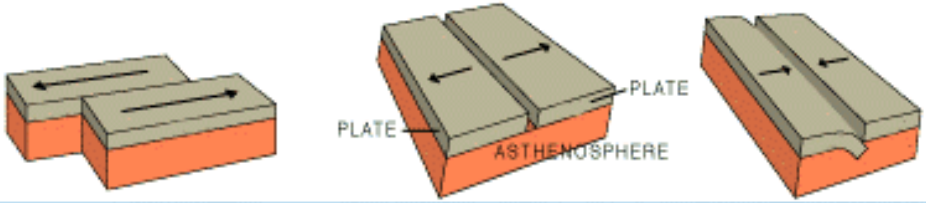
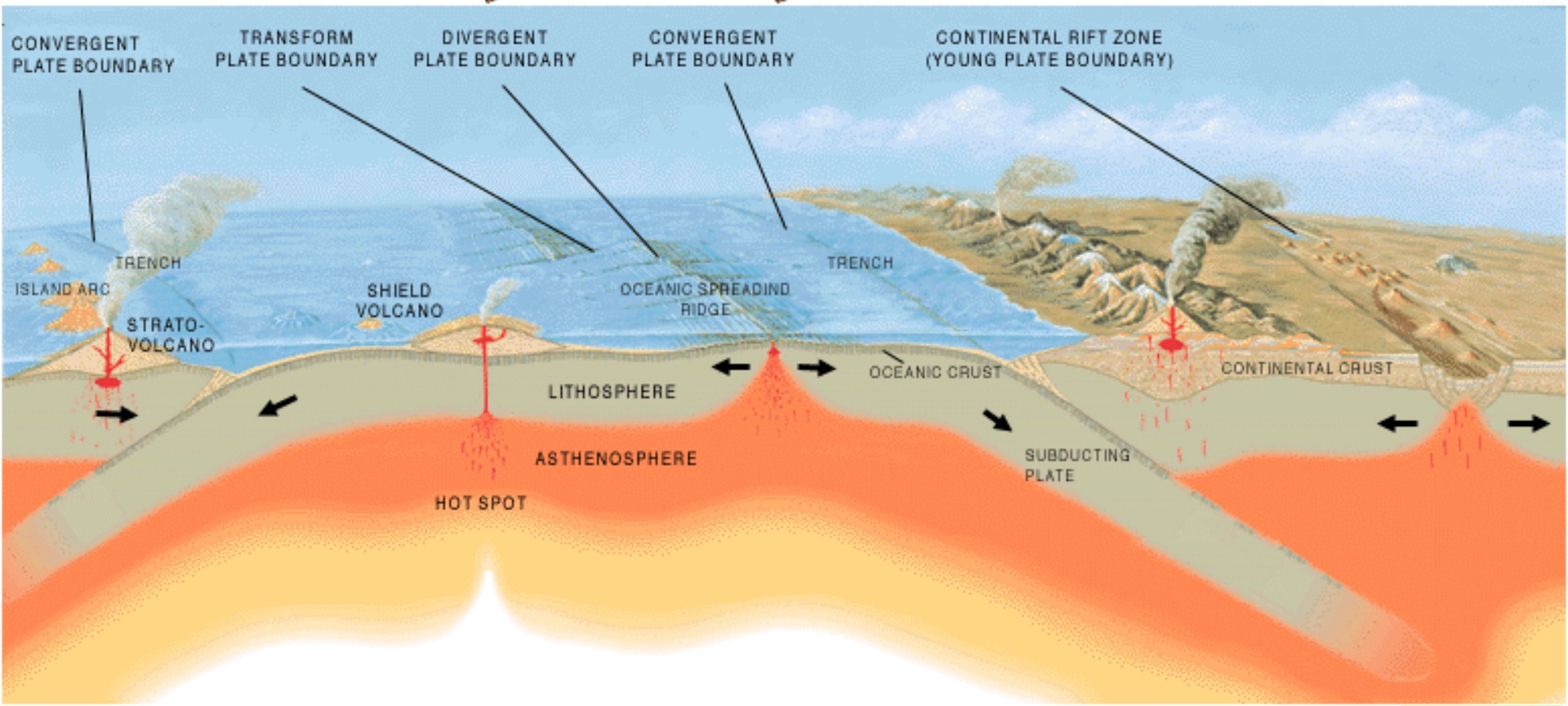
Plate Tectonics





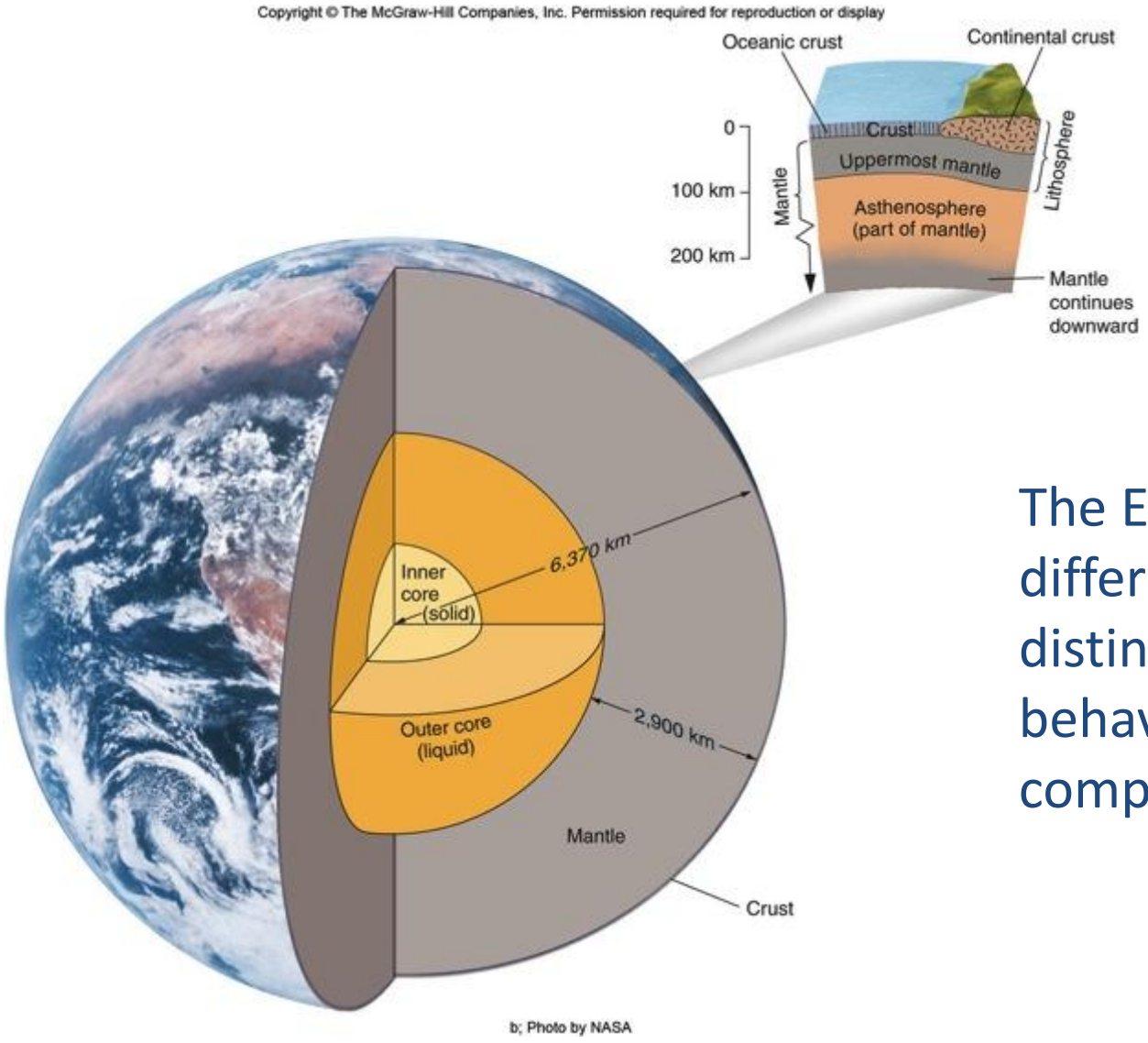
USGS

Basics : Plate Tectonics

Students should be able to:

- Illustrate and label the layers of the Earth (Inner Core, Outer Core, Mantle Regions, Crust) and describe the basic properties of these layers (composition and behavior).
- Identify the components of the lithosphere.
- Describe and draw the different types of plate boundaries (divergent, convergent and transform)
- Recognize and interpret associations between plate boundaries and associated features (eg. Trenches, mountains, volcanoes, mid-ocean ridges)

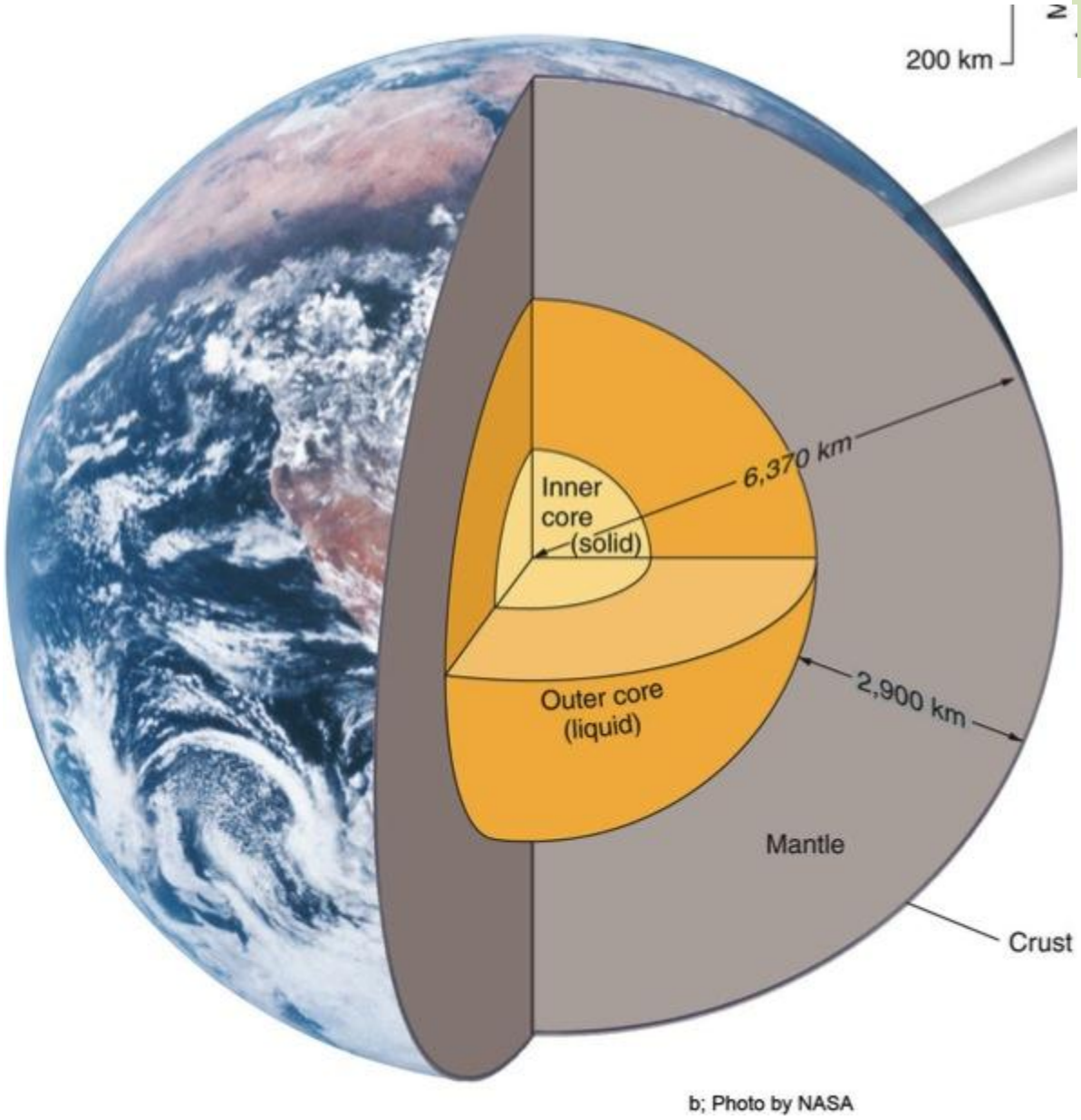
THE EARTH'S LAYERED STRUCTURE



The Earth is divided into different layers that are distinct in terms of their behaviour and composition.

Textbook Figure 1.7

The Core



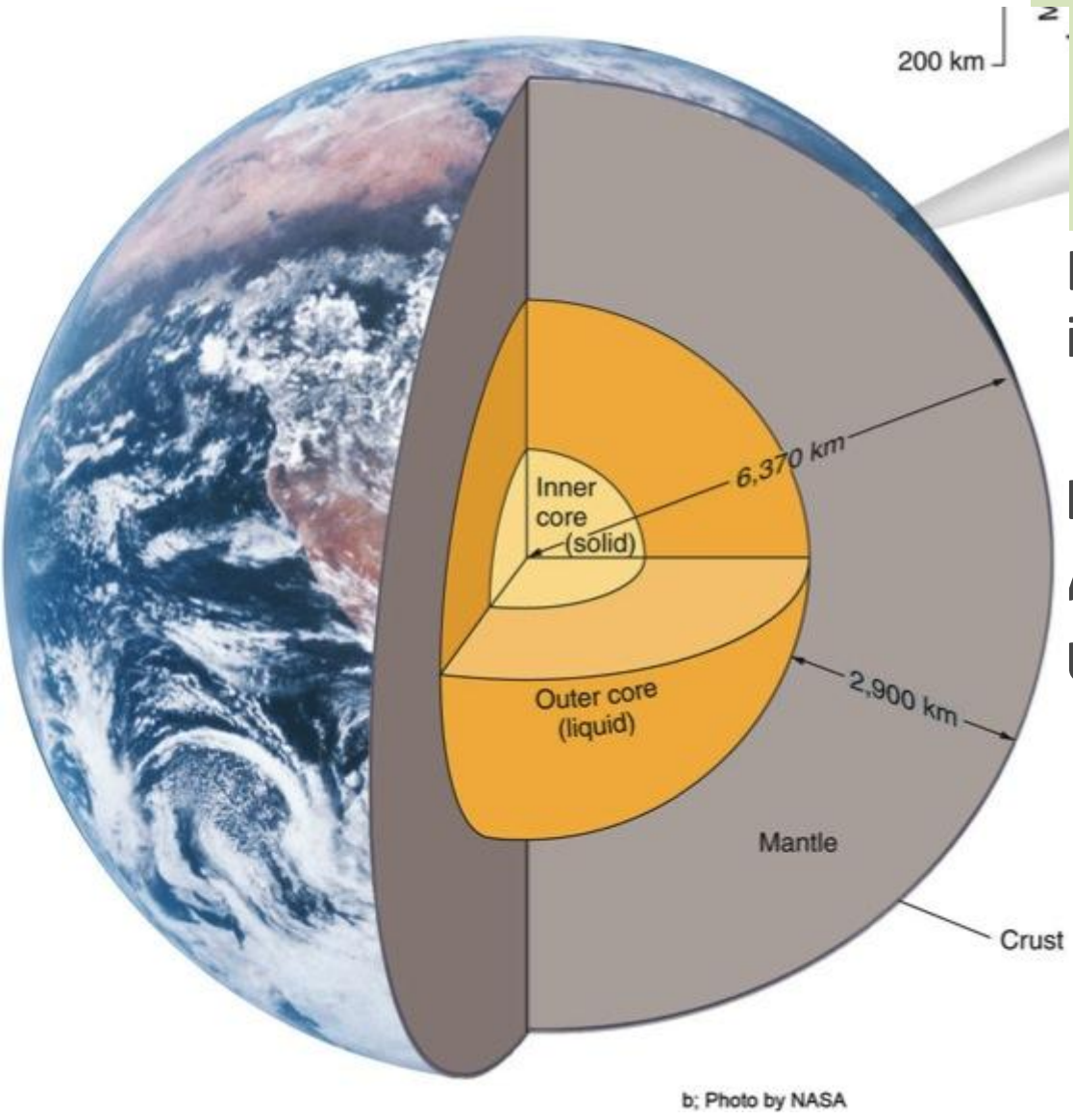
Predominantly iron and nickel

Inner Core is Solid

Outer Core is Liquid

Textbook Figure 1.7

The Mantle

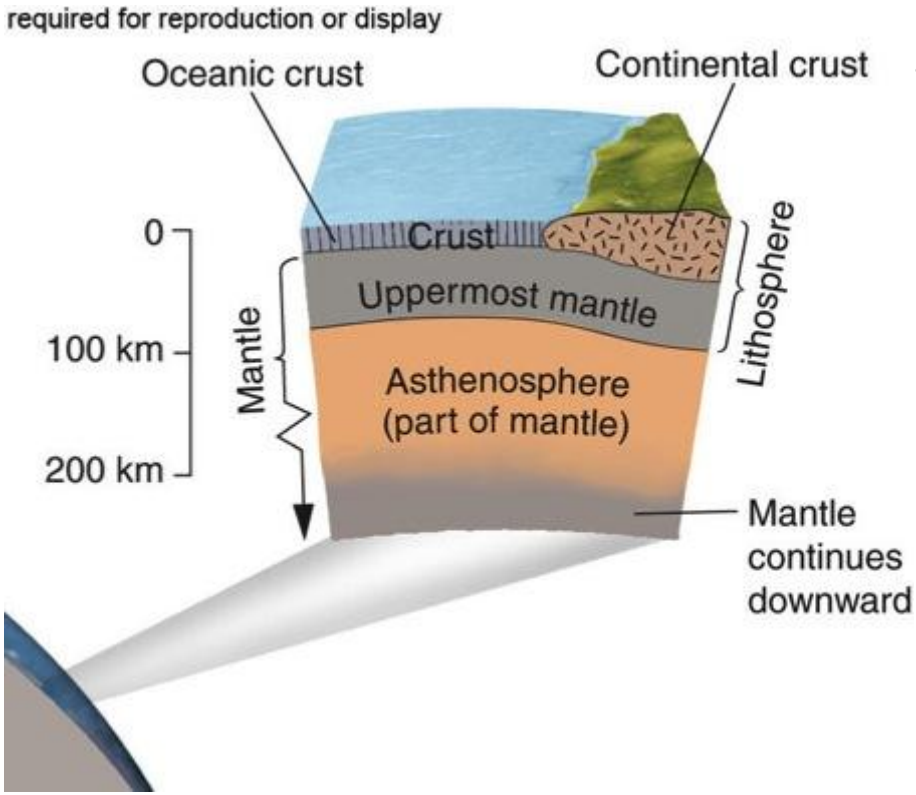


Less dense with abundant iron and magnesium, silicates

Lower Mantle	rigid
Asthenosphere	plastic
Uppermost Mantle	Rigid

Textbook Figure 1.7

Uppermost Mantle + Crust= Lithosphere



The **uppermost mantle** and overlying **crust** are less dense than the underlying layers. Together, they form the rigid **lithosphere** that moves over the plastic asthenosphere.

Lithosphere ranges in thickness from ~50km to ~200 km.

Note that there are two types of crust: **(1) Oceanic Crust**

(2) Continental Crust

Textbook Figure 1.7

Mechanics of the Earth: Internal Layering

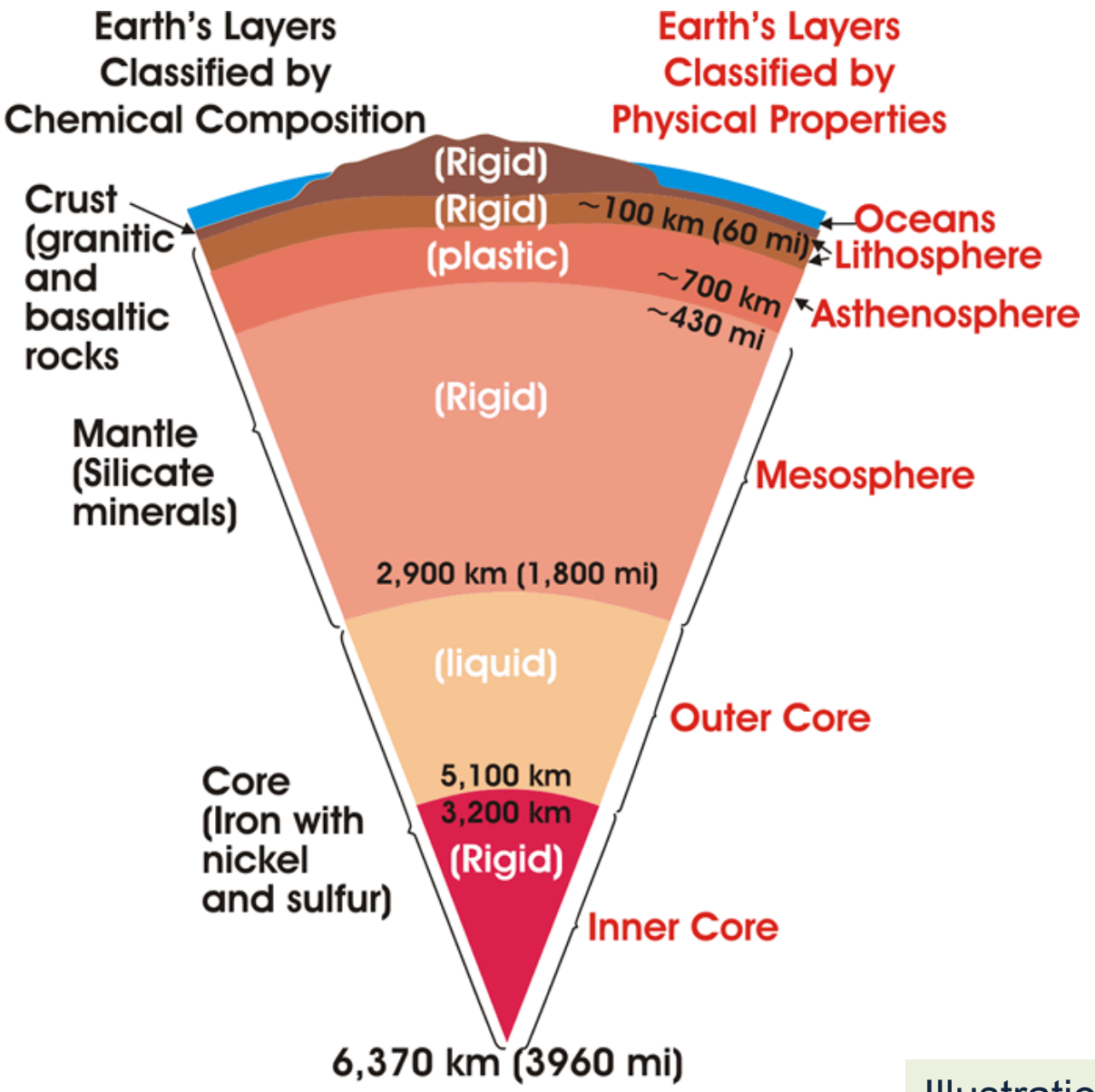
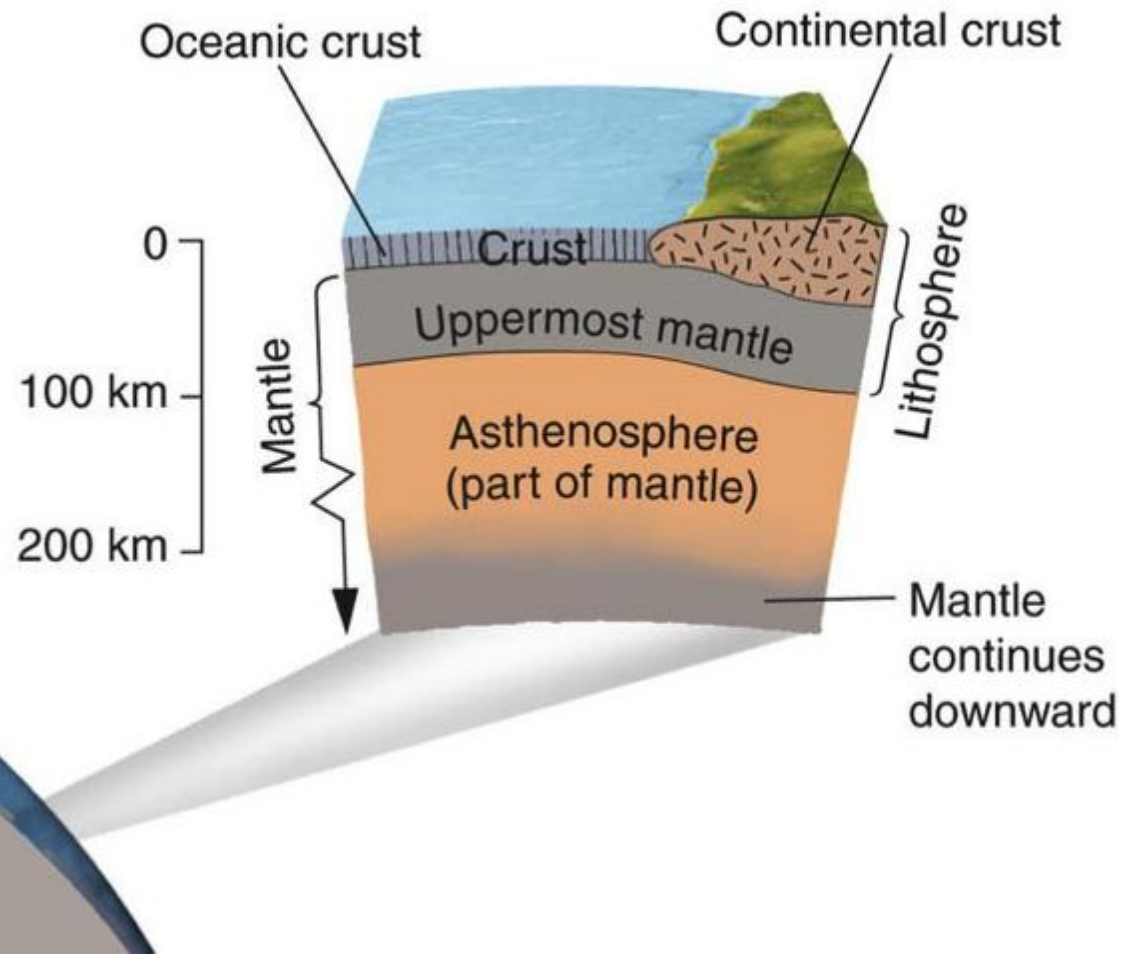


Illustration from USGS

Anatomy of a Plate

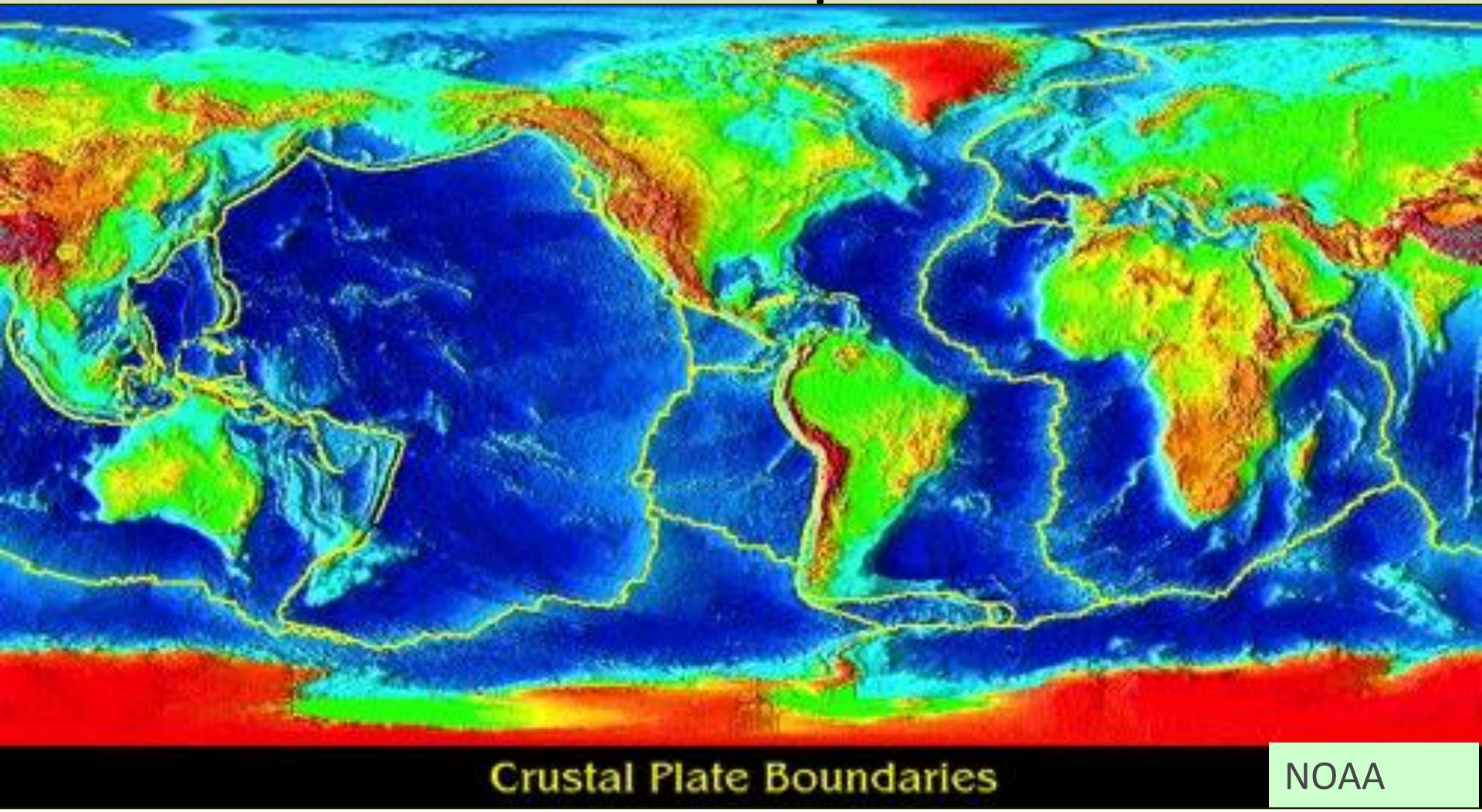


Lithosphere=
Crust + Upper Mantle

Plates are blocks of lithosphere "floating" on ductile asthenosphere

Textbook Figure 1.7

The Lithosphere



The lithosphere is broken into a number of large plates and many more smaller plates.

The lithospheric (tectonic) plates move on top of the weak asthenosphere.

Illustration from USGS

The Lithosphere

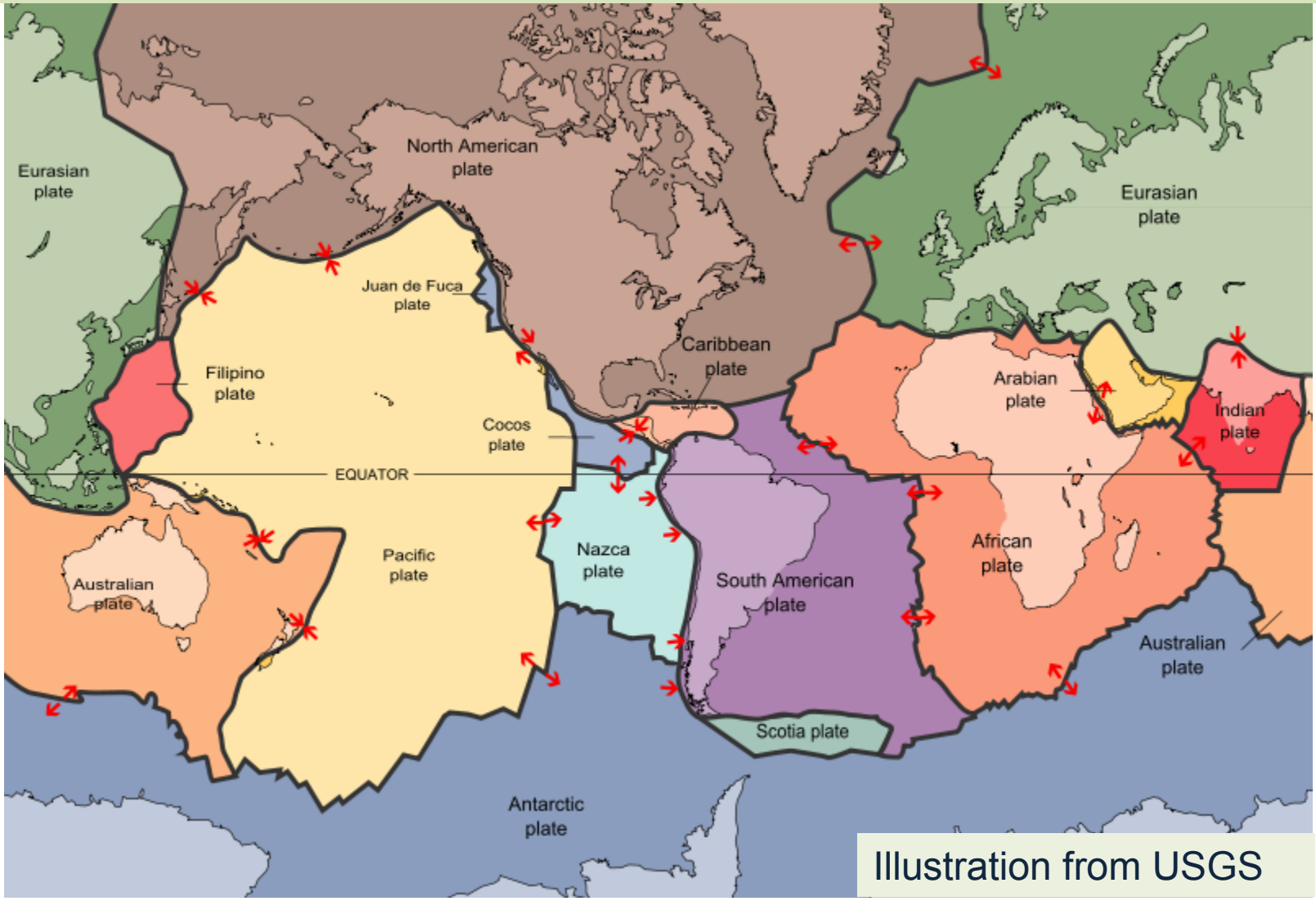


Illustration from USGS

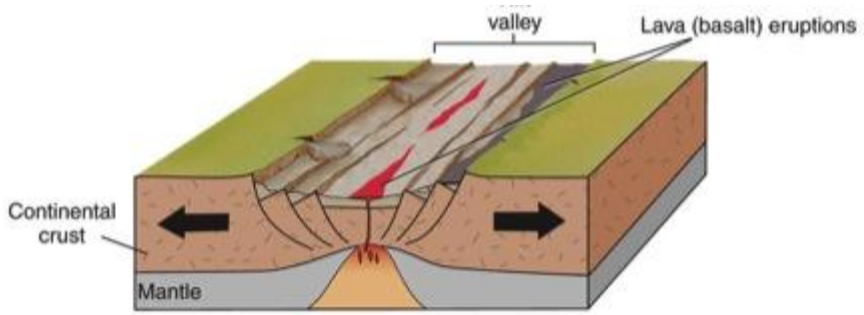
The lithosphere is broken into a number of large plates and many more smaller plates.

The lithospheric (tectonic) plates move on top of the weak asthenosphere.

Divergent Boundaries

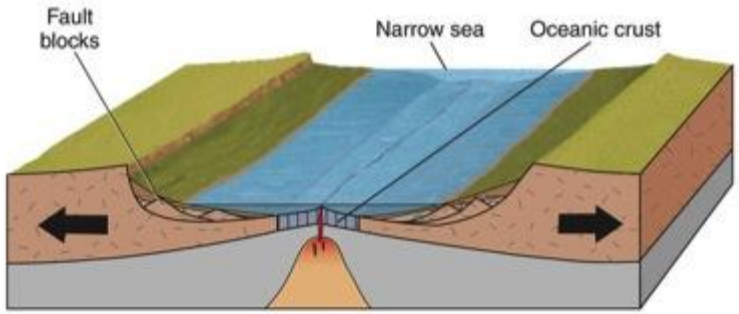
plates are spreading apart

1) Rift Valley



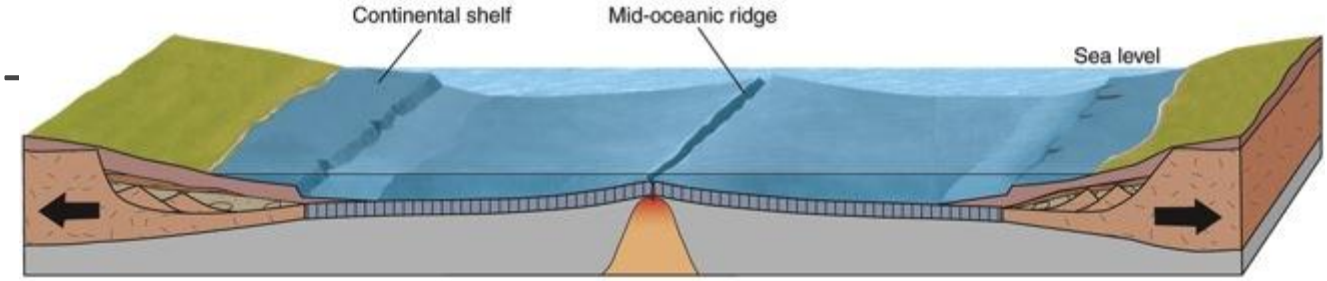
A–Continent undergoes extension. The crust is thinned and a rift valley forms.

2) Continued rifting



B–Continent tears in two. Continent edges are faulted and uplifted. Basalt eruptions form oceanic crust.

3) Mature ocean basin with mid-oceanic ridge

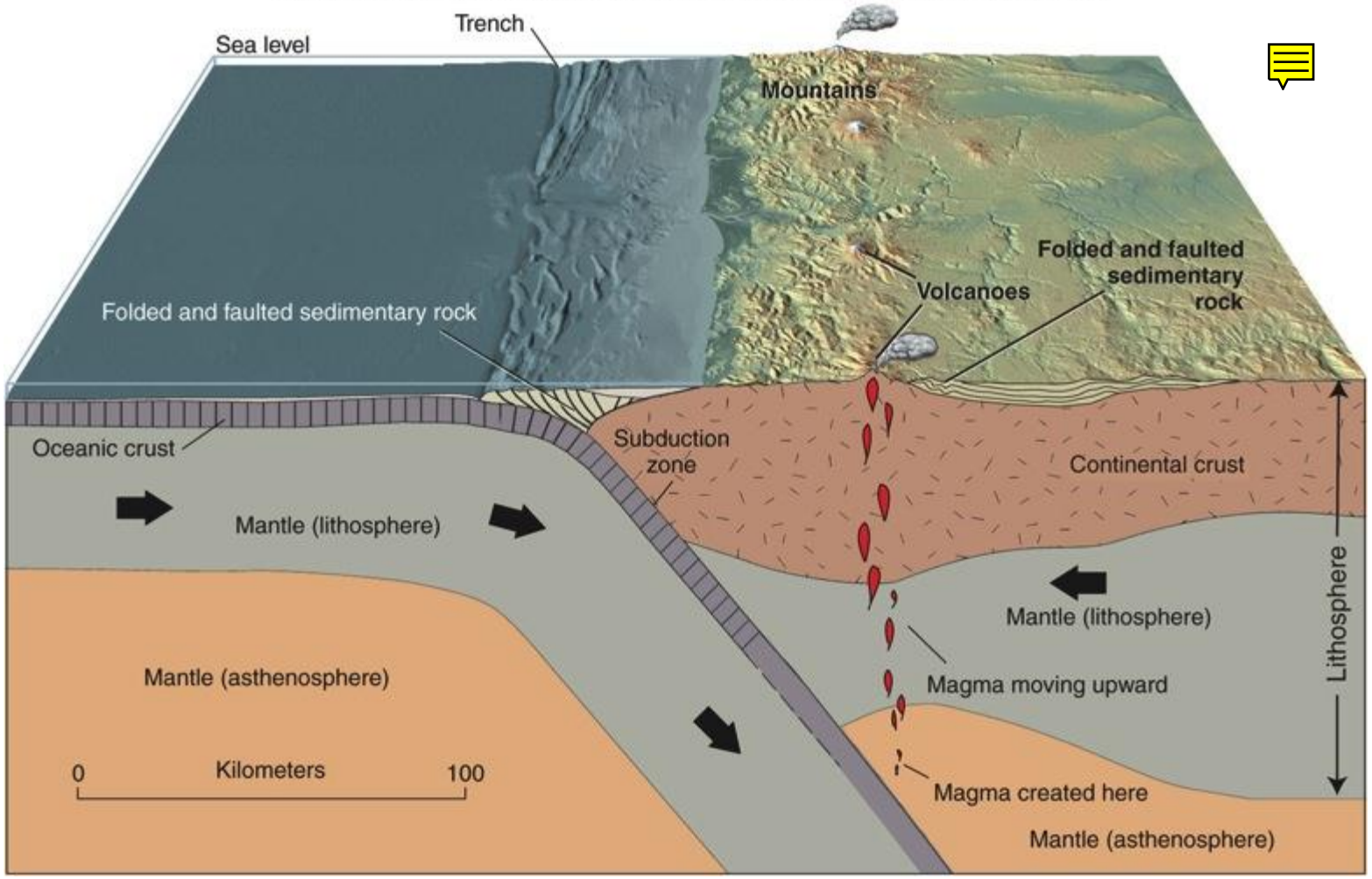


C–Continental sediments blanket the subsiding margins to form continental shelves. The ocean widens and a mid-oceanic ridge develops, as in the Atlantic Ocean.

Textbook Figure 1.9

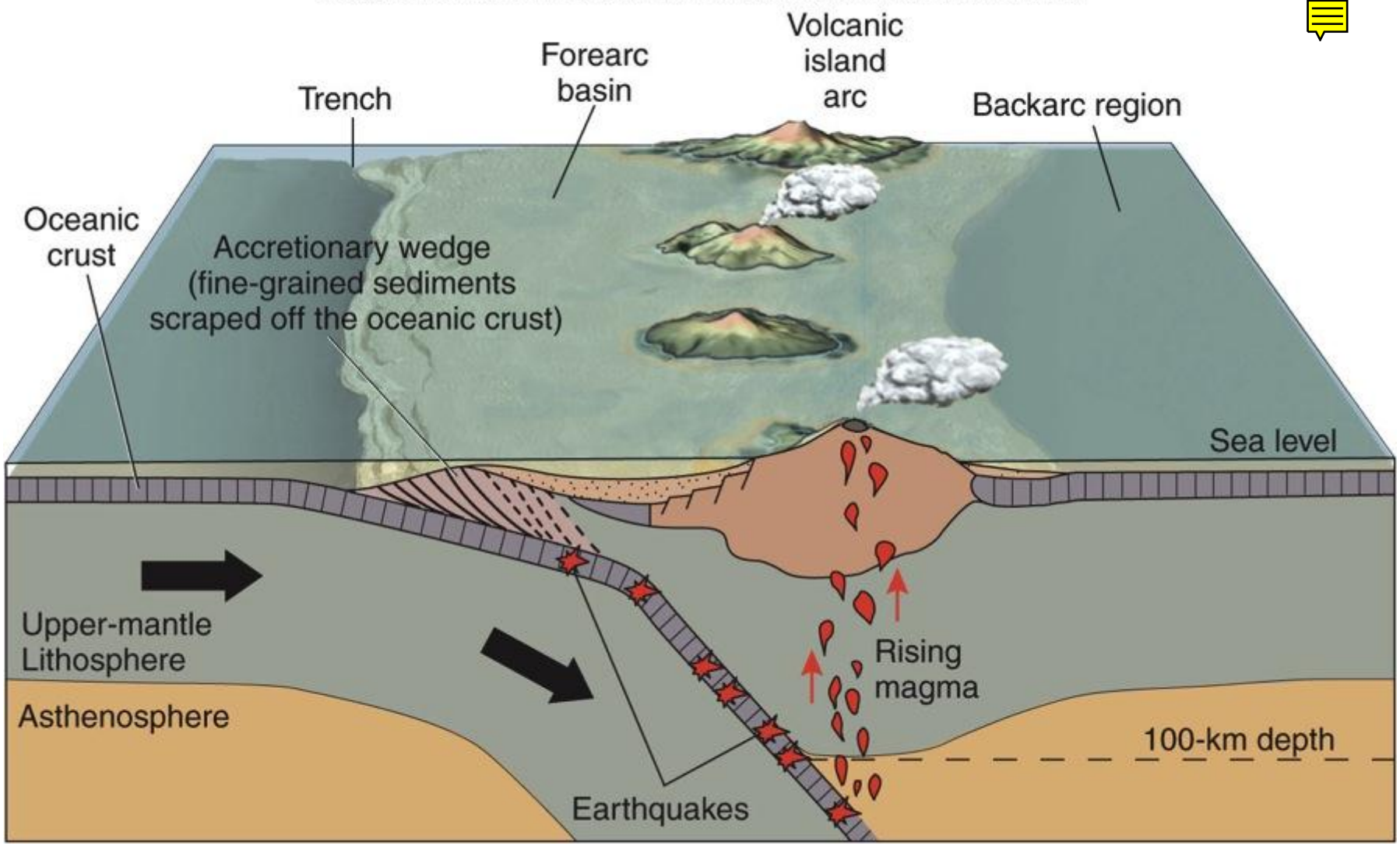
Convergent Boundaries

convergence between oceanic and continental lithosphere



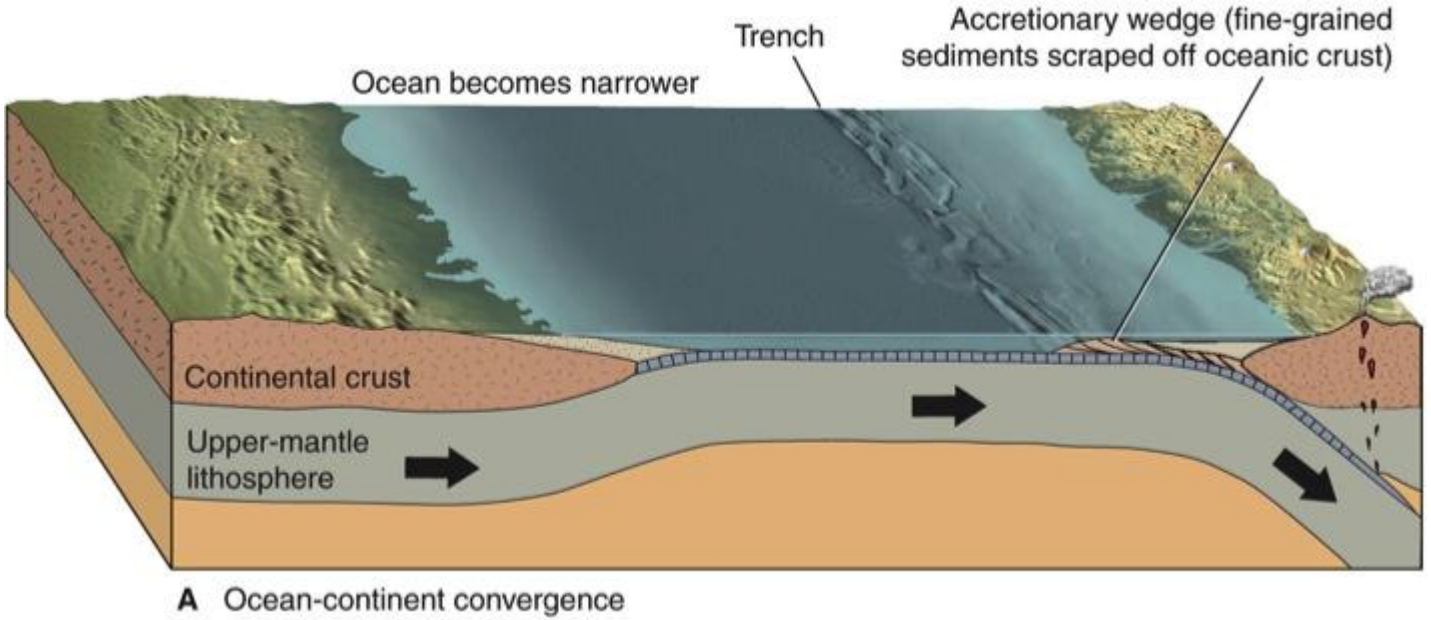
Textbook Figure 1.10

convergence between oceanic and oceanic lithosphere

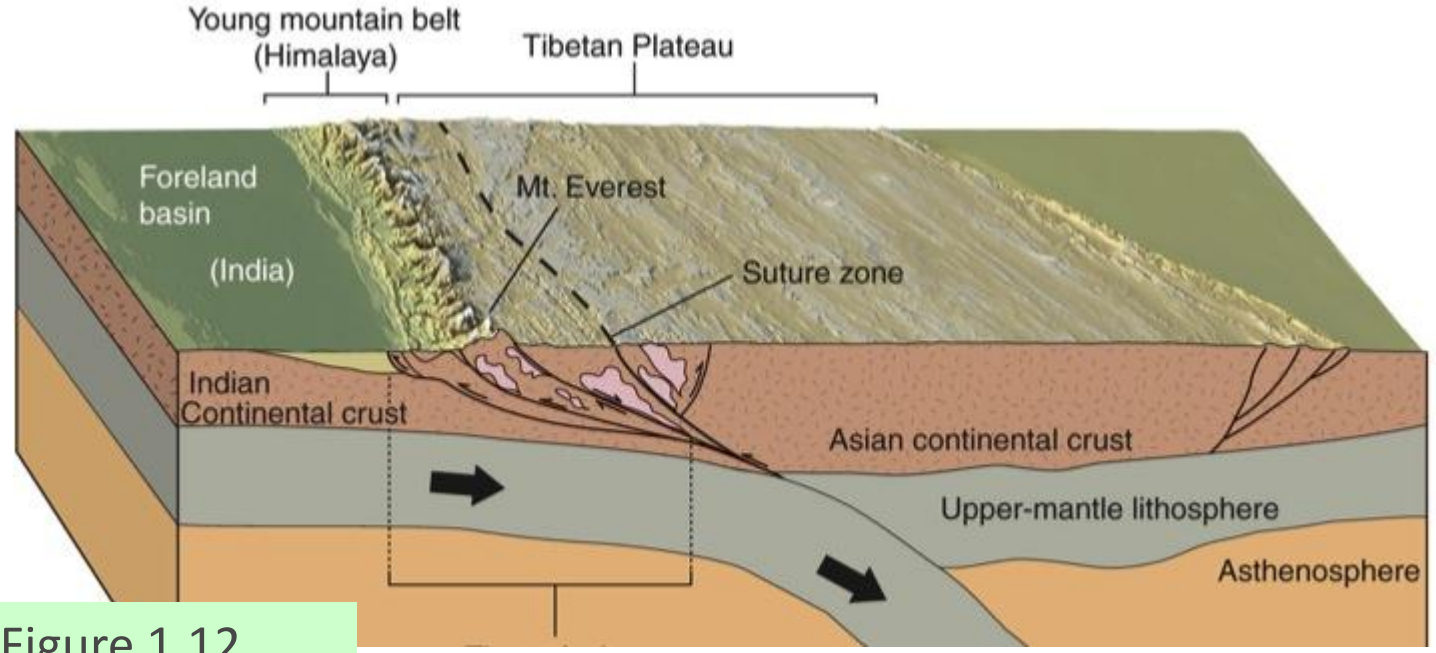


Textbook Figure 1.11

convergence between continental and continental lithosphere



A Ocean-continent convergence

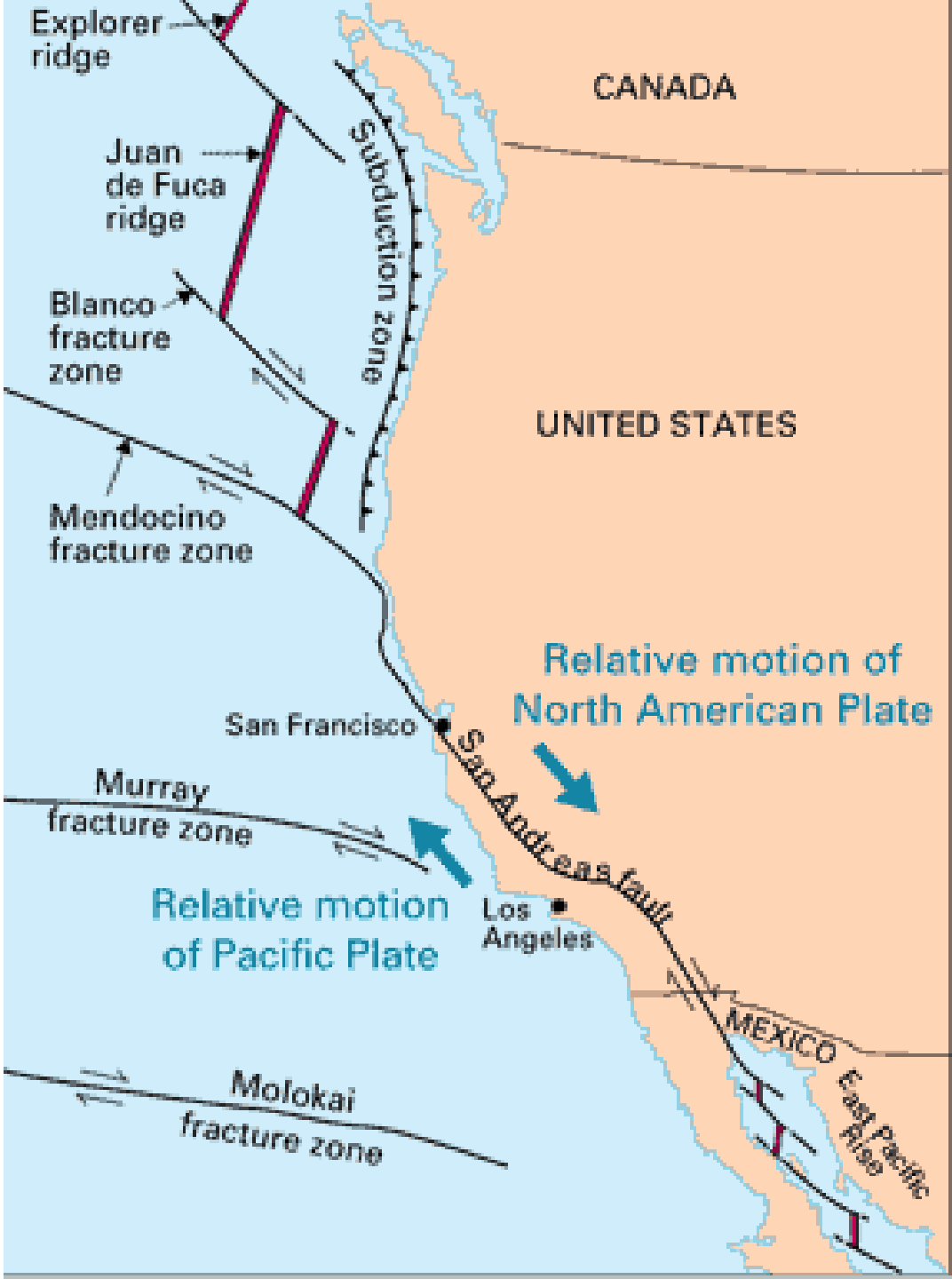


Textbook Figure 1.12

Transform Boundaries

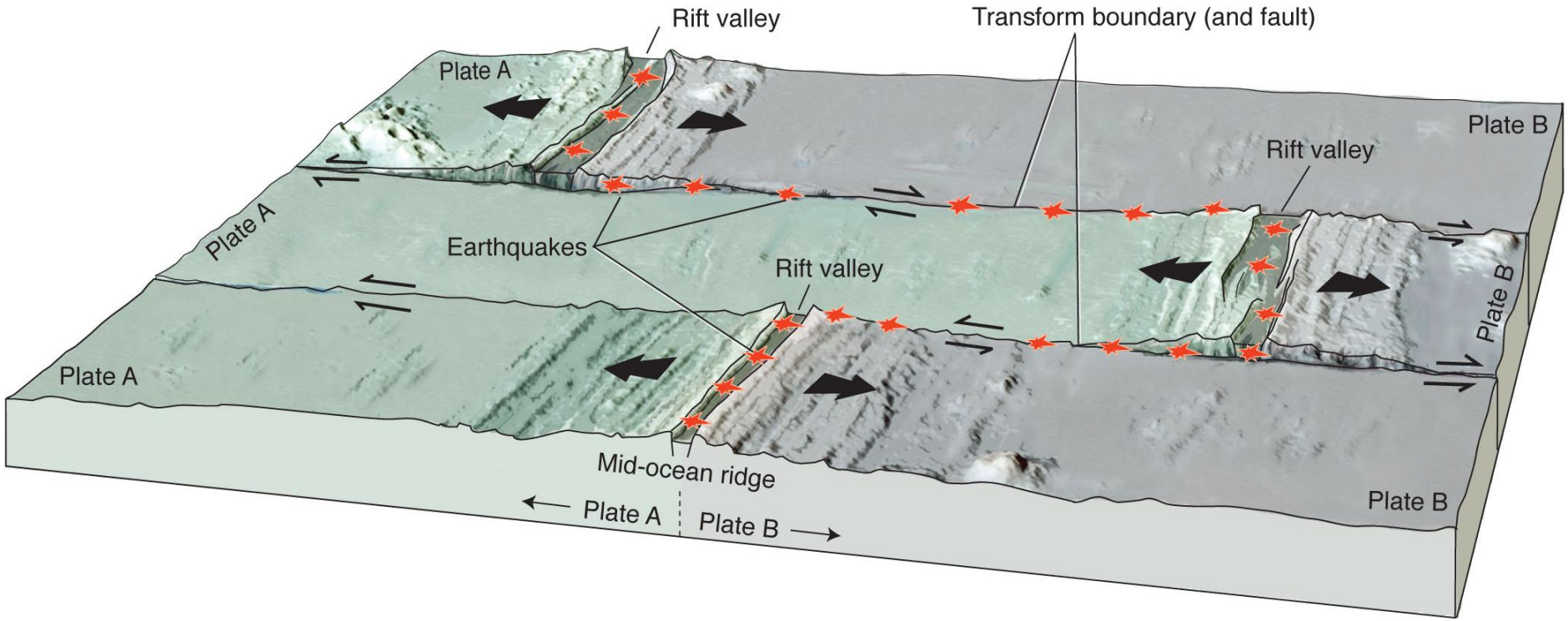
plates are sliding past one another

Why?



Textbook Figure 1.13

Transform Boundaries



Plates are sliding past one another. Why?

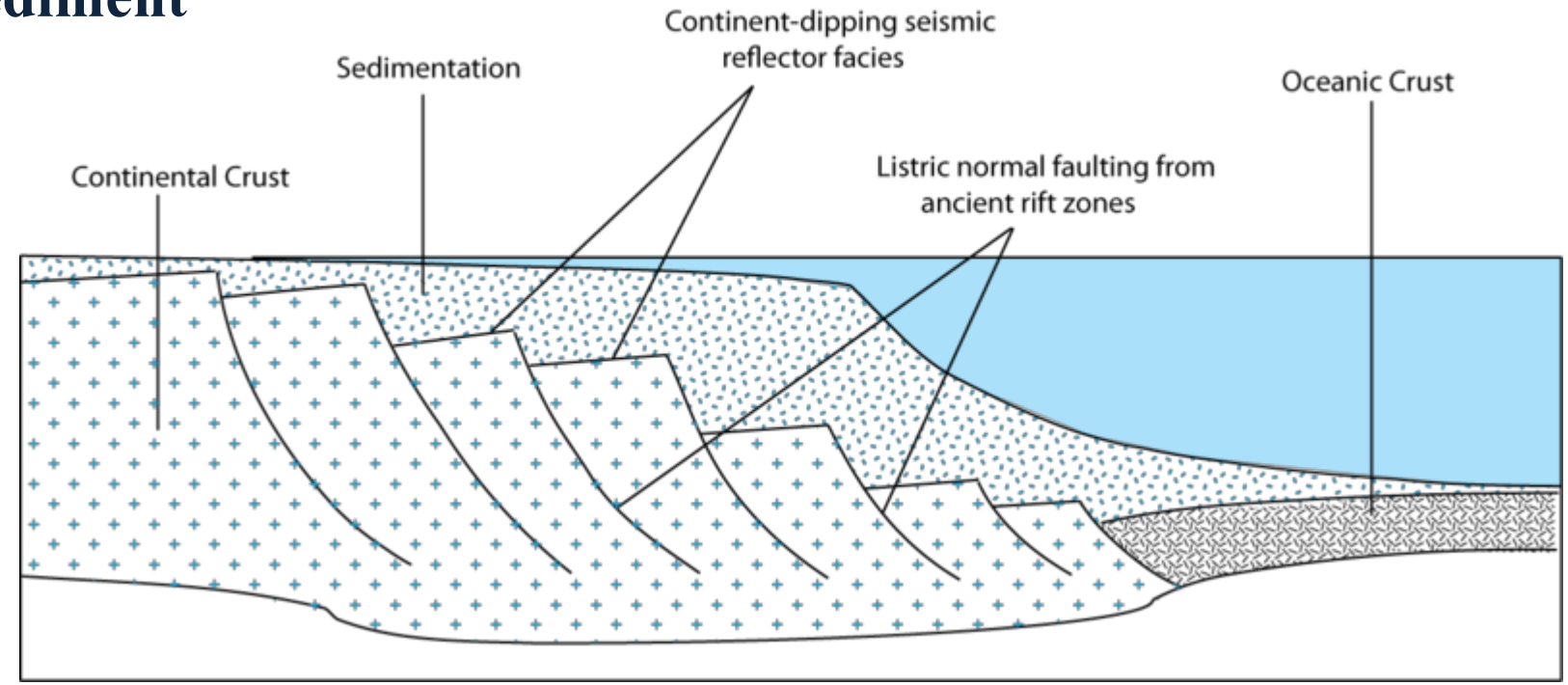
Textbook Figure 1.13

Types of Margins: Active v. Passive

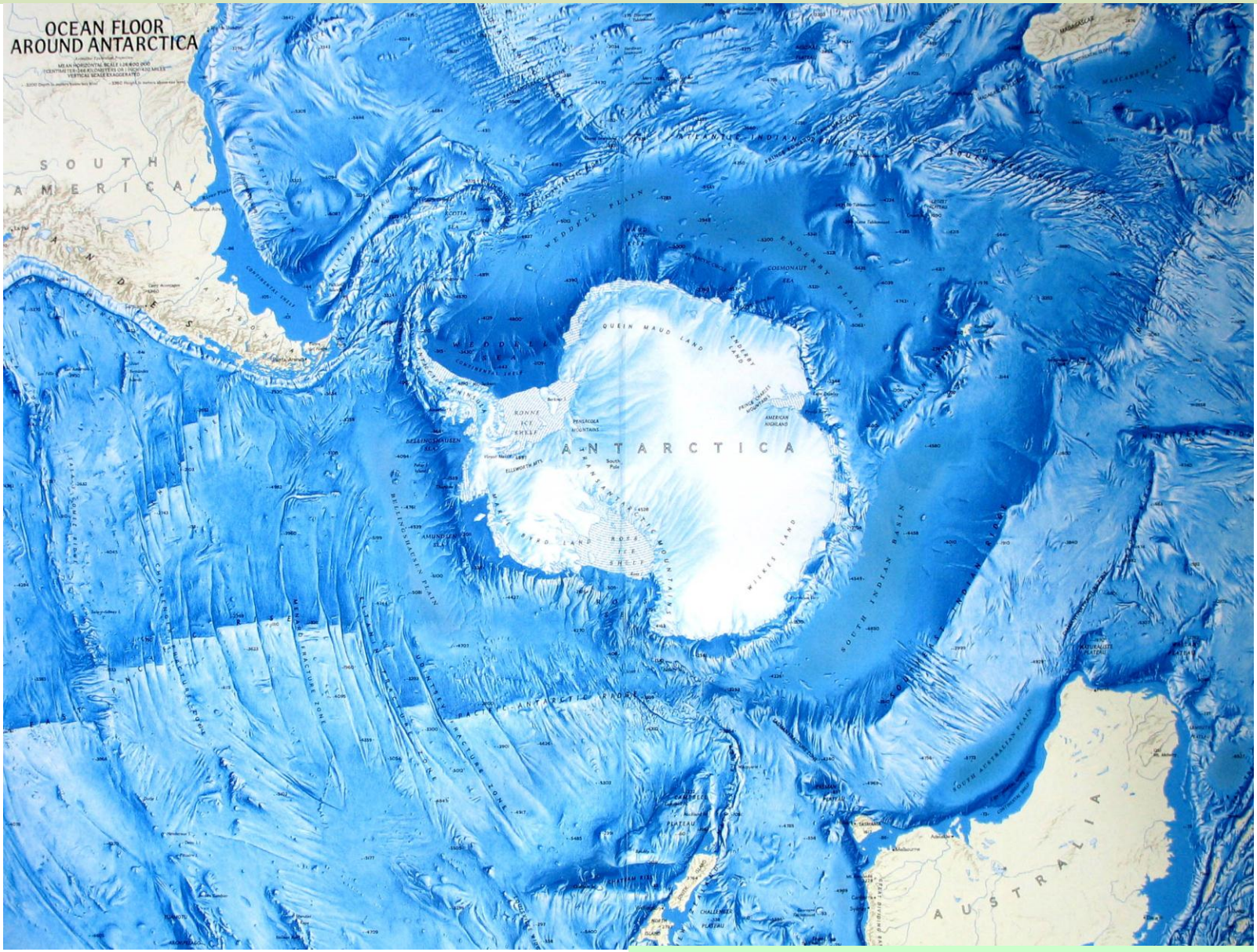
We refer to the regions where lithospheric plates are interacting with each other as **Active Margins**

Transitions between oceanic and continental crust where there is no interaction between plates are referred to as **Passive Margins**

Passive Margins are typically marked by thick accumulations of sediment



Types of Margins: Active v. Passive



Bathymetric Map: National Geographic Society

Active and Passive Margins

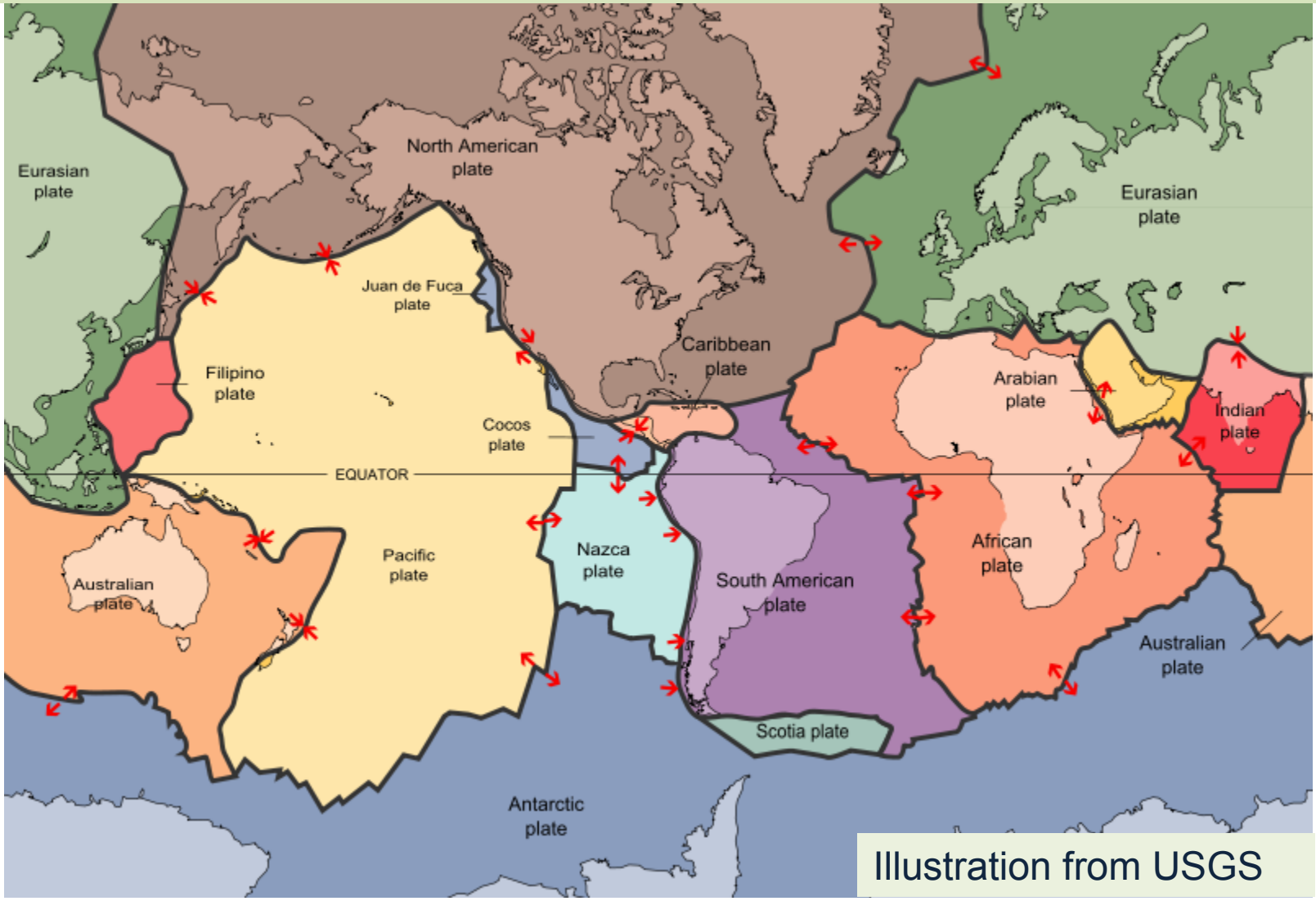
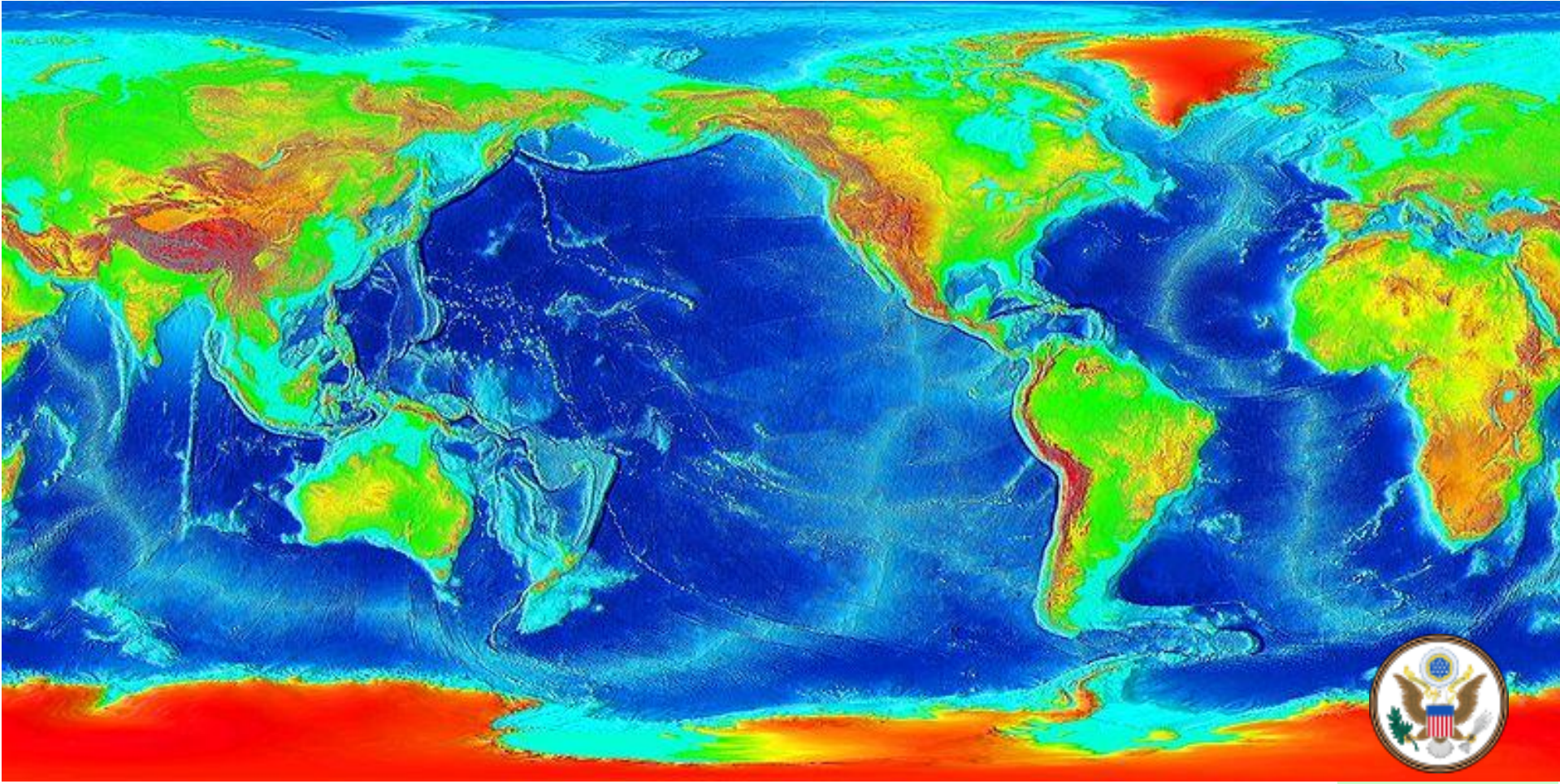


Illustration from USGS

What is happening around Antarctica?



NOAA

Landforms and features associated with different margins form broad belts across the Earth.

Note: Trenches at subduction zones, mountains at convergent boundaries, ridges at divergent margins & offset of mid-ocean ridges at transform boundaries.

Terms to Get Comfortable With

Divergent/Convergent/Transform Boundary

Subduction Zone

Trench

Spreading Ridge/mid-ocean ridge

Lithosphere

Plate

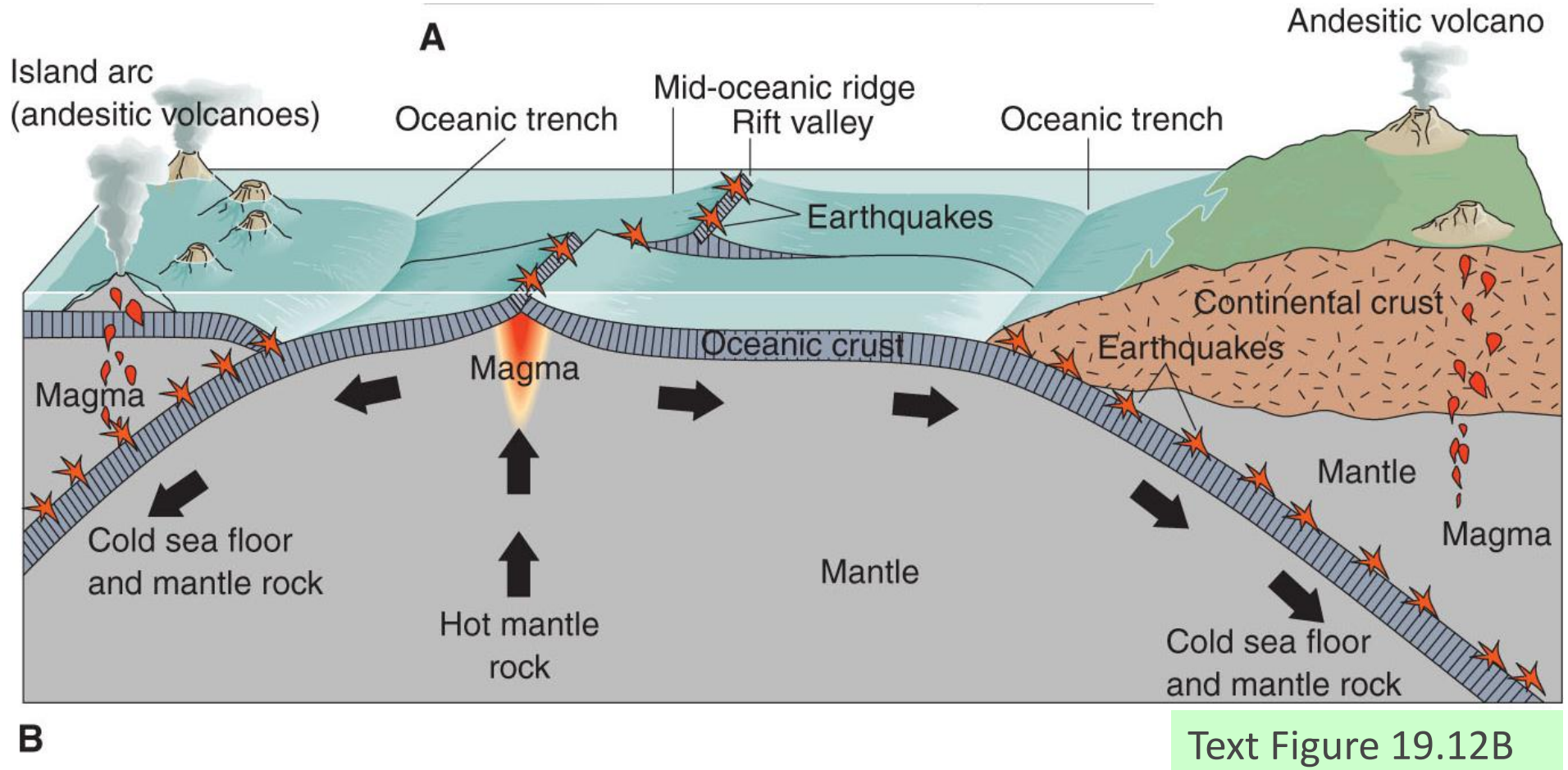
Crust

Mantle

Asthenosphere

Inner/Outer Core

Next Class: Plate Tectonics II



Text Figure 19.12B

Readings & Reminders

For next class- Chapter 19 or tectonics chapter(s) of any introductory text.

Looking online? Try: http://pubs.usgs.gov/gip/dynamic/dynamic.html

Describe the development of plate tectonic theory . What were/are the lines of evidence? How do they relate to Wegener‘s original hypothesis?

What drives plate movements?

What is a hot spot?

What are the differences between the three types of convergent boundaries in terms of

a) what kind of plates are involved

b) what happens to the two interacting plates

c) which types are associated with volcanic activity and why?