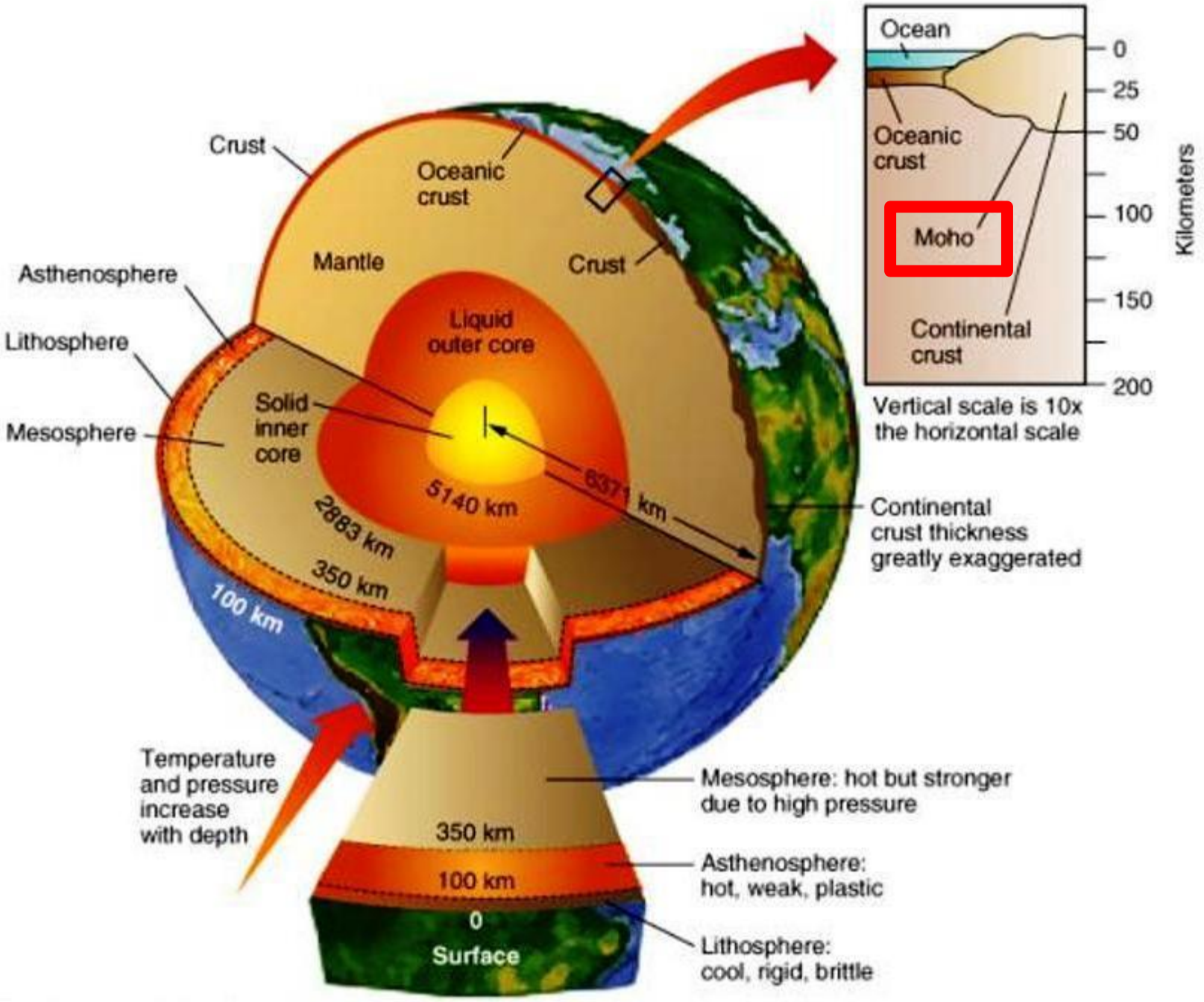
Geologic Processes

Continental Drift

Plate Tectonics

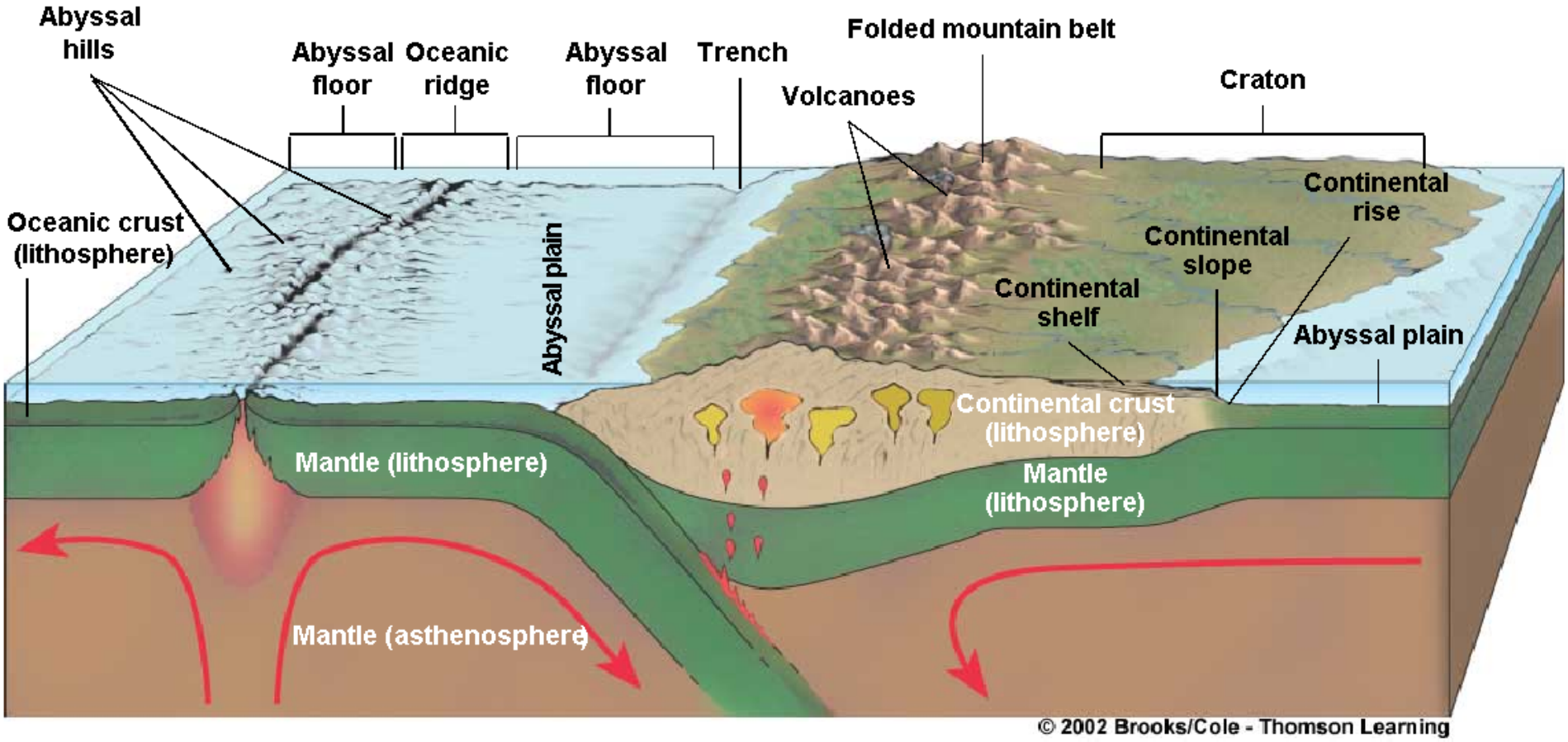
Earthquakes

Volcanoes



Geologic Processes

- Constant changes
- Driven by internal processes
  - Build up the planet's surface
  - Energy provided from heat in the interior
  - Causes the mantle to deform and flow



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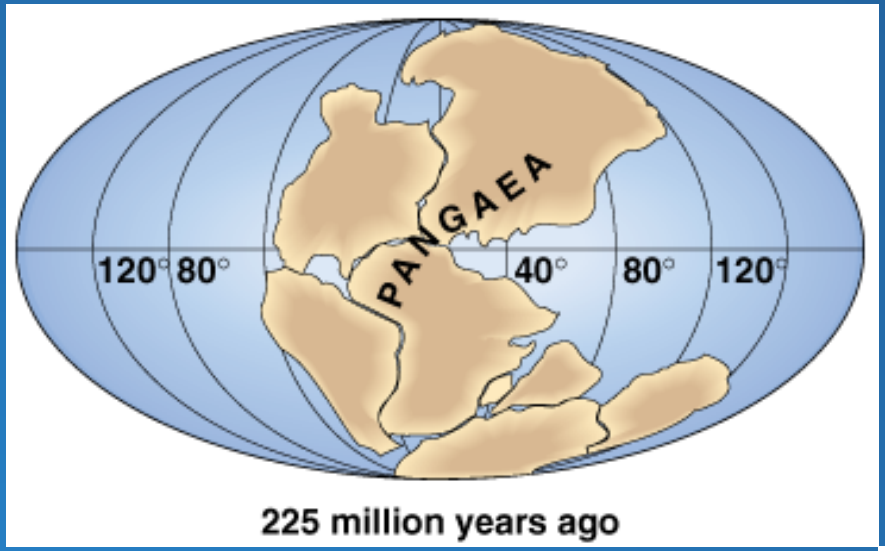
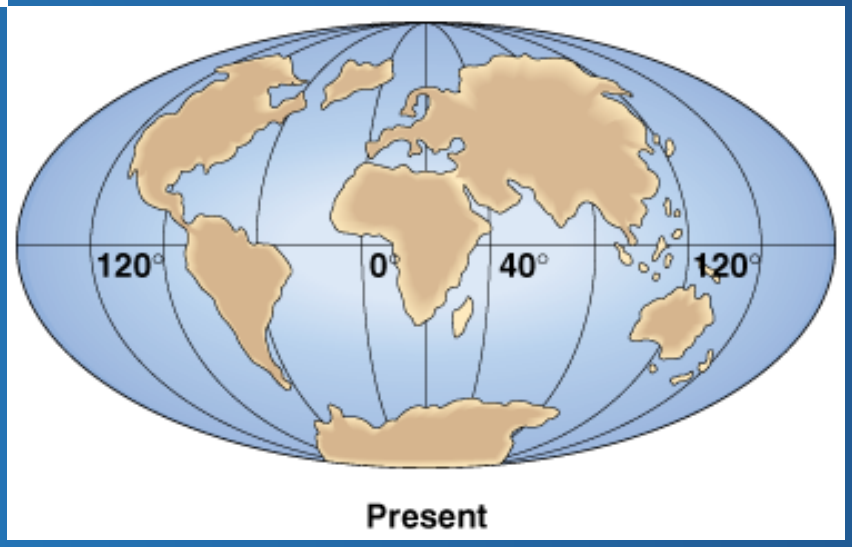
Slide

Pangea



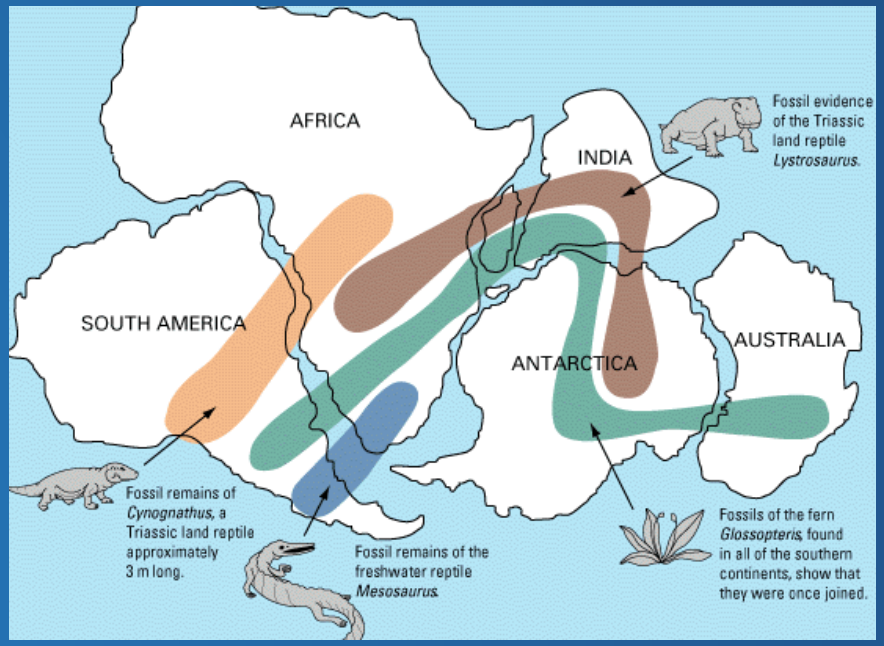
225 million years ago



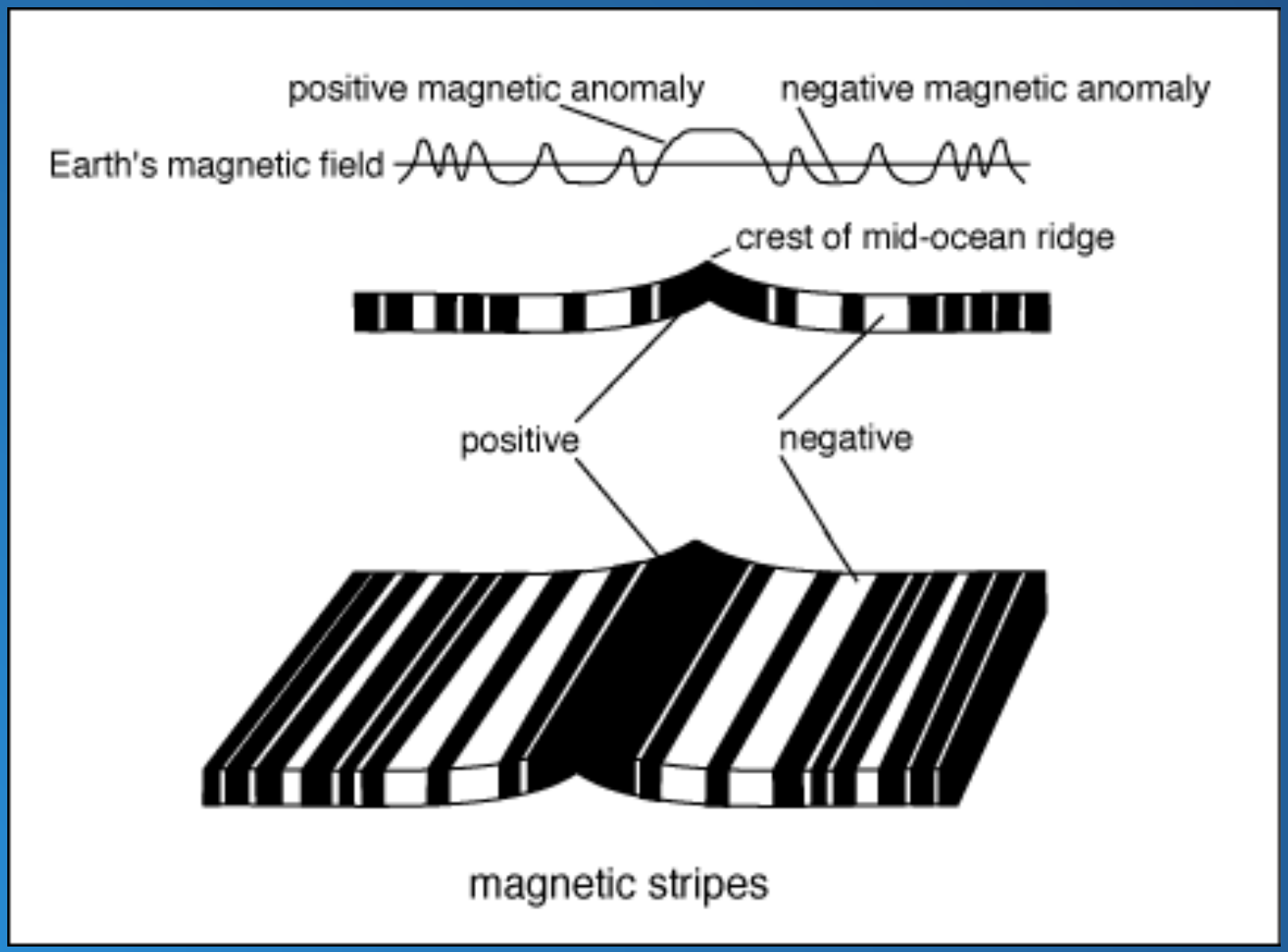
Present

Continental Drift

- Hypothesis proposed in 1912 by Alfred Wegener
- Initial Observations
  - Same fossils, landforms, glacial deposits, paleomagnetism across continents
  - Fit of continents
- Proposed that continents move very slowly over millions of years
- Rejected for failure to provide mechanism

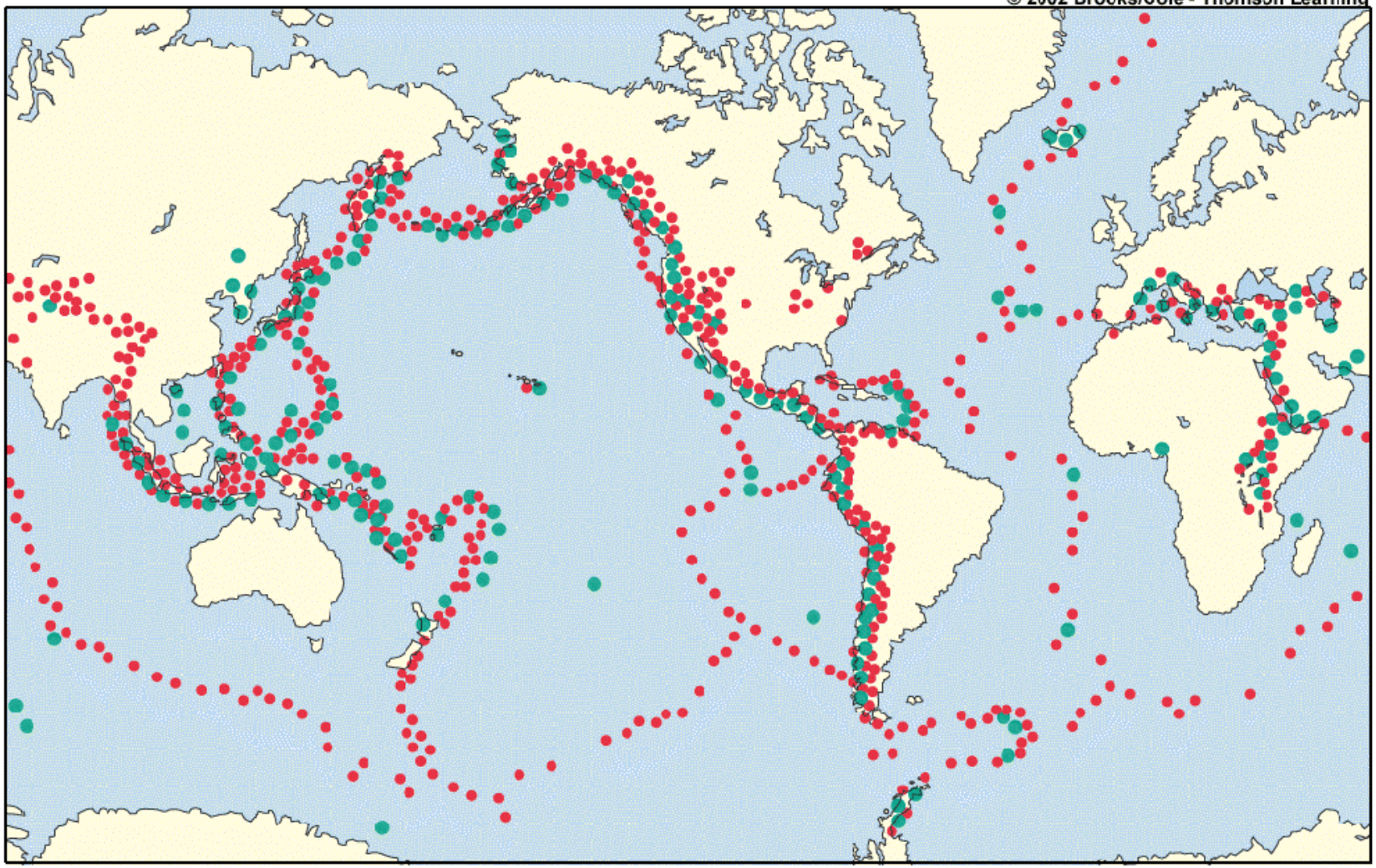


Paleomagnetism



Theory of Plate Tectonics

- Accepted in early 1960's
  - Mechanism identified by Harry Hess's research on sea floor spreading
- Movement of tectonic/lithospheric plates
  - 60 miles thick
  - Made up of continental & oceanic crust
  - Different plates = different speeds
  - Move via mantle convection currents
  - Produces volcanoes, earthquakes, oceanic ridge system, & trenches
- Helps explain patterns of biological evolution



Volcanoes

Earthquakes

Fig. 10.5a, p. 214

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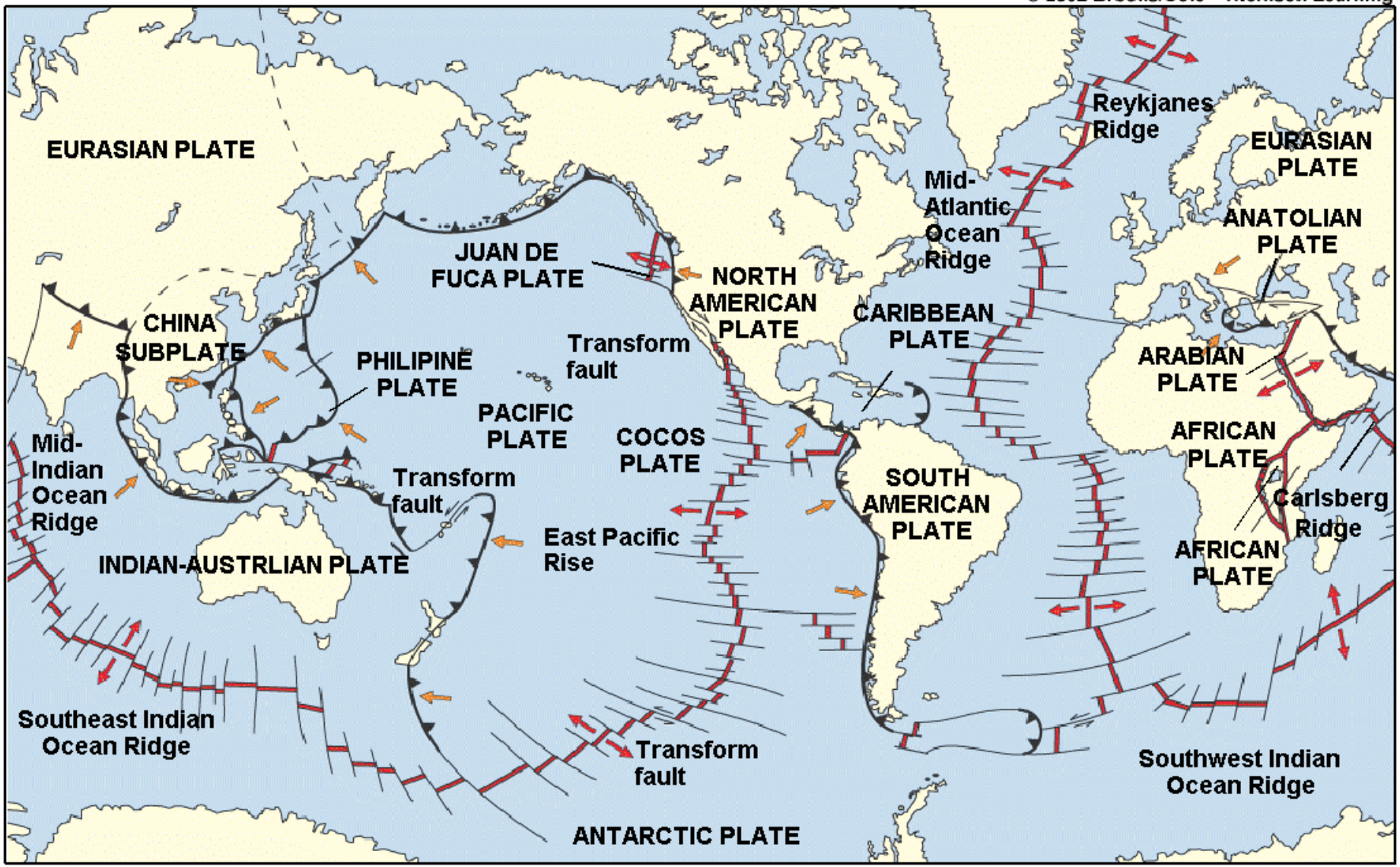

Convergent plate boundaries

Plate motion at convergent plate boundaries

Divergent ( ) and transform fault ( ) boundaries

Plate motion at divergent plate boundaries

Plate system

Fig. 10.5b, p. 214

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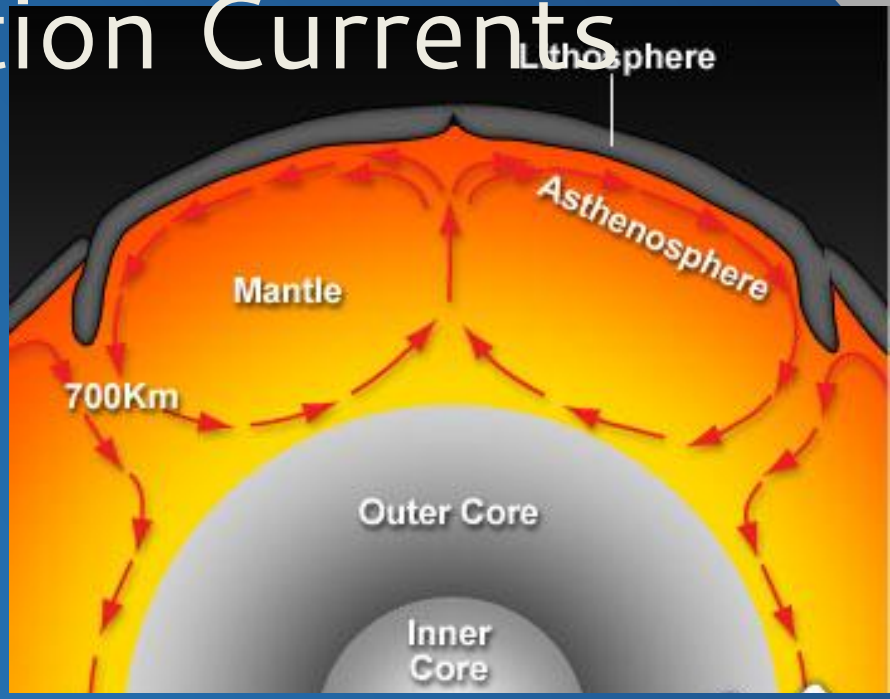
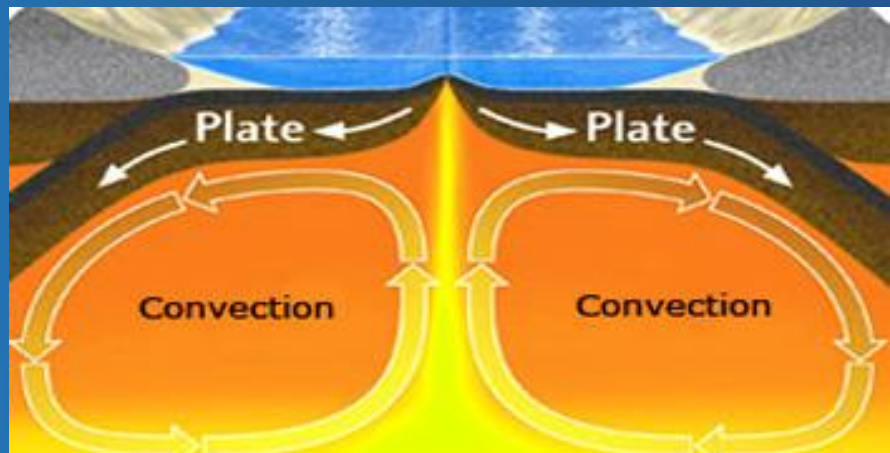
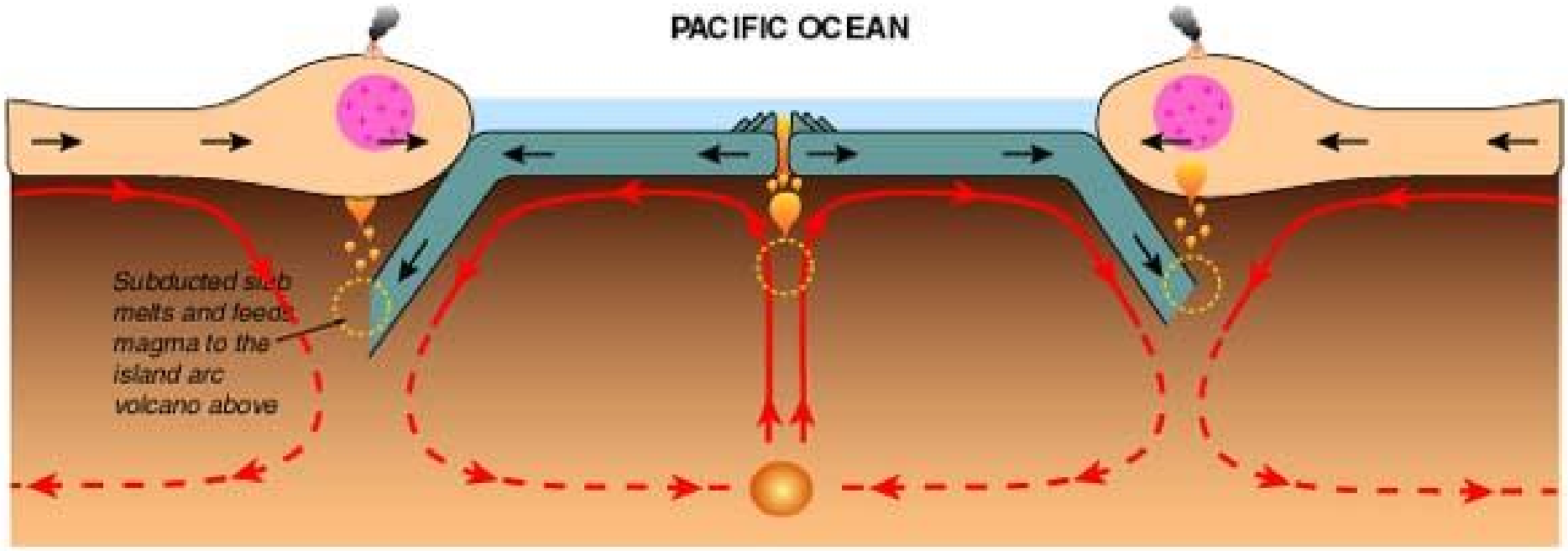
How the Plates Move: Mantle Convection Currents

- Rigid lithospheric plates on top of semi-fluid asthenosphere
- Powered by heat from core
- Hot rises, cold sinks
- Plates surf on the resulting motion





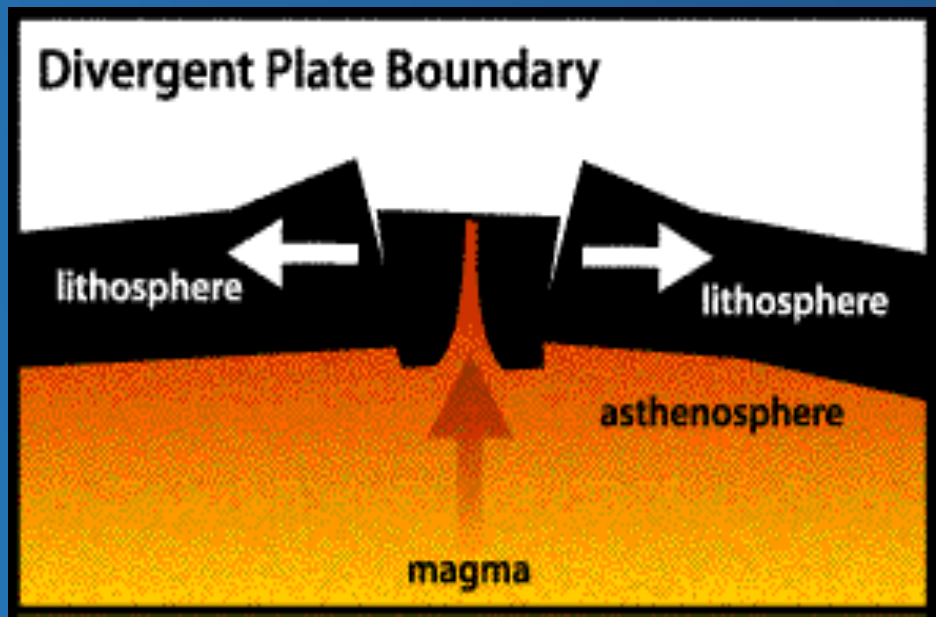
How the Plates Move on Mantle Convection Currents



All around the edge of the Pacific, ocean crust is being subducted beneath continental crust. As a result, the Pacific is surrounded by a chain of volcanoes - known as the Ring of Fire

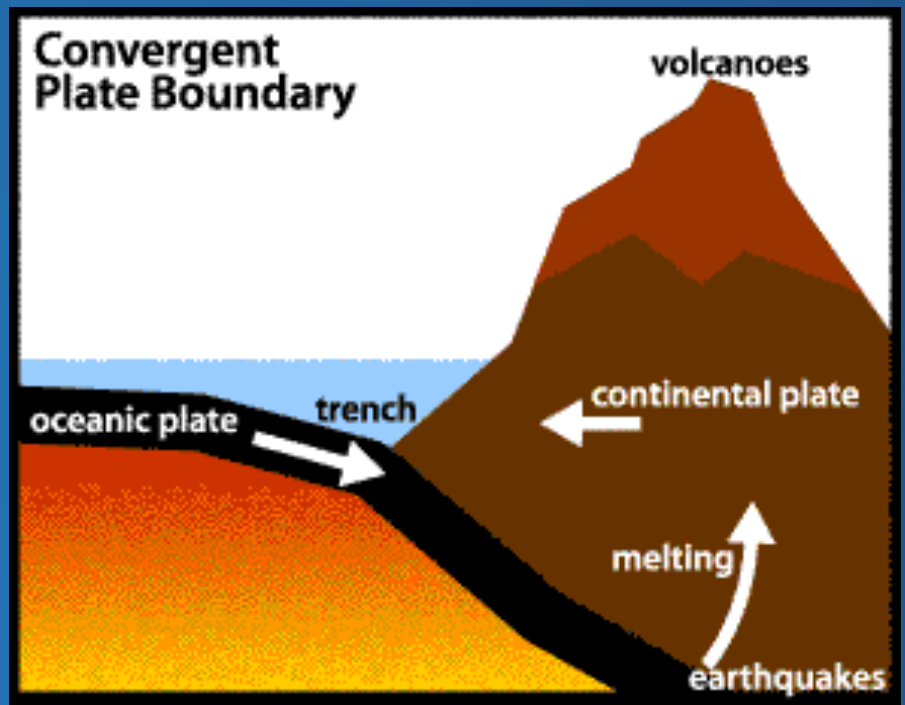
How the Plates Move: Ridge Push

- **Divergent boundary**: rising edges of 2 convection cells push magma up at same location
- New crust pushes the older crust/lithospheric plates away from the area
- Produces
  - Mid-ocean ridges
  - New crust

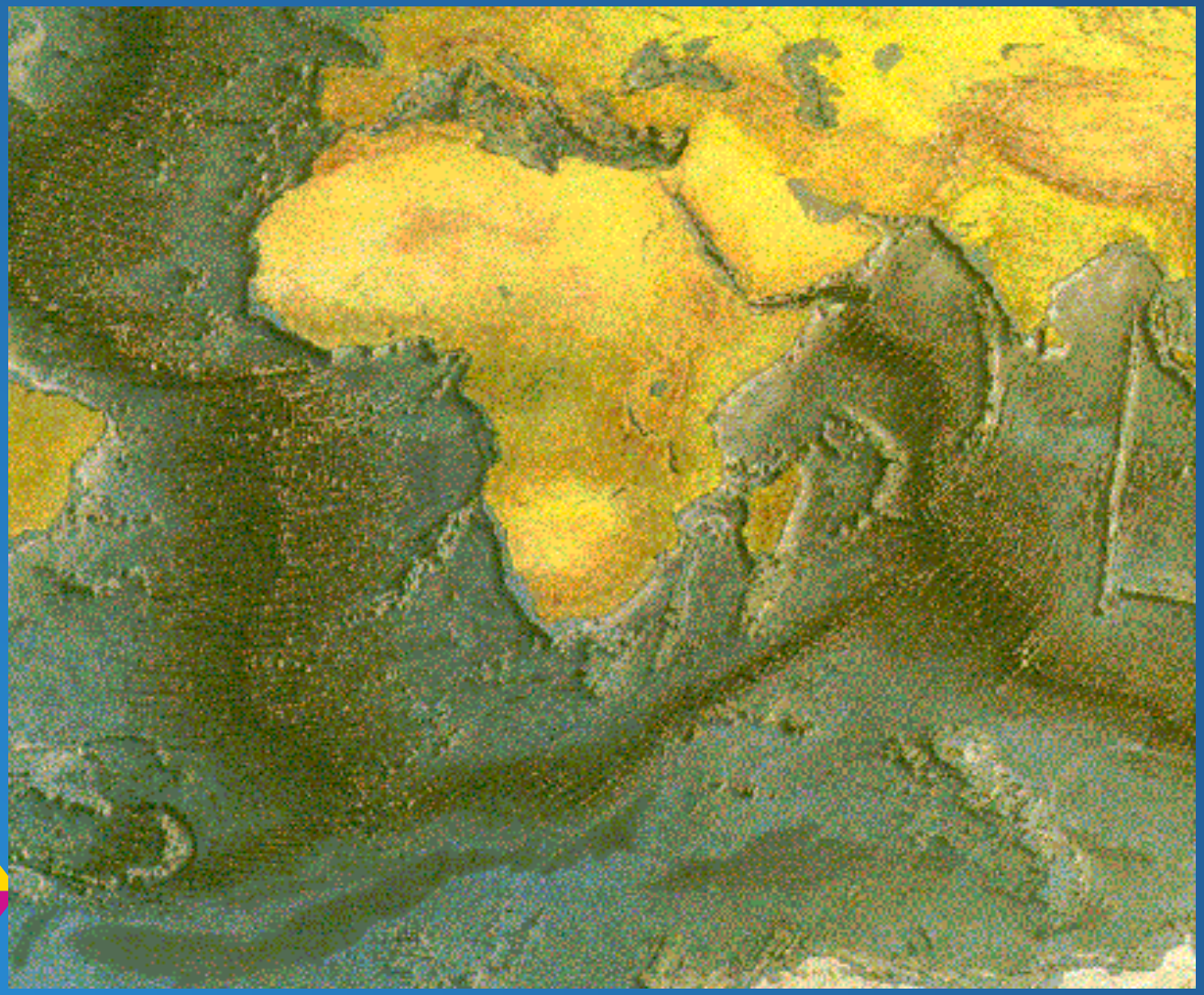


How the Plates Move: Gravity/Slab Pull

- **Convergent boundary**: descending edges of 2 convection cells pull the denser crust (oceanic > continental) below the less dense crust
- Subducted plate melts into mantle
- Produces
  - Subduction zone
  - Trench
  - Volcanic Arc
    - Continental
    - Islandic
  - Earthquakes



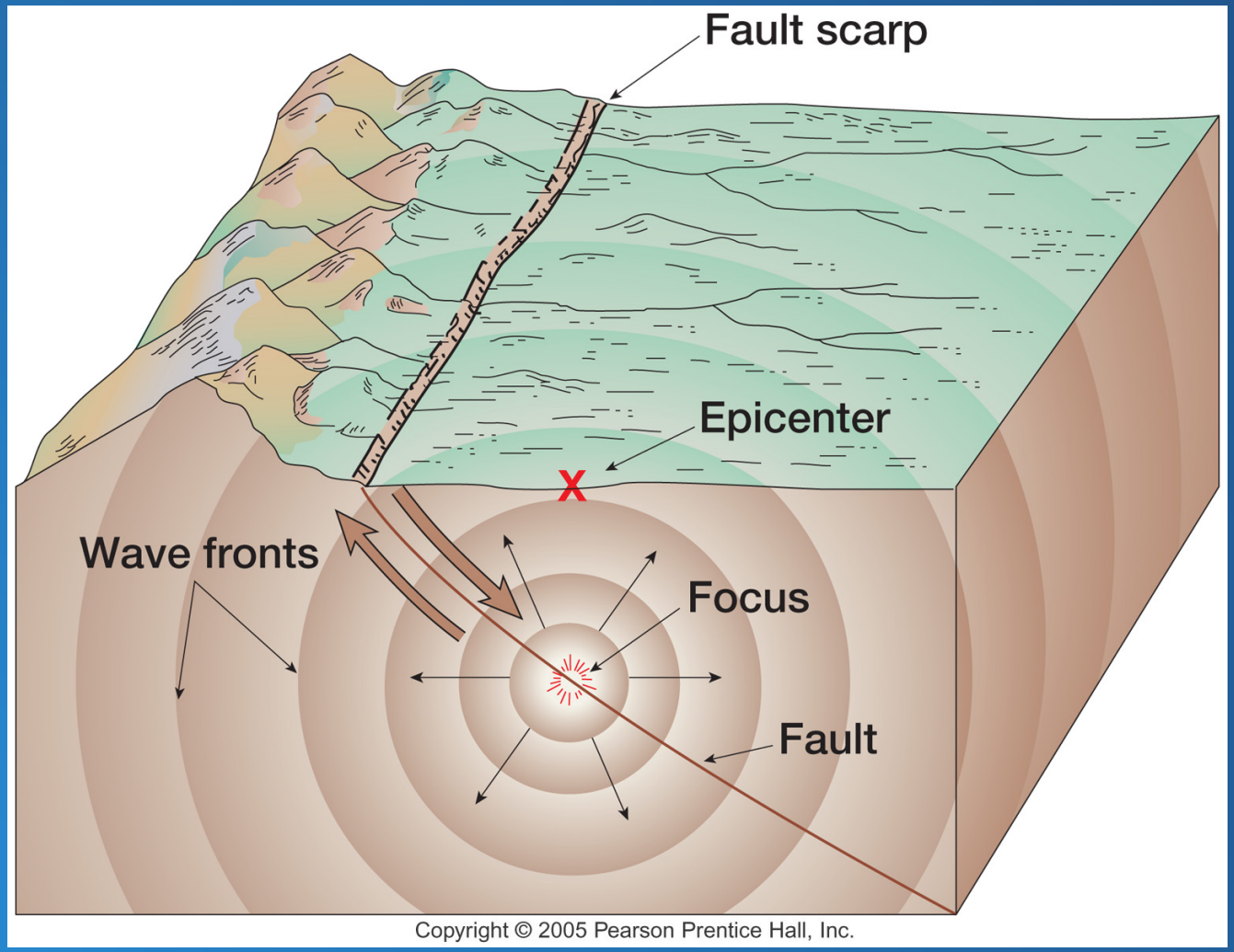
Mid-Atlantic Ridge System



Earthquakes

- Sudden release of energy accompanies motion along fault line
- **Focus** vs. **epicenter**
- Richter scale is logarithmic (3.0 is 100 times stronger than 1.0)
- Environmental Impacts
  - Habitat—destruction via shaking and shifting of ground; possible rock slides; fire
  - Water—possible tsunamis; pollution following recession of flood water

Fault vs. Epicenter

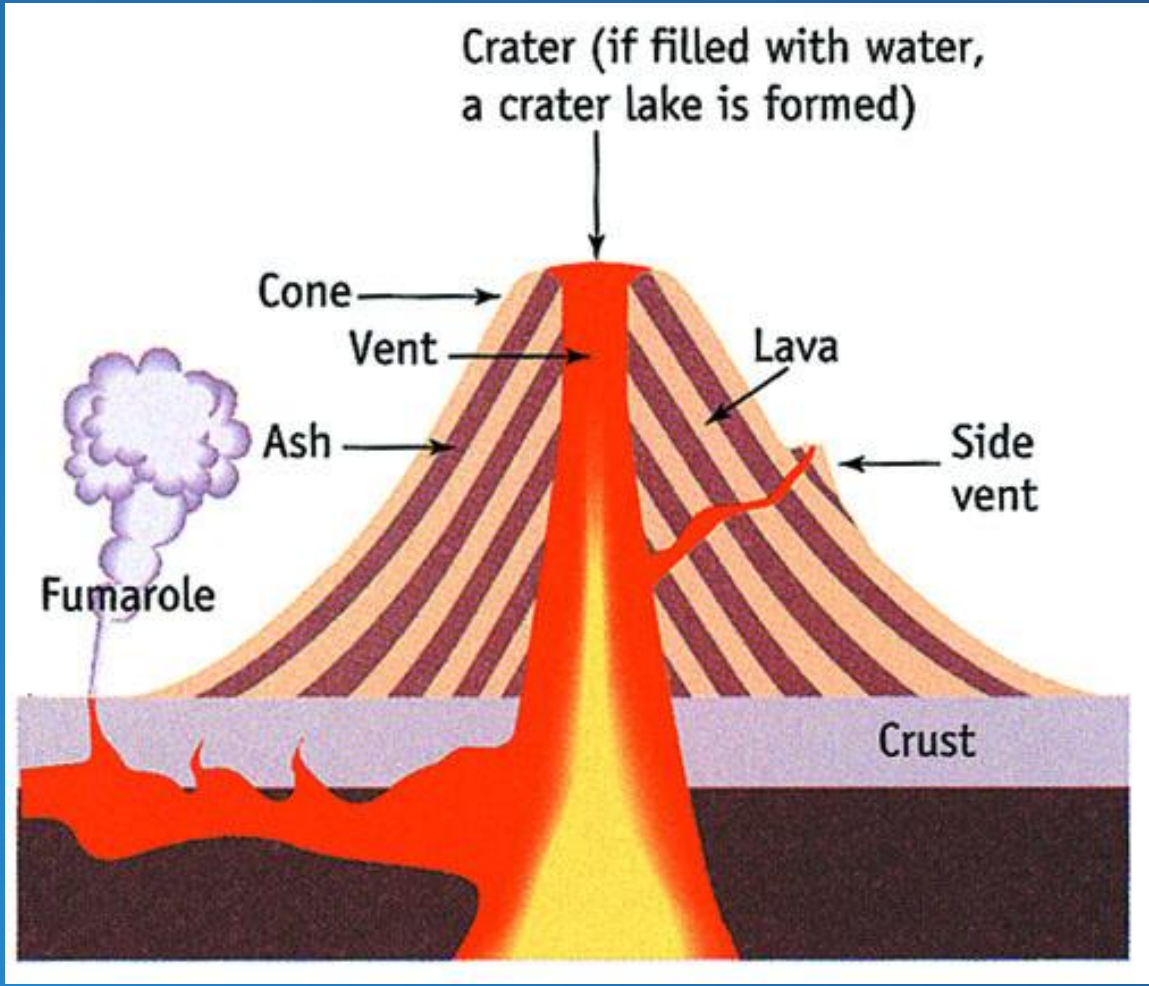


Earthquakes

Volcanoes

- Magma breaches the crust through vent or crack
- Eject ash, cinders, lava, & gases (H_2O, CO_2, SO_2)
- Environmental impacts
  - Habitat—destroy current; form mountains & lakes; aids early succession species
  - Soil—can induce slides/erosion; enriched via ash and weathering of volcanic rock
  - Atmosphere—lower air quality; produces acid rain; ash blocks solar input

Volcanoes


Crater (if filled with water, a crater lake is formed)
Cone
Vent
Lava
Ash
Side vent
Fumarole
Crust

Minimizing Geohazard Impacts

Predict & map likely locations

- Historical records
- Siesmic measurements
- Earthquakes: Improve structures
  - Engineering & technology
  - Establish/modify building codes
- Volcanoes
  - Adjust land use
  - Effective evacuation plans