January 15, 2015
GEOL 1030-003 Notes

Lecture 2—Plate Tectonics

Plate Tetonics

- Almost all Earth processes relate back to this
  - ① Ex. Climate, flora & fauna, volcances, earthquakes, rock & mineral distribution, fossil fuel deposits, etc
  - ② Ex. Antartica Climate
    - Today— Ant. at S. Pole, surranded by cold, oceanic current
    - ~~90 Ma~~ — Ant. was farther North and had climate like Canada's, with lots of plants + animals living there
    - ~~Tectonics~~ changed continent's location, which affected its climate, flora & fauna

What Is Plate Tetonics

- Lithosphere divided into several pieces (plates) that move around Earth's surface
  - ① Described as "floating" on the ductile asthenosphere
  - ② Ex. Icebergs moving around surface of ocean

- Note: Plate boundaries do Not correspond to continent & ocean boundaries
- Some plates contain just oceanic crust, Some contain just continental crust, and Some contain both
- Remember: the crust = just upper part of lithosphere

Discovering Plate Tetonics

- Early cartographers (map-makers) noticed that the continen looked like puzzle pieces that could fit together
- Early 20th century: Alfred Wegener developed Continental Drift hypothesis
  - ① Thought continents moved (drifted) over time. Evidence:
    - Continental boundaries fit together
    - Some fossil species found on opposite sides of ocea
      - Ex. Mesosaurs were small reptiles whose fossils are found in Africa & South America
- Hypothesis (C.D.) didn't get much support right away
  - ① Wegner couldn't explain HOW Continents moved
  - ② Idea dismissed until 1940s
- WWII: lots of Submarine warfare necessitated detailed maps of ocean floor
- Scientists knew there was a Mid-Ocean Ridge—a long mountain chain that runs throughout world's oceans
  - ① Ex. Like seam on a baseball

Seafloor Anomalies

- Scientists found unusual features on seafloor while mapping (1940s-1960s)
- Found magnetic anomalies in seafloor rocks
- Rocks close to MOR record normal magnetic polarity
  - ① Magnetic mineral grains point North
- But moving farther from MOR, rocks begin alternating b/t Normal & Reverse polarity

- Meant that Earth's magnetic field changed thru time, and seafloor rocks not all same age
  - ① Dating seafloor rocks confirmed this
  - ② On map— hot colors = young rocks, cool colors = old rocks
  - ③ Rocks youngest near MOR & progressively older as you move away from MOR

Explaining the Anomalies

- Magnetic & age anomalies produce mirror images to east and west of MOR
- Led to <u>Seafloor Spreading Hypothesis</u>
  - ① Lava rises to surface of MOR, cools to form new rocks, then the rocks get pushed aside as more lava comes up to the surface
- Seafloor Spreading revived Wegner's hypothesis
  - ① Provided mechanism for making continents move

How Do Plates Move?

- <u>Seafloor spreading</u> driven in part by <u>convection</u>— hot, low-density material moves upward, displacing cooler, higher density material
- Convection within ductile asthenosphere helps move brittle lithospheric plates

New Hypotheses

- Know that convection is only one process that makes plates move
- <u>Ridge Push Model</u>— buoyant material near MOR pushes plates apart & they slide downhill away from the MOR
- <u>Slab Pull Model</u>- as one end of the plate sinks, it pulls the rest of the plate down behind it