8.9A,B Continental Drift and Plate Tectonics

http://www.freewebs.com/morganisrupert/photos.htm

atienzajudyanne09.blogspot.com

The History of Plate Tectonics

- 1910- German scientist Alfred Wegener curious about the relationship of the continents.
- Formed the hypothesis that all the continents had once been joined together in a single land mass and have since drifted apart.

Alfred Wegener

The History of Plate Tectonics

- He called this super continent PANGAEA, meaning all lands.
- Over tens of millions of years Pangaea began to break apart and pieces slowly moved toward present day locations known as continents.
- His theory was called Continental Drift Theory.

Alfred Wegener

Continental Drift Since Pangaea

225 million years ago

180–200 million years ago

135 million years ago

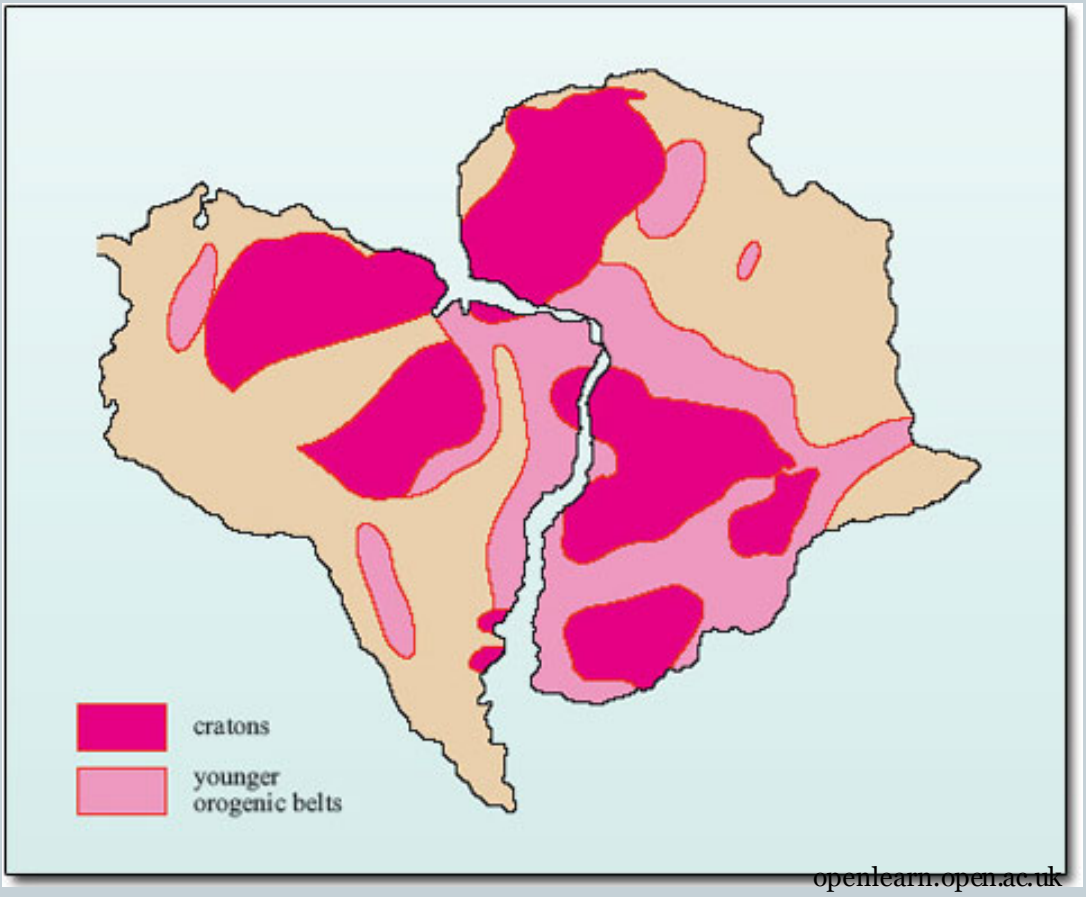
65 million years ago

Earth today

Continental Drift Evidence

Evidence from Landforms

When Wegener pieced together maps of Africa and South America, he saw a **mountain range** running from east to west in south Africa that matched with a mountain range in Argentina.



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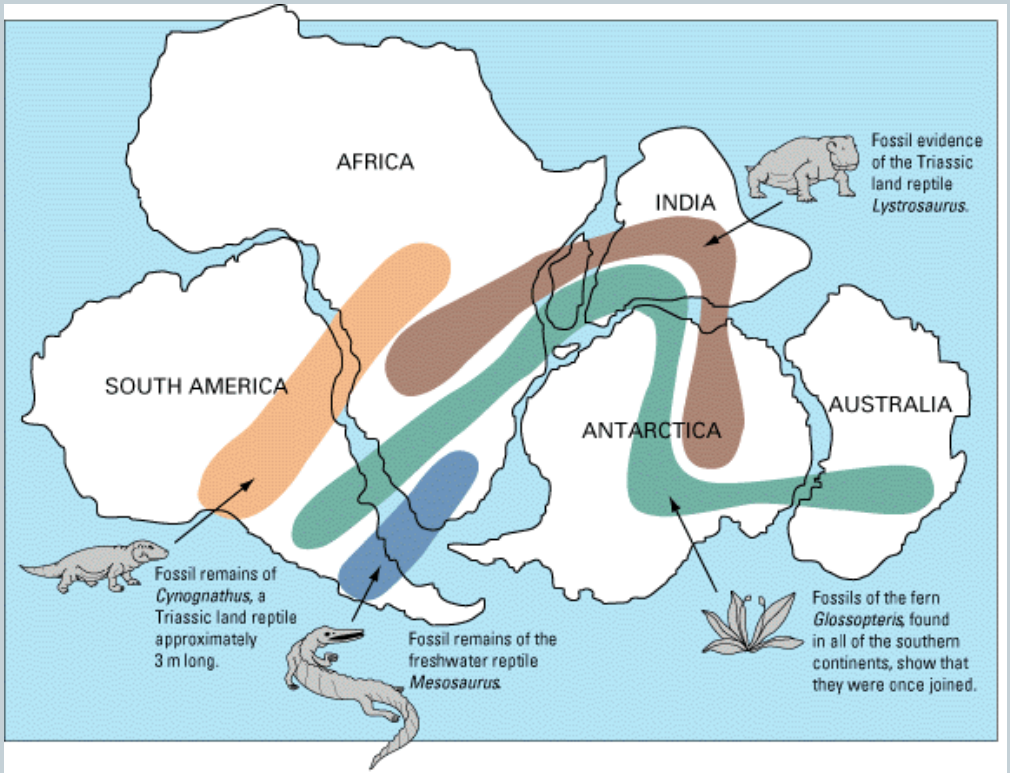
Evidence from Fossils

- A <u>fossil</u> is a trace of an organism that has been preserved in rock.
- Fossil leaves of a species of plant were found in Africa, South America, Australia, India, and Antarctica.
- The seeds could not have been carried by wind or waves.



absoluteastronomy.com

Evidence from Climate

Knowing the type of plants, animals, insects and single celled organisms that are associated with the climate can help determine the previous locations of the continents.

- Move toward the equator, climate becomes warmer.
- Move toward the poles, climate becomes colder.

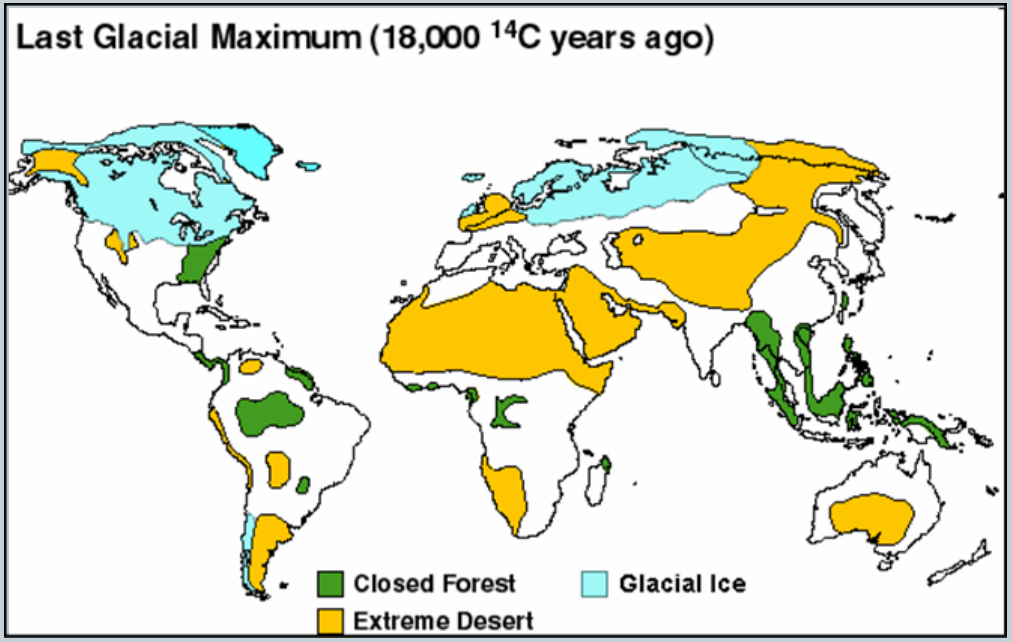


Plate Tectonics

- Other Scientists said NO WAY to Wegener's theory!
- There was no way to explain the movement of the continents.
- Wegener died in 1930.
- Then in the 1960's, the technology became available to explain the movement of the continents!
- It had to do with mapping the ocean floors, and connecting earthquakes with volcanoes, and what was inside the earth.

How Tectonic Plates Move

- Powered by forces in Earth's iron inner core.
- Plates move on top of the asthenosphere.
- Convection currents:
  - Rocks near the core are heated and become less dense than the cool upper mantle rocks
  - The warmer rocks rise while the cooler rocks sink creating slow vertical currents within the mantle
  - This creates pockets of circulation within the mantle forcing the movement of the plates
- Convection currents move the plates only a few centimeters per year.

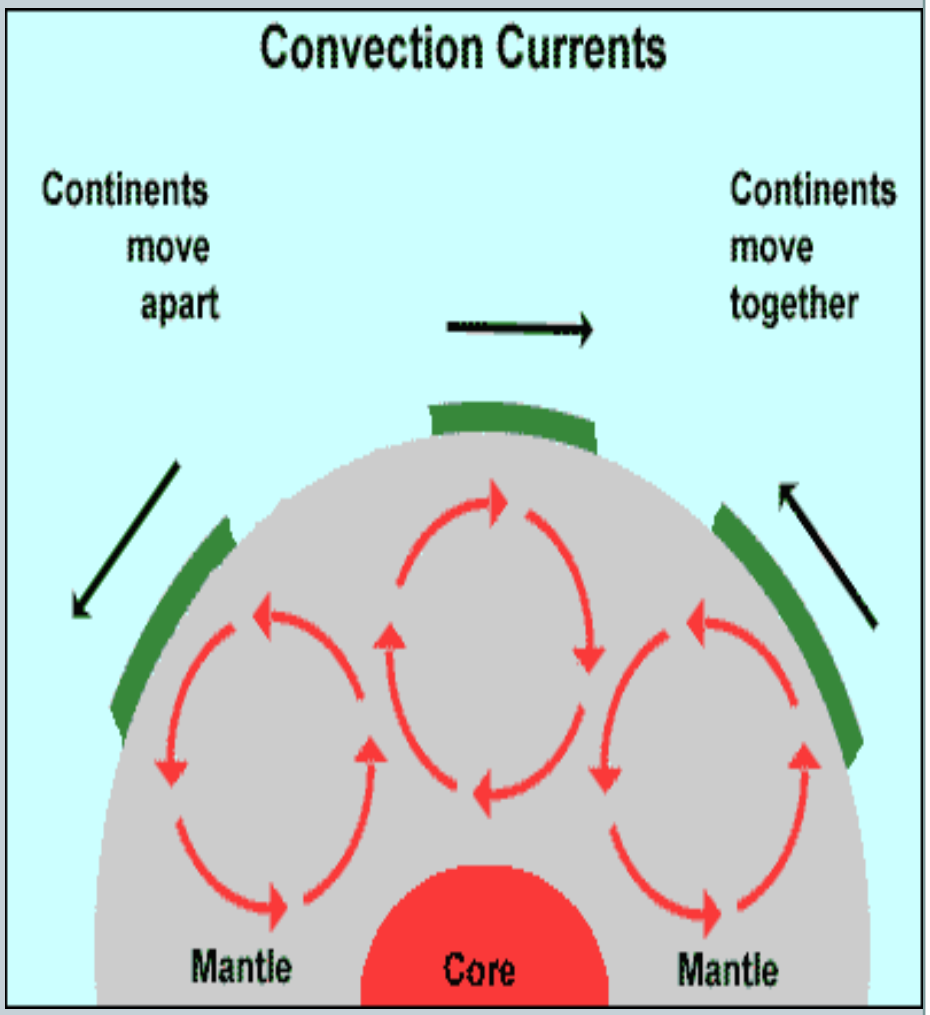


Plate Tectonics

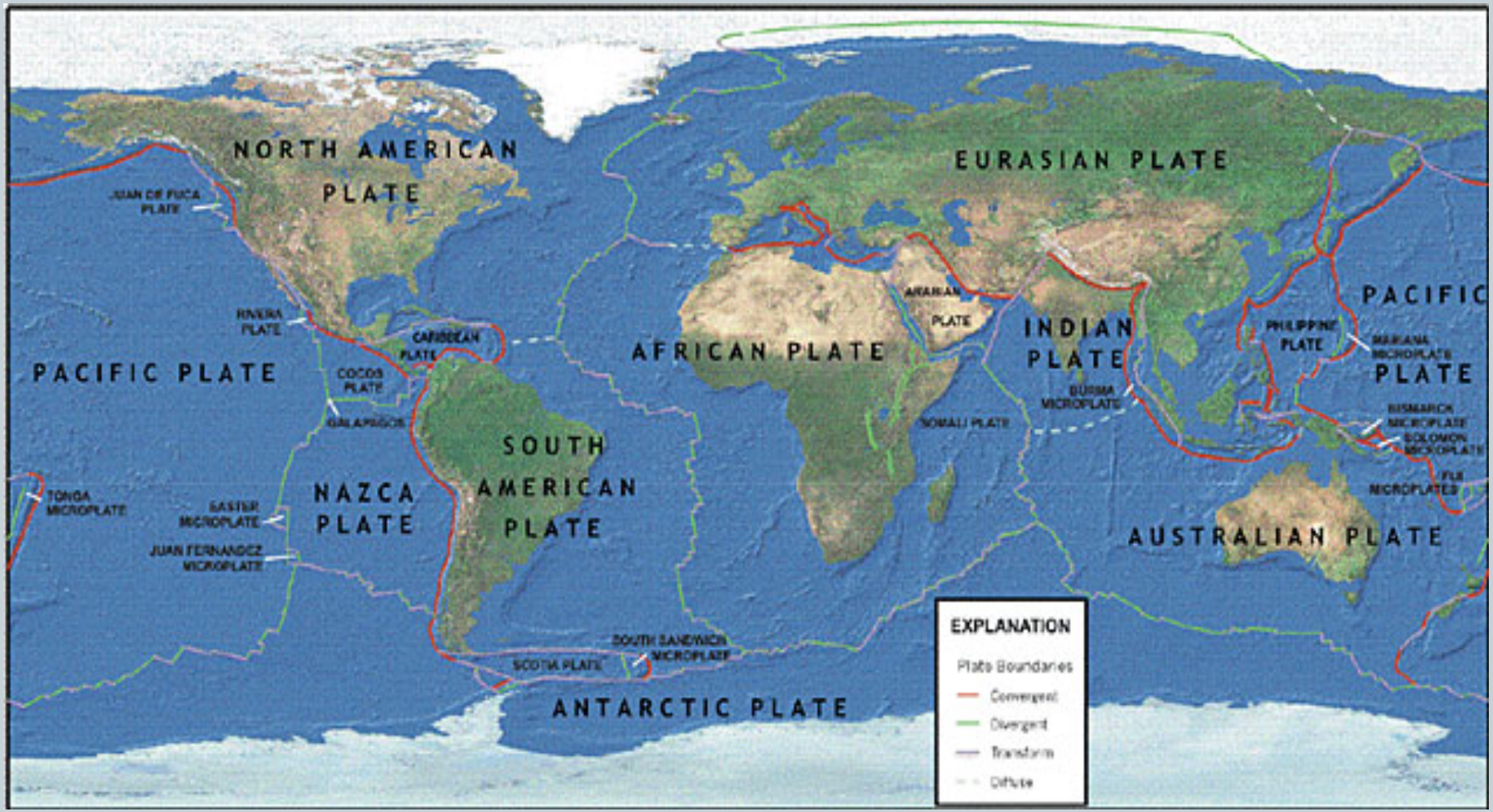
Plate Tectonics is a scientific theory which describes the large scale motions of Earth's lithosphere.

The lithosphere is a mosaic of irregular segments known as tectonic plates.

Properties of the tectonic plates:

- Solid rock 4-40 miles thick
- Vary in size and shape
- Definite borders that cut through continents and oceans.

Tectonic Plates



Types of Plate Boundaries
Convergent Boundaries

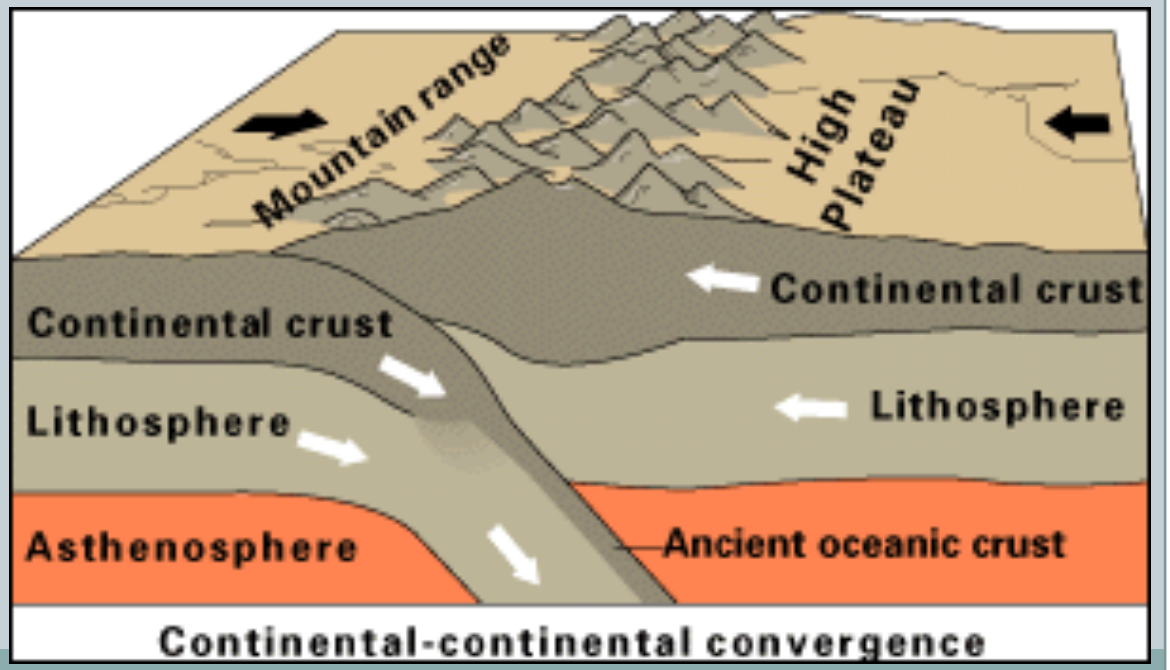
Convergent Boundaries

- When two plates come together.

Three Types of Convergence
Continental – Continental

Continental – Continental

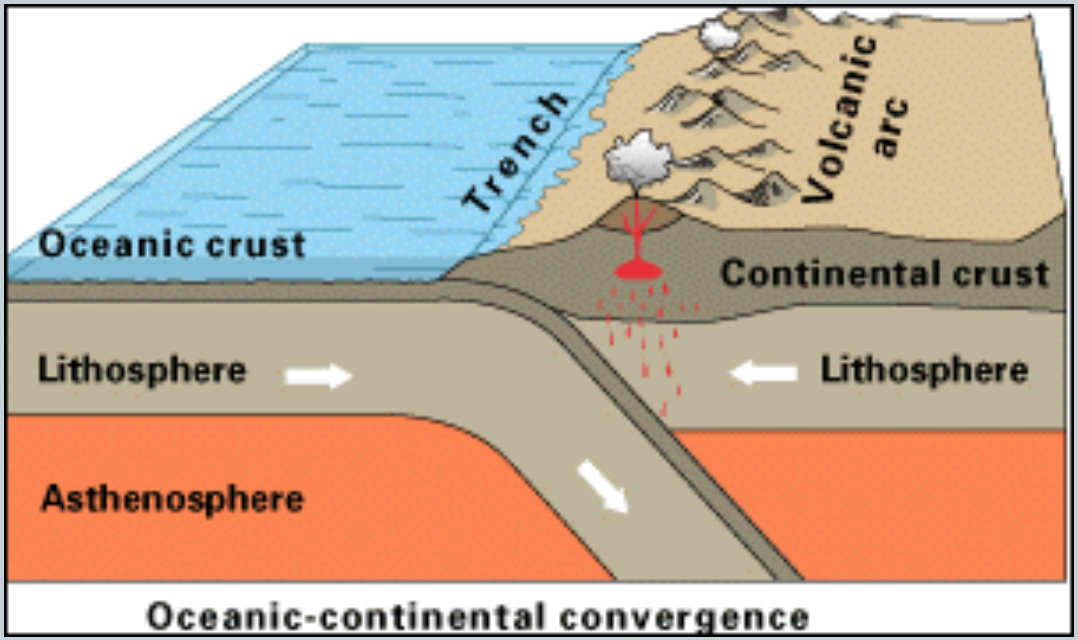
- Neither is subducted because the rock is not dense, and resists downward motion
- Crust tends to buckle and push upward or sideways



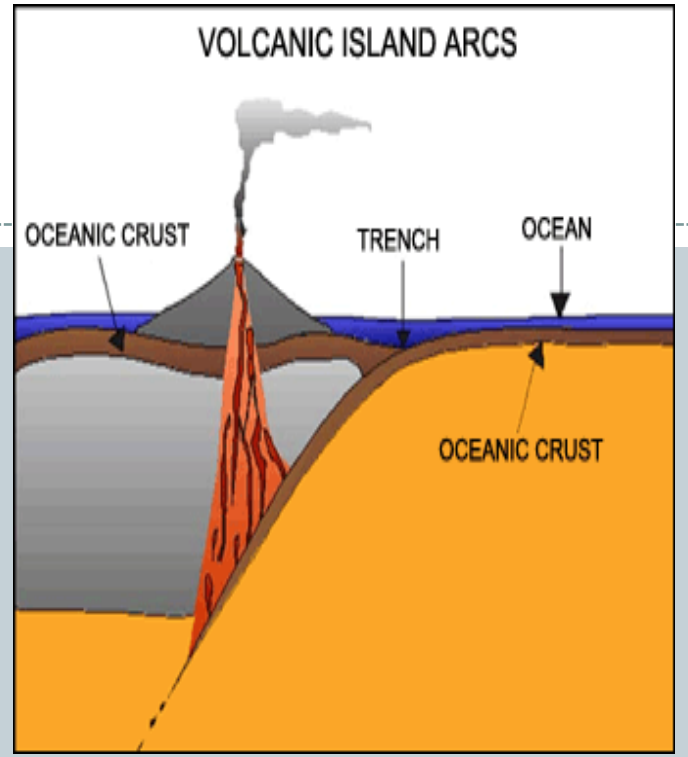
Three Types of Convergence
Oceanic – Continental

Oceanic – Continental

- Oceanic plate subducts under the continental plate.
  - Known as a Subduction Zone
- Continental plate is lifted and a mountain range is created.
- Sinks smooth and continuously into the subduction trench and recycled back into the earth.
- Breaks into smaller pieces, is locked in place for long periods of time then sudden movement generates large earthquakes.

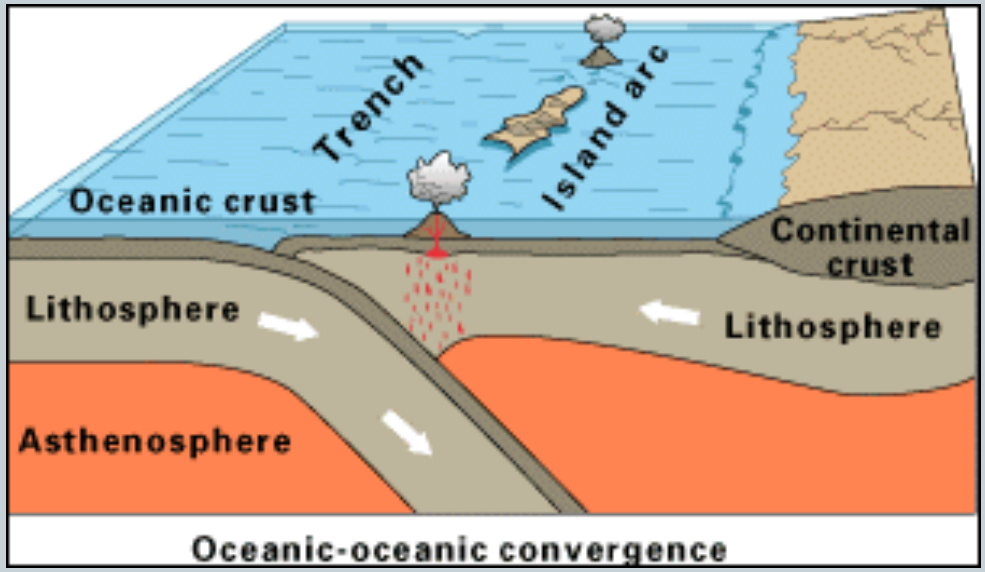


Three Types of Convergence
Oceanic – Oceanic



Oceanic – Oceanic

- One plate is subducted under the other. (the younger of the two because it is less dense)
- A deep oceanic trench is formed.
  - Ex. Marianas Trench, deepest location of Earth itself (36,201 ft.)
- An undersea volcano is formed.
- Over years, erupted lava and debris pile up until a submarine volcano forms an island volcano.
  - Strung out in chains called island arcs.
  - Examples: Marina Islands south of Japan, Hawaii



Types of Plate Boundaries
Divergent Boundaries

Divergent Boundaries

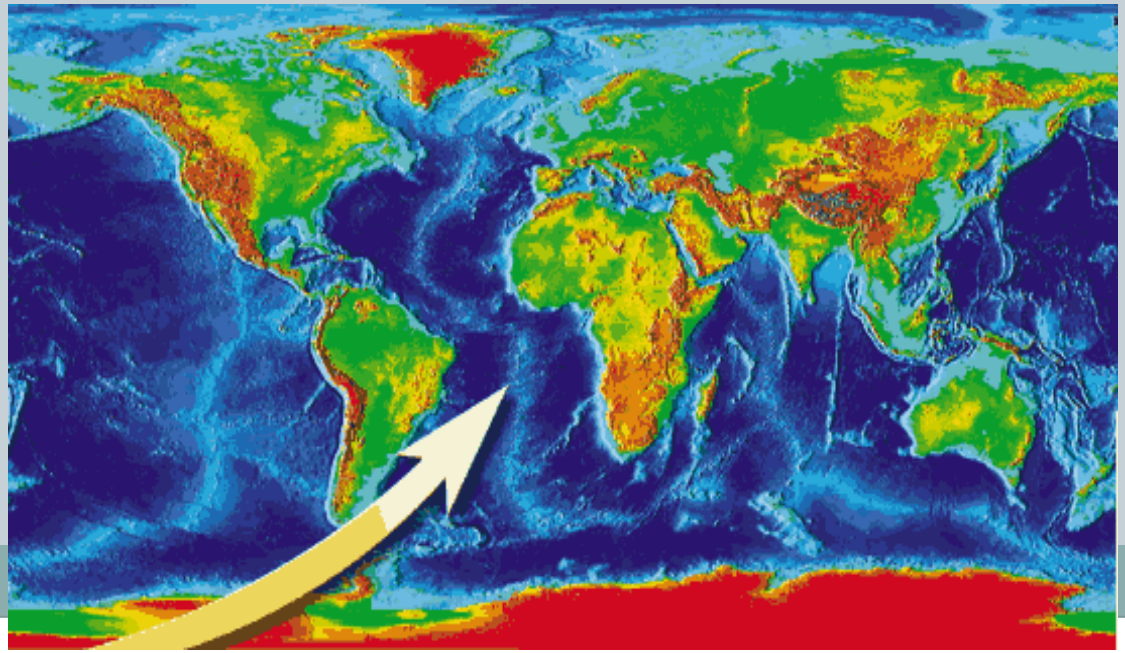
- Two or more plates pull away from each other.
- New crust is created.
  - Oceans born and grow wider known as **Sea Floor Spreading**.
  - Land separates to form a 'rift'
  - Eventually break apart into distinct land masses and surrounding water will fill the space.

Divergent Boundary
Sea Floor Spreading

- Oceanic plates moving apart creates mid ocean ridges.
- Molten material rises and erupts then spreads out, pushing older rock to the side, eventually towards a deep ocean trench.
- As it cools, forms a strip in the center.
- Continuous cycle

Earth's longest mountain range is underwater known is the Mid-Ocean Ridge system.

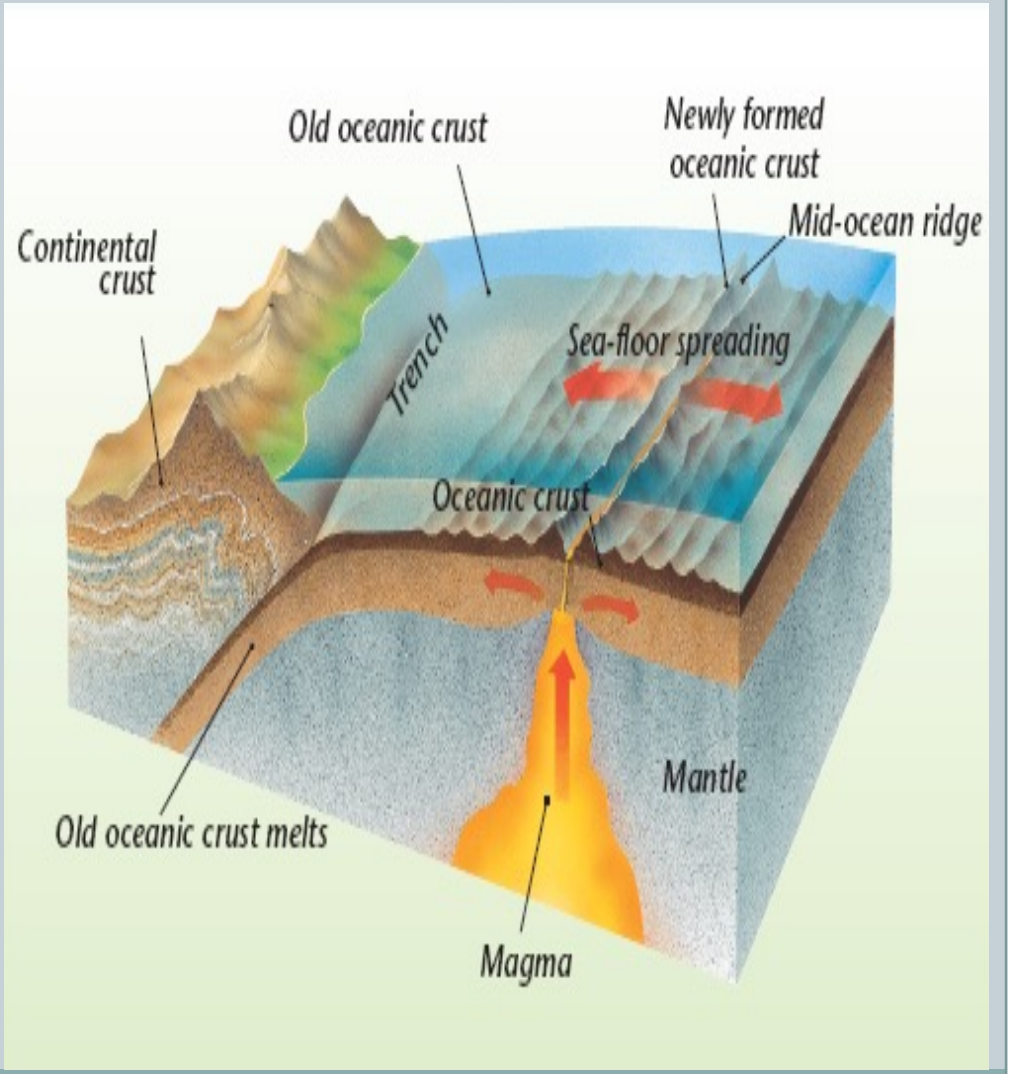
It is more than 35,000 mi. long.



Sea Floor Spreading?

How can the ocean floor keep getting wider?

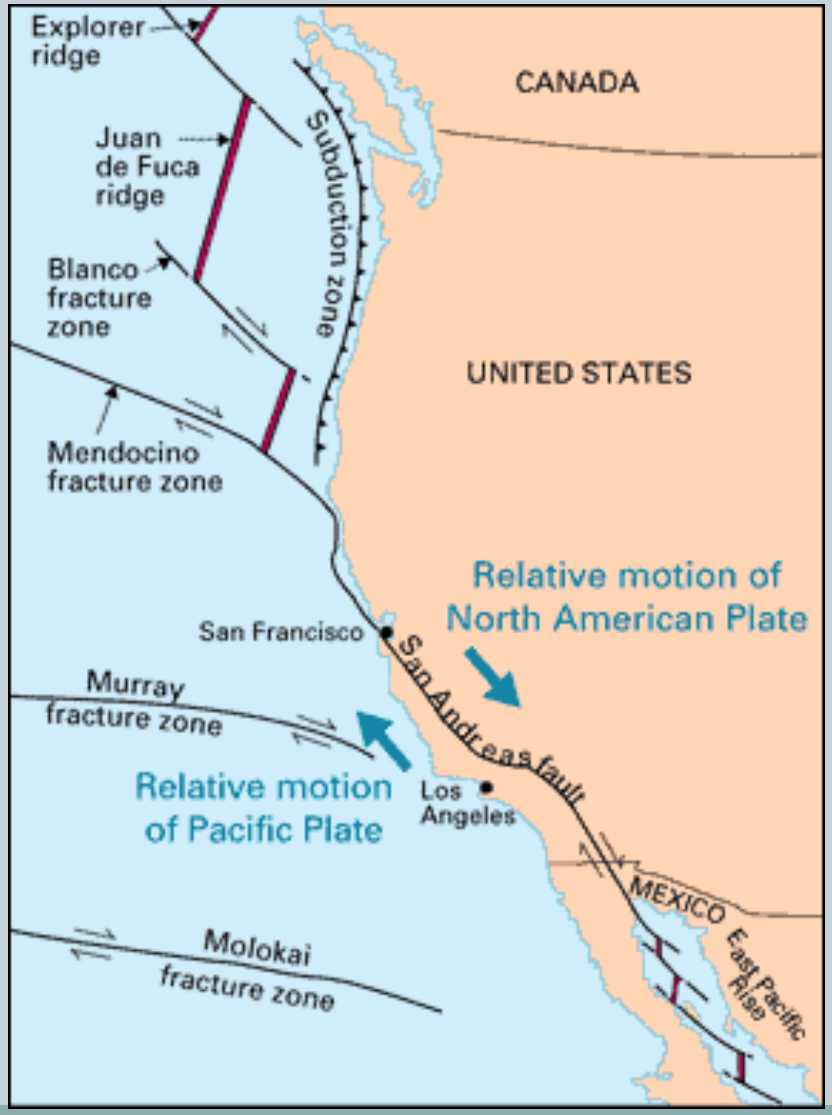
- It doesn't. It will plunge into deep underwater canyons called deep ocean trenches.
- Trenches forms where oceanic crust bends downward.
- Again, <u>subduction</u> is the process by which one plate sinks beneath another and back into the mantle.



Types of Plate Boundaries
Transform Boundaries

Transform Boundaries

- Two plates slide, shear, or grind horizontally past one another.
- Commonly known as faults.
- Mostly found on the ocean floor.
  - Offset active spreading ridges producing zig-zag plate margins
  - Defined by shallow earthquakes.
- Can occur on land
  - Ex. San Andreas Fault



Faults and Fault Movements

- Stress is a force that adds potential energy to rock until it changes shape or breaks and moves.
- When stress builds up in the lithosphere, it causes the rock to break, or changes the rock's shape or volume, creating a fault. This is called deformation.
- Deformation is due to plate movement.
- When the rock along the fault breaks and slides it causes an earthquake.
- This occurs typically along a boundary where plate motion compresses, pulls, or shears the crust.

Types of Faults

Fault Animations

Normal fault	**occurs when rocks are pulled apart causing one side to move downward.**
Reverse fault	**occurs when rocks crack and are compressed, thrusting upward and forming an overhang.**
Thrust fault	**a special type of reverse fault with a very low angle fault plane, typically <15 degrees.**
Strike-Slip fault	**occurs when rocks on either side slide past each with relatively no vertical motion.**