Continental Drift to Plate Tectonics: From hypothesis to theory

Part B: The theory of plate tectonics

Key understandings:

- *earth's oceanic crust is broken into 12 large (and several smaller) pieces or "plates"; pieces of continental crust "ride" on some of these plates*
- *convection cells in the asthenosphere cause the plates to move*
- *three basic plates movements: divergent, convergent, transform*
- *different features are created at different boundaries, depending on the plate movement*

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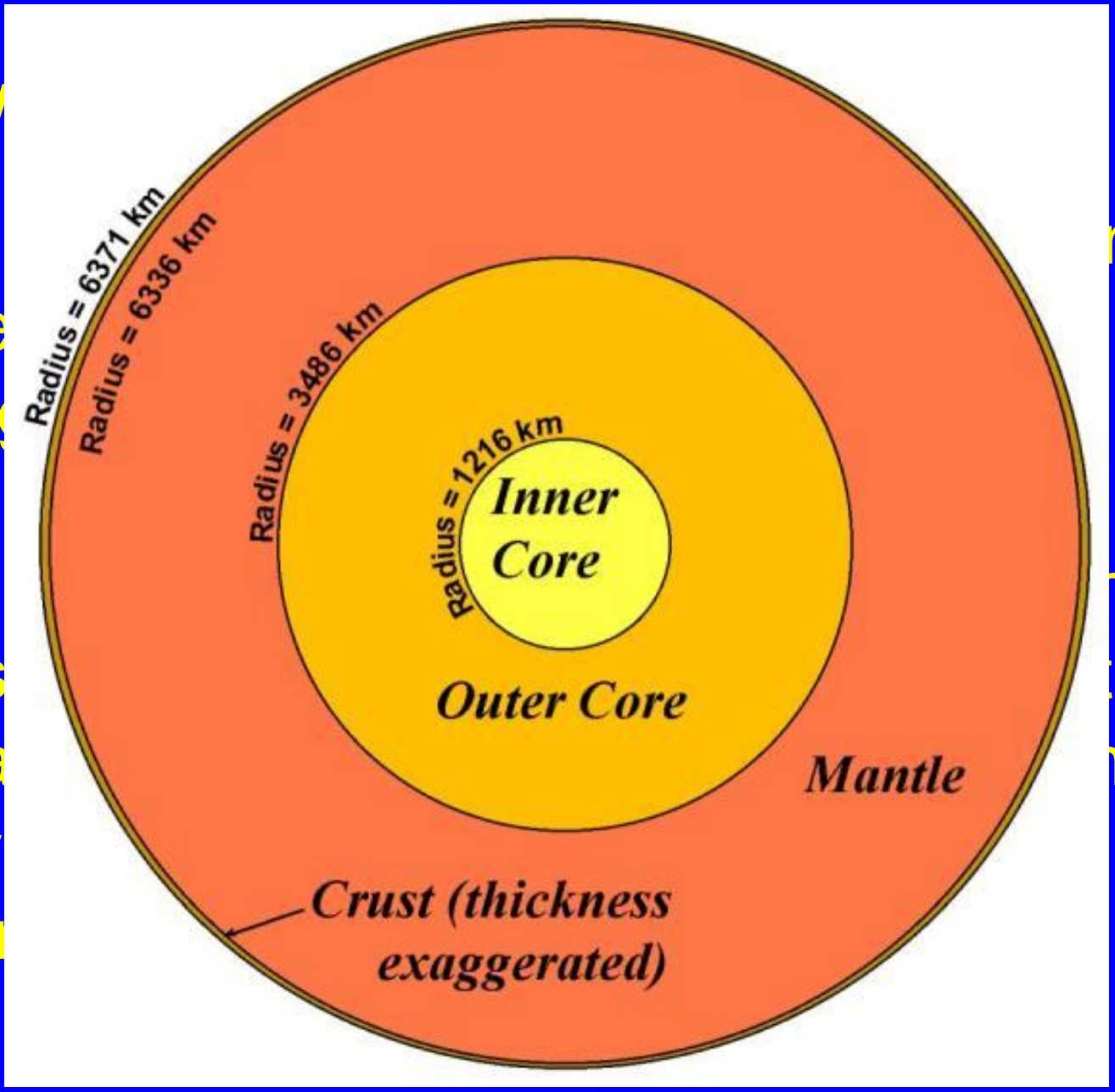

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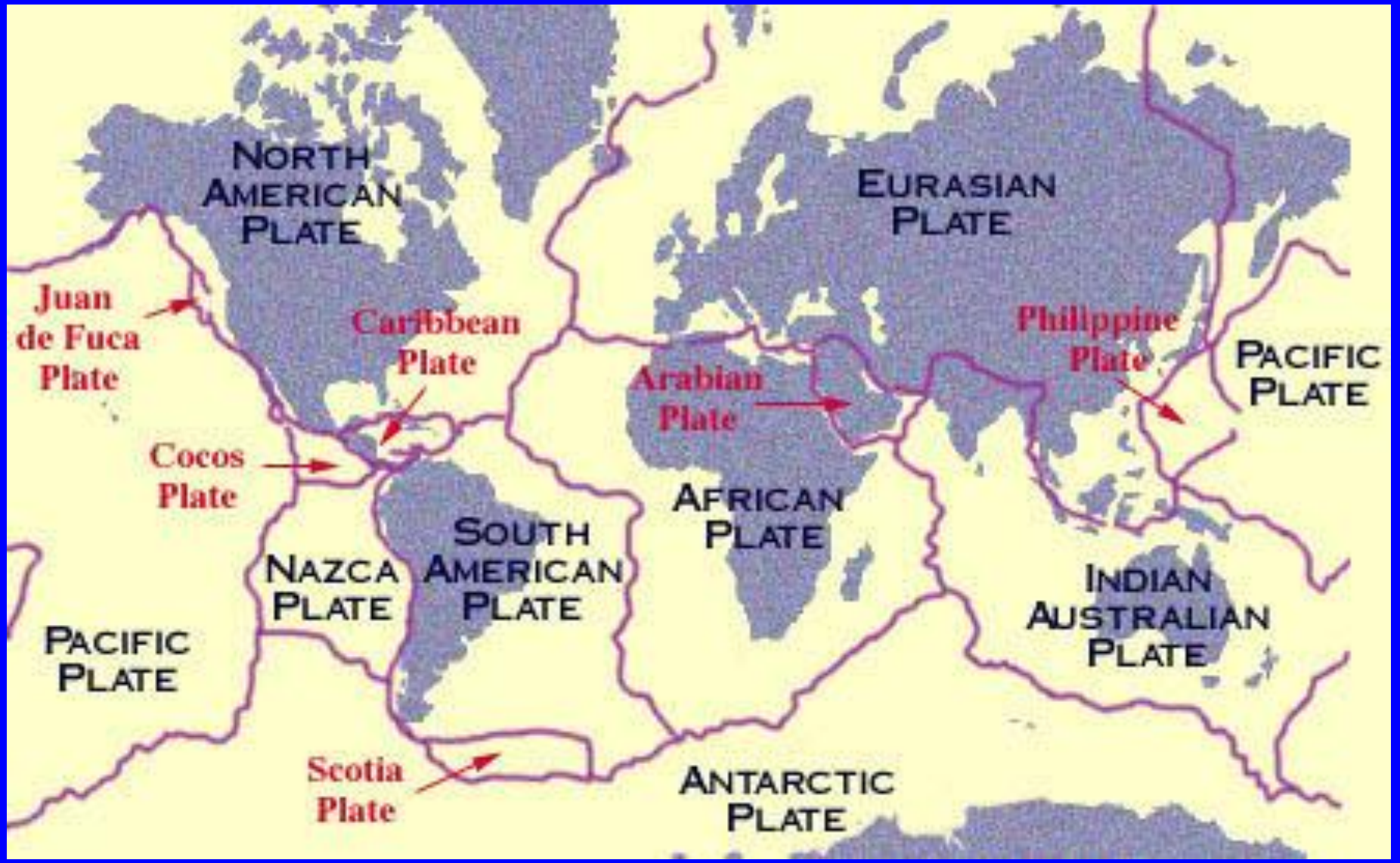
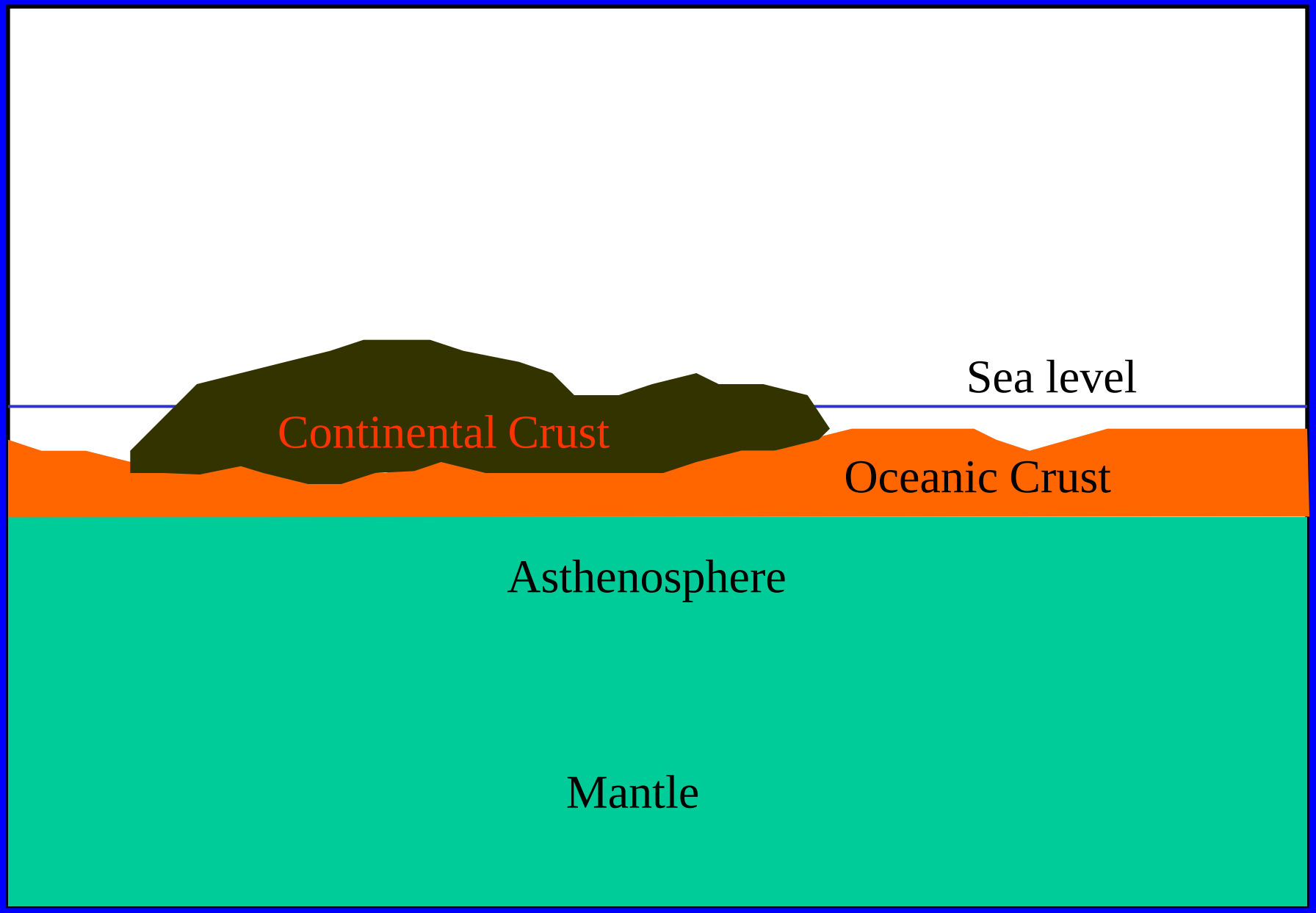


http://observe.arc.nasa.gov/nasa/earth/tectonics/graphics/worldplates.jpg

Remember, there are two types of crust:

Oceanic crust, which extends all over the earth and is broken into the 12 large and many smaller plates; and,

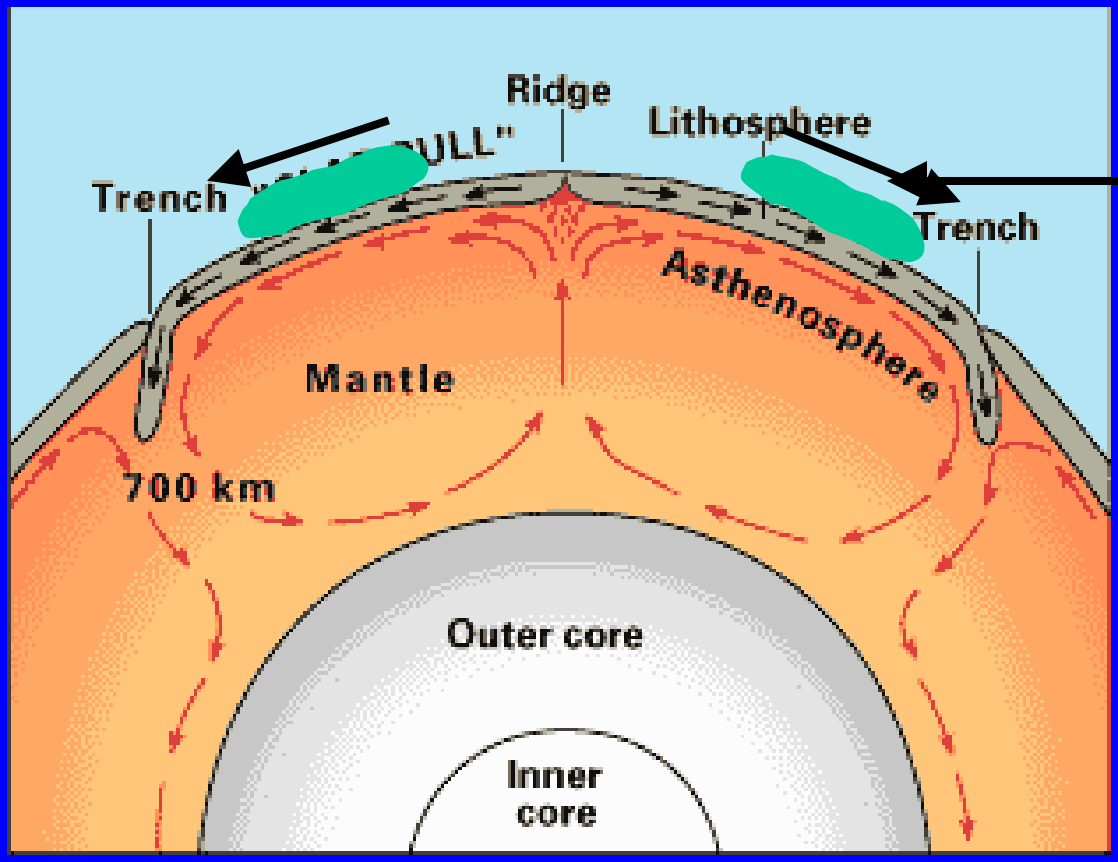
Continental crust, which “rides around” on top of the oceanic crustal plates


Sea level
Continental Crust
Oceanic Crust
Asthenosphere
Mantle

These plates are continually moving, spreading from the center, sinking at the edges, and being regenerated.

Convection currents in the **asthenosphere** beneath the plates move the crustal plates in different directions.

The source of heat driving the convection currents is radioactivity deep in Earth's mantle.



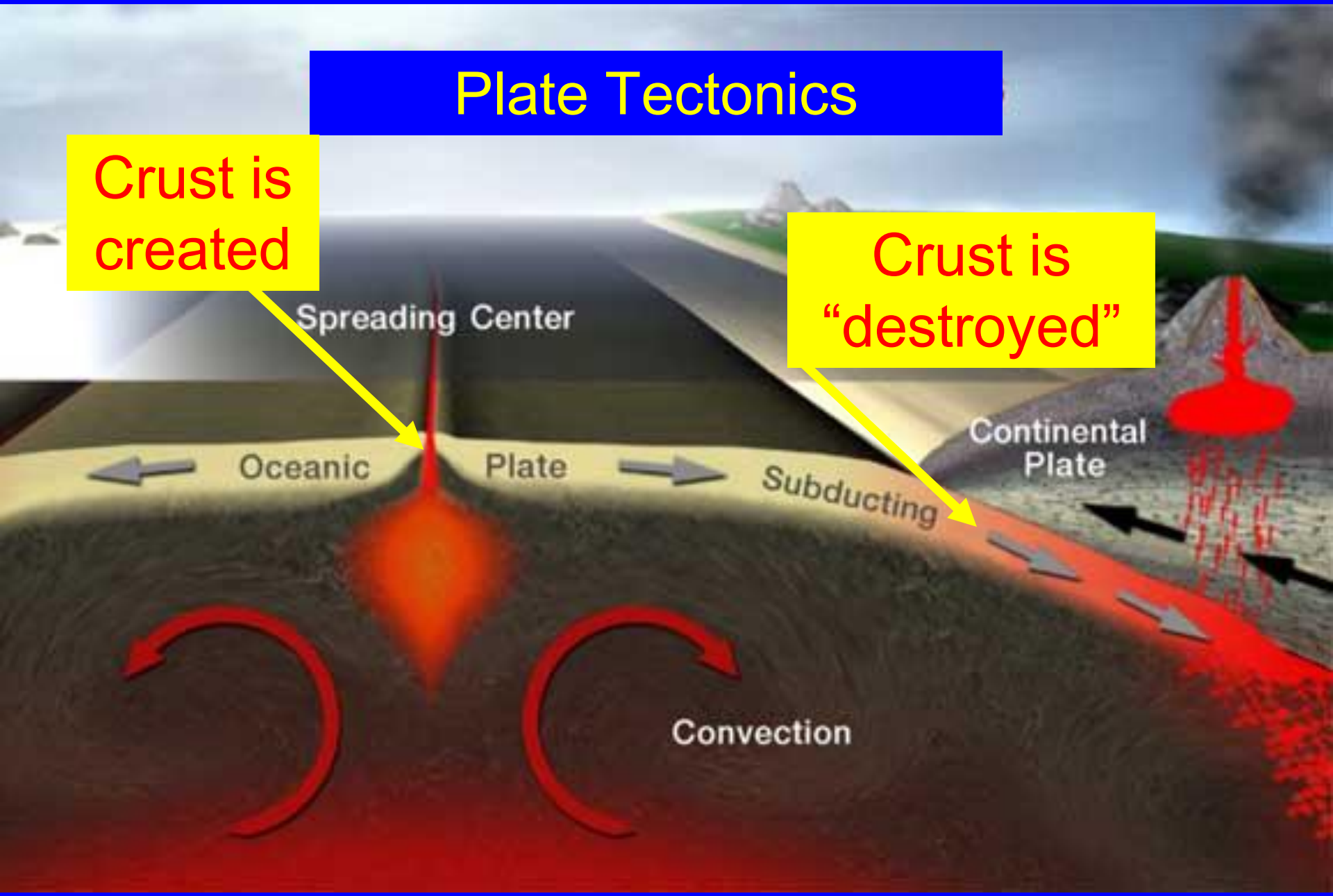
http://geog.ouc.bc.ca/physgeog/contents/10i.html

Convection currents power the plate movements. Convection currents rise up from the radioactive core, carrying heat to the thin crust of the earth.

At the mid ocean ridges, magma erupts between the two plates, forcing the two plates apart and creating mid-oceanic mountain ridges as it cools and solidifies. At the mid-oceanic ridges new crust is created.

But Earth's crust is in balance, so that as new crustal material is created, old crust is "removed". This happens at the trenches, where one plate slides down towards the mantle. The plate melts back into the mantle.

Plate Tectonics

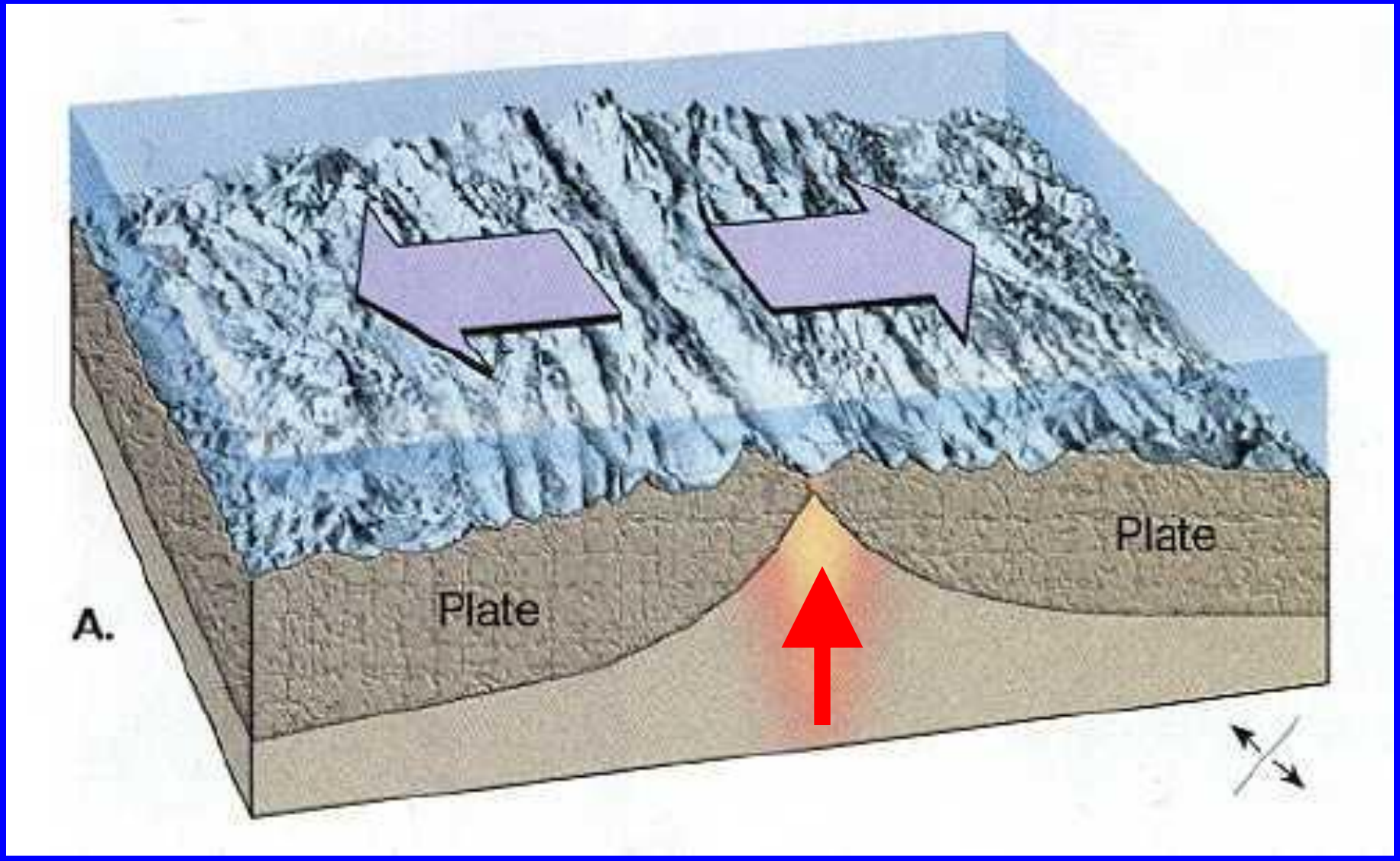


http://geothermal.marin.org/GEOpresentation/images/img007.jpg

There are **three** basic plate movements or boundaries.

1. **Divergent:**

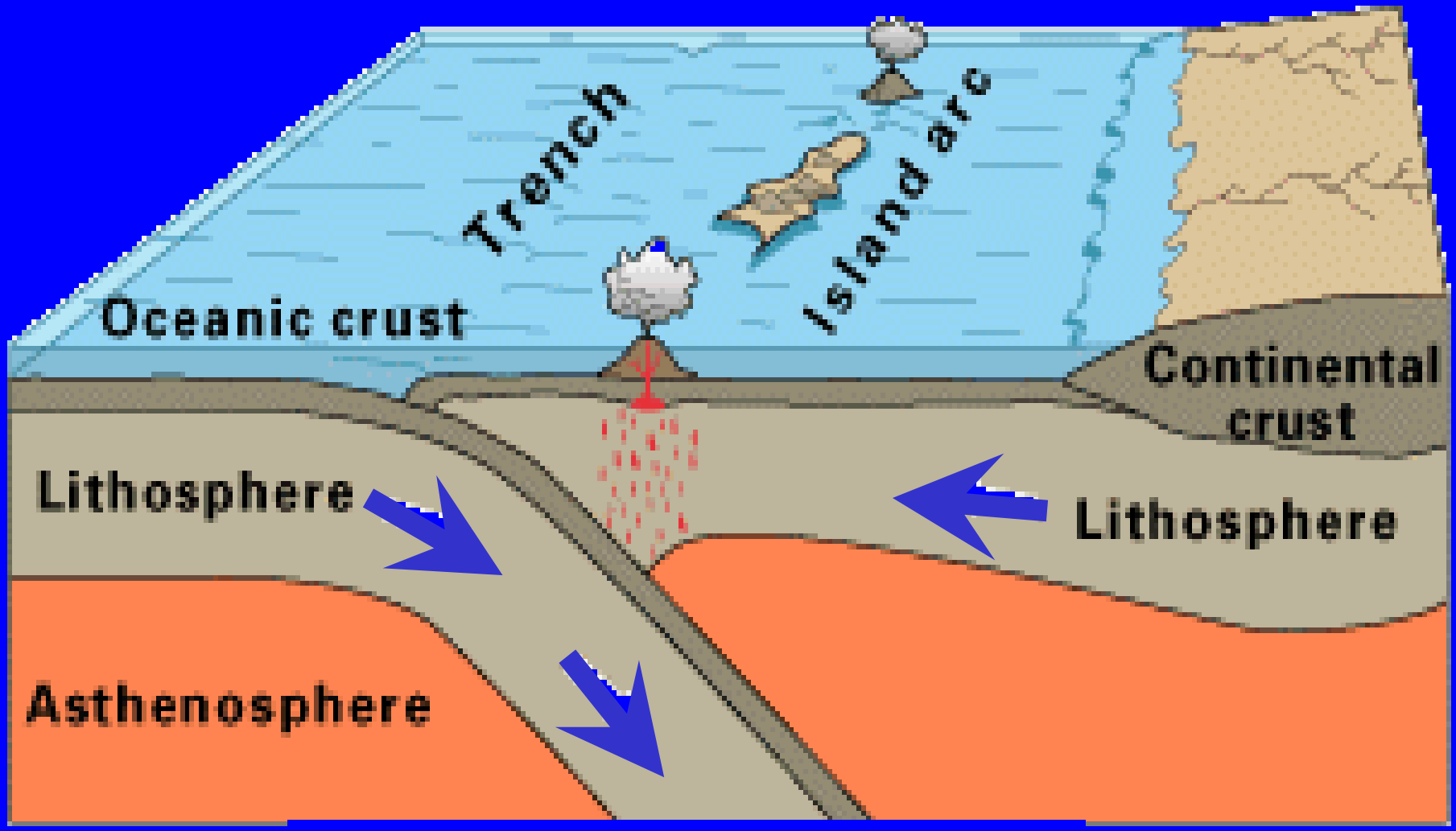
- where the plates move apart
- new magma wells up to the surface forming new crust
- the Mid-Atlantic ridge is a prime example.



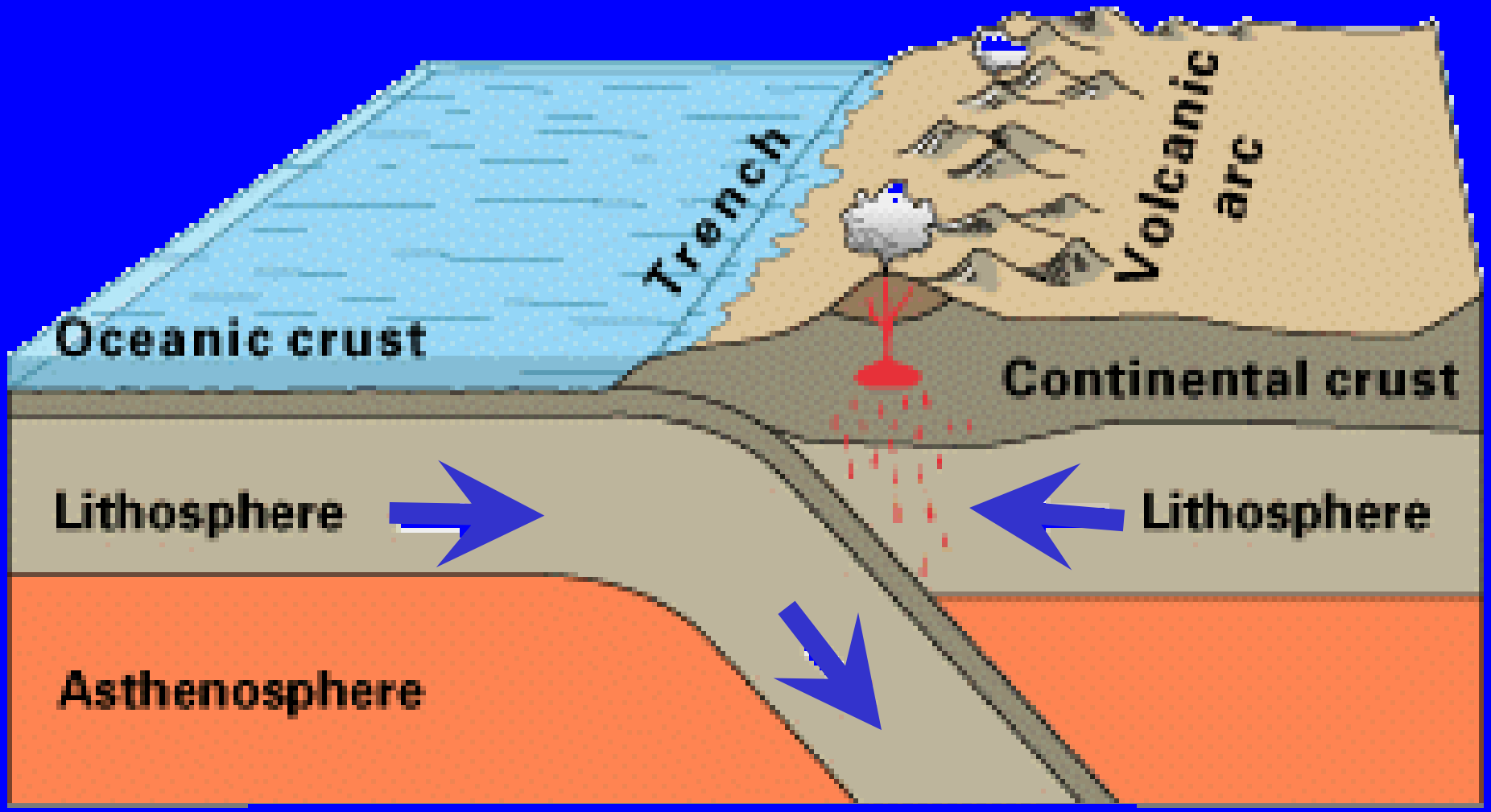
http://www.geo.lsa.umich.edu/~crlb/COURSES/117/Lec19/div.jpeg

2. Convergent:

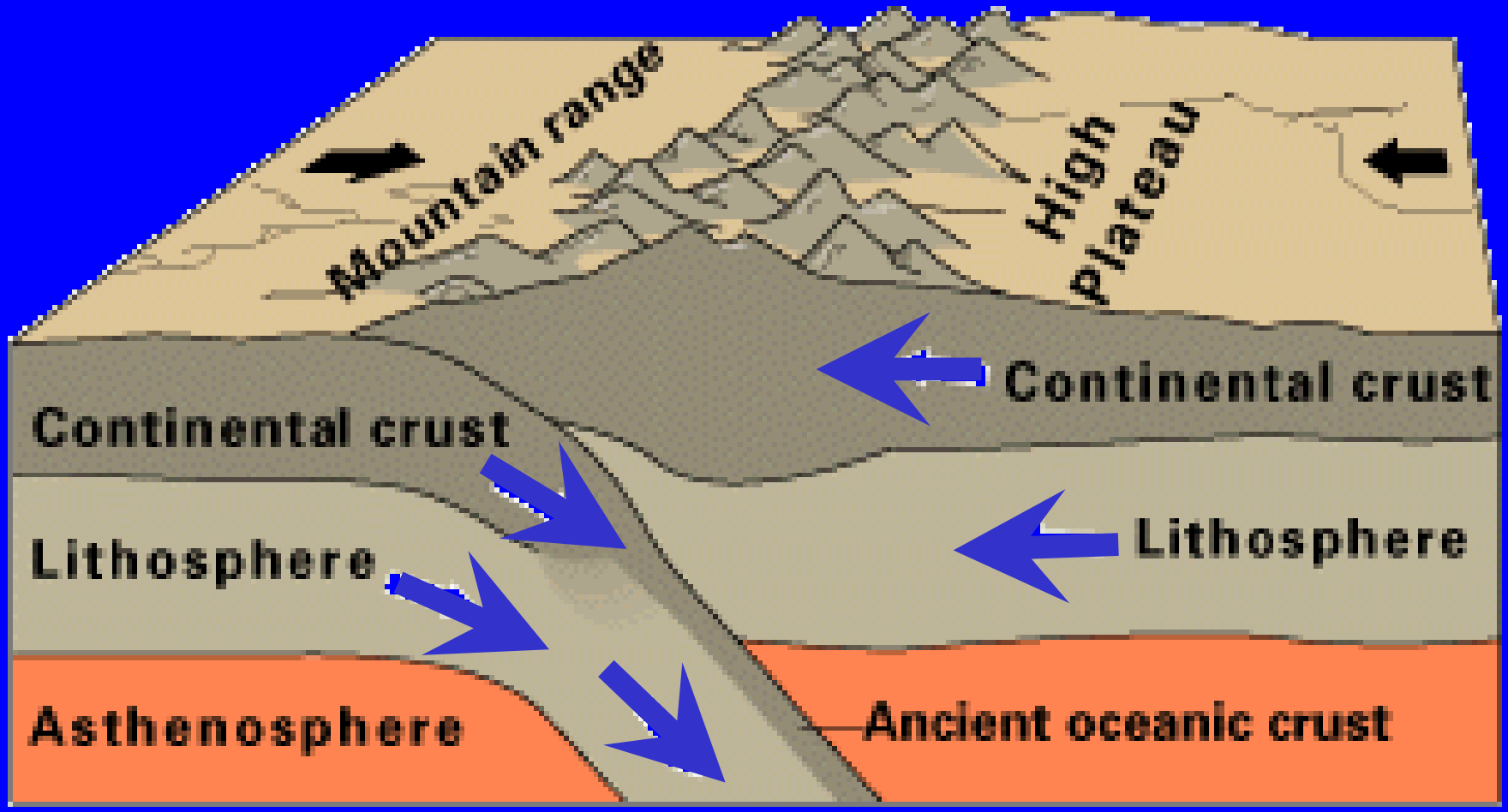
- two plates come together
- one plate subducts (goes under) the other plate, creating a **subduction zone**
- the crust at the leading edge of the subducting plate melts back into the mantle
- the Pacific Rim of Fire is a good example of this
- 3 different types of convergent boundaries



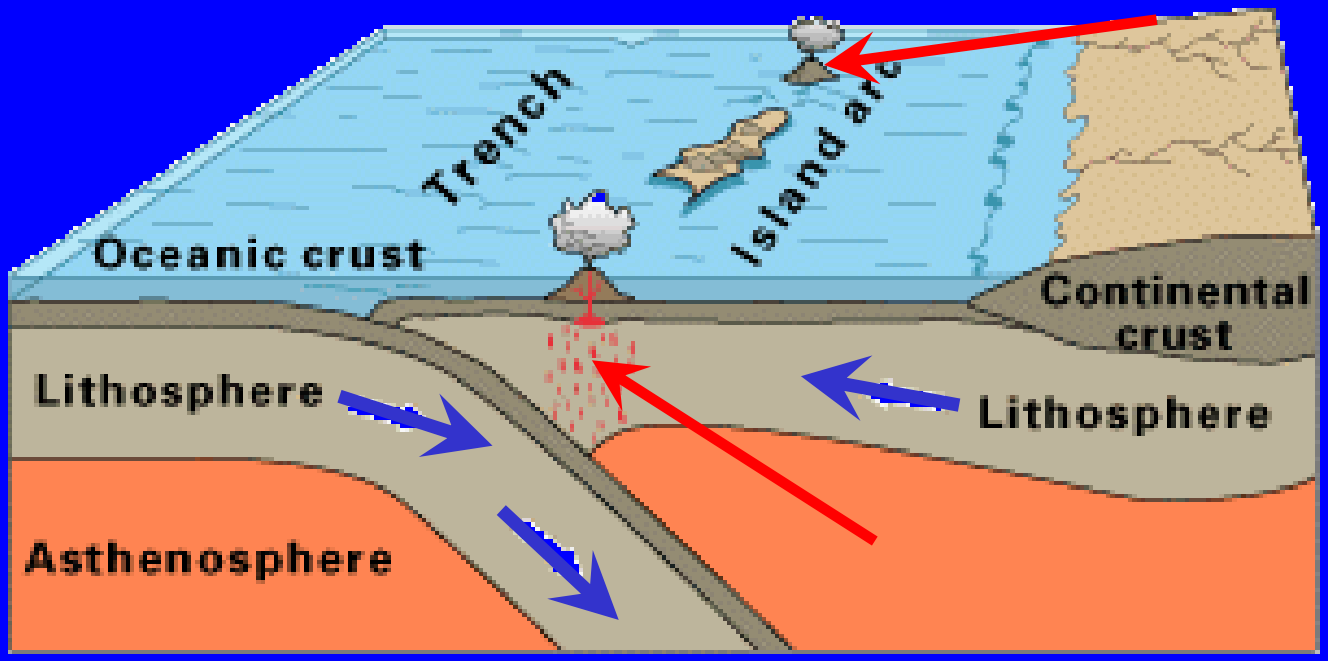
A. Mid Ocean Convergence Zone: Oceanic Crust to Oceanic Crust.



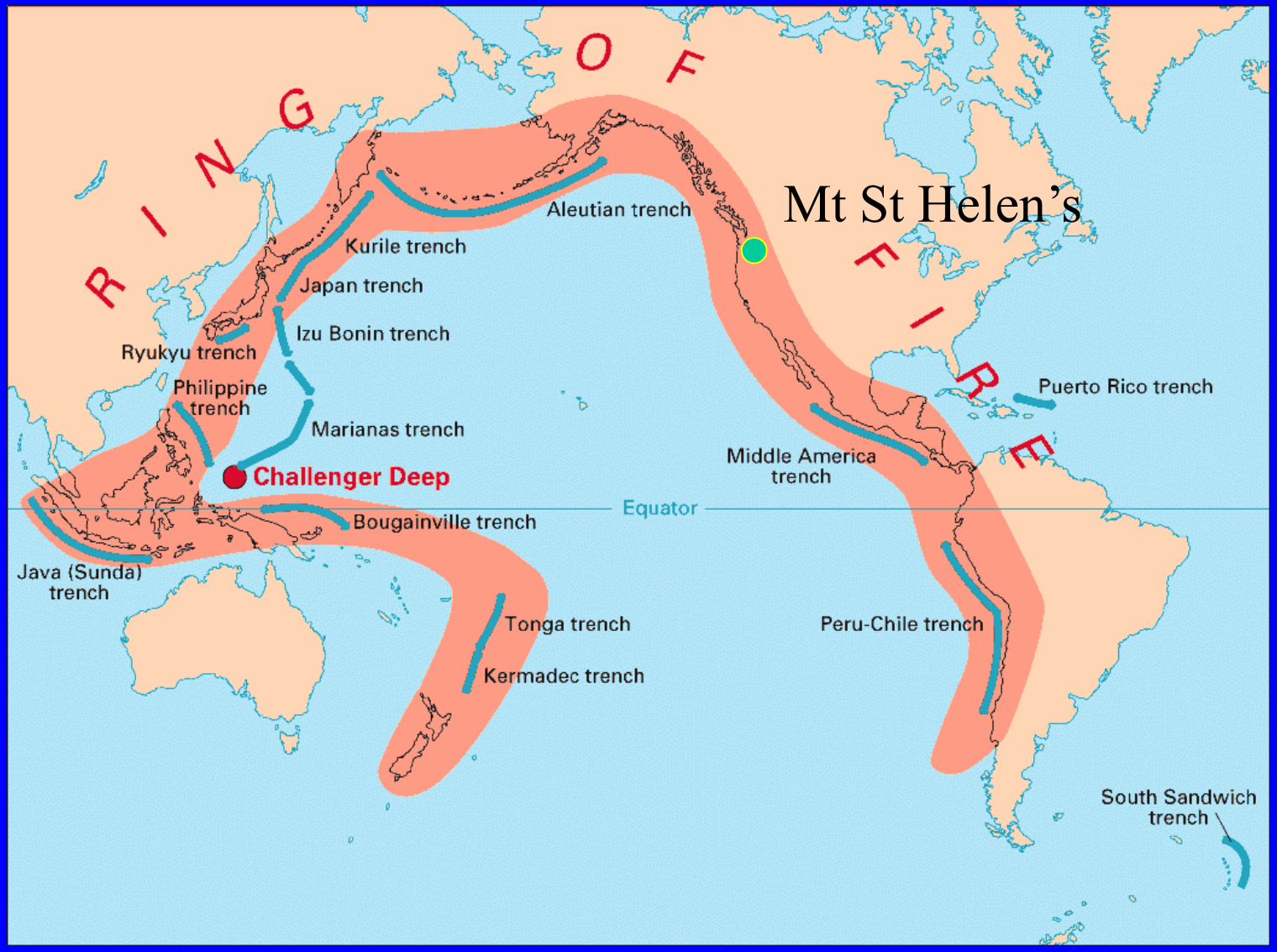
B. Convergence Zone: Oceanic Crust and Continental Crust



C. Convergence Zone: Continental Crust to Continental Crust



Less dense material that has accumulated on the surface of the crust melts as it goes down into the mantle. Because it is less dense, it rises back up as liquid rock, and creates volcanoes and volcanic islands beside the trench. Japan is a good example of this.



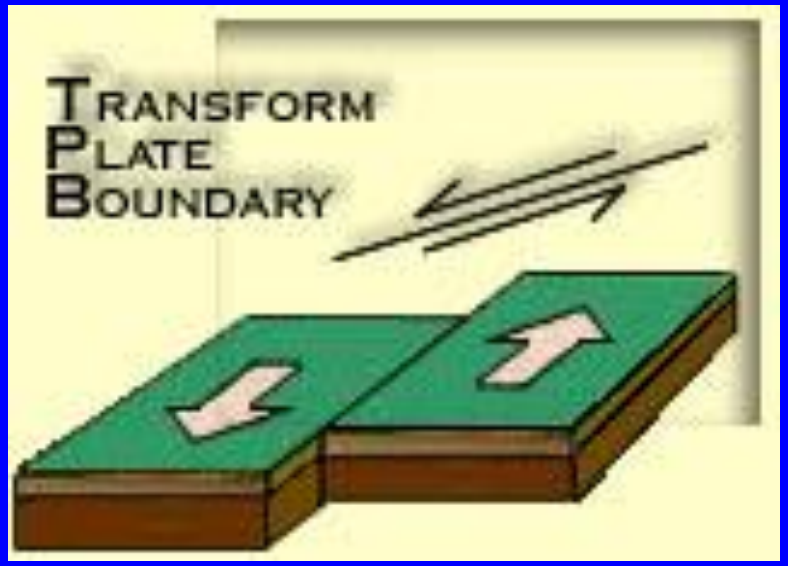
The Pacific Ring of Fire

http://en.wikipedia.org/wiki/Mount_St._Helens

http://en.wikipedia.org/wiki/Image:Sthelens3.jpg

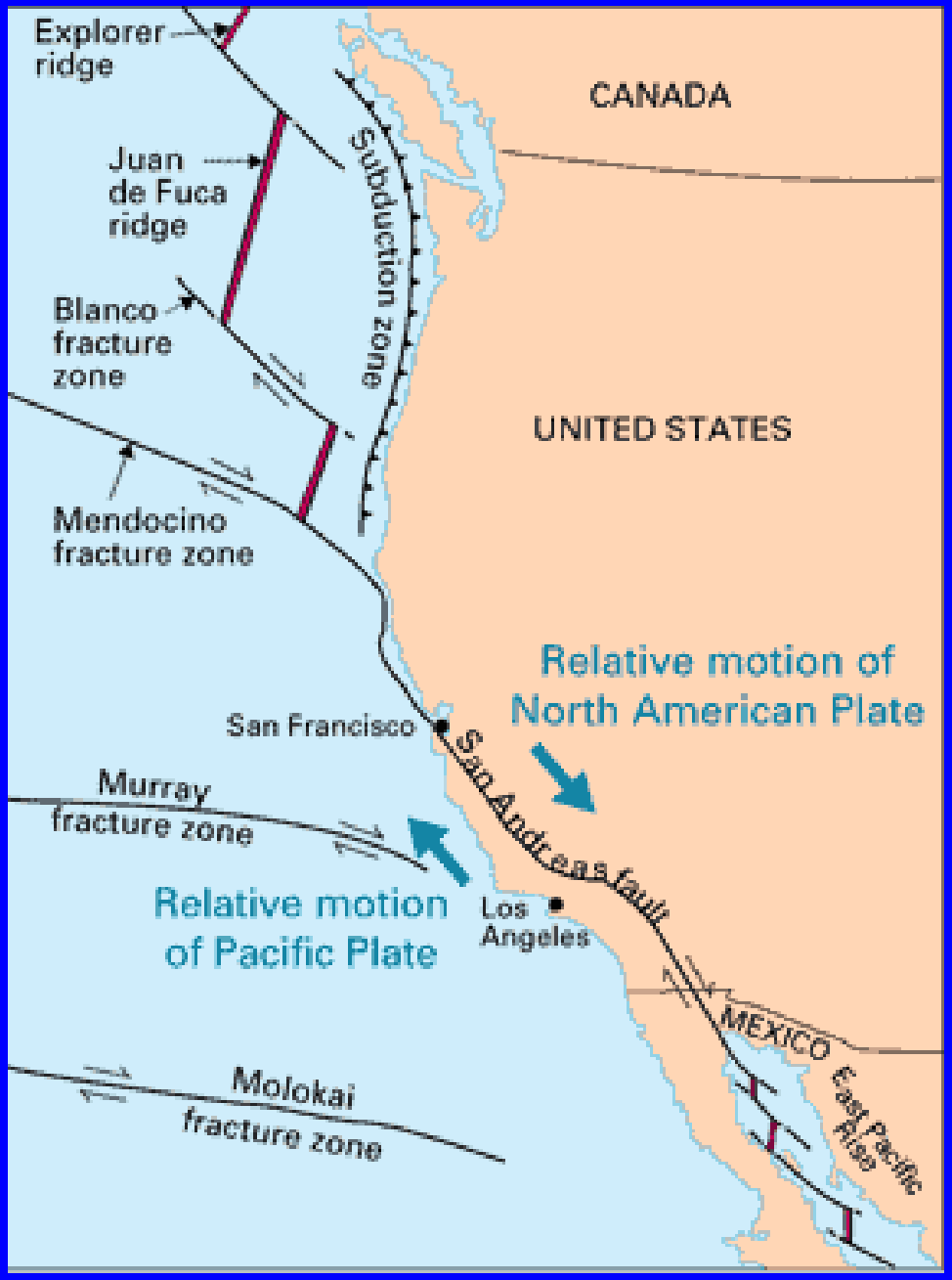
3. Transform Boundaries:

- two plates slide past each other
- this can create tremendous friction, which may be eventually released in the form of violent earthquakes
- the San Andreas Fault is a transform boundary

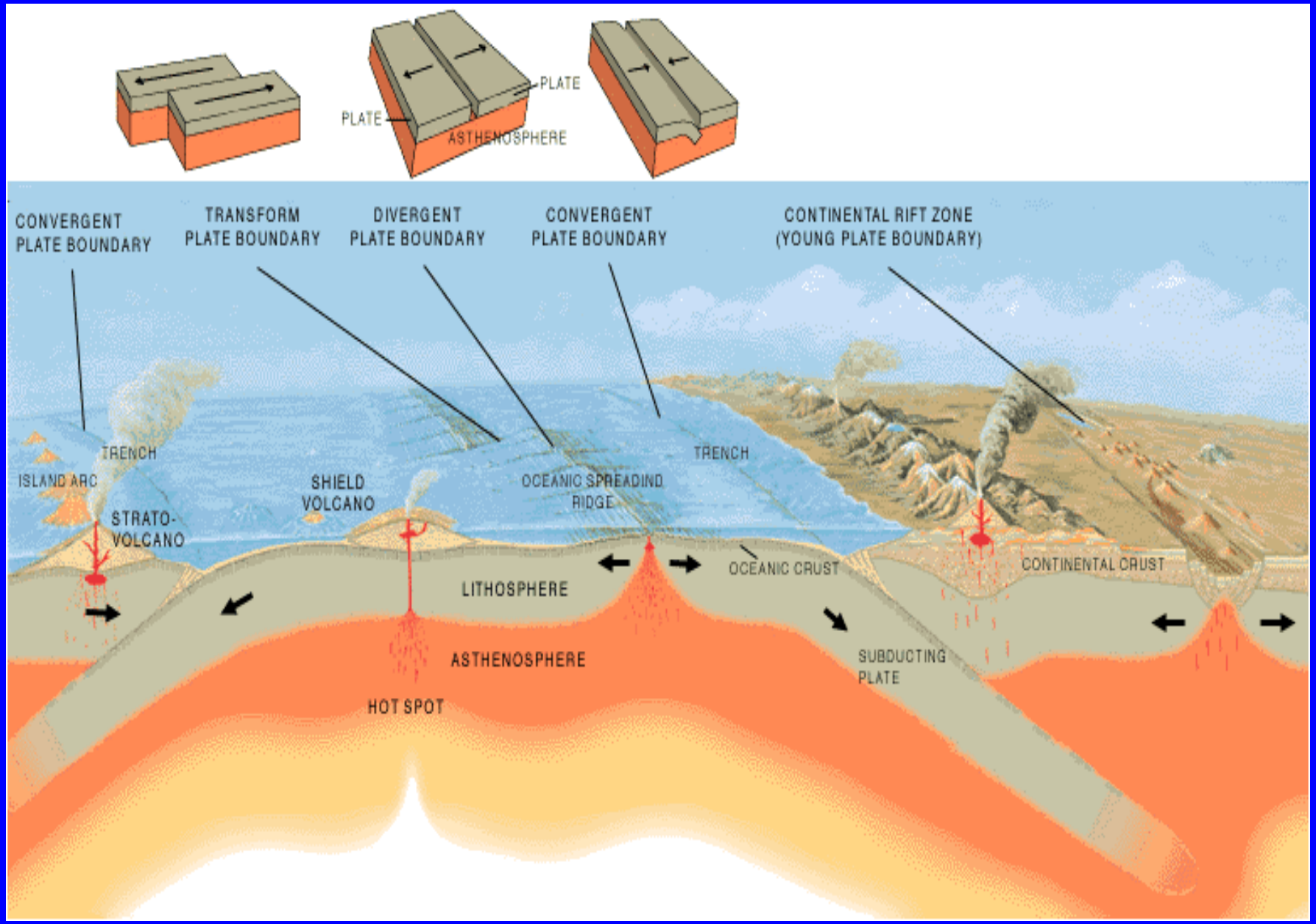


http://observe.arc.nasa.gov/nasa/earth/tectonics/graphics/Image43.jpg

Transform plate margins: where two plates slip past one another.

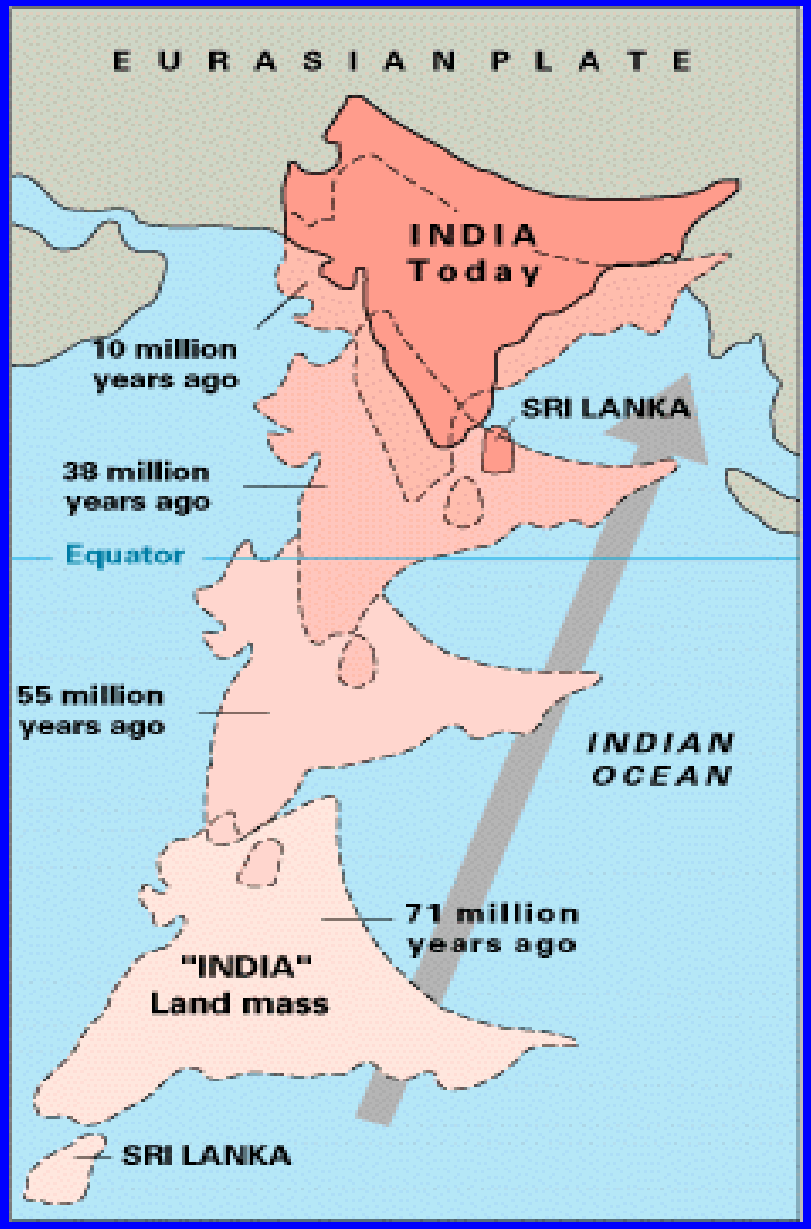


The San Andreas Fault, California

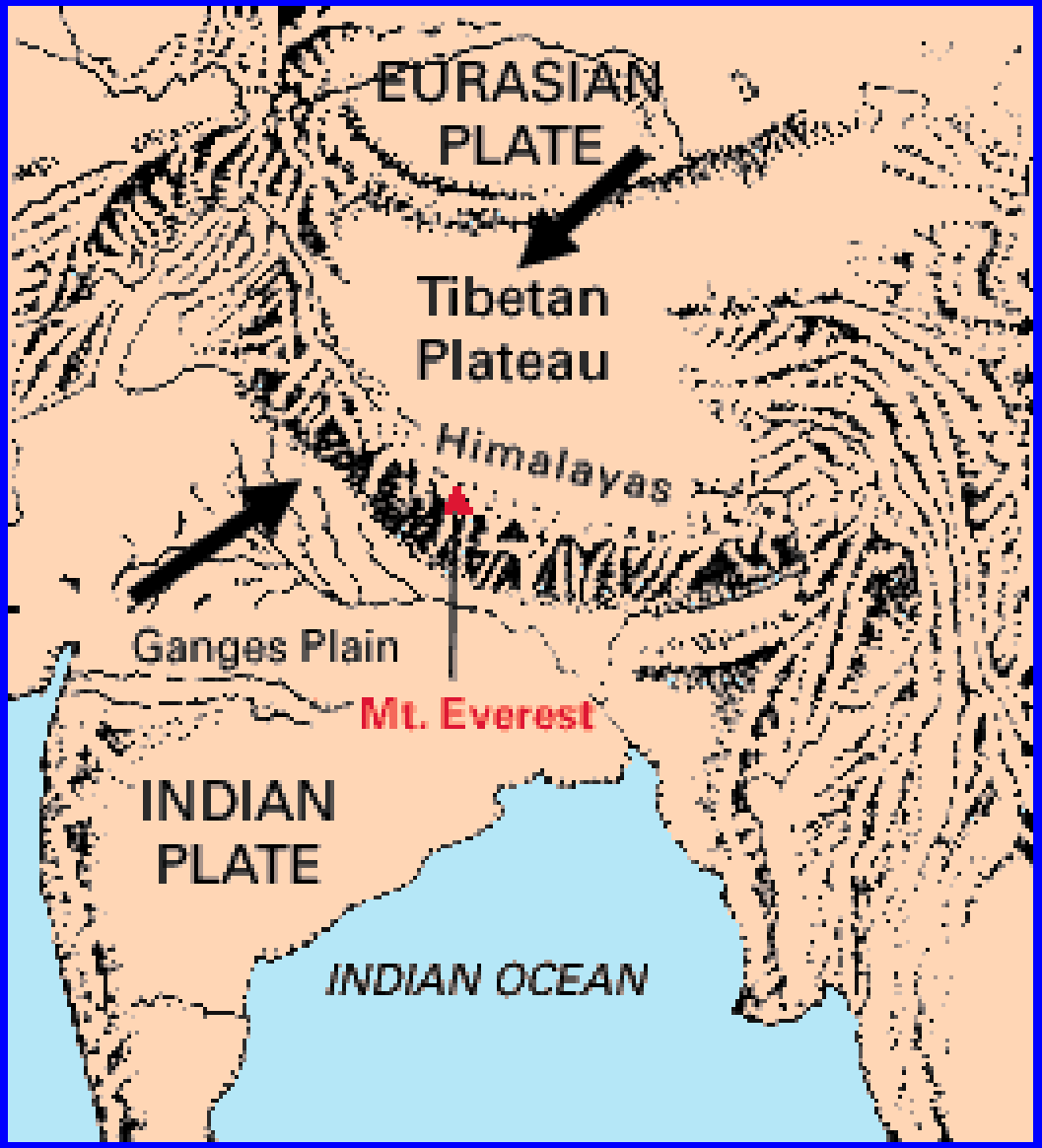


The main types of plate boundaries.

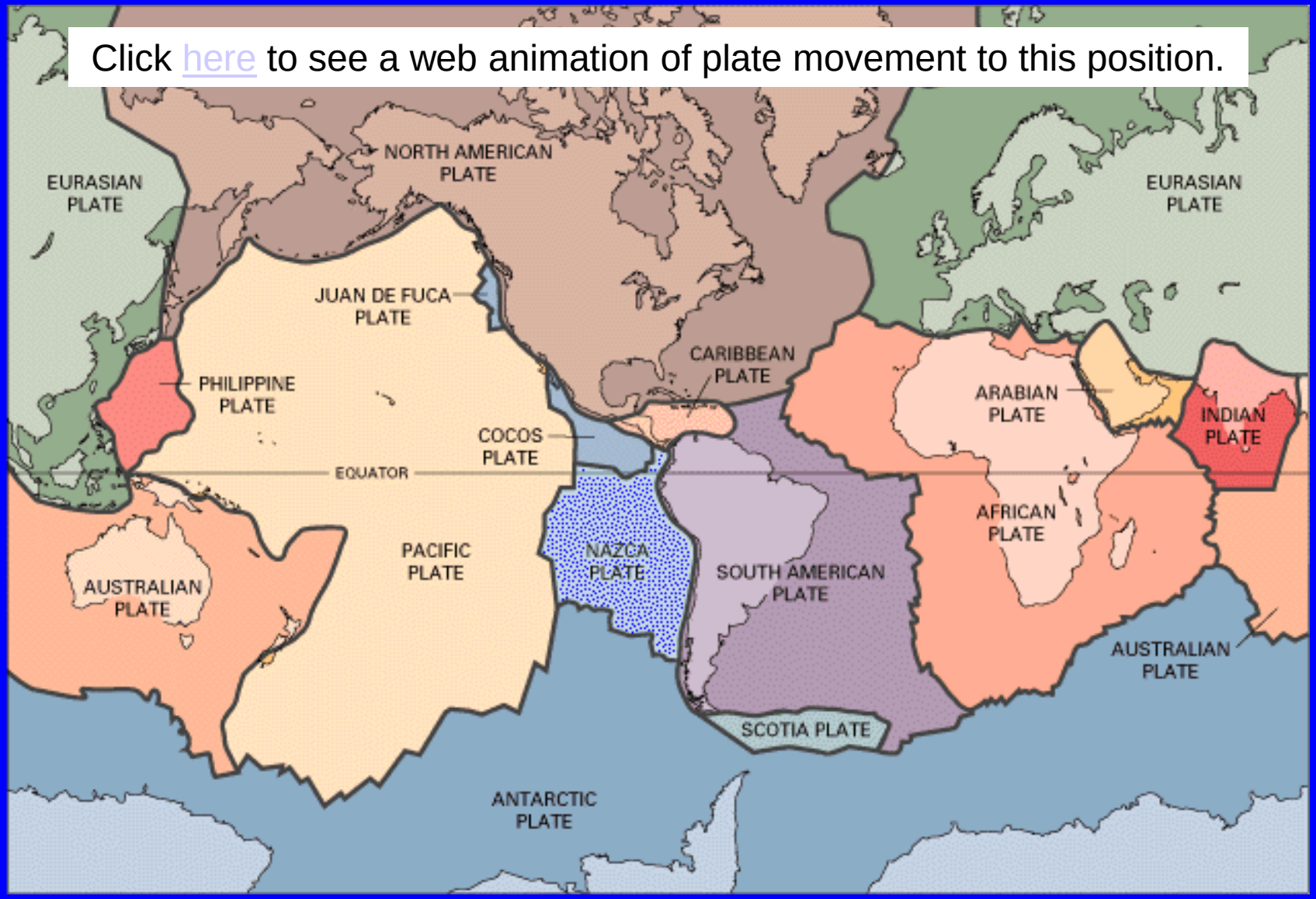
Indian Plate collides with Eurasian Plate



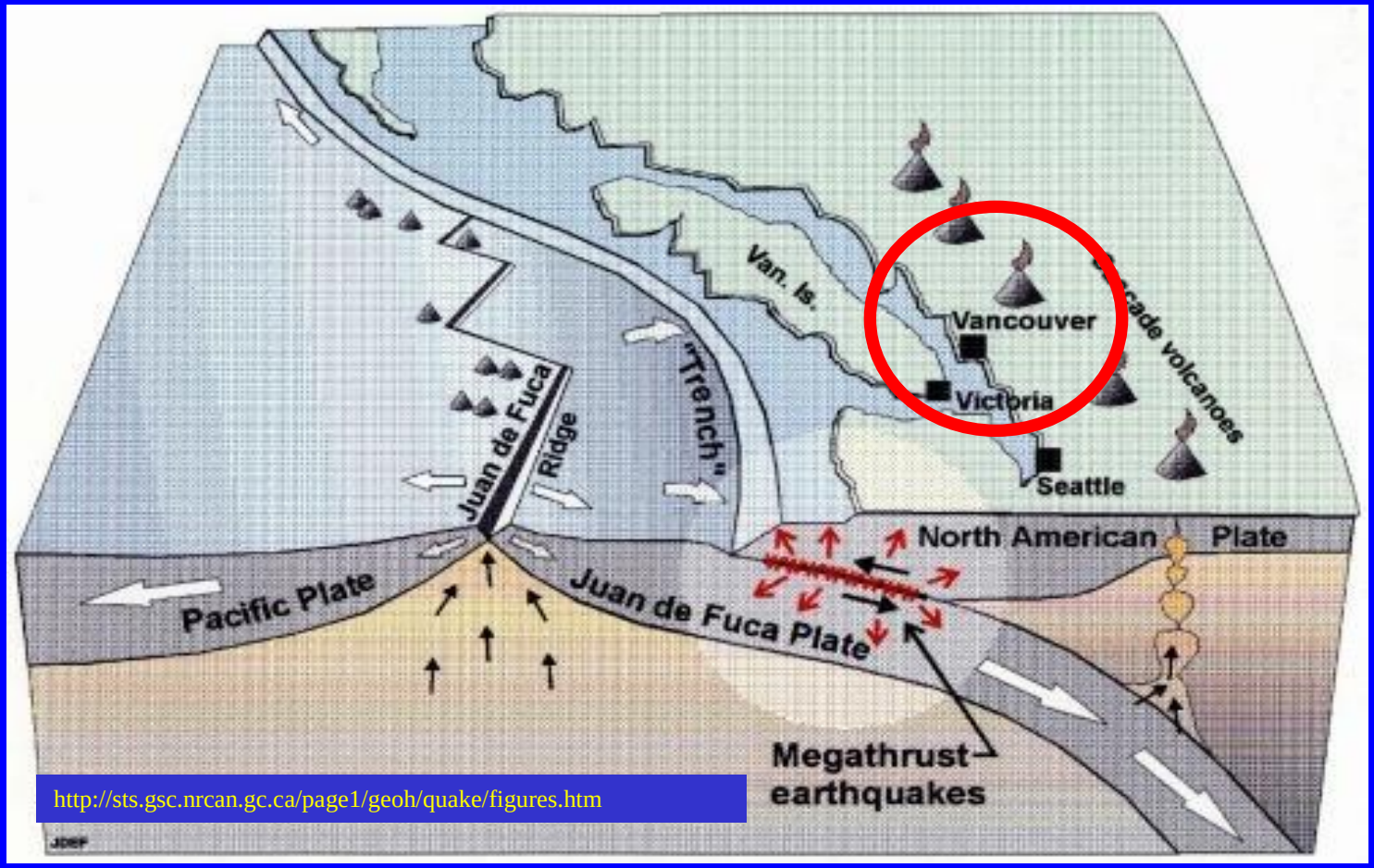
The result: the Himalayas and Mt. Everest



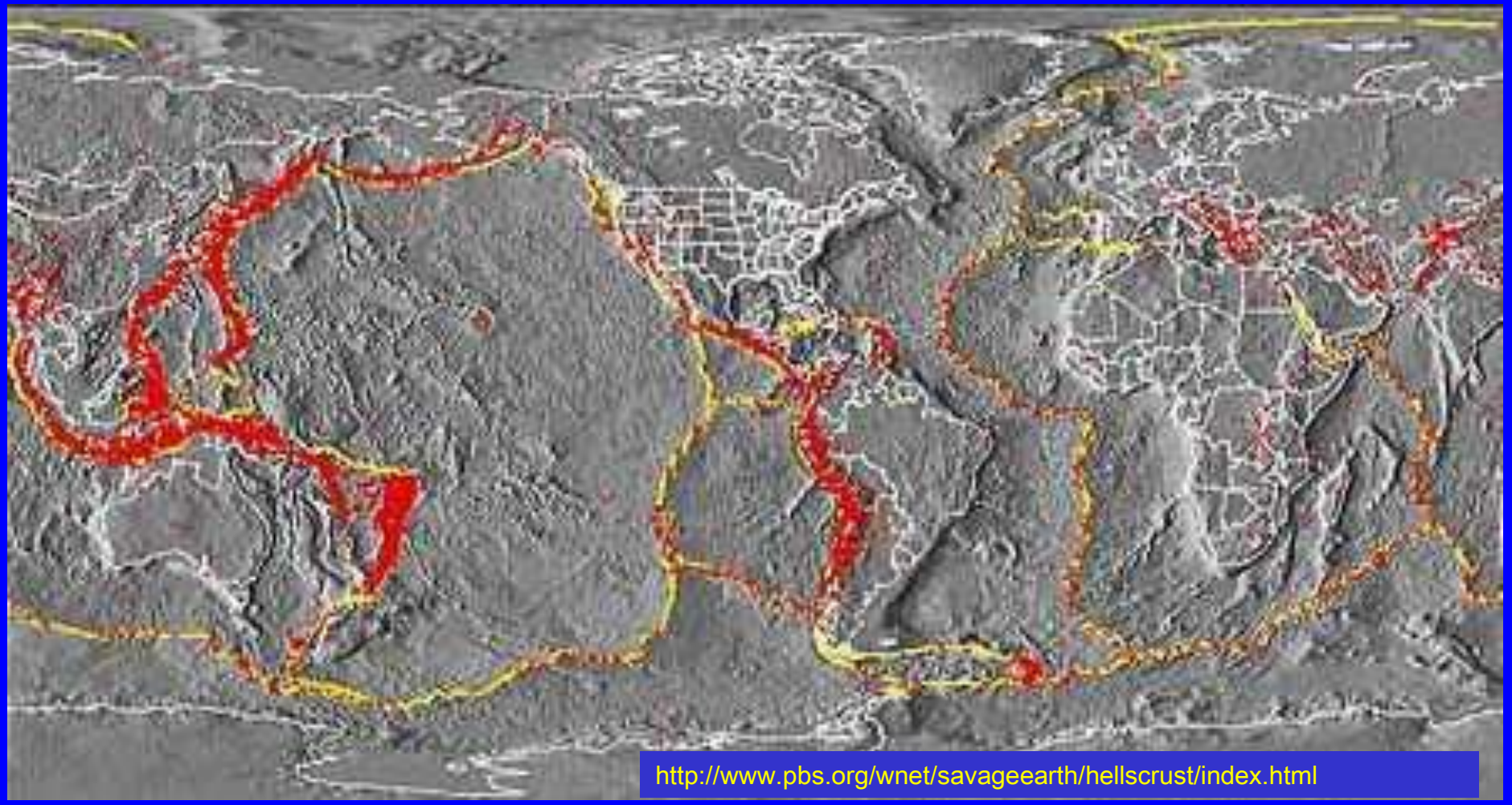
Click here to see a web animation of plate movement to this position.



earthquake.usgs.gov/ faq/plates.html



Tectonic setting of western British Columbia and Washington state. The oceanic Juan de Fuca plate is moving beneath the continental North America plate at a rate of about 4 cm/year. Earthquakes occur along parts of the boundary between the two plates.



This map, which shows 20th-century earthquakes in red, illustrates how they cluster on the edges of the major tectonic plates (outlined in yellow).

The End