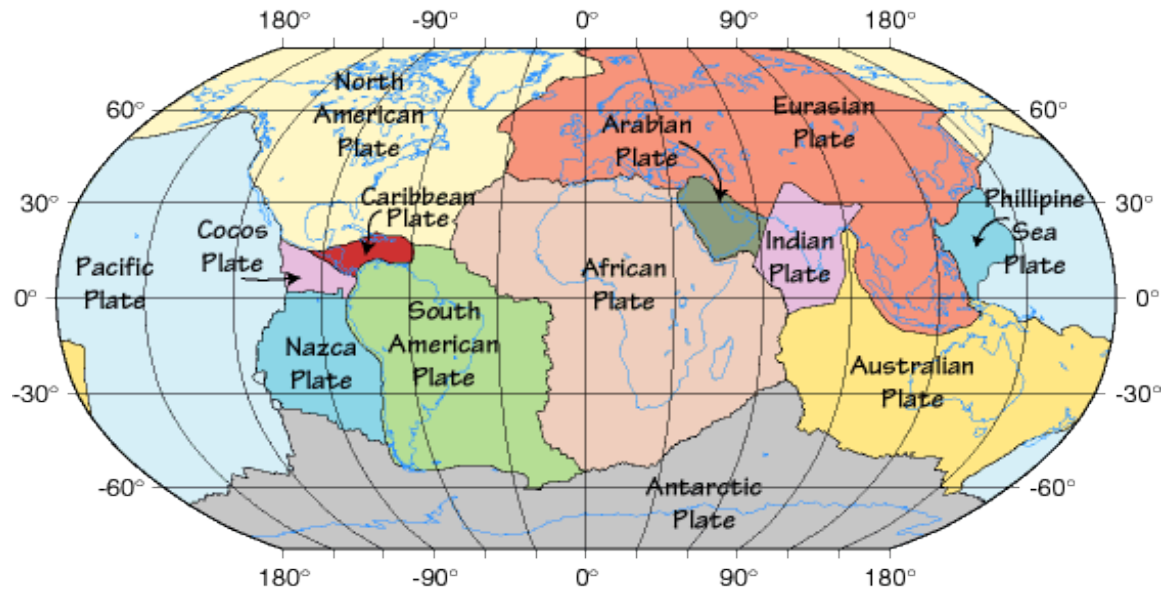


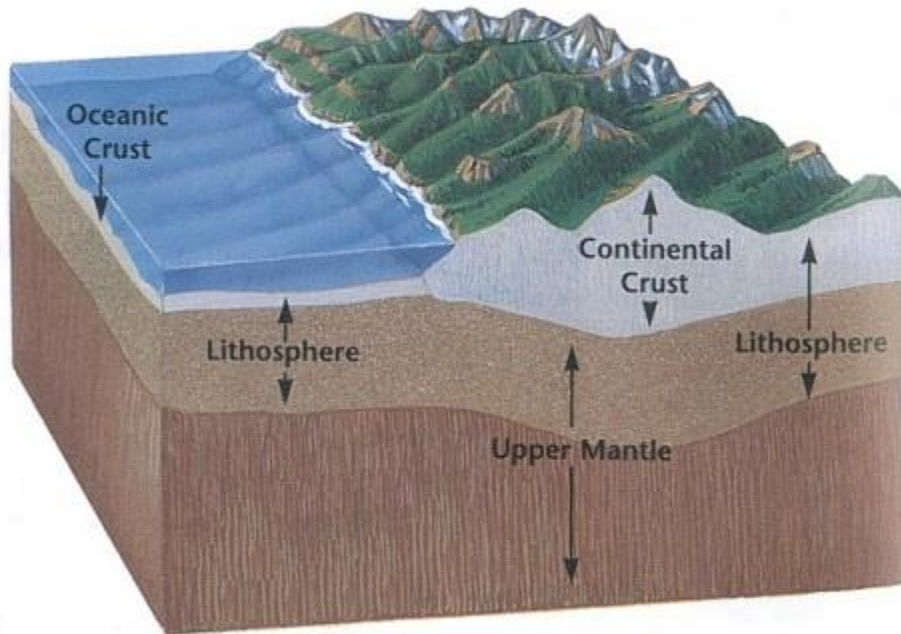
**Continental  
Drift**

# Lithosphere

**Tectonic  
Plates**

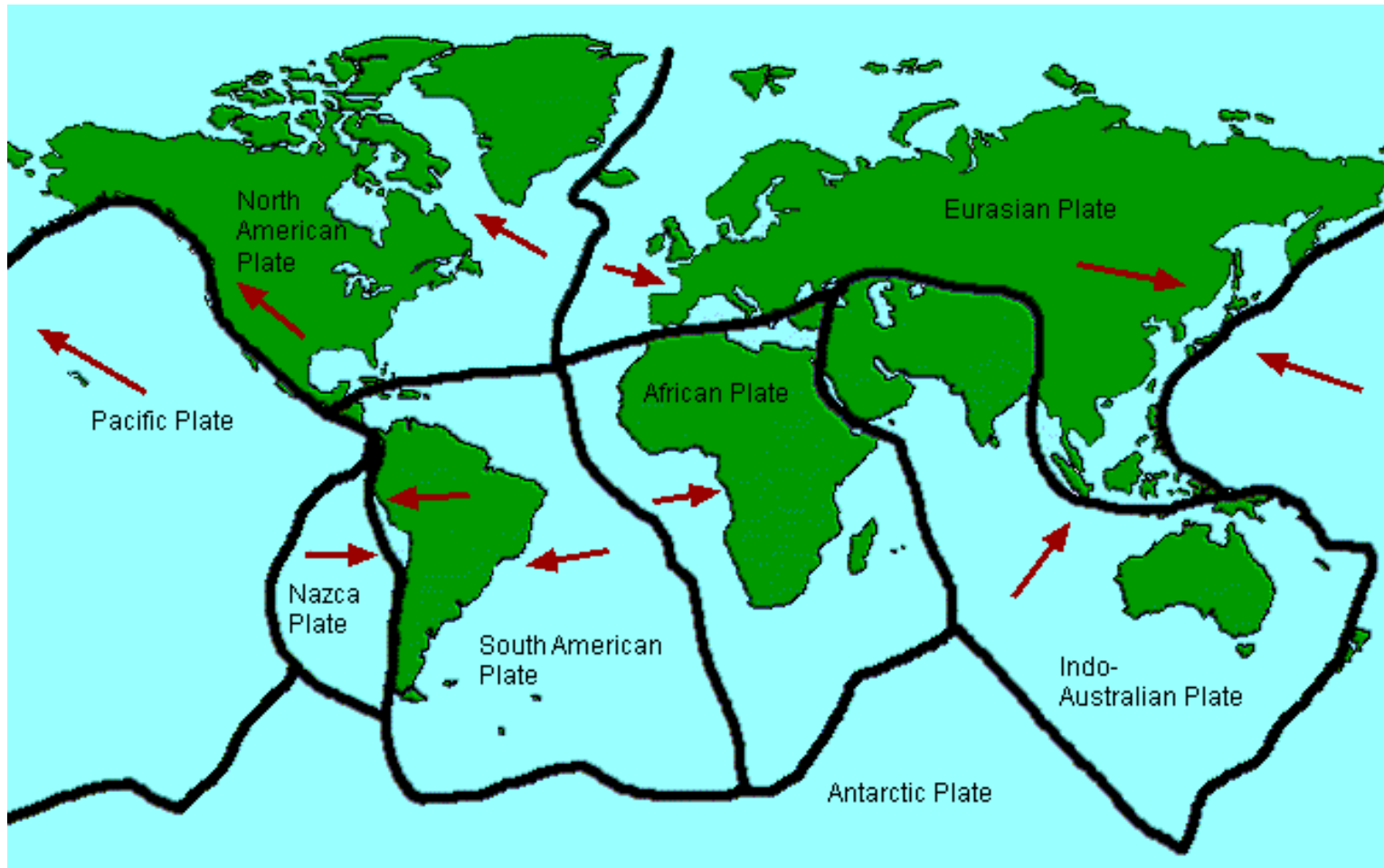


# Lithosphere: Sphere of Rock



- 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

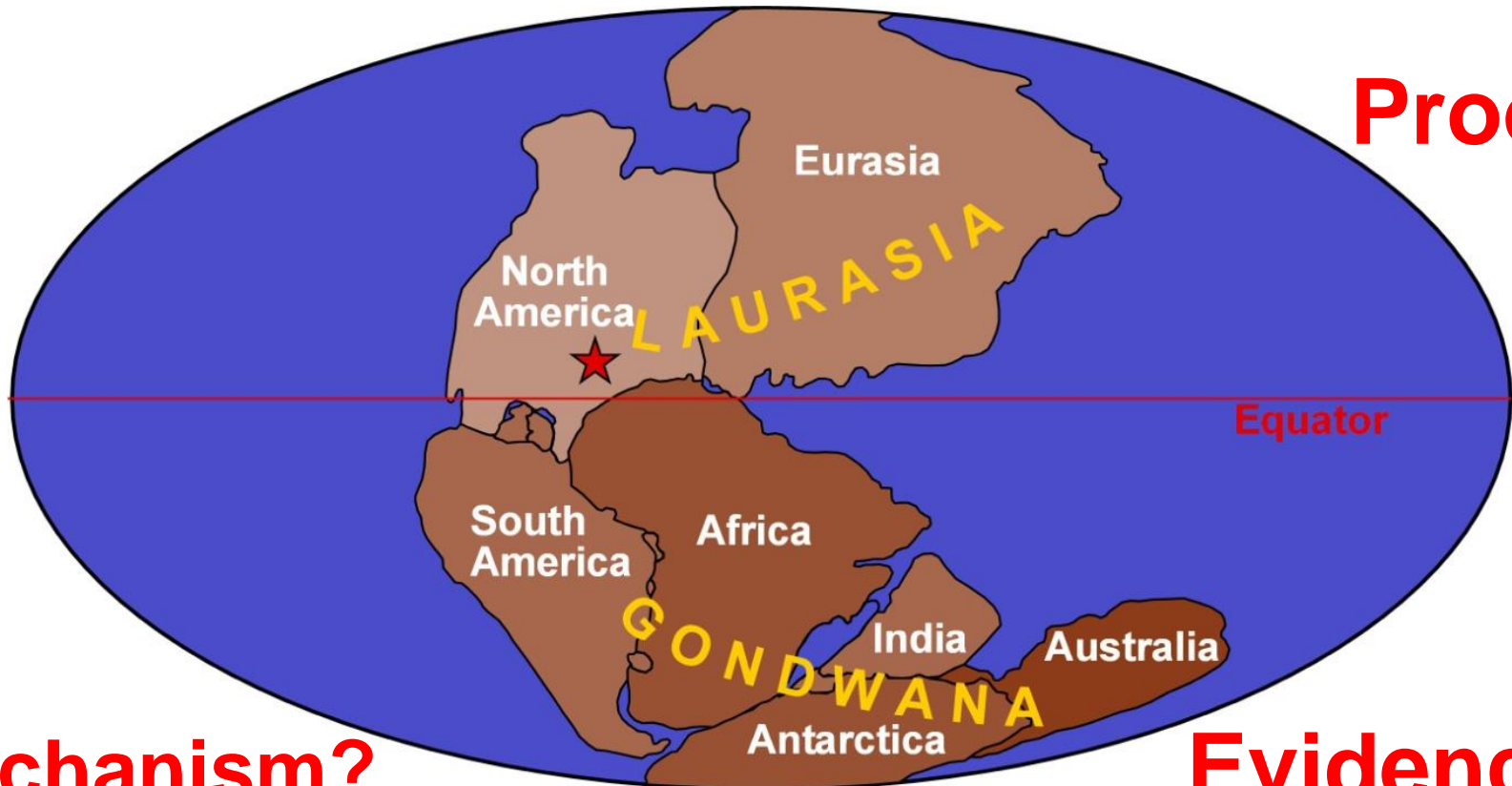


All tectonic plates **move** in different directions 1-2 inches per year.

# 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**.

**Proof?**

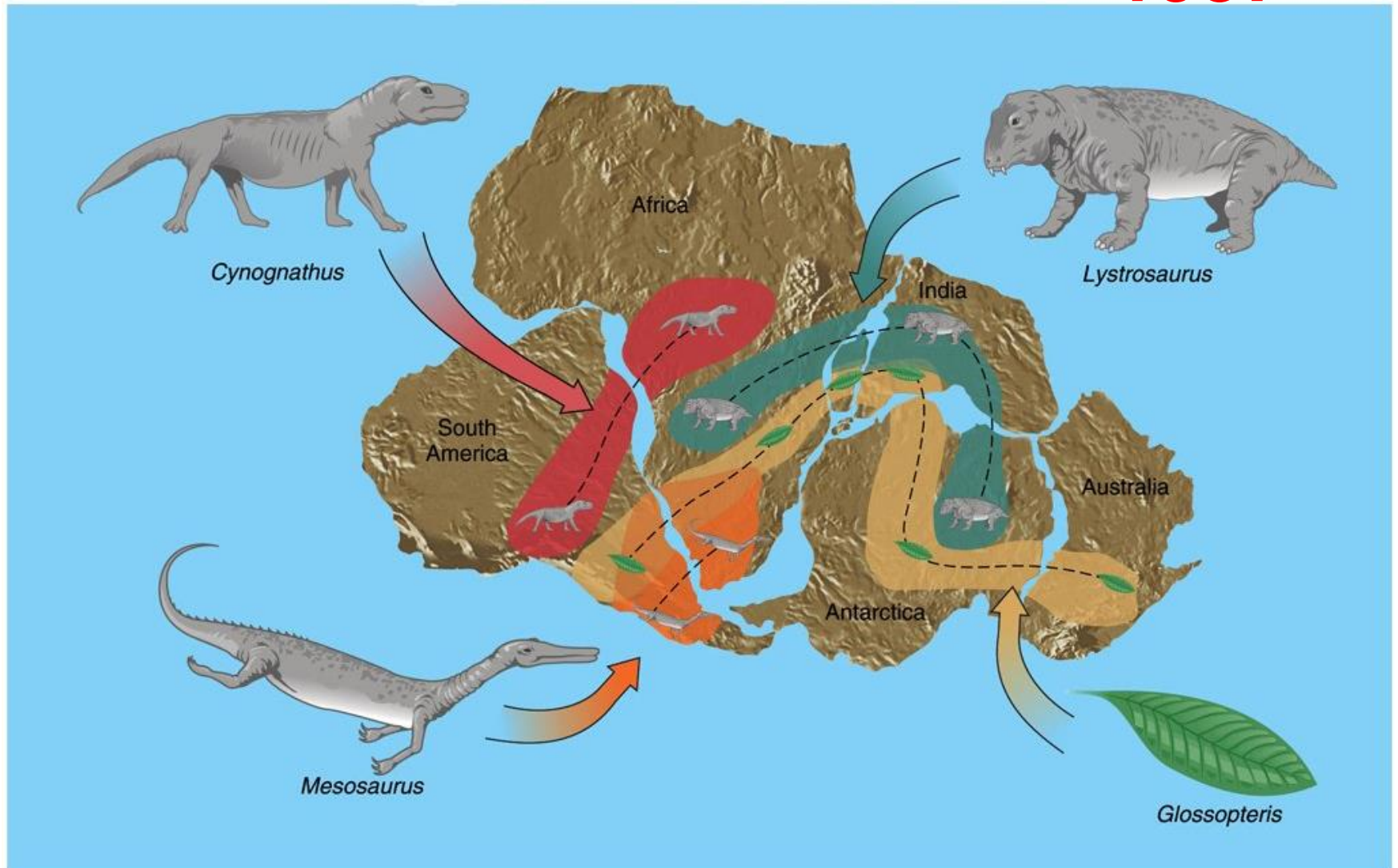


**Mechanism?**

**Evidence?**



# Continental Drift: Fossil Evidence 1937

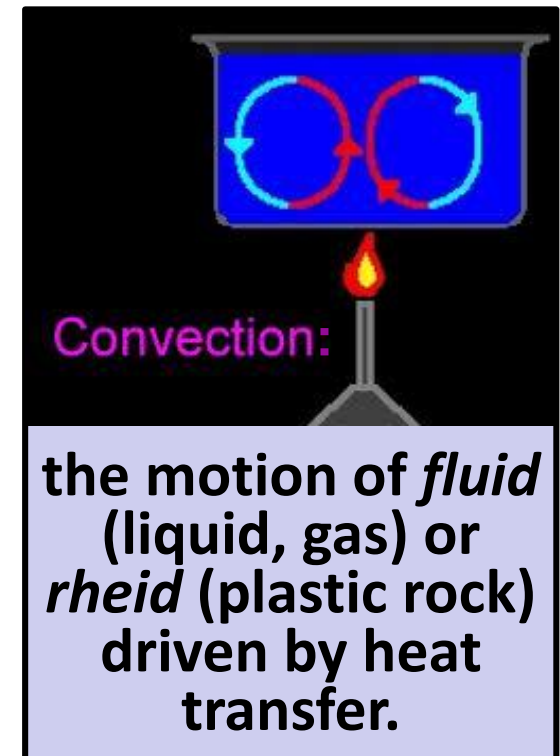
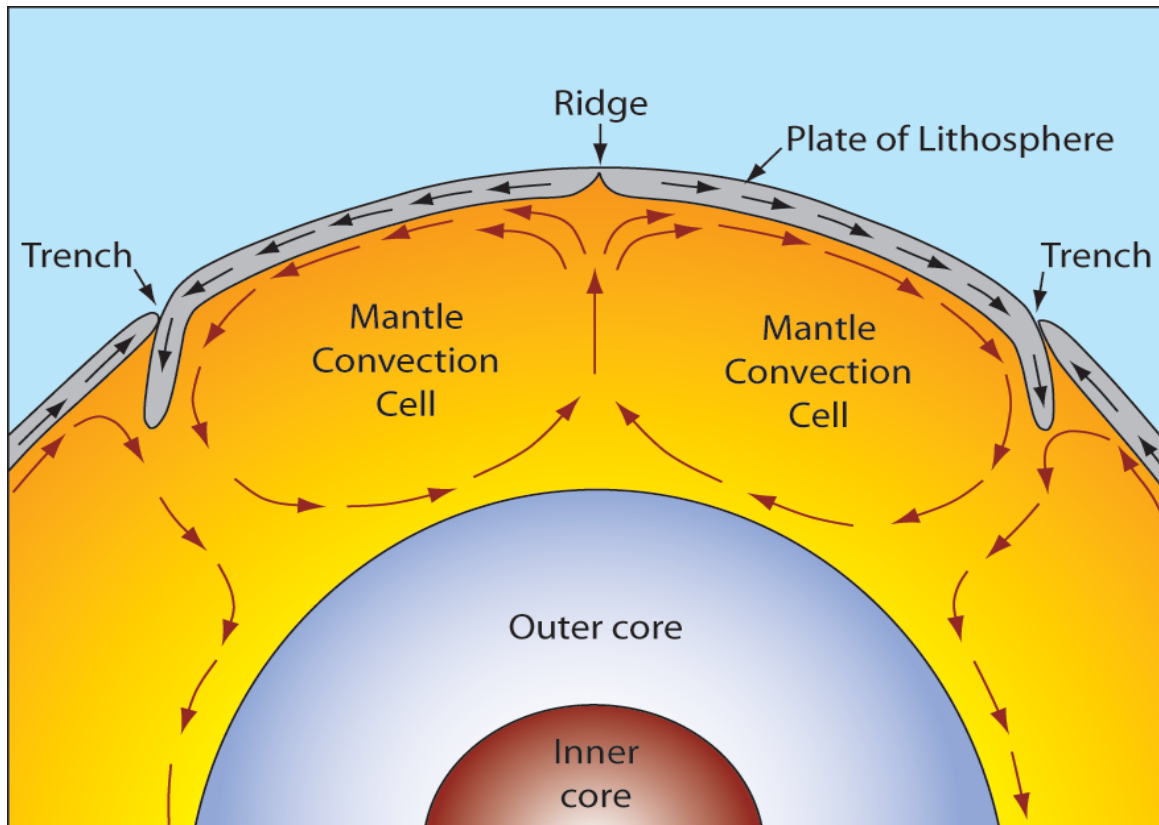


# Continental Drift: Debate

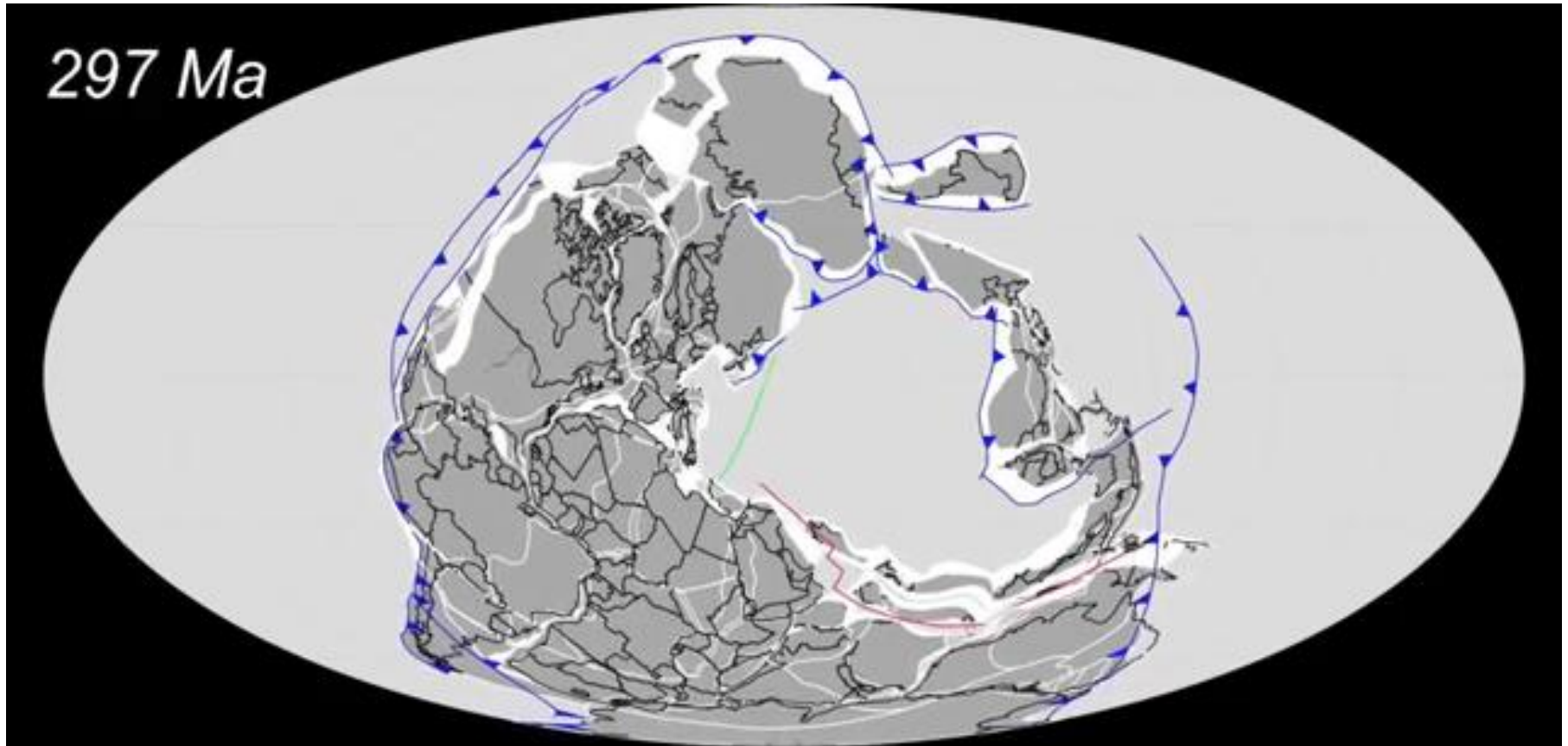
- Fifty years long lively debate started between "drifters" or "mobilists" (proponents of the theory) and "fixists" (opponents), during which the **theory of plate tectonics was born**.
- Early "weak" evidence:
  - Parts of **Scotland and Ireland** contain **rocks very similar** to those found in **Newfoundland and New Brunswick**.
  - The **Caledonian Mountains of Europe** and parts of the **Appalachian Mountains of North America** are very similar in structure and composition.
- Strong geophysical evidence:
  - **Paleomagnetism**, the rocks of different ages show a variable magnetic field direction consistent with continents movement.
  - Late 1950s and early 60s data on the **bathymetry of the deep ocean floors** and the nature of the oceanic crust; **evidence of seafloor spreading** along the *mid-oceanic ridges*.

# 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=IlnwyAbczog>



# Plate Movement Simulation

**Past 1500 million years** (full length simulation)

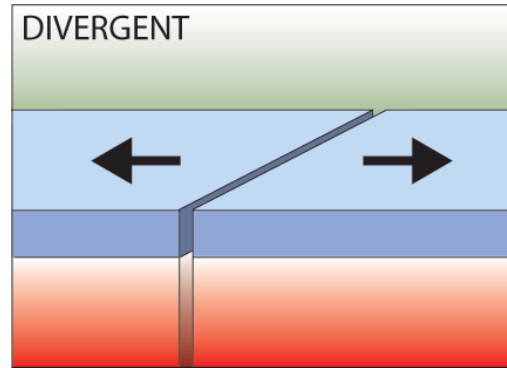
<https://www.youtube.com/watch?v=IlnwyAbczog>

**Same with oceans/landforms labeled**

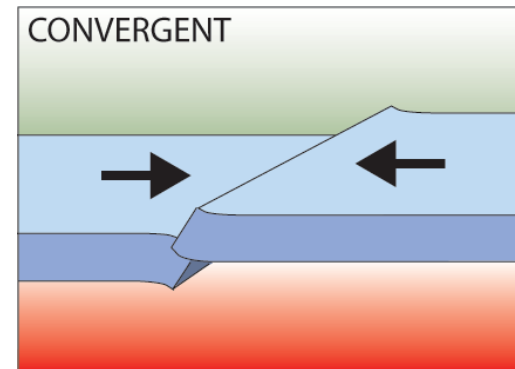
<https://www.youtube.com/watch?v=AsCZY-k-0uc>

# Three types of plate boundary

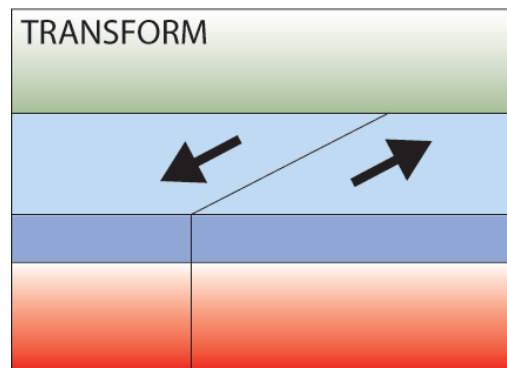
- **Divergent**



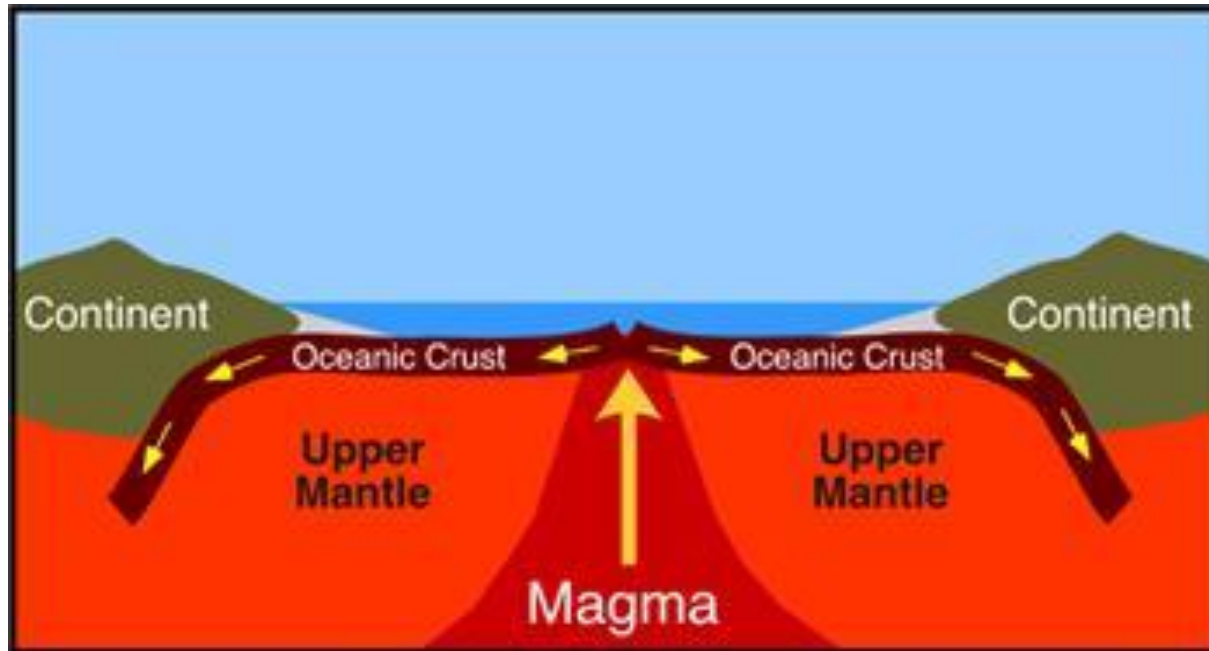
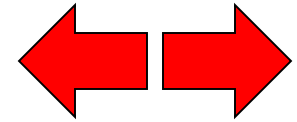
- **Convergent**



- **Transform**



# Divergent Boundaries

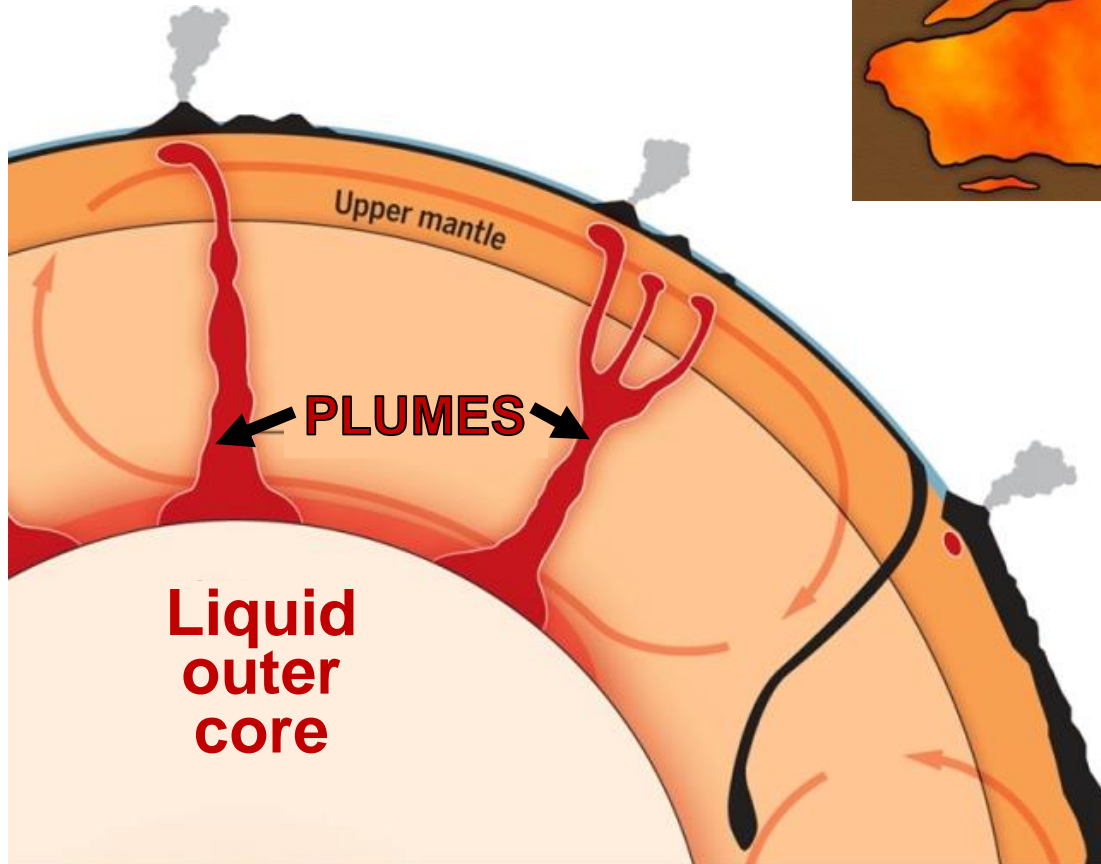
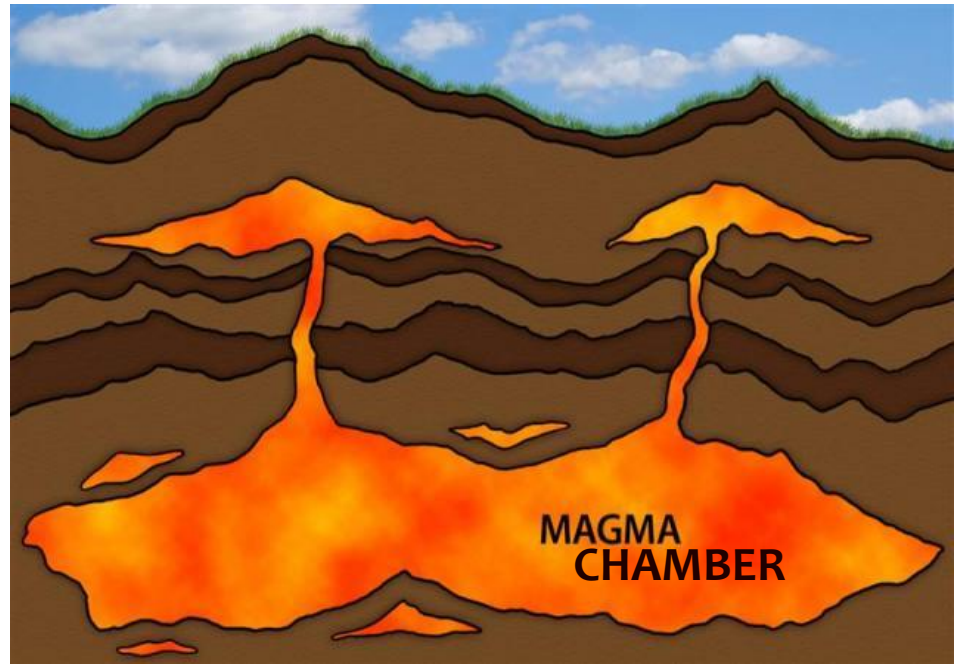


- **Spreading ridges:**
  - as plates **move apart**, new material is **erupted** to fill the gap
  - young crust is formed

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

# Magma

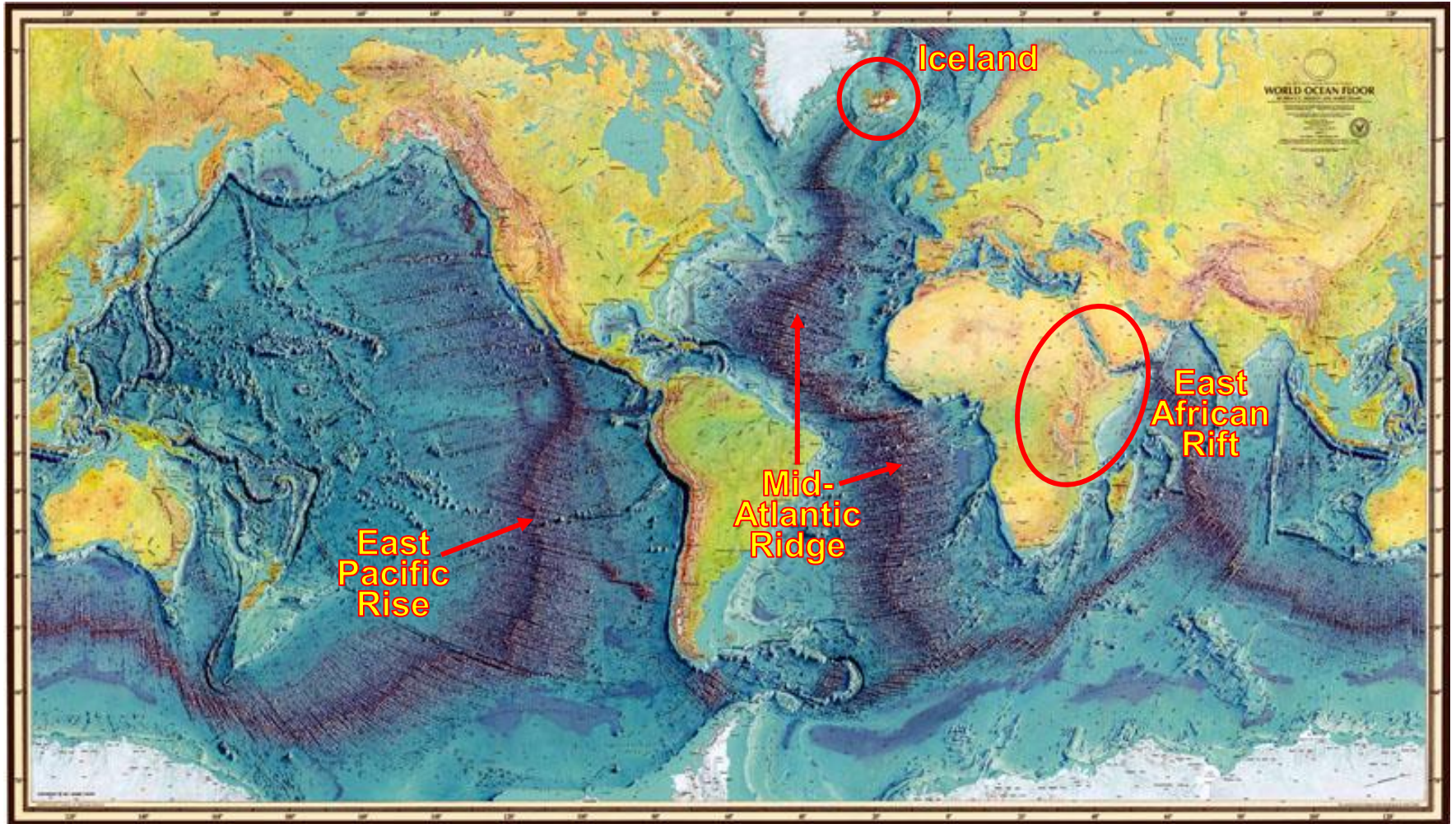
- Partially molten rock found in high temperature, low pressure environments beneath the Earth's surface.



- 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.

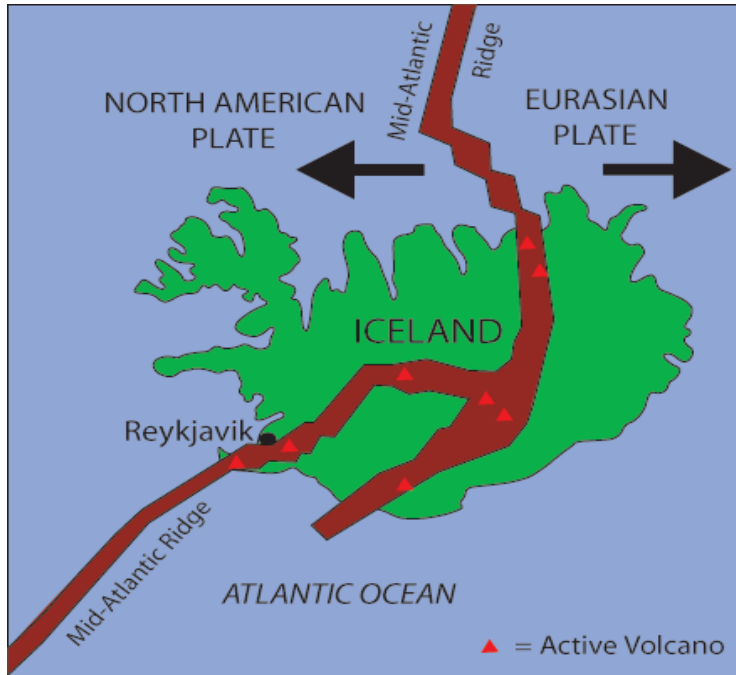


# World's Ocean Ridges and Continental Rifts



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

# Iceland: an example of continental drift



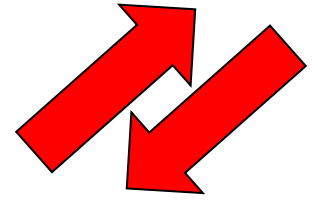
Iceland has a ***divergent plate boundary*** running through its middle.

In fact, the island exists because of this feature!

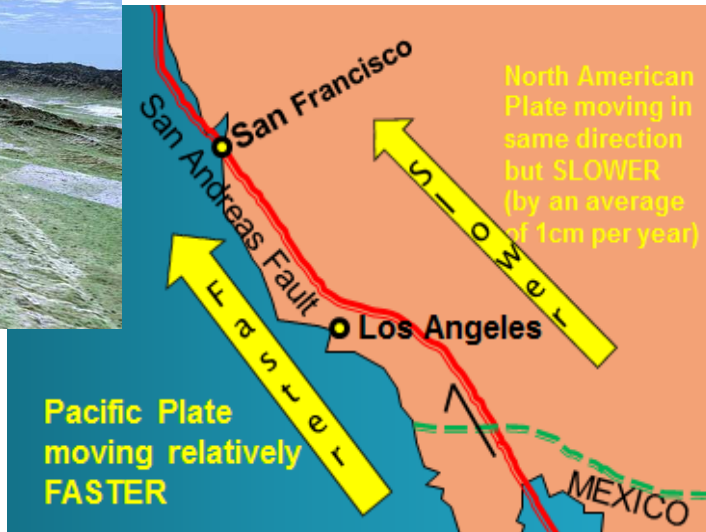
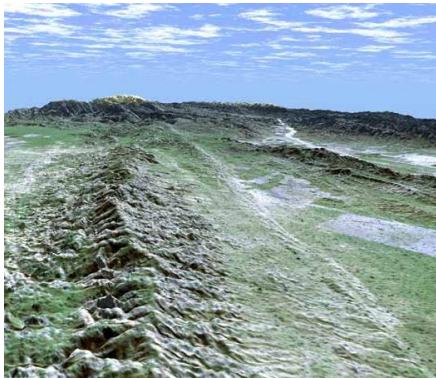
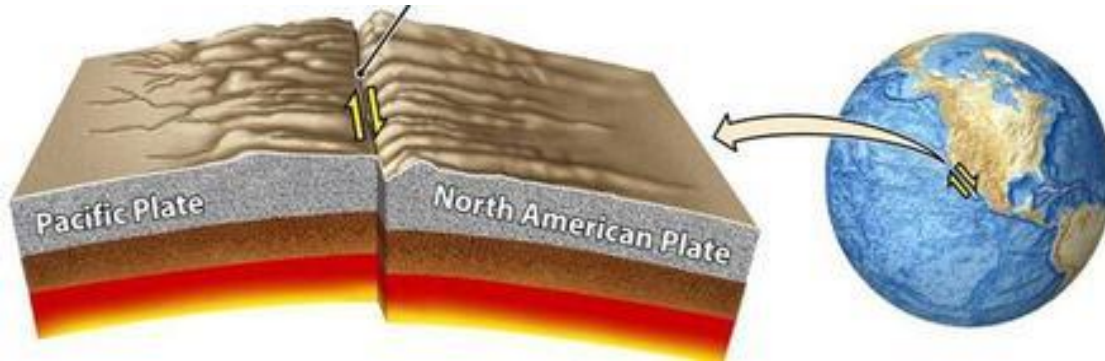




# Transform Boundaries



- Plates slide past each other



## San Andreas Transform Fault