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Warm-Up | Volcanoes

Lesson Question

What causes volcanoes?

Lesson Goals

- **Identify** the reasons why Earth's volcanic regions are located in certain areas.
- **Explain** what happens when a volcano erupts.
- **Distinguish** the two types of volcanic eruptions.
- **Describe** the three stages of volcanic activity.
- **Explain** how volcanoes create various landforms.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

hot spot	an area where material from deep in the mantle rises and melts, forming magma
lava	liquid rock found at Earth's surface
magma	liquid rock found beneath Earth's surface
magma chamber	a large pool of magma deep under Earth's surface
pipe	the channel in a volcano through which magma rises to reach Earth's surface

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Words to Know

vent	the opening at the top of a volcano
viscosity	the measure of a liquid's resistance to flow
volcano	a weak spot in the crust where magma pushes to the surface

Plates and Boundaries

Earth's crust is broken into major pieces called plates.

- Plates carry both land and water.
- Plates move very slowly.
- Plate boundaries occur where two plates meet.
  - The three types of boundaries are divergent, convergent, and transform.

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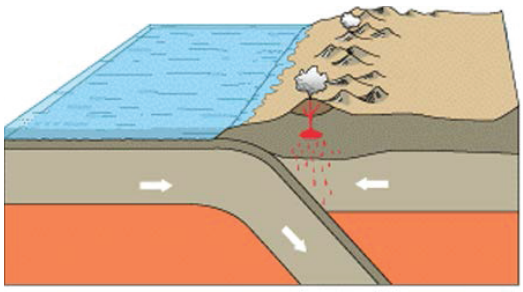
Subduction

The process of subduction produces [volcanoes].

- [Denser] plate slides under lighter plate.
- Crust material becomes molten rock.
- [Molten] rock rises back toward surface.
- Volcanic activity occurs on lighter plate.



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Volcanoes

A **volcano** is a weak spot in Earth's crust where molten material comes to the surface.

- Magma – molten rock found beneath Earth's surface
- Lava – molten rock found on Earth's surface

Locations of Volcanoes

Volcanoes occur in many locations that stretch across continents and oceans.



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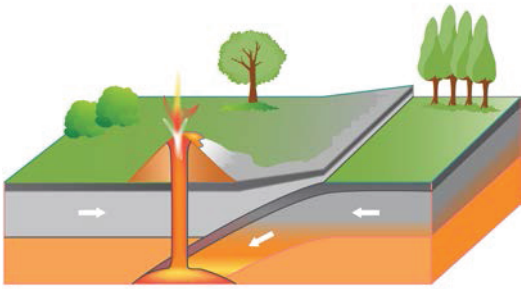
Volcanoes at Convergent Boundaries

Volcanoes commonly form along convergent boundaries.

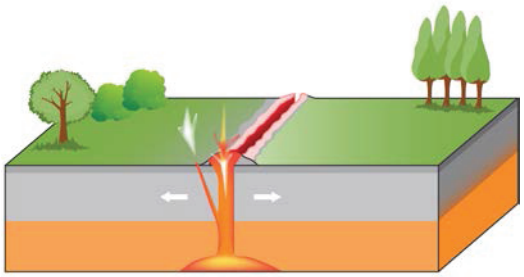
- Subduction occurs.
- Magma breaks through the [crust].
- Volcanic mountains form when this happens on [land].
- Island arcs form when this happens at [sea].



Volcanoes at Divergent Boundaries

Volcanoes can form along divergent boundaries on land and under the ocean.

- Plates move away from each other.
- [Magma] flows out of cracks in crust.
- This forms rift [valleys], where crust is pulling apart.
- It also forms mid-ocean ridges, where crust is being lifted up by a hot spot in the [mantle].



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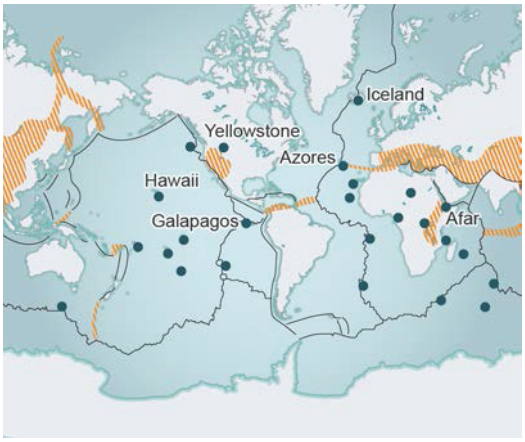
Hot Spots

Volcanoes also form at **hot spots**.

- Material from the mantle rises and erupts through the crust.
  - In the middle of [plates]
  - On or near boundaries



Hot Spot Activity

Hot spots can create [volcanoes] or [geothermal] activity.



The [Hawaiian] Islands formed over a hot spot.



[Yellowstone] National Park lies over a hot spot, leading to geothermal activity.

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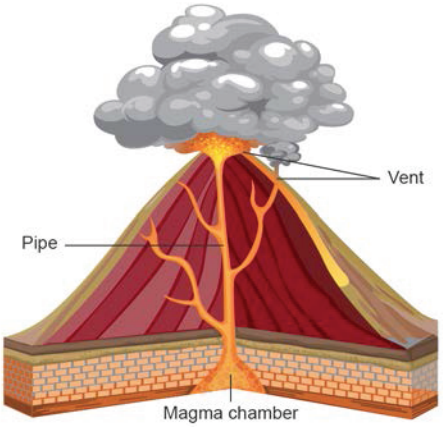
Features of a Volcano

Volcanoes have several important features that are key to eruptions.

- **Magma chamber** – pocket of magma below the surface
- Pipe – chamber in a volcano where magma rises
- Vent – area where molten material, gas, and ash erupt from a volcano



Exterior Volcanic Features

When volcanoes erupt, they create features.



Crater



Lava flow

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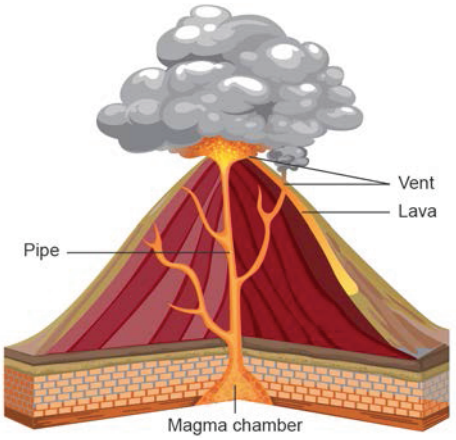
Details of an Eruption

Volcanic eruptions are caused by [explosions] in magma chambers.

- Dissolved gases trapped in [magma] are under a lot of pressure.
- As magma rises, pressure decreases, causing the gases to expand and form [bubbles].
- The force of the expanding [gases] pushes the magma from the magma [chamber] through the pipe and vent.



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Quiet Eruptions

The physical properties of a volcano's magma determine how the volcano erupts.

- Quiet eruption
  - Magma is low in [silica] and has a [low] **viscosity**.
  - Gases bubble out gently, and lava flows quietly.
  - [Lava] sets fire to and buries everything in its path.

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Explosive Eruptions

The second type of volcanic eruption is called an explosive eruption.

- Magma is high in silica, and it has a [high] viscosity.
- Gases become trapped in the volcano's [pipe], causing them to violently explode.
- Gases push magma out with great force.
- This force breaks lava into [fragments] that cool quickly and harden.

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Volcanic Activity

The three stages of volcanic activity are active, dormant, and extinct.



[Active] – erupting or shows signs of erupting again soon



[Dormant] – hasn't erupted for a long time but may in future



[Extinct] – unlikely to erupt again

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Monitoring Volcanoes

Geologists constantly monitor the conditions around volcanoes.

- Tiltmeters and GPS detect surface changes.
- Seismometers detect vibrations below the surface.
- Gas monitoring measures carbon dioxide and sulfur dioxide.
- Sound monitoring listens to sounds inside the volcano.

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Landforms from Lava and Ash

Six important landforms are created by volcanic lava and ash. The first three are shield volcanoes, cinder cone volcanoes, and composite volcanoes.



Shield Volcano



Cinder Cone Volcano



Composite Volcano

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Landforms from Lava and Ash

The other three landforms created from volcanic lava and ash are lava plateaus, calderas, and volcanic soils.



Lava [plateau]



[Caldera]



[Volcanic] soils

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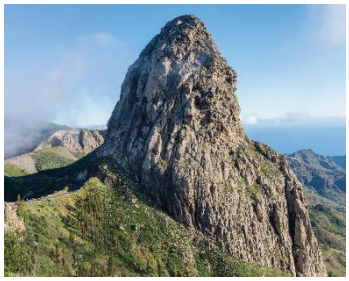
Landforms from Magma

When magma cools below the surface, it creates some fascinating features. These landforms are not visible until surrounding rock erodes, which takes millions of years.



Volcanic neck – a pipe that fills with [hardened] magma



[Batholith] – a large mass cooled deep inside Earth



Dome mountain – raised [crust] from hardened magma

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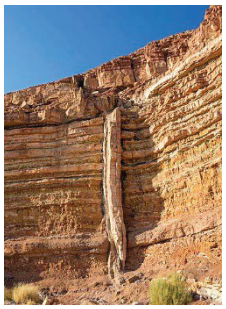
Landforms from Magma

Magma also creates landforms by intruding into existing rock formations.



A [dike] is a hardened magma intrusion that cuts vertically through older rock layers.



A [sill] is a hardened magma intrusion that cuts horizontally across layers.

Geothermal Activity

The heat associated with volcanic activity can create distinct geological features, too.



[Geysers] occur when heated water erupts.



Hot springs are found where water is [heated] by magma.



Mud pots are pools of boiling, [acidic] mud.

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Lesson Question

What causes volcanoes?

Answer

(Sample answer) When there is a weak spot in Earth's crust, magma can rise to the surface, causing a volcano.

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Review: Key Concepts

A volcano forms at a weak spot in Earth's crust where magma comes to the surface.

- Volcanoes occur at convergent boundaries, divergent boundaries, and hot spots.
- The two kinds of eruptions are determined by magma.
  - Quiet eruptions: Magma is low in silica and has low viscosity.
  - Explosive eruptions: Magma is high in silica and has high viscosity.
- Volcanoes are classified as active, dormant, or extinct.

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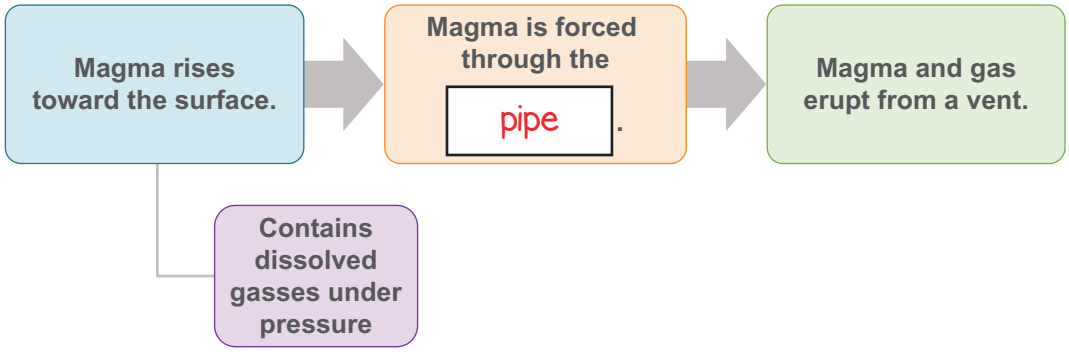
Review: Key Concepts



Review: Key Concepts

Volcanic Landforms from Lava and Ash

- Shield volcanoes
- Cinder cone volcanoes
- Composite volcanoes
- Lava plateaus
- Calderas
- Volcanic soils

Volcanic Landforms from Magma

- Volcanic necks
- Batholiths
- Dome mountains
- Dikes
- Sills

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Use this space to write any questions or thoughts about this lesson.

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