

Ch. 10—Plate Tectonics

Mr. Aprill

Revised: 1/12/12

(Does not include in class videos)

Continental Drift

- Evidence of Continental Drift
 - 1800's accurate maps of Earth were first developed.
 - People noticed the continents could have fit together.
 - 400 years ago—Dutch map maker Abraham Ortelius noted the similarities in the coastlines between Africa and South America.
 - 1912—Alfred Wegener (VEG nur)—proposed the Theory of Continental Drift.



Pangaea

- Pangaea

- *All continents were once joined & broke up 200 million years ago.

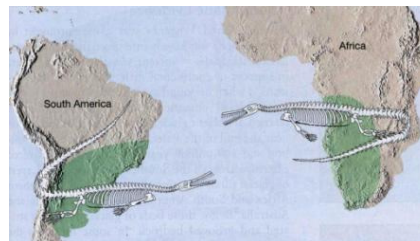
- This land mass was called – Pangaea.

- *Pangaea = "all land"



Clues to Continental Drift

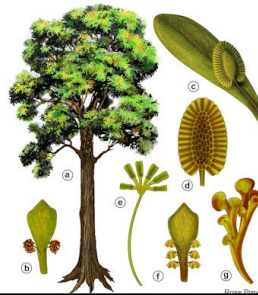
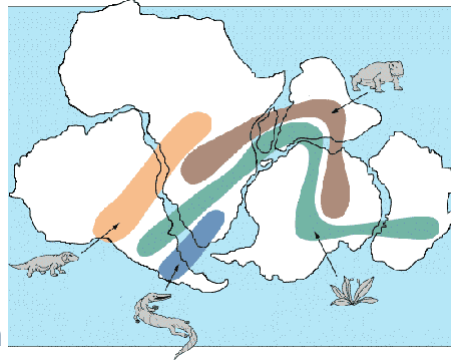
1. Puzzle like fit
2. Fossil Clues
 - *Mesosaurus*—reptile found on land & in freshwater. (About 3.3 feet long)
 - Fossils were found in South America & Africa.
 - Unlikely that Mesosaurus swam between the continents.
 - **THEY BELIEVE THEY CROSSED OVER WHEN THE CONTINENTS WERE CONNECTED.**



Clues to Continental Drift

2. Fossil Clues (Cont)

- *Glossopteris*—fossil fern
- Found in Africa, Australia, India, South America, & Antarctica.
- It was believed that when connected they had similar climate.



Clues to Continental Drift

3. Paleoclimatic Clues

- Fossils of warm-weathered plants have been found in arctic regions (Island of Spitsbergen).
- Glacial deposits & surfaces scoured & polished by glaciers found around equator (South America, Africa, India, Australia)
- Parts of these continents were covered with glaciers.
- Ancient coral reefs found in Antarctica



Clues to Continental Drift

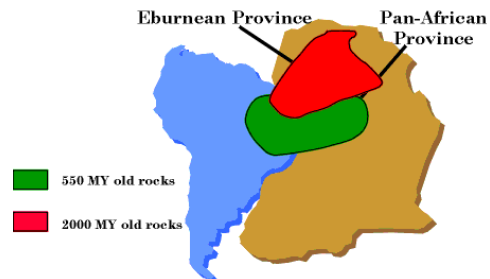
4. Rock Clues

- Similar rocks are found on different coasts.
- Ex. Appalachian Mountains similar to rocks of Greenland & western Europe.



Clues to Continental Drift

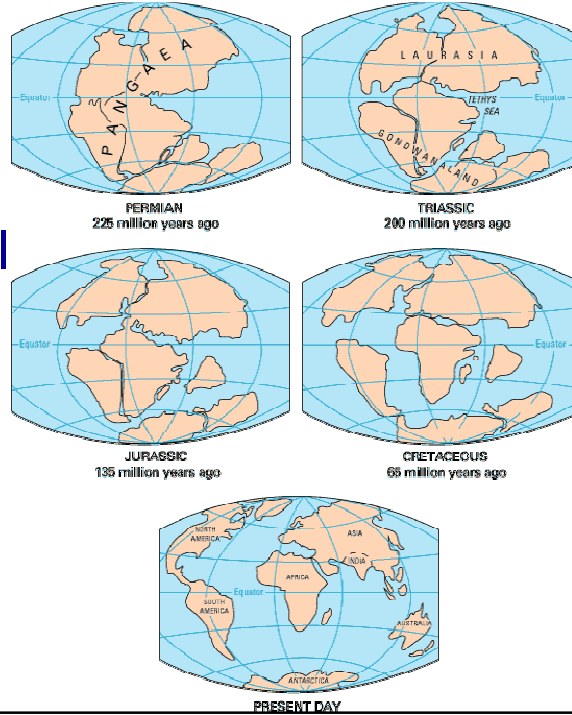
- Ex. Rocks of western Africa similar to rocks of eastern South America.



- **THIS IDEA WAS REJECTED AT THE TIME BECAUSE IT WAS SO RADICALLY DIFFERENT AT THE TIME.**
- **LATER MORE CLUES WERE FOUND AS TECHNOLOGY IMPROVED.**

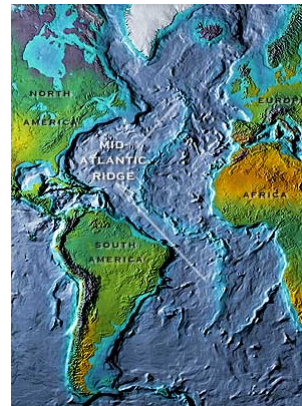
Computer Models of Continental Drift

[100 Million Years In the Future Animation](#)



Seafloor Spreading

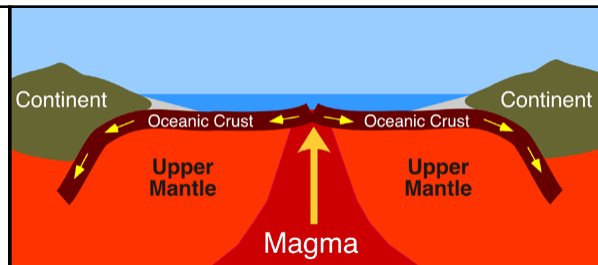
- Clues on the Ocean Floor
- Technology lead to further clues.
- Echo-sounding devices
 - 1940's-1950's on ships
- Discovered
 - Underwater mountains
 - Mid-Ocean Ridges
- **Scientists wondered what formed the Mid Ocean Ridge.**



Sea Floor Spreading



Seafloor Spreading



- Early 1960s
 - Harry Hess (Princeton University)
 - Proposed: “seafloor spreading”
 1. Hot (less dense) material in mantle.
 2. Forced upwards at mid-ocean ridge.
 3. Flows sideways, carries seafloor away from ridge.
 4. It cools, becomes more dense, sinks
 5. As it sinks, forms trenches.

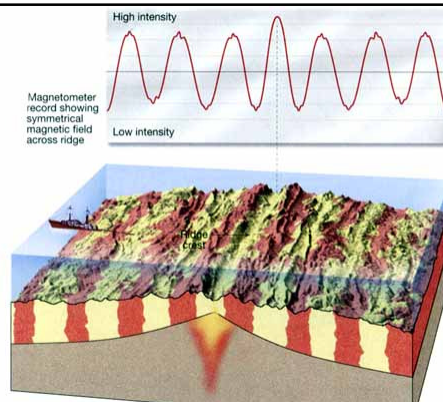
Evidence for Spreading

- *Glomar Challenger*, research ship, '68
 1. Drilling Rig to obtain rock samples
 2. Rock samples 180+ million years old were found.
 - Note: some continental rocks are 4 billion years old.
 - **Why are the seafloor rocks so young?**
 - Rocks close to the ridges are younger.



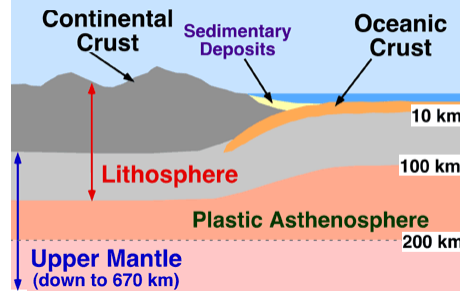
Magnetic Clues

- Basalt
 - Rock samples collected from seafloor.
 - Contains what ore?
 - Iron
 - Aligns itself according to magnetic field orientation at the time.
- Rock samples show several reversals in Earth's magnetic field.
- **Magnetometer**--Instrument, which records magnetic data.
- Found: magnetic alignment reverses back & forth, parallel to the mid-ocean ridge.



Theory of Plate Tectonics

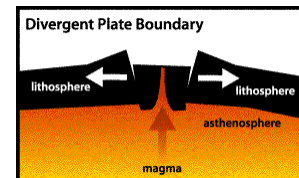
- Theory of Plate Tectonics—Earth's crust & upper mantle are broken into sections.



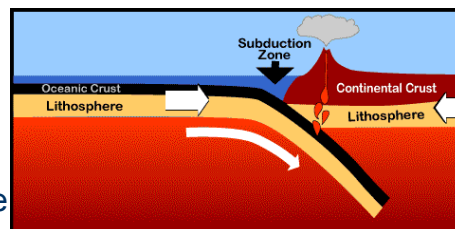
- Plates—crust & part of upper mantle which move together as one unit.
 - **Plates are like rafts that float around on the mantle.**
 - Lithosphere—100 km thick layer.
 - Less Dense than the layer below.
 - Asthenosphere—the plates move around above this layer.

Plate Boundaries

- Divergent Boundaries (moving apart)
 - Ex. Mid Atlantic Ridge
 - Ex. *Great Rift Valley (East Africa)*



- Convergent Boundaries
 - 3 Types
 - 1. Subduction Zone
 - *Continental* Plates Collide
 - One less dense than other.
 - More dense plate sinks.
 - Ex. *Andes (South America)*



2. Ocean-Ocean Collisions AND Continental- Continental Collisions

- A. Ocean-Ocean
 - Same as subduction zone, but with *ocean plates*
 - Ex. *Japan*.
- B. Two *continental plates* collide
- Both are less dense than asthenosphere
- Usually NO subduction
- Crumble when they collide.
 - Ex. *Himalayan Mountains (Asia)*

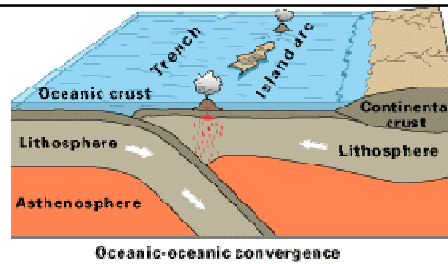
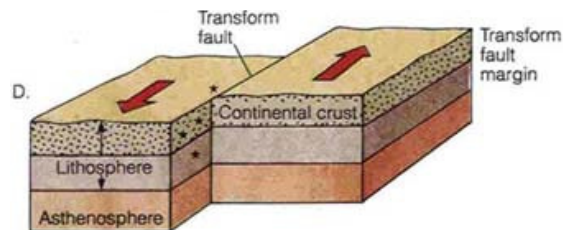


Plate Boundaries

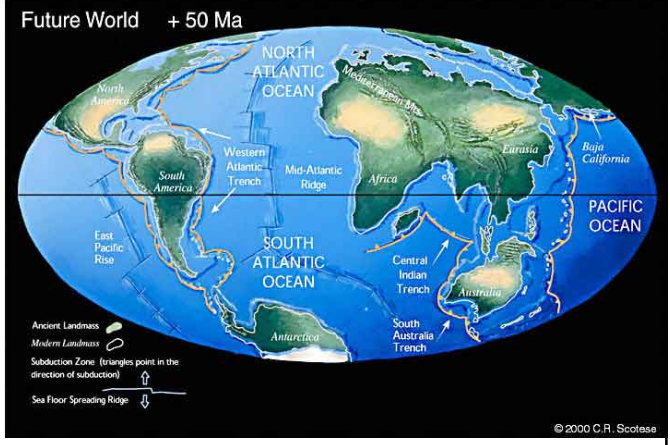
Plate Boundaries



3. Transform Fault Boundaries

- 2 plates *slide* past one another.
- Can move in the same direction. OR
- Opposite directions.
- Ex. North American Plate & Pacific Plate
- San Andreas Fault

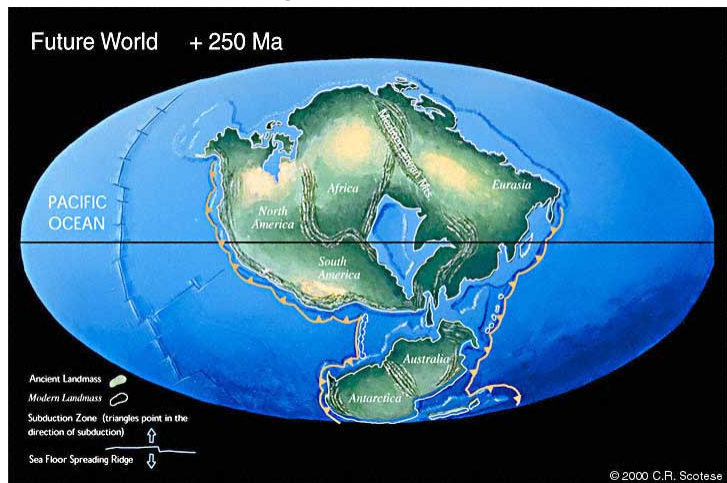
Plate Movement Simulator



[Let's see what happens when we move various plates](#)

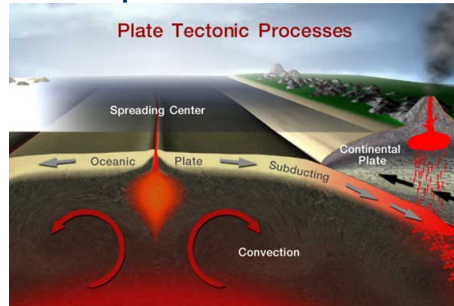
[Animations of Plates over the years](#)

250 Million Years from Now

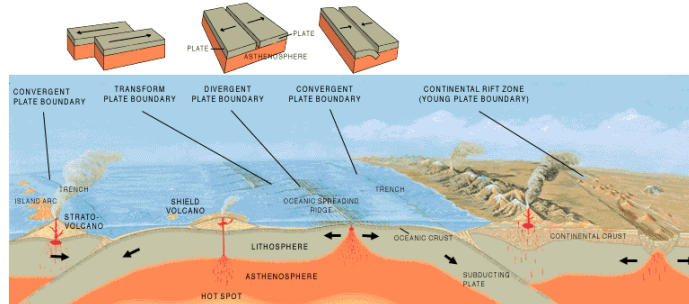


Causes of Plate Tectonics

- Hypothesize: similar to the process of heating your home.
 - Convection Currents
 - Heat
 - Rises
 - Cooling
 - Sinking
 - All these combine to create convection.



Effects of Plate Tectonics



- Volcanoes
- Earthquakes
- Mountains
- Faults & Rift Valleys
- Strike-Slip Faults