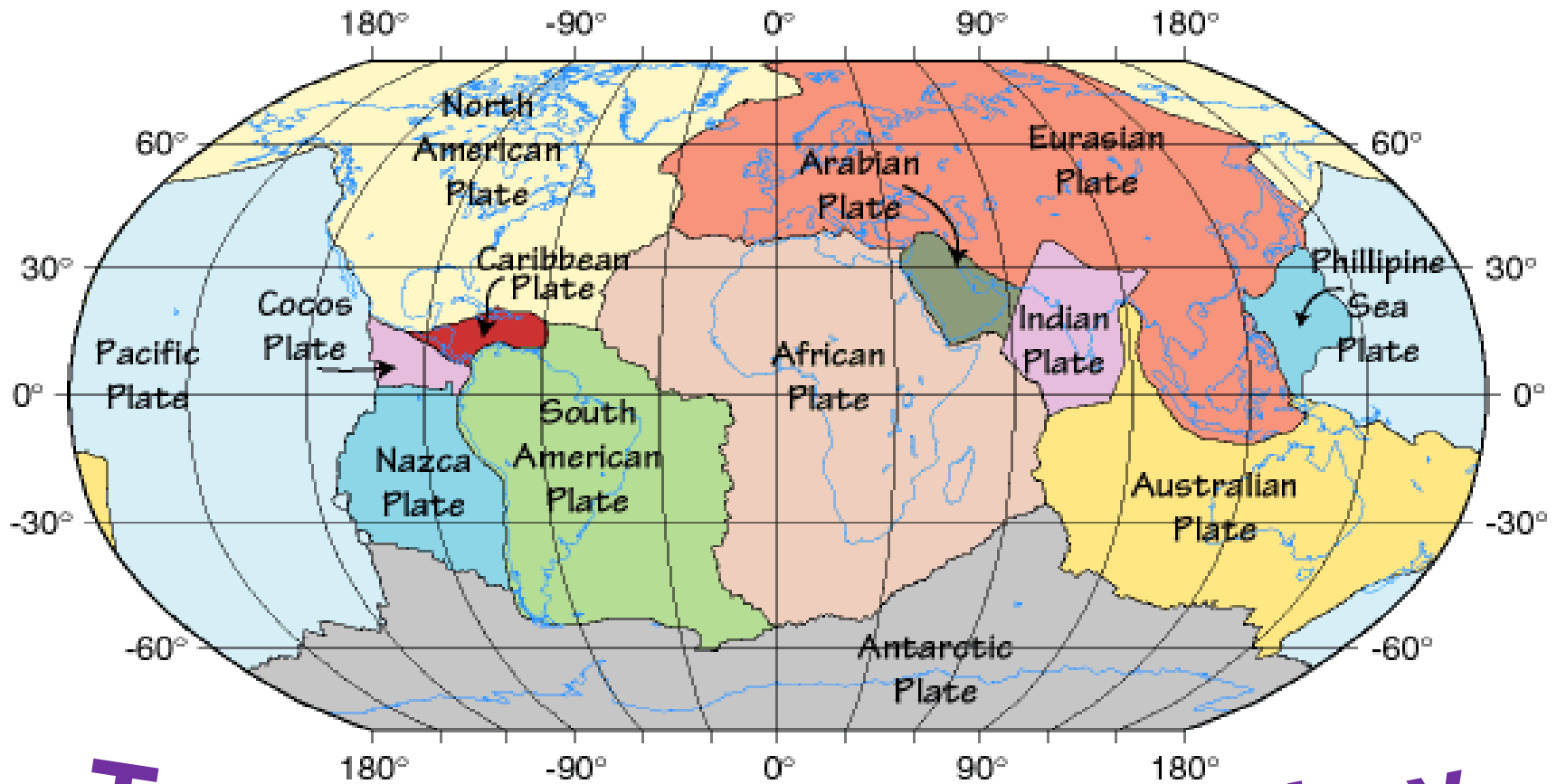


# Lithosphere

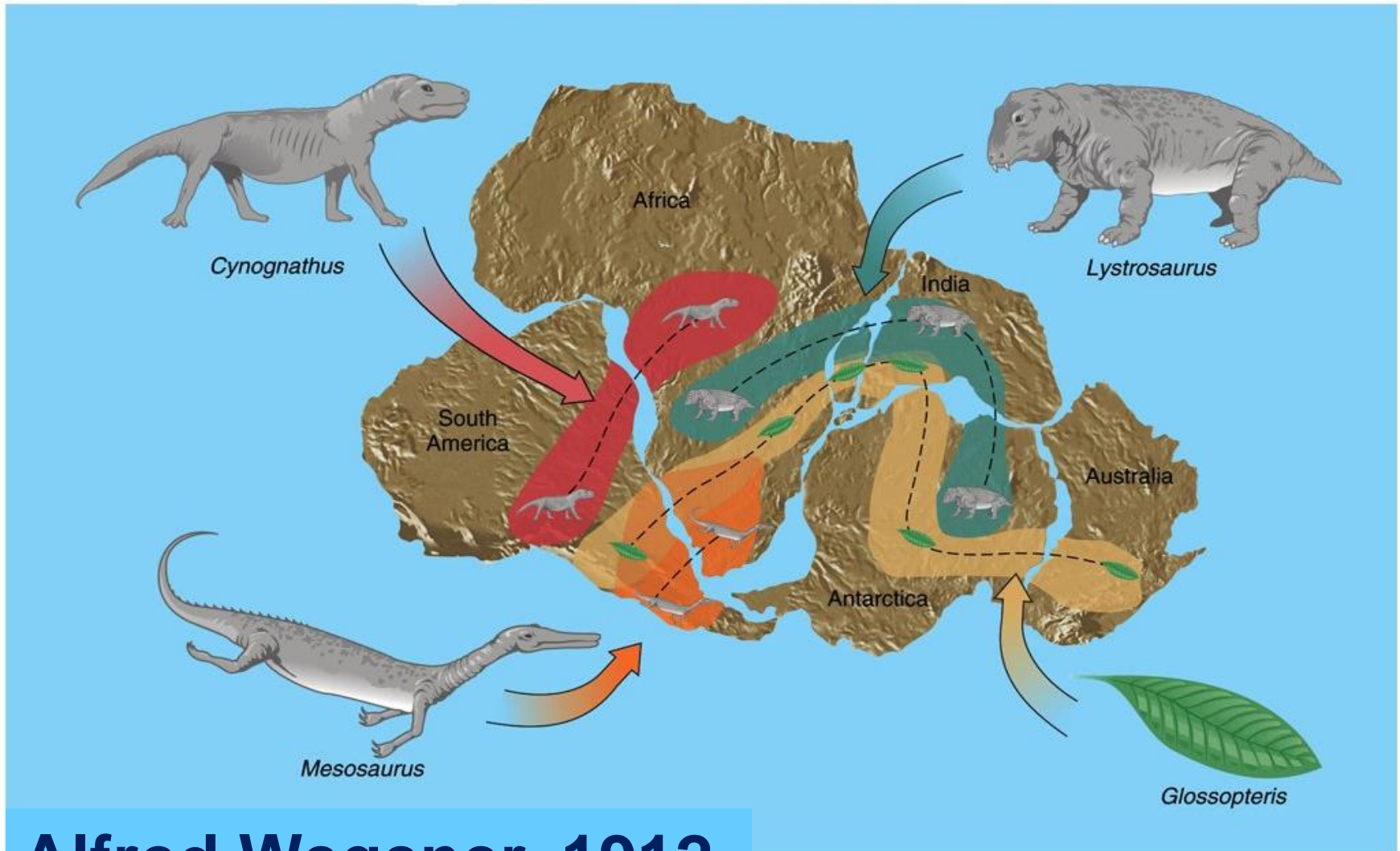


**Tectonic  
Plates**

and

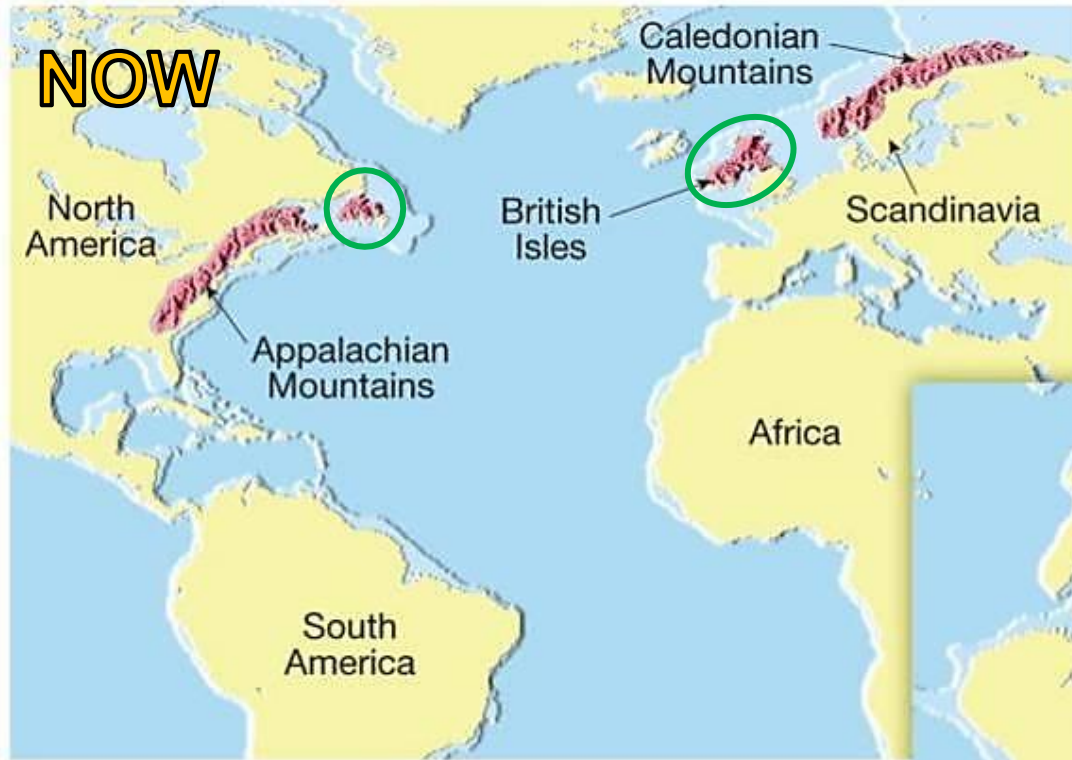
**How They  
Move**

# Continental Drift: Fossil Evidence



**Alfred Wegener, 1912**

# Matching Mountain Ranges

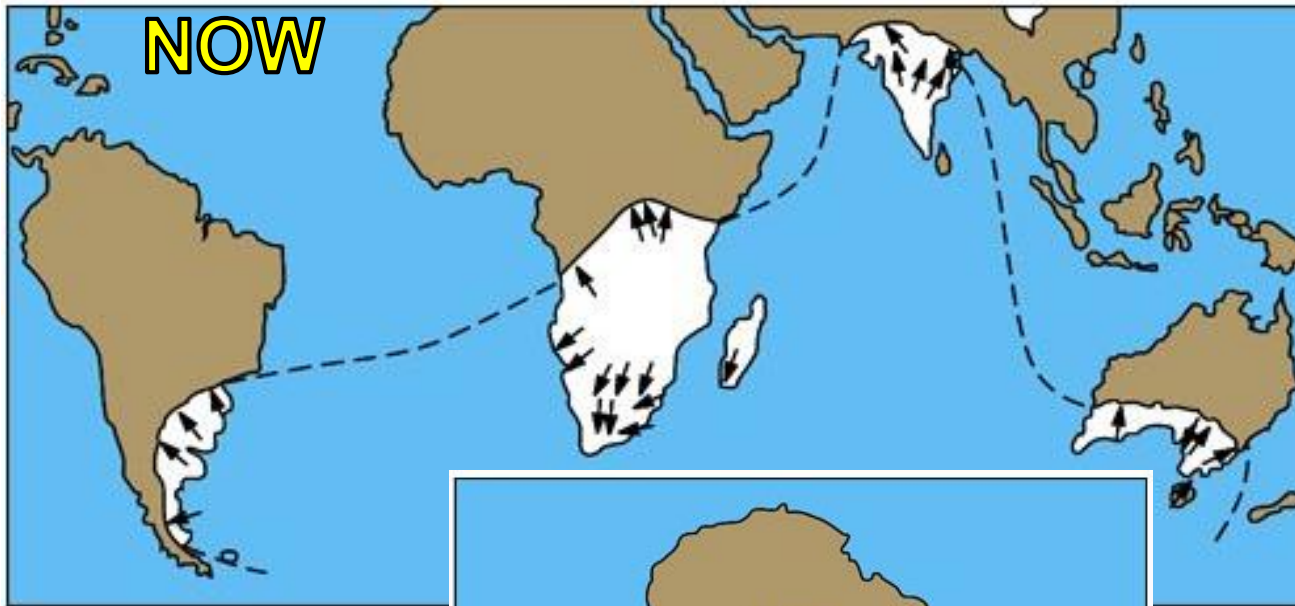


- Parts of **Scotland and Ireland** contain rocks very similar to those found in **Newfoundland and New Brunswick**.

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

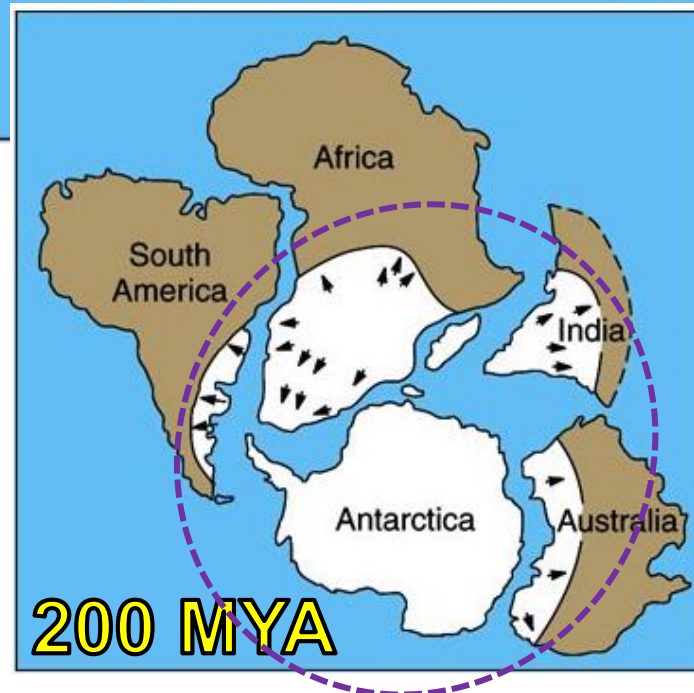


# Paleo Glaciation Evidence



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

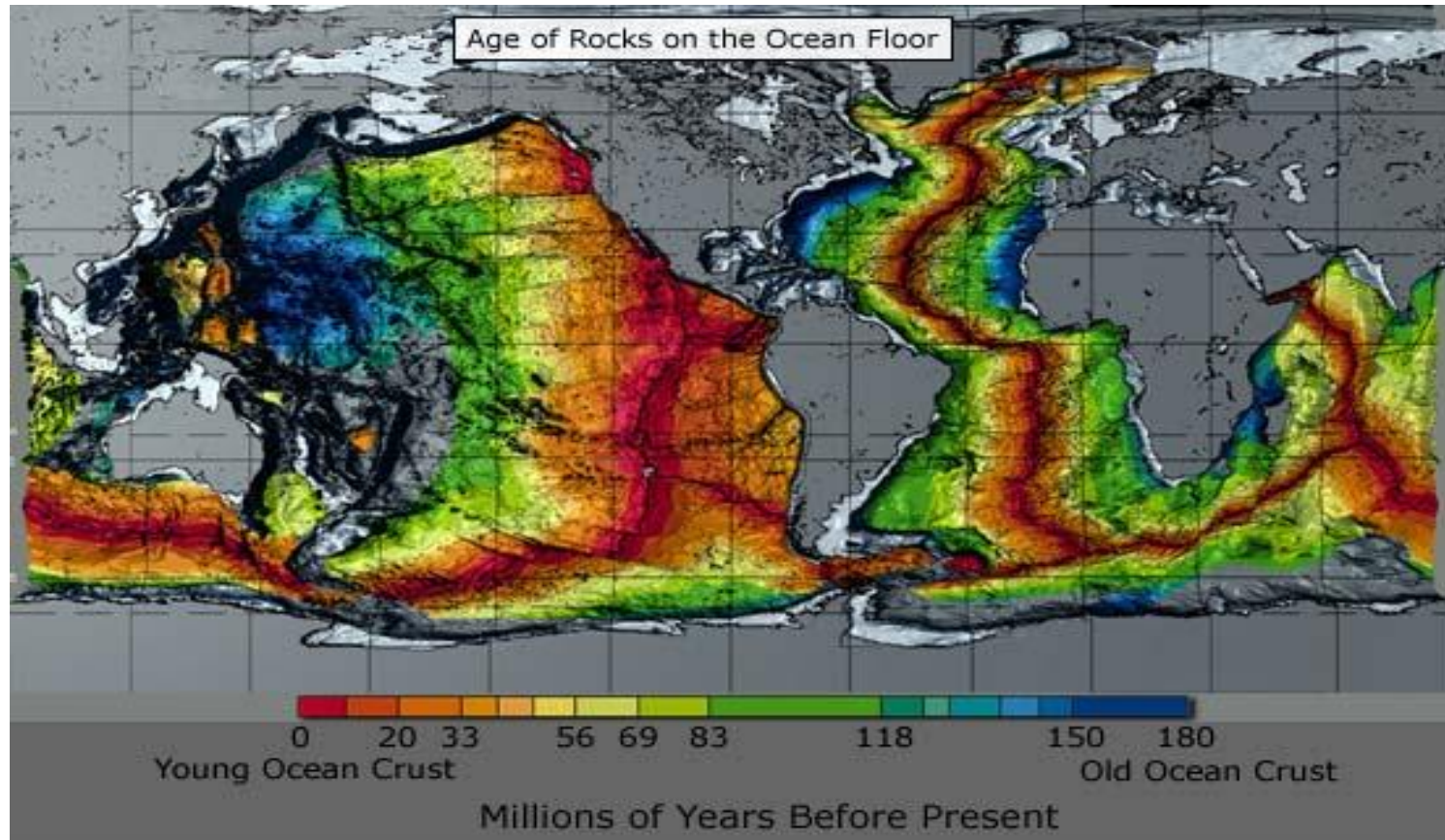
- Glacier retreat “scars” are evident in rocks that are now located in tropical (very warm!) regions.



- 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.

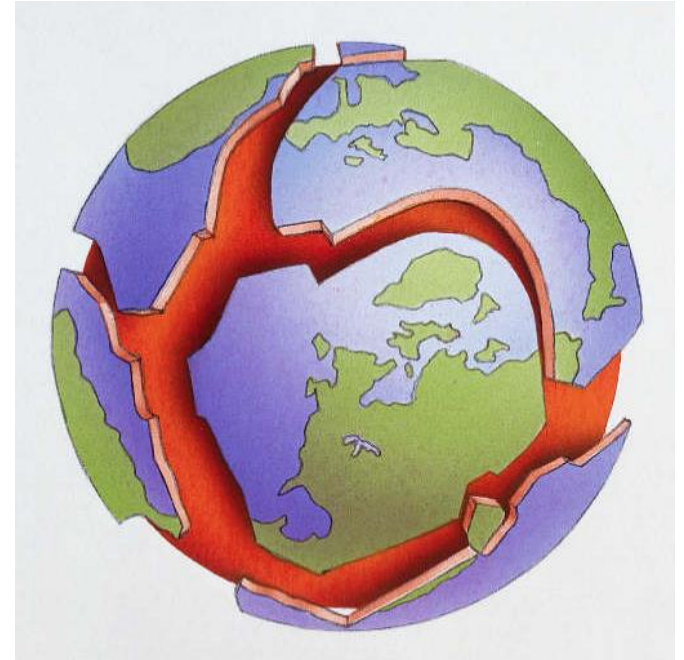
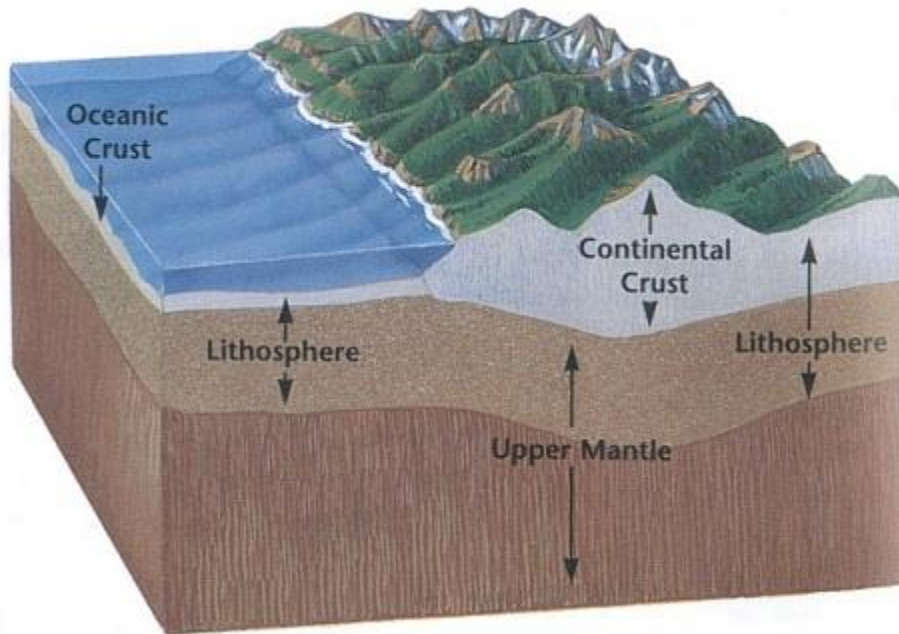
# Strong Geophysical Proof

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



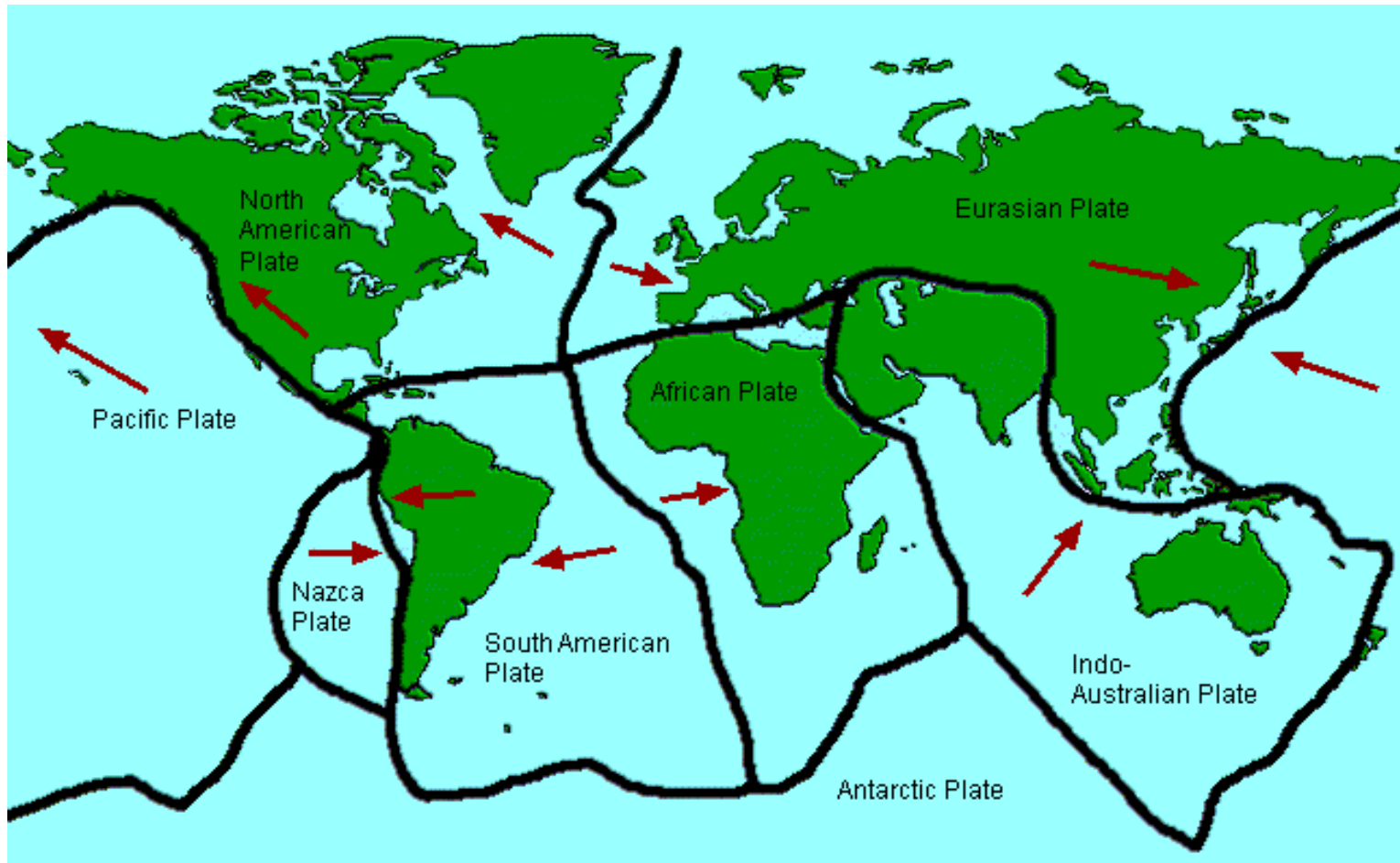
Late 1950s and early 60s data on the **bathymetry of the deep ocean floors** and the nature of the oceanic crust revealed **evidence of seafloor spreading** along the *mid-oceanic ridges*.

# 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)

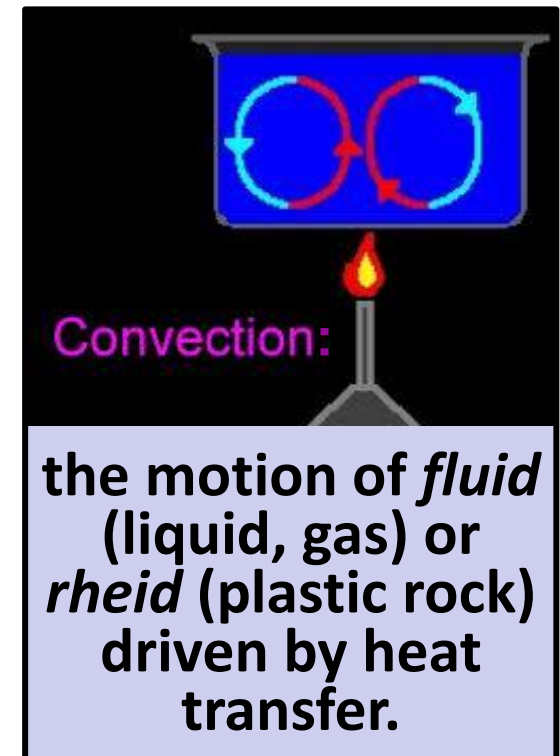
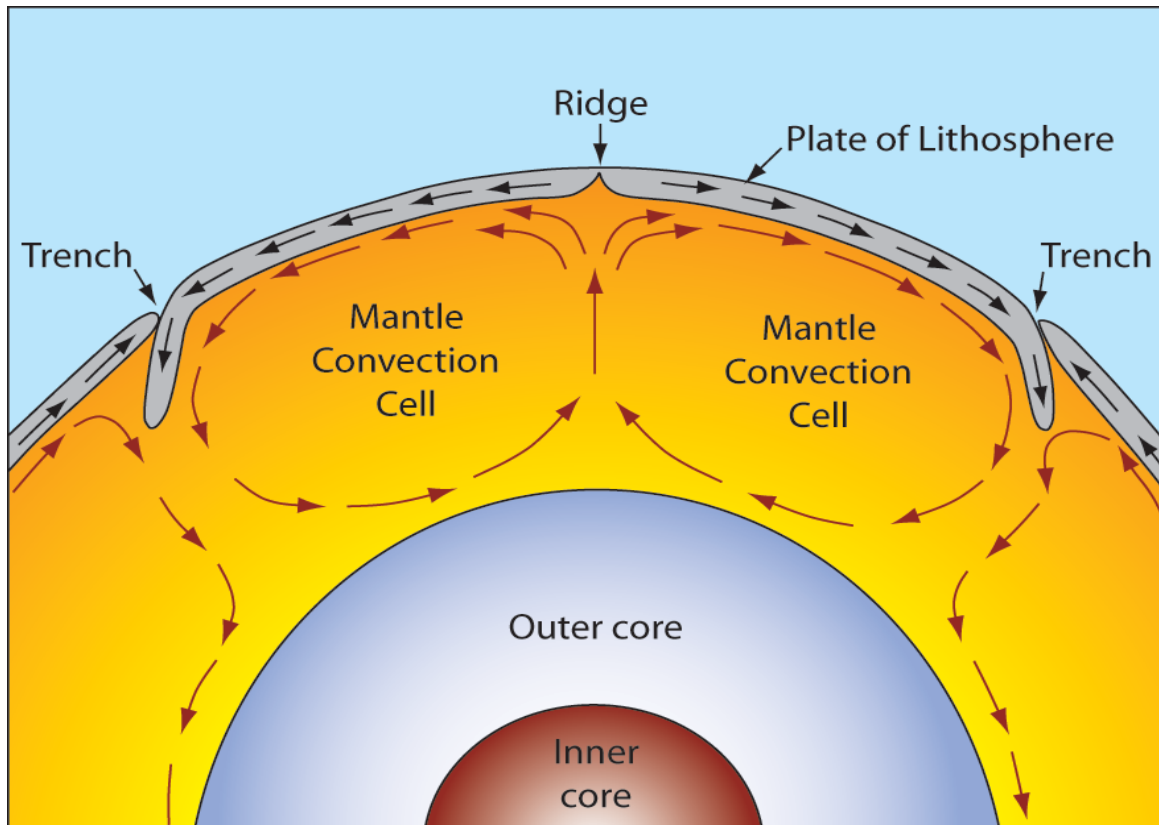
# Major Tectonic Plates



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

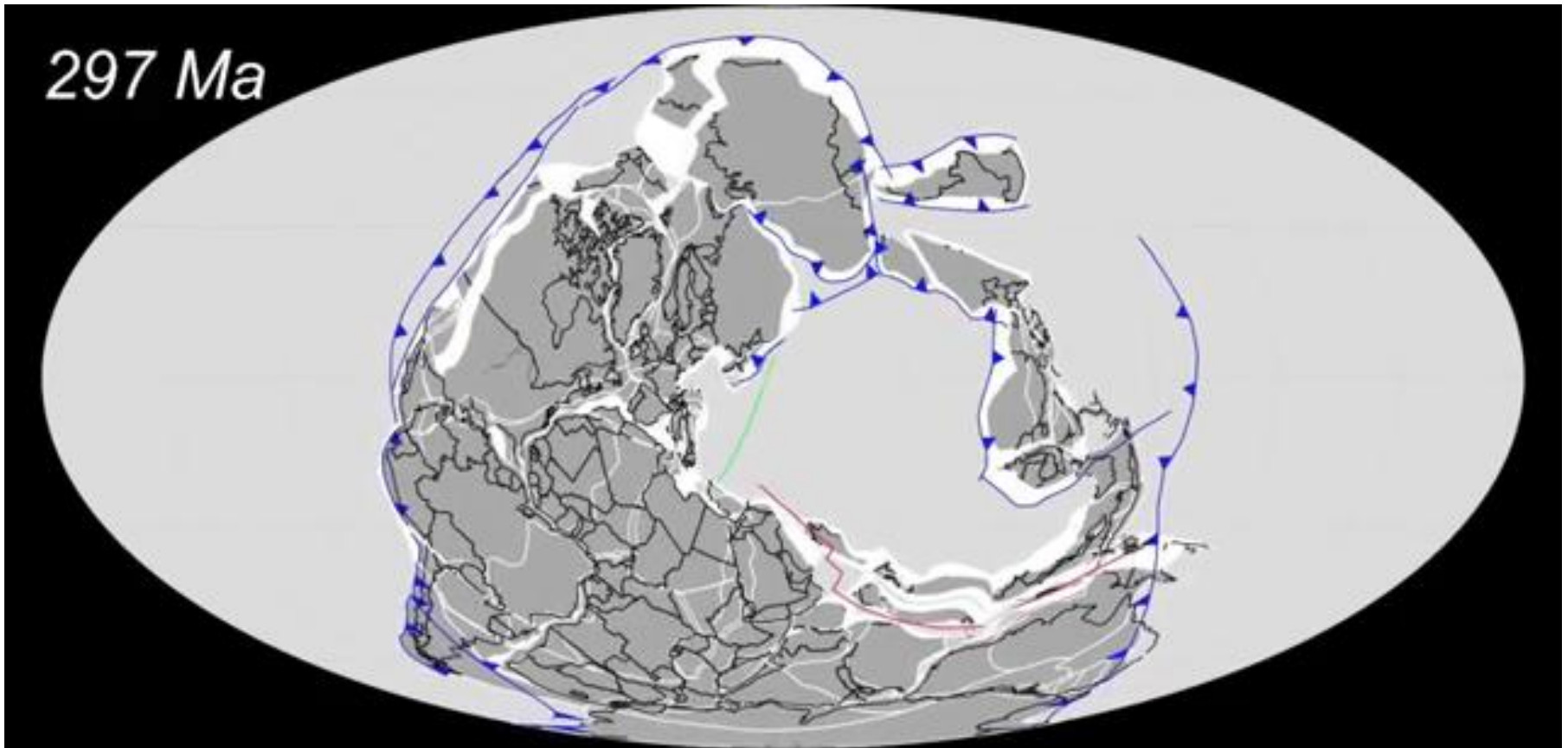
# How do Plates Move?

- 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**.





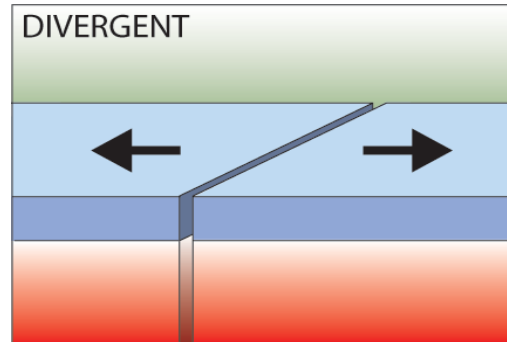
# Plate Movement Simulation (past 300 million years)



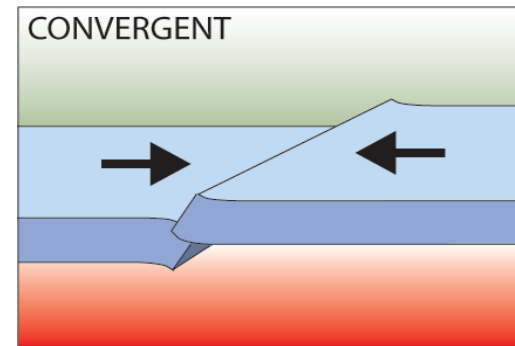
<https://www.youtube.com/watch?v=llnwyAbczog>

# Three types of plate boundary

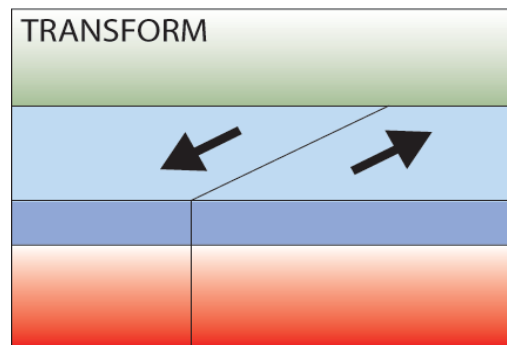
- **Divergent**



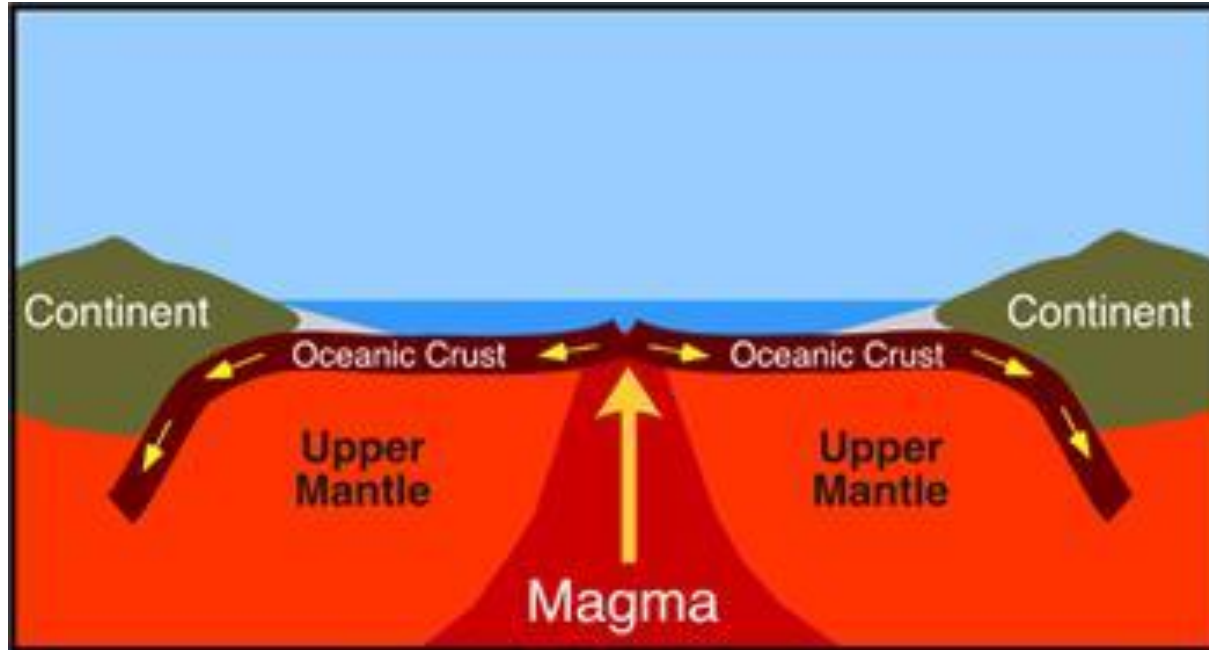
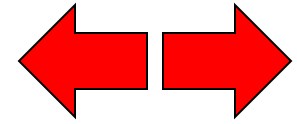
- **Convergent**



- **Transform**



# Divergent Boundaries

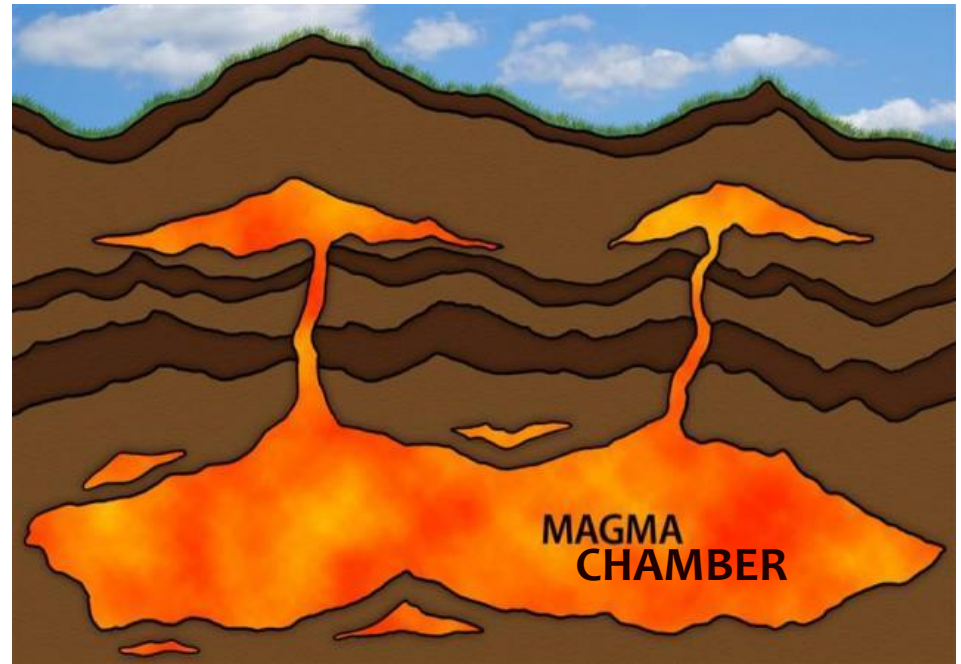
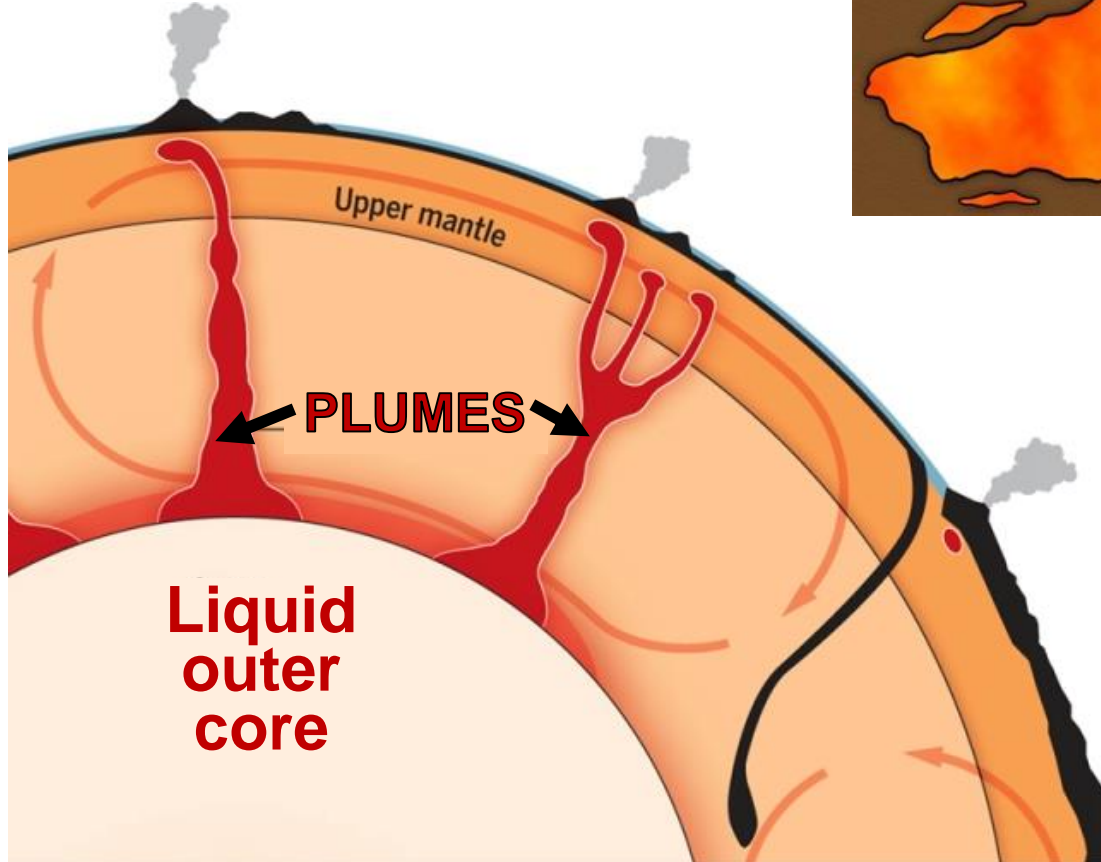


- Spreading ridges:
  - as plates **move apart**, new material is **erupted** to fill the gap
  - young crust is formed

**What is magma and where does it come from?**

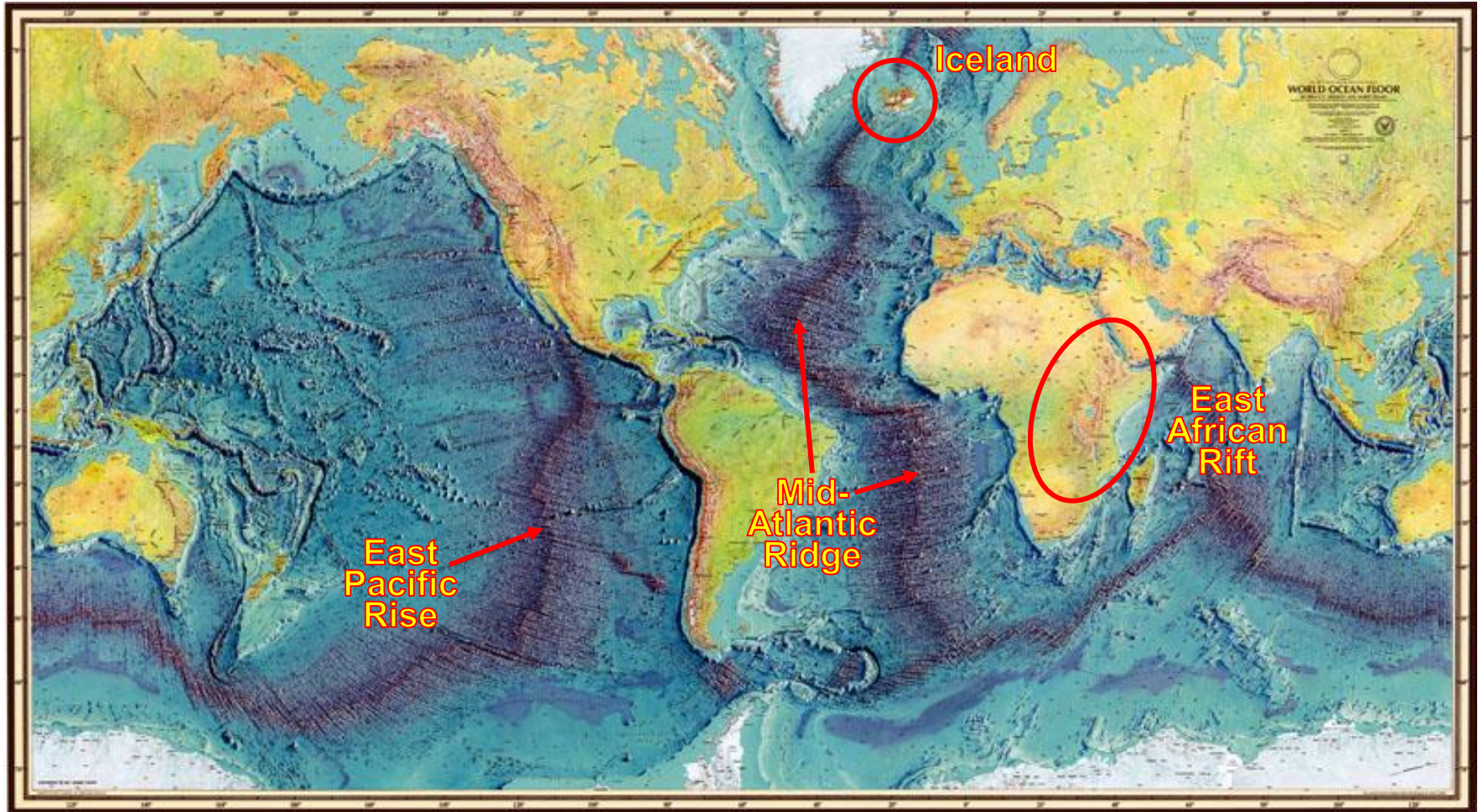
# Magma

- Partially molten rock found in high temperature, low pressure environments beneath the Earth's surface.



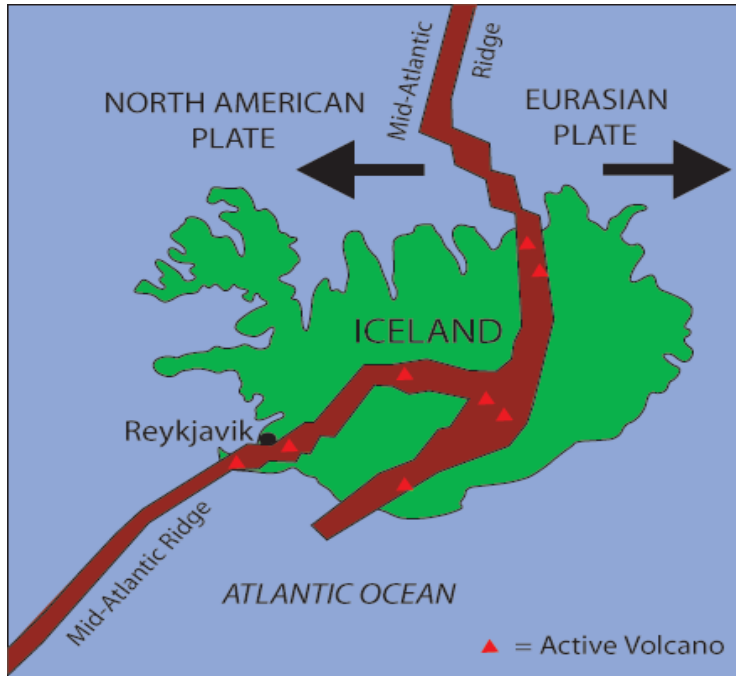
- Develops and collects in **magma chambers** usually within several miles of the Earth's surface.
- May also rise in **mantle plumes** directly from the outer core/mantle boundary.

# World's Ocean Ridges and Continental Rifts



The ocean floor is not flat! It has well-pronounced **mountain ridges** running along the spreading plate boundaries.

# Iceland: an example of continental drift



Iceland has a ***divergent plate boundary*** running through its middle.

In fact, the island exists because of this feature!

