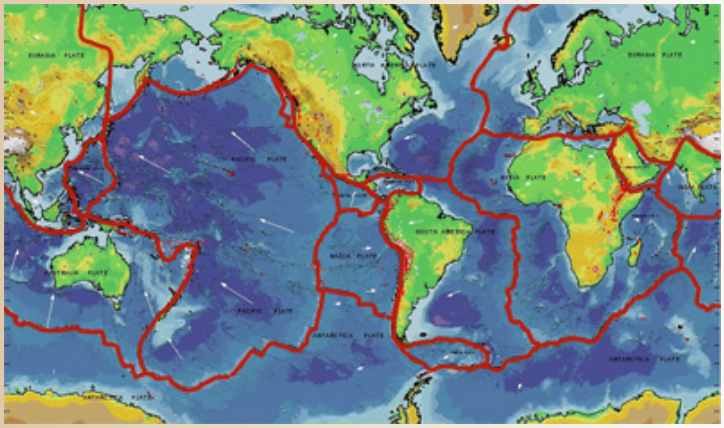
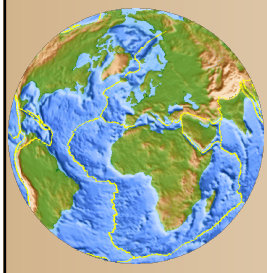
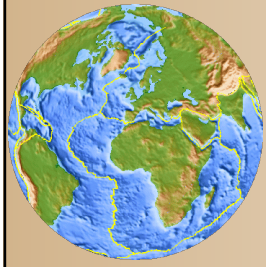
Continental Drift and Plate Tectonics



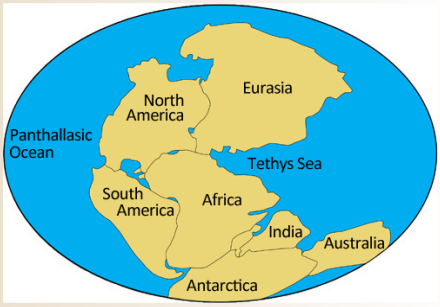


In 1912, a German scientist named *Alfred Wegener* noticed that the Earth's continents seemed to fit together like puzzle pieces. He proposed the <u>theory of continental drift</u> to explain what he saw.



Continental Drift

According to the theory, about 250 million years ago, the continents were once a part of a super continent. The supercontinent was known as Pangaea, which means "all land."

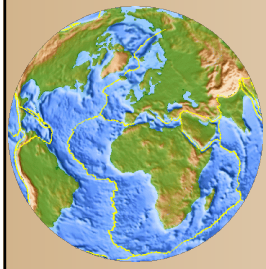


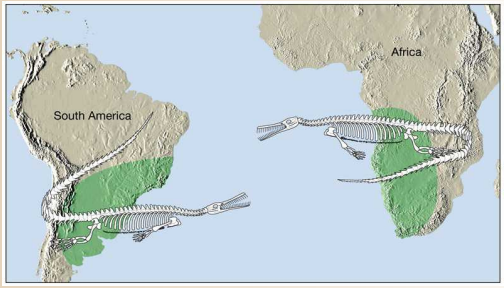
About 180 million years ago, Pangaea split into two huge continents: Laurasia and Gondwana. These continents then started breaking apart and drifting until they reached their current positions today.

Evidence to Support Continental Drift

1) Similar Fossils
2) Types of Rocks
3) Glaciation Patterns on surfaces that were widespread

1) Similar fossils (that could not have traveled across entire oceans) were found on several different landmasses.





Example: *Mesosaurus,* a freshwater reptile, was found in South America and Southern Africa.

Evidence to Support Continental Drift

2) Rock types that are found on continents that are oceans apart are further evidence to support continental drift.

Example: Matching mountain ranges in North America and Great Britian / Scandinavia.

3) Glacial deposits have been found in areas that today have tropical climates, also suggesting that the continents were once connected.

Continental drift and the changes to the Earth can be explained by plate tectonics. The theory of plate tectonics states that Earth's lithosphere (land) is broken into large sections called tectonic plates that move and change position over time.

Continental plates support the land while oceanic plates support the oceans.

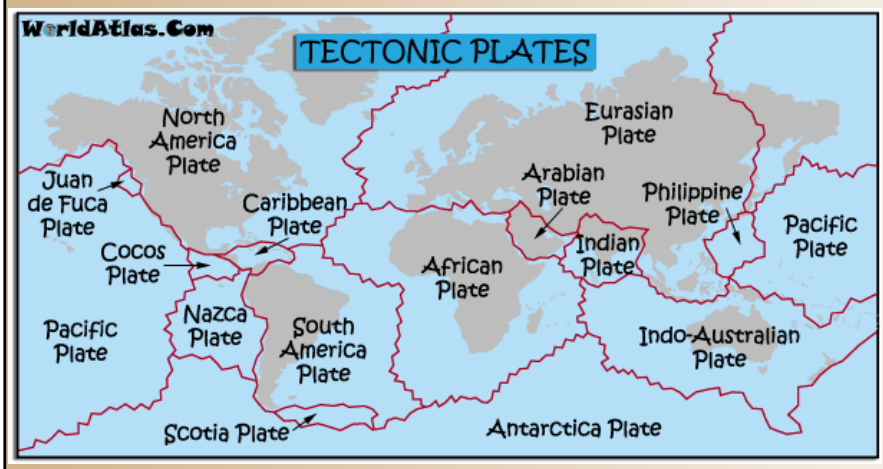
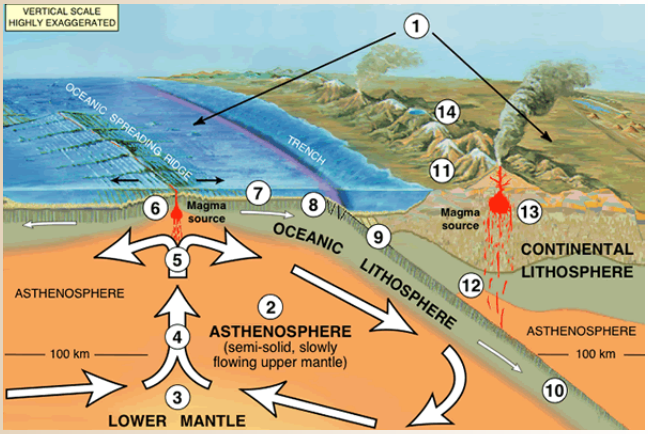
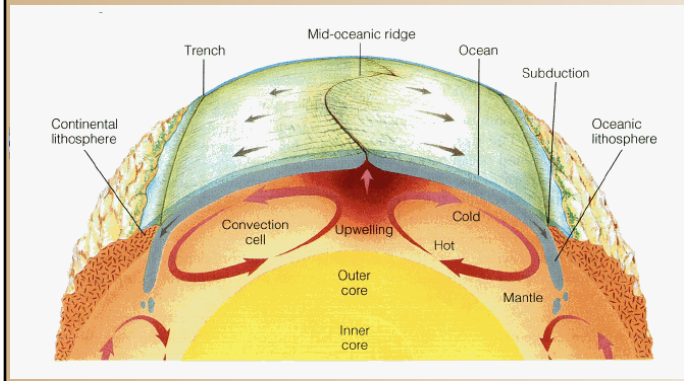


Plate Tectonics

Tectonic plates float on a dense, molten layer of semi-fluid rock known as the *asthenosphere*. Temperature differences in the asthenosphere cause slow moving currents.



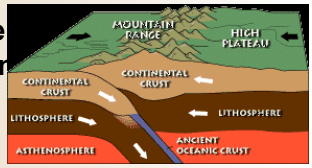


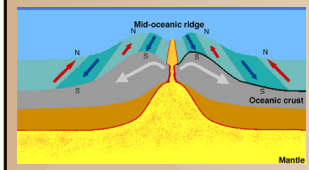
The motion of the currents causes the plates above to move as well. Where currents are rising, plates are pushed apart. Where currents are sinking, plates are pulled together.

Types of Plate Boundaries

Plate boundaries are where tectonic plates touch.

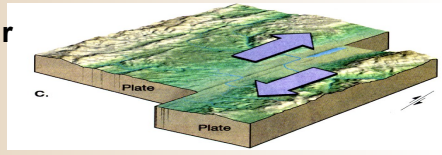
Convergent Boundaries: Are formed where the plates converge or move together. Often cause mountains to form.





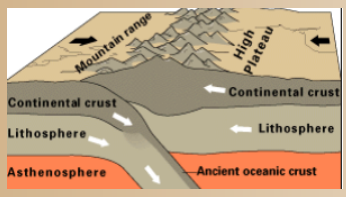
Divergent Boundaries: Are formed where the plates diverge or move apart. Create mid-ocean ridges, new land, or can produce volcanoes on land.

Transform Fault Boundaries: occur where two plates grind past each other. Causes earthquakes.

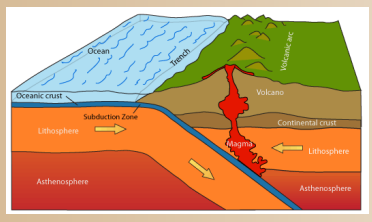


The type of boundary depends on how the tectonic plates move relative to one another.

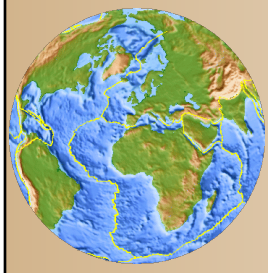
Convergent Boundaries

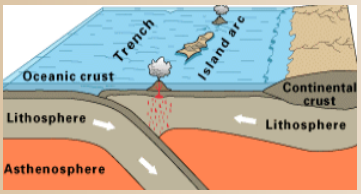


<u>Continental - Continental</u>: two plates with continental crust collide and push upward, creates mountain ranges, sometimes earthquakes.
ex. Himalayan mountains



<u>Oceanic - Continental</u>: Because it is denser, the oceanic plate is subducted beneath a continental plate, creates mountain range
ex. Andes Mountain range in South America





<u>Oceanic - Oceanic</u>: one oceanic plate is subducted beneath another oceanic plate, creates a trench, undersea volcanoes --> islands
Ex. the Aleutian islands in Alaska were formed this way

Drawing Plate Boundaries

The <u>subduction zone</u> is where the denser oceanic crust sinks below the continental plate. Old ocean crust gets pushed down into the asthenosphere, where it is remelted and recycled.

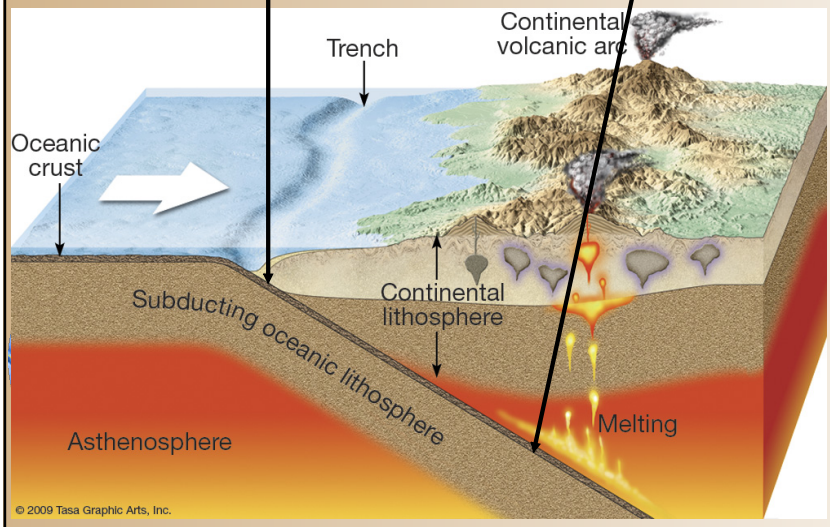
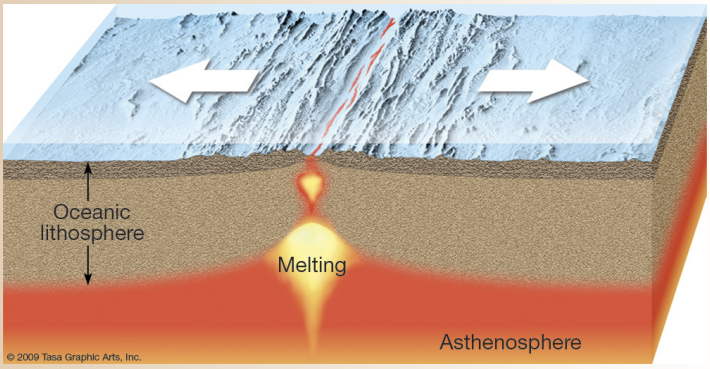


image from tasaclips.com/illustrations.html

Divergent Plate Boundaries

Where two plates separate and move apart. Where two oceanic plates are moving apart, new ocean floor forms as magma rises toward the surface and hardens. The oceans get wider, and a long chain of volcanic mountains, called the mid-ocean ridge, forms along the boundary.

Ex. the mid-Atlantic Ridge

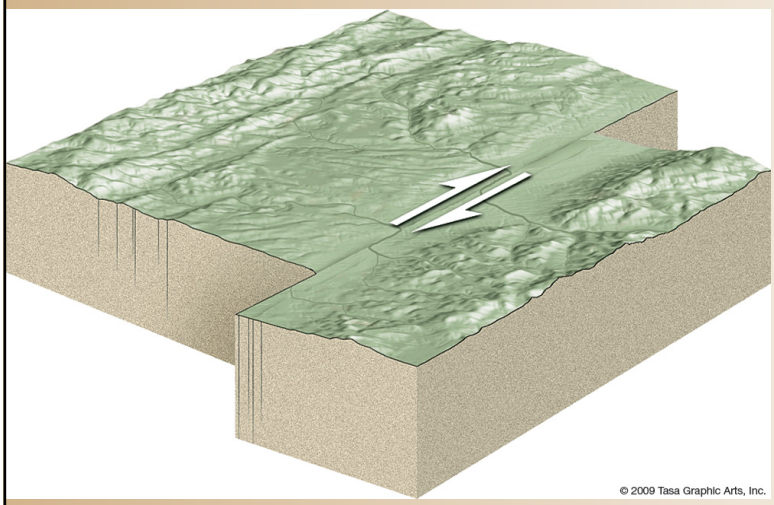


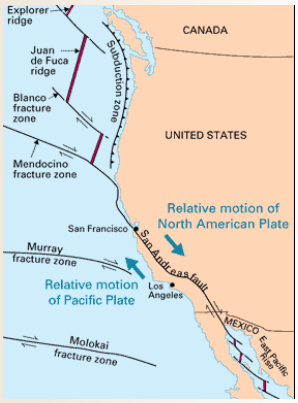
When two continental plates separate, a ridge, or rift, is formed. Streams and rivers flow into the rift valley to form a long linear lake. If the rift drops below sea level, ocean waters to flow in, creating a narrow, shallow sea. If the rift grows deeper and wider, a new ocean basin could be produced.

Ex. The East Africa Rift Valley

Transform Fault Boundaries

Tectonic plates slide past each other horizontally. Because the plates have irregular edges, they grind and jerk, producing earthquakes.





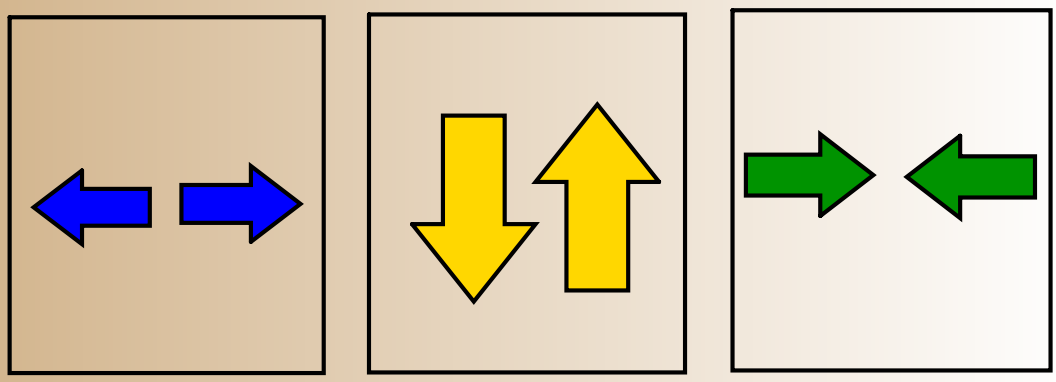
Ex. San Andreas fault in California

Three Types of Boundaries:

Transform **Divergent**

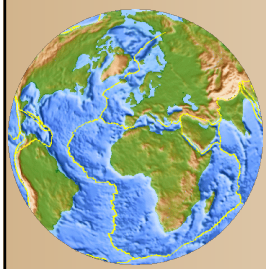
Convergent

Label the boxes below to indicate the movement of the three types of boundaries.



Typically, plates only move a few centimeters per year, but can still cause earthquakes, volcanoes, and the formation of mountains.

The December 26, 2004, Indonesian earthquake that caused devastating tsunamis all around the Indian Ocean and South Asia was unusual because the plates moved 10m (33ft) horizontally and 4-5m (13-16 ft) vertically!



It has taken 169,000,000 years (169 million years) for New York and Africa to reach their current locations, if they are moving apart at 4 cm a year:

$$\frac{6760\ \text{km}}{1}\left|\frac{1000\ \text{m}}{1\ \text{km}}\right|\frac{100\ \text{cm}}{1\ \text{m}} = 676{,}000{,}000\ \text{cm}$$

676,000,000 cm / 4 cm per year = 169,000,000 years