

Name: _____

Plate Tectonics

Date: _____ Period: _____

The Physical Setting: Earth Science

Supplemental: Plate Tectonics Summary

In 1912 Alfred Wegener noticed the continents seemed to fit together like a jigsaw puzzle. He proposed that the continents were once compressed into a single super continent called Pangaea meaning "all lands". His idea that the locations of the continents had changed was called Continental Drift. 250 MYA Pangaea consisted of all the major continents. 200 MYA rifting created the Atlantic Ocean between North America and Africa. 100MYA continued rifting in the south sends India northward. 50 MYA Australia begins to separate from Antarctica. Present day, India has collided with Asia to form the Himalayas.

It was observed that fossils of the same period were found in both South America and Africa or in both North America and Europe. How did these organisms travel across vast oceans? Could there have been a land bridge across the Atlantic? Wegener proposed that rocks formed together in the same area and were later broken and drifted apart. The same layers in the same order are now separated by large distances.

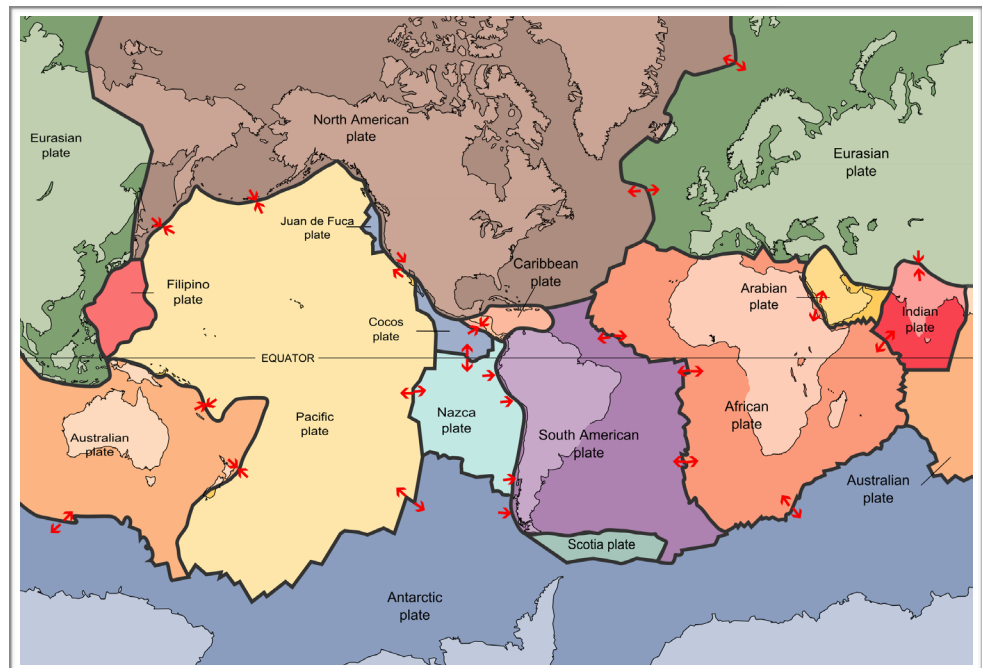
Many geologists doubted Wegener's ideas. Wegener could not explain the driving mechanism that causes the continents to move. By the late 1920's Wegener's ideas began to be dismissed.

In 1929 Arthur Holmes expanded on one of Wegener's many hypotheses – the idea of thermal convection. Heated substances become less dense and rise. At the surface, substances will cool and then sink. The repeated risings and fallings create a convection current that may be enough to move the continents. Holmes ideas received little attention until 1962 when Harry Hess developed essentially the same hypothesis with more supporting evidence – it's now called sea floor spreading.

The Core is iron & nickel and very hot – solid inner core and liquid outer core (km/yr). The Asthenosphere is the lower part of the upper mantle and very plastic (liquid-like). The Lithosphere (lithos = stone) is the rigid portion of the upper mantle and crust. Oceanic crust is mostly basalt and denser than continental crust which is mostly granite and andesite.

Students know features of the ocean floor (magnetic patterns, increase age away from the ridge, and sea-floor topography) provide evidence of plate tectonics. Old oceanic crust goes back into the mantle at ocean trenches while new crust is formed at the center of mid-ocean ridges (sea floor spreading). Mid-ocean ridges are mountain chains rising from the ocean floor. As you move away from the center of the mid-ocean ridge the rocks get older. The youngest part of the ocean floor is in the middle.

Paleomagnetic evidence exists for sea floor spreading. The Earth's magnetic field switches about every 1/2 million years from north to south. New ocean crust records the magnetic field strength and direction in striped pattern giving the relative ages of the sea floor as you move away from the mid-ocean ridge.



Supplemental: Plate Tectonics Summary

The locations of the plate boundaries can be seen by mapping the locations of the Earth's volcanoes and earthquakes. Divergent plate boundaries are where two plates move apart. Early on this divergence creates a rift zone (or rift valley on land) where the surface breaks and drops as the two plates move apart. Magma creating new crust rises through the weakened section and eventually forms a mid-ocean ridge. The Red Sea and the rift zone across Iceland are prime examples.

Convergent plate boundaries are where two plates collide. There are three types. Oceanic-continental convergent plate boundaries form an ocean trench and subduction zone offshore and volcanoes in the mountain range created by the collision. Oceanic-oceanic convergent plate boundaries create an arc of volcanic islands in addition to the ocean trench and subduction zone. A subduction zone is where one plate boundary is forced down below the other plate boundary. When two continents collide, a mountain range is formed, but there are no volcanoes in these mountains. The Himalayas are a good example of a continental-continental plate boundary.

Transform Fault plate boundaries are where two plates slide past each other. The San Andreas Fault is a good example where the Pacific plate is sliding past the North American plate. Mid-oceanic ridge systems are often offset along fracture zones and transform faults.

Questions:

1. What did Alfred Wegener cite as evidence to support his idea of "Pangaea"?
2. Why did scientists not support Alfred Wegener's ideas?
3. List and describe three pieces of evidence to support sea-floor spreading
4. What is a subduction zone?
5. List and describe the motions associated with the three types of plate motions.