How to Use This Presentation

- To View the presentation as a slideshow with effects select "View" on the menu bar and click on "Slide Show."
- To advance through the presentation, click the right-arrow key or the space bar.
- From the resources slide, click on any resource to see a presentation for that resource.
- From the Chapter menu screen click on any lesson to go directly to that lesson's presentation.
- You may exit the slide show at any time by pressing the Esc key.

End Of Slide

Resources

Chapter Presentation

Bellringers

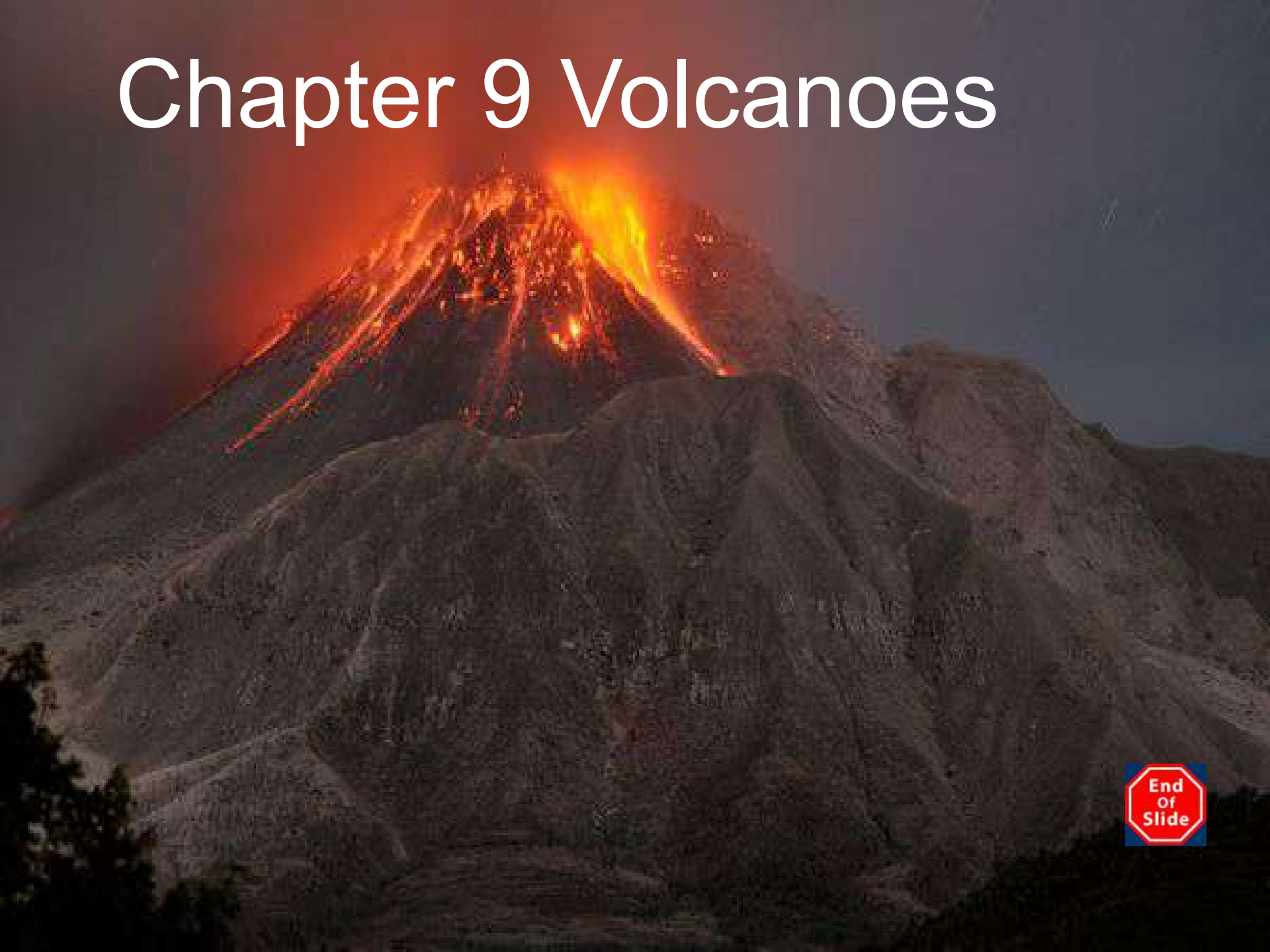
Transparencies

Standardized Test Prep

Image and Math Focus Bank

Visual Concepts

Chapter 9 Volcanoes

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Pacific Ocean
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Mt. St. Helens (Washington)
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Table of Contents

End Of Slide

Bellringer

Make a labeled drawing showing what happens when a volcano erupts. Then describe the photographs on pages 156 and 157 in your textbook. Why do the characteristics of volcanic eruptions vary?

Illustrate your responses in your **science journal.**

End Of Slide

Objectives

- **Distinguish** between nonexplosive and explosive volcanic eruptions.
- **Identify** the features of a volcano.
- **Explain** how the composition of magma affects the type of volcanic eruption that will occur.
- **Describe** four types of lava and four types of pyroclastic material.

End Of Slide

Volcanic Eruptions

- A **volcano** is a vent or fissure in the Earth's surface through which molten rock and gases are expelled.

- Molten rock is called **magma.**

- Magma that flows onto the Earth's surface is called **lava.**

End Of Slide

Nonexplosive Eruptions

- Nonexplosive eruptions are the most common type of volcanic eruptions. These eruptions produce relatively calm flows of lava in huge amounts.

- Vast areas of the Earth's surface, including much of the sea floor and the Northwestern United States, are covered with lava from nonexplosive eruptions.

End Of Slide
Chapter menu
Resources

Explosive Eruptions

- While explosive eruptions are much rarer than non-explosive eruptions, the effects can be incredibly destructive.

- During an explosive eruption, clouds of hot debris, ash, and gas rapidly shoot out from a volcano.

- An explosive eruption can also blast millions of tons of lava and rock from a volcano, and can demolish and entire mountainside.

End Of Slide
Chapter menu
Resources

What Is Inside a Volcano?

- The interior of a volcano is made up of two main features.

- The **magma chamber** is the body of molten rock deep underground that feeds a volcano.

- The **vent** is an opening at the surface of the Earth through which volcanic material passes.

End Of Slide
Chapter menu
Resources

Magma and Vents

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

What Makes Up Magma?

- By comparing magma from different eruptions, scientists have learned that the composition of the magma affects how explosive a volcanic eruption is.

- The key to whether an eruption will be explosive lies in the silica, water, and gas content of the magma.

End Of Slide
Chapter menu
Resources

What Makes Up Magma?, *continued*

- **Water and Magma Are an Explosive Combination**

If the water content of magma is high, an explosive eruption is more likely.

- While underground, magma is under intense pressure and water in it stays dissolved. If the magma quickly moves to the surface, pressure suddenly decreases and the water and other compounds become gases.

- As gases expand rapidly, an explosion can result.

End Of Slide

What Makes Up Magma?, *continued*

- **Silica-Rich Magma Traps Explosive Gases**

Magma with a high silica content also tends to cause explosive eruptions.

- Silica-rich magma has a stiff consistency, so it flows slowly and tends to harden in a volcano's vents. As a result, it plugs the vent.

- As more magma pushes up from below, pressure increases. If enough pressure builds up, an explosive eruption takes place.

End Of Slide

What Erupts from a Volcano?

- Magma erupts as either lava or pyroclastic material.

- **Lava** is liquid magma that flows from a volcanic vent.

- **Pyroclastic material** forms when magma is blasted into the air and hardens.

End Of Slide
Chapter menu
Resources

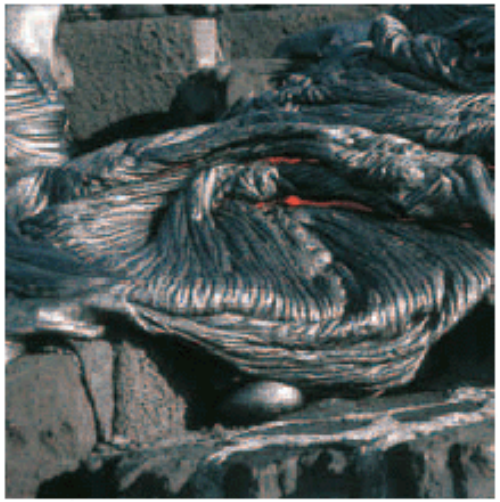
What Erupts from a Volcano?, *continued*

- **Types of Lava** The viscosity of lava, or how it flows, varies greatly. Lava that has high viscosity is stiff. Lava that has low viscosity is more fluid.

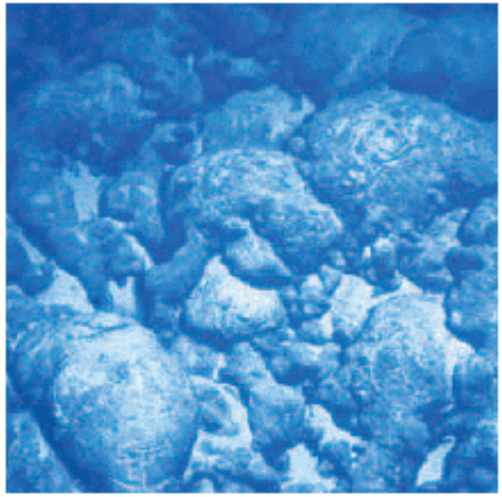
- The viscosity of lava affects the surface of a lava flow in different ways. Four types of lava are shown on the next slide.

End Of Slide
Chapter menu
Resources

Aa lava pours out quickly and forms a brittle crust. The crust is torn into jagged pieces as molten lava continues to flow underneath.



Pahoehoe lava flows slowly, like wax dripping from a candle. Its glassy surface has rounded wrinkles.



Pillow lava forms when lava erupts underwater. As you can see here, this lava forms rounded lumps that are the shape of pillows.

Blocky lava is cool, stiff lava that does not travel far from the erupting vent. Blocky lava usually oozes from a volcano and forms jumbled heaps of sharp-edged chunks.

What Erupts from a Volcano?, *continued*

- **Types of Pyroclastic Material** When magma explodes from a volcano and solidifies in the air, pyroclastic material is formed.

- Pyroclastic material also forms when powerful eruptions shatter existing rock.

What Erupts from a Volcano?, *continued*

There are four types of pyroclastic material:

- **Volcanic bombs** are large blobs of magma that harden in the air.

- **Volcanic blocks** are pieces of solid rock erupted from a volcano. Volcanic blocks are the largest pieces of pyroclastic material.

End Of Slide
Chapter menu
Resources

Volcanic Bomb and Block

What Erupts from a Volcano?, *continued*

- **Lapilli** are small, pebblelike bits of magma that hardened before they hit the ground.

- **Volcanic ash** forms when the gases in stiff magma expand rapidly and the walls of the gas bubbles explode into tiny, glasslike slivers. Ash makes up most of the pyroclastic material in an eruption.

End Of Slide
Chapter menu
Resources

Lapilli and Volcanic Ash

What Erupts from a Volcano?, *continued*

- **Pyroclastic flows** are dangerous volcanic flows that are produced when enormous amounts of hot ash, dust, and gases are ejected from a volcano.

- Pyroclastic flows can race downhill at speeds of more than 200 km/h.

- The temperature at the center of a pyroclastic flow can exceed 700°C.

End Of Slide
Chapter menu
Resources

Pyroclastic flow

Bellringer

Look through this section, and write a definition for the following terms: *shield volcano, cinder cone volcano, composite volcano, volcanic crater,* and *caldera*.

Record your definitions in your **science journal.**

End Of Slide

Objectives

- **Explain** how volcanic eruptions can affect climate.
- **Compare** the three types of volcanoes.
- **Compare** craters, calderas, and lava plateaus.

End Of Slide

Volcanic Eruptions and Climate Change

- During a large-scale volcanic eruption, enormous amounts of volcanic ash and gases are ejected into the upper atmosphere.

- As volcanic ash and gases spread throughout the atmosphere, they can block enough sunlight to cause global temperature to drop.

- Other effects of volcanic eruptions are shown in the following Visual Concepts presentation.

End Of Slide

Effects of Volcanoes on Earth

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

Different Types of Volcanoes

- Volcanic eruptions can cause profound changes in climate, but the changes to the Earth's surface are more familiar.

- Perhaps the best known of all volcanic landforms are the volcanoes themselves.

End Of Slide

Different Types of Volcanoes, *continued*

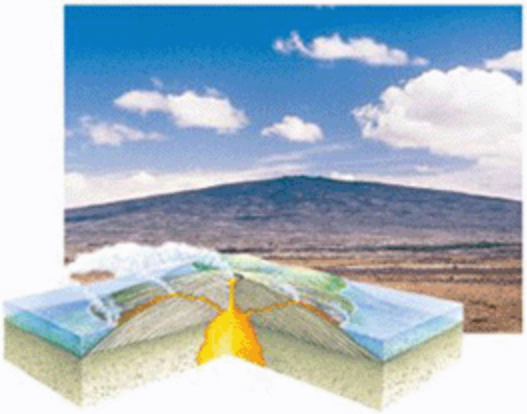
There are three basic types of volcanoes:

- **Shield Volcanoes**
- **Cinder Cone Volcanoes**
- **Composite Volcanoes**

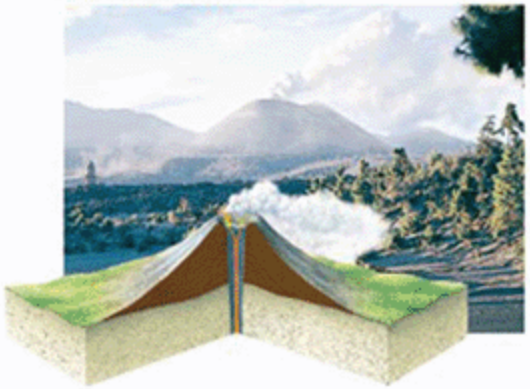
End Of Slide

Three Types of Volcanoes

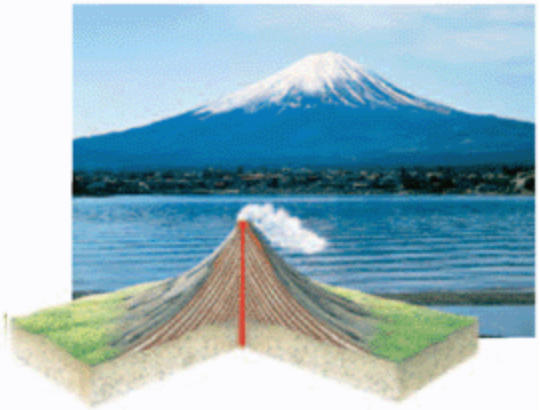
Shield volcano



Cinder cone volcano

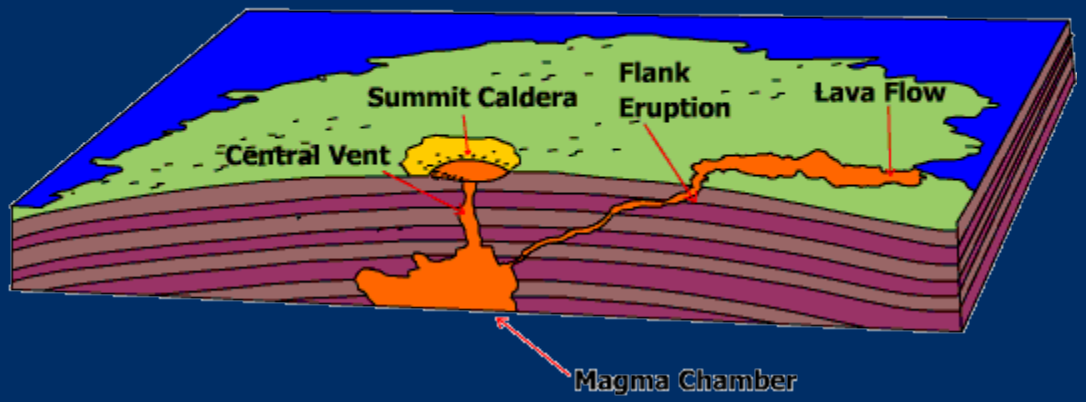


Composite volcano



Different Types of Volcanoes, *continued*

- **Shield volcanoes** are built of layers of lava that are released from repeated nonexplosive eruptions. The lava spreads out over a wide area, creating a volcano with gently sloping sides.



End Of Slide

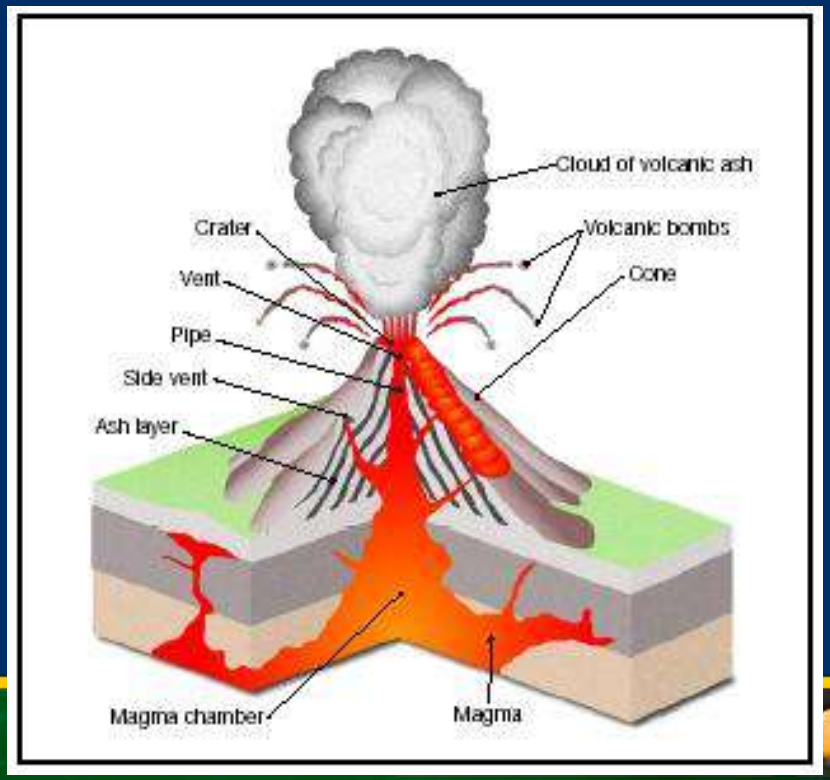
Different Types of Volcanoes, *continued*

- Shield volcanoes

End Of Slide

Different Types of Volcanoes, *continued*

- **Cinder cone volcanoes** are made of pyroclastic material usually produced from moderately explosive eruptions. The pyroclastic material forms steep slopes.



End Of Slide

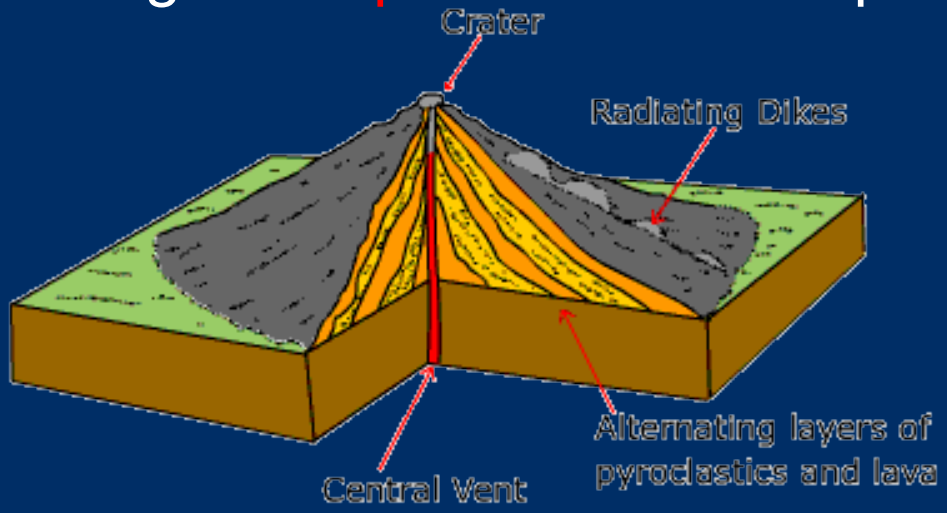
Resources

Different Types of Volcanoes, *continued*

- Cinder cone volcanoes

Different Types of Volcanoes, *continued*

• **Composite volcanoes** are formed from explosive eruptions of pyroclastic material, followed by quieter flows of lava. These formations, among the most common types of volcanoes, have broad bases and sides that get steeper toward the top.



Different Types of Volcanoes, *continued*

- Composite volcanoes

End Of Slide

Other Types of Volcanic Landforms

- In addition to volcanoes, there are other landforms produced by volcanic activity.

- **Craters** are funnel-shaped pits near the top of the central vent of a volcano.

Craters

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

Crater Lake National Park (Oregon)

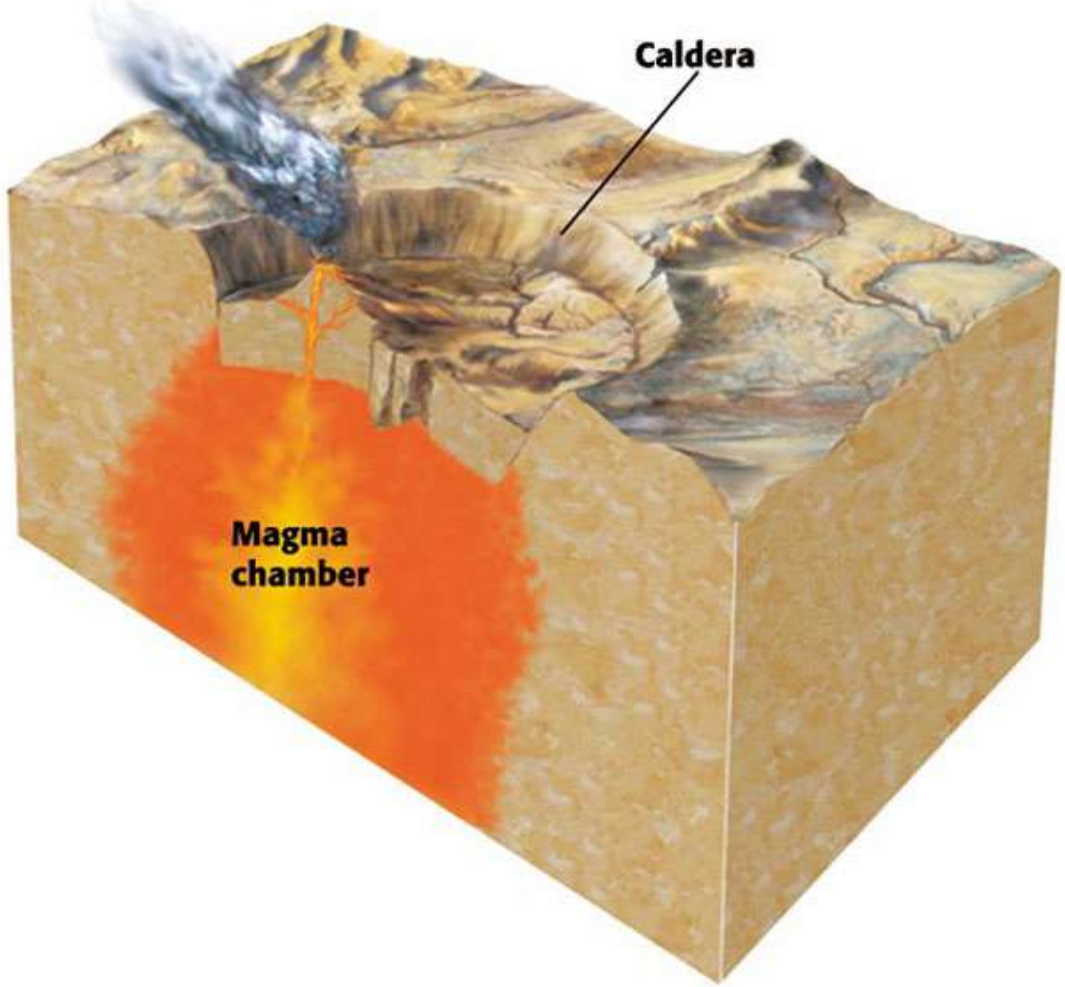
Other Volcanic Landforms, *continued*

- **Calderas** are large, semicircular depressions that form when the magma chamber below a volcano partially empties and causes the ground above to sink.

- Calderas can appear similar to craters, but are many times larger.

End Of Slide

The Formation of a Caldera



Other Volcanic Landforms, *continued*

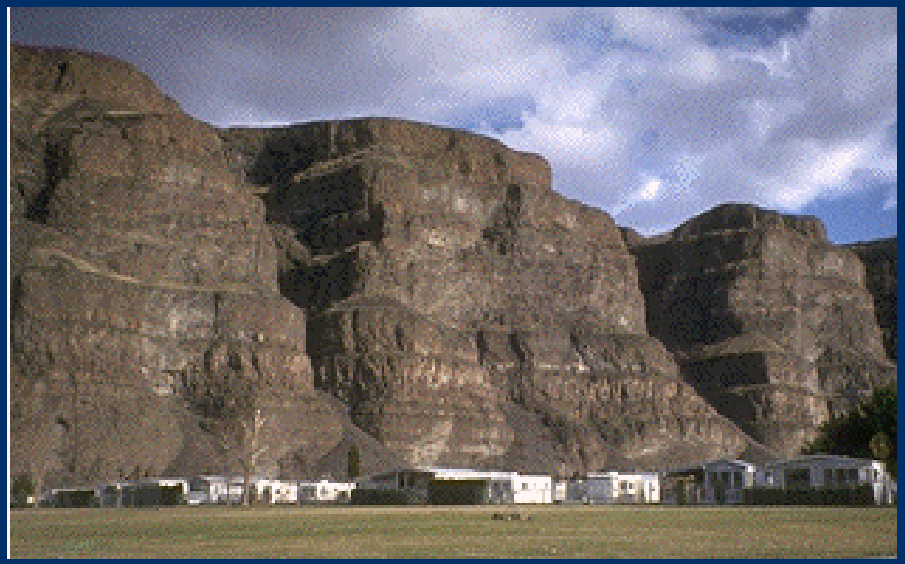
- **Lava Plateaus** are wide, flat landforms that result from repeated nonexplosive eruptions of lava that spread out over a large area.

- The lava that formed lava plateaus usually erupted from long cracks, or rifts, in the crust over a period of millions of years.

End Of Slide
Chapter menu
Resources

Other Volcanic Landforms, *continued*

- Lava Plateaus



Bellringer

Imagine you live on a volcanic island. List the signals that would tell you the volcano was about to erupt.

Record your responses in your **science journal.**

End Of Slide

Objectives

- **Describe** the formation and movement of magma.
- **Explain** the relationship between volcanoes and plate tectonics.
- **Summarize** the methods scientists use to predict volcanic eruptions.

End Of Slide

The Formation of Magma

- Understanding how magma forms helps explain why volcanoes erupt. Magma forms in the deeper regions of the Earth's crust and in the uppermost layers of the mantle.

- The following Visual Concerts presentation explains how pressure and temperature aid in the formation of magma, and how magma is formed in the mantle.

End Of Slide
Chapter menu
Resources

Magma Formation

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

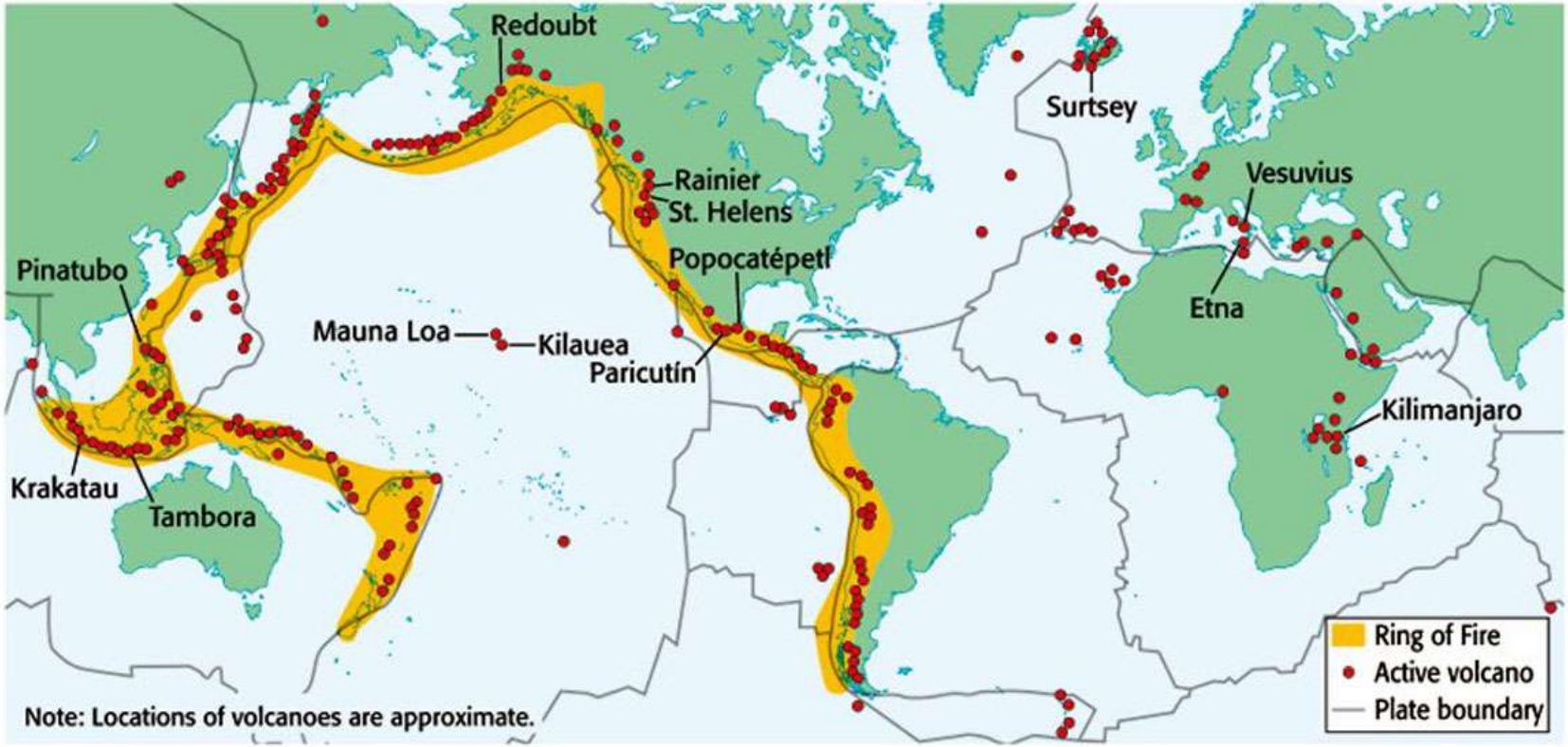
Where Volcanoes Form

- The locations of volcanoes give clues about how volcanoes form.

- The map on the next slide shows the location of some of the worlds most active volcanoes.

End Of Slide
Chapter menu
Resources

The Location of Major Volcanoes



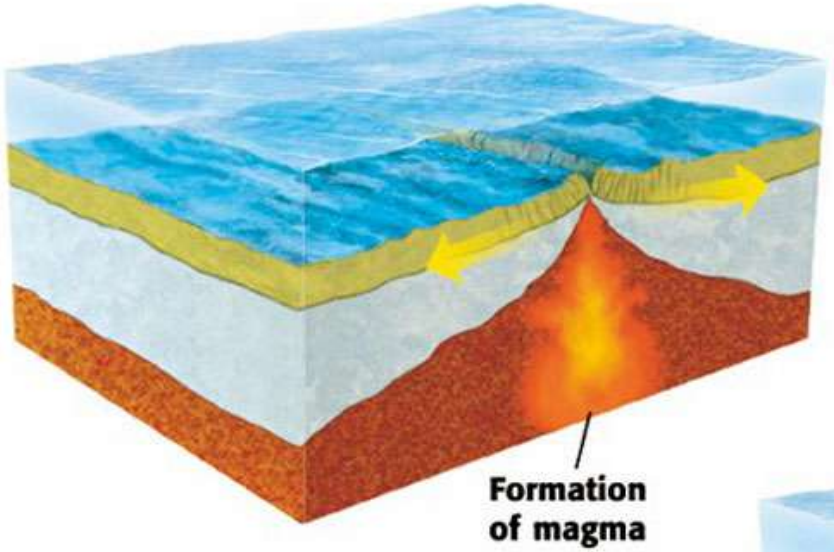
When Tectonic Plates Separate

- At a divergent boundary, tectonic plates move away from each other, forming a set of deep cracks called a **rift zone** between the plates.

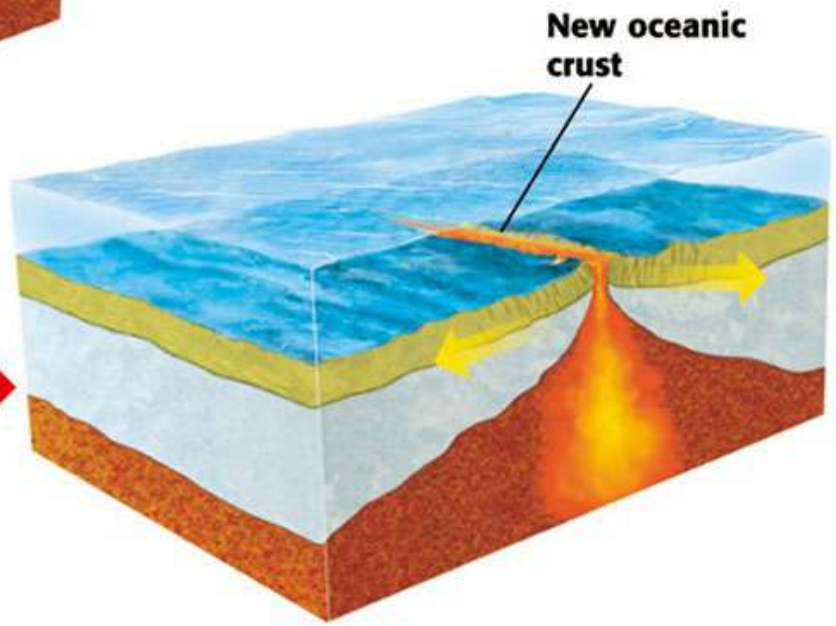
- Mantle rock rises to fill the gap opened by the separating tectonic plates. When mantle rock nears the surface, pressure decreases, which causes the mantle rock to melt and form magma.

End Of Slide

How Magma Forms at a Divergent Boundary



Mantle material rises to fill the space opened by separating tectonic plates. As the pressure decreases, the mantle begins to melt.



Because magma is less dense than the surrounding rock, it rises toward the surface, where it forms new crust on the ocean floor.

When Tectonic Plates Separate, *continued*

- **Mid-Ocean Ridges Form at Divergent Boundaries** Lava that flows from undersea rift zones produces volcanoes and mountain chains called mid-ocean ridges.

- At these mid-ocean ridges, lava flows out and creates new crust. Most volcanic activity on Earth occurs at mid-ocean ridges.

End Of Slide

When Tectonic Plates Collide

- Convergent boundaries are places where tectonic plates collide.

- When an oceanic plate collides with a continental plate, the oceanic plate usually slides underneath the continental plate. This is a process called **subduction.**

When Tectonic Plates Collide, *continued*

- **Subduction Produces Magma** As descending oceanic crust scrapes past the continental crust, the temperature and pressure increase.

- The following Visual Concepts presentation shows how subduction produces magma, and how that magma can rise to form a volcano.

End Of Slide

Volcano Formation at Convergent Boundaries

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

Hot Spots

- Not all magma develops along tectonic plates boundaries. Some volcanoes are located at places known as hot spots.

- **Hot spots** are volcanically active places on the Earth's surface that are far from plate boundaries.

- Some scientists think that hot spots are directly above columns of rising magma, called mantle plumes.

End Of Slide

Hot Spots, *continued*

- A hot spot often produces a chain of volcanoes. One theory is that the mantle plume stays in the same spot while the tectonic plates move over it.

- Other scientists think that hot spots are the result of cracks in the Earth's crust.

- The theory argues that hot-spot volcanoes occur in chains because they form along the cracks in the Earth's crust.

End Of Slide

Predicting Volcanic Eruptions

Volcanoes are classified in three categories:

- **Active Volcanoes**
- **Dormant Volcanoes**
- **Extinct Volcanoes**

Active, Dormant, and Extinct Volcanoes

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.

End Of Slide

Predicting Volcanic Eruptions, *continued*

- **Measuring Small Quakes and Volcanic Gases**

Most active volcanoes produce small earthquakes as the magma within them moves upward and causes the surrounding rock to shift.

- Just before an eruption, the number and strength of the earthquakes increase. Monitoring these quakes is one way to predict an eruption.

- Studying the ratio of certain gases in a volcano also may help predict eruptions.

End Of Slide

Predicting Volcanic Eruptions, *continued*

- **Measuring Slope and Temperature** As magma moves upward prior to an eruption, it can cause the Earth's surface to swell, and the side of a volcano may even bulge.

- Scientists can use instruments and satellite technology to detect changes in a volcano's slope.

- Infrared satellite images record changes in surface temperature and gas emissions of a volcano to watch if the magma below is rising.

End Of Slide

Concept Map

Use the terms below to complete the concept map on the next slide.

eruptions
composite volcanoes
shield volcanoes
lava
cinder cone volcanoes

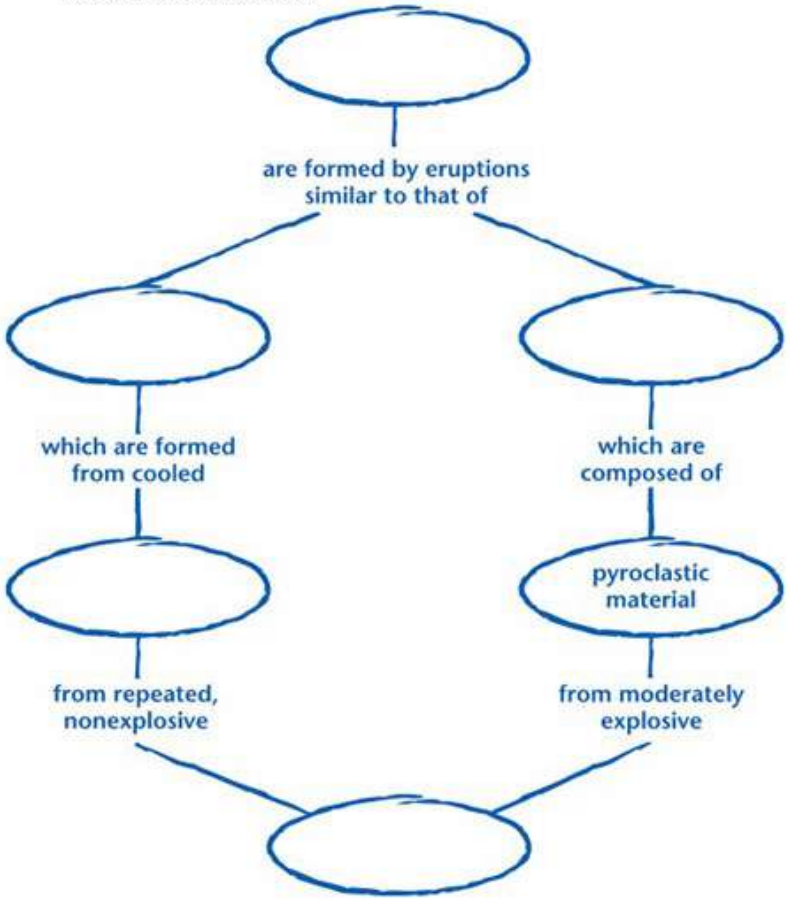
End Of Slide

Volcanoes

Volcanoes

Use the following terms to complete the concept map below:

eruptions, composite volcanoes, shield volcanoes, lava, cinder cone volcanoes

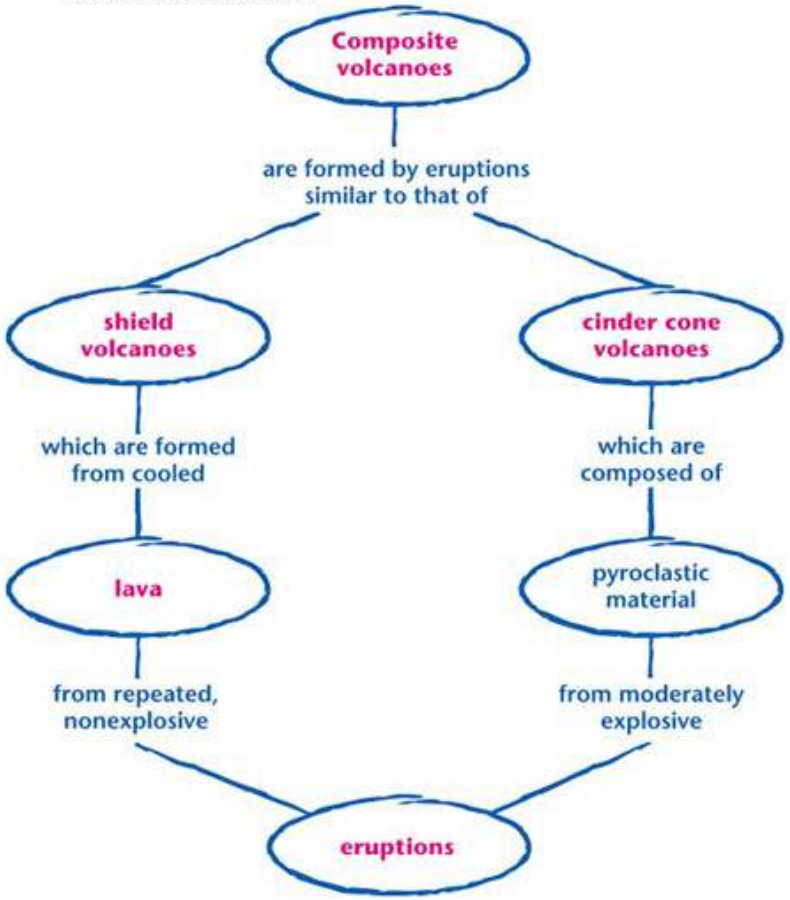


Volcanoes

Volcanoes

Use the following terms to complete the concept map below:

eruptions, composite volcanoes, shield volcanoes, lava, cinder cone volcanoes



End of Chapter 9 Show

End Of Slide

Chapter menu

Resources

Reading

Read each of the passages. Then, answer the questions that follow each passage.

End Of Slide

Passage 1 When the volcanic island of Krakatau in Indonesia exploded in 1883, a shock wave sped around the world seven times. The explosion was probably the loudest sound in recorded human history. What caused this enormous explosion?

Continued on the next slide

Passage 1, *continued* Most likely, the walls of the volcano ruptured, and ocean water flowed into the magma chamber of the volcano. The water instantly turned into steam, and the volcano exploded with the force of 100 million tons of TNT. The volcano ejected about 18 km^3 of volcanic material into the air.

Continued on the next slide

Passage 1, *continued* The ash clouds blocked out the sun, and everything within 80 km of the volcano was plunged into darkness for more than two days. The explosion caused a tsunami that was nearly 40 m high. Detected as far away as the English Channel, the tsunami destroyed almost 300 coastal towns. In 1928, another volcano rose from the caldera left by the explosion. This volcano is called Anak Krakatau.

End Of Slide

1. In the passage, what does *tsunami* mean?

A a large earthquake

B a shock wave

C a giant ocean wave

D a cloud of gas and dust

End Of Slide

1. In the passage, what does *tsunami* mean?

A a large earthquake

B a shock wave

C a giant ocean wave

D a cloud of gas and dust

End Of Slide

2. According to the passage, what was the size of the Krakatau explosion probably the result of?

F pyroclastic material rapidly mixing with air

G 100 million tons of TNT

H an ancient caldera

I the flow of water into the magma chamber

End Of Slide

2. According to the passage, what was the size of the Krakatau explosion probably the result of?

F pyroclastic material rapidly mixing with air

G 100 million tons of TNT

H an ancient caldera

I the flow of water into the magma chamber

End Of Slide

3. What does the Indonesian word *anak* probably mean?

A father

B child

C mother

D grandmother

End Of Slide

3. What does the Indonesian word *anak* probably mean?

A father

B child

C mother

D grandmother

End Of Slide

Passage 2 Yellowstone National Park in Montana and Wyoming contains three overlapping calderas and evidence of the cataclysmic ash flows that erupted from them. The oldest eruption occurred 1.9 million years ago, the second eruption happened 1.3 million years ago, and the most recent eruption occurred 0.6 million years ago.

Continued on the next slide

Passage 2, *continued* Seismographs regularly detect the movement of magma beneath the caldera, and the hot springs and geysers of the park indicate that a large body of magma lies beneath the park. The geology of the area shows that major eruptions occurred about once every 0.6 or 0.7 million years. Thus, a devastating eruption is long overdue. People living near the park should be evacuated immediately.

End Of Slide

1. In the passage, what does *cataclysmic* mean?

A nonexplosive

B ancient

C destructive

D characterized by ash flows

End Of Slide

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A nonexplosive

B ancient

C destructive

D characterized by ash flows

End Of Slide

2. Which of the following clues are evidence of an active magma body beneath the park?

F cataclysmic ash flows

G the discovery of seismoclasts

H minor eruptions

I seismograph readings

End Of Slide

2. Which of the following clues are evidence of an active magma body beneath the park?

F cataclysmic ash flows

G the discovery of seismoclasts

H minor eruptions

I seismograph readings

End Of Slide

3. Which of the following contradicts the author's conclusion that an eruption is "long overdue"?

A Magma has been detected beneath the park.

B With a variation of 0.1 million years, an eruption may occur in the next 100,000 years.

C The composition of gases emitted indicates that an eruption is near.

D Seismographs have detected the movement of magma.

End Of Slide

3. Which of the following contradicts the author's conclusion that an eruption is "long overdue"?

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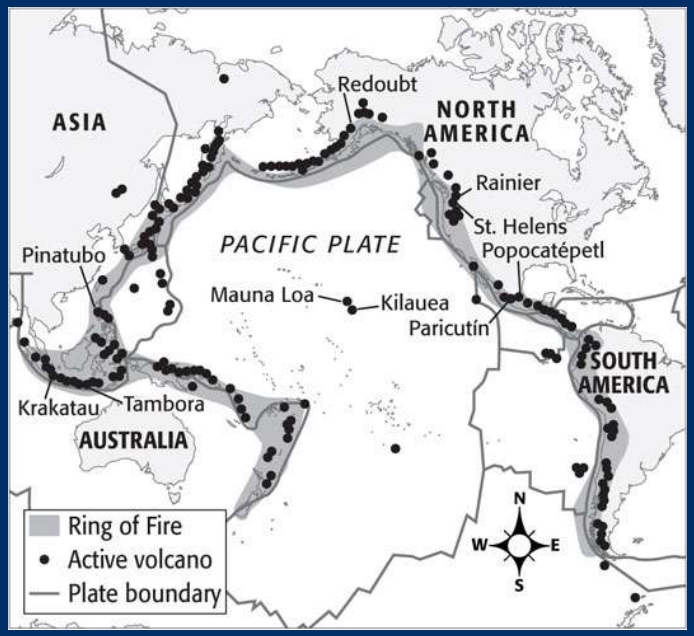
C The composition of gases emitted indicates that an eruption is near.

D Seismographs have detected the movement of magma.

End Of Slide

Interpreting Graphics

The map below shows some of the Earth's major volcanoes and the tectonic plate boundaries. Use the map below to answer the questions that follow.



End Of Slide
Chapter menu
Resources

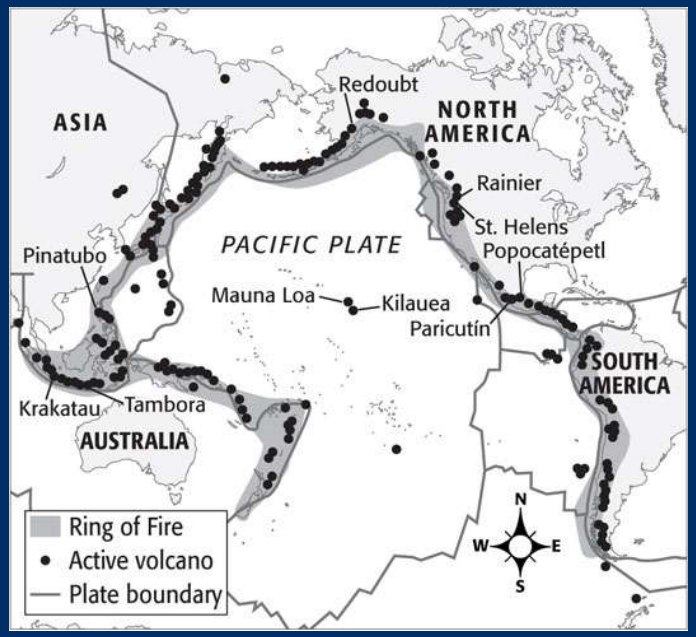
1. If ash from Popocatépetl landed on the west coast of the United States, what direction did the ash travel?

A northeast

B northwest

C southeast

D southwest



End of Slide

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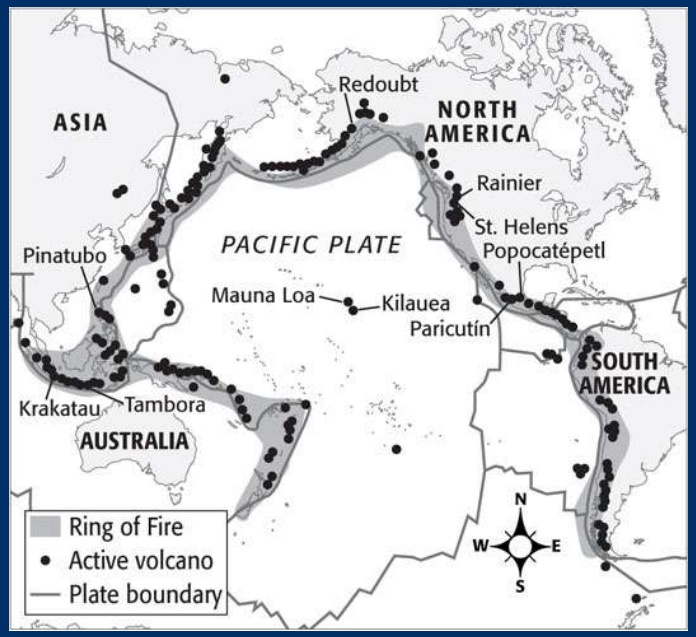


End Of Slide

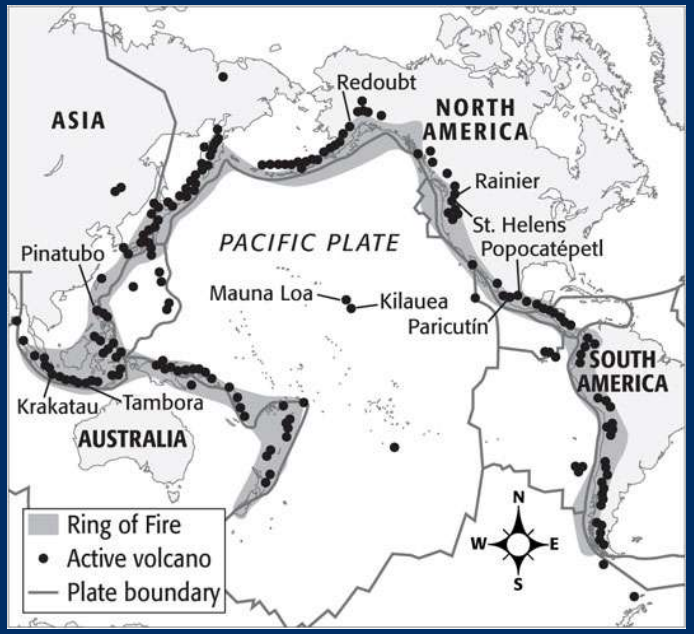
2. Why aren't there any active volcanoes in Australia?

F Australia is not located on a plate boundary.

G Australia is close to Krakatau and Tambora.

H Australia is near a plate boundary.

I Australia is near a rift zone.



End Of Slide

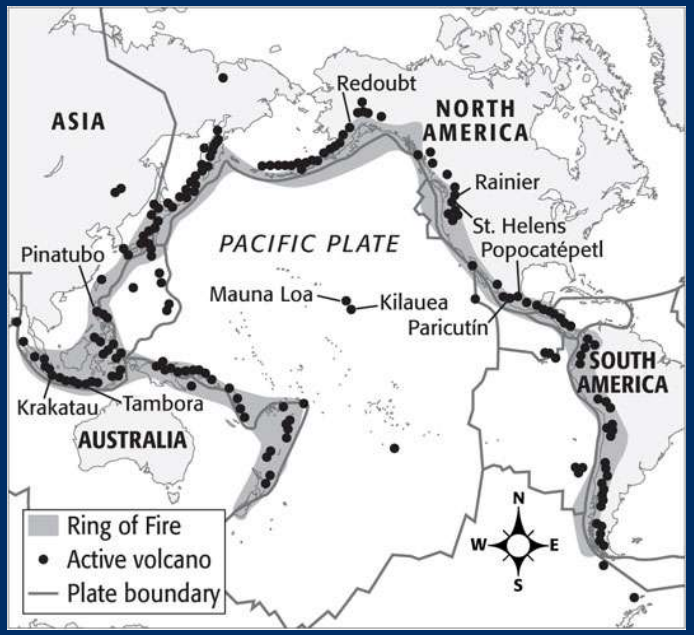
2. Why aren't there any active volcanoes in Australia?

F Australia is not located on a plate boundary.

G Australia is close to Krakatau and Tambora.

H Australia is near a plate boundary.

I Australia is near a rift zone.



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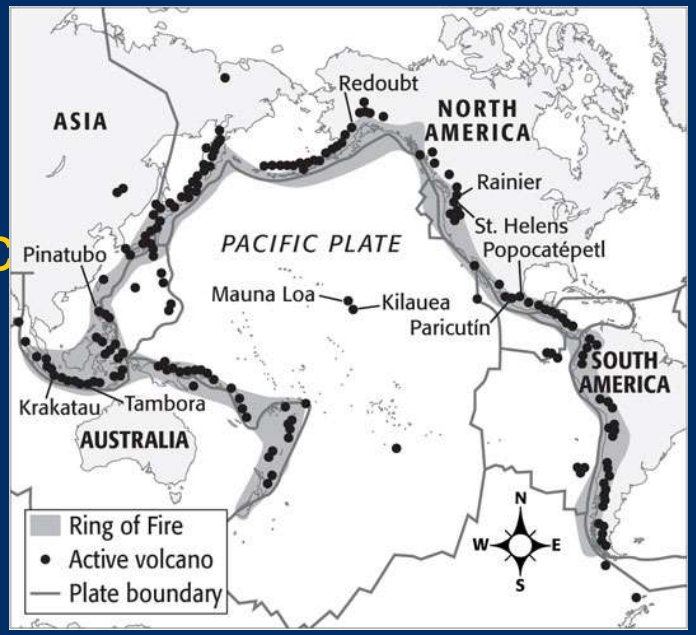
3. If a scientist traveled along the Ring of Fire from Mt. Redoubt to Krakatau, which of the following most accurately describes the directions in which she traveled?



A west, southeast, east

B west, southeast, west

C west, southwest, east

D west, southwest, west

End Of Slide

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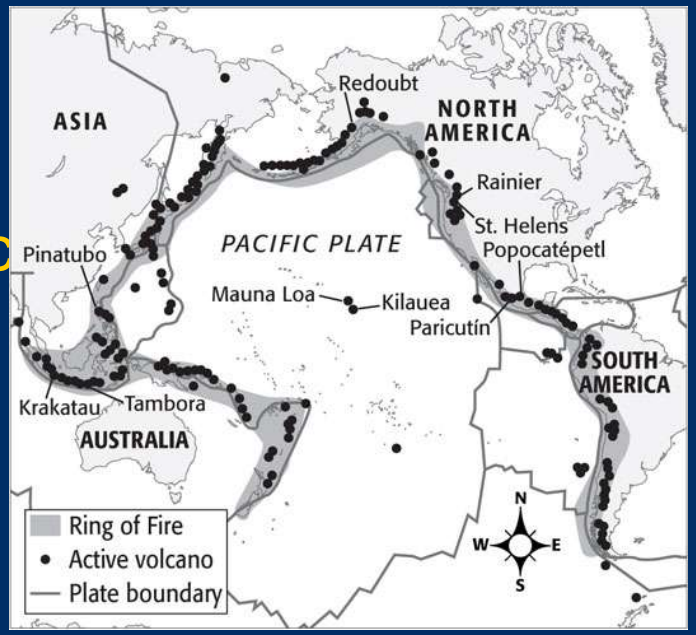

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C west, southwest, east

D west, southwest, west

End Of Slide

Math

Read each question, and choose the best answer.

End Of Slide

1. Midway Island is 1,935 km northwest of Hawaii. If the Pacific plate is moving to the northwest at a rate of 9 cm per year, how long ago was Midway Island over the hot spot that formed the island?

A 215,000 years

B 2,150,000 years

C 21,500,000 years

D 215,000,000 years

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2. In the first year that the Mexican volcano Paricutín appeared in a cornfield, it grew 360 m. The volcano stopped growing at about 400 m. What percentage of the volcano's total growth occurred in the first year?

F 67%

G 82%

H 90%

I 92%

End Of Slide

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3. A pyroclastic flow is moving down a hill at 120 km/h. If you lived in a town 5 km away, how much time would you have before the flow reached your town?

A 2 min and 30 s

B 1 min and 21 s

C 3 min and 12 s

D 8 min and 3 s

End Of Slide

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4. The Columbia River plateau is a lava plateau that contains 350,000 km^3 of solidified lava. The plateau took 3 million years to form. What was the average rate of lava deposition each century?

F 0.116 km^3

G 11.6 km^3

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End Of Slide

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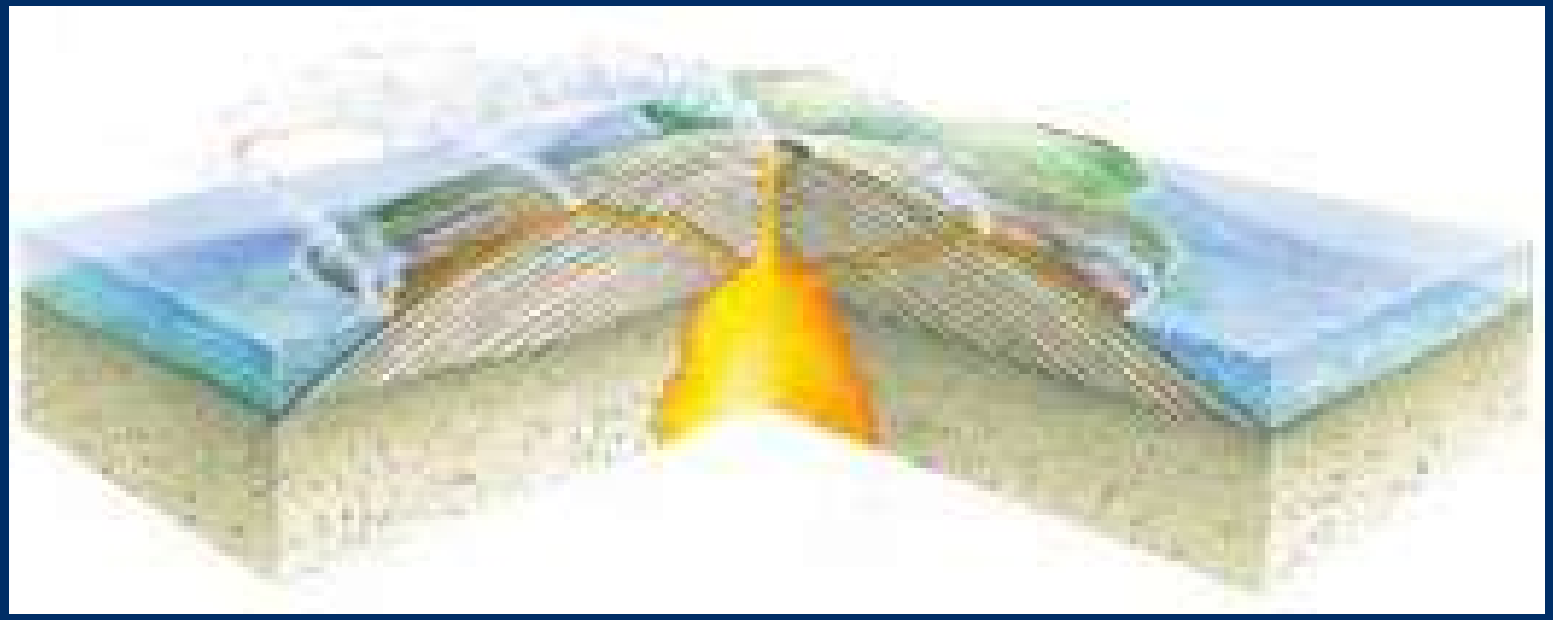
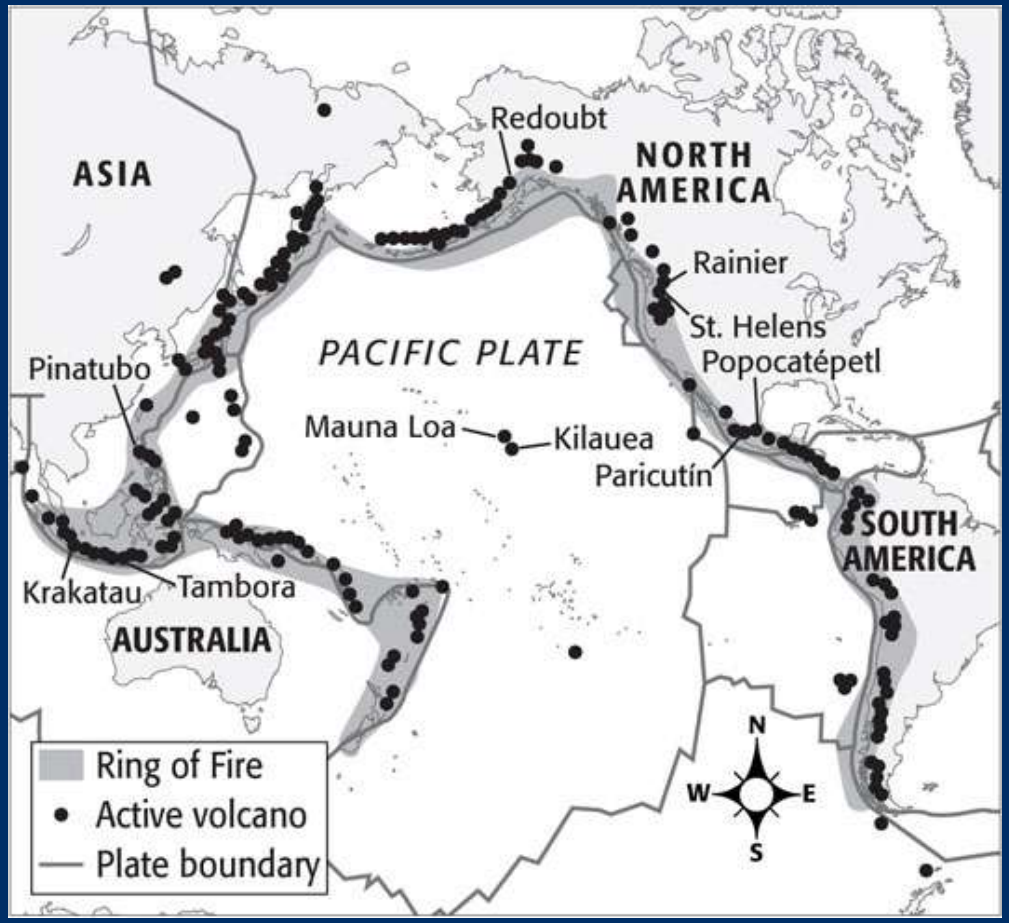
Chapter menu

Resources



Standardized Test Preparation



How Magma Forms at a Convergent Boundary