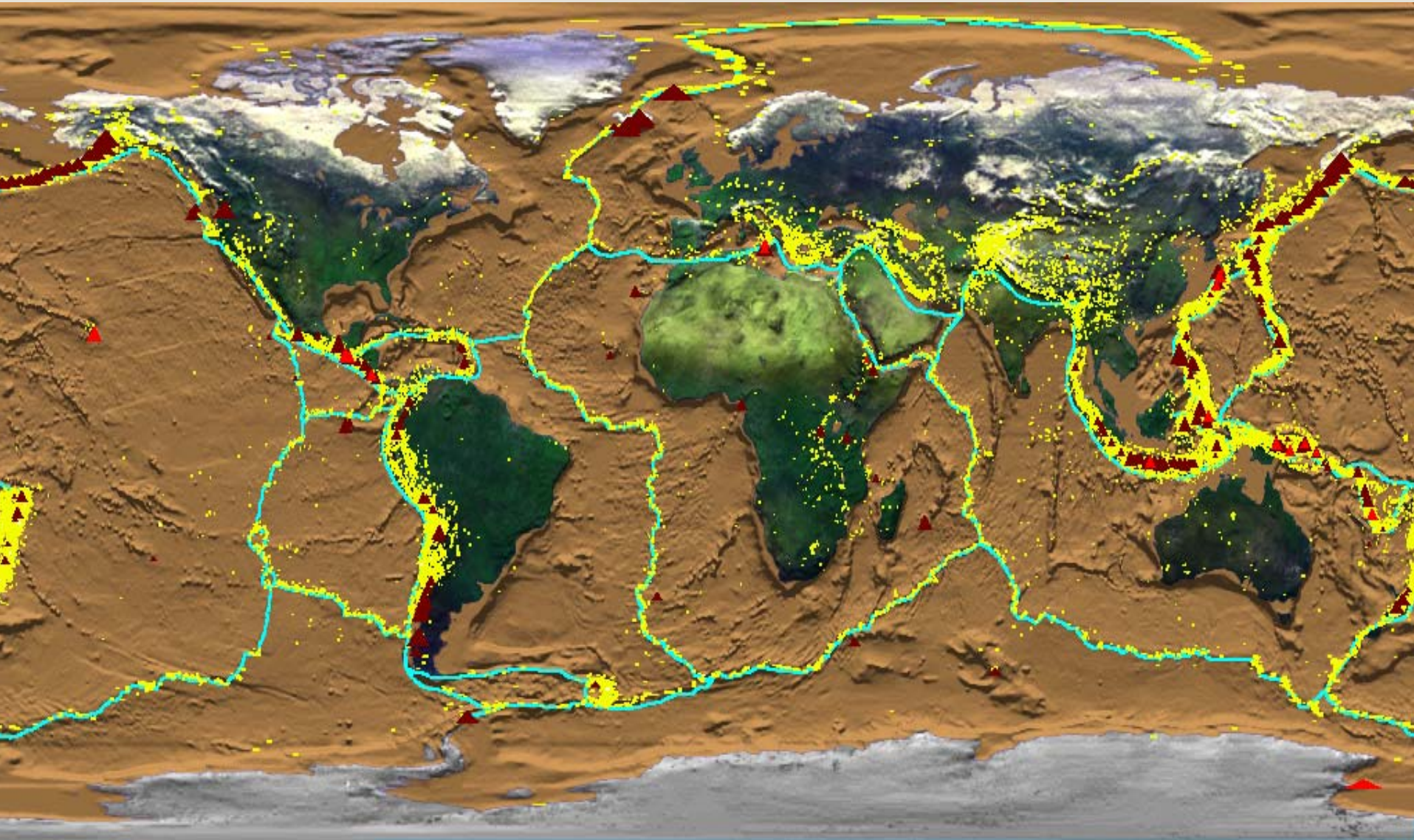


Plate Tectonics: the major plates



Seven major plates:

One for each continent

North America

South America

Africa

Eurasia

Antarctica

One with two smaller continents

Indo-Australian

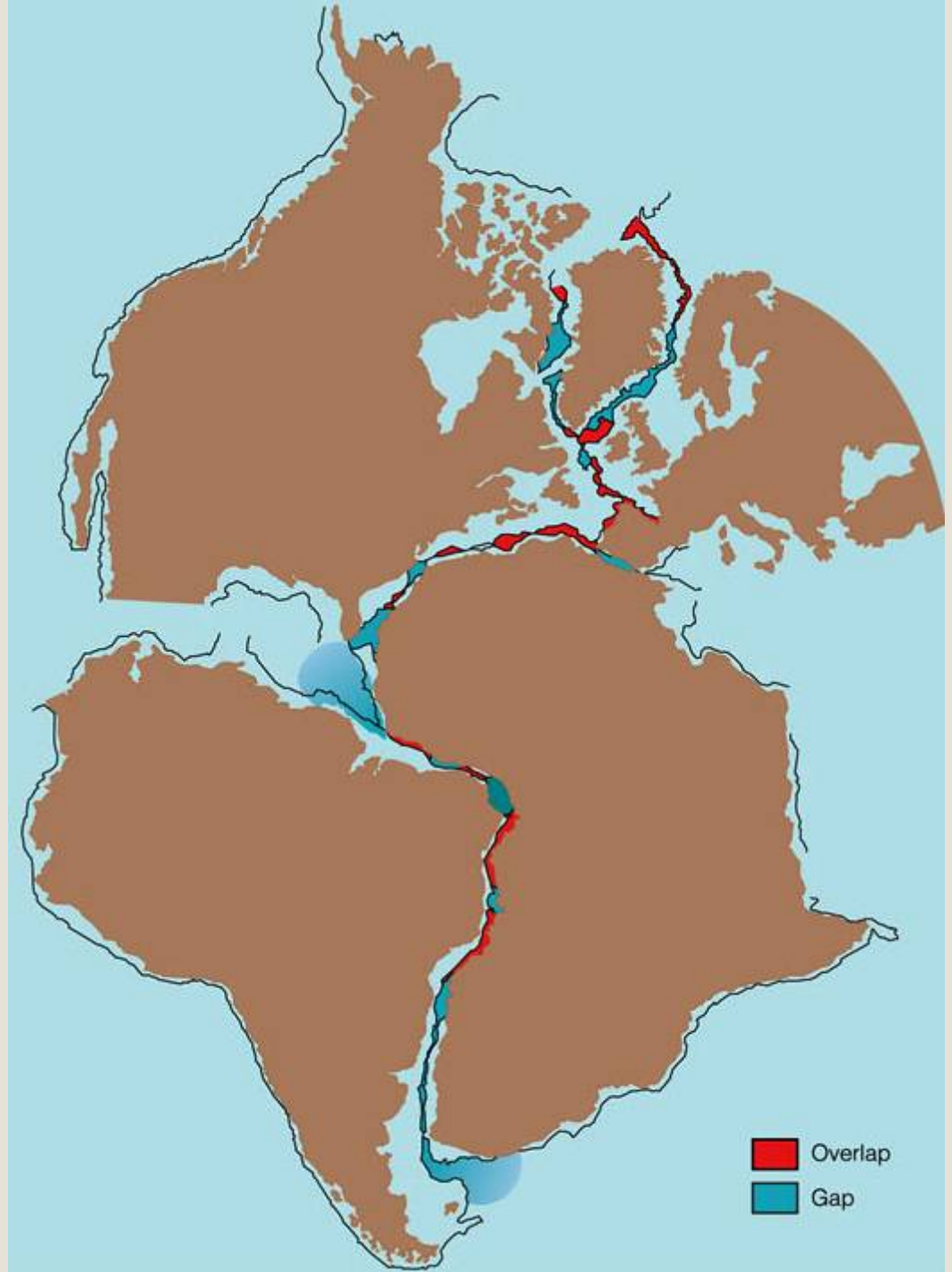
And one that's all ocean

Pacific

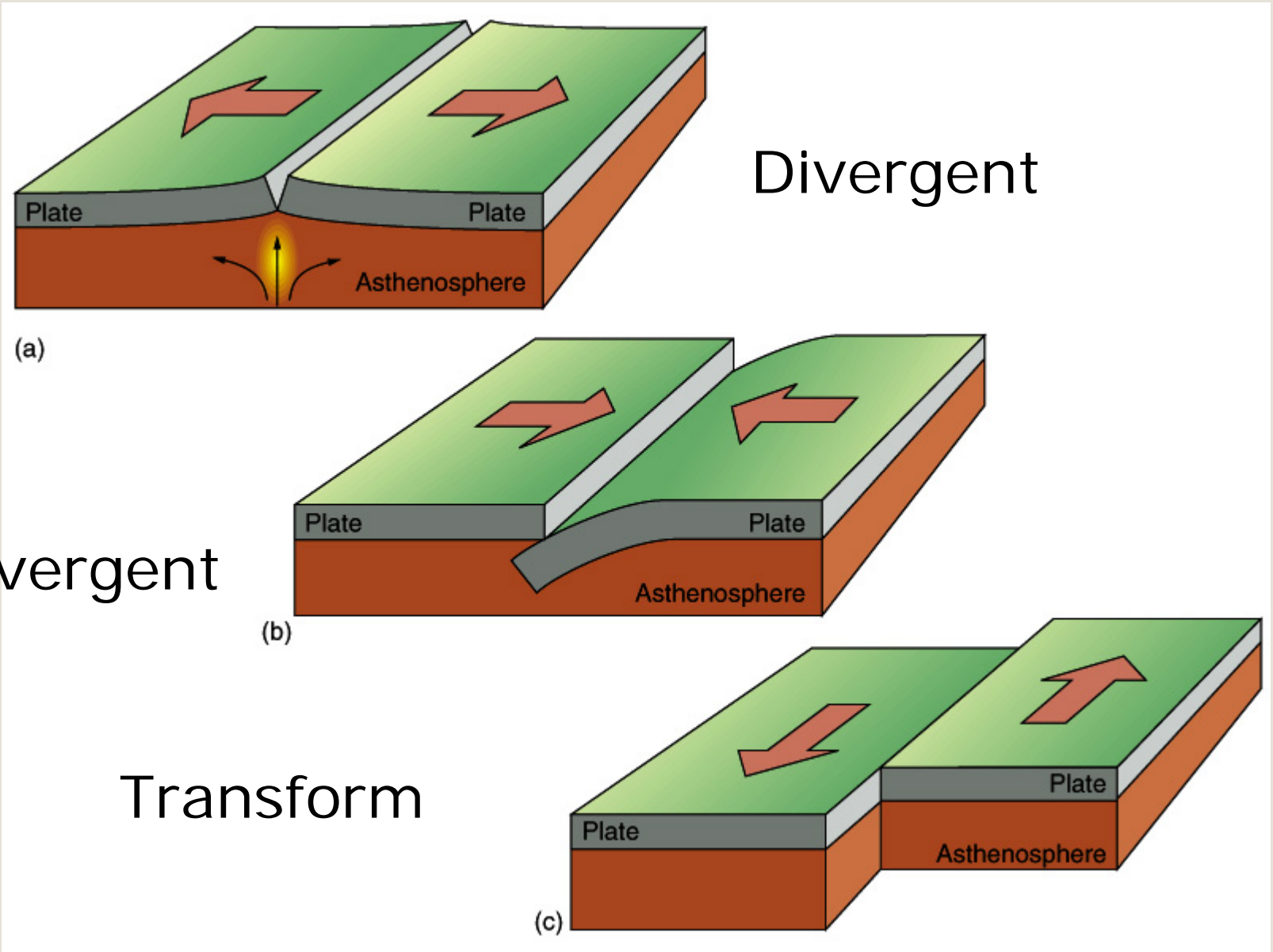
Continental fit

Some of the original evidence

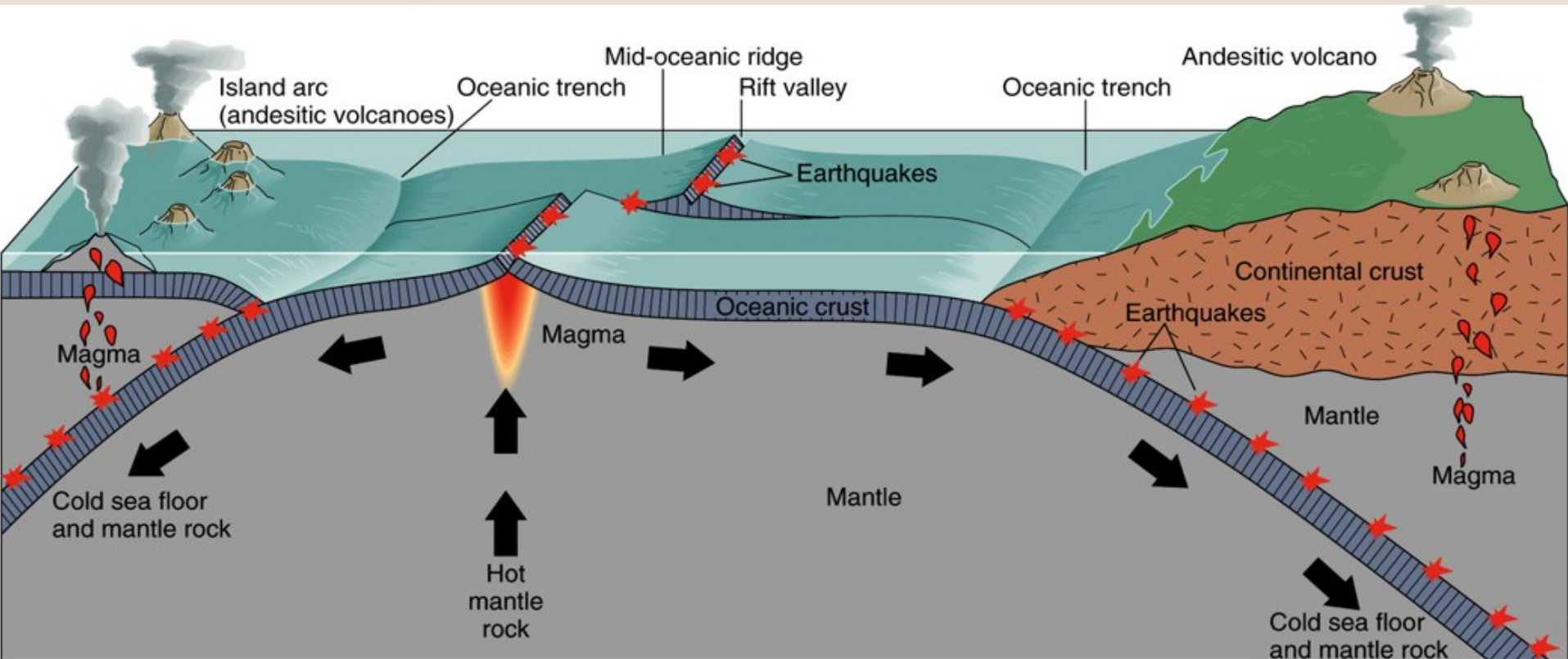
Proposed by Alfred Wegener in 1912



Three types of plate boundaries



All the tectonic pieces



Two types of crust: Oceanic

Continental

Three combinations of crust interactions:

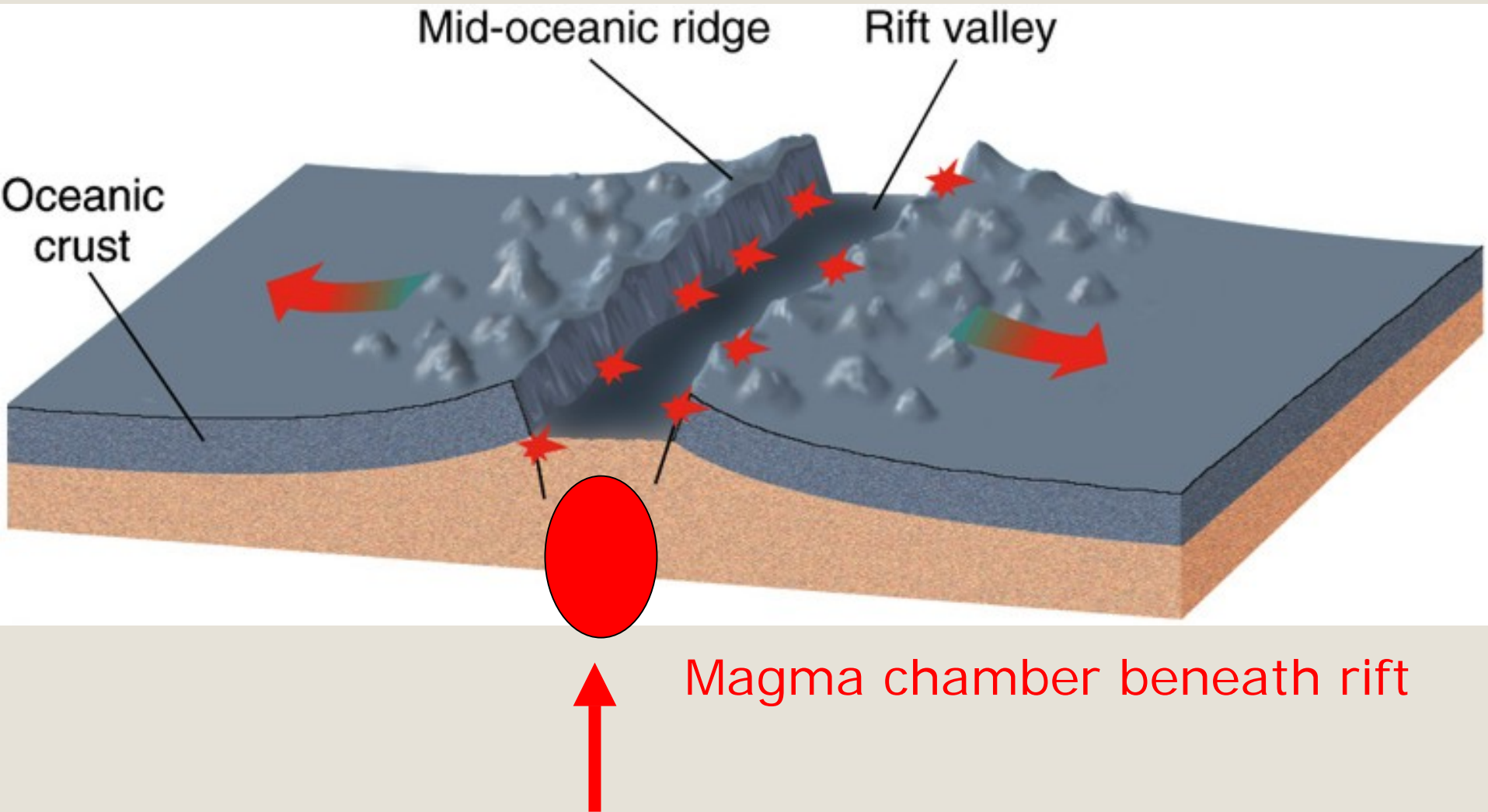
Oceanic - Oceanic

Oceanic - Continental

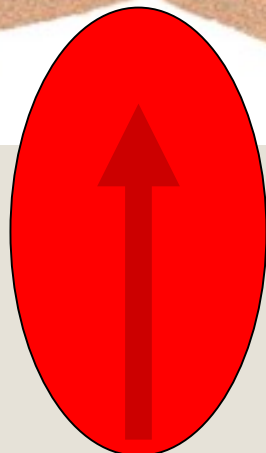
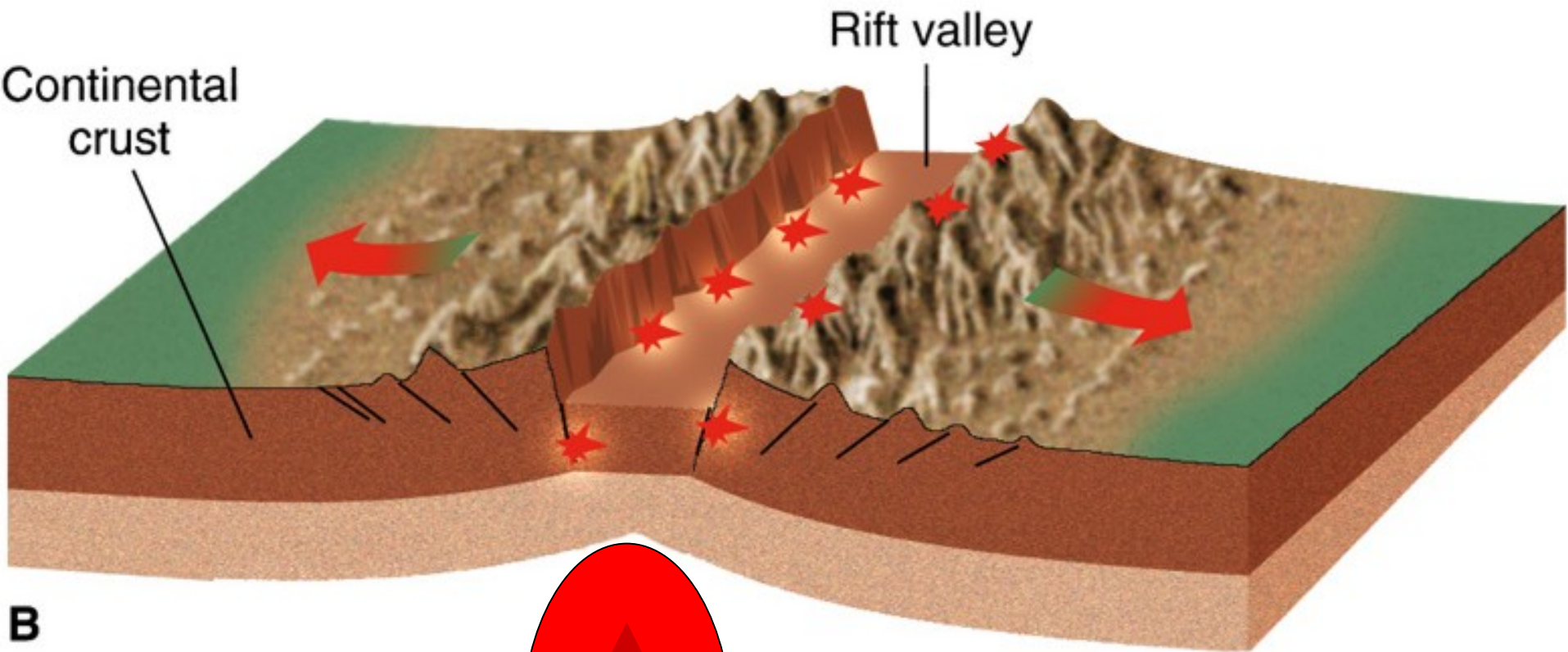
Continental - Continental

Divergent plate boundary – mid-ocean ridge system

New oceanic crust is being created

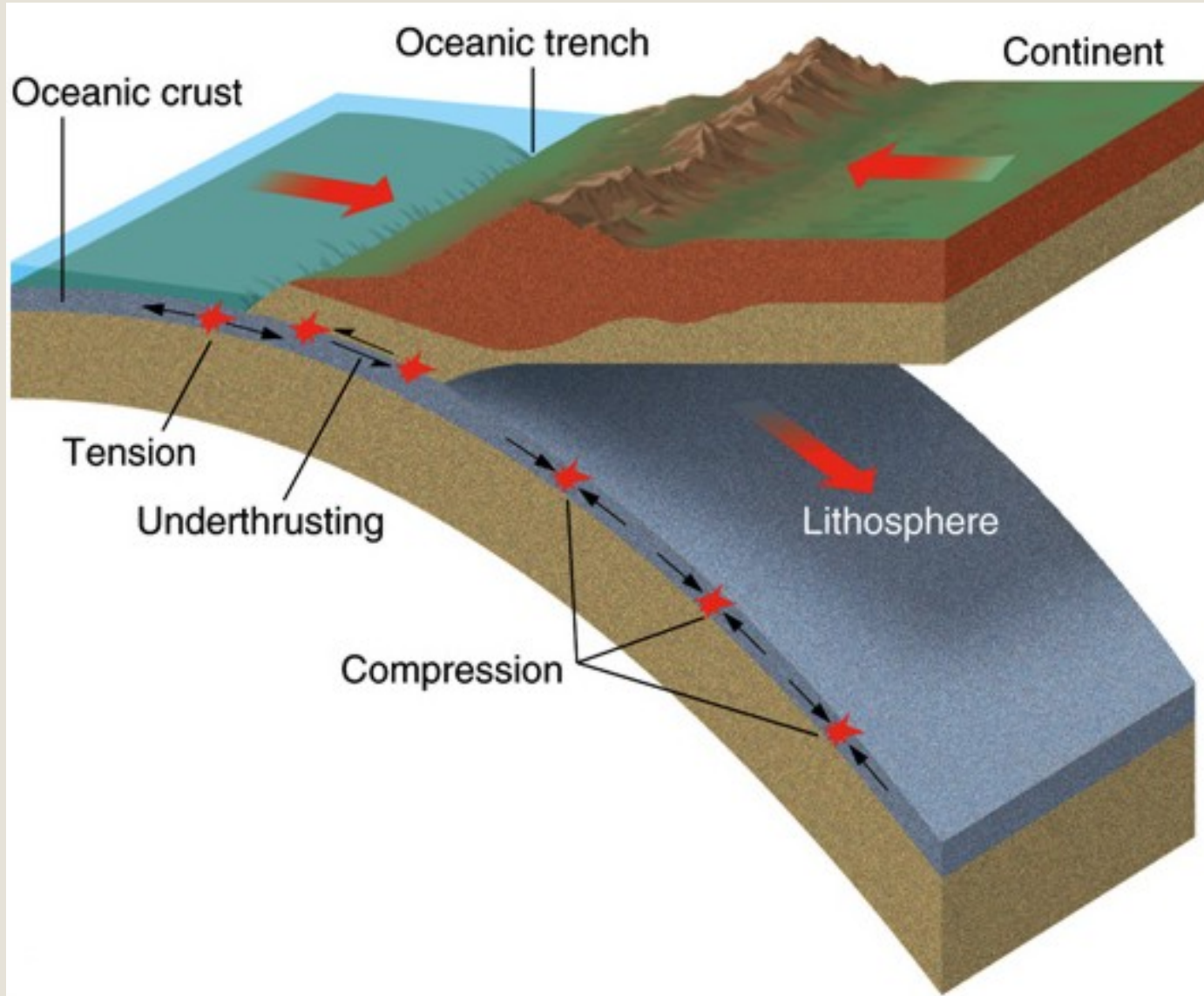


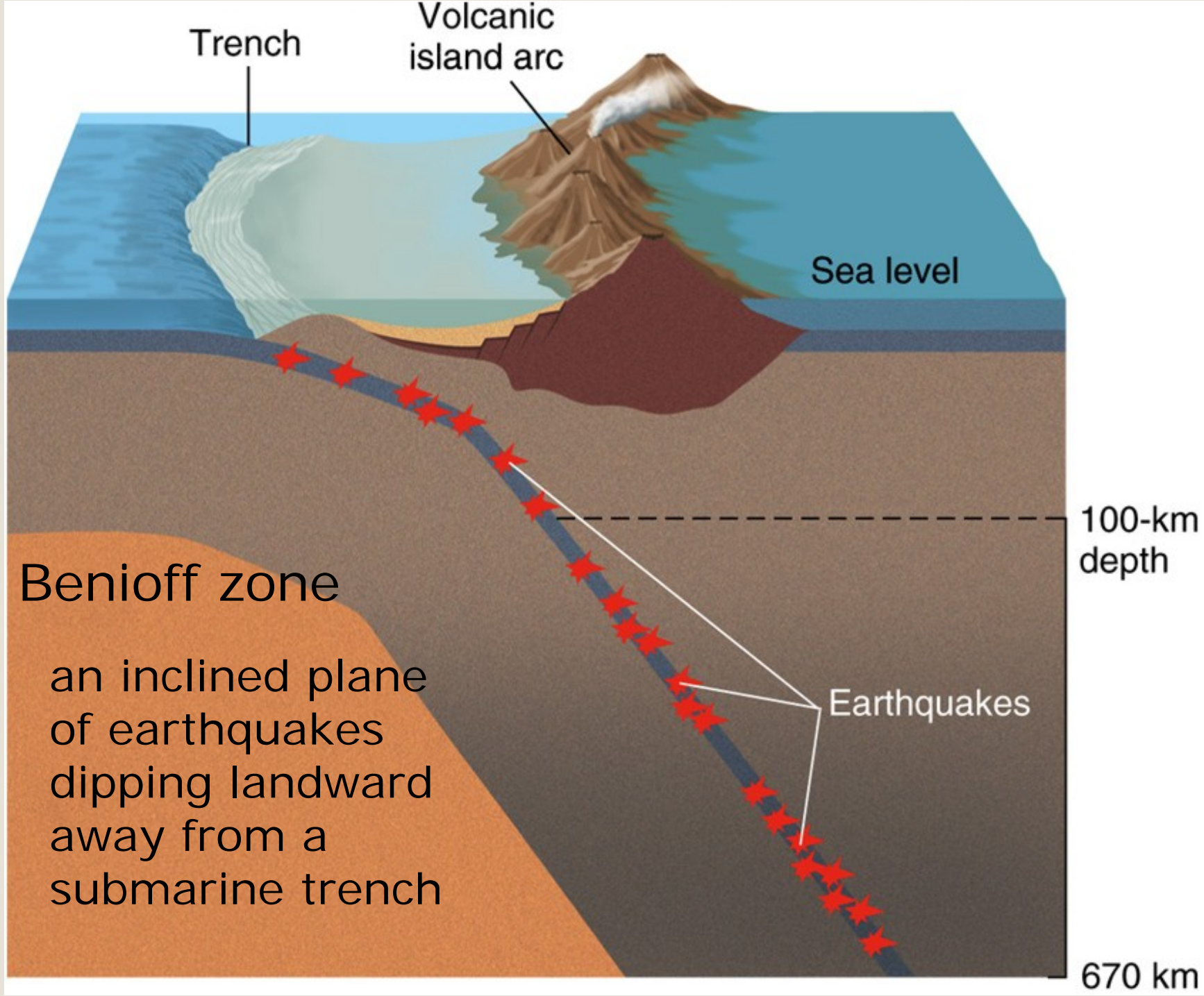
Divergent boundary – Rifting of a continent



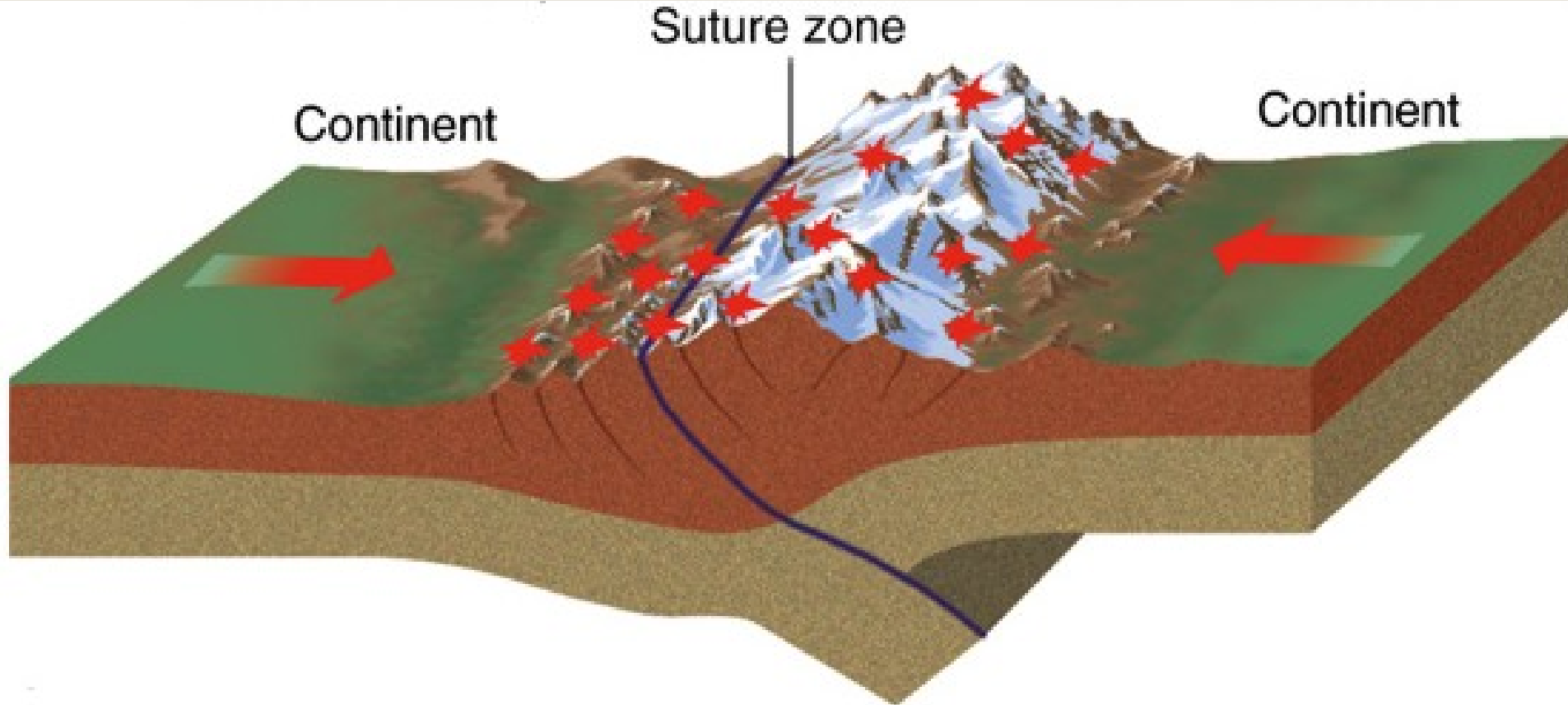
Mantle plume beneath rift

Convergent boundary – subduction system





Convergent boundary – continental collision

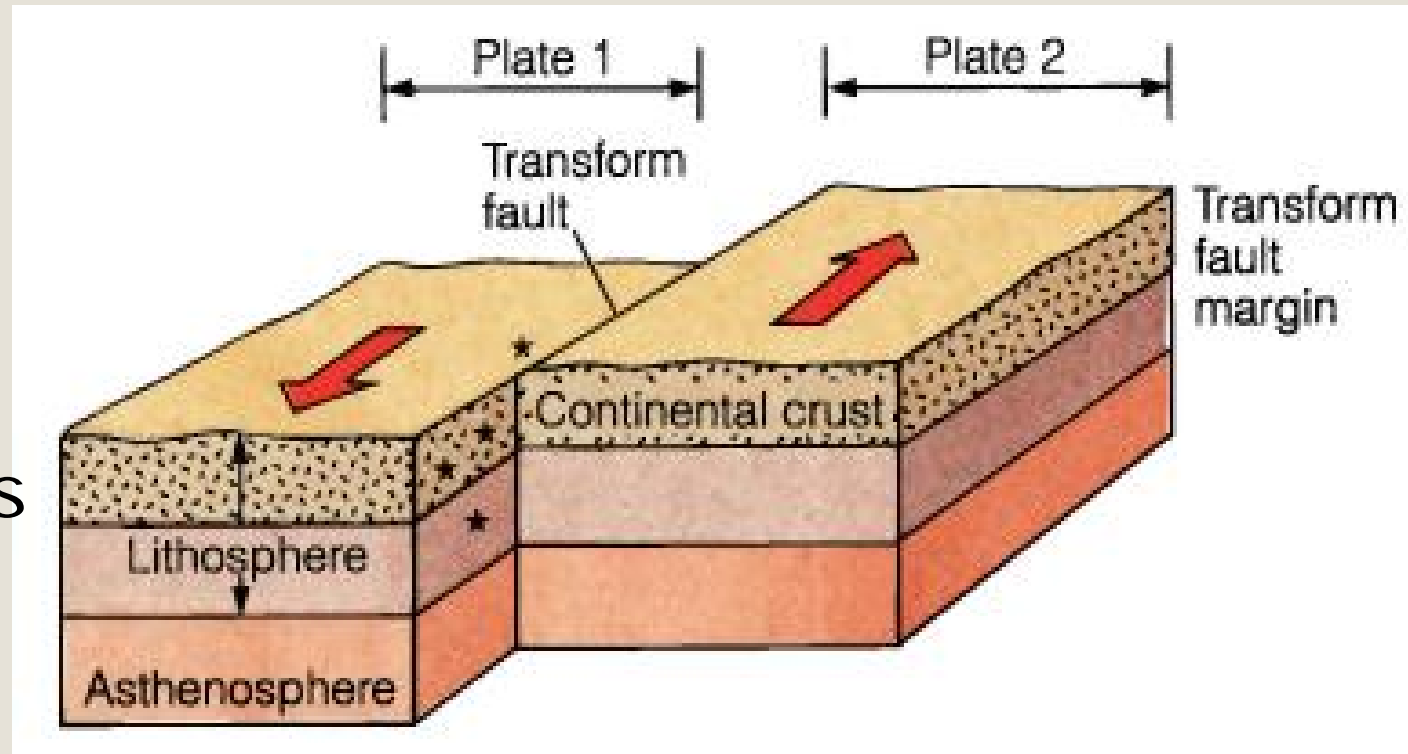


Produces a double thickness of continental crust

Transform Plate Boundary

Modern example:

San Andreas Fault System



San Andreas fault *zone*

A whole system
of faults

Most of the
movement
is SSE to NNW



San
Francisco
area

San
Francisco Bay
is bounded
by two major
faults

San Andreas
Hayward



Plates on the globe

African Plate

A plate has both types of crust

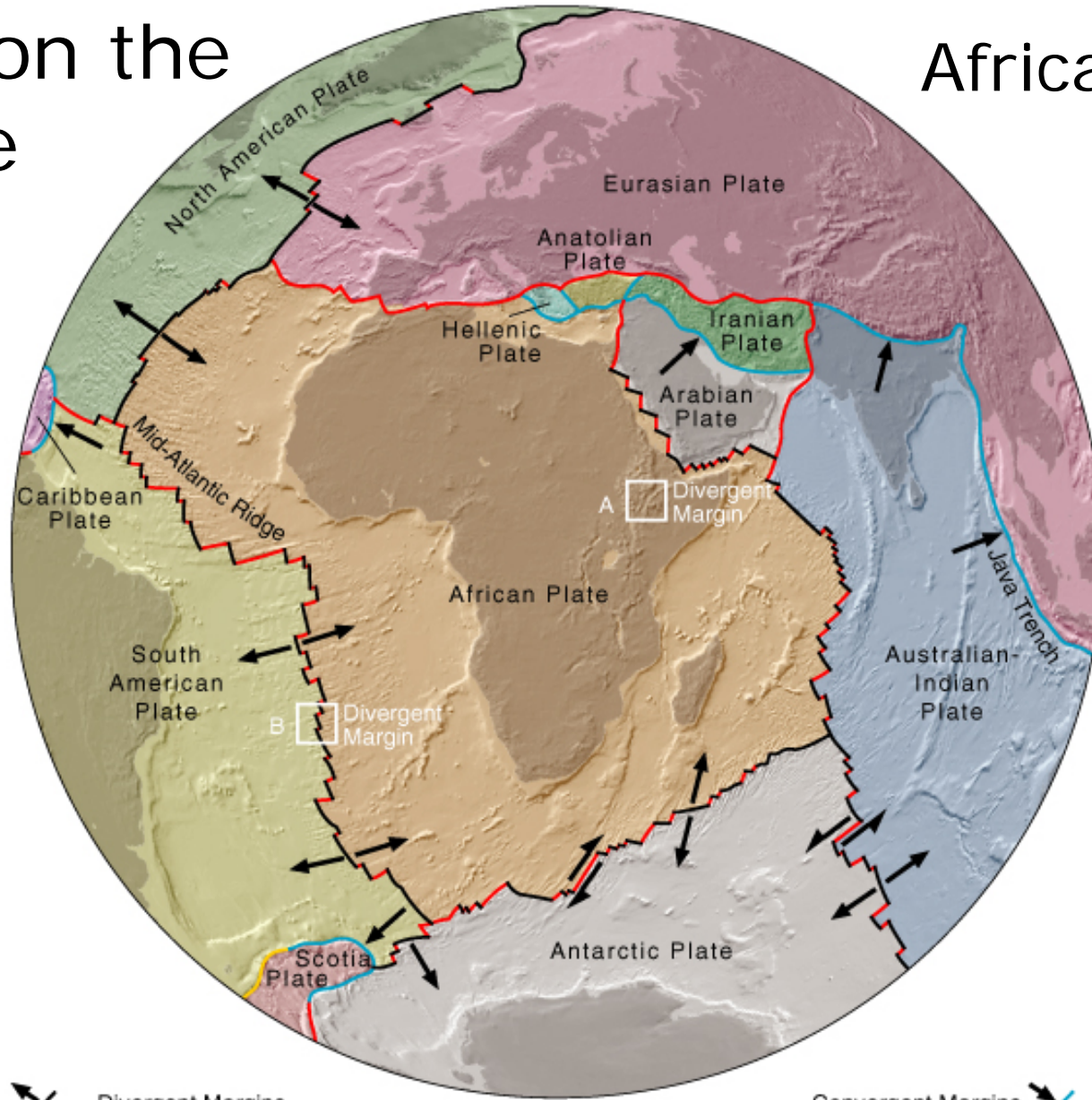
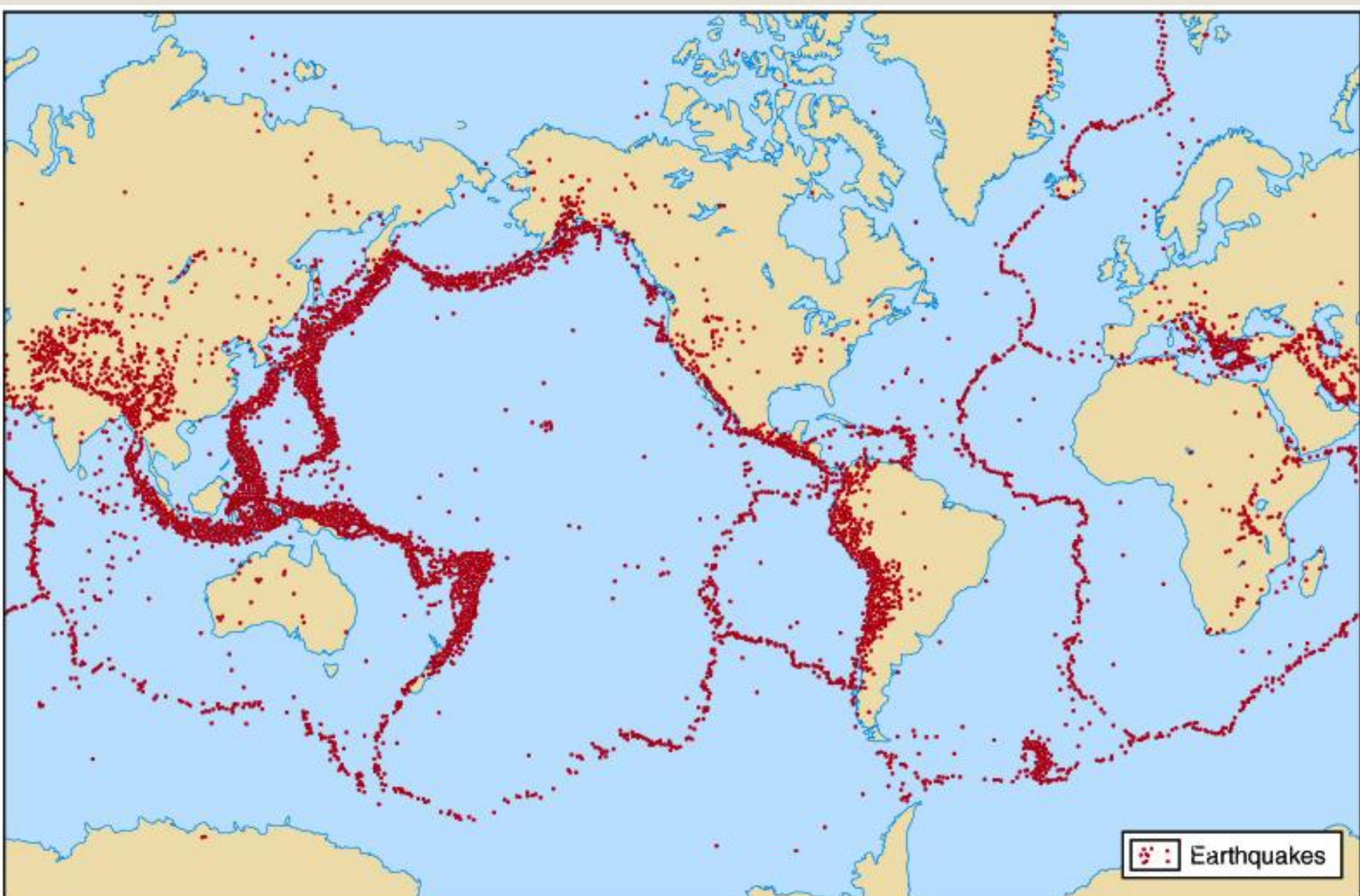
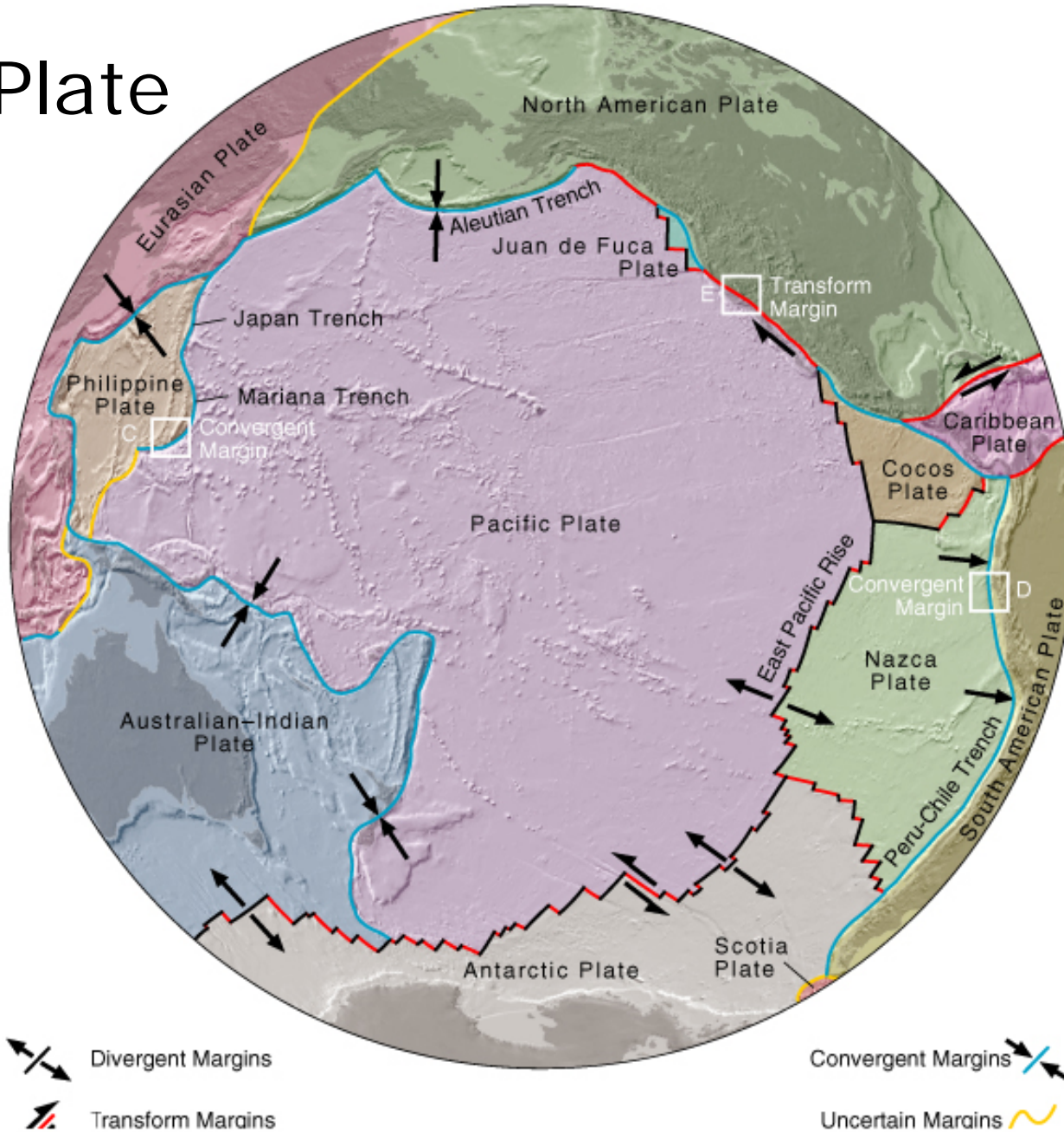


Plate boundaries defined by earthquakes

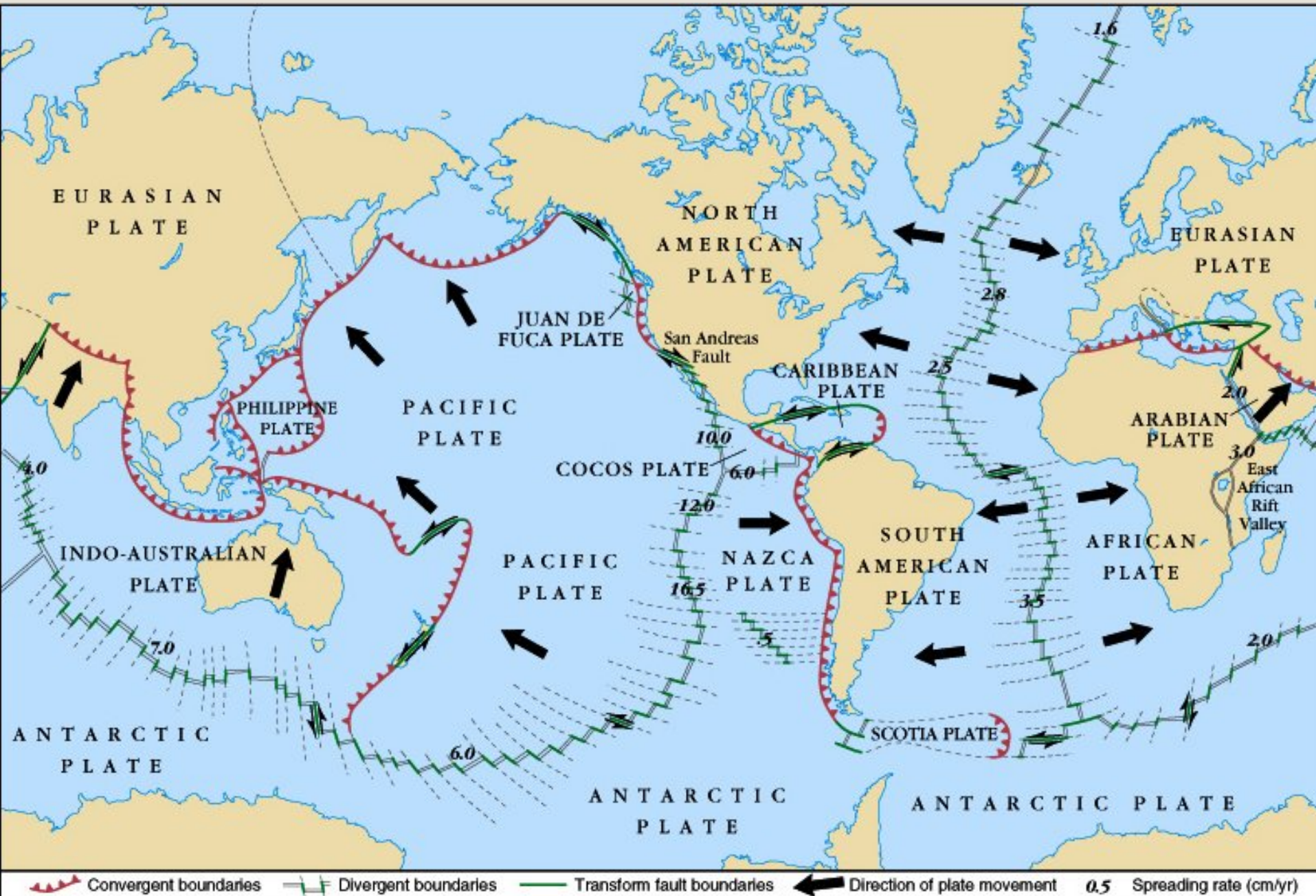


Pacific Plate

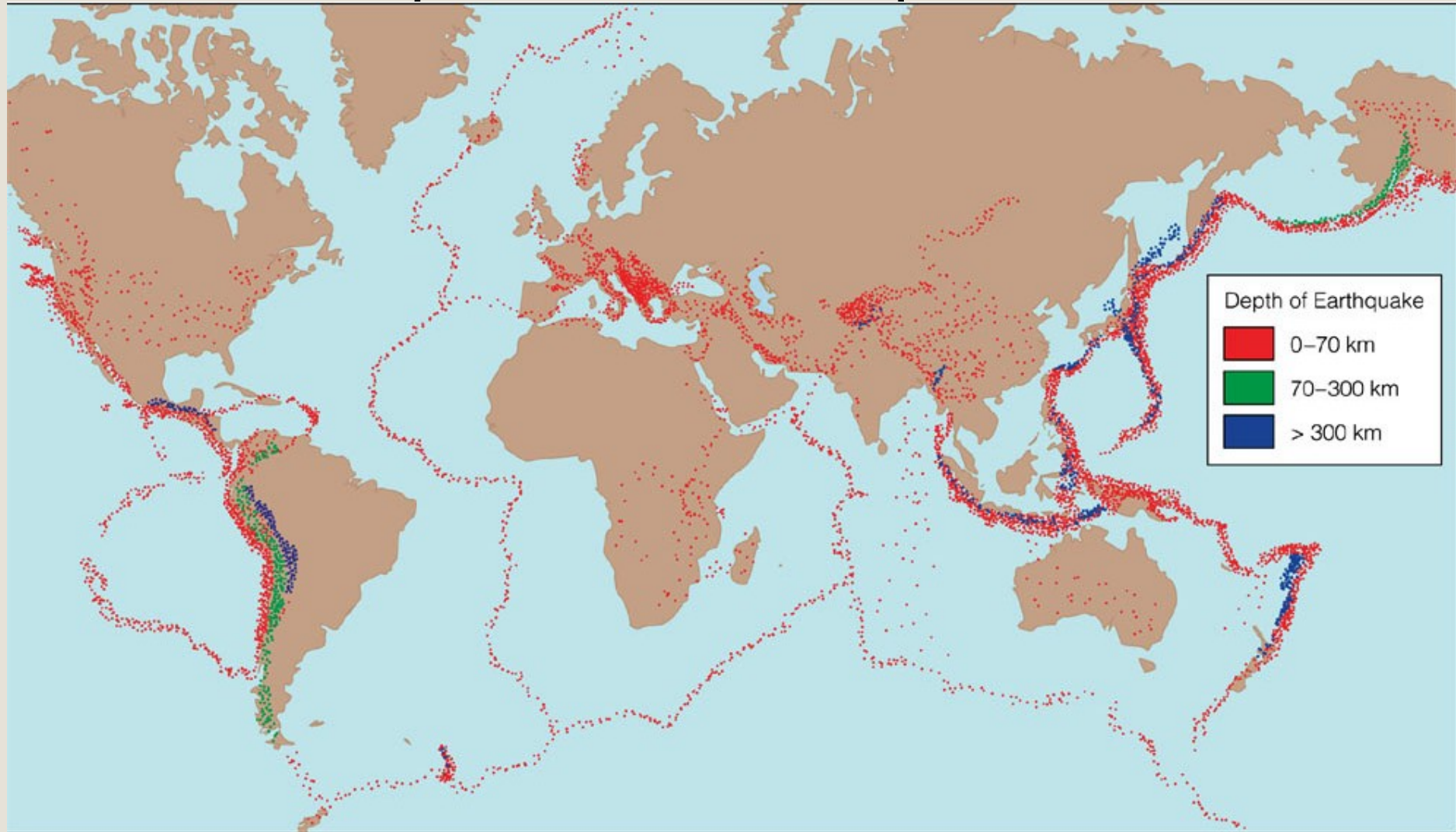
The Ring of Fire



Relative Motion of Plates



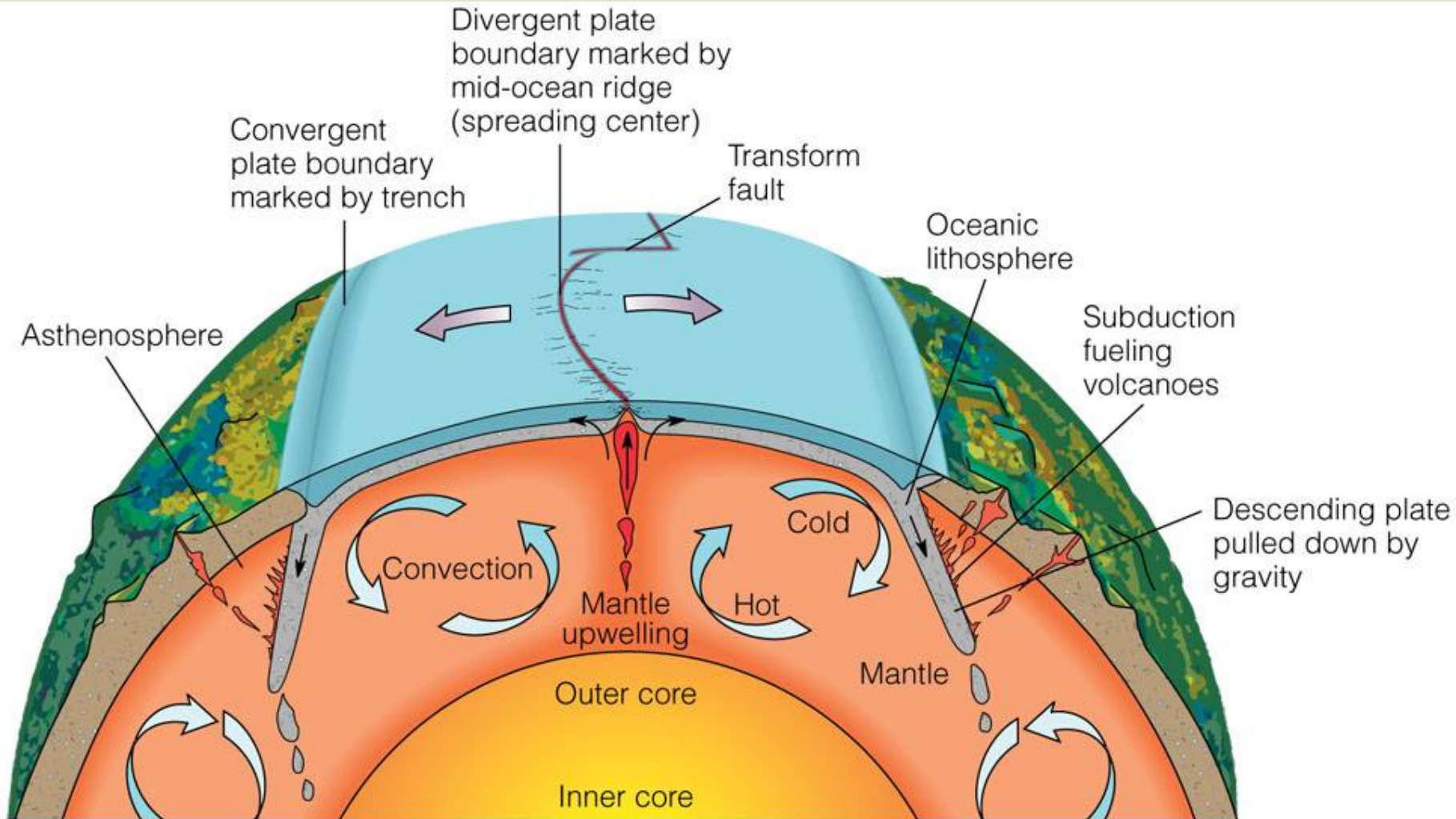
Different depths for earthquakes



MOR shallow earthquakes

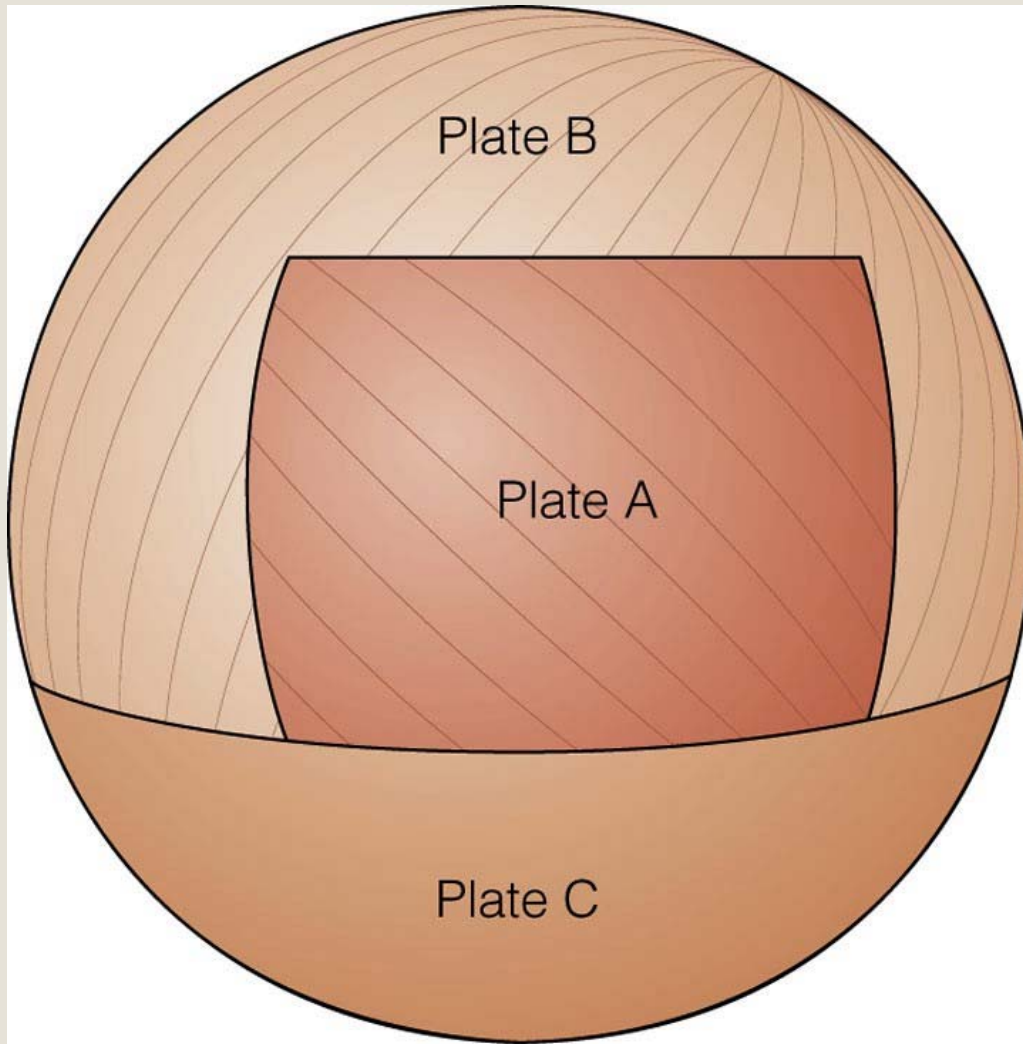
Subduction zones shallow/intermed/deep

What drives plate tectonics?



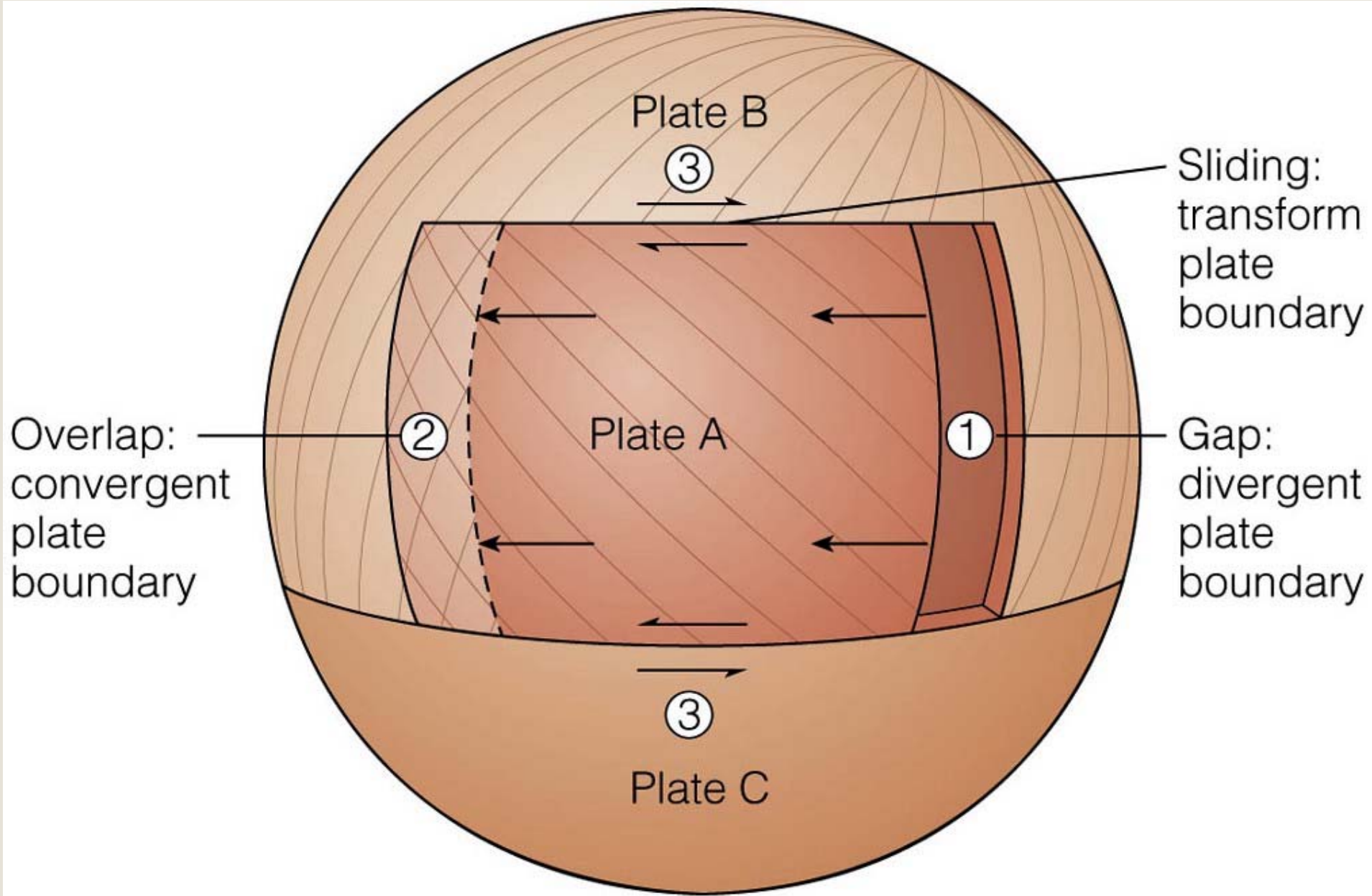
Mantle convection

Tectonic plates on a sphere

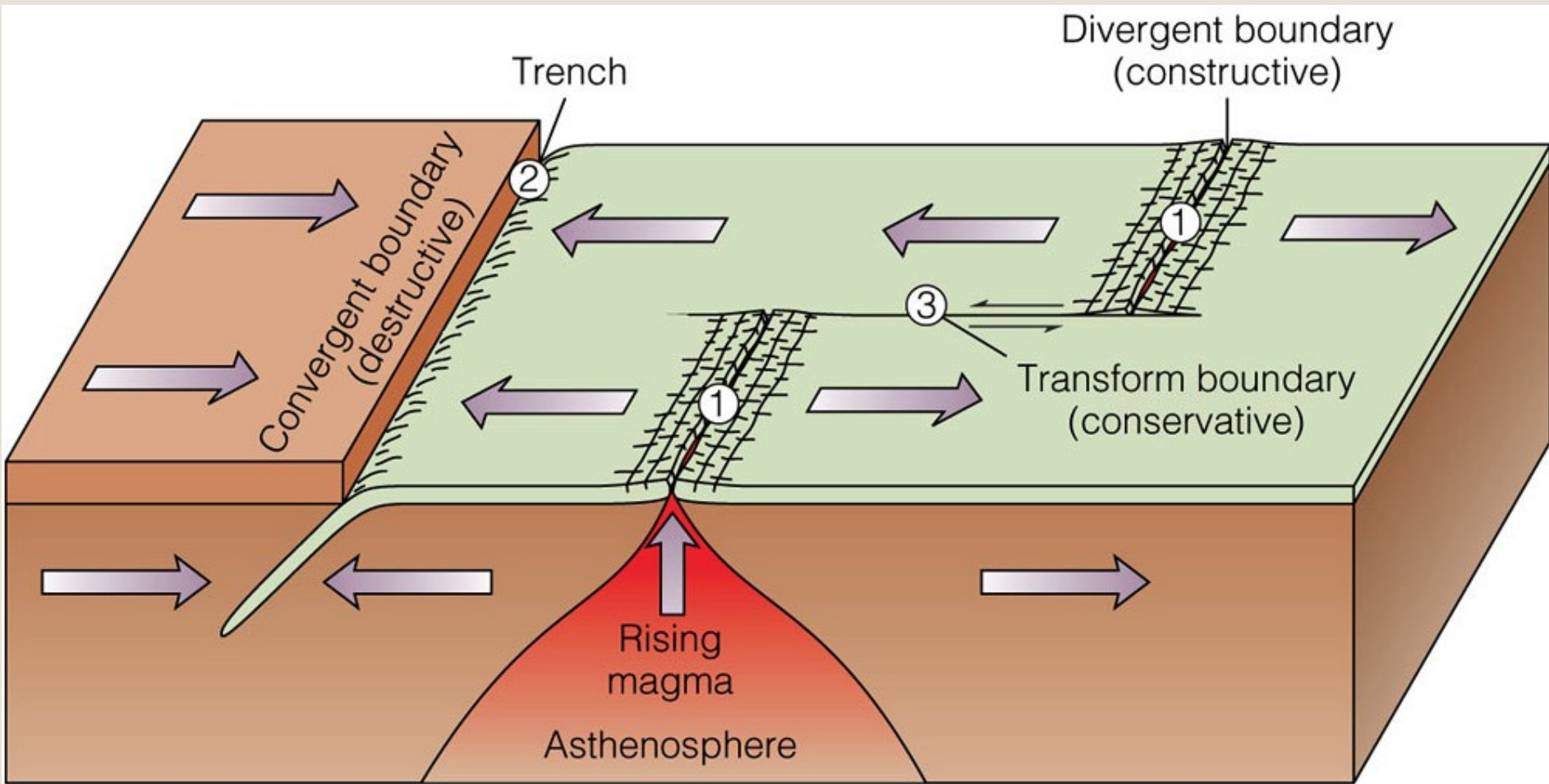


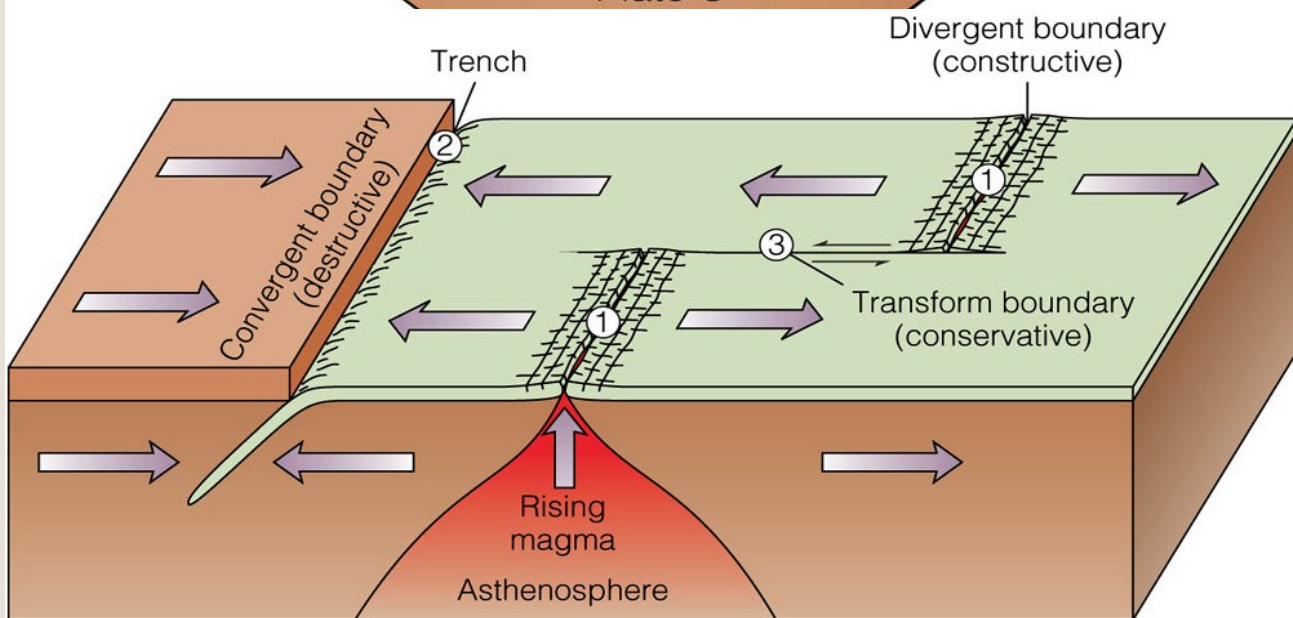
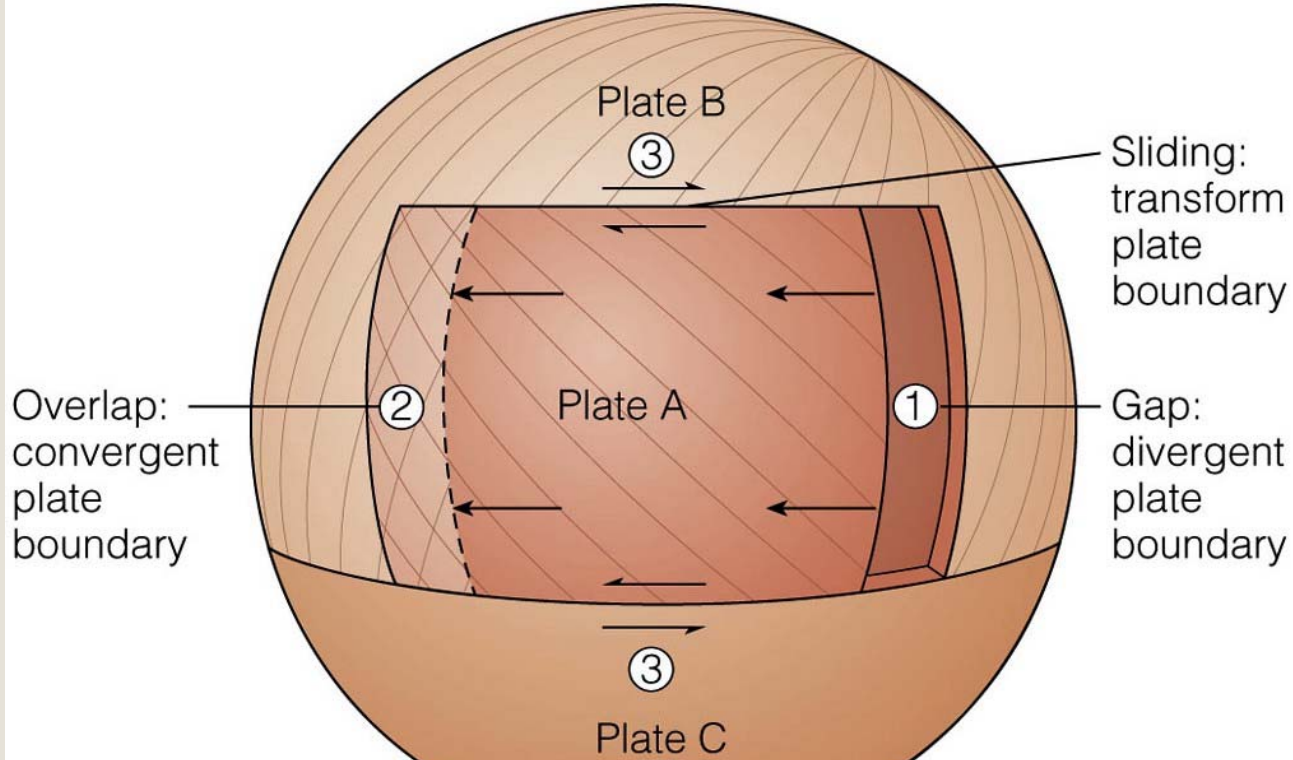
Plates moving across the curved surface of the planet *must* interact with other plates

Tectonic plates on a sphere



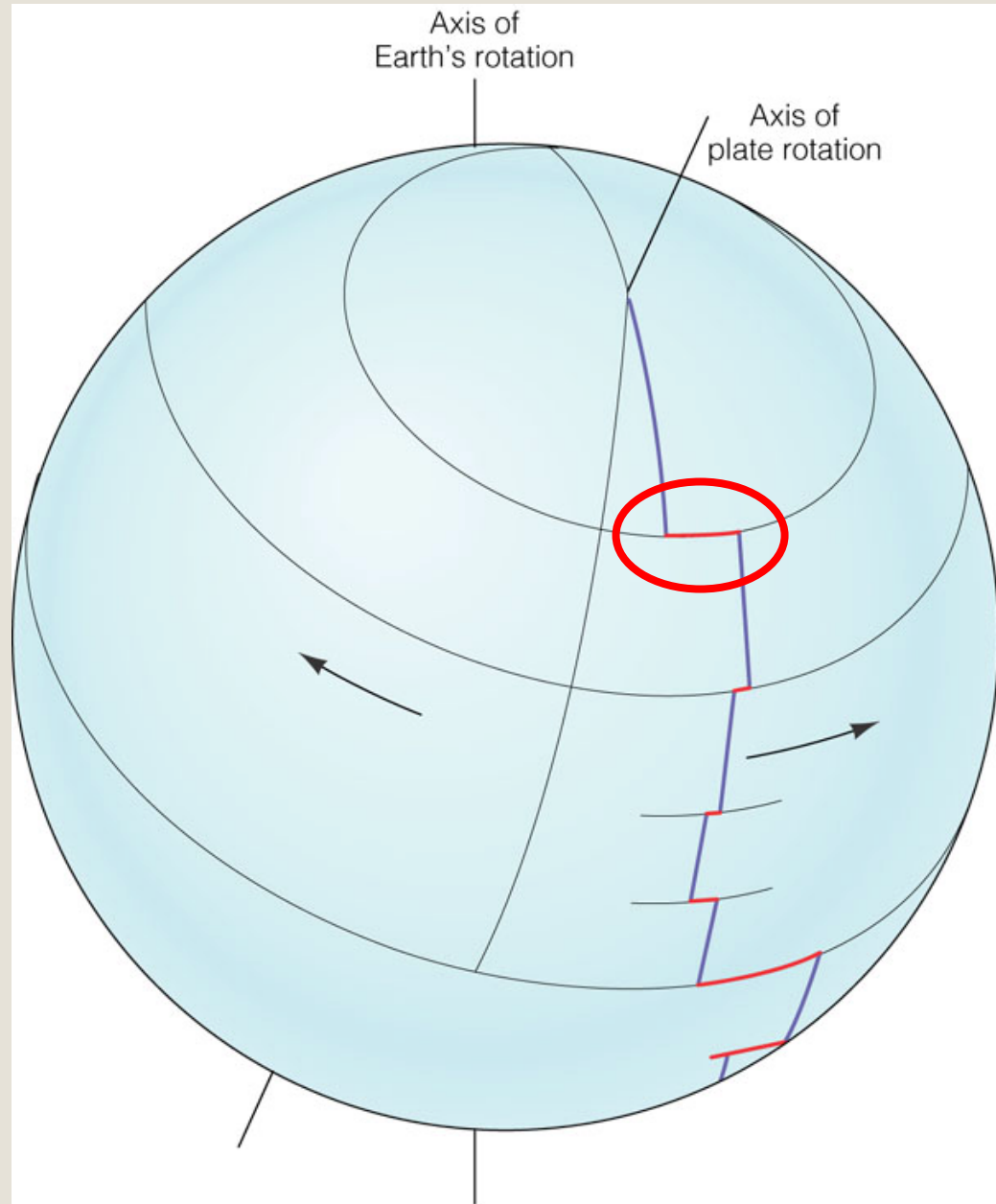
Types of plate boundaries



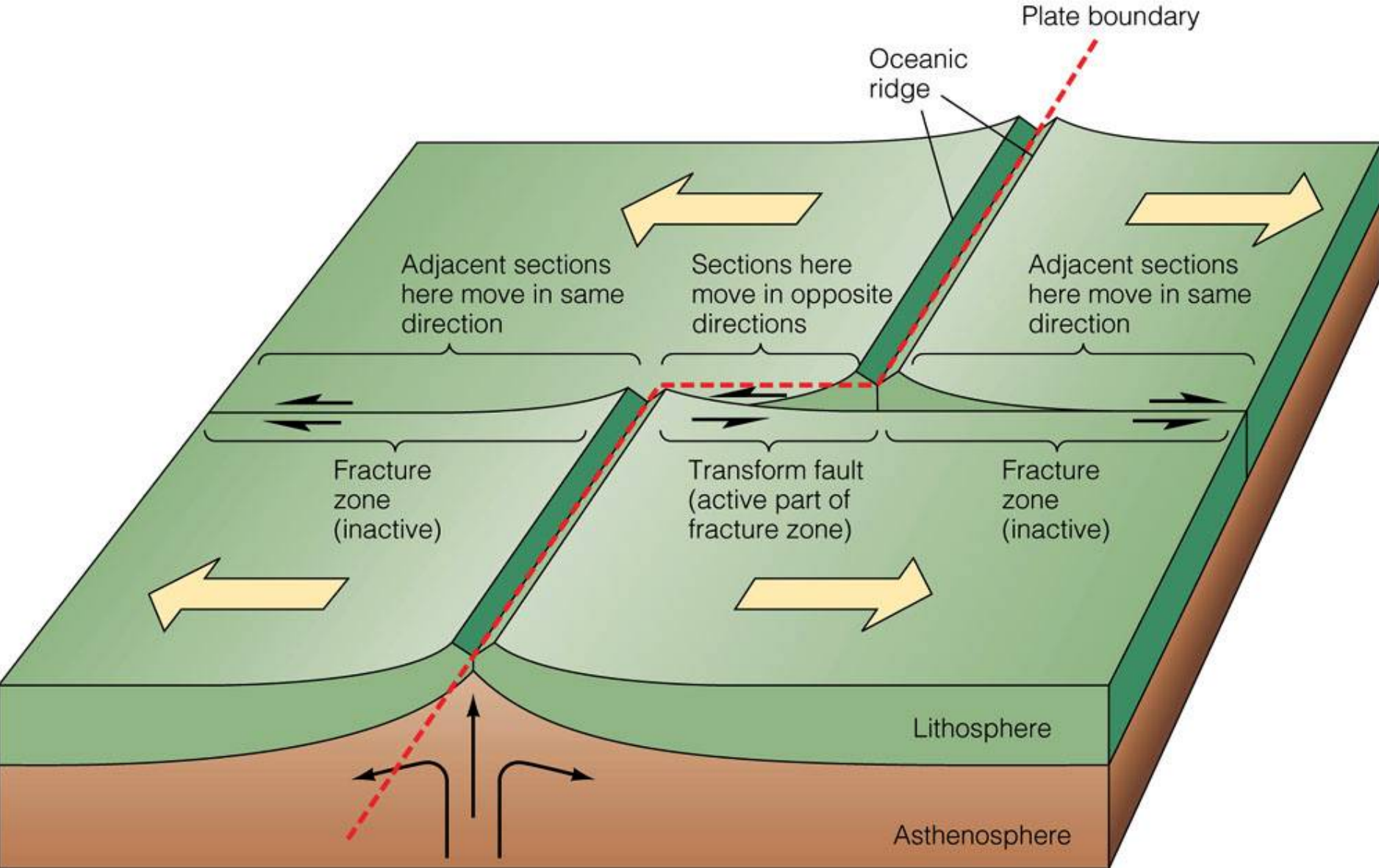


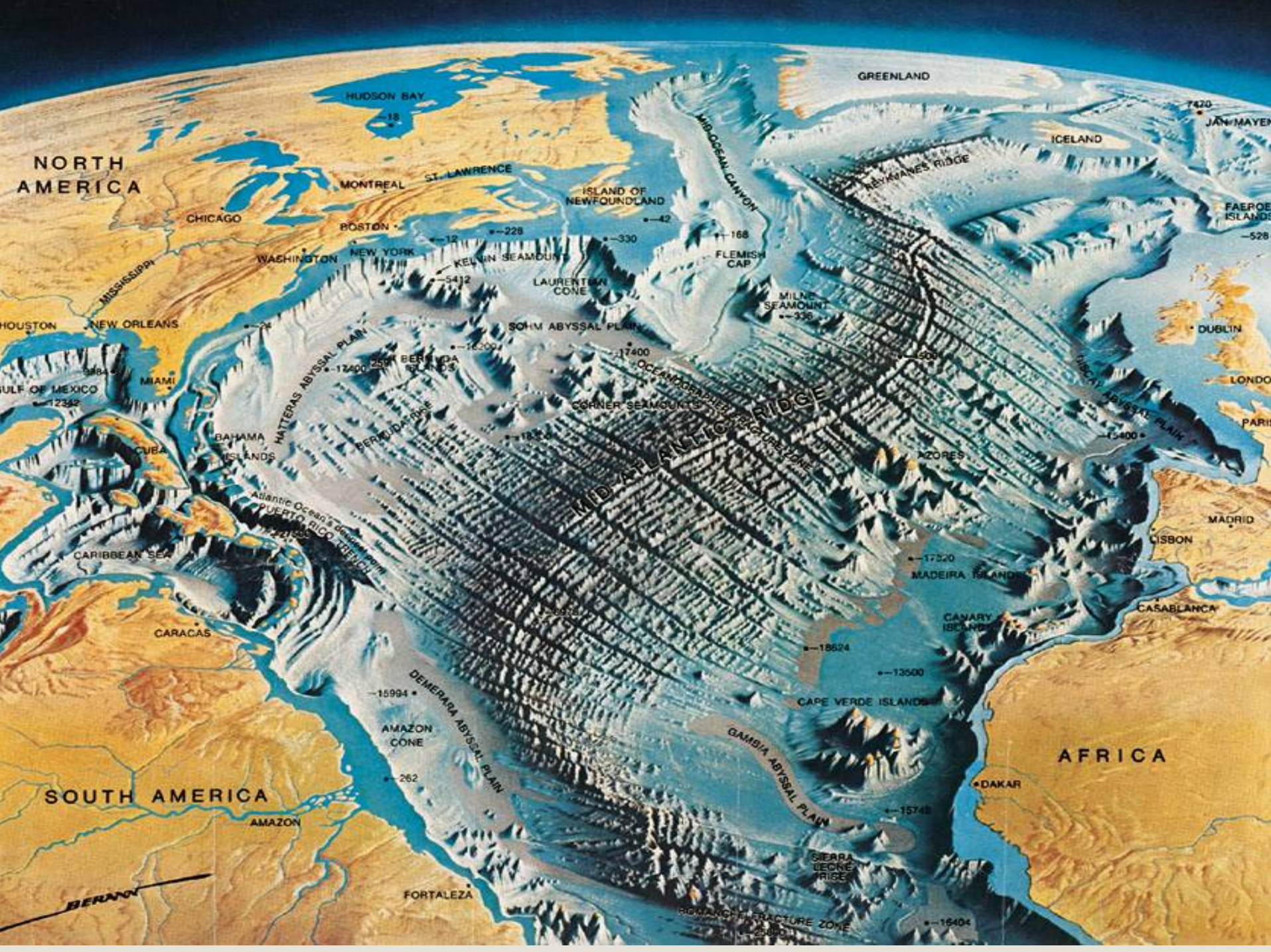
A rigid plate moving across a curved surface

Something's
got to give

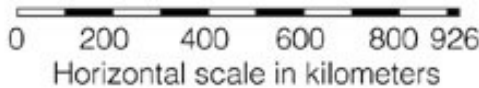
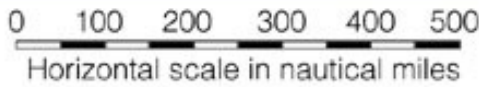
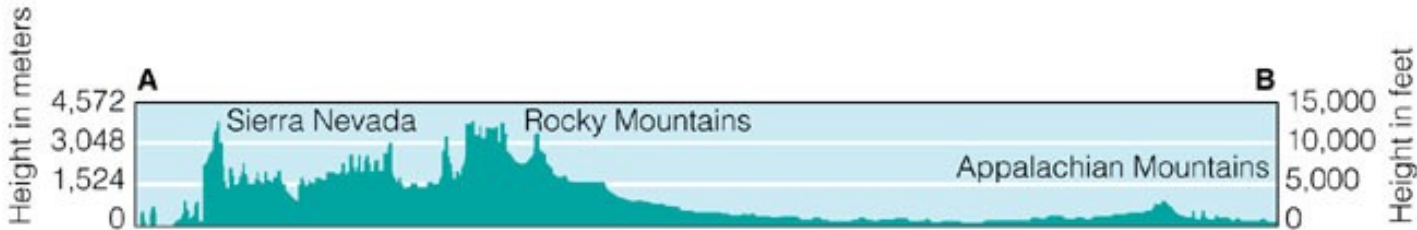


Ridge offsets



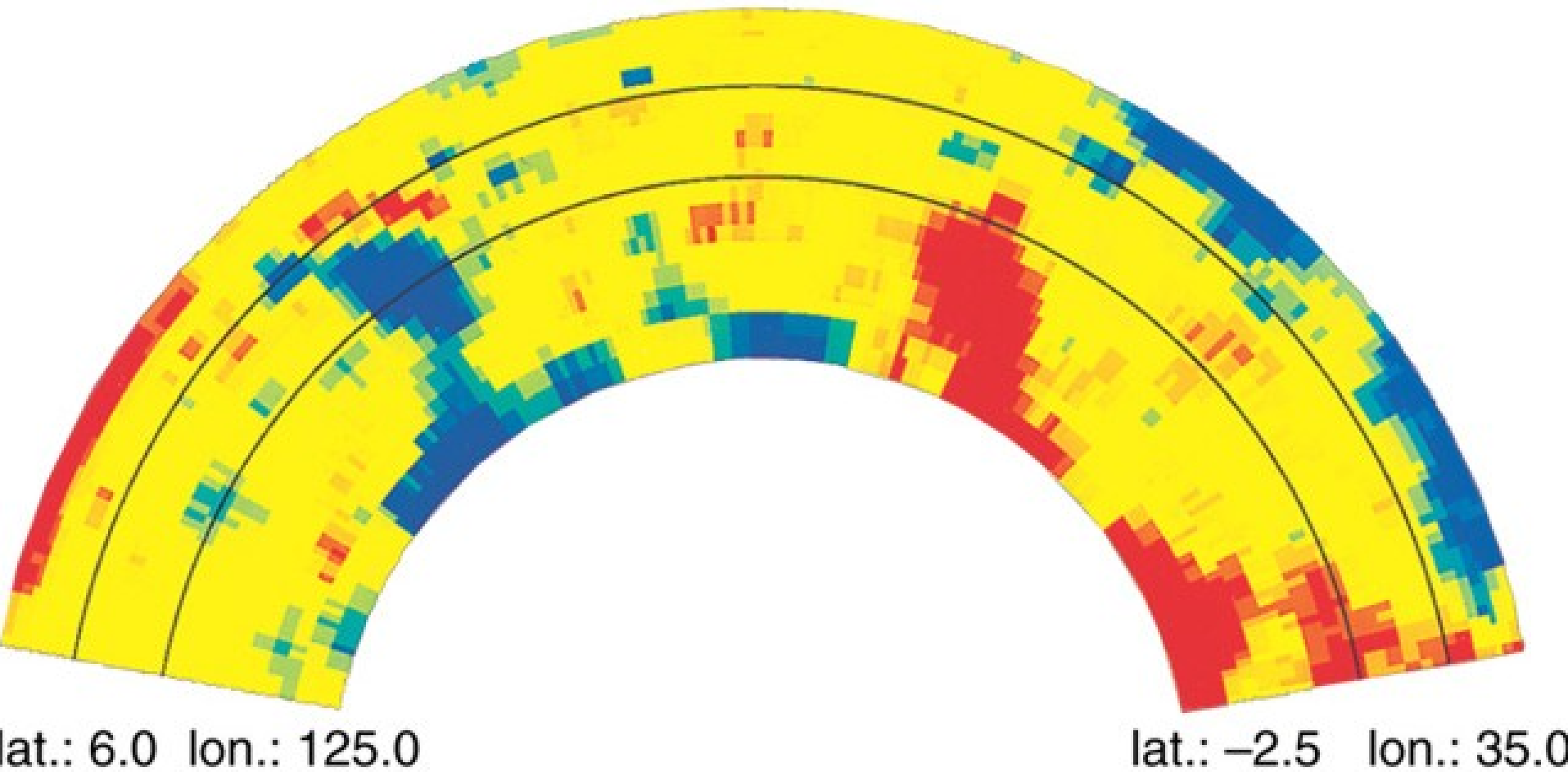


Mid-ocean ridge system



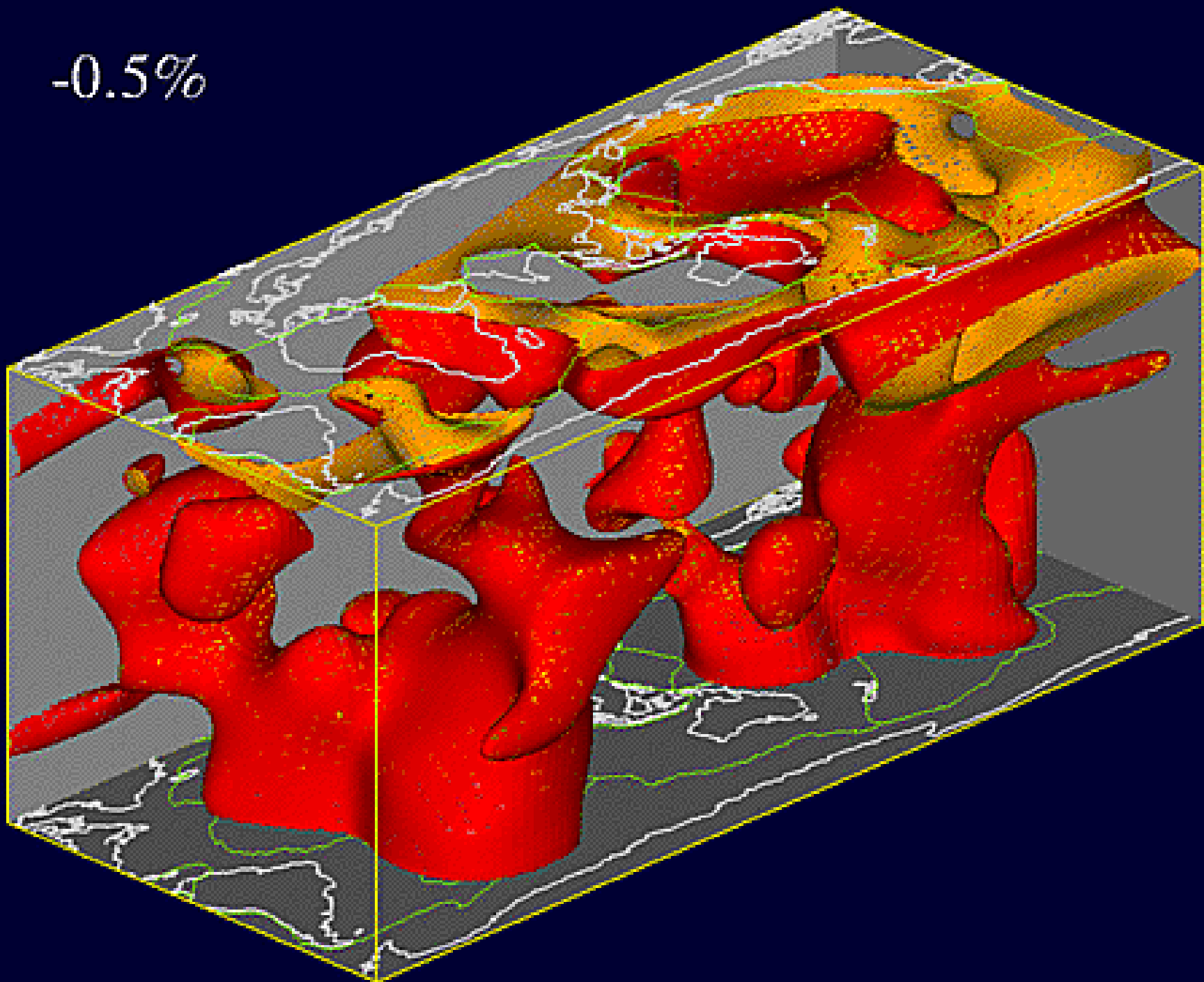
Vertical x 100

Seeing inside the Earth: Mantle tomography

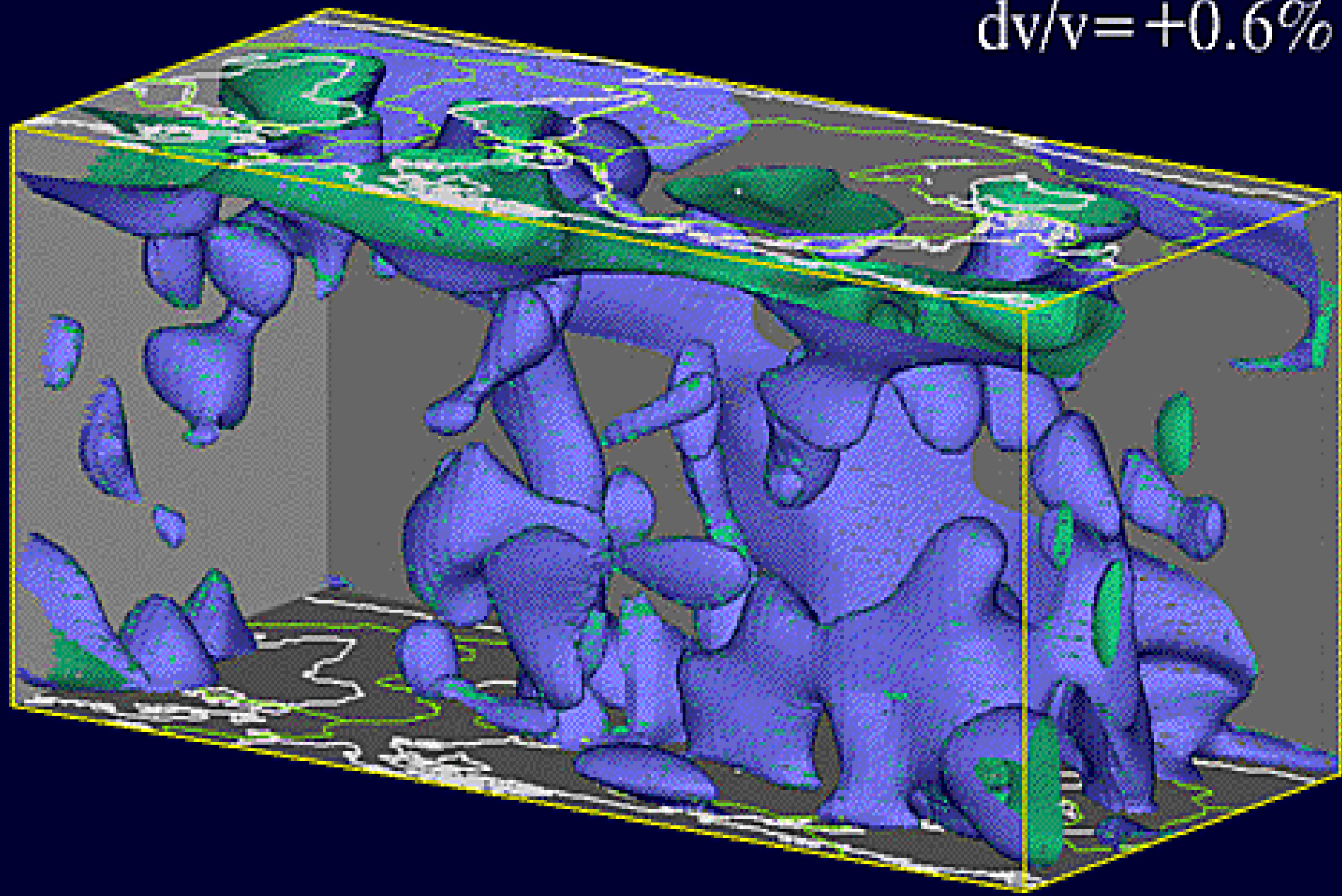


Cross section of mantle velocity

-0.5%



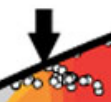
$dv/v = +0.6\%$



Mantle tomography

CENTRAL AMERICA

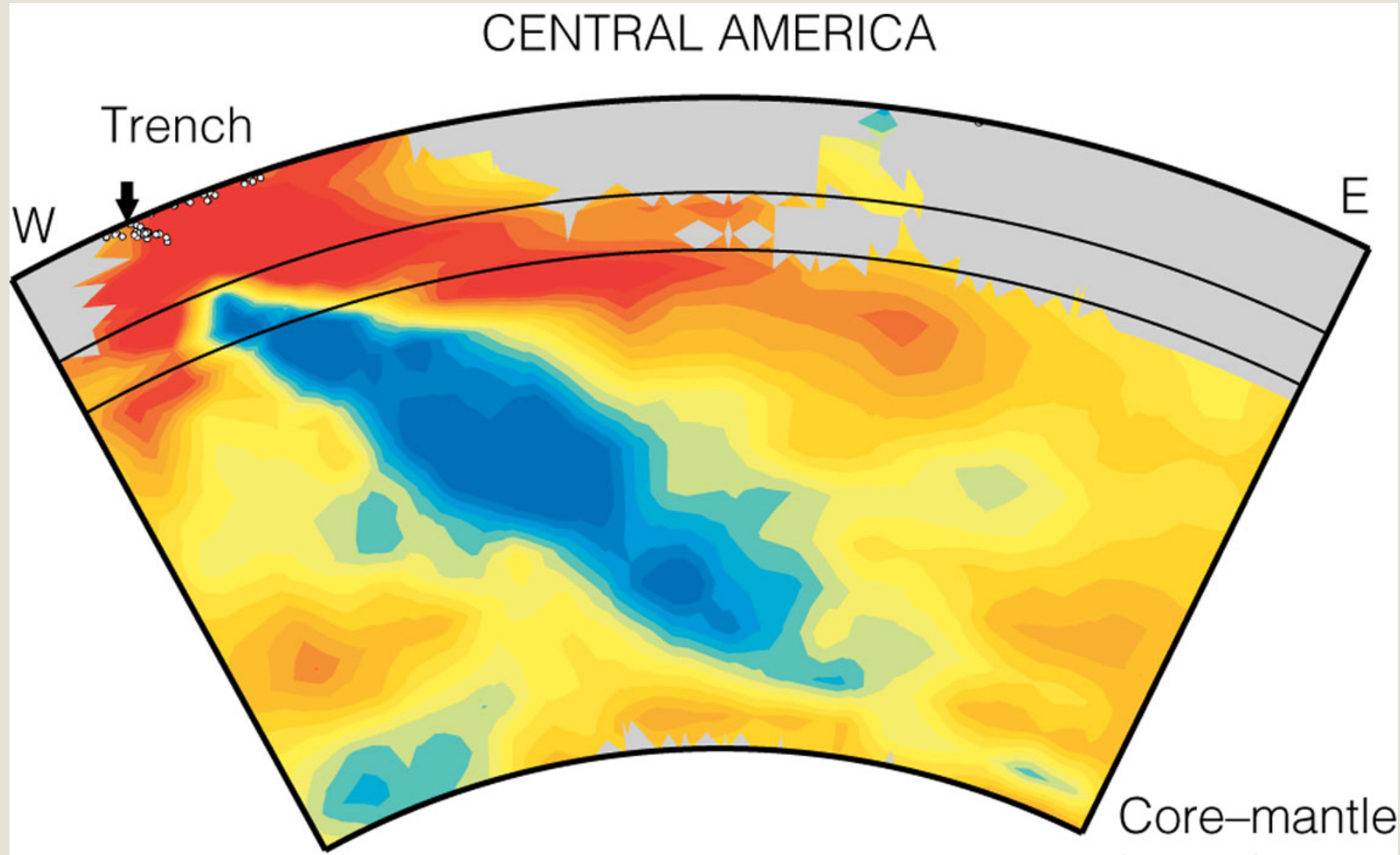
Trench



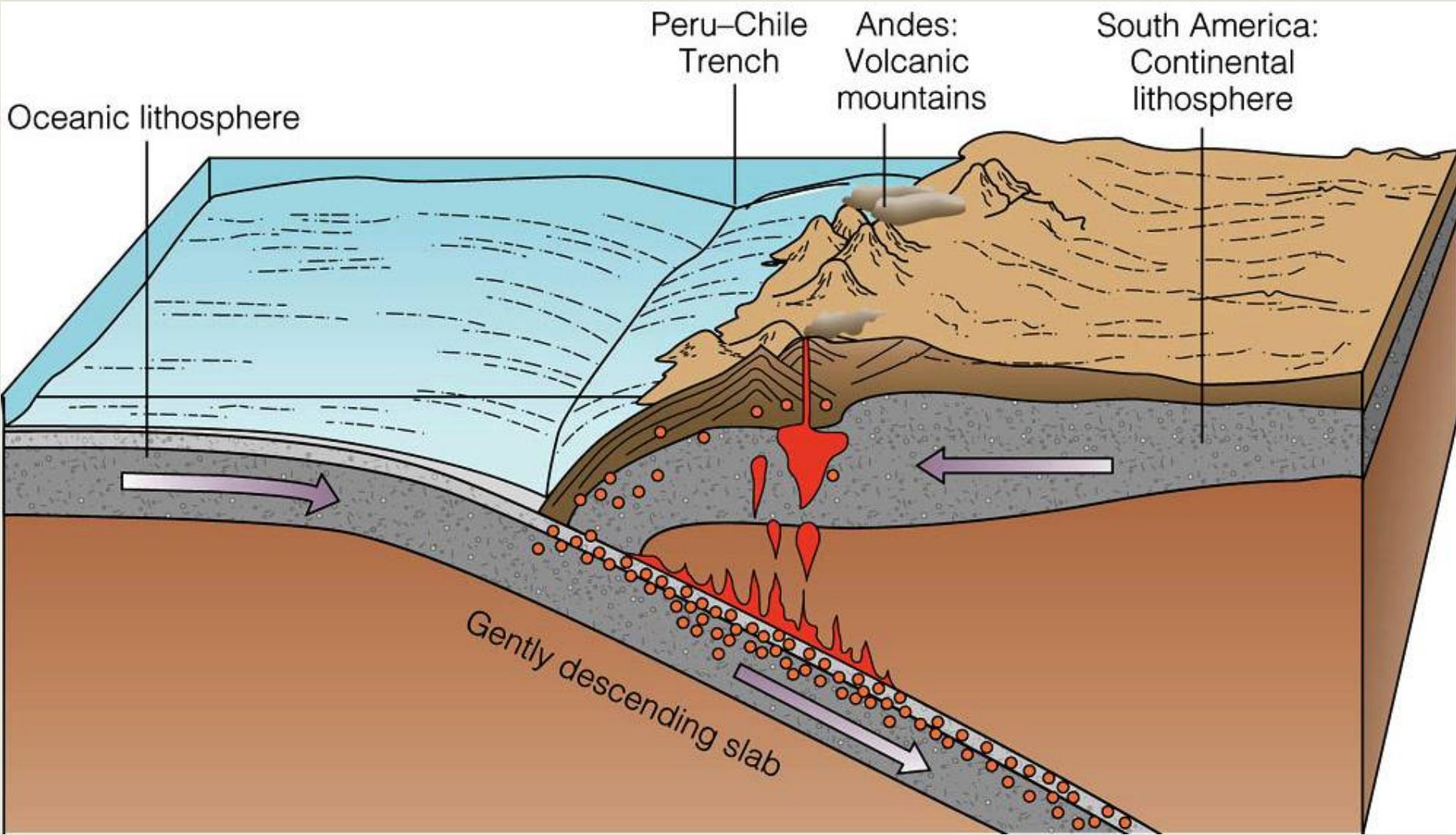
E

W

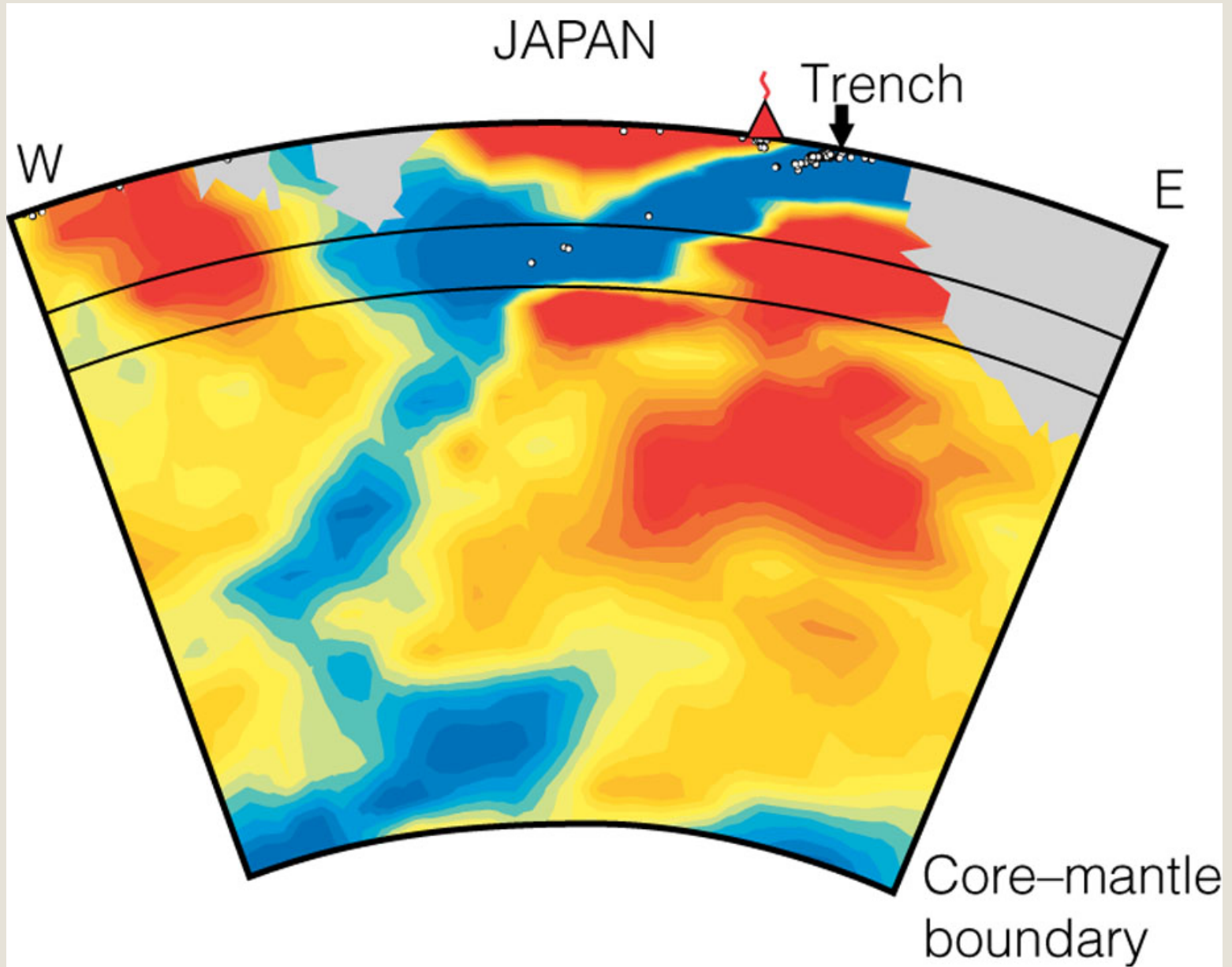
Core-mantle boundary



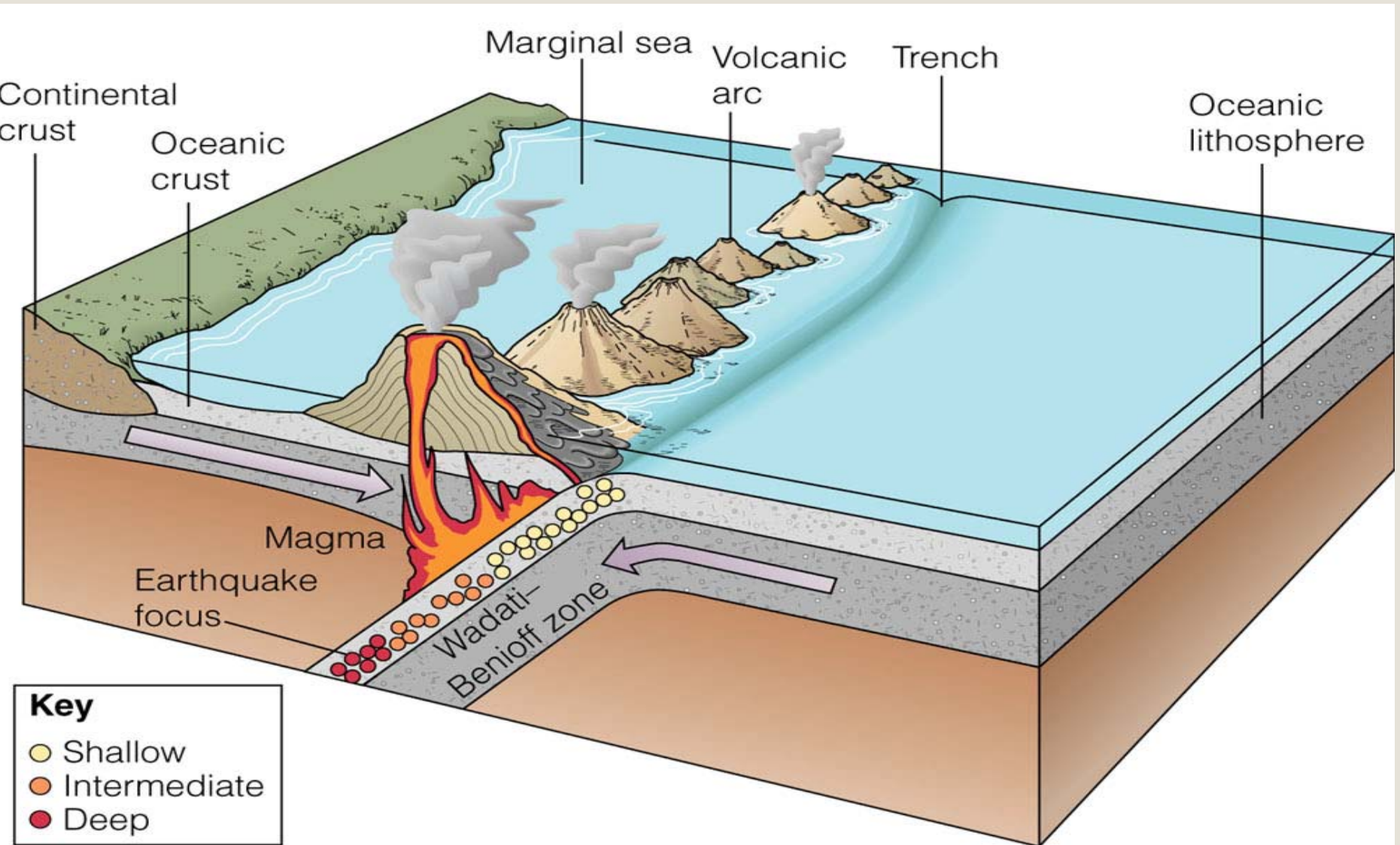
Convergent margin – oceanic to continental



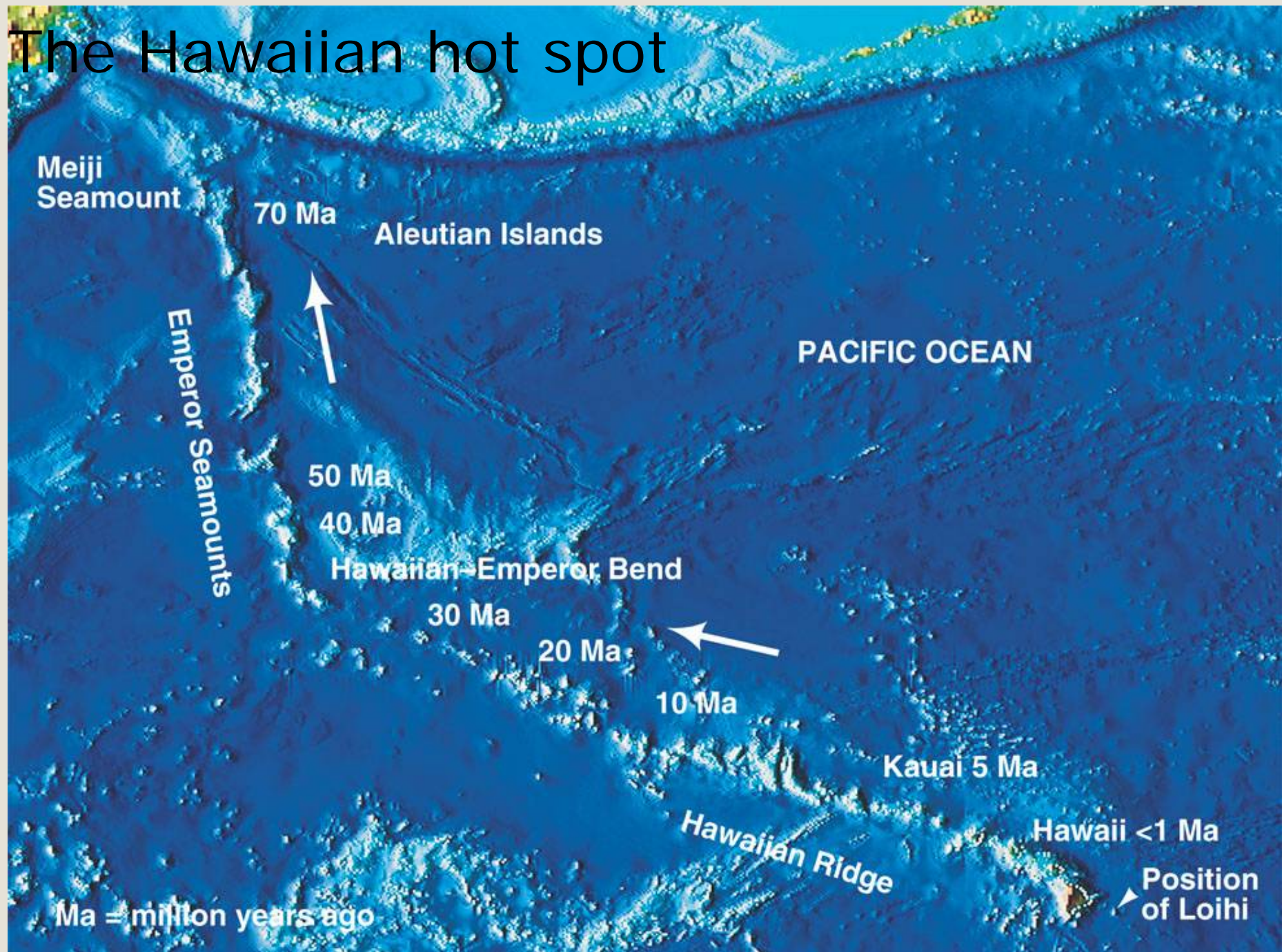
Mantle tomography



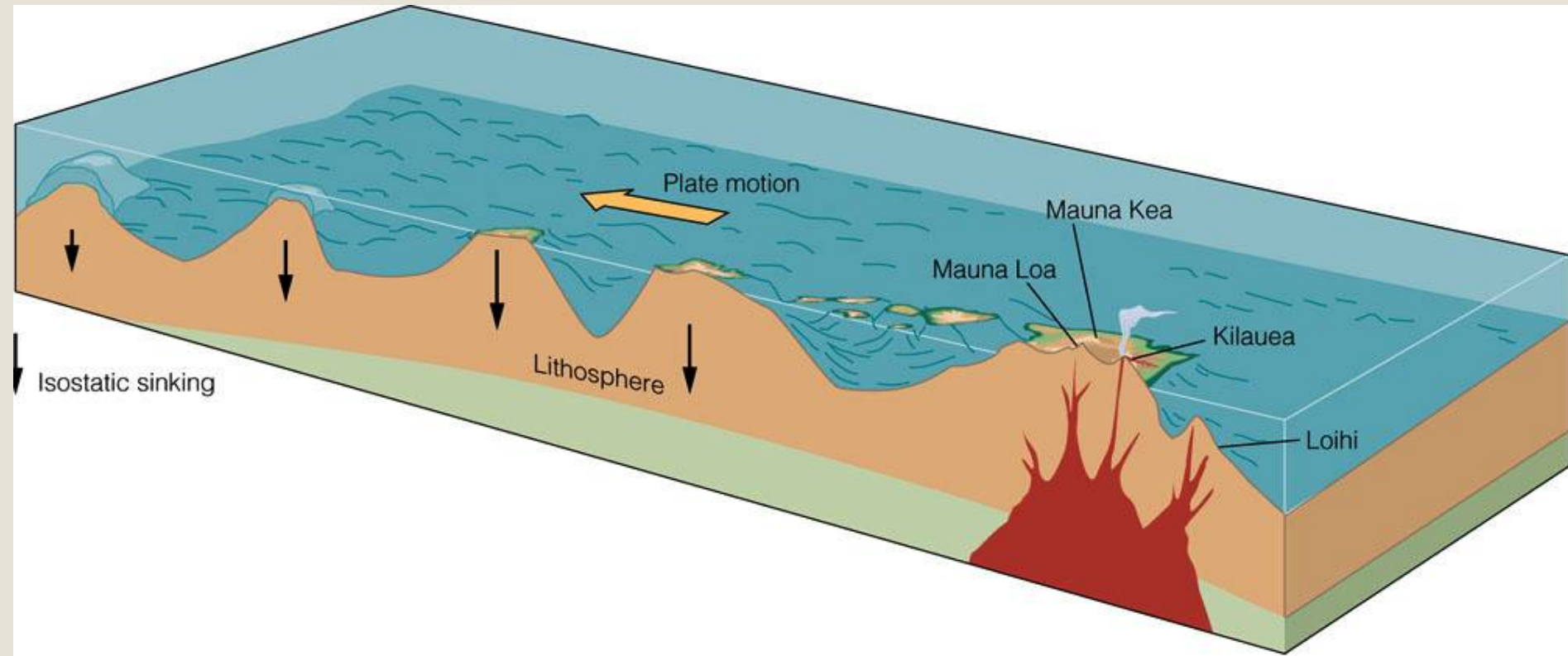
Convergent margin – oceanic to oceanic



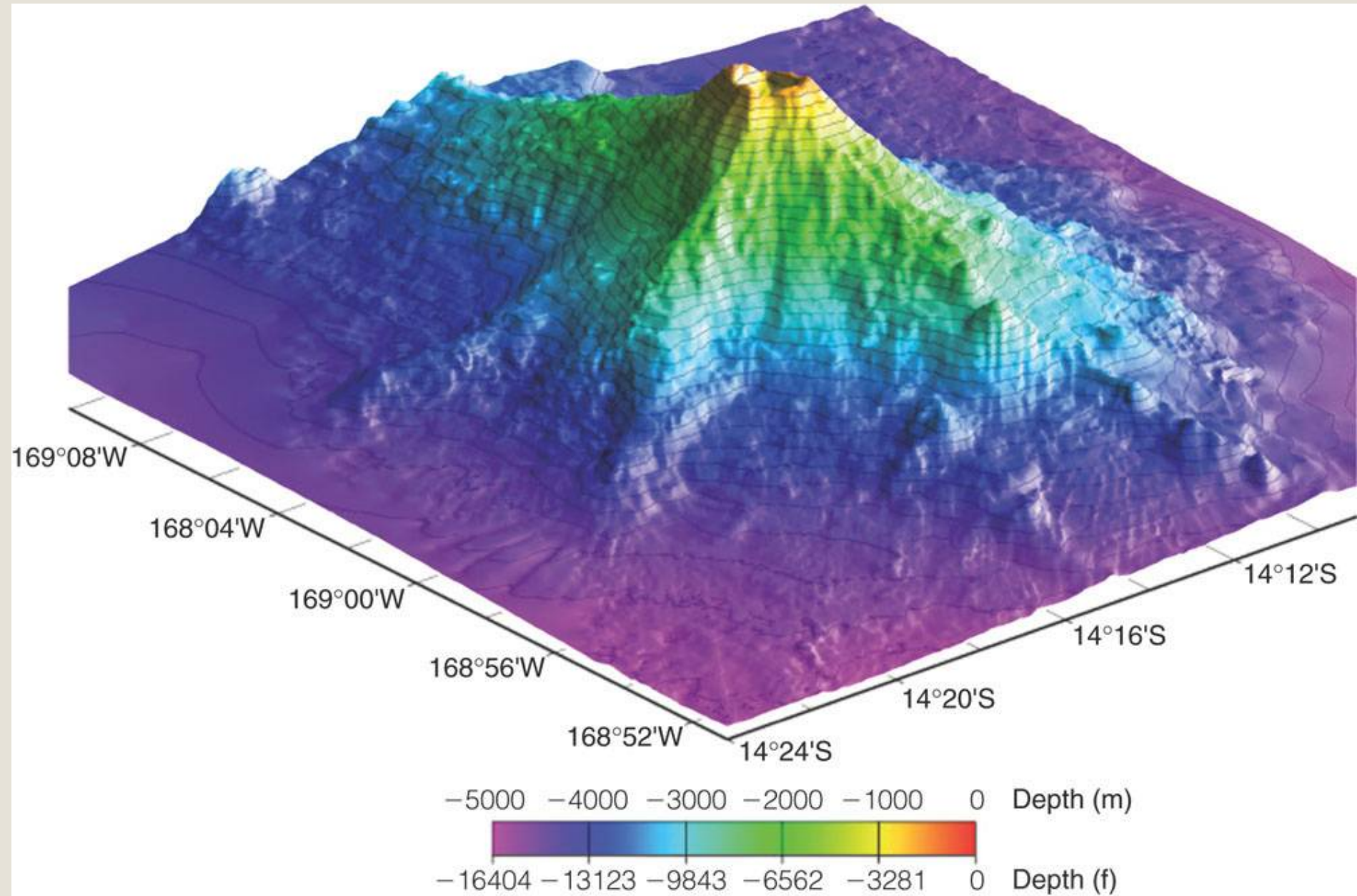
The Hawaiian hot spot



The Hawaiian hot spot



A single seamount



The Hawaiian hot spot

as a mantle
plume

