

When Mount St. Helens erupted, trapped gases caused the north side of the mountain to explode. Volcanic ash was ejected high into the atmosphere.



A **volcano** is a mountain that forms when magma reaches the surface.

Volcanoes can result from several different geological processes and can take a variety of forms.

Formation of a Volcano



How do volcanoes form?



Under certain conditions, small amounts of mantle rock can melt, forming liquid magma. The magma rises upward through the crust, erupting at the surface as a volcano.

Formation of a Volcano

The process that leads to a volcanic eruption begins deep inside Earth.

Magma rises because it is less dense than the solid rock around and above it.

Formation of a Volcano

How a Volcano Erupts

- Magma is under pressure and contains dissolved gases, including carbon dioxide and water vapor.
- Lower pressure near the surface allows the gases in magma to expand rapidly.
- An eruption occurs when the gases bubble out through a crack in the crust, propelling magma to the surface.

Formation of a Volcano

Structure of a Volcano

- Before an eruption, magma often collects in a pocket called a **magma chamber**.
- Magma slowly accumulates in the magma chamber until enough pressure builds up to start an eruption.
- Then, magma rises to the surface in a narrow, vertical channel called a **pipe**.

Formation of a Volcano

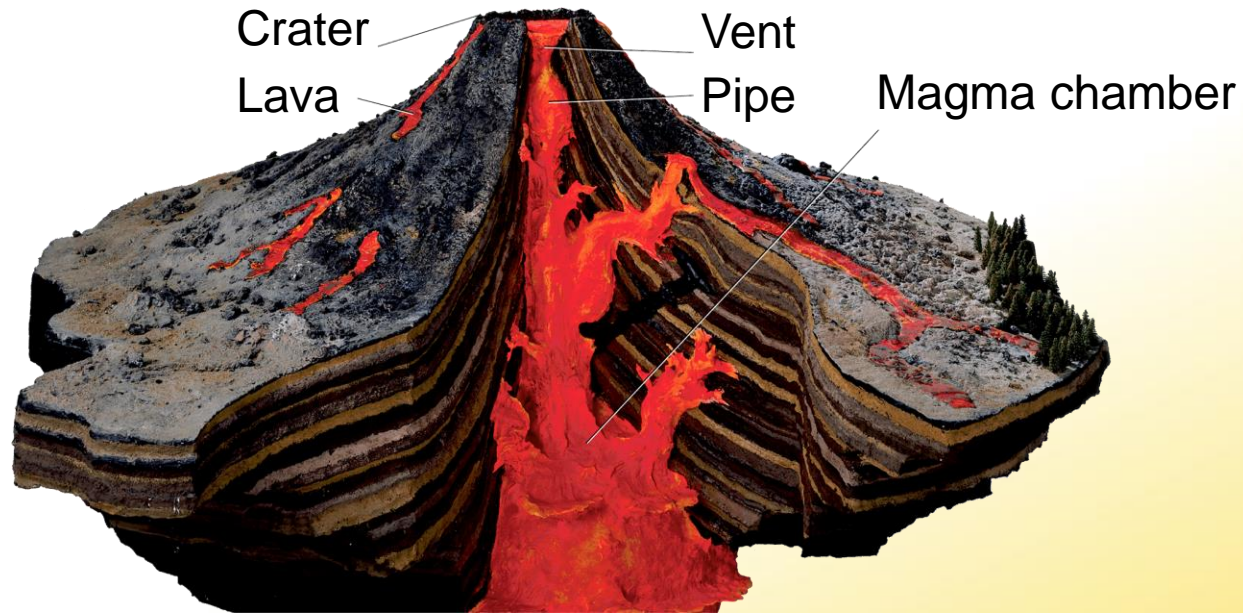
- An opening in the ground where magma escapes to the surface is called a **vent**.
- Often there is one central vent at the top of a volcano. Sometimes there are other vents that open along a volcano's side.
- At the top of the central vent in most volcanoes is a bowl-shaped pit called a **crater**.

Formation of a Volcano

- After an eruption, a volcano's magma chamber and main vent may empty of magma, creating a hollow shell.
- If this shell collapses inward, it creates a huge depression, called a **caldera**, at the top of the volcano.

Formation of a Volcano

When a volcanic mountain erupts, magma under pressure is forced upward from the magma chamber. Magma flows onto the surface as lava.



Quiet and Explosive Eruptions



Why are some volcanic eruptions quiet and others explosive?



Volcanoes erupt explosively or quietly, depending on the characteristics of the magma.

Quiet and Explosive Eruptions

Magma can vary in viscosity, the resistance to flow.

Magma with high viscosity is thick and resists flowing. Magma with low viscosity is thin and flows easily.

Quiet and Explosive Eruptions

There are three main factors that determine the viscosity of magma: temperature, water content, and silica content.

- Higher temperatures lower the viscosity of magma, so it flows more easily.
- Water in magma helps it flow more easily.
- Magma that is high in silica has high viscosity.

Quiet and Explosive Eruptions

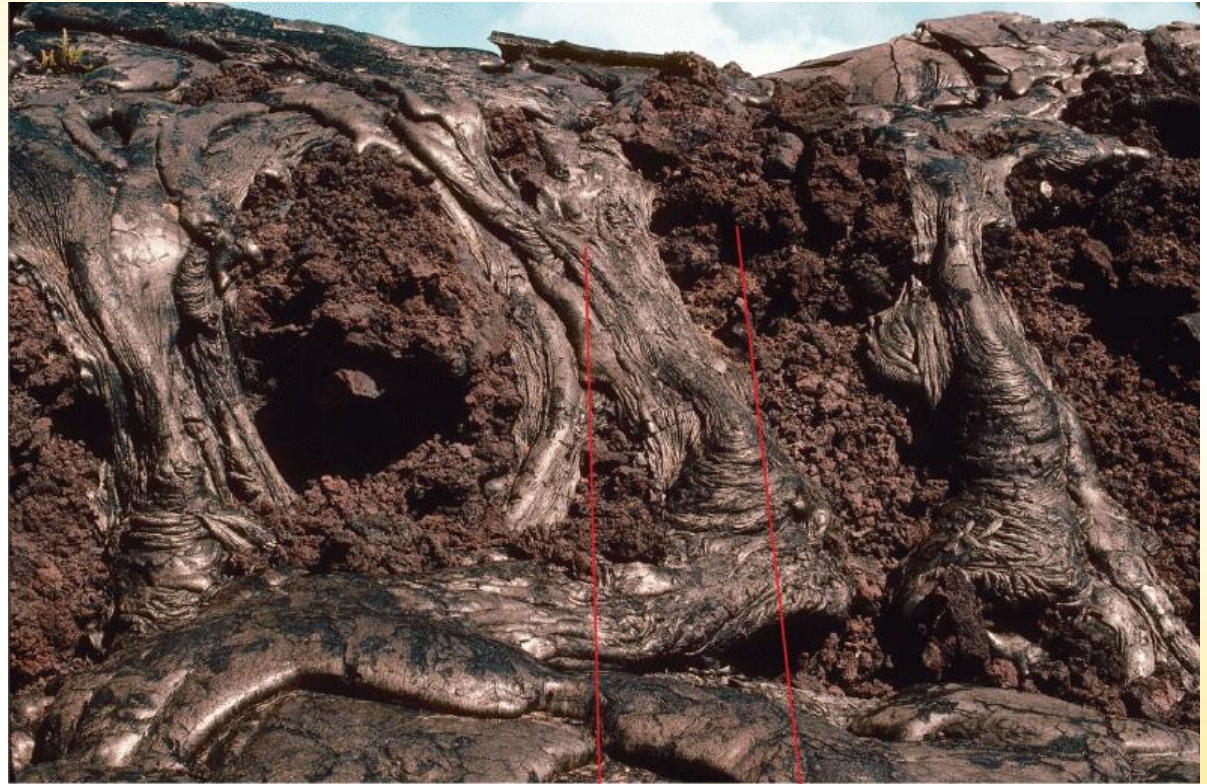
Quiet Eruptions

Volcanoes that have very hot, low-silica magma generally erupt quietly.

- In a quiet eruption, lava erupts in a stream of low-viscosity lava, called a lava flow.
- Lava flows from a quiet eruption can travel for great distances.

Quiet and Explosive Eruptions

Quiet eruptions produce two different kinds of lava: chunks called aa, or smooth coils called pahoehoe.



pahoehoe

aa

Quiet and Explosive Eruptions

Mt. Kilauea in Hawaii erupts quietly, producing low-viscosity lava flows.



Quiet and Explosive Eruptions

Explosive Eruptions

High-silica magma produces explosive eruptions.

- Thick magma can clog a volcanic pipe, causing enormous pressure to build up.
- When the volcano finally explodes, lava and hot gases are hurled outward.

Location and Types of Volcanoes



Where are volcanoes found?



Most volcanoes occur along plate boundaries or at hot spots in the crust.

Location and Types of Volcanoes

Volcanoes often form along a converging plate boundary where an oceanic plate is subducted into the mantle.

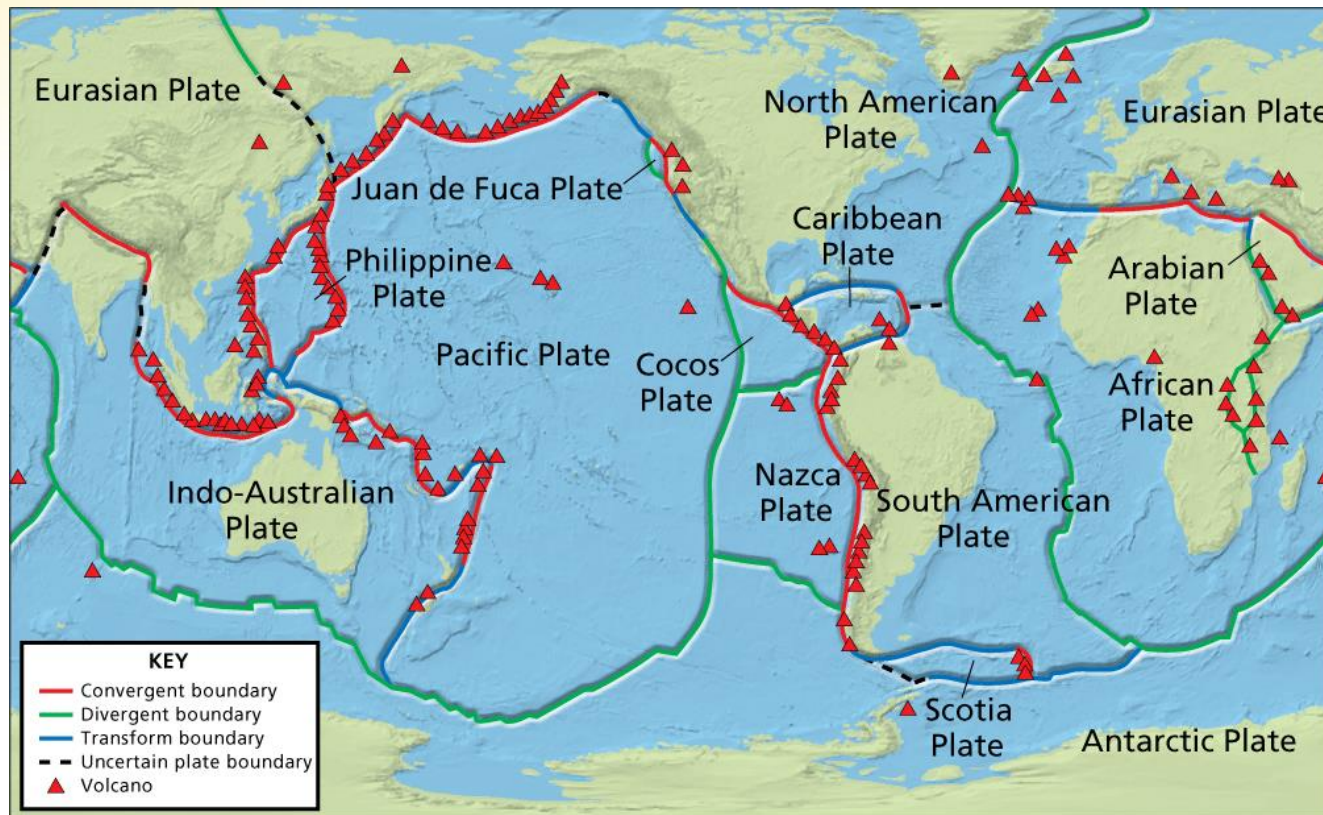
- As it sinks through the mantle, the plate causes melting.
- Magma forms and rises to the surface.

Location and Types of Volcanoes

- Volcanoes also form along a diverging plate boundary where magma rises to fill the gap between two separating plates.
- Some volcanoes occur at **hot spots**, regions where hot rock extends from deep within the mantle to the surface.

Location and Types of Volcanoes

Except for hotspot volcanoes, most of the world's volcanoes form near plate boundaries.



Location and Types of Volcanoes



The three major types of volcano are shield volcanoes, cinder cones, and composite volcanoes.

Location and Types of Volcanoes

Different types of volcanic eruptions produce different types of volcanoes.

Each type is named for its shape or interior structure.

Location and Types of Volcanoes

A quiet eruption of low-viscosity lava produces a wide, flat volcano called a **shield volcano**.

If an eruption is entirely ash and cinders, the result will be a small, steep-sided volcano called a **cinder cone**.

A volcano that forms from explosive eruptions that produce a combination of lava and ash is called a **composite volcano**.

Other Igneous Features



What landforms are formed from lava and magma?



Igneous features formed by magma include batholiths, sills, dikes, and volcanic necks.

Other Igneous Features

Sometimes magma does not reach the surface, but cools and hardens in the crust.

This magma forms intrusive igneous rock that may eventually be forced upward and exposed at Earth's surface.

Lava plateaus are features formed of extrusive igneous rock.

Other Igneous Features

A **batholith** is the largest type of intrusive igneous rock mass.

Magma sometimes squeezes into a crack between layers of rock.

- If the crack is parallel to existing rock layers, the magma hardens into a structure called a **sill**.
- If the crack cuts across rock layers, the hardened magma forms a **dike**.
- When magma hardens in a volcano's pipe, a structure called a **volcanic neck** may form.

Other Igneous Features

Ship Rock in New Mexico is a volcanic neck. It formed when the soft rock around a volcano's pipe wore away, revealing hard, igneous rock. The long ridge extending from the volcanic neck is a dike.



Assessment Questions

1. An opening in the ground where magma escapes to the surface is called a
 - a. vent.
 - b. crater.
 - c. pipe.
 - d. magma chamber.

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- very hot, low-silica magma.
 - high-silica magma.
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 - hot spots.
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Assessment Questions

4. What type of structure forms when magma hardens in a volcano's pipe?
- a. a batholith
 - b. a sill
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