Name _____ Date _____ Class _____

Drifting Continents

Key Concepts

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

In 1910, a young German scientist named Alfred Wegener became curious about why the coasts of several continents matched so well, like the pieces of a jigsaw puzzle. He formed a hypothesis that Earth's continents had moved! **Wegener's hypothesis was that all the continents had once been joined together in a single landmass and have since drifted apart.** He named this supercontinent Pangaea, meaning "all lands." According to Wegener, **Pangaea** existed about 300 million years ago. Over tens of millions of years, Pangaea began to break apart. The pieces of Pangaea slowly moved toward their present-day locations, becoming the continents of today. The idea that the continents slowly moved over Earth's surface became known as **continental drift.** In a book called *The Origin of Continents and Oceans,* Wegener presented his evidence. **Wegener gathered evidence from different scientific fields to support his ideas about continental drift. He studied land features, fossils, and evidence of climate change.**

Mountain ranges and other landforms provided evidence for continental drift. For example, Wegener noticed that when he pieced together maps of Africa and South America, a mountain range running from east to west in South Africa lines up with a range in Argentina. Also, European coal fields match up with coal fields in North America.

Fossils also provided evidence to support Wegener's theory. A **fossil** is any trace of an ancient organism preserved in rock. The fossils of the reptiles *Mesosaurus* and *Lystrosaurus* and a fernlike plant called *Glossopteris* have been found on widely separated landmasses. This convinced Wegener that the continents had once been united.

Wegener used evidence from climate change to further support his theory. For example, an island in the Arctic Ocean contains fossils of tropical plants. According to Wegener, the island once must have been located close to the equator. Wegener also pointed to scratches on rocks made by glaciers. These scratches show that places with mild climates today once had climates cold enough for glaciers to form. According to Wegener's theory, Earth's climate has not changed. Instead, the positions of the continents have changed.

Wegener also attempted to explain how the drift of continents took place. **Unfortunately, Wegener could not provide a satisfactory explanation for the force that pushes or pulls the continents.** Because he could not identify the cause of continental drift, most geologists rejected his theory. For nearly half a century, from the 1920s to the 1960s, most scientists paid little attention to the idea of continental drift. Then new evidence about Earth's structure led scientists to reconsider Wegener's bold theory.

Name _____ Date _____ Class _____

The Theory of Plate Tectonics

Key Concepts

- What is the theory of plate tectonics?
- What are the three types of plate boundaries?

Earth's lithosphere is broken into separate sections called **plates.** The plates fit closely together along cracks in the crust. They carry the continents, or parts of the ocean floor, or both. **Plate tectonics** is the geological theory that states that pieces of Earth's lithosphere are in constant, slow motion, driven by convection currents in the mantle. A **scientific theory** is a well-tested concept that explains a wide range of observations. **The theory of plate tectonics explains the formation, movement, and subduction of Earth's plates.**

The plates float on top of the asthenosphere. Convection currents rise in the asthenosphere and spread out beneath the lithosphere, causing the movement of Earth's plates. As the plates move, they produce changes in Earth's surface, including volcanoes, mountain ranges, and deep-ocean trenches. The edges of different pieces of the lithosphere meet at lines called plate boundaries. **Faults**—breaks in Earth's crust where rocks have slipped past each other—form along these boundaries.

There are three types of plate boundaries: transform boundaries, divergent boundaries, and convergent boundaries. The plates move at amazingly slow rates, from about 1 to 24 centimeters per year. They have been moving for tens of millions of years. A **transform boundary** is a place where two plates slip past each other, moving in opposite directions. Earthquakes occur frequently along these boundaries. The place where two plates move apart, or diverge, is called a **divergent boundary.** Most divergent boundaries occur at the mid-ocean ridge. When a divergent boundary develops on land, two slabs of Earth's crust slide apart. A deep valley called a **rift valley** forms along the divergent boundary. The place where two plates come together, or converge, is a **convergent boundary.** When two plates converge, the result is called a collision. When two plates collide, the density of the plates determines which one comes out on top. Oceanic crust is more dense than continental crust.

When two plates carrying oceanic crust meet at a trench, the plate that is less dense dives under the other plate and returns to the mantle. This is the process of subduction. When a plate carrying oceanic crust collides with a plate carrying continental crust, the more dense oceanic plate plunges beneath the continental plate through the process of subduction. When two plates carrying continental crust collide, subduction does not take place because both plates are mostly low-density granite rock. Instead, the plates crash head-on. The collision squeezes the crust into mighty mountain ranges.

About 260 million years ago, the continents were joined together in the supercontinent Pangaea. About 225 million years ago, Pangaea began to break apart. Since then, the continents have moved to their present locations.