



Volcanoes



What Causes volcanoes?

**Upward force of magma
because it is less dense than
rock**

Mt. St Helens before eruption



S
S

USGS Photo by Harry Glicken, May 17, 1980

Mount St. Helens - 24 September 2004 - 17:09:01 Pacific Daylight Time



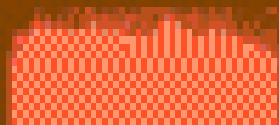
Johnston Ridge Observatory - Mount St. Helens National Volcanic Monument





Volcanoes terms

- **Vent is where magma moves onto earth's surface**
- **Crater is a steep walled depression around a vent**



Causes of Volcanoes

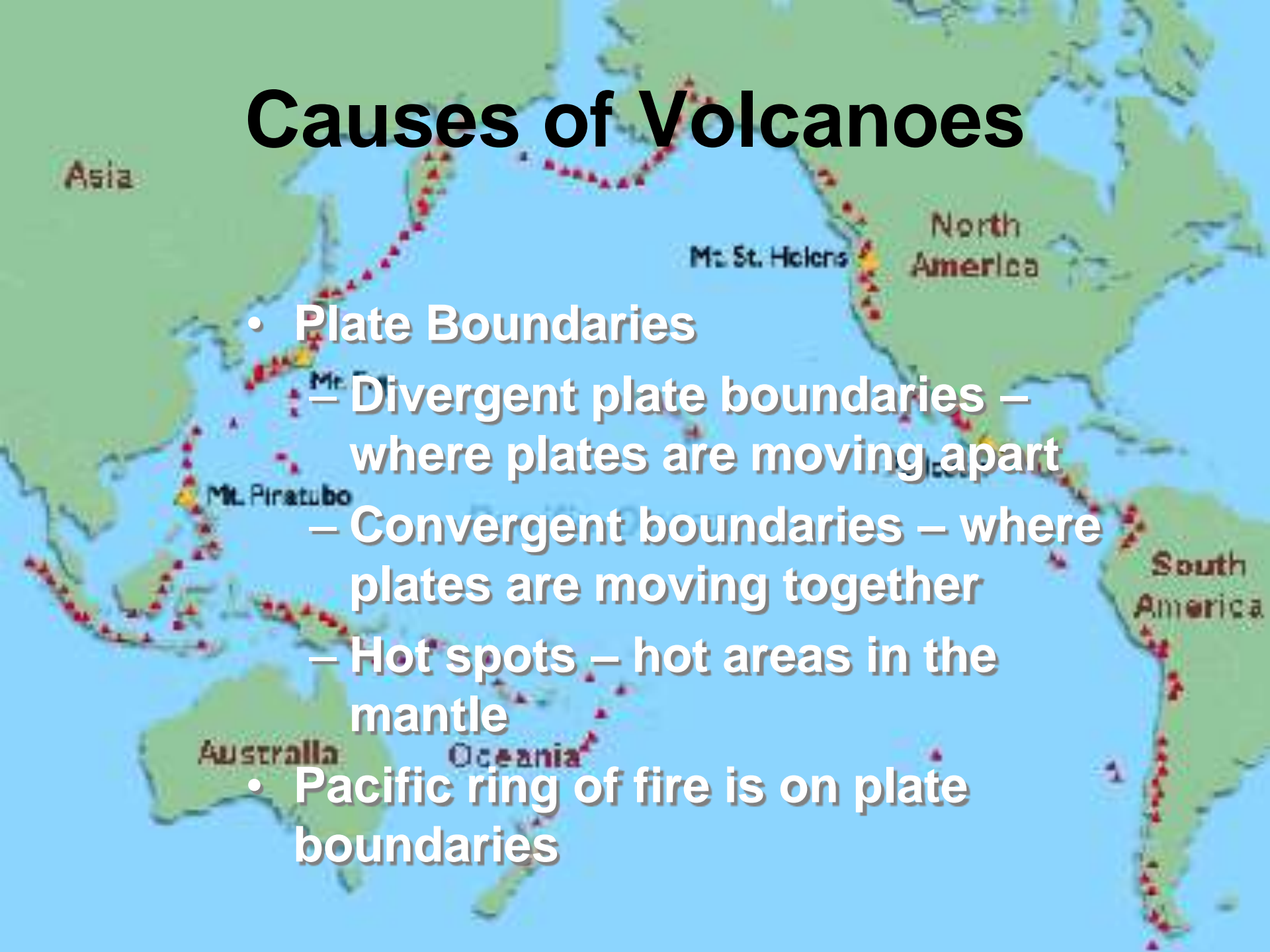
- **Plate Boundaries**

- Divergent plate boundaries – where plates are moving apart

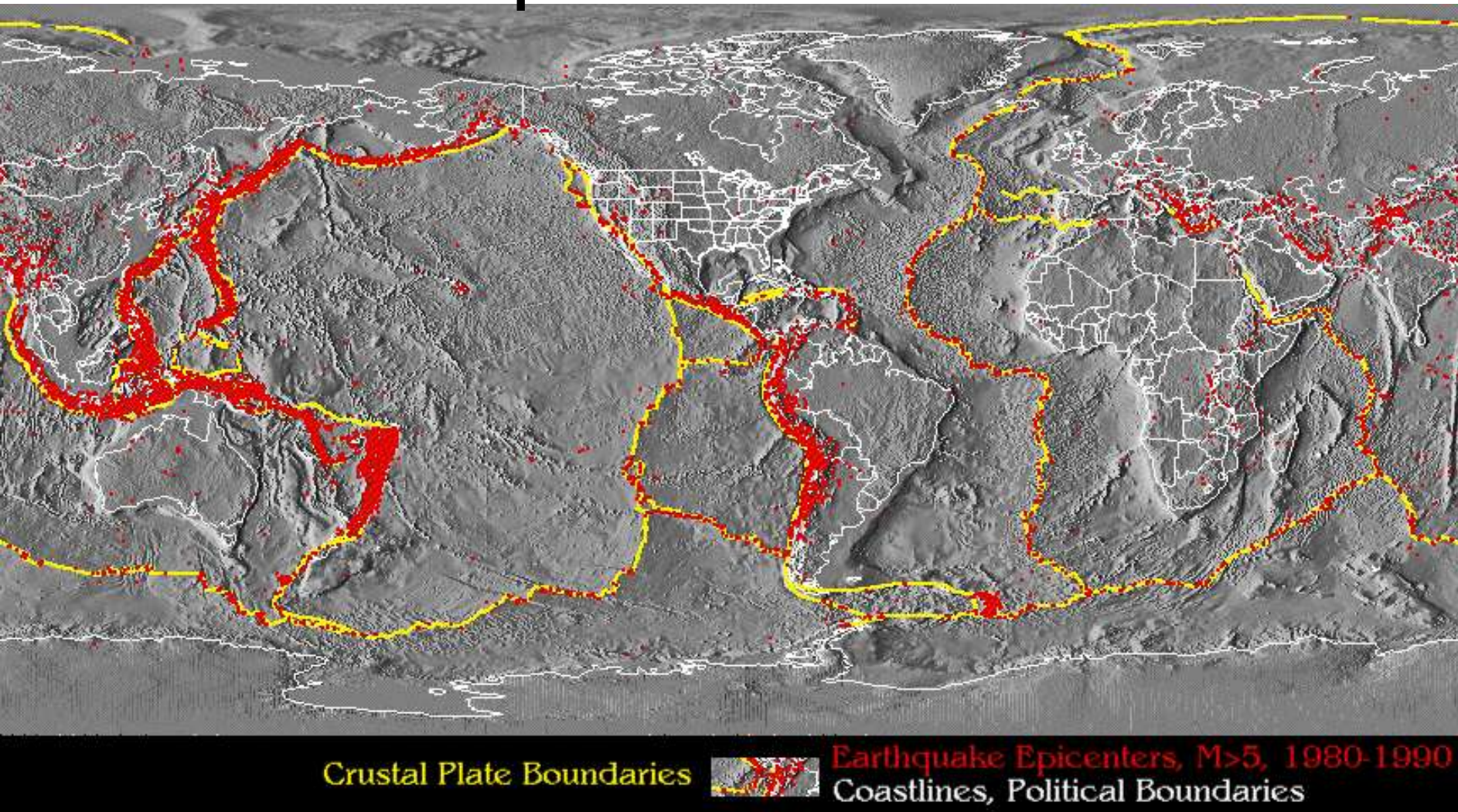
- Convergent boundaries – where plates are moving together

- Hot spots – hot areas in the mantle

- Pacific ring of fire is on plate boundaries

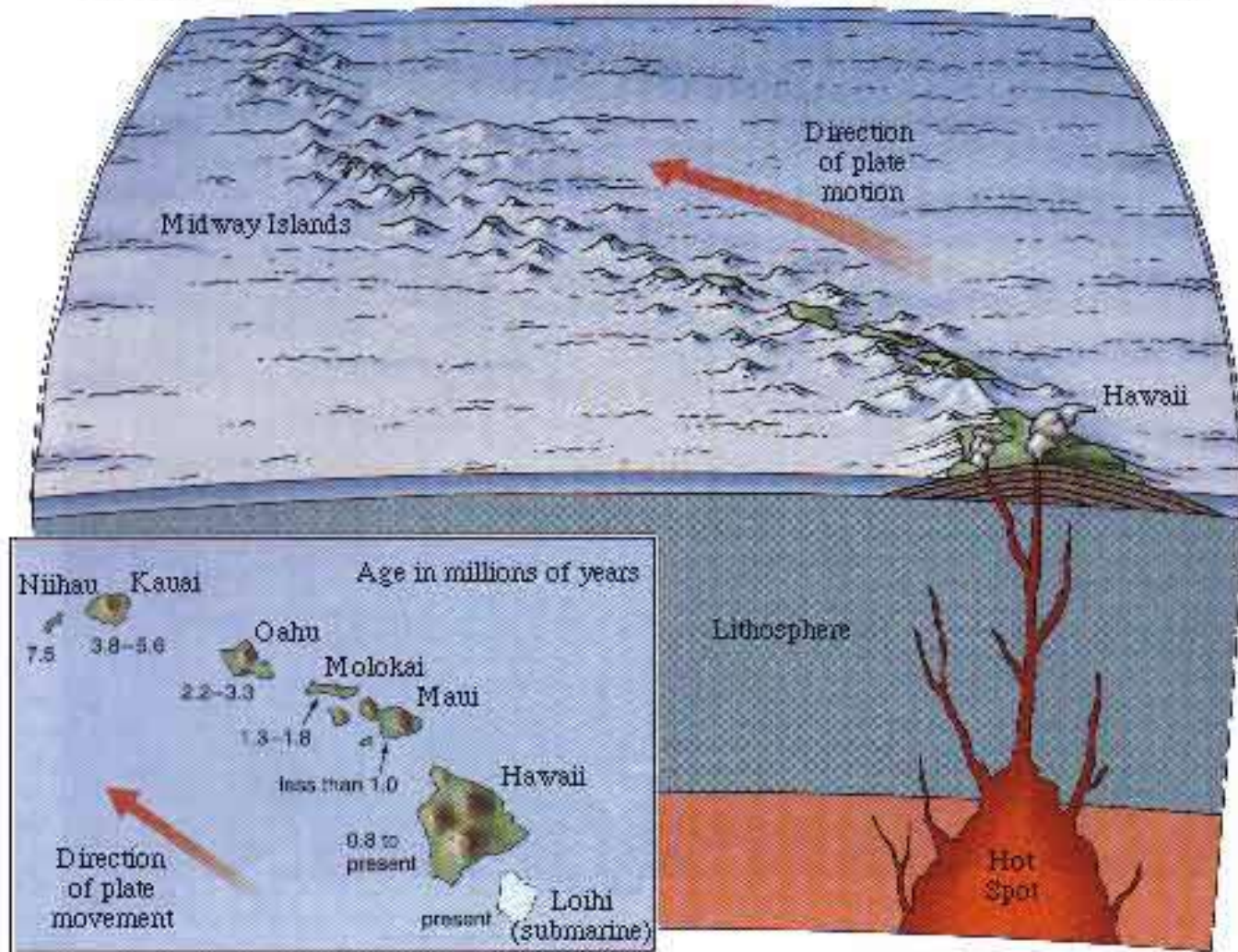


Earthquakes Worldwide

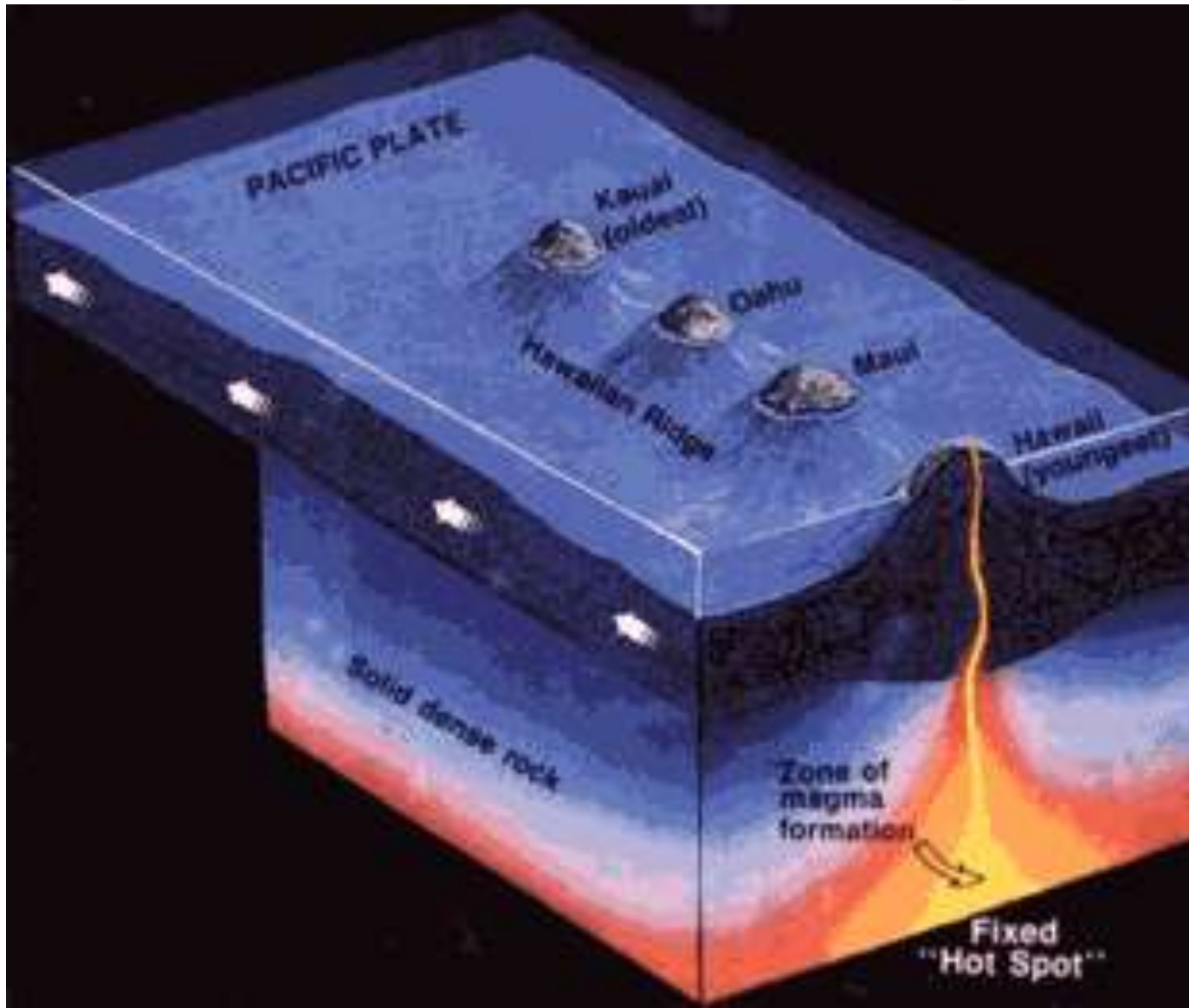


Mid-Plate Hotspots

Hawaiian Hot Spot and Hawaiian-Emperor Chain

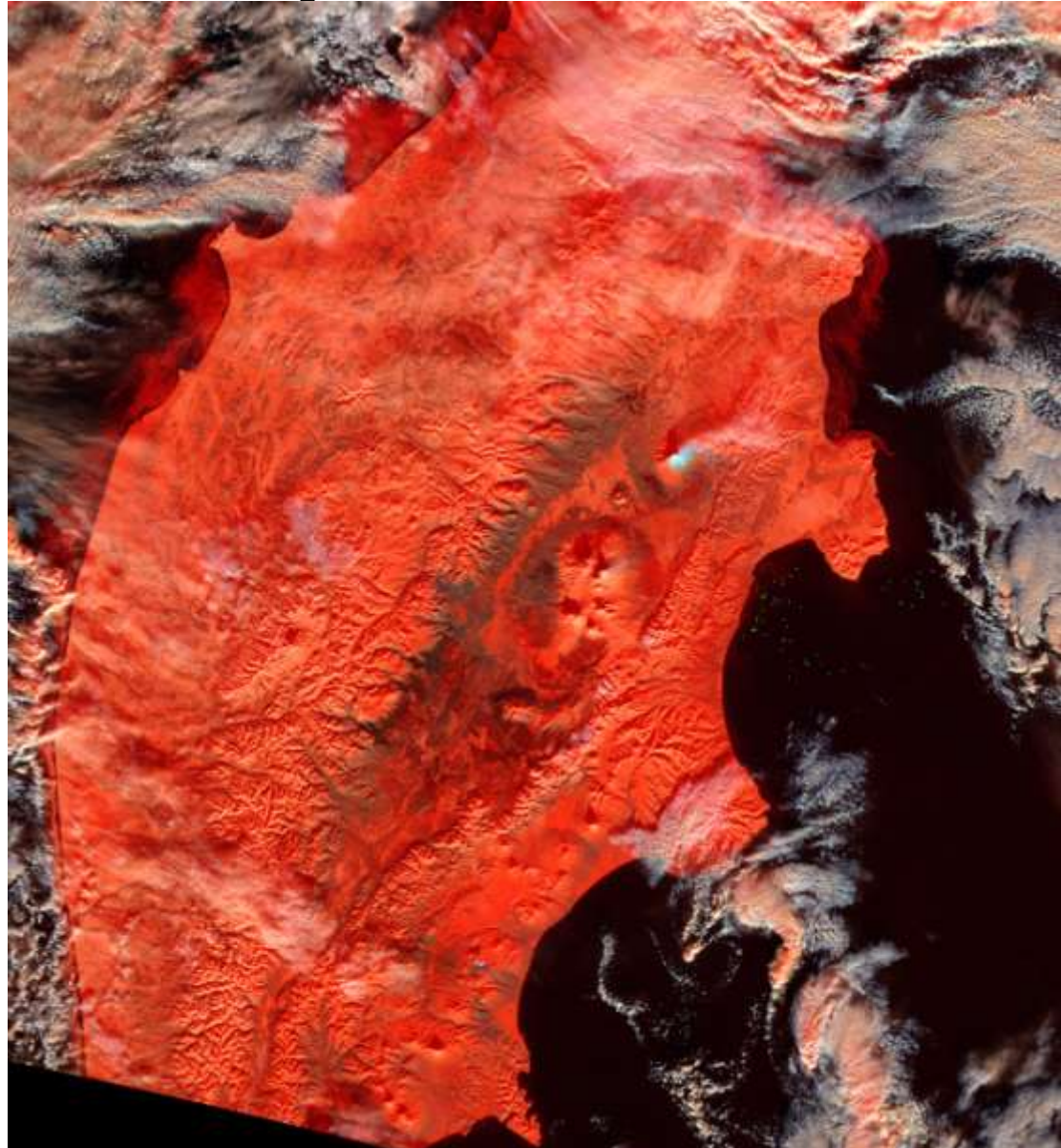


Mid-Plate Hotspots



Types of eruptions

- Explosive and violent
- Quiet lava flows
- Combination of the two



A powerful volcanic eruption is captured in this image, showing a thick, dark plume of ash and smoke rising vertically from a mountain. The plume is dense and billowing, with a dark, almost black core surrounded by lighter, greyish-brown ash. The eruption is set against a backdrop of a clear blue sky with some light clouds. The foreground shows a dark, rocky landscape with some sparse vegetation. The text "Explosive and violent" is overlaid on the image in a bold, orange font with a black outline, slanted diagonally across the center.

Explosive and violent

6 8:32:47.0



7 8:32:53.3



8 8:33:03.7



9 8:33:18.8



Volcanoes

Time lapse of the eruption



Quiet lava flow



- **Causes of variation**
 - Trapped gases
 - Composition of magma

Volcanoes



Quiet
lava
flows



Types of Magma

- **Basaltic magma is very fluid and produces quiet eruptions**
- **Granitic magma – causes violent eruptions**
 - Gets trapped in vents
 - Doesn't flow
 - Gases build up
 - Magma water content causes different amounts of energy release

water content also influences the violence of the explosion



Bridger mountains

A large volcanic eruption is shown, with a massive plume of ash and smoke rising into the sky. The plume is thick and billowing, with a dark, rocky base. The background shows a hazy, overcast sky and a dark, rocky landscape. The text is overlaid on the left side of the image.

Forms of volcanoes

Shield Volcano

Cinder cone volcano

Composite volcano

Shield (Basic) Cone

Mauna Loa Hawaii -USA

Shield Volcanoes are enormous features built up only from layers of lava. They produce lots of lava but they tend not to erupt violently.

Layers of Lava

Lava Flow

10,000m

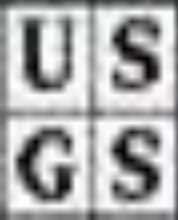
250 miles

Composite volcano to scale



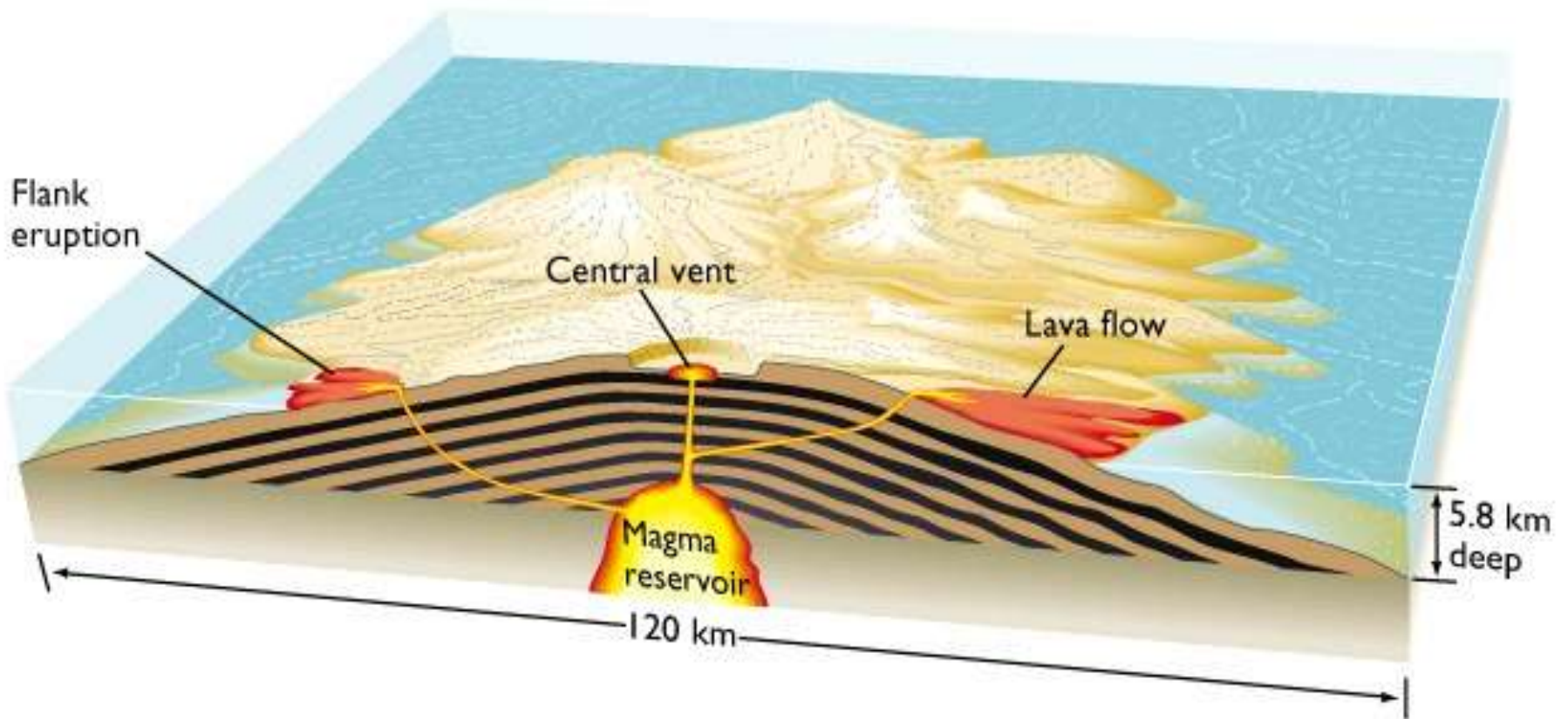
Shield volcano

- quiet eruptions that cause gentle sloping sides



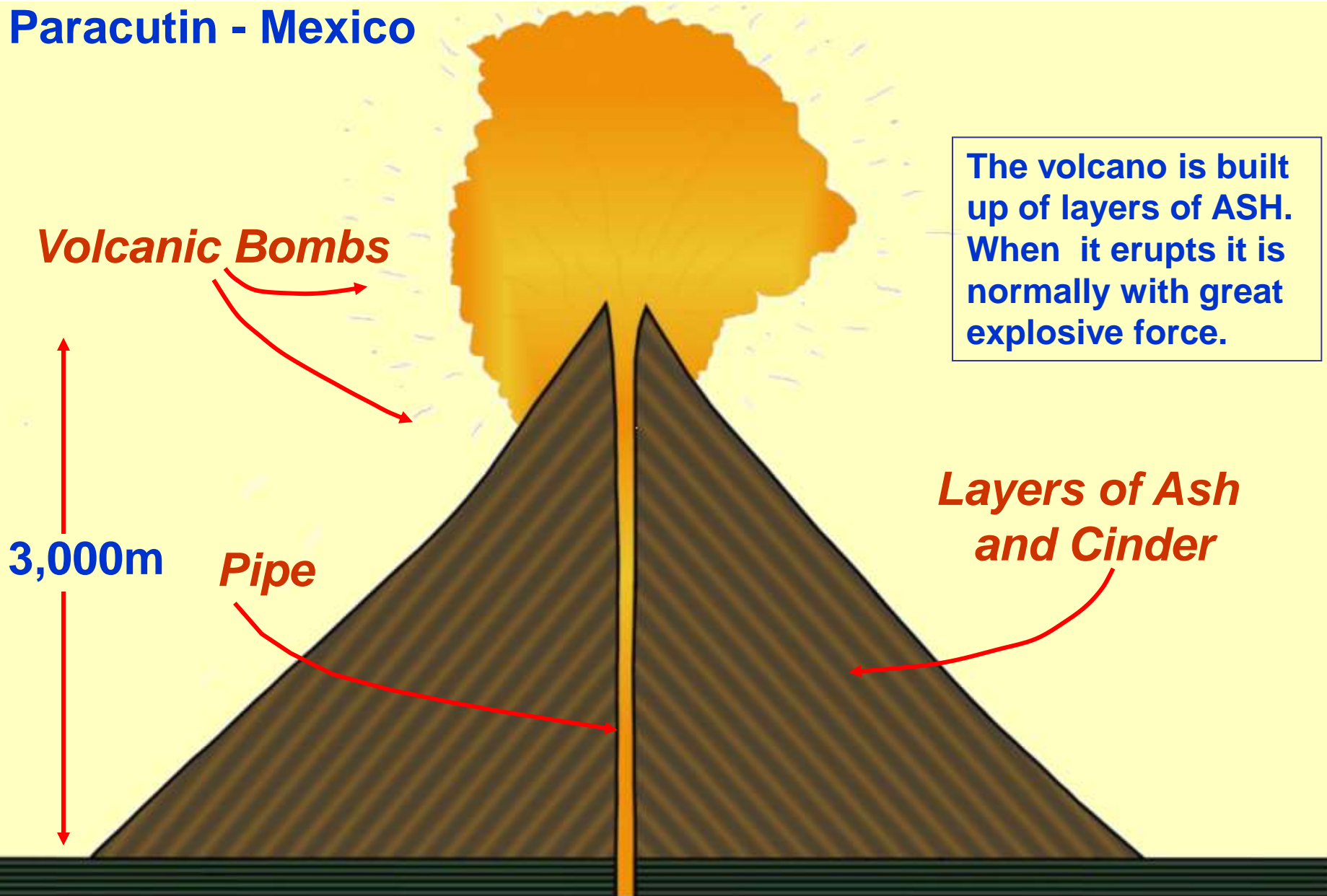
Volcanoes

Shield



Ash and Cinder Cone

Paracutin - Mexico



Cinder cone volcano

A photograph of a cinder cone volcano erupting. A large, bright red plume of lava is being thrown high into the air from the summit of the volcano. The volcano itself is a dark, conical shape. The sky is blue with some white clouds. The overall scene is dramatic and powerful.

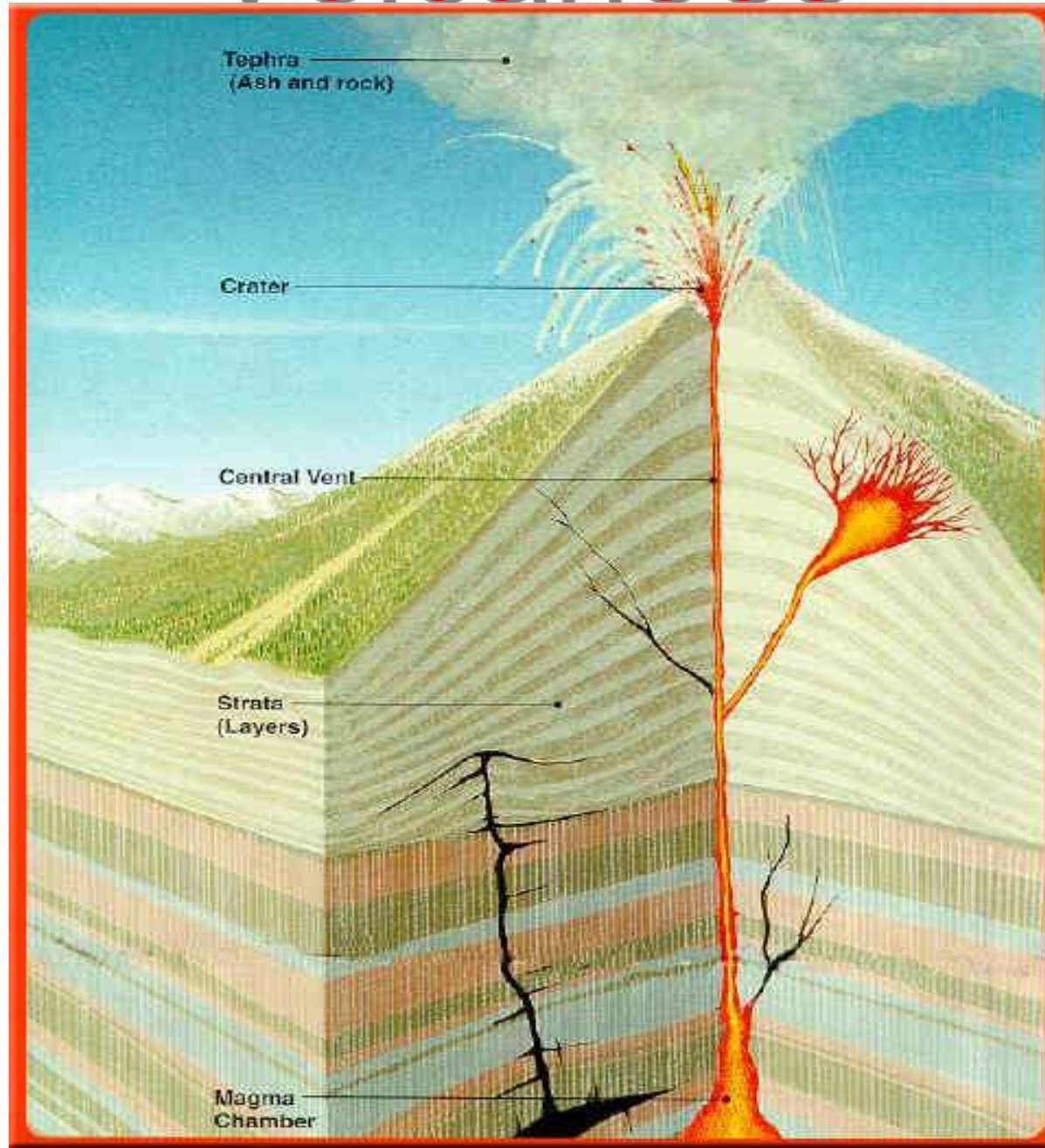
explosive eruptions that throw lava high in the air, the lava cools and forms different sizes of volcanic material called tephra which falls into a cinder cone

Composite volcano

- vary between quiet and violent going from tephra layer to quiet lava flow



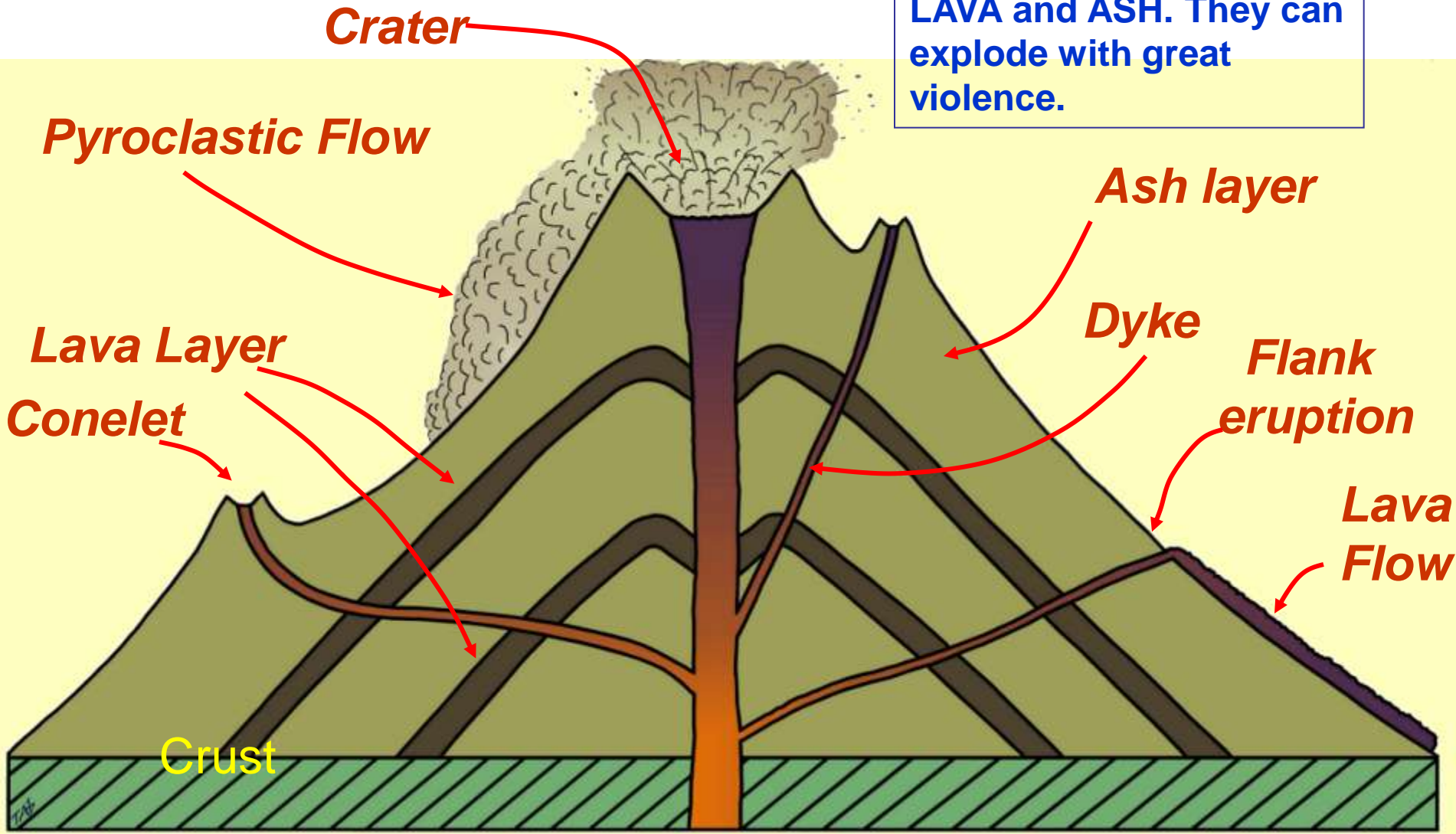
Volcanoes



Composite Cone

Mt St Helens - USA

The volcano is built up of alternate layers of LAVA and ASH. They can explode with great violence.



Igneous Rock Features



- **Batholiths** – magma cools before reaching surface
- **Dikes & Sills**
 - **Dike** – magma squeezed into vertical cracks and cools
 - **Sill** – magma squeezes into a horizontal crack
- **Other features**

Volcanic neck

- magma cools in a volcanic vent



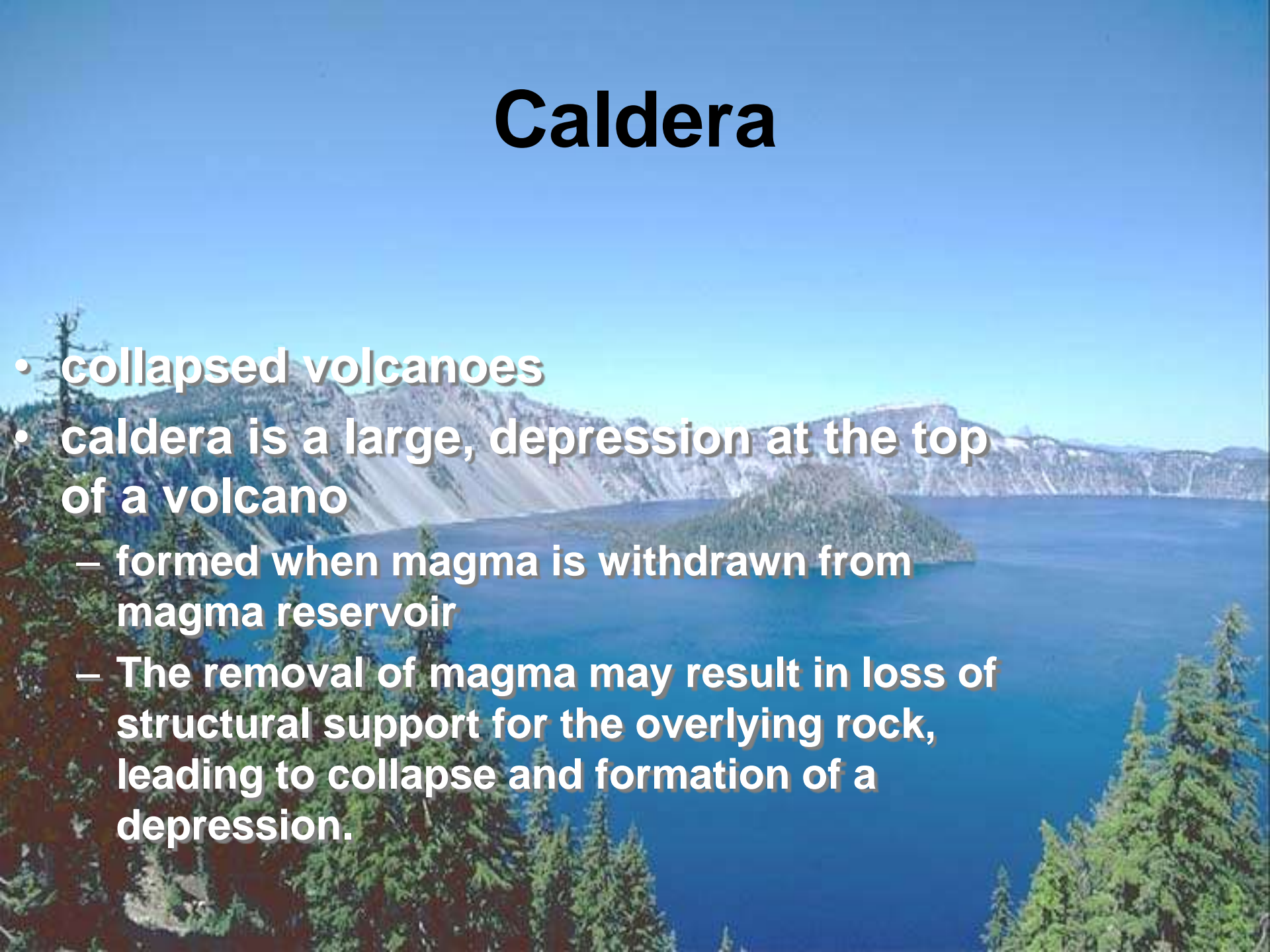
Shiprock is a volcanic neck, an erosional remnant, northwest New Mexico



Devils Tower, Wyoming

Caldera

- collapsed volcanoes
- caldera is a large, depression at the top of a volcano
 - formed when magma is withdrawn from magma reservoir
 - The removal of magma may result in loss of structural support for the overlying rock, leading to collapse and formation of a depression.

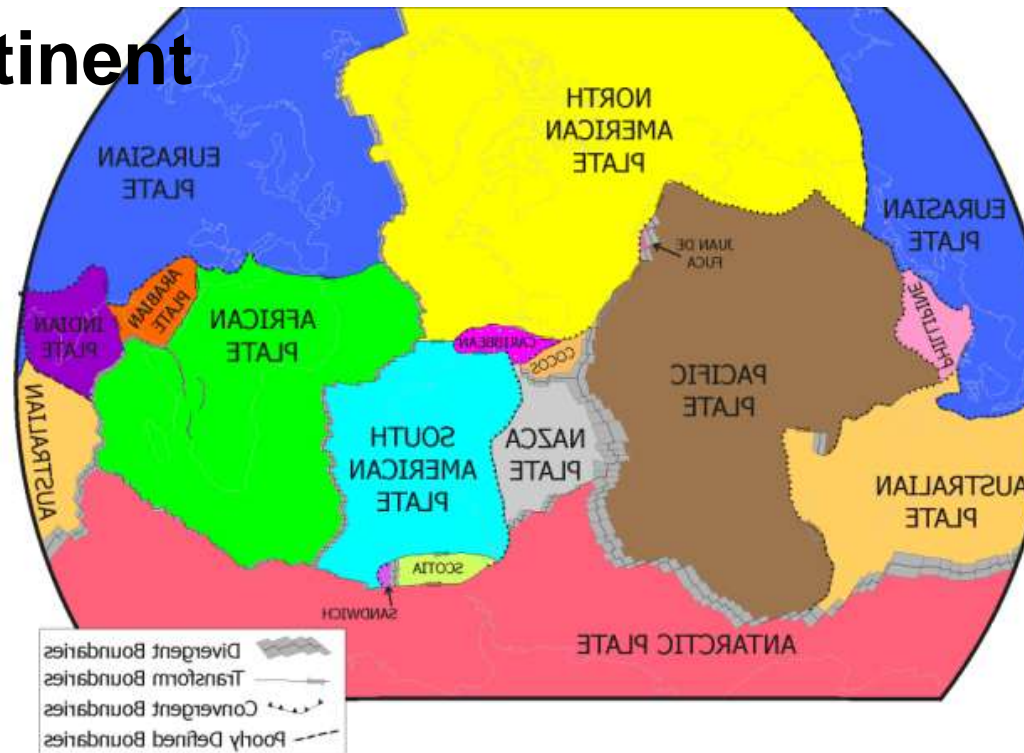


Quiz

1. What are the three types of lava flows?
2. What are the three types of volcanoes and what type of lava flow cause each?
3. What are the three causes of volcanoes?
4. Name three geological formations that are the result of volcanoes.
5. What type of lava causes quiet lava flows?

Plate Tectonics – *Continents are moving*

- Evidence for Continental drift (The idea that the continents have moved to the position they are in now)
- Wegener proposed the Idea in 1912 at the time there was opposition
- Pangaea – super continent

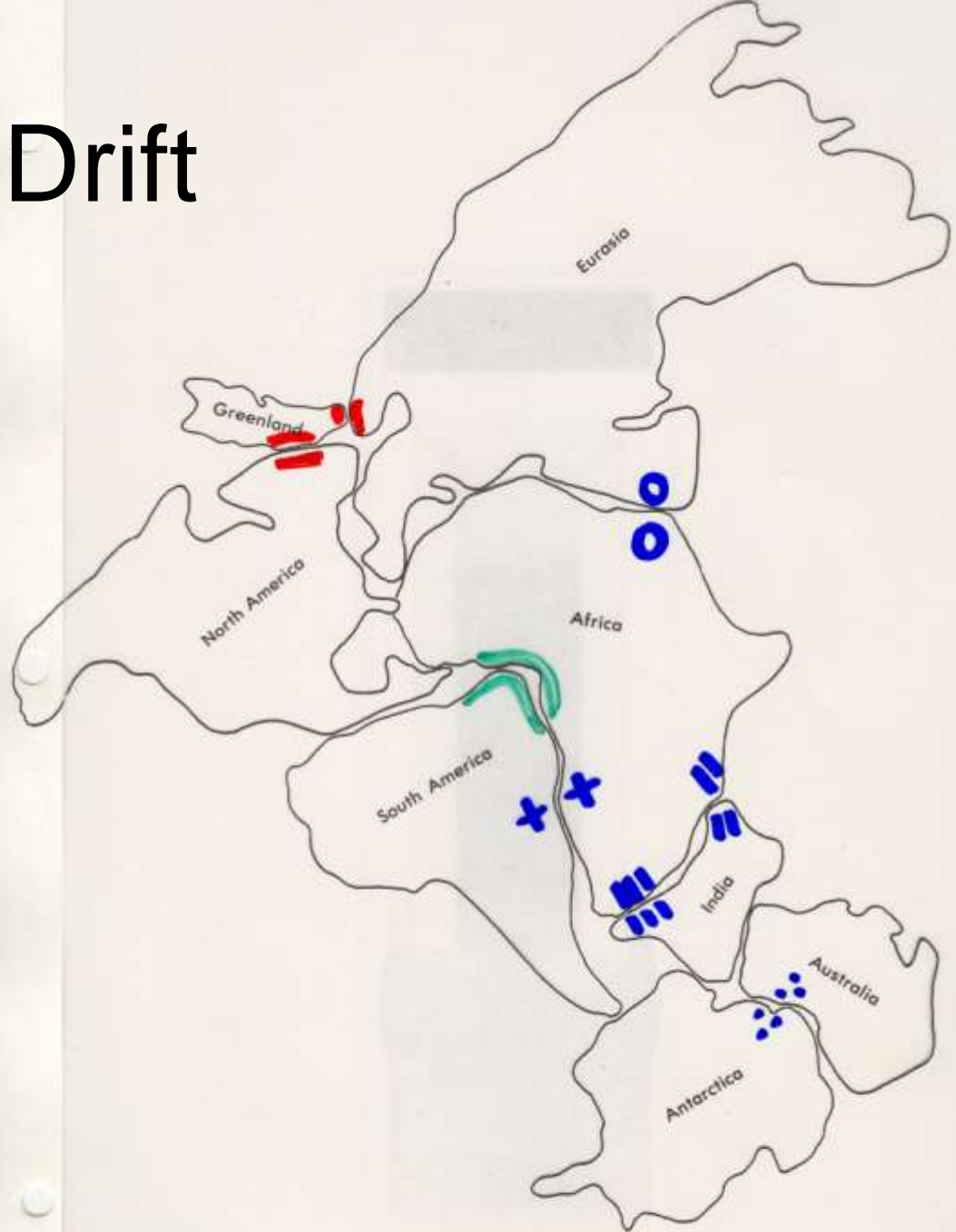


Alfred Wegener

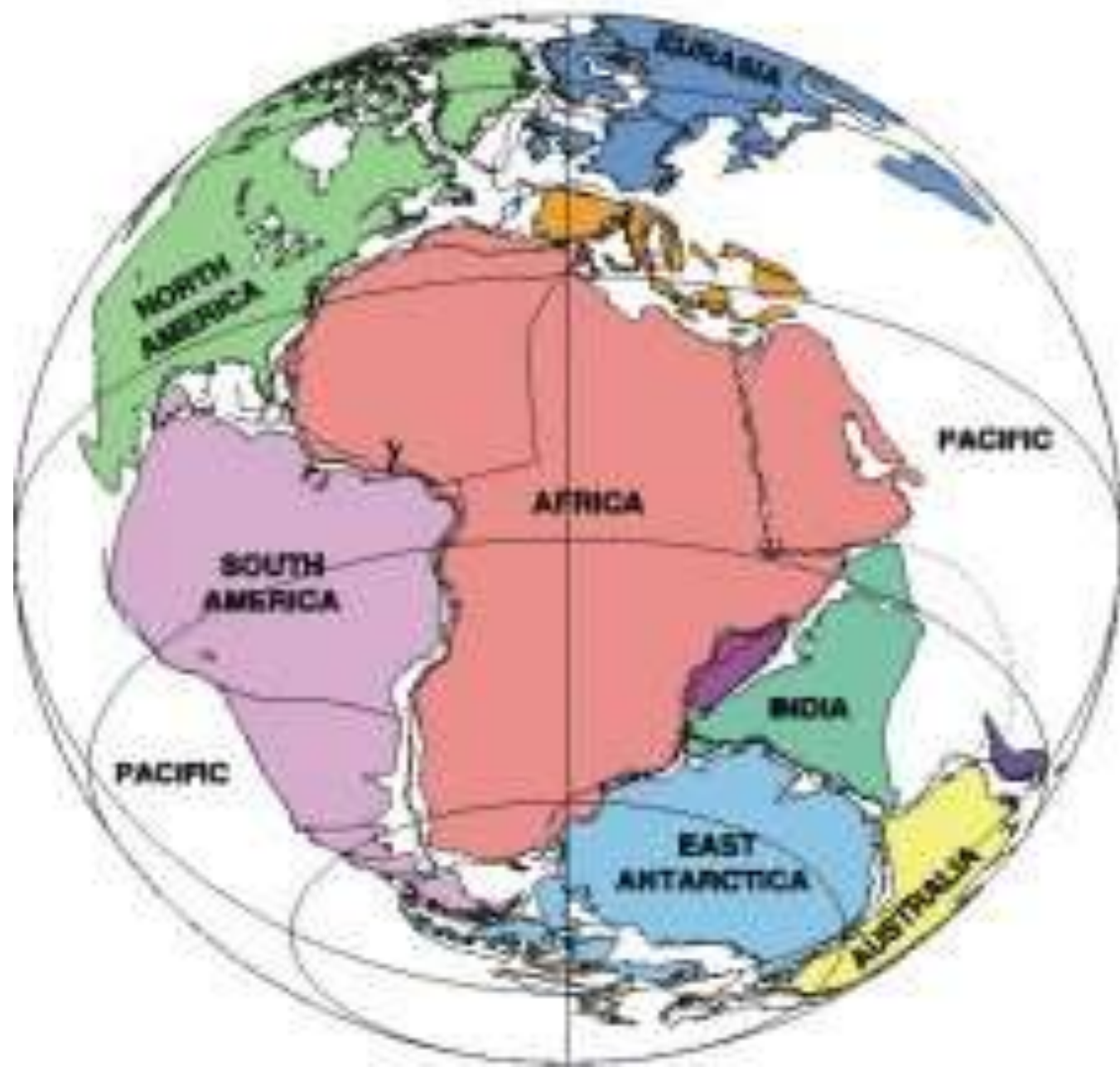


Continental Drift

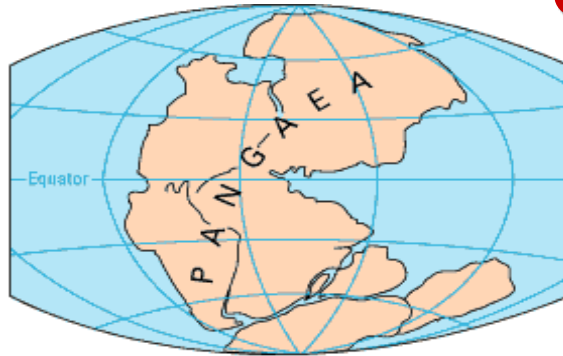
Wegener proposed the theory that the crustal plates are moving over the mantle. This was supported by fossil and rock type evidence; also matching of coastline shapes.



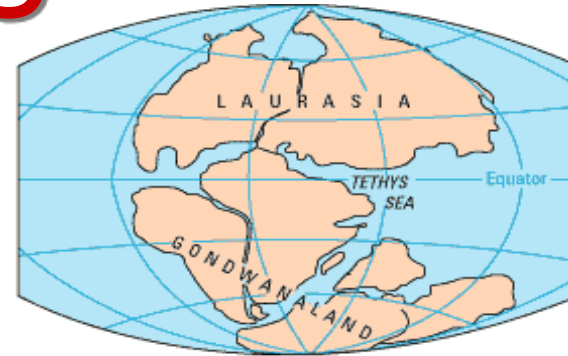
PANGAEA



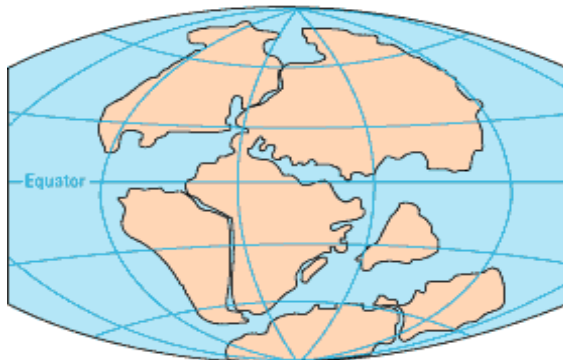
Pangea



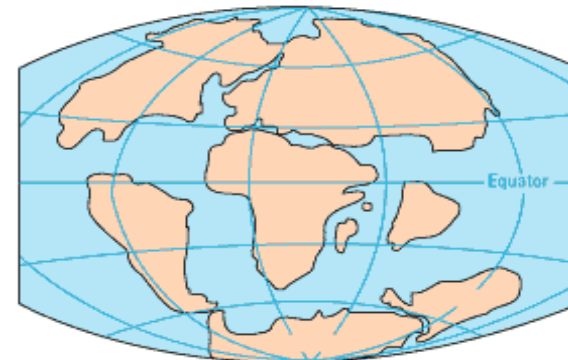
PERMIAN
225 million years ago



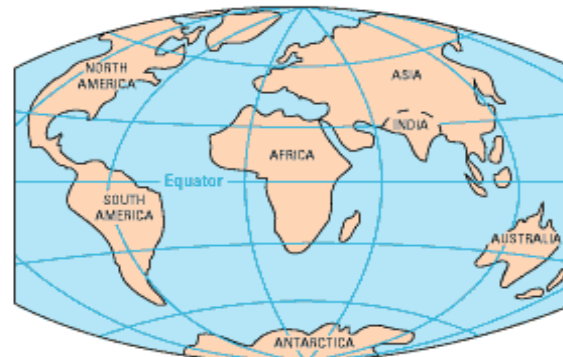
TRIASSIC
200 million years ago



JURASSIC
135 million years ago



CRETACEOUS
65 million years ago



PRESENT DAY

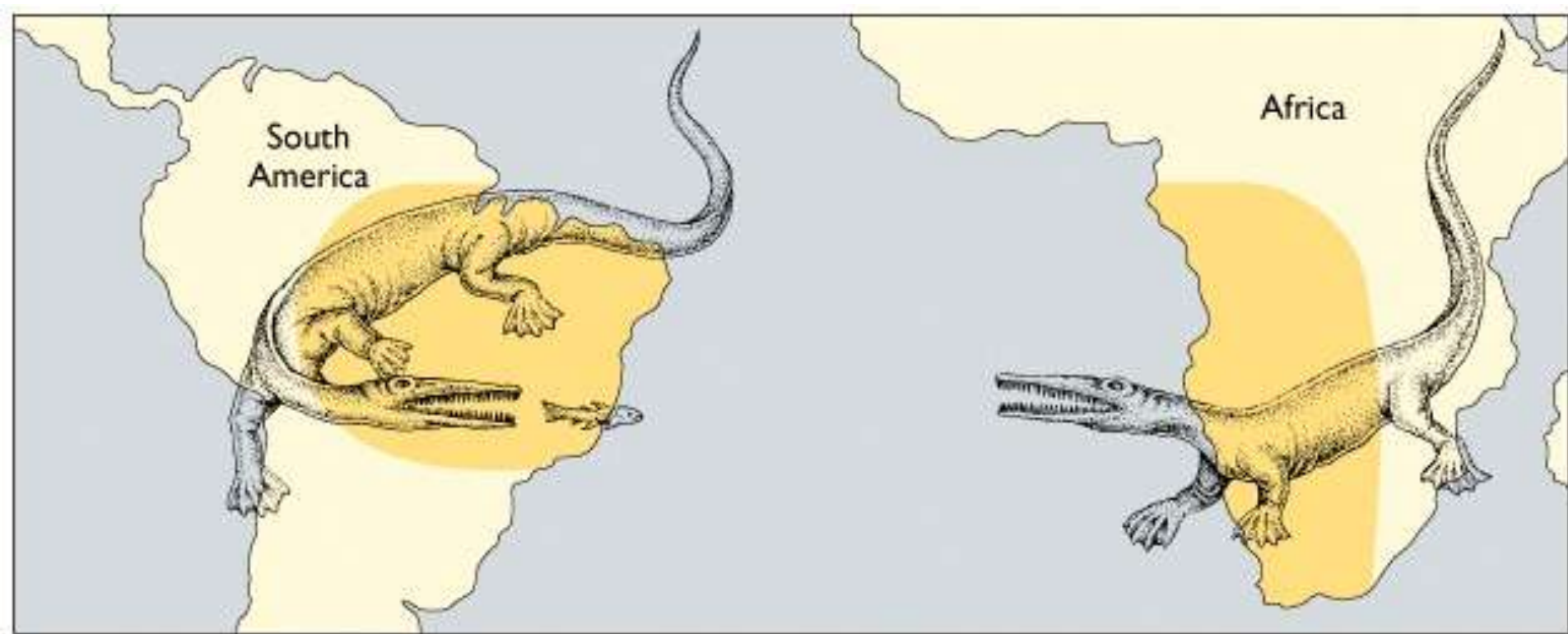
The
break up
of
Pangea

Evidence to Support the continental drift theory

- **Puzzle like fitting together**
- **Fossils that are alike are found on different continents that were thought to be once connected**
- **Similar climates in fossil record**
- **Similar rock on different continents that were once connected.**

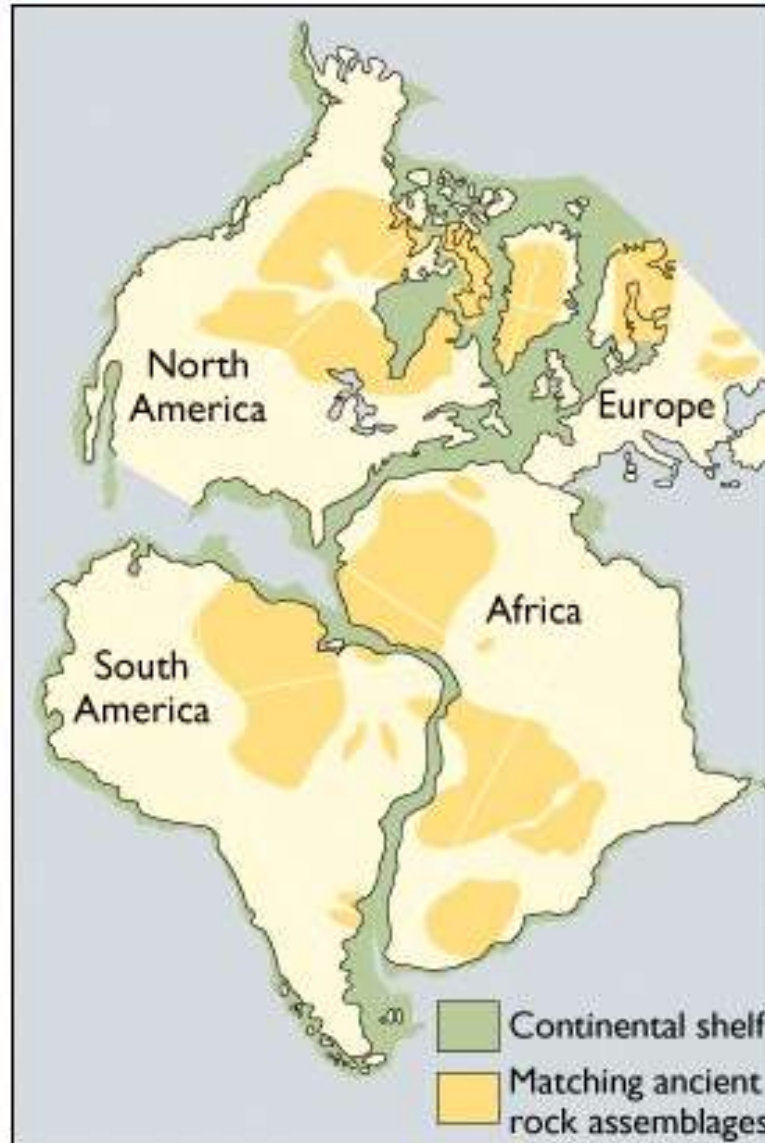


Similar Fossils



Our first evidence of tectonic motion is based on similar fossils and rock types on opposing sides of the ocean

Puzzle pieces



Tectonic Plates

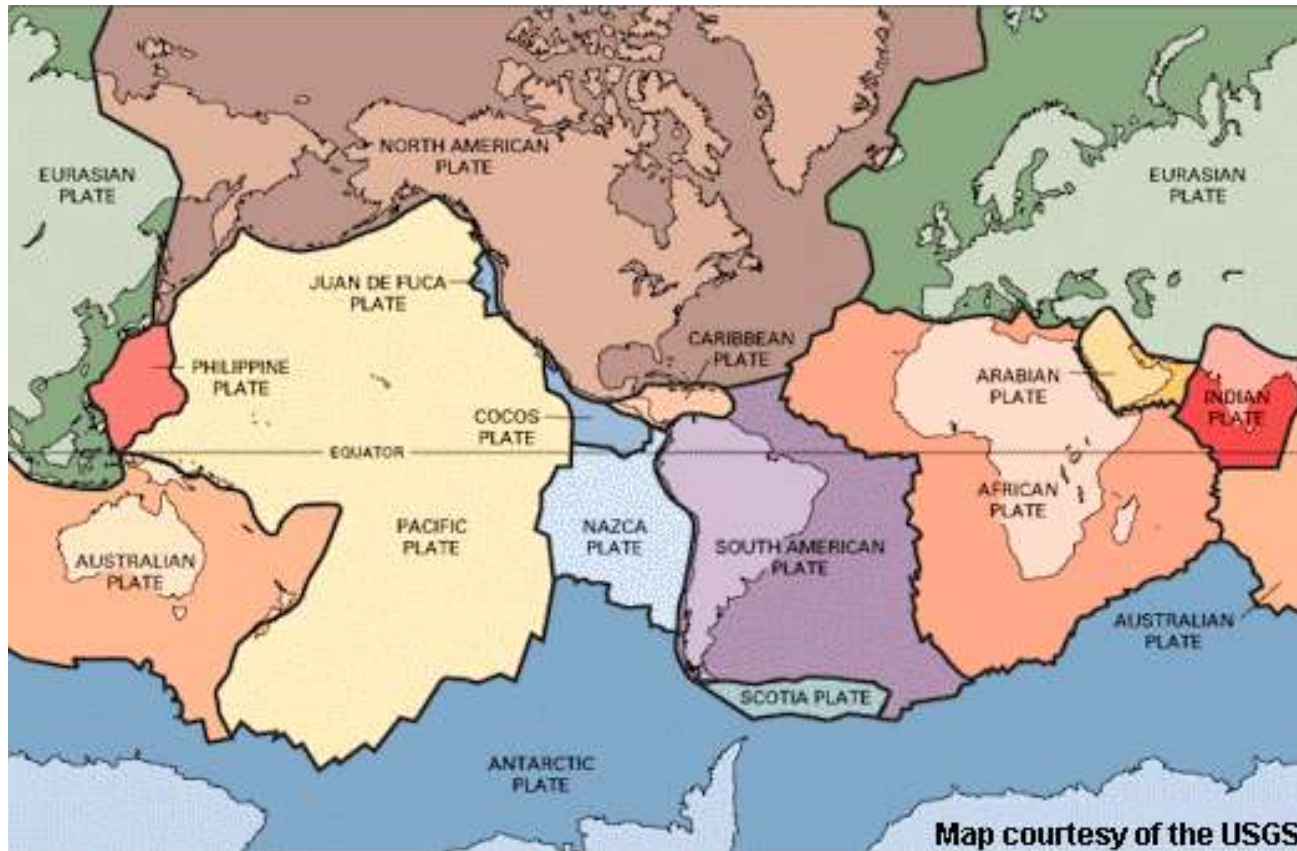
Today plate boundaries are determined by examining the location of volcanoes and earthquakes.

Volcanoes result from the friction (heat) of the plates motion.

Earthquakes occur where plate rub against one another

Plate Boundaries

- Cracks in the plates are called faults



Theory of plate tectonics

- the earth's crust and upper mantle is broken in to sections that move
- Plate Boundaries
 - Divergent – moving apart
 - Convergent – moving together
 - Transform fault boundary

Divergent Plate Boundaries

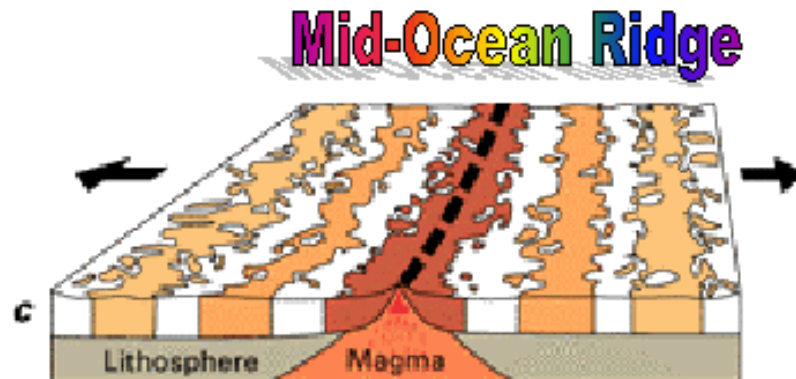


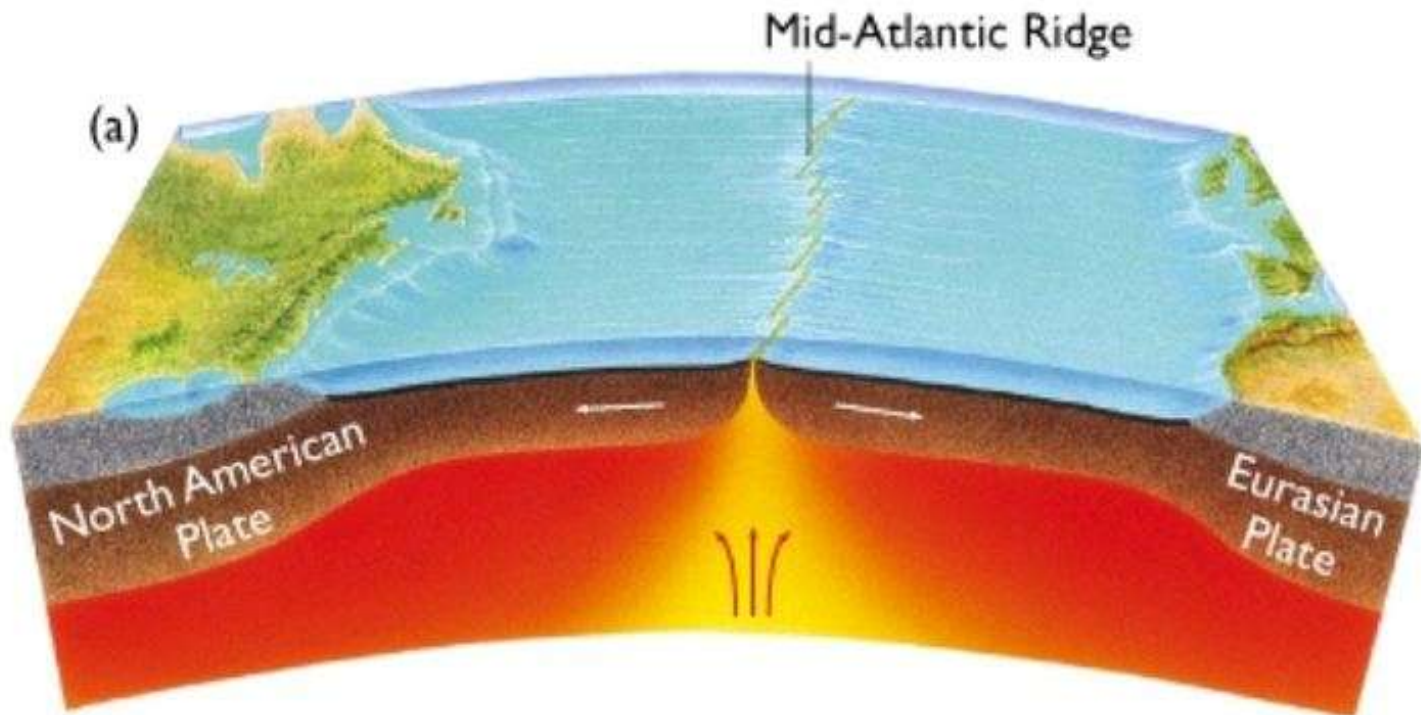
Plate Boundaries

- Divergent Boundary – moving apart
- Convergent Boundary – moving together
- Transform Fault Boundary – moving sideways past each other

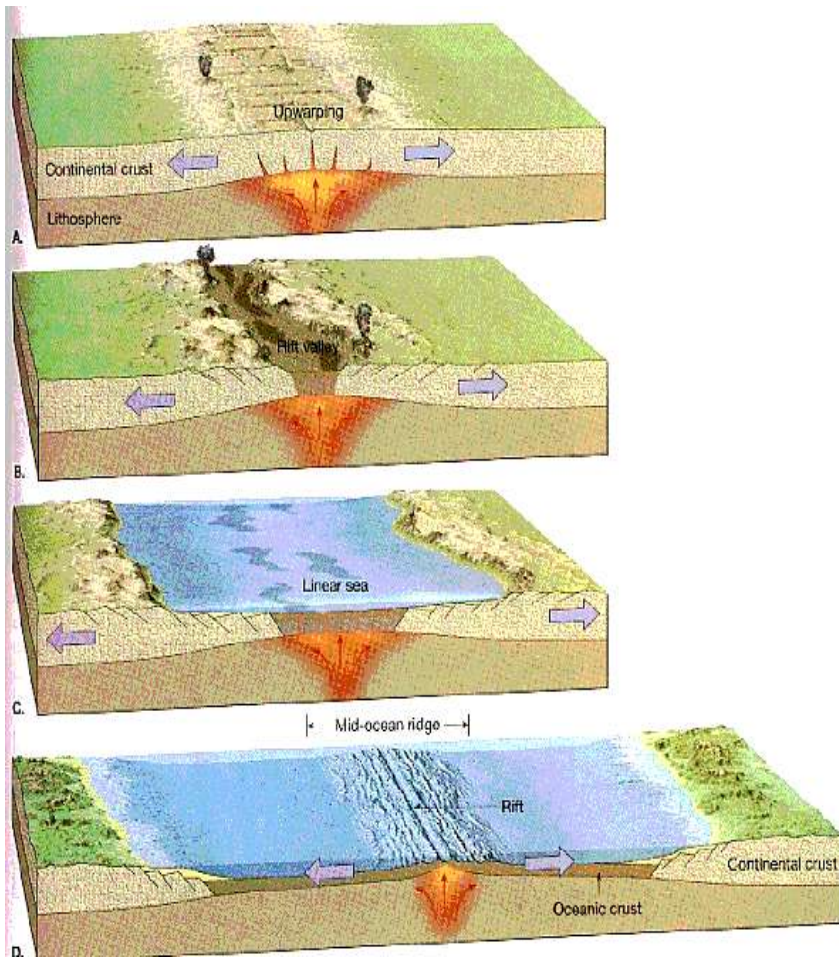
How could continents move?

- Spreading seafloor
 - Youngest rocks are in the middle
 - Reverse polarity of magnetic fields of rocks laid down p. 301

Rifting and Seafloor Spreading

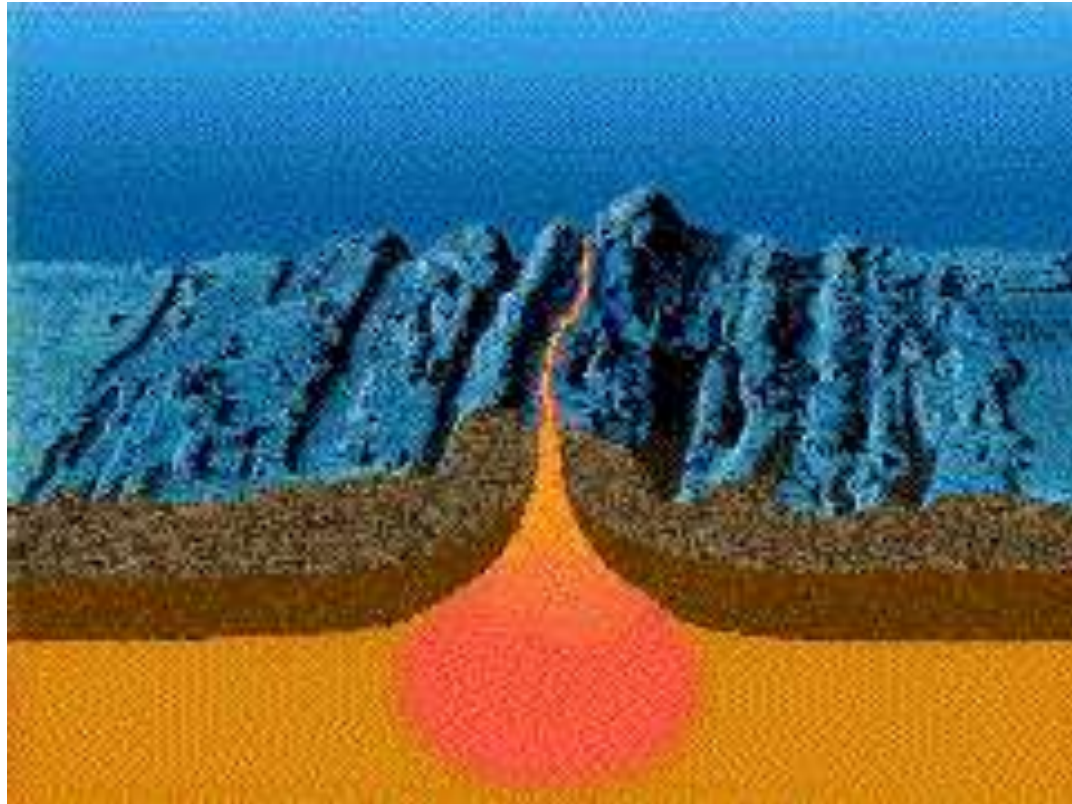


Sea floor spreading

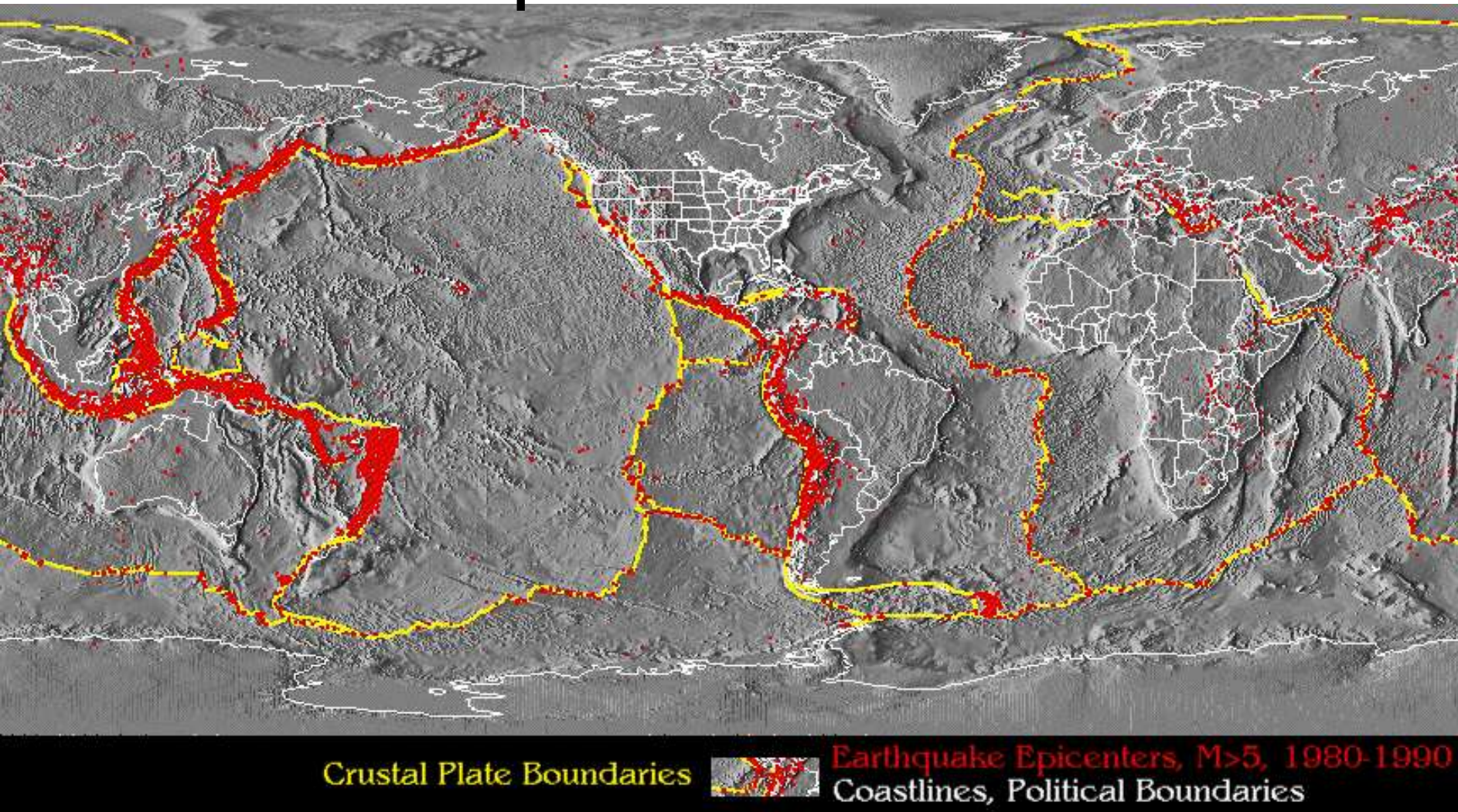


- Large continents begin to crack and split apart
- The gaps fill with water
- Small seas become oceans
- The mid ocean ridge continues to produce new crust

Tectonic Plates



Earthquakes Worldwide

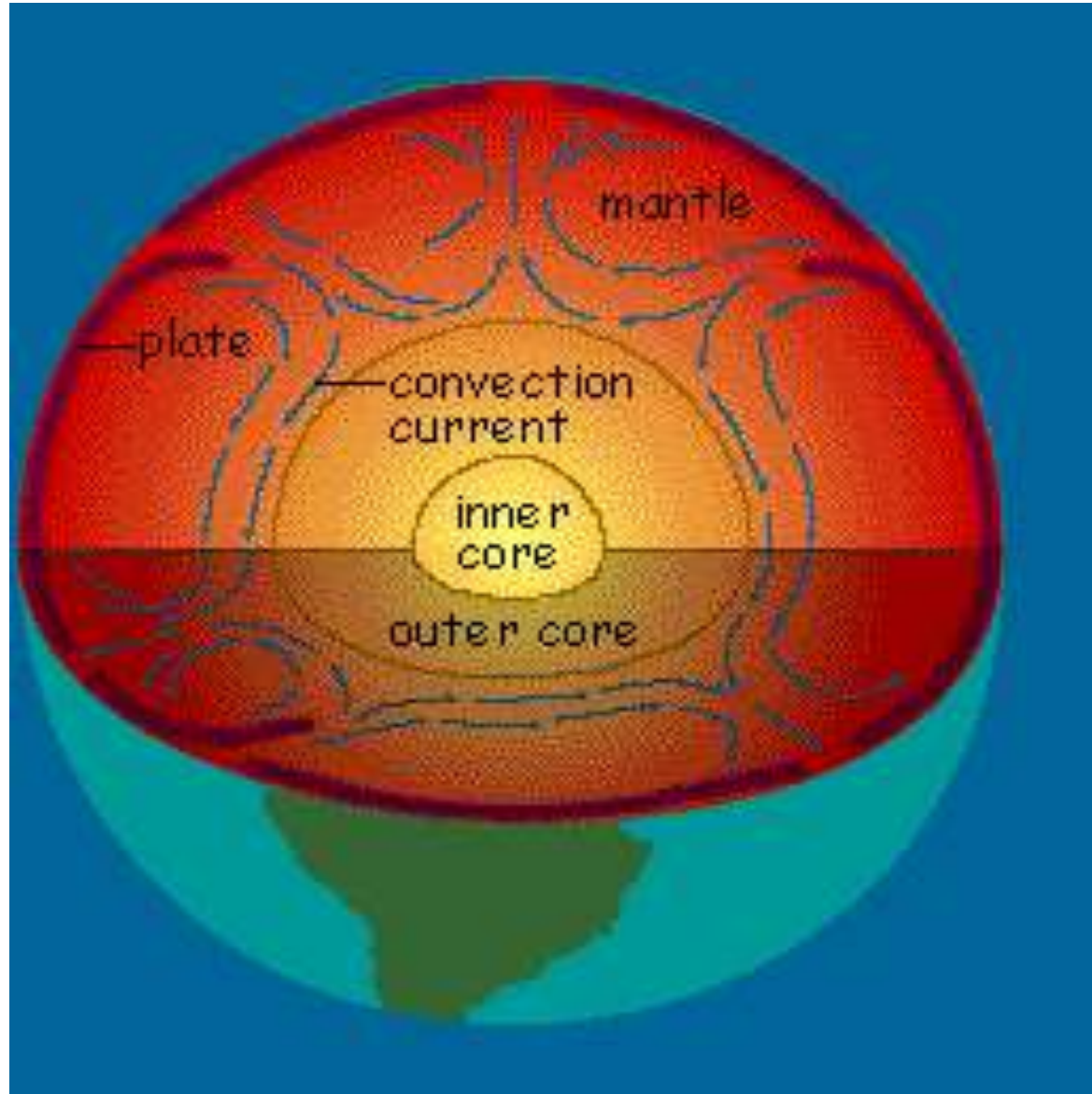


Why do the Plates Move?

- No single idea explains everything but we can identify several forces that contribute to the movement of the plates.
 - Slab pull
 - The sinking of the cooled dense oceanic plates pulls on the rest of the plate
 - Ridge rises
 - The material deposited on the top of the ridge slides down from the rise pushing on the plate
 - Convection
 - Movement within the mantle could be part of the driving force behind the motion of the plates.

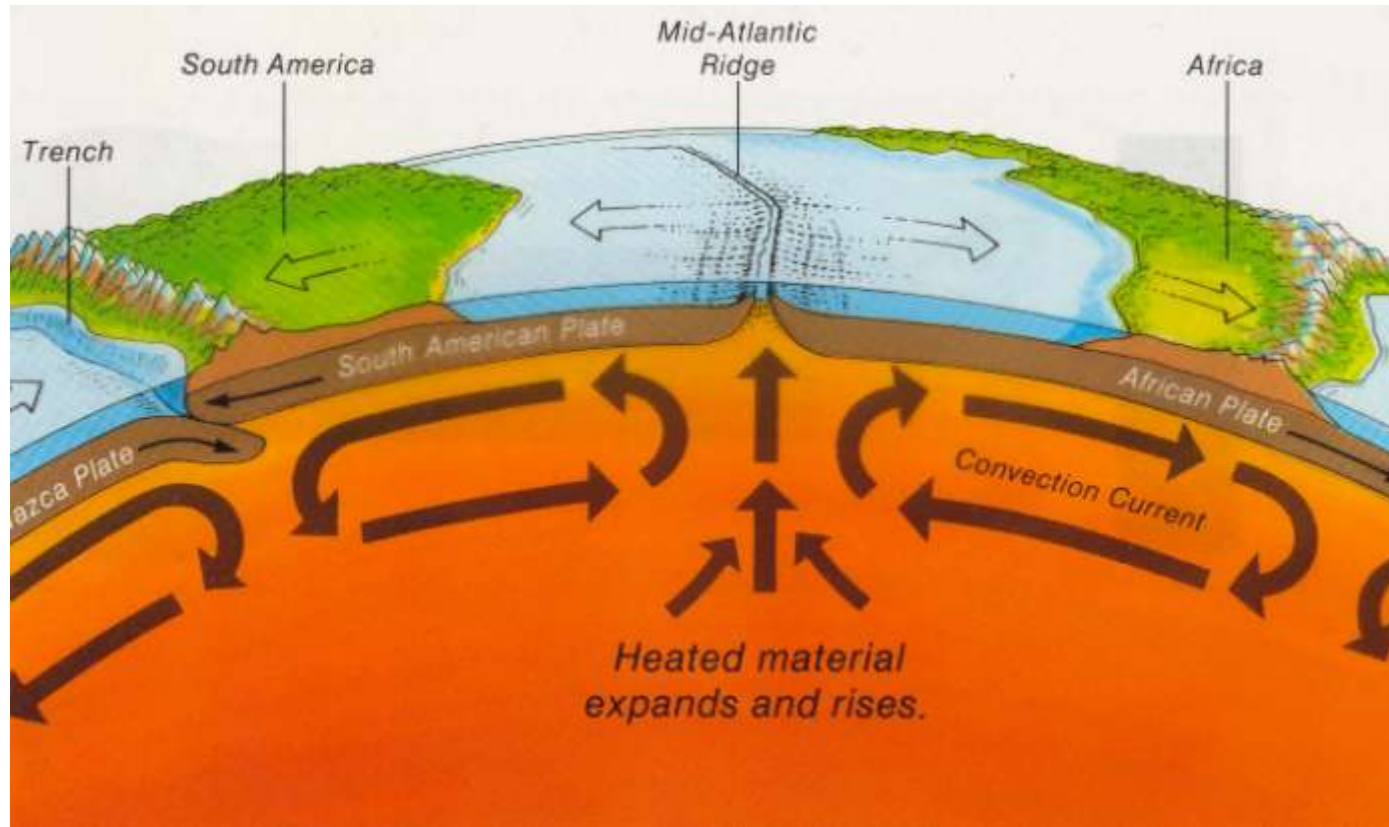
Causes of Plate Tectonics

- Convection
Currents
Results of Plate
movement



Convection Currents

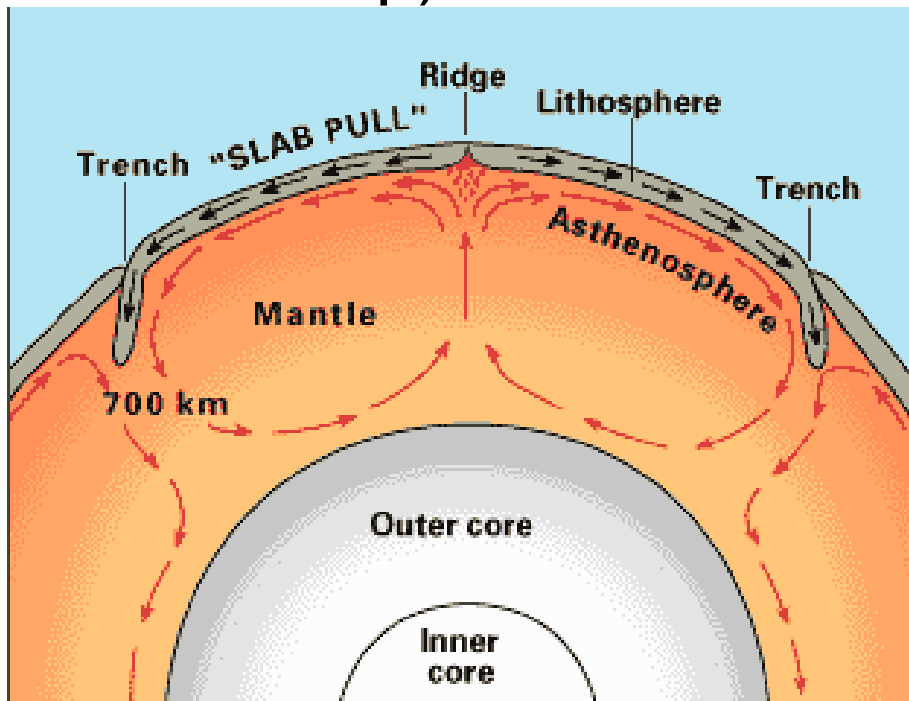
- How could the continents drift?



The force responsible for plate movement is _____.

What Causes the Plates to Move?

- **Convection**- hot magma rises, cool magma sinks (like a lava lamp)

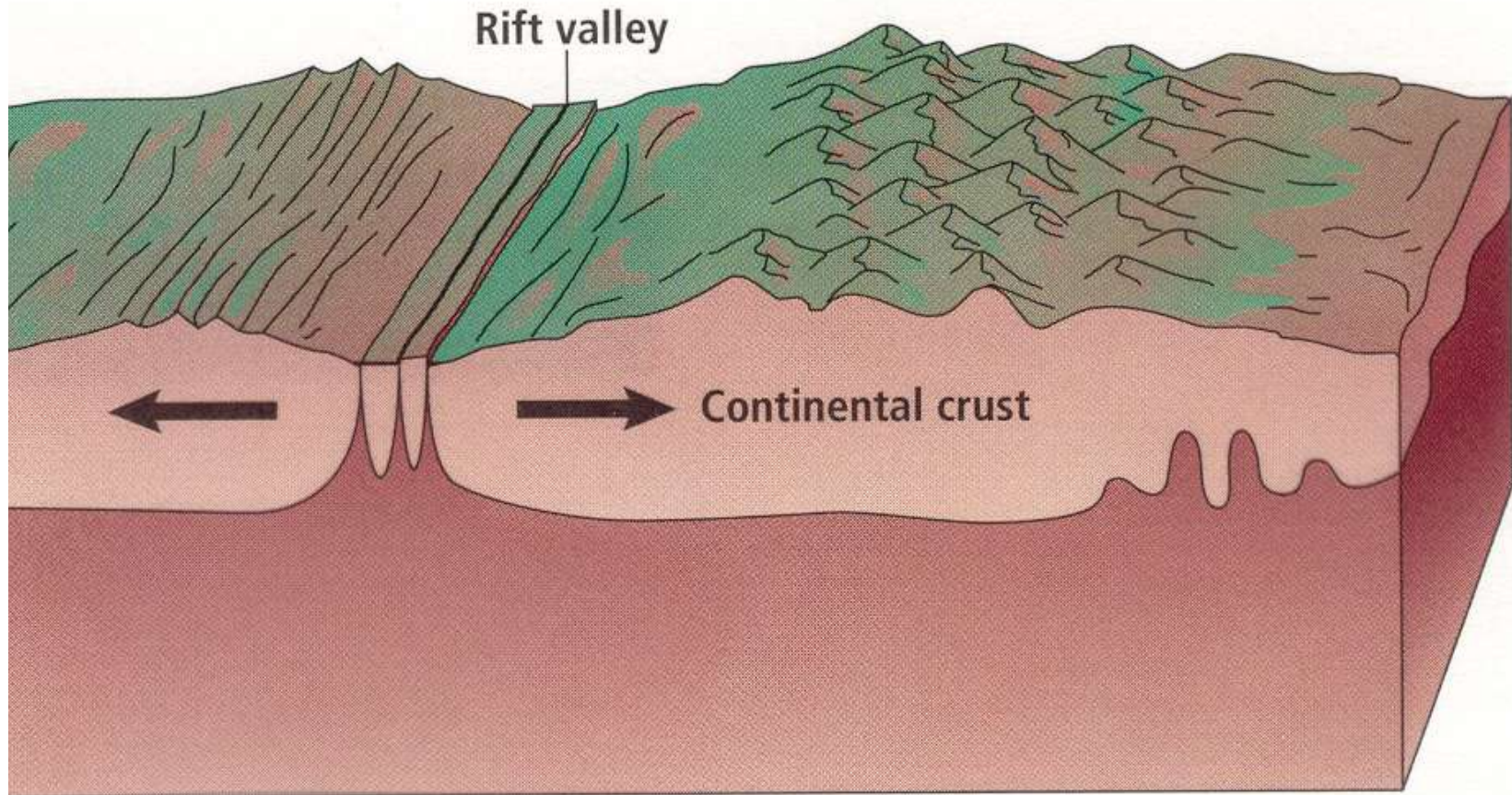


Results of Plates moving

- **Rift valleys are the result of divergent plate boundaries**
- **Mountains arcs and volcanoes tend to be the results of convergent boundaries**
- **Strike slip faults cause earth quakes**

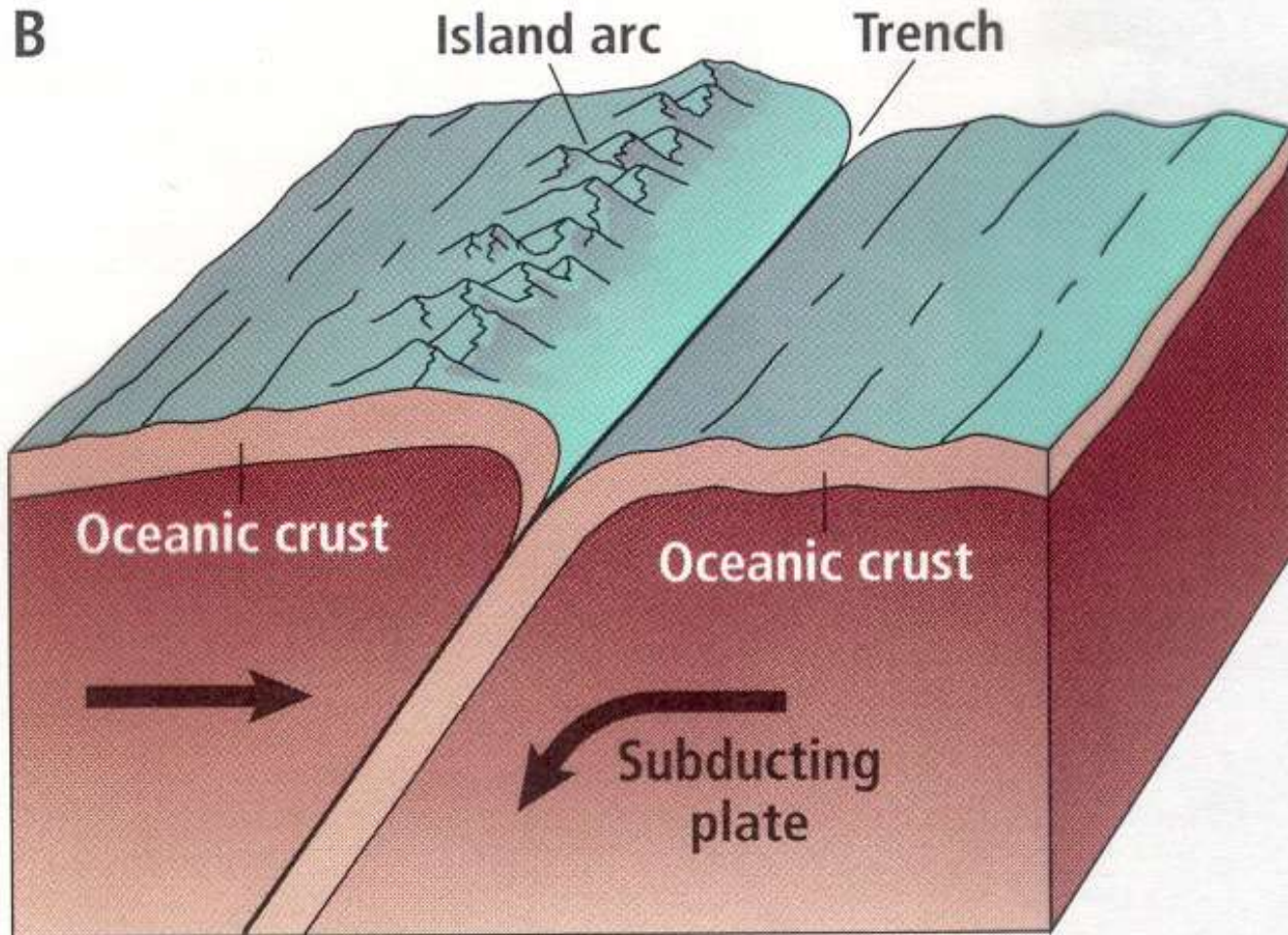
Types of Plate collisions

- **Ocean plate – continental plate collision**
 - **Creates subduction zones**
- **Ocean plate – ocean plate collision**
 - **Trenches to form**
- **Continental – continental collision**
 - **Mountain ranges formed**



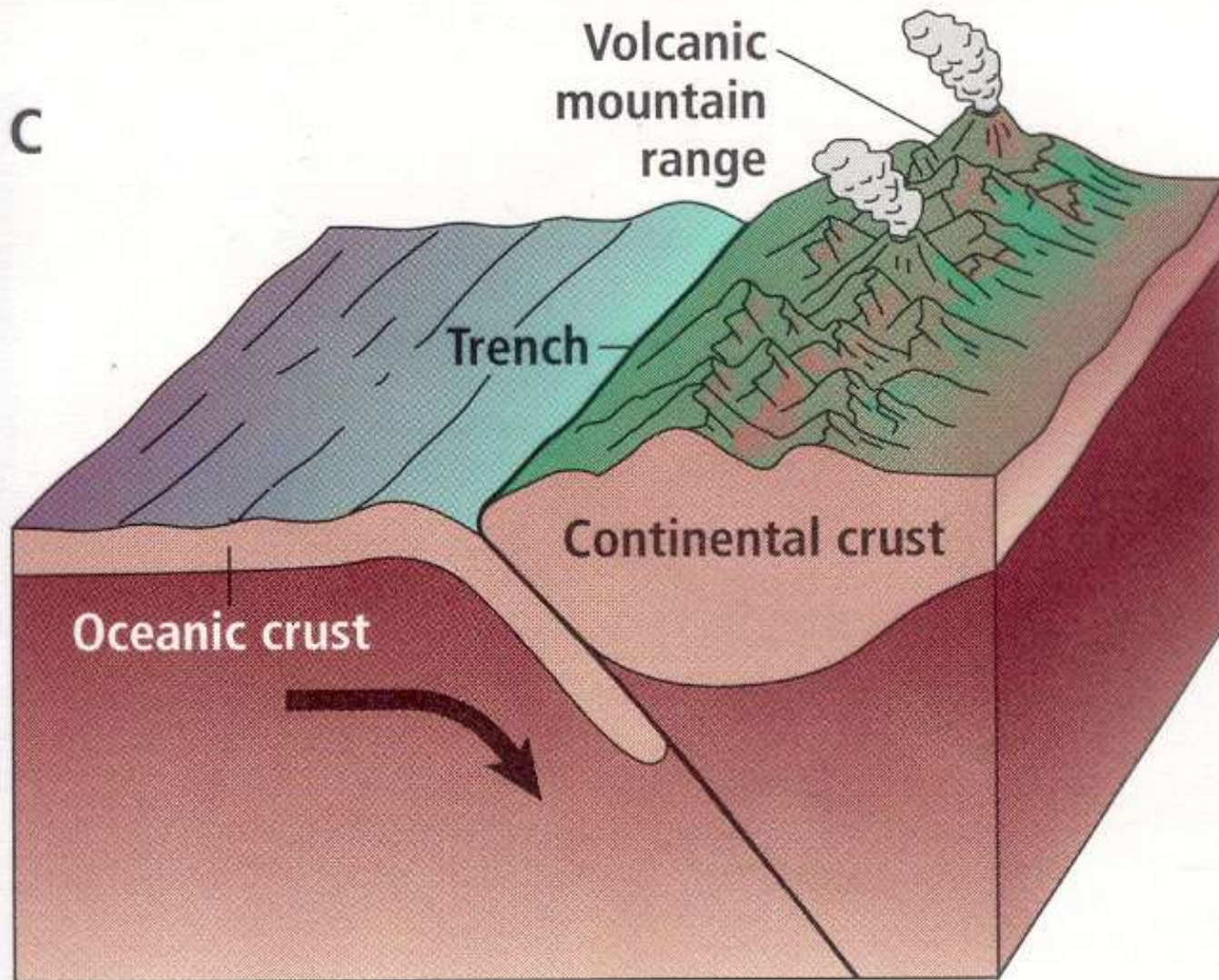
Divergent boundary of two continental plates.

Creates a rift valley. Example: East African Rift

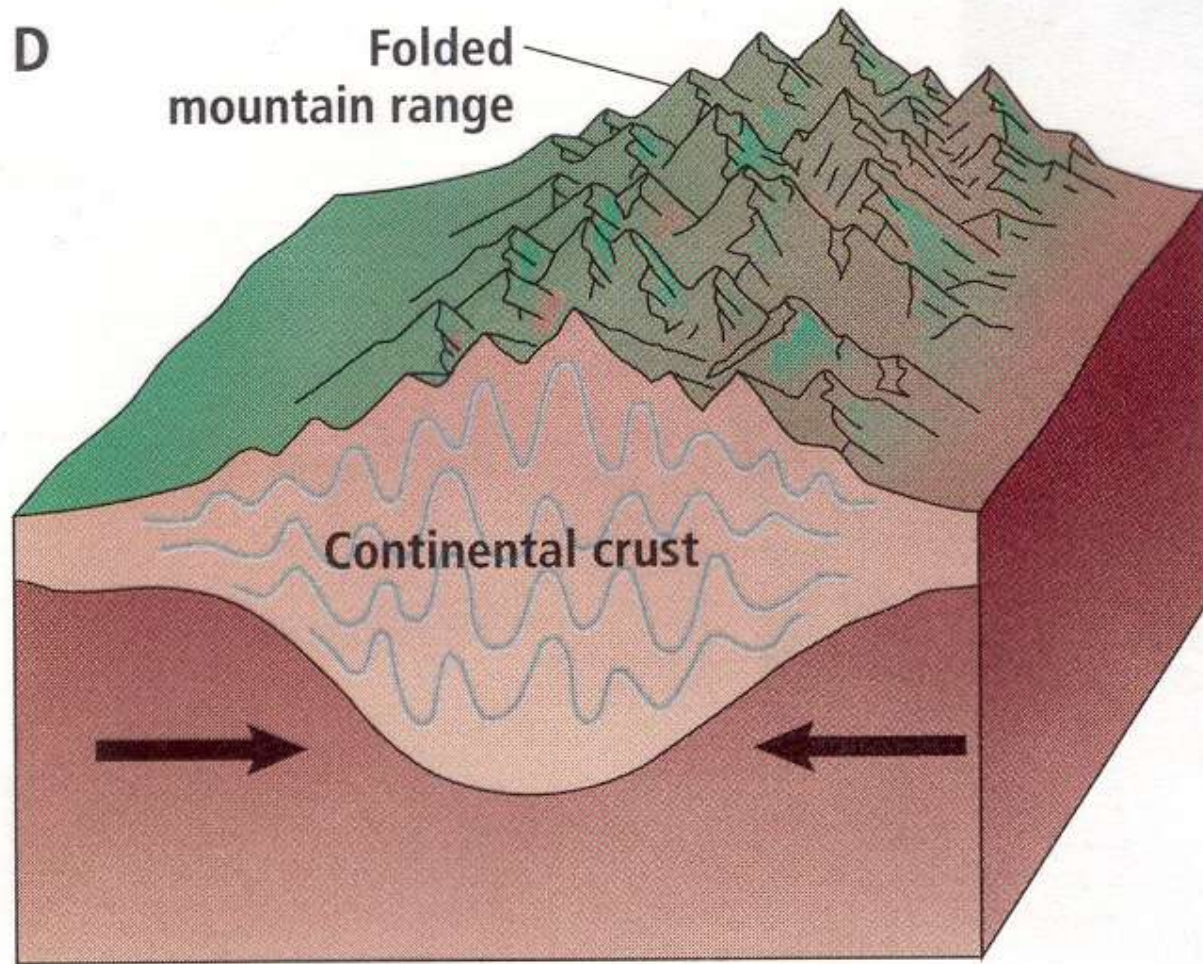


Convergent boundary of two oceanic plates.

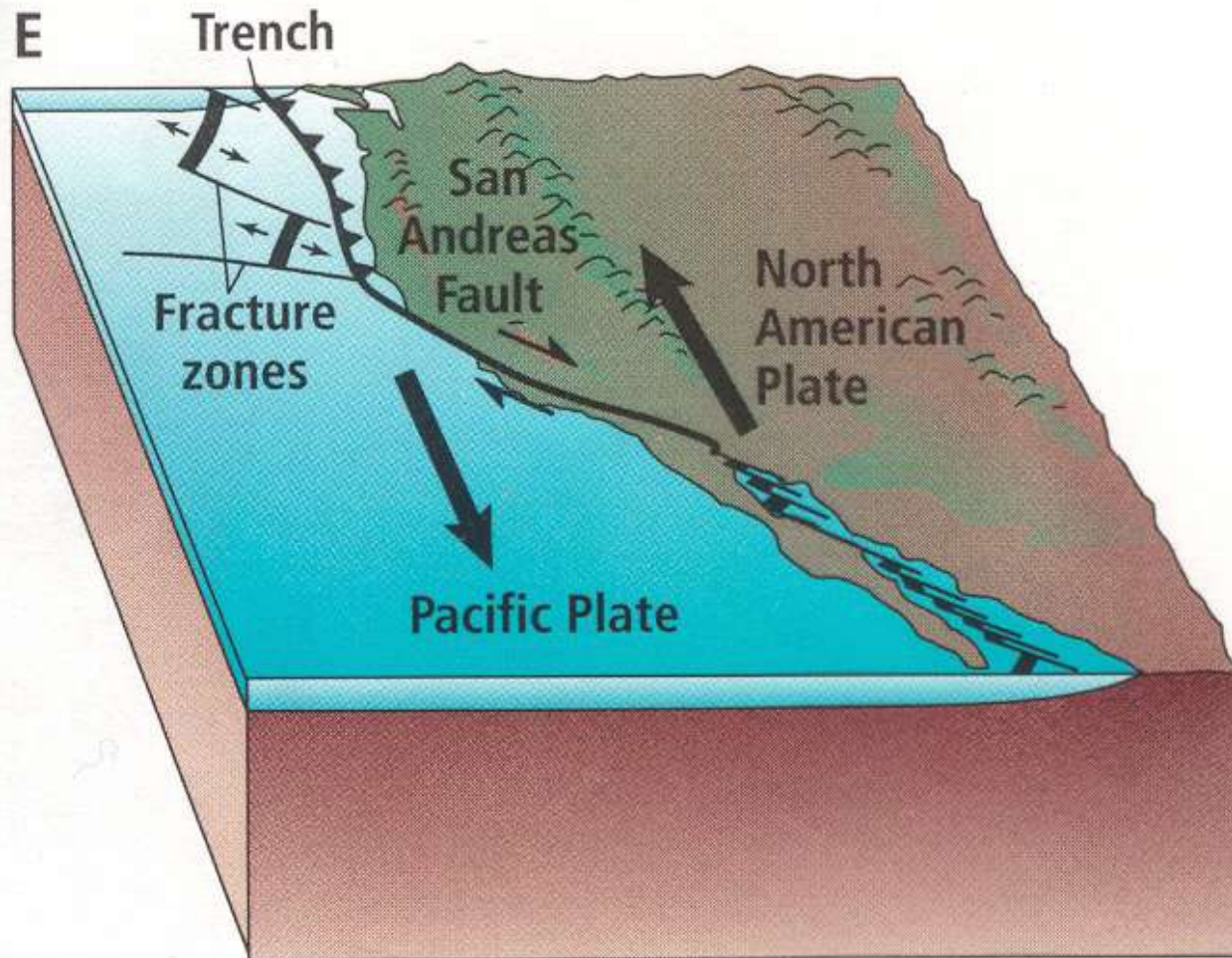
Creates an island arc and a trench. Example: Japan



Convergent boundary of an oceanic plate and a continental plate. Forms a volcanic mountain range and a trench. Examples: Cascades or Andes Mts



Convergent boundary of two continental plates. Forms a folded mountain range. Examples: Himalayas, Alps, Appalachians



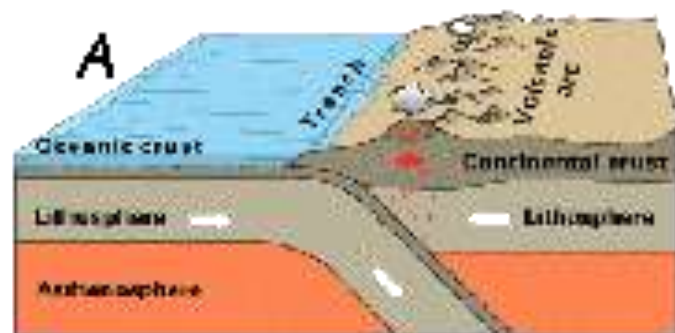
Transform-fault boundary where the North American and Pacific plates are moving past each other.

Example: San Andreas Fault in California

Plate Boundaries Review

- Places where plates move apart are called divergent boundaries.
- When continental plates diverge a rift valley is formed.
- When two oceanic plates converge what is created?
an island arc and a trench
- The Appalachians formed mainly from continental plate collisions and therefore are a folded mountain range.
- The force moving the plates is Convection currents

Convergent Plate Boundaries



Ocean - Continent



Continent - Continent



Ocean - Ocean

Andes Mountains, South America

