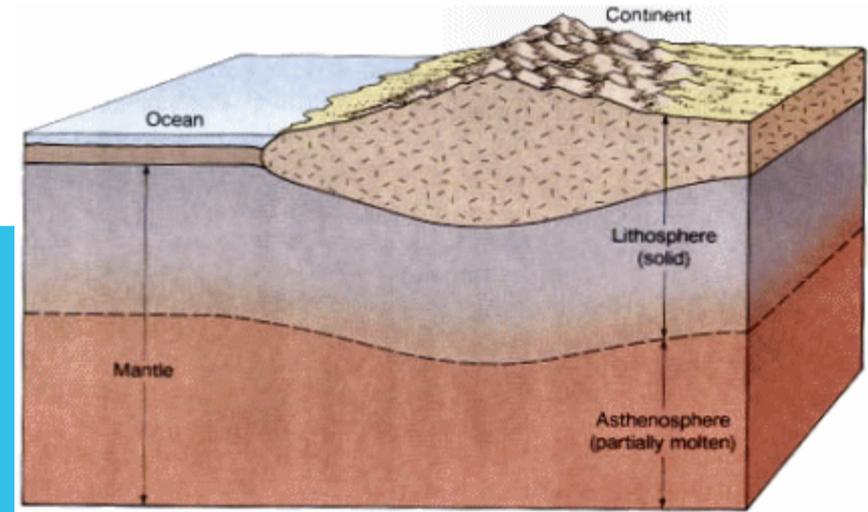
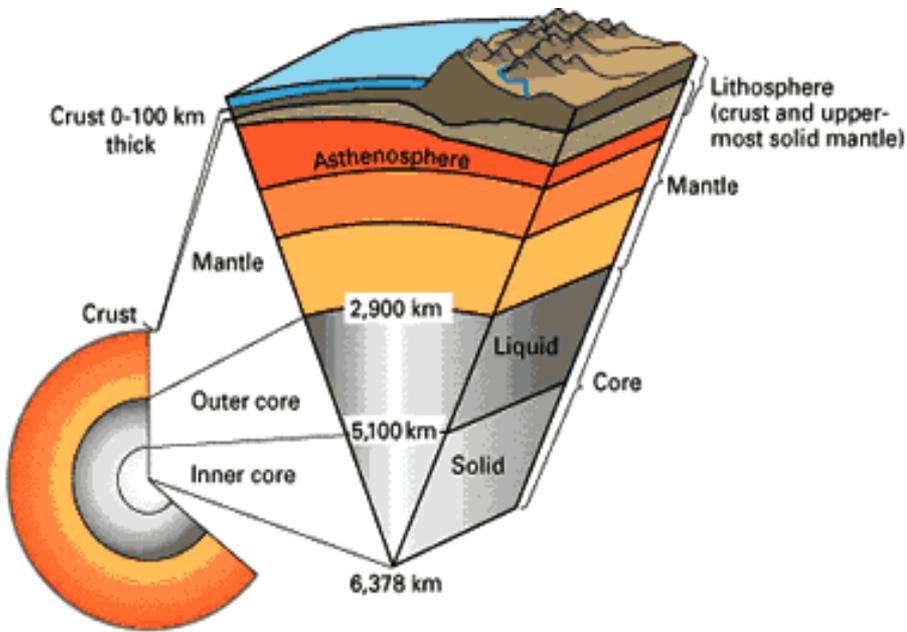


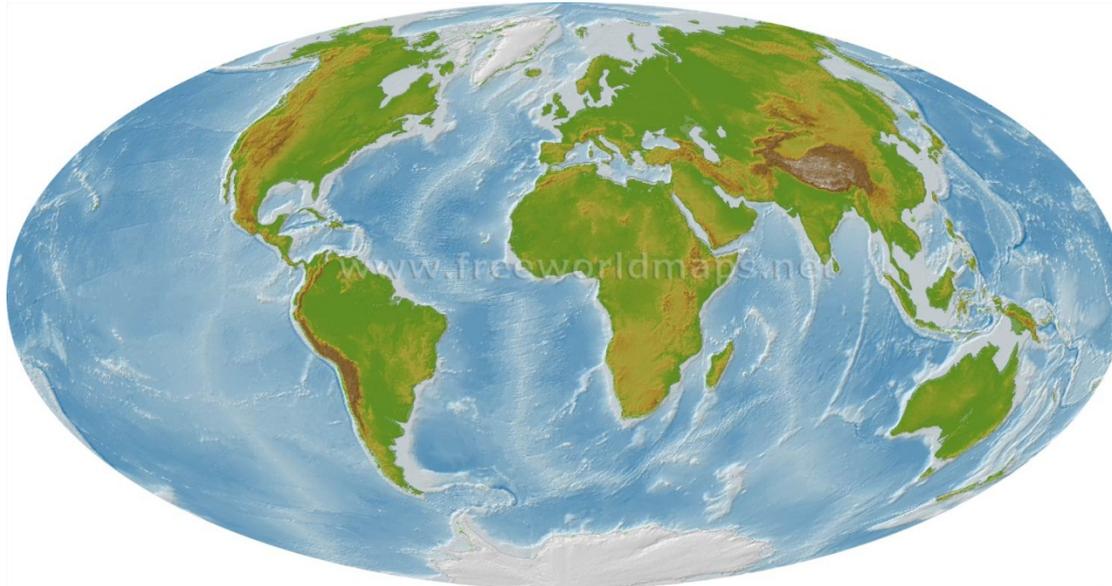
CHAPTER 17: PLATE TECTONICS

BACKGROUND KNOWLEDGE

- **Lithosphere** – the **rigid outer layer of the earth**. The continental crust and oceanic crust.
 - Continental crust – land
 - Oceanic crust – ocean floor
- **Asthenosphere** – layer of rock just below the lithosphere. It is solid but **soft**. (The mantle)



THE CONTINENTAL PUZZLE..



Do you notice anything about the shape of the continents?

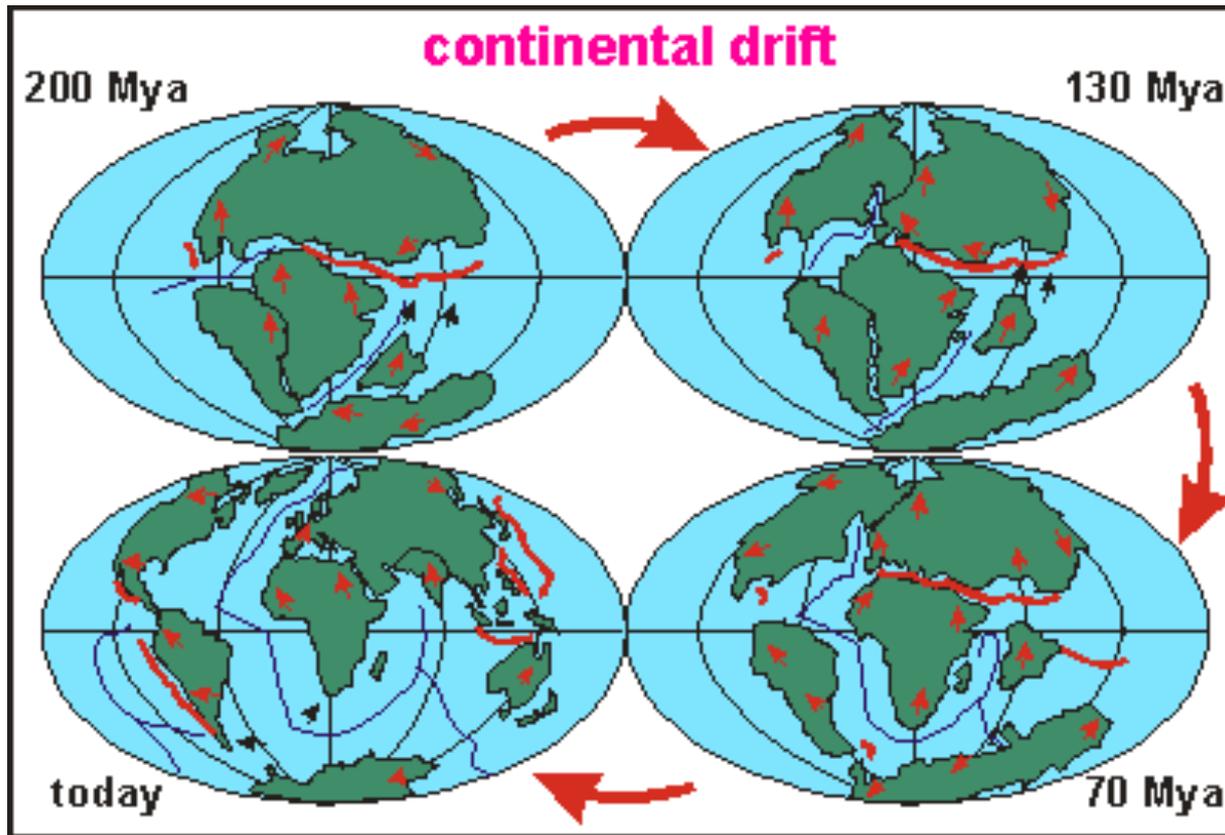
SEC 17.1 CONTINENTAL DRIFT

- Alfred Wegener, a German scientist, noticed that the coastlines of South America and Africa looked like they could fit together like a **puzzle**.
- In 1915, he proposed his hypothesis of *Continental Drift*.
- **Continental Drift – the continents had once been joined to form a single supercontinent called Pangaea.**
- He hypothesized that over the last 200 million years the **continents broke apart and drifted slowly to their positions today.**



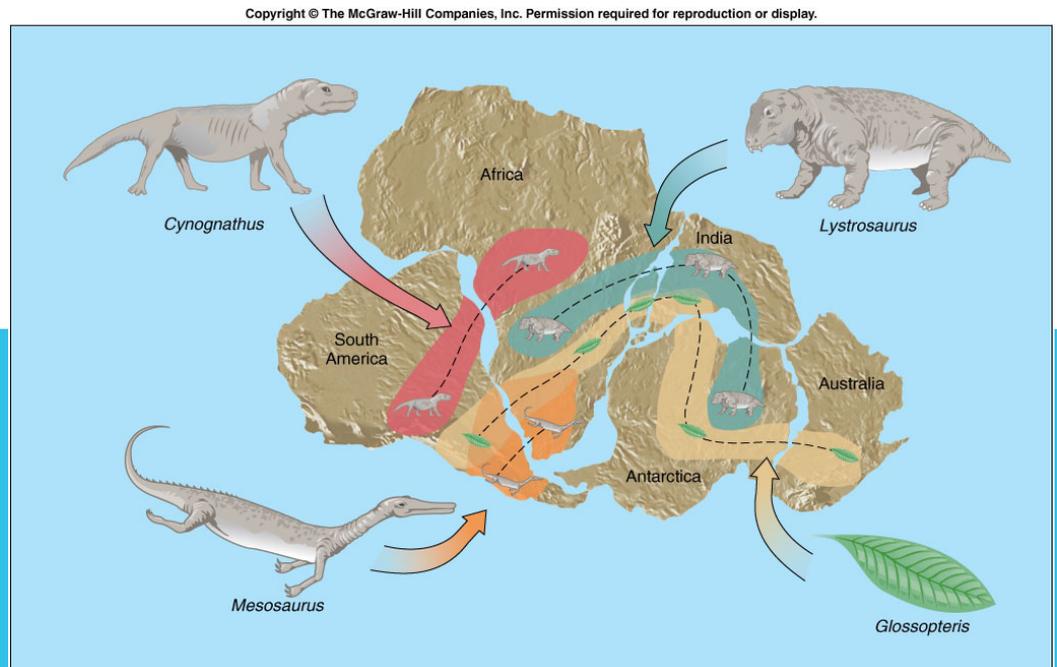
Pangaea Supercontinent – 200 million years ago

CONTINENTAL DRIFT



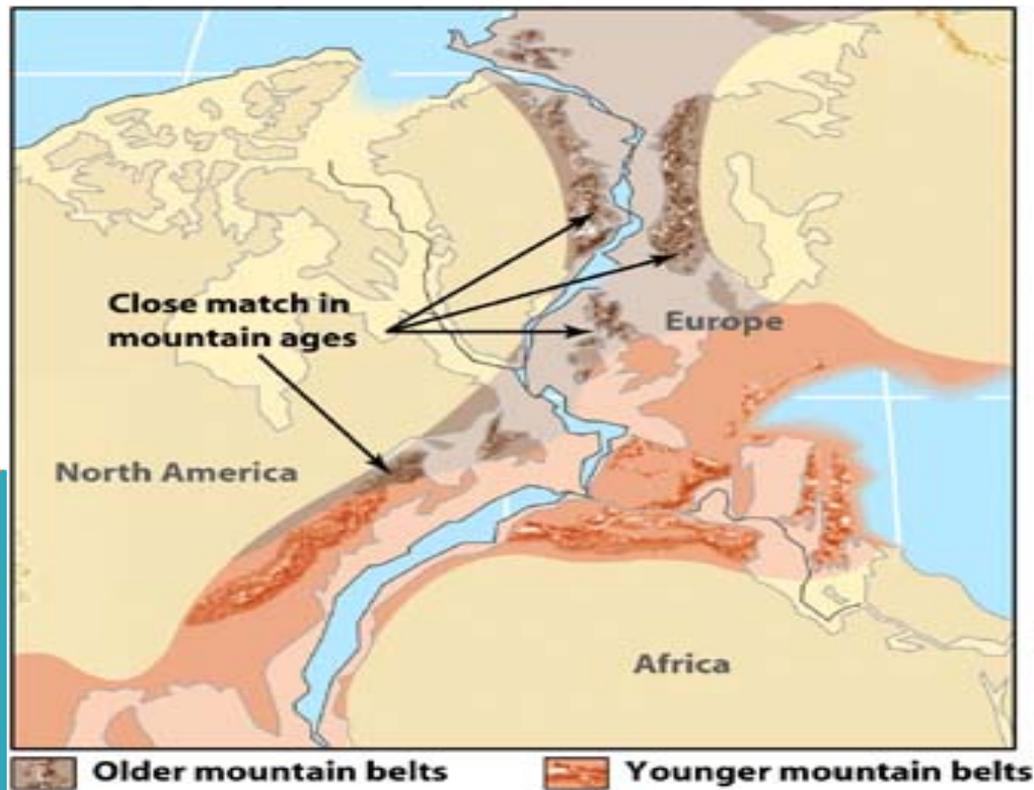
EVIDENCE

- Scientists need evidence to back up their claims.
- **Fossils** – fossils from the same ancient animals were found in South America and Africa.
- Mesosaurus - A reptile that could not have lived in salt water.
- South America and Africa must have been joined at one time.
- Think jigsaw puzzle.



EVIDENCE

- Rock types – Today there are matching rock types within mountain belts on different continents.
- Appalachian Mountains in the U.S. and mountains in Britain and Scandinavia share similar rock types and ages.



EVIDENCE

- Ancient climates – Wegener also found evidence of similar climates on different continents.
- Glacial till – deposits of glacial sediment on continents that are now in tropical climates. Also, rocks scratched by glaciers.
- Evidence that North America had tropical swamps. We know that North America does not have tropical swamps now.



NATURE OF SCIENCE...

- Wegener's hypothesis of continental drift was a new, radical idea.
- Other scientists thought Wegener was wrong. **His hypothesis was rejected!**
- **Why? Because Wegener did not know exactly what caused the continents to move.**
- Eventually, *technology* led to new discoveries and the acceptance of continental drift.

CHECK FOR UNDERSTANDING, PG

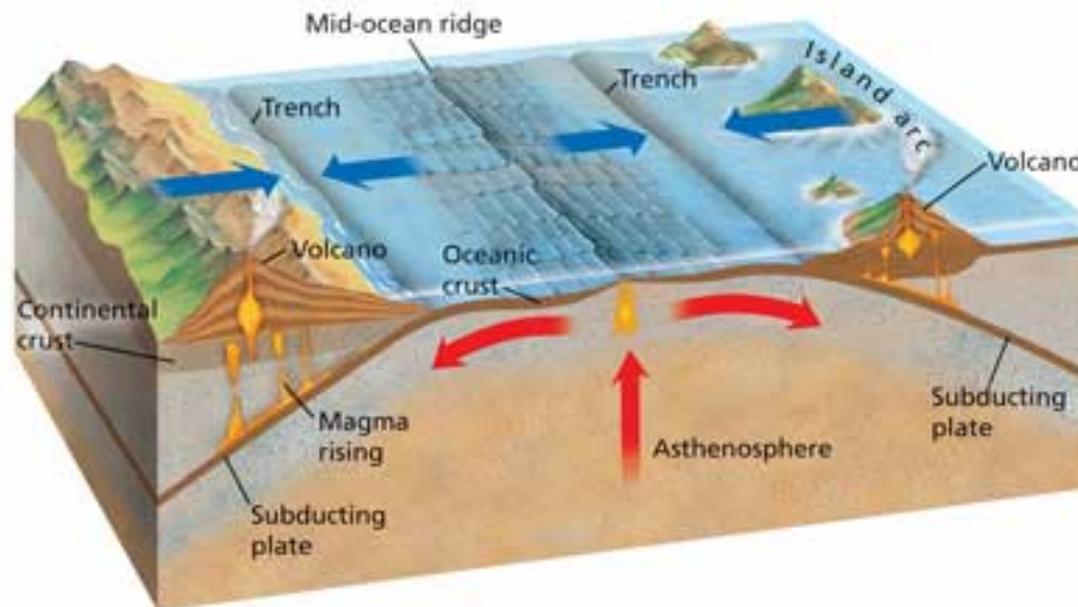
1. What early evidence suggested that Earth's continents might be moving?
2. List the three types of evidence outlined in the text and explain how they support Wegener's theory.
3. Why was Wegener's hypothesis rejected by most scientists of the early 1900's?

SEC 17.2 SEAFLOOR SPREADING

- Remember that scientists rejected continental drift.
- But new technology led to new scientific discoveries.
- Sonar – sound waves are emitted to calculate the distance to an object.
- Scientists began mapping the ocean floor using sonar.

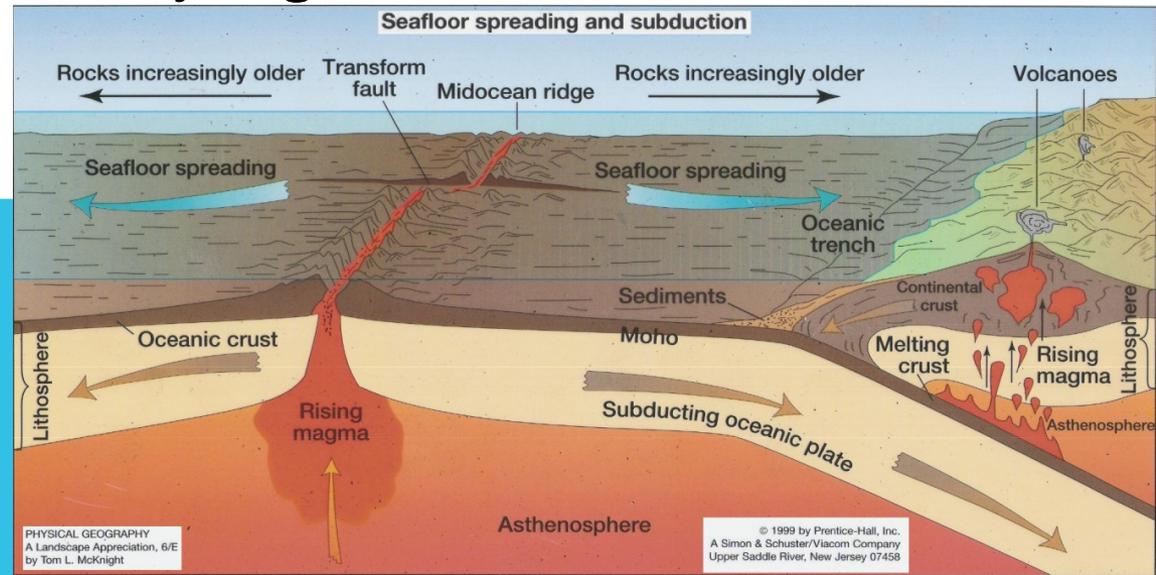
THE OCEAN FLOOR

- The ocean floor is not a flat.
- **Deep-ocean trenches** – form the deepest part of the oceans. They occur on the edges of oceans near continents.
- **Mid-ocean ridges** – a long chain of mountains in the center of oceans.
- **Rift valley** – a central valley occurring in the middle of a mid-ocean ridge. It looks like a canyon.



SEAFLOOR SPREADING

- What is **seafloor spreading**? Think of a conveyer belt at the grocery store...
- Magma gets pushed out of the mid-ocean ridge (long mountain chain).
- The magma spreads out along each side. It cools and hardens into rock (oceanic crust).
- More lava forms at the mid-ocean ridge, pushes the older stuff outward.
- The result? – Oceanic crust is young in the middle and old on the outside.



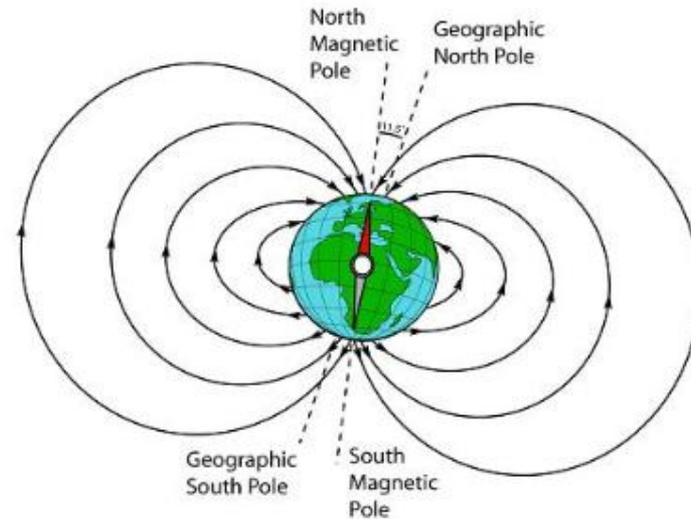
EVIDENCE FOR SEAFLOOR SPREADING

- Sea-floor spreading explained how ocean basins can grow wider or close up.
- What evidence is there for sea-floor spreading?



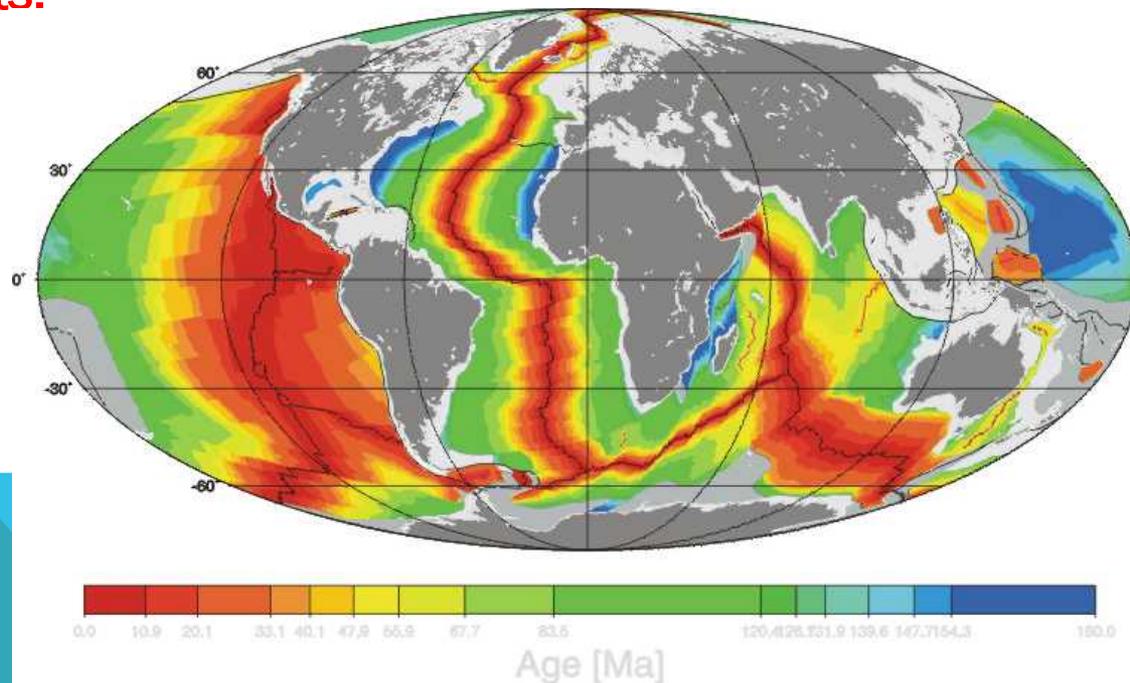
1. MAGNETIC STRIPS

- Magma that cools and forms the ocean floor is rich in iron.
- When the magma cools the grains in the rocks line up with the earth's magnetic field.
- **Paleomagnetism** – rocks acquire the polarity of the earth's magnetic field at that time.



2. AGE OF OCEAN FLOOR

- Age of the ocean floor
- Ocean floor is youngest along the rift valley of the mid-ocean ridge.
- Ocean floor is oldest in the subduction zones or near the continents.



CHECK FOR UNDERSTANDING

1. How do ridges and trenches support the theory of seafloor spreading?
 2. How are ocean-floor rocks and sediments evidence of seafloor spreading?
 3. How do magnetic strips support seafloor spreading?
 4. What would Wegener say after seeing this evidence?
- 

17.3 THEORY OF PLATE TECTONICS

- The lithosphere is broken into several huge pieces called plates.
- Deep faults separate the plates.
- **Theory of Plate Tectonics: earth's lithospheric plates move slowly relative to each other, driven by convection currents in the mantle.**

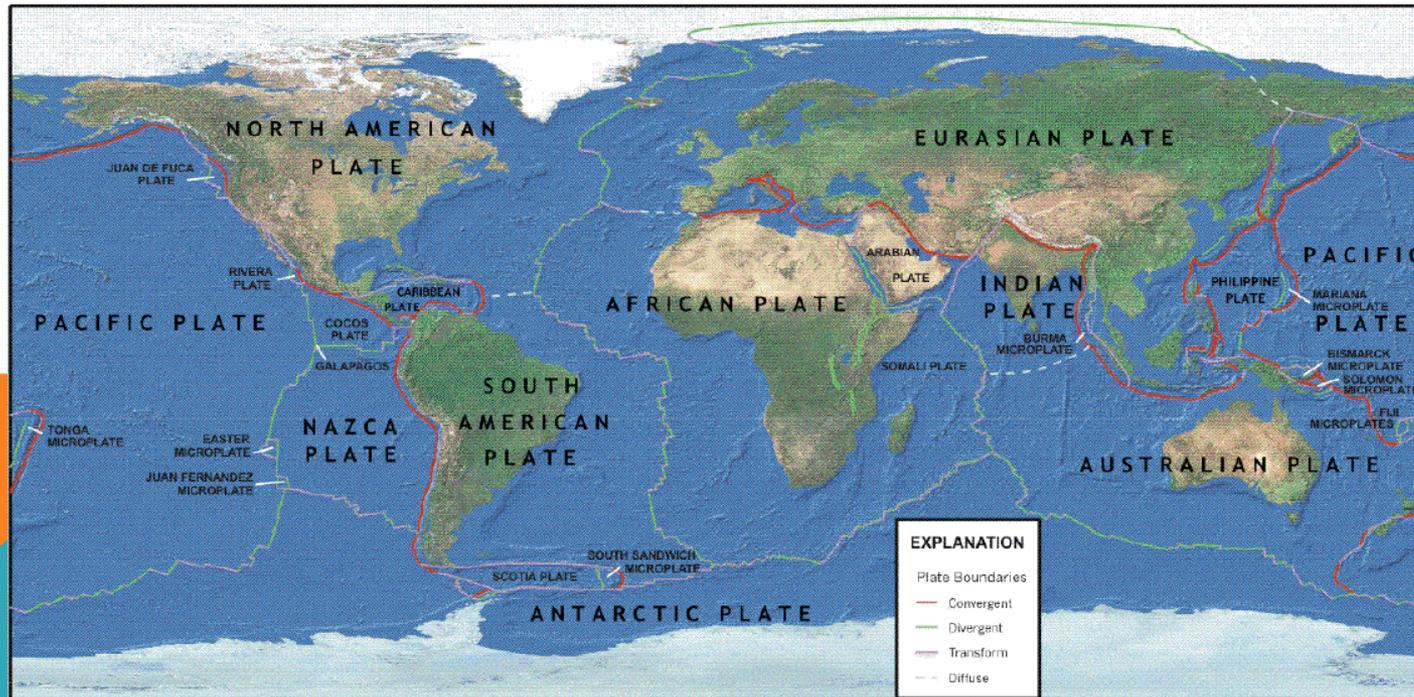


PLATE BOUNDARIES

There are three types of plate boundaries

- Divergent
- Convergent
- Transform



PLATE BOUNDARIES

- Divergent boundary – a boundary where two of earth's plates move away from each other.
- Oceanic crust is created at divergent boundaries.

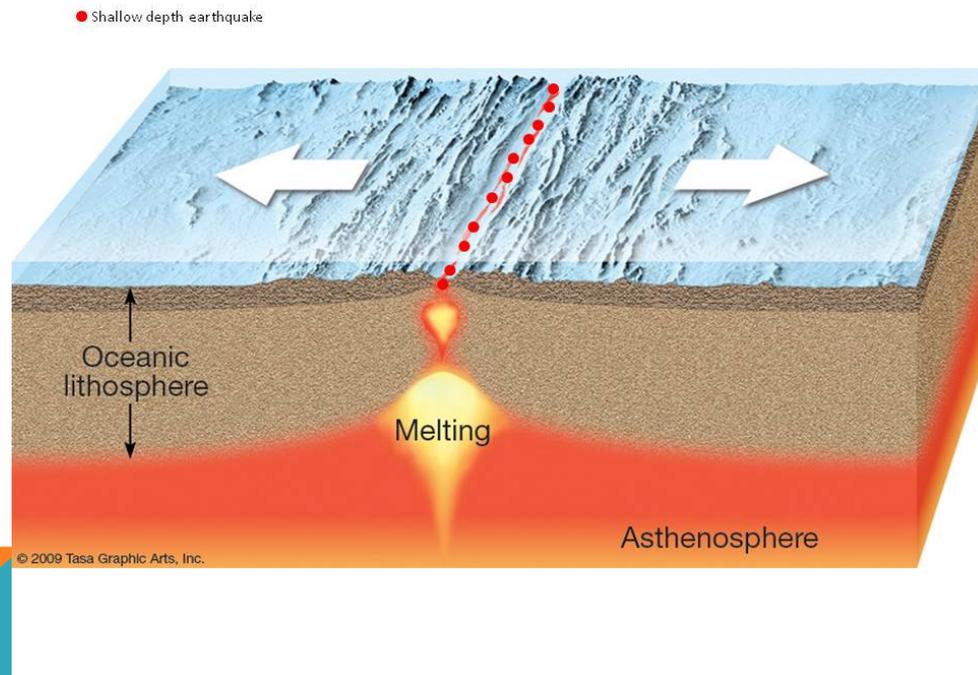
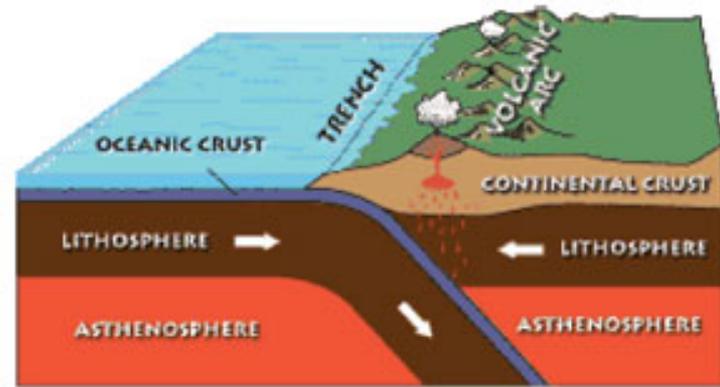


PLATE BOUNDARIES

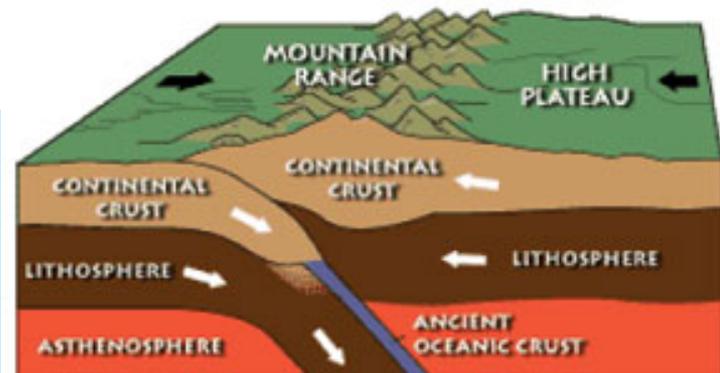
- **Convergent boundary – a boundary where two plates collide.**
- Ocean – Ocean
- Ocean – Continental
- Continental – Continental
- **Subduction Zone**



Oceanic vs. Continental Plate Convergence



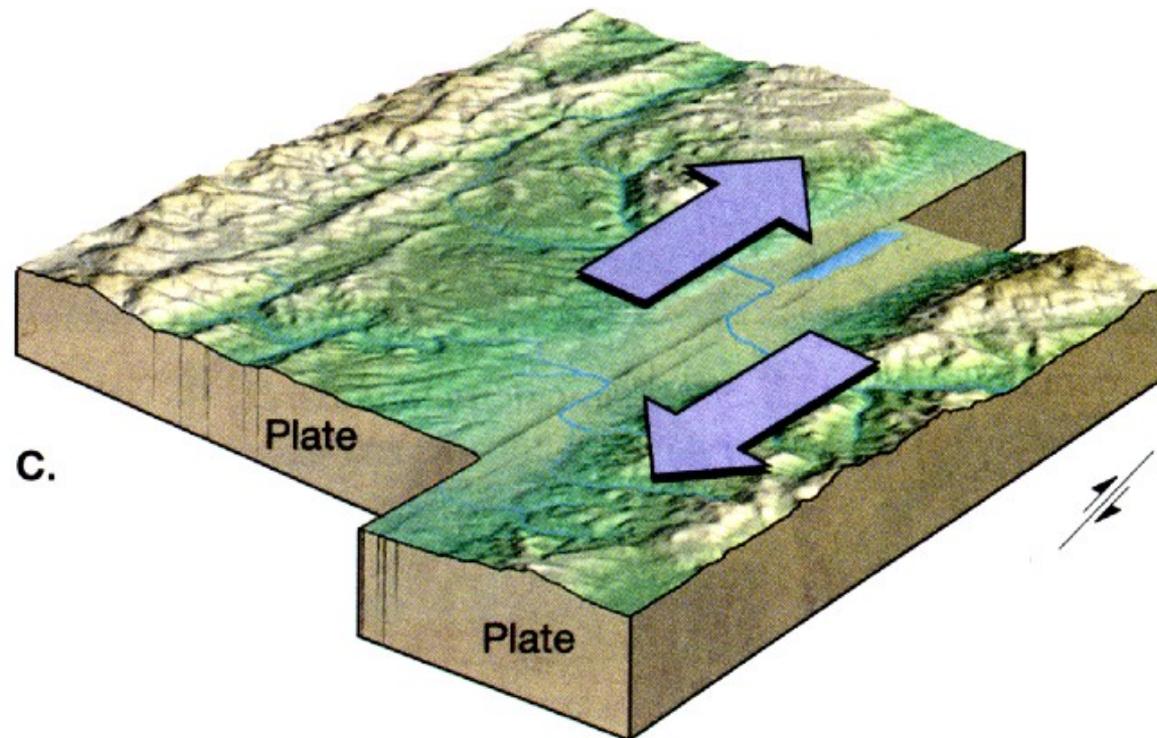
Oceanic vs. Oceanic Plate Convergence



Continental vs. Continental Plate Convergence

PLATE BOUNDARIES

- Transform fault boundary – a boundary where two plates slide past one another but crust isn't created or destroyed.



CHECK FOR UNDERSTANDING

1. Explain the theory of plate tectonics.
2. List the three types of plate boundaries and describe what happens at each.
3. The ocean floor has been compared to a conveyer belt. Defend this comparison.

17.4 MECHANISMS OF PLATE MOTION

- Convection current – the continuous flow that occurs in a fluid because of differences in density. Warm material is less dense so it rises. Cooler material is denser so it sinks.
- Convection currents in the mantle provide the basic driving forces for plate motions.
- Oceanic crust is coldest and most dense farther away from the mid-ocean ridge. This is known as “slab-pull.”
- Near mid-ocean ridges, the asthenosphere is elevated. Oceanic crust slides down this elevation. This is known as “ridge-push.”

PLATE MOTION...

- **Convection currents within the earth drive plate motion.**
- Hot material within the mantle moves upward. At the same time, cooler, denser slabs of oceanic lithosphere sink back into the mantle.

