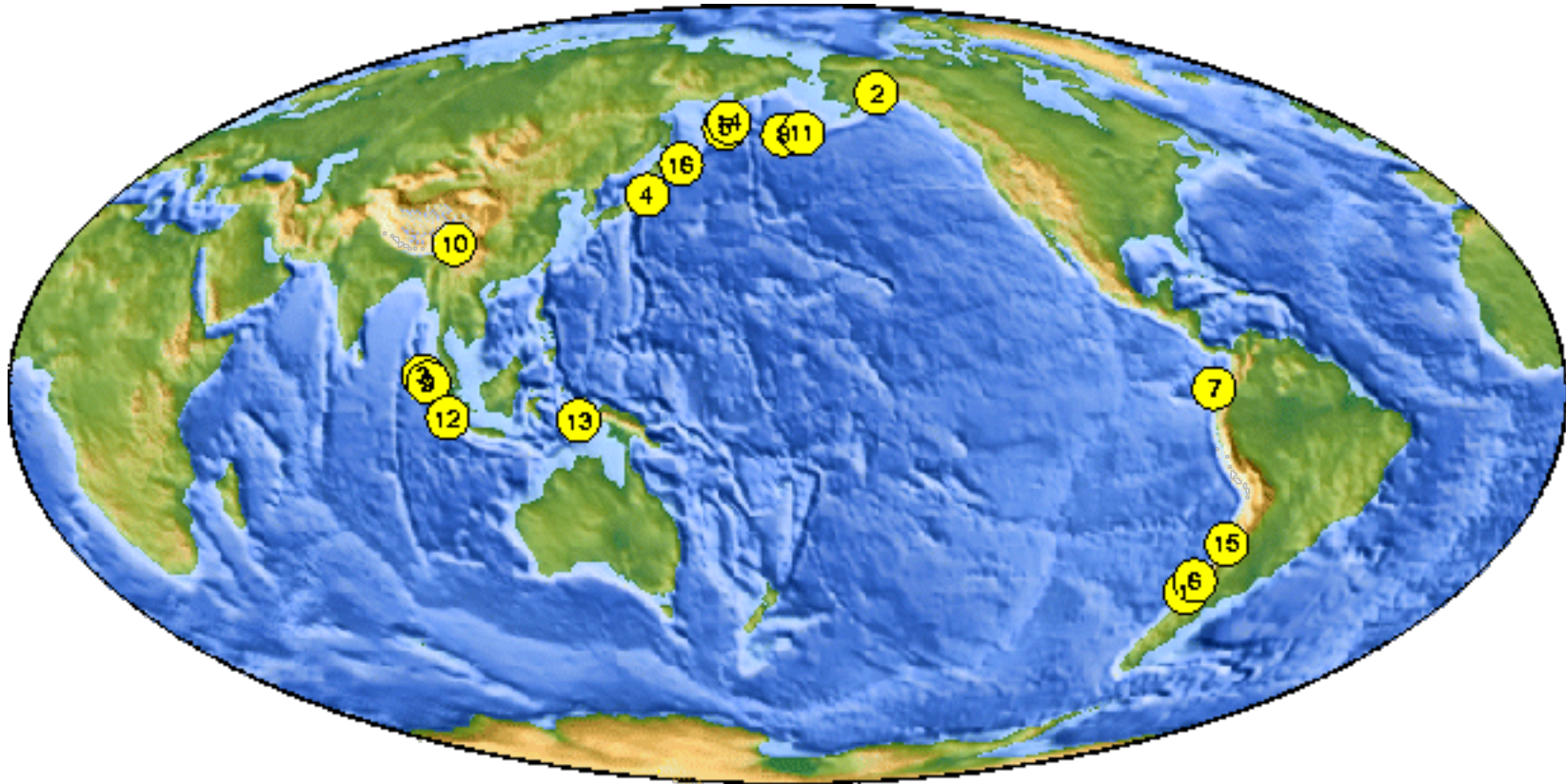


10 largest earthquakes in the world



USGS National Earthquake Information Center

http://wwwneic.cr.usgs.gov/neis/eqlists/10maps_world.html

Where do earthquakes occur?

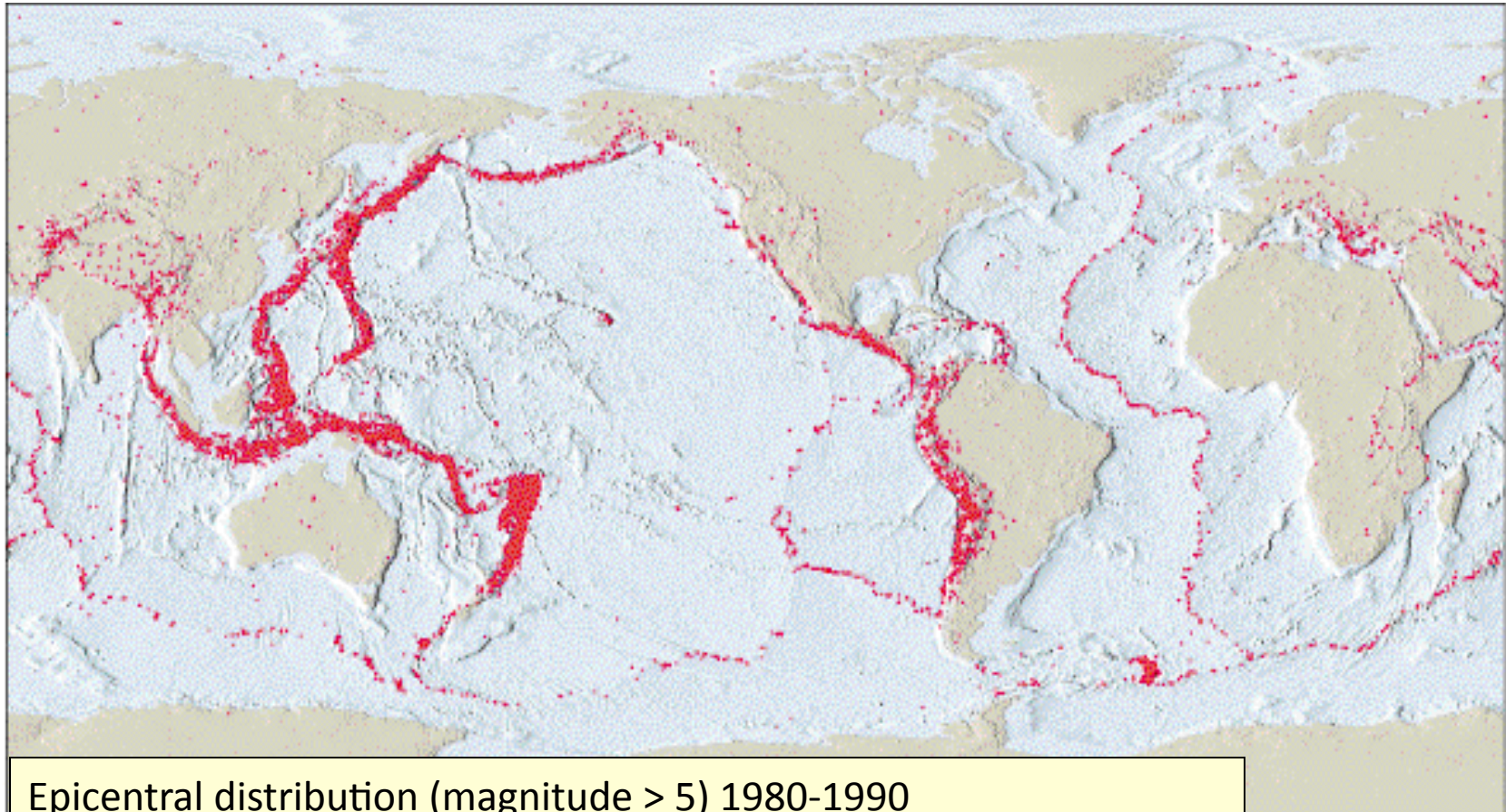


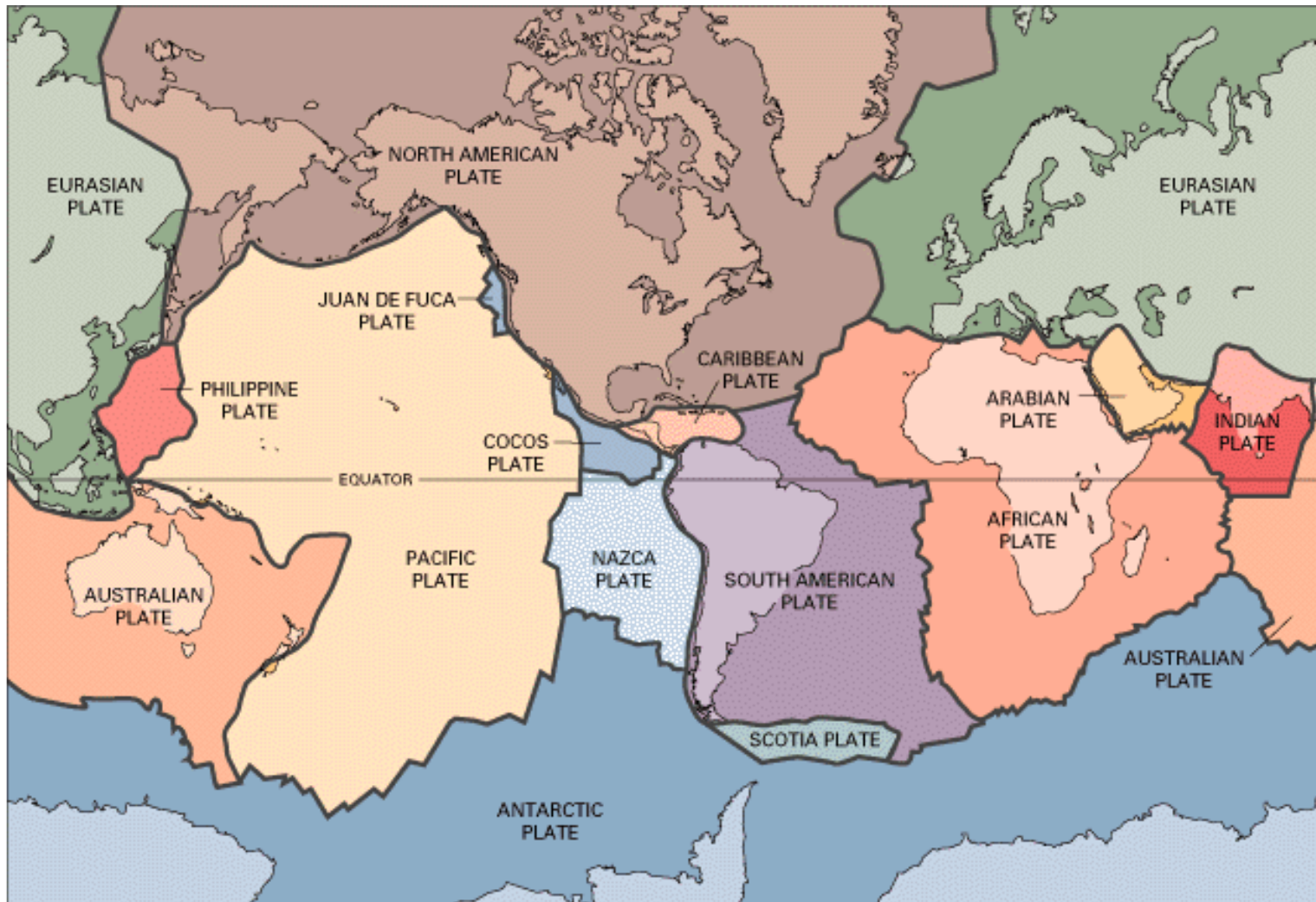
Plate tectonics and continental drift

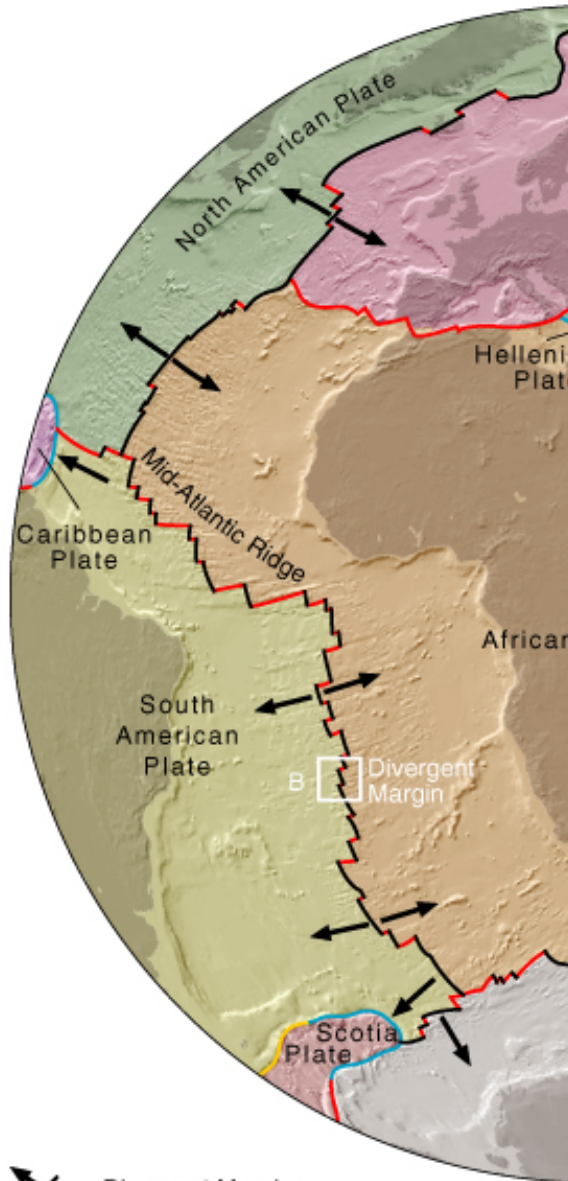
Pangea – a
“supercontinent”



Motion of continents on the Earth’s surface – for example, evidence from the “fit” of the continental shelves of south America and Africa! -Alfred Wegener, 1914

Lithospheric plates on Earth





- Divergent Margins
- Transform Margins

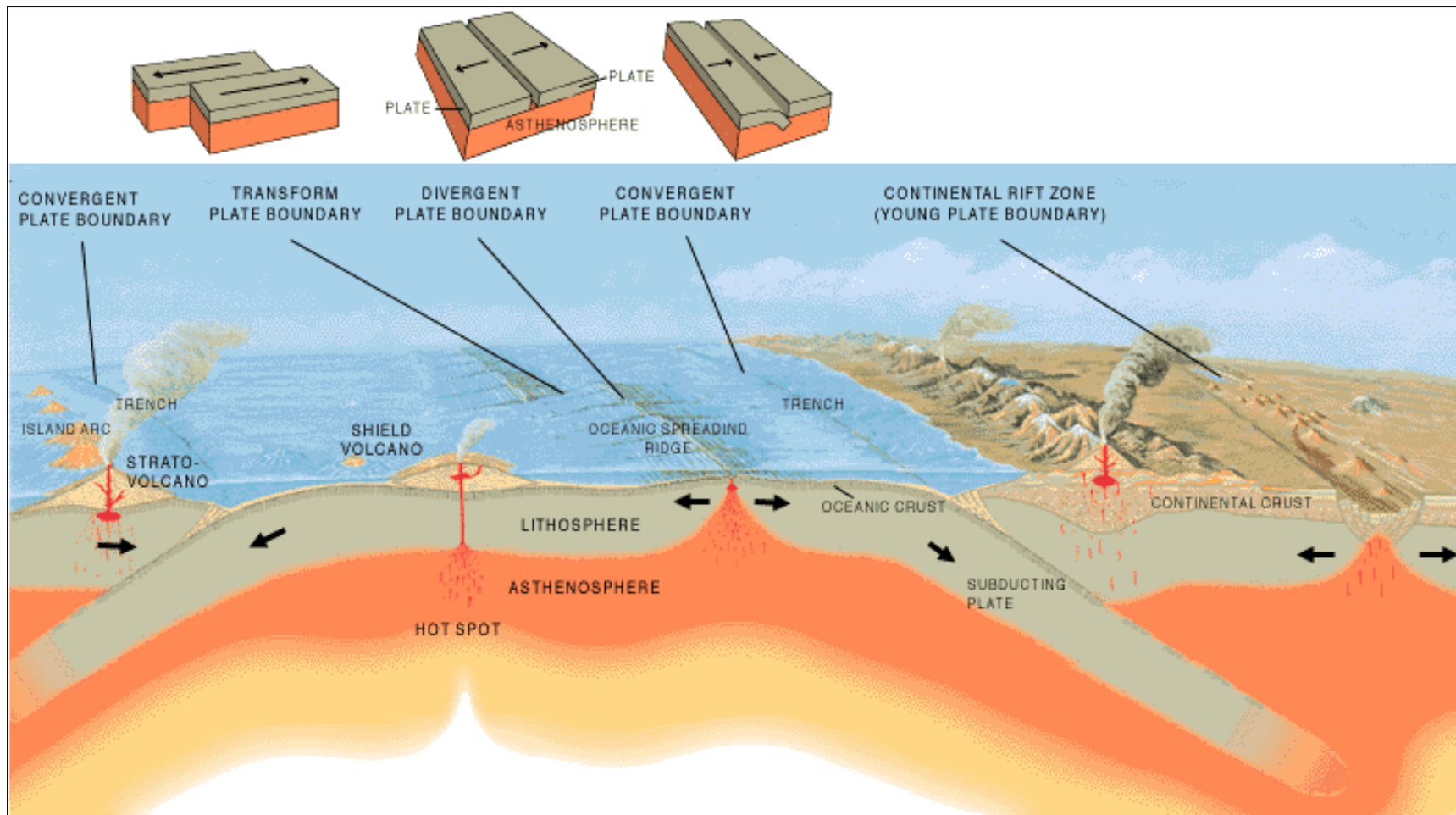
Copyright 1999 John Wiley and Sons, Inc. All rights reserved.

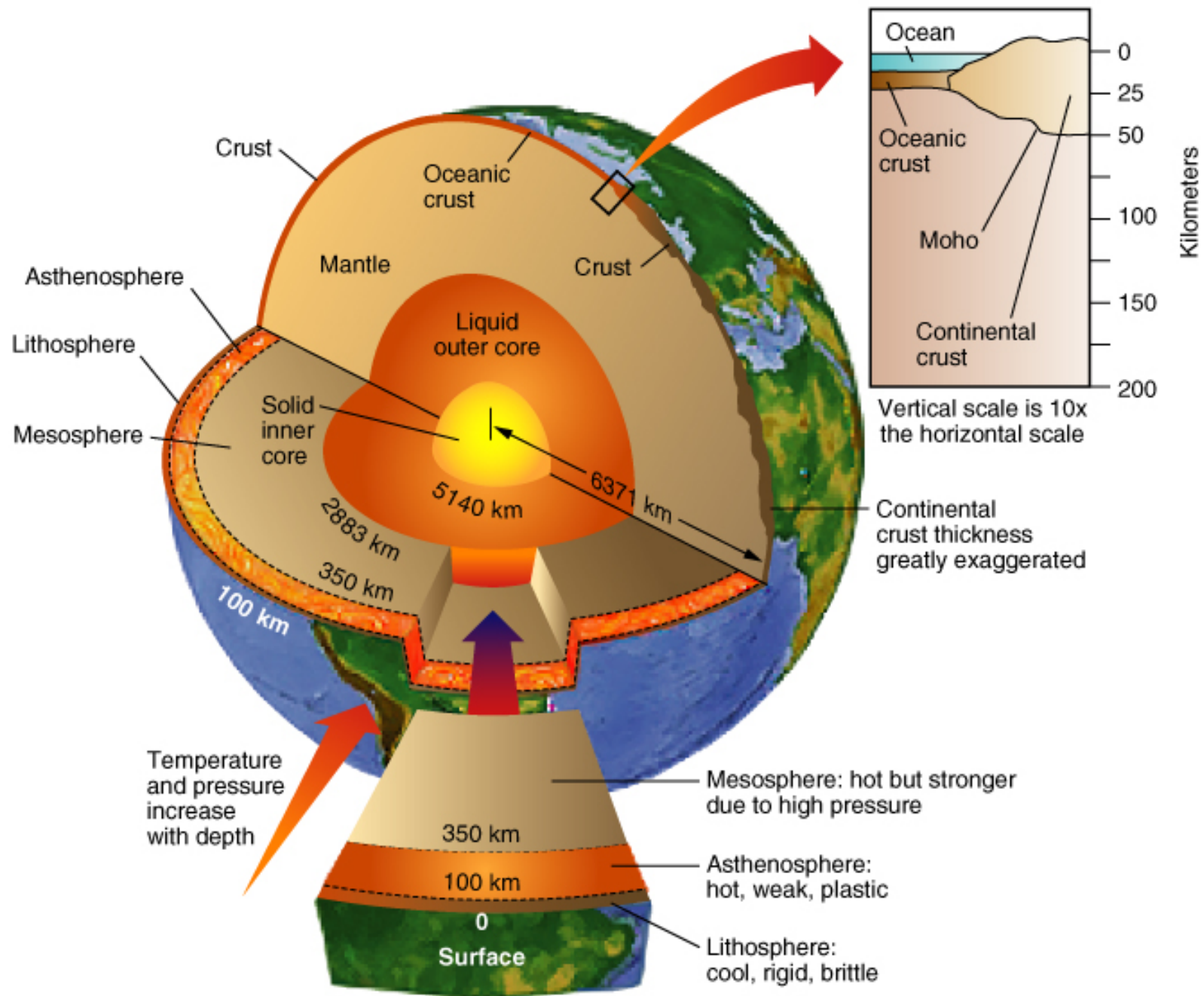


- Divergent Margins
- Transform Margins
- Convergent Margins
- Uncertain Margins

Copyright 1999 John Wiley and Sons, Inc. All rights reserved.

Plate boundaries – 3 types



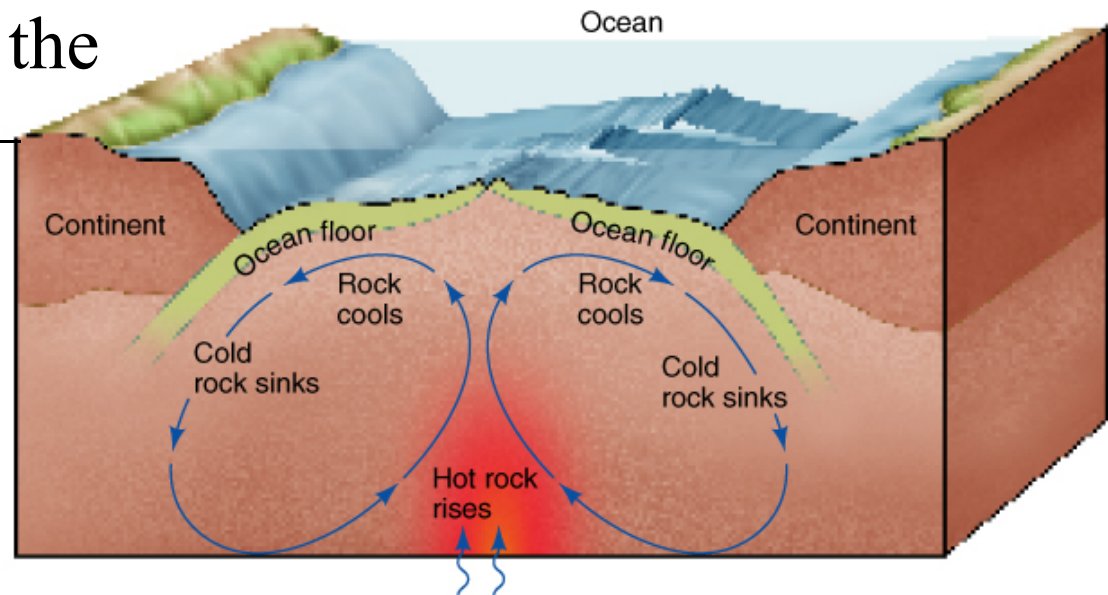


What causes plate motion?

T-6

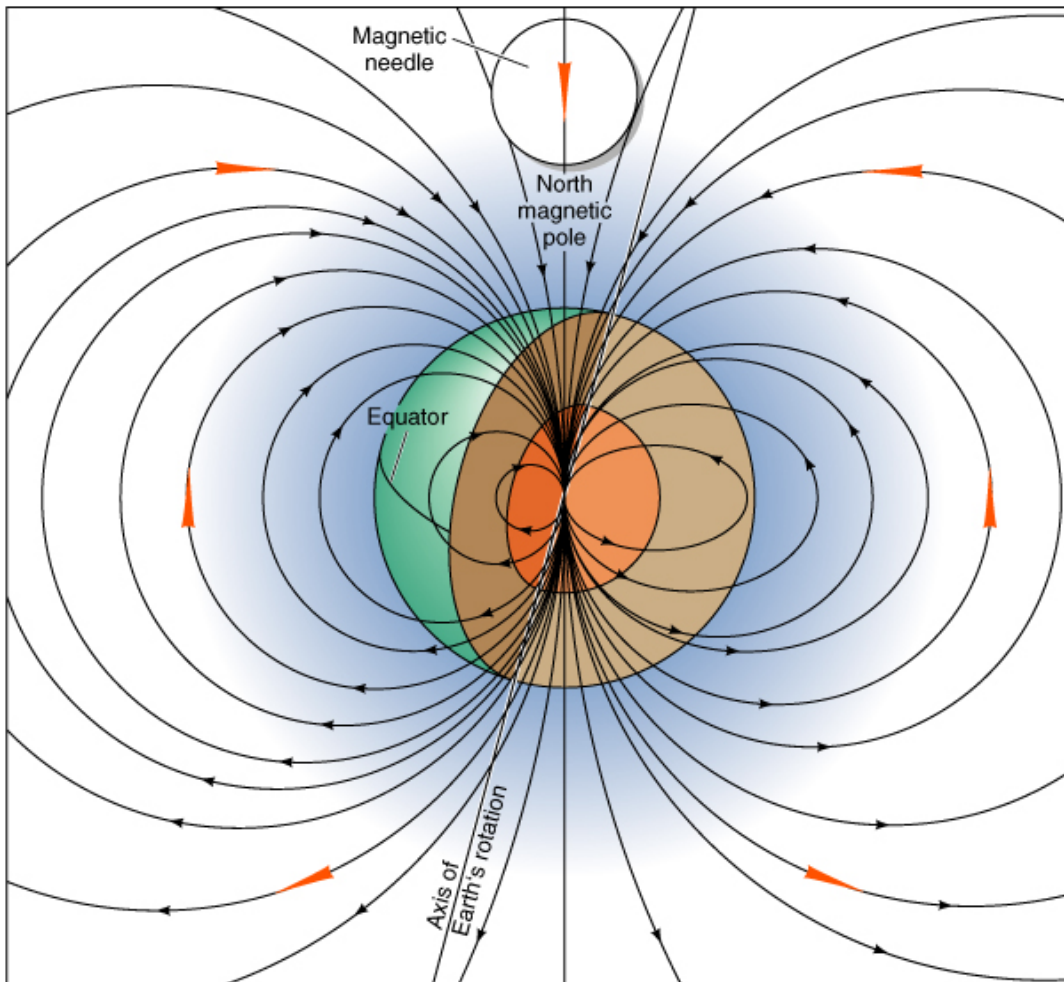


- **Circulation within the mantle** – mantle rocks flow very slowly, over millions of years!
- This flow allows the Earth to lose heat **primary heat loss mechanism** – the cooling from the nebula continues today!



Copyright 1999 John Wiley and Sons, Inc. All rights reserved.

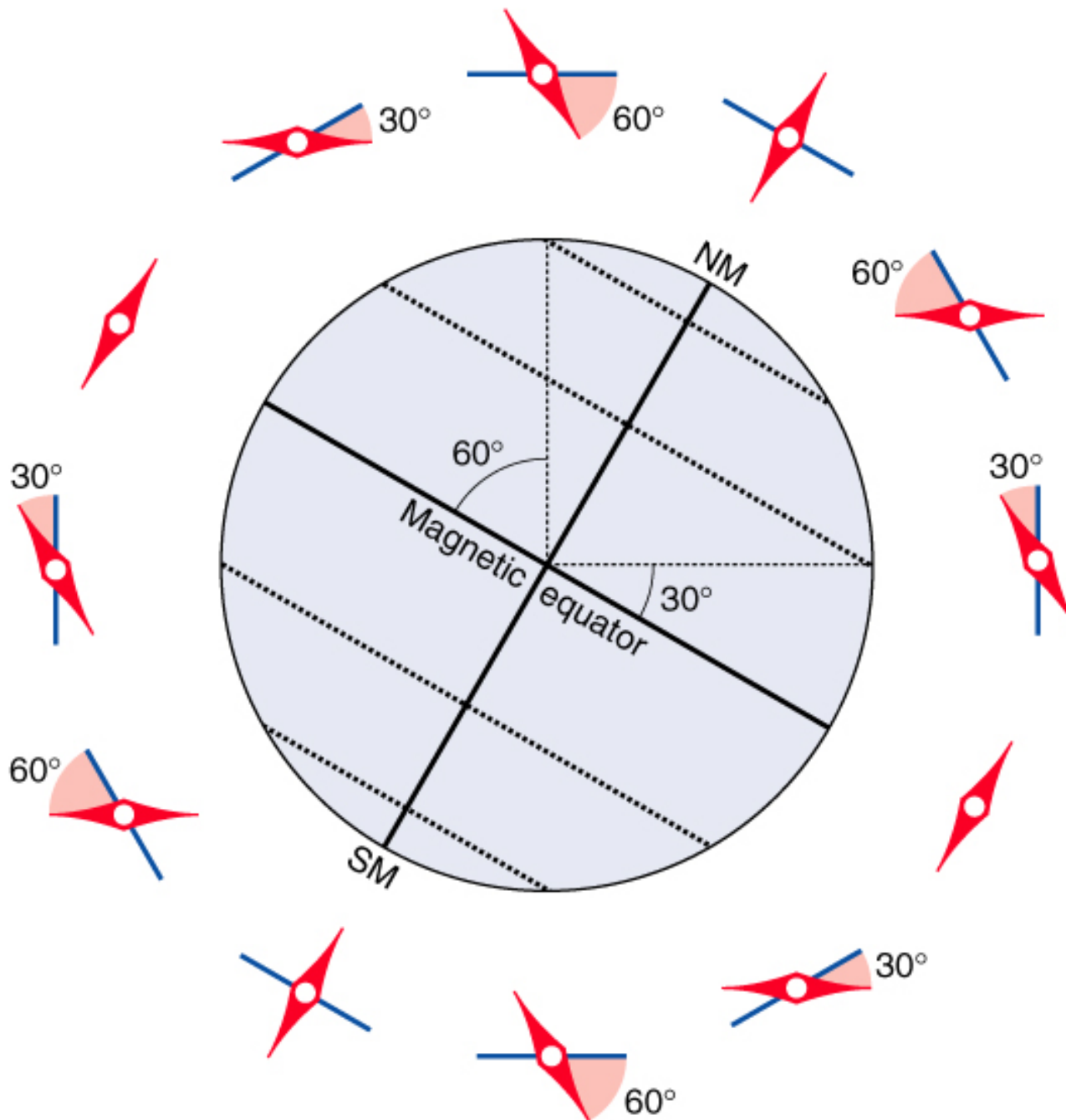
Plate tectonics and modern evidence for it - I



I. Apparent polar wander (APW) of the continents.

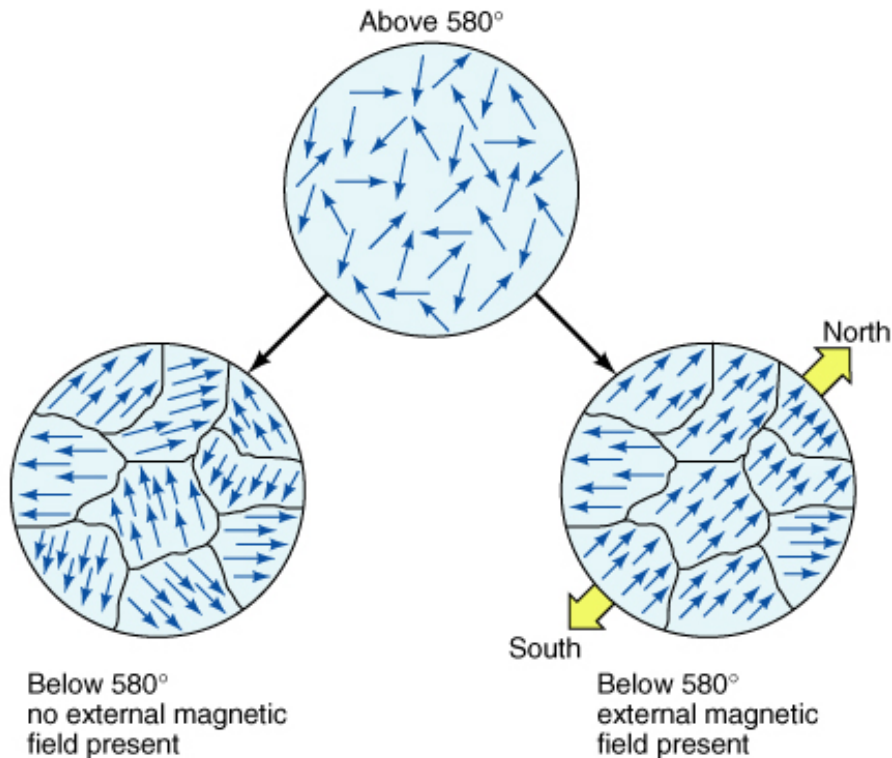
What does this mean??

First, recall that Earth has a magnetic field



The inclination of a compass needle changes with latitude

Some rocks have magnetic minerals that are like little compasses



As an igneous rock cools, the magnetic minerals all align with the Earth's magnetic field and then, once cooled, the *alignment cannot change!!!*

Apparent polar wander

- Rocks of different ages on the same continent point to different positions of the magnetic north pole!
- Magnetic poles do move slightly, but most of this is due to the rocks (on continents) moving!

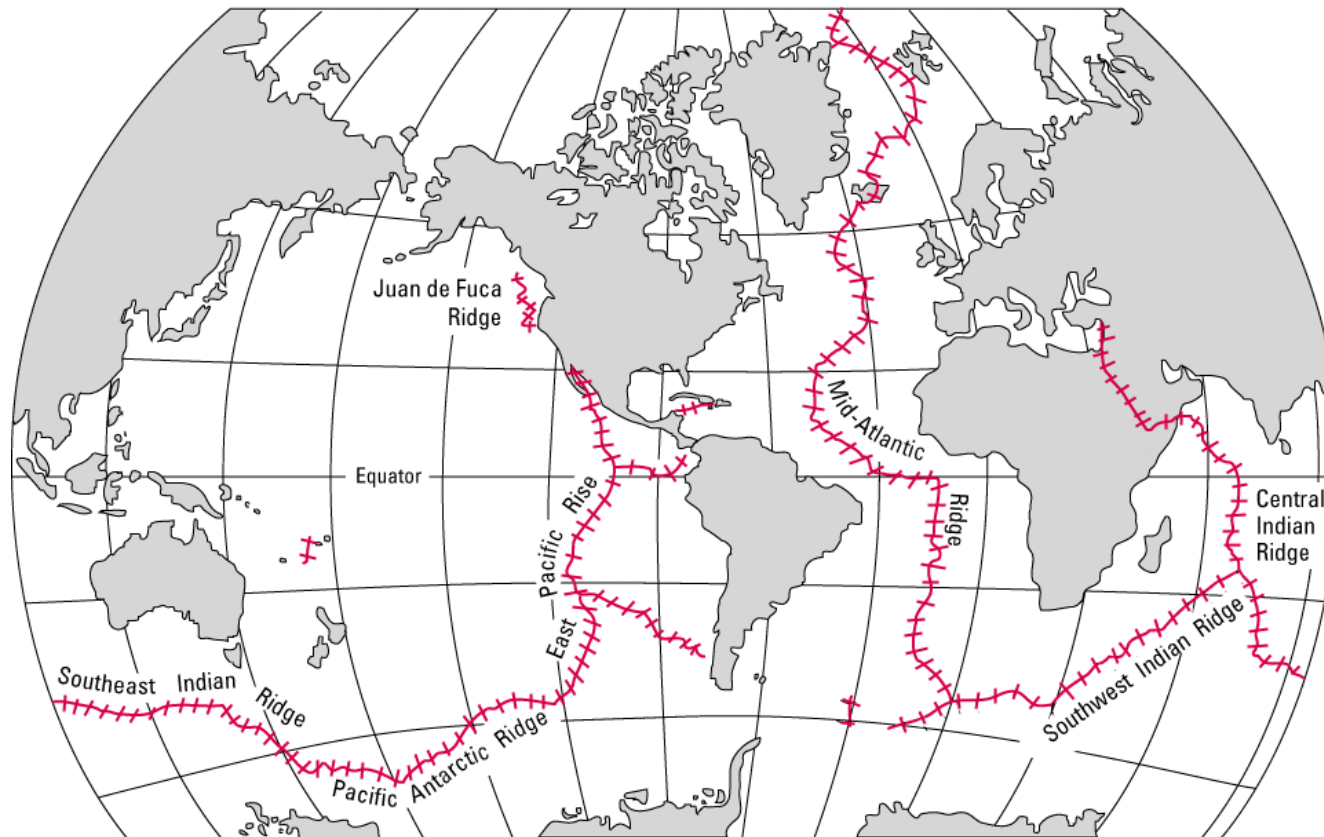
Apparent wandering of the geographic South Pole in the last 65 million years.



Wegener proposed that the poles remained fixed and that the continents moved over time.

- Rocks on different continents give different **apparent polar wander paths** –even if they are of the same ages! **Thus, the continents have drifted!**

Plate tectonics and modern evidence for it - II

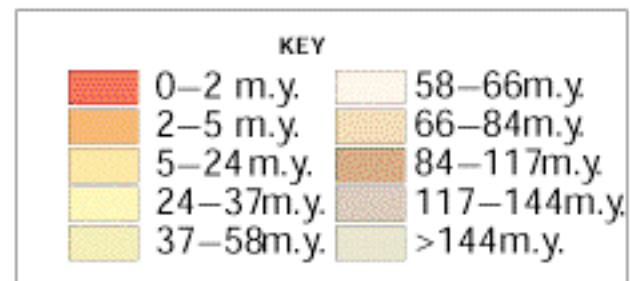
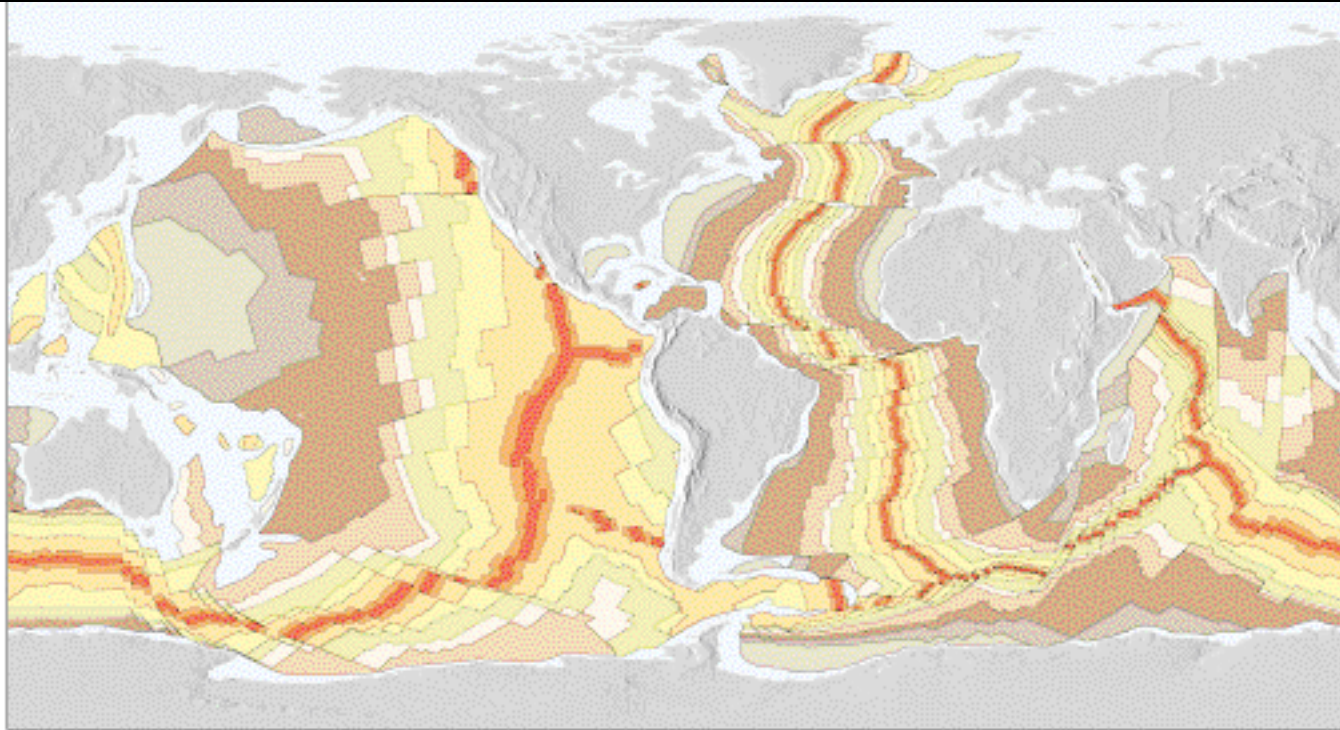


II. Sea Floor Spreading.

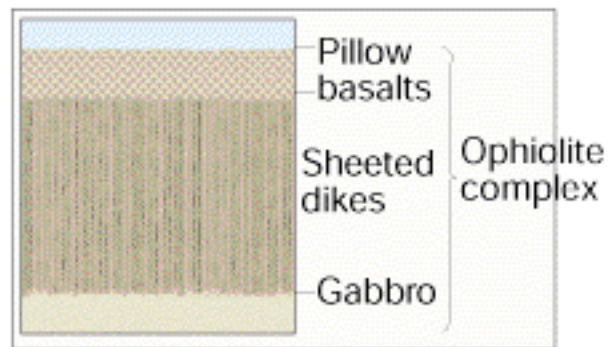
What does this mean??

Global mid-ocean ridge system

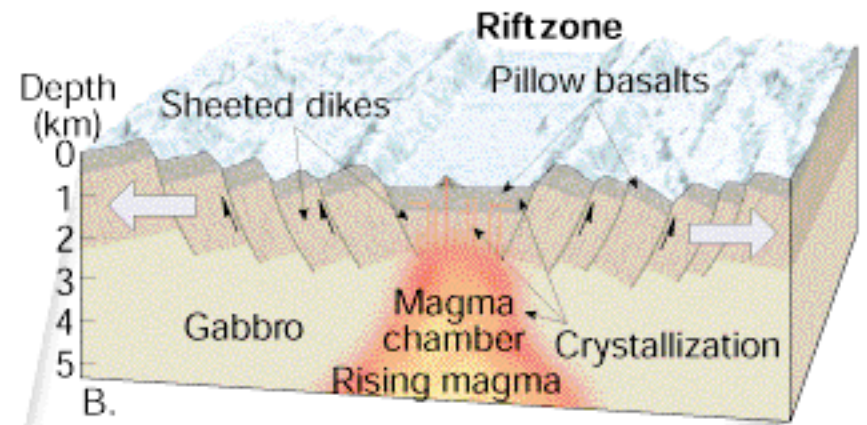
Age of the ocean floor



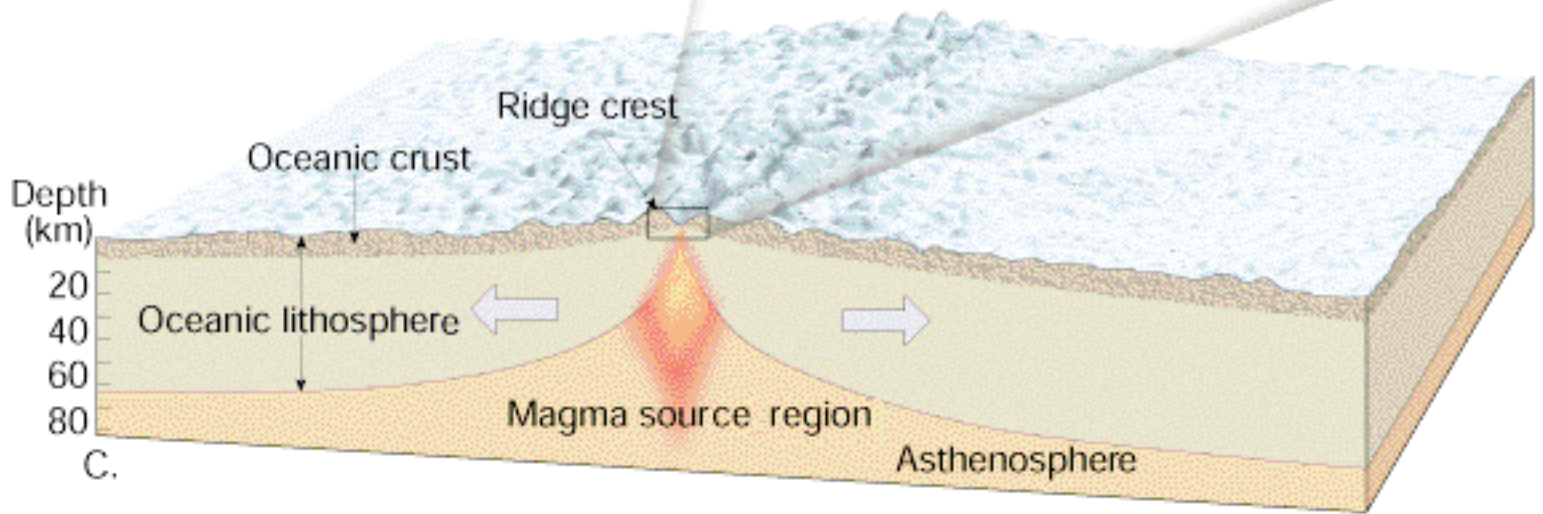
Ridge processes



A.

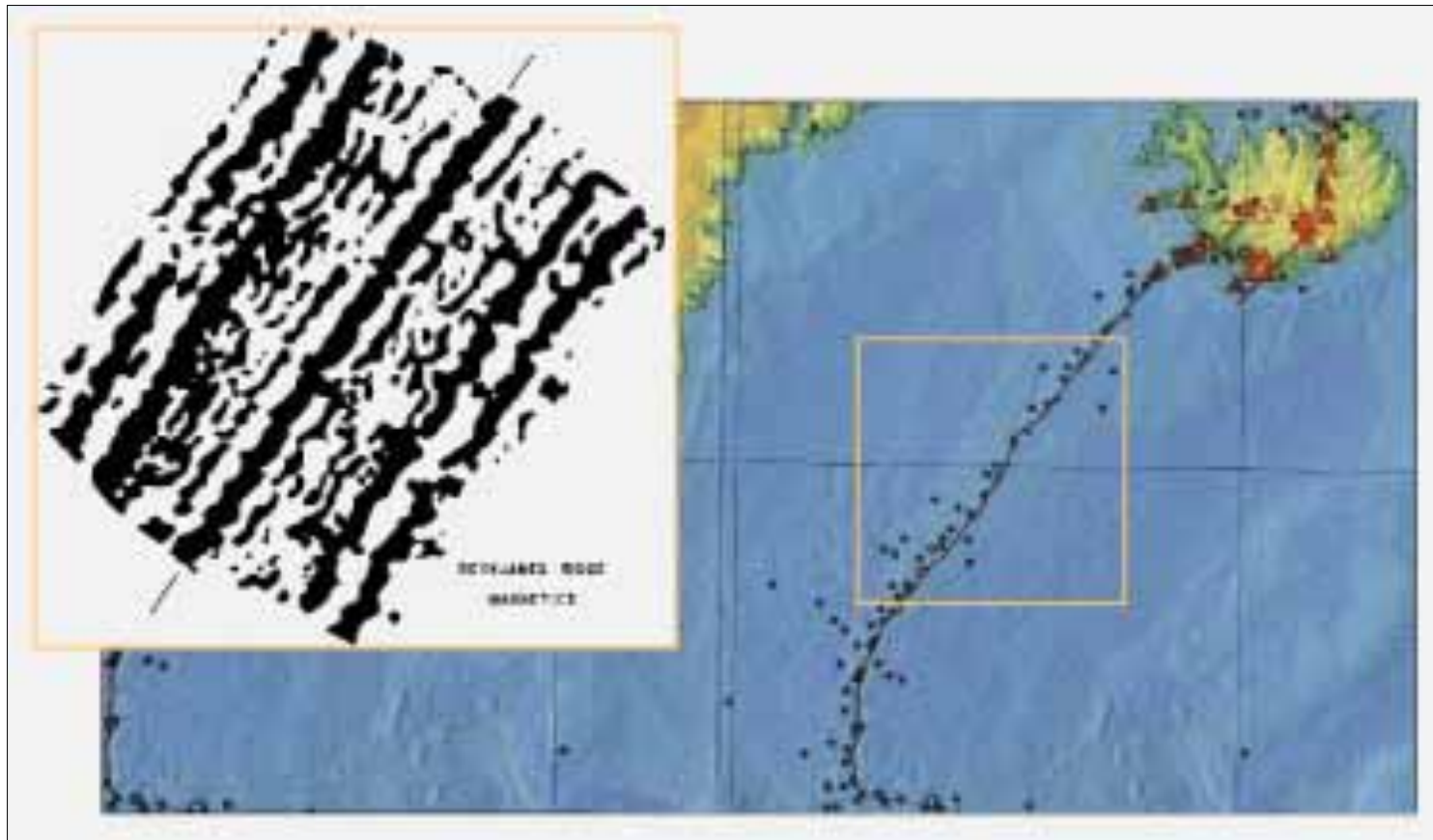


B.

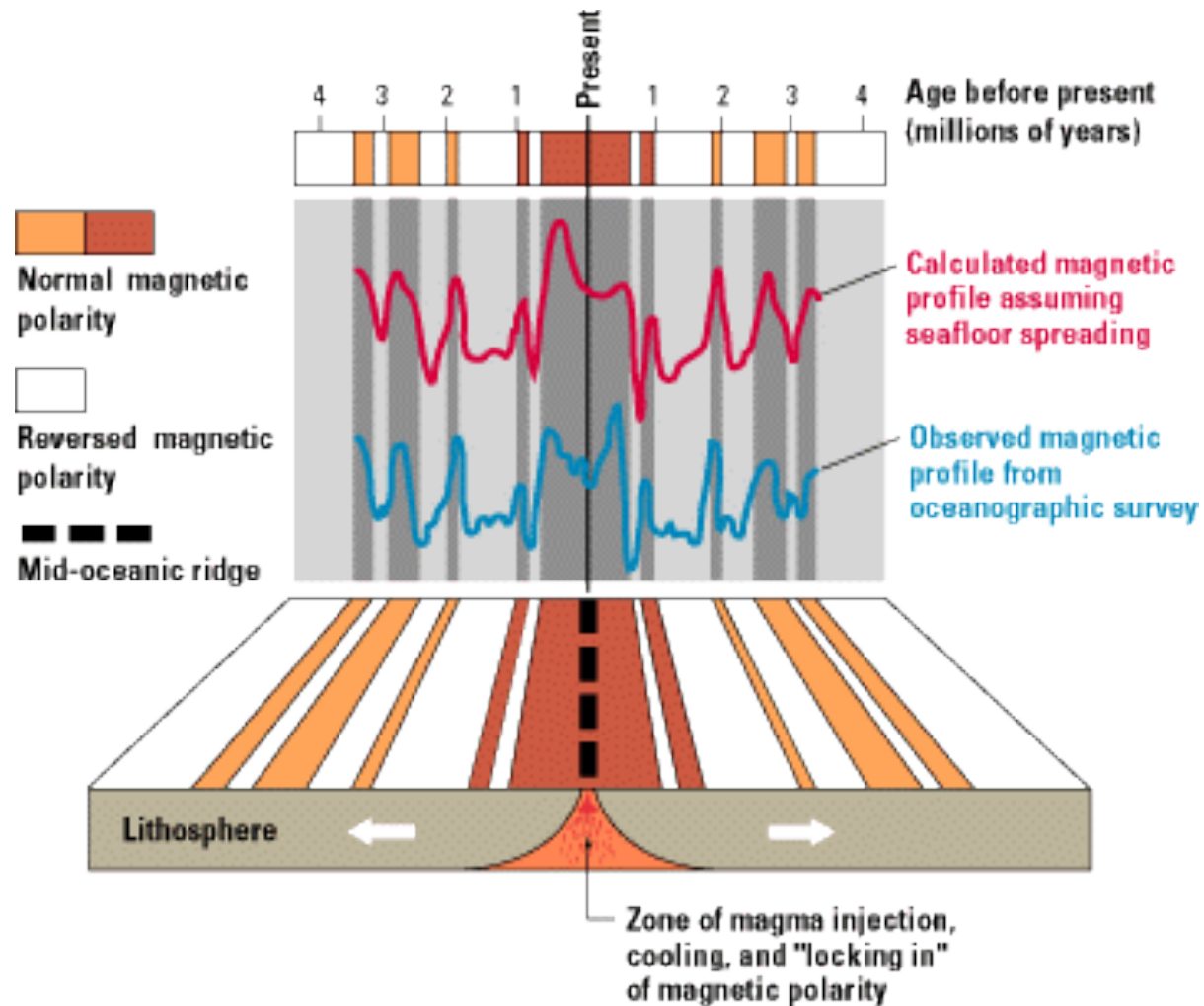


C.

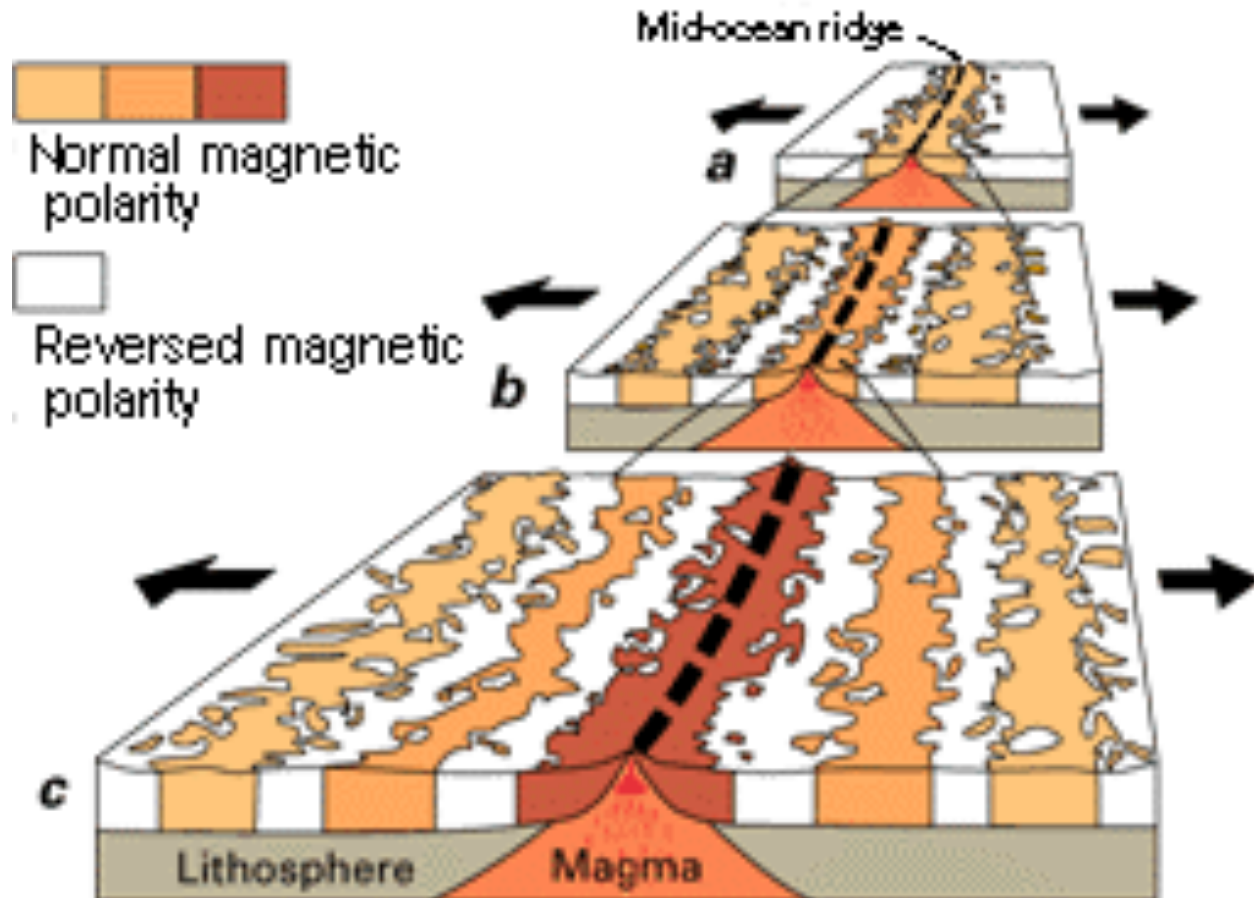
Magnetic stripes on the seafloor



Evidence for sea-floor spreading

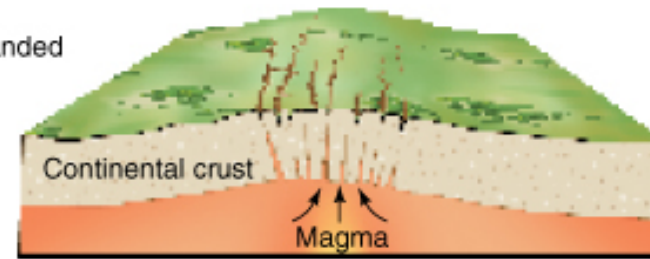


Seafloor Spreading and Plate Tectonics

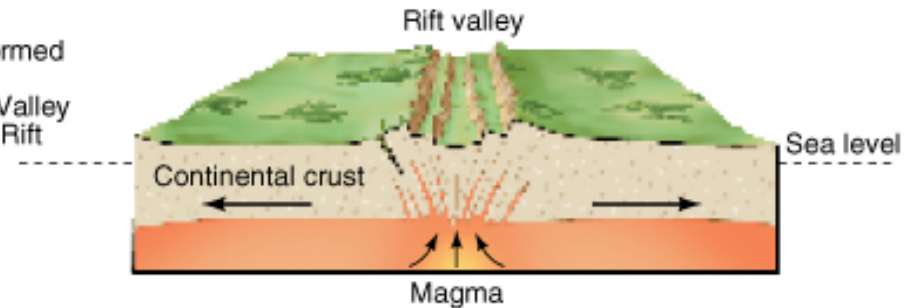


Mid-ocean ridges and continental rifts: divergent plate boundaries

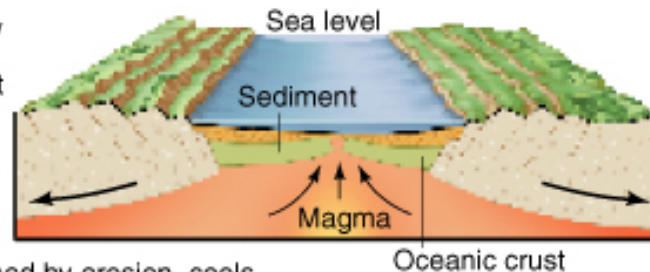
Uplift of a broad area
Crust heated and expanded
Example:
Colorado Plateau



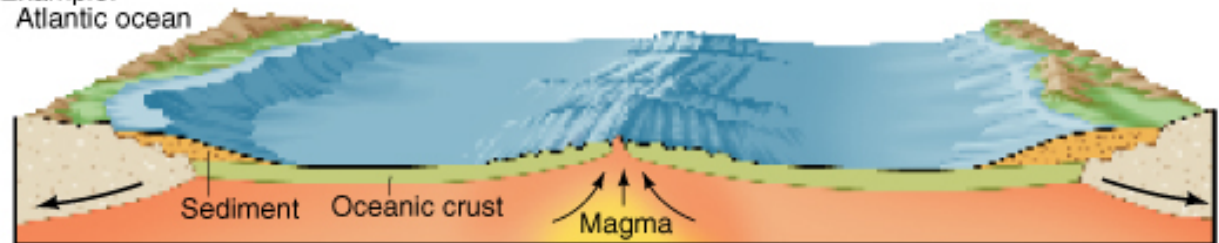
Rift valleys formed
Example:
African Rift Valley
Rio Grande Rift



Oceanic crust and new ocean forms
Erosion reduces height of flanking continent
Example:
Red Sea

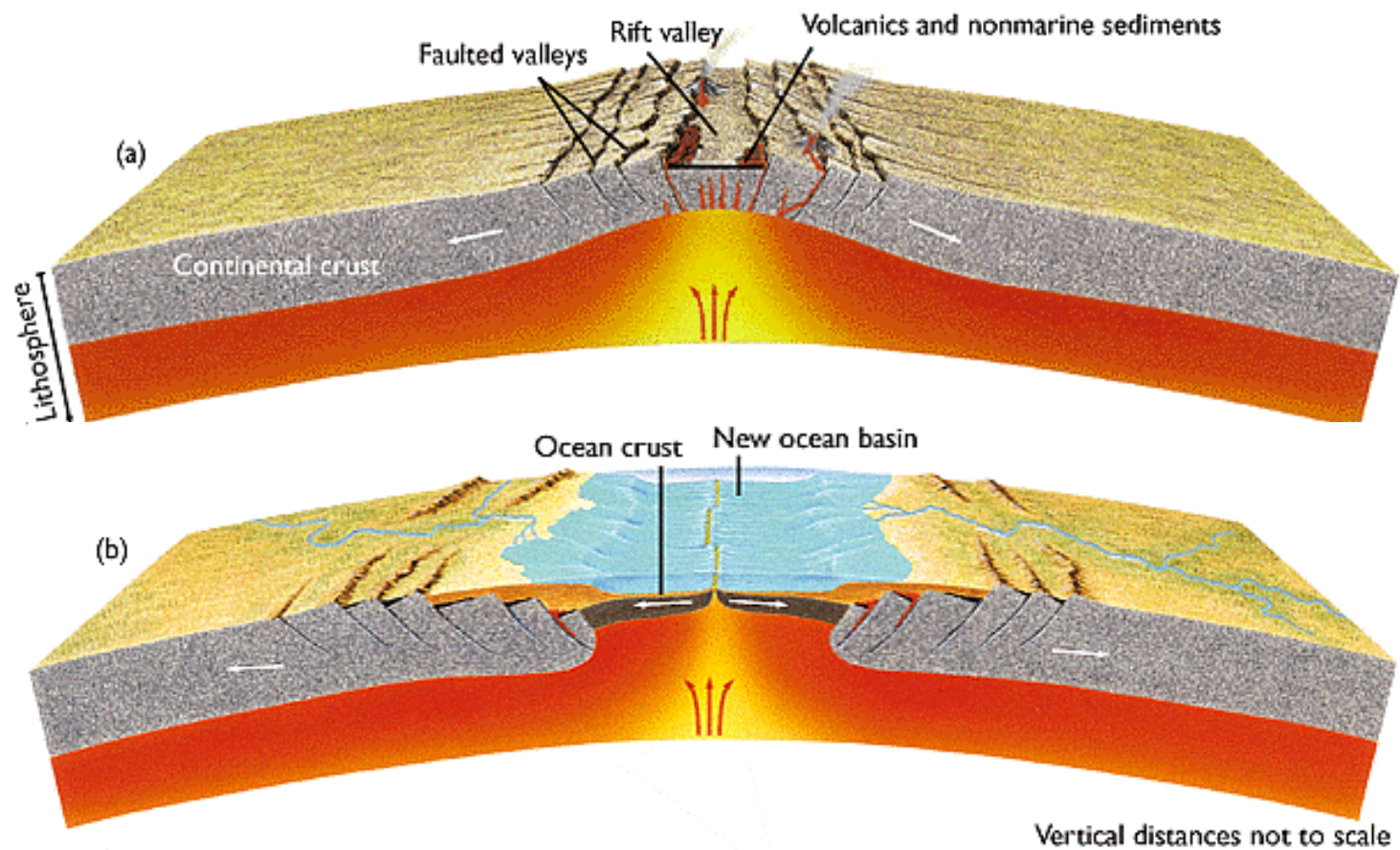


Continental crust, thinned by erosion, cools, contracts and sinks beneath the sea
Example:
Atlantic ocean

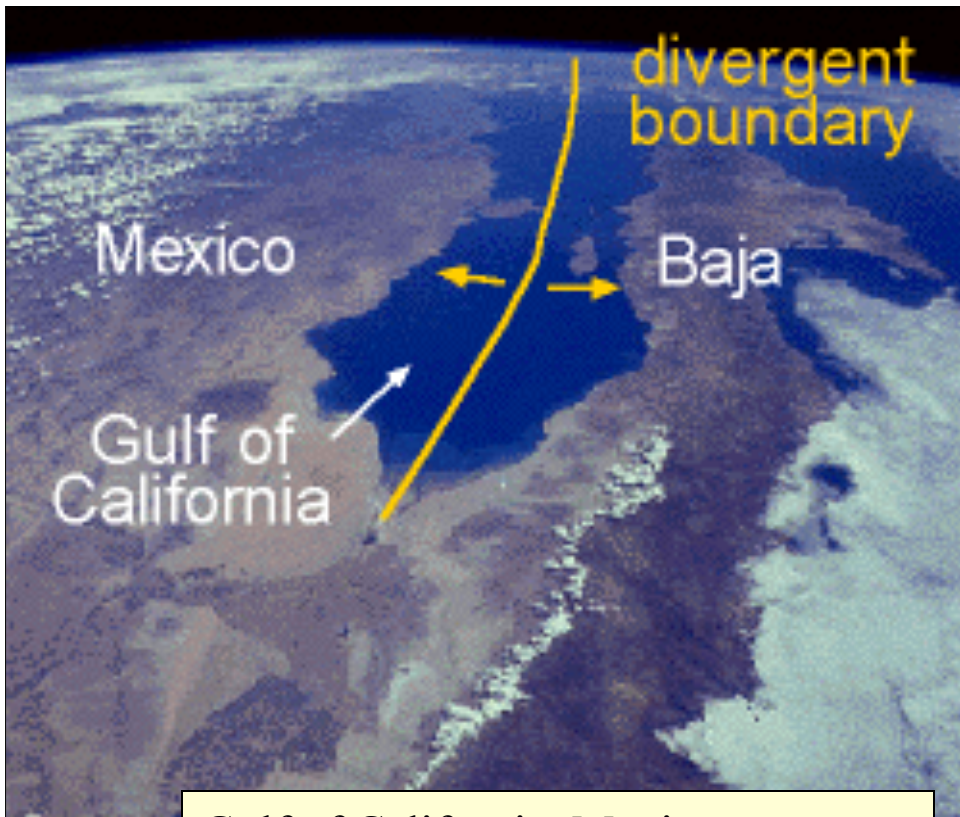


Divergent – Continental rifting → mid-ocean ridge!

We live in a continental rift – the **Rio Grande rift**



Continental rifts that are in the process of forming oceans!

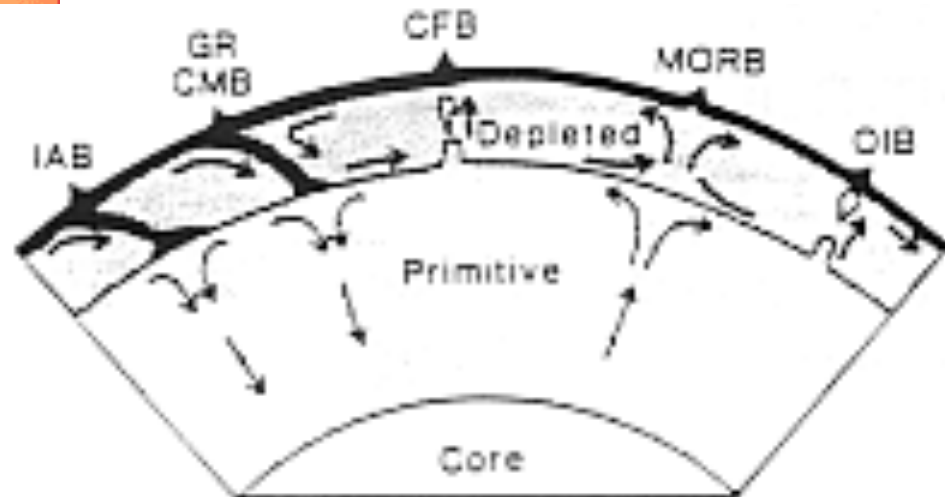
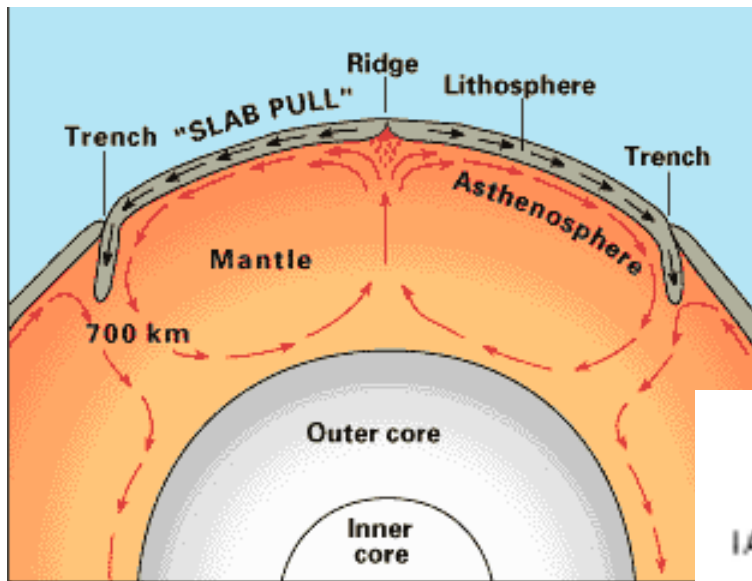


Gulf of California, Mexico



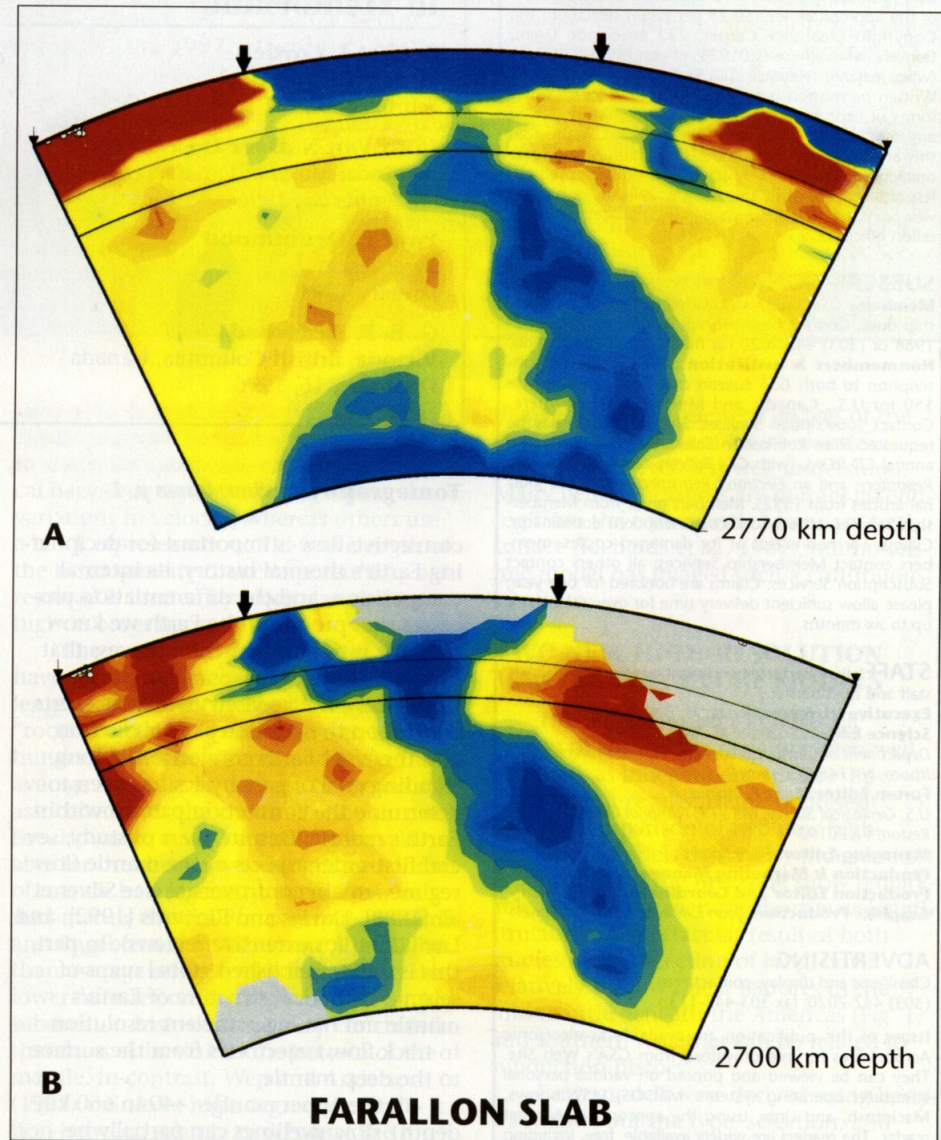
Red Sea

Mantle convection – whole vs. layered

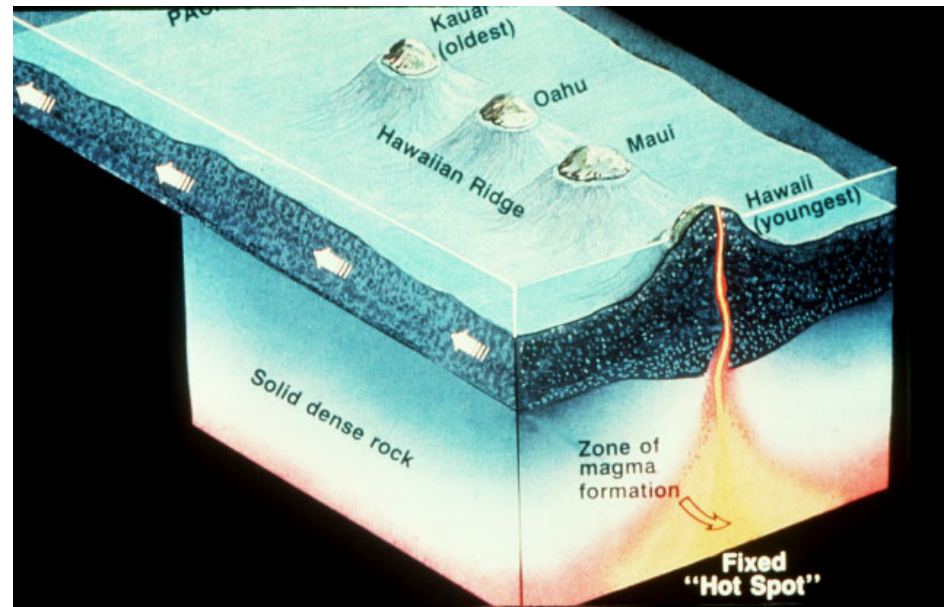


A. 2-LAYER CONVECTION






Seismic waves
are used to
image subducted
oceanic slabs! –
favor whole
mantle
convection

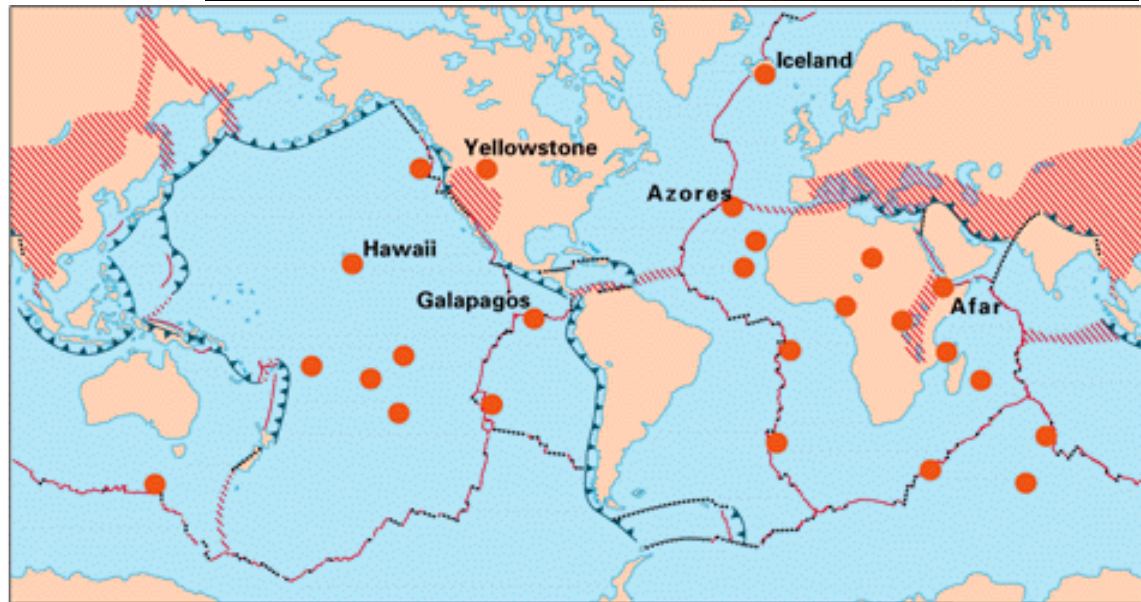


Hotspots



EXPLANATION

-  Divergent plate boundaries—Where new crust is generated as the plates pull away from each other.
-  Convergent plate boundaries—Where crust is consumed in the Earth's interior as one plate dives under another.
-  Transform plate boundaries—Where crust is neither produced nor destroyed as plates slide horizontally past each other.
-  Plate boundary zones—Broad belts in which deformation is diffuse and boundaries are not well defined.
-  Selected prominent hotspots



Hawaii

What direction is
plate currently moving?

When was shift?

What direction was
plate moving
50 Myr ago??

