

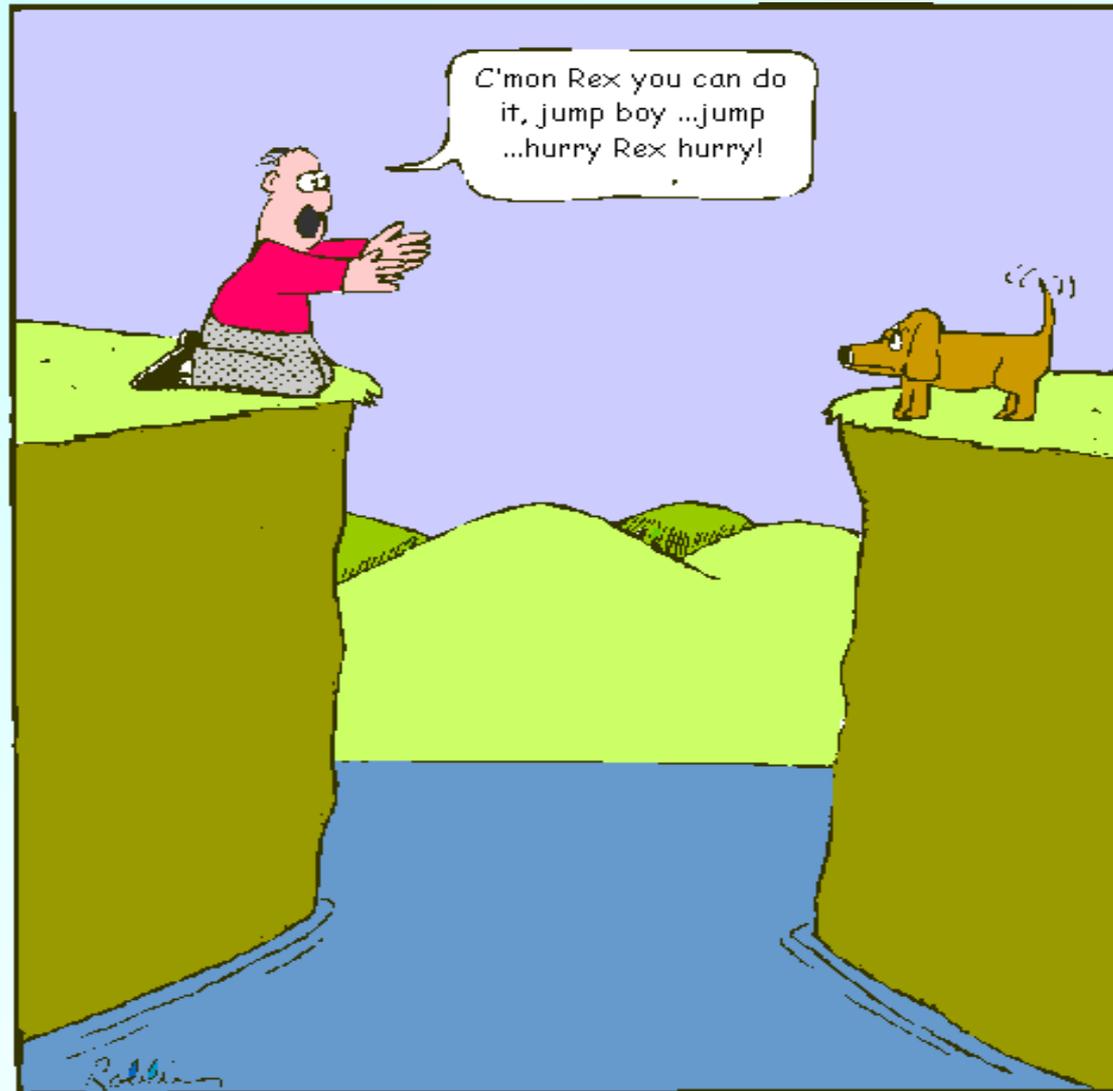
CONTINENTAL DRIFT AND PLATE TECTONICS

CONTINENTAL DRIFT

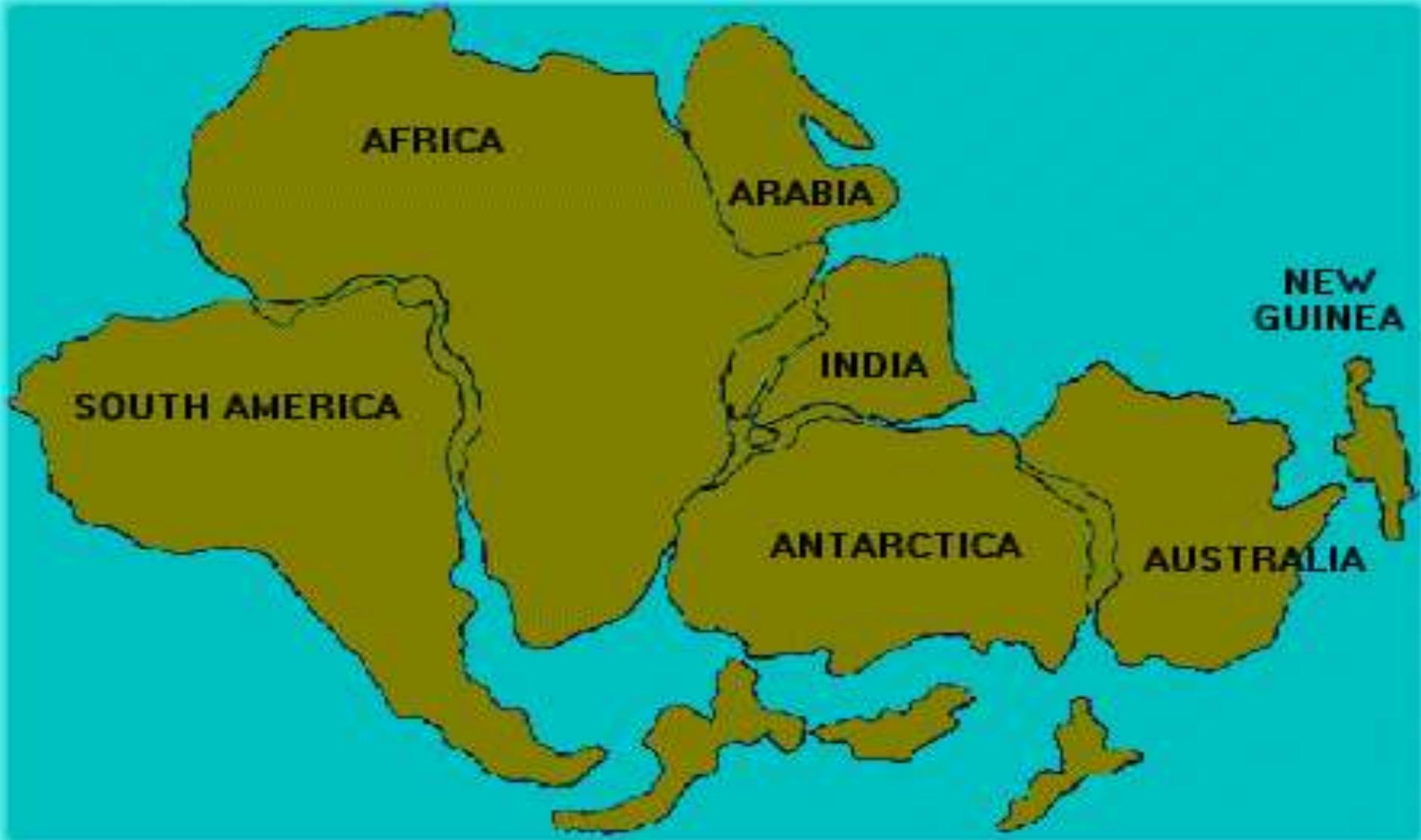
× “Father”
of this
theory is
Alfred
Wegener.



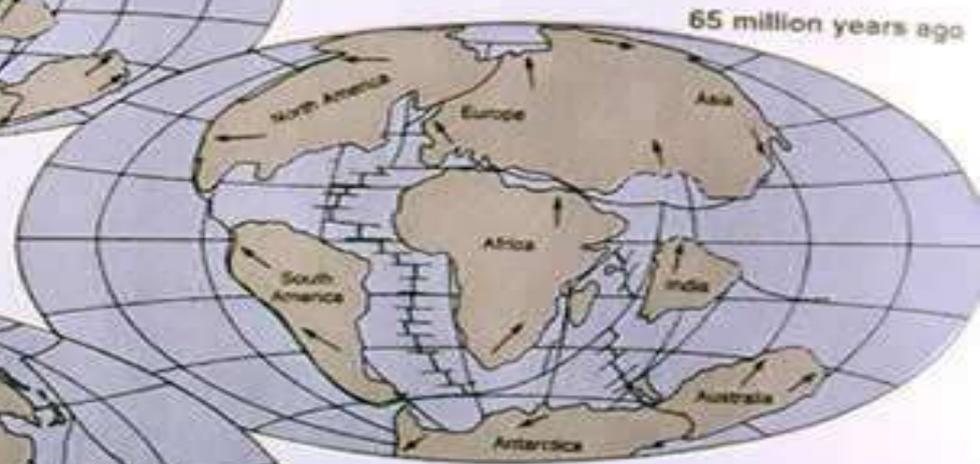
UNTOLD TRAGEDIES OF CONTINENTAL DRIFT!!



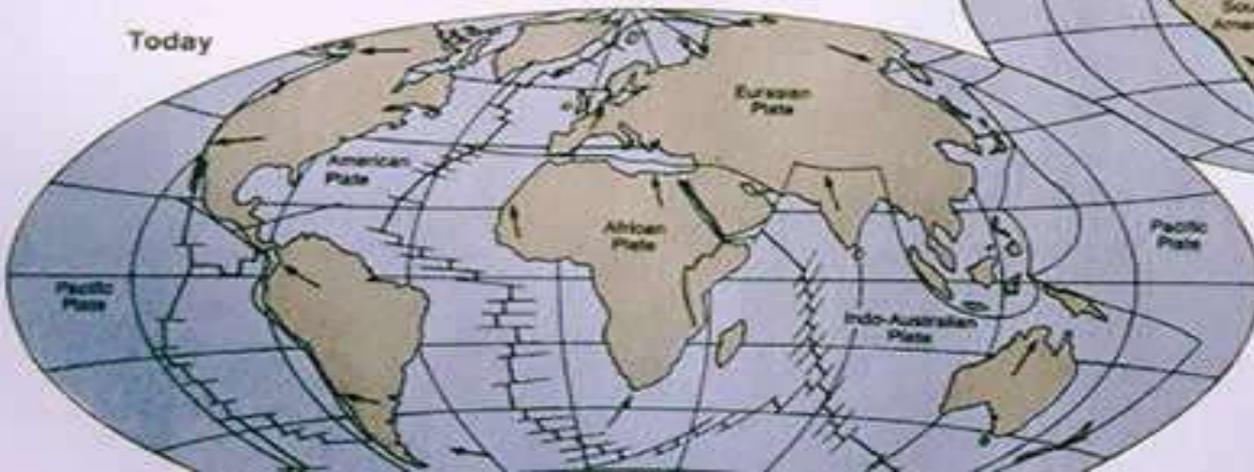
PANGAEA



CONTINENTAL DRIFT



Today

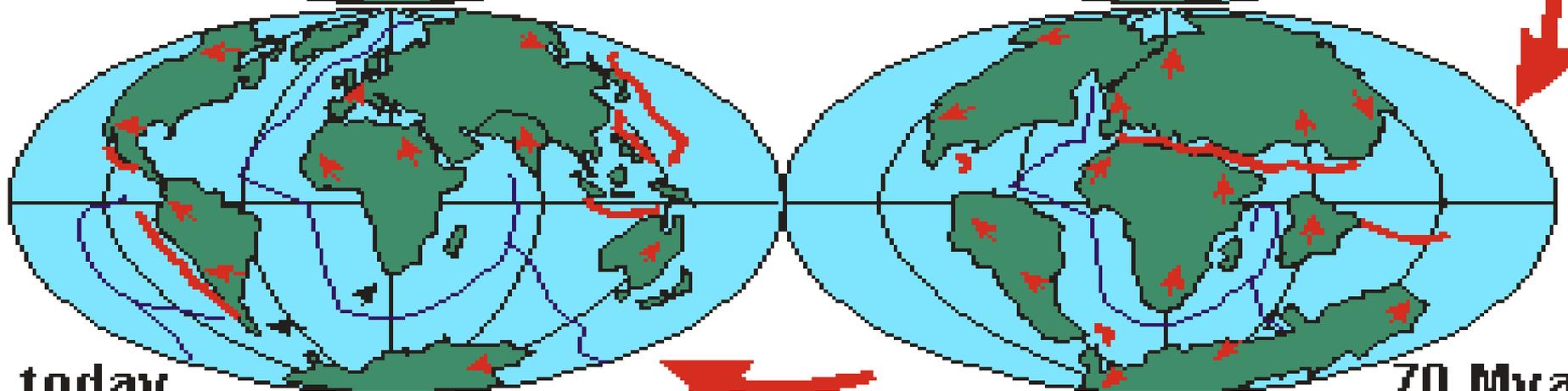
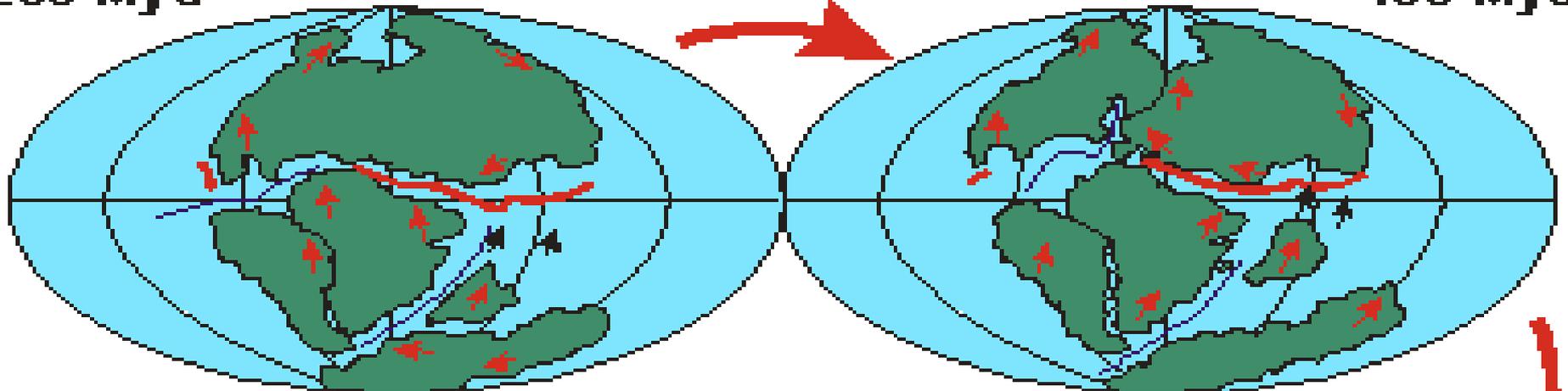


ANOTHER VIEW OF DRIFT

continental drift

200 Mya

130 Mya



today

70 Mya

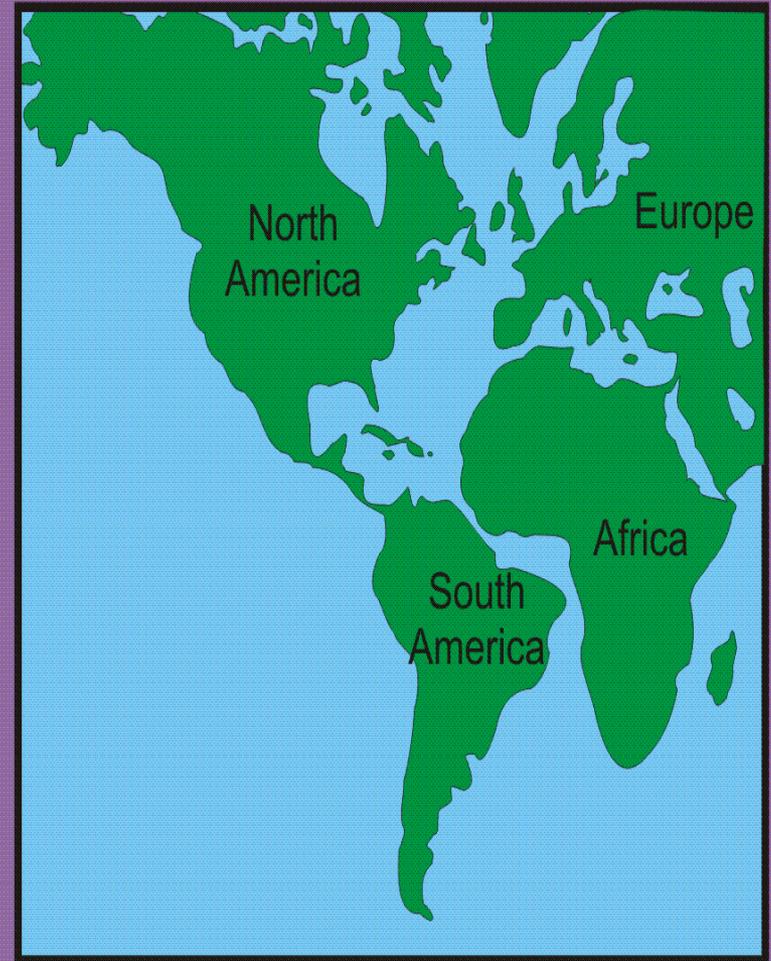
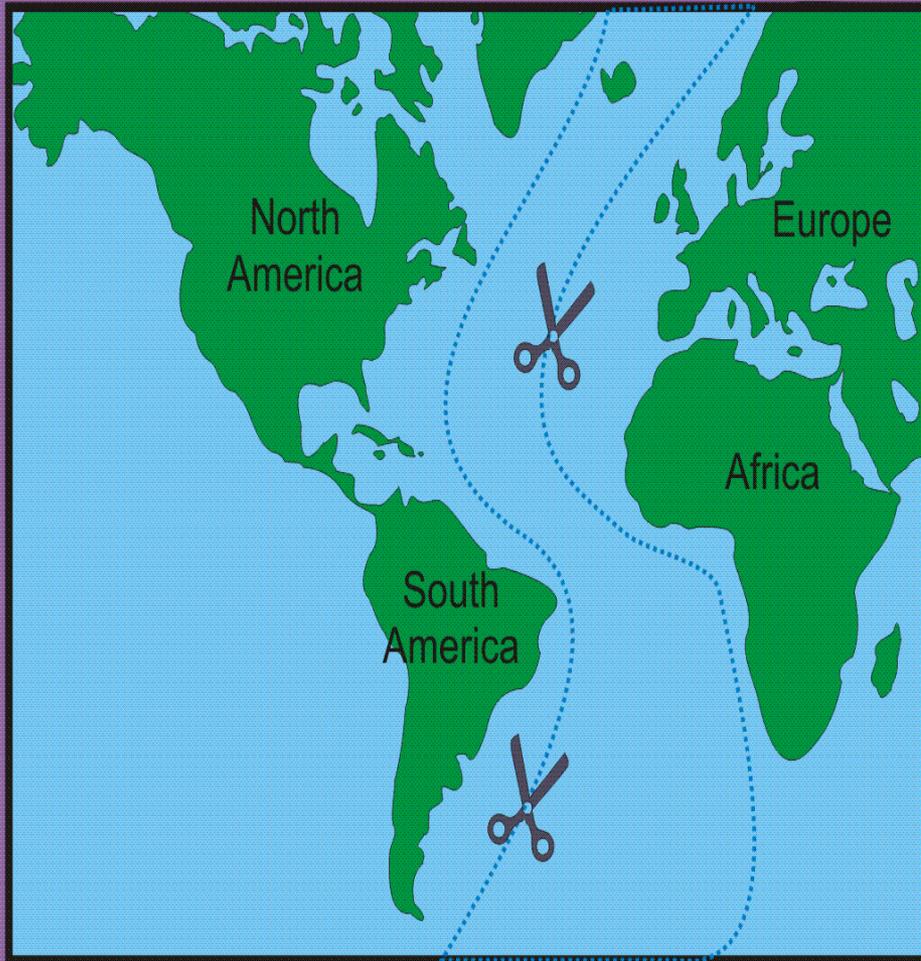
WHAT EVIDENCE DID WEGENER HAVE?

- × Wegener provided four main pieces of evidence to support his theory that the continents had been drifting over time.

1. JIGSAW PUZZLE

- ✘ Wegener noticed that if we could move present day continents around, several continents look like they would fit together like pieces of a jigsaw puzzle.

1. JIGSAW PUZZLE



2. FOSSILS

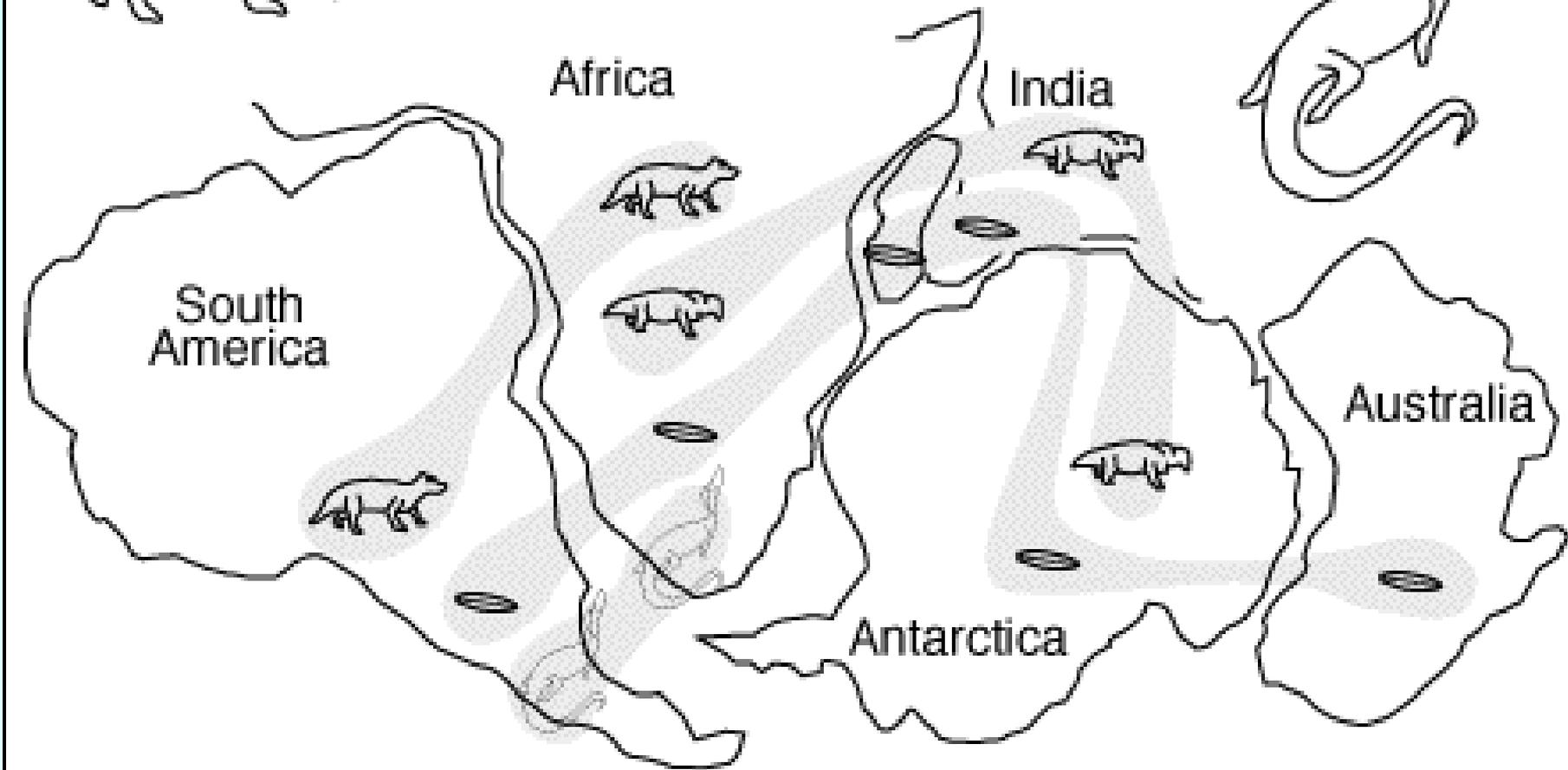
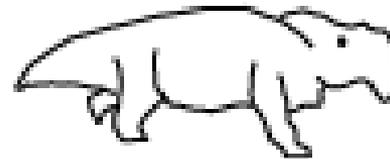
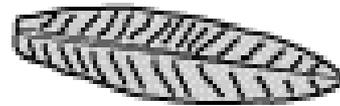
- ✘ Wegener also found fossils of the same plants and animals on different continents now separated by vast oceans. They could only be found this way if the continents had once been joined together.

Cynognathus

Glossoscoptes

Lystrosaurus

Mesosaurus

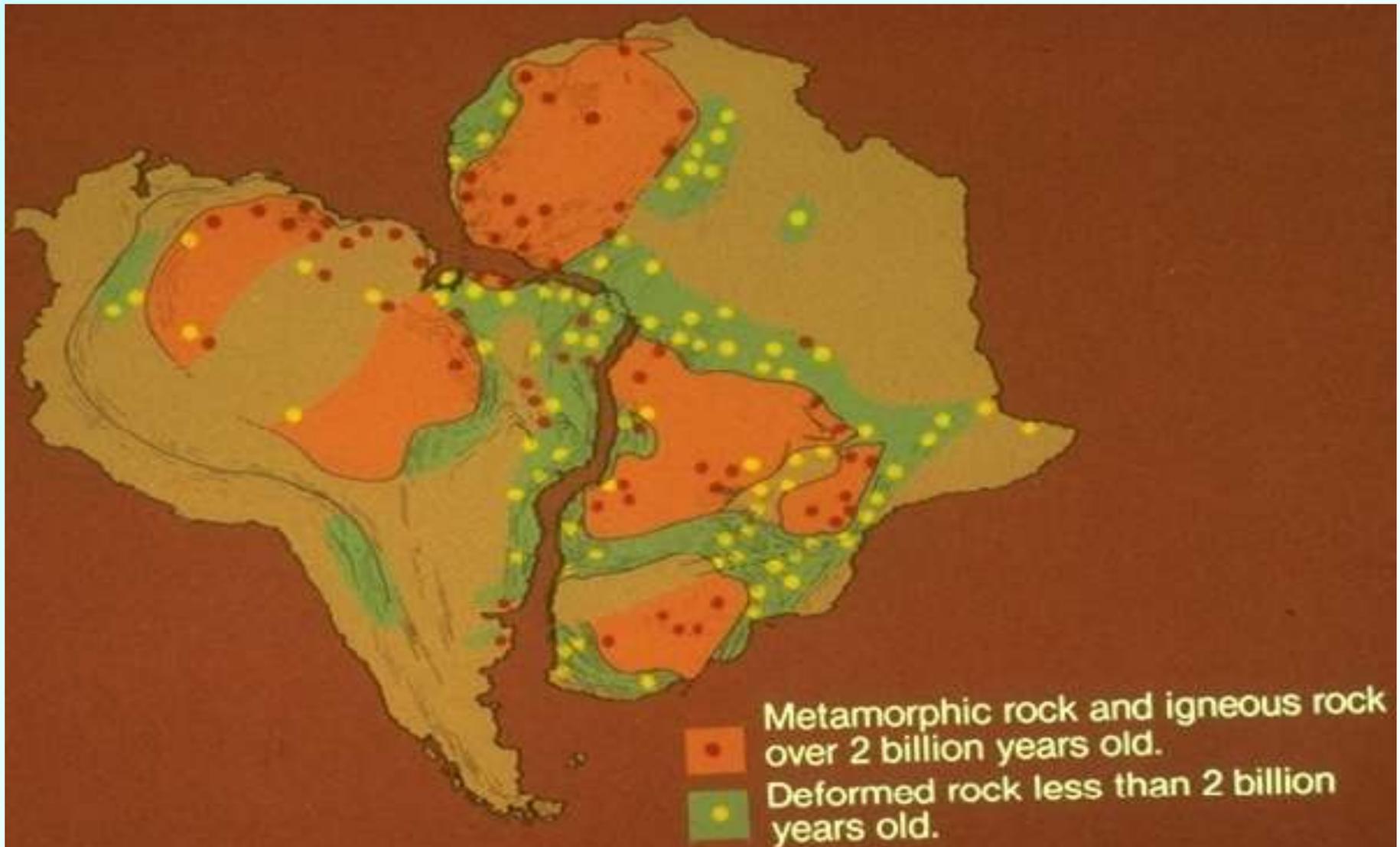


Distribution of fossils across the southern continents of Pangea.

3. ROCK SEQUENCE

- × Wegener also found that mountain ranges have a similar sequence of type of rock and age on both sides of the Atlantic Ocean, suggesting they were once part of the **same** mountain range.

3. ROCK SEQUENCE



4. GLACIAL SCARS

- ✘ Wegener found evidence of glacial scars left behind by giant ice sheets from the same time period in Southern Africa, India, Australia and South America.

4. GLACIAL SCARS



A



B

WHAT COULD MOVE THE CONTINENTS?



WEGENER'S WEAKNESS

- ✘ Unfortunately for Wegener, he could not explain what force was powerful enough to move entire continents around the planet

WEGENER'S EXPEDITION



„Das Große Eis“
Aufnahme: Dr. Georgi



WEGENER'S WEAKNESS

- ✘ Alfred Wegener **died** on expedition in Greenland in 1930 still searching for answers to the question of what force could be responsible for the movement of the continents.

ALFRED WEGENER

1880 - 1930



GET READY TO BOOGY!

[HTTP://WWW.YOUTUBE.COM/WATCH?V=T1-CES1EKTO](http://www.youtube.com/watch?v=T1-CES1EKTO)

REVIEW:

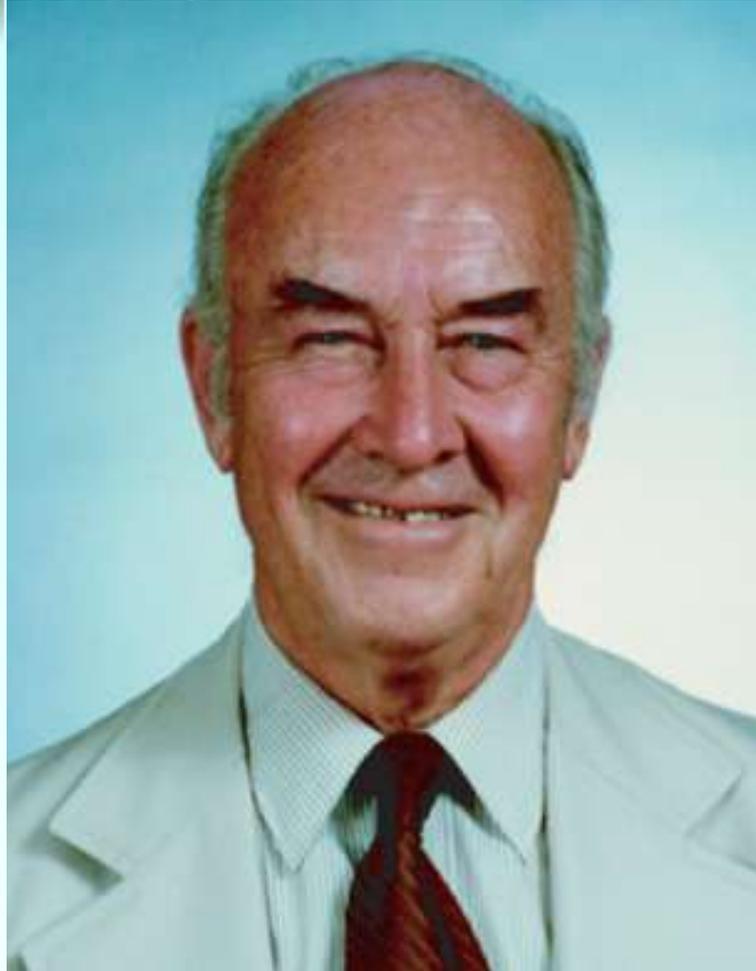
[HTTP://WWW.YOUTUBE.COM/WATCH?V=5Q8HZF9VVE](http://www.youtube.com/watch?v=5Q8HZF9VVE) (11 MINUTES)

THEORY OF PLATE TECTONICS

- ✘ Though several scientists contributed to this theory, the “father” of the Plate Tectonic theory was J. Tuzo Wilson, a Canadian geophysicist...

J. TUZO WILSON 1908-1993

(“FATHER” OF PLATE
TECTONICS)



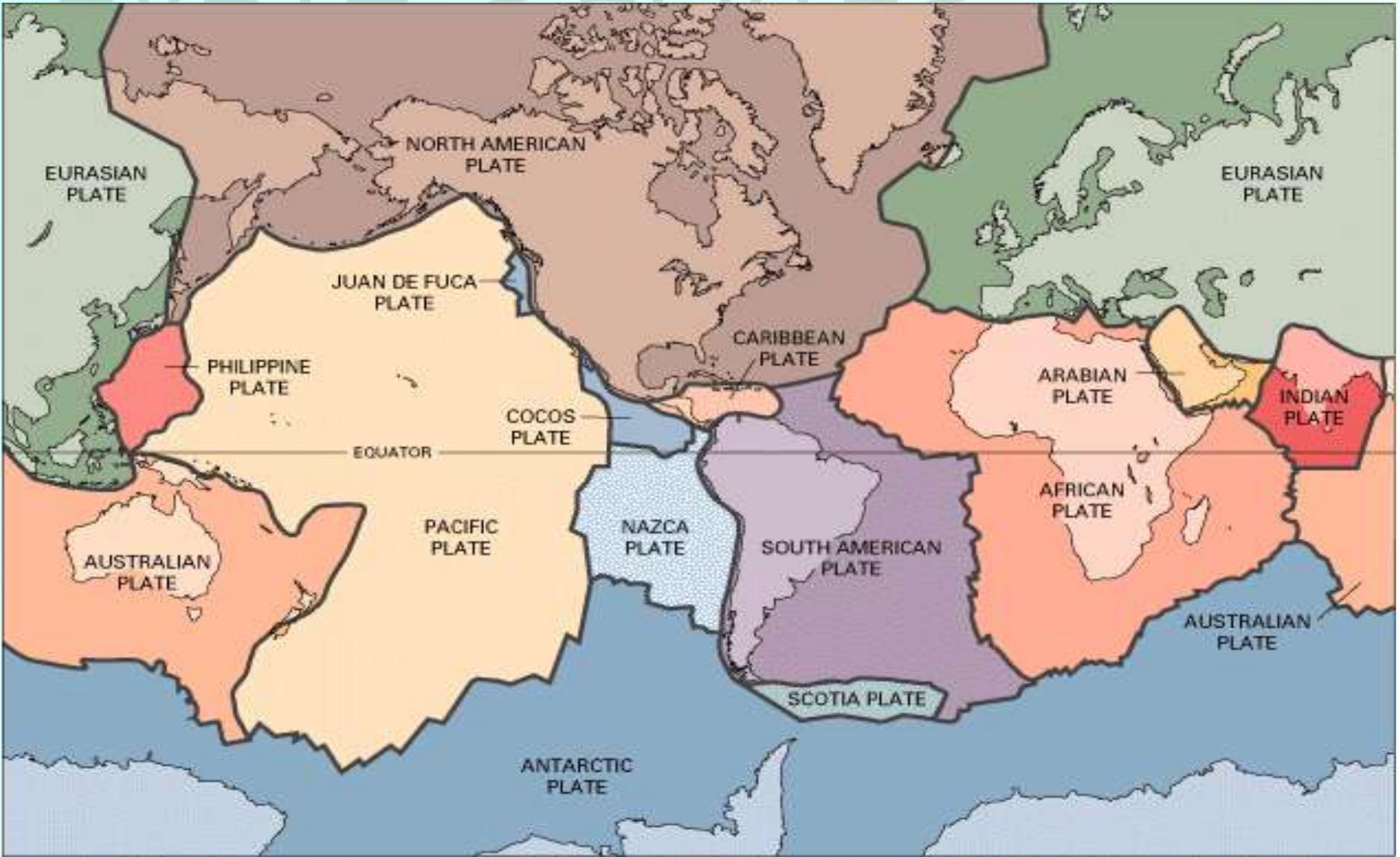
THEORY OF PLATE TECTONICS

- ✘ Advances in technology in the 1960's led to the development of the theory of plate tectonics which validated but improved upon Wegener's earlier theory of continental drift.

PLATE TECTONICS

- ✘ This theory states that the Earth's crust is broken up into several pieces called plates that move over a layer of hot magma (molten rock) in the mantle layer of the Earth, below the crustal plates.

EARTH'S PLATES



PLATES

- × This theory states that the earth's crustal plates are made up of two things:
- × 1) Continental Crust and
- × 2) Oceanic Crust

WHICH PLATE DO WE LIVE ON?

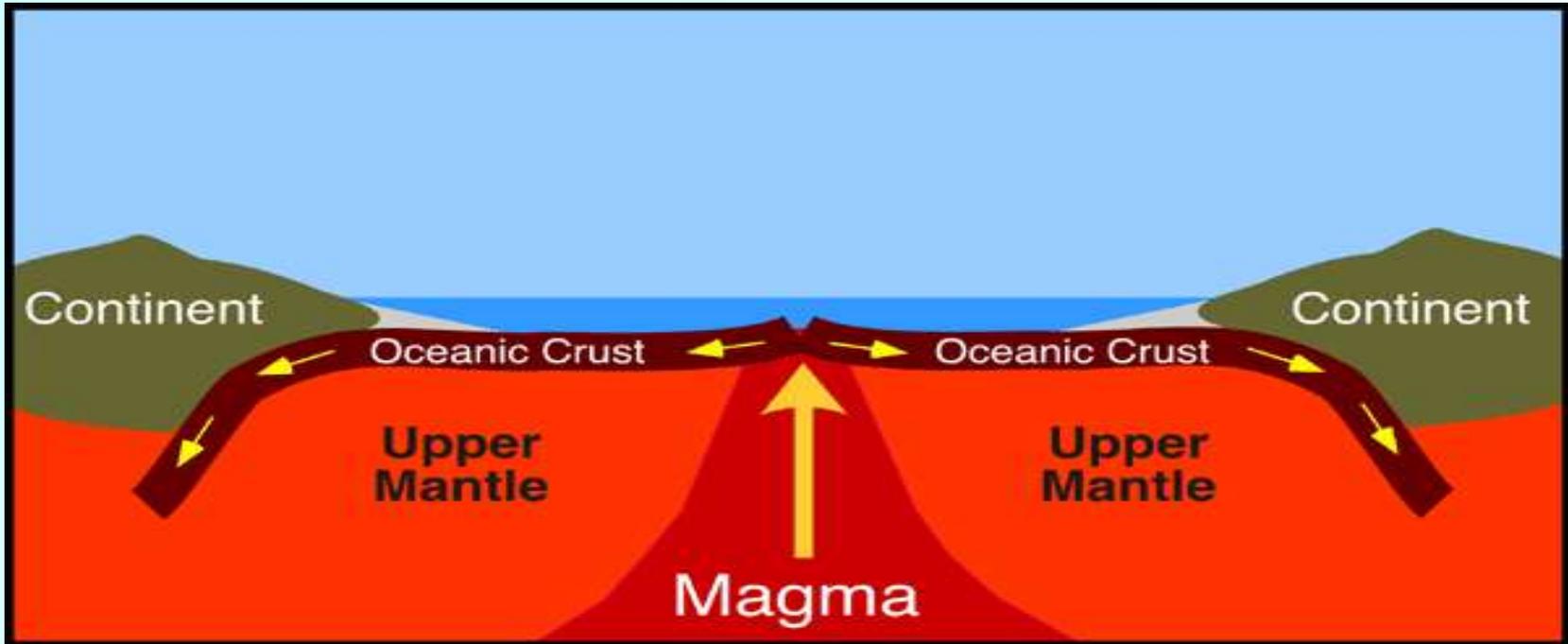
× The North-American Plate!



CONVECTION CURRENTS

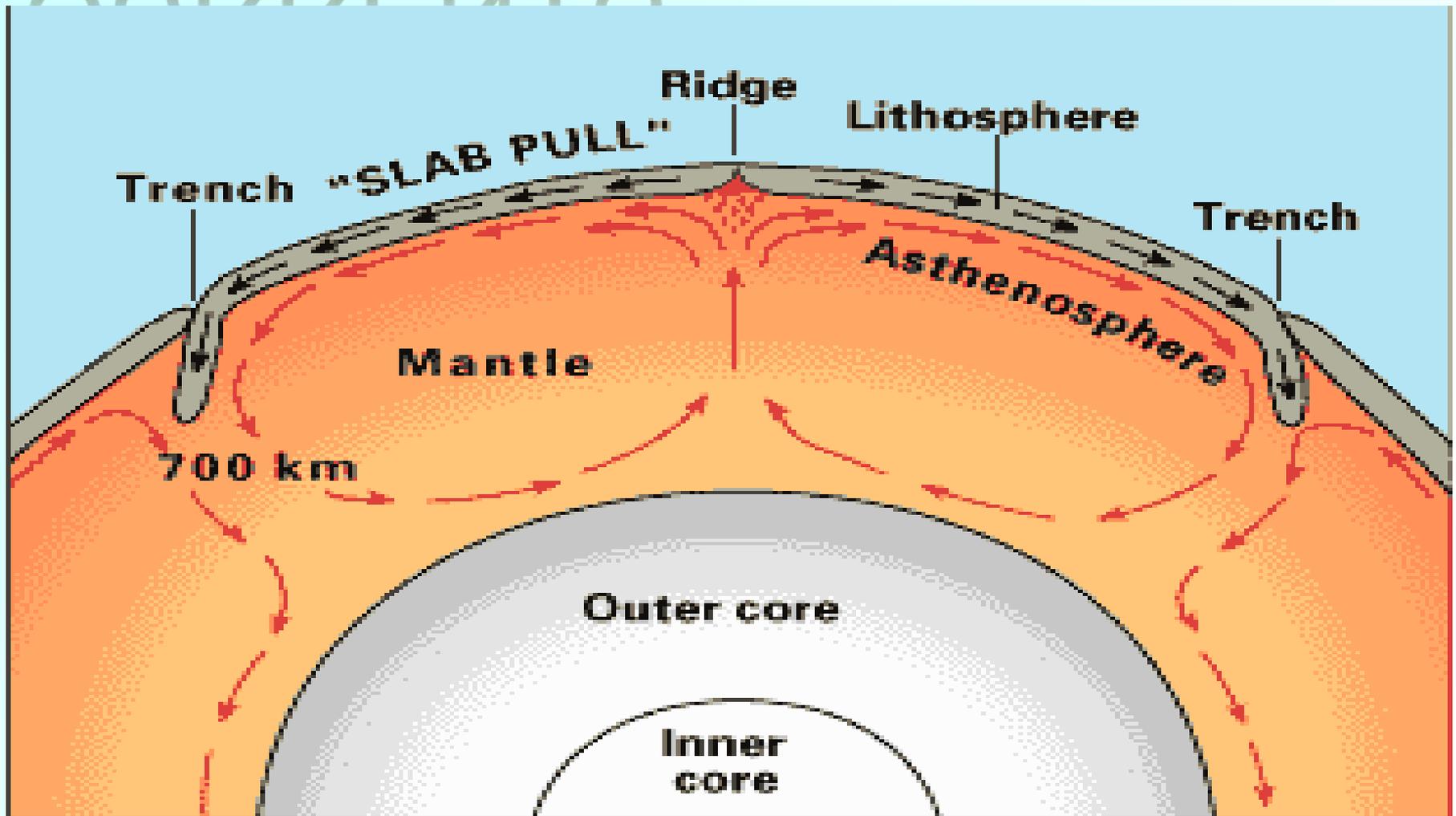
- ✘ The Earth's crustal plates move due to convection currents in the Asthenosphere layer of the upper mantle.

THE CRUST AND UPPER MANTLE



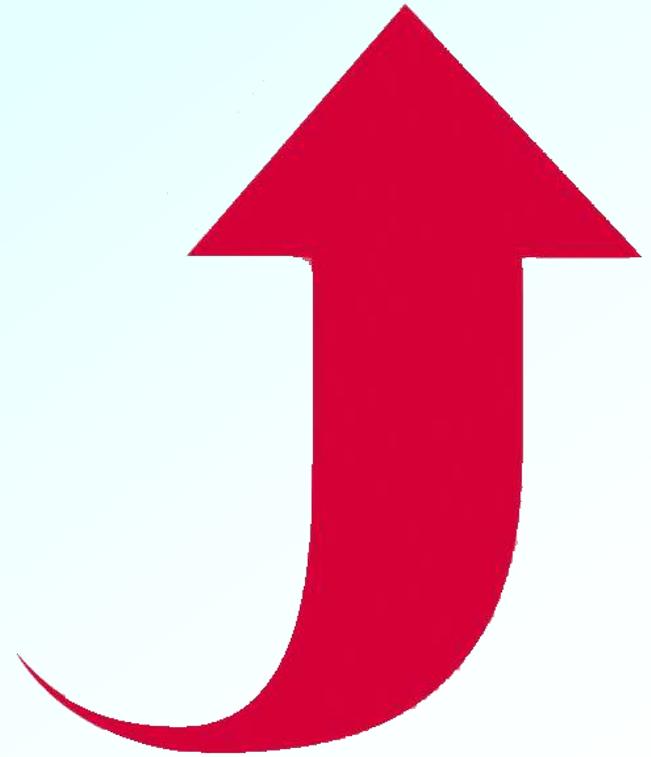
Heat from the core, causes magma in the upper mantle to move.

CONVECTION CURRENTS



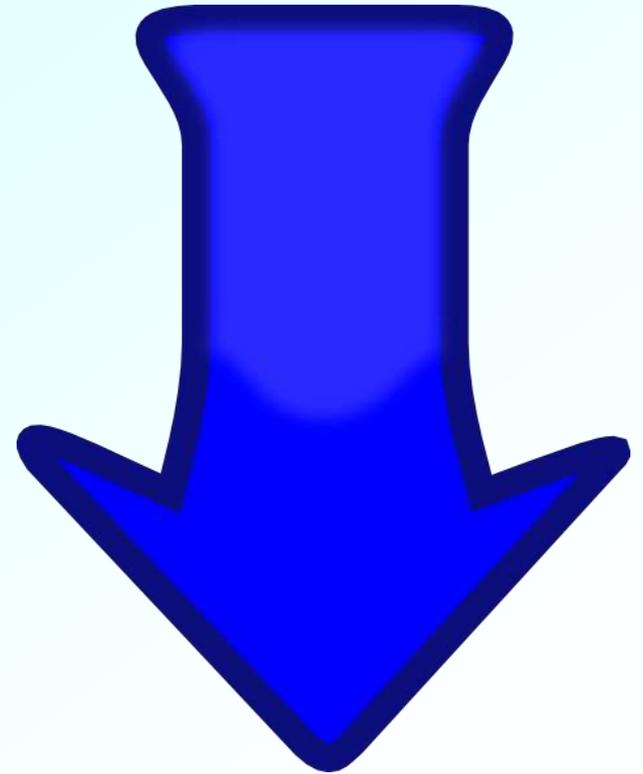
HOW CONVECTION WORKS

- × Magma in the mantle is heated by the core so it rises towards the crust.



HOW CONVECTION WORKS

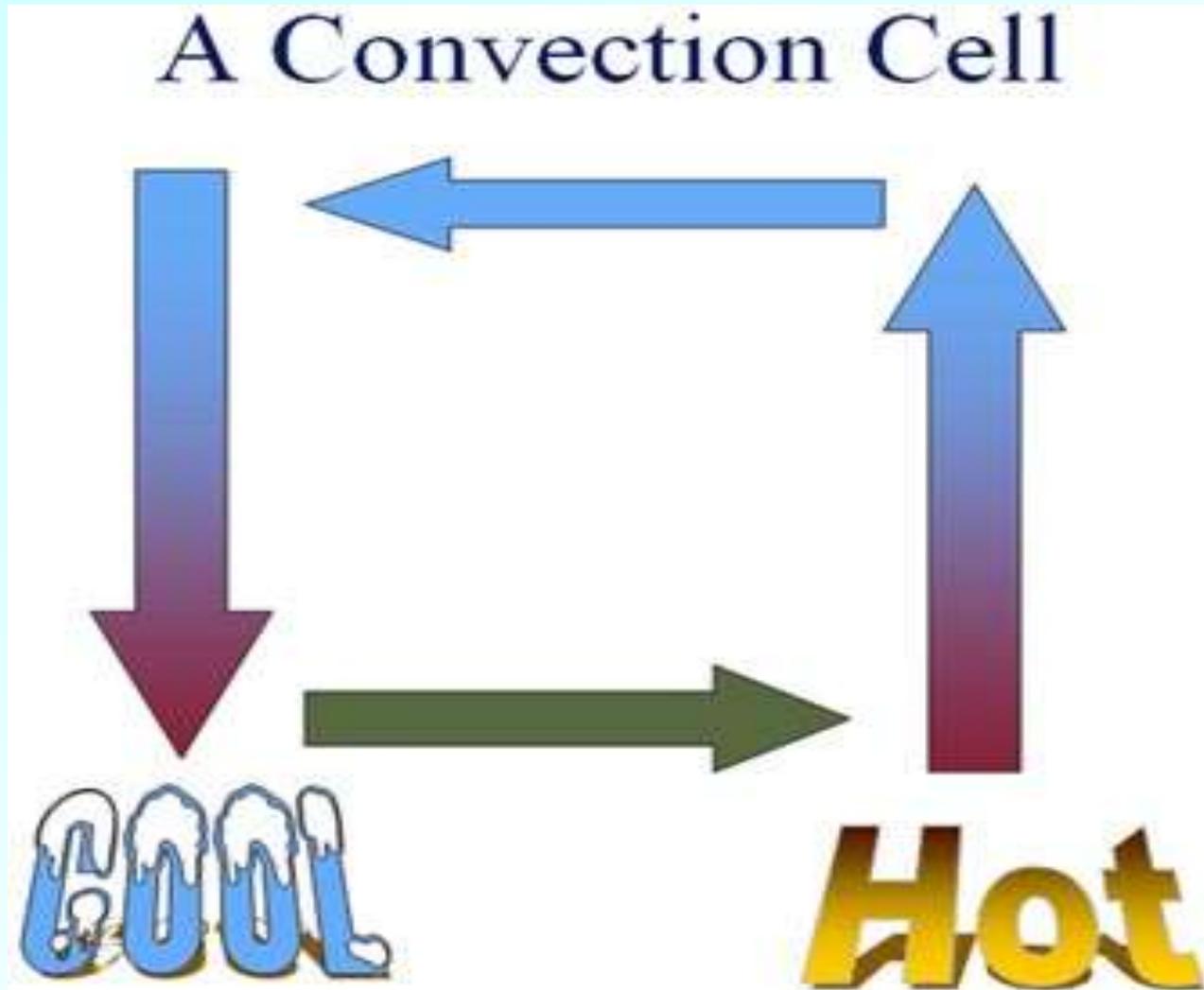
✘ After it rises
the magma
nears the crust
begins to cool
then starts to
sink.



HOW CONVECTION WORKS

As hot magma rises, it then cools. The cool magma then sinks towards the core, where it gets re-heated. Hot magma rises again creating continuous movement called a convection current or cycle of moving magma in the mantle.

HOW CONVECTION WORKS

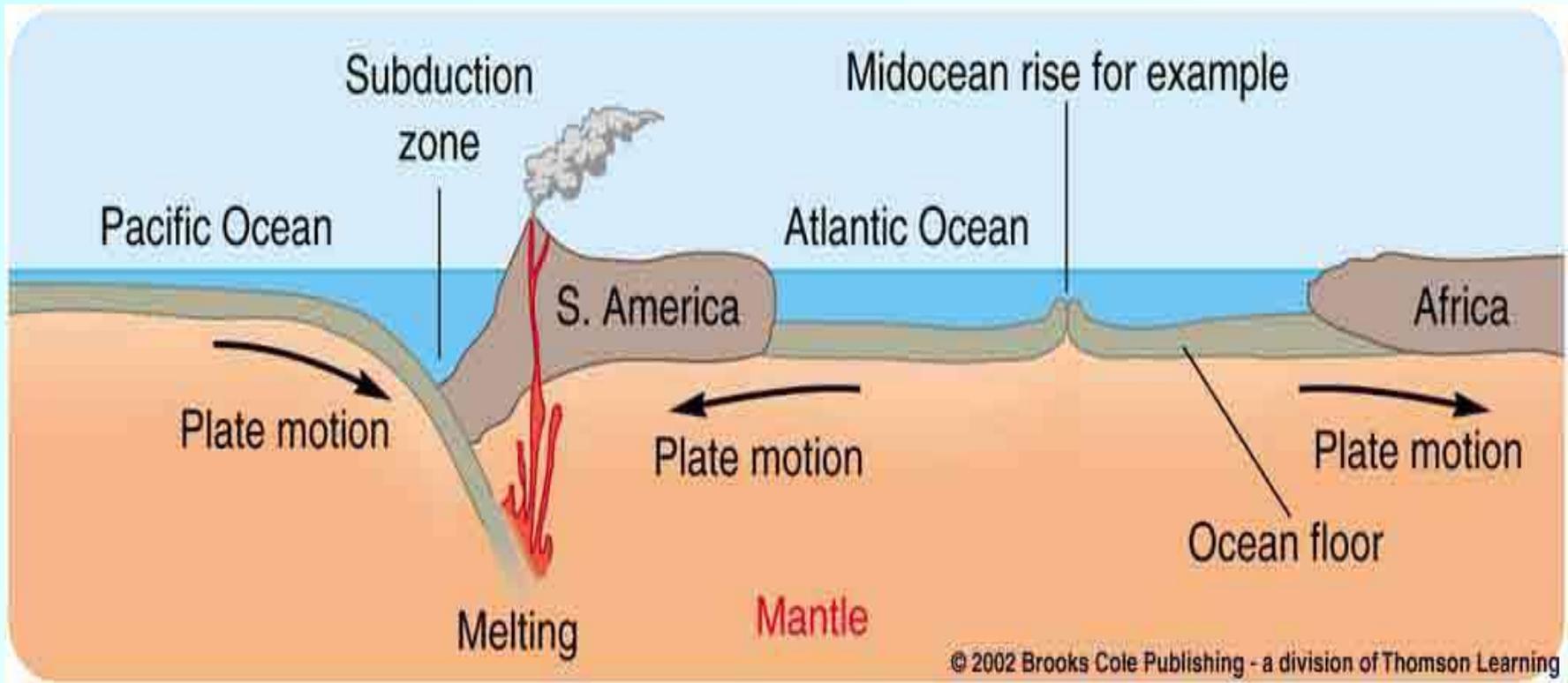


CONVEYOR BELT

- ✘ The continental and oceanic crust act like a conveyor belt on top of this moving magma. Convection currents in the mantle move the crustal plates
 - i) towards each other (converging),
 - ii) away from each other (diverging)
and
 - iii) side by side (transforming) past each other.

PLATE MOVEMENT

Mid-Atlantic Ridge



CREATIVE FORCE

- ✘ Tectonic plate movement can be creative in that it can create mountain ranges when plates collide such as the Himalayas that border India, Nepal and Pakistan to name a few countries.

1.A) PLATE CONVERGENCE (COLLIDING PLATES CREATE MOUNTAIN RANGES)

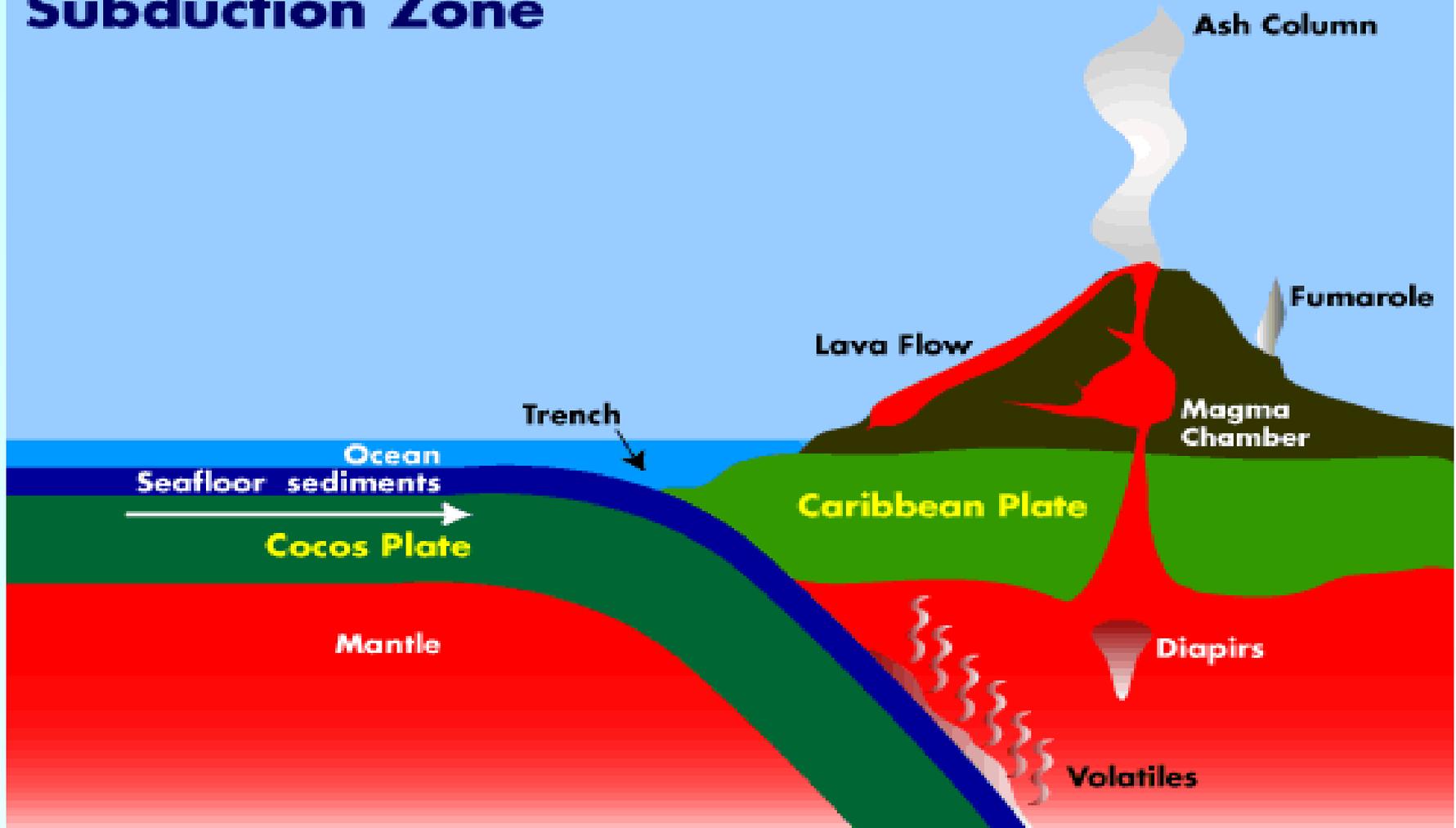


DESTRUCTIVE FORCE

- ✘ Plate movement can also be considered destructive as plates that subduct (one plate dives below another) can consume crustal rock and turn it back into magma with heat and pressure.

1.B) PLATE SUBDUCTION

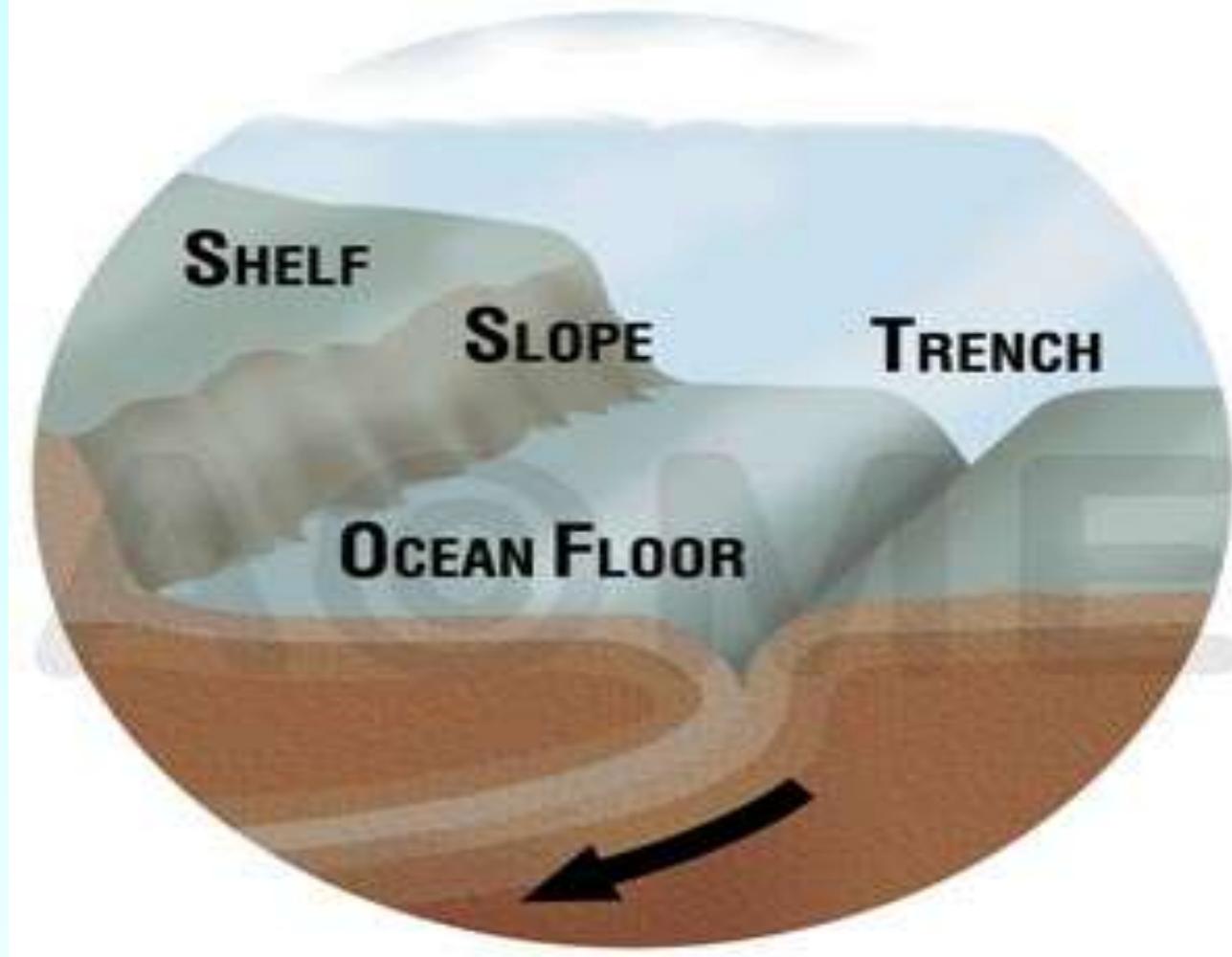
Anatomy of a Subduction Zone



WHAT HAPPENS NEXT?

- ✘ When plates collide or subduct, they create erupting volcanic mountains, and deep ocean trenches (a very deep ditch on the ocean floor).

OCEAN TRENCH



2.) PLATE DIVERGENCE (PLATES SEPARATING)

- ✘ When plates diverge or separate, they move away from each other causing the crust in between to stretch and become thin and brittle. This make it easy for magma to rise up and create mid-ocean ridges or rift valleys.

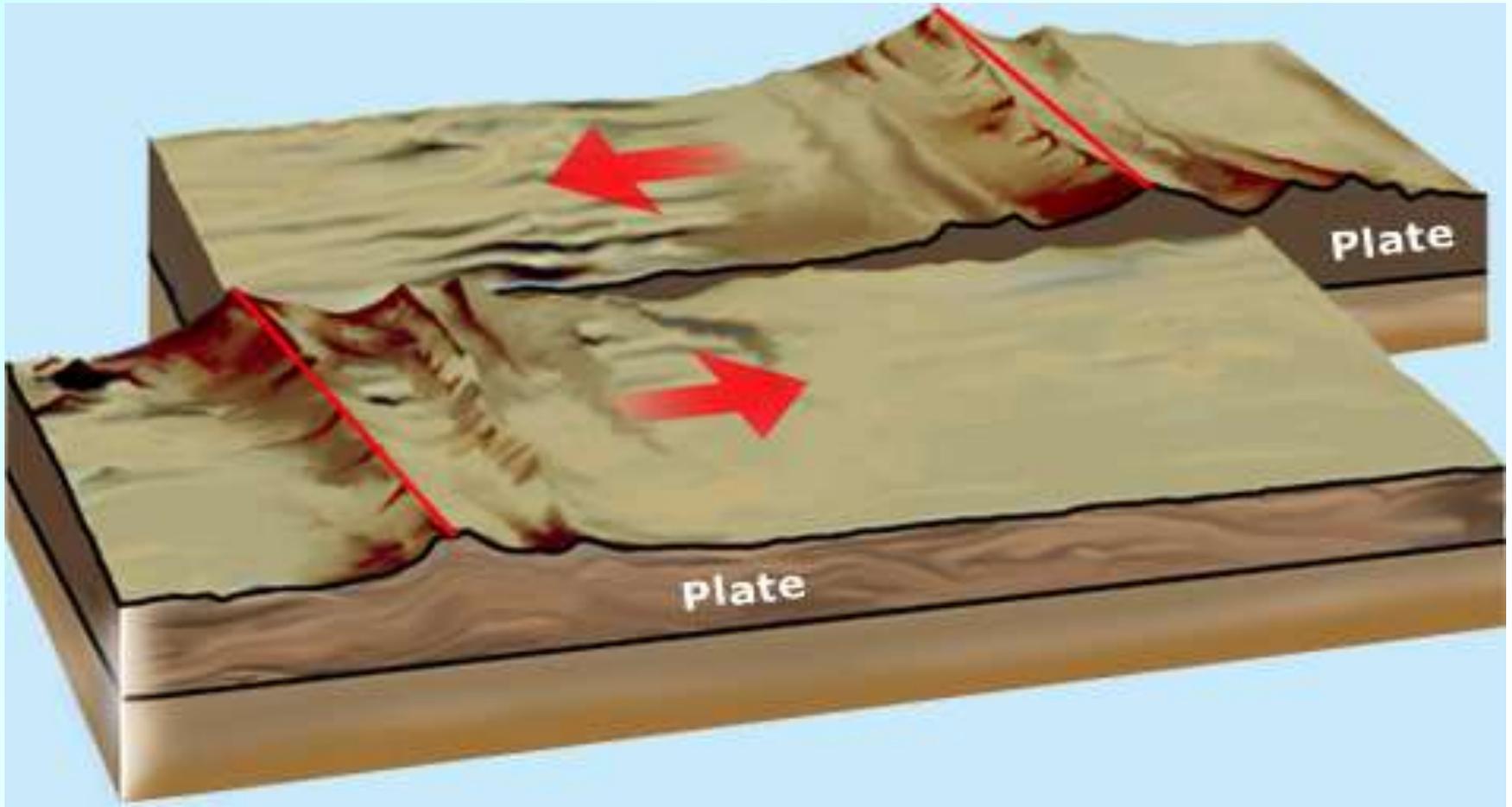
OCEAN RIDGES (THE MID-ATLANTIC RIDGE)



3.) TRANSFORM PLATES

- ✘ Where plates slide past one another there are transform plate boundaries. As the plates are jagged they get stuck and pressure builds up, eventually breaking apart in an earthquake.

SLIDING PLATES



TRANSFORM BOUNDARY

- ✘ There is a major transform plate boundary in California where the San Andreas Fault is located, along which Earthquakes are common.

SAN ANDREAS FAULT



IN A NUT-SHELL!

- ✘ The theory of Plate Tectonics helps to explain:
 - ✘ i) how the cooling and heating of magma creates convection currents;

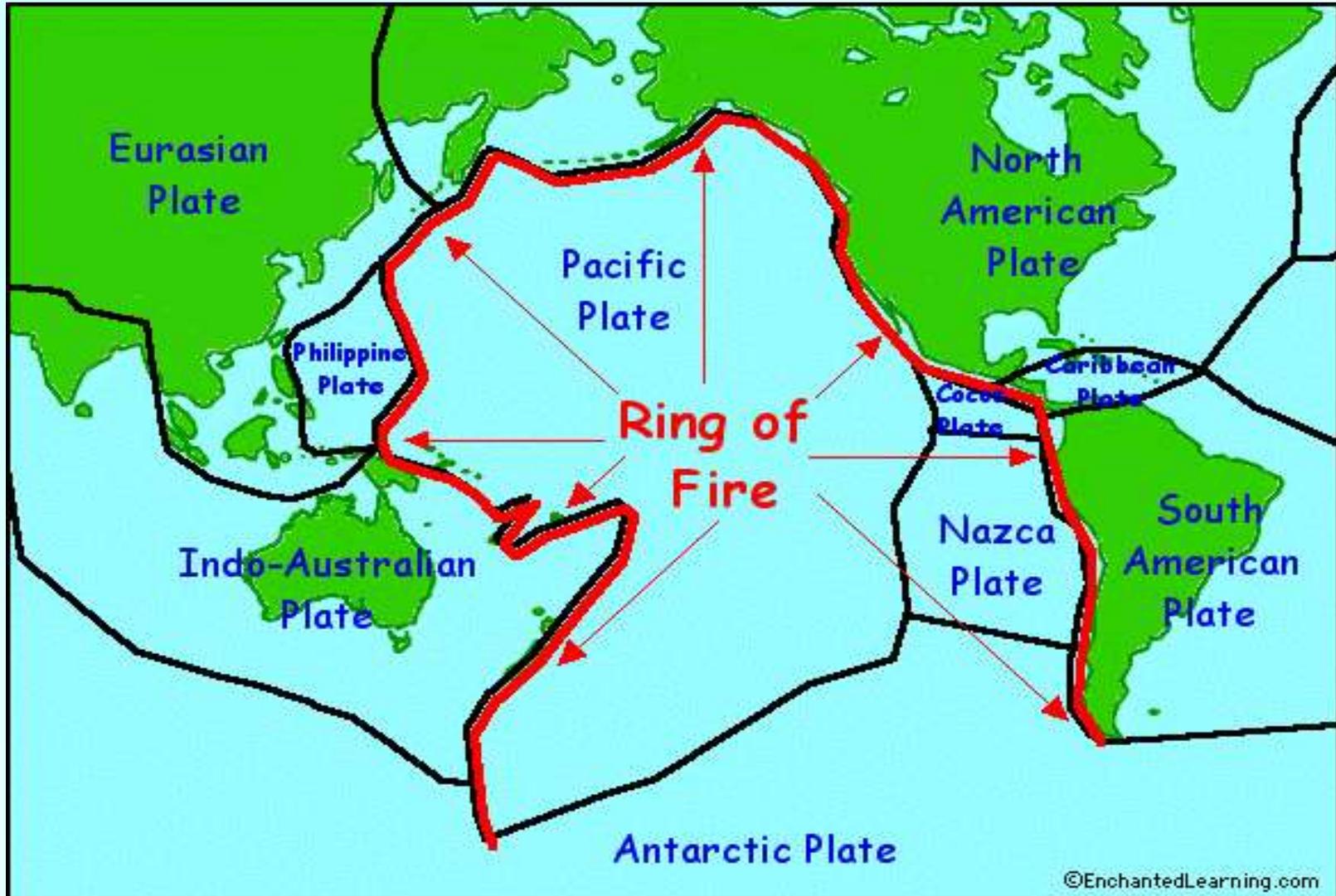
IN A NUT-SHELL....

- ✘ ii) convection currents move the continental and oceanic crustal plates towards, away and side by side each other;

IN A NUT-SHELL....

- × iii) The movement of these crustal plates creates mountain ranges, volcanic eruptions, ocean ridges and trenches, rift valleys and earthquakes, all of which shape and reshape our planet.

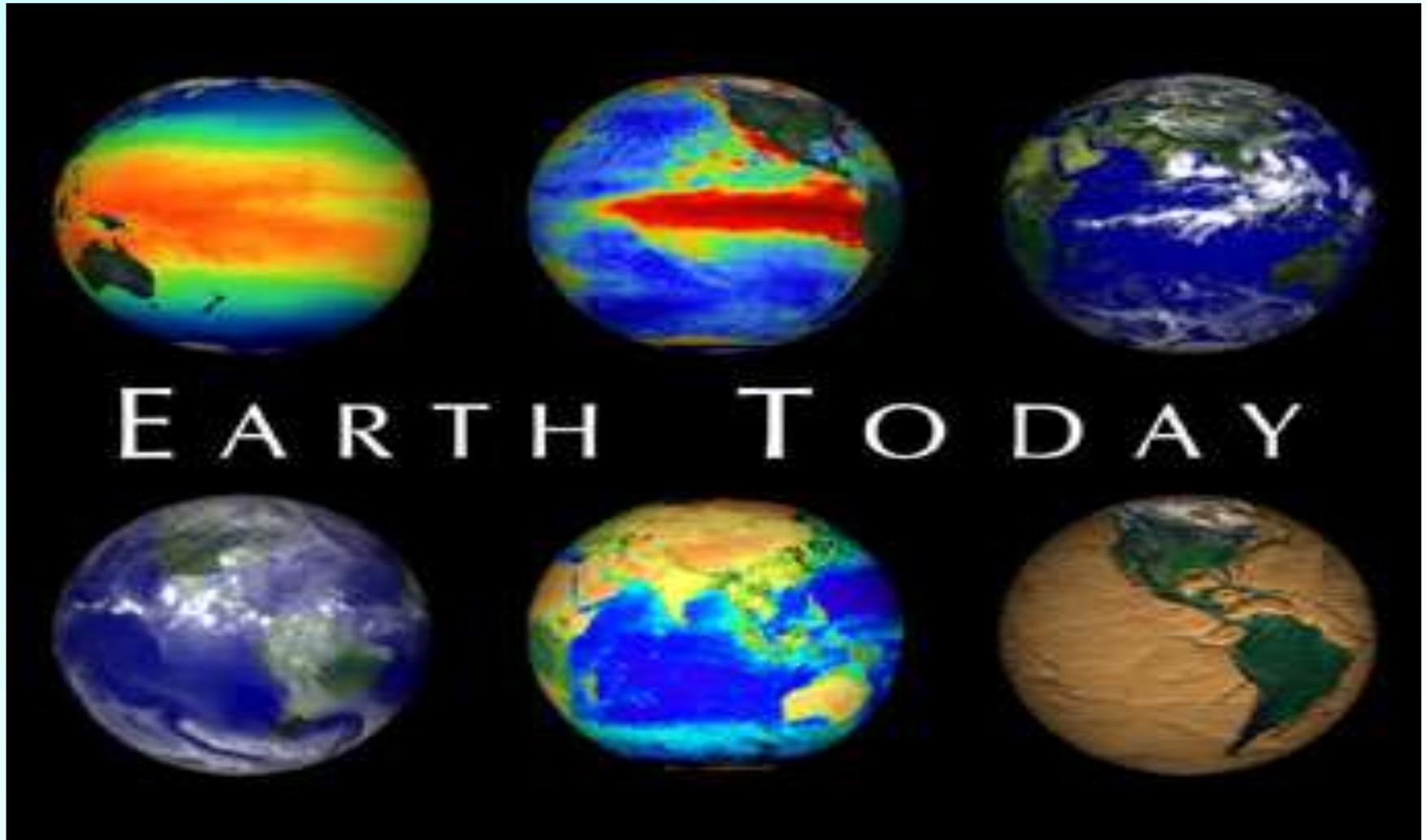
THE PACIFIC “RING OF FIRE”



THE PACIFIC “RING OF FIRE”

- ✘ The most active part of the planet for Earthquake and Volcanic Activity is found along the Ring of Fire which is mostly a subduction boundary found around the edges of the Pacific Plate, where it comes into contact with continental plates.

OUR DYNAMIC PLANET



EARTH



Review:

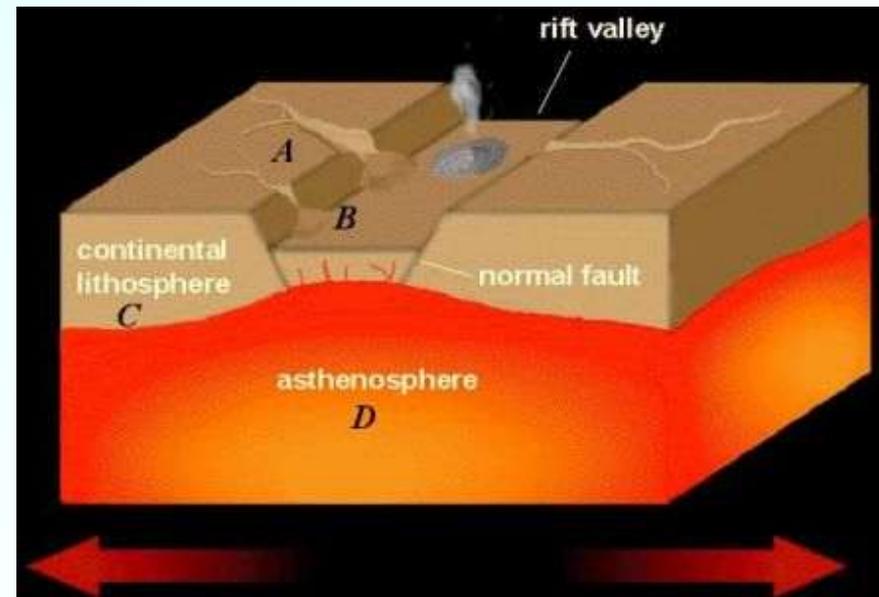
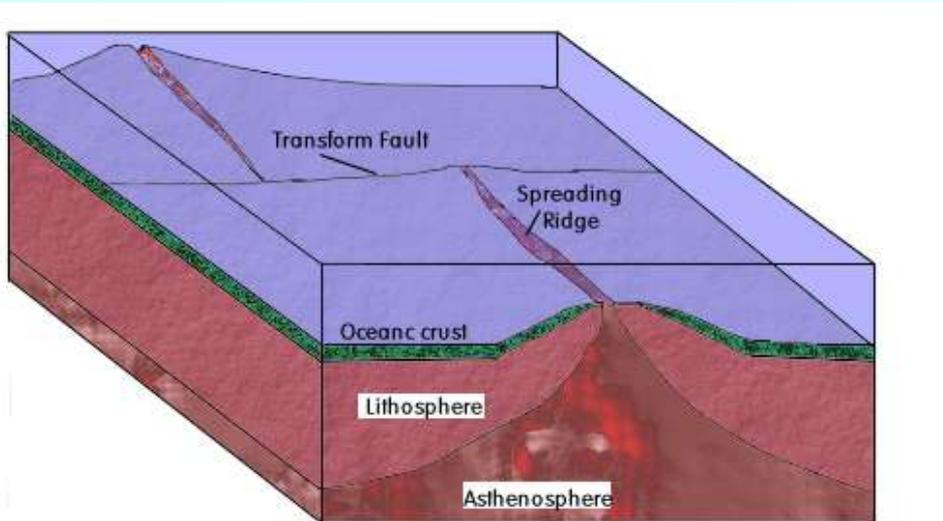
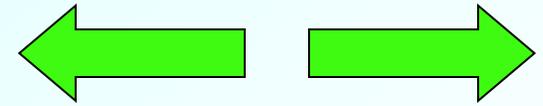
http://www.youtube.com/watch?v=1-HwPR_4mP4

(7 minutes)

DIVERGENT BOUNDARIES

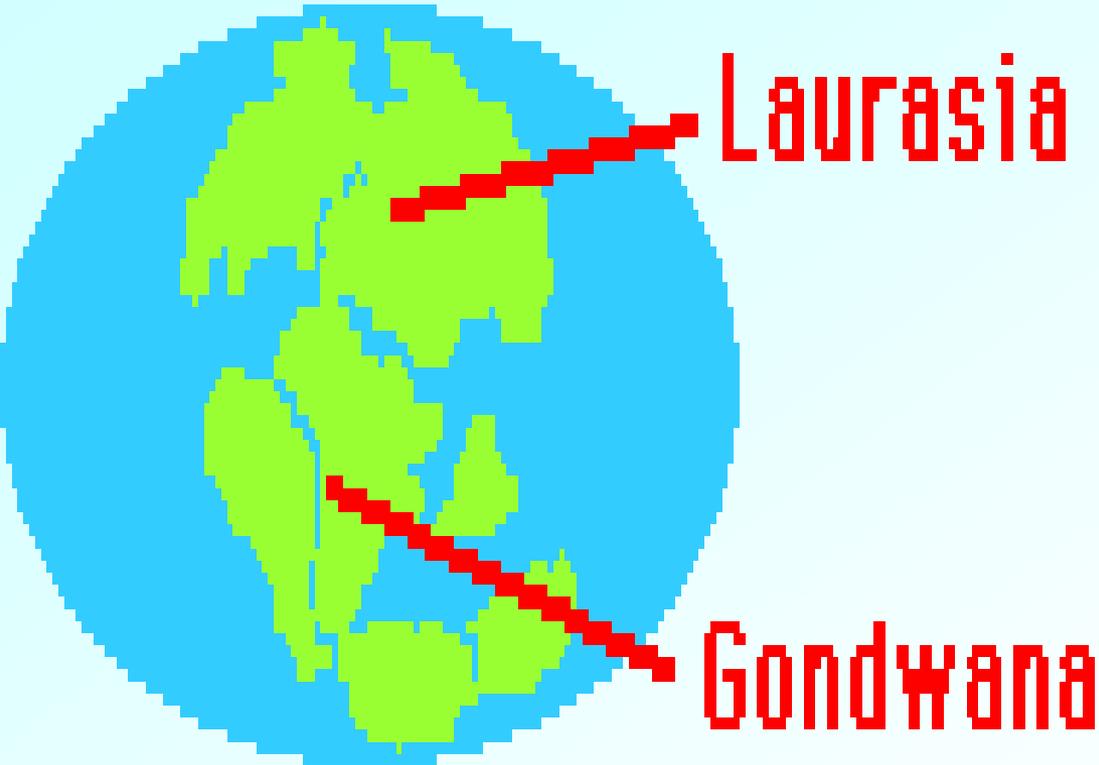
- ✘ A divergent boundary is a place where two plates move apart

EXAMPLE: Sea Floor Spreading



Warm -Up 1/7/09

- × Pangaea broke up into 2 smaller super continents. What are they?



Pangaea started to break up into two smaller super continents, called Laurasia and Gondwana, during the late Triassic.

Short Answer

1. Explain the process that causes the Earth's tectonic plates to move.

2. Describe the type of plate boundary that forms mountains and islands.
3. Explain the theory of *continental drift*. Who proposed the theory and what evidence did he provide to prove his theory. Identify and explain at least 4 types of evidence.
5. There are 3 main kinds of boundaries. Formulate an illustration of each one

Plate Tectonics Project

Checklist:

- ❑ *Plates diagram*
- ❑ *Define and Identify **Plates** and **Plate boundaries***
- ❑ *Write 1 paragraph explaining the **Theory of Plate Tectonics**. (also explain plate boundaries)*

Warm -Up

1. The surface of the Earth is constantly changing. Name **3 slow changes** and **3 rapid (fast) changes**.

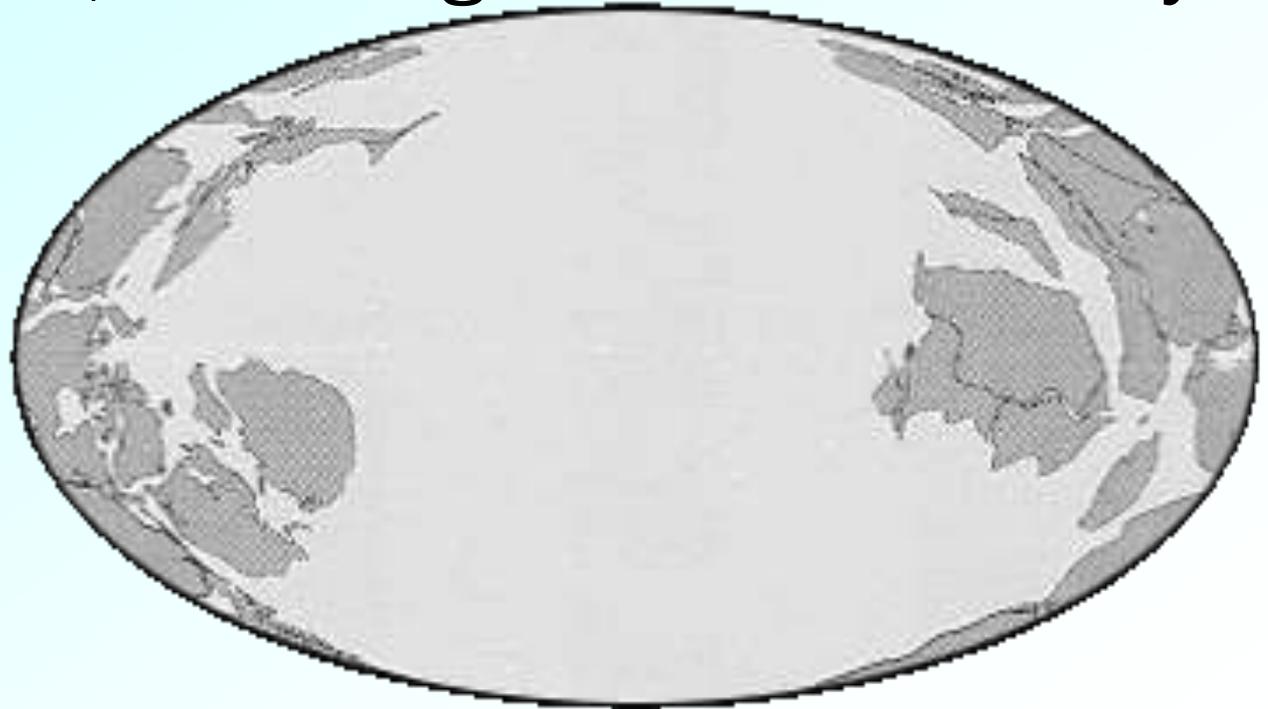
CONTINENTAL DRIFT THEORY

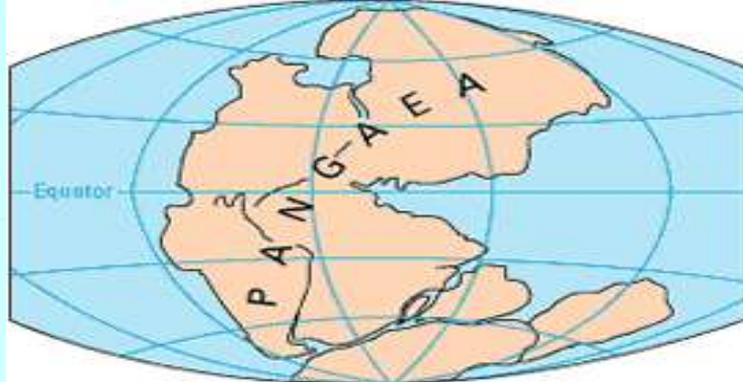
- × Continental drift is the hypothesis that all the continents had once been joined together in a single landmass.
 - + Alfred Wegener named this supercontinent Pangaea.
 - + Pangaea existed about **300** million years ago. This was the time when reptiles and winged insects first appeared.



CONTINENTAL DRIFT THEORY

- ✘ Over tens of millions of years, Pangaea began to break apart.
- ✘ The pieces slowly moved toward their present-day locations, becoming the continents they are today.

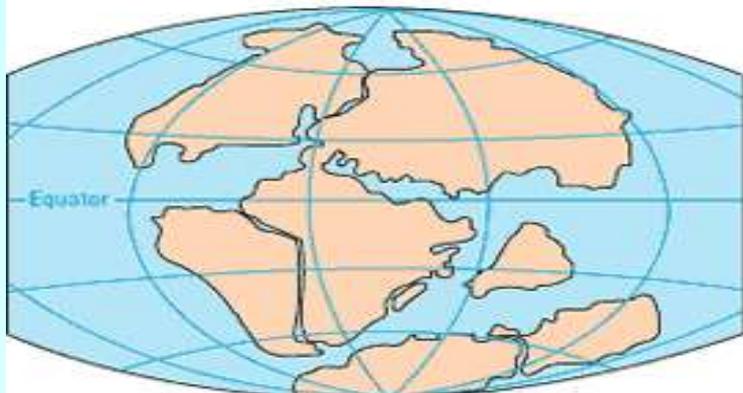




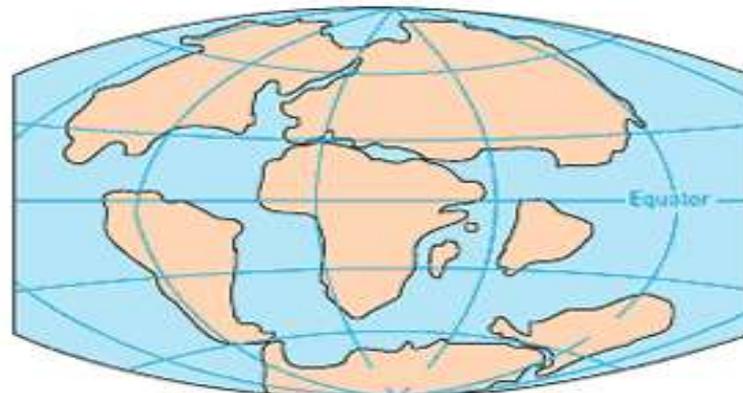
PERMIAN
225 million years ago



TRIASSIC
200 million years ago



JURASSIC
135 million years ago



CRETACEOUS
65 million years ago



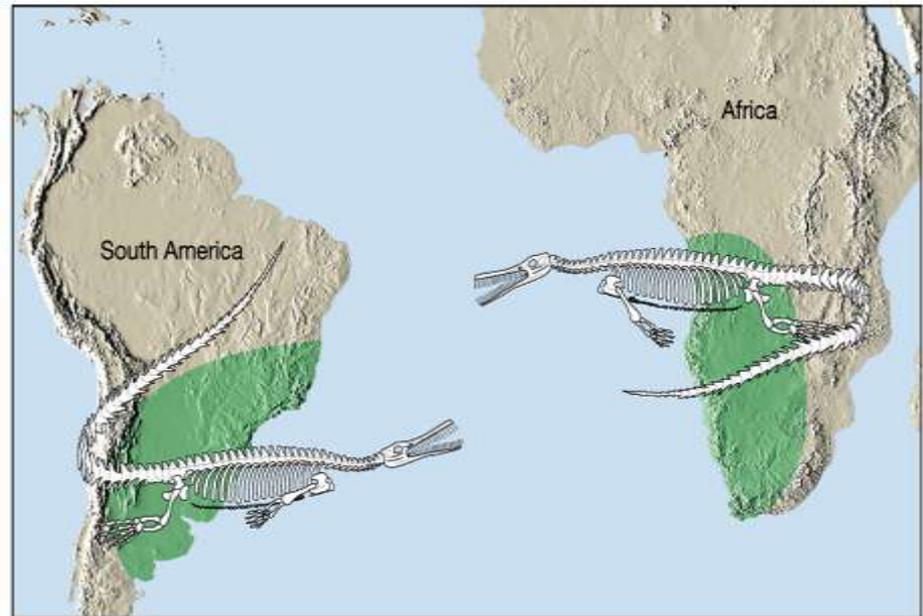
PRESENT DAY

*Image by
USGS.org*

EVIDENCE:

× Fossils

- + A fern like plant (*Glossopteris*) have been found in rocks in Africa, South America, Australia, India, and Antarctica.

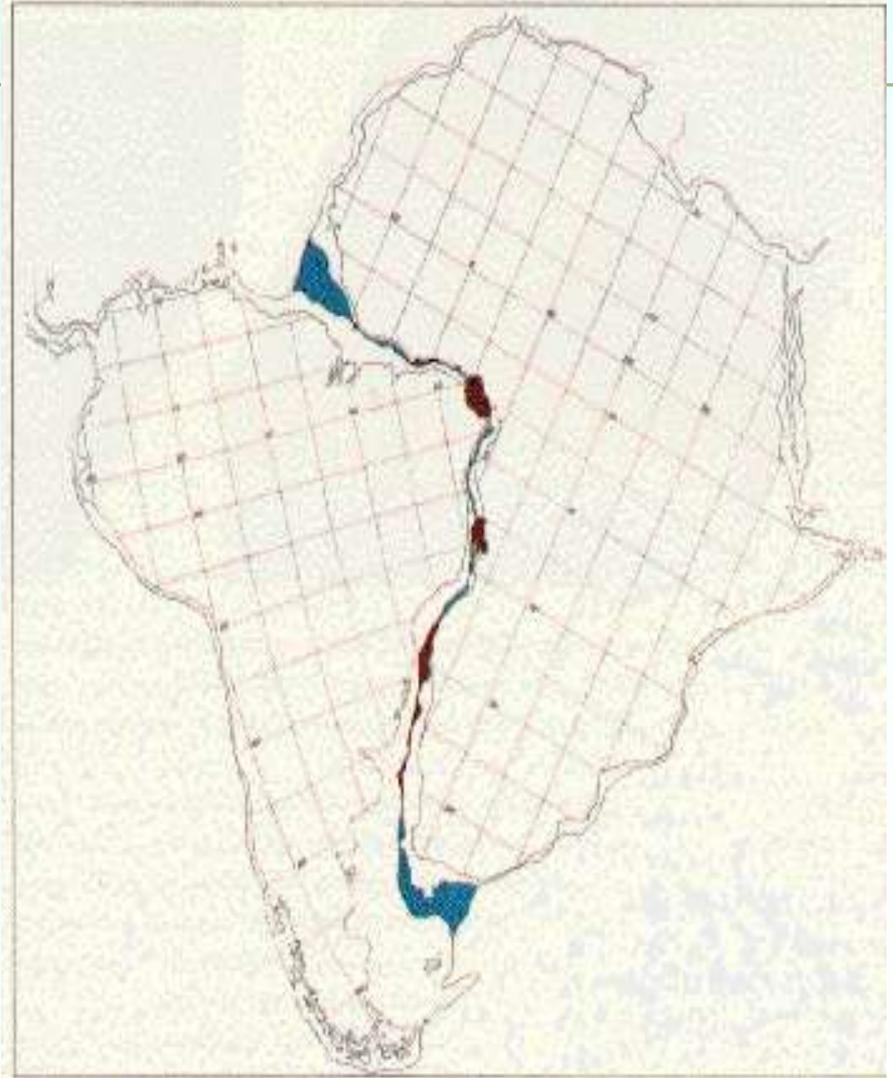


EVIDENCE:

× Puzzle Pieces

+ Continents fit together like puzzle pieces.

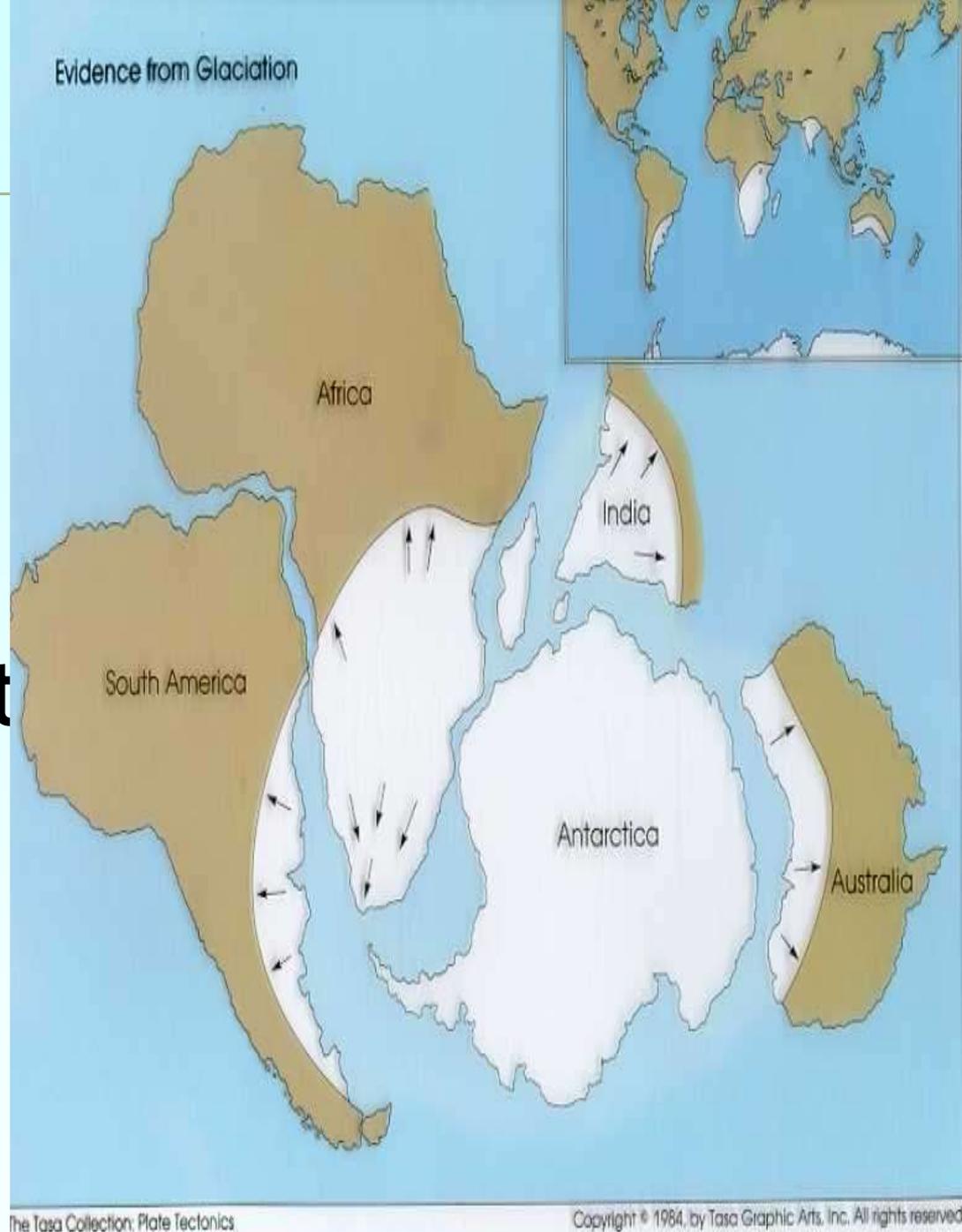
+ Mountain ranges in South America and Africa line up.



EVIDENCE:

× Climate Clues

+ **Glacial**
evidence was
found on
continents that
have a warm
climate.



Evidence for continental drift

A. Puzzle like fit of continents

B. _____

1. *Mesosaurus*

2. *Glossopteris*

C. _____

1. _____

2. Glacial deposits

D. _____

1. _____

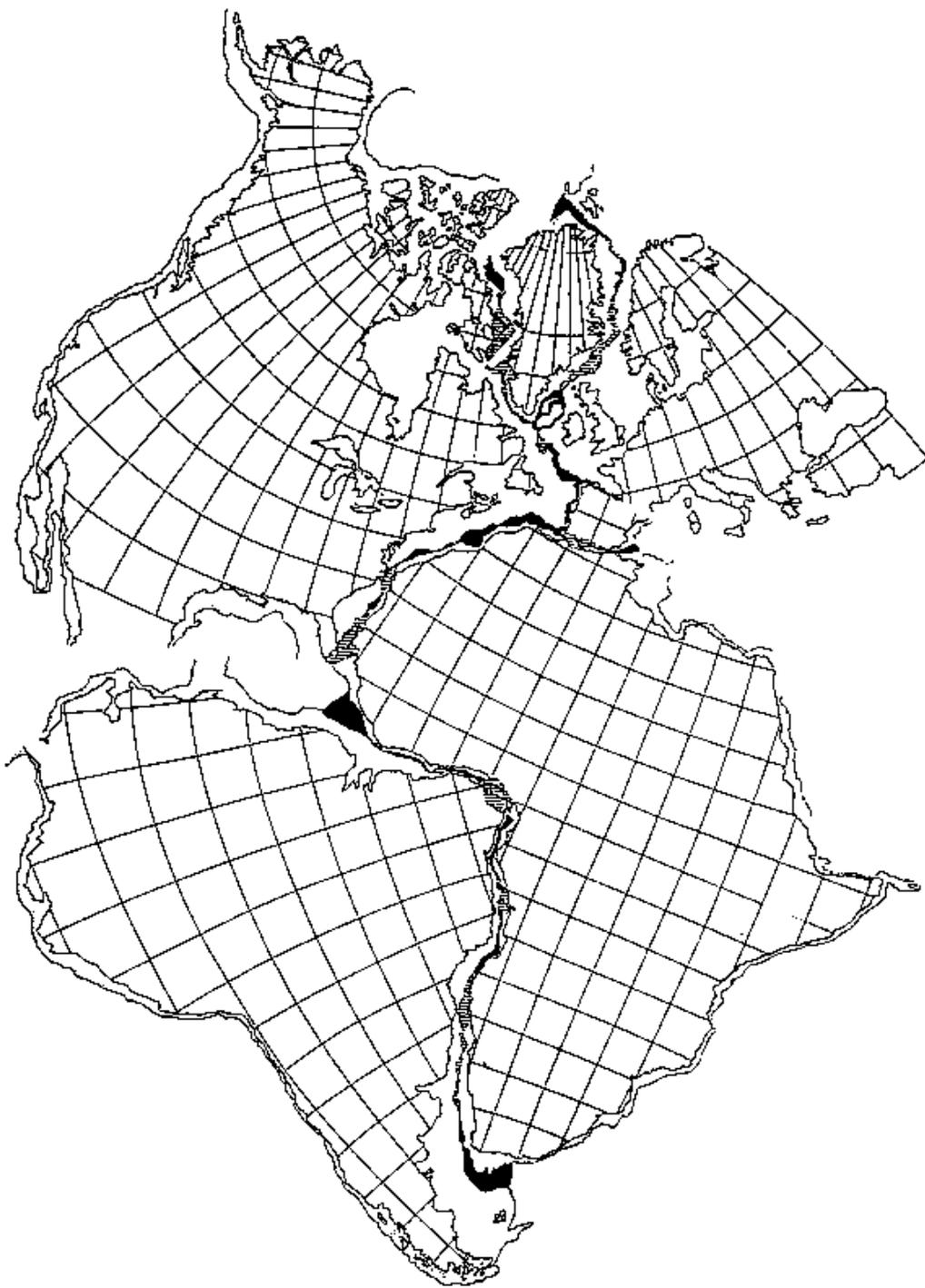
- Climate clues
- Fossil clues
- Rock clues
- Glaciers
- Mountain Ranges

ESSAY

- ✘ *Describe how the earth's surface has changed over time. Identify and explain both slow and rapid changes to the earth's surface. Provide details and examples.*

SHORT ANSWER

- ✘ **What scientific data was used to support the theory of continental drift? Identify and explain at least 4 types of evidence.**

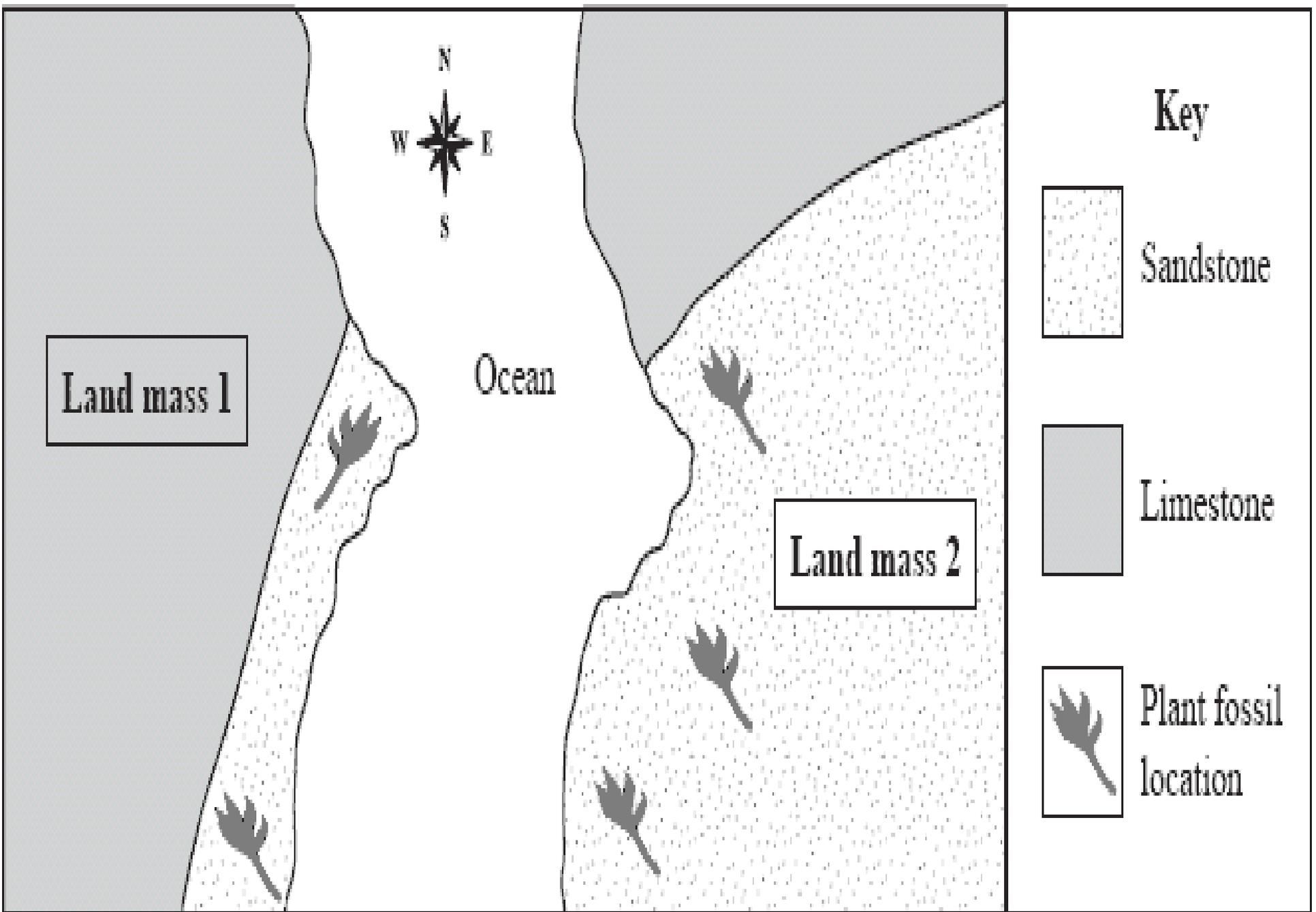


I. Vocabulary to DEFINE:

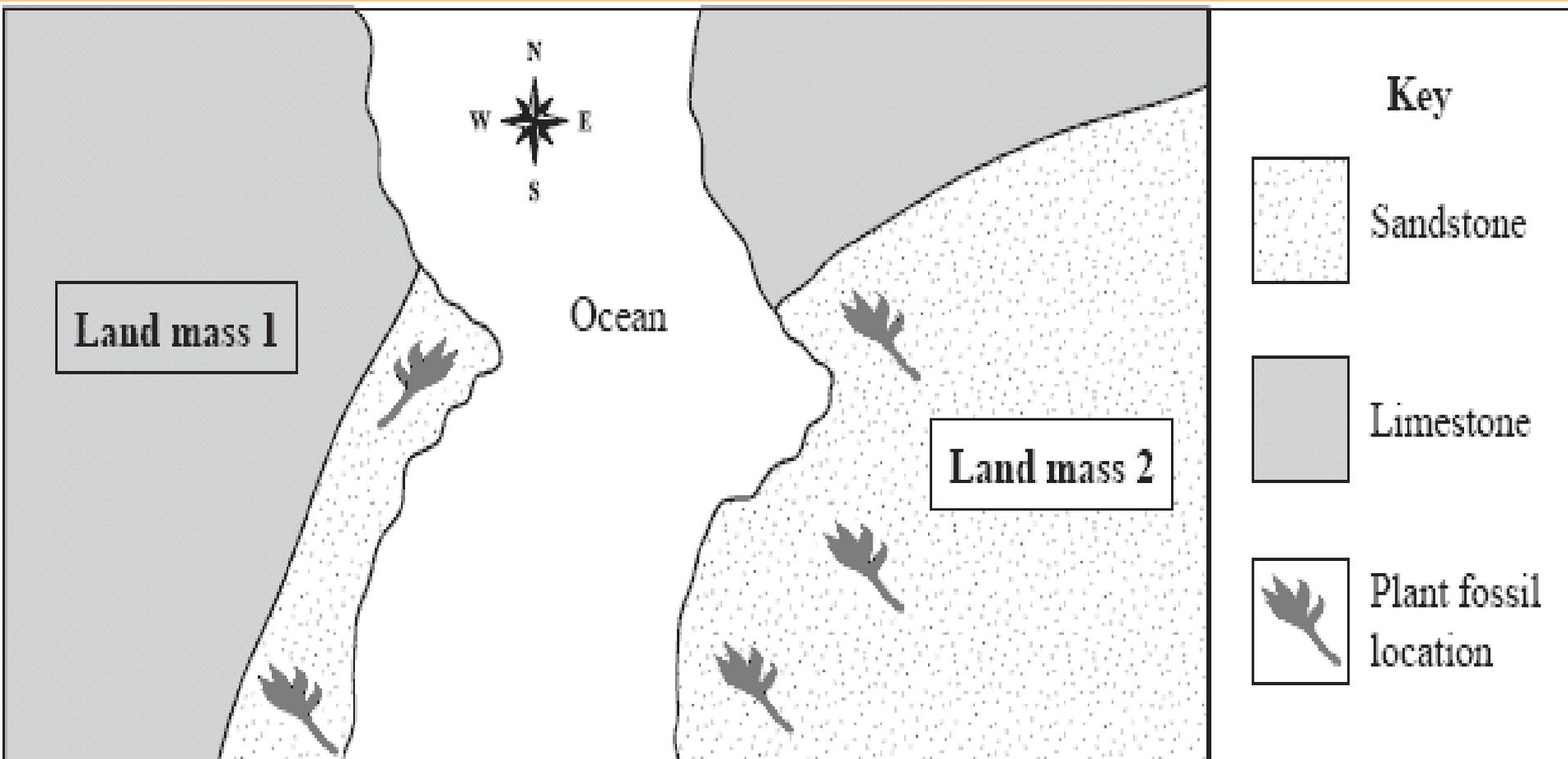
- × Theory of Plate Tectonics
- × Theory of Continental Drift
- × Plate

× Ocean-Floor
Spreading

- × Mid-Ocean Ridge
- × Pangaea
- × Lithosphere
- × Convection current



- A. Using the diagram, identify two pieces of evidence that support the scientist's theory that the land masses were once together.
- B. Explain how each piece of evidence you identified supports the scientist's hypothesis



DIRECTIONS :Find the LIES and the TRUTHS!

**Truthful
Tim**



Subduction is a process in which old ocean floor sinks back into the ground

There are 4 types of plate boundaries.

- Tension
- Divergent
- Convergent
- Strike Slip

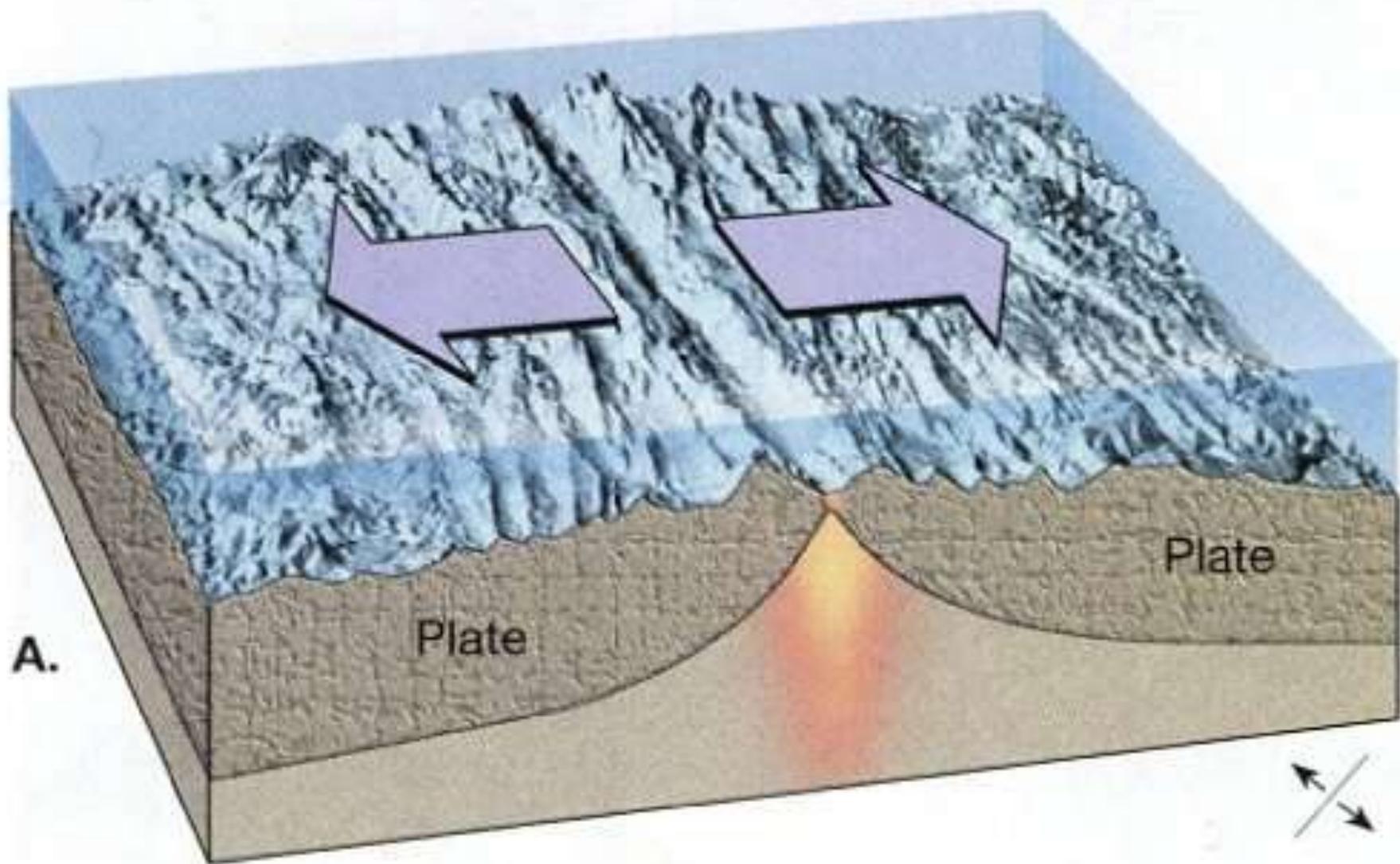
Mountain ranges in South America and Africa line up

Trenches are the deepest parts of the ocean.

+A animal fossil (*Glossopteris*) has been found in rocks in Africa, South America, Australia, India, and Antarctica.

Larry the Lier





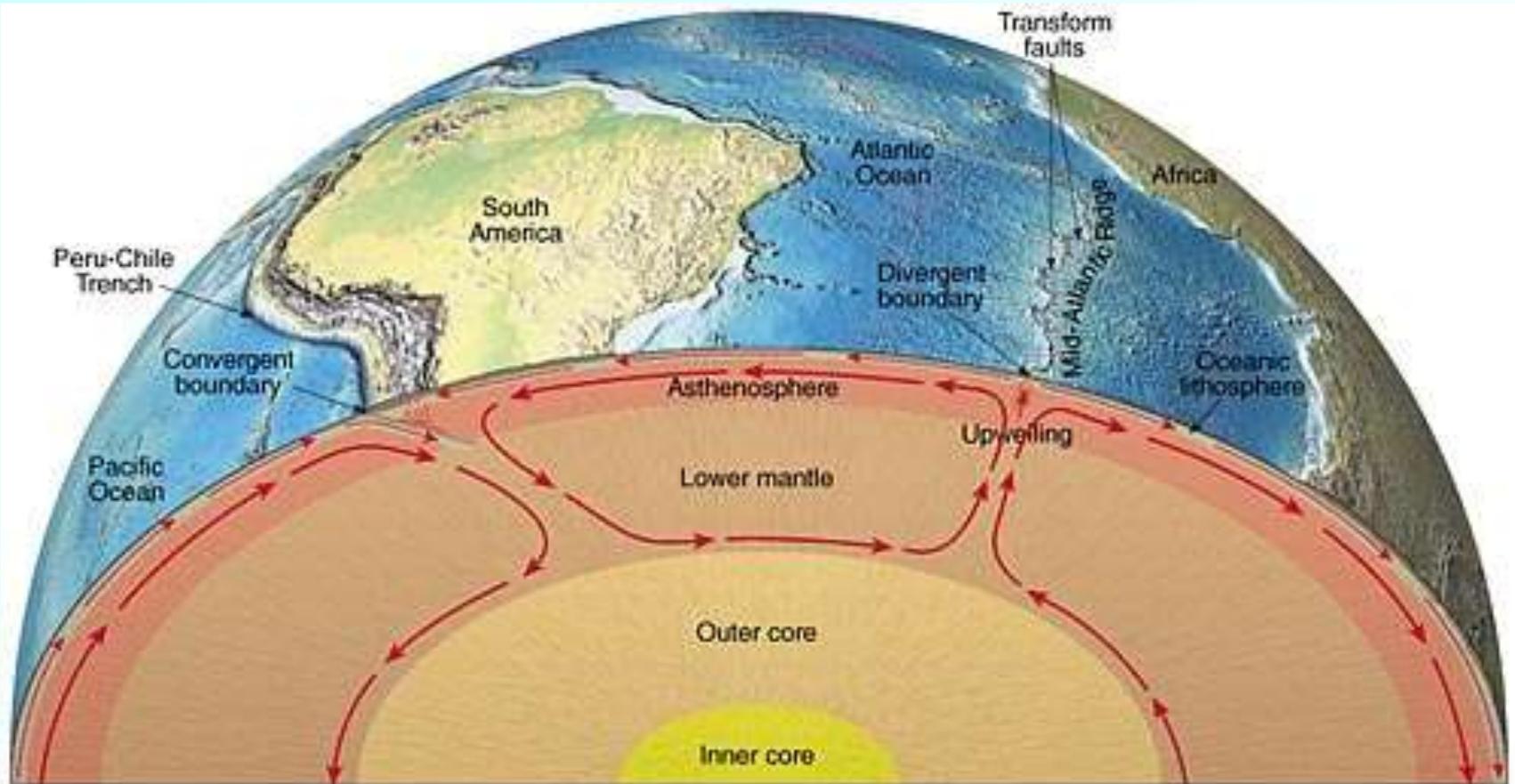
Warm -Up 1/1 1/10

What happens when there is movement at Transform Plate (strike-slip) boundaries?

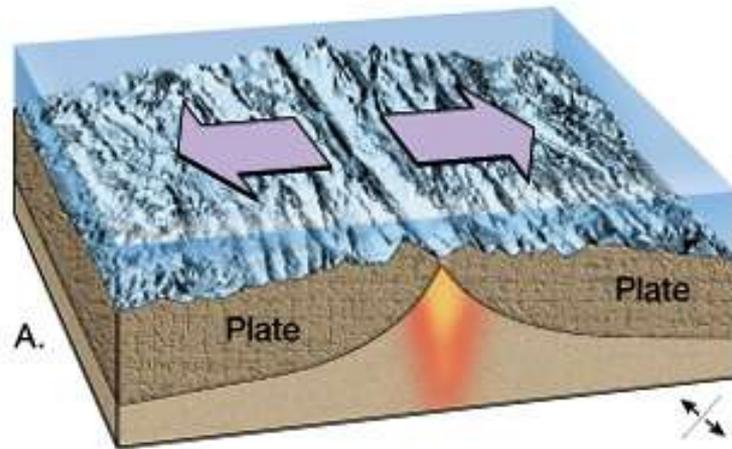
- A) volcano
- B) Mountains are formed
- C) sea floor spreading

PLATE TECTONICS

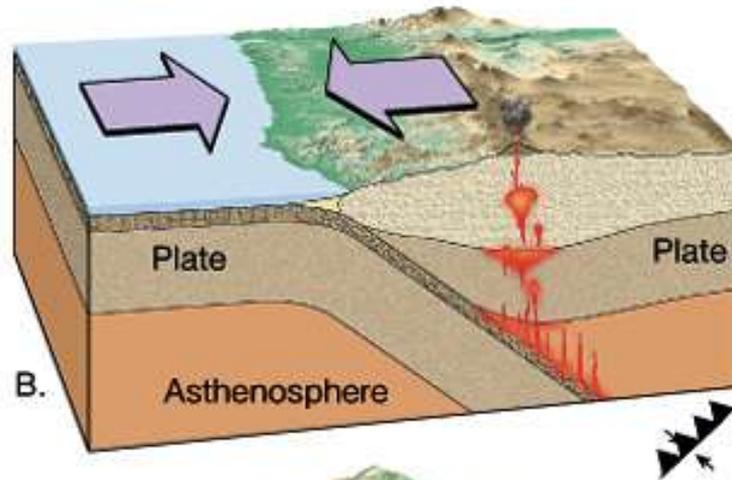
- ✘ It is believed that the plates are moving because of convection currents in the mantle.



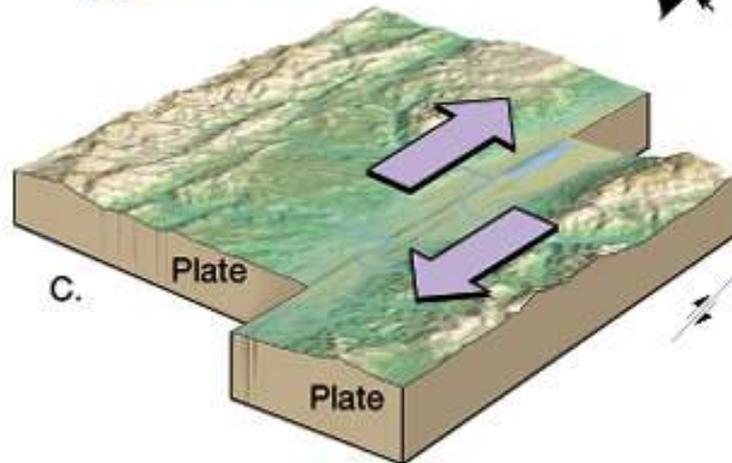
DIVERGENT



CONVERGENT



TRANSFORM

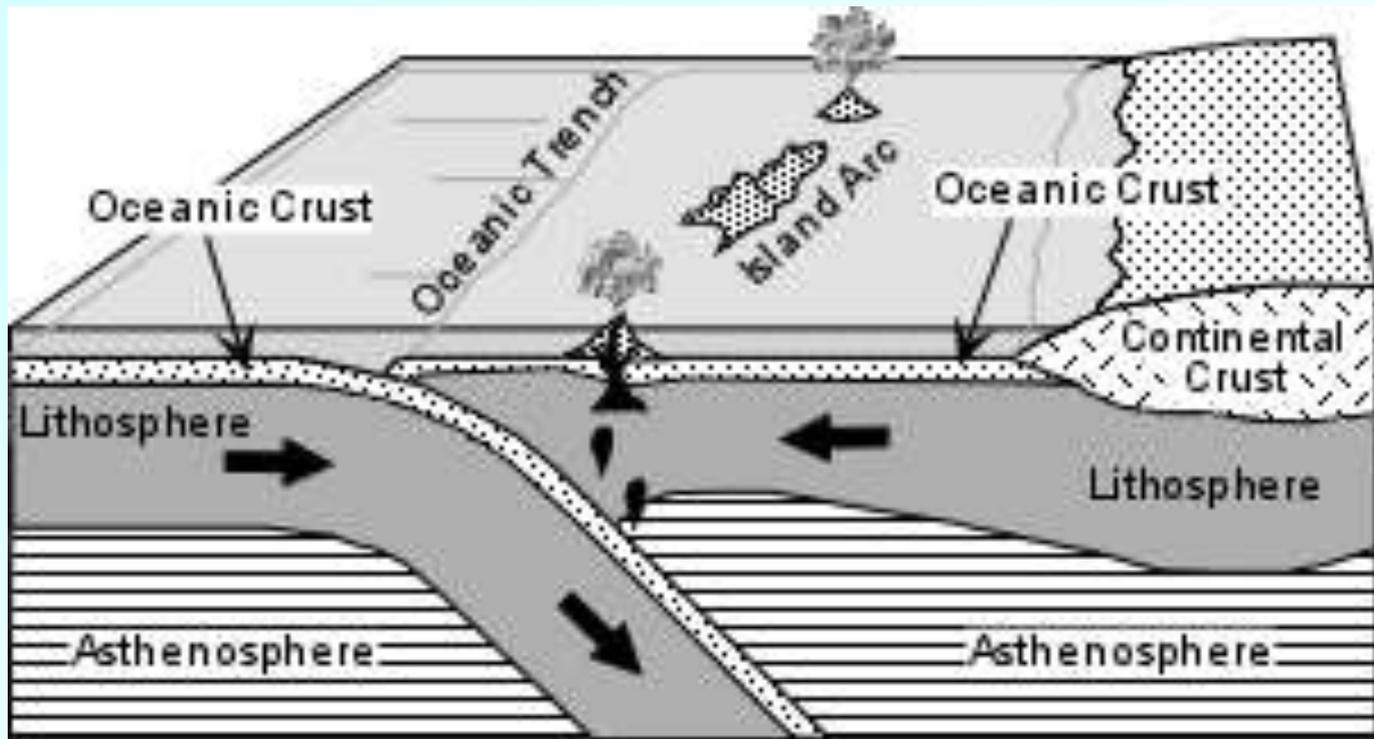


Assignment:

- ✘ Copy and label **PLATE TECTONICS** diagram pg 65. Include definition of Theory of Plate Tectonics
- ✘ Answer questions pg 71 # 1-4

CONVERGENT BOUNDARIES

- ✦ Oceanic-Oceanic convergent boundary- subduction occurs



Ocean - Ocean Convergence

Plate Boundaries

Earth's Tectonic Plates

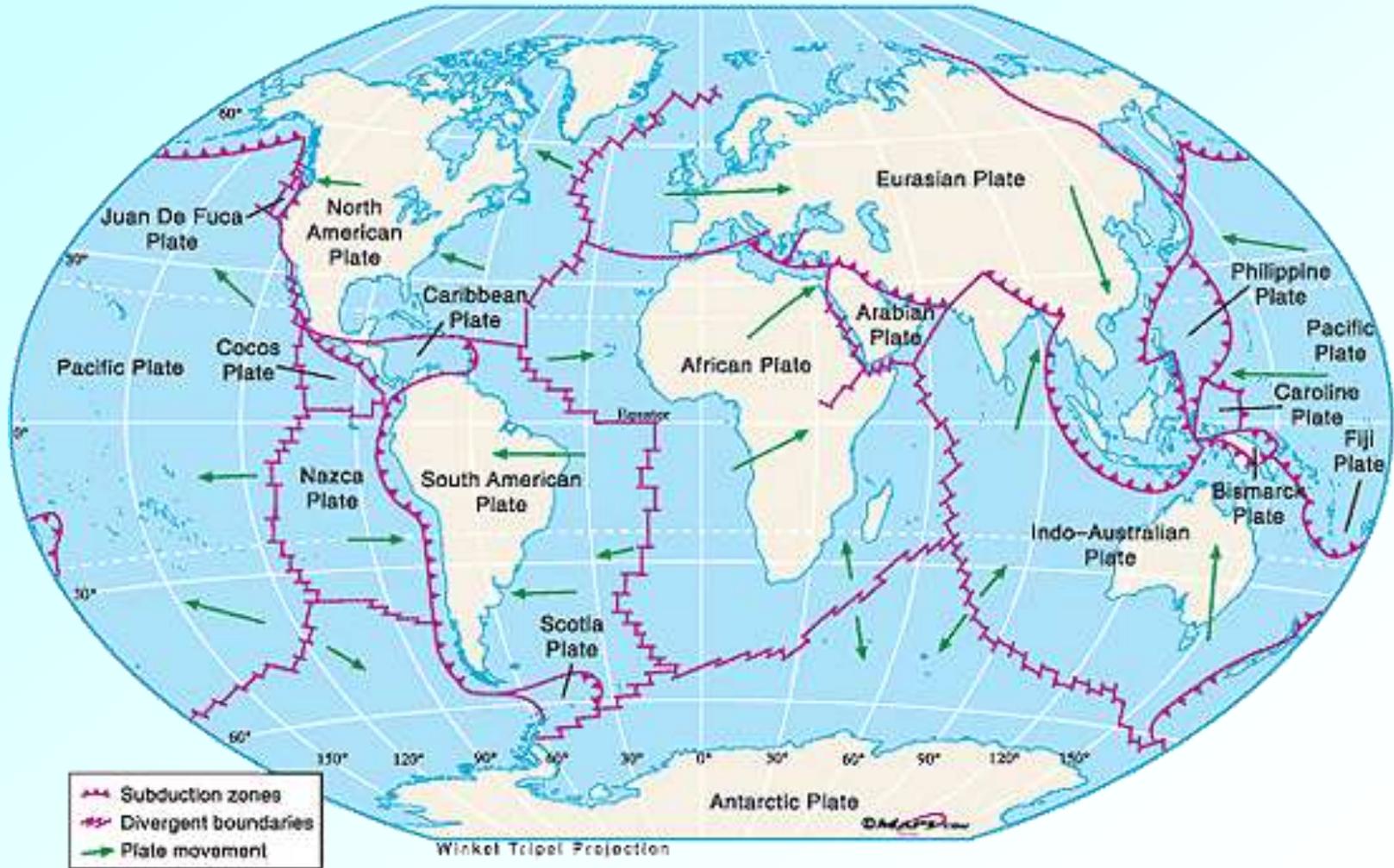


Plate Tectonics

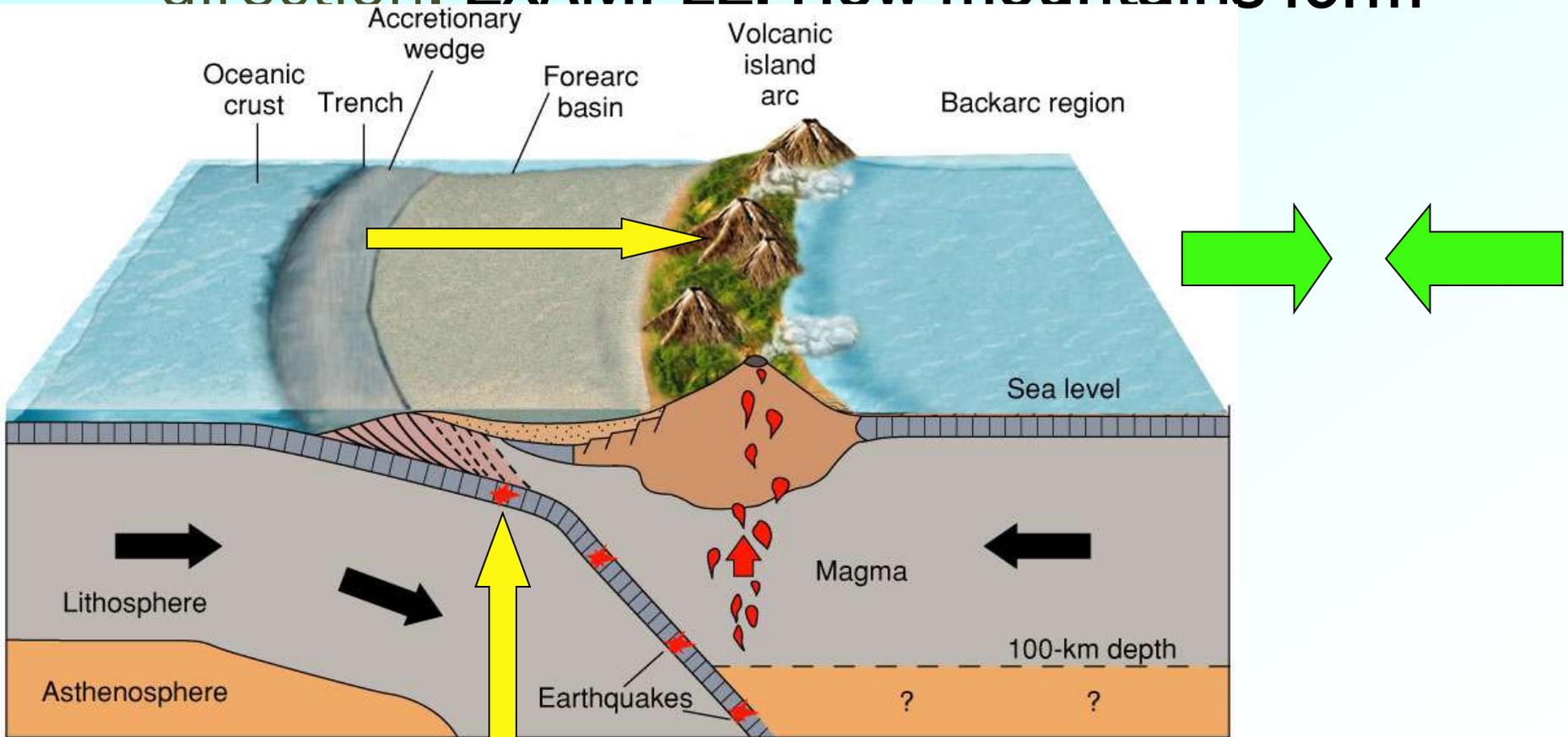


Tectonic Plate Boundary Types:

- Extensional 
- Compressional 
- Transform (sliding) 

CONVERGENT BOUNDARIES

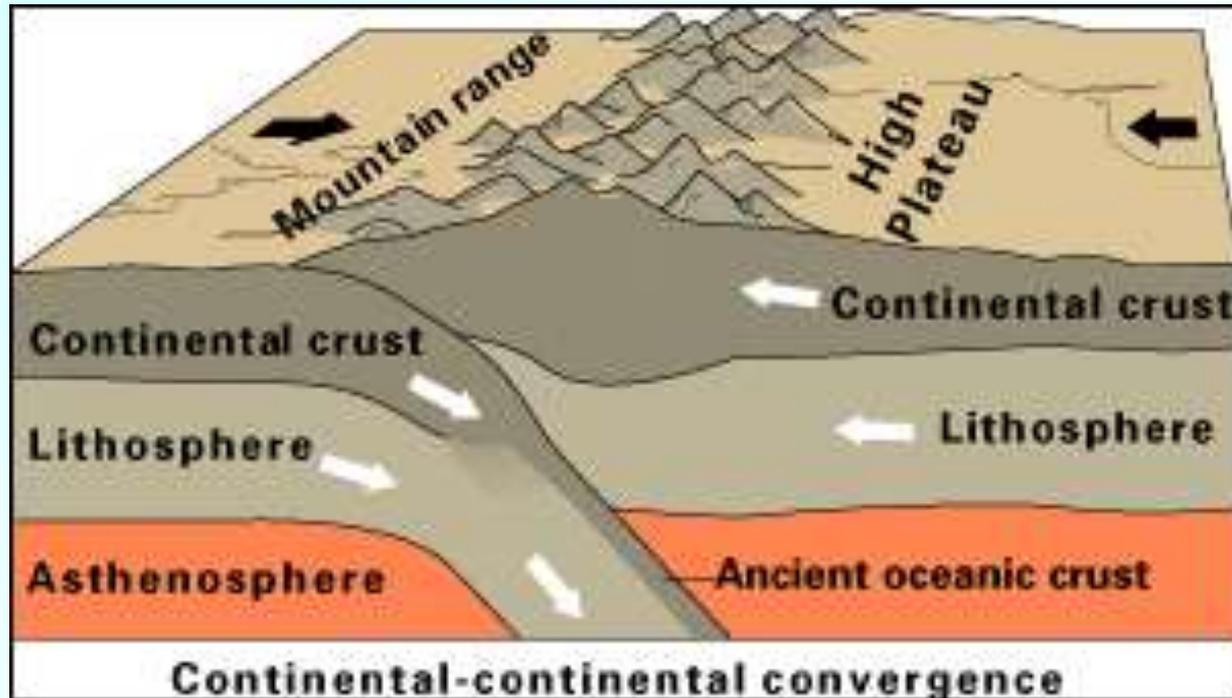
✘ When plates are pushed together in the same direction. **EXAMPLE: How mountains form**



✘ **EXAMPLE: Where sea floor is destroyed**

CONVERGENT BOUNDARIES

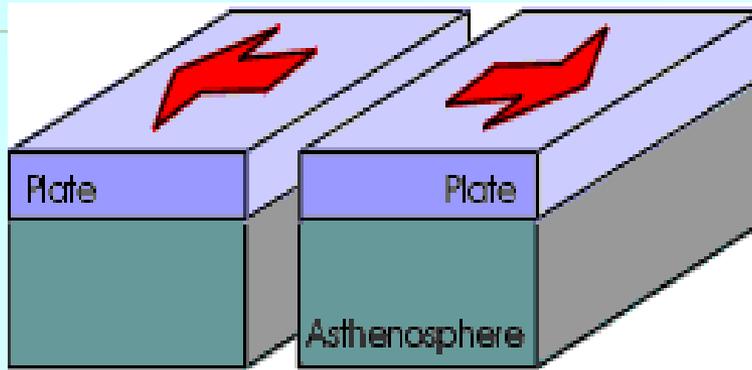
- ✘ Continental-Continental- the plates crash head-on. The collision squeezes the crust into mighty mountain ranges.



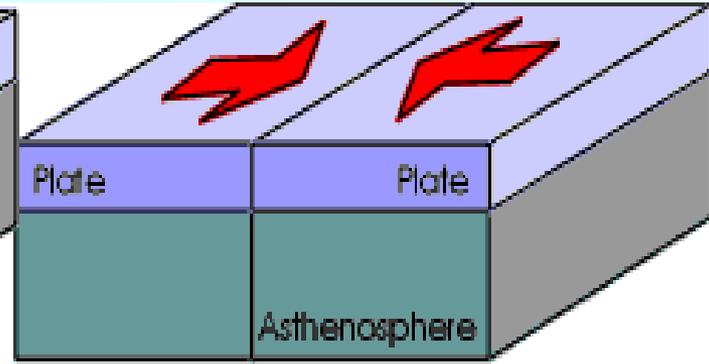
Assignment:

- ✘ Work on **Continental Drift** questions with your partner
- ✘ Answer questions in complete sentences

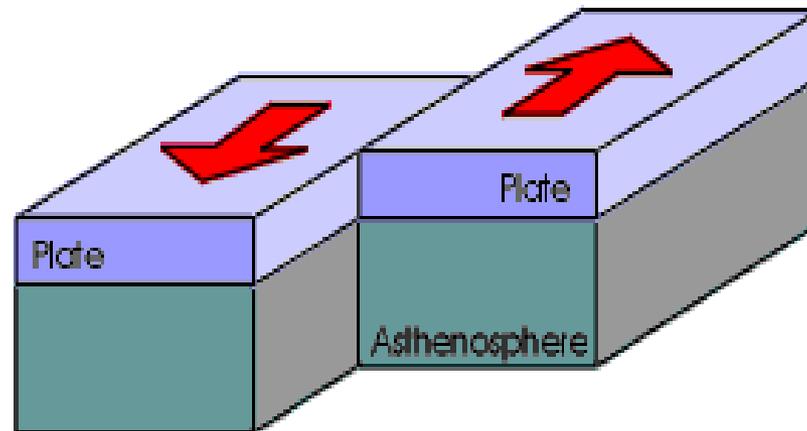
Sketch each Plate Boundary – describe in your own words what happens at each plate boundary below each picture.



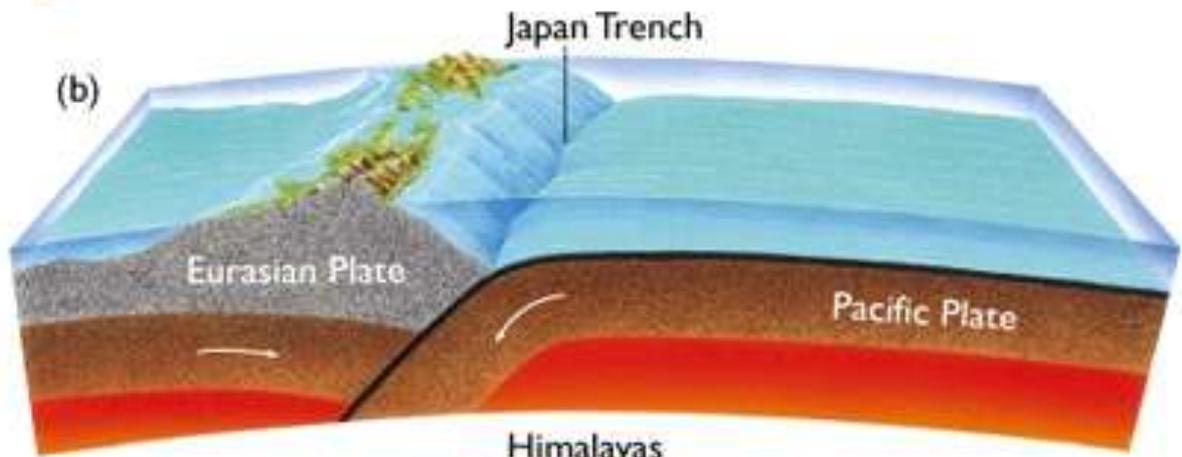
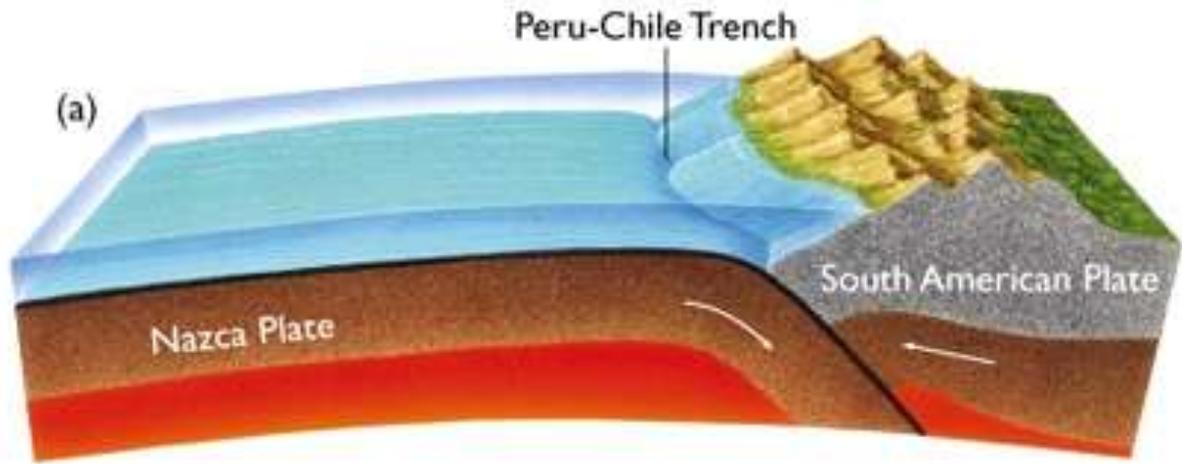
Divergent
-forms new ocean floor



Convergent
-forms mountains

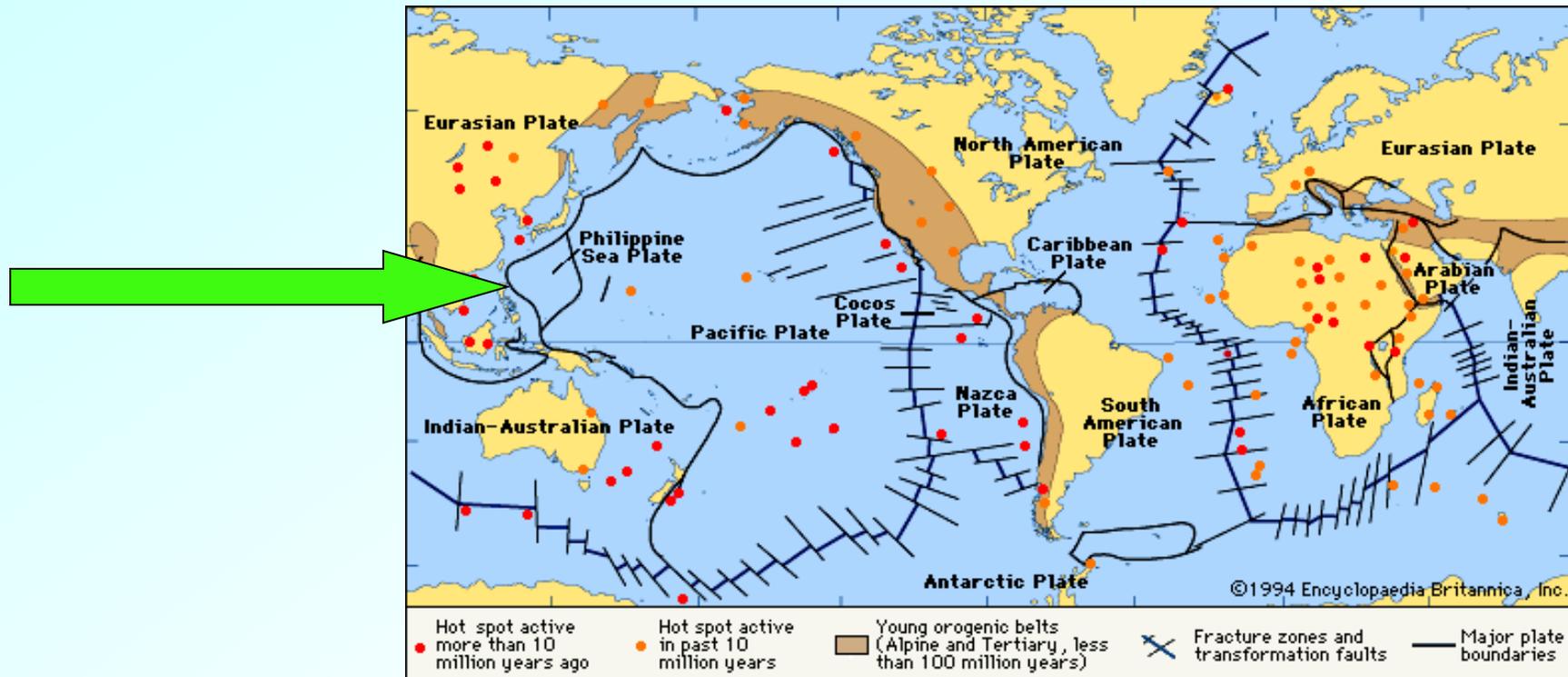


Transform (Strike-Slip)
-causes Earthquakes



Warm-Up

Which plate boundary caused the earthquake in Japan ?



1. What is the Earth made of?

- A. The crust, the mantle and the core
- B. The skin, the pulp and the core
- C. The plates, the magma and the core

2. Which of the following statement is true about the continental crust?

- A. It is made of relatively dense rocks.
- B. It is made of relatively light materials.
- C. It is about 7 km thick.

3. Which of the following statements is false about magma?

- A. It is a layer of molten rock.
- B. Its temperature is about 2000 (C.
- C. It is the same as the mantle.
- D. It rises to the Earth's surface during an eruption.

4. Plates move due to

- A. subduction
- B. convection currents in the mantle
- C. sea-floor spreading

5. Which of the following results in the extension of plates?

- A. sea-floor spreading
- B. continental drift
- C. subduction

6. Which of the following is not true of sea-floor spreading?

- A. Oceanic ridge is formed.
- B. It is basically volcanic.
- C. A depression called oceanic trench is formed.

7. Subduction causes all of the following except

- A. earthquakes
- B. oceanic ridge
- C. fold mountains

8. Which of the following is *not part* of the process of sea-floor spreading?

- A. Rocks break and a crack is formed between the plates when they move towards each other.
- B. Magma rises through the crack and seeps out onto the ocean floor.

9. The process subduction *does not* include:

- A. Plates move towards each other.
- B. The thinner, less dense plate will slide under the denser plate.

Short Answer

4. What scientific data was used to support the theory of continental drift? Identify and explain at least 4 types of evidence.

5. There are 3 main kinds of boundaries. Formulate an illustration of each one.

EVIDENCE

1. Fossil Clues
2. Puzzle Clues
3. Climate Clues
4. Rock Clues