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Plate Tectonics

- Almost all earth processes relate back to plate tectonics
  - Climate, flora/fauna, volcanoes, earthquakes, etc
- EX: climate in Antarctica
  - Today: south pole, by cold ocean current
  - 90 mil GA: Antarctica was further north, had a climate like Canada's
  - tectonics changed its location, changing climate

What are plate tectonics?

- Lithosphere is divided in to plate that move around surface
  - "float" on ductile asthenosphere
- Plate boundaries do not correspond to continent/ocean boundaries
- Some plate contain only continental, some only oceanic, some both
- **Crust=upper part of lithosphere**
- early cartographers noticed that continents fit together like puzzle pieces
- Early 20th century: Alfred Wegner developed **continental drift** hypothesis
  - Evidence
    - 1. Continental boundaries fit together
    - some fossil species were found on opposite sides of the ocean ex: mesosaurus fossil found in Africa and South America.
  - Did not get much support right away because Wegner couldn't explain how the continents moved.
    - Dismissed until the 1940s
  - WWII-lots of submarine warfare=maps of ocean floor
    - Scientists already know of **Mid Atlantic Ridge** (long mountain chain extending throughout the world's oceans)
  - Scientists found interesting things while mapping the ocean floor
    - Magnetic qualities in seafloor rocks
      - Rocks near MOR record normal magnetic polarity (mineral grains point north)
      - Rocks farther form the ridge alternate between normal and revers polarity
      - This means earth's magnetic field changed throughout time, and the seafloor ricks are not all the same age
    - Drifting seafloor rocks confirmed this (mirror image to the east and west of ridge)
    - Led to **seafloor spreading hypothesis**: lava rises to seafloor @ MOR, cools to form new rocks, rocks get pushed aside as more lava comes to the surface.
  - Revived Wegner's continental drift hypothesis because it provided a mechanism for making continents move

- Driven by convection-hot, low density material moves upward, while cooler, high density material moves down
- Convection within the ductile asthenosphere moves lithosphere around

New Hypothesis

- Now we know that convection is only 1 process
- **Ridge Push model**: buyout material near the MOR pushes the plates apart and they slide downhill/away from the MOR
- **Slab-Push model**: as one end of the plate sinks, it pulls the rest of the plate down behind it
- **Slab-Subduction model**: the descending plate sucks down some asthenosphere, helping stir the convection cell

When a plate moves, so do the ones around it:

- Boundaries
  - Pull away
  - Run into each other
  - Slide past each other
- **Divergent**: move away from each other
  - A) **seafloor spreading**: divergent boundary between 2 oceanic crust plates, characterized by underwater volcanoes
  - B) **"rift valley"**: divergent boundary in continental crust. Ex- East Africa Rift Valley
  - C) **Triple Junction**: Y-shaped split. 1 arm may become an active plate boundary, others become failed rifts.
- Convergent: 2 plates collide head on
  - A) **subduction zone**: 1 oceanic plate, other is continental (sometimes both are oceanic). Plate with oceanic crust is subducted because it is denser. Characterized by volcanic activity/earthquakes.
  - B) **collision zone**: both plates are continental; low density makes it hard to subduct. Ex-try to get a cork to stay underwater
    - Rocks are pushed up instead of down.
    - Where mountain belts form
- **Transform**: 2 plates slide past each other
  - Plates must overcome high friction to move
  - EARTHQUAKES
  - Ex- San Andreas Fault: N American and Pacific plates. San Francisco is on a different plate than Los Angeles, California is separating from the US.