

# Plate Tectonics

**How do the plates move?**

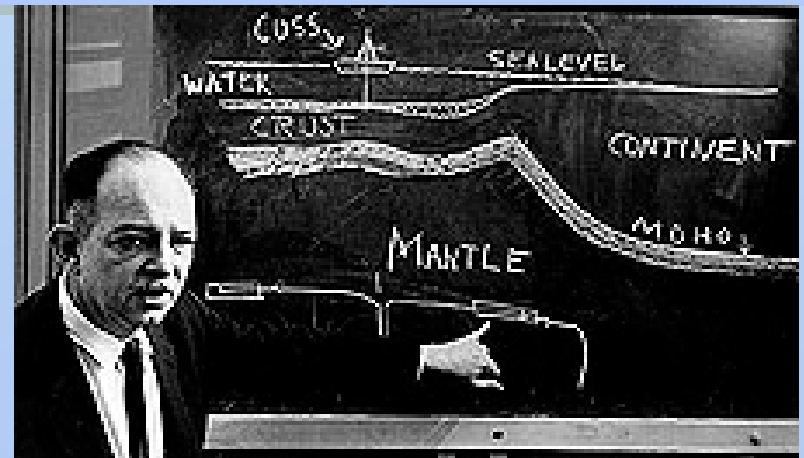
# Continental Drift Hypothesis

- In 1915, Alfred Wegener's hypothesis about Continental Drift couldn't explain the forces that could move continents.
- Wegener wasn't the first to notice how the continents fit together but he was one of the first to realize that the Earth's surface had changed over time.
- His hypothesis says that continents that are separated have been joined together at one point in the past and have been moving apart.
- He thought that the continents plowed through the oceans as they moved.

# Sea-Floor Spreading Hypothesis

- In the 1960s, Harry H. Hess came up with an hypothesis about the sea floor spreading apart which supported the idea of moving continents.
- Hess proved Wegener's basic idea right and clarified the mechanism that broke the once-joined continents into the seven with which we are familiar.
- The continents are attached to the plates and do not move independently of them. But the plates themselves shift and change shape, carrying the continents along.

•Sea floor spreading is based on the idea of convection currents in the mantle.



# The theory of Plate Tectonics

- The discovery of palaeomagnetism and the development of oceanography was a necessary step in the development of science which Wegener's idea awaited.
- According to the plate tectonic model, the surface of the Earth consists of a series of relatively thin, but rigid, plates which are in constant motion driven by convection currents in the mantle.

# The mechanics of Plate Tectonics

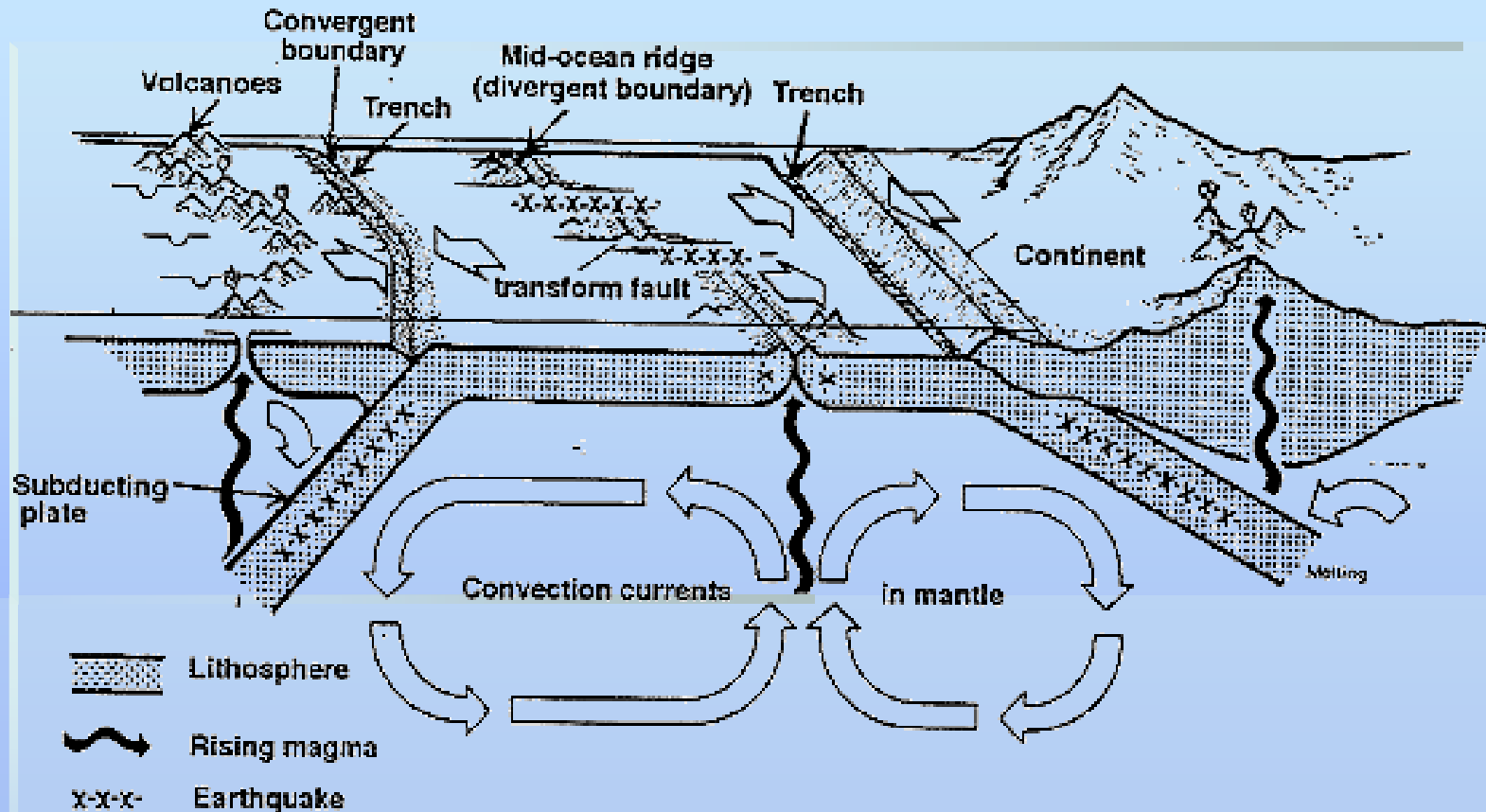
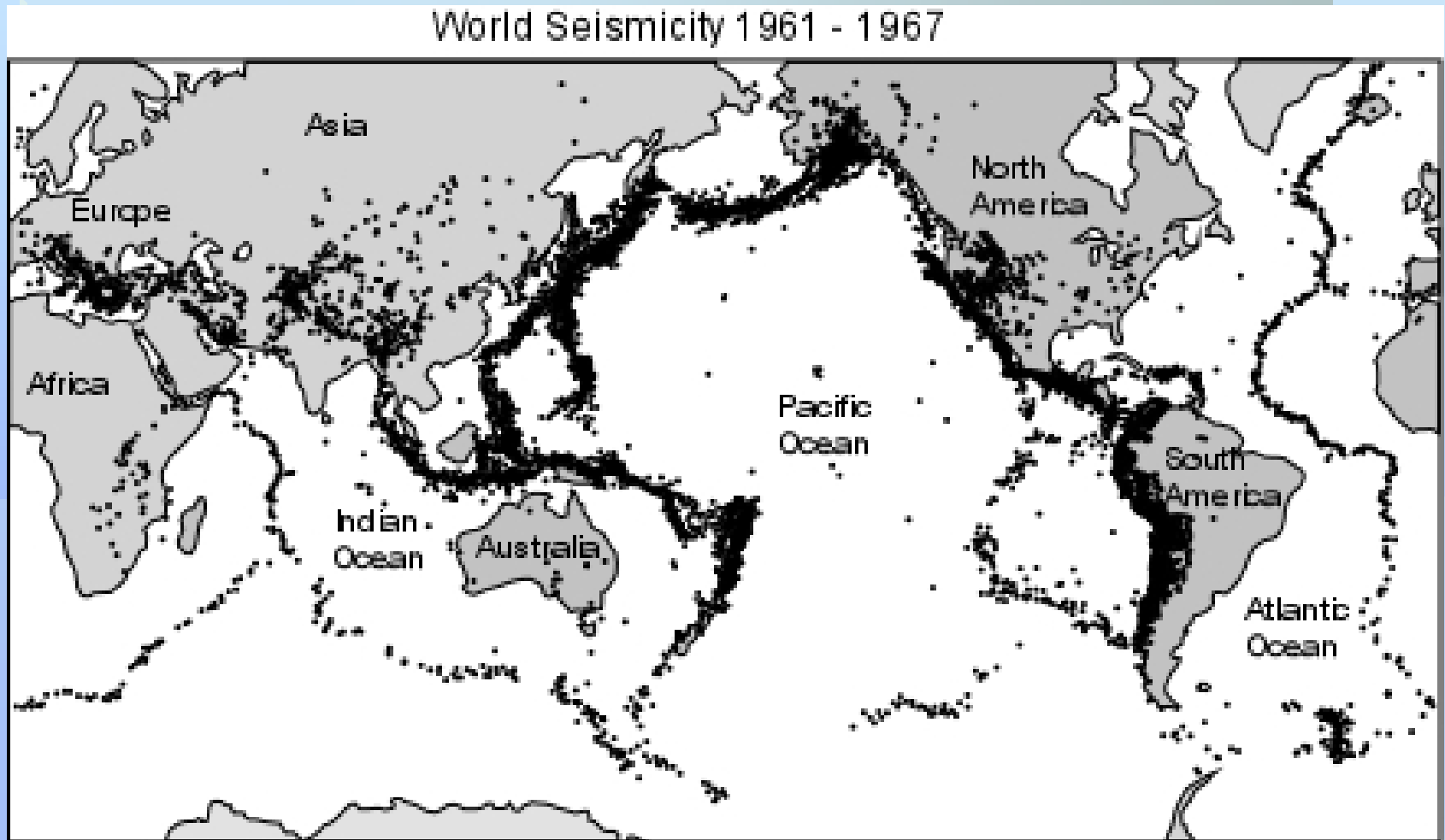


Figure 2. Sea-floor spreading. Modified from NSTA/FEMA (1988).

Earthquake locations - one of the ways we can see where plate boundaries are





PERMIAN  
225 million years ago



TRIASSIC  
200 million years ago



JURASSIC  
135 million years ago



CRETACEOUS  
65 million years ago

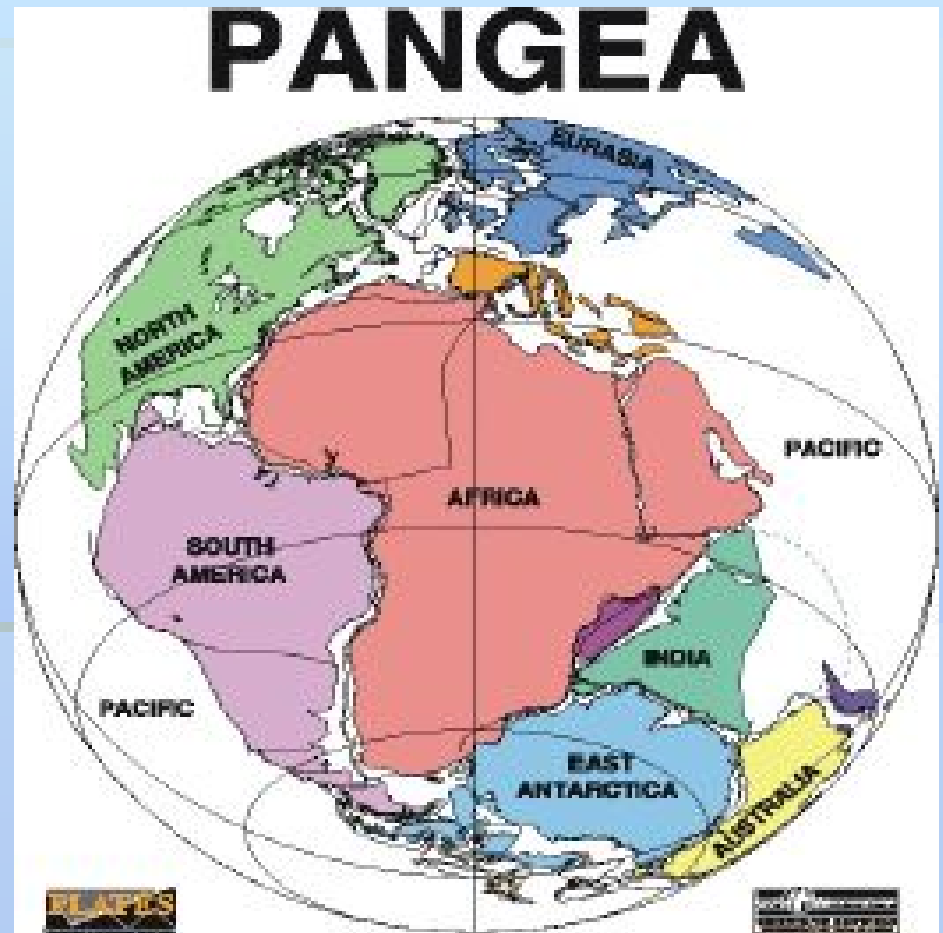
# The breakup of Pangea



PRESENT DAY

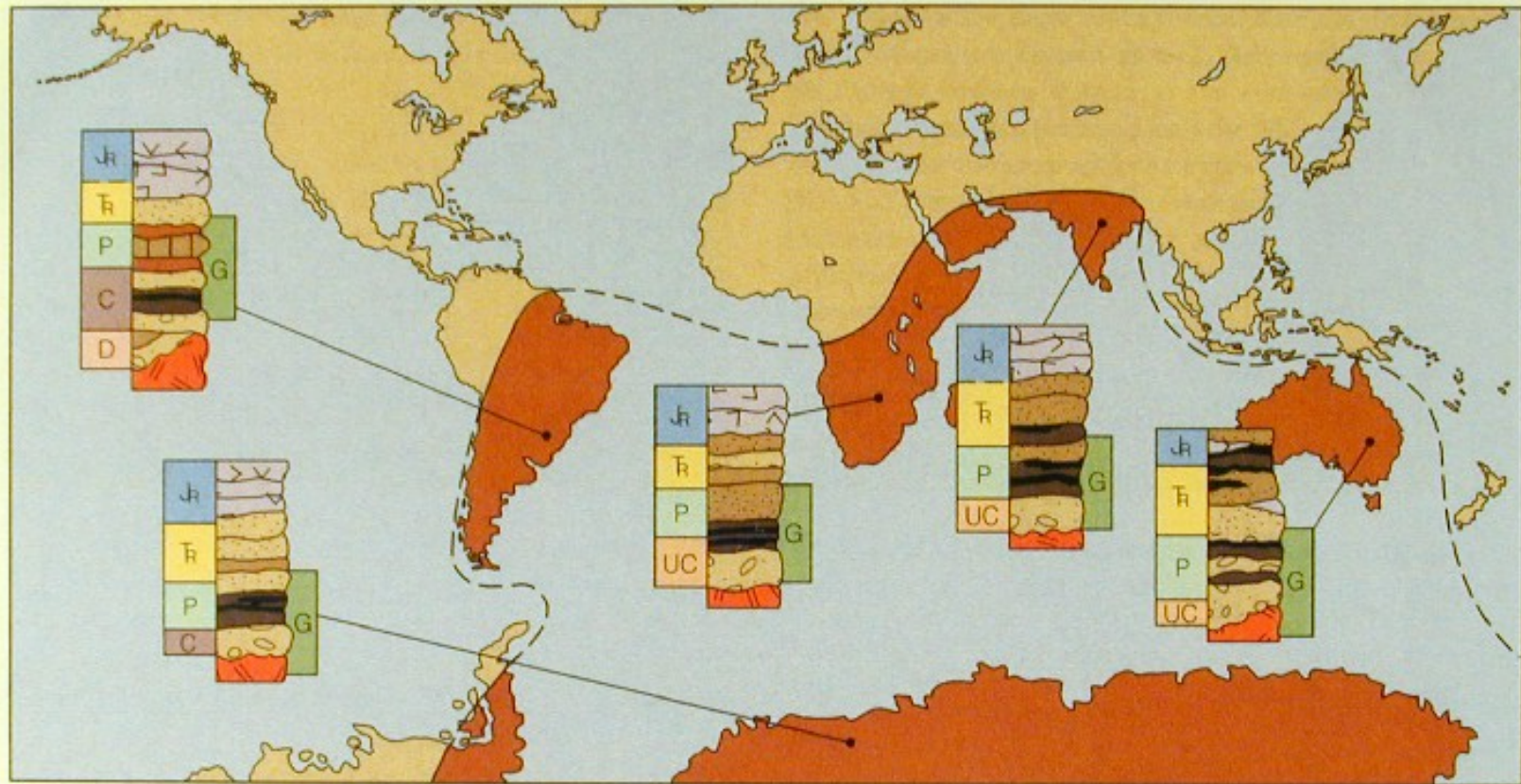
# Evidence for Continental Drift

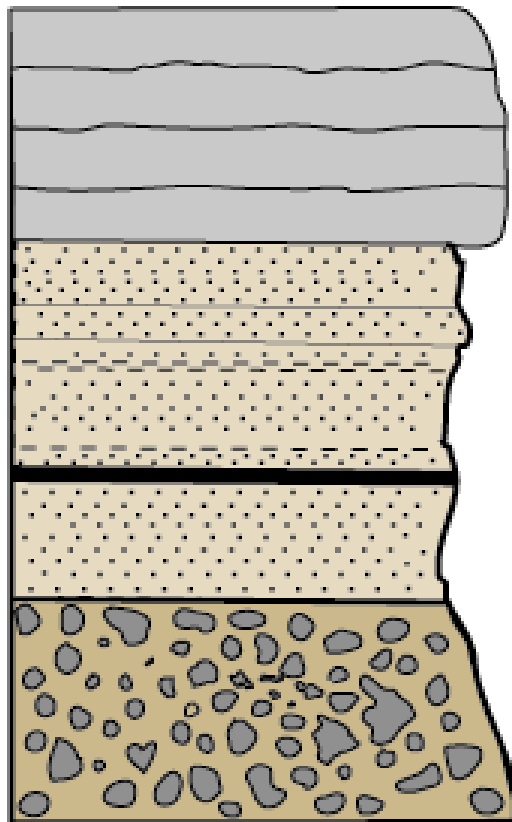
- The continents fit together especially if the continental shelves are included
- How they fit together works with the other evidence
- Movement is responsible for many landforms; changes to the crust





# Continental Drift Evidence in Rocks





basalt  
lava  
flows

sandstone  
shale

coal

glacial  
till

*Glossopteris*  
fossils

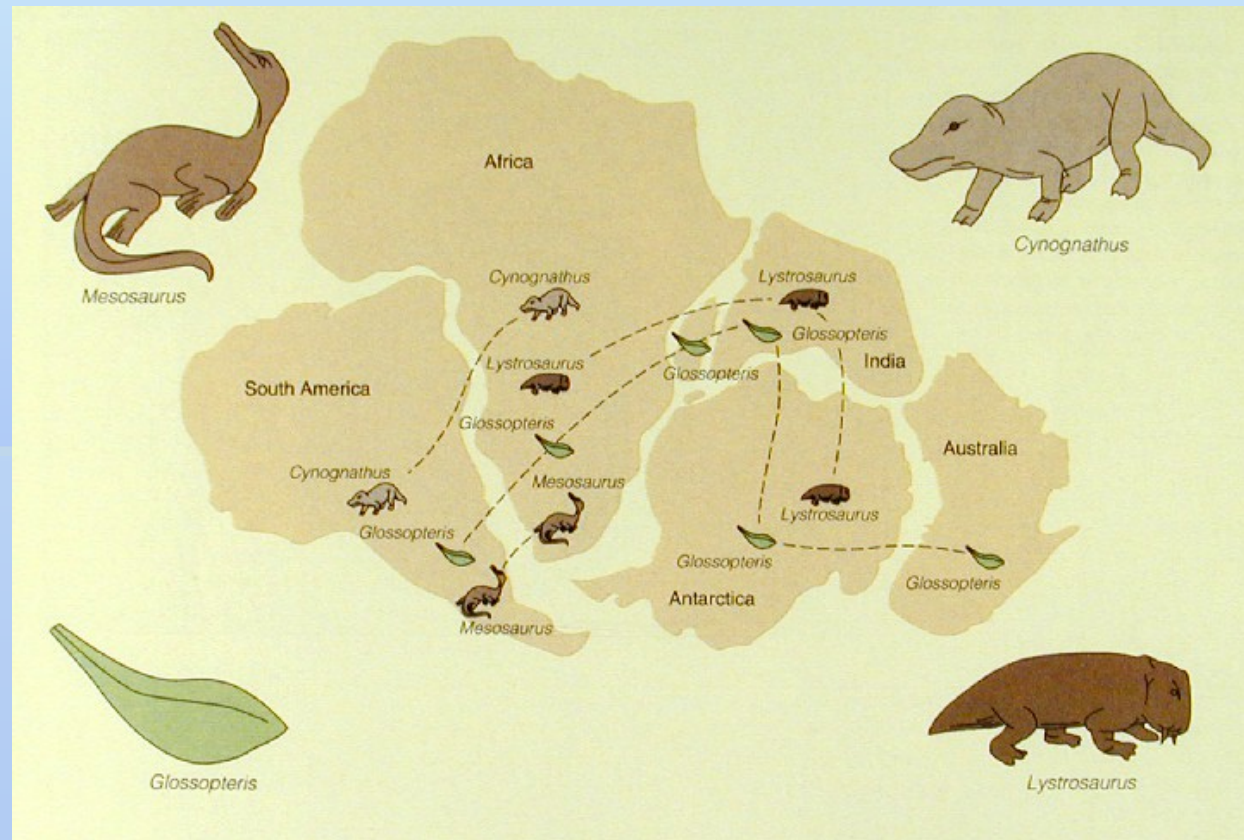
Similar layers of rock were formed in Antarctica, Australia, South America, Africa, and India before Pangea broke apart. *Glossopteris* fossils were found in the rocks on each continent.

# Evidence for Continental Drift

Faunal and Floral Similarities.

Madagascar and India

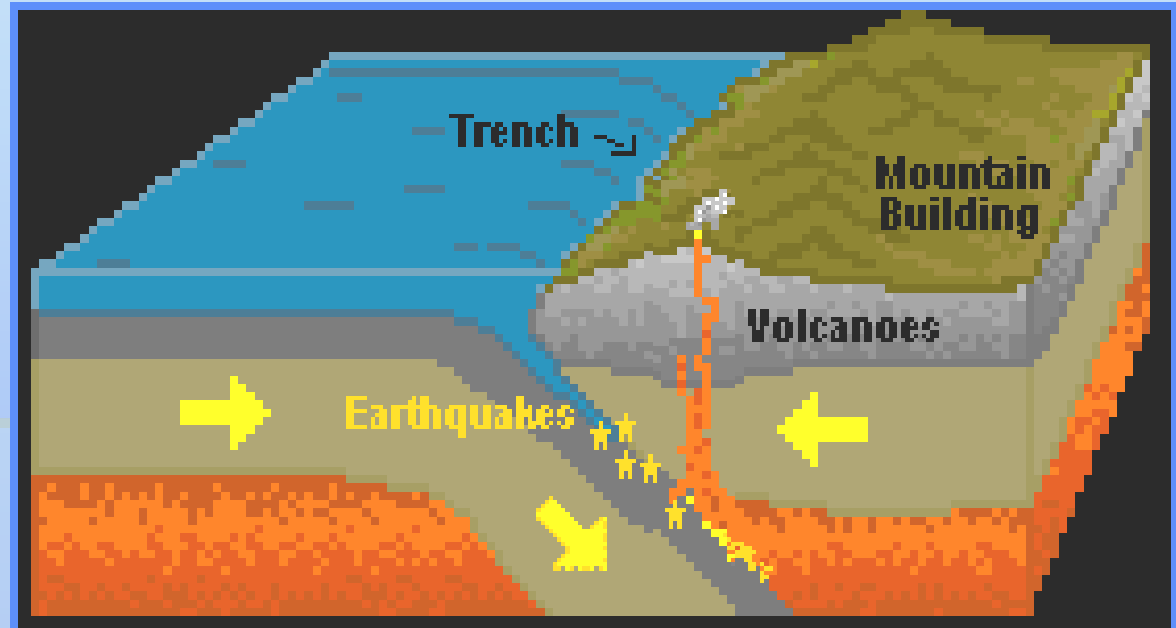
*Glossopteris* Flora



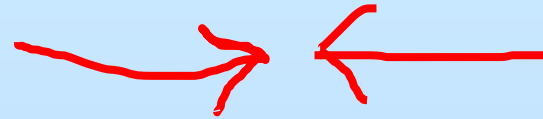
# What Goes On At Oceanic-Continental Convergent Plate Boundaries?



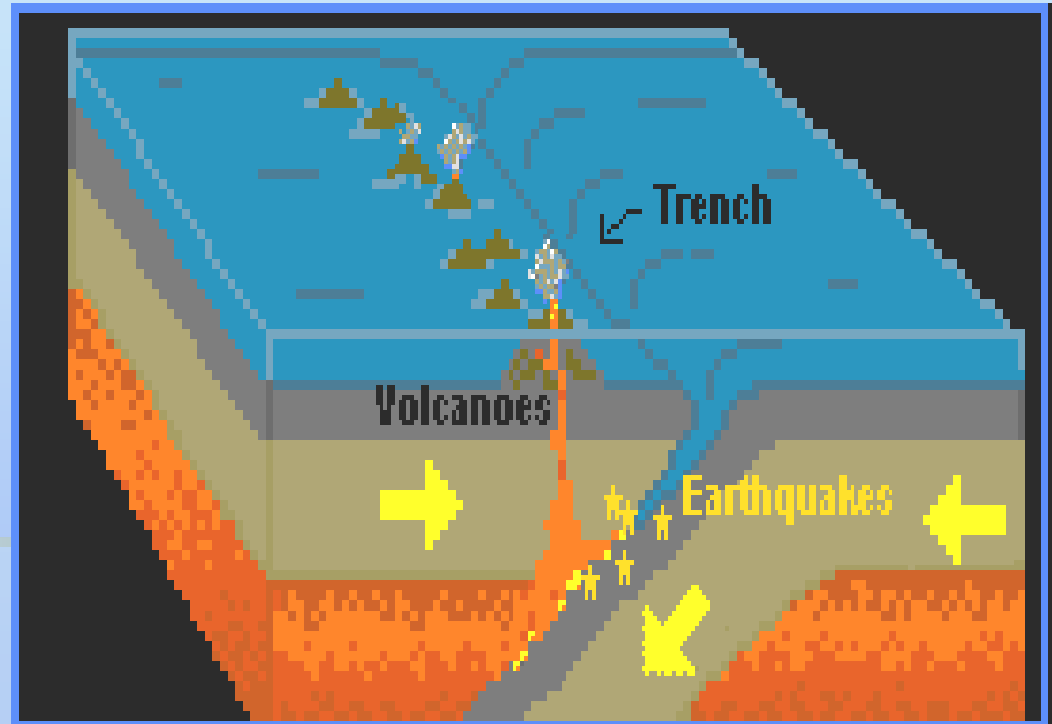
- Earthquakes occur as the ocean plate subducts
- An ocean trench forms as the sea floor bends
- Volcanoes form as magma erupts from the subduction zone
- Mountains form as sediments are folded and faulted



# Oceanic-Oceanic Convergent Plate Boundary

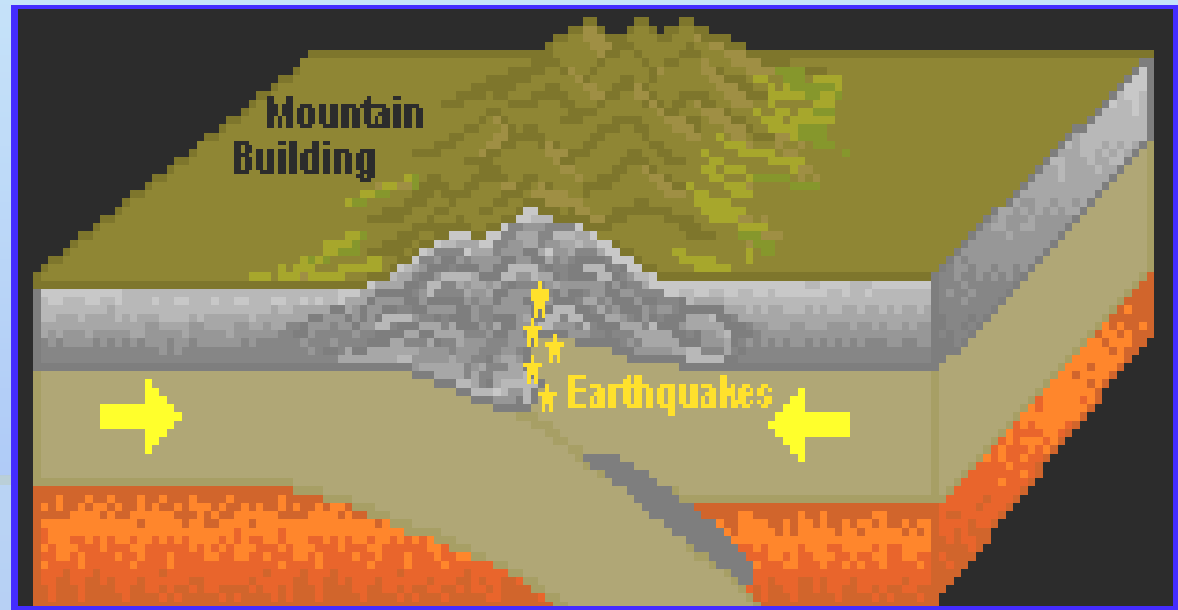


- Earthquakes occur as one ocean plate subducts
- An ocean trench forms as the sea floor bends
- A volcanic island arc forms as magma rises above the subduction zone



# Continental-Continental Convergent Plate Boundary

- Mountain building occurs as the continental crust is folded and faulted
- Earthquakes occur as two continents collide
- NO volcanic activity
- India crashes into Asia
- Himalayan Mountains and Tibetan Plateau are formed



# Plate Boundaries



# Transform Plate Boundary

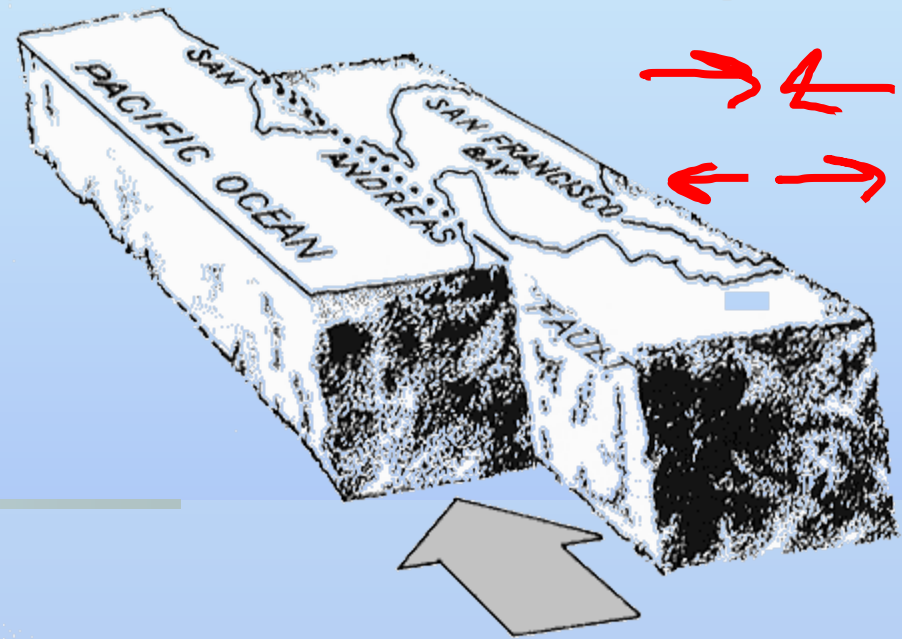
- **San Andreas Fault**
- **Earthquakes only**





# Transform Plate Boundaries

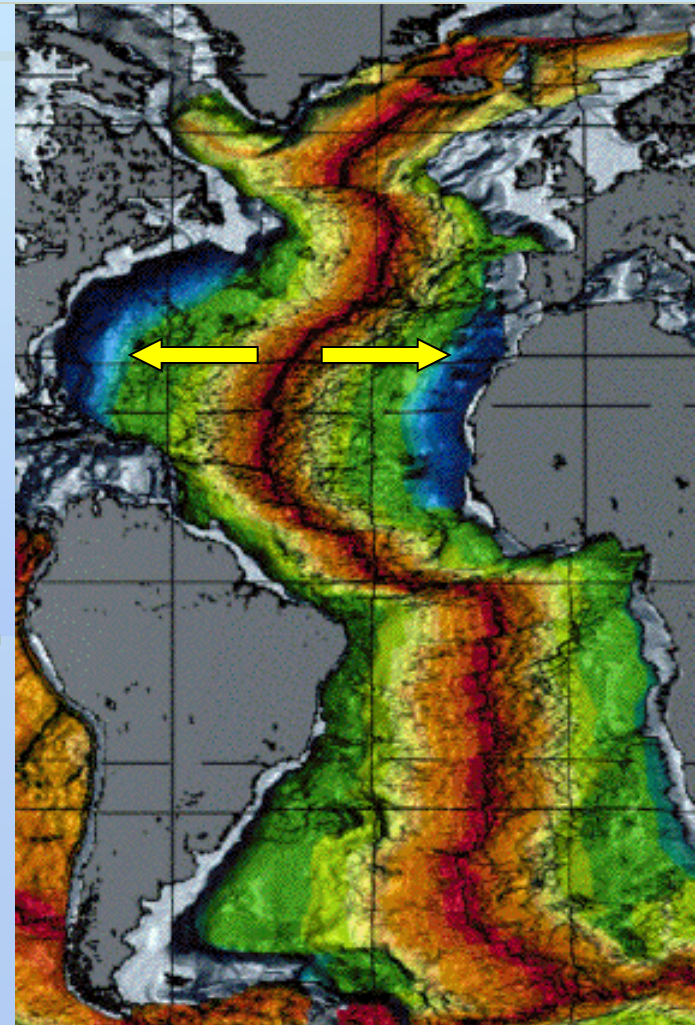
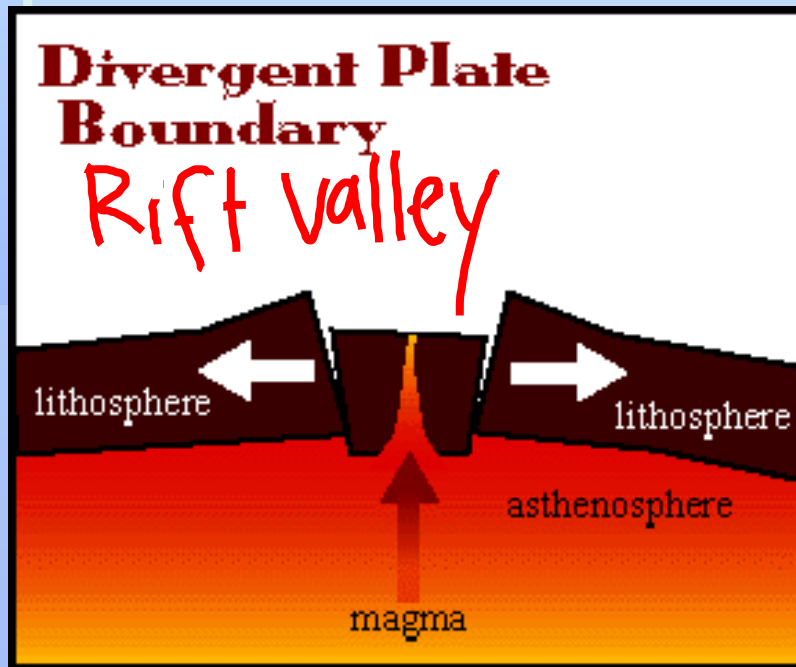
*transform*



# Divergent Boundaries



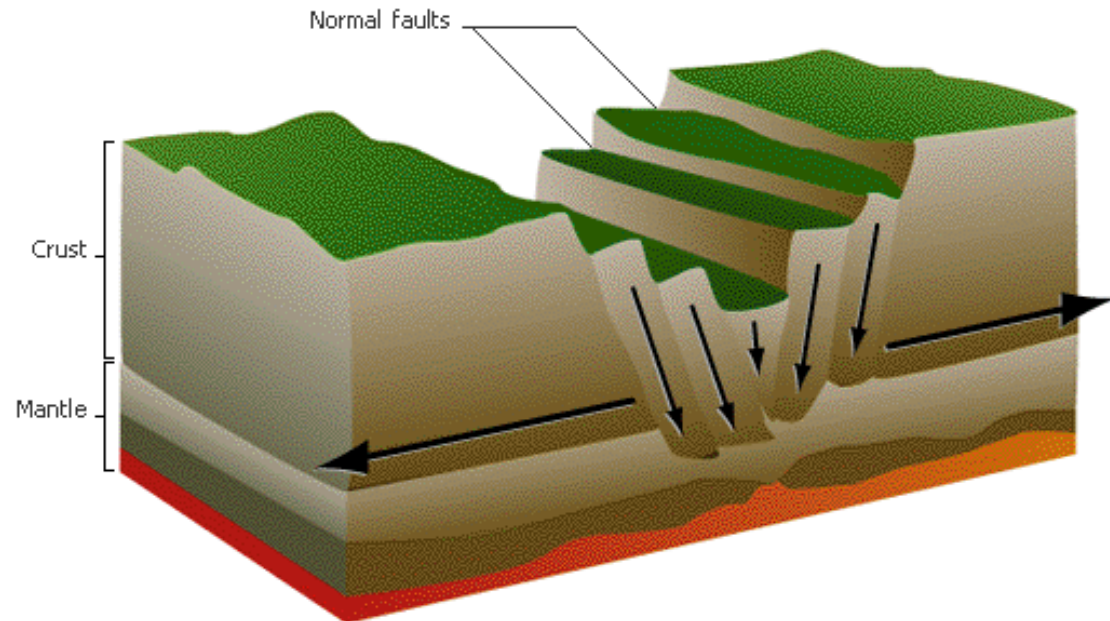
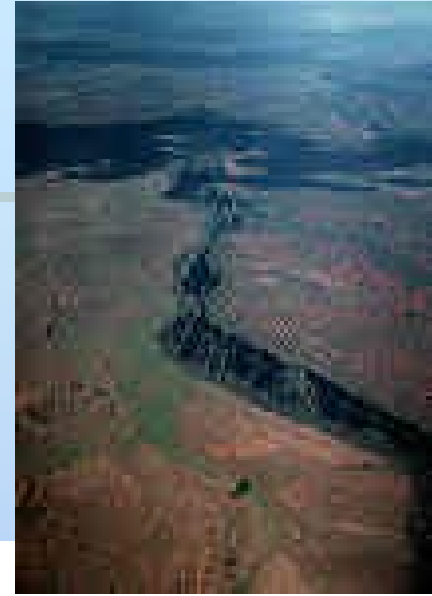
- Pulls apart oceanic crust
- Creates sea floor spreading
- Forms mid-ocean ridges



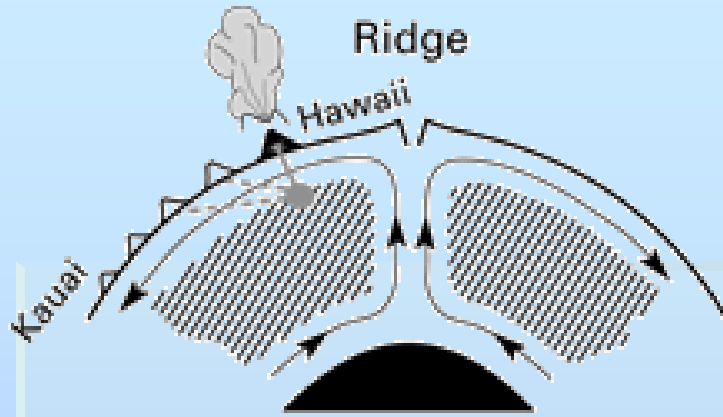
# Rift Valley

What kind of boundary is this?

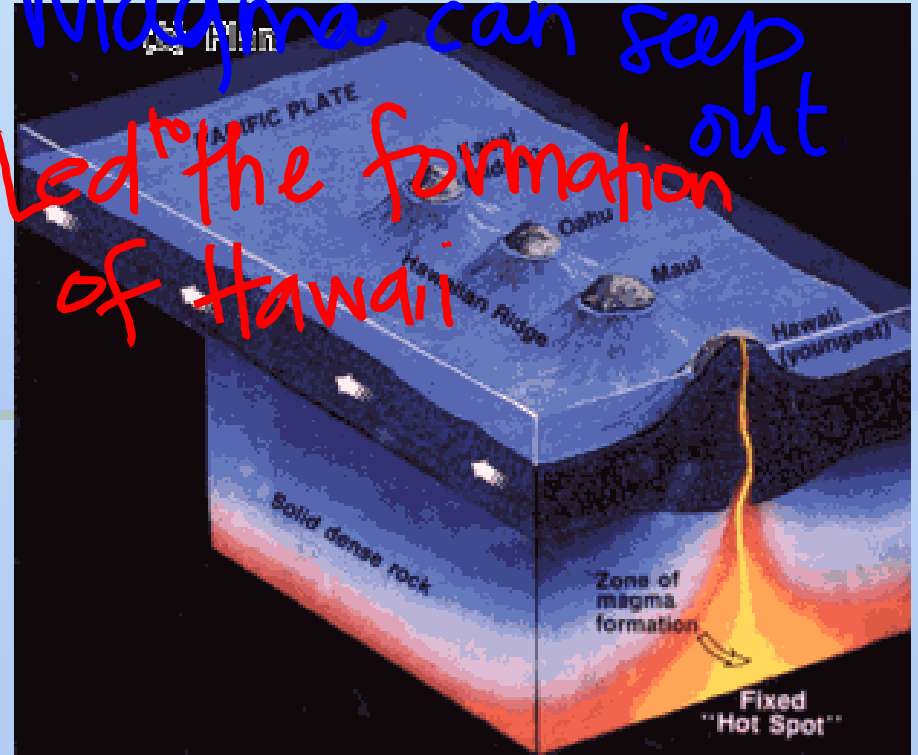
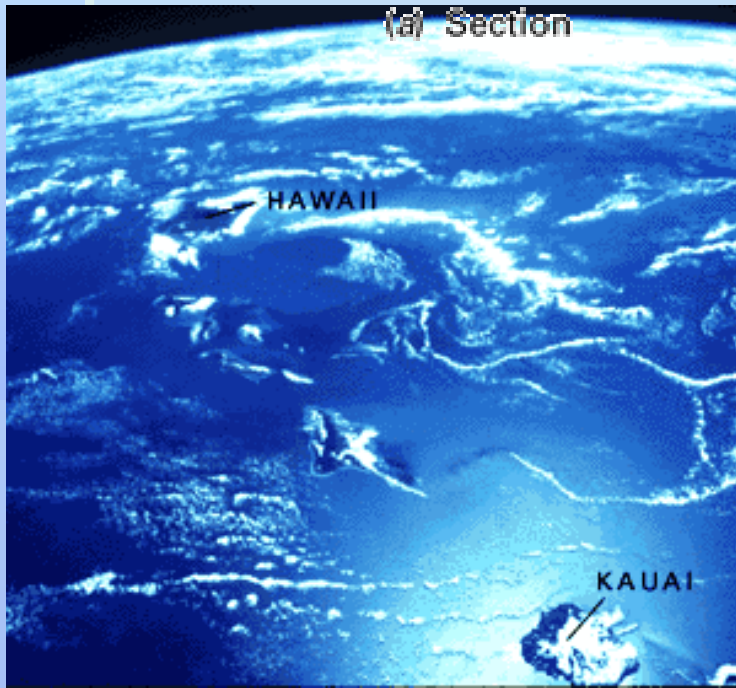
- Rift valleys are long, deep valleys bound by parallel faults.
- They form where Earth's crust is being pulled apart.
- Rift valleys can appear on land or beneath bodies of water.



# Hot Spots



Weak points in crust  
Magma can seep out  
Led to the formation of Hawaii



New studies suggest that hotspots are neither deep phenomena nor "fixed" in position over geologic time, as assumed in the popular plume model.

# What Moves the Plates?

- **Convection currents in the earth's mantle**
- **Slab-pull in the trenches**
- **Pushing out new crust from mid-ocean ridges**