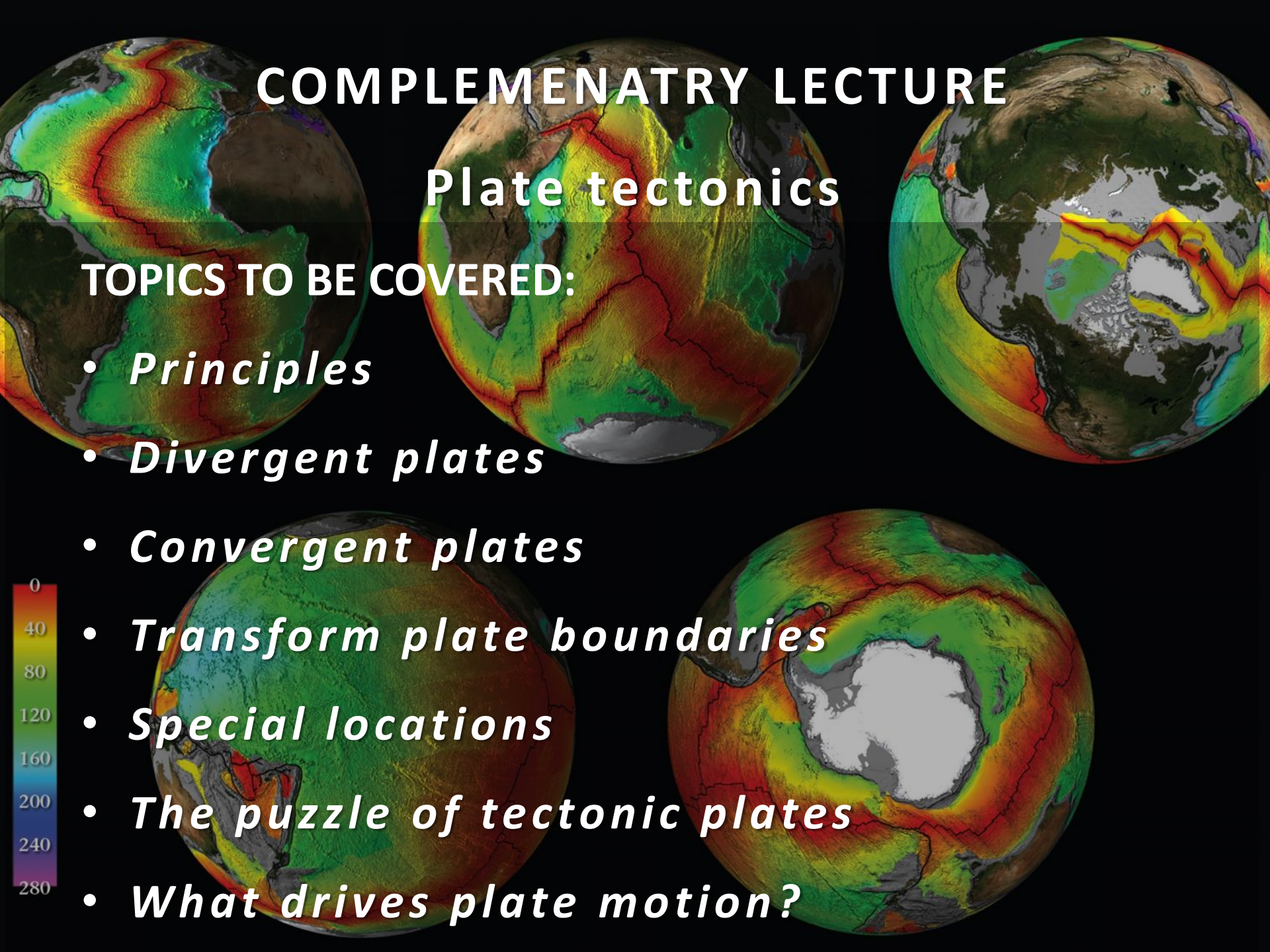
COMPLEMENATRY LECTURE

Plate tectonics

TOPICS TO BE COVERED:

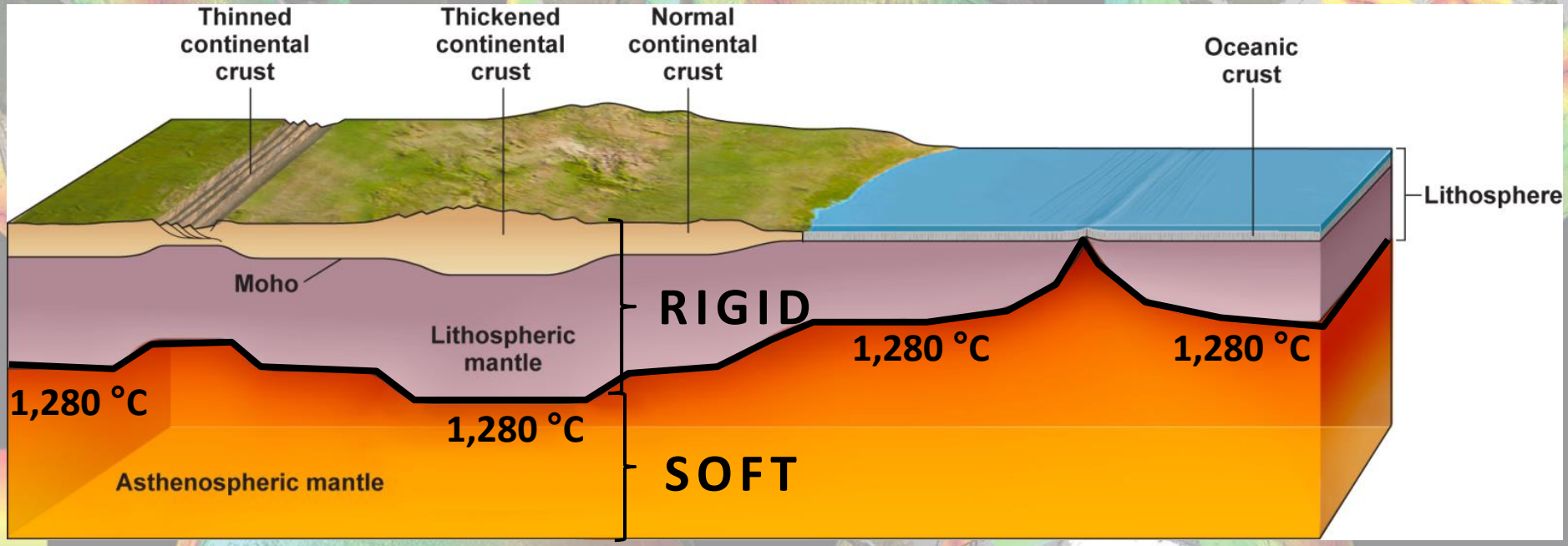
- *Principles*
- *Divergent plates*
- *Convergent plates*
- *Transform plate boundaries*
- *Special locations*
- *The puzzle of tectonic plates*
- *What drives plate motion?*



8. The Continental Drift

Principles of the plate tectonics

CONCEPTS: Lithosphere and Asthenosphere



Lithosphere RIGID or BRITTLE is 100-150 thick → CRUST + LITHOSPHERIC MANTLE

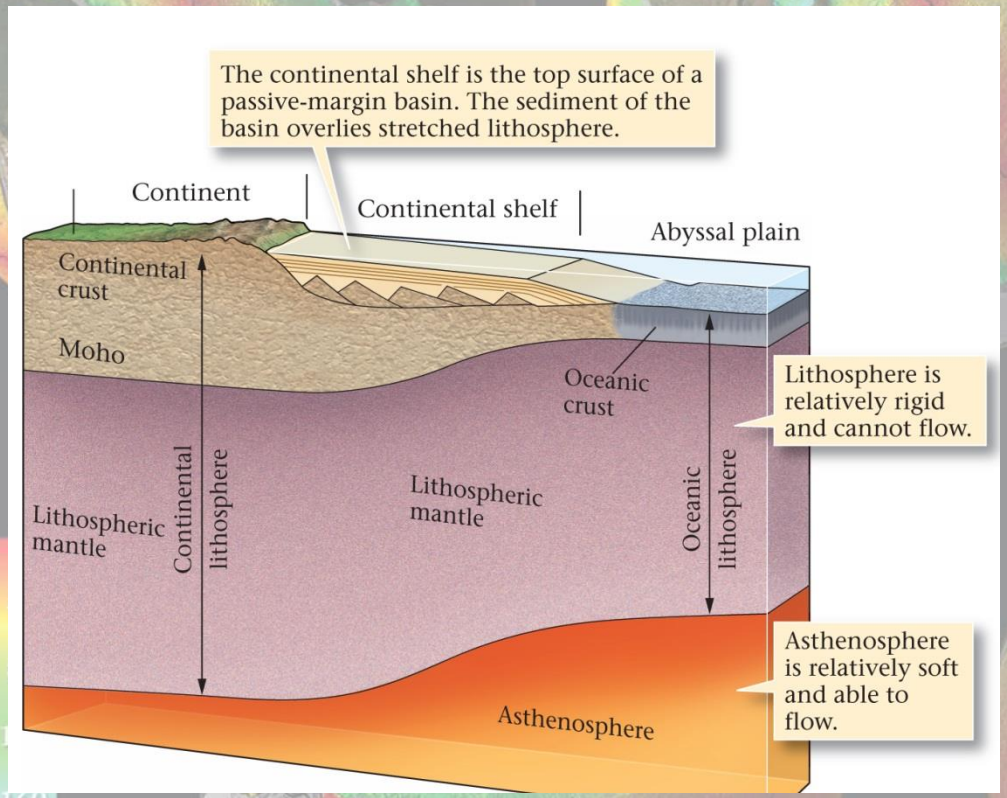
Asthenosphere SOFT or PLASTIC

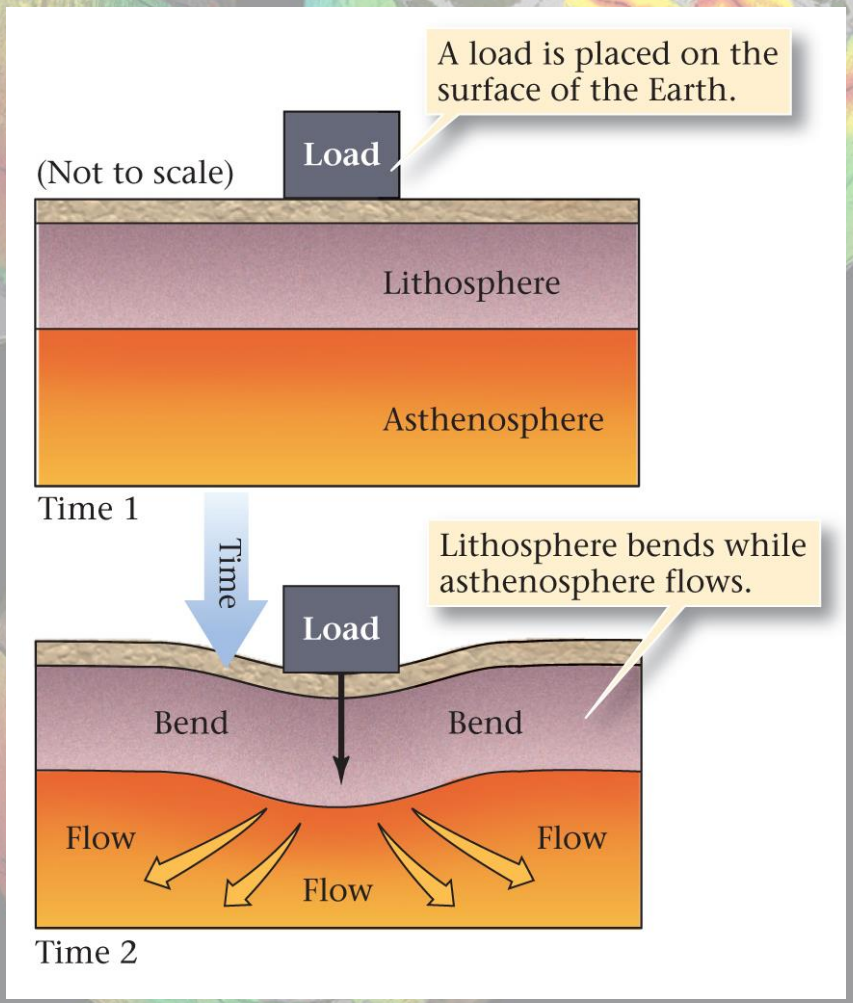
The boundary between Lithosphere and Asthenosphere where T = 1,280 °C

8. The Continental Drift

Principles of the plate tectonics

CONCEPTS: Lithosphere and Asthenosphere



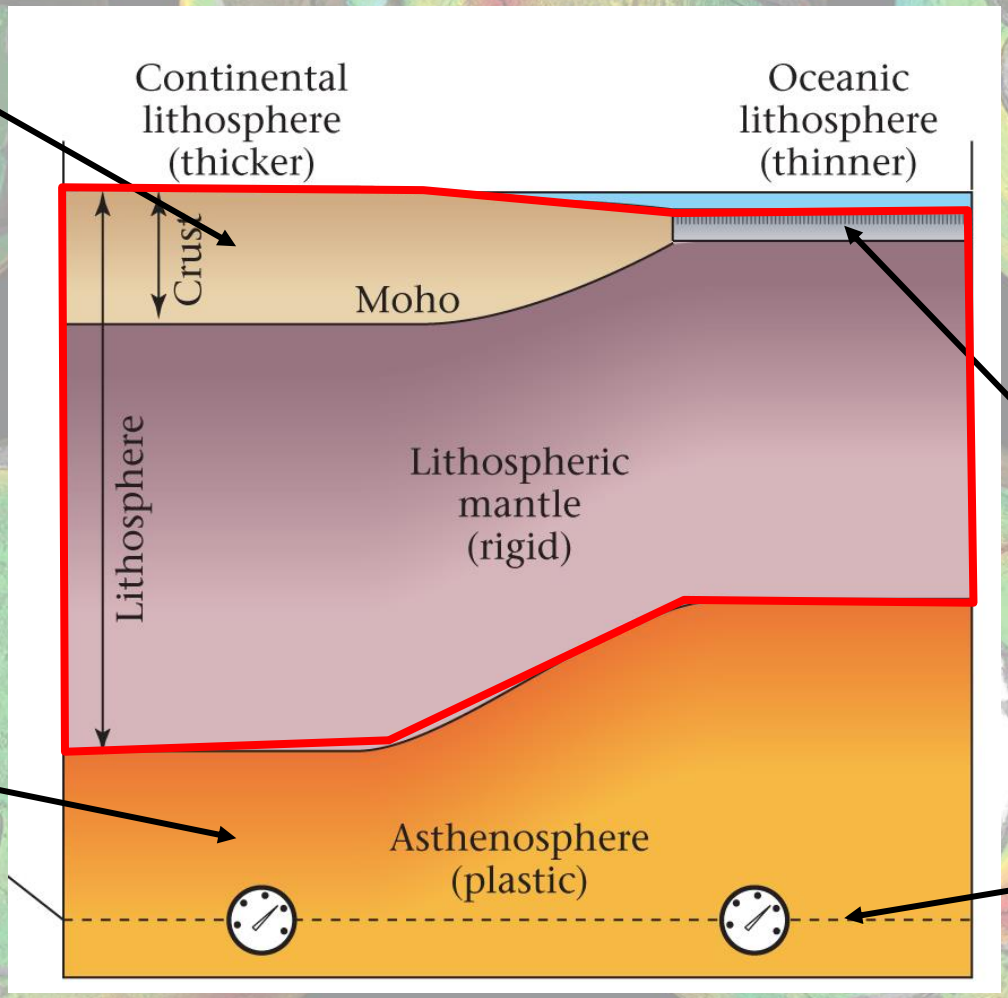


8. The Continental Drift

Principles of the plate tectonics

CONCEPTS: Lithosphere and Asthenosphere

Low-density felsic rocks



High-density mafic rocks

Very high-density ultramafic rocks

Constant pressure

8. The Continental Drift

Principles of the plate tectonics

CONCEPTS: passive margins

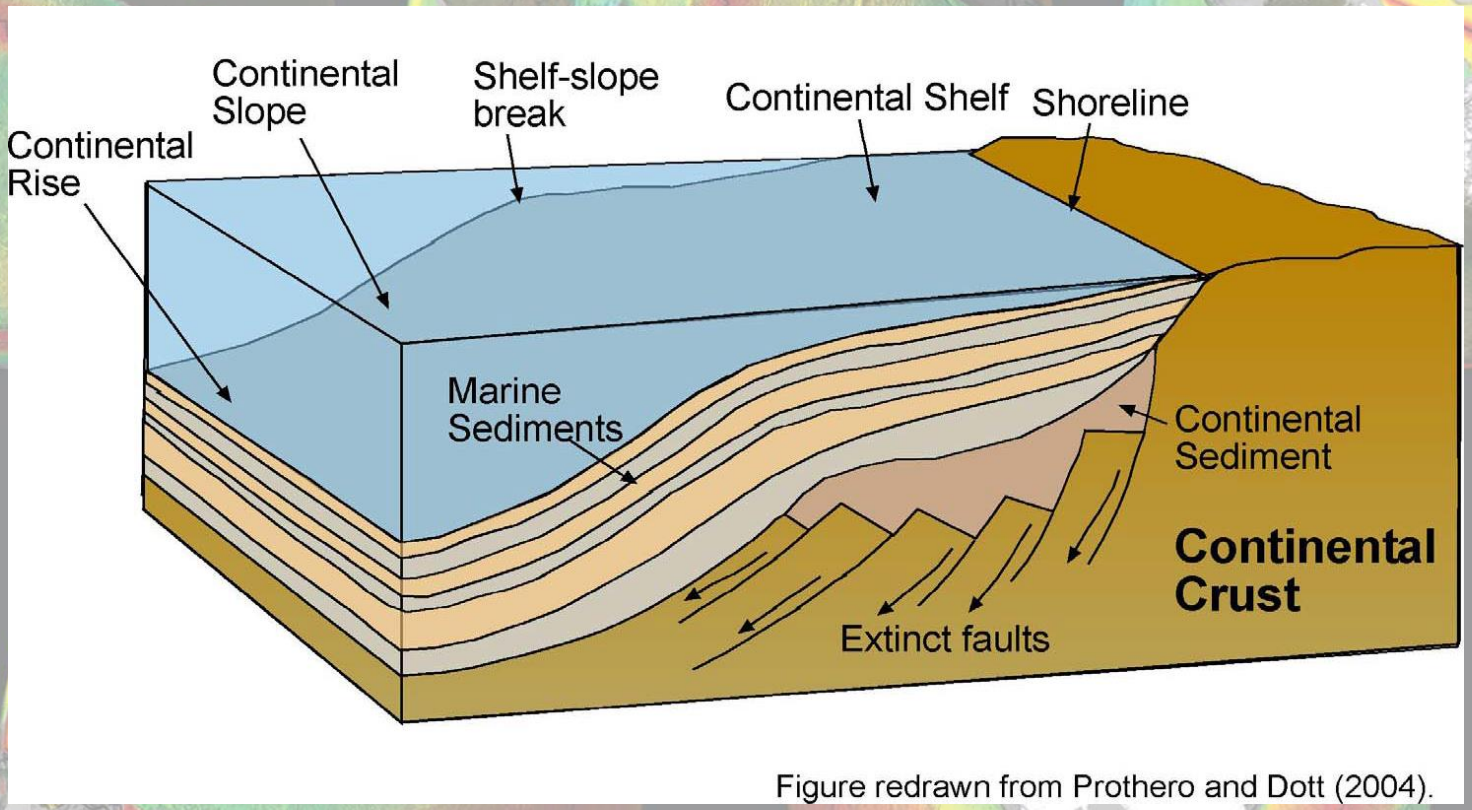
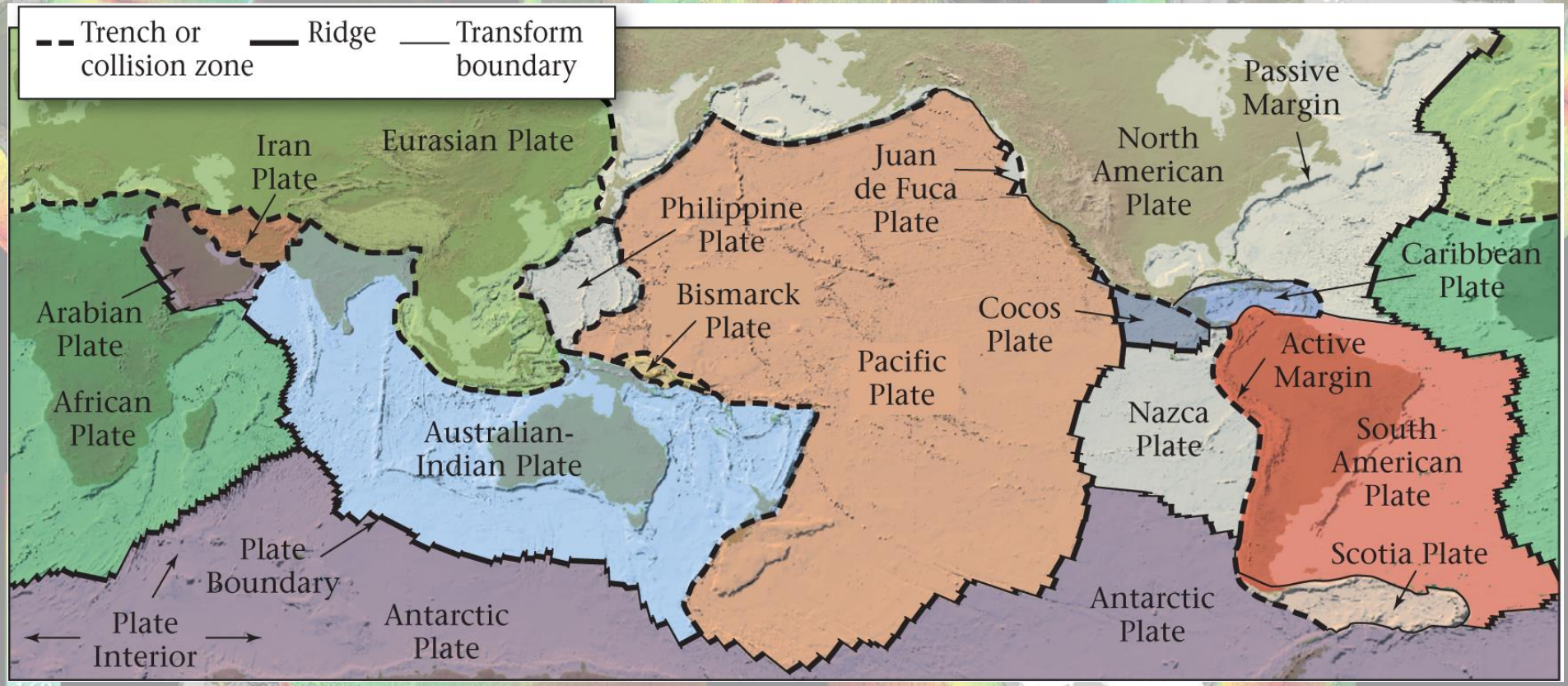


Figure redrawn from Prothero and Dott (2004).

A passive margin is a boundary between a continent and an ocean but is not a plate boundary!

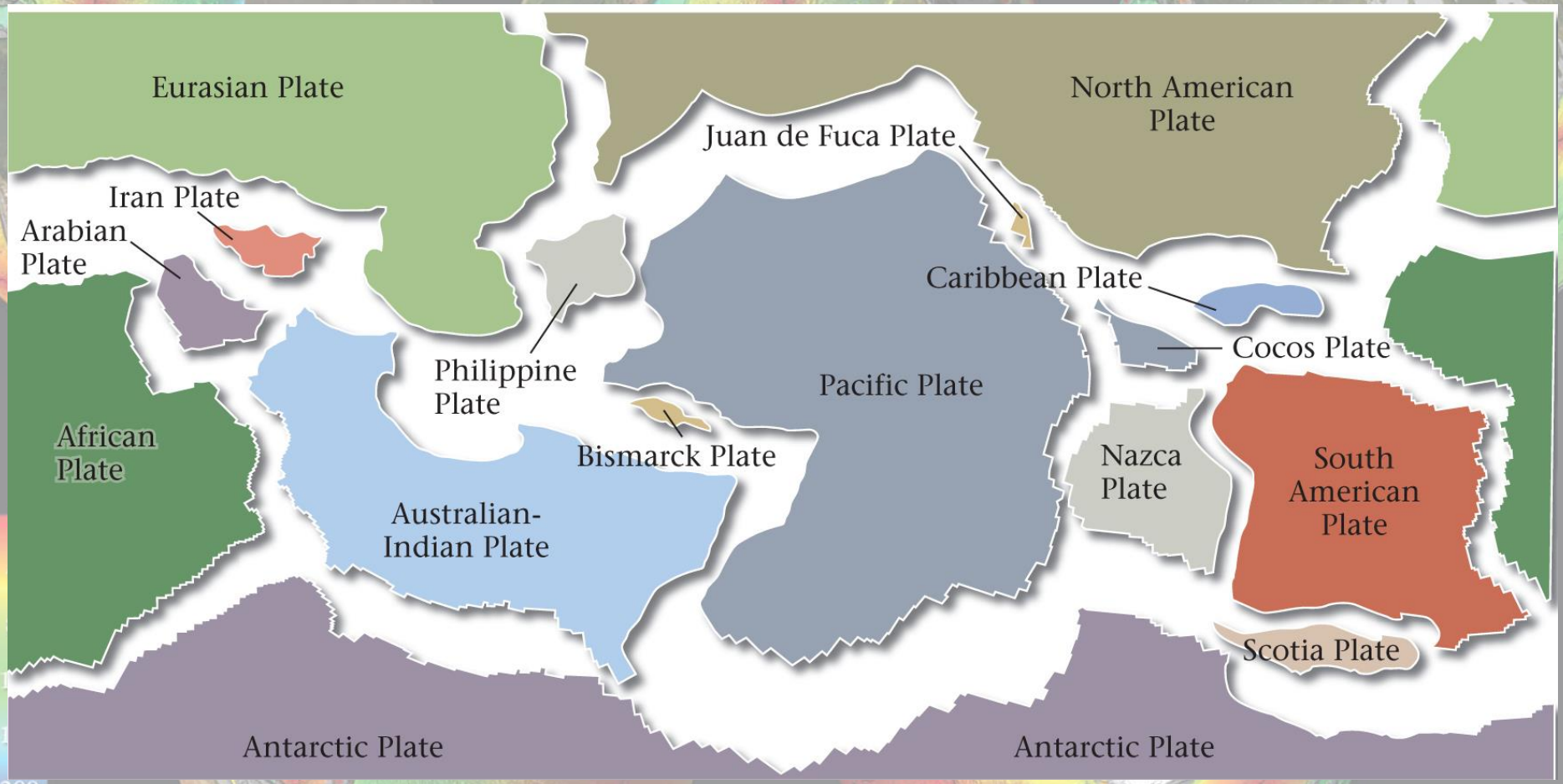
8. The Continental Drift

Principles of the plate tectonics



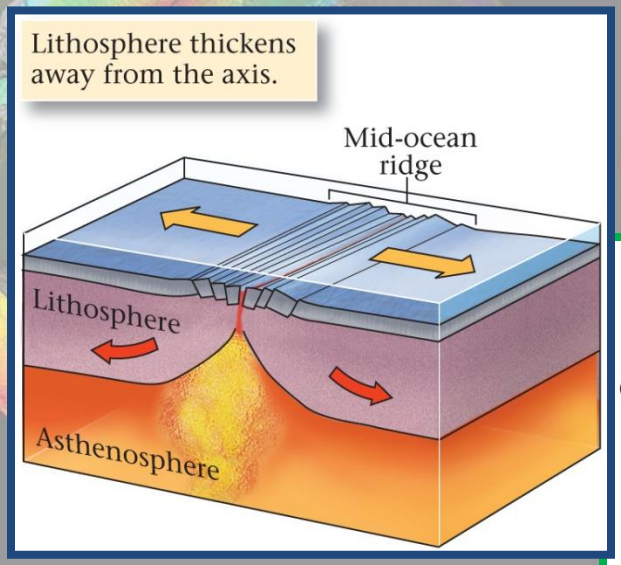
8. The Continental Drift

Principles of the plate tectonics

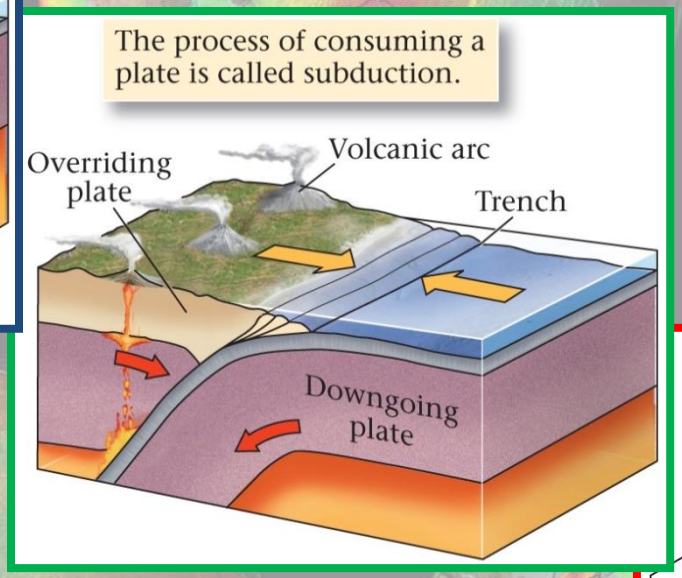


8. The Continental Drift

Principles of the plate tectonics

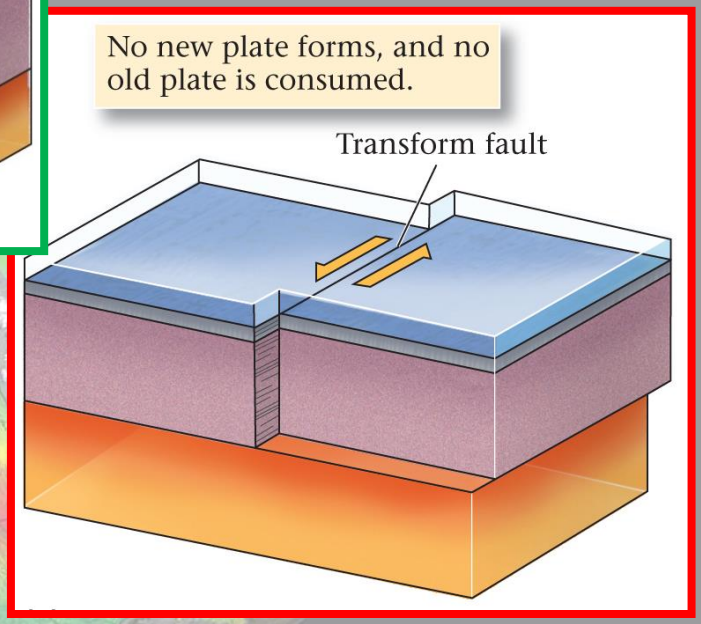


DIVERGENT



CONVERGENT

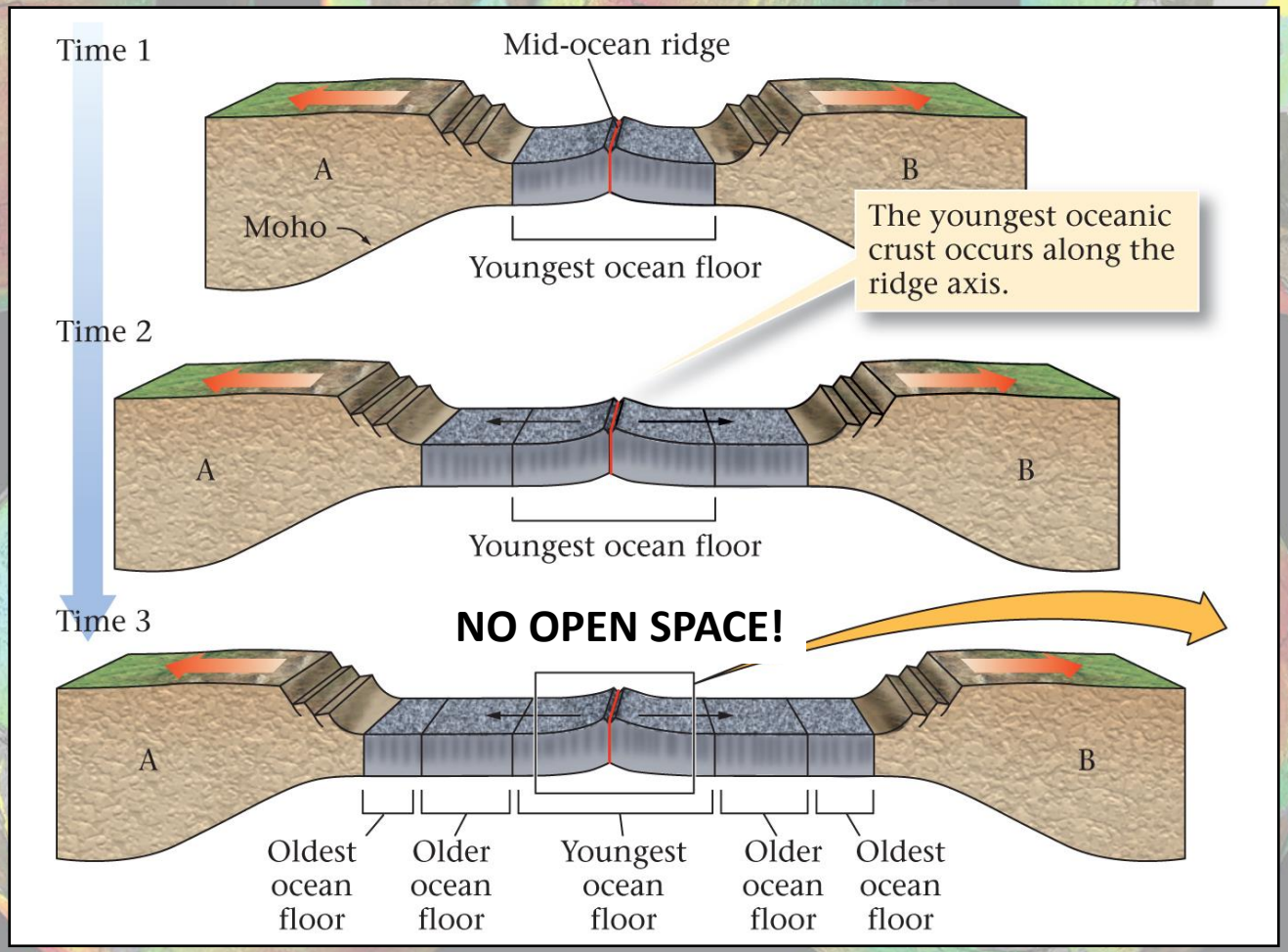
TRANSFORM



8. The Continental Drift

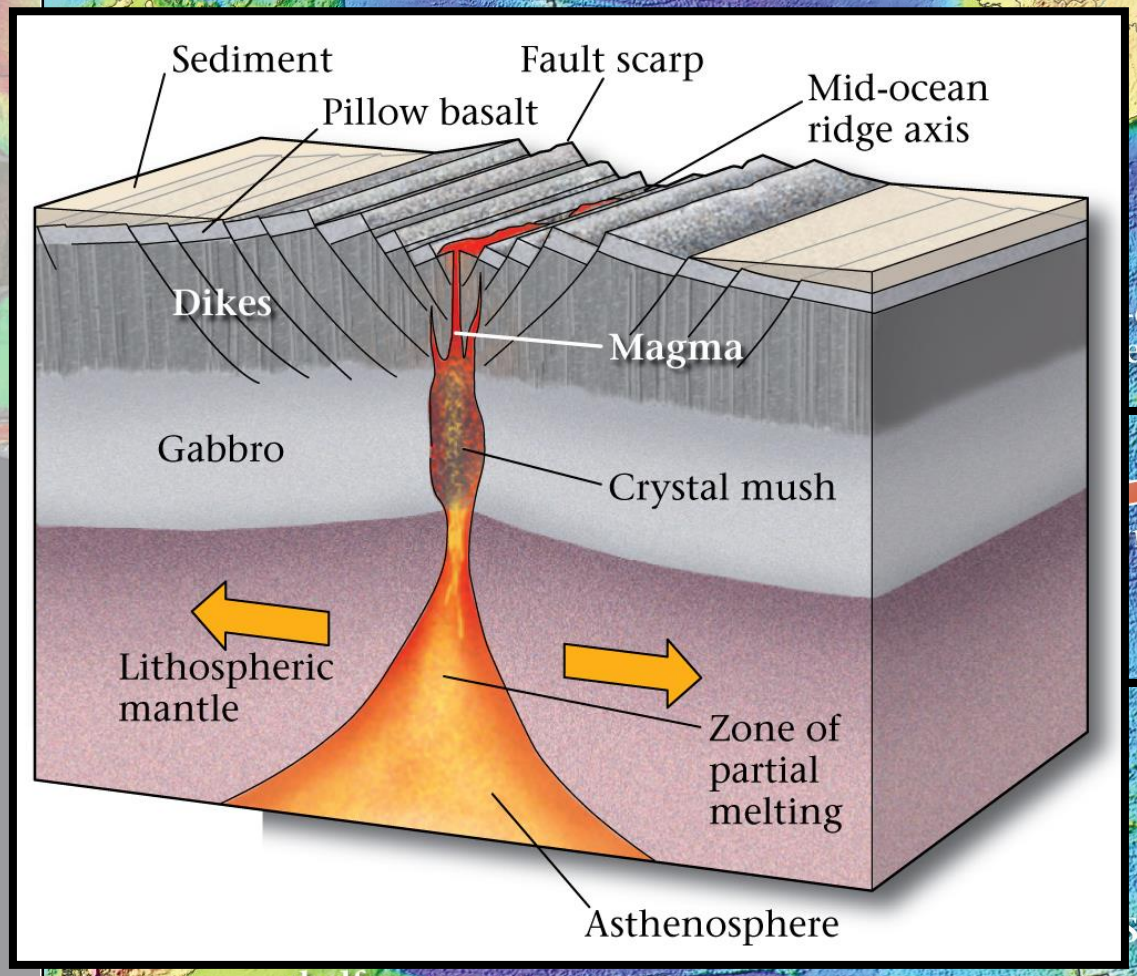
Divergent plates

Divergent plates = SEA-FLOOR SPREADING



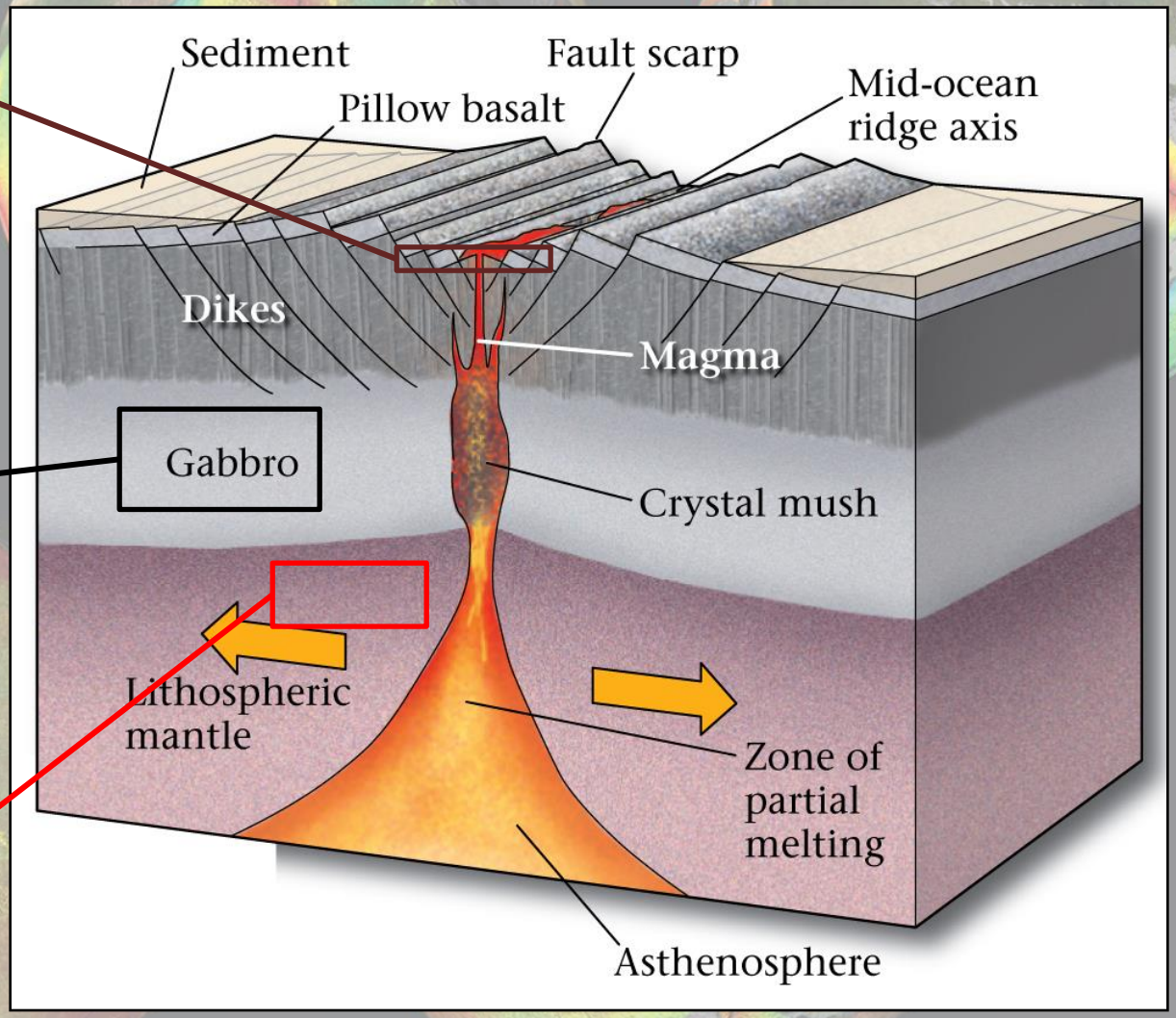
8. The Continental Drift

Divergent plates



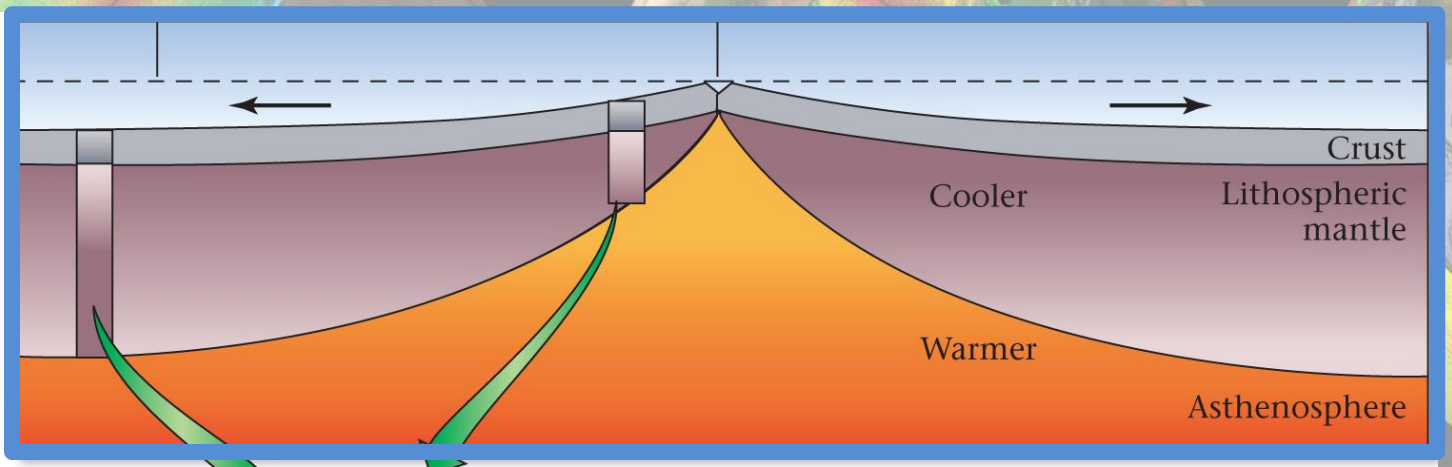
8. The Continental Drift

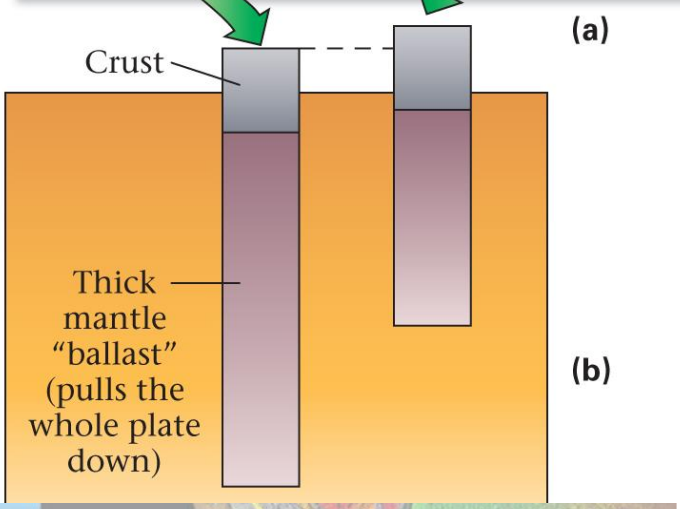
Divergent plates

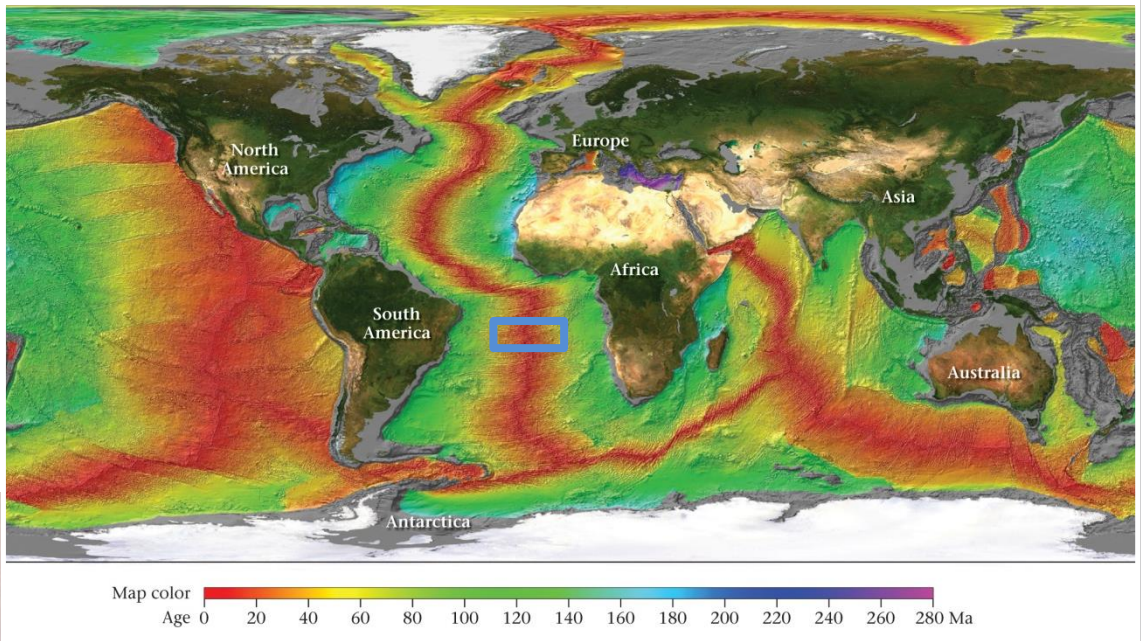


8. The Continental Drift

Divergent plates



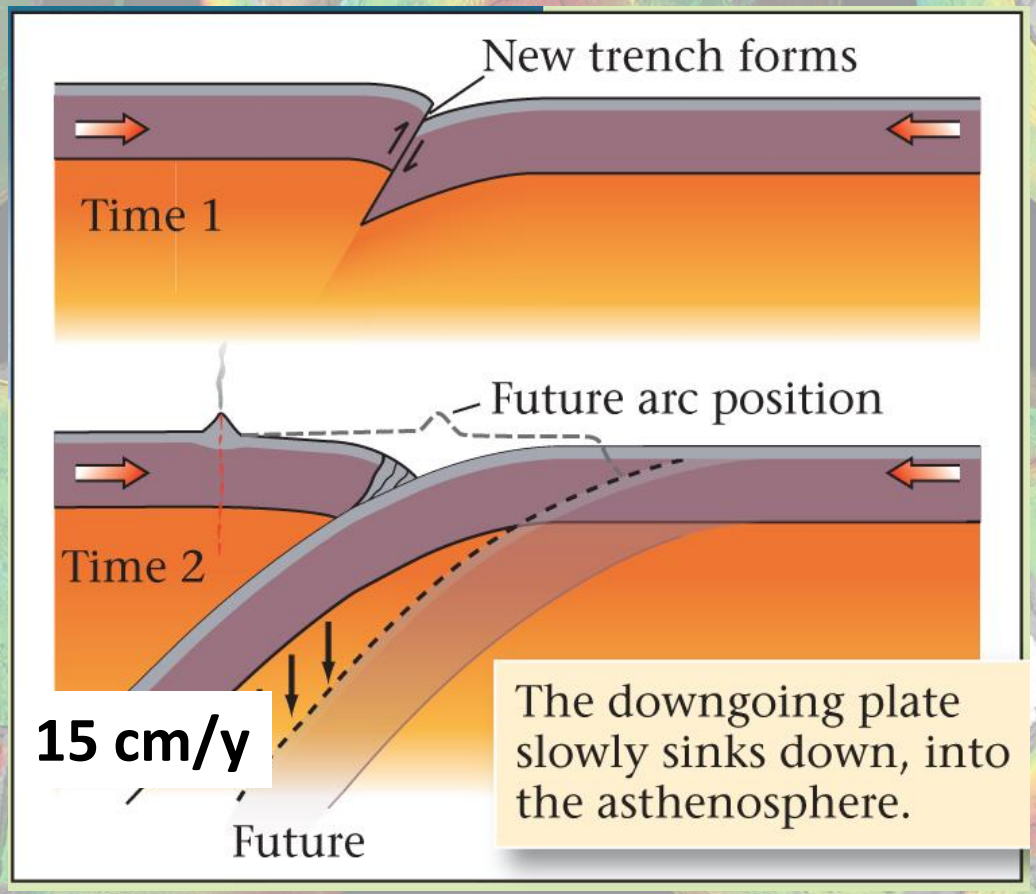




8. The Continental Drift

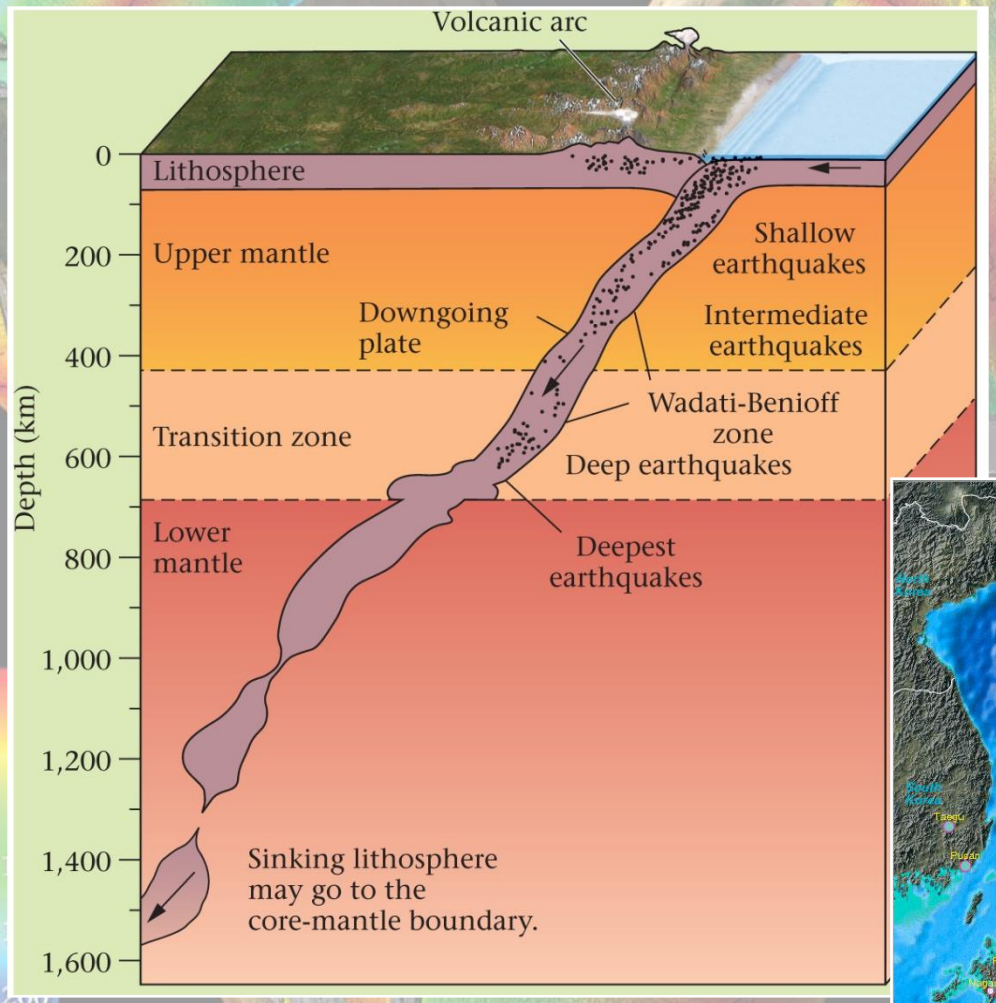
Convergent plates

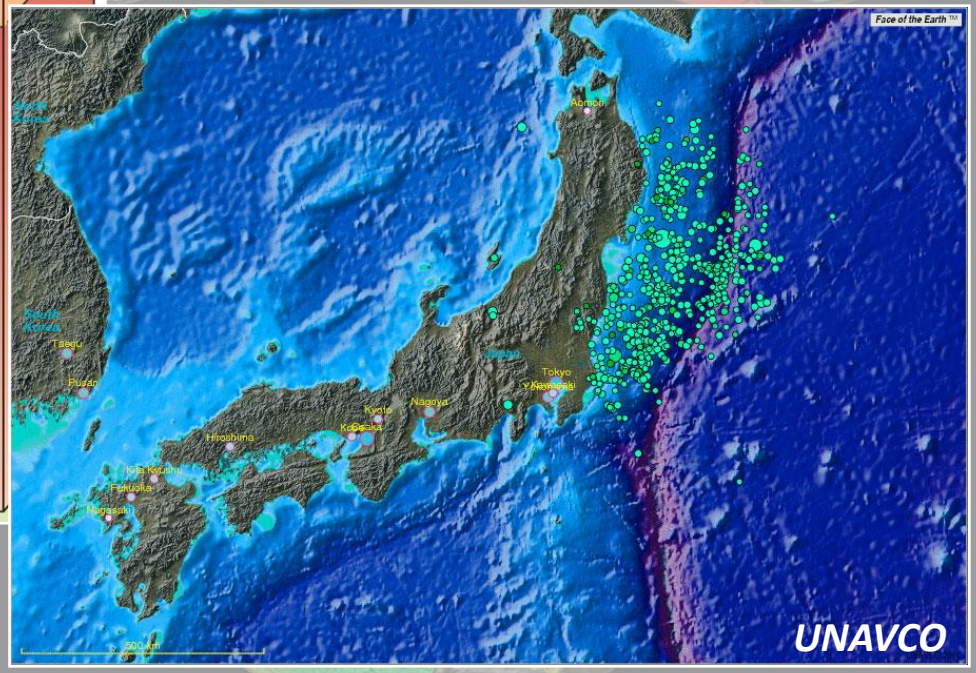
CONCEPT: Subduction, is the sinking process of a plate under another.



8. The Continental Drift

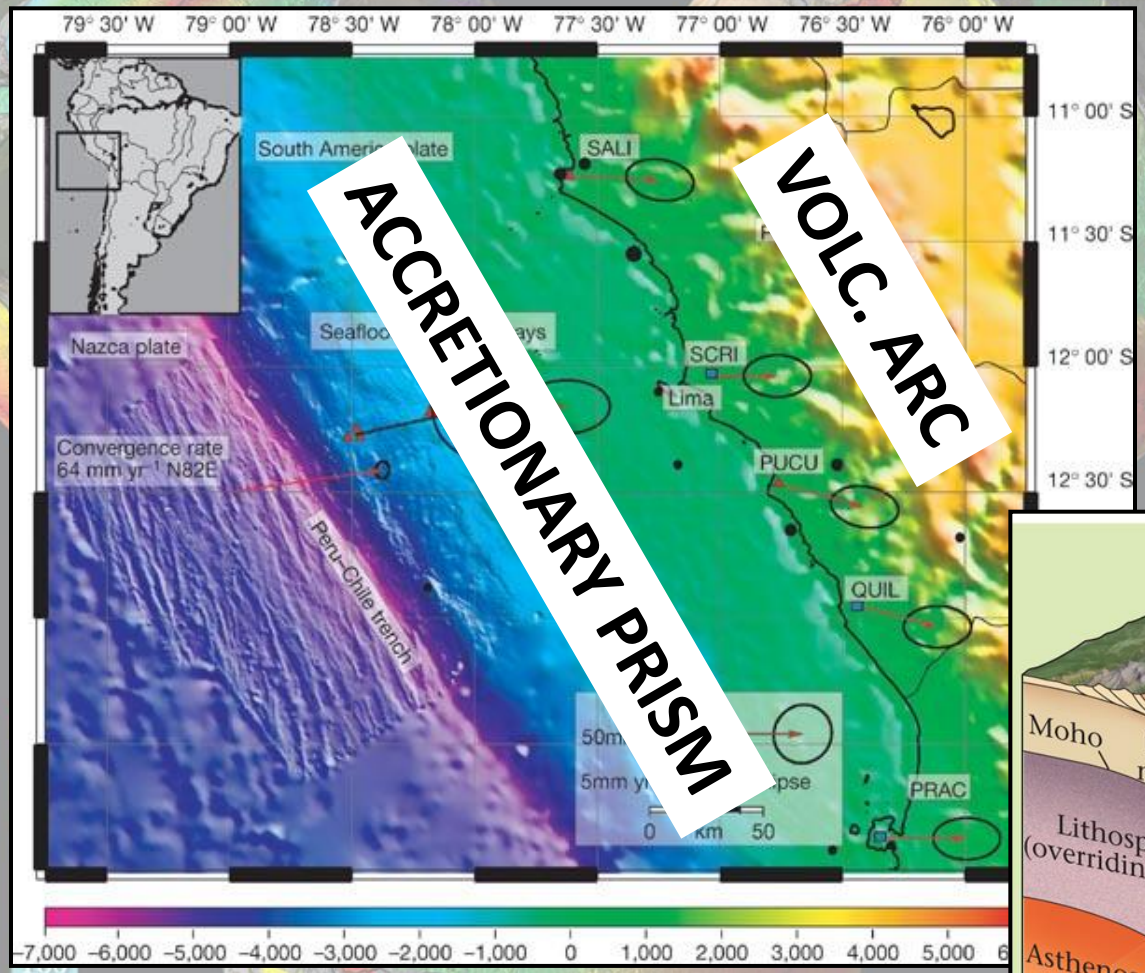
Convergent plates





8. The Continental Drift

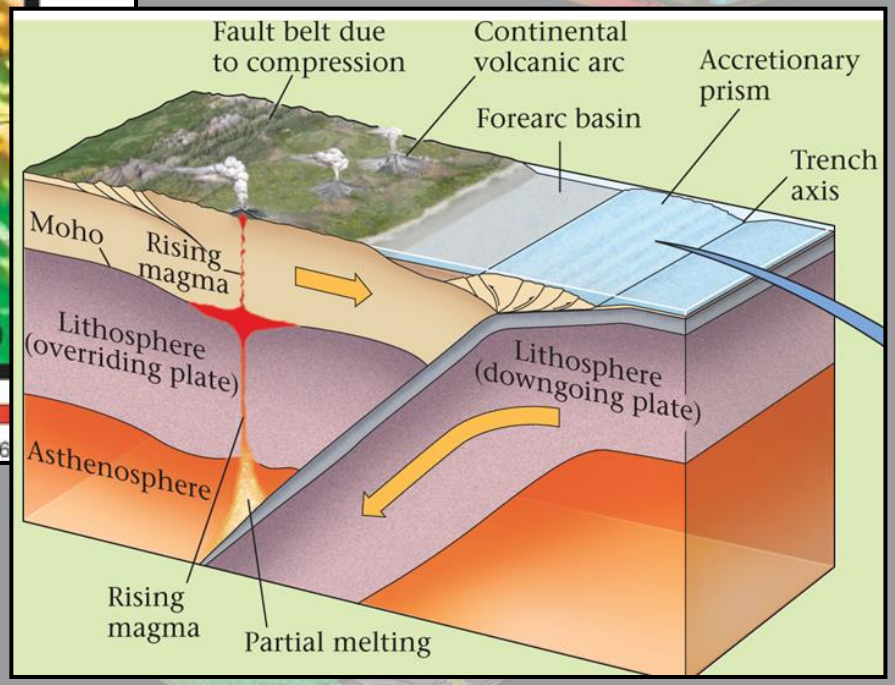
Convergent plates



Gagnon et al., 2005

Marine sediments get scrapt into a wedge-shaped **accretionary prism**.

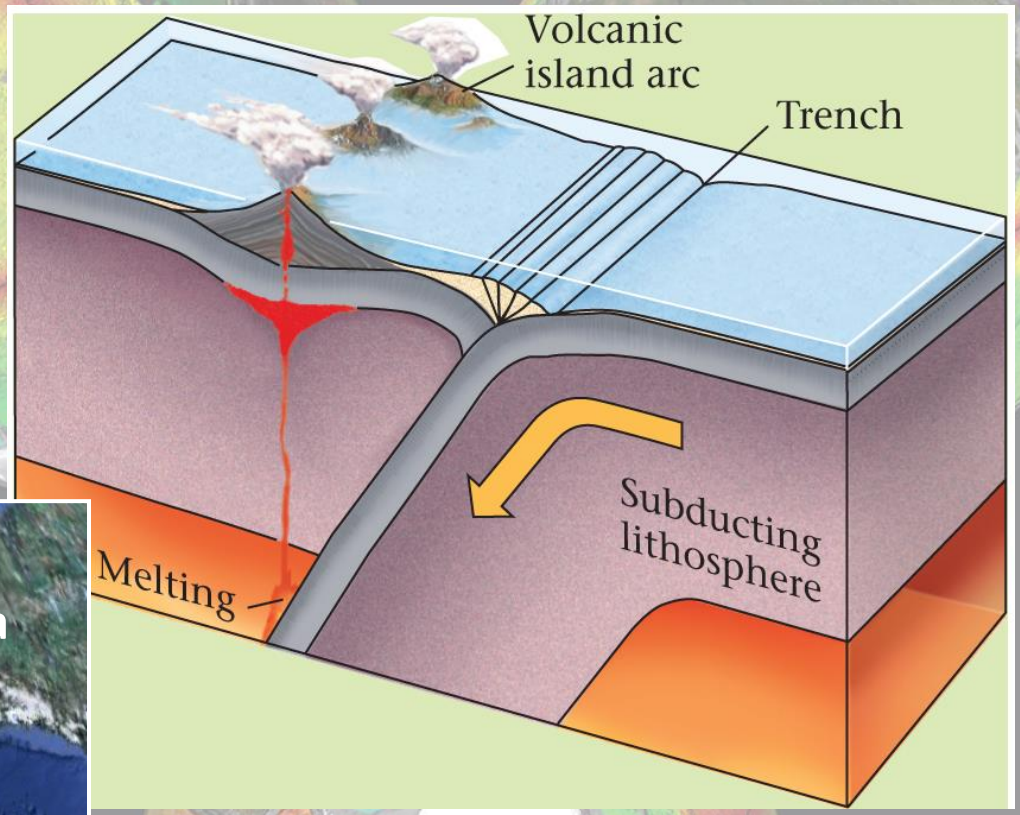
Melting of subducting lithosphere induce the formation of a **volcanic arc**.



200
240
280

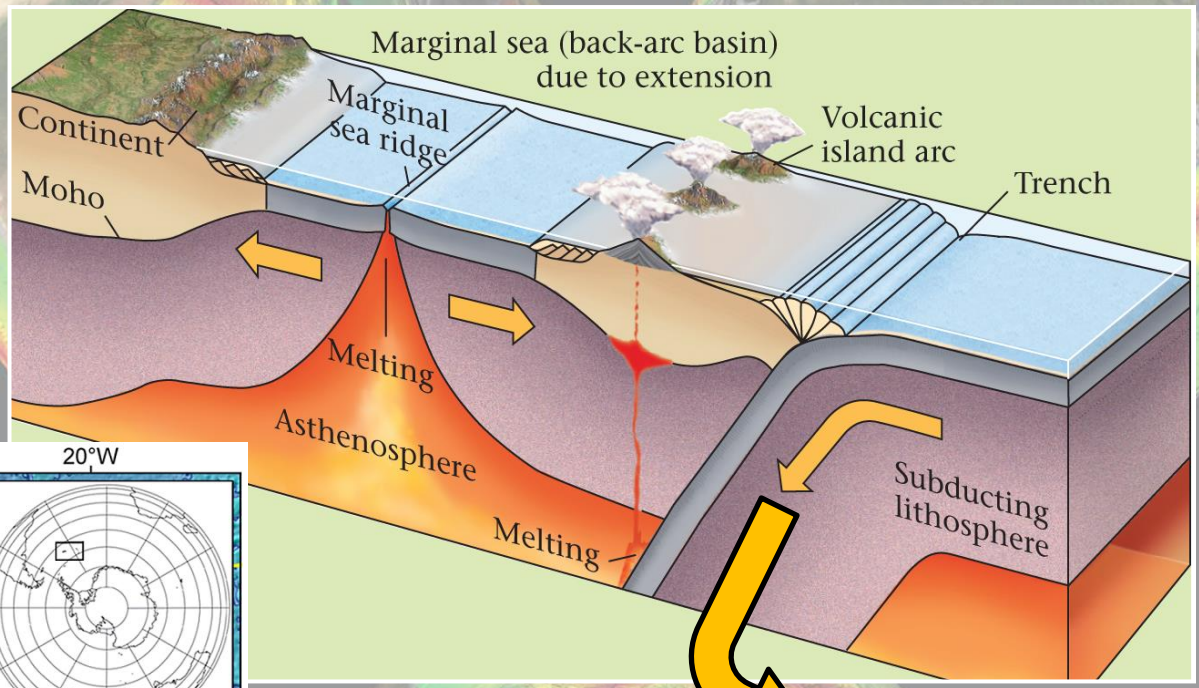
8. The Continental Drift

Convergent plates

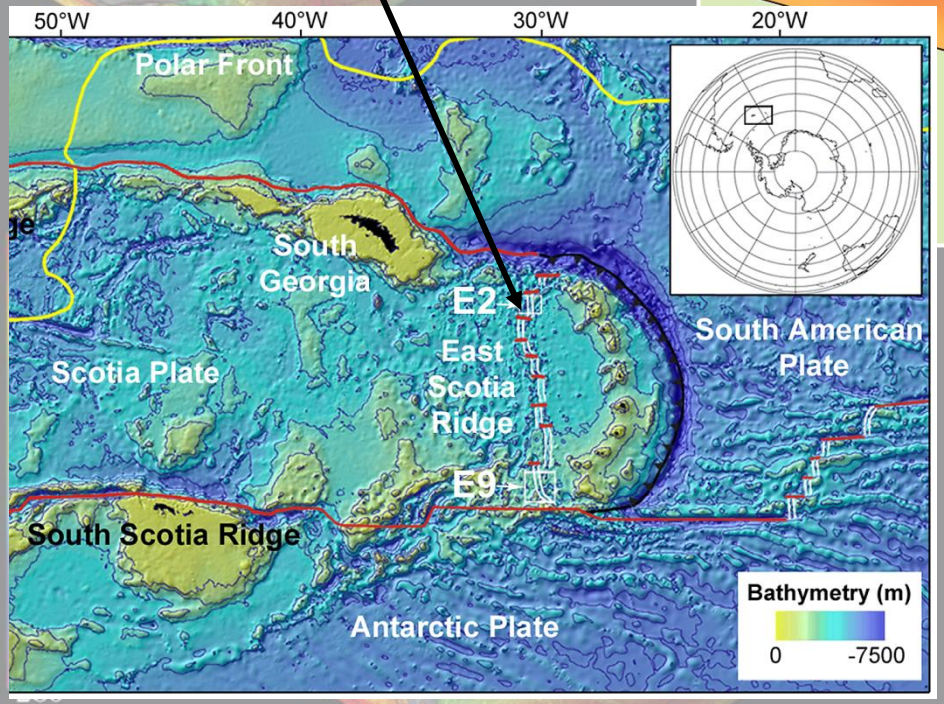


8. The Continental Drift

Convergent plates



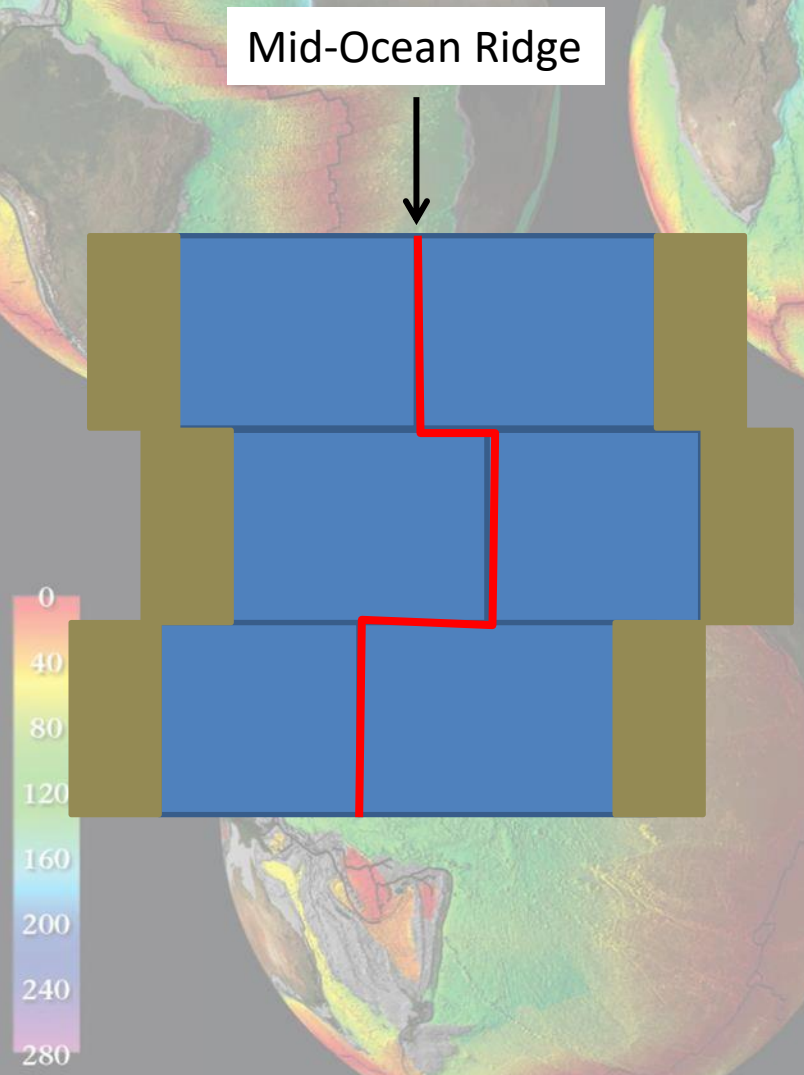
Back-arc Basin
(sea-floor spreading)

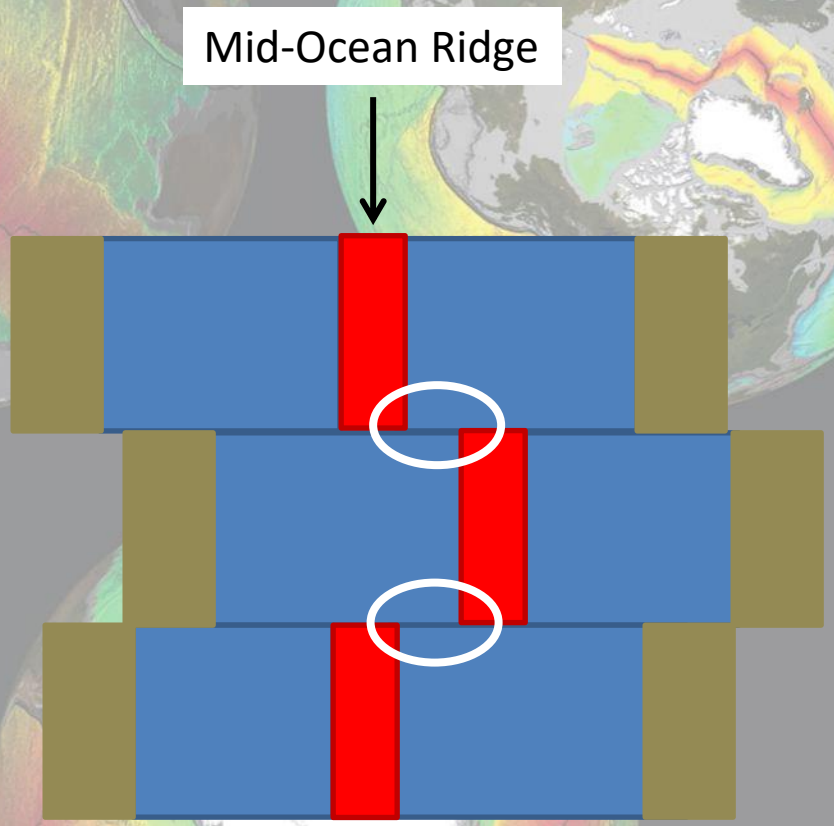


Subducting plates "drags" the overriding plate inducing extensional stress in the back-arc basin with the consequent sea-floor spreading.

8. The Continental Drift

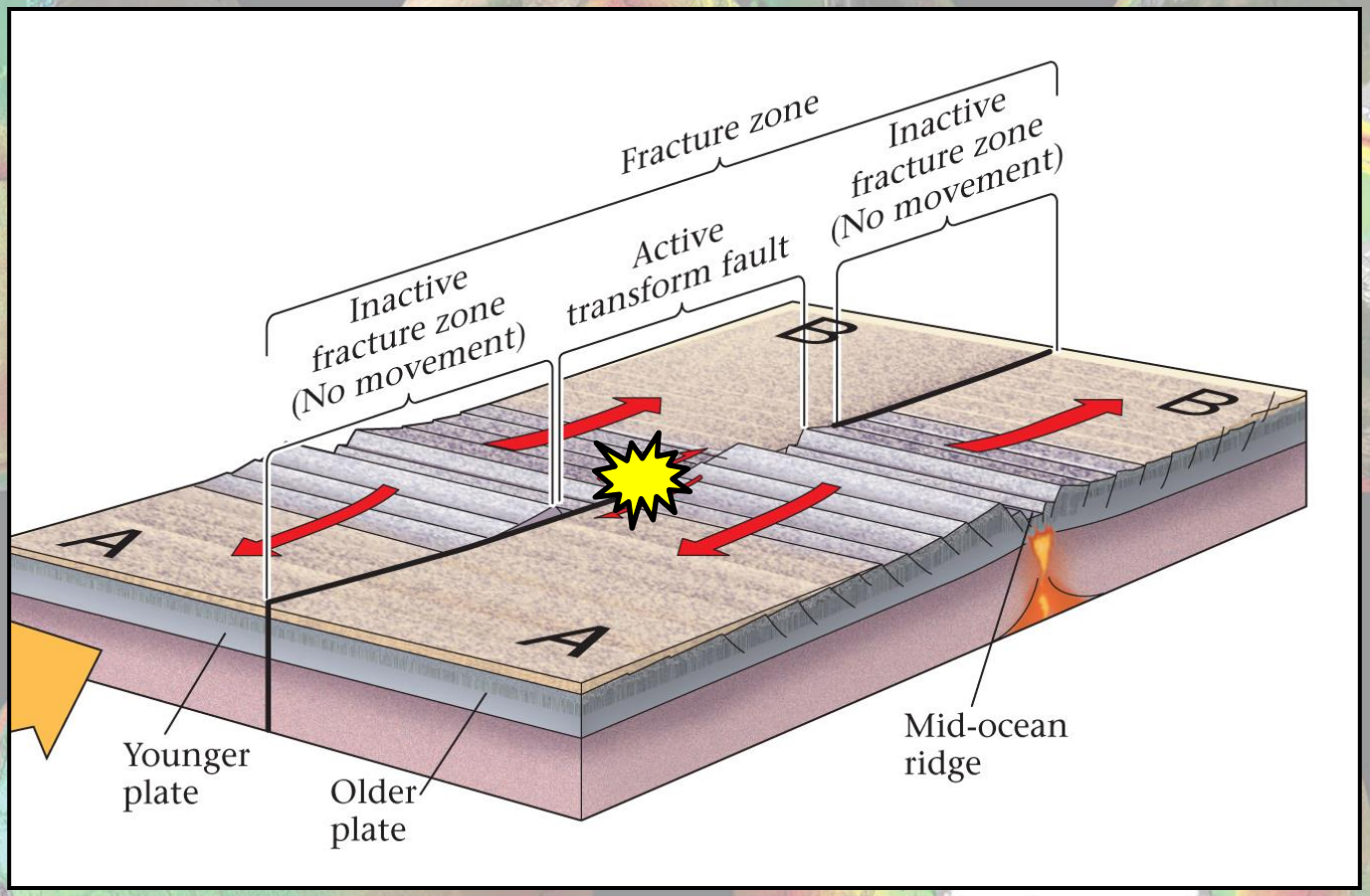
Transform plate boundaries





8. The Continental Drift

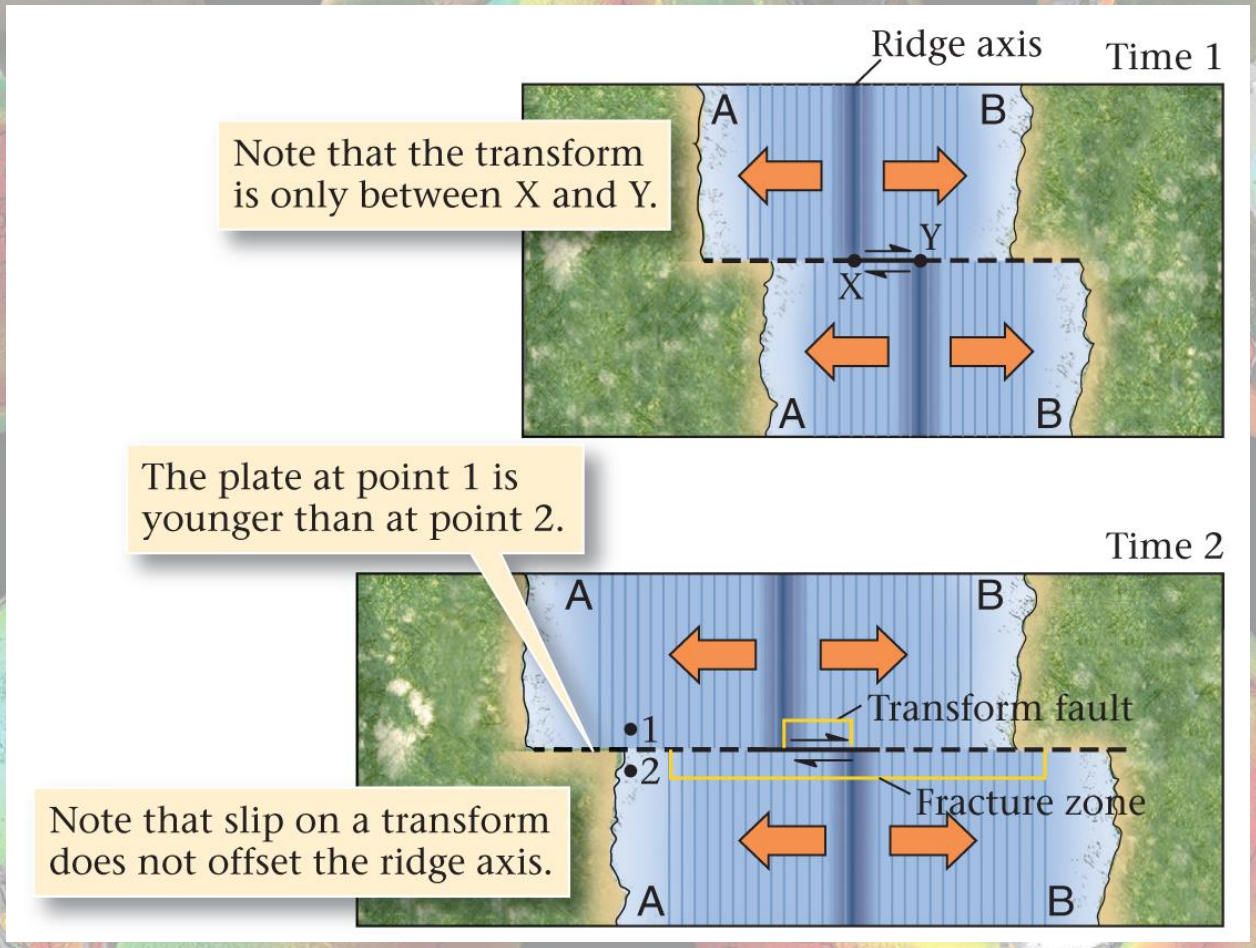
Transform plate boundaries



Active fault slip occurs only on the segment that lies between two ridge segments

8. The Continental Drift

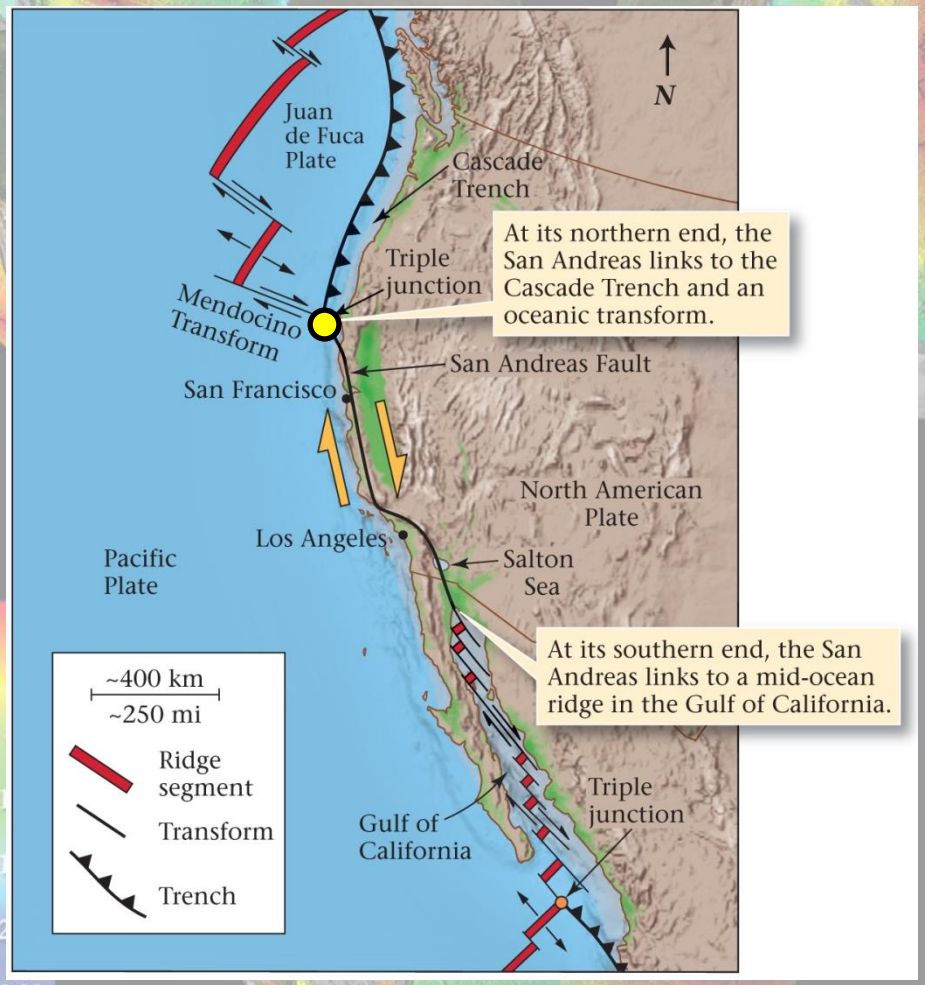
Transform plate boundaries

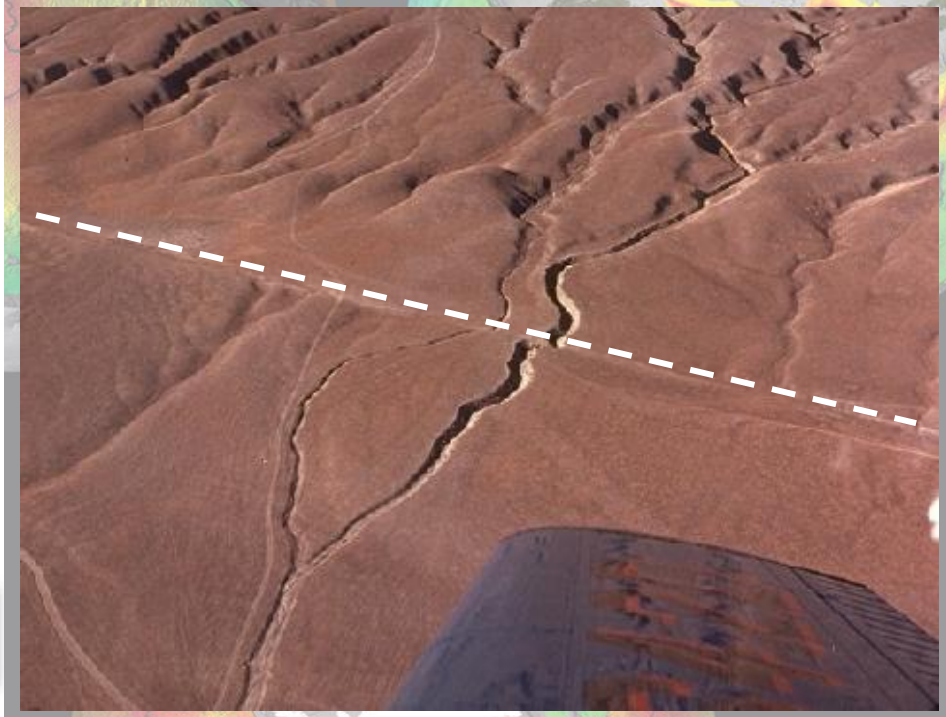


NO CRUST FORMATION, NO CRUST CONSUMPTION

8. The Continental Drift

Transform plate boundaries



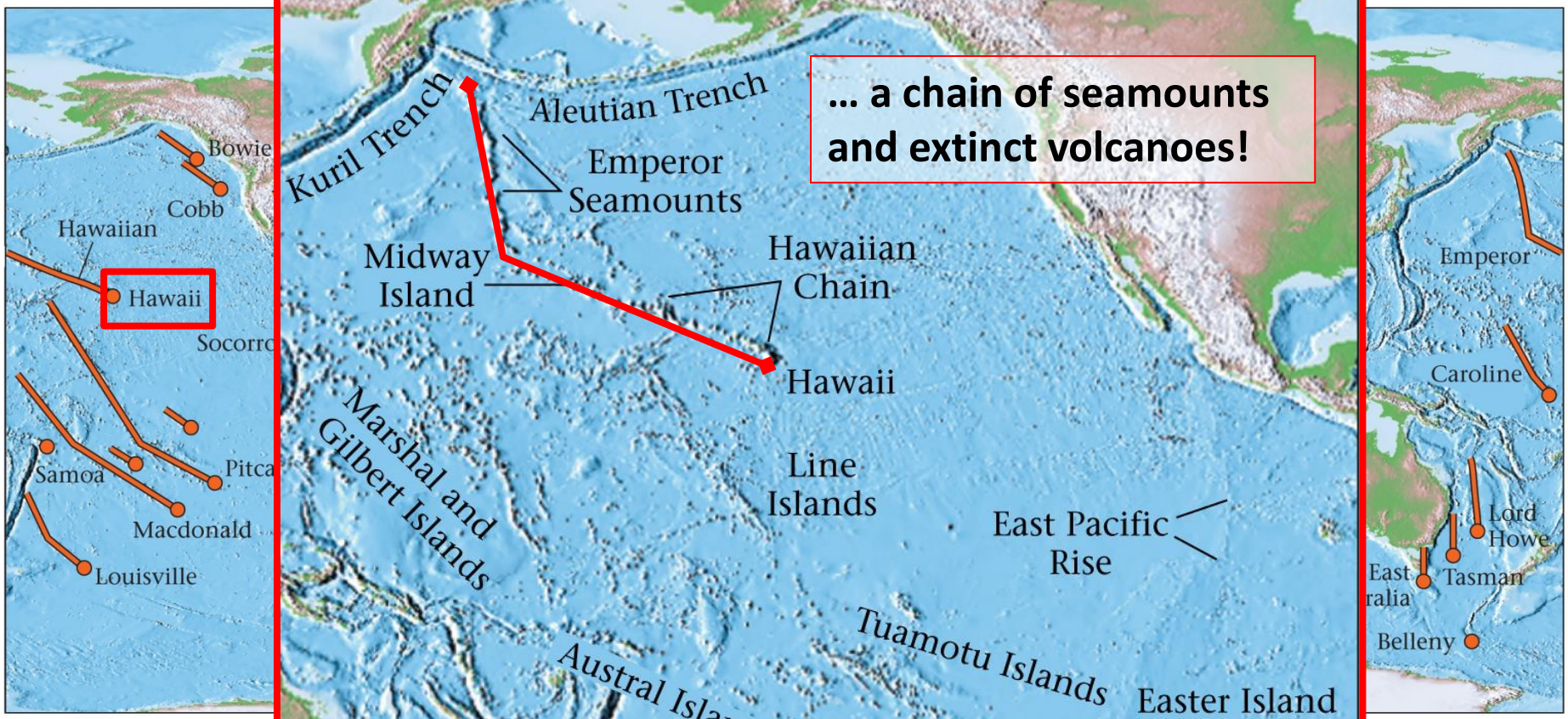


Triple junction = contact between three plate boundaries

8. The Continental Drift

Special locations

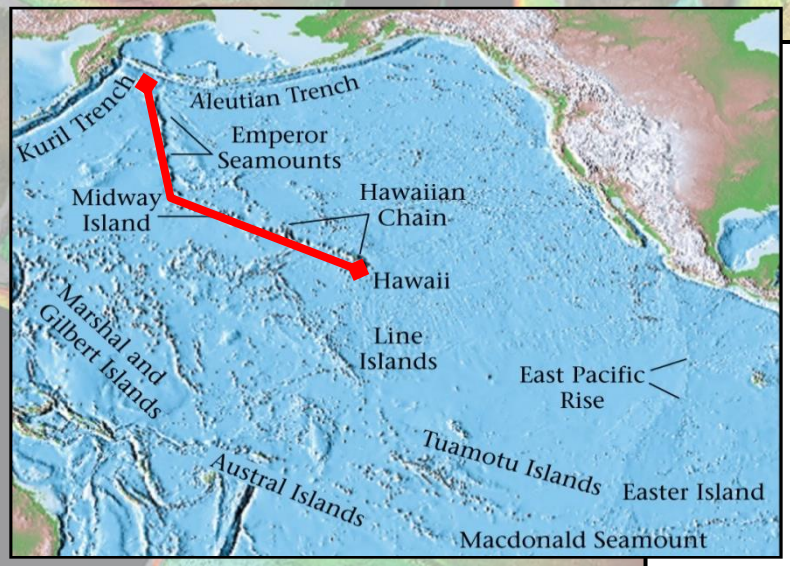
CONCEPT: Hot spots

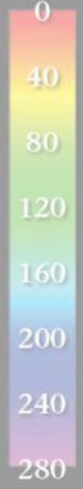


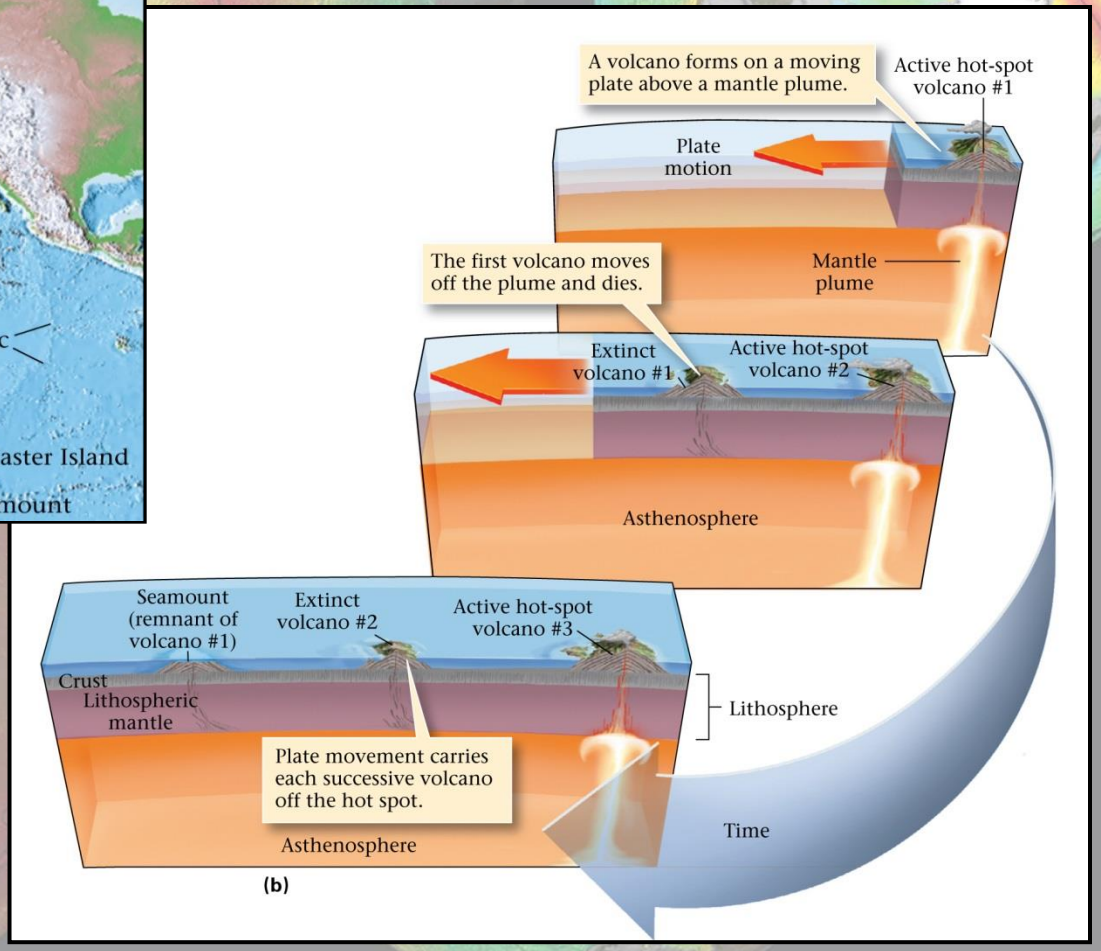
8. The Continental Drift

Special locations

CONCEPT: Hot spots

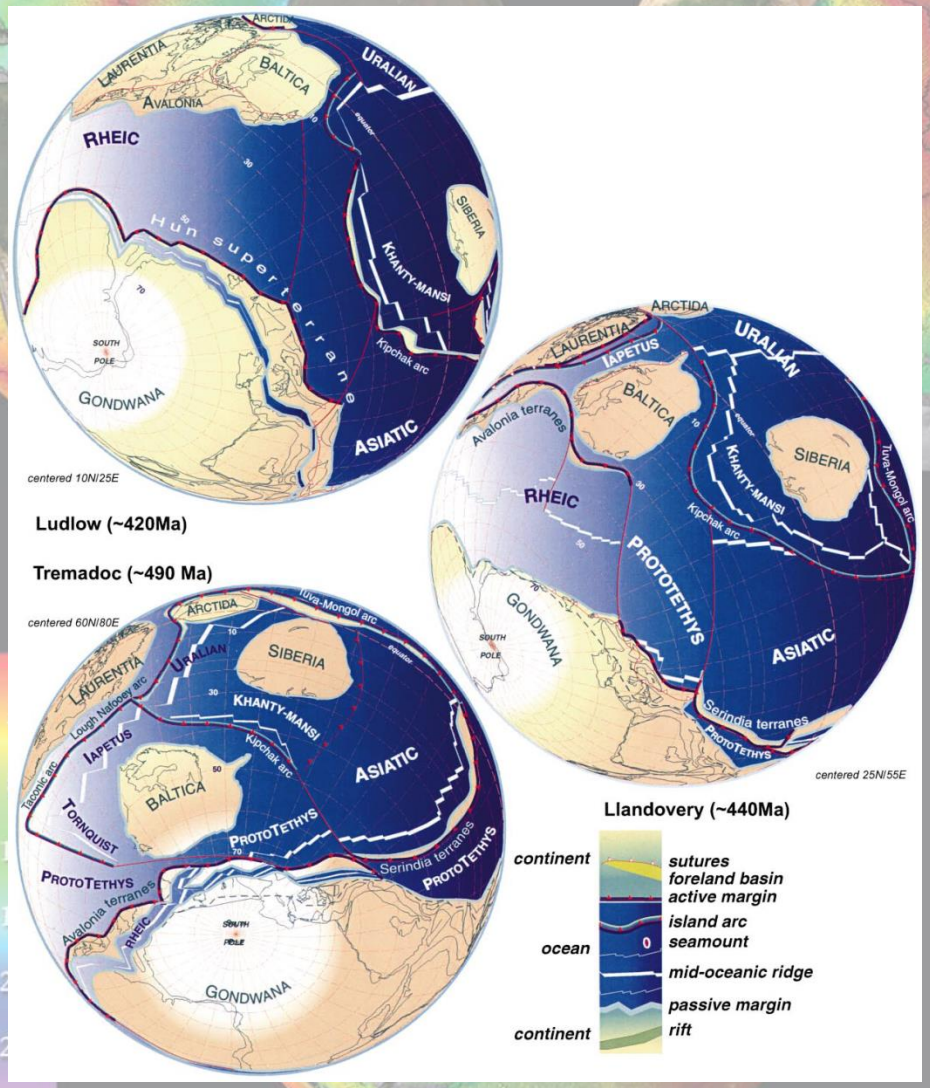


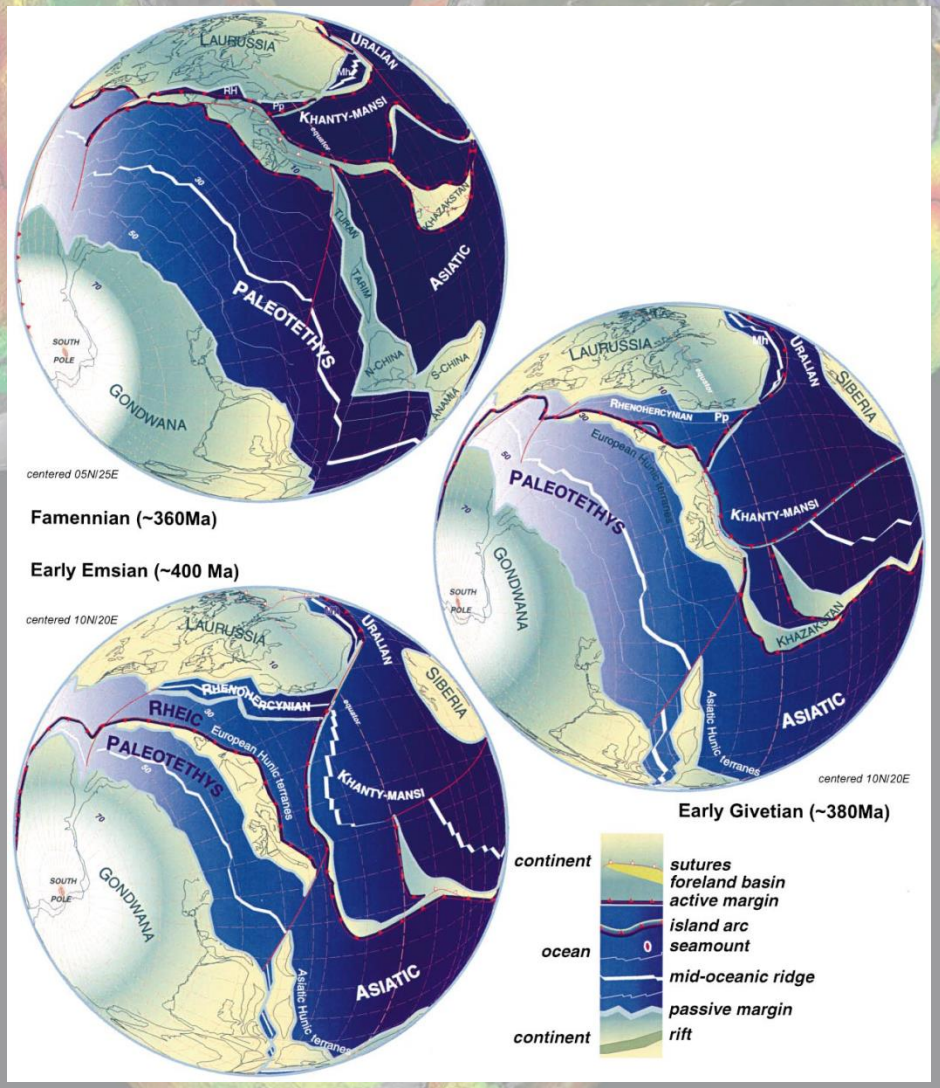




8. The Continental Drift

The puzzle of tectonic plates

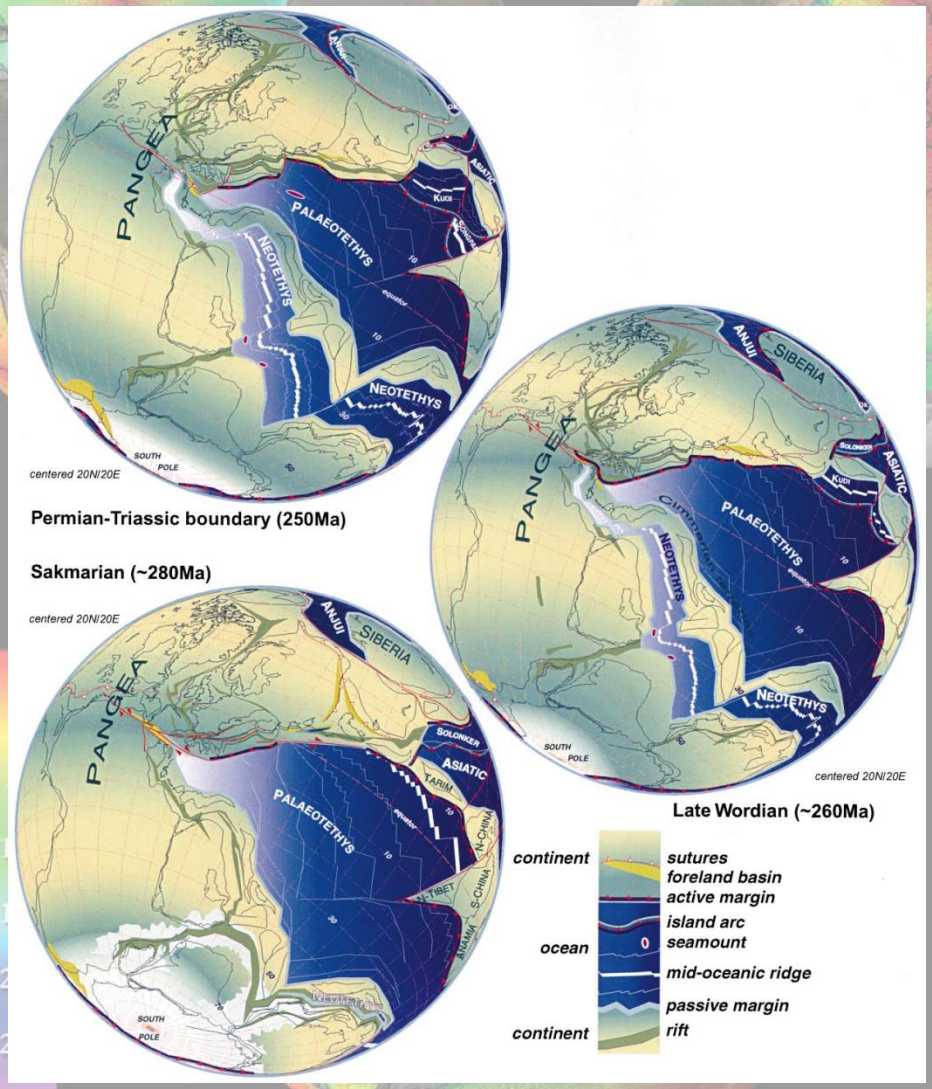


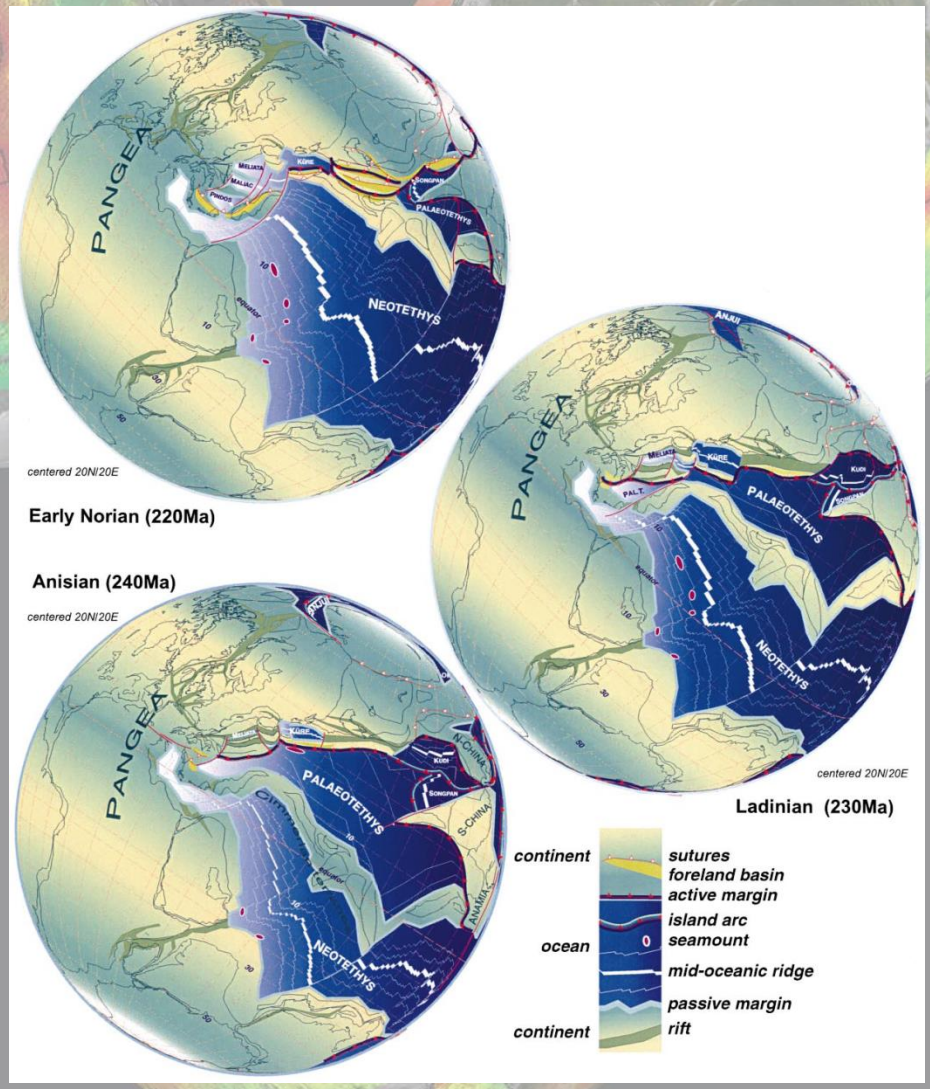


Stampfli and Borel 2002

8. The Continental Drift

The puzzle of tectonic plates

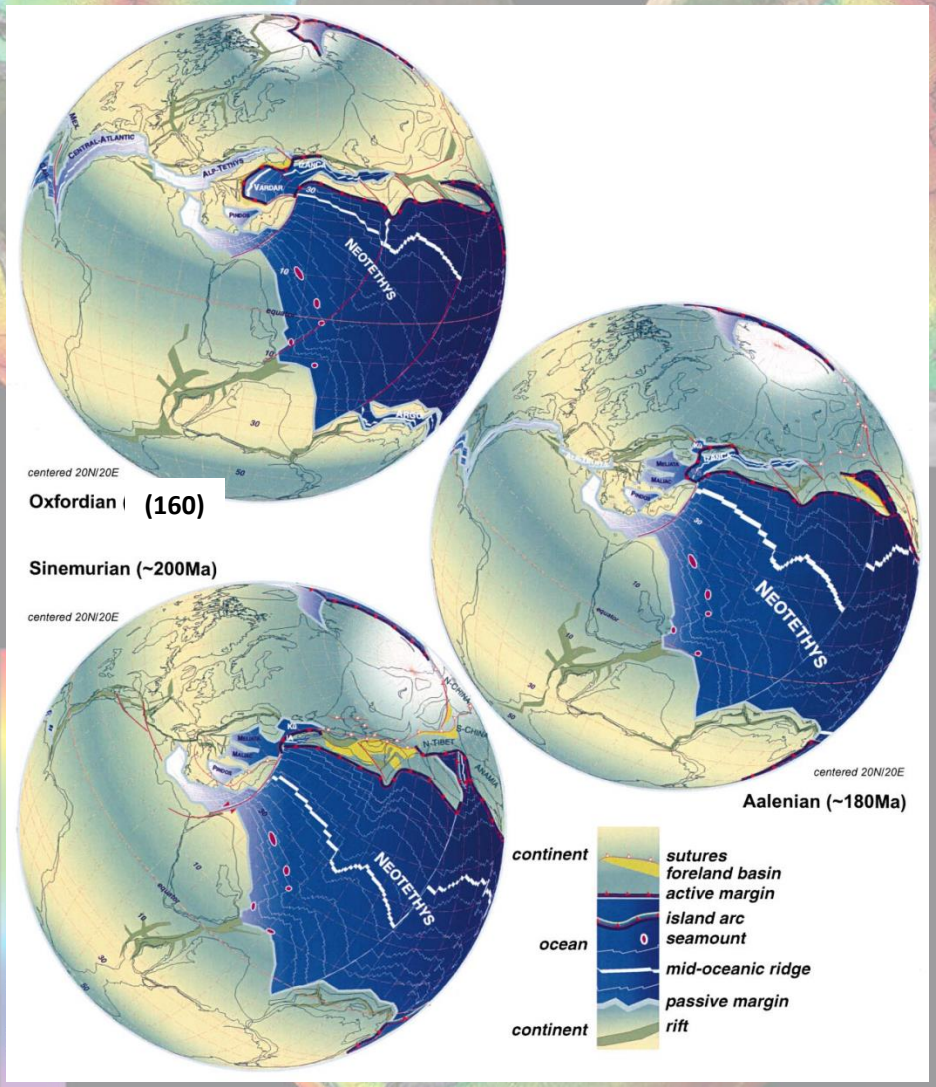


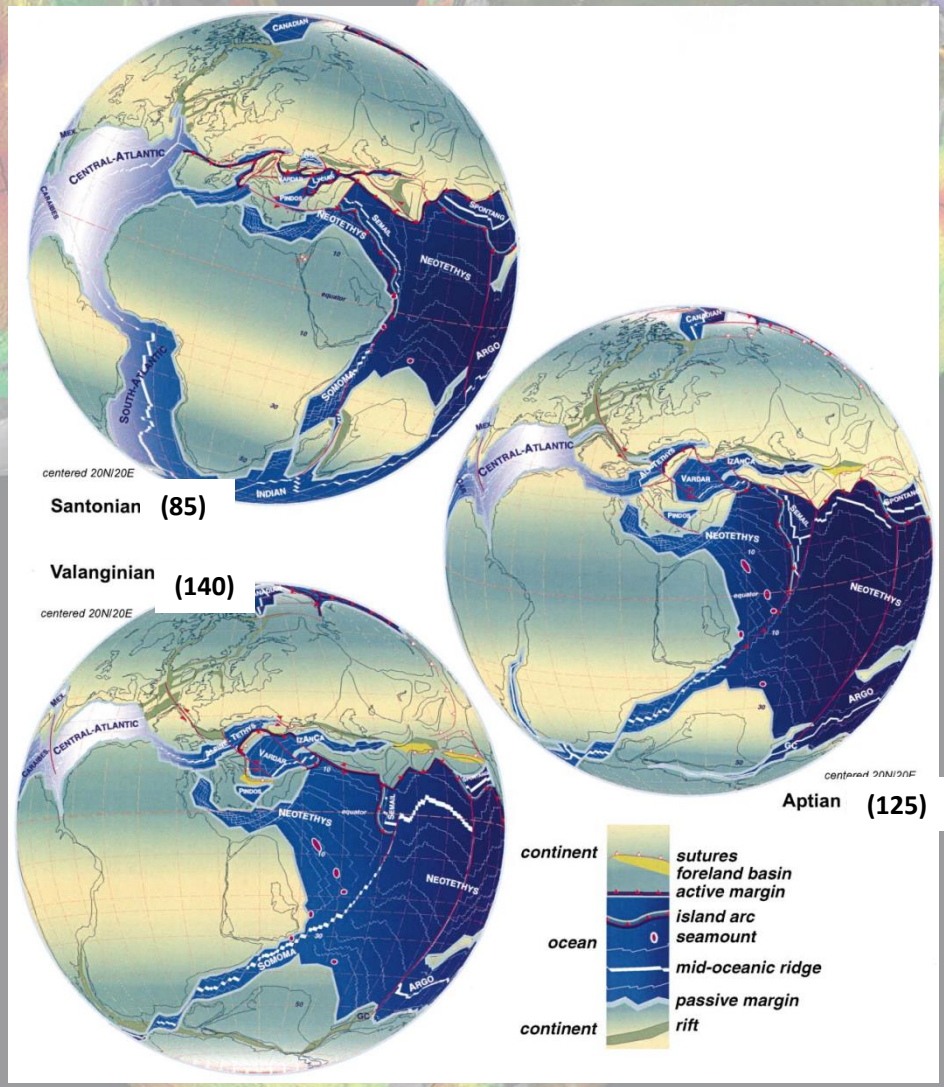


Stampfli and Borel 2002

8. The Continental Drift

The puzzle of tectonic plates

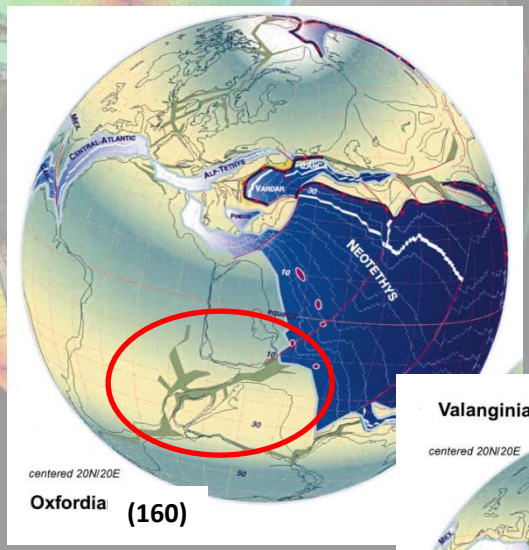


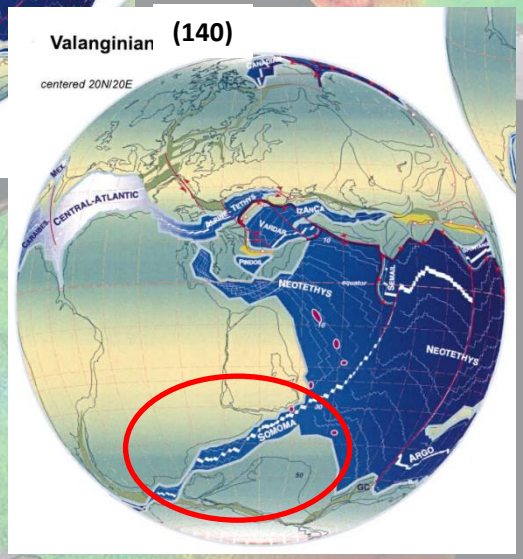


Stampfli and Borel 2002

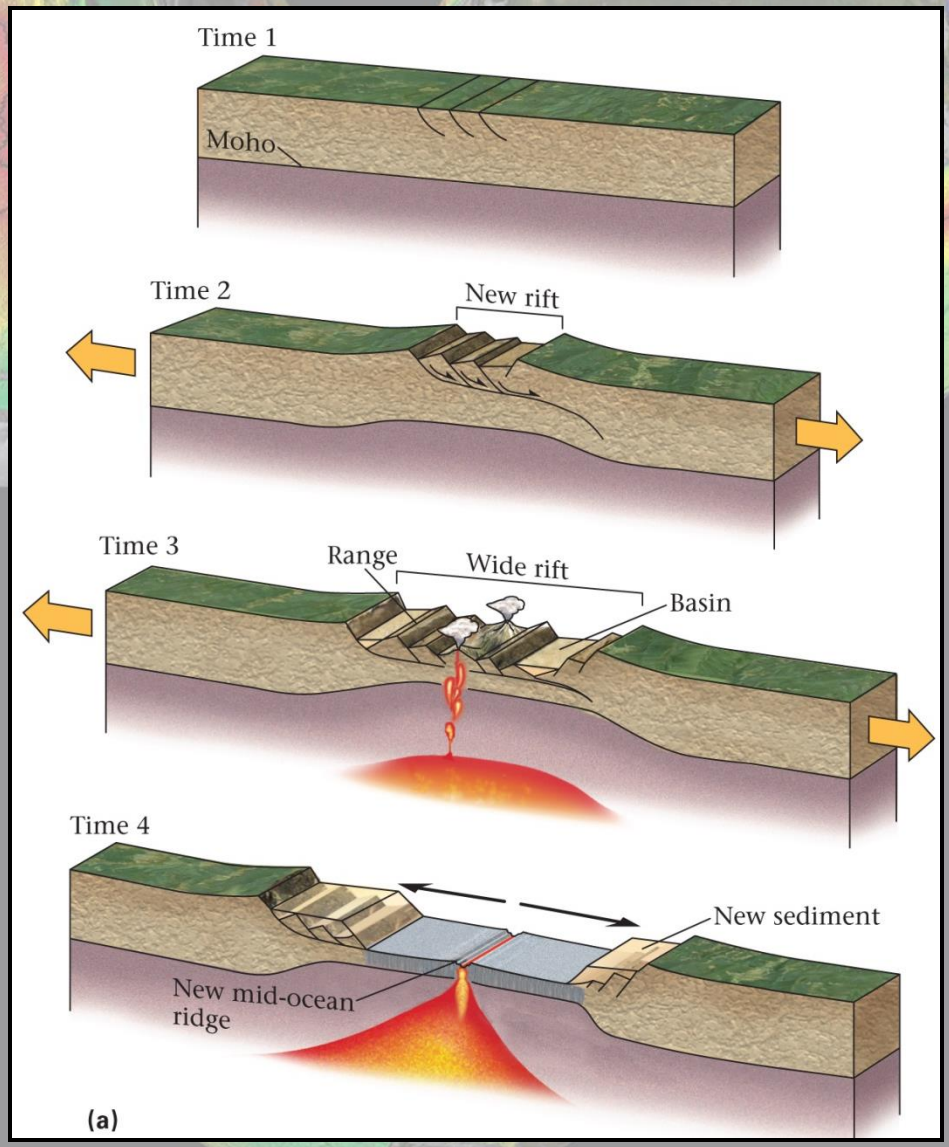
8. The Continental Drift

The puzzle of tectonic plates





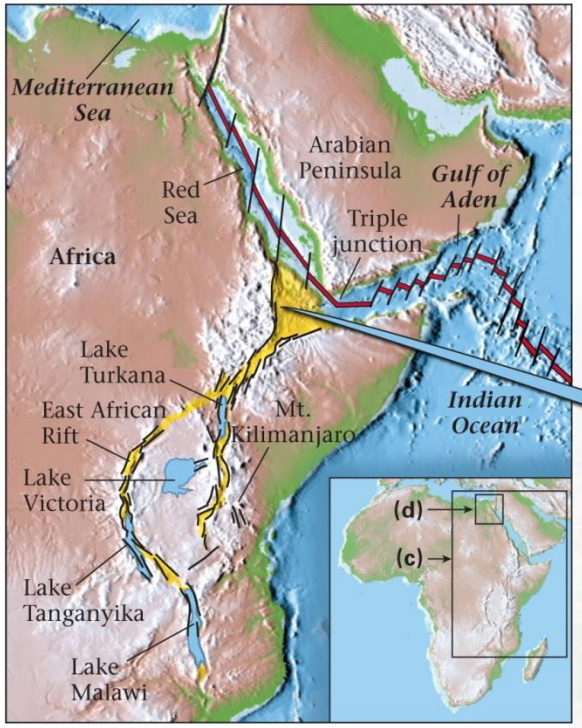
CONTINENTAL RIFTING



8. The Continental Drift

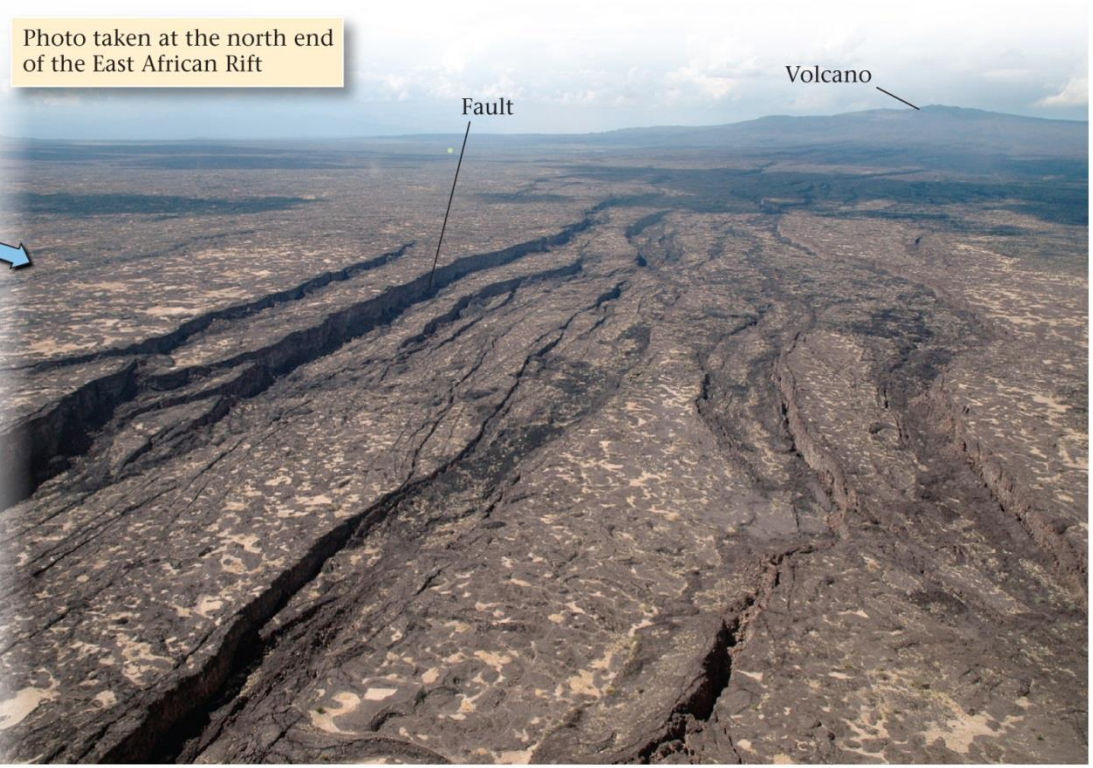
The puzzle of tectonic plates

CONCEPT: Continental rifting



The Red Sea started as a rift!

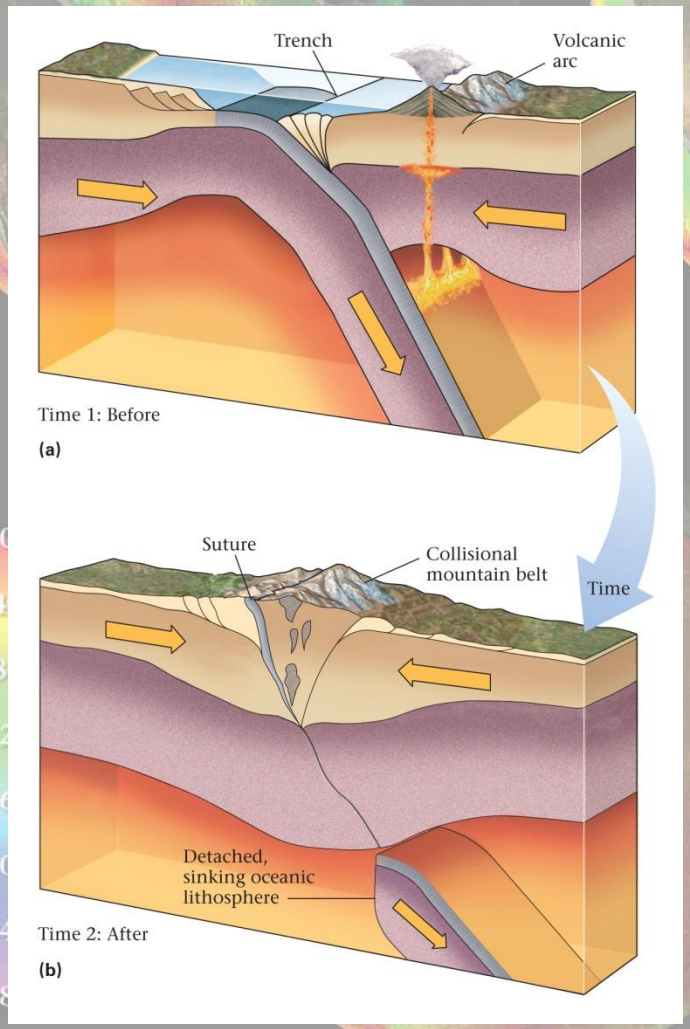
The East African Rift is growing today



8. The Continental Drift

The puzzle of tectonic plates

CONCEPT: Continental collision



(a) Subduction consumes an oceanic plate until two continents collide.
(b) After the collision, the oceanic plate detaches and sinks into the mantle. Rock caught in the collision zone gets broken, bent, and squashed and forms a mountain range.

Continental collision is the final part of the subduction process.

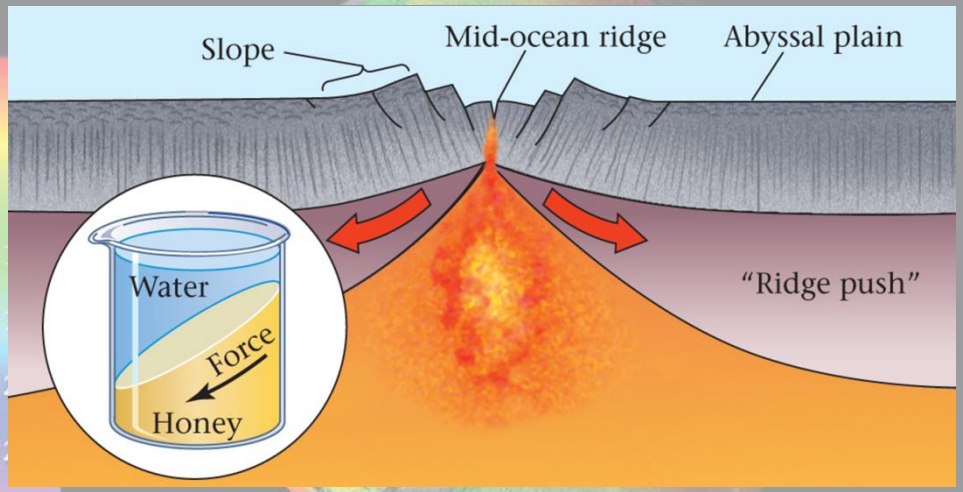
8. The Continental Drift

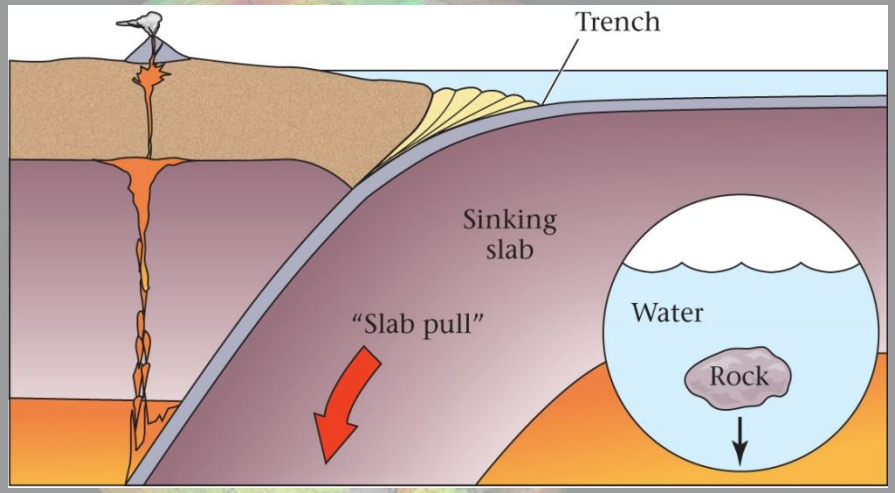
What drives plate motion?

Old hypothesis → Convective flows in the asthenosphere drag the plates

1 - Ridge-push force = gravity push apart the ancient lithosphere

2 - Slab-pull force = subducting plate (slab) pull down the above lithosphere





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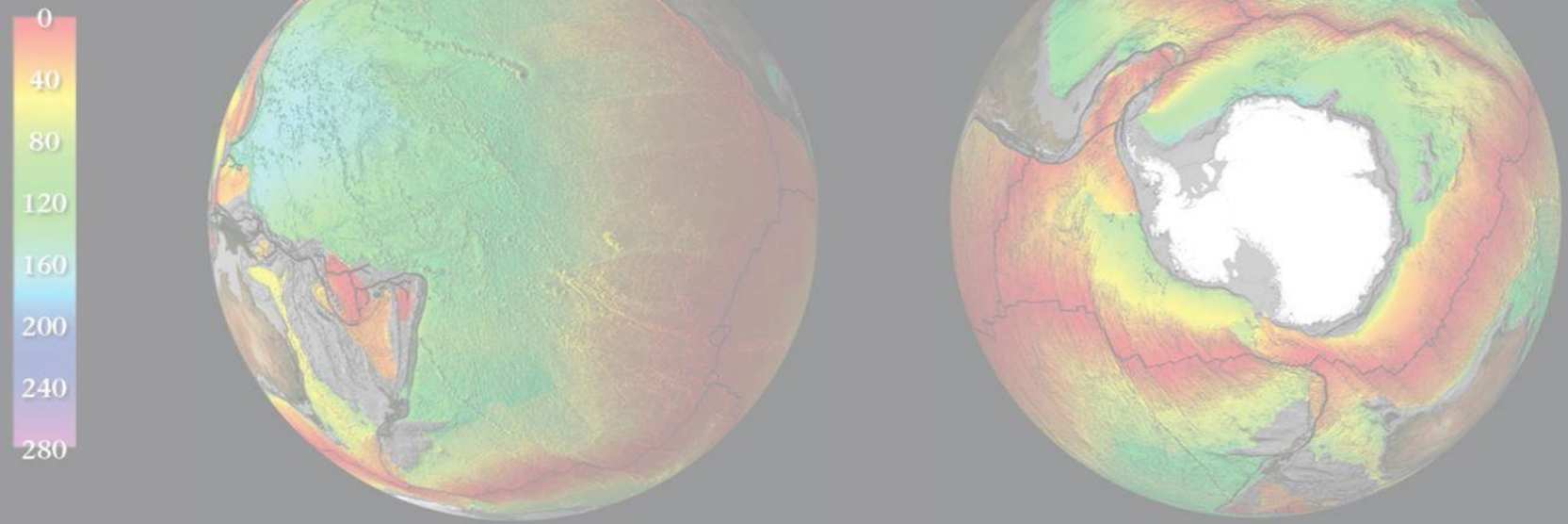
The Way the Earth Works: Plate Tectonics
pp. 86-115



QUESTIONS?