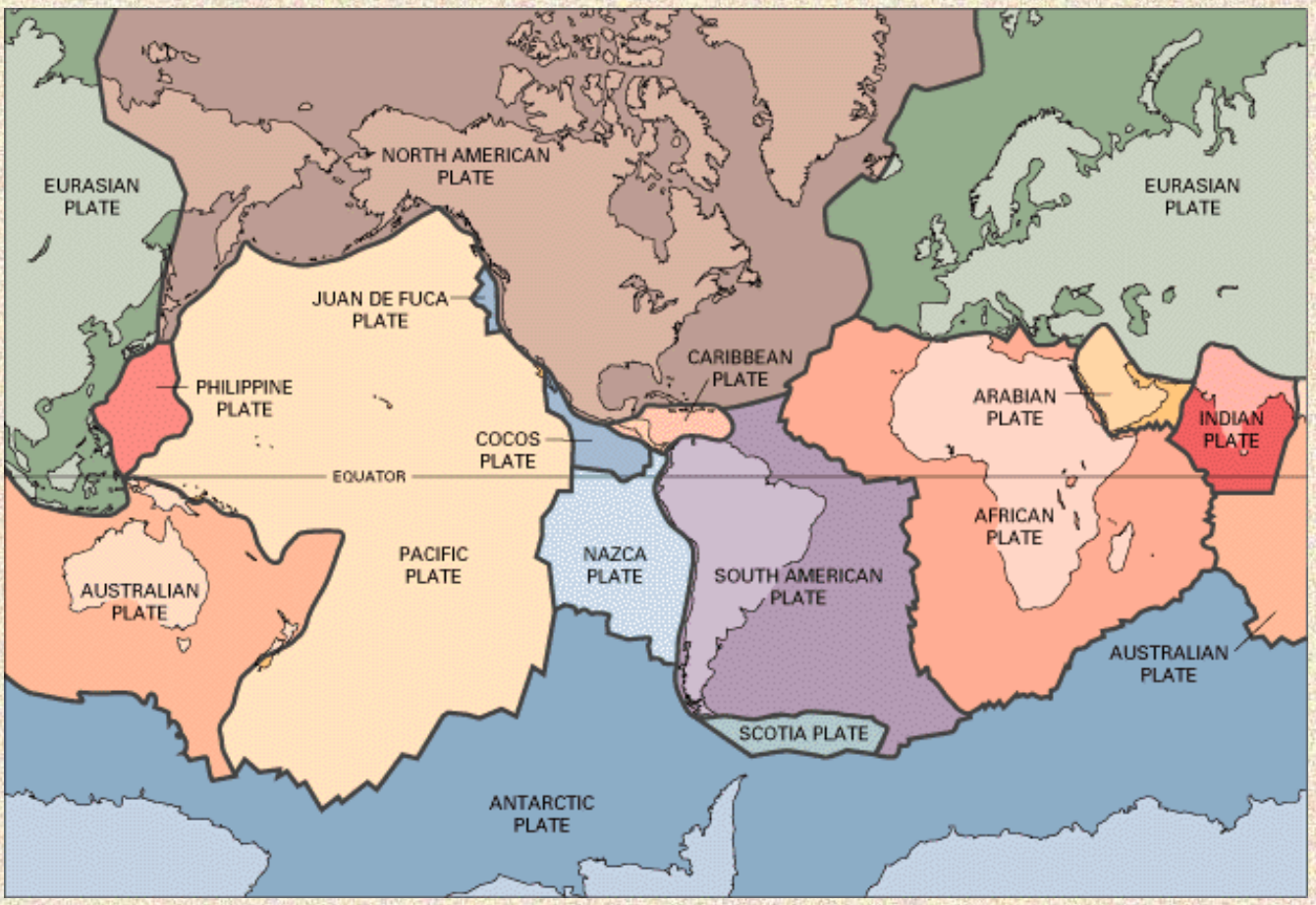
Plate Tectonics

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.

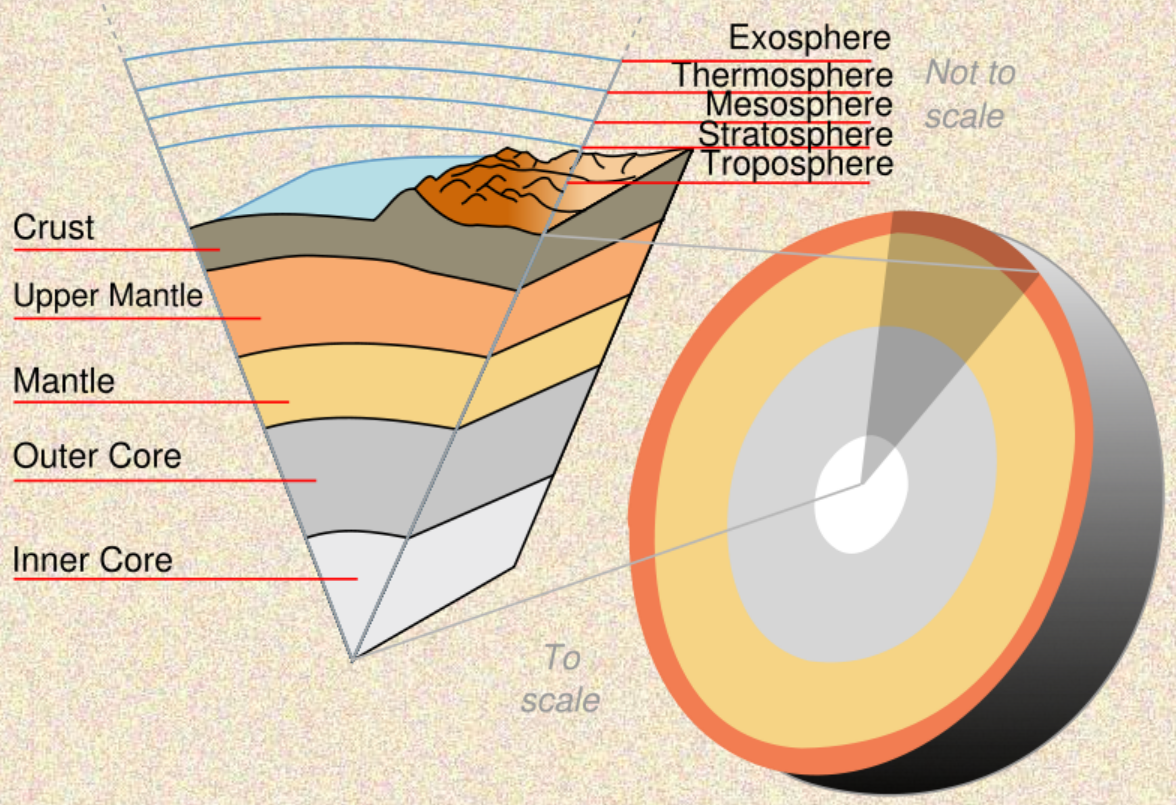
World Plates



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.

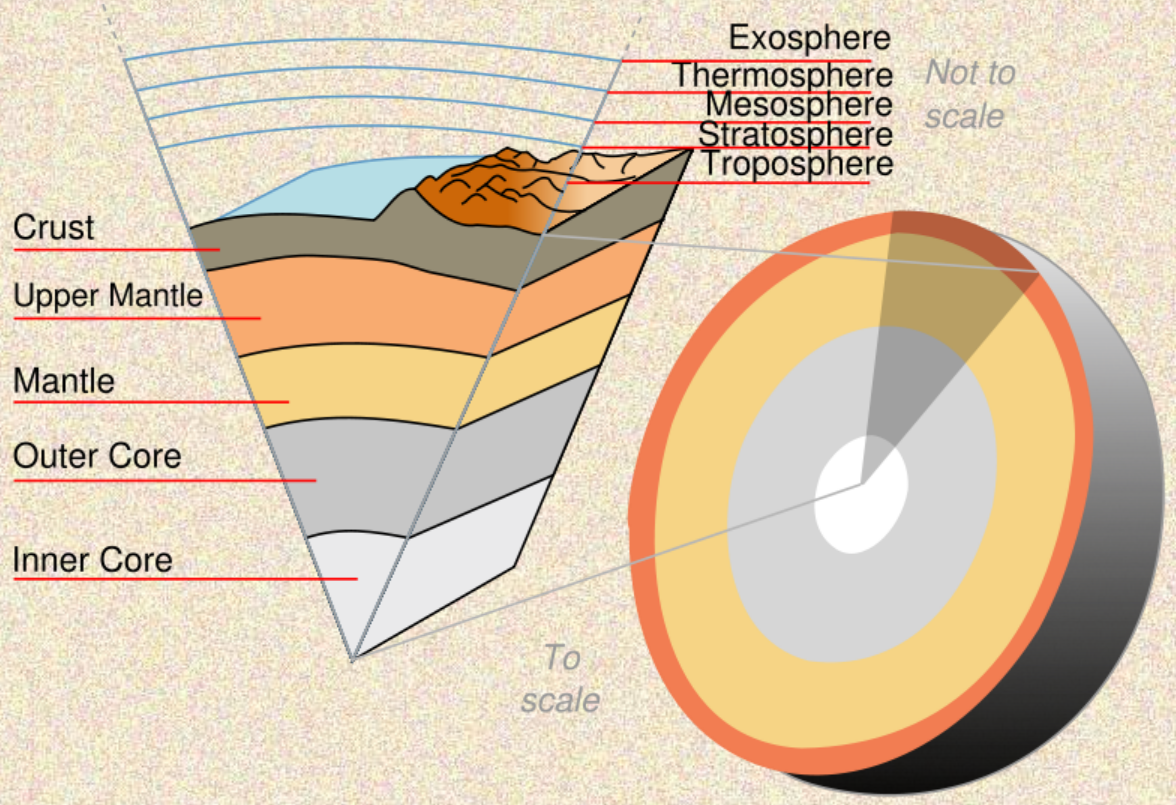
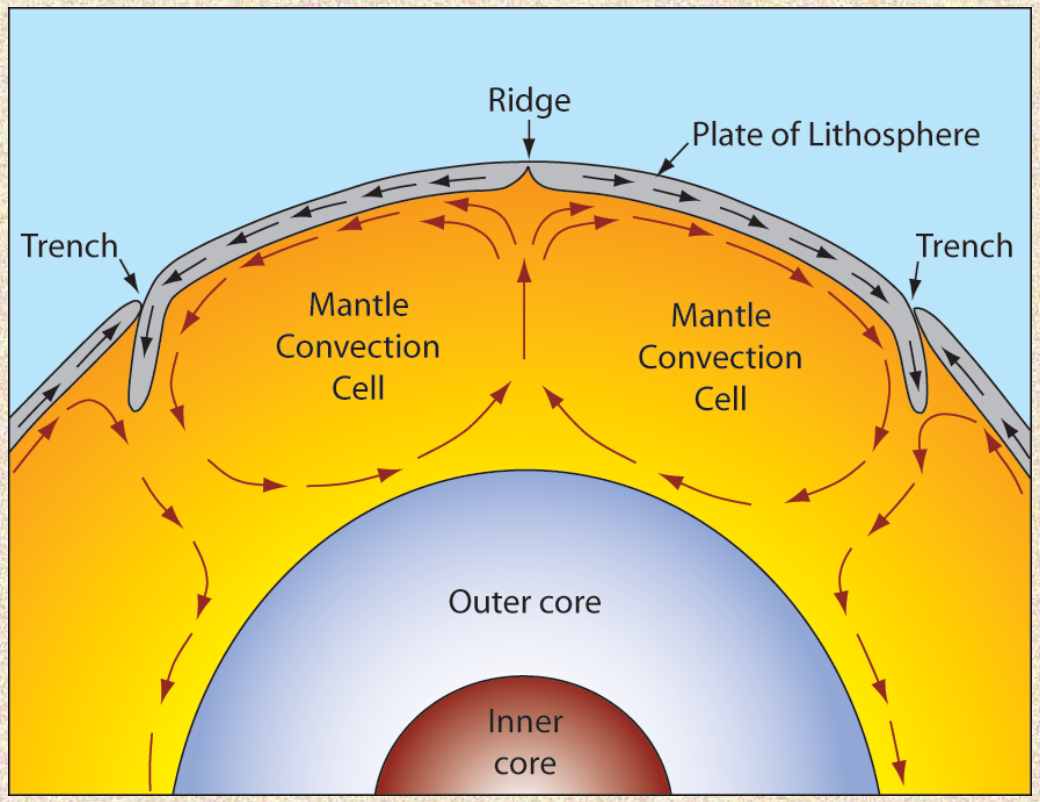


Plate Movement

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



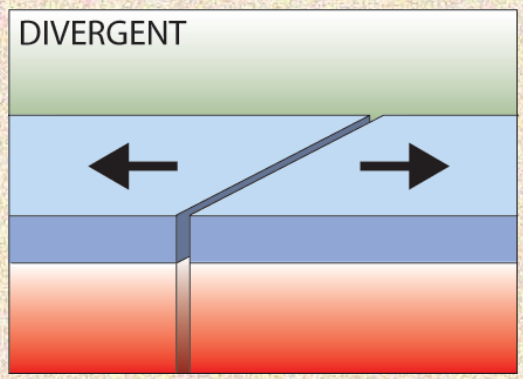
Practical Exercise 1

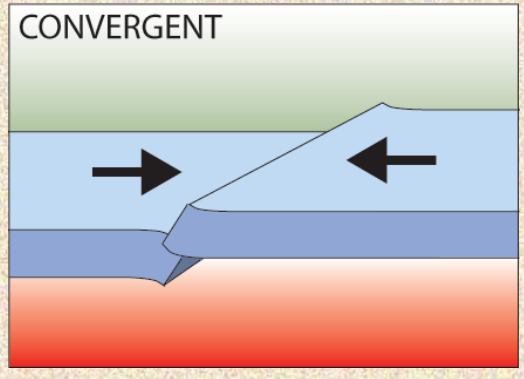
Supercontinents!

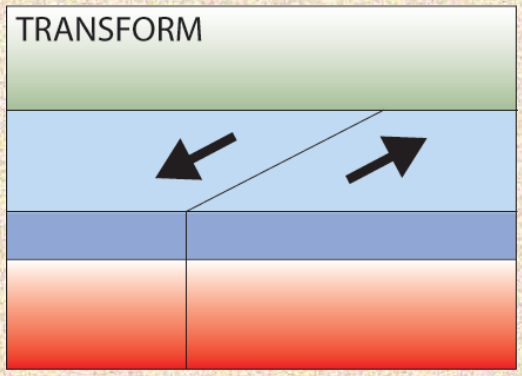
What happens at tectonic plate boundaries?

Three types of plate boundary

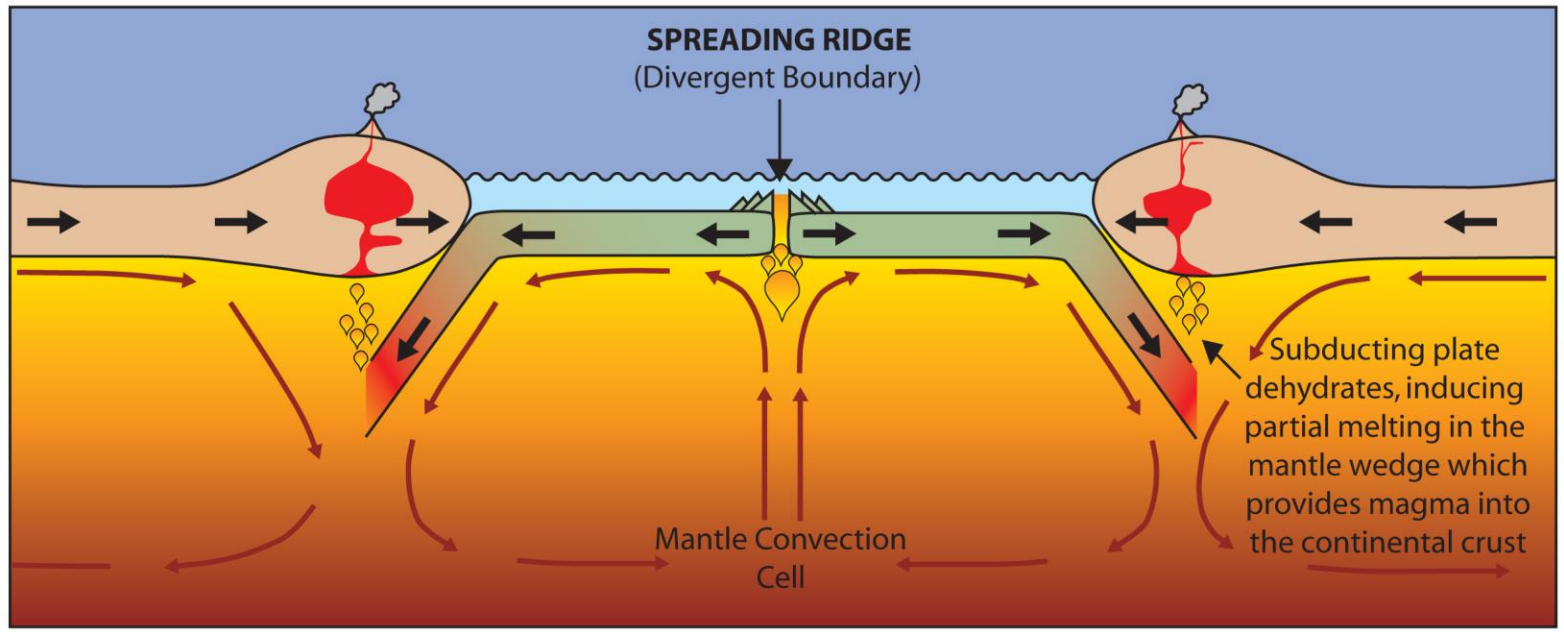
- Divergent
- Convergent
- Transform





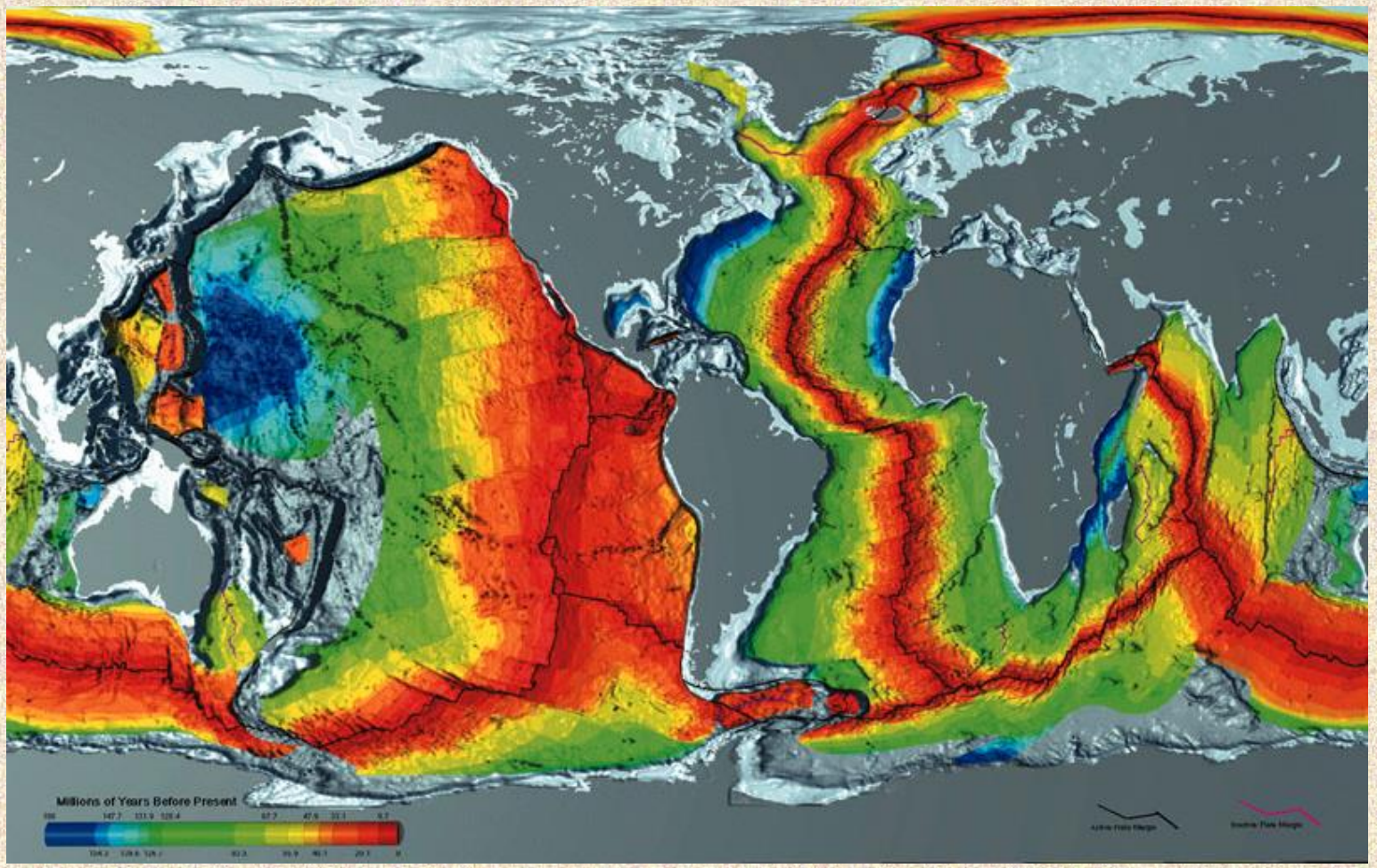


Divergent Boundaries



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

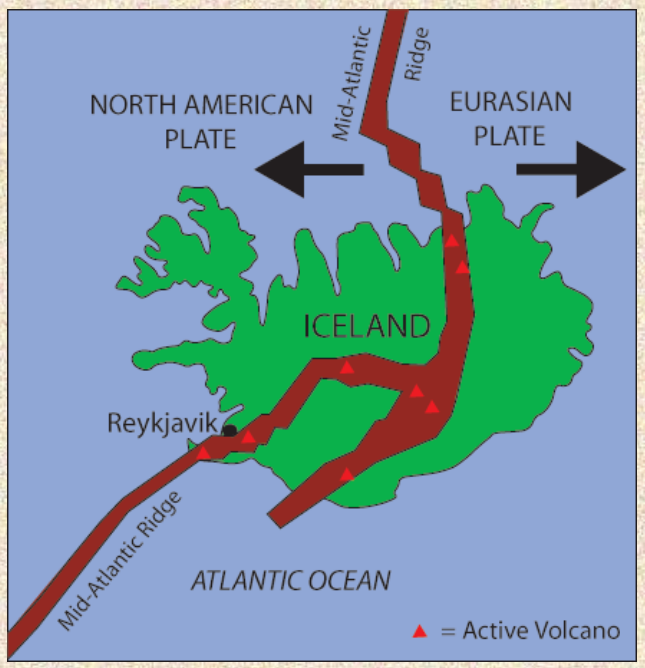
Age of Oceanic Crust



Courtesy of www.ngdc.noaa.gov

Iceland: An example of continental rifting

- Iceland has a divergent plate boundary running through its middle

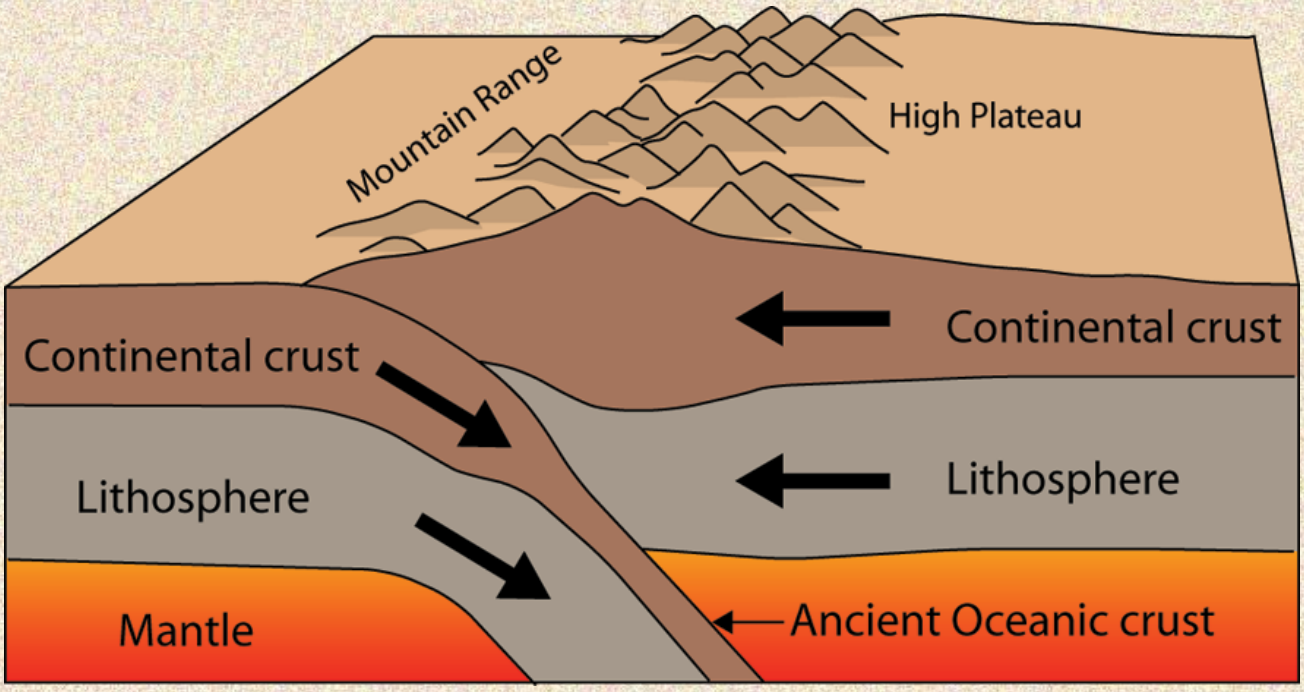


Convergent Boundaries

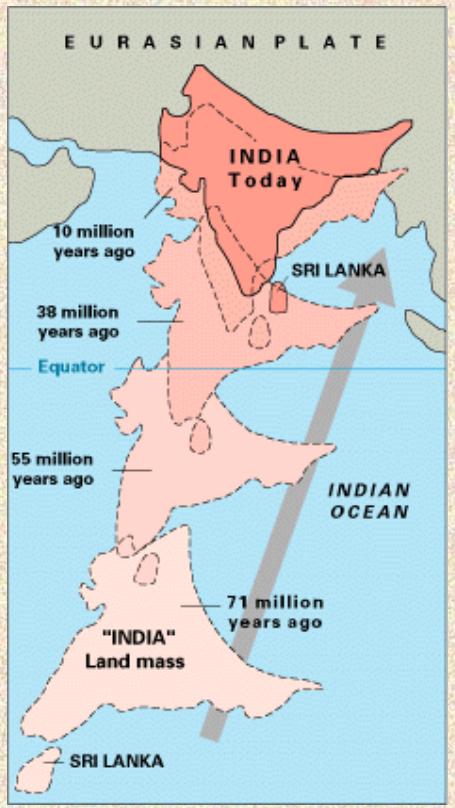
- There are three styles of convergent plate boundaries
  - Continent-continent collision
  - Continent-oceanic crust collision
  - Ocean-ocean collision

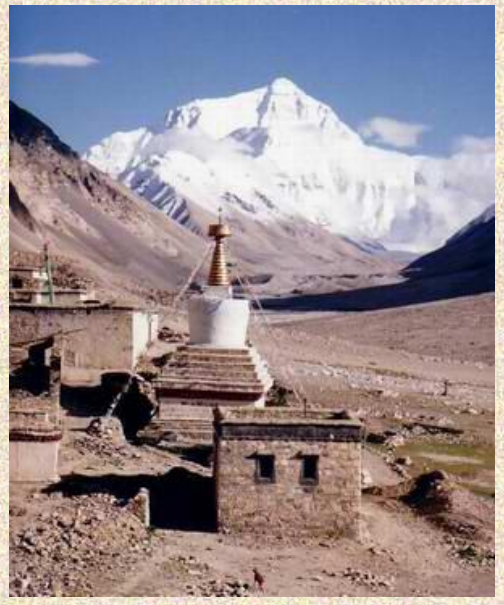
Continent-Continent Collision

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



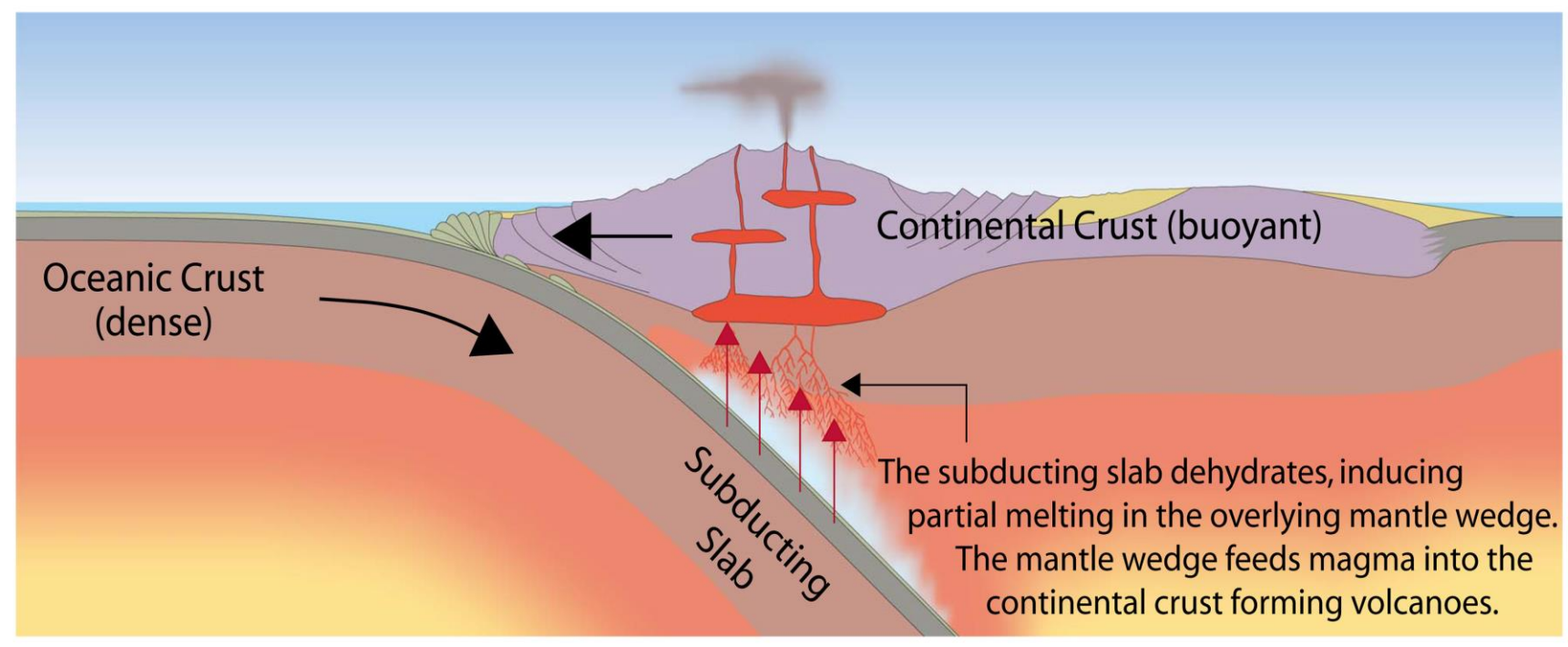
Himalayas


EURASIAN PLATE
INDIA
Today
10 million
years ago
SRI LANKA
38 million
years ago
Equator
55 million
years ago
INDIAN
OCEAN
71 million
years ago
"INDIA"
Land mass
SRI LANKA

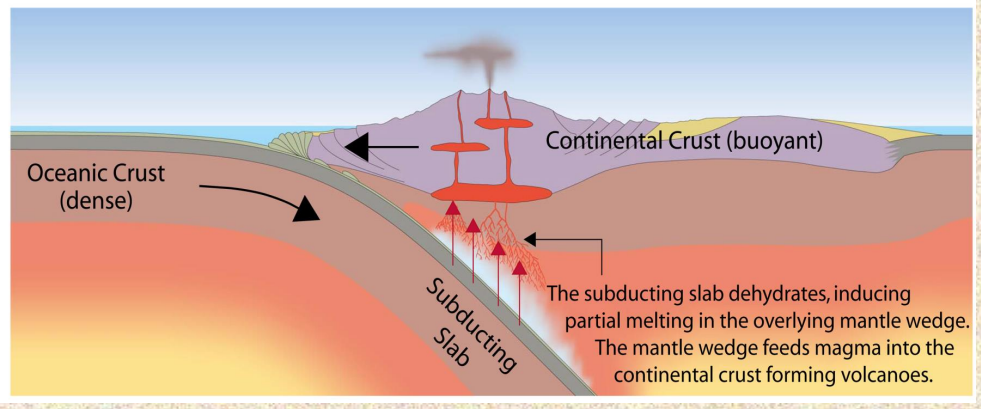


Continent-Oceanic Crust Collision

- Called SUBDUCTION



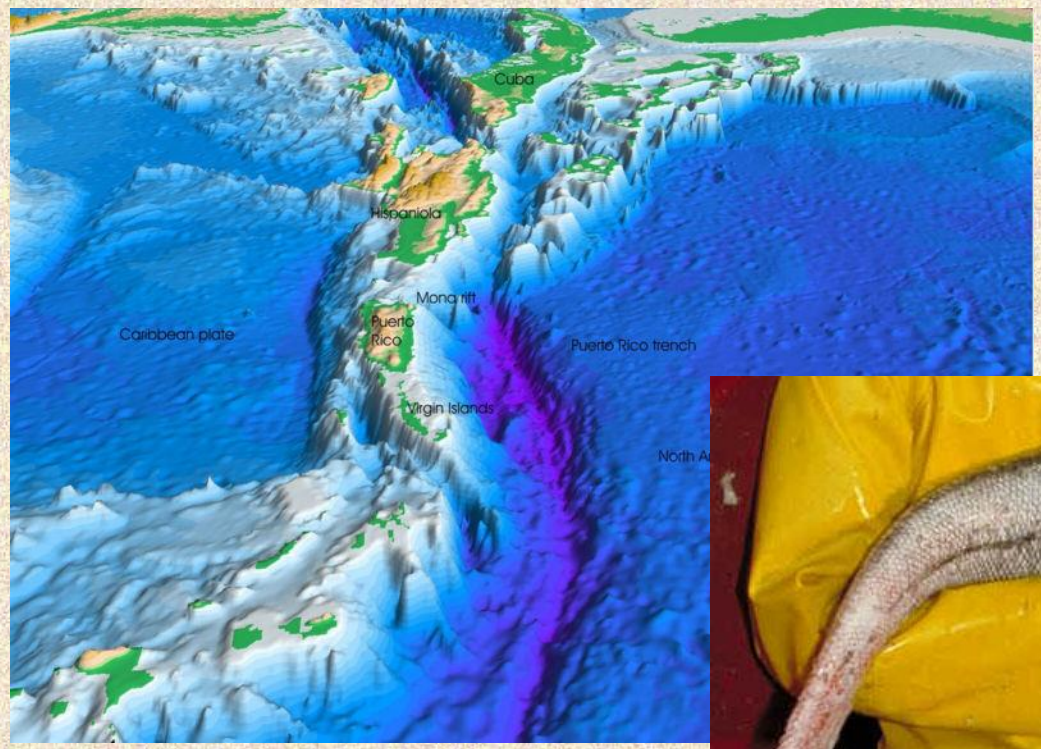
Subduction

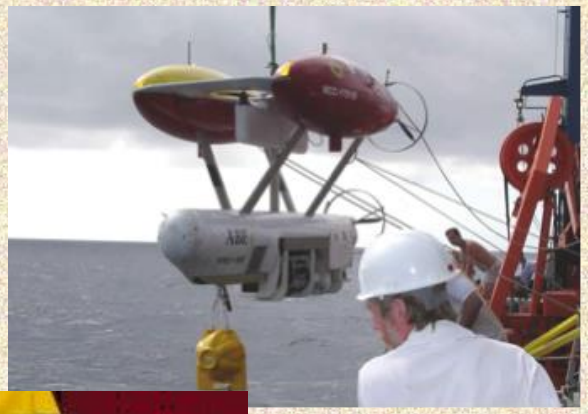


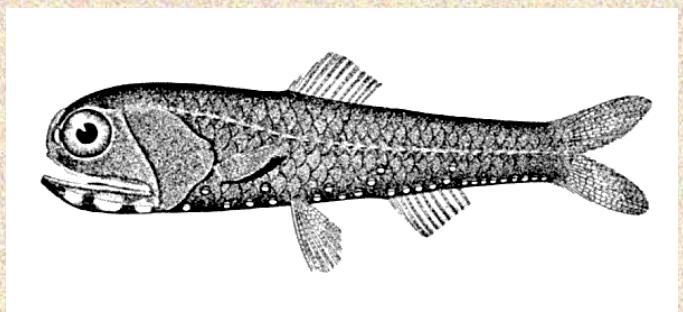
- Oceanic lithosphere subducts underneath the continental lithosphere
- Oceanic lithosphere heats and dehydrates as it subsides
- The melt rises forming volcanism
- E.g. The Andes

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!

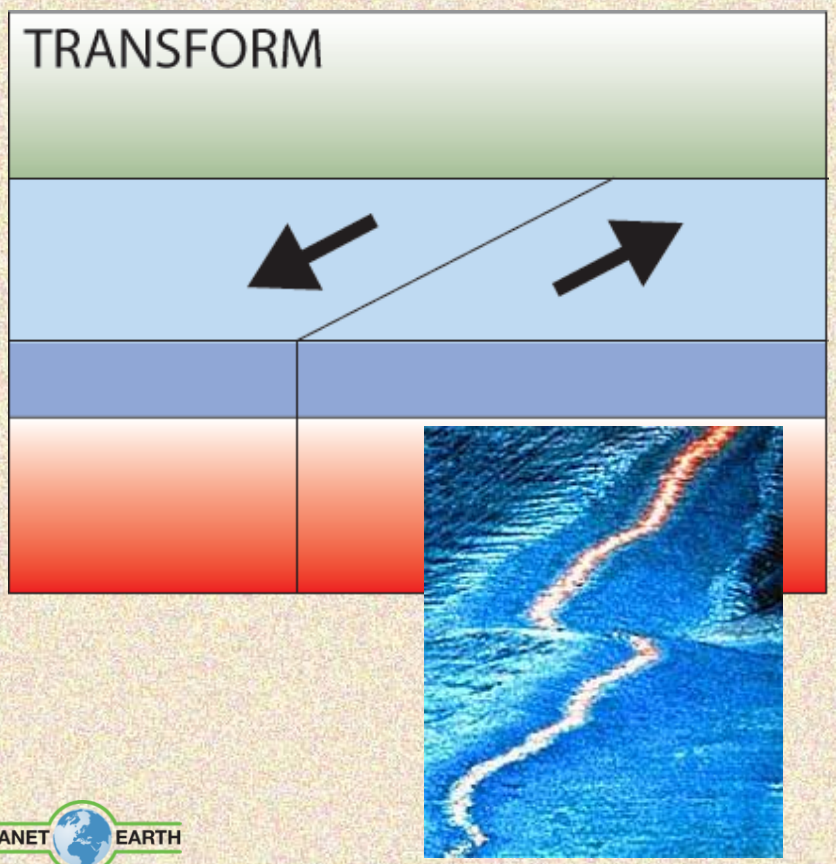

Cuba
Hispaniola
Mona rift
Puerto Rico
Caribbean plate
Puerto Rico trench
Virgin Islands

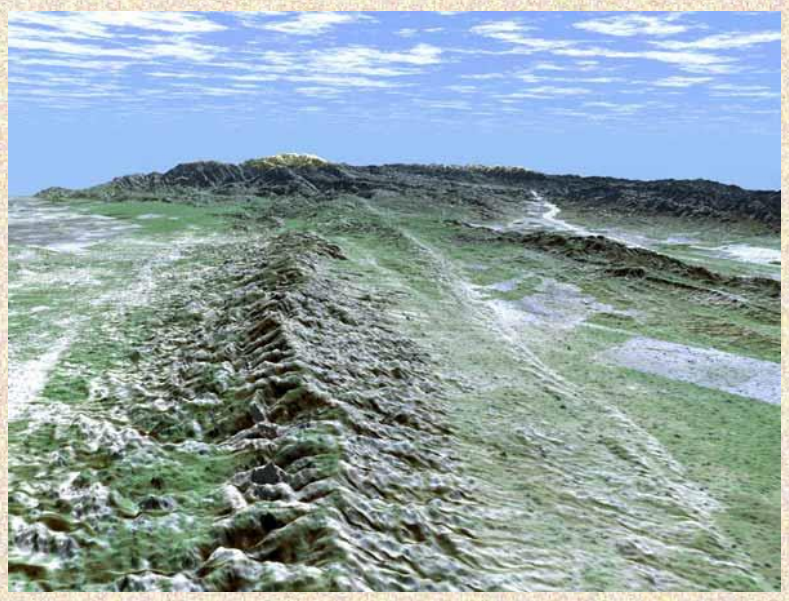




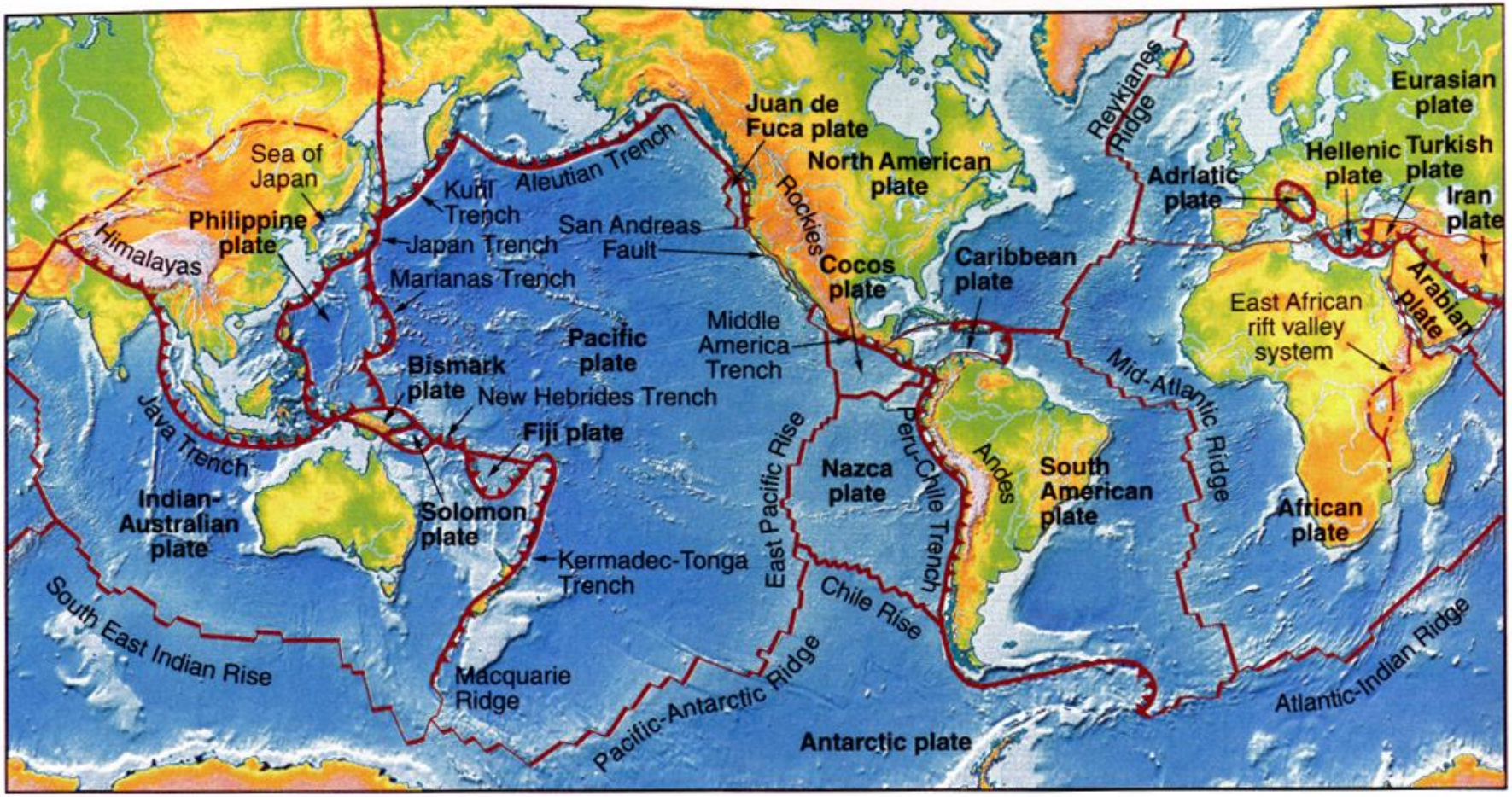
Transform Boundaries

- 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

Practical Exercise 2

Where will the UK be in:

1,000 years?

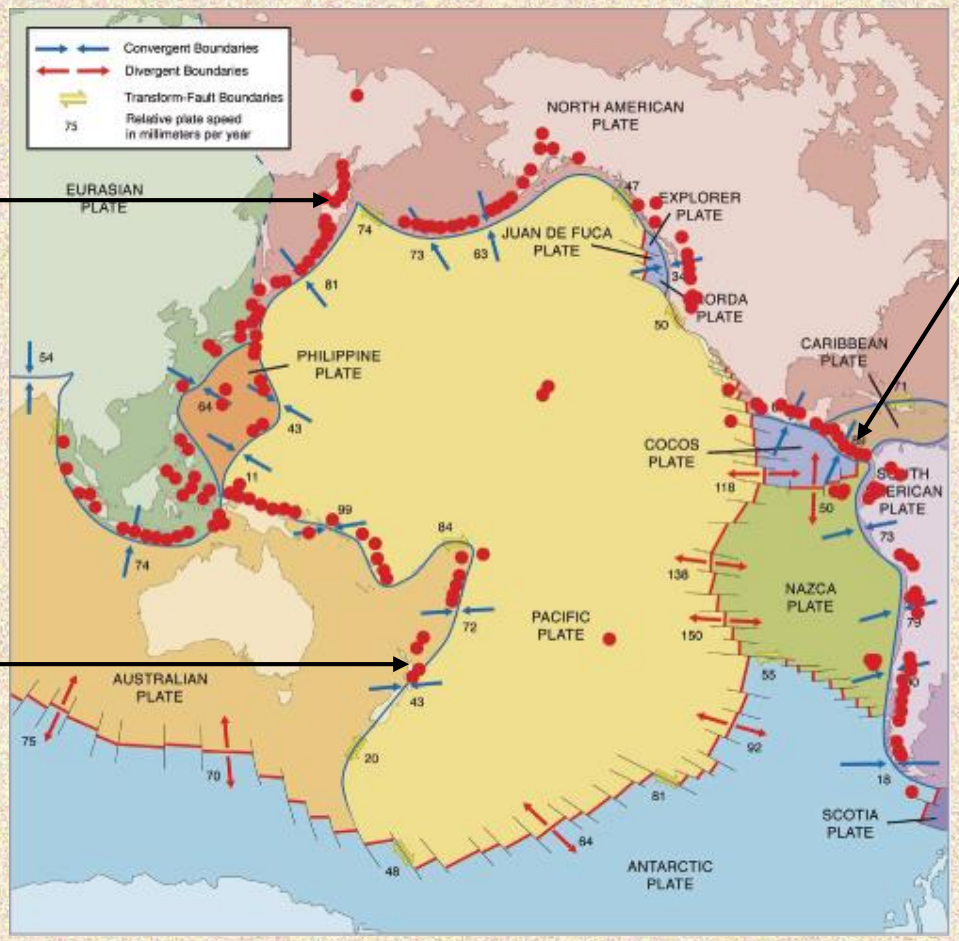
1,000,000 years?

1,000,000,000 years?

Volcanoes and Plate Tectonics…

…what's the connection?

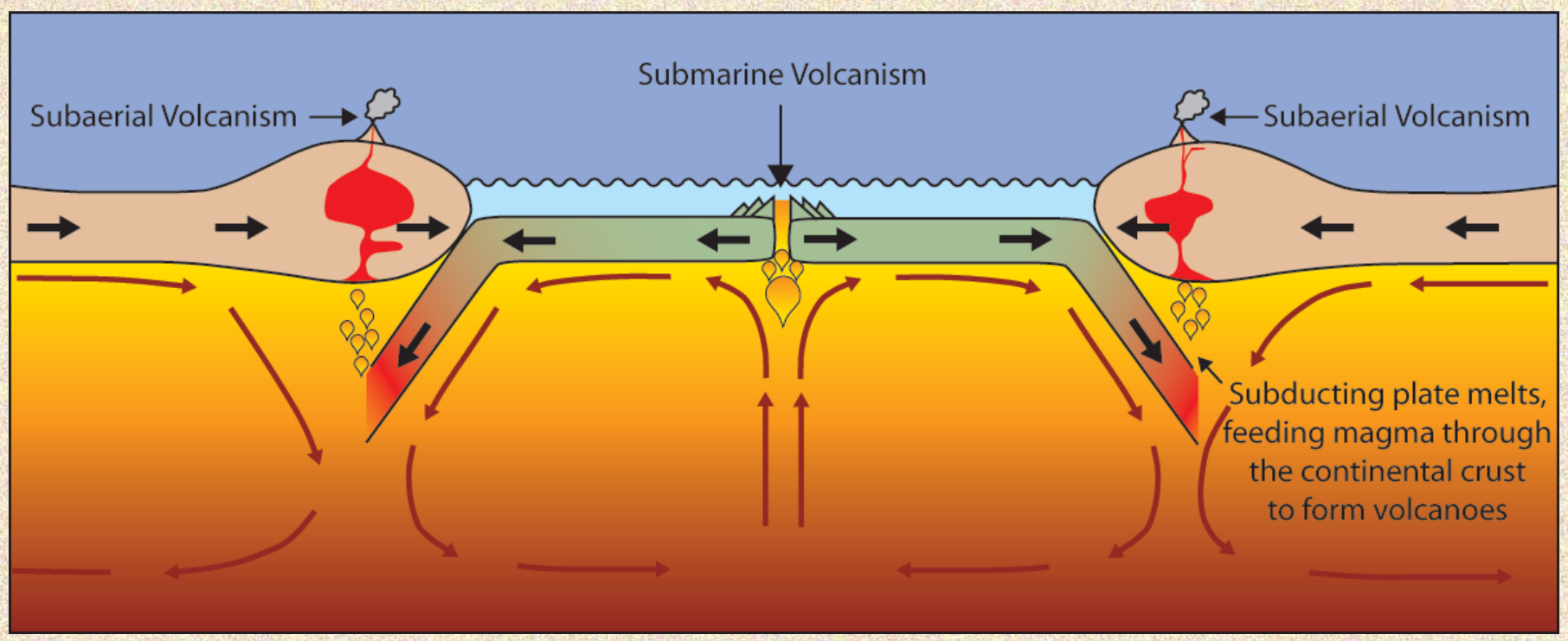
Pacific Ring of Fire



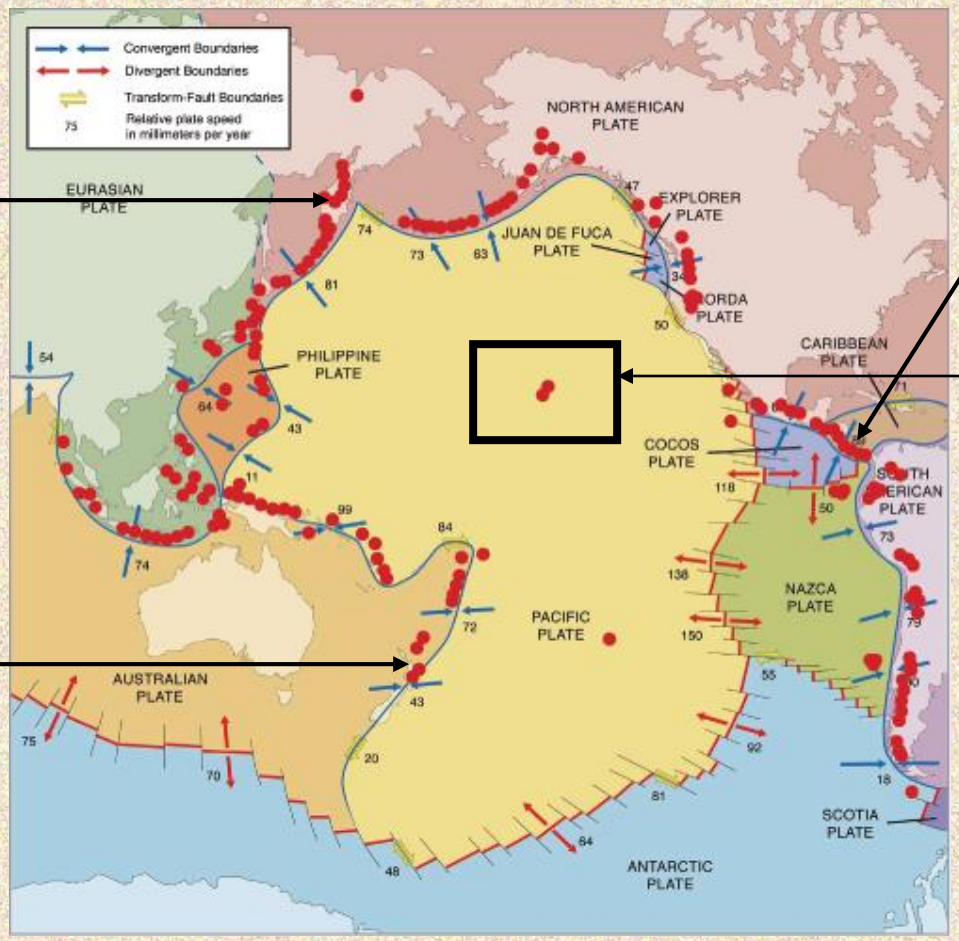
Volcanism is mostly focused at plate margins

Volcanoes are formed by:

- Subduction - Rifting - Hotspots



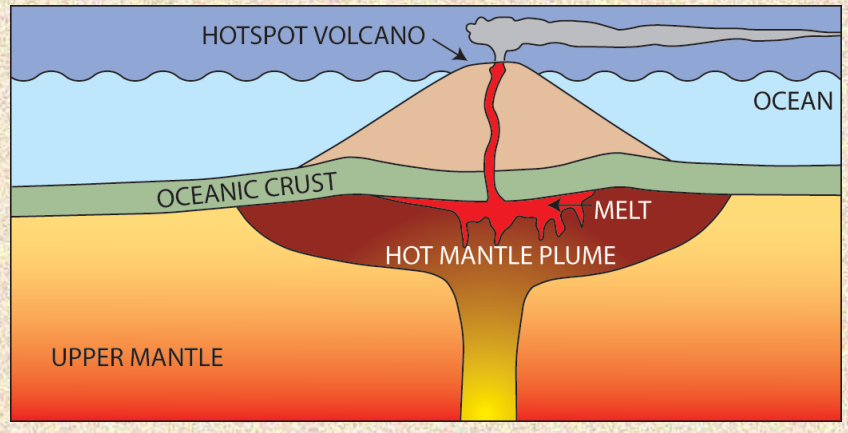
Pacific Ring of Fire



Hotspot volcanoes

What are Hotspot Volcanoes?

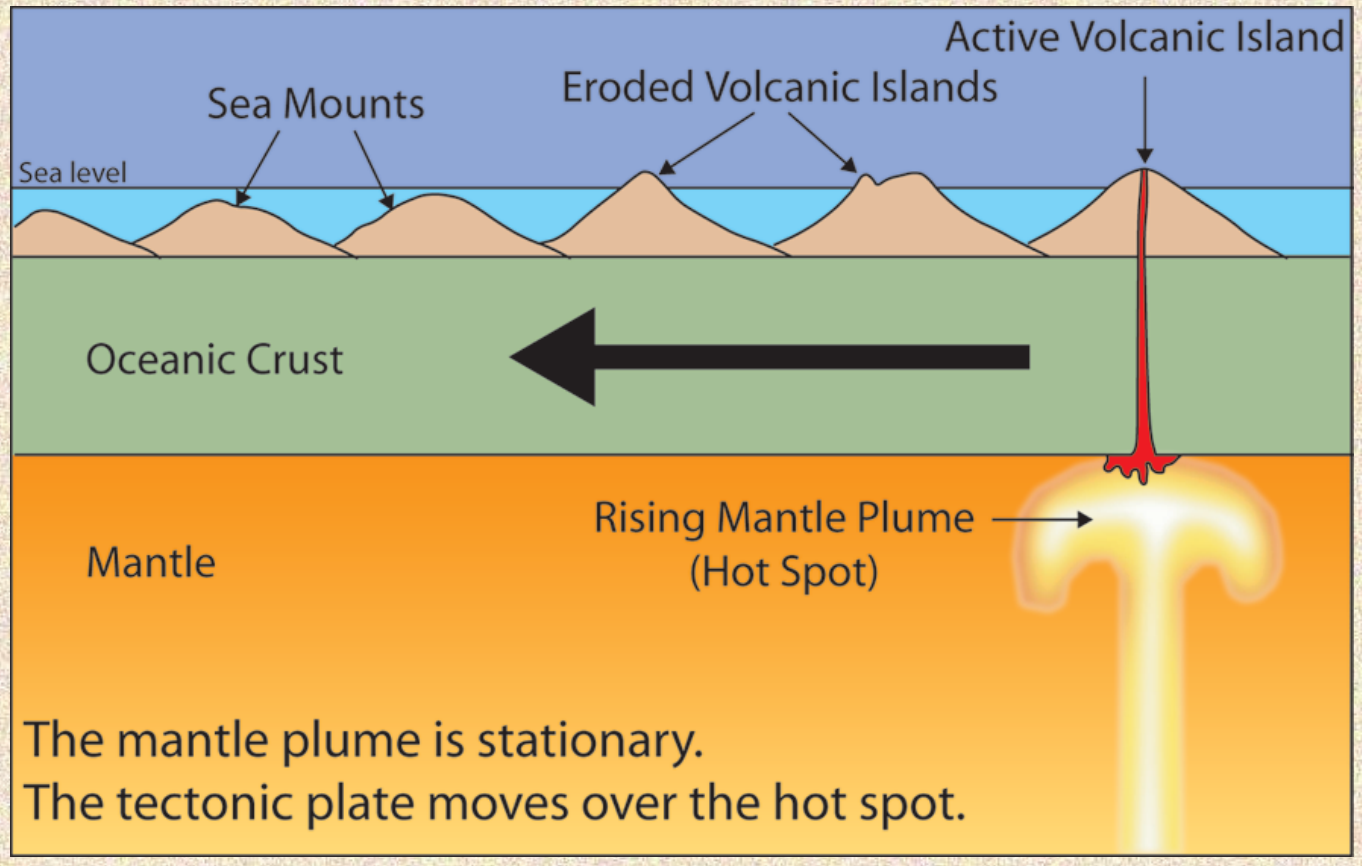
- Hot mantle plumes breaching the surface in the middle of a tectonic plate



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

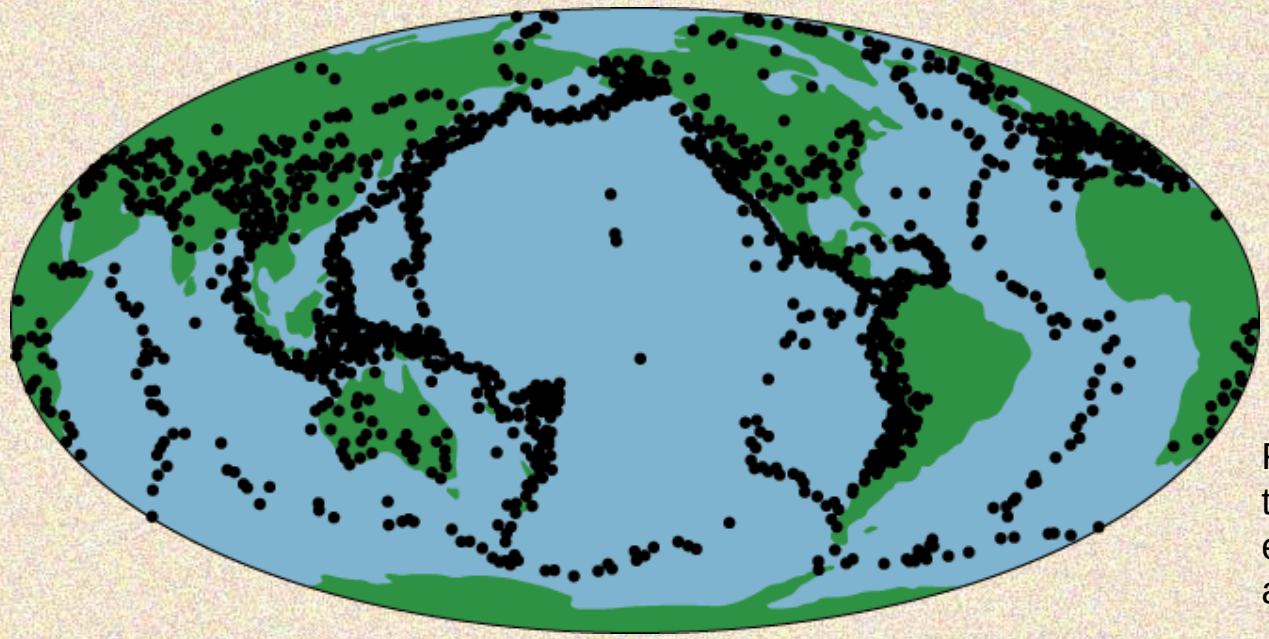


Figure showing the distribution of earthquakes around the globe

- 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?

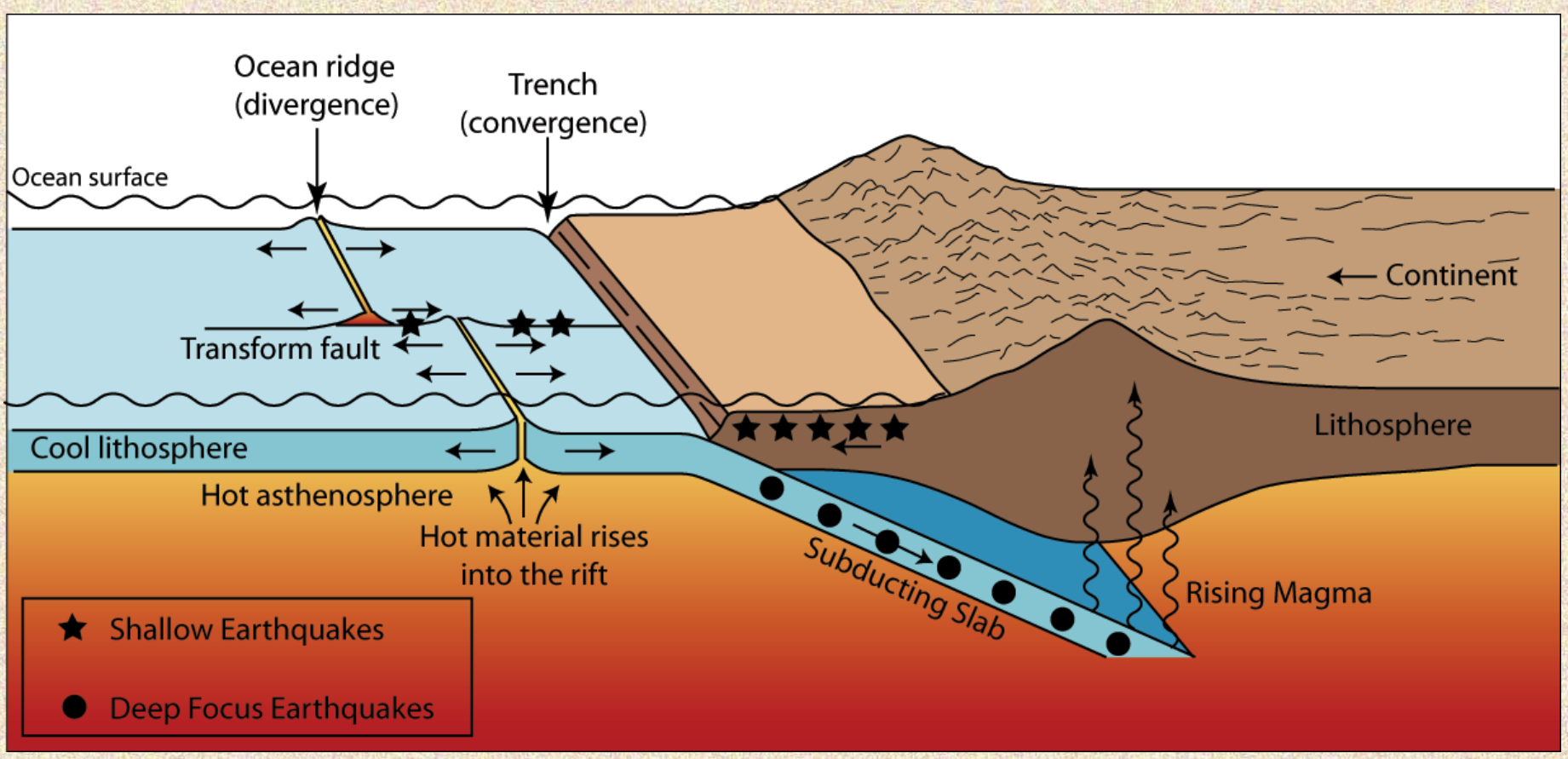


Figure showing the tectonic setting of earthquakes

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