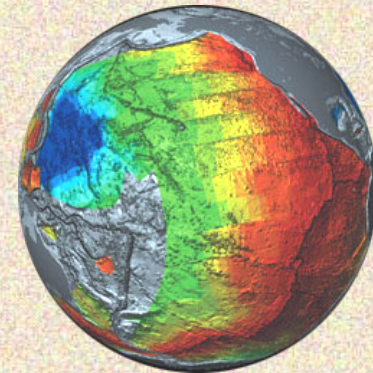
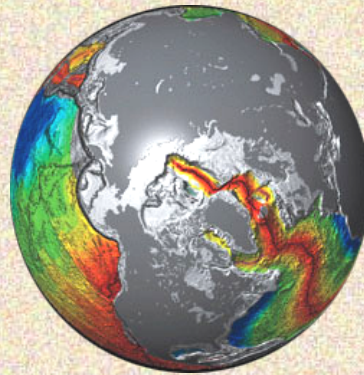
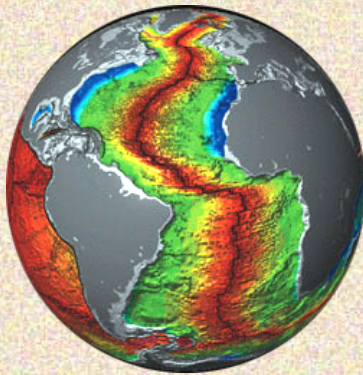




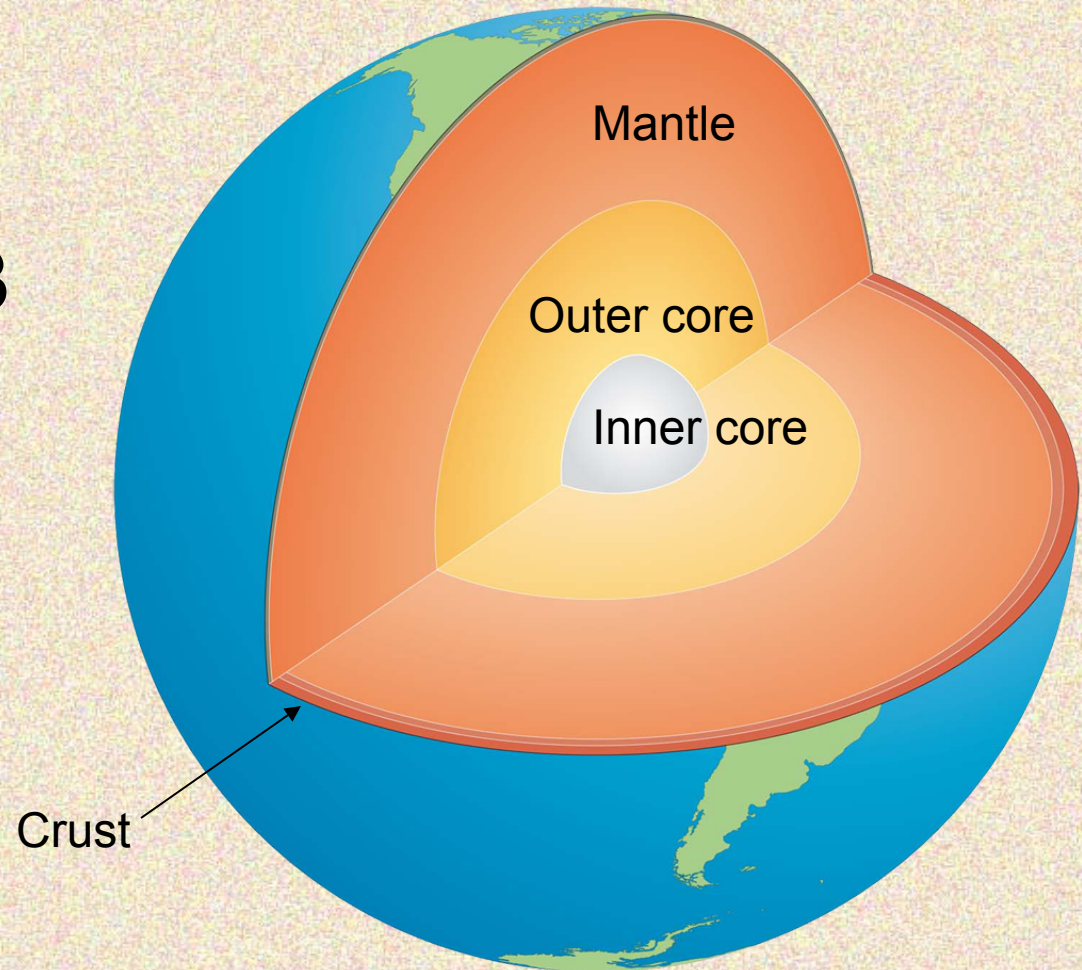
The Structure of the Earth and Plate Tectonics





Structure of the Earth

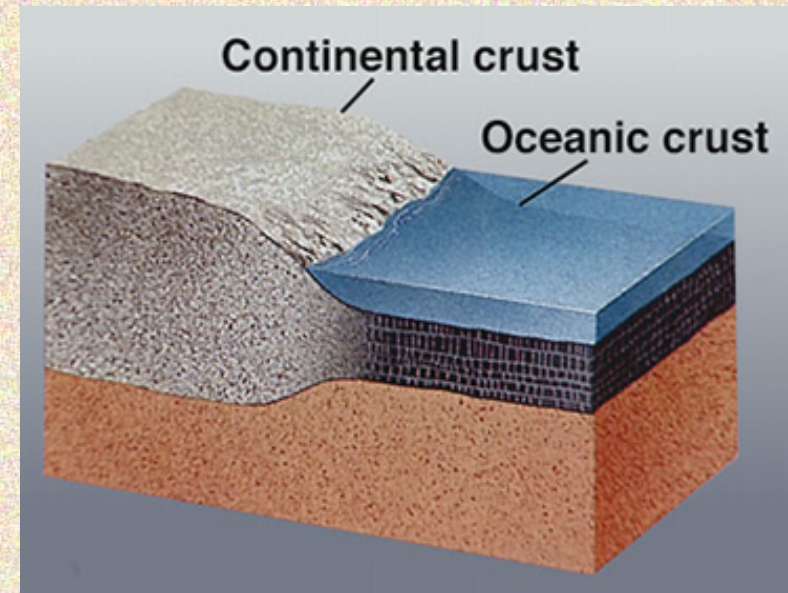
- The Earth is made up of 3 main layers:
 - Core
 - Mantle
 - Crust





The Crust

- This is where we live!
- The Earth's crust is made of:



Continental Crust

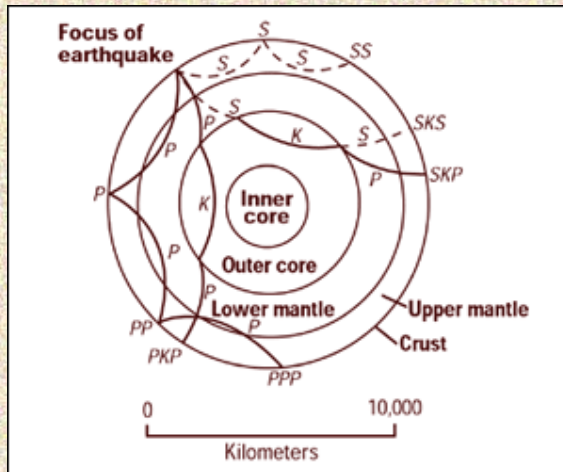
- thick (10-70km)
- buoyant (less dense than oceanic crust)
- mostly old

Oceanic Crust

- thin (~7 km)
- dense (sinks under continental crust)
- young

How do we know what the Earth is made of?

- Geophysical surveys: seismic, gravity, magnetics, electrical, geodesy
 - Acquisition: land, air, sea and satellite
 - Geological surveys: fieldwork, boreholes, mines





What is Plate Tectonics?



- If you look at a map of the world, you may notice that some of the continents could fit together like pieces of a puzzle.

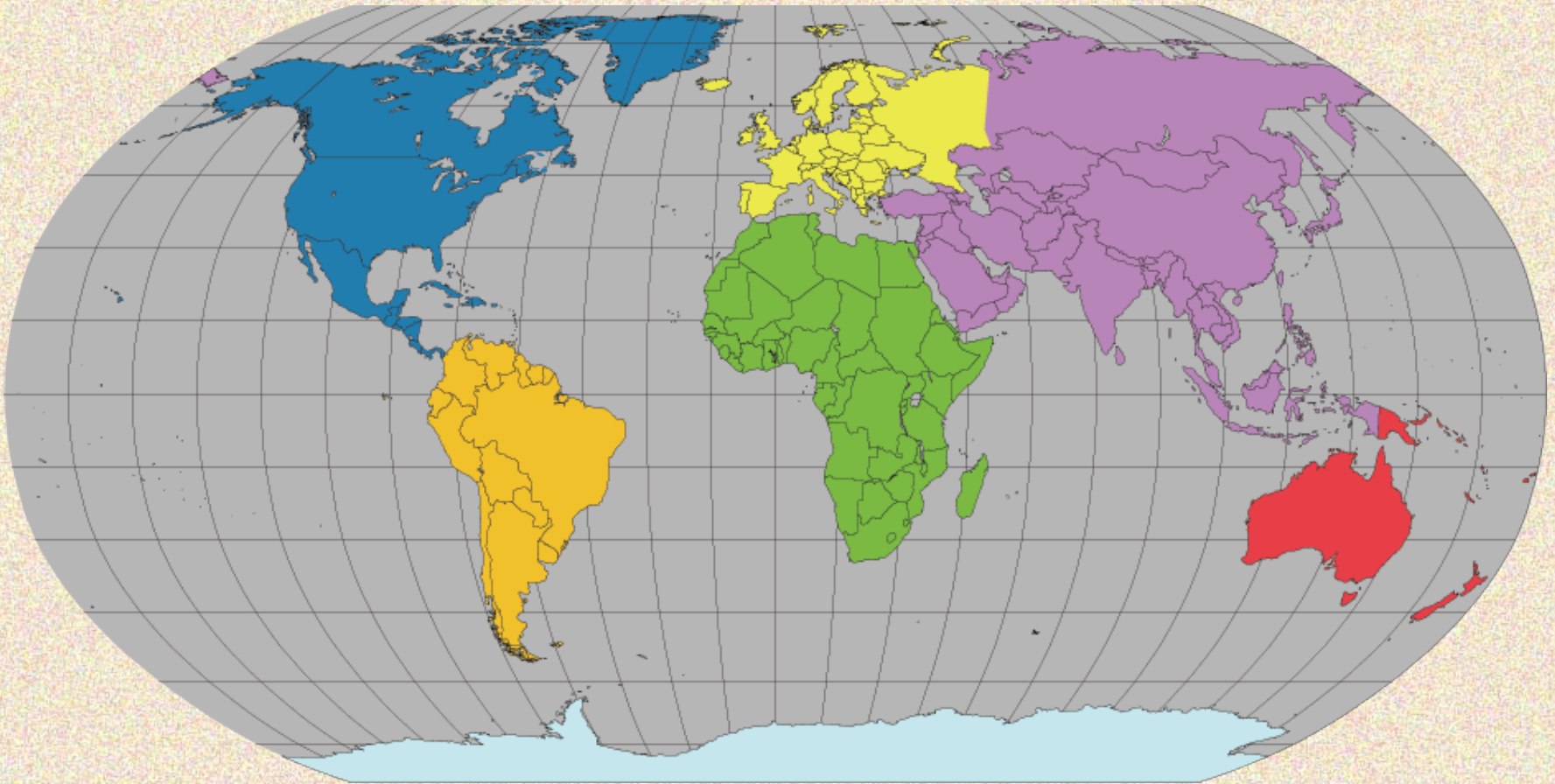


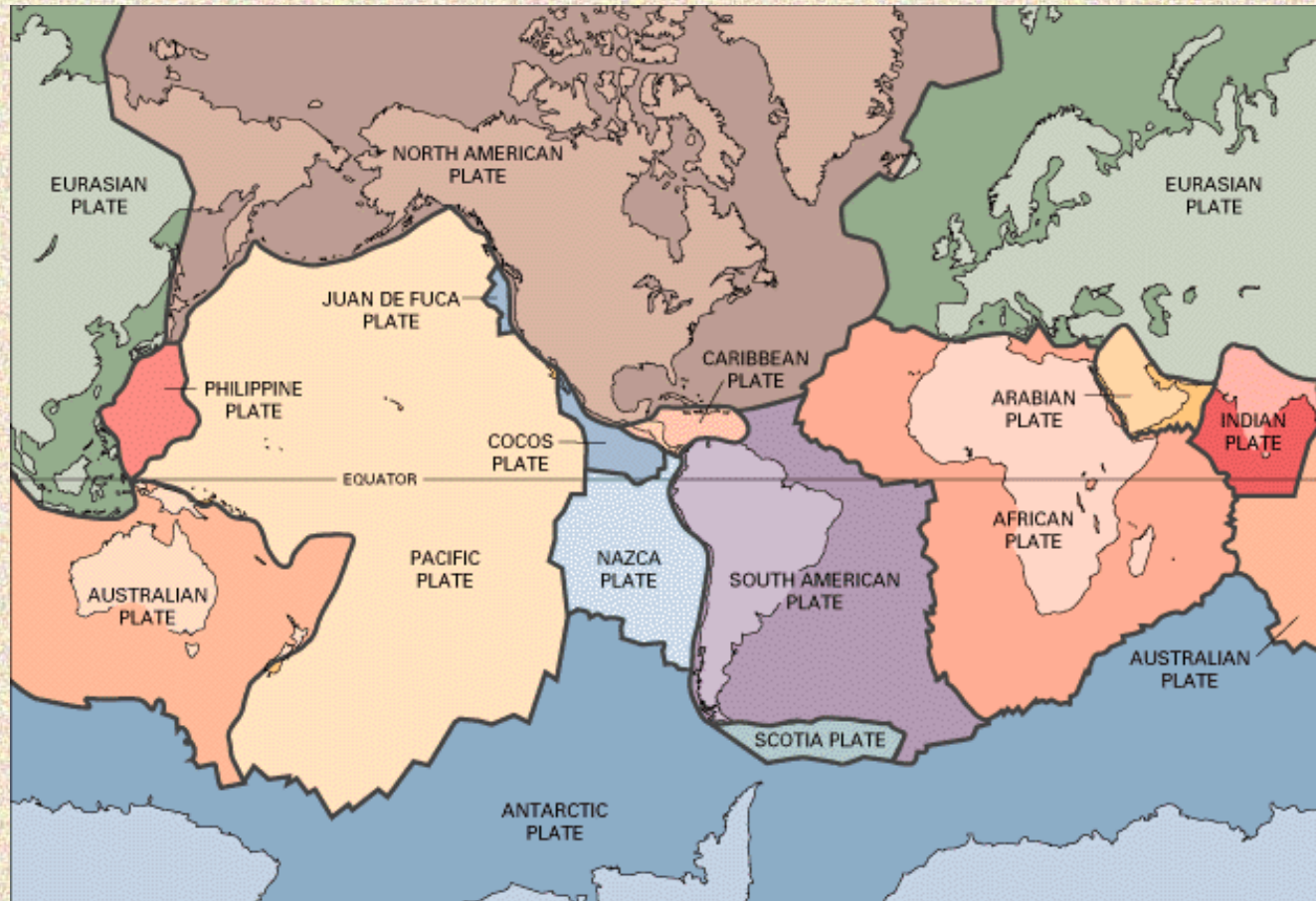


Plate Tectonics

- The Earth's crust is divided into 12 major plates which are moved in various directions.
- This plate motion causes them to collide, pull apart, or scrape against each other.
- Each type of interaction causes a characteristic set of Earth structures or “tectonic” features.
- The word, tectonic, refers to the deformation of the crust as a consequence of plate interaction.



World Plates

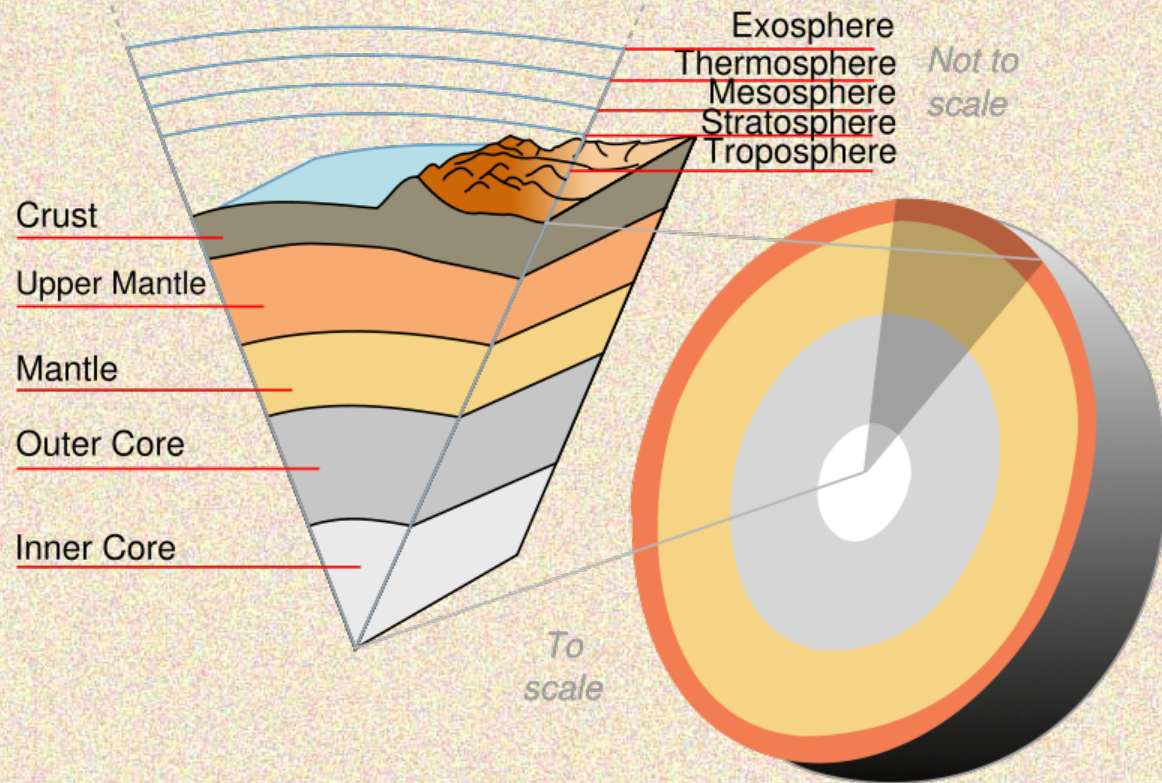




What are tectonic plates made of?

- Plates are made of rigid **lithosphere**.

The lithosphere is made up of the crust and the upper part of the mantle.





What lies beneath the tectonic plates?

- Below the lithosphere (which makes up the tectonic plates) is the asthenosphere.

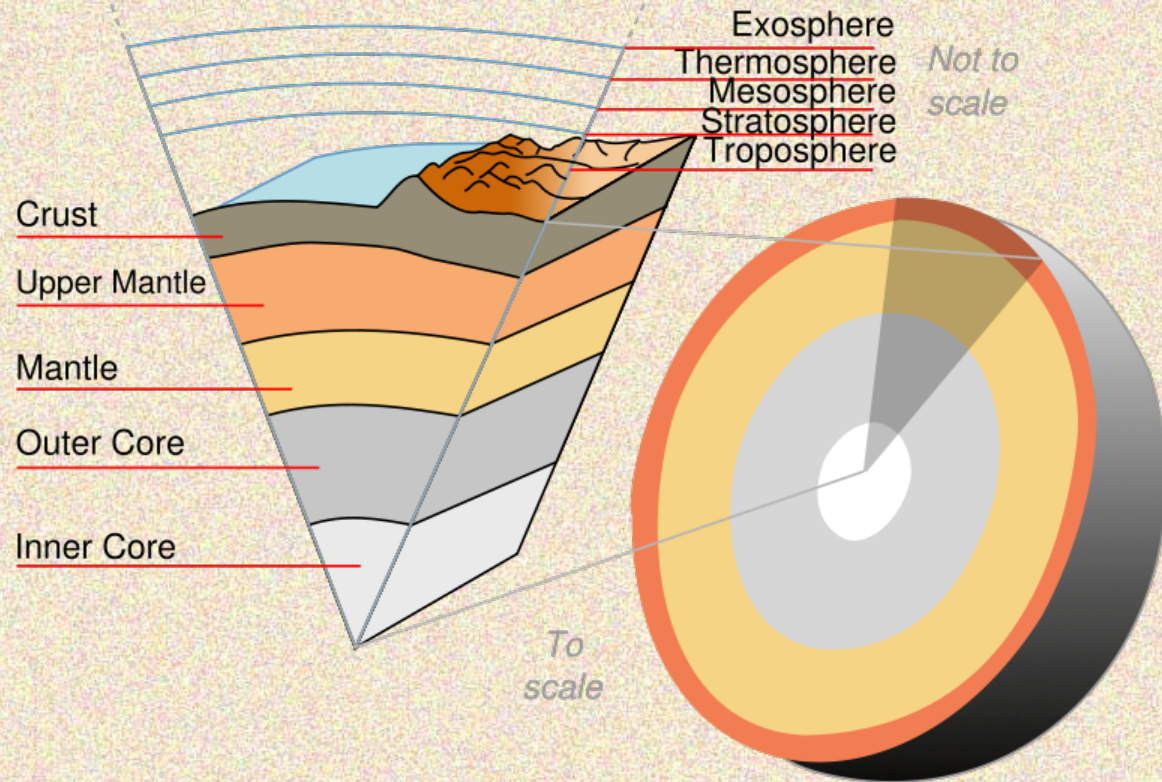
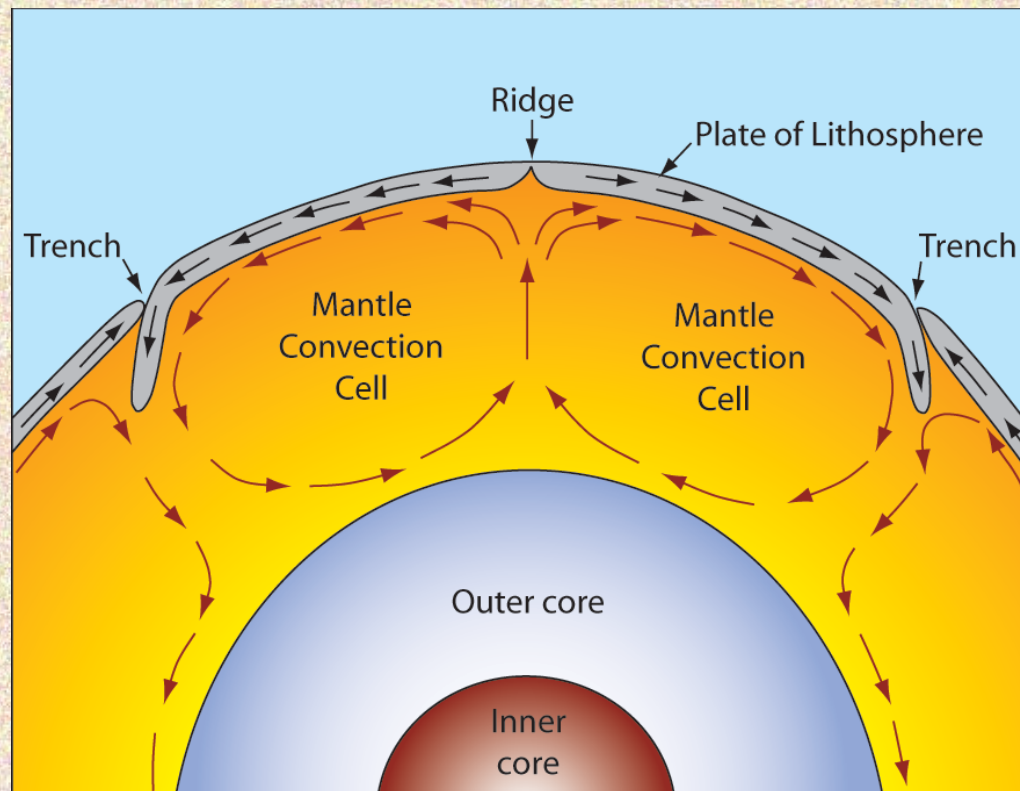




Plate Movement

- “Plates” of lithosphere are moved around by the underlying hot mantle convection cells



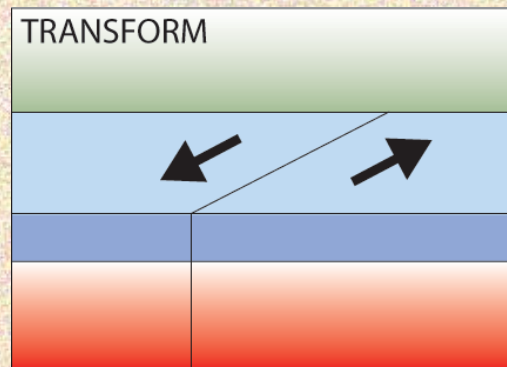
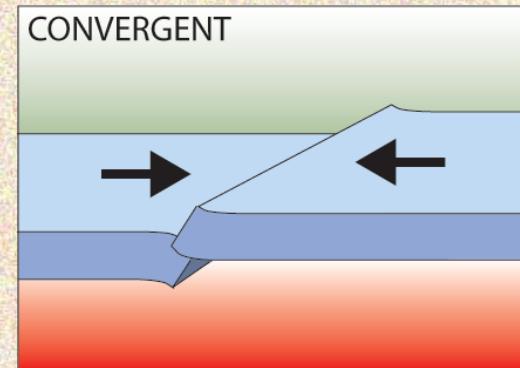
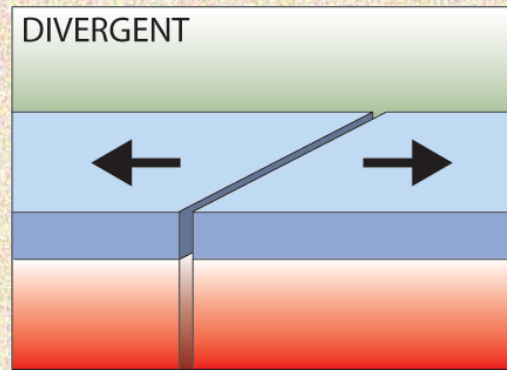


What happens at tectonic plate boundaries?



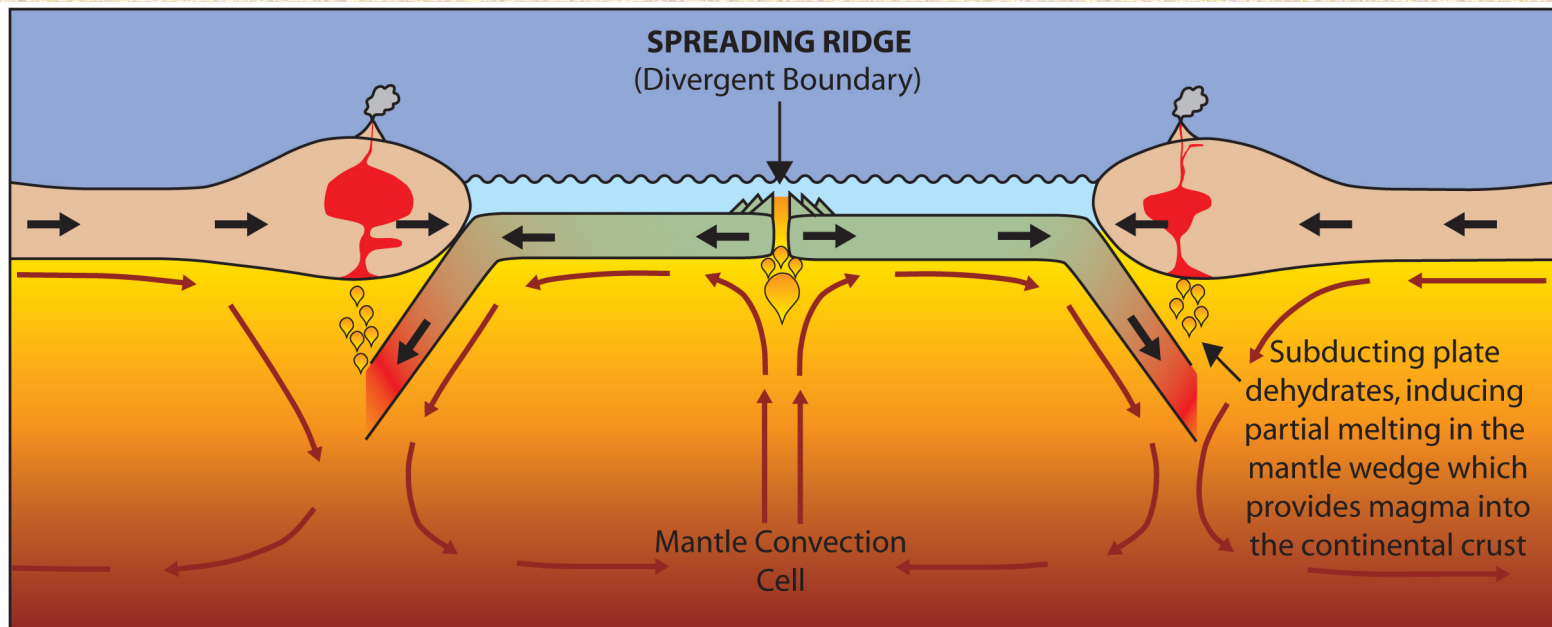
Three types of plate boundary

- Divergent
- Convergent
- Transform





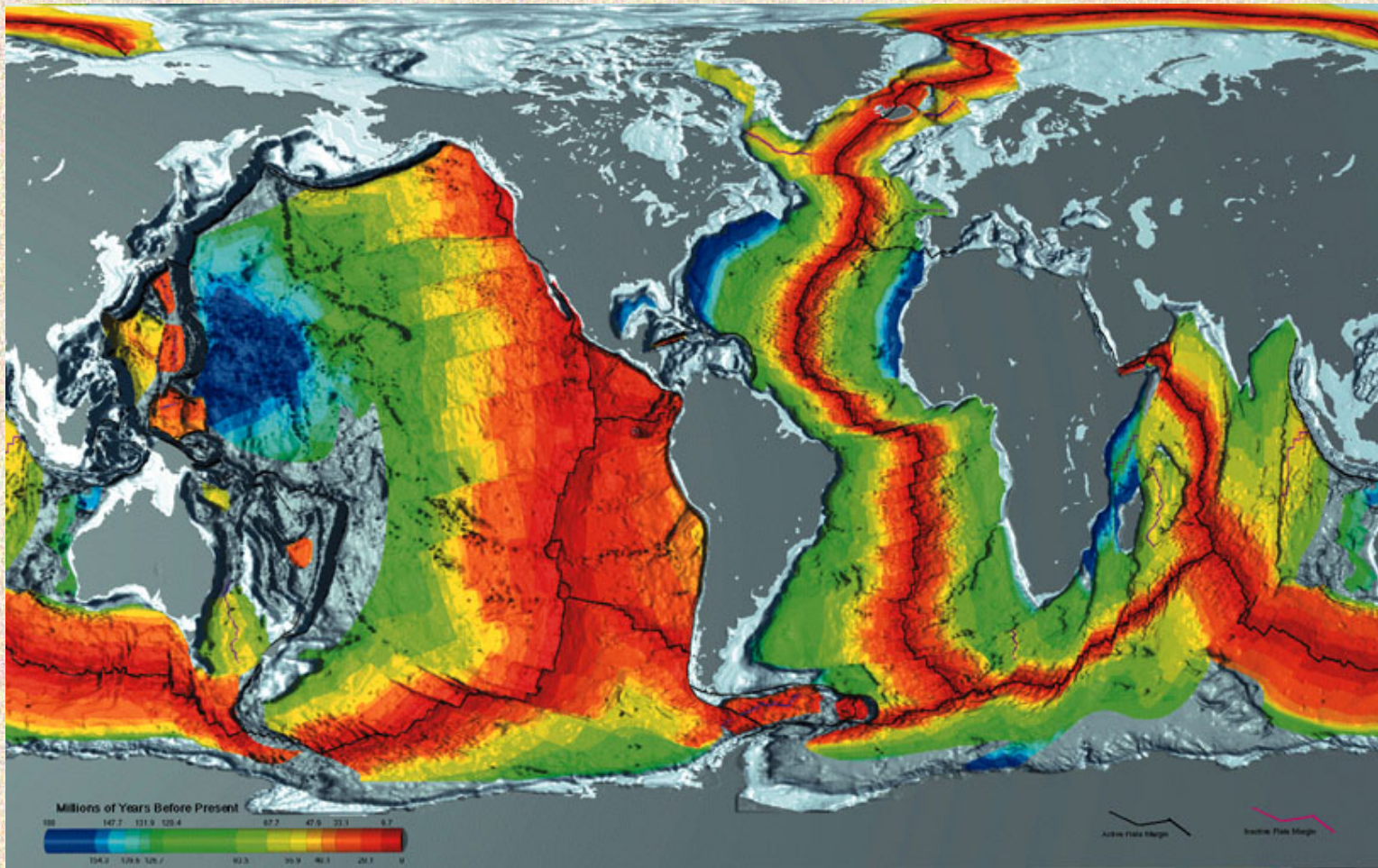
Divergent Boundaries



- Spreading ridges
 - As plates move apart new material is erupted to fill the gap



Age of Oceanic Crust



Iceland: An example of continental rifting

- Iceland has a divergent plate boundary running through its middle





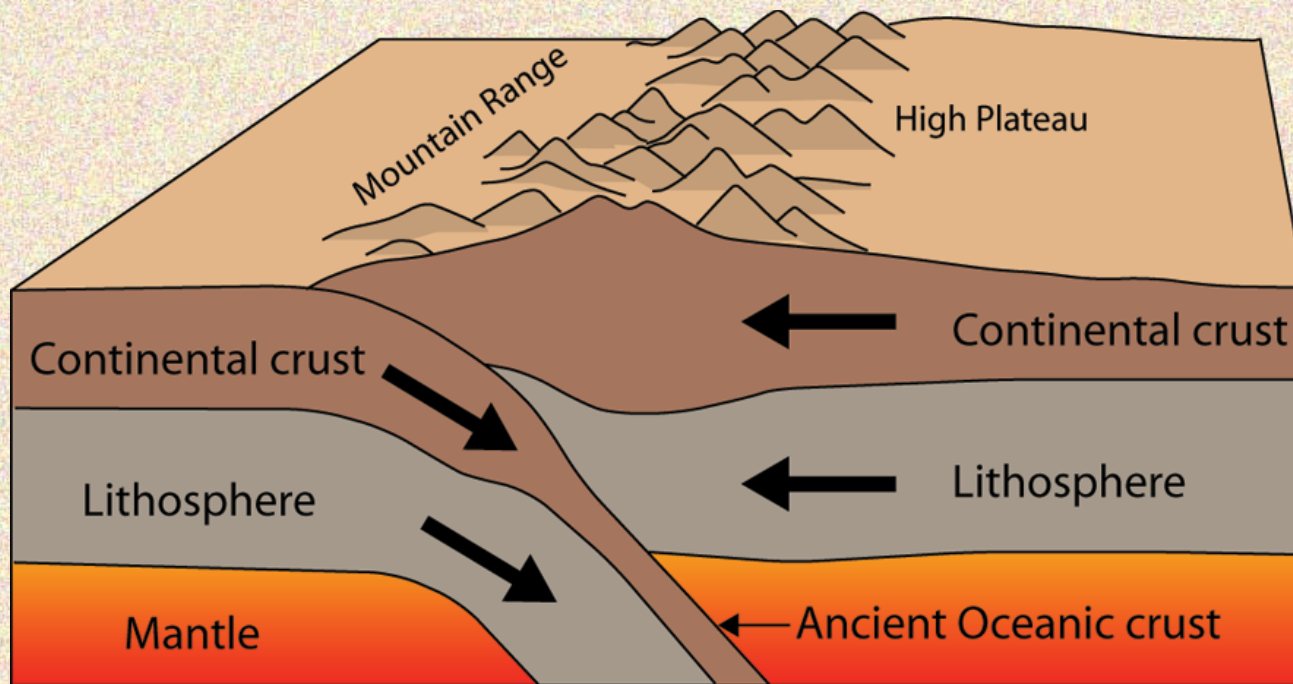
Convergent Boundaries

- There are three styles of convergent plate boundaries
 - Continent-continent collision
 - Continent-oceanic crust collision
 - Ocean-ocean collision



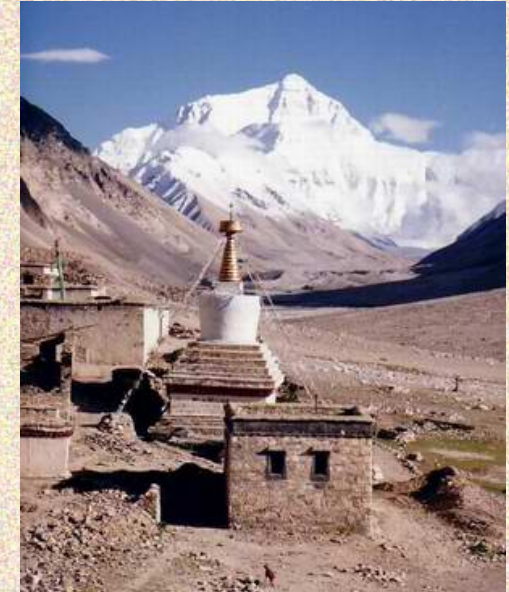
Continent-Continent Collision

- Forms mountains, e.g. European Alps, Himalayas





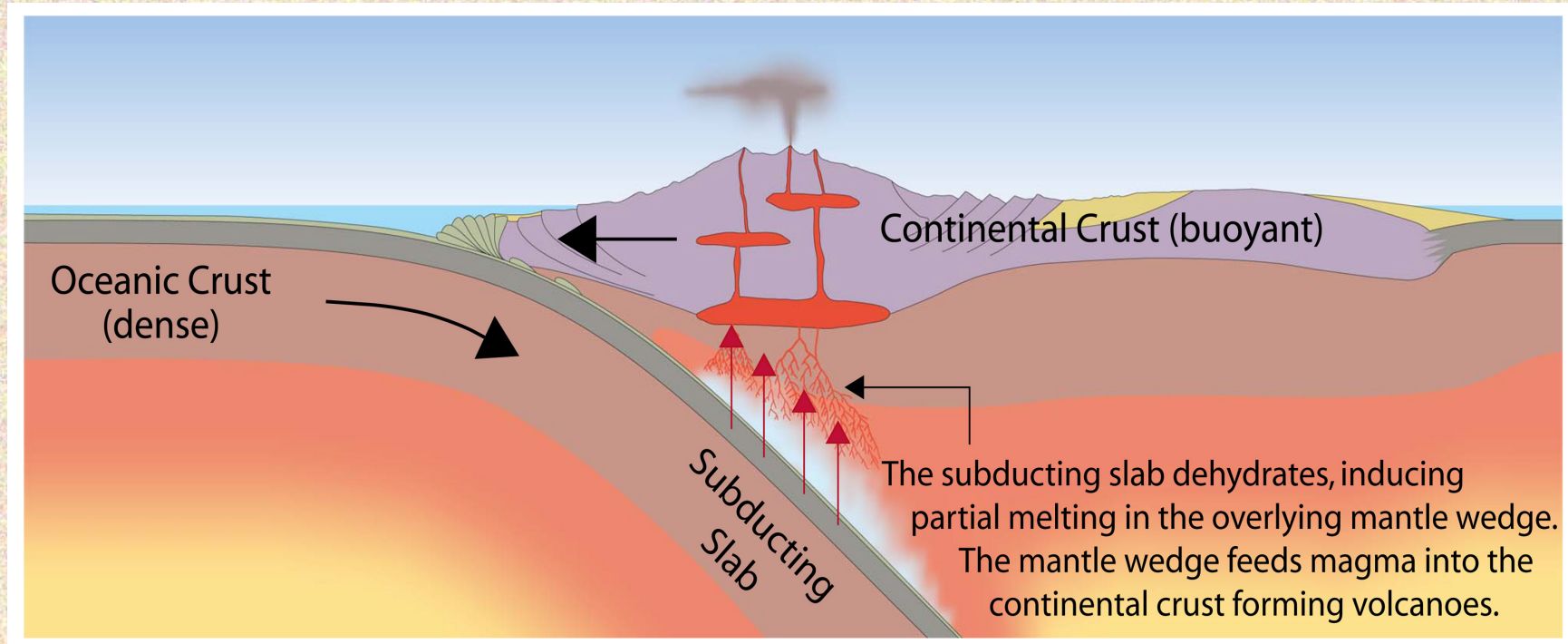
Himalayas





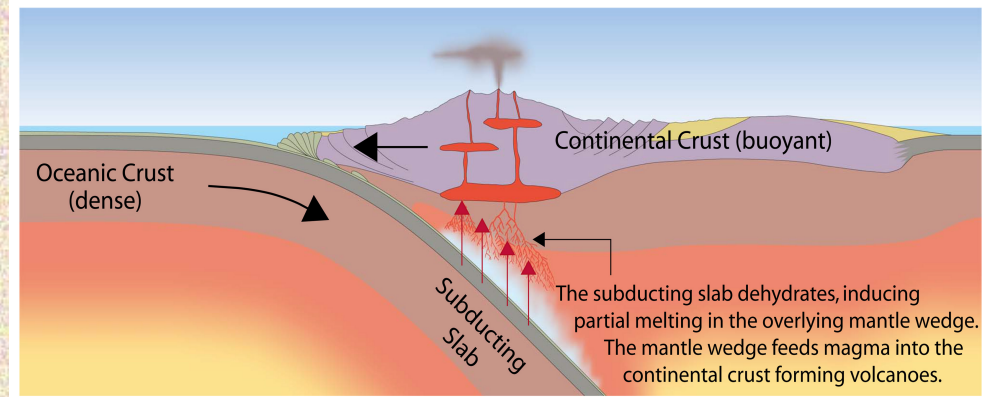
Continent-Oceanic Crust Collision

- Called SUBDUCTION





Subduction



- Oceanic lithosphere subducts underneath the continental lithosphere
- Oceanic lithosphere heats and dehydrates as it subsides
- The melt rises forming volcanism
- E.g. The Andes



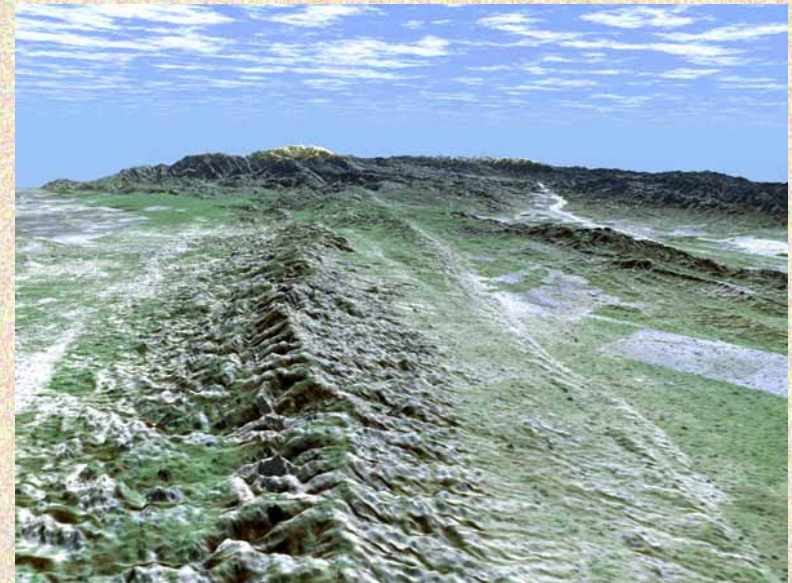
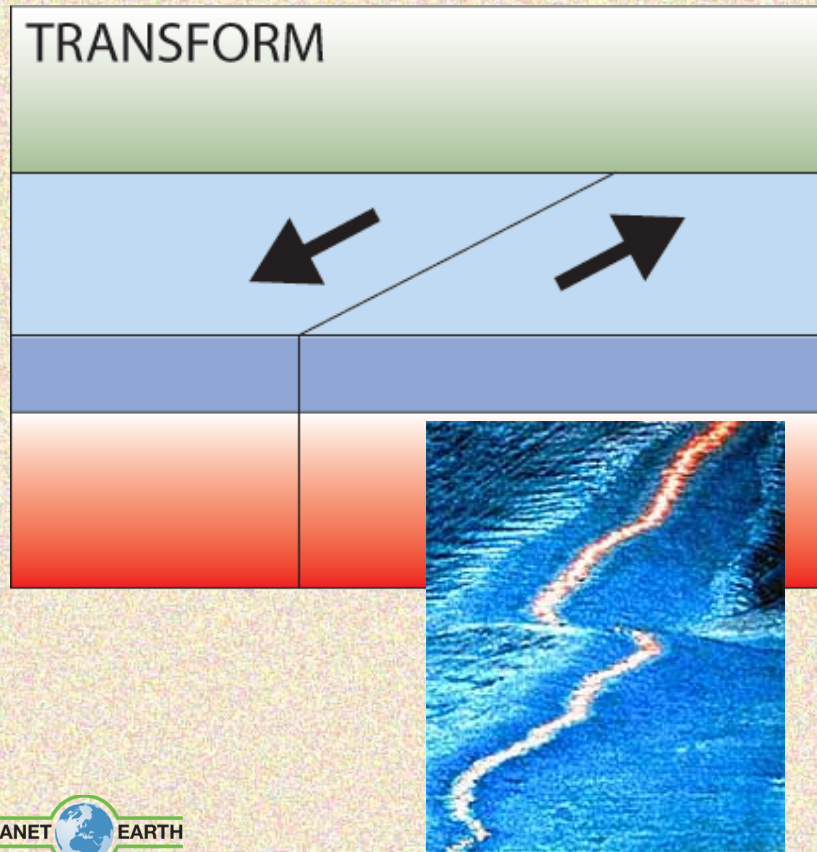
Ocean-Ocean Plate Collision

- When two oceanic plates collide, one runs over the other which causes it to sink into the mantle forming a **subduction zone**.
- The subducting plate is bent downward to form a very deep depression in the ocean floor called a **trench**.
- The worlds deepest parts of the ocean are found along trenches.
 - E.g. The Mariana Trench is 11 km deep!

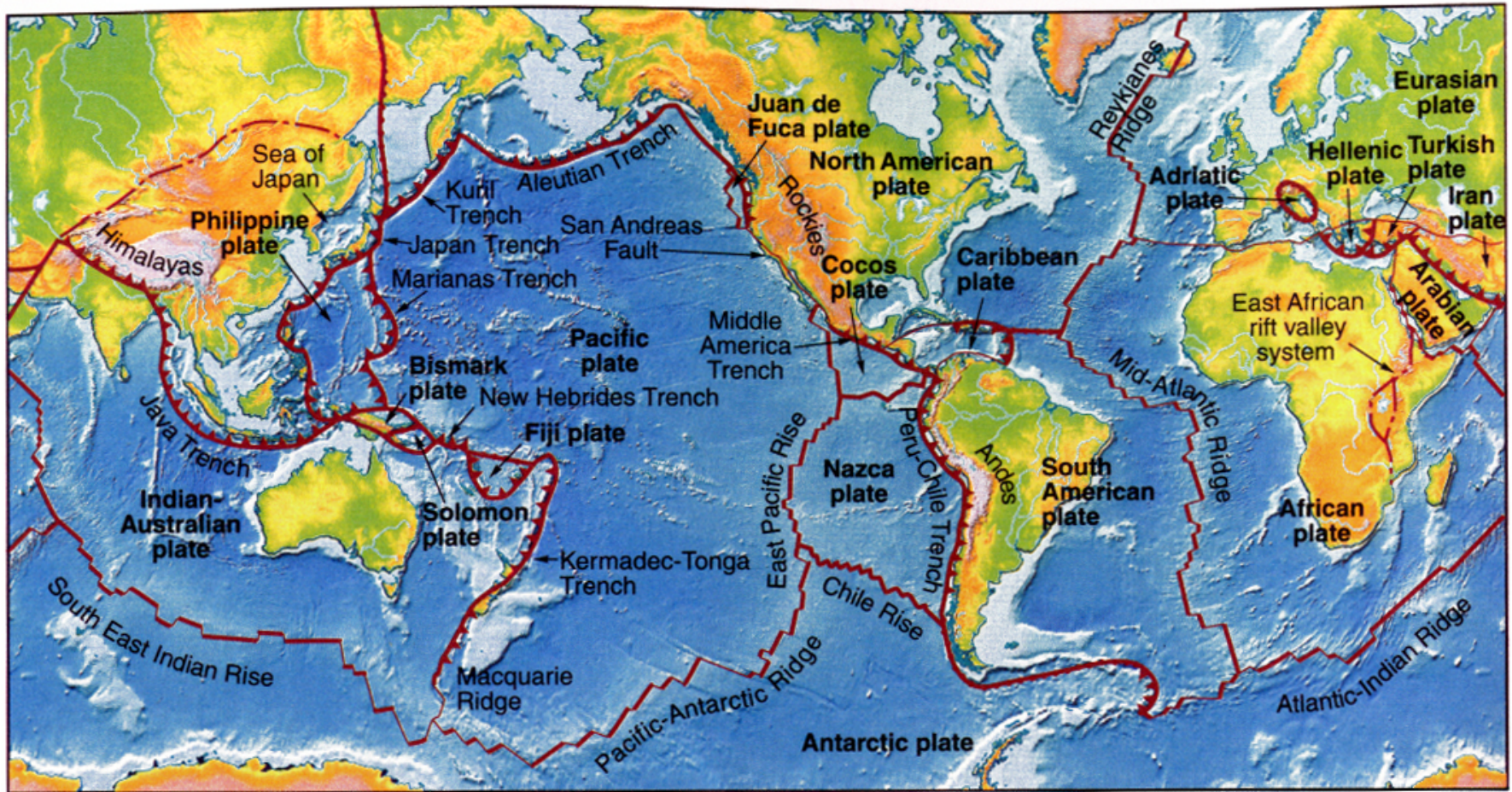


Transform Boundaries

- Where plates slide past each other



Above: View of the San Andreas transform fault



Ridge axis
divergent boundary

Transform

Subduction zone
Convergent boundary

Zones of Extension within continents

Uncertain plate
boundary

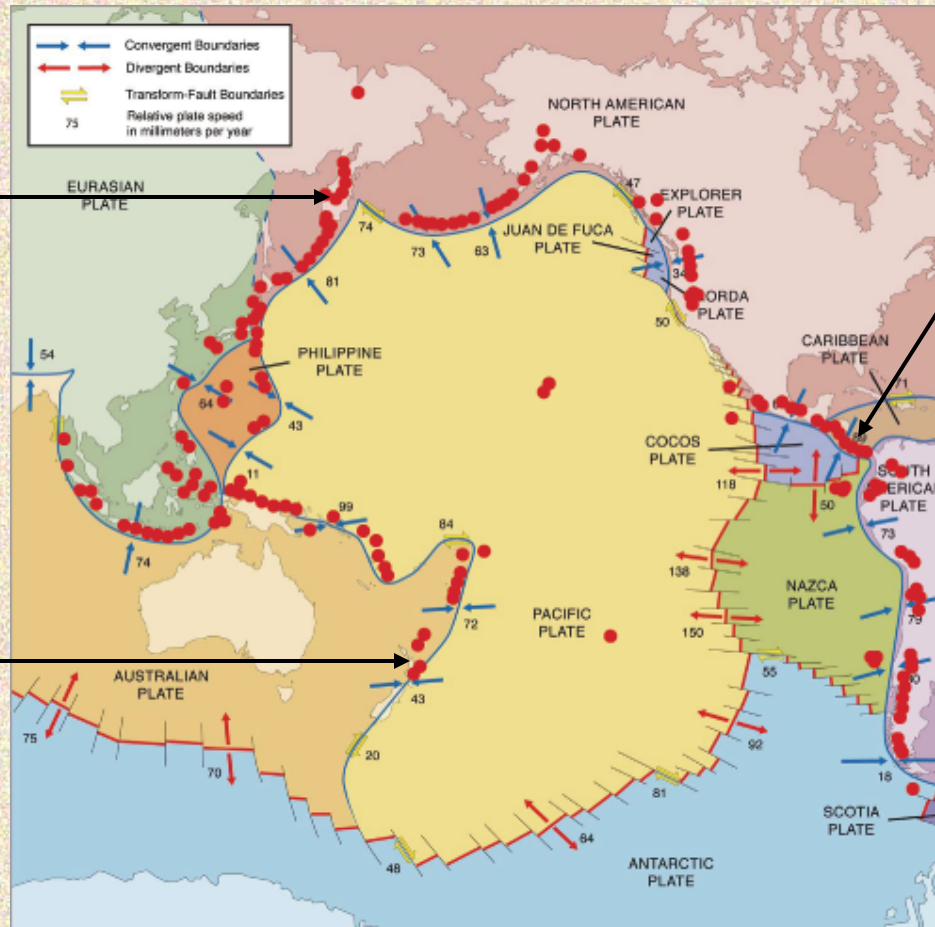
Earth Plate



Volcanoes and Plate Tectonics...

...what's the connection?

Pacific Ring of Fire

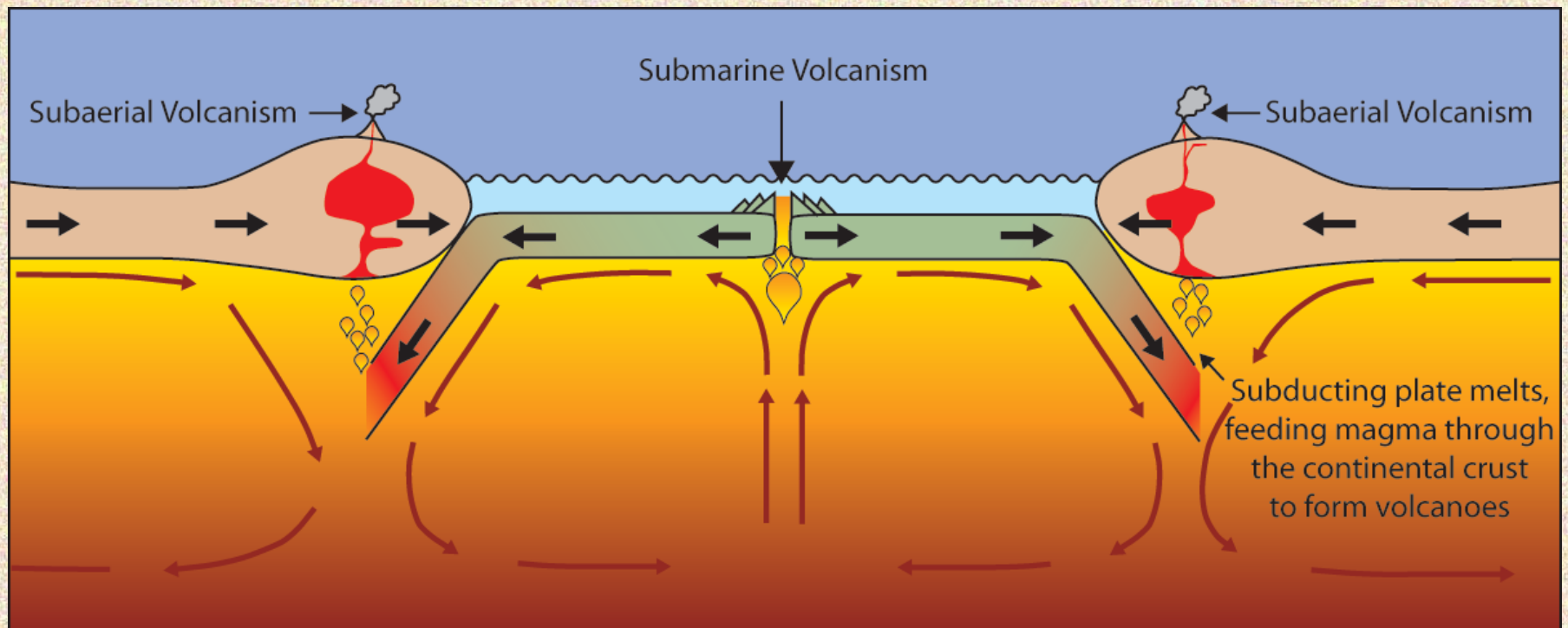


Volcanism is mostly focused at plate margins

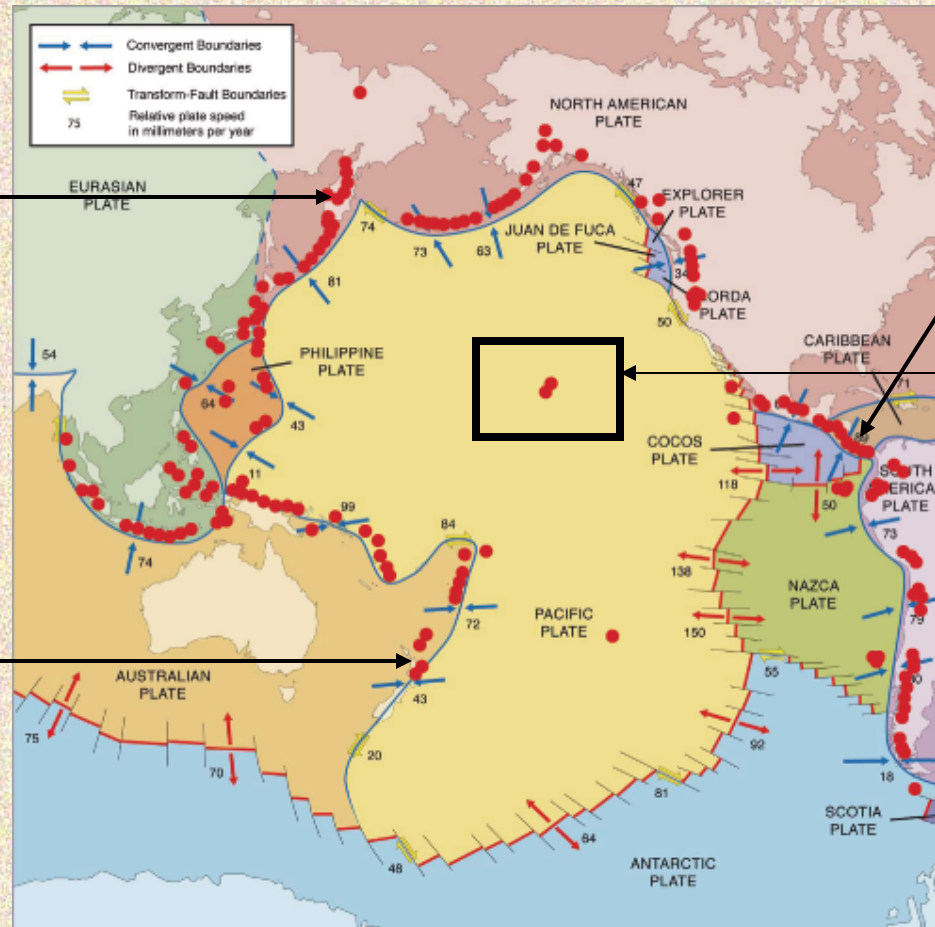


Volcanoes are formed by:

- Subduction
- Rifting
- Hotspots



Pacific Ring of Fire



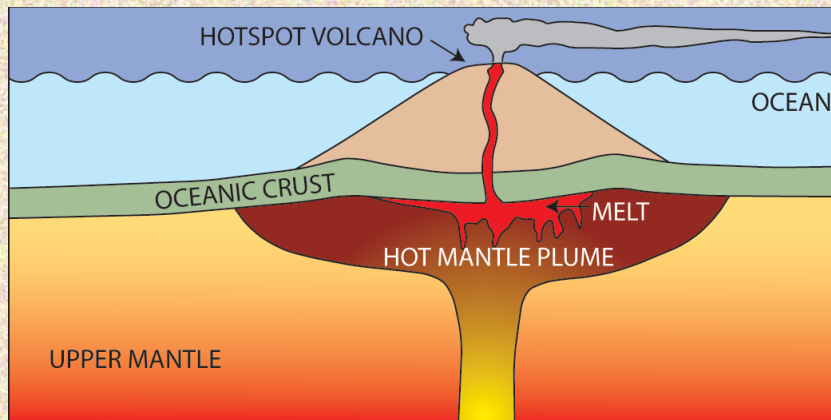
Hotspot
volcanoes





What are Hotspot Volcanoes?

- Hot mantle plumes breaching the surface in the middle of a tectonic plate



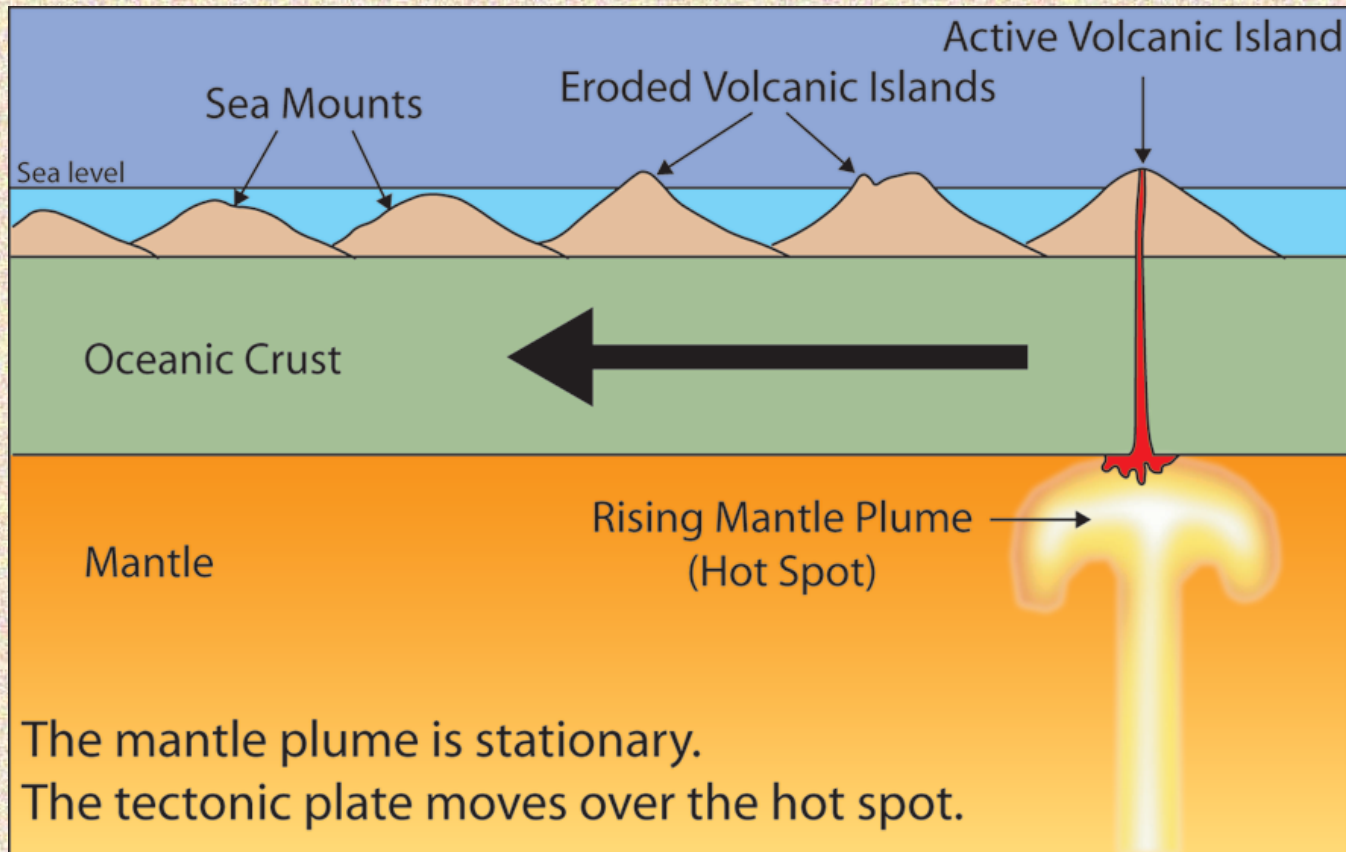
The Hawaiian island chain are examples of hotspot volcanoes.



Photo: Tom Pfeiffer / www.volcanodiscovery.com



The tectonic plate moves over a fixed hotspot forming a chain of volcanoes.



The volcanoes get younger from one end to the other.



Earthquakes and Plate Tectonics...

...what's the connection?



- As with volcanoes, earthquakes are **not** randomly distributed over the globe

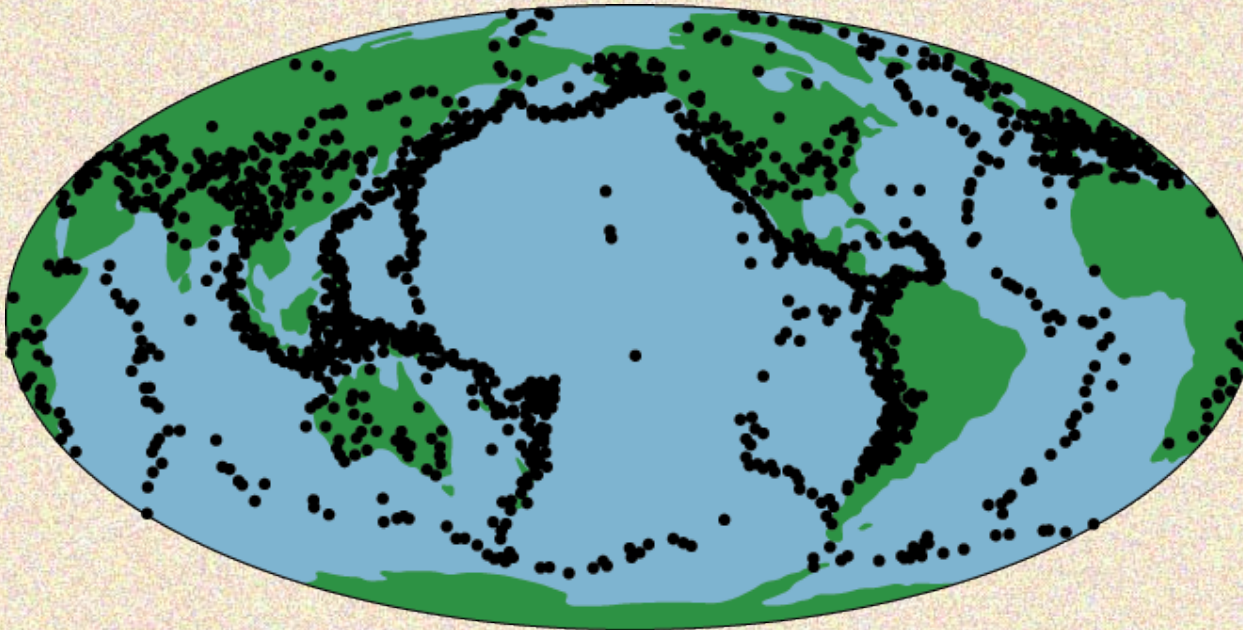


Figure showing
the distribution of
earthquakes
around the globe

- At the boundaries between plates, friction causes them to stick together. When built up energy causes them to break, earthquakes occur.

Where do earthquakes form?

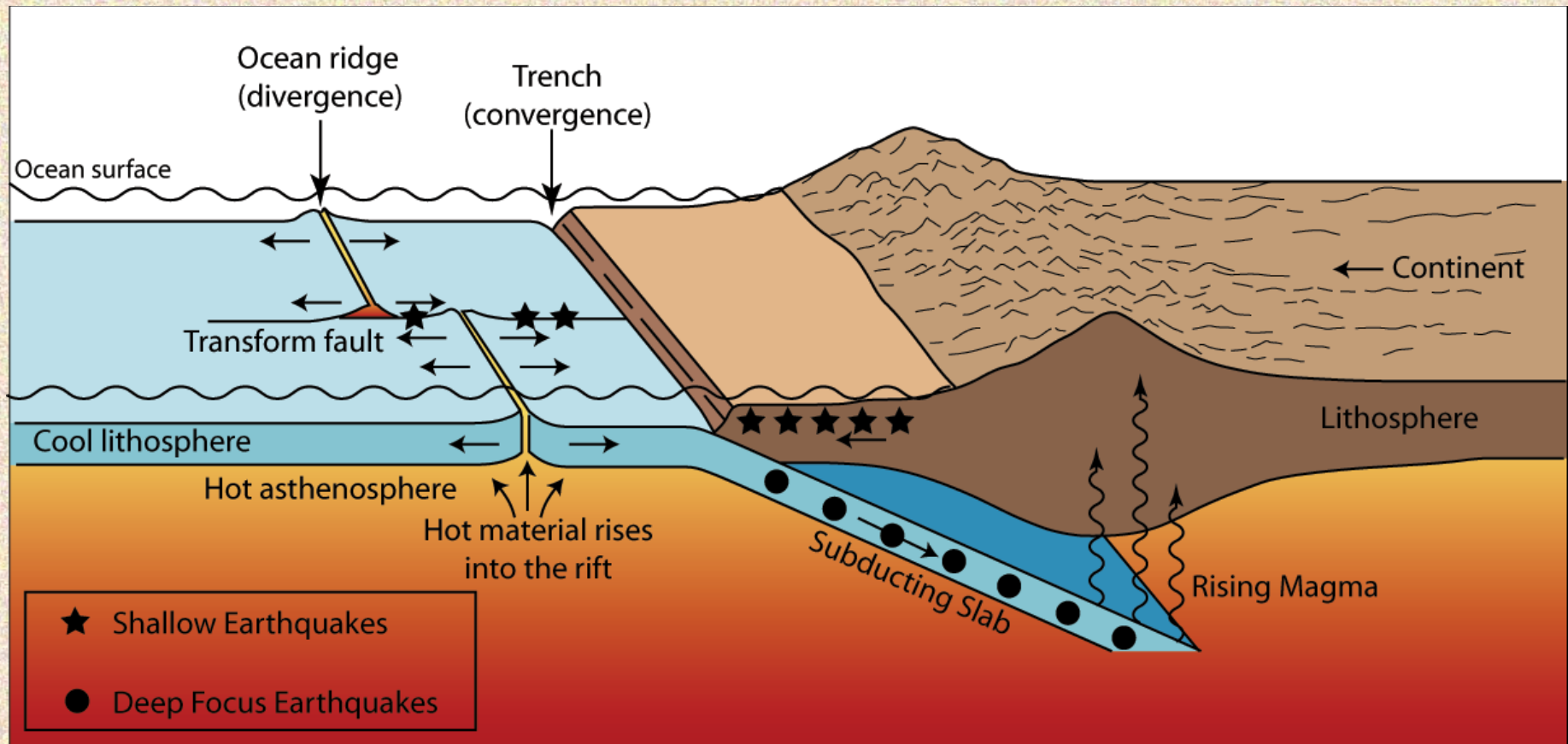


Figure showing the tectonic setting of earthquakes



Plate Tectonics Summary

- The Earth is made up of 3 main layers (core, mantle, crust)
- On the surface of the Earth are tectonic plates that slowly move around the globe
- Plates are made of crust and upper mantle (lithosphere)
- There are 2 types of plate
- There are 3 types of plate boundaries
- Volcanoes and Earthquakes are closely linked to the margins of the tectonic plates