Section 3

Drifting Continents

Reading Preview

Key Concepts

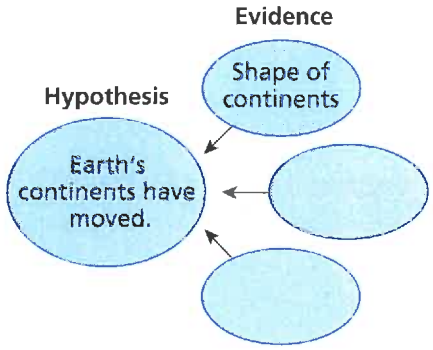
- What was Alfred Wegener's hypothesis about the continents?
- What evidence supported Wegener's hypothesis?
- Why was Wegener's hypothesis rejected by most scientists of his day?

Key Terms

- continental drift
- Pangaea
- fossil

Target Reading Skill

Identifying Supporting Evidence As you read, identify the evidence that supports the hypothesis of continental drift. Write the evidence in a graphic organizer like the one below.



Lab zone

Discover Activity

How Are Earth's Continents Linked Together?

1. Find the oceans and the seven continents on a globe showing Earth's physical features.
2. How much of the globe is occupied by the Pacific Ocean? Does most of Earth's dry land lie in the Northern or Southern Hemisphere?
3. Find the points or areas where most of the continents are connected. Find the points at which several of the continents almost touch, but are not connected.
4. Examine the globe more closely. Find the great belt of mountains running from north to south along the western side of North and South America. Can you find another great belt of mountains on the globe?

Think It Over

Posing Questions What questions can you pose about how oceans, continents, and mountains are distributed on Earth's surface?

Five hundred years ago, the sea voyages of Columbus and other explorers changed the map of the world. The continents of Europe, Asia, and Africa were already known to mapmakers. Soon mapmakers were also showing the outlines of the continents of North and South America. Looking at these world maps, many people wondered why the coasts of several continents matched so neatly. For example, the coasts of Africa and South America look as if they could fit together like jigsaw-puzzle pieces. In the 1700s, geologists thought that the continents had always remained in the same place. But early in the 1900s, one scientist began to think that the continents could have once been joined in a single landmass.

FIGURE 11
Continental Puzzle Today's continents provide clues about Earth's history. **Observing** *Which coastlines of continents seem to match up like jigsaw-puzzle pieces?* (Hint: *Refer to the map in Figure 12.*)

Continental Drift

In 1910, a young German scientist named Alfred Wegener (VAY guh nur) became curious about the relationship of the continents. He hypothesized that Earth's continents had moved! **Wegener's hypothesis was that all the continents were once joined together in a single landmass and have since drifted apart.** Wegener's idea that the continents slowly moved over Earth's surface became known as **continental drift.**

According to Wegener, the continents drifted together to form the supercontinent **Pangaea** (pan JEEuh). *Pangaea* means "all lands." According to Wegener, Pangaea existed about 300 million years ago. This was the time when reptiles and winged insects first appeared. Tropical forests, which later formed coal deposits, covered large parts of Earth's surface.

Over tens of millions of years, Pangaea began to break apart. The pieces of Pangaea slowly moved toward their present-day locations. These pieces became the continents as they are today.

Wegener gathered evidence from different scientific fields to support his ideas about continental drift. He studied land features, fossils, and evidence of climate change. In 1915, Wegener published his evidence for continental drift in a book called *The Origin of Continents and Oceans.*

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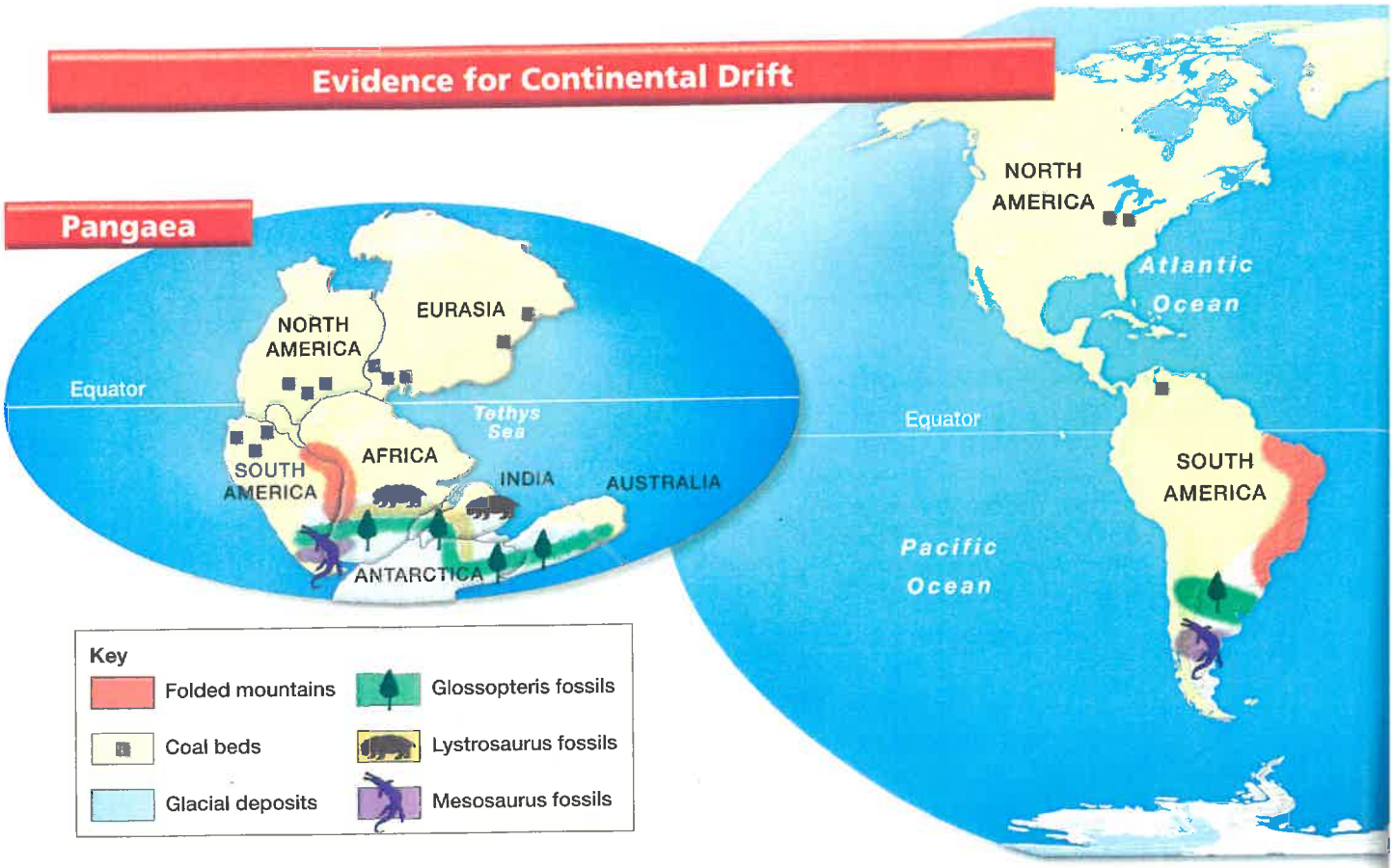


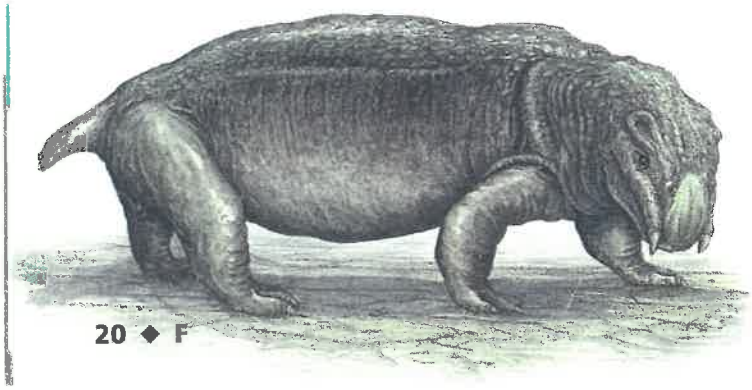
FIGURE 12
Fossils and rocks found on different continents provide evidence that Earth's landmasses once were joined together in the supercontinent Pangaea.
Inferring *What do the matching mountain ranges in Africa and South America show, according to Wegener's hypothesis?*

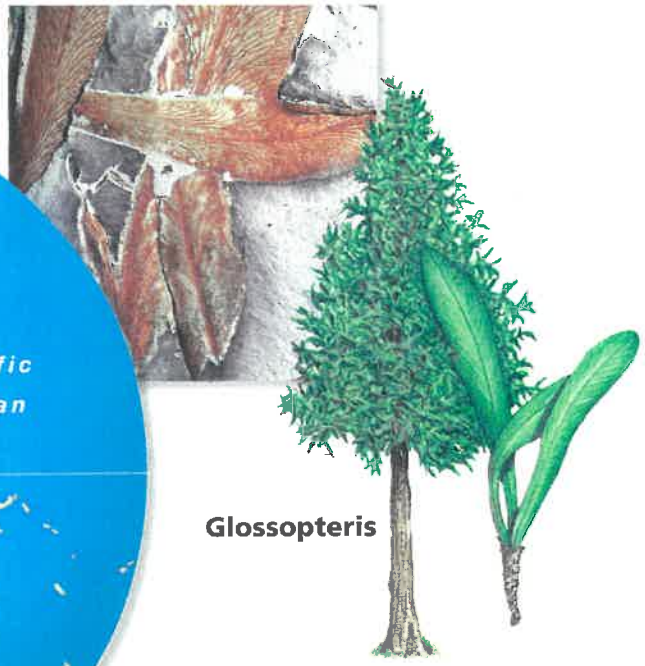
Evidence From Land Features As shown in Figure 12, mountains and other features on the continents provided evidence for continental drift. For example, when Wegener pieced together maps of Africa and South America, he noticed that mountain ranges on both continents line up. He noticed that European coal fields match up with coal fields in North America.

Evidence From Fossils Wegener also used fossils to support his argument for continental drift. A **fossil** is any trace of an ancient organism that has been preserved in rock. For example, *Glossopteris* (glaw SAHP tuh ris), was a fernlike plant that lived 250 million years ago. *Glossopteris* fossils have been found in rocks in Africa, South America, Australia, India, and Antarctica. The occurrence of *Glossopteris* on these widely separated landmasses convinced Wegener that Pangaea had existed.

Other examples include fossils of the freshwater reptiles *Mesosaurus* and *Lystrosaurus*. These fossils have also been found in places now separated by oceans. Neither reptile could have swum great distances across salt water. Wegener inferred that these reptiles lived on a single landmass that has since split apart.

Lystrosaurus





Glossopteris

Mesosaurus

Evidence From Climate Wegener used evidence of climate change to support his hypothesis. As a continent moves toward the equator, its climate becomes warmer. As a continent moves toward the poles, its climate becomes colder. But the continent carries with it the fossils and rocks that formed at its previous locations. For example, fossils of tropical plants are found on Spitsbergen, an island in the Arctic Ocean. When these plants lived about 300 million years ago, the island must have had a warm and mild climate. According to Wegener, Spitsbergen must have been located closer to the equator.

Geologists found evidence that when it was warm in Spitsbergen, the climate was much colder in South Africa. Deep scratches in rocks showed that continental glaciers once covered South Africa. Continental glaciers are thick layers of ice that cover hundreds of thousands of square kilometers. But the climate of South Africa is too mild today for continental glaciers to form. Wegener concluded that when Pangaea existed, South Africa was much closer to the South Pole. According to Wegener, the climates of Spitsbergen and South Africa changed because these landmasses had moved.

Reading Checkpoint **How would continental drift affect a continent's climate?**

FIGURE 13
Alfred Wegener
Although scientists rejected his theory, Wegener continued to collect evidence on continental drift and to update his book. He died in 1930 on an expedition to explore Greenland's continental glacier.

Wegener's Hypothesis Rejected

Wegener attempted to explain how continental drift took place. He suggested that the continents plowed across the ocean floors. **Unfortunately, Wegener could not provide a satisfactory explanation for the force that pushes or pulls the continents.** Because Wegener could not identify the cause of continental drift, most geologists rejected his idea.

For geologists to accept continental drift, they would also have had to change their ideas about how mountains form. In the early 1900s, many geologists thought that mountains formed because Earth was slowly cooling and shrinking. According to this hypothesis, mountains formed when the crust wrinkled like the skin of a dried-up apple.

Wegener said that if these geologists were correct, then mountains should be found all over Earth's surface. But mountains usually occur in narrow bands along the edges of continents. Wegener developed a hypothesis that better explained where mountains occur and how they form. Wegener proposed that when continents collide, their edges crumple and fold. The folding continents push up huge mountains.

Reading Checkpoint **According to Wegener, how do mountains form?**

Section 3 Assessment

Target Reading Skill

Identifying Supporting Evidence Refer to your graphic organizer about continental drift as you answer Question 2 below.

Reviewing Key Concepts

1. a. **Identifying** Who proposed the concept of continental drift?
   b. **Summarizing** According to the hypothesis of continental drift, how would a world map have changed over the last 250 million years?
2. a. **Reviewing** What evidence supported the hypothesis of continental drift?
   b. **Explaining** How did fossils provide evidence for continental drift?
   c. **Forming Hypotheses** Deposits of coal have been found beneath the ice of Antarctica. But coal only forms in warm swamps. Use Wegener's hypothesis to explain how coal could be found so near to the South Pole.
3. a. **Explaining** Why did most scientists reject Wegener's hypothesis of continental drift?
   b. **Making Judgments** Do you think the scientists of Wegener's time should have accepted his hypothesis? Why or why not?

Lab zone **At-Home Activity**

Moving the Continents Using a world map and tracing paper, trace the outlines of the continents that border the Atlantic Ocean. Label the continents. Then use scissors to carefully cut your map along the edges of the continents. Throw away the Atlantic Ocean. Place the two remaining pieces on a dark surface and ask family members to try to fit the two halves together. Explain to them about continental drift and Pangaea.