slowly from the vent, like the eruptions at the Kilauea volcano. What causes these differences?

Two factors determine whether an eruption will be explosive or quiet. One factor is the amount of water vapor and other gases trapped in the magma. The other factor is how much silica is in the magma. Silica is a compound made of the elements silicon and oxygen. ✓

How do trapped gases affect eruptions?

What happens if a can of soda is shaken up and then opened quickly? Pressure from the gas in the drink is released suddenly, and the drink sprays everywhere. Something similar occurs with volcanoes. Gases, like water vapor and carbon dioxide, are trapped in magma by the pressure of the surrounding magma and rock. As magma nears the surface, it is under less pressure. This allows the gas to escape from the magma. Gas escapes easily from some magma during quiet eruptions. However, gas that builds up to high pressures causes explosive eruptions.

Study Coach

Two-Column Notes As you read, organize your notes in two columns. In the left column, write the main idea. Next to it, in the right column, write information to support the main idea.

✓ Reading Check

1. **Explain** What determines how a volcano will explode?



Think it Over

2. **Explain** Why does some magma contain a lot of water vapor?

Reading Check

3. **Determine** Is basaltic magma low or high in silica?



Think it Over

4. **Cause and Effect** Why does granitic magma cause explosive eruptions?

How does water vapor affect eruptions?

The magma at some convergent plate boundaries contains a lot of water vapor. This happens because an oceanic plate and some of its water slides under other plate material at some convergent plate boundaries. The trapped water vapor in the magma can cause explosive eruptions.

Composition of Magma

The second major factor that affects the nature of eruptions is the composition of magma. Magma can be divided into two major types—silica poor and silica rich.

What causes quiet eruptions?

Magma that is low in silica is called basaltic (buh SAWL tihk) magma. It is fluid and produces quiet eruptions like those at Kilauea. This type of lava pours from the volcanic vents and runs down the sides of a volcano. This is called *pahoehoe* (pa HOY hoy) lava. When *pahoehoe* lava cools, it forms a ropelike structure. If the same lava flows at a lower temperature, it forms stiffer, slower moving lava called *aa* (AH ah) lava.

Quiet eruptions form volcanoes over hot spots, which is how the Hawaiian volcanoes formed. Basaltic magma also flows from rift zones, which are long, deep cracks in Earth's surface. Many lava flows in Iceland are from rift zones.

Basaltic magma is so fluid that when it is forced upward in a vent, the trapped gases can escape easily. As a result, the explosion is quieter, sometimes forming lava fountains. Lava that flows underwater forms pillow lava formations. Just as their name suggests, they are shaped like pillows.

What causes explosive eruptions?

Magma that contains a lot of silica, or granitic magma, produces explosive eruptions, like those at Soufrière Hills volcano. This magma sometimes forms in areas where Earth's plates are moving together and one plate slides under the other. As the sinking plate goes deeper, some rock melts. The magma is forced upward because it is less dense than the rock around it. As it moves up, it comes in contact with Earth's crust, and becomes enriched in silica. Silica-rich granitic magma is thick. As a result, gas gets trapped inside, causing pressure to build up. When an explosive eruption occurs, the gases expand quickly, often carrying pieces of lava in the explosion.

What is andesitic magma?

There is another type of magma—andesitic magma. Andesitic magma contains more silica than basaltic magma, but less than granitic magma. It often forms at convergent plate boundaries where one plate slides under the other. Because of the higher silica content, andesitic magmas erupt more violently than basaltic magmas.

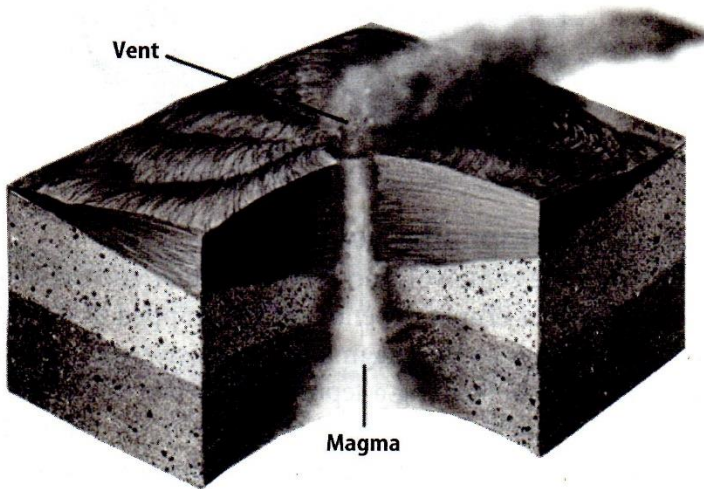
The word *andesitic* comes from the Andes mountain range located in South America. These mountains contain many andesite rocks. Many of the volcanoes that circle the Pacific Ocean also are made up of andesite.

Forms of Volcanoes

All volcanoes do not look alike. The shape of a volcano depends on whether it was formed by a quiet or explosive eruption. The shape also depends on what type of lava it is made of—basaltic, granitic, or andesitic. The three basic types of volcanoes are shield volcanoes, cinder cone volcanoes, and composite volcanoes.

What is a shield volcano?

Quiet eruptions of basaltic lava spread out in flat layers. These layers build up and form a broad volcano, as shown in the figure below. A broad, gently sloping volcano formed by quiet eruptions of basaltic lava is a **shield volcano**. The Hawaiian Islands are examples of shield volcanoes.

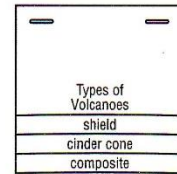


Think it Over

- 5. Compare and Contrast** Of the three types of magmas, which causes the least explosive eruptions?
-

FOLDABLES™

- B Take Notes** Make a layered book Foldable using two sheets of notebook paper. As you read, take notes on the three kinds of volcanoes.



Picture This

- 6. Determine** Use your pen or pencil to draw how lava erupts out of the shield volcano in the figure.

✓ Reading Check

7. Describe What type of lava forms flood basalts?

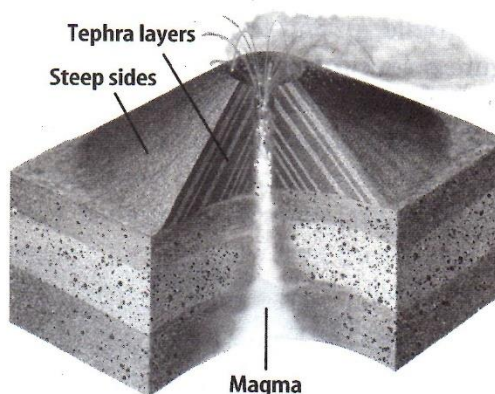
Picture This

8. Illustrate Use your pen or pencil to draw how lava erupts from the cinder cone volcano in the figure.

Flood Basalts The same basaltic lava that forms shield volcanoes also forms flood basalts. Basaltic lava can flow out of Earth's surface through large cracks called fissures (FIH zhurz). This type of eruption does not form volcanoes. It forms flood basalts and accounts for the greatest amount of erupted volcanic material. The basaltic lava flows over Earth's surface, covering large areas with thick deposits of basaltic igneous rock. The Columbia Plateau, located in the northwestern United States, is a flood basalt. Much of the new seafloor that begins at mid-ocean ridges forms as underwater flood basalts. ✓

What is a cinder cone volcano?

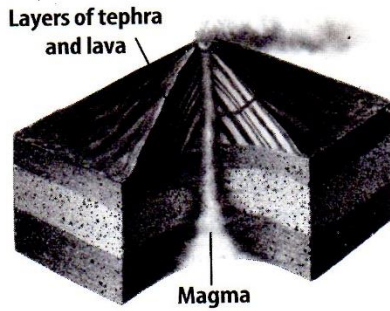
Explosive eruptions throw lava and rock high into the air. Bits of rock and solidified lava dropped from the air during an explosive volcanic eruption are called **tephra** (TEH fruh). Tephra comes in different sizes from small pieces of volcanic ash to large rocks called bombs and blocks. **Cinder cone volcanoes** are steep-sided, loosely packed volcanoes formed when tephra falls to the ground. The figure below shows the tephra layers and steep sides of a cinder cone volcano.



What is a composite volcano?

Sometimes the same volcano has both quiet and explosive eruptions. How it erupts depends on the trapped gases and how much silica is in the magma. An explosive period can release gas and ash, forming a tephra layer. Then, the eruption can become a quieter type, erupting lava over the top of the tephra layer. A **composite volcano** is built by alternating explosive and quiet eruptions that produce layers of tephra and lava. Composite volcanoes are found mostly where Earth's plates come together and one plate sinks beneath the other.

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Forming a Composite Volcano Soufrière Hills volcano is a composite volcano like the one shown in the figure above. This volcano formed when the ocean floor of the North American Plate and South American Plate slid under the Caribbean Plate. Magma was formed. The alternating eruptions of lava and tephra produced the composite volcano.

Where were other volcanic eruptions?

Soufrière Hills volcano is listed and described in the table below. As you read about some well-known volcanic eruptions, compare the types of volcanoes with their erupting force.

| Thirteen Selected Eruptions | | | | | | | |
|------------------------------|------|-------------|----------------|---------------|------------------|--------------------------|----------------------|
| Volcano and Location | Year | Type | Eruptive Force | Magma Content | | Ability of Magma to Flow | Products of Eruption |
| | | | | Silica | H ₂ O | | |
| Mount Etna, Sicily | 1669 | composite | moderate | high | low | medium | lava, ash |
| Tambora, Indonesia | 1815 | cinder cone | high | high | high | low | cinders, ash |
| Krakatau, Indonesia | 1883 | composite | high | high | high | low | cinders, ash |
| Mount Pelée, Martinique | 1902 | cinder cone | high | high | high | low | gas, ash |
| Vesuvius, Italy | 1906 | composite | moderate | high | low | medium | lava, ash |
| Mount Katmai, Alaska | 1912 | composite | high | high | high | low | lava, ash, gas |
| Paricutín, Mexico | 1943 | cinder cone | moderate | high | low | medium | ash, cinders |
| Surtsey, Iceland | 1963 | shield | moderate | low | low | high | lava, ash |
| Mount St. Helens, Washington | 1980 | composite | high | high | high | low | gas, ash |
| Kīlauea, Hawaii | 1983 | shield | low | low | low | high | lava |
| Mount Pinatubo, Philippines | 1991 | composite | high | high | high | low | gas, ash |
| Soufrière Hills, Montserrat | 1995 | composite | high | high | high | low | gas, ash, rocks |
| Popocatepetl, Mexico | 2000 | composite | moderate | high | low | medium | gas, ash |

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Think it Over

9. **Identify** Name the two kinds of alternating layers that form a composite volcano.

Think it Over

10. **Interpret** What kind of volcano is Krakatoa? What was its eruptive force?

● After You Read

Mini Glossary

cinder cone volcano: steep-sided, loosely packed volcano formed when tephra falls to the ground

composite volcano: volcano built by alternating explosive and quiet eruptions that produce layers of tephra and lava

shield volcano: broad, gently sloping volcano formed by quiet eruptions of basaltic lava

tephra (TEH fruh): bits of rock and solidified lava dropped from the air during an explosive volcanic eruption

1. Review the terms and their definitions in the Mini Glossary. Then write a sentence explaining which two kinds of volcanoes are likely to erupt tephra.

2. Read the sentence in the box below labeled *cause*. Think of what happens as a result of this. Choose a sentence listed below that tells what will probably occur next and write it in the box labeled *effect*.

CAUSE:

Magma is thick and traps gases.

EFFECT:

At a convergent boundary, plates collide.

At a divergent boundary, plates pull apart.

There will be a violent eruption.

There will be a quiet eruption.

3. Did this study strategy of writing your notes in two columns help you learn the concepts in this section? Why or why not?

