

1/8/18

Today we will be taking notes on pages 87-88 of your notebook.

If you don't know it, it is worth writing down.

I will be quizzing on material we cover today through Wednesday on Thursday.

Objective

- I can explain how Plate Tectonics work.
- I can explain what the major plates are and where they meet.
- I can explain the effects of plates meeting.

From Continental Drift to Plate Tectonics

A Scientific Revolution Begins:

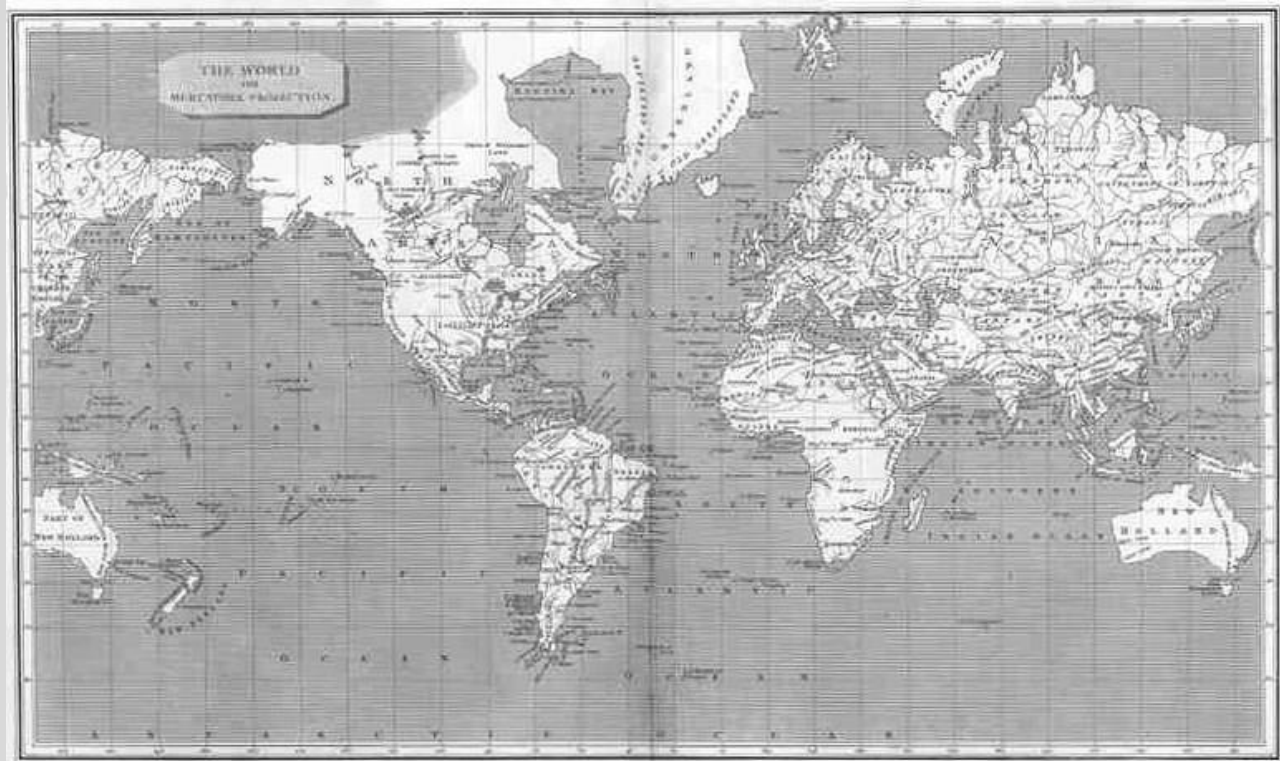
- Before the 1960s most geologists thought that ocean basins and continents existed in fixed positions
 - Idea of continental movement had been rejected for more than 50 years after its first proposal
 - North American geologists were the most vocal in their rejection because most evidence was collected from continents other than North America

- New technologies developed during and after WWII allowed geologists to discover that landmasses
 - Collide to create mountains
 - Split apart to create new ocean basins
 - Sections of seafloor plunge into the mantle
- By 1968 geologists revised their thinking and began to accept that ocean basins and continents move steadily, but very slowly

Continental Drift: An Idea Before its Time

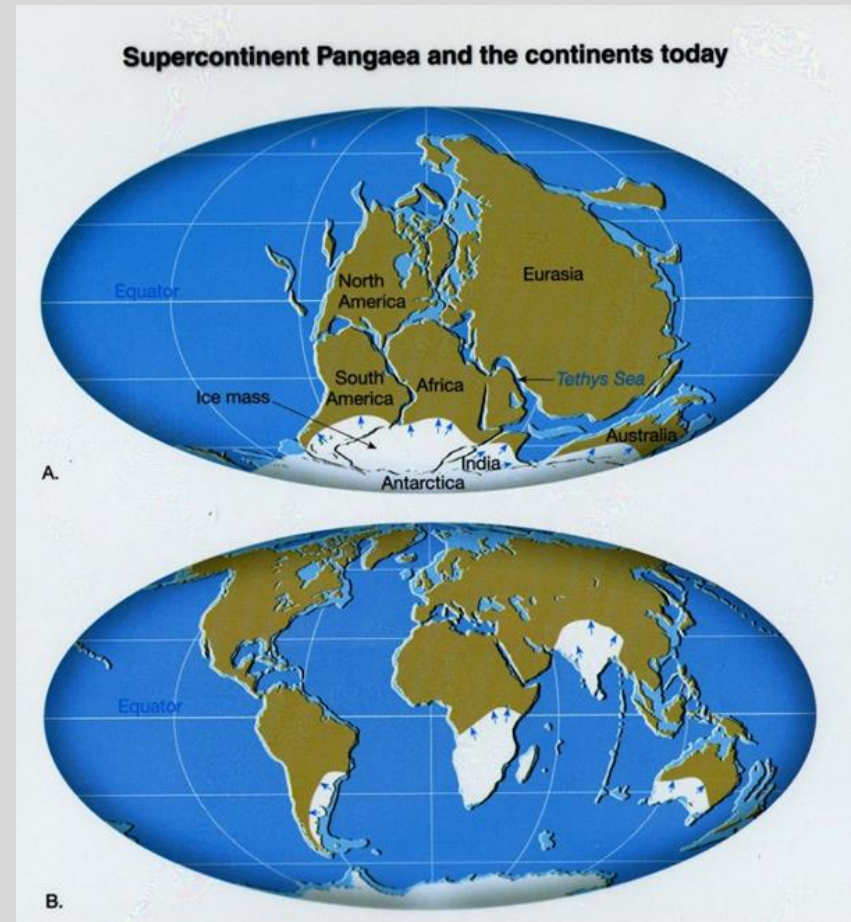
Early Observations:

- Idea that continents were once joined started in mid-1600s as better world maps became available
 - Based on appearance of how coastlines seemed to fit together



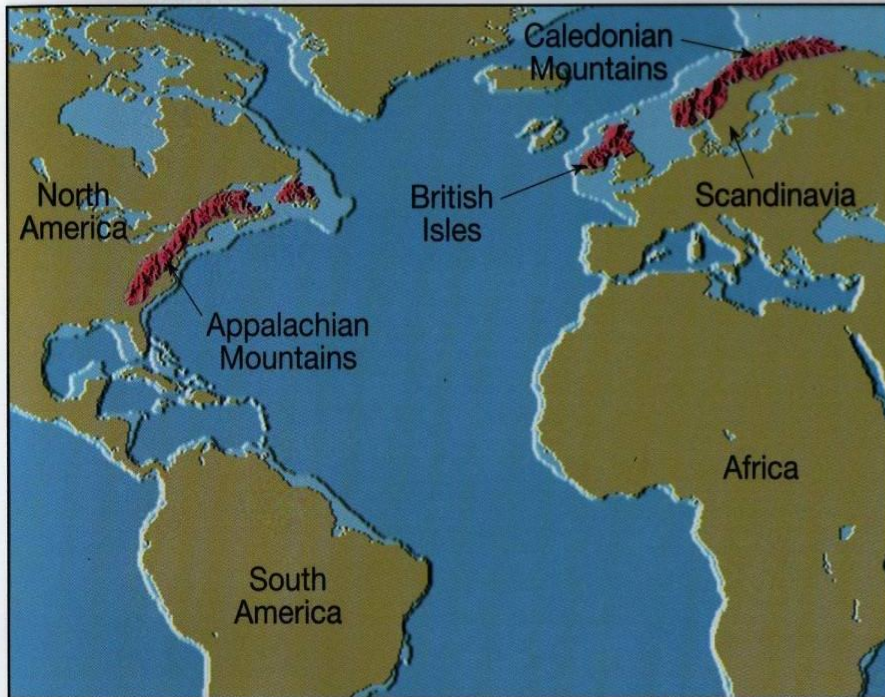
Continental Drift Hypothesis:

- 1912, Alfred Wegener proposed that the continents had all been joined together as a single land mass called Pangea
 - 250 million years ago forces under Earth's crust caused Pangea to break apart, and the continents “drifted” to current positions

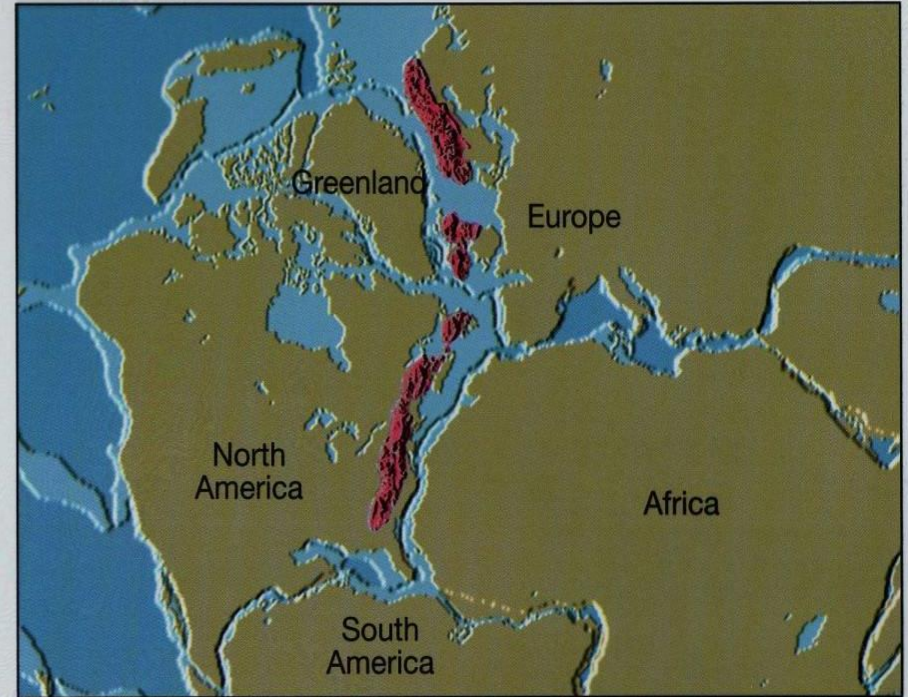


Evidence for Continental Drift:

- Rocks - same rocks from an ancient mountain chain are found in Northeast U.S. and Northwest Europe

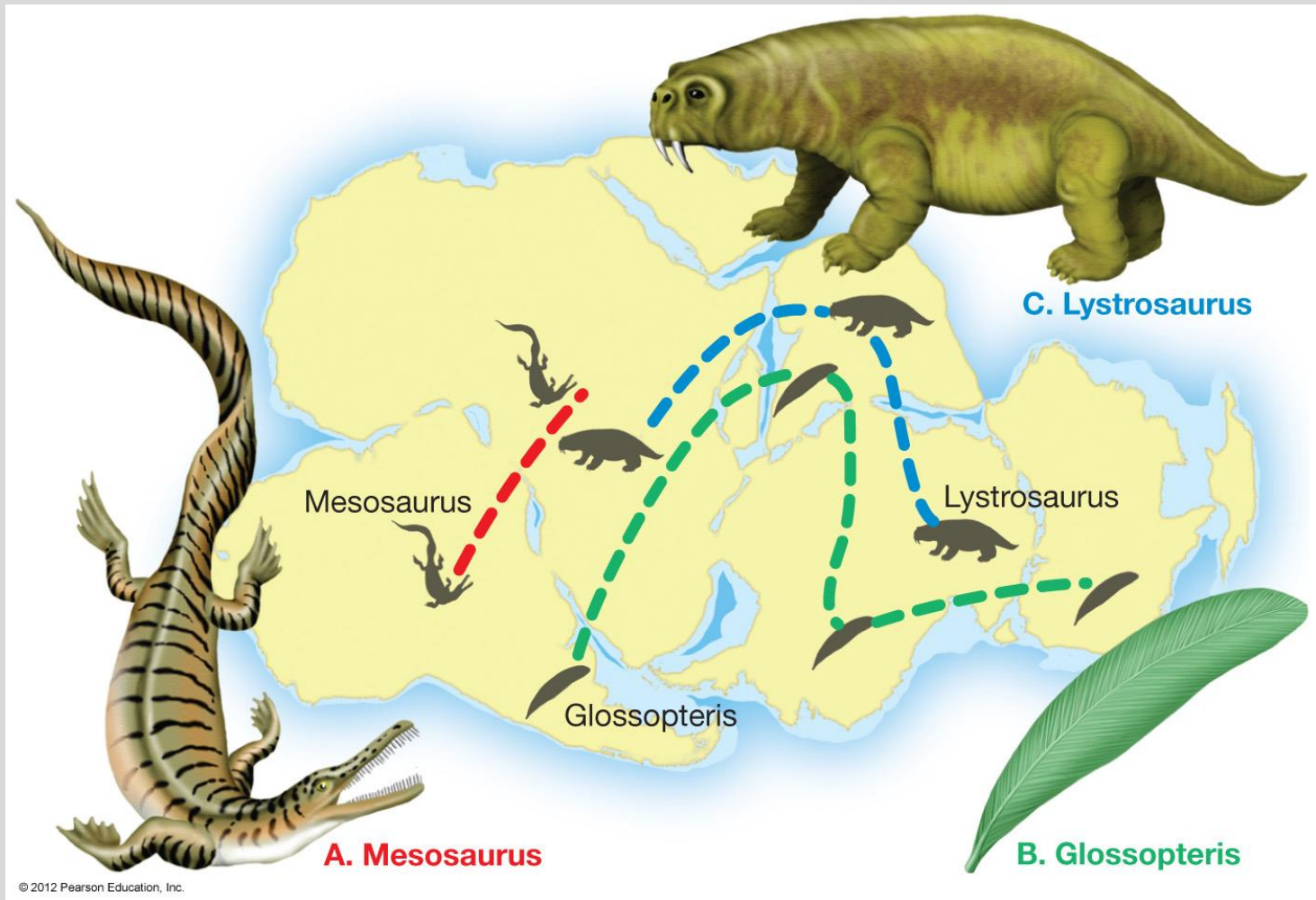


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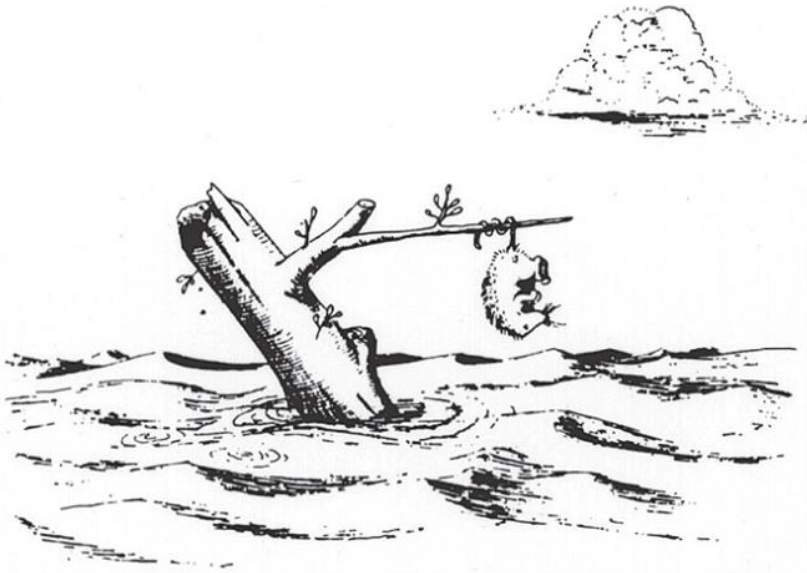


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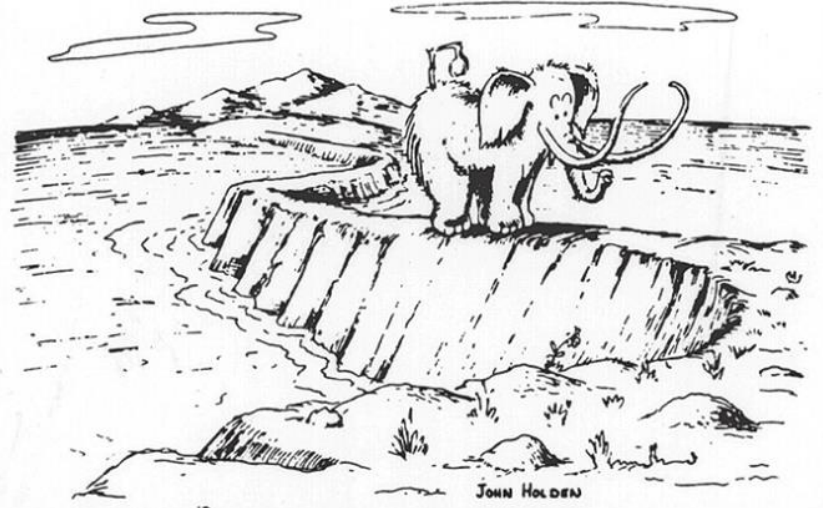
- Fossils - the fossilized remains of the same types of plants and animals are found on continents that are currently separated by thousand of miles of water



RAFTING



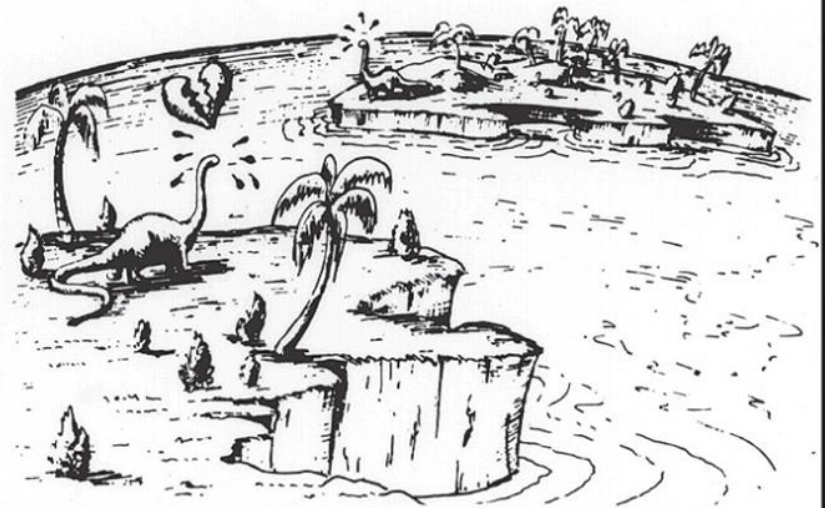
ISTHMIAN LINKS



ISLAND STEPPING STONES



CONTINENTAL DRIFT



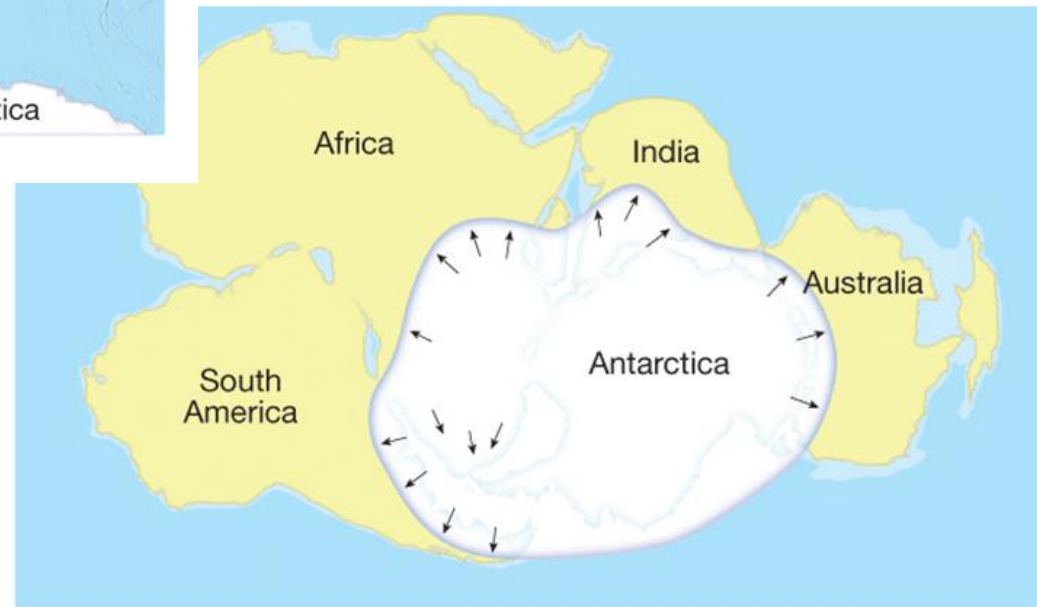
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- Continue your notes on Page 89-90

- Glacial deposits - deposits of an ice age over 300 million years old found on a few continents currently too warm to have glaciers



B.



C.

- Continental jigsaw puzzle - Wegener cited similarities of coastlines of S. America and Africa and how they seemed to fit together



The Great Debate

Rejection of the Drift Hypothesis:

- Wegener proposed two separate theories to explain continental drift
 - Proposal 1 - Moon's gravity moved continents
 - Physics proved moon couldn't exert enough force to move continents without halting Earth's rotation
 - Proposal 2 – Continents moved through ocean floor
 - Scientists knew that crust was solid enough that continents couldn't move through ocean floor without destroying it

- Ultimately, Wegener's hypothesis was rejected because he could not explain how the continents moved

The Theory of Plate Tectonics

Plate Tectonics Theory:

- The Theory of Plate Tectonics states that Earth's crust is broken into sections called tectonic plates which ride on a sea of partially molten rock, as the molten rock moves the plates and continents move also
 - Lithosphere is solid rocky crust floating on asthenosphere allowing continents to move as it moves
 - Asthenosphere is partially molten upper mantle that slowly moves

- There are many plates of various size
 - 7 major, 7 intermediate, and several minor
- Most only move a few inches a year
- Plate motion driven by unequal distribution of heat within Earth

Seafloor Spreading

Ocean Floor Topography:

- Ocean floor mapping after WWII led to the discovery that it wasn't flat but held a variety of topographic features
 - Ocean ridges – underwater mountain ranges where volcanism and earthquakes common
 - Ocean ridges extend about 43,000 miles in length along the ocean floor

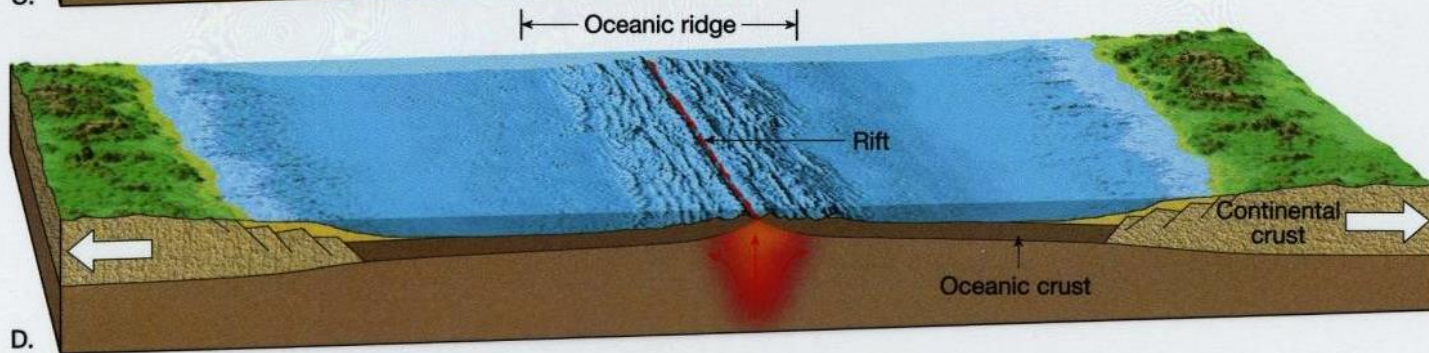
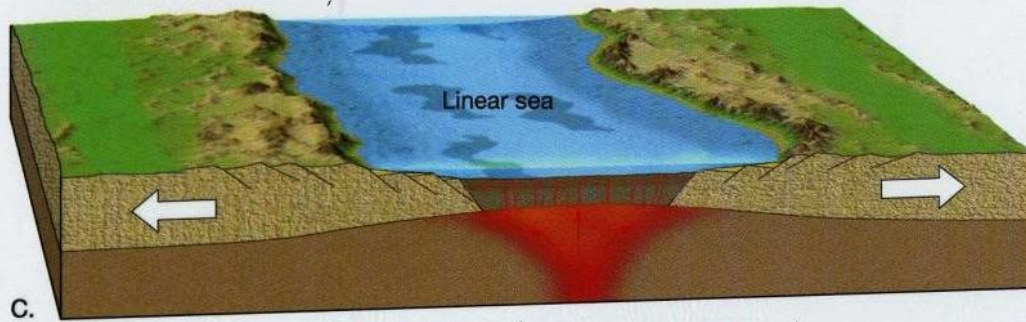
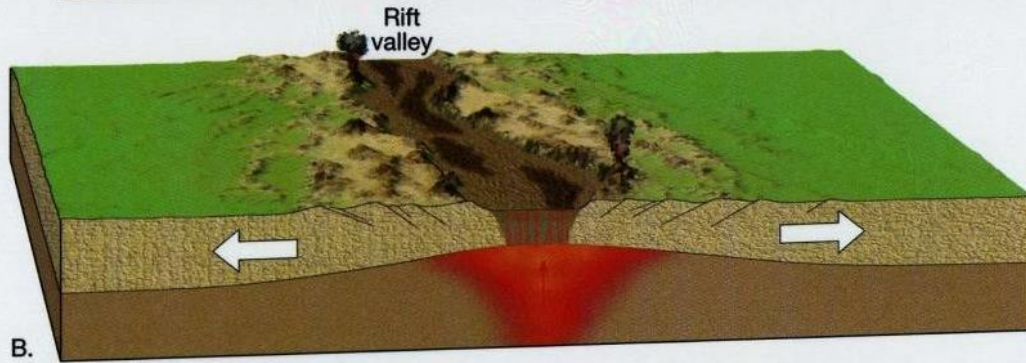
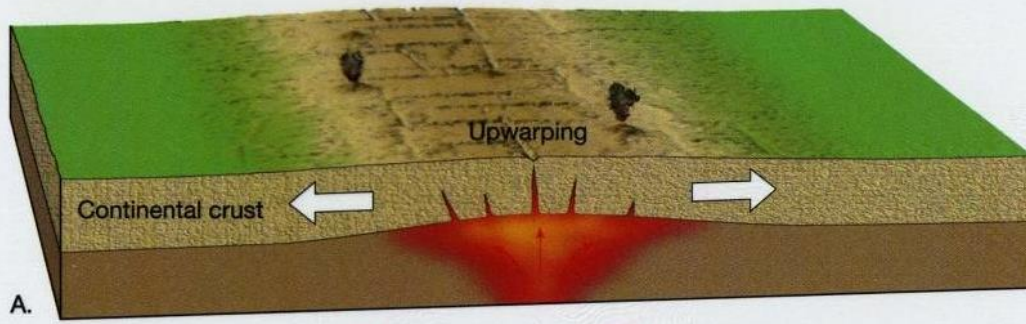
- Deep ocean trenches – long, narrow, deep depressions on ocean floor where ocean crust is recycled producing earthquakes and volcanism
 - Deepest point in ocean is Marianas trench which extends 7 miles from the ocean floor and 11 miles from the ocean surface

Divergent Boundaries

Divergent Boundaries:

- Divergent boundaries form where two tectonic plates move away from each other
 - Most divergent boundaries occur along mid-ocean ridges
 - Magma wells up to fill gaps left behind creating new ocean floor as plate move apart

- Divergent boundaries can occur on Earth's surface where they first create a rift valley
 - Eventually rift valley will spread far enough apart that it will fill in with water to become a shallow sea and possibly a new ocean basin



Quiz Tomorrow (1/11/18)

10 short answer questions, 15 points

- Who Proposed the Continental Drift Hypothesis?
- 4 pieces of evidence for Continental Drift
- Why was Wegener's hypothesis rejected
- When was it finally accepted
- How many MAJOR tectonic plates are there?
- Who proposed the theory of seafloor spreading?*
- What is a divergent boundary?
- What are the types of convergent boundaries?*
- Transform Fault examples*
- What drives plate motion?*

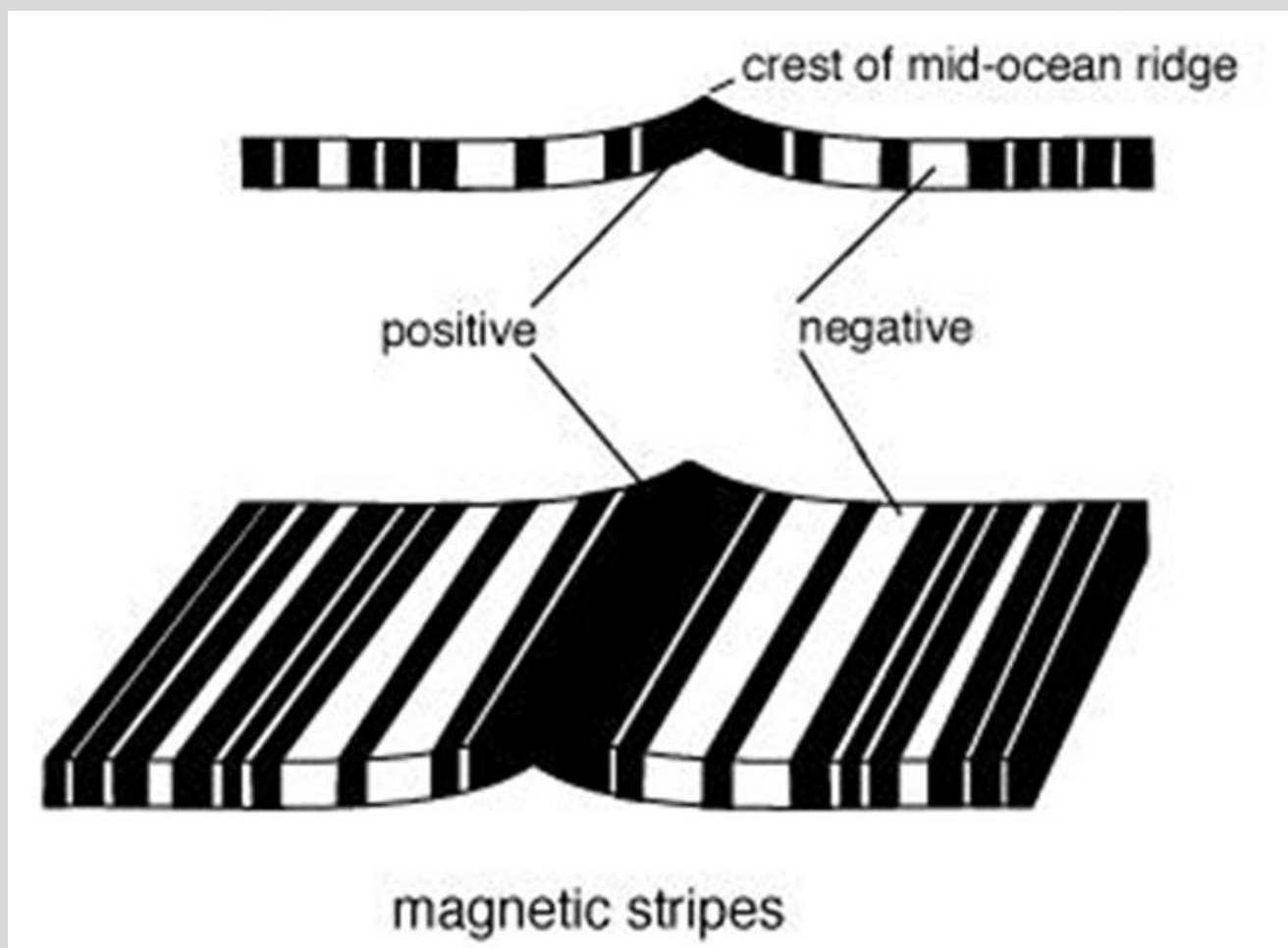
*denotes we will cover this material today

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- Continue notes on page 91/92 (or wherever you are)

Magnetism and Magnetic Reversal:

- Magnetic fields are generated by flowing molten iron in outer core
 - Magnetic field reversal occurs when flow in outer core changes direction
 - Reversals cause changes in the way iron minerals align as cooling and crystallization occurs
 - Creates positive and negative stripes along ocean floor and on land which are the same on both sides of the ocean ridges



Theory of Seafloor Spreading:

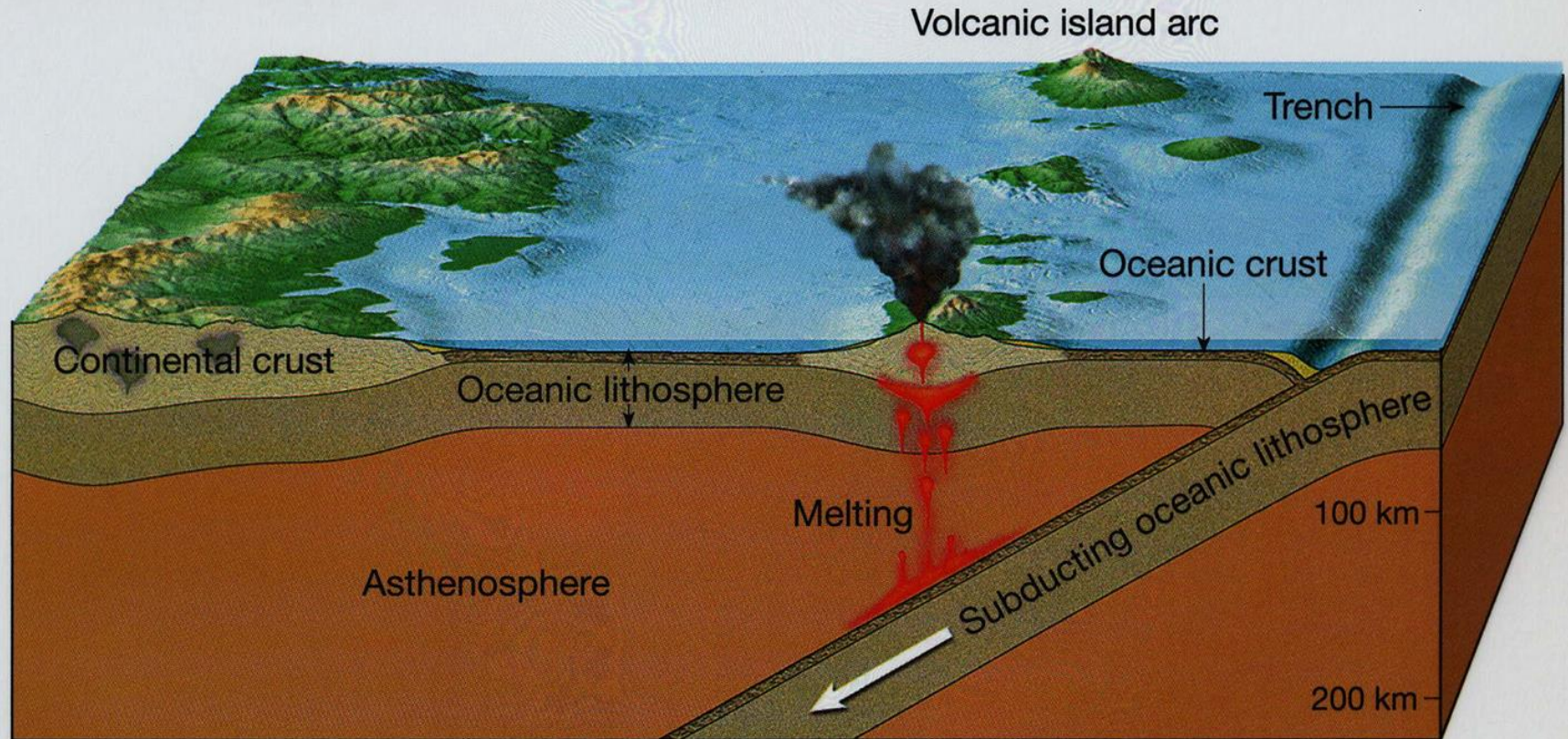
- Proposed by Harry Hess who looked at topography, magnetic reversal information, and compared the ages of ocean crust and thickness of sediment layers at the ridges and trenches
 - Ocean crust is youngest at ridges and oldest at trenches
 - Sediment layer is thinnest at ridges and thickest at trenches
- Hess' theory proved Continental Drift theory and Wegener right by providing a mechanism for continental movement

Convergent Plate Boundaries and Subduction

Convergent Boundaries:

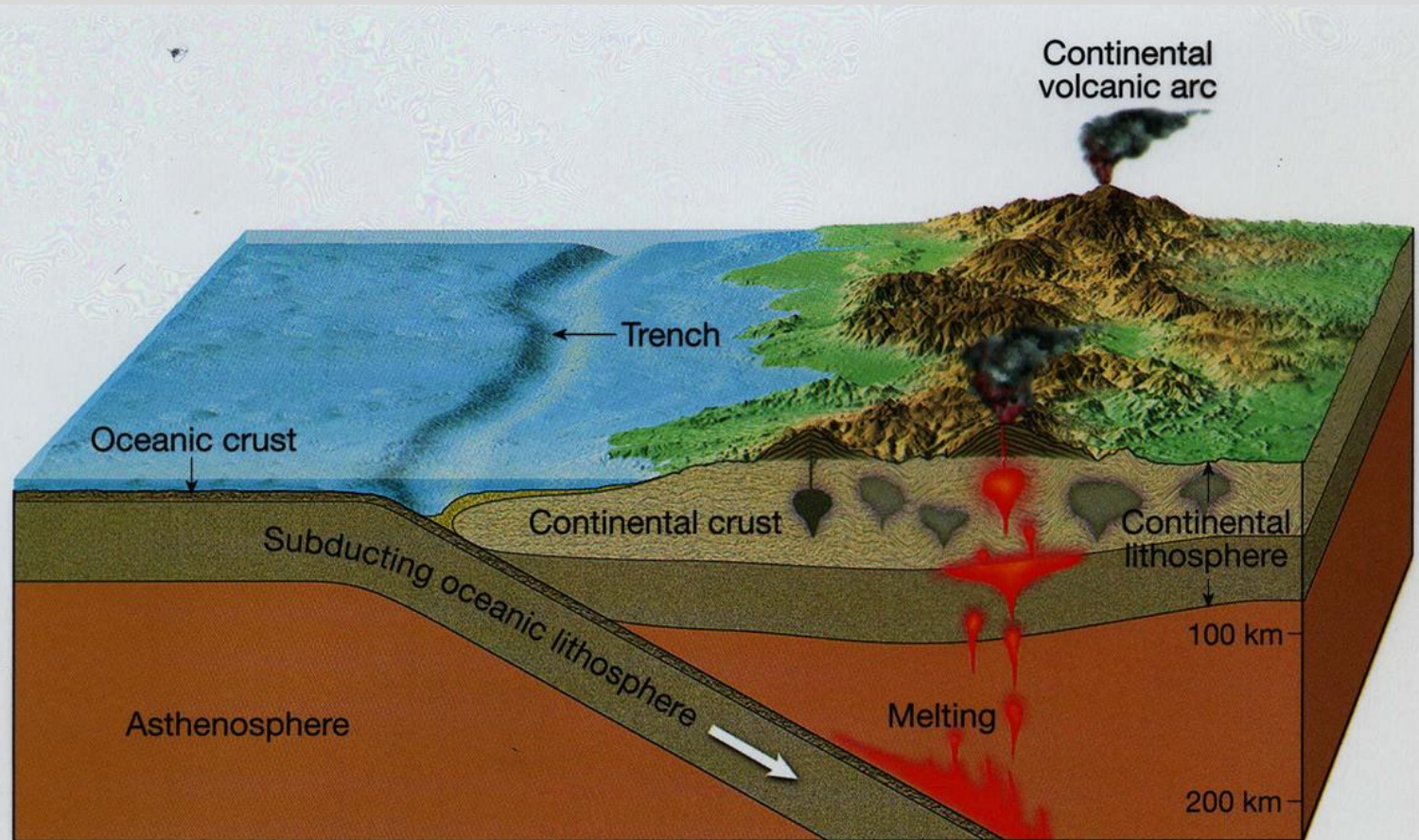
- Convergent boundaries form where two tectonic plates come together, subduction often occurs as a heavier tectonic plate slides under the a lighter plate, crust is often recycled
 - There are three types of convergent boundaries

- Oceanic – Oceanic
 - Earthquakes, volcanism, and trenches common
 - Volcanic island arcs form on non-subducted plate
 - Japan, Indonesia, Aleutian Islands of Alaska

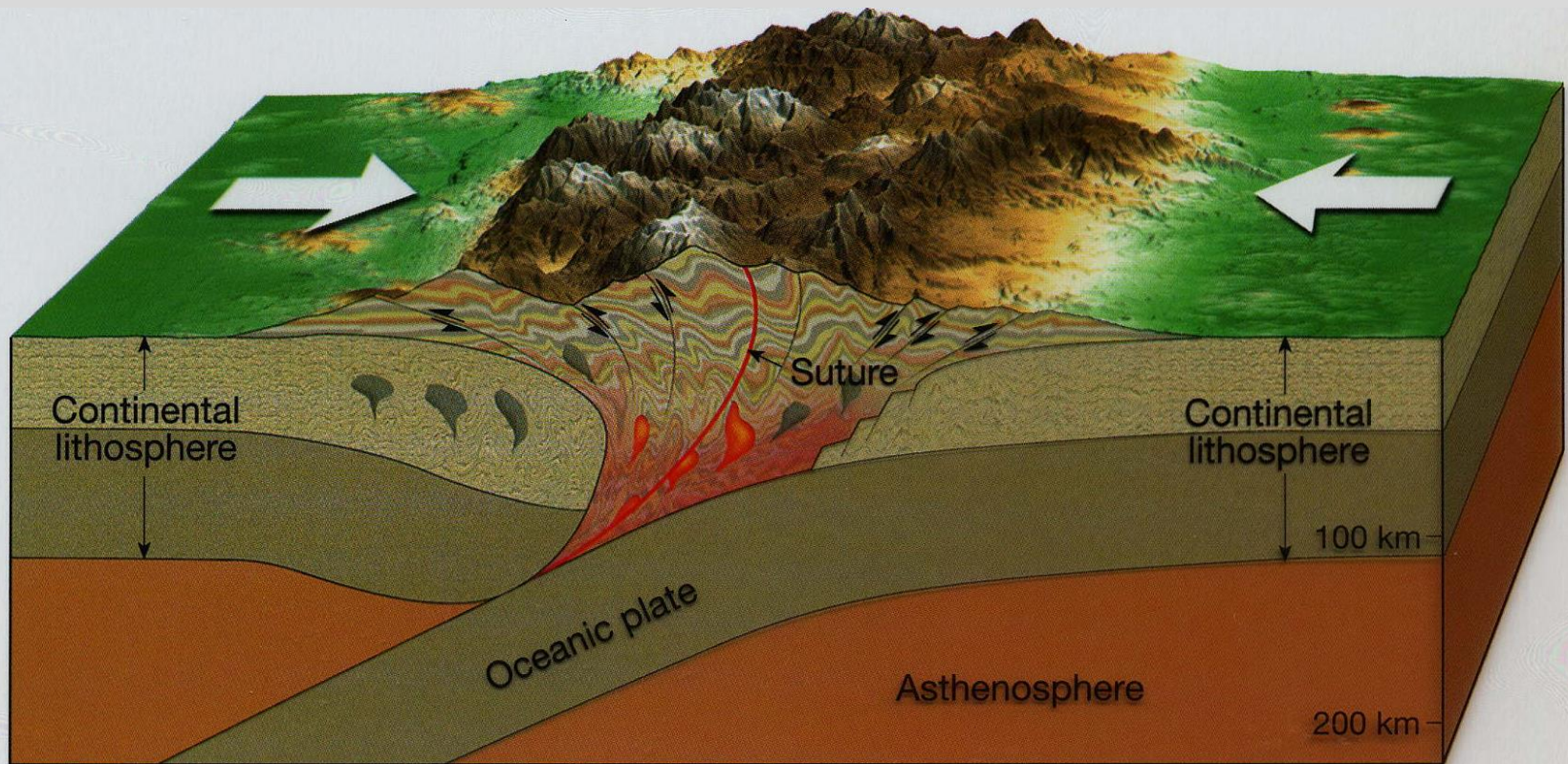


B.

- Oceanic – Continental
 - Earthquakes, volcanism, and trenches common
 - Continental volcanic arcs form on non-subducted plate
 - Cascades Mts., Mt. Vesuvius



- Continental – Continental
 - Earthquakes and folded mountains common
 - Himalayas, Alps, and Appalachians



C.

Transform Plate Boundaries

Transform Faults:

- Transform boundaries form where two tectonic plates slide past each other without producing or destroying lithosphere
 - Earthquakes are common
- Transform boundaries commonly occur along ocean ridges but can develop at Earth's surface
 - San Andreas Fault is one of the most studied transform faults

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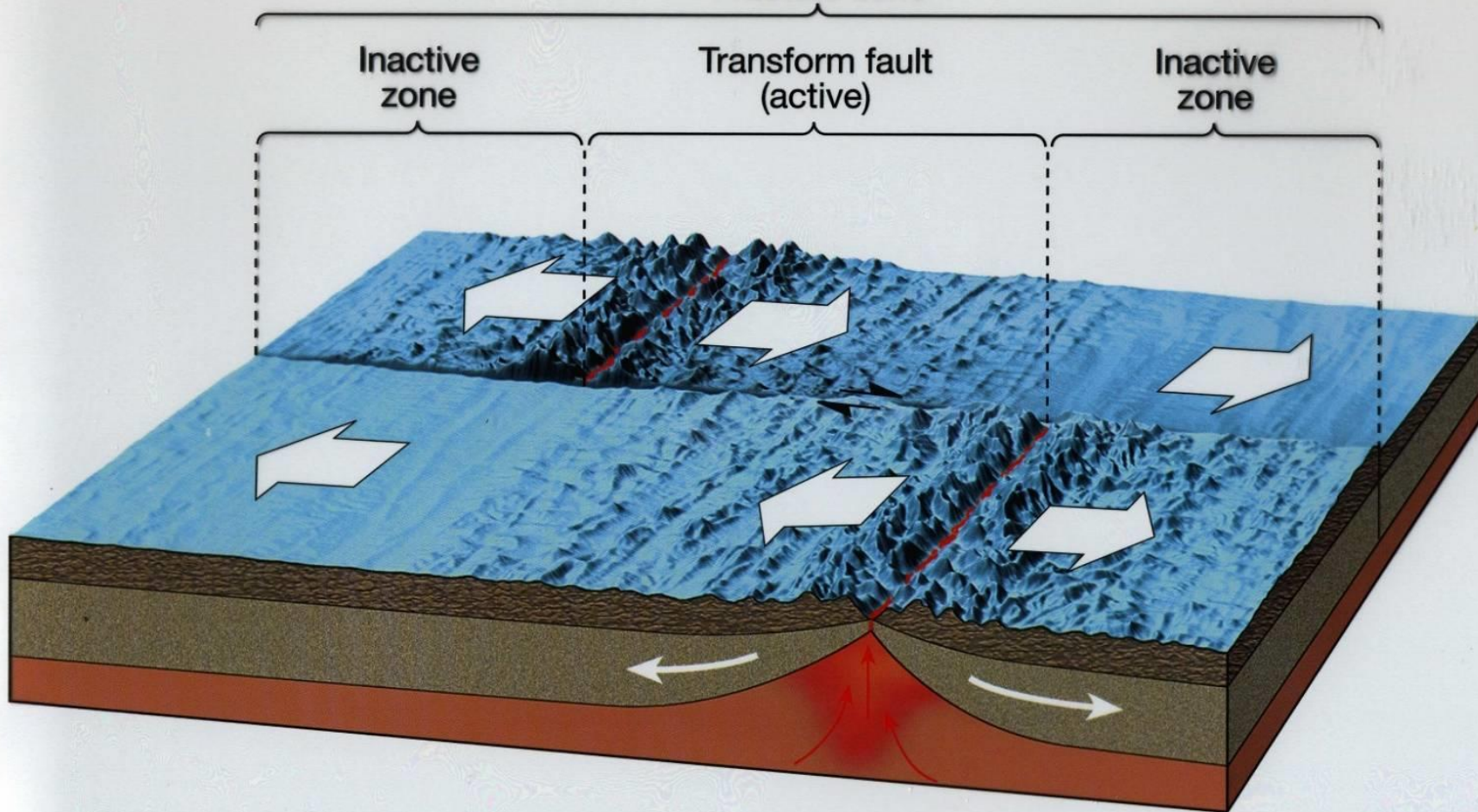
Transform faults

Fracture zone

Inactive zone

Transform fault (active)

Inactive zone



What Drive Plate Motions

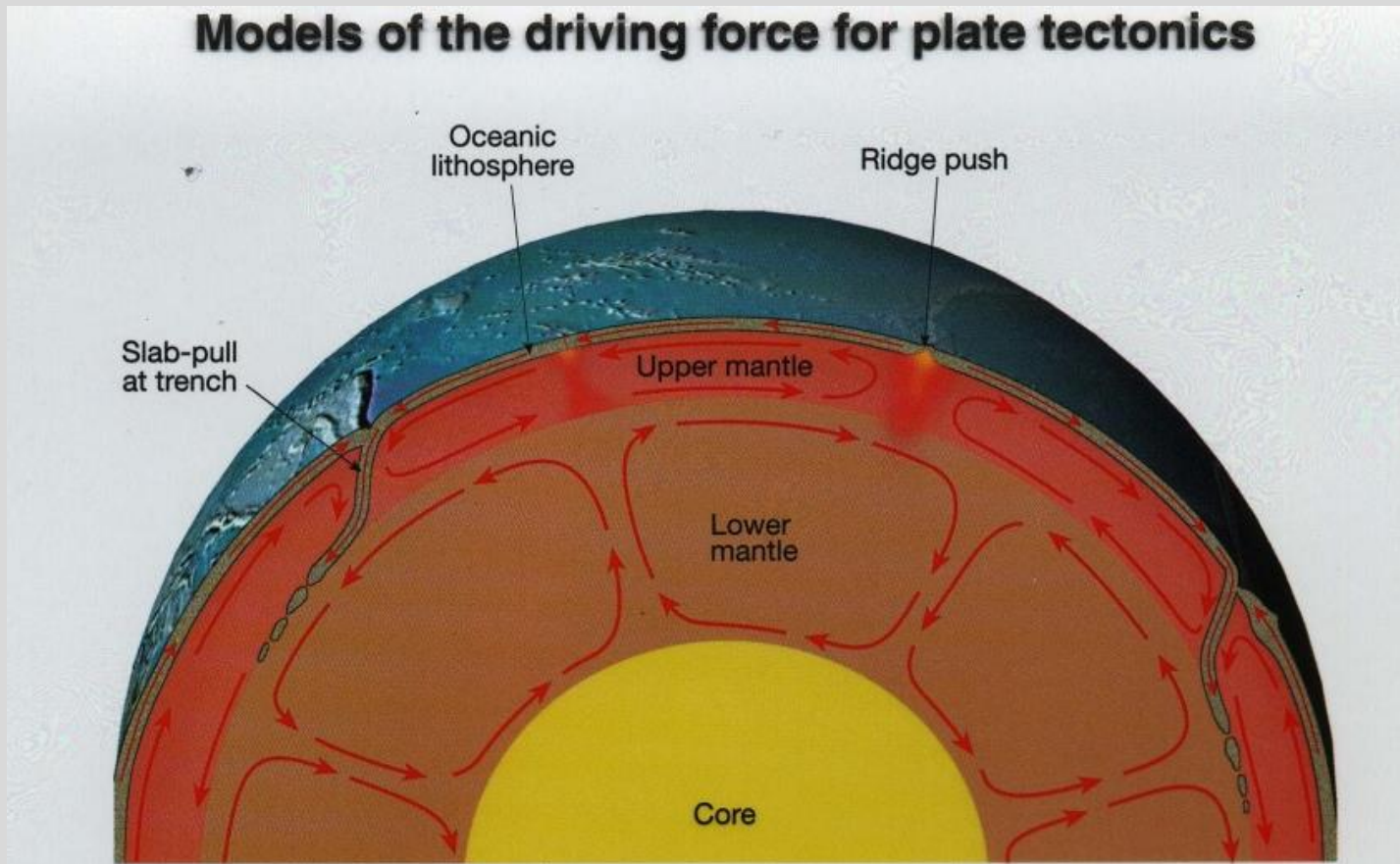
Mantle Convection and Plate Motions:

- Scientists generally agree that Mantle Convection is the driving force of Plate Tectonics
 - Magma creates new ocean crust at ridges
 - Crust recycled at subduction zones (trenches)
 - Process repeats over and over



Ridge Push and Slab Pull:

- Uplifted ridges push oceanic plates toward trenches where older crust begins to subduct
- Weight and gravity pull subducting slab further into subduction zone where crust is recycled



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