

Geology & The Sea Floor



- Lithosphere-solid part of Earth (the crust and the upper most part of the mantle)
- Hydrosphere-liquid part of Earth
- Coastlines, water depth & sediment type are affected by the constant movement of continents and rocks




World Ocean

5 Basins

- Pacific
- Atlantic
- Indian
- Arctic
- Antarctic



Layers of Earth

- The Core- innermost iron rich layer
 - Two parts, a solid inner & a liquid outer
 - Movement of liquid produces the Earth's magnetic field
 - The Mantle- outermost solid layer
 - Includes the mesosphere (majority of mantle) and asthenosphere (very upper part of mantle)
 - Extremely hot
 - Boiling point for rock
 - Flows like liquid but very slow
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Crust-thin skin like layer

- The Crust (two types)

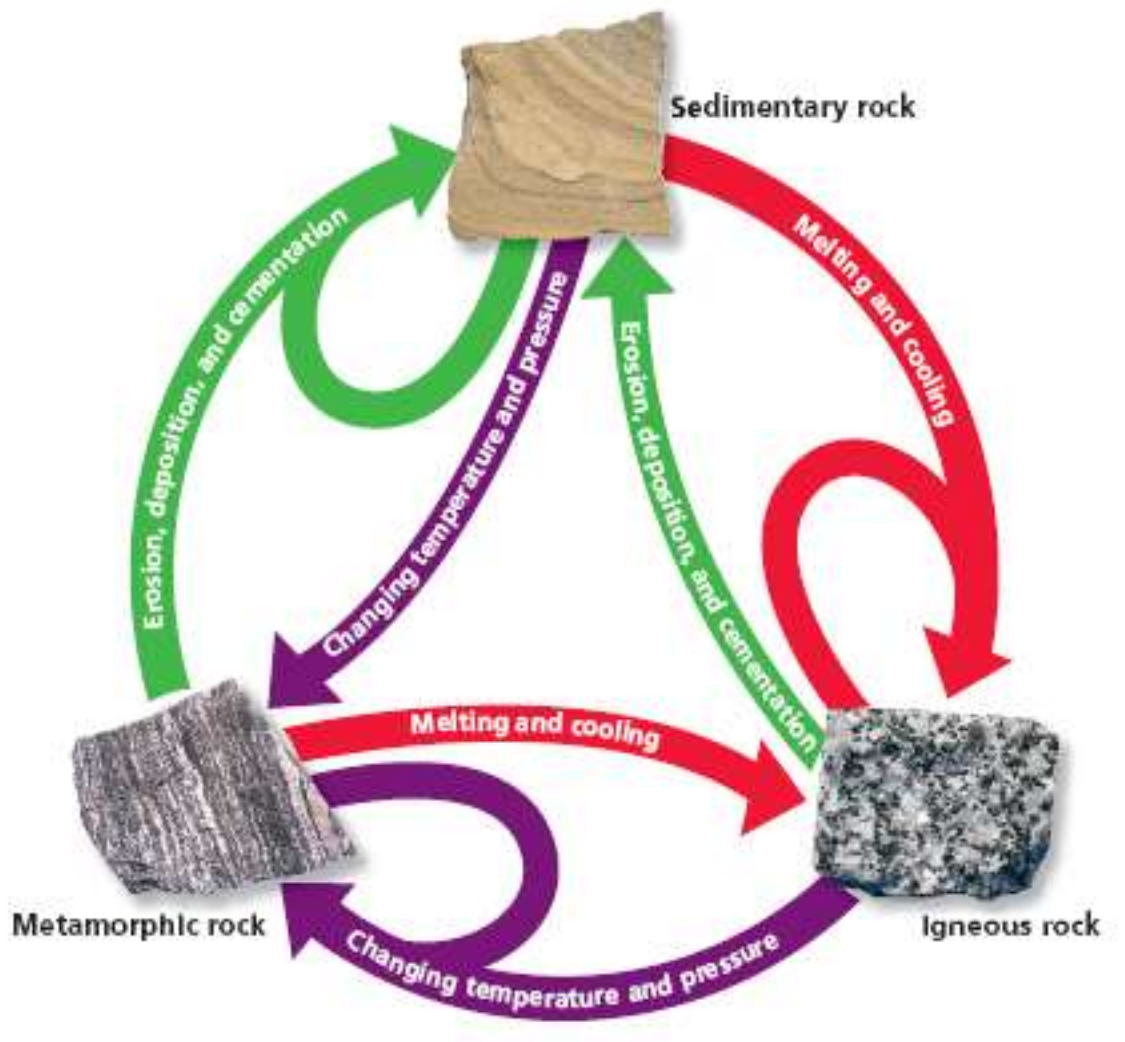
1. Oceanic Crust

- 3 miles thick
- Sea floor
- Basalt- a dark colored mineral
- Denser (average $2.9\text{g} / \text{cm}^3$)

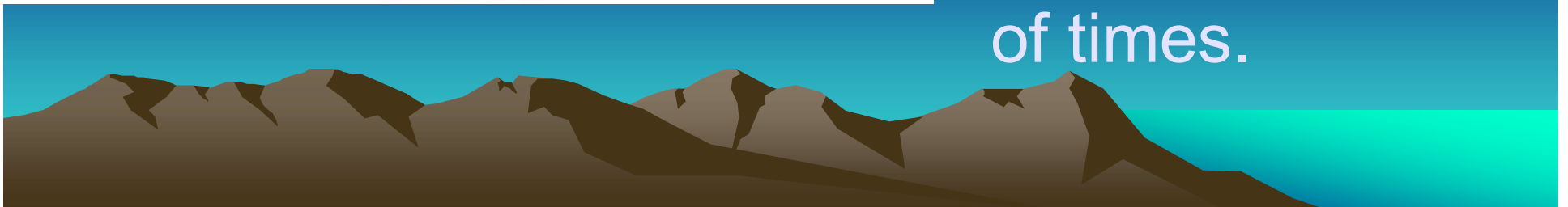
2. Continental Crust

- 10-30 miles thick
- Granite- a light colored mineral
- Less dense (average $2.8\text{g} / \text{cm}^3$)

- ****Think of continental & oceanic crust floating on mantle like icebergs**



The Rock Cycle –
The changing of rock from one type to another; does not go in just one direction. Any given rock can go through any part of the cycle any number of times.



3 Types of Rocks

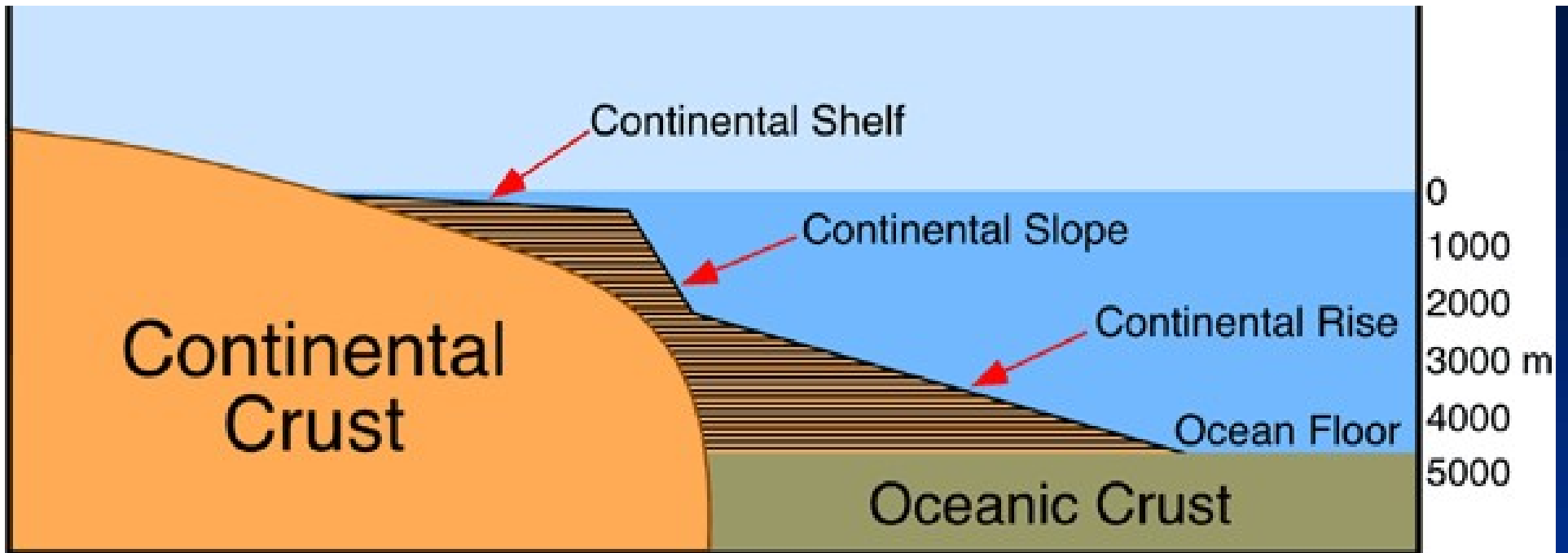
- 1. igneous – formed when magma or lava cools and hardens.
- 2. sedimentary rock – formed when sediment is cemented together
- 3. metamorphic – formed when heat and pressure changes the rock chemically



Isostatic equilibrium

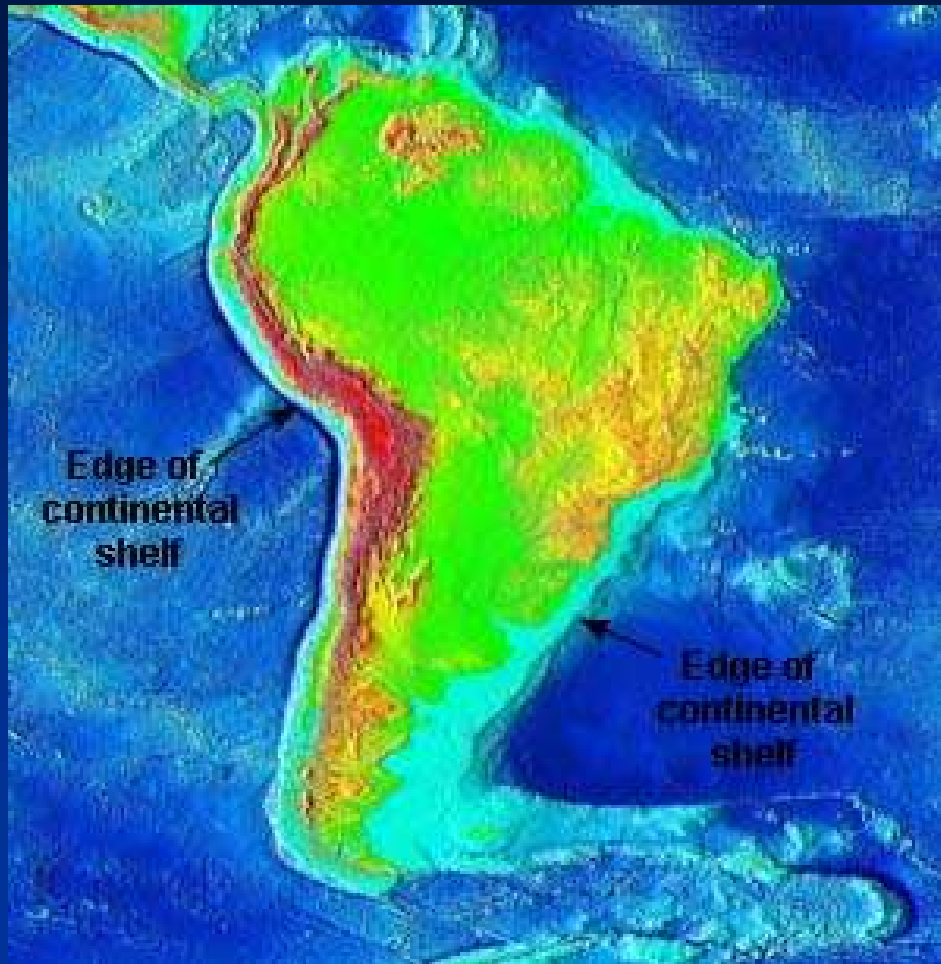
- The balance between the weight of the crust and the buoyancy from the mantle
 - ❖ Balance is disrupted as material is added to oceanic crust or leave continental crust.
 - ❖ To restore equilibrium, landmasses will sink or rise along a fault (a weak area in the crust where plates sink, rise, or slide past each other).



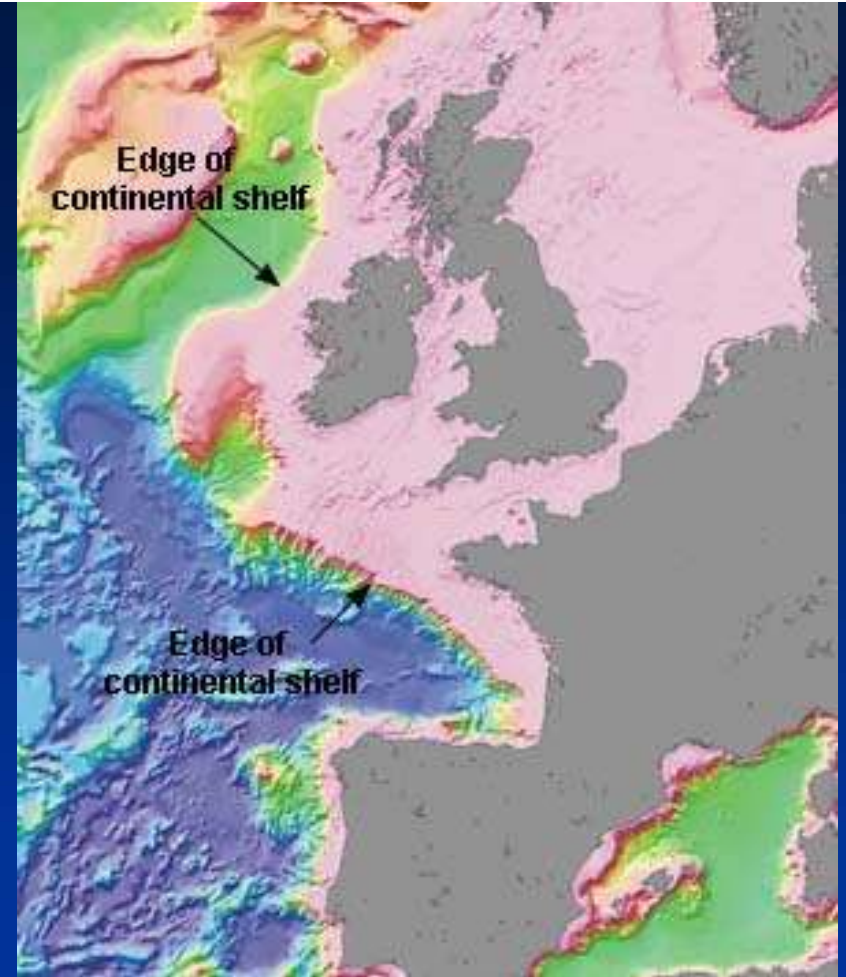


Structure of Ocean Basins

- Continental Crust- land
- Continental Shelf- gradual decline
- Continental Slope- sharp decline
- Continental Rise- levels out to meet sea floor
- Abyssal Plain/Deep Ocean



Narrow Shelf – South America



Wide Shelf – UK and Europe

- Alfred Wegener

- 1912- Continental drift was proposed

- ❖ Theory of Continental drift – The continents were once a single landmass that drifted apart and continue to drift.

- Single landmass was called Pangaea.





PANGAEA
225 million years ago



LAURASIA
GONDWANALAND
TETHYS SEA
200 million years ago



JURASSIC
135 million years ago



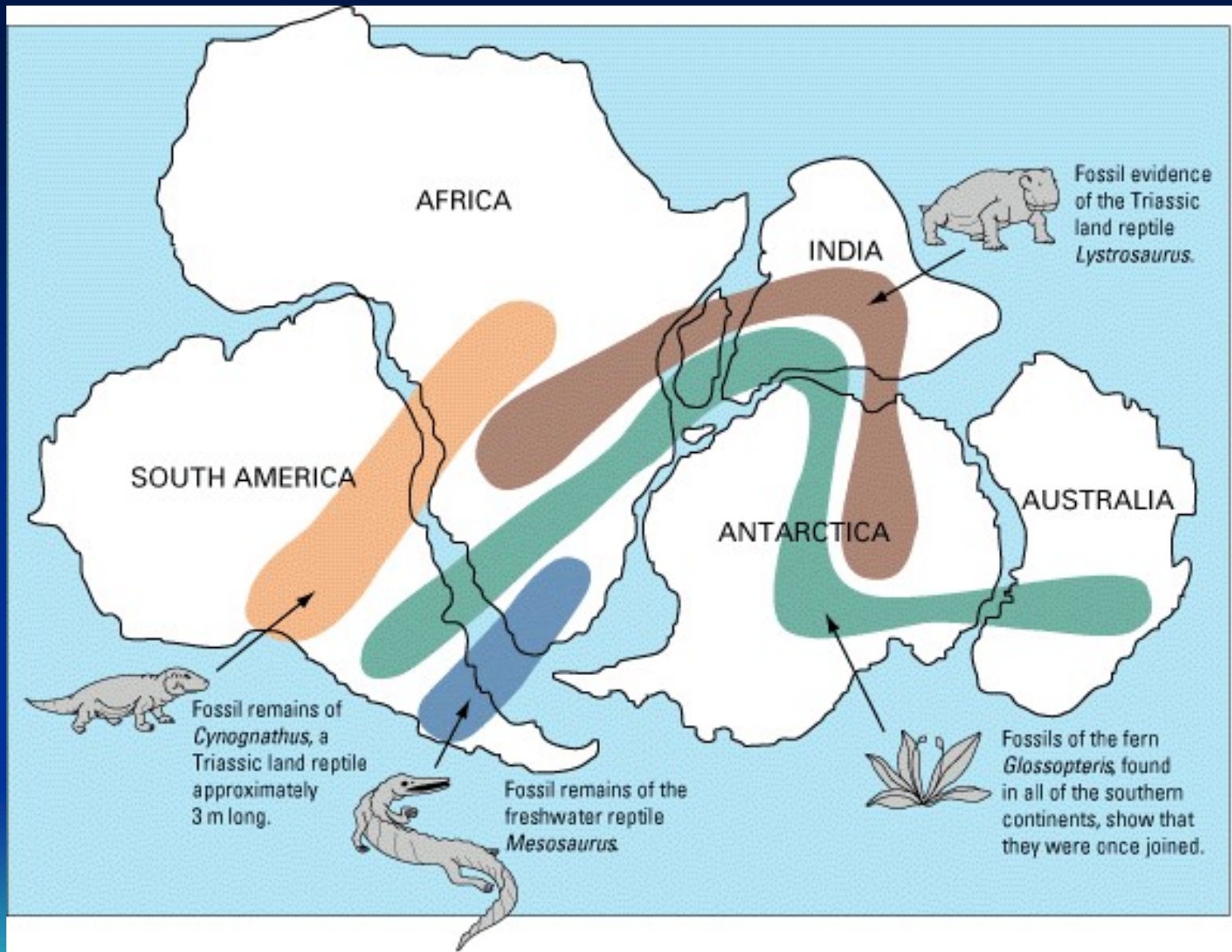
CRETACEOUS
65 million years ago



PRESENT DAY

- .
 - Evidence to support Wegener's theory:
 - Fossil, coal deposits, etc. is evidence of joined continents.
 - Rock formations similar on coasts of separate continents
 - Climatic evidence – evidence of glaciers in Africa and ferns in Antarctica





Theory was not accepted

- Wegner could not explain how continents move, so theory was not accepted
- Until 1950's-1960's evidence was found & called **Plate Tectonics**



Theory of Seafloor Spreading

- Sonar revealed the Mid-oceanic ridge system
 - A continuous chain of volcanic, submarine mountains that encircle the globe
- Largest geological feature on the planet
 - Some rise so high they form islands



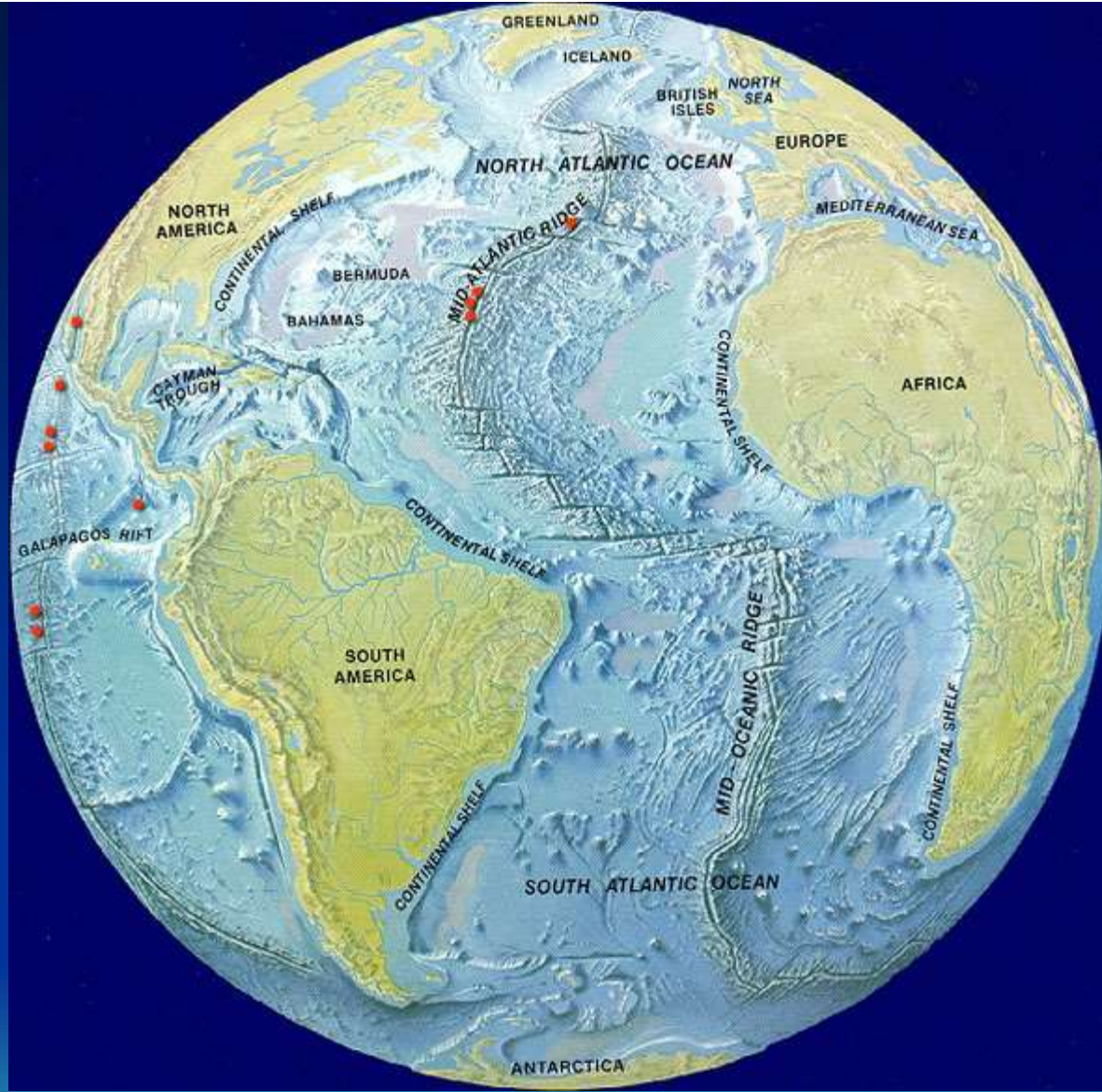
- Atlantic-known as the Mid-Atlantic Ridge
- Pacific-known as the East Pacific Rise
 - Responsible for volcanoes & earthquakes

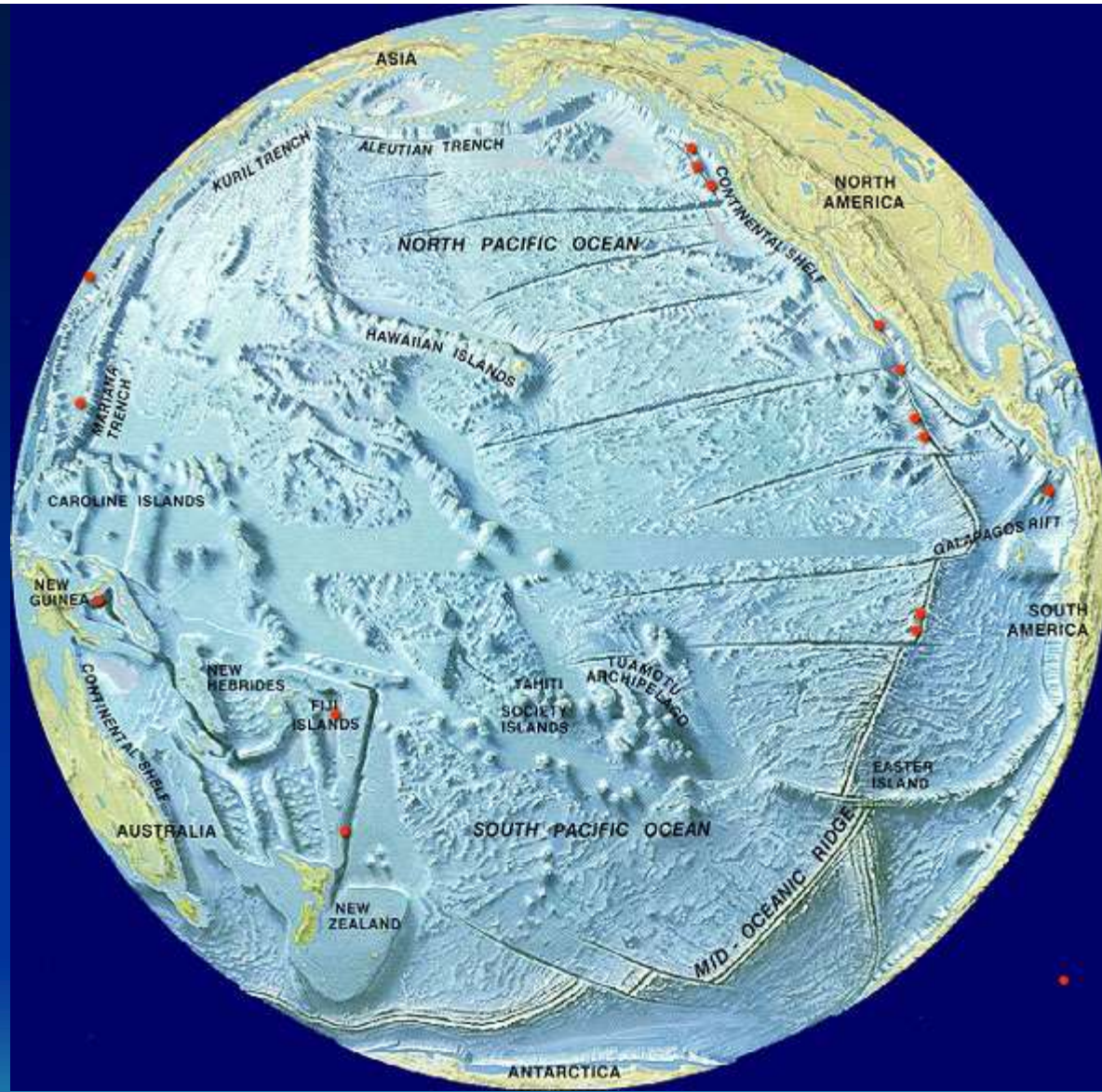
Mt Everest- ~29,000 ft

Hawaiian Mt- ~33,000 ft

Mariana Trench- ~35,000 ft deep



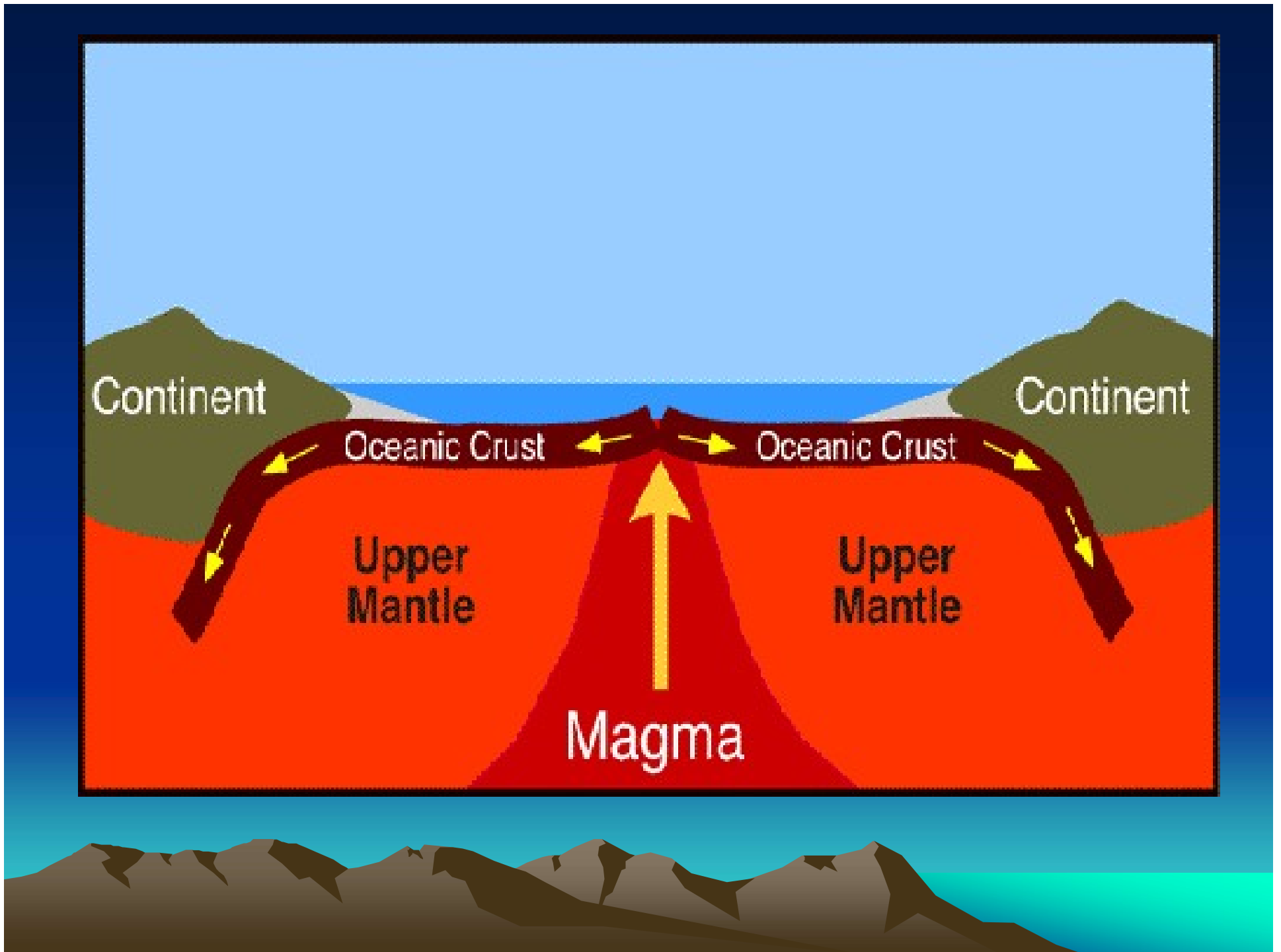




Creation and Destruction of Seafloor

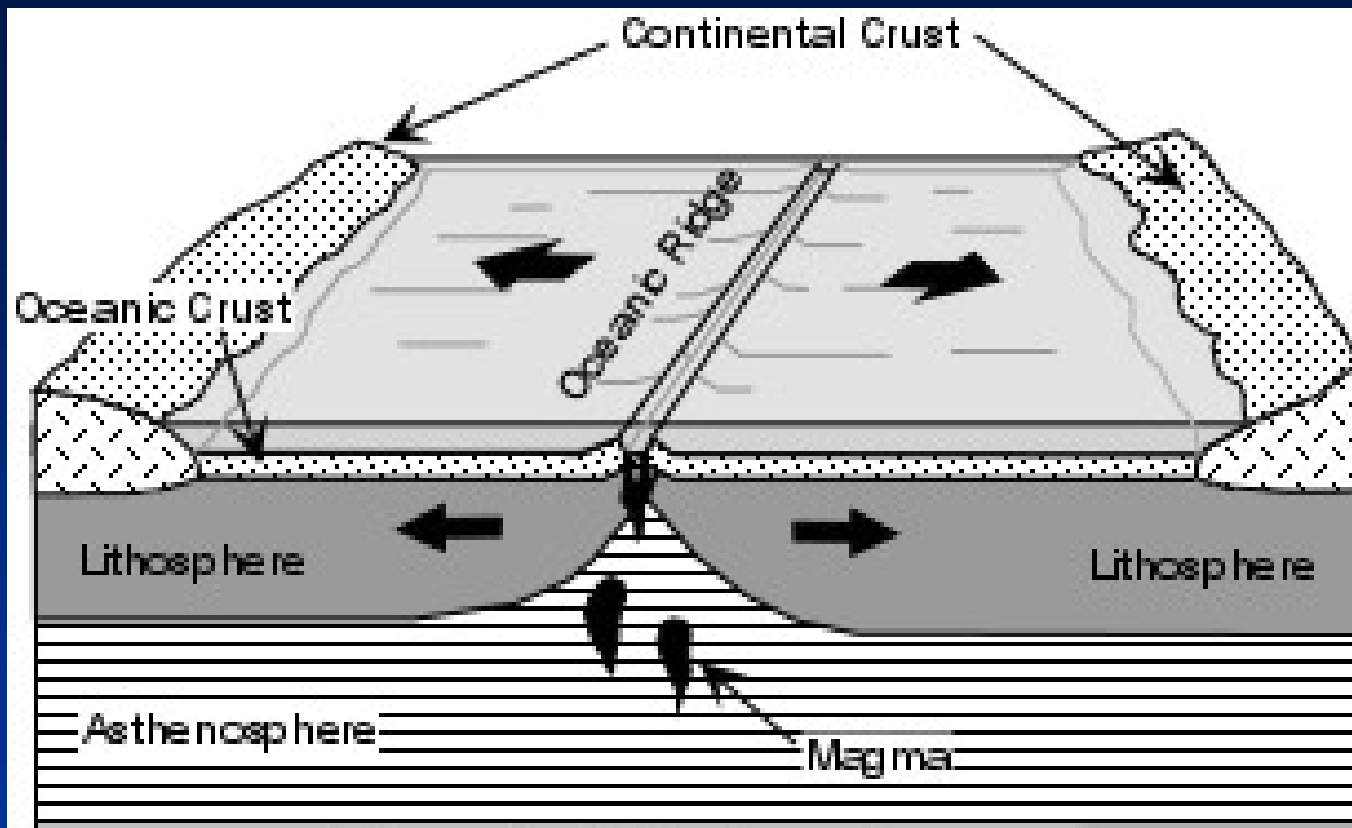
- 1960 – Hess and Dietz hypothesize seafloor is in constant state of creation and destruction called seafloor spreading
- New crust comes from rift valley at mid-ocean ridge.
- Old seafloor sinks at the trenches (subduction zone)





- **Sea Floor spreading**
 - Oceanic crust separates
 - Rifts (valleys) are formed
 - Released pressure from the hot mantle causes material to melt and rise
 - Crust gets pushed up & causes ridge
 - Molten material cools when reaches surface, hardens & forms new crust



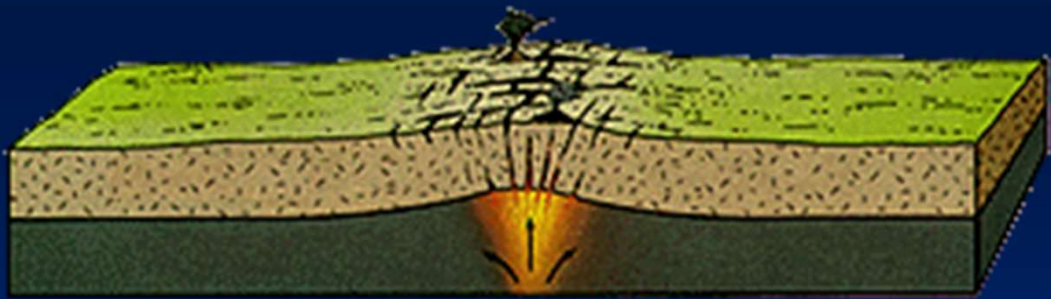


Diverging Plate Boundary
Oceanic Ridge - Spreading Center



Methods of plate movement

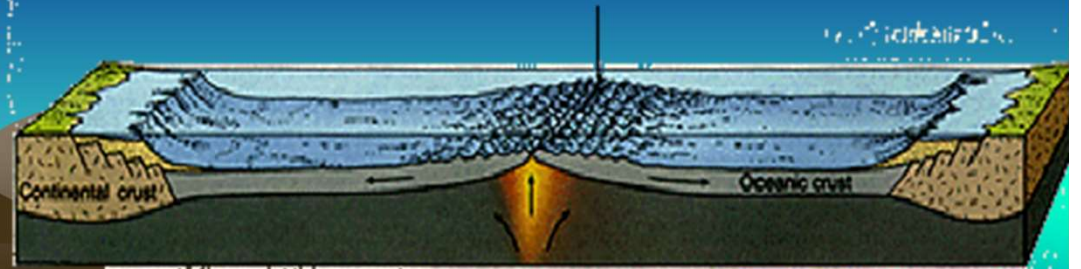
- Lithospheric plates-crust & upper part of mantle
- The mantle drives the movement of the plates via **CONVECTION**
- Move about 2 cm a year
- Trenches usually created by
 - Continental & Oceanic
 - Oceanic & Oceanic

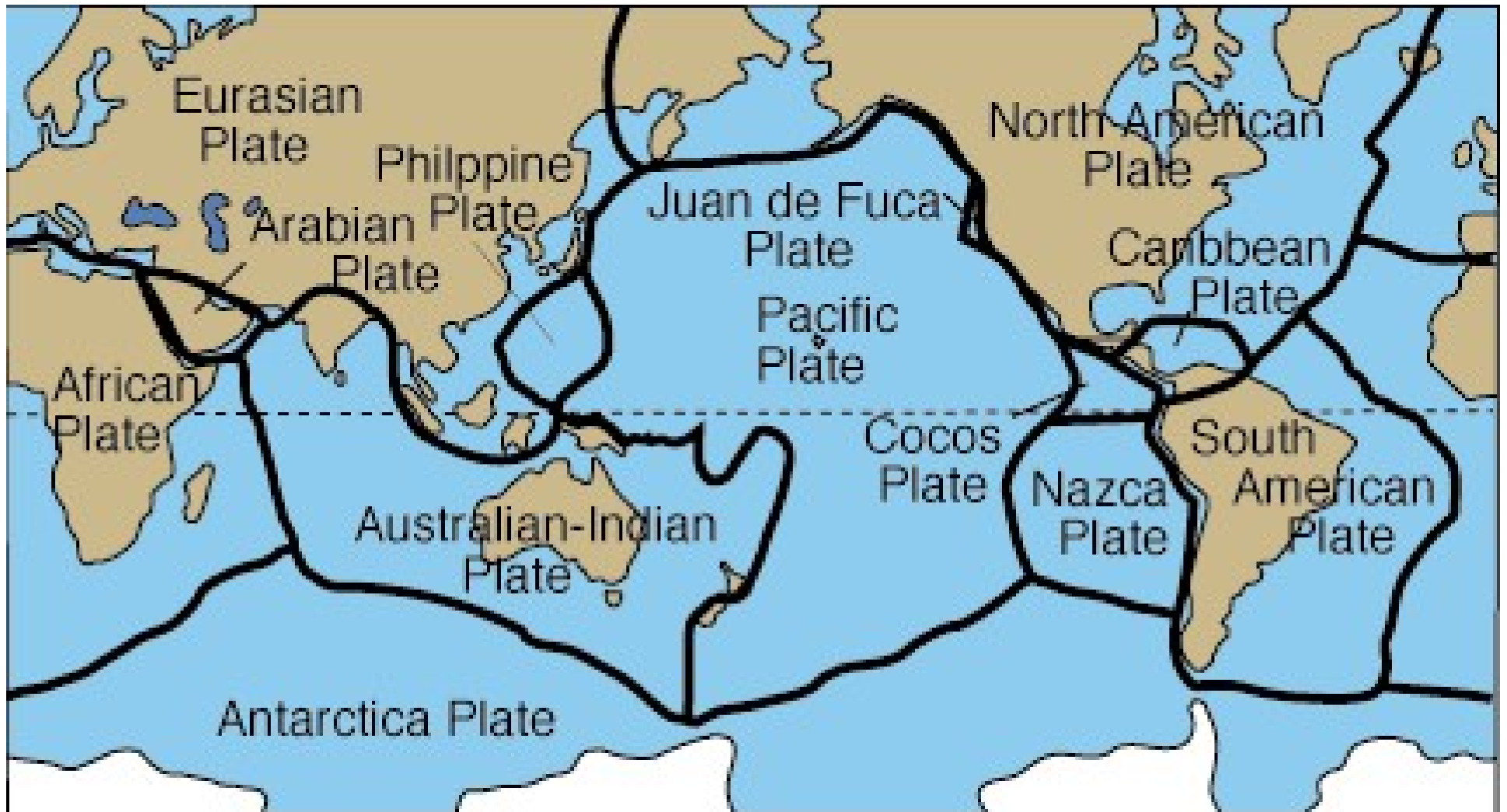


RIFT VALLEY

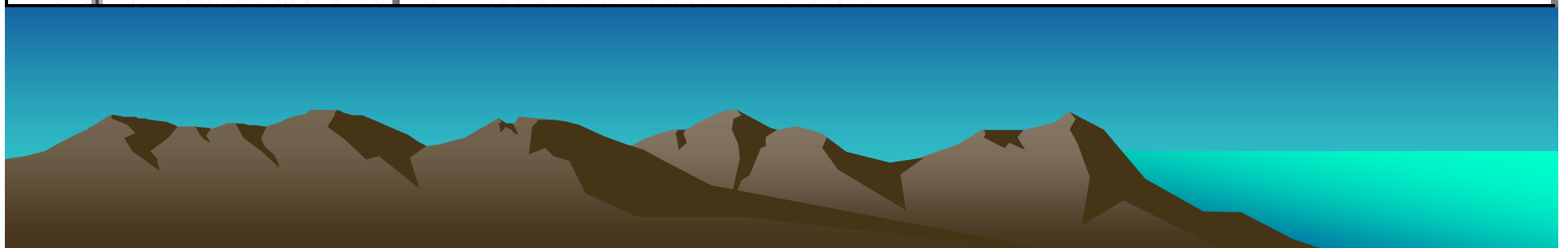


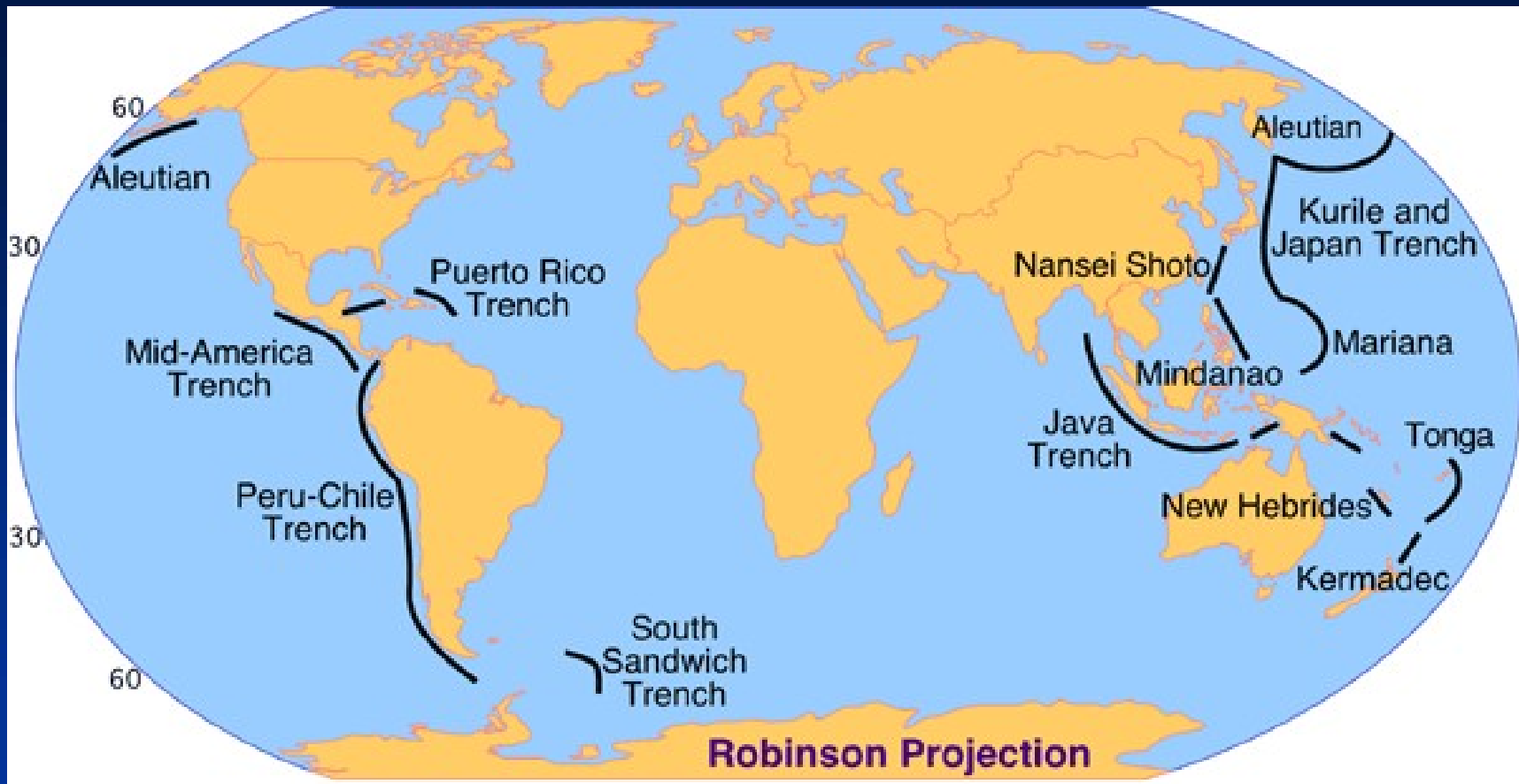
RIFT VALLEY





Major tectonic plates of the world.





Location of Trenches

