

# Lithosphere

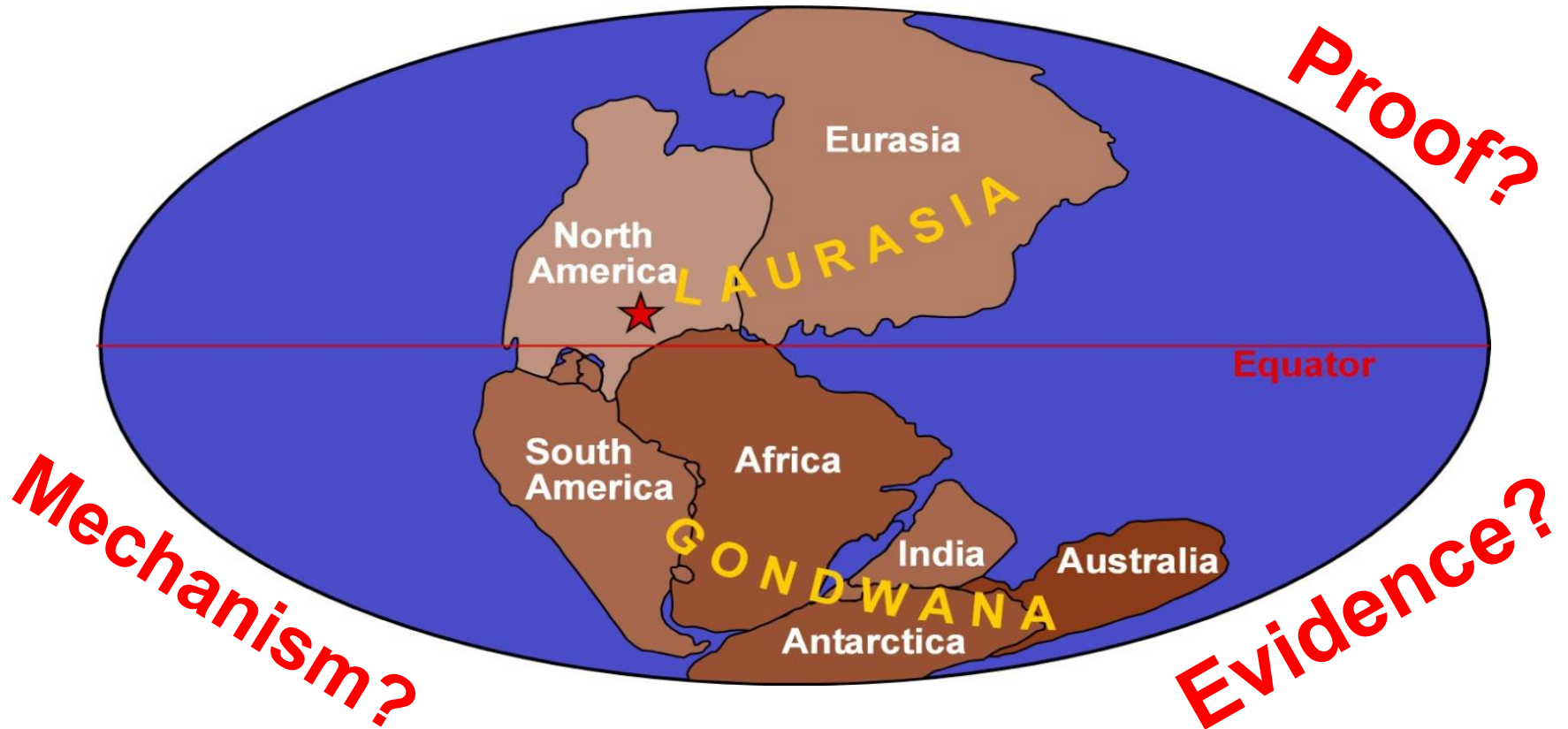
## Part 1



**“Americas... ..were torn away from Europe and Africa” -  
Abraham Ortelius, 1596**

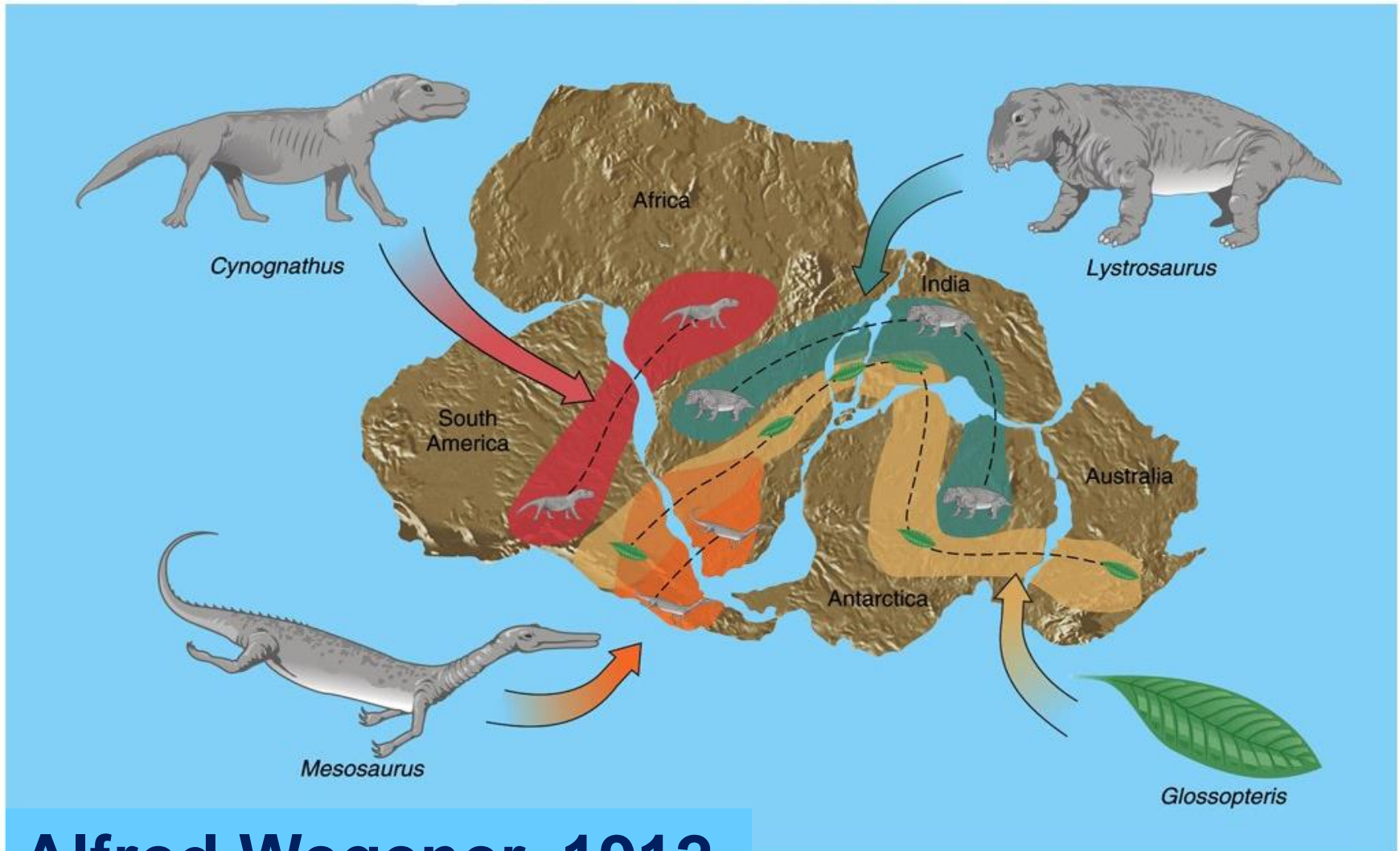
# Continental Drift

- In the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, geologists assumed that the Earth's major features were fixed.
- In 1912, **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**.



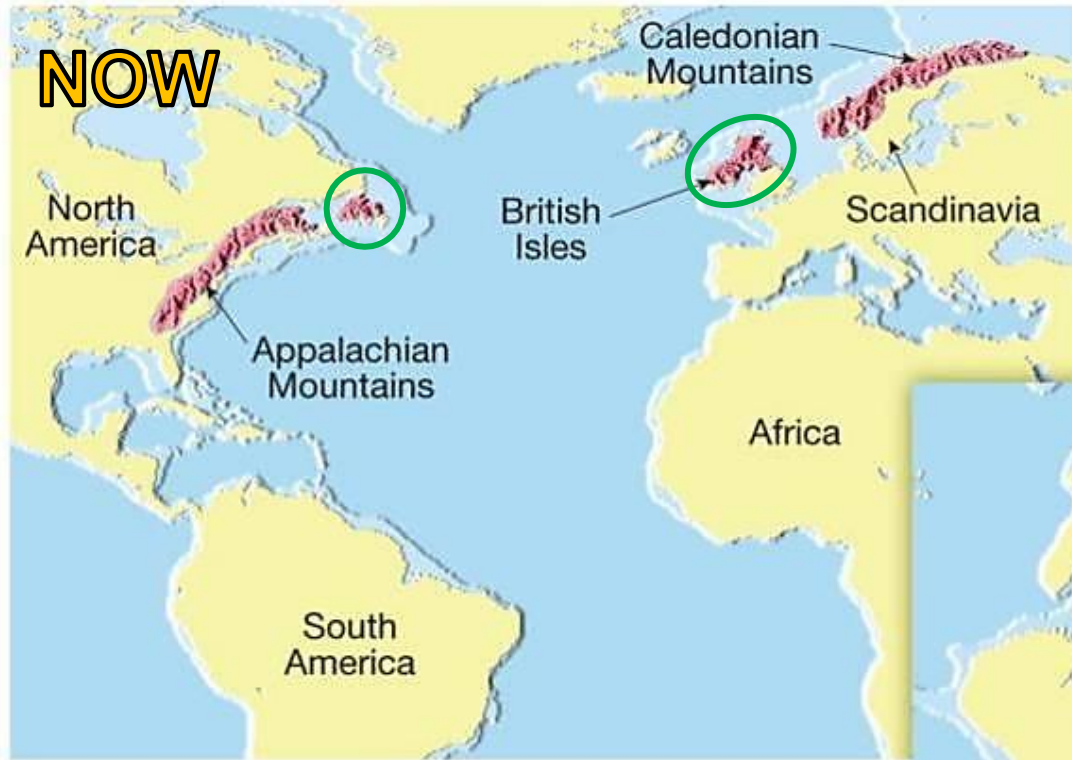


# Continental Drift: Fossil Evidence



**Alfred Wegener, 1912**

# Matching Mountain Ranges

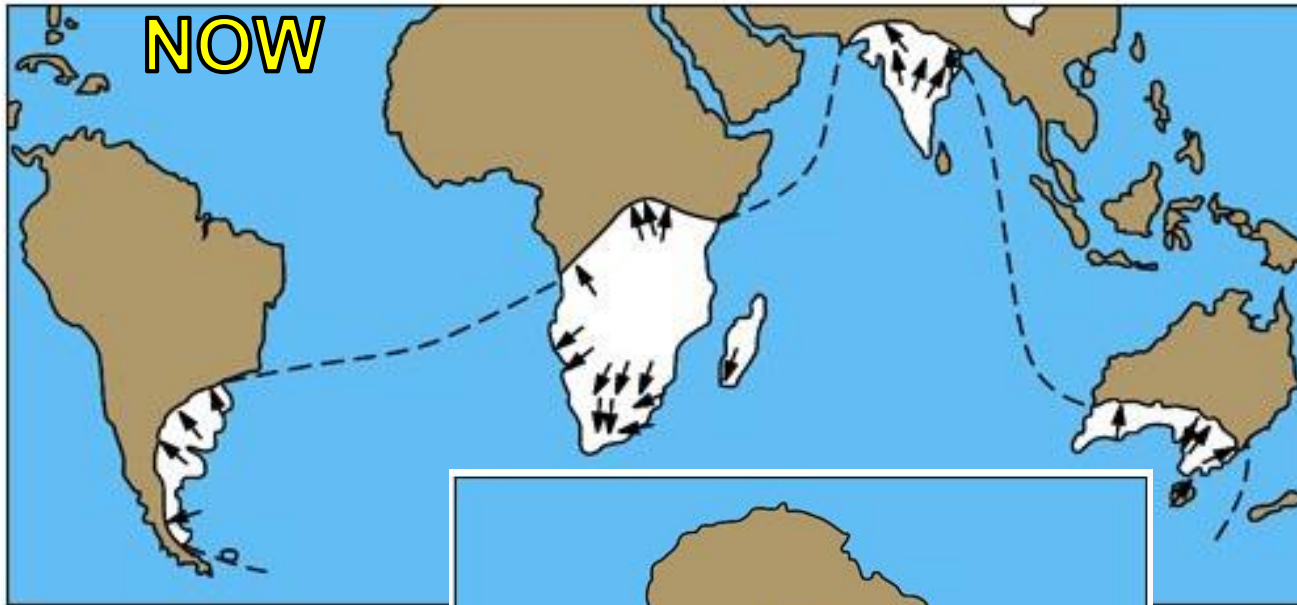


- Parts of **Scotland and Ireland** contain rocks very similar to those found in **Newfoundland and New Brunswick**.

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

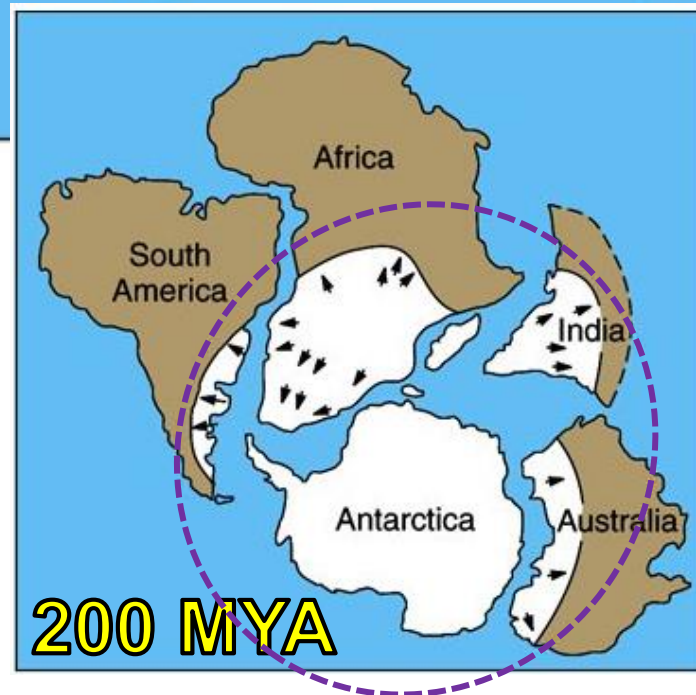


# Paleo Glaciation Evidence



- 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.

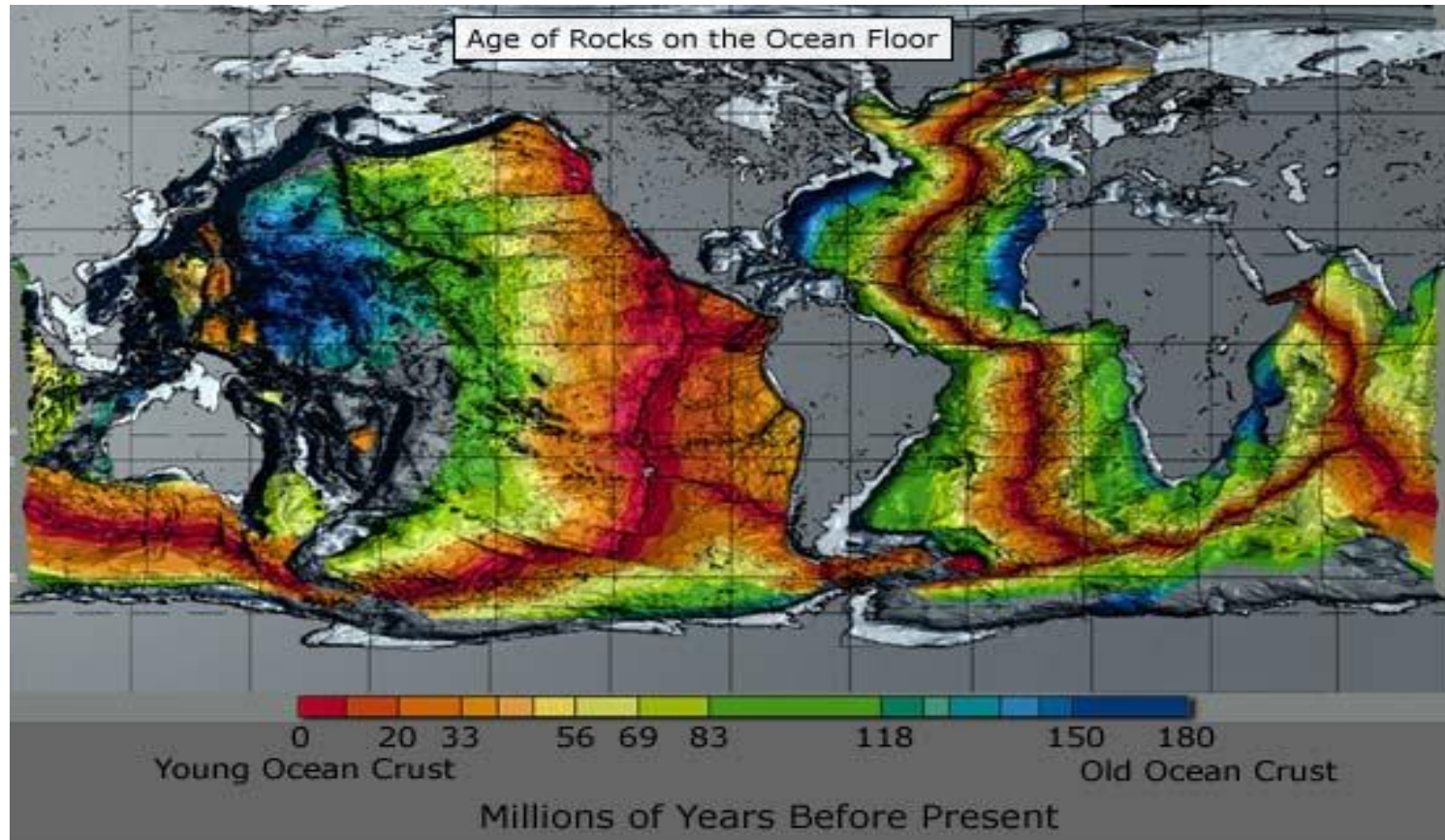


- This data is consistent with the ice flow of a **single ancient ice cap that once covered a part of Pangea**, similar to the Antarctic ice sheet of our time.



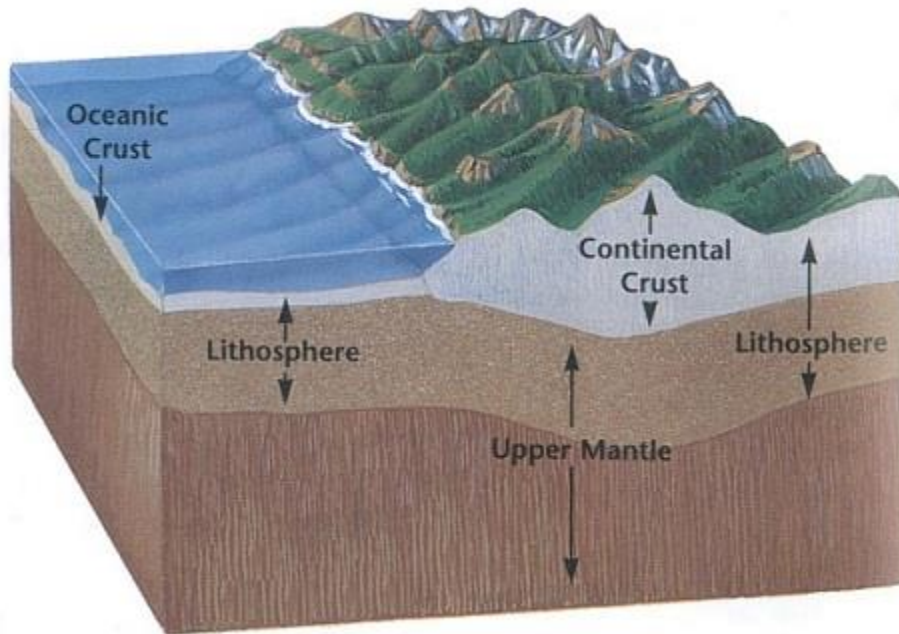
# Strong Geophysical Proof

Oceanic crust is seldom more than **200 million years old!**



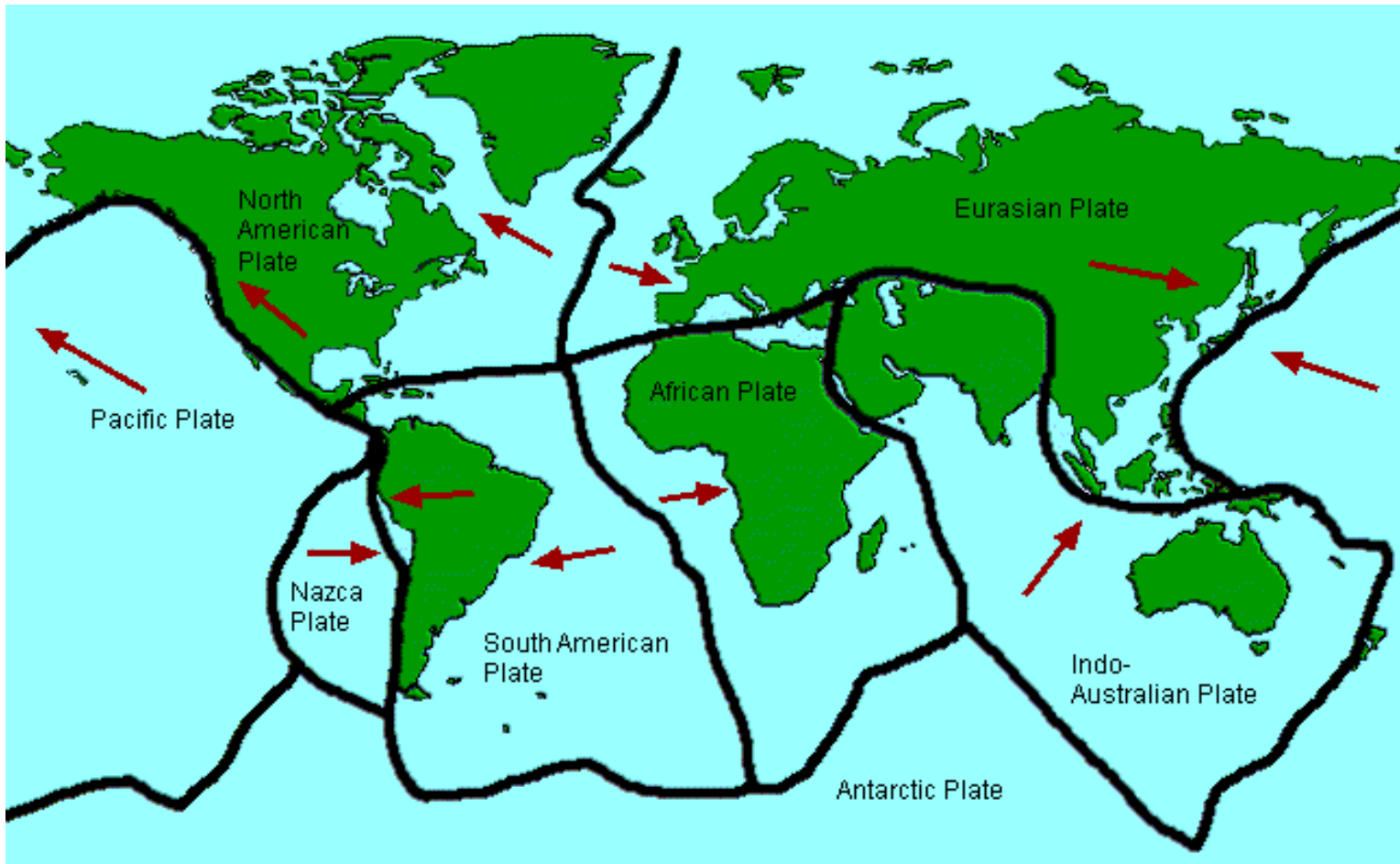
Late 1950s and early 60s data on the **bathymetry of the deep ocean floors** and the nature of the oceanic crust revealed **evidence of seafloor spreading** along the *mid-oceanic ridges*.

# Lithosphere: Sphere of Rock



- rigid outer layer
- made of **crust** and the **uppermost** part of the **mantle**
- broken into pieces called **tectonic plates**
- eight major tectonic plates (plus several minor)

# Major Tectonic Plates

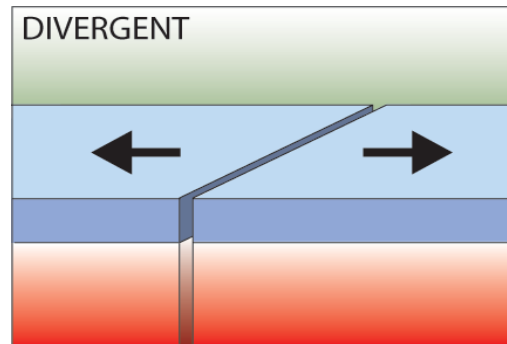


All tectonic plates **move** in different directions 1-2 inches per year.



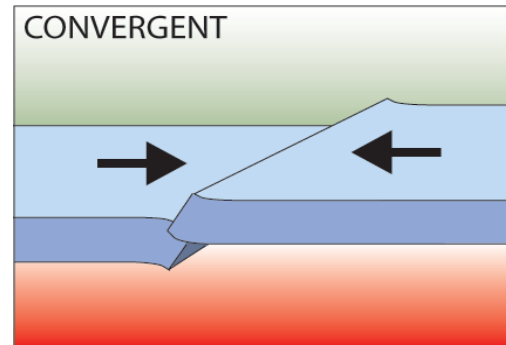
# Three types of plate boundary

- **Divergent**



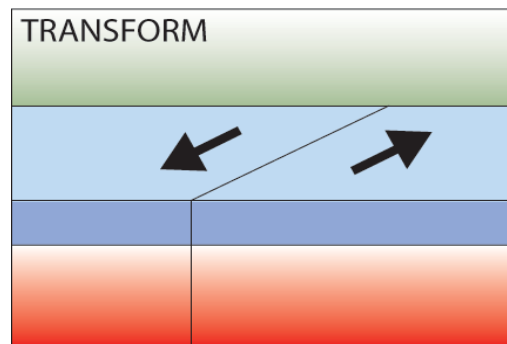
*plates move  
AWAY from  
each other*

- **Convergent**



*plates move  
TOWARDS  
each other*

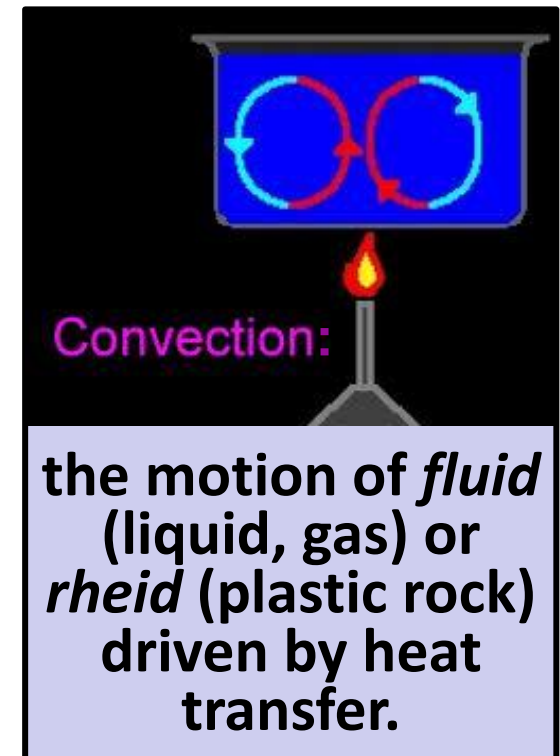
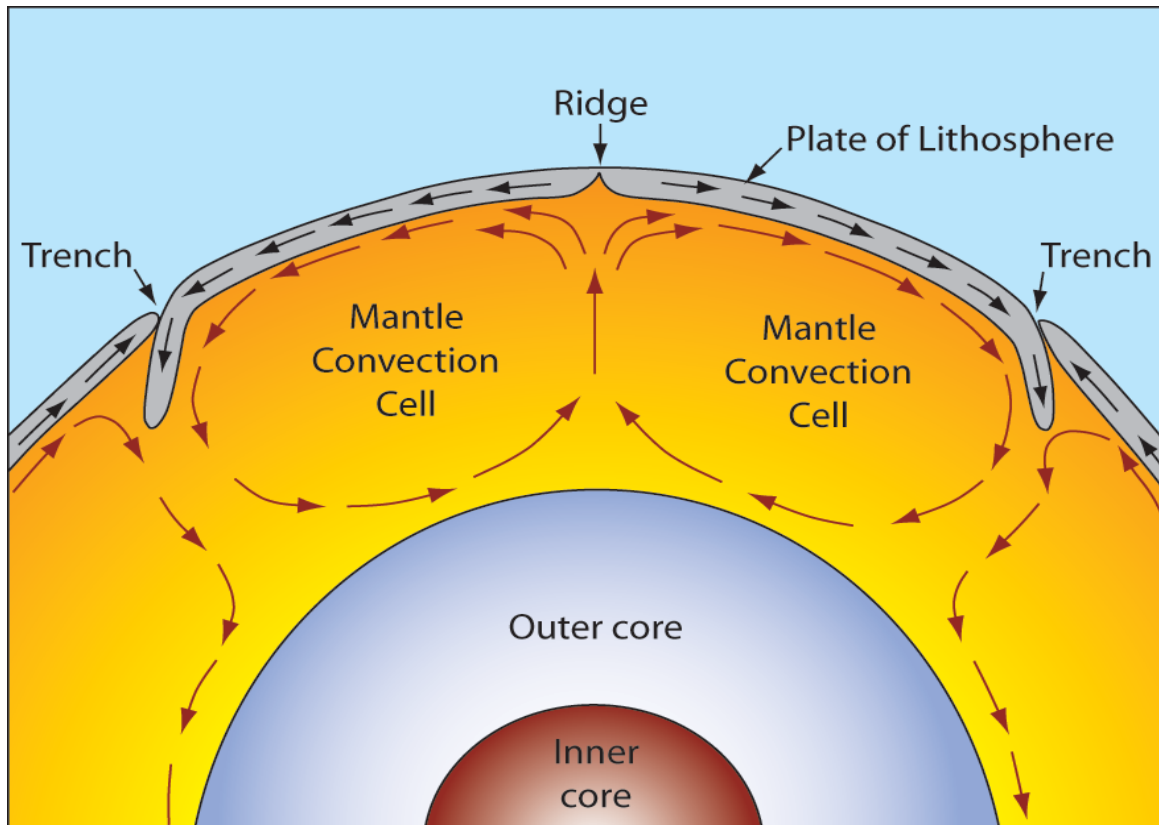
- **Transform**



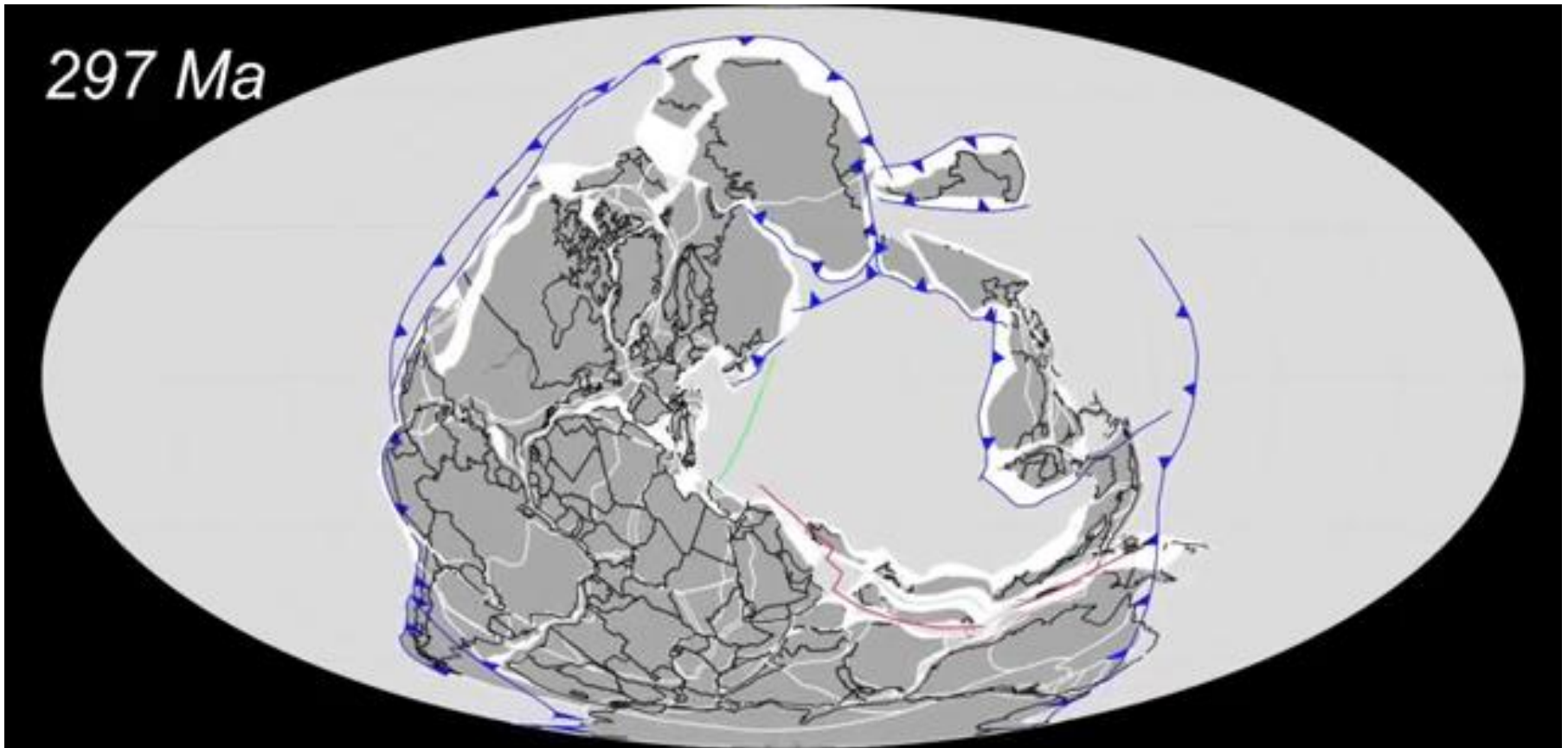
*plates SLIDE PAST  
each other*

# How do Plates Move?

- The driving forces of plate motion is **an active subject of on-going research** within geophysics.
- Leading theory: plates of lithosphere are moved around by **convection in the underlying hot mantle**.



# Plate Movement Simulation (past 300 million years)



<https://www.youtube.com/watch?v=llnwyAbczog>



# The plate boundary experiment

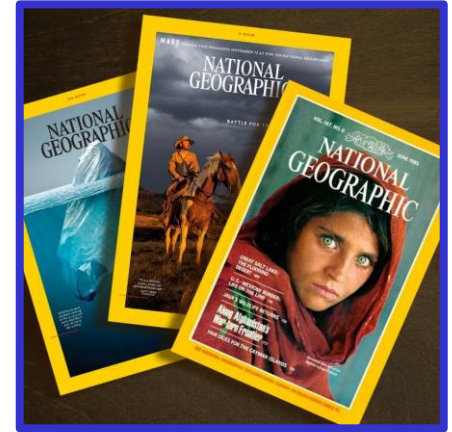


## You will need:

2 **thick** paperback books to represent **continental plates**.

2 **slim** journals/catalogs to represent **oceanic plates**.

A **table** (flat surface).



## You will try to **play out plate interaction** for:

- 1) Divergent boundary – place any two “plates” on the table so that their sides touch and move them *away* from each other.
- 2) Convergent boundary – place any two “plates” on the table and push *towards* each other; try with all possible pairs of “plates” (thick+thick, thick+thin, thin+thin).
- 3) Transform boundary - take any two “plates”, put them side by side on the table so they are in contact, then *slide against* each other.
- 4) In all cases, **note and write down what happens!**