

Important information from Chapter 1

Distinguish between:

Natural hazard // Disaster // Catastrophe

What role does human population play in these categories?

Know how to read a Hazard Map, such as Figure 1.4 in your textbook.

What is a tectonic plate?

How many major plates are there?

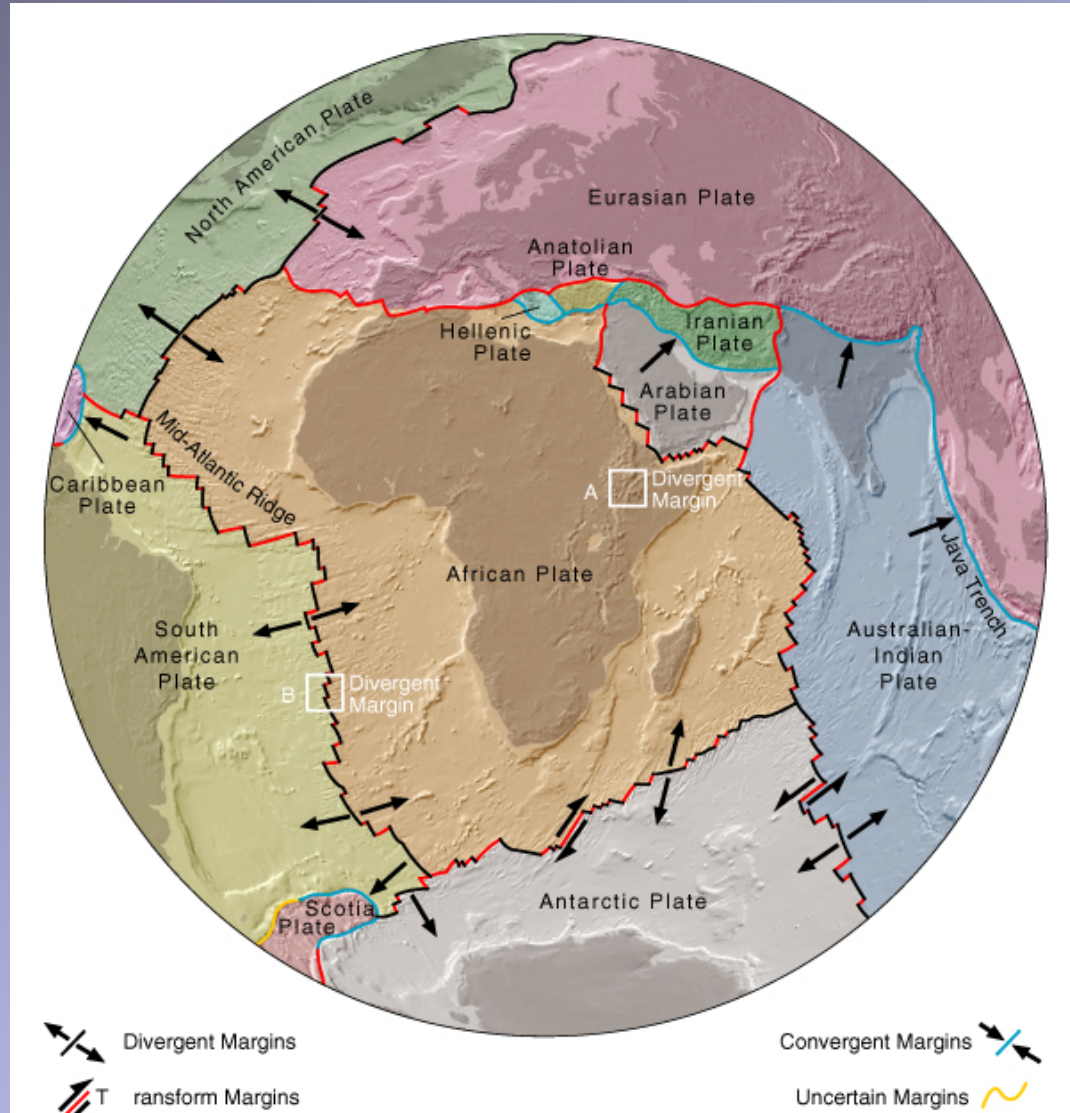
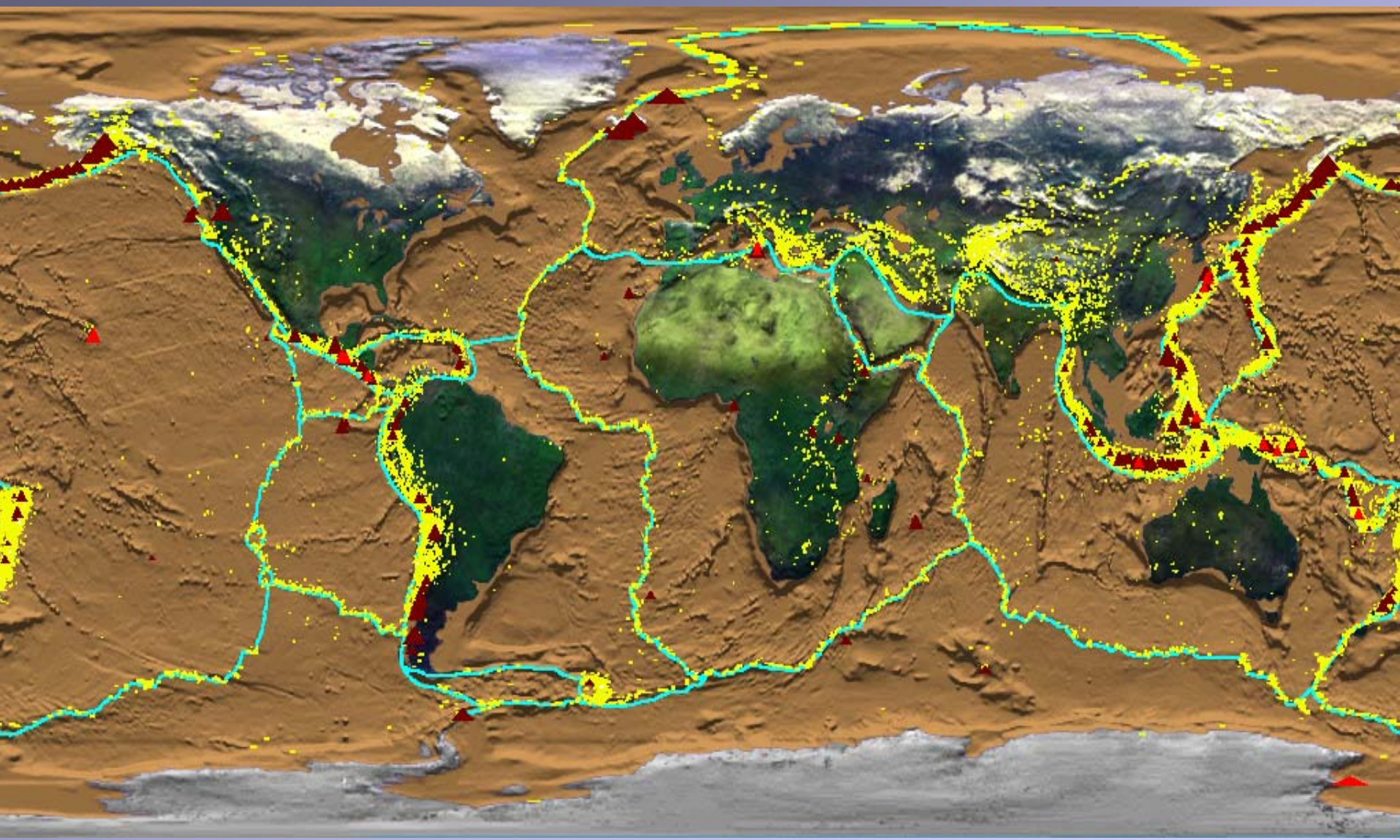


Plate Tectonics – Plate Margins



The three primary interior layers of the Earth, determined from seismic velocity are:

Starting from the top....

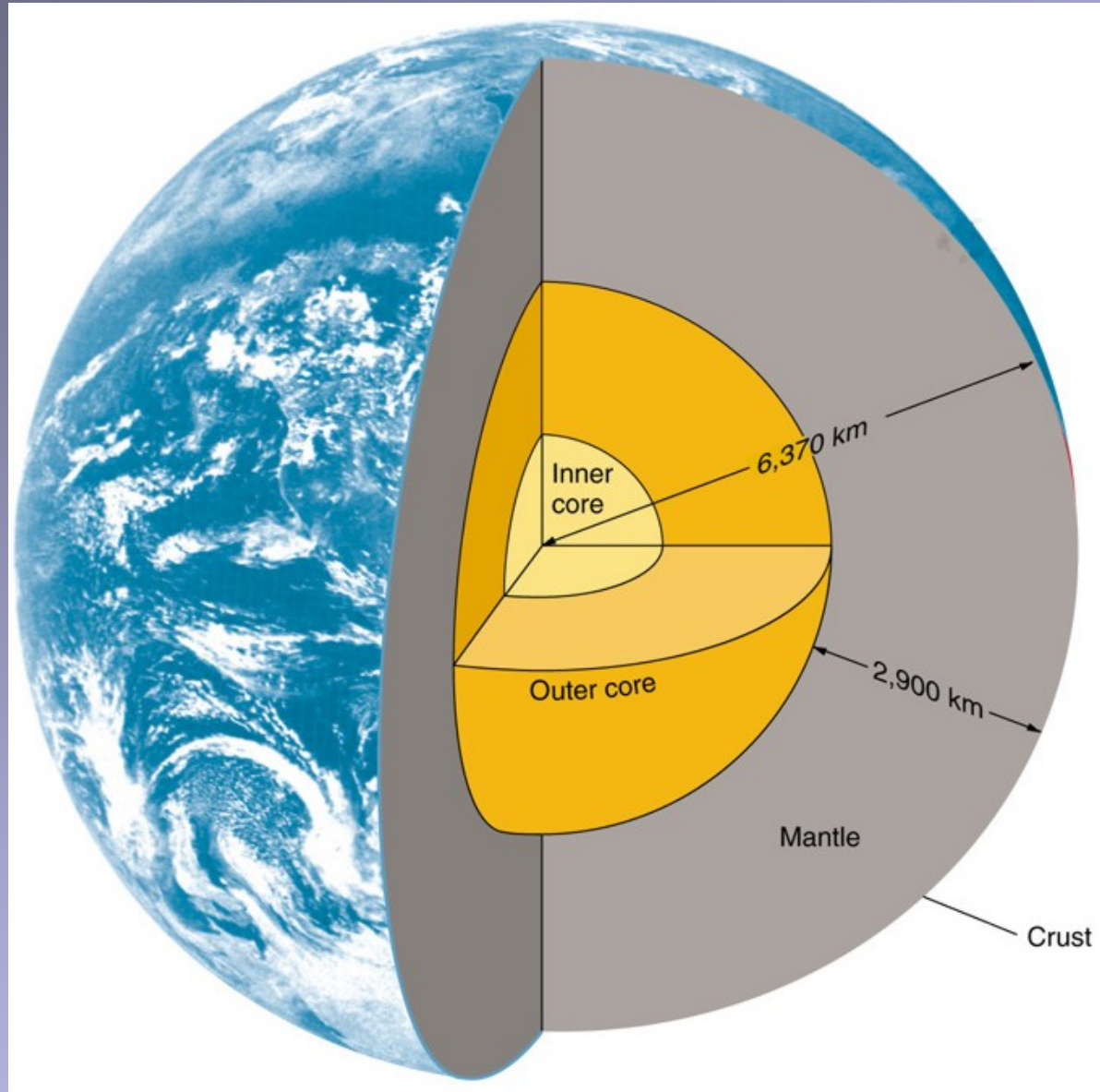
Crust

Mantle

Core (outer & inner)

Some properties of each layer:

Internal layers of the Earth



A seismic P wave is:

Primary – arrives first

Caused by compression

Able to move through liquid

Faster than an S wave

What are the ultimate sources of energy on this planet?

On the Earth surface:

almost entirely driven by solar energy

What processes?

The interior of the planet:

decay of radioactive elements in the core

What processes?

And a minor contributor:

gravity

What processes?

Geologists can interpret thickness and composition of the internal layers of the Earth by :

A. good guesses

B. deep drilling to collect rock samples

C. evaluating the velocity of seismic waves moving through the Earth

And how is that done?

Earth layers by seismic velocity

Velocity changes with material and density

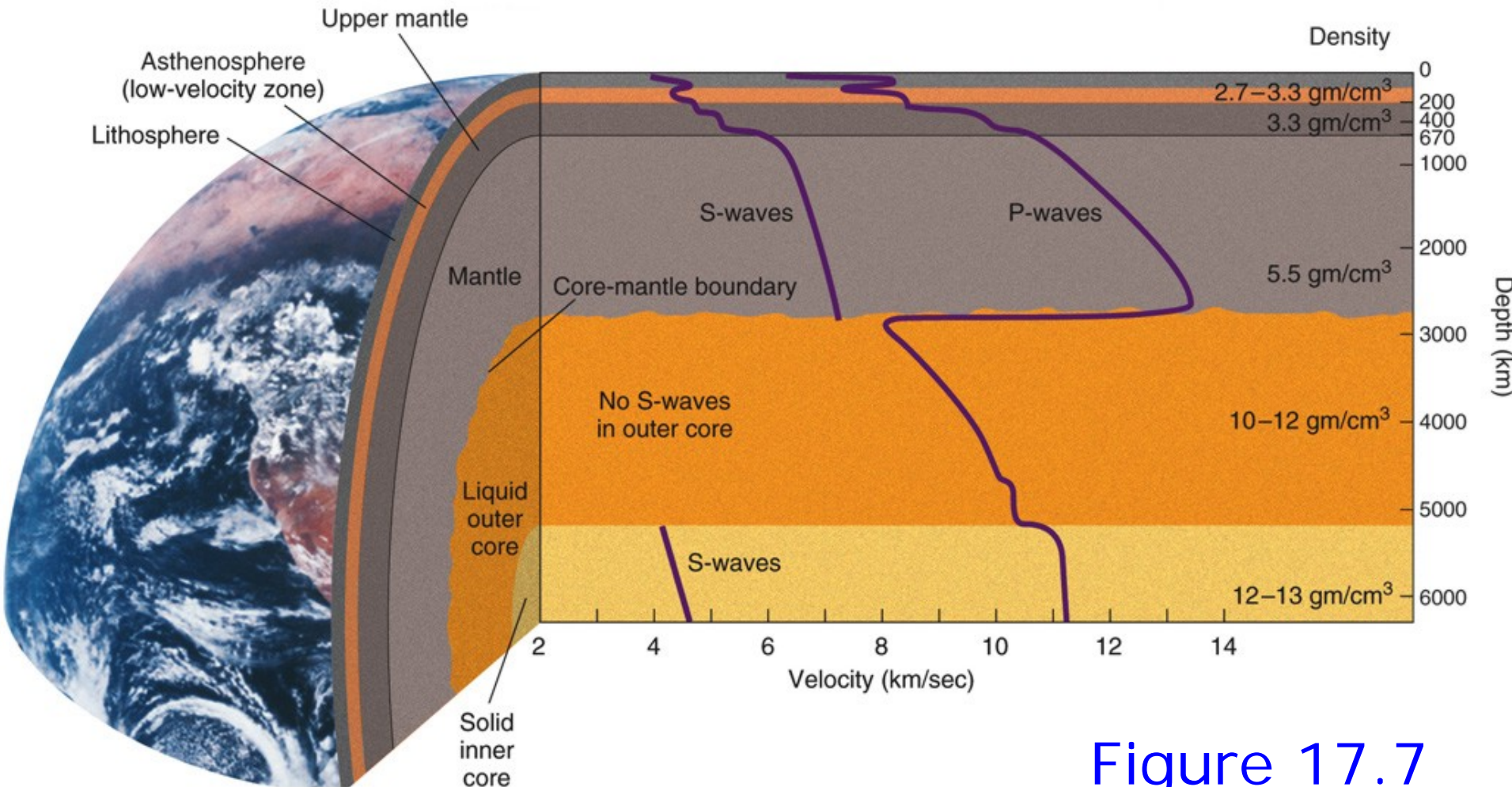


Figure 17.7

The internal layer of the Earth that has the greatest volume (about 70% of the total volume of the planet) is the:

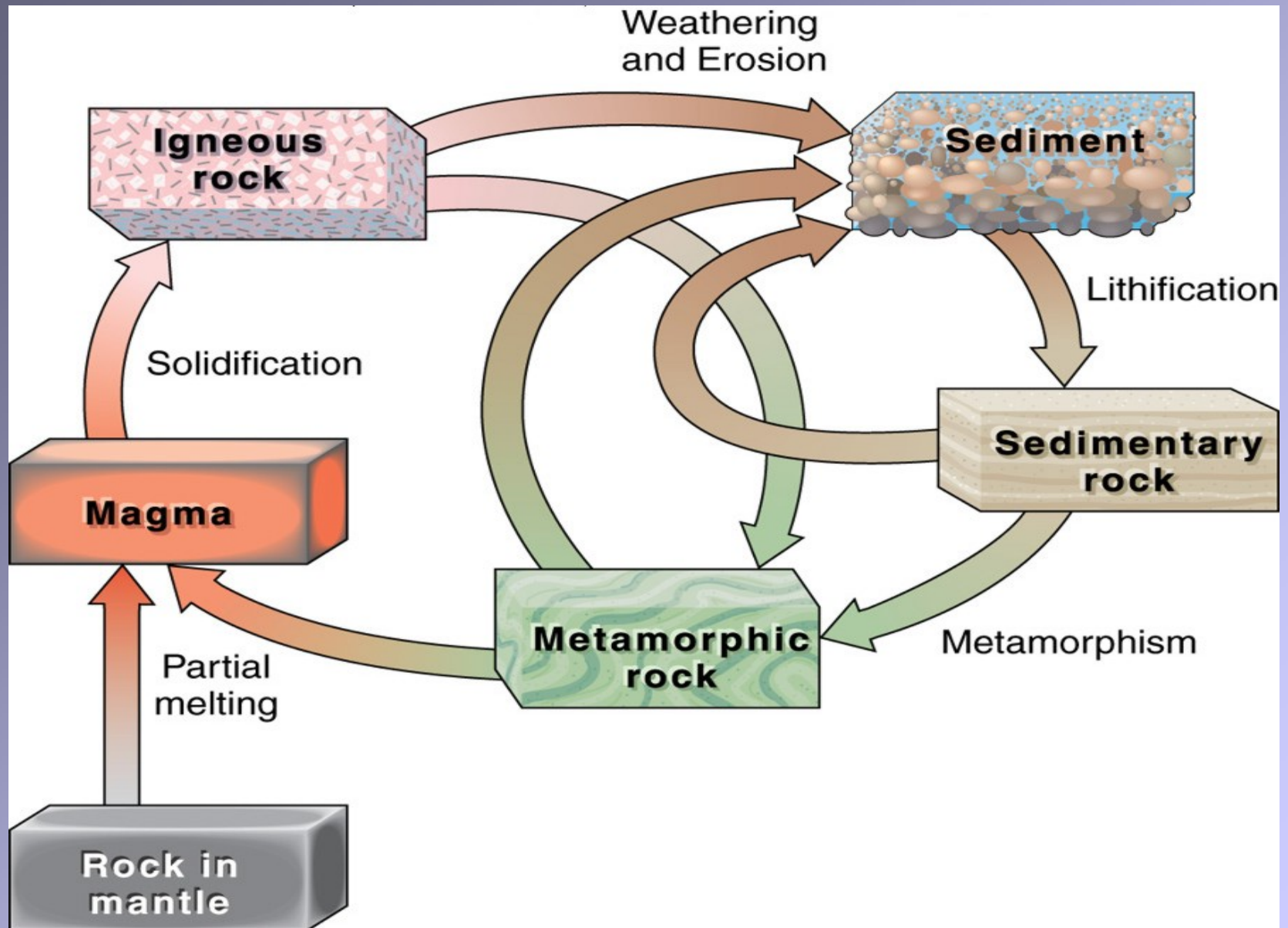
A. mantle

B. core

C. lithosphere

D. world ocean

Rock cycle



The “spheres” of the Earth that we can see at the Earth surface are the:

A. crust, mantle, and core

B. lithosphere, asthenosphere, mesosphere

C. magnetosphere and ionosphere

D. lithosphere, hydrosphere, atmosphere,
and biosphere

The 'spheres' of Earth

Magnetosphere – magneto: magnetic field

Ionosphere – ionos: ions, charged particles

Atmosphere – atmos: vapor

Hydrosphere – hydro: water

Biosphere – bios: life

Interior of the planet:

Lithosphere – lithos: rock, rigid

Asthenosphere – astheno: weak

Mesosphere – meso: middle

Core

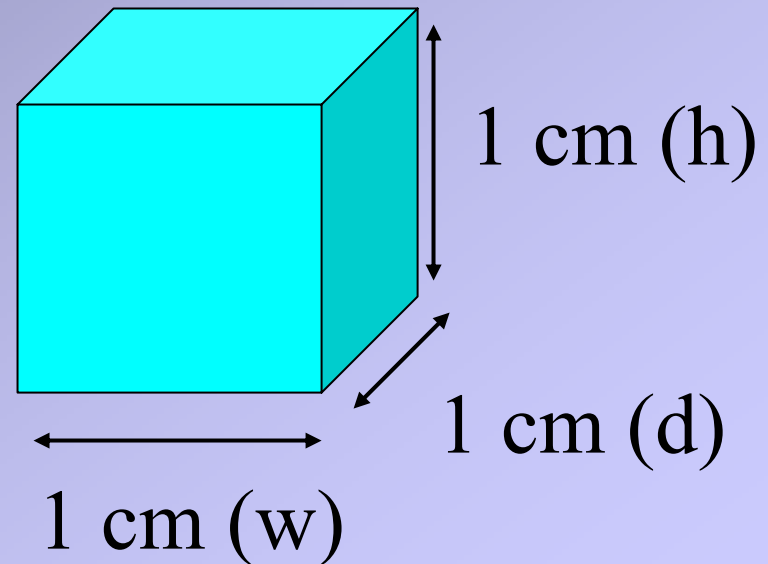
Density is defined as (1)_____, and in the metric system has units of (2)_____

- A. (1) volume of material,
(2) cubic meters [m^3]
- B. (1) increase of velocity,
(2) meters per second per second [m/sec^2]
- C. (1) total mass of an object,
(2) grams [g] or kilograms [kg]
- D. (1) mass per unit volume,
(2) grams per cubic centimeter [g/cm^3]

Density

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Units are $\frac{\text{grams}}{\text{cm}^3}$



By definition, in the metric system,
one gram of mass is equal to :

A. *What?*

Exponential increase in a factor

1

10

100

1000

1 000 000

*And HOW does
this apply to
EARTHQUAKES?*

In plate tectonics, a trench is a:

A. convergent plate boundary

B. divergent plate boundary

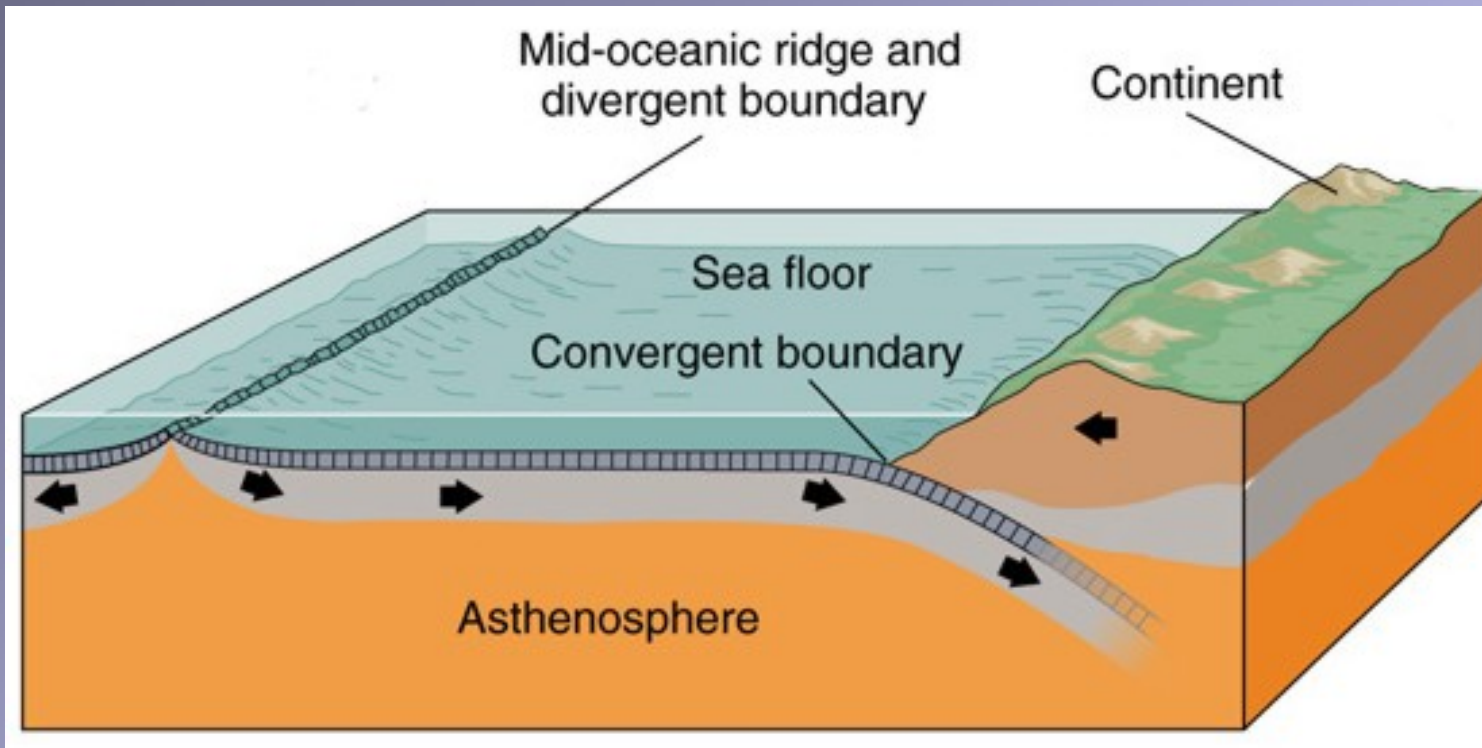
C. mantle plume

D. transform or displacement plate boundary

Plate boundaries

Divergent

Convergent



Transform

In plate tectonics, a mid-ocean ridge is a:

A. convergent plate boundary

B. divergent plate boundary

C. subduction zone

D. transform or displacement plate boundary

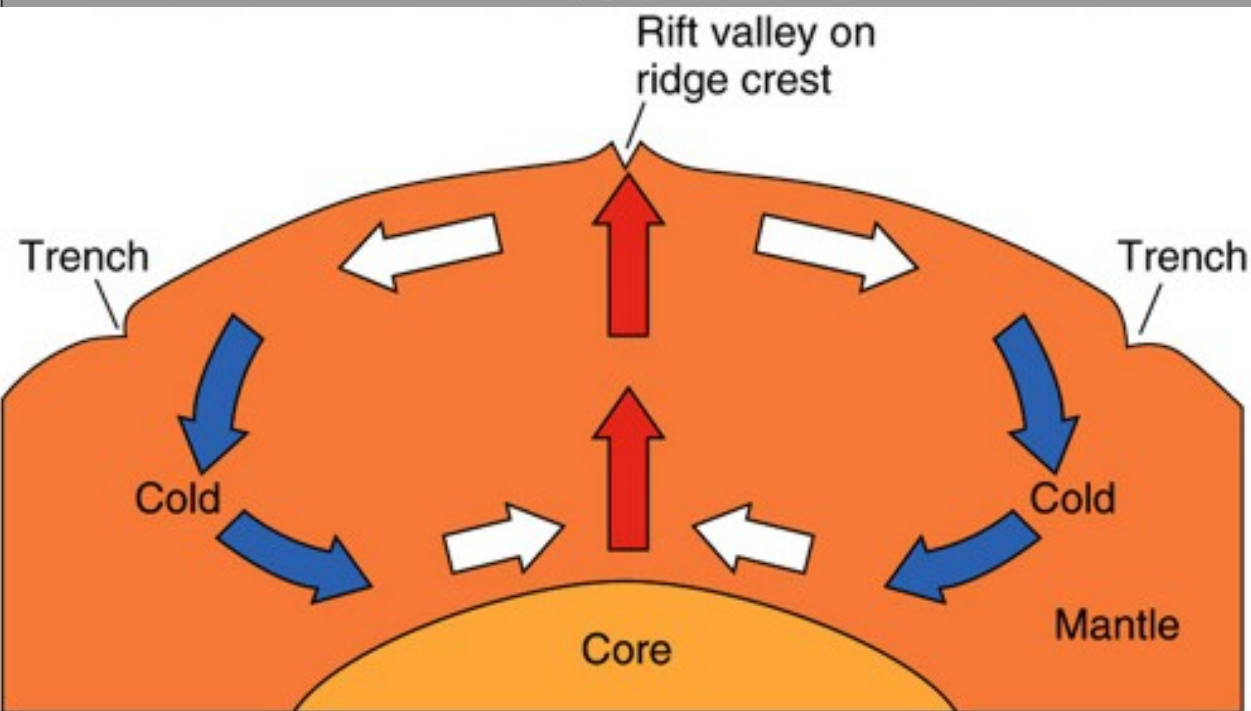
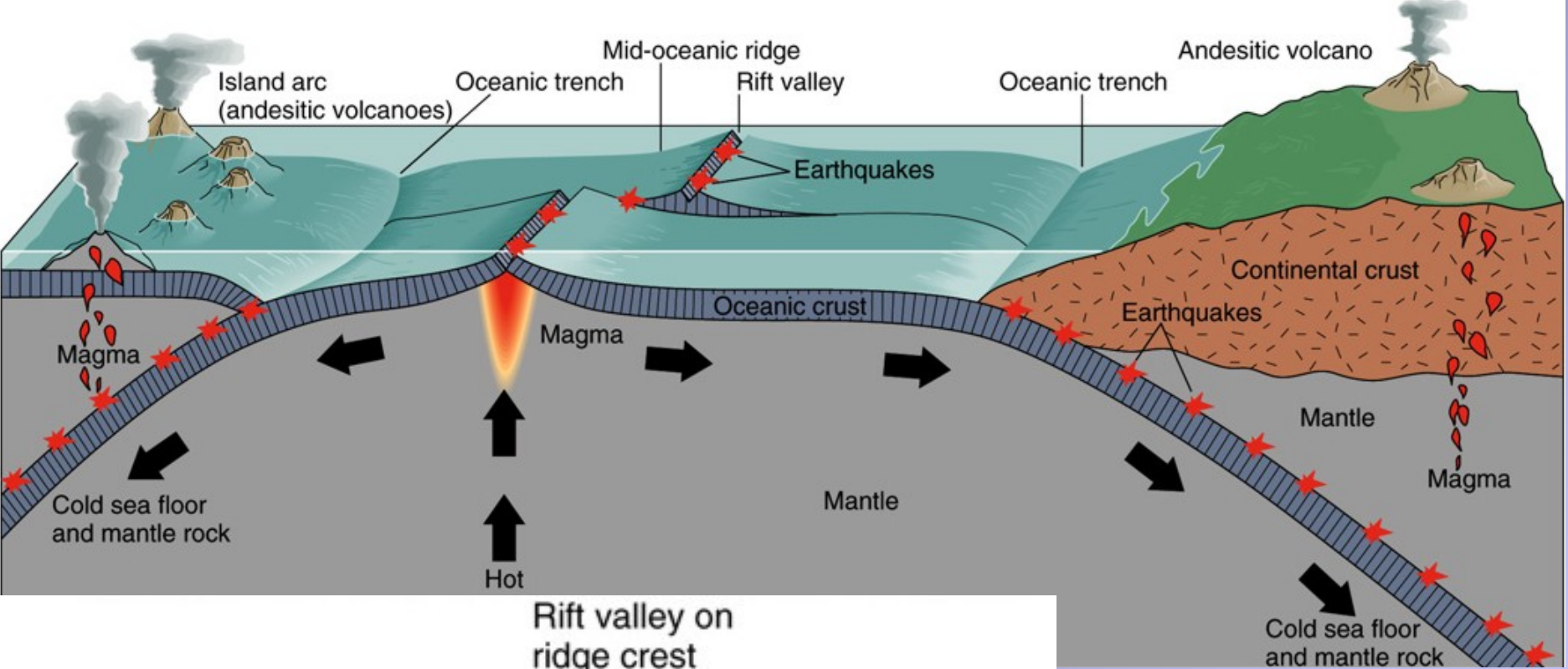
The forces that move the tectonic plates on the Earth surface are caused by:

A. gravitational pull of the Moon

B. the rotation of the Earth

C. continental rifting

D. _____



Mantle convection

At transform plate boundaries, two plates:

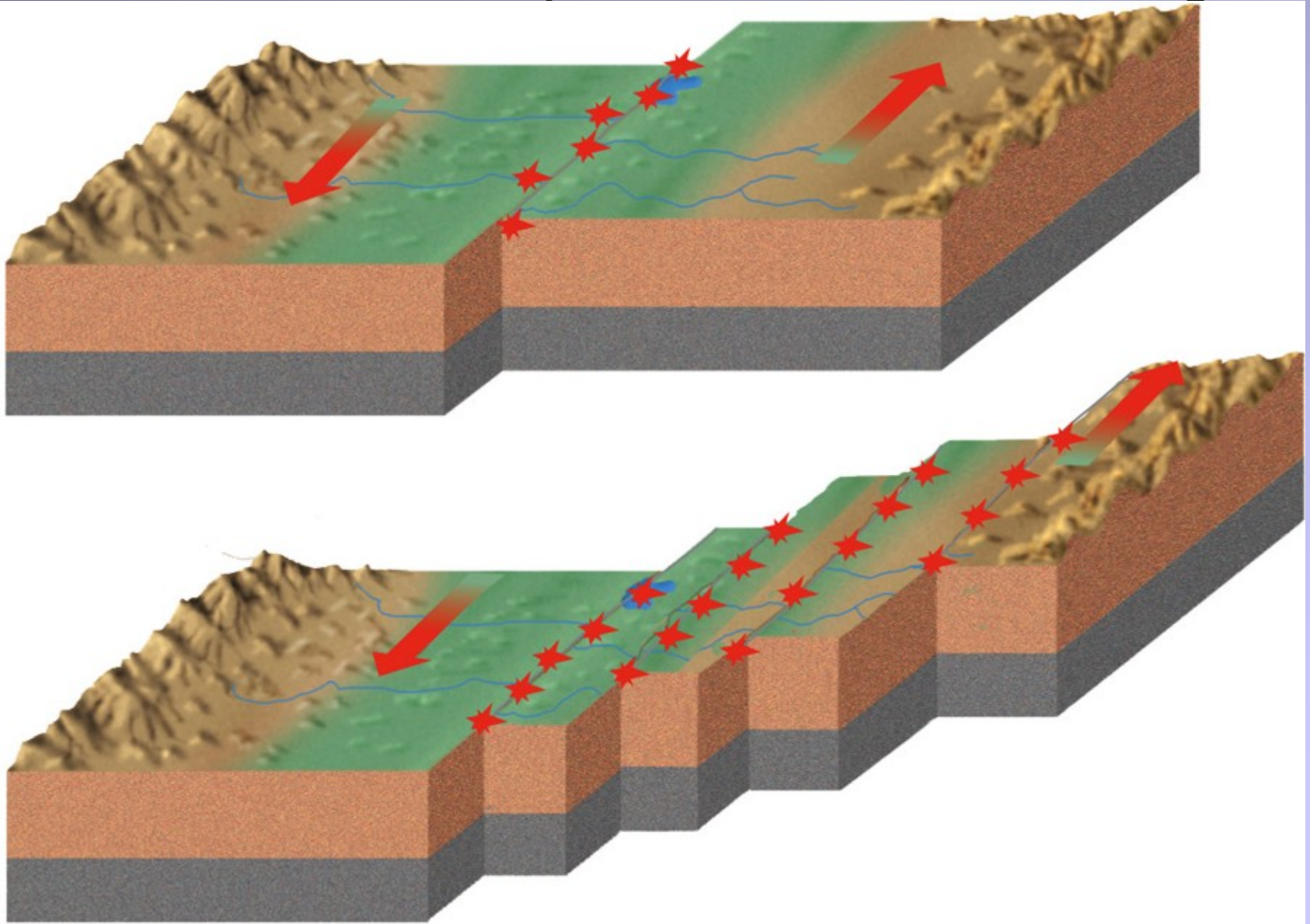
A. move in opposite directions toward each other

B. slide past each other horizontally

C. move in opposite directions away from each other

D. are subducted into the mantle

Transform or displacement boundary



The San Andreas Fault, which runs from the Gulf of California to Cape Mendocino, is a:

- A. trace of a hot spot
- B. an example of continental rifting
- C. seismically inactive fault
- D. _____

There are two different types of crust,
which are :

continental crust **and** **oceanic crust**

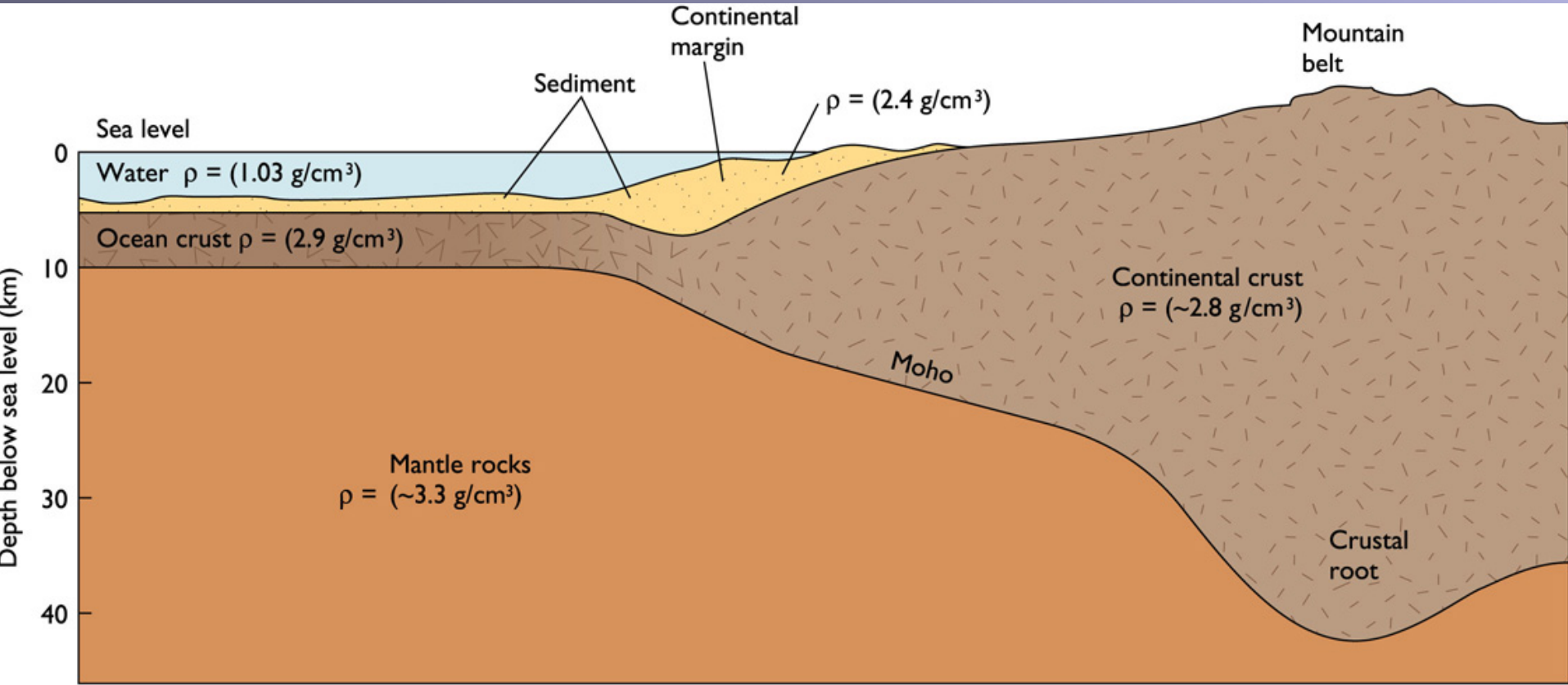
Relative age?

Relative density?

Relative thickness?

Composed of what rock type?

Continental crust



(c) OCEANIC CRUST VERSUS CONTINENTAL CRUST

Two types of crust ...

And collisions between these types of crust produce three combinations:

oceanic – oceanic

oceanic – continental

continental – continental

Continental crust floats on the mantle because of:

- A. mantle convection
- B. the lower density of continental crust
- C. gas bubbles trapped in granite
- D. subduction

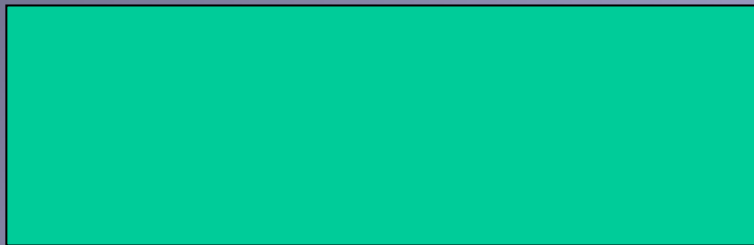
If all of the water were drained from the oceans, the surface of the Earth what would you see?

the continents sitting high and
the ocean basins sitting low

And how are *isostasy* and *buoyancy* related to this?

If the ocean basins were drained of water, what would you see?

Continental lithosphere



Sea level



Oceanic lithosphere



The three primary layers of the crust and mantle, defined by strength and viscosity as related to plate tectonic processes are:

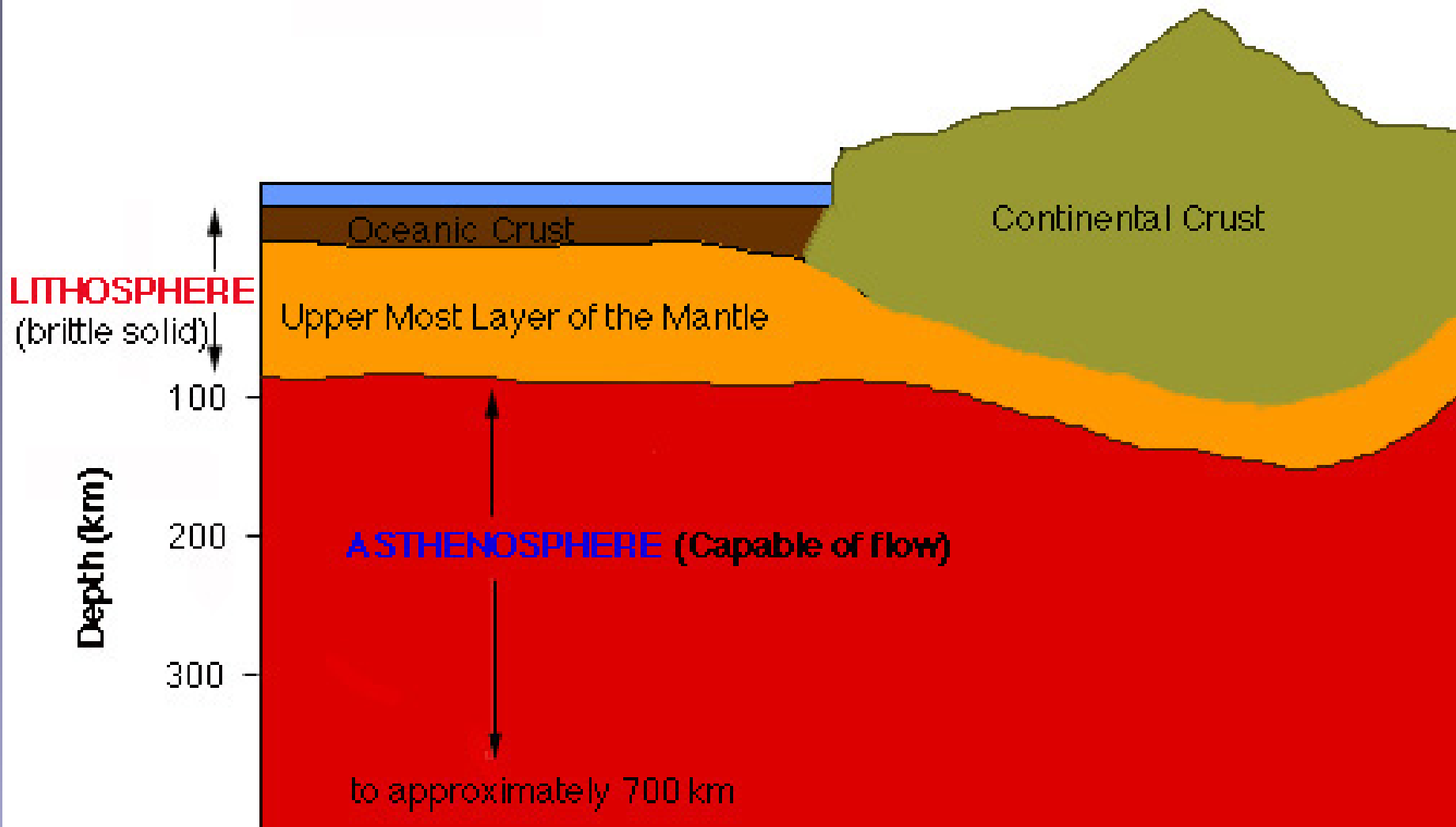
A. crust, mantle, core

B. mesosphere, outer core, inner core

C. lithosphere, asthenosphere, mesosphere

D. atmosphere, hydrosphere, lithosphere

Lithosphere, asthenosphere, mesosphere



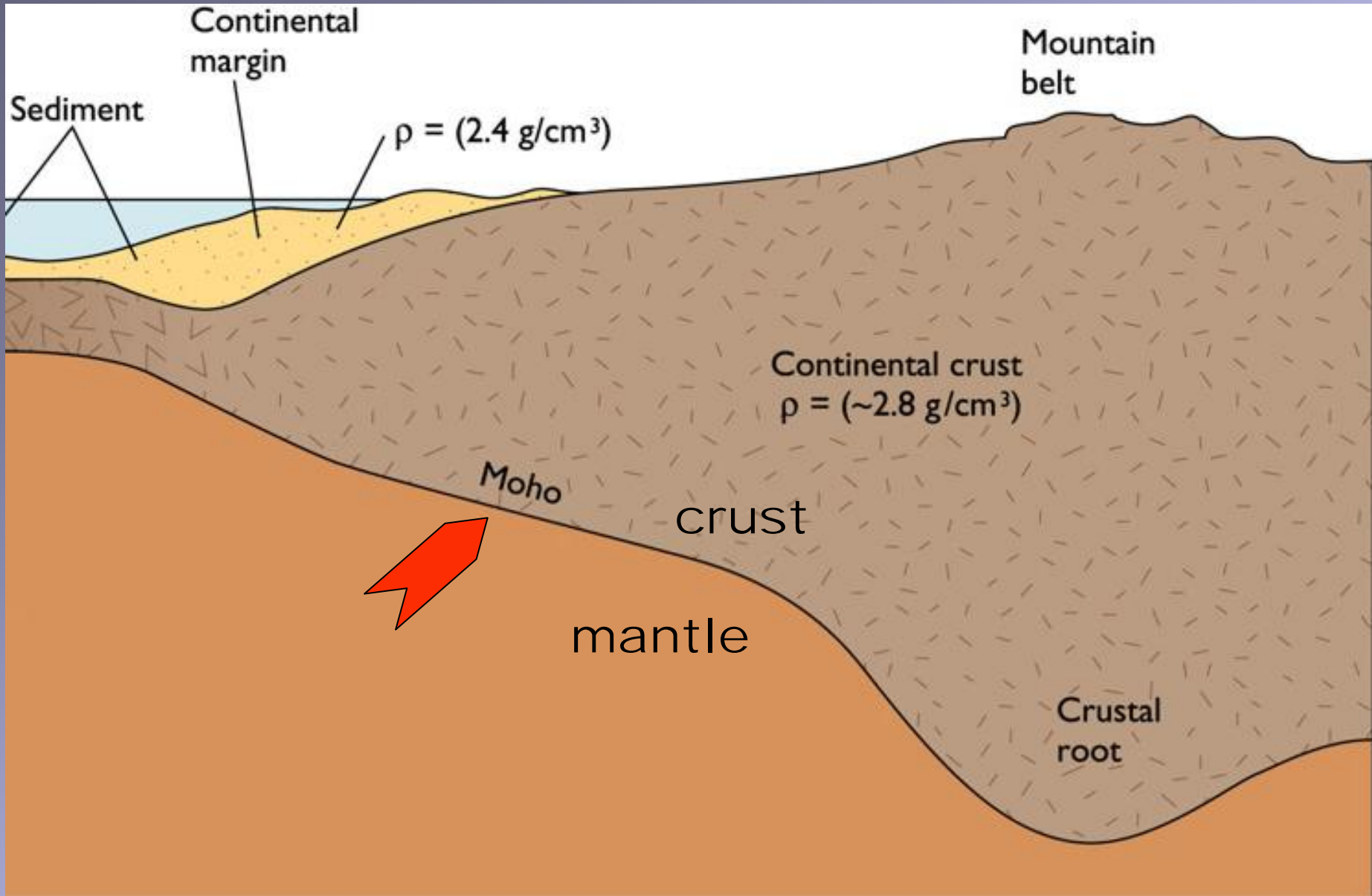
The difference between the terms 'crust' and 'lithosphere' is that:

- A. the lithosphere is composed only of mantle rocks
- B. 'crust' refers to continental rocks and 'lithosphere' refers to oceanic rocks
- C. earthquakes occur only in the crust
- D. the lithosphere includes the crust and the uppermost part of the mantle

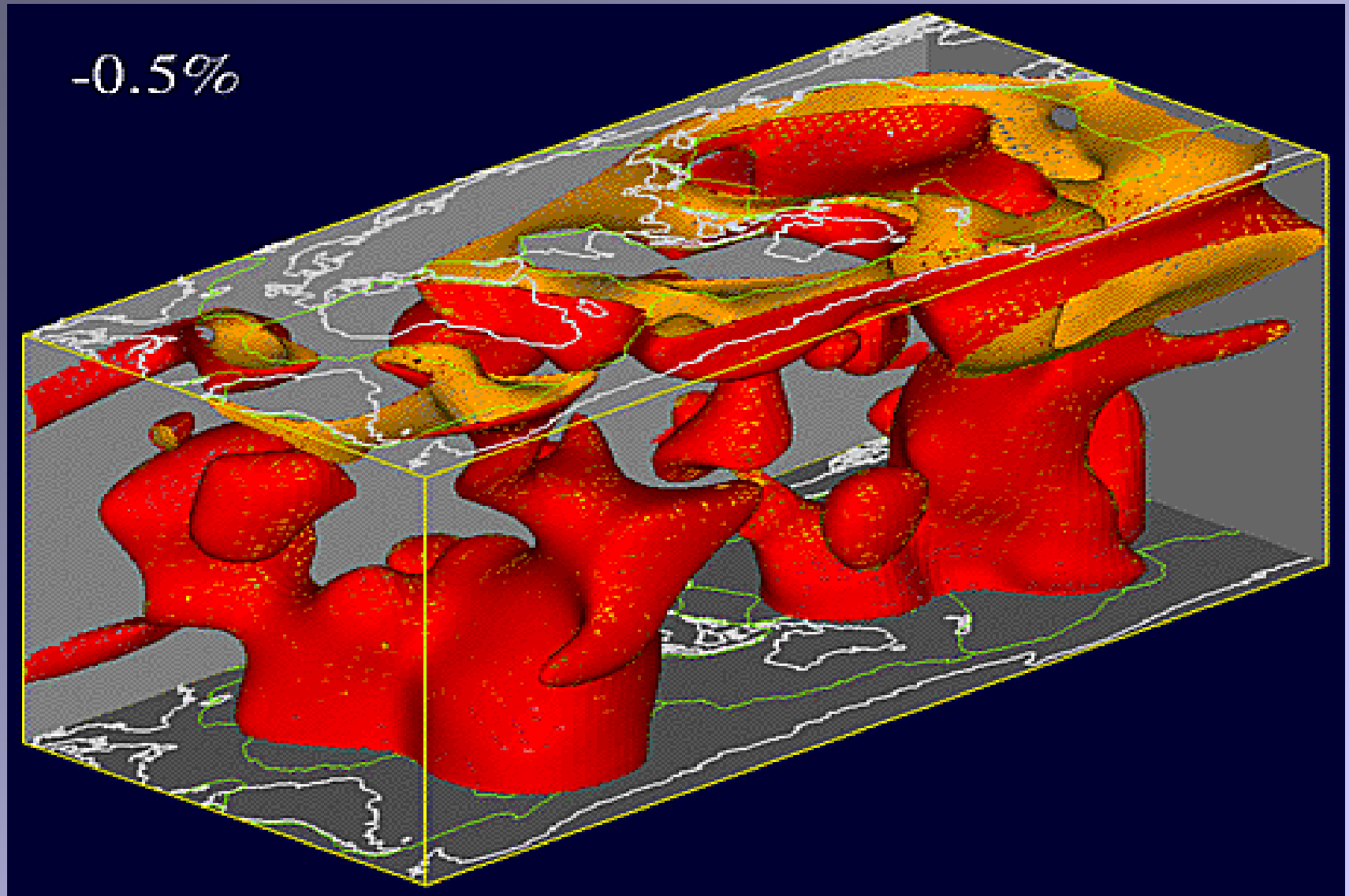
The boundary called the Moho (short for Mohorovičić discontinuity) separates:

- A. oceanic crust from continental crust
- B. ocean sediments from oceanic crust
- C. crust from mantle
- D. P waves from S waves

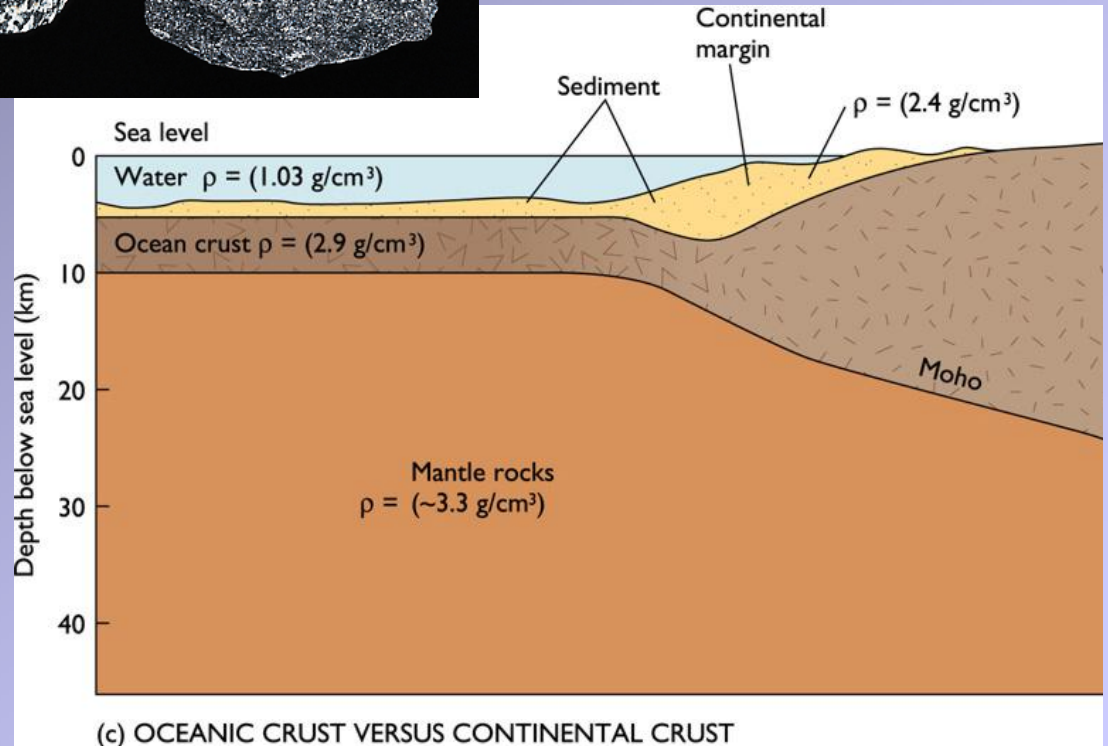
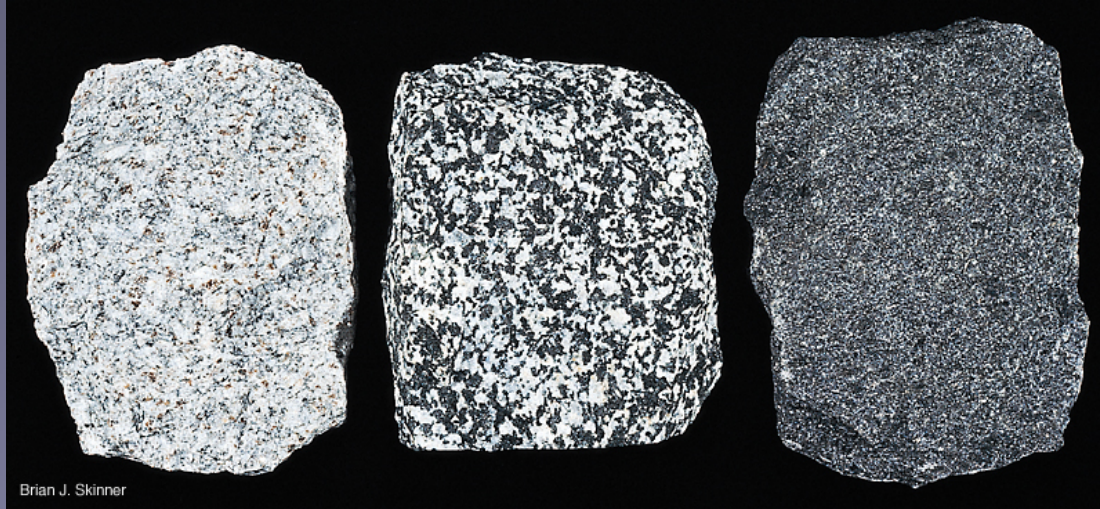
Moho



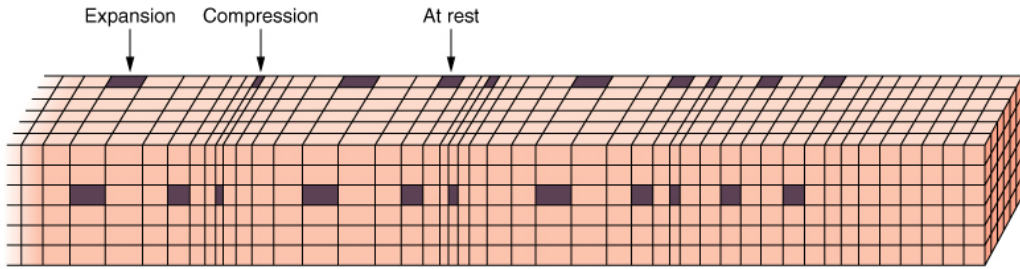
What drives plate tectonics?



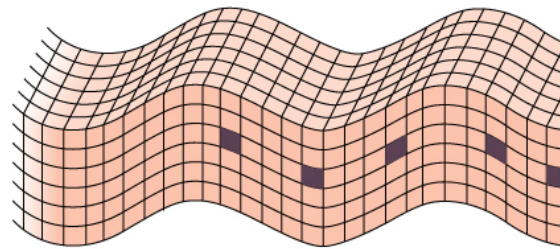
What is continental crust made of? Oceanic crust?



How does seismic energy move through the Earth?



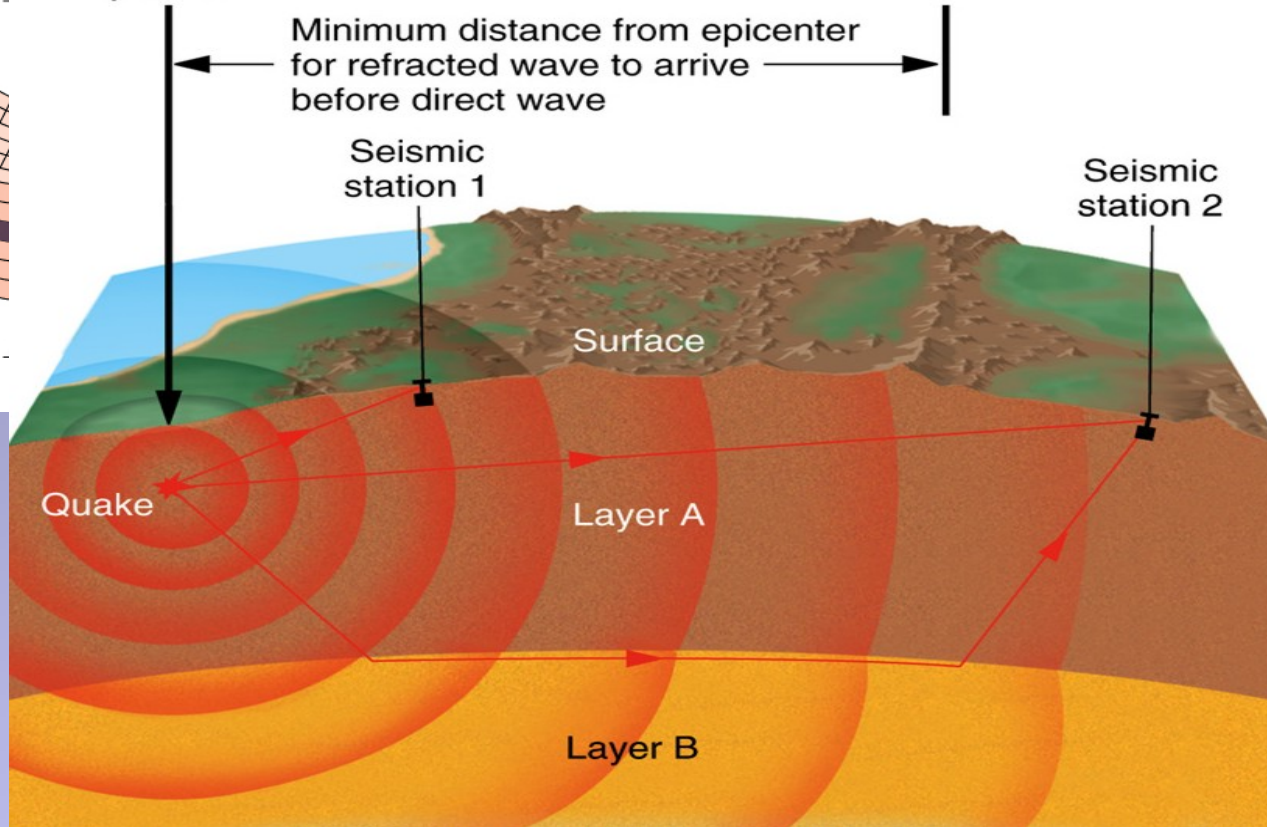
A. P wave



B. S wave

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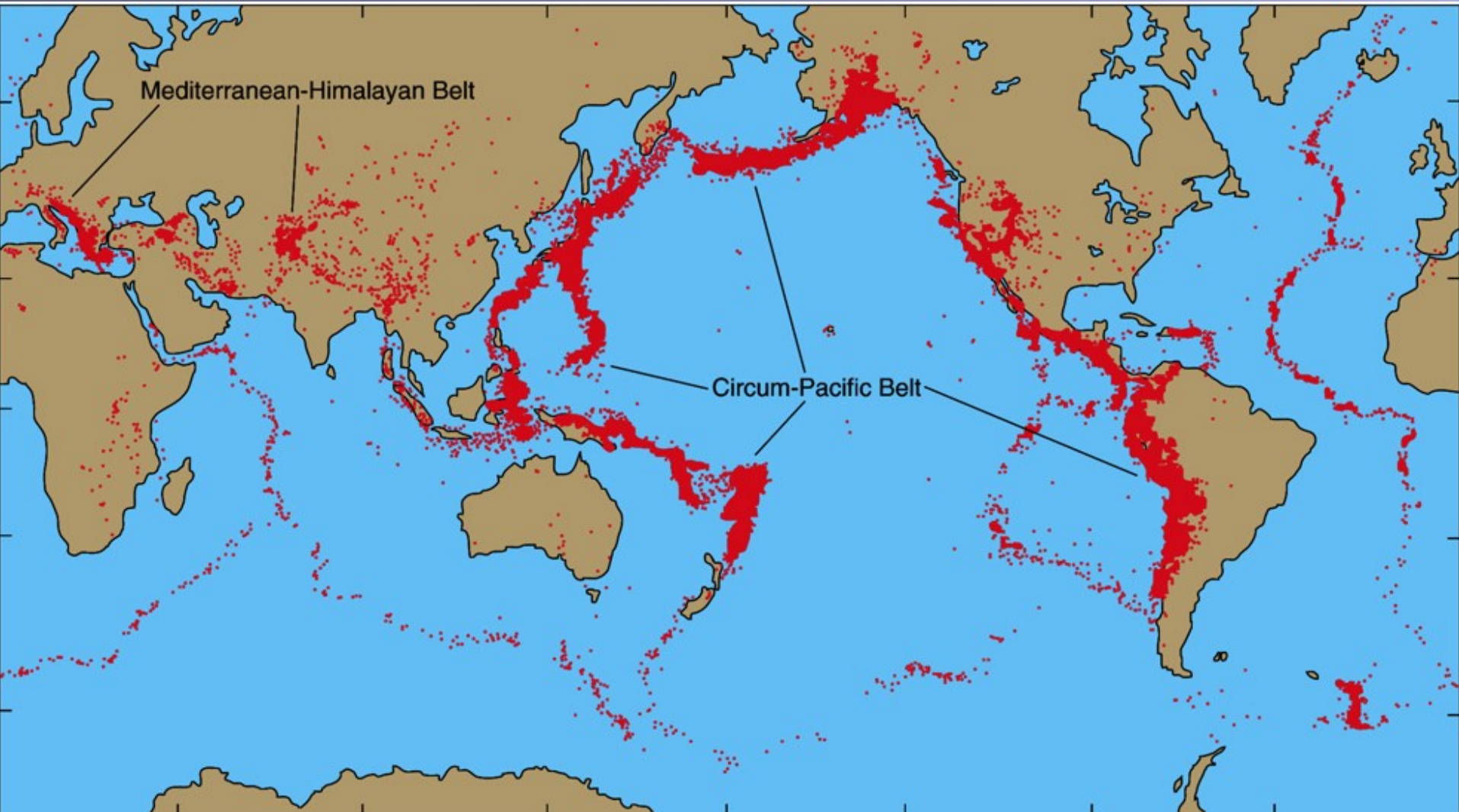
Direction of P-wave travel
Epicenter



The Pacific Ocean is called the “ring of fire” because:

Why?

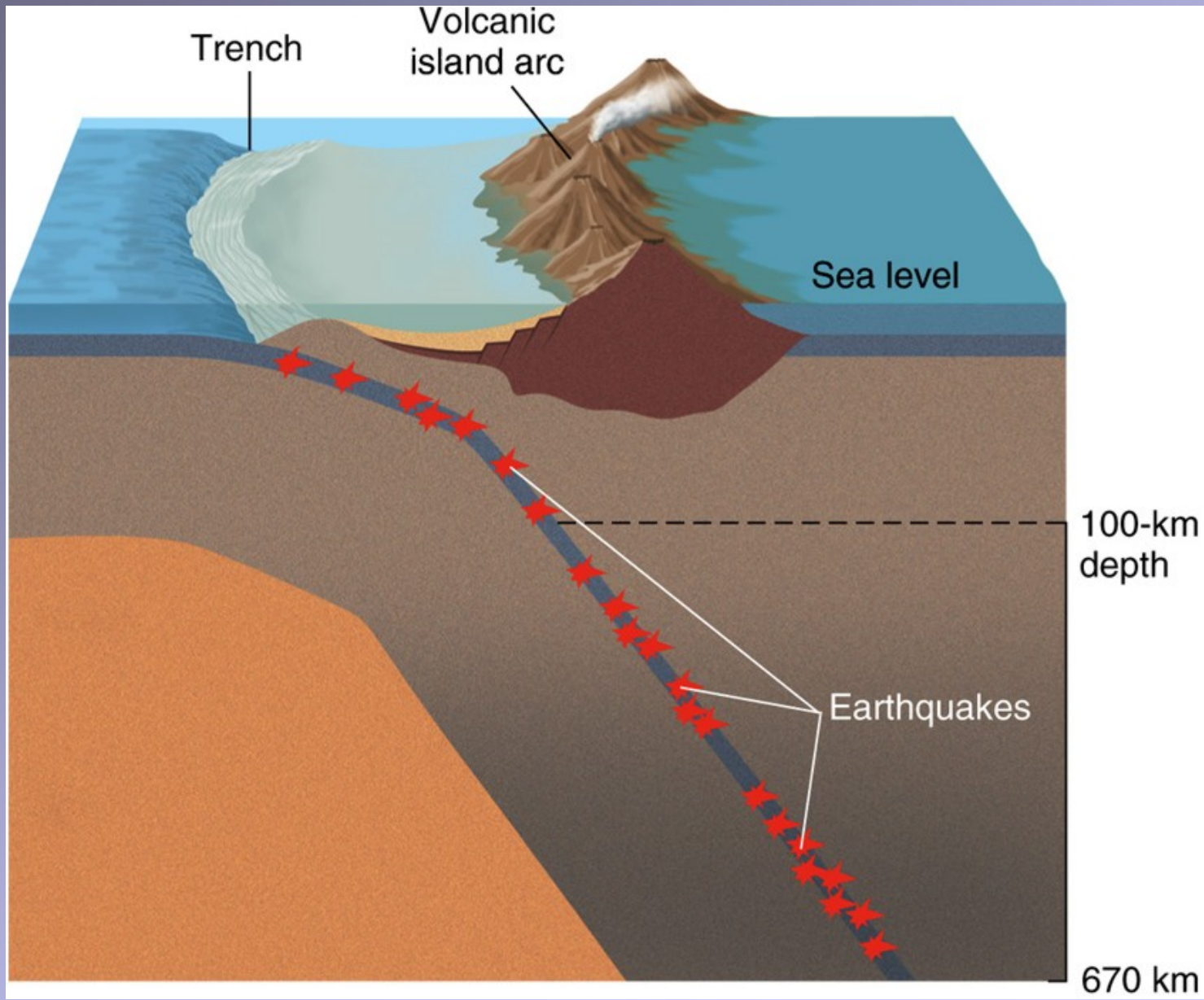
Pacific "ring of fire"



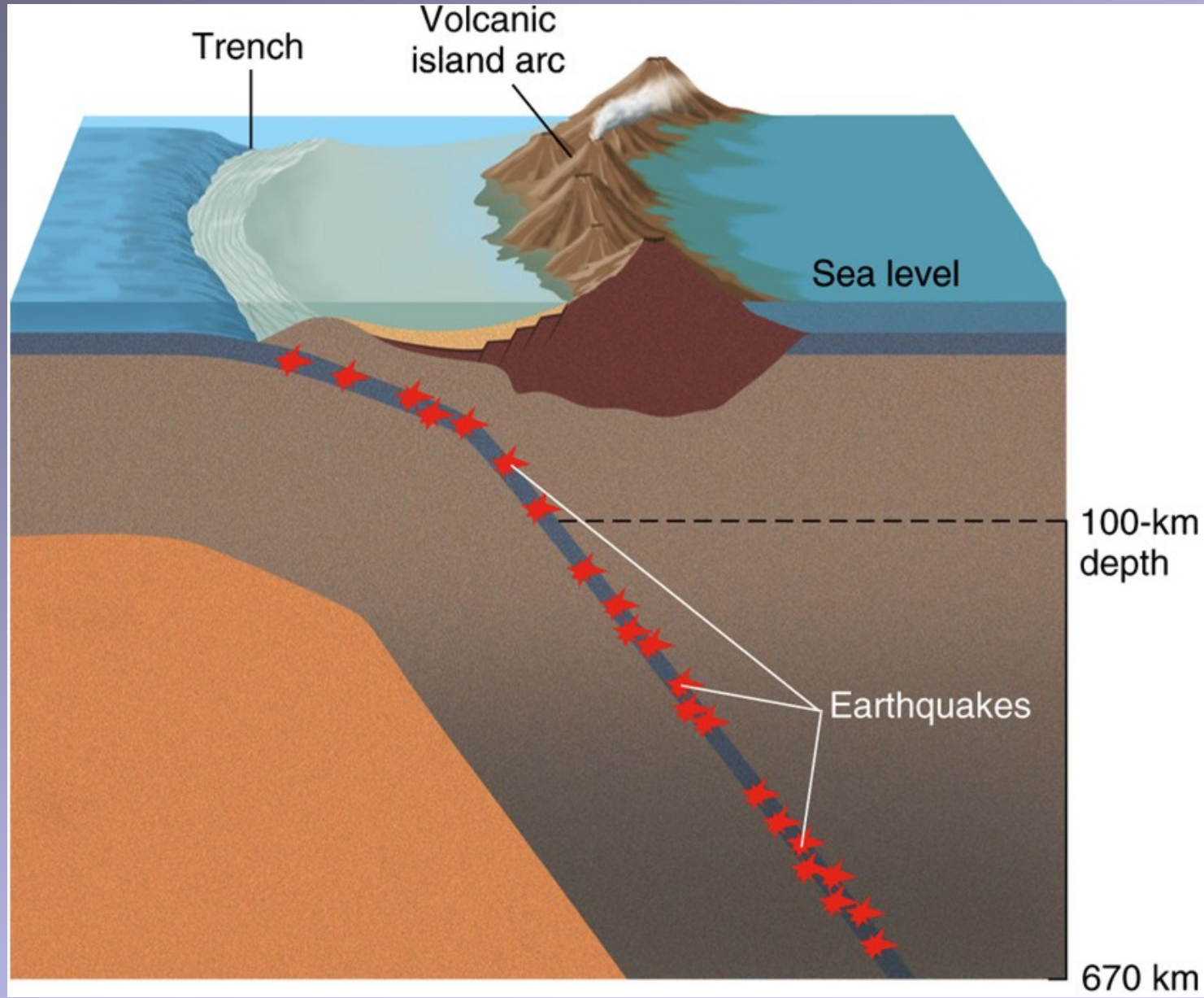
A Benioff zone can be found:

- A. landward of a trench
- B. under the Rocky Mountains
- C. only under continental crust
- D. near the Hawaiian Islands

Benioff zone



A Benioff zone is defined by:

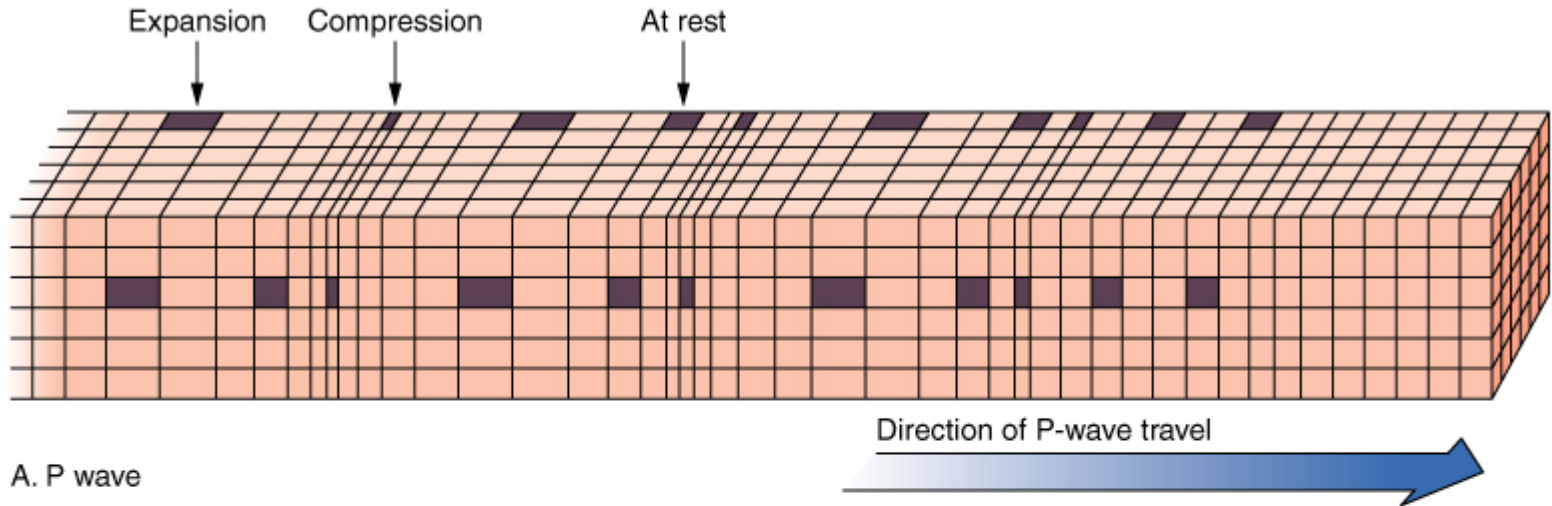


Rocks of the asthenosphere generally are:

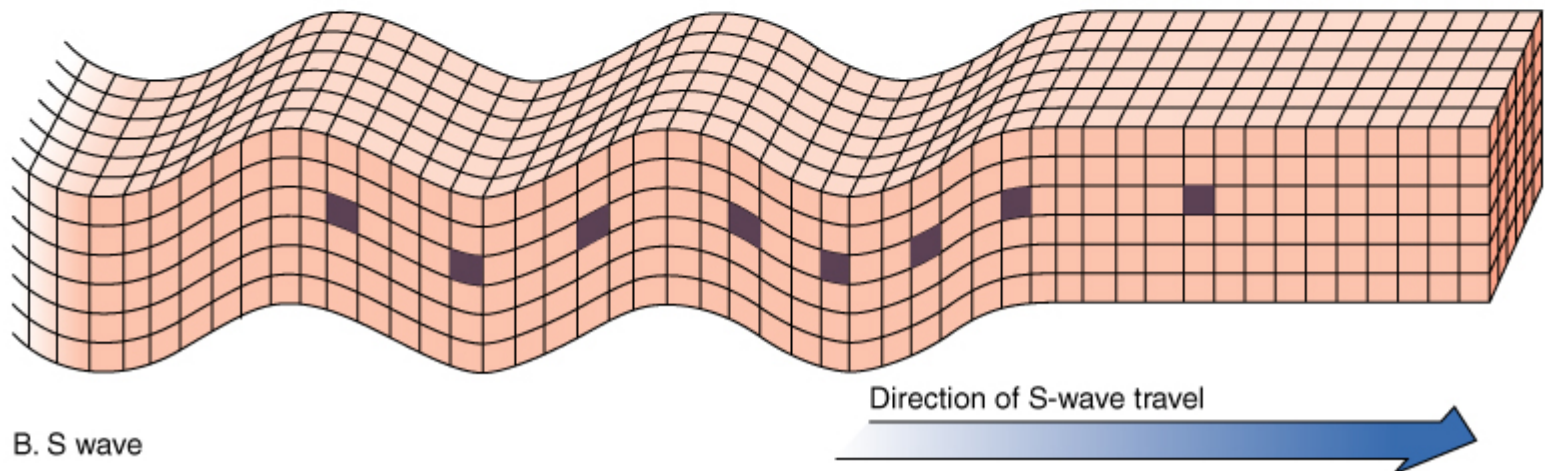
- A. relatively cool and brittle, and will fracture under stress
- B. liquid
- C. metallic, mostly iron and nickel
- D. like hot silly putty

The difference between the motion of P waves and S waves is:

P



S



The minimum number of seismic stations needed to locate the epicenter of an earthquake is:

A. 1

B. 2

C. 3

D. 5

Locating the epicenter of an earthquake



The fastest seismic waves are:

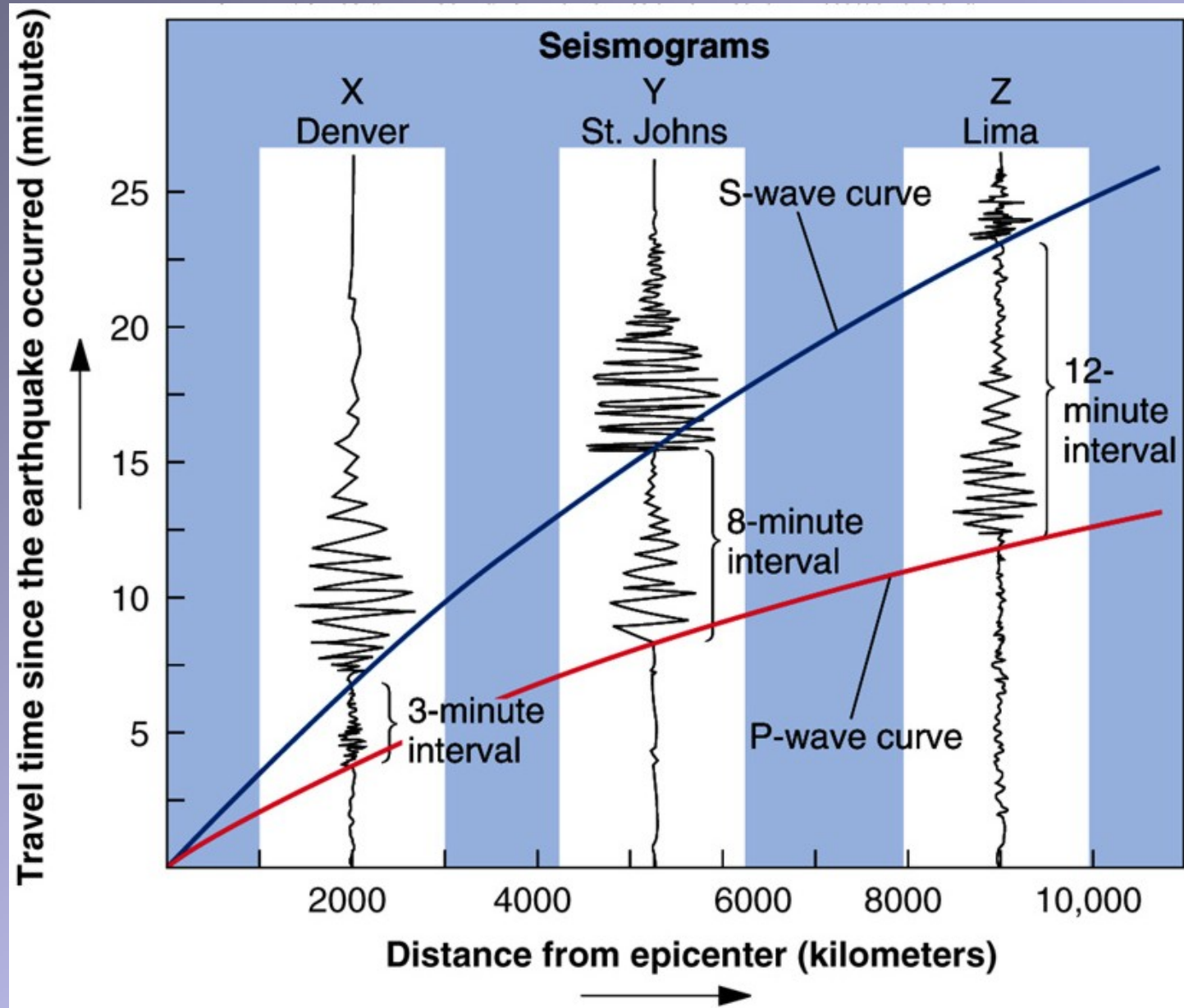
A. surface waves

B. S waves

C. P waves

D. tsunamis

Arrival time of seismic waves



The seismic shadow zone for S waves created by a large earthquake is caused by:

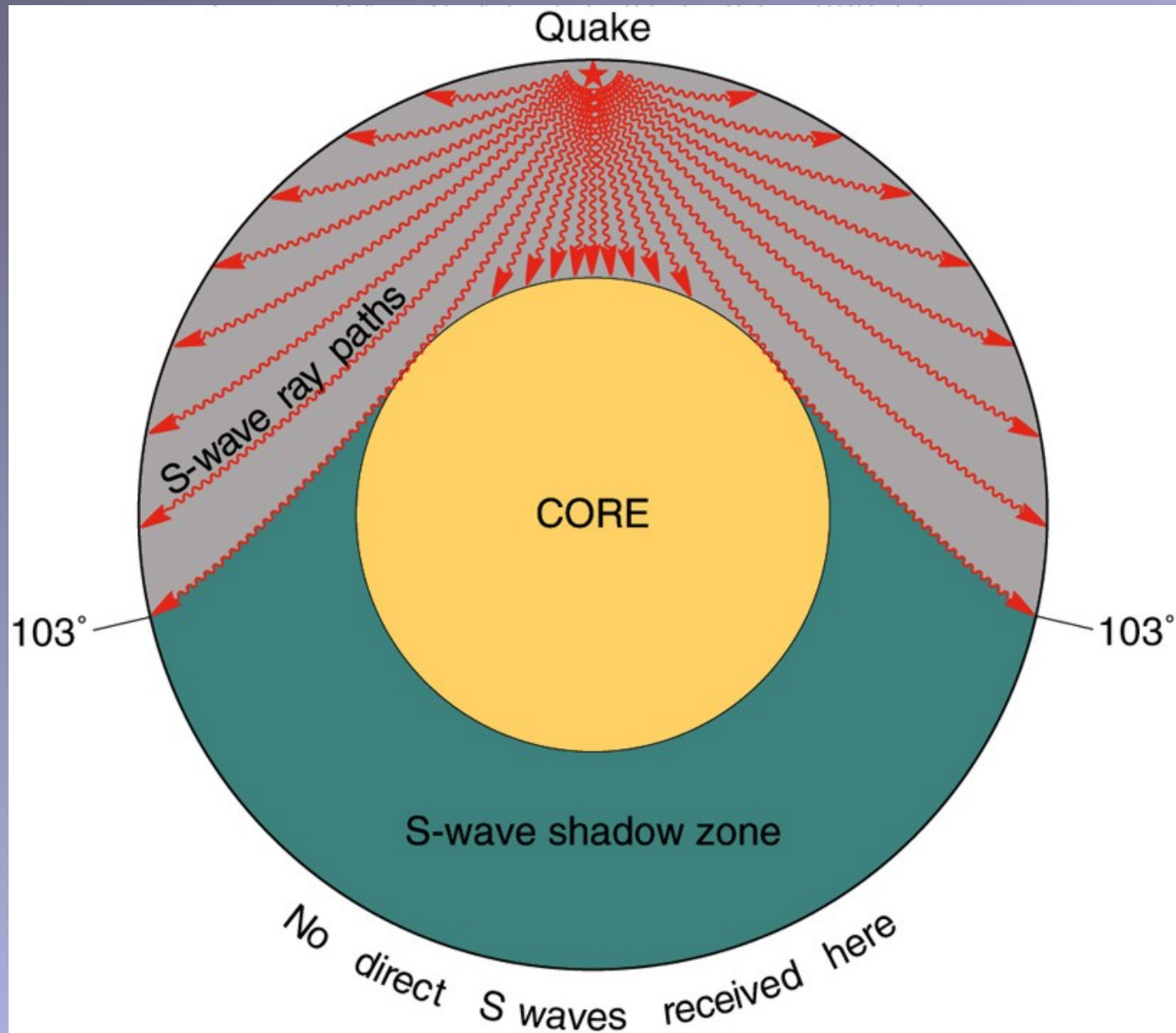
A. oscillating compressional forces

B. shear waves can not pass through the liquid outer core

C. shear waves can not pass through the mantle

D. reflection at the Moho

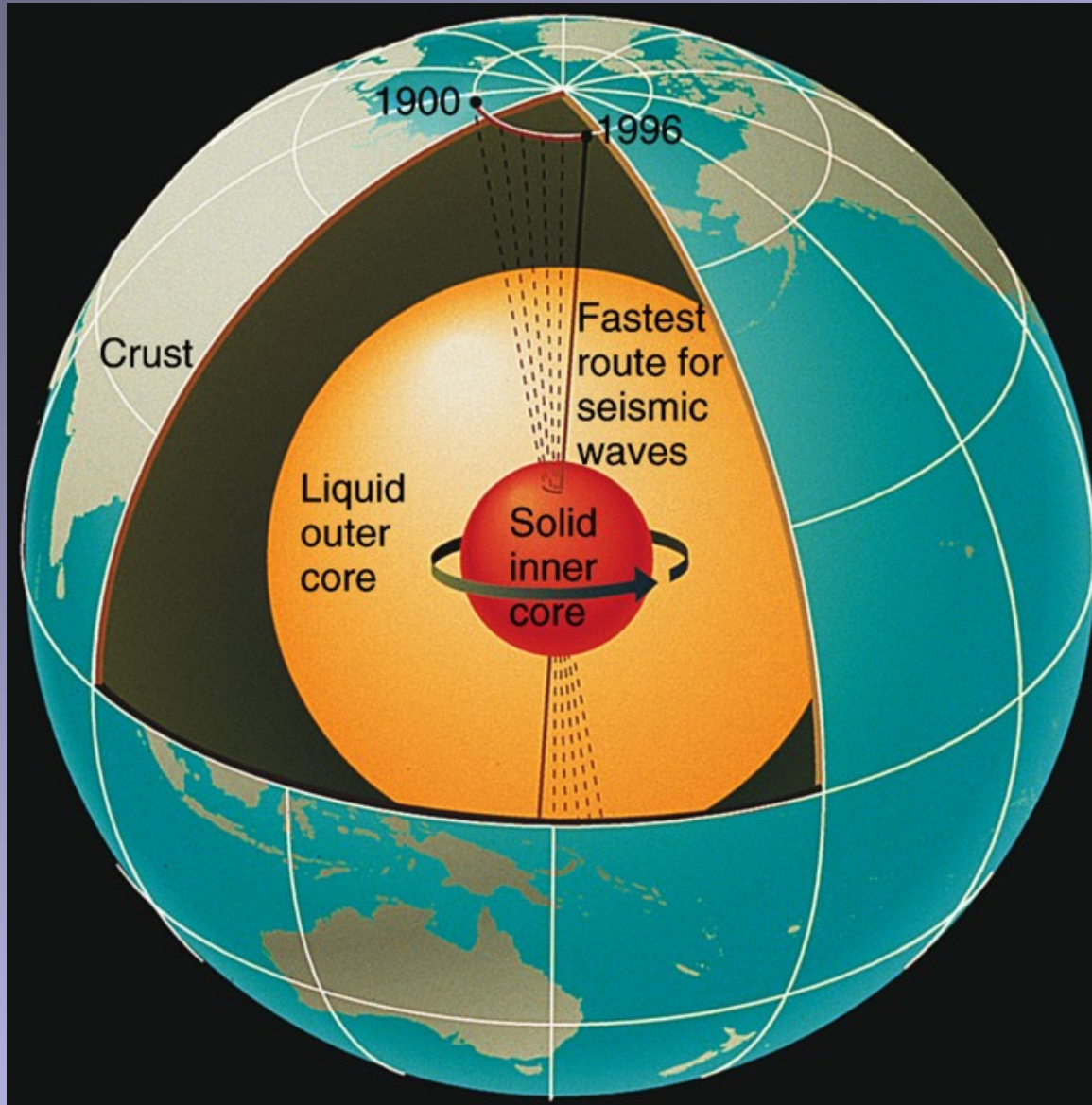
Shadow zone for S waves



The outer core is composed of:

- A. molten metal (mostly iron and nickel)
- B. solid metal (mostly iron and nickel)
- C. partially melted granite
- D. basalt recycled by subduction

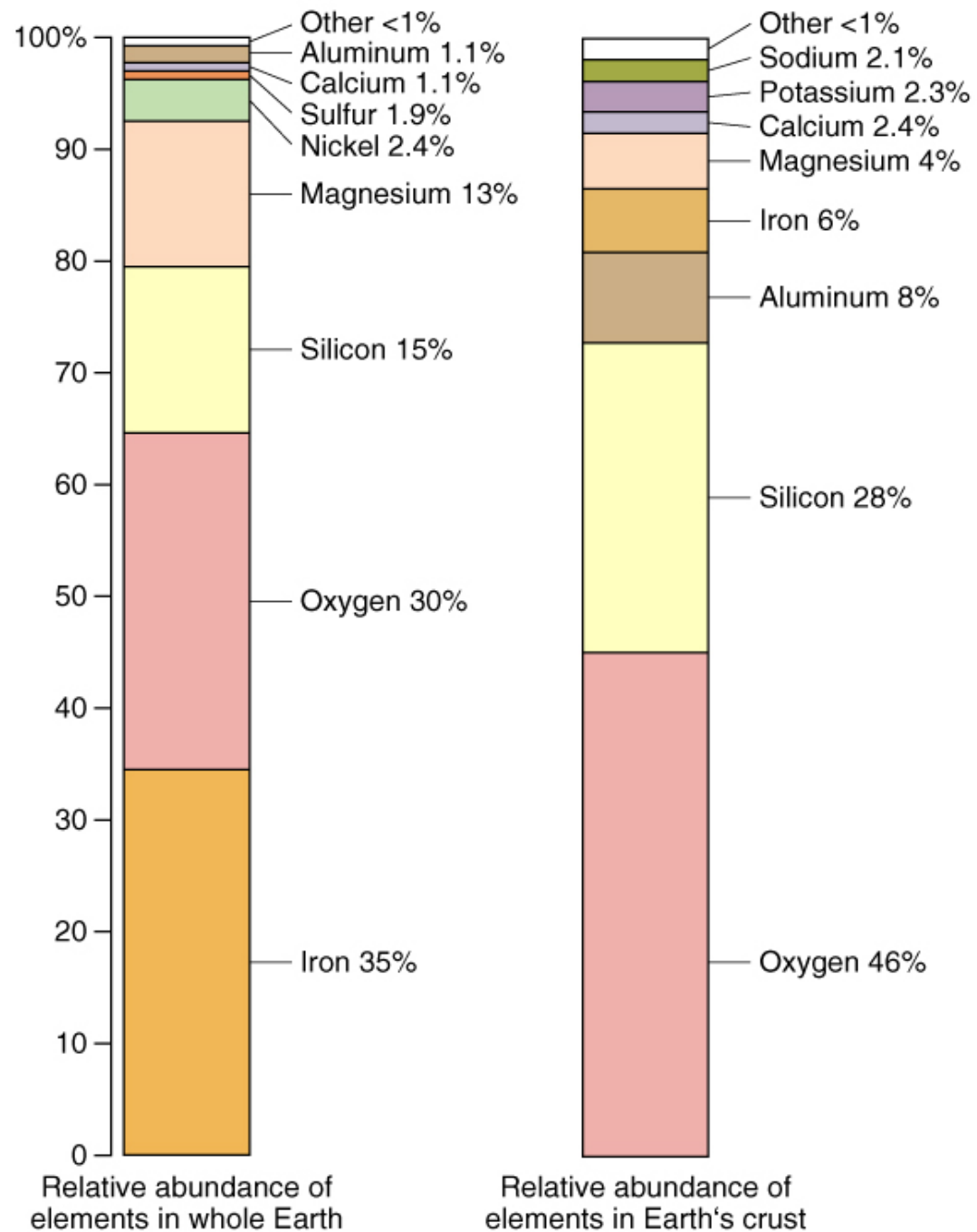
Solid inner core spins inside liquid outer core



Compared with the mantle and core, the continental crust has more:

- A. iron (Fe), magnesium (Mg), and nickel (Ni)
- B. silicon (Si), aluminum (Al), and oxygen (O)
- C. nuclear fusion
- D. all of the above

Relative abundance of elements



What caused the differentiation of the interior layers of the Earth?

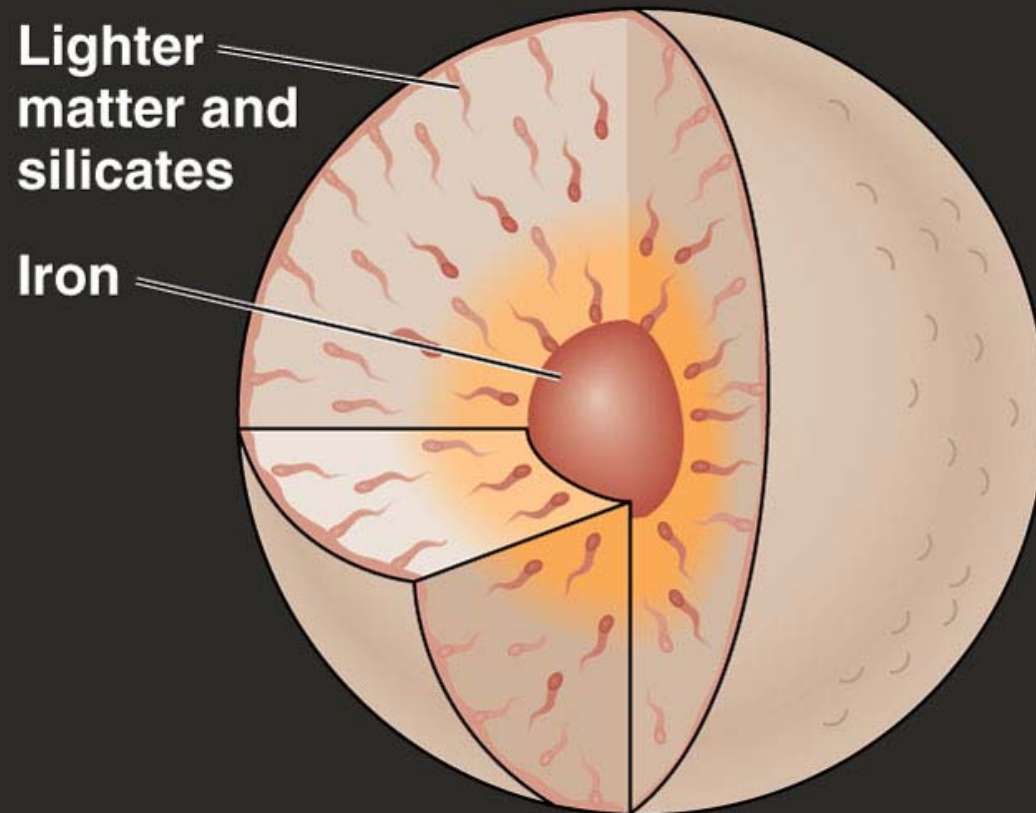
A. heating by the Sun

B. an impact by a large body (about the size of Mars) that also created the Moon

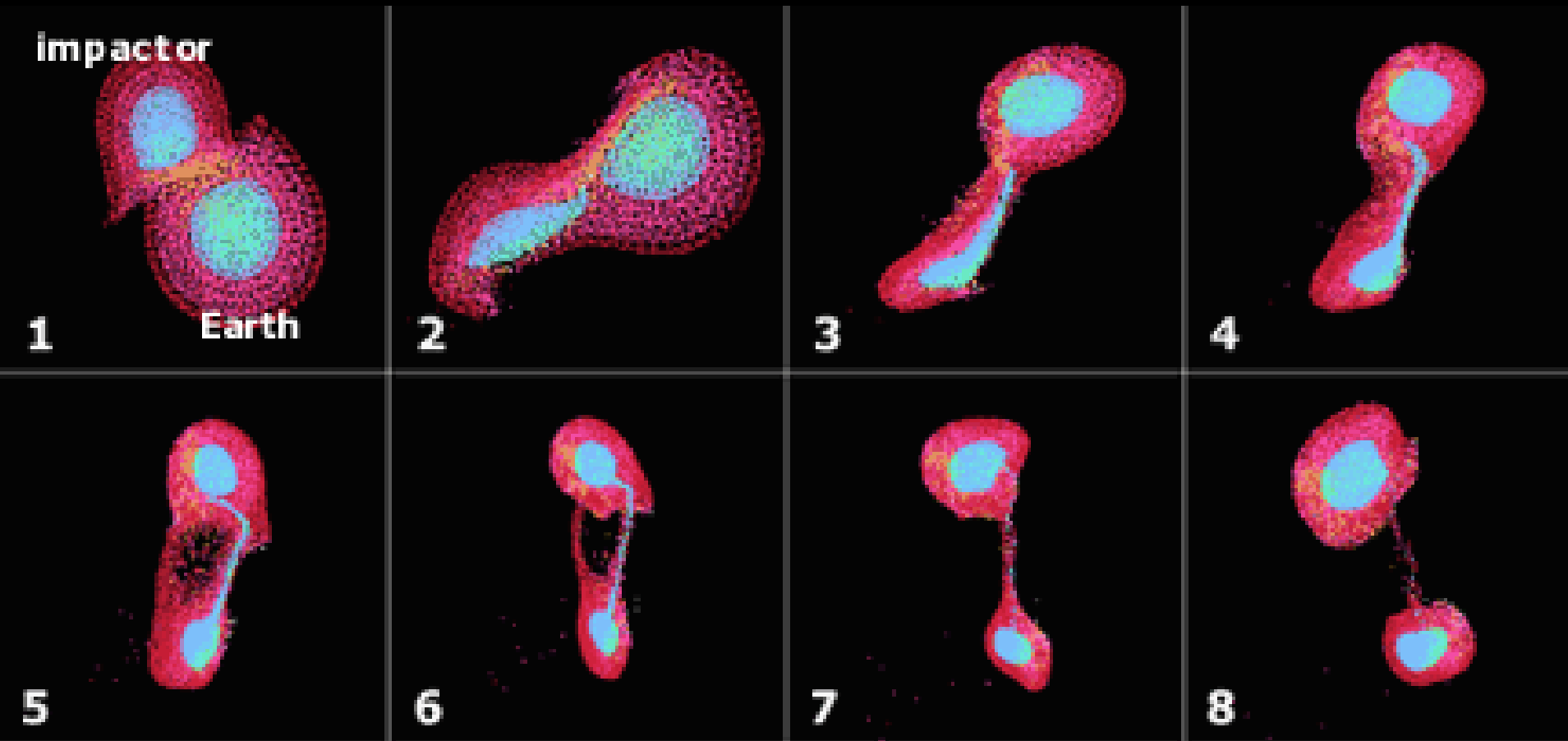
C. melting and buoyancy (high-density materials moved to the center and low-density materials rose to the surface)

D. the magnetic field caused iron to move to the center

What caused the differentiation of the interior layers of the Earth?



Hot blobs in space



(Courtesy of A. G. W. Cameron, Harvard College Observatory.)

After the collision that created the Moon

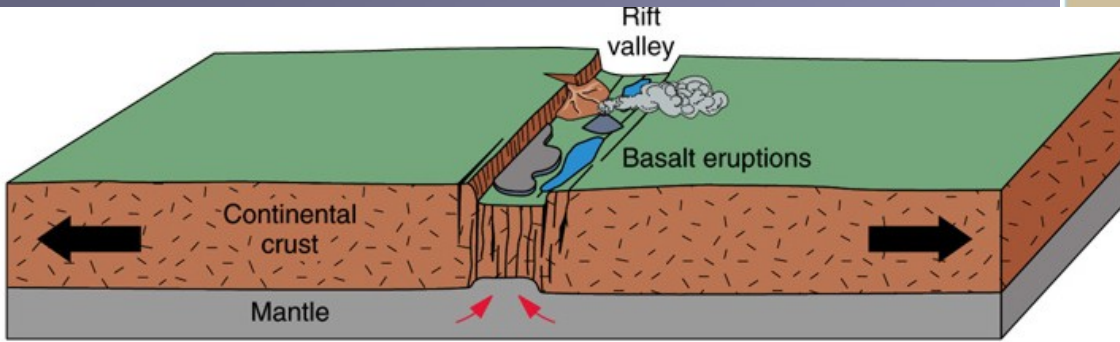
The interior layer of the Earth that responds to stress by deforming like hot silly putty, and allows movement of the tectonic plates is the:

- A. asthenosphere
- B. crust
- C. lithosphere
- D. outer core

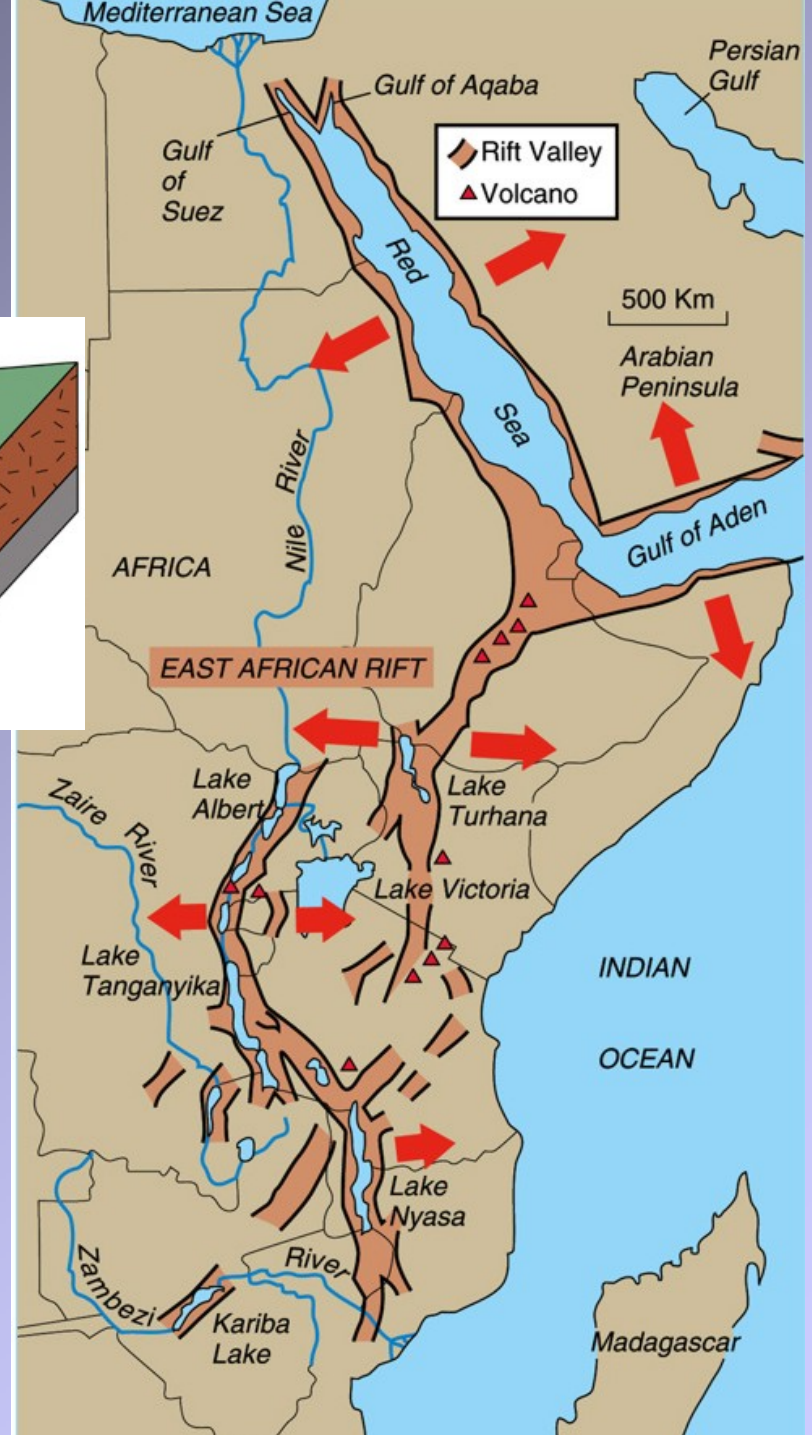
The East African Rift Valley is an example of:

- A. a continent-continent convergent boundary
- B. an ocean-continent convergent boundary
- C. an ocean-ocean convergent boundary
- D. continental rifting

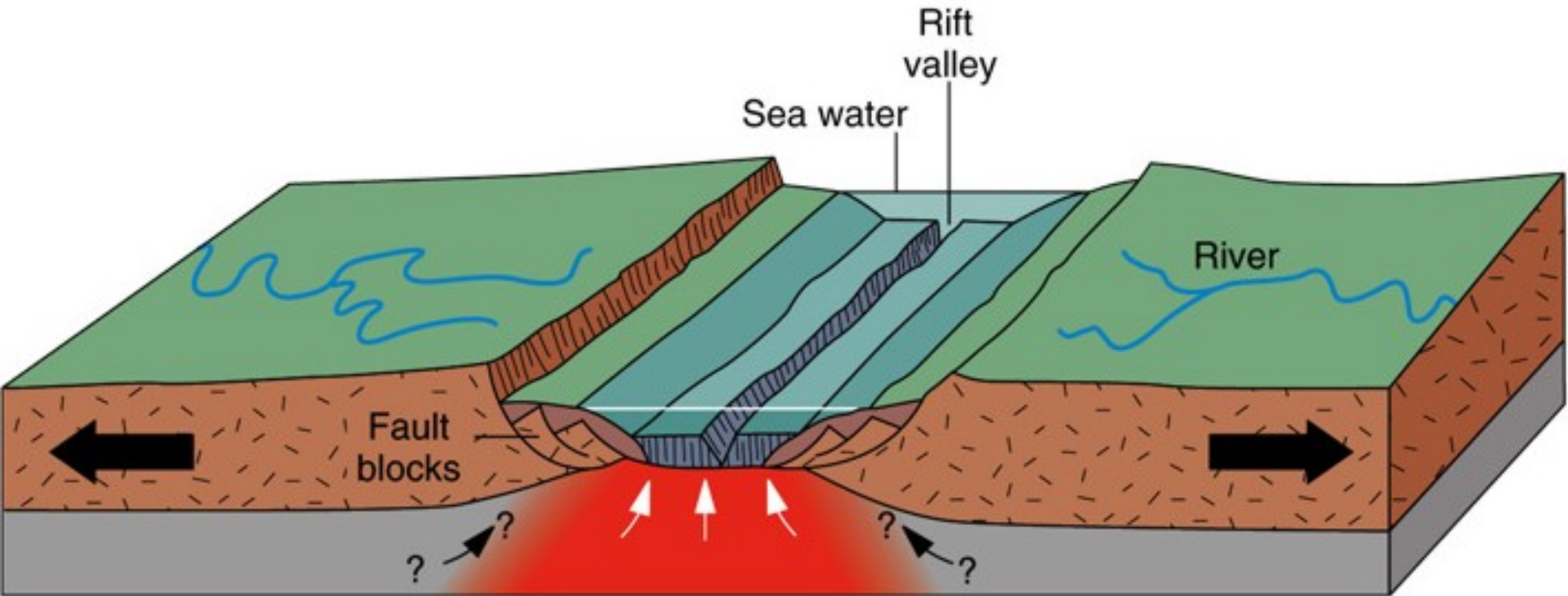
East African Rift Valley



A Continent undergoes extension. The crust is thinned and a rift valley forms (East African Rift Valleys).



Red Sea



B Continent tears in two. Continent edges are faulted and uplifted. Basalt eruptions form oceanic crust (Red Sea).

New oceanic crust is created at:

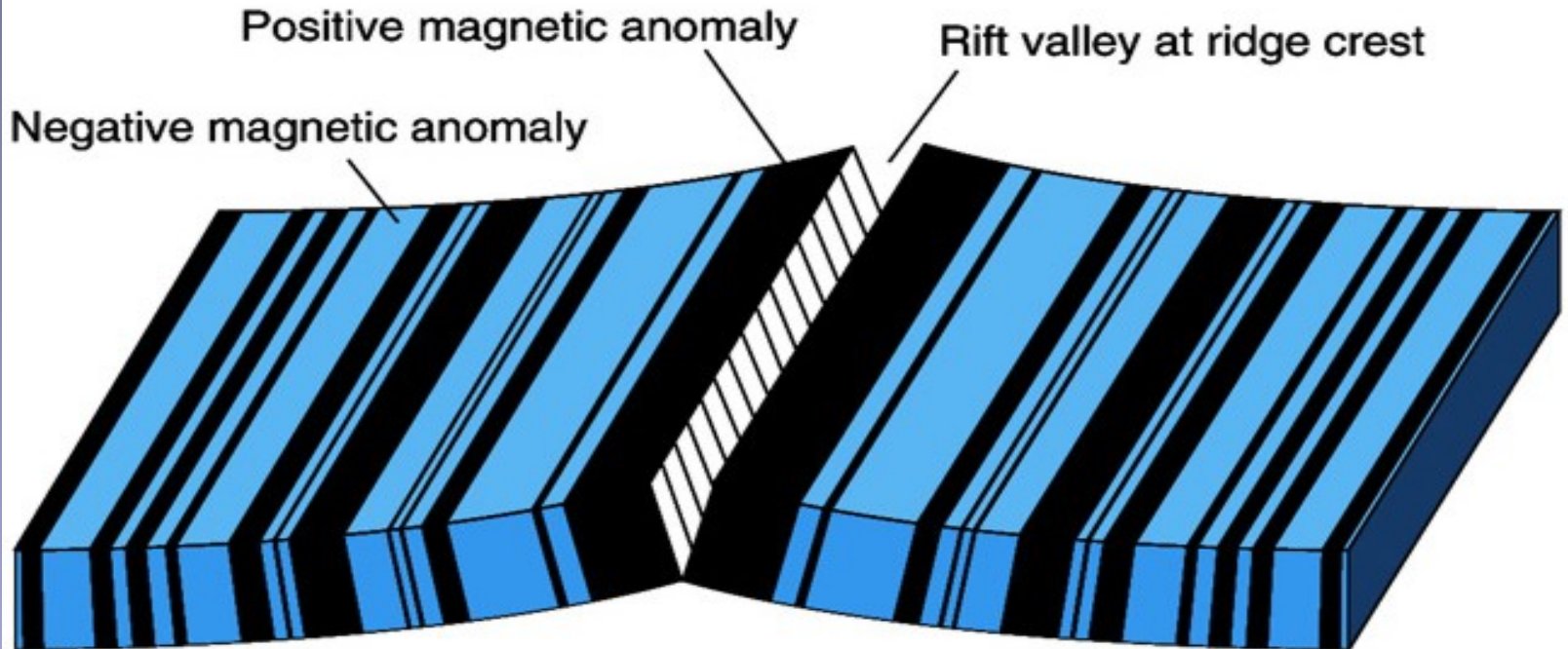
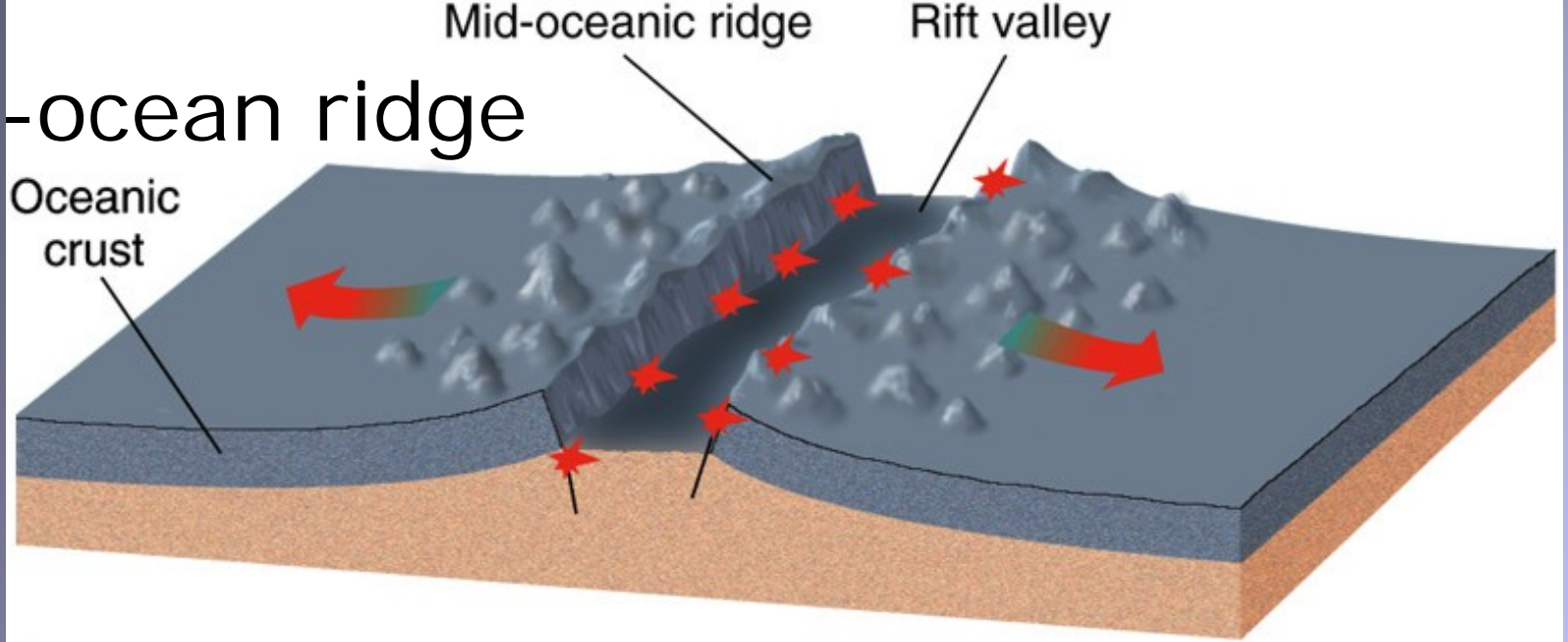
A. a divergent boundary such as a trench

B. a convergent boundary such as along the San Andreas fault

C. volcanic island arcs

D. _____

Mid-ocean ridge



10 Kilometers

Significance of these stripes?

Subduction at an **oceanic-oceanic** convergent boundary produces:

A. coastal mountain ranges such as the Andes Mountains

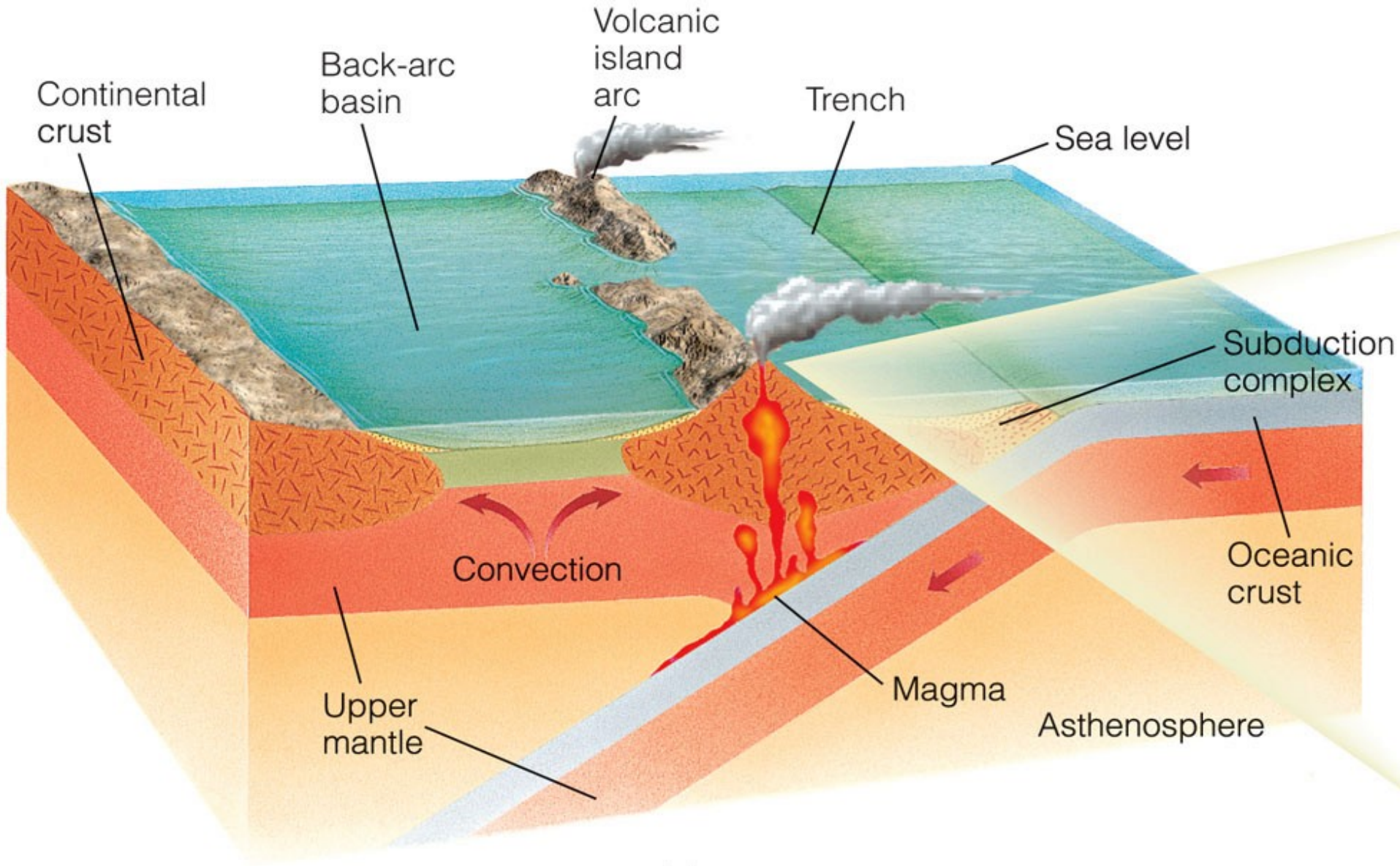
B. long, linear lakes such as those in the East African Rift Valley

C. mid-ocean ridges

D. _____

Volcanic island arc

An example is....



Volcanic island arc – Japan



The relation between earthquakes and plate boundaries

