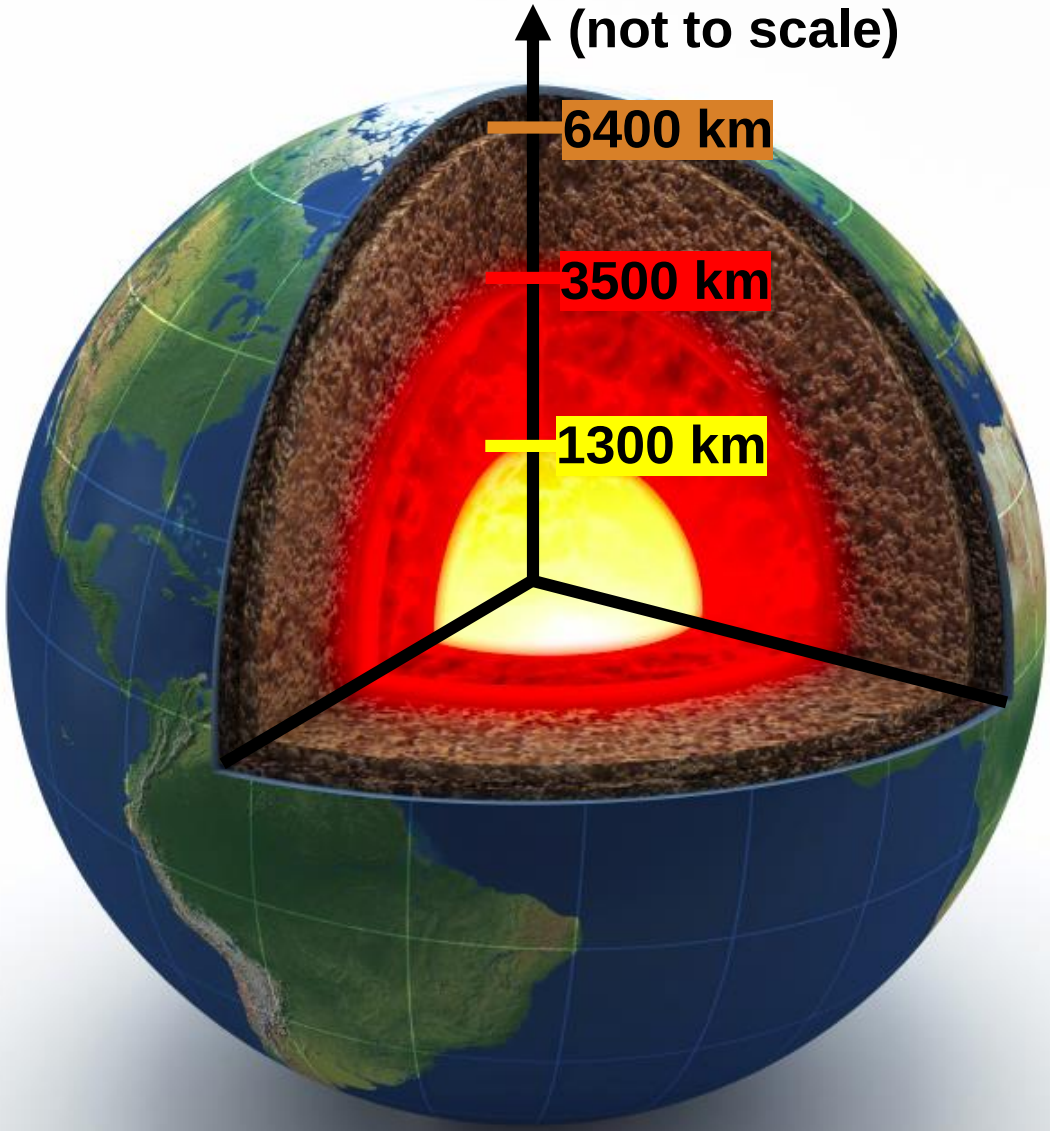
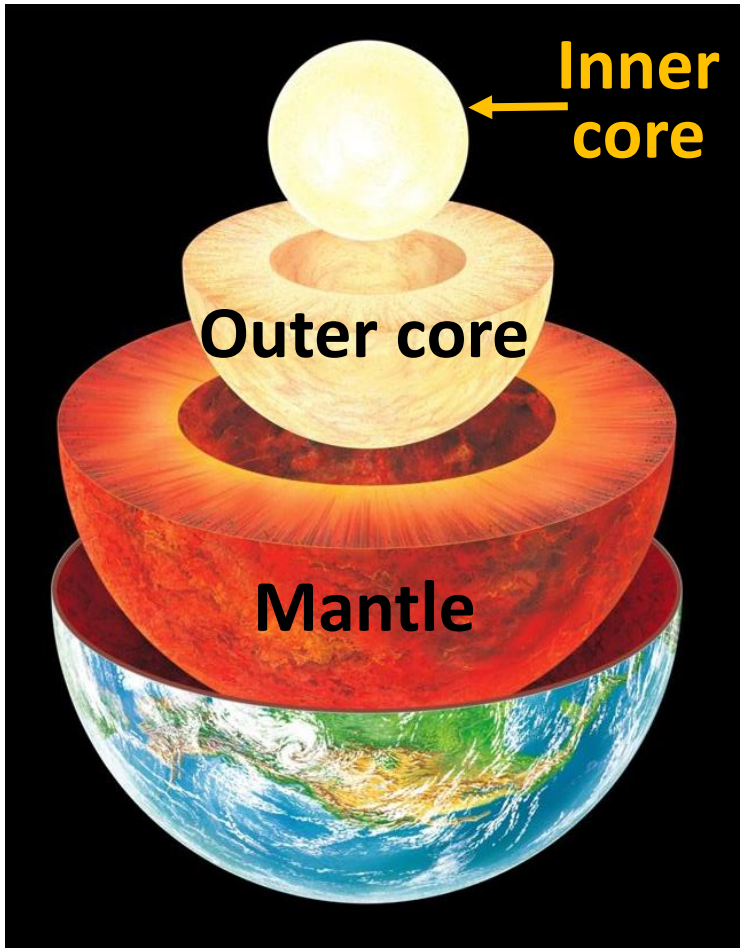
Inside Earth: Layers

- **Inner core**
  - R = 1300 km (0-800 mi)
- **Outer core**
  - 1300-3500 km (800-2200 mi)
- **Mantle**
  - 3500-6400 km (2200-4000 mi)
- **Crust**
  - tops mantle
  - 5-50 km thick (3-25 mi)



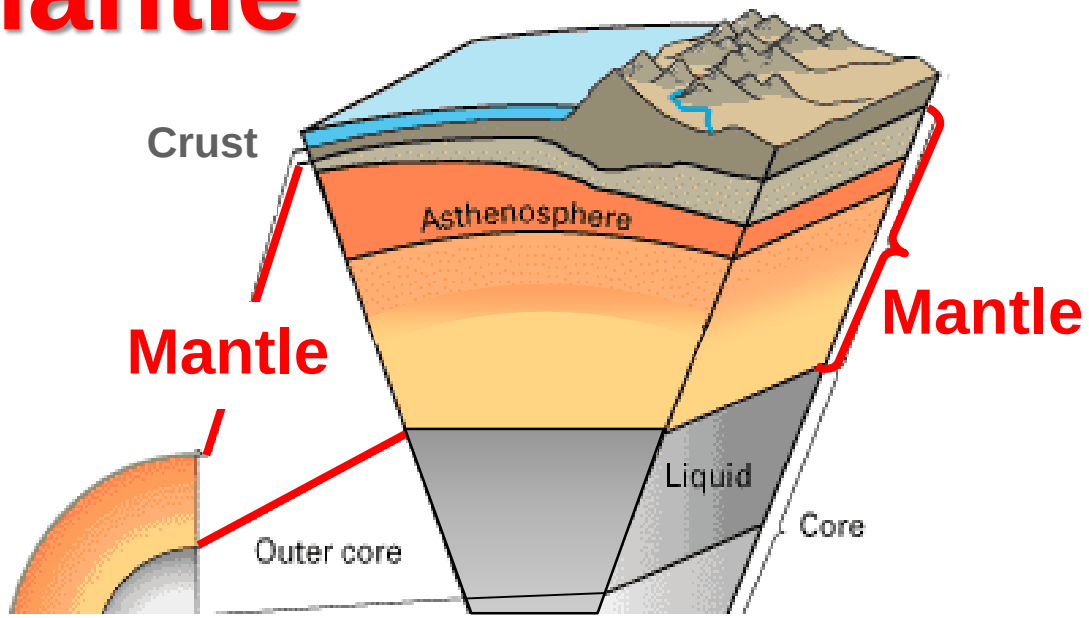
The Core

- **16% of Earth's volume**
- **Two sections:**
  - **inner core**
    - **total diameter ~2600 km**
    - **T ~ 6,000-7,000 K (>10,000°F)**
    - **solid, very dense**
    - **nickel-iron alloy**
    - **grows ~1 mm per year**
  - **outer core**
    - **~2200 km thick**
    - **liquid**
    - **T ~ 4,000-6,000 K (~6,700-10,300°F)**
    - **primarily iron with some nickel and sulfur**
    - **convection of liquid metals creates the Earth's magnetic field**



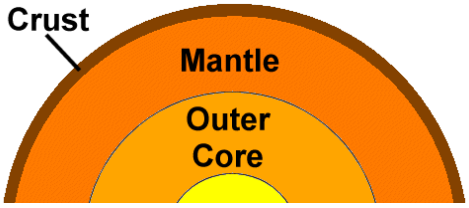
The Mantle

- **2900 km thick**
- **~84% of Earth's volume**

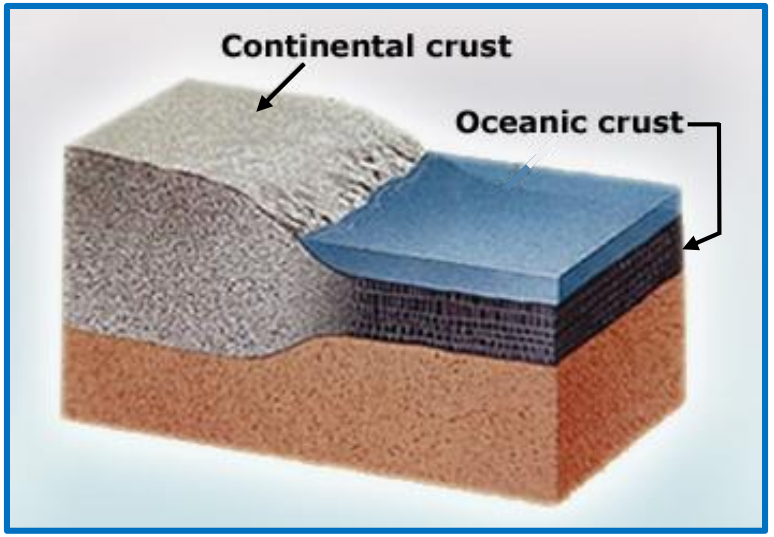


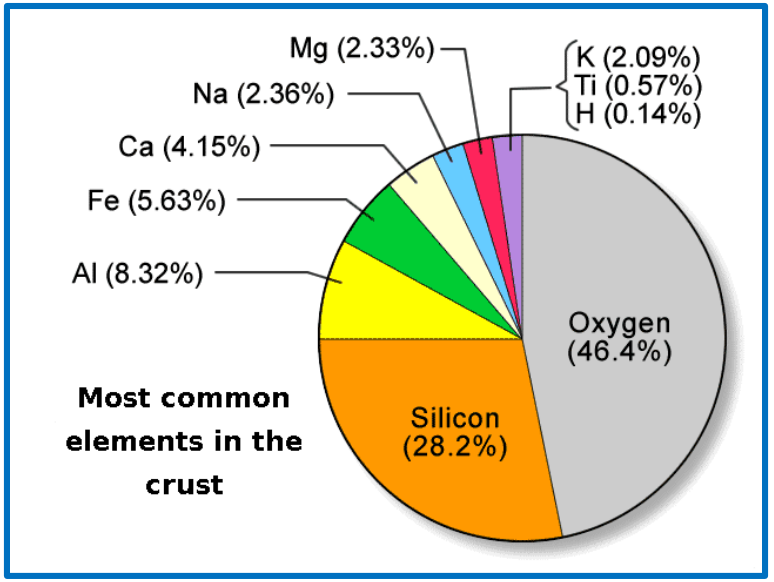
- **Three regions:**
  - **lower region**
    - — dense, solid (due to *enormous pressure*!)
    - — temperatures between ~2000-3,500 K (~3,100-5,800°F)
  - **upper region (*asthenosphere*, *"weak" sphere*)**
    - — has reduced pressures and rock strength
    - — plastic rock (at pressures and temperatures found in this region, mantle rock can deform and flow slowly).
  - **uppermost region**
    - — solid; temperatures between 750-1200 K (~900-1,700°F)

The Crust



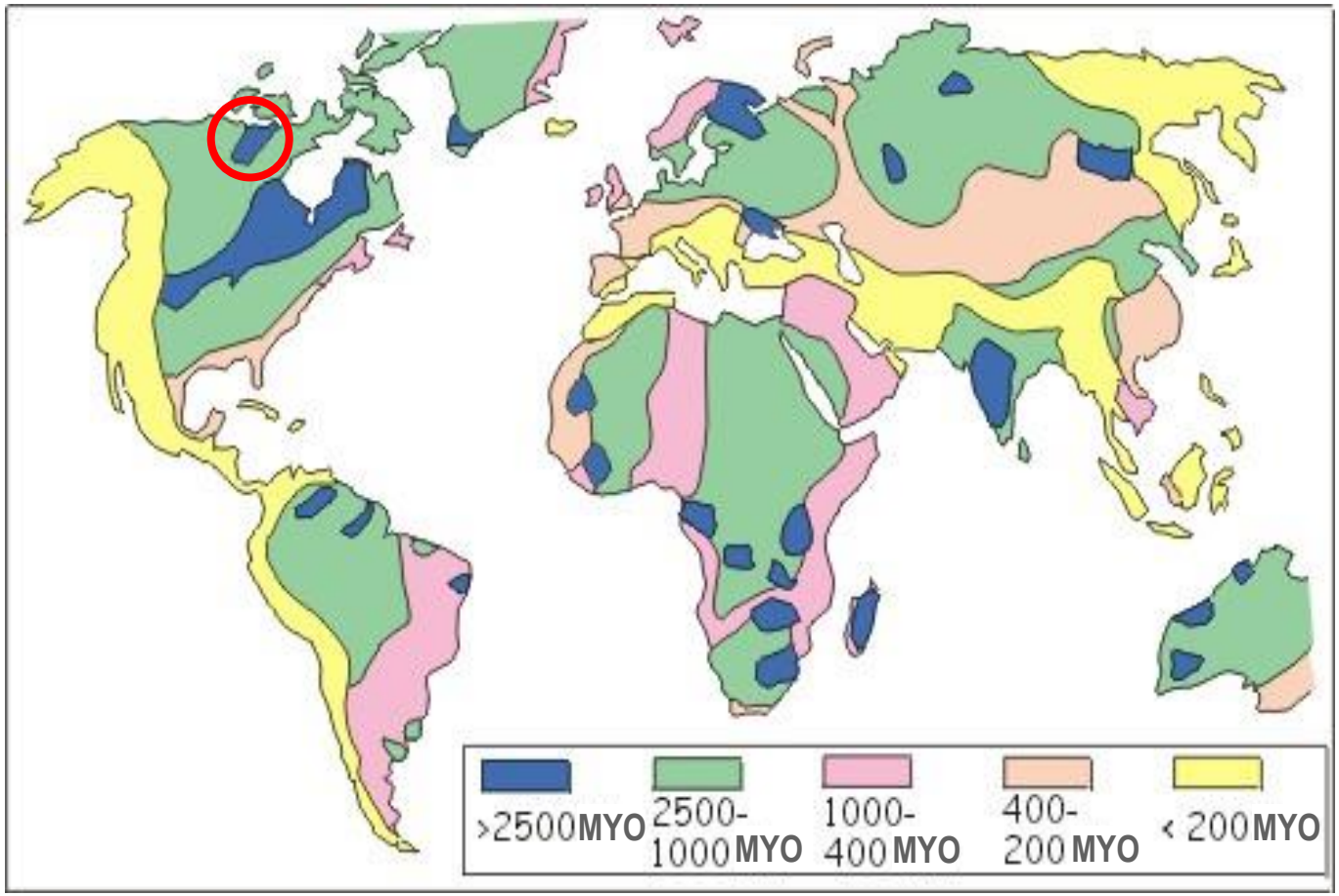
- **<1% of Earth's mass**
- **Solid**
- **Two types:**
  - **oceanic crust**
    - **55% of the surface**
    - **6 to 10 km thick**
    - **composed of basalts**
    - **relatively young (*<200 MYO*)**
  - **continental crust**
    - **45% of the surface**
    - **70% by volume**
    - **25 to 70 km thick**
    - **granites *(less dense)***
    - **mostly old (*up to 3.5-4 BYO*)**





Age of Continental Crust

The oldest rocks on Earth are found within the stable cores of the continents. The oldest known intact crustal fragment, Acasta Gneiss (located in Northwest Territories, Canada), is estimated to be ~4 billion years old.

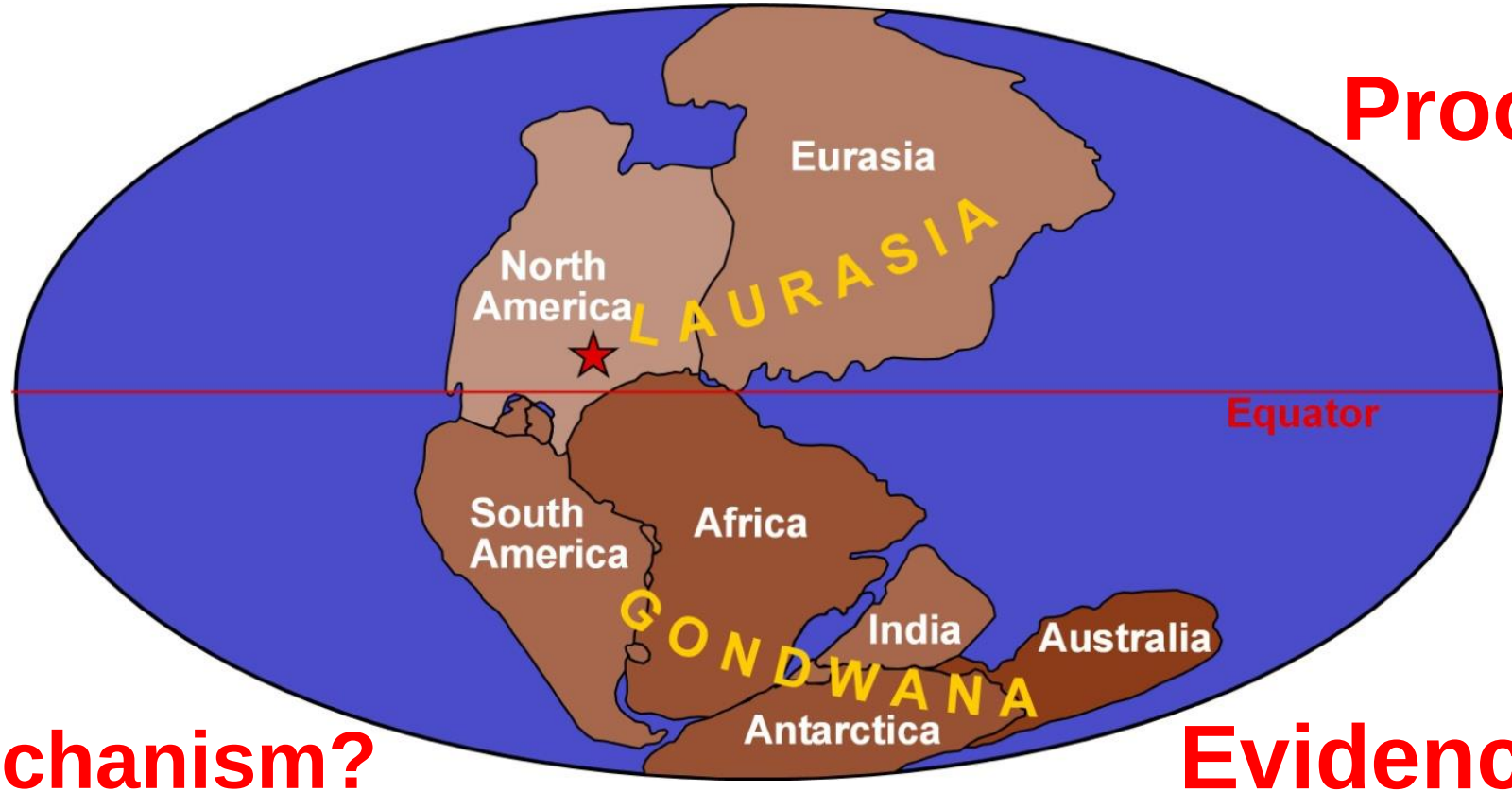


How old is that rock?

By analyzing radioactive minerals in igneous rocks (*those formed through the cooling and solidification of magma or lava*), scientists can tell how much time has passed since rocks solidified.

Continental Drift

- **In the late 19th and early 20th centuries, geologists assumed that the Earth's major features were fixed.**
- **<u>In 1912</u>, Alfred Wegener proposed that up until about 200 million years ago, all of the present continents were joined together into a single super-continent later called Pangea.**

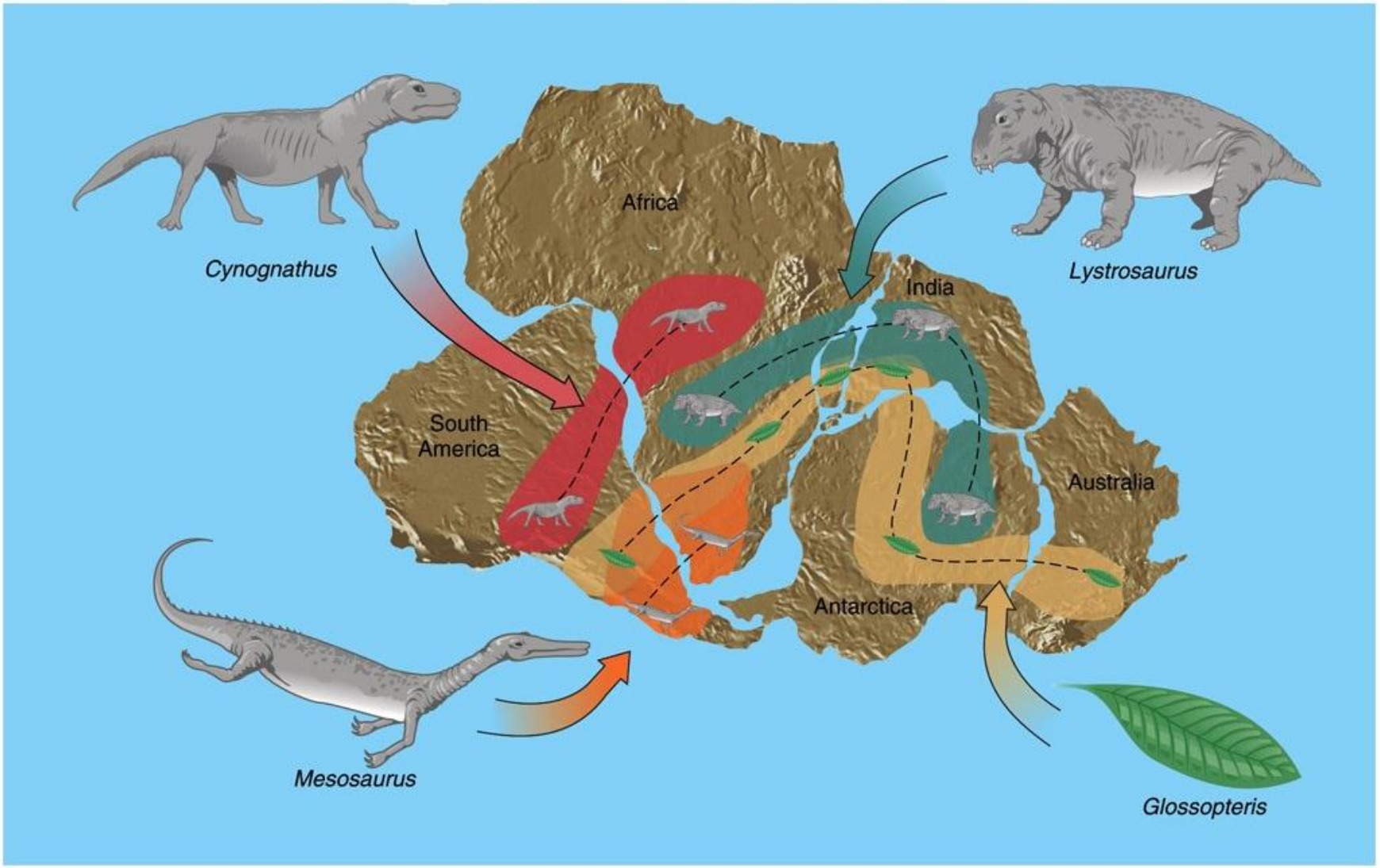


Proof?

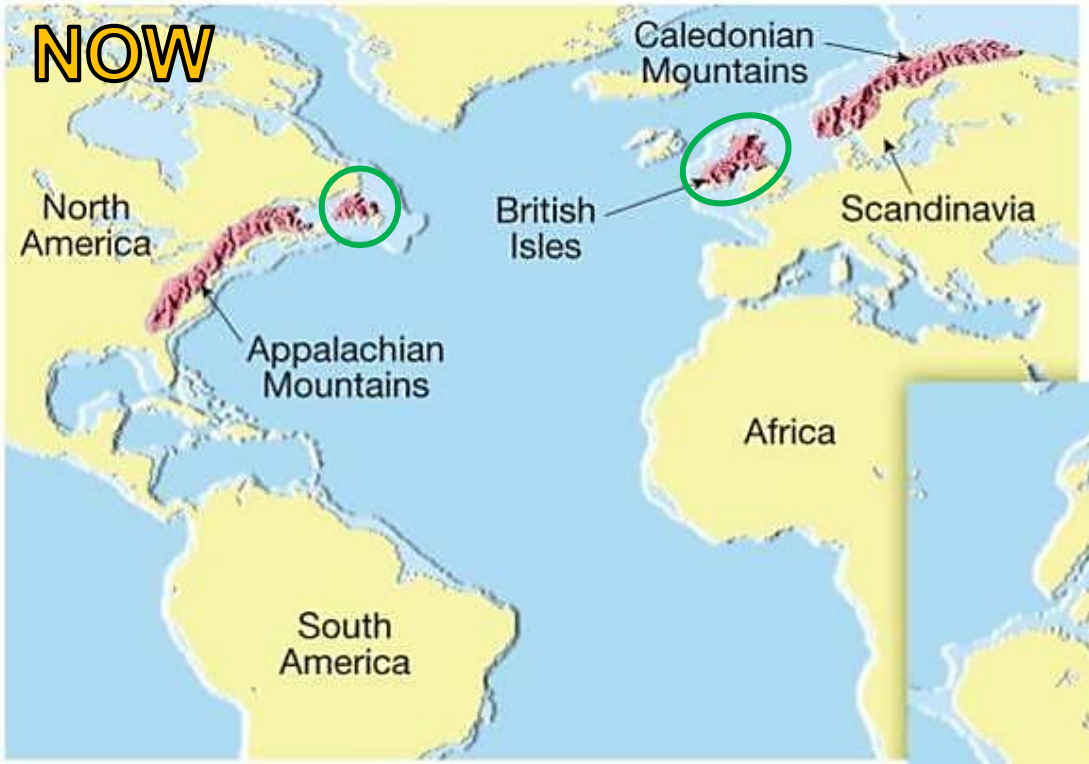
Mechanism?

Evidence?

Continental Drift: Fossil Evidence



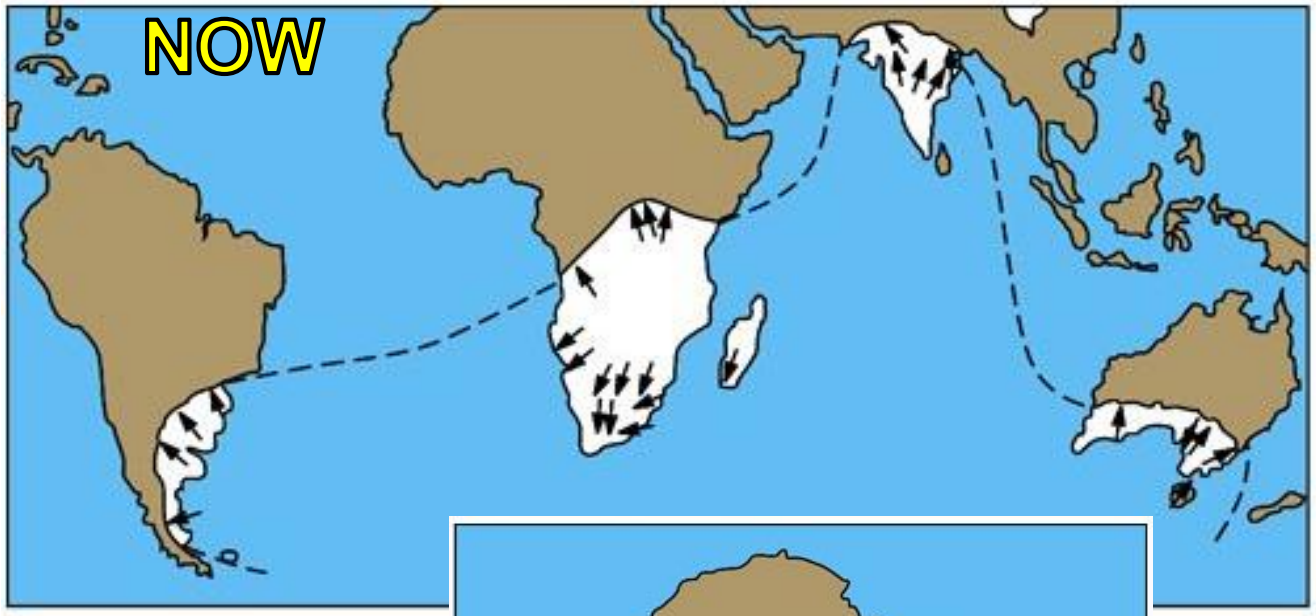
Matching Mountain Ranges



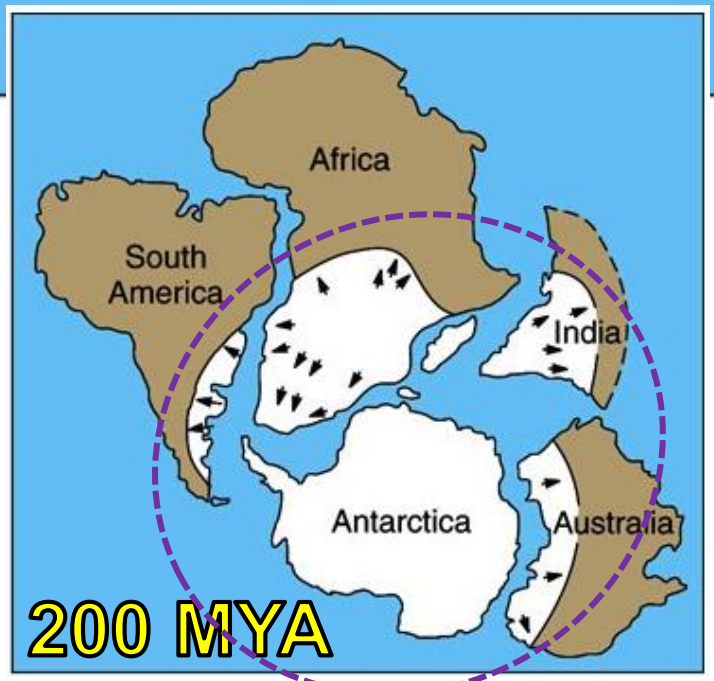
- Parts of Scotland and Ireland contain rocks very similar to those found in Newfoundland and New Brunswick.

- The Caledonian Mountains of Europe and parts of the Appalachian Mountains of North America are very similar in structure and composition.

Paleo Glaciation Evidence



- Ancient glacial deposits are found on the southern ends of all Southern Hemisphere continents.

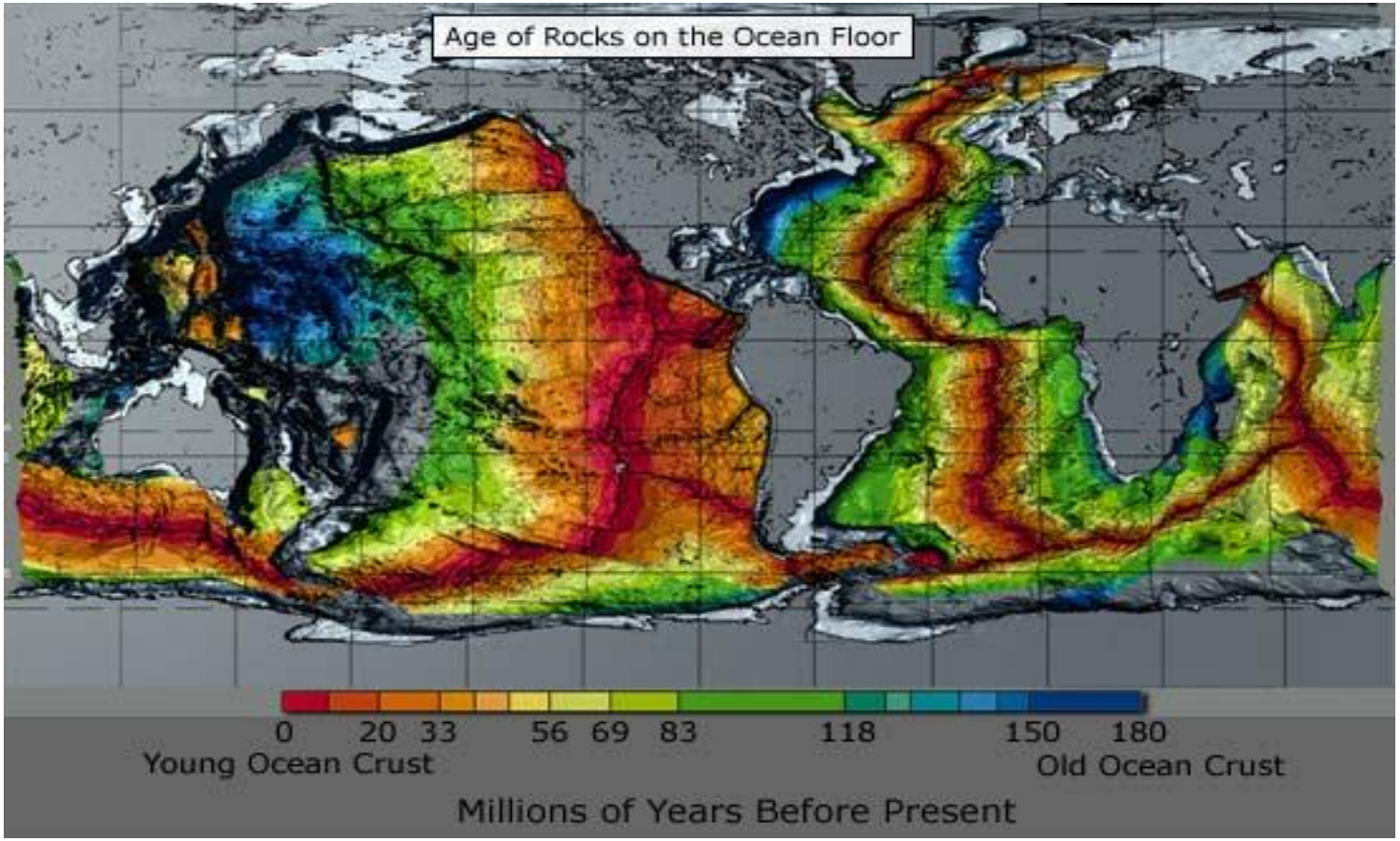


- Glacier retreat "scars" are evident in rocks that are now located in tropical (very warm!) regions.

- This data is **consistent with the ice flow of a single ancient ice cap that once covered a part of Pangea**, similar to the Antarctic ice sheet of our time.

Strong Geophysical Proof

Oceanic crust is seldom more than 200 million years old!



Late 1950s and early 60s data on the bathymetry of the deep ocean floors and the nature of the oceanic crust revealed evidence of seafloor spreading along the *mid-oceanic ridges*.

Continental Drift Simulation

The Past

https://www.youtube.com/watch?v=UwWWuttntio

The Future

https://www.youtube.com/watch?v=bQywDr-btz4