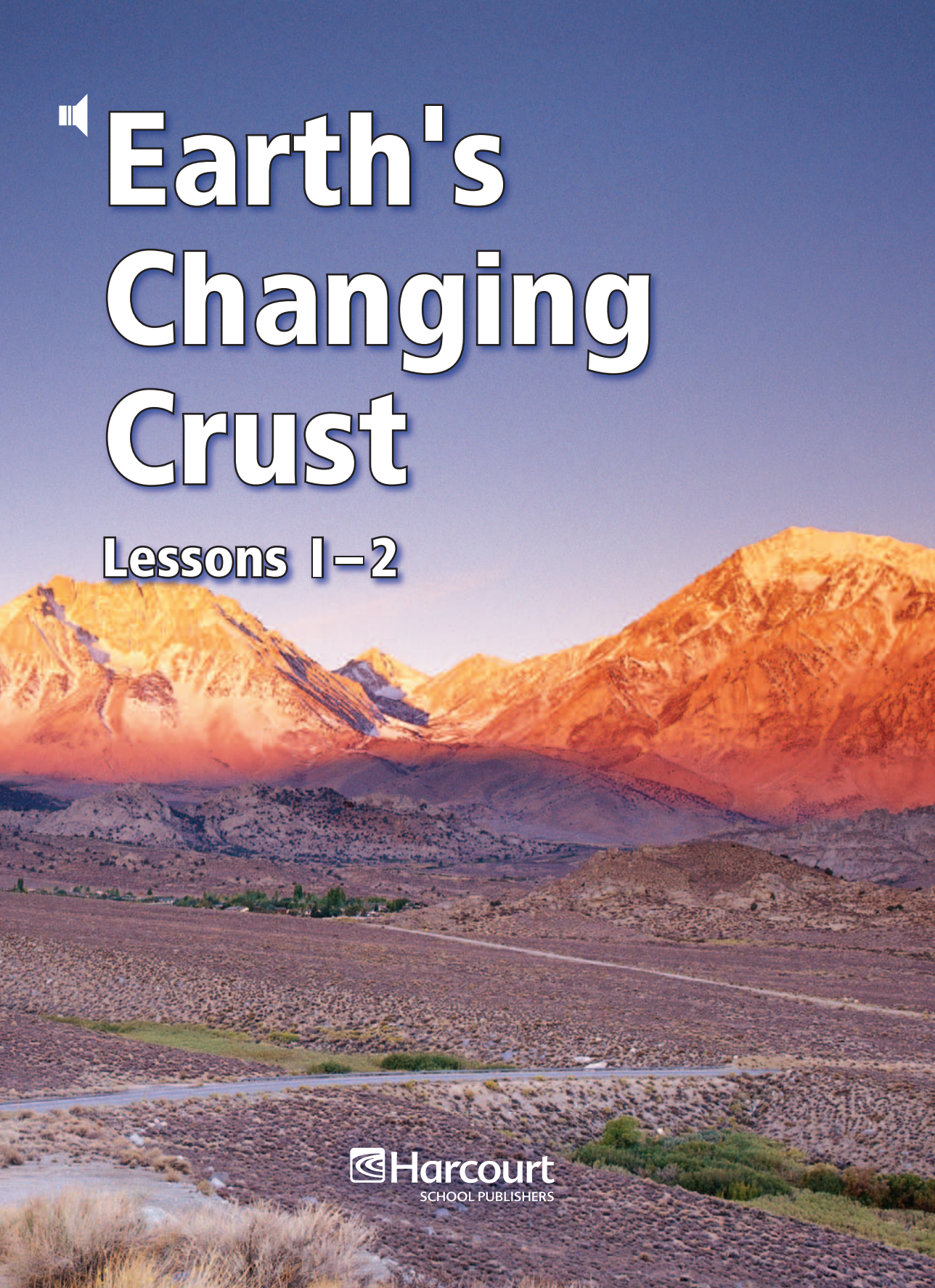
Earth's Changing Crust

Lessons 1–2



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Earth's Changing Crust

Lessons 1–2

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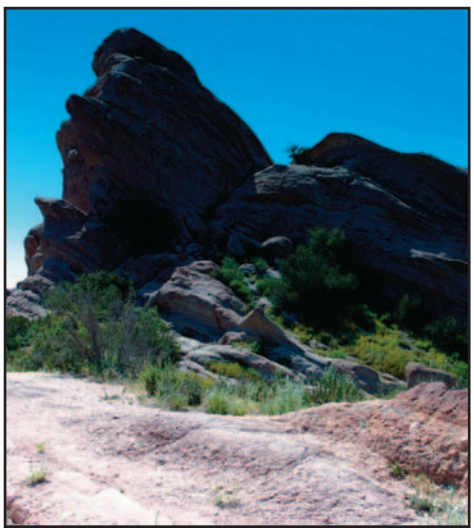
Lesson 1

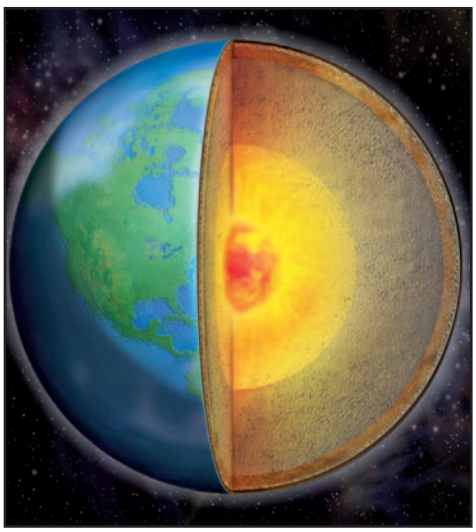
What Are the Layers of Earth?

VOCABULARY

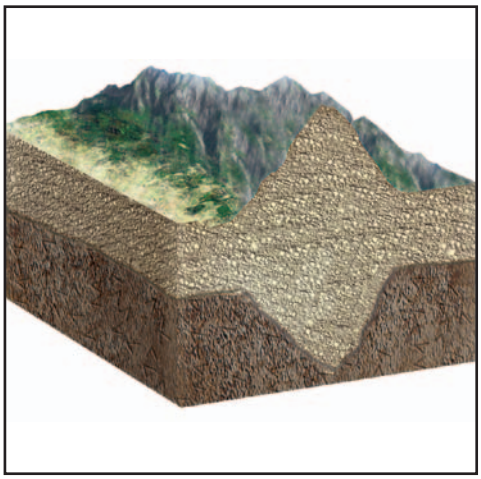
- crust
- mantle
- lithosphere
- asthenosphere
- core
- convection



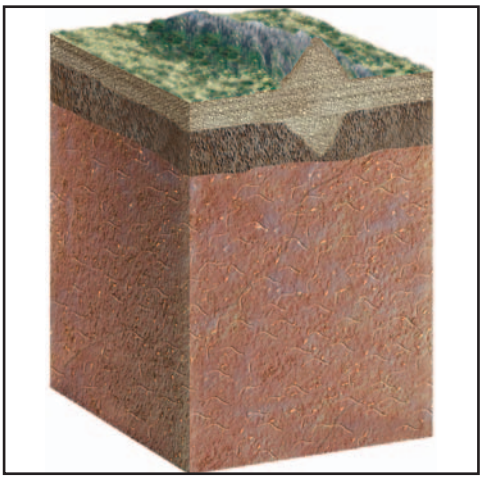
We live on Earth's **crust**.



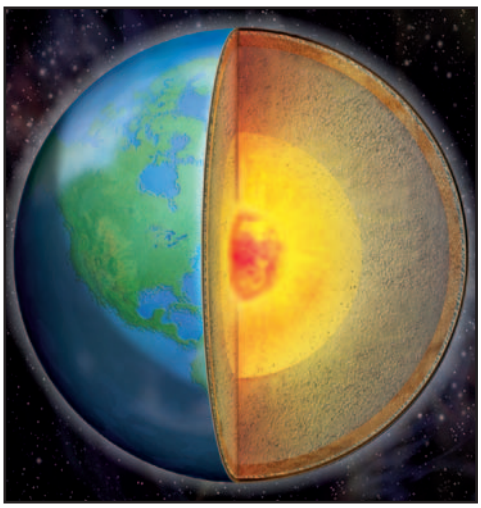
The **mantle** is just under Earth's crust. It is all of the rock from just below the crust to just above the core.



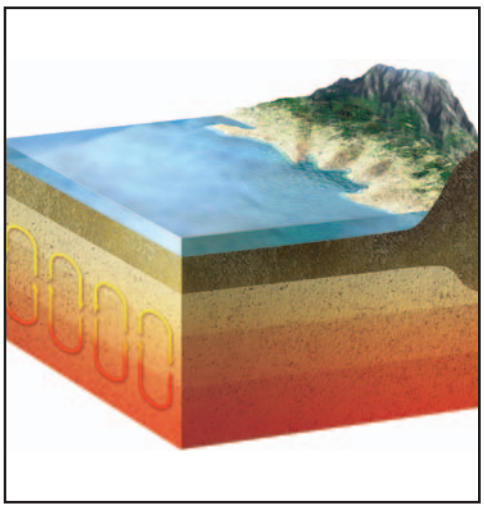
The ground you stand on is part of the **lithosphere**.



The layer of Earth called the **asthenosphere** is in the mantle below the lithosphere.



The deepest layer of Earth is the **core**.



Convection in Earth's mantle causes plate movement.

READING FOCUS SKILL

COMPARE AND CONTRAST

You **compare** when you look at how things are alike. You **contrast** when you look at how things are different.

As you read, **compare** Earth's layers to see how they are alike.

Earth's Layers

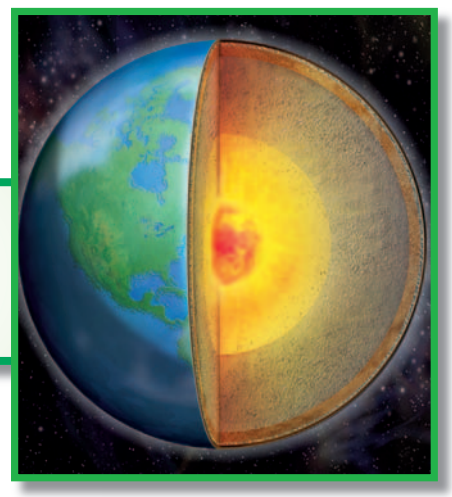
Earth is made up of different layers. The **crust** is Earth's hard, rocky outer layer. The dry land and the ocean floor make up the Earth's crust.

The **mantle** is the layer beneath the crust. The mantle layer directly under the crust is stiff. Below the stiff layer, the mantle is a thick layer of hot, soft rock.

The Earth's crust and the upper mantle make up the **lithosphere**. It is cool and stiff. Below the lithosphere is the **asthenosphere**. The asthenosphere is a layer of hot, soft rock that can bend and flow.

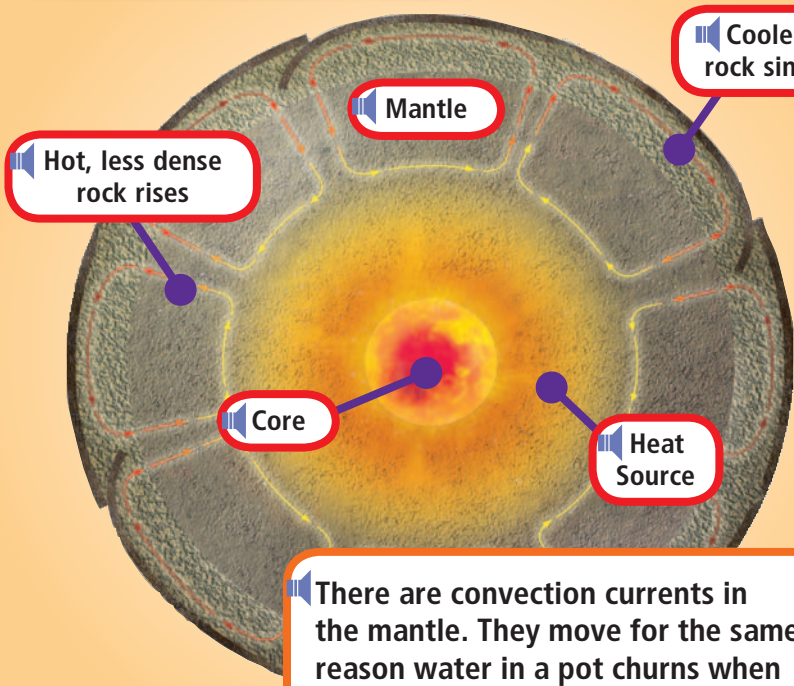
The **core** is below the mantle. The core is at Earth's center. It is mostly made of the metals iron and nickel. The core has two parts. The outer core is liquid. The inner core is solid.

How are the upper mantle and the crust alike?



Earth is divided into three layers—the crust, mantle, and core.

Convection Currents



There are convection currents in the mantle. They move for the same reason water in a pot churns when it boils. Instead of a burner, though, the source of heat for Earth's convection currents is the hot core.

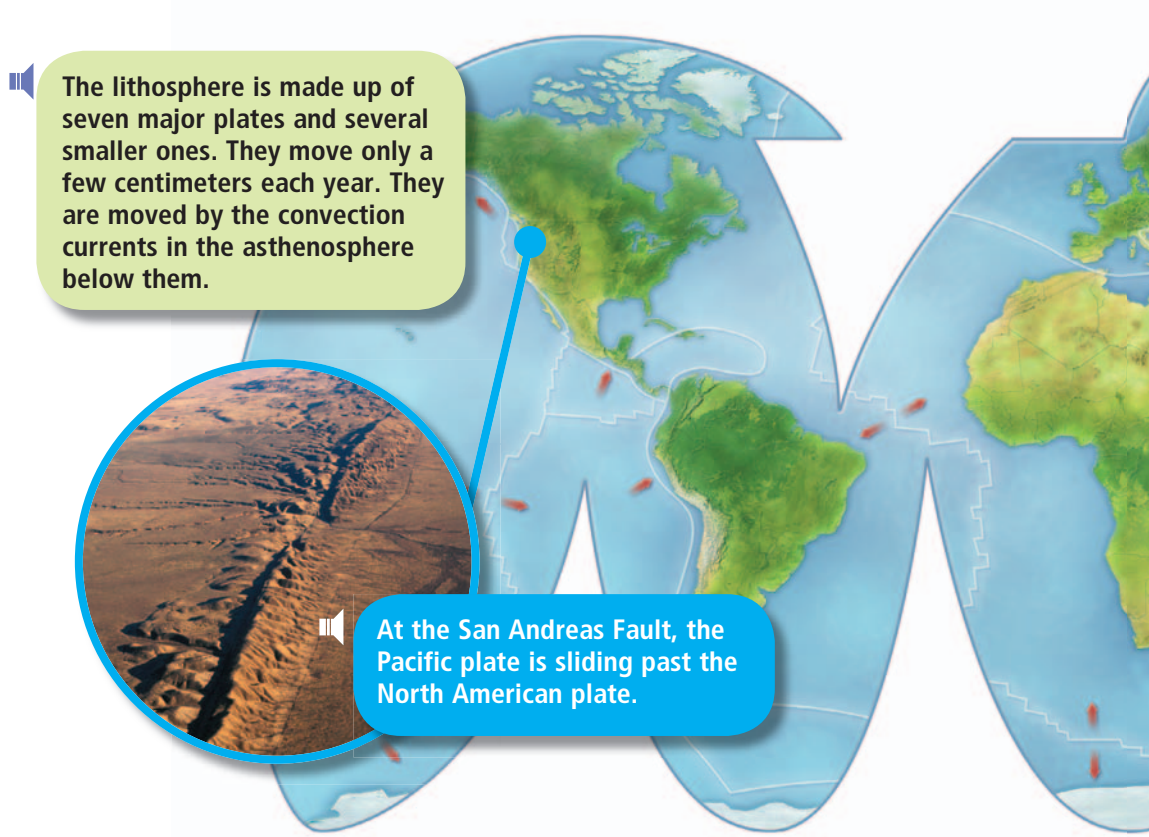
Inside Earth

Earth is hottest at its core. Heat moves up from the core through the mantle by convection. **Convection** is the transfer of heat energy that happens through the movement of matter. Convection currents carry heat through the inside of Earth.

Heat from the core makes rock at the bottom of the mantle hotter than rock above it. This rock becomes less dense, or lighter. It rises through the mantle toward the surface. The hot rock cools as it rises. When it cools, the rock becomes denser. The cooler rock begins to sink back down through the layers, and the cycle goes on.

Focus Skill

How are convection currents in water like convection currents in Earth's mantle?

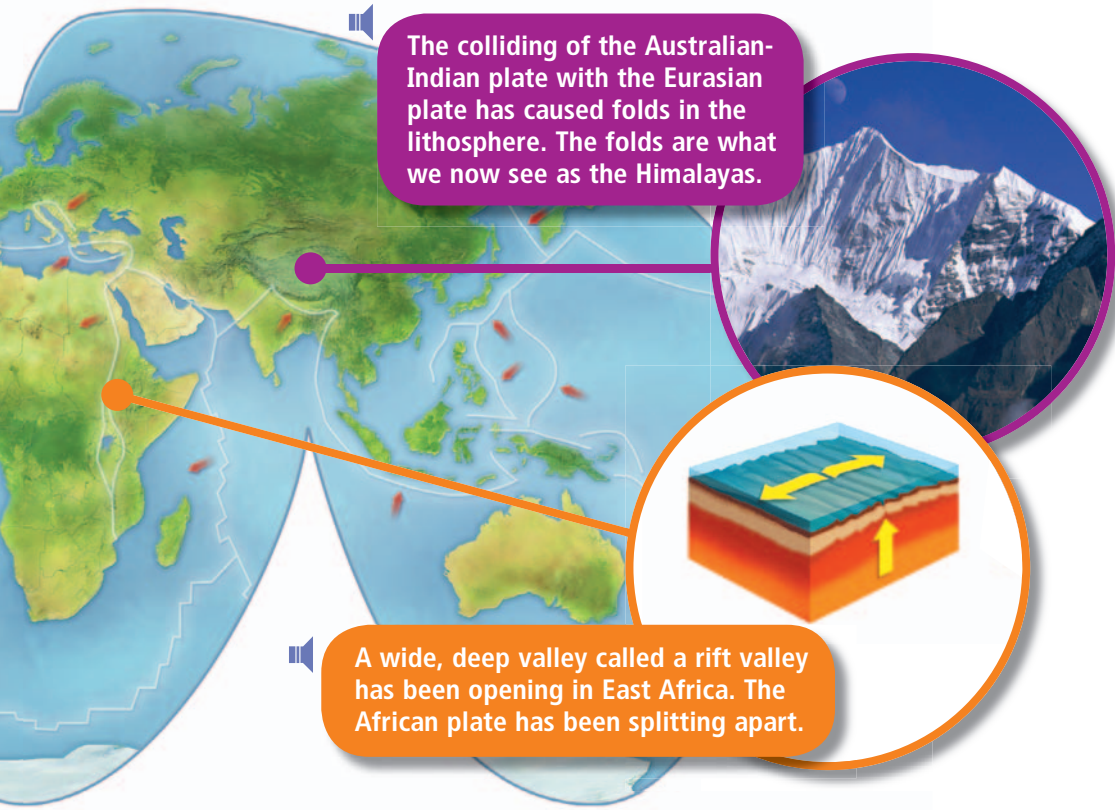


The Active Crust

The lithosphere is made up of several large plates. *Plates* are sections of Earth's surface. They fit together like large puzzle pieces. A *continental plate* holds crust from dry land. An *oceanic plate* holds crust from the sea floor. Some plates carry both continents and ocean.

These plates are always moving. We cannot see the movement. It is very slow. Plates move only a few centimeters each year.

As the plates move, they can collide, split apart, or grind past each other. The movement of plates can cause mountains to form or grow taller. Volcanoes can form or erupt when plates move. Most earthquakes and volcanic eruptions take place near the edges of plates. This is one way scientists know that the plates move.



One very active area of earthquakes and volcanoes is found around the rim of the Pacific Ocean. It is called the Ring of Fire.

Focus Skill

How is a continental plate different from an oceanic plate?

Review

Focus Skill

Complete these compare and contrast statements.

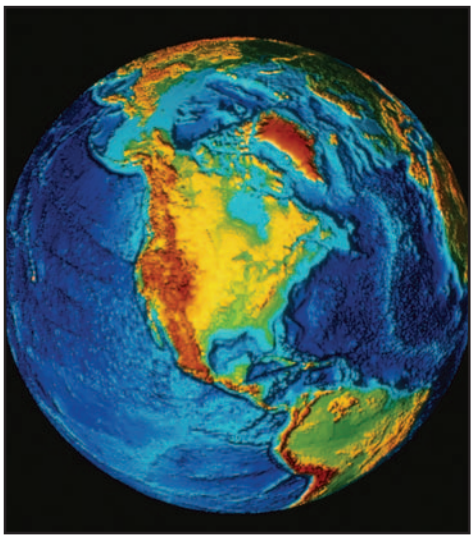
1. The crust and the outer core are different because the outer core is _____ .
2. The crust and the upper mantle are alike because they both make up the _____ .
3. The _____ of the lithosphere fit together like puzzle pieces.
4. Rock in the lithosphere is different from rock in the _____ . The deeper rock is hotter and more flexible.

Lesson 2

What Is the Evidence for Plate Tectonics?

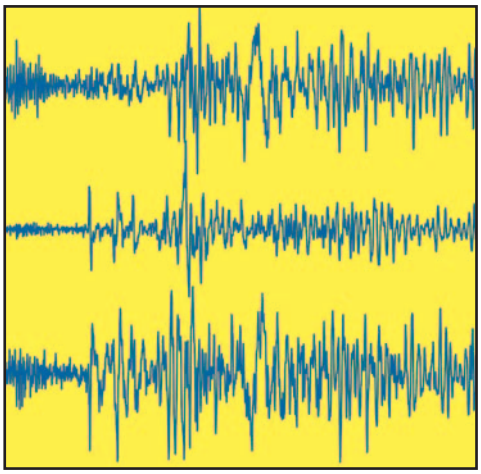
VOCABULARY

- continental drift
- fossil
- plate tectonics
- earthquake
- mid-ocean ridge
- volcano



All the continents may once have been connected. Then they moved apart. This movement is called **continental drift**.

You can find a **fossil** in a piece of rock. It is a sign of past life.



An **earthquake** is a shaking that happens when rock in Earth's crust moves.

Earth's crust is made up of moving plates. This is the theory of **plate tectonics**.

A **mid-ocean ridge** is a mountain chain in the ocean.

This **volcano** is now covered with snow. It is not active.

READING FOCUS SKILL

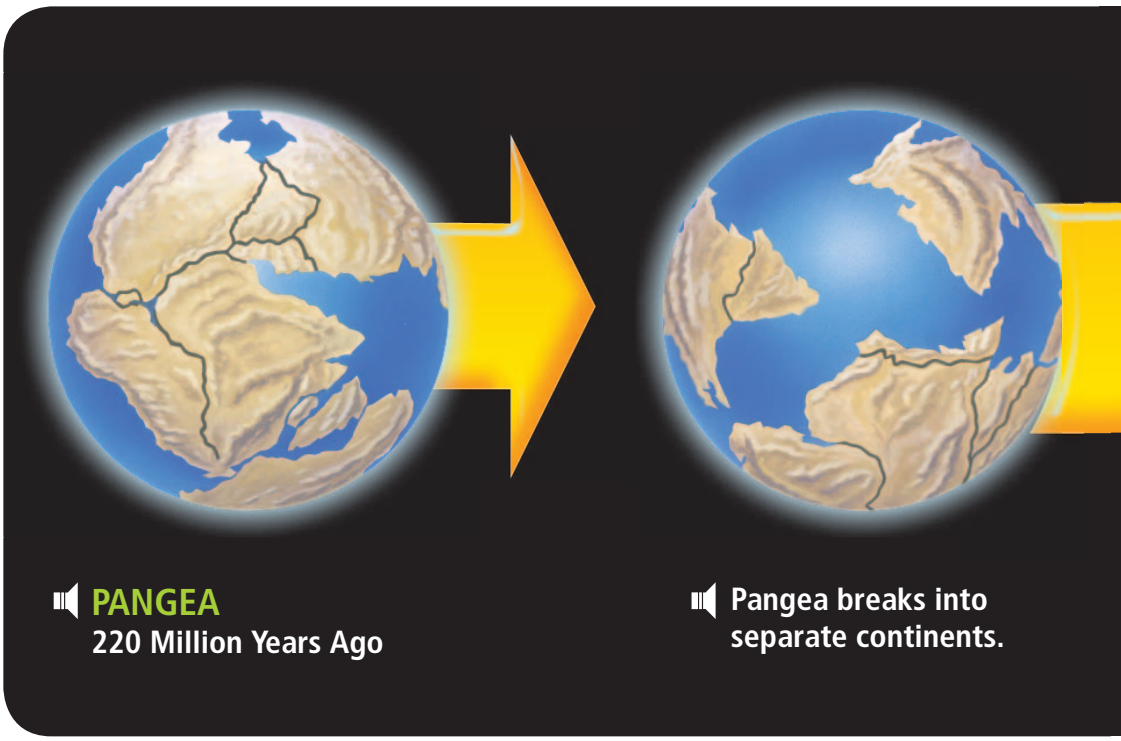
SEQUENCE

When you put things in **sequence** you put them in order. Follow the **sequence** of events when continents move.

The Story of Drifting Continents

Many years ago, scientists studied maps of the world. They noticed that Africa and South America looked like two pieces of a giant puzzle. South America appeared to fit into the left side of Africa.

A German scientist, Alfred Wegener, proposed the theory of **continental drift**. He was able to show that all of Earth's continents were once connected. Wegener called the huge continent Pangea (pan•JEE•uh), which means "all of Earth".



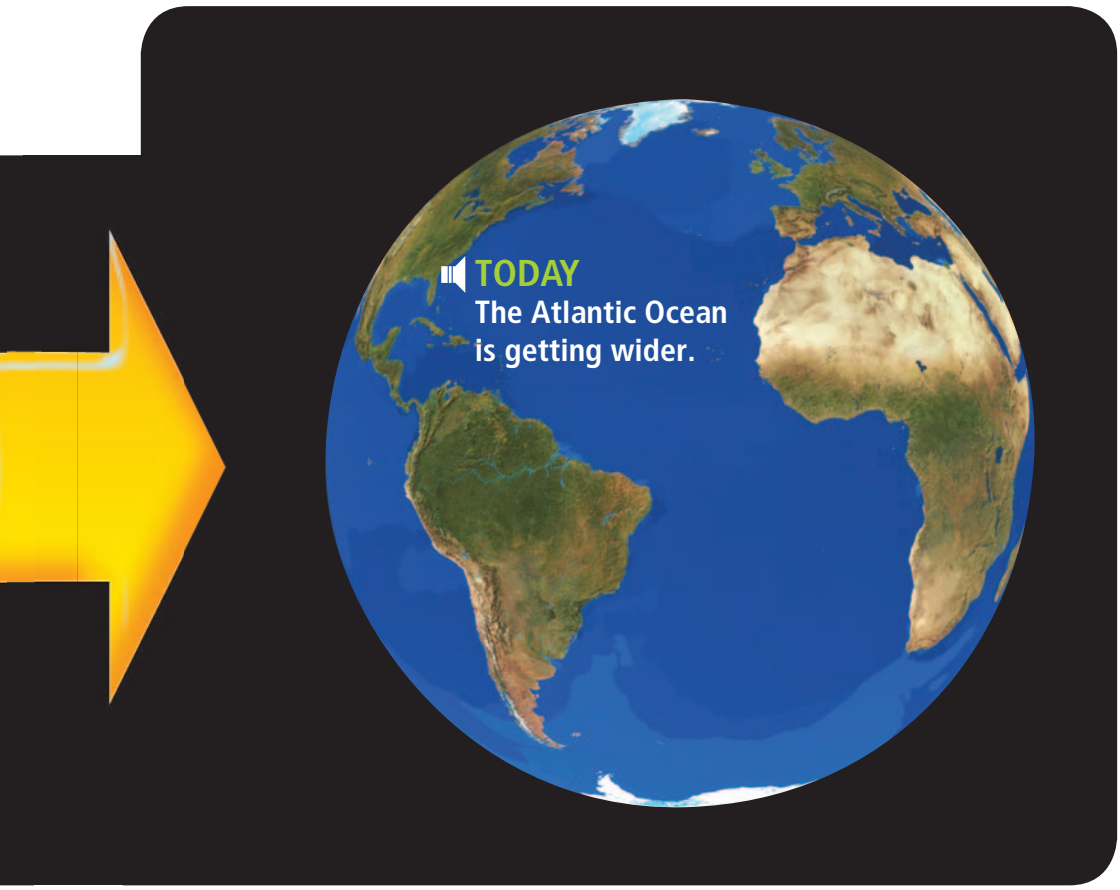
PANGEA
220 Million Years Ago

Pangea breaks into separate continents.

Pangea existed about 225 million years ago. Over long periods of time, the landmasses broke apart and drifted away from one another. Today, the continents are still moving very slowly. North and South America are moving away from Europe and Africa.

Focus Skill

Before the continents drifted, what did they form?



Clues from the Past

Wegener found evidence to support his theory. He discovered a lizard **fossil** in South America. A fossil is what remains of a living thing from the past. The same type of fossil was found in southern Africa. The lizards are very small. They could not have swum across the Atlantic Ocean. Wegener reasoned that the two continents must have been joined at one time.

These formations are found in both Africa and South America.

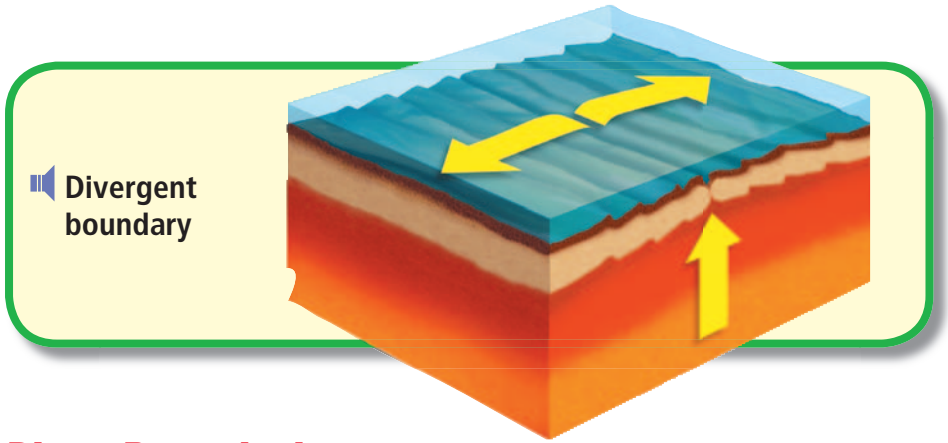
Mountain ranges provide more evidence that continents moved. The Appalachian Mountains in North America are similar to mountains in Europe. Wegener concluded that North America and Europe had once been joined. The mountains on the two continents were a single mountain range millions of years ago.

Some places that are tropical rain forests now were once covered in ice. Only a shift in location could explain how the climates changed.

Also, the kind of plants that formed coal in warm tropical areas. However, coal is found in North America, where the climate is cooler. This is evidence that North America has changed location over millions of years.

Focus Skill

Wegener's theory said North America and Europe were once joined. What happned after that?



Divergent boundary

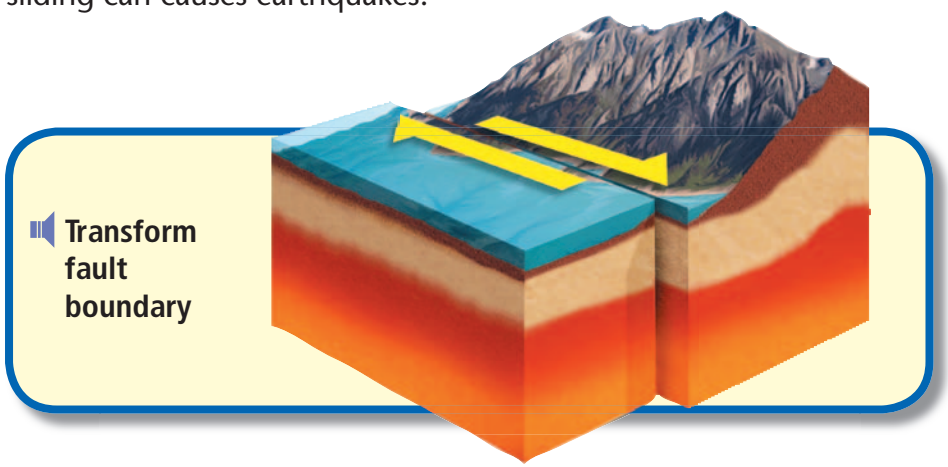
Plate Boundaries

Earth's surface is made up of plates that move. This theory is known as **plate tectonics**. The movement of plates can cause mountains to form and grow taller. Movement of plates also causes earthquakes. An **earthquake** is the shaking of the ground when rocks in the crust move.

A *boundary* is the place where two plates meet. There are three types of plate boundaries.

At a *divergent boundary*, plates move apart from each other. A **mid-ocean ridge** is a mountain range that forms along a divergent boundary. This is often on the ocean floor. As the plates move, melted rock rises between them.

At a *transform fault boundary*, plates slide past each other. This sliding can causes earthquakes.



Transform fault boundary

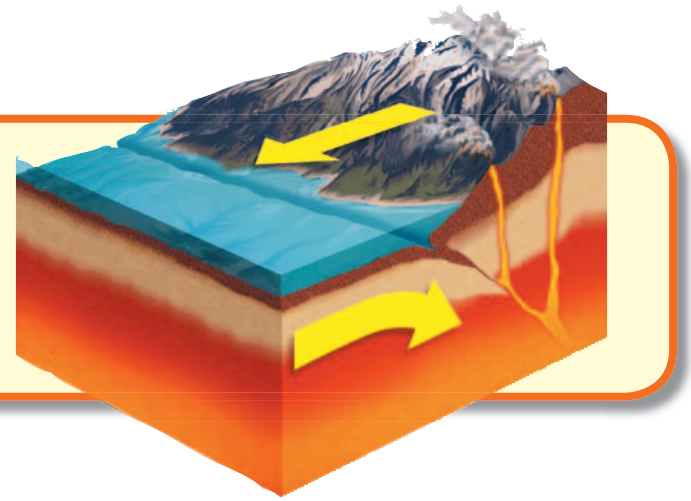
A *convergent boundary* forms when two plates move toward each other. Earth's surface is folded and bent and mountains are formed.

Often when one plate is pushed below another, rock in the lithosphere melts. The melted rock, or magma, may rise to form a **volcano**. A volcano is a mountain that forms when melted rock is pushed to Earth's surface. Then the rock builds up.

Focus Skill

What sequence of events causes a volcano to form?

Convergent boundary



Review

Focus Skill

Complete these sequence statements.

1. Before Earth's continents became separated, they formed a connected landmass he called _____ .
2. After Alfred Wegener discovered the same _____ in South America and Africa he decided the two continents must have been joined.
3. Two plates slide past each other. _____ may happen.
4. After plates on the sea floor move apart, a _____ may form.

GLOSSARY

asthenosphere [as•THEN•uh•sfir] A zone of rock in the mantle that can flow.

continental drift [kahnt•uhn•ENT•uhl DRIFT] The theory that Earth's landmasses were once connected and have drifted to where they are today.

convection [kuhn•VEK•shuhn] The transfer of heat energy through the movement of matter.

core [KOHR] The layer of Earth that extends from Earth's center to the bottom of the mantle.

crust [KRUHST] The thin outermost layer of Earth, which includes both dry land and the ocean floor.

earthquake [ERTH•kwayk] A shaking of Earth's crust, caused by the release of energy at a fault.

fossil [FAHS•uhl] The remains or signs of past life.

lithosphere [LITH•uh•sfir] The cool, solid portion of Earth that includes all of the crust and part of the upper mantle.

mantle [MAN•tuhl] The thick layer of Earth beneath the crust.

mid-ocean ridge [mid•OH•shuhn RIJ] A chain of mountains in the ocean.

plate tectonics [PLAYT tek•TAHN•ikz] The theory that Earth's crust is divided into plates that are always moving.

volcano [vahl•KAY•noh] A mountain formed by molten rock that is pushed to Earth's surface and builds up.

Think About the Reading

1. How are the crust, mantle, and core different? What section of your Reader should you read again to learn more about Earth's layers?
2. How does the map on page 12 help you understand the plates of the lithosphere?

Hands-On Activity

Trace the continents from a world map. Cut out each continent and place all of them on a table in their present-day locations. Try putting all the continents together into one landmass.

1. What did you notice about the shapes before you put them together?
2. Do they fit together well?

School-Home Connection

At transform fault boundaries, plates slide past each other in opposite directions. This often produces earthquakes. With a family member, look at a map of California and try to find the San Andreas fault. Find other fault lines in the state. Do any of them lie in your area.