# Inside the Earth

- A journey to the centre of Earth

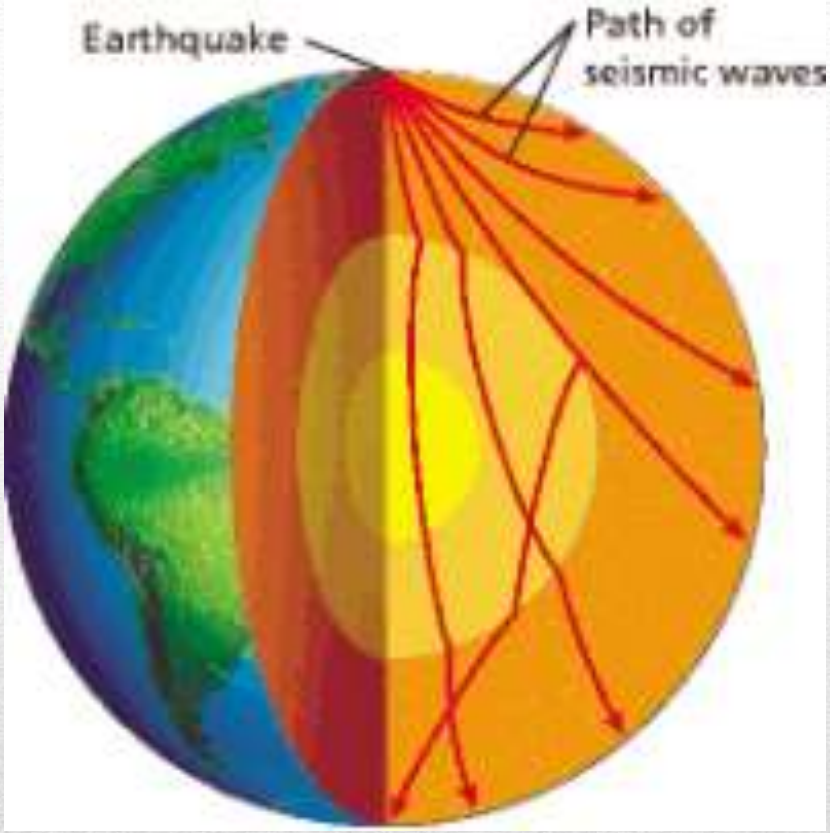
Dr.A.BALUKKARASU

| | |
|---|---|
| Seismic waves | Outer core |
| Temperature | Inner core |
| Pressure | Igneous Rocks |
| Crust | Volcanic Rocks |
| Oceanic crust | Seafloor spreading |
| Continetal crus | Palate tectonics |
| Lower mantle | Continental drift |
| Lithospher | Convection current |
| Asthenosphere | Pangaea |

# Key Terms

# Earth's Changing Surface

- Earth's surface is constantly changing
- Geologists have used two main types of evidence to learn about Earth's interior:
  - direct evidence from rock samples
  - indirect evidence from seismic waves

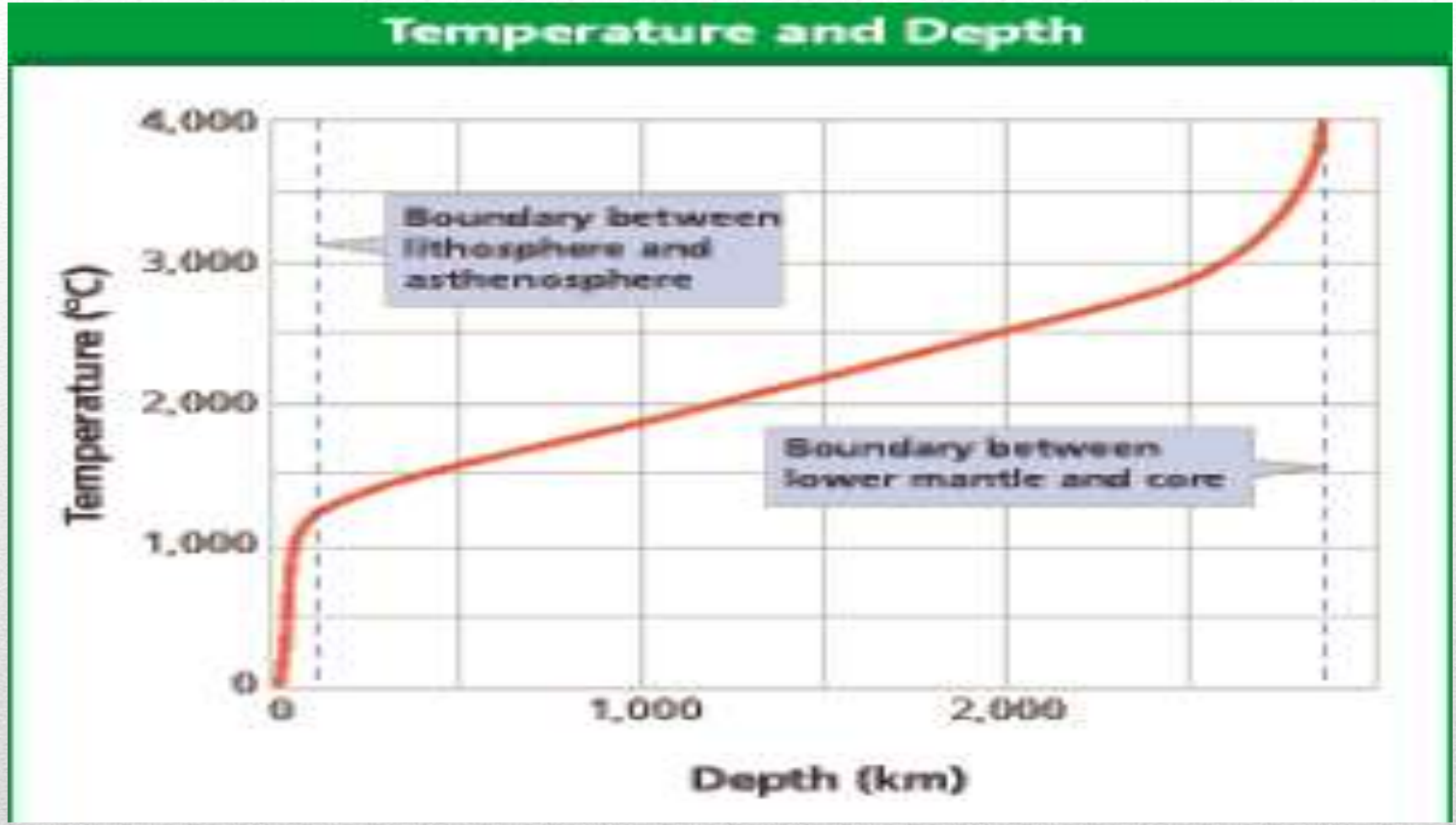



- **Scientists study the speed and the path of seismic waves**

# Studying Earth's Interior

# Earth's Structure

- The three main layers of Earth are the **crust, the mantle, and the core**. These layers vary greatly in **size, composition, temperature, and pressure**.

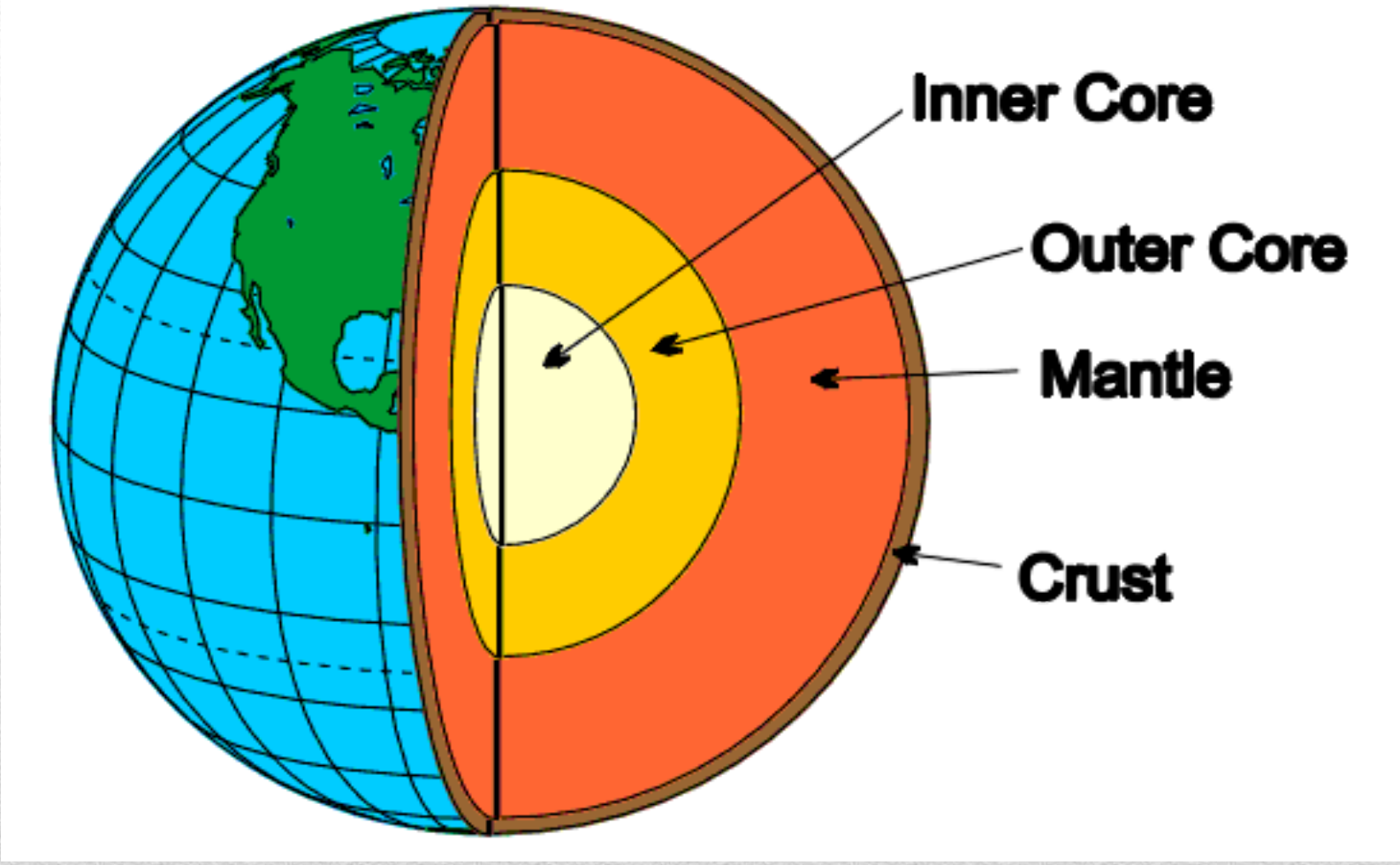



# Temperature

Dr.A.BALUKKARASU

- Pressure is the force pressing on an area
- Because of the weight of the rock above, pressure inside Earth increases as you go deeper

# Pressure




# Journey to the Core!

Dr.A.BALUKKARASU

# The Crust

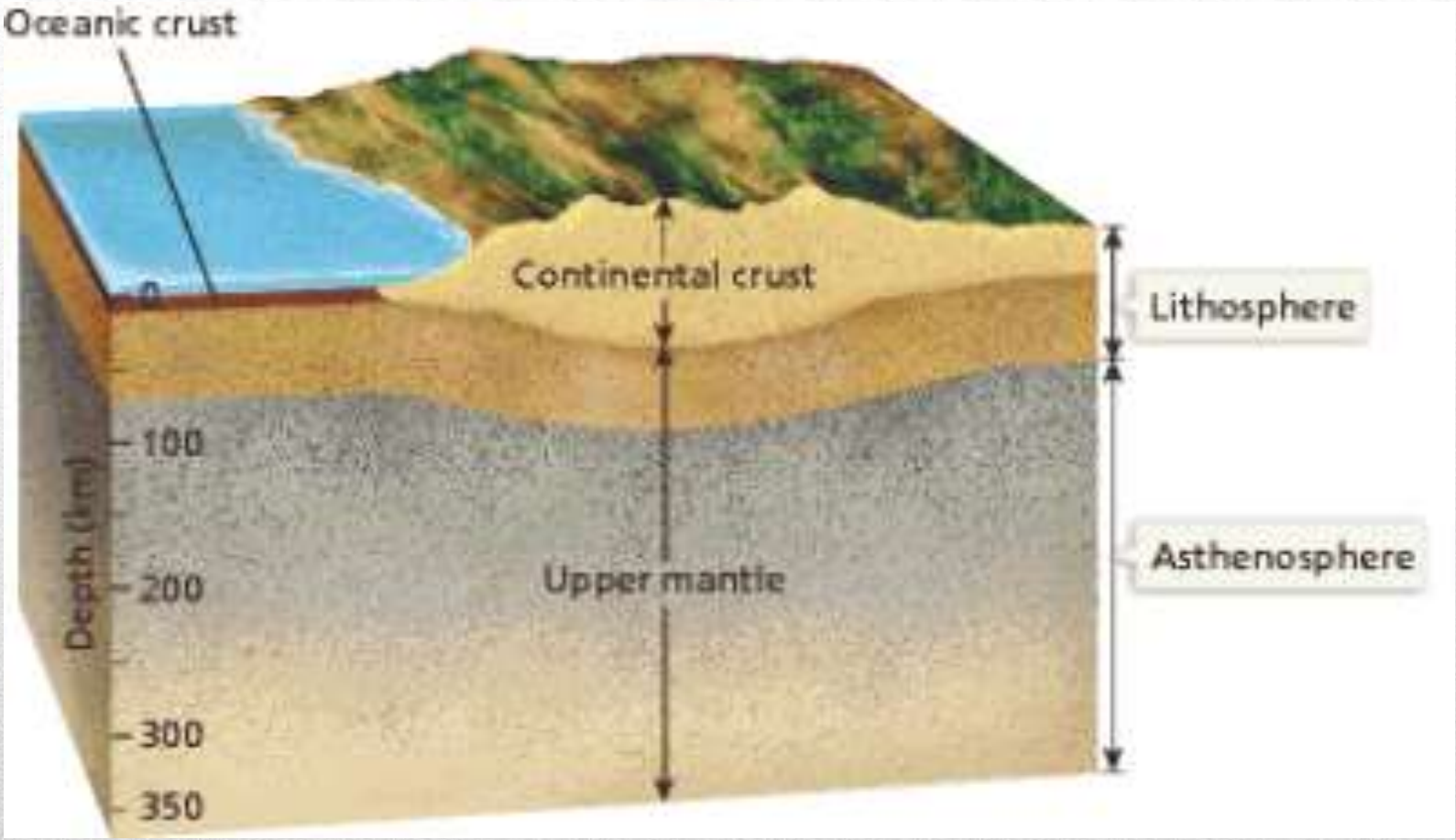
- **The crust** is a layer of solid rock that includes both dry land and the ocean floor.
- Earth's crust is very thin compared to what lies underneath
  - The crust can be compared to the thin skin of an onion

# The Crust

- **The oceanic crust** lies beneath the ocean and is composed of **basalt** which is dark and has a fine texture
- The **continental crust** is composed mostly of **granite** which is light in color and tends to be coarse
  - The crust is thickest underneath mountains

# The Mantle

- The **Mantle** is a thick layer of hot rock
- Overall the Mantle is about 3, 000 km thick

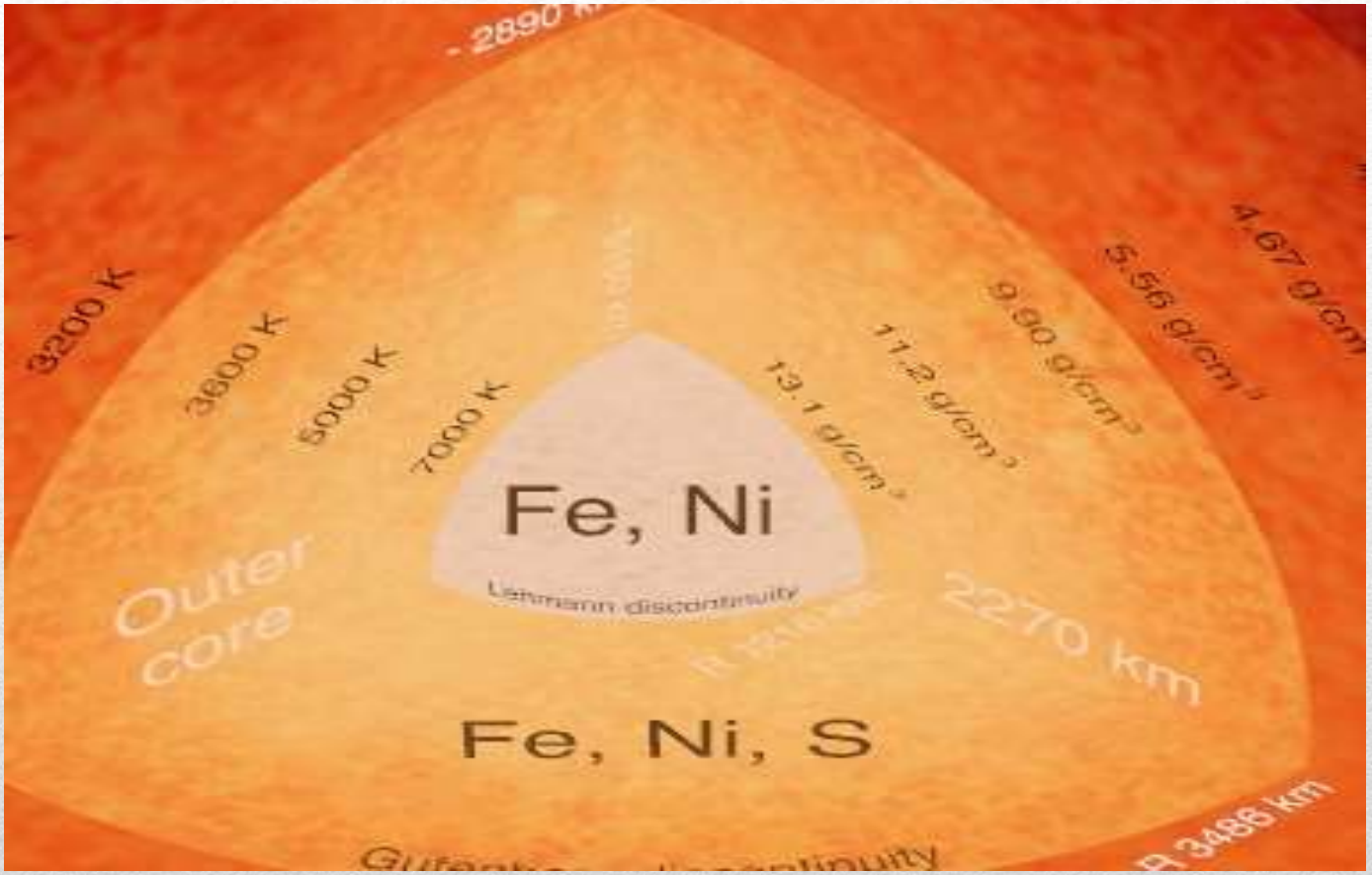



# Layers of the Mantle

Dr.A.BALUKKARASU

# The Mantle

- The uppermost part of the mantle is very similar to the crust. The uppermost part of the mantle and the crust together form a rigid layer called the **lithosphere**
- The asthenosphere is below the lithosphere and is hotter, under more pressure, and is flexible
  - The asthenosphere's texture can be compared to that of hot tar
- Beneath the asthenosphere, the mantle is solid rock and extends down to the core



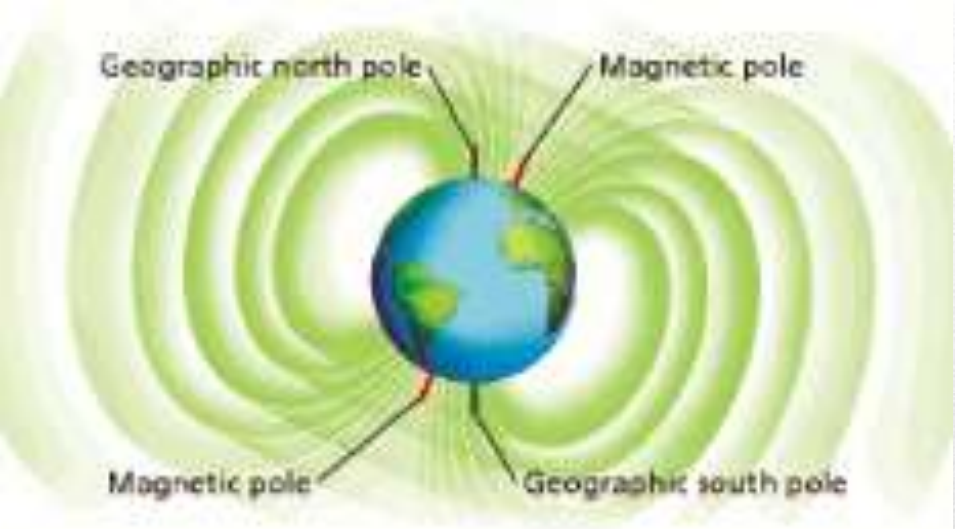

# Earth's Core

Dr.A.BALUKKARASU

# Earth's Core

- **Earth's core is divided into two layers**:
  - The **outer core**
    - The outer core is a molten *liquid* layer of metal
  - The **inner core**
    - The inner core is a *solid* metal ball composed primarily of **nickel** and **iron**

- Scientists think that movements in the liquid outer core create Earth's magnetic field.




**Earth's Magnetic Field**
Like a magnet, Earth's magnetic field has north and south poles.

# Earth's Magnetic Field

# CONVECTION IN THE MANTLE

Heavy materials are sinking towards downward and light materials are coming upward

Dr.A.BALUKKARASU

- **Key Concepts**
- How is heat transferred?
- What causes convection currents?
- What causes convection currents in Earth's mantle?

**Key Terms**

- Radiation
- conduction
- convection
- density
- convection current

# convection currents plays major role

# TYPES OF HEAT TRANSFER

Dr.A.BALUKKARASU


- The transfer of heat within a material or between materials that are touching

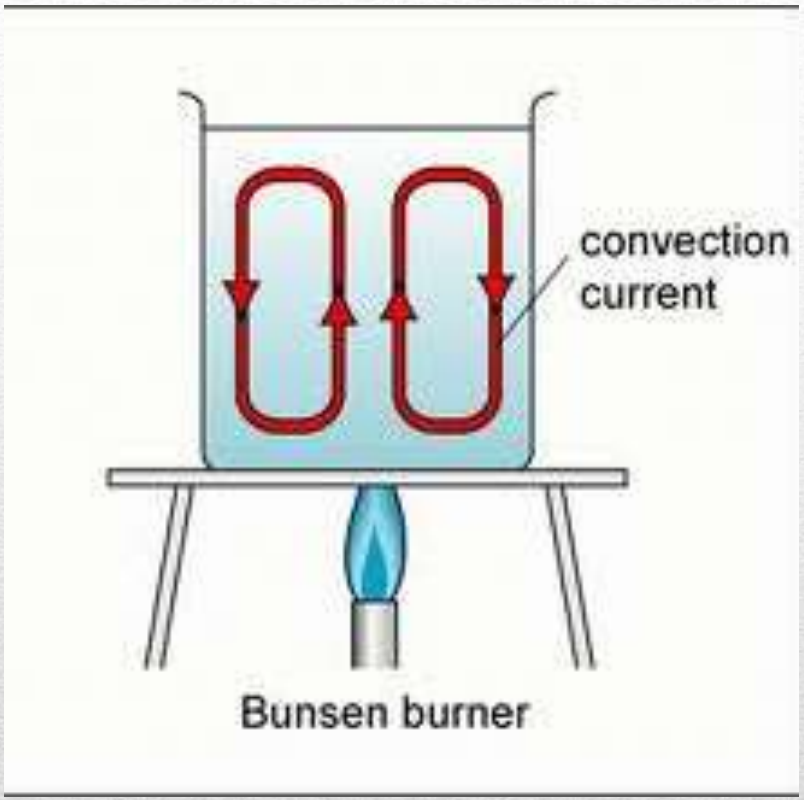
# Conduction

- The transfer of energy through space.


# Radiation

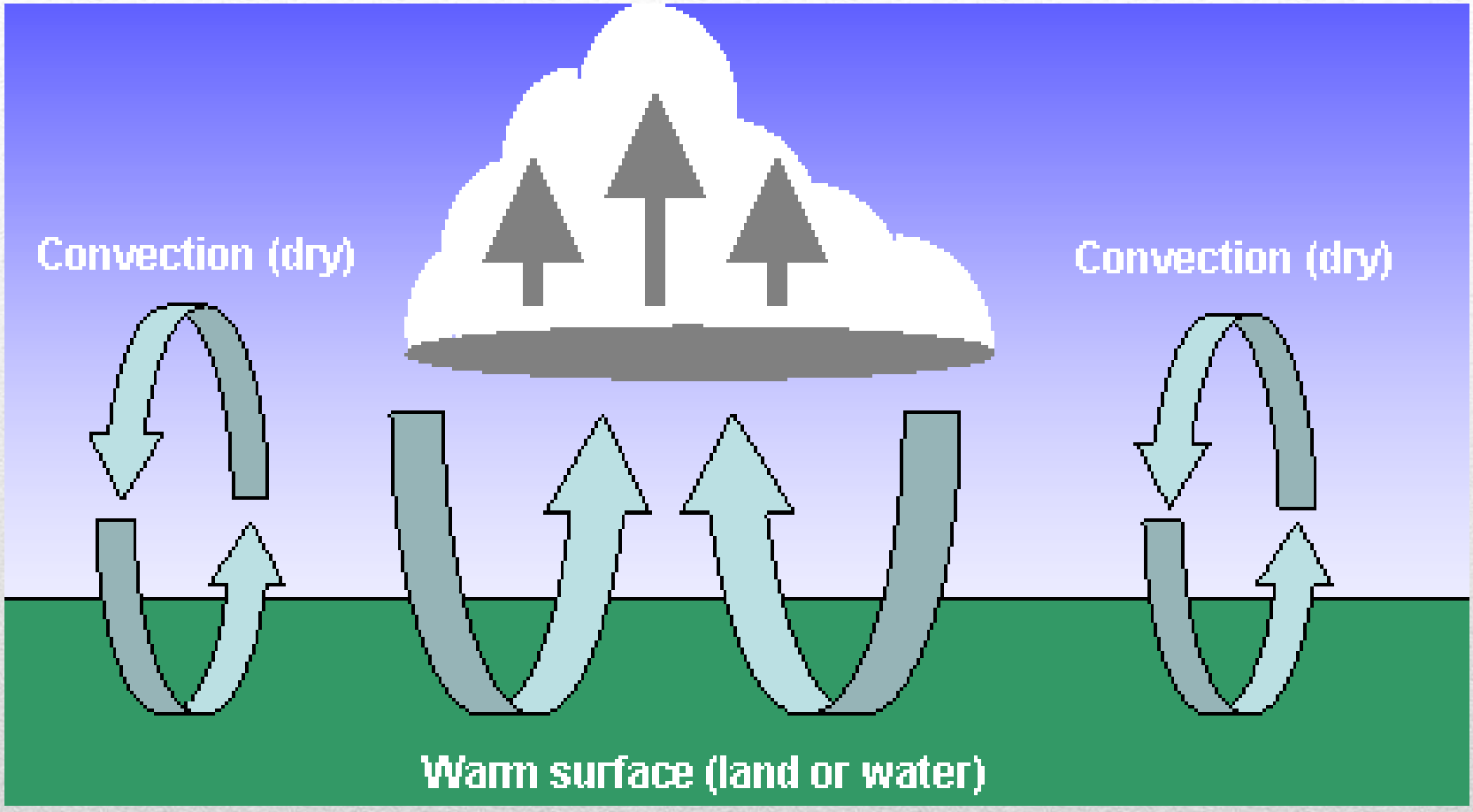
# Convection

- The transfer of heat by movement of a fluid.



- Heat transfer by convection is caused by differences of **temperature** and **density** within a fluid.
- **Density = Mass/Volume**


# Density

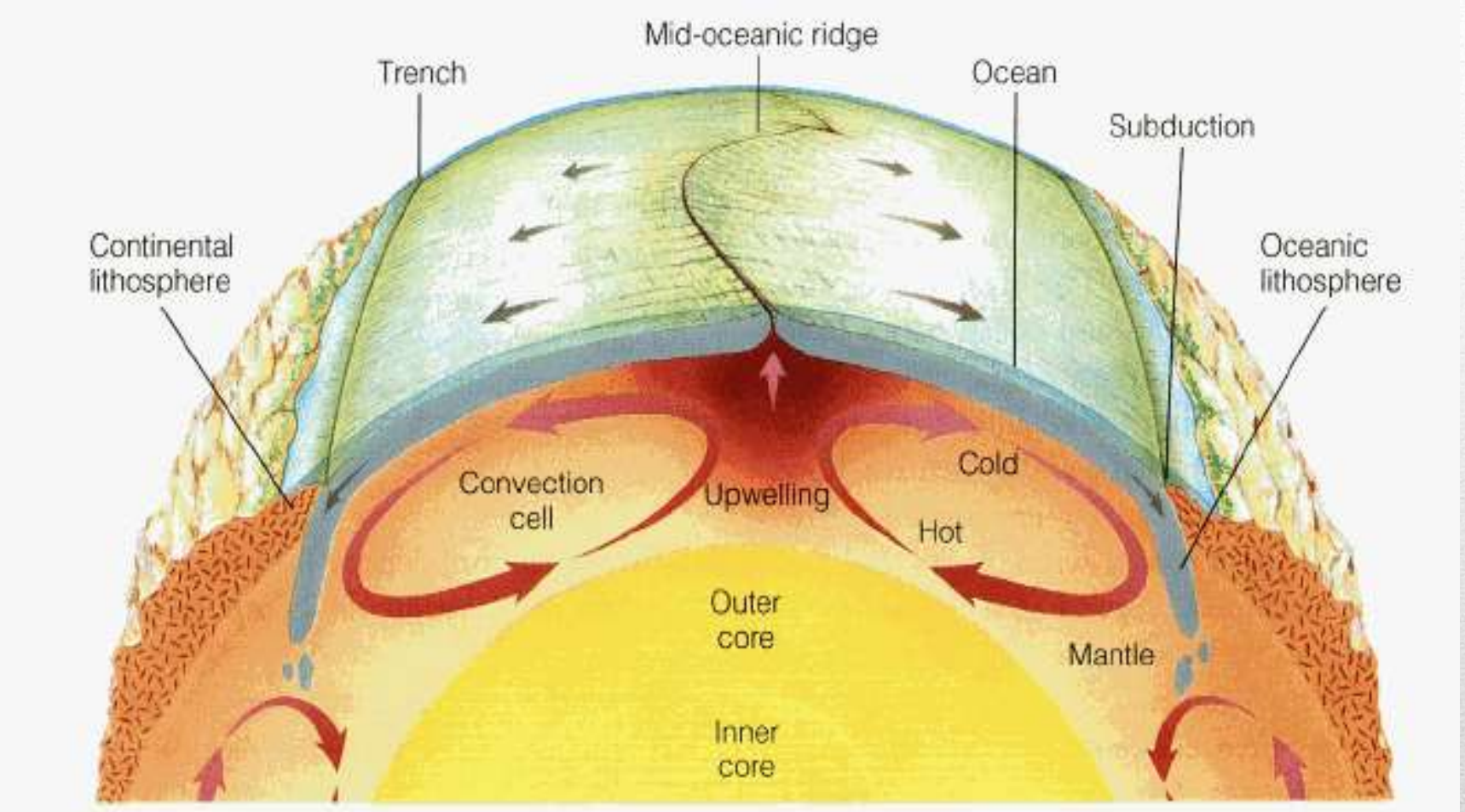



# Convection heats our atmosphere

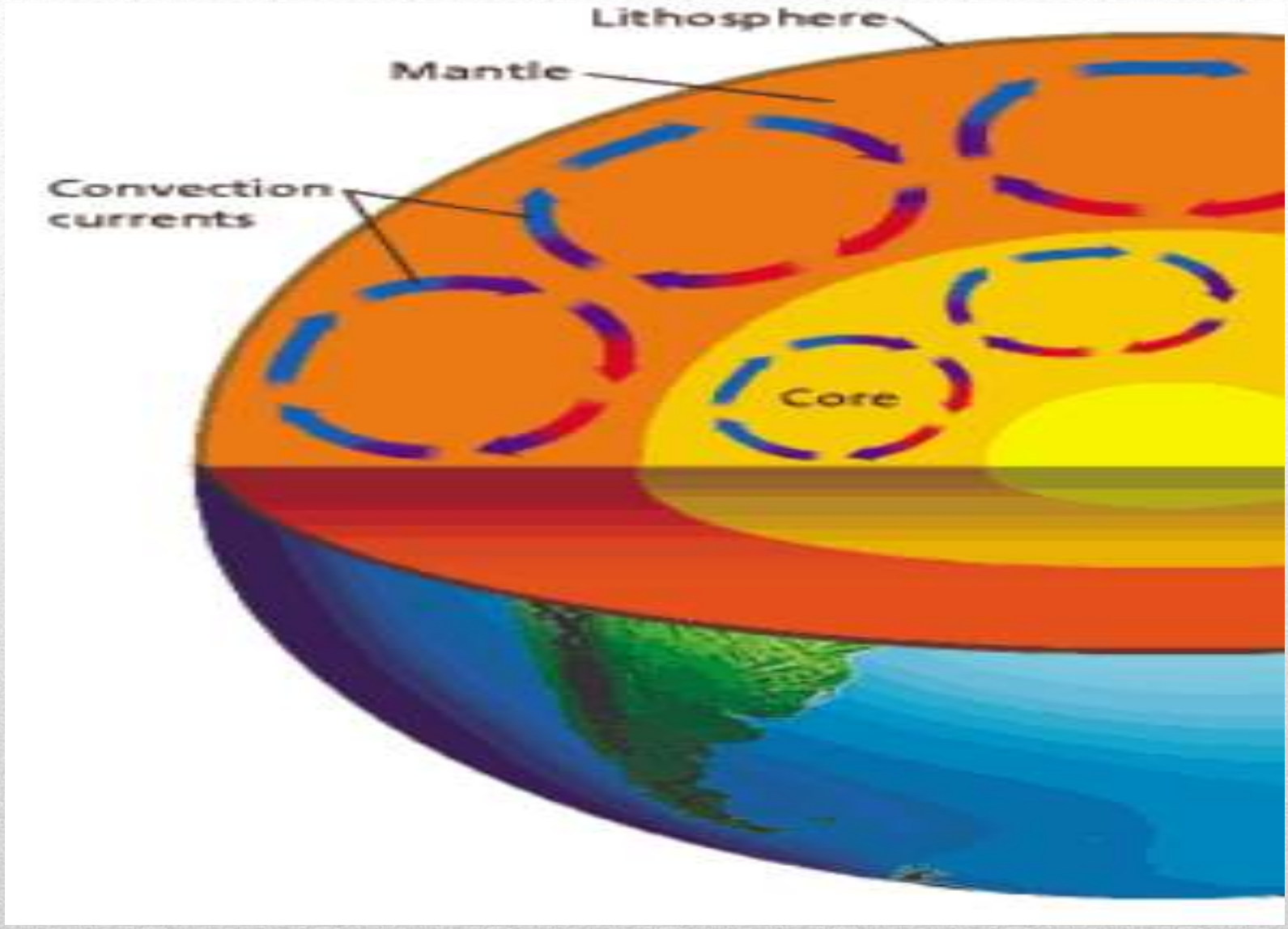
Dr.A.BALUKKARASU

- **Convection current**-The movement of a fluid, caused by differences in temperature, that transfers heat from one part of the fluid to another
- Differences in **temperature** and **density** cause convection currents.
  - Heating and cooling of the fluid, changes in the fluid's density, and the force of gravity combine to set convection currents in motion.
  - Convection currents continue as long as heat is added.

# Convection Currents




# Convection currents also heat the Mantle


Lithosphere
Mantle
Convection currents
Core

MANTLE CONVECTION CURRENTS, RIDGE PUSH AND SLAB PULL ARE THREE OF THE FORCES THAT HAVE BEEN PROPOSED AS THE MAIN DRIVERS OF PLATE MOVEMENT

# Drifting continents

Dr.A.BALUKKARASU

# Continental Drift

- **Continental Drift**- The hypothesis that the continents slowly move across Earth's surface
- First proposed in 1910 by **Alfred Wegener**
  - Wegener's hypothesis was that all the continents were once joined together in a single landmass and have since drifted apart.


# Pangaea

According to Wegner, Pangaea existed about 300 million years ago

Additional **evidence** for **Pangaea** is found in the geology of adjacent continents, including matching geological trends between the eastern coast of South America and the western coast of Africa. The polar ice cap of the Carboniferous Period covered the southern end of **Pangaea**.

# Evidence of Pangaea

# Chapter 7b Earth

## 1. Crust and Upper mantle

History of Plate Tectonics

Mountain Chains and Oceanic Ridge

Lithosphere and Asthenosphere:

Major plates

## 2. Plate Boundaries

Mid Atlantic Ridge

Magnetic Anomalies

Converging and Diverging Boundaries

Hot Spots

Changing Surface

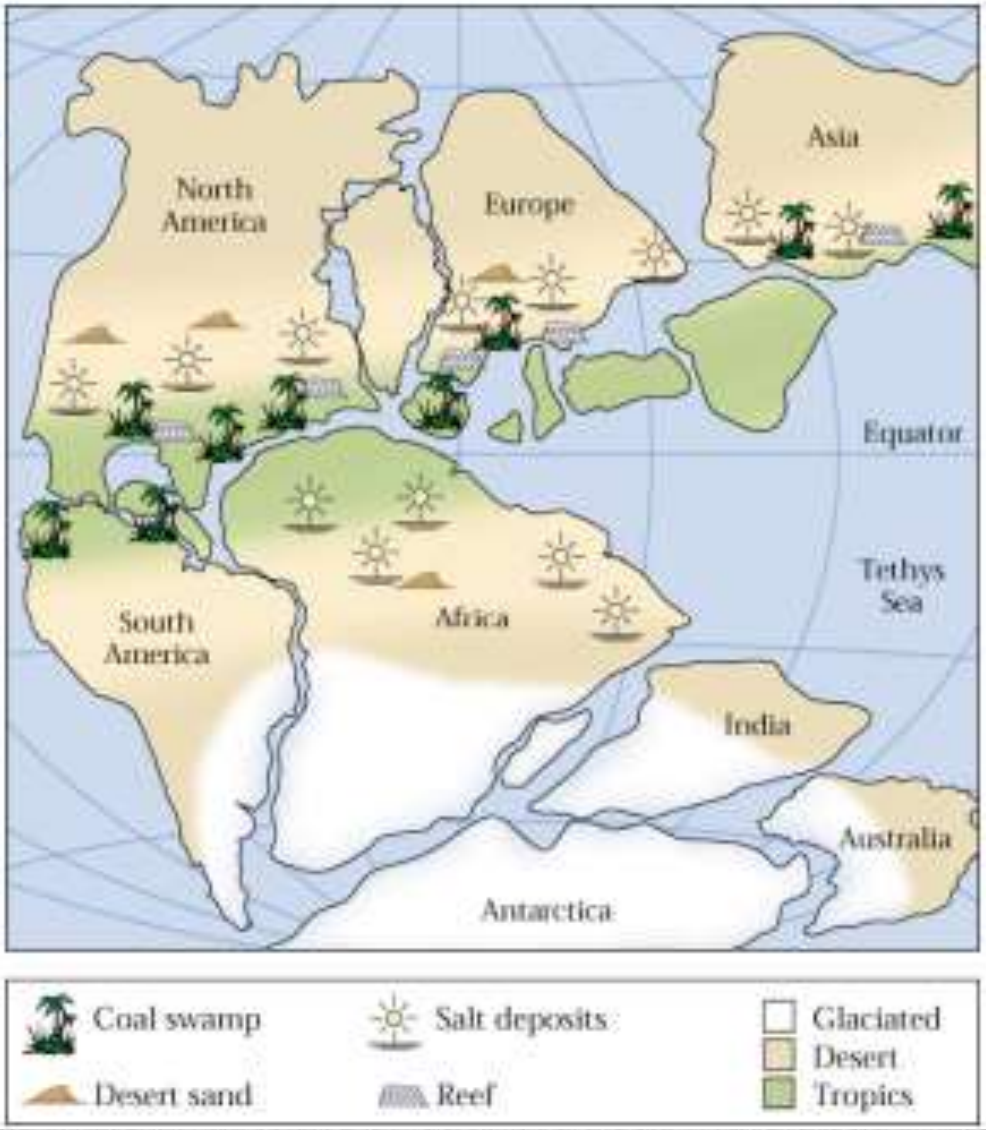
## 3. Tides

Neap and Spring


(200 million years ago)

# Evidence for Pangaea

1. Fit of the Continents
2. Past Climate Belts and Distribution of Fossils
3. Matching Rock Types



# Alfred Wegener (1880-1930)

- proposed continental drift in 1915
- proposed all land mass was once a single body called "Pangaea"
- Pangaea started to drift apart ~200 million years ago

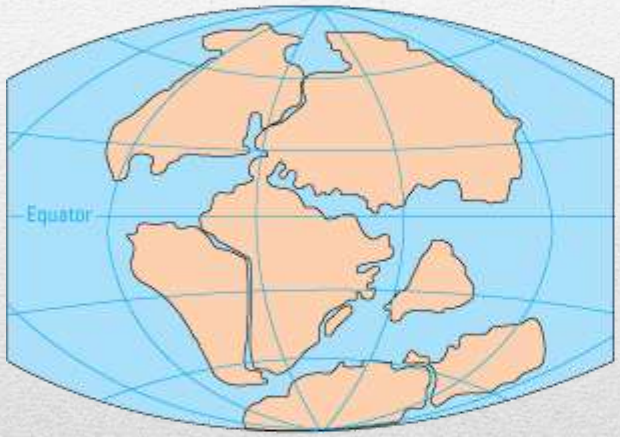
- no one believed his ideas until 1950s!!
- he froze to death on an exploratory trip to Greenland in 1930


# From Land Features:

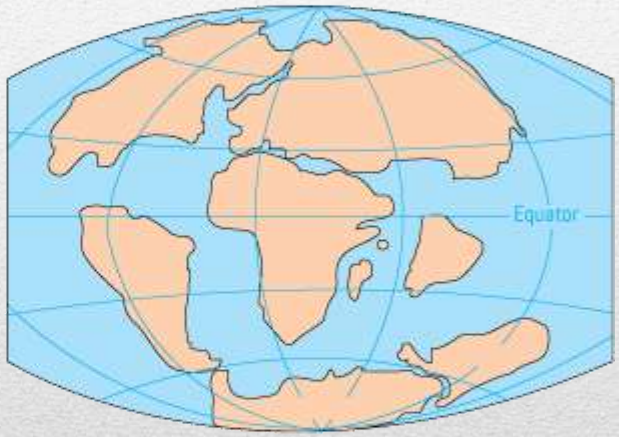
- **mountains and other features on the continents provided evidence for continental drift**


PERMIAN
225 million years ago

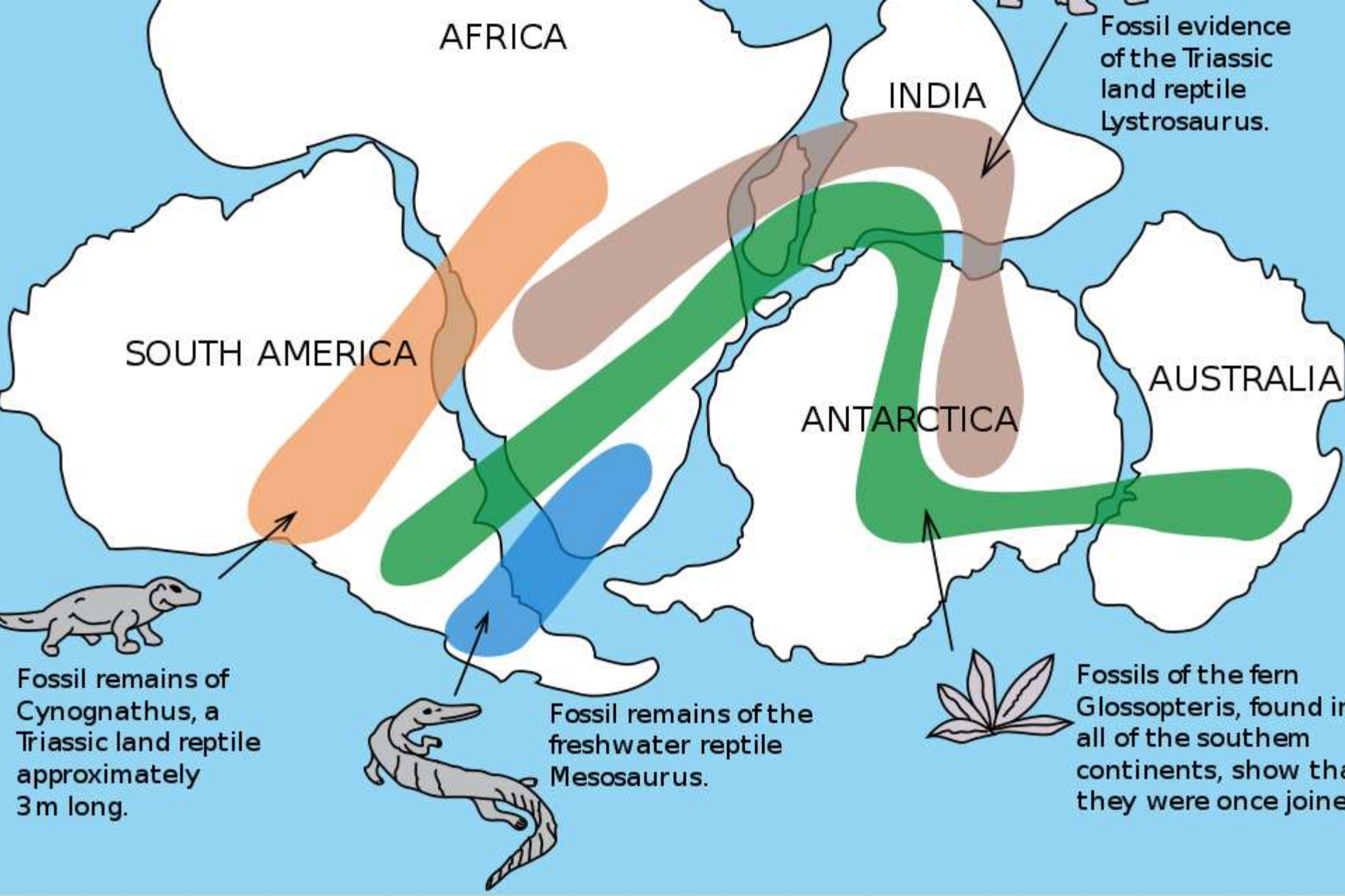

TRIASSIC
200 million years ago

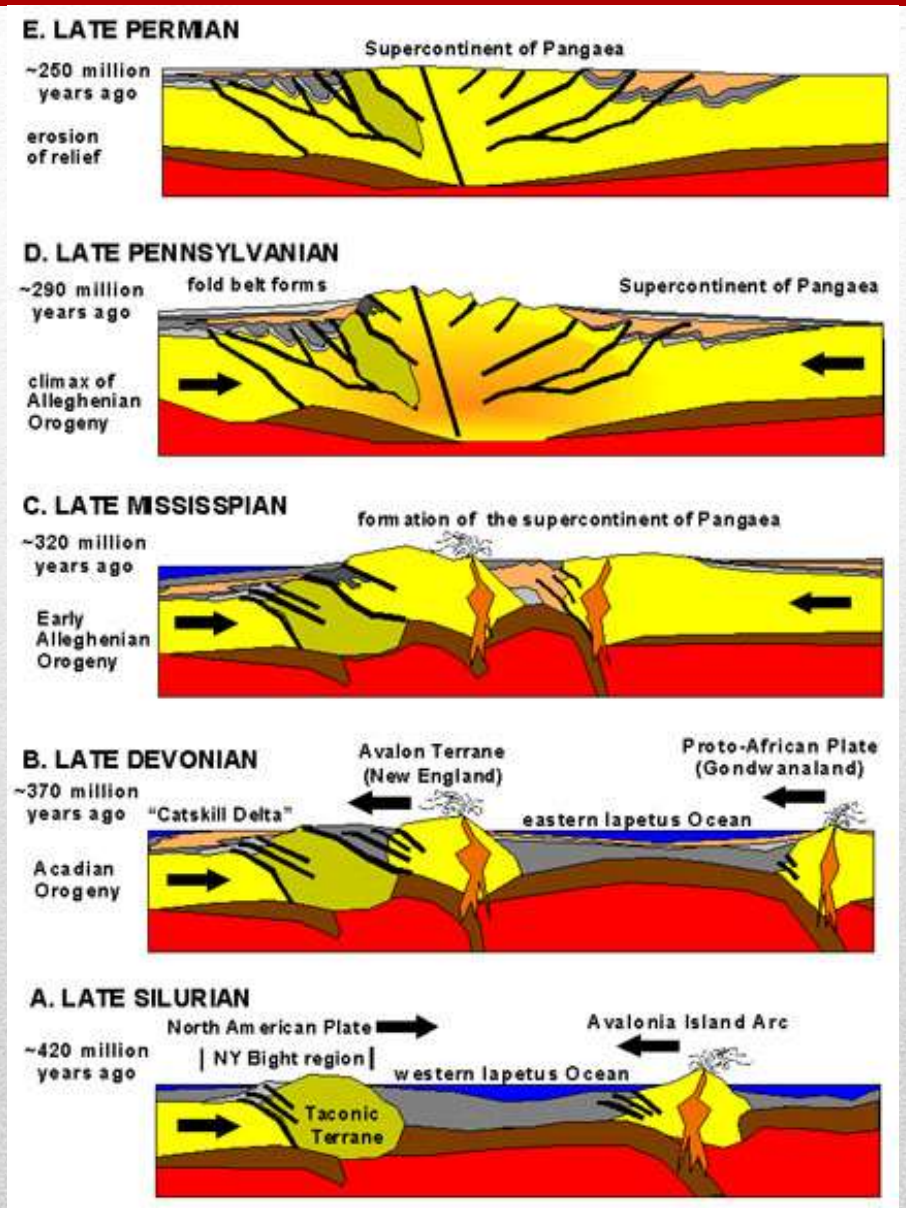



JURASSIC
150 million years ago




CRETACEOUS
65 million years ago


AFRICA
INDIA
Fossil evidence of the Triassic land reptile Lystrosaurus.
SOUTH AMERICA
AUSTRALIA
ANTARCTICA
Fossil remains of Cynognathus, a Triassic land reptile approximately 3 m long.
Fossil remains of the freshwater reptile Mesosaurus.
Fossils of the fern Glossopteris, found in all of the southern continents, show that they were once joined


E. LATE PERMIAN
Supercontinent of Pangaea
~250 million years ago
erosion of relief
D. LATE PENNSYLVANIAN
~290 million years ago
fold belt forms
Supercontinent of Pangaea
climax of Alleghenian Orogeny
C. LATE MISSISSPIAN
formation of the supercontinent of Pangaea
~320 million years ago
Early Alleghenian Orogeny
B. LATE DEVONIAN
Avalon Terrane (New England)
Proto-African Plate (Gondwanaland)
~370 million years ago
"Catskill Delta"
eastern Iapetus Ocean
Acadian Orogeny
A. LATE SILURIAN
North American Plate
Avalonia Island Arc
~420 million years ago
NY Bight region
western Iapetus Ocean
Taconic Terrane


**Plates: 6 large plates**

**(e.g., Pacific Plate)**

**7-10 small plates**

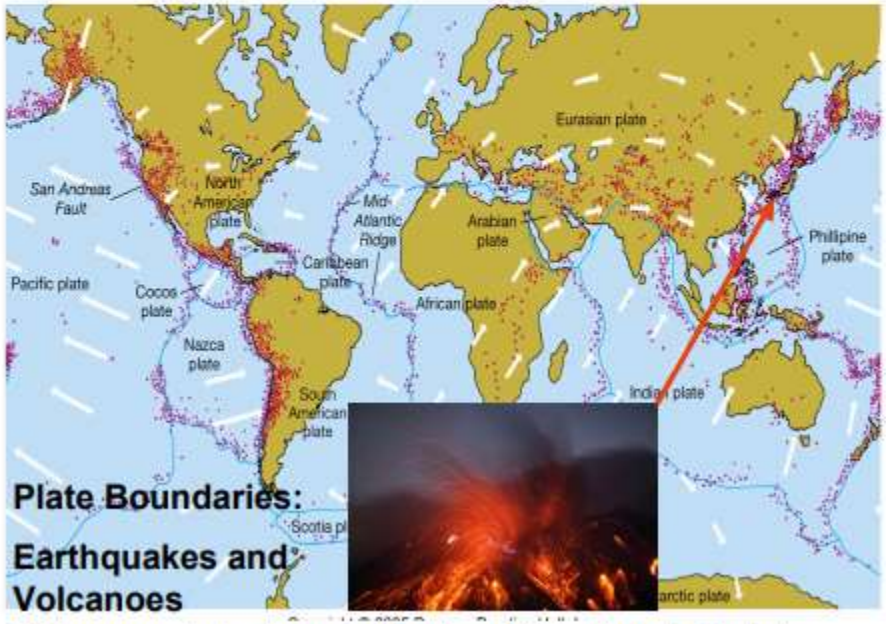
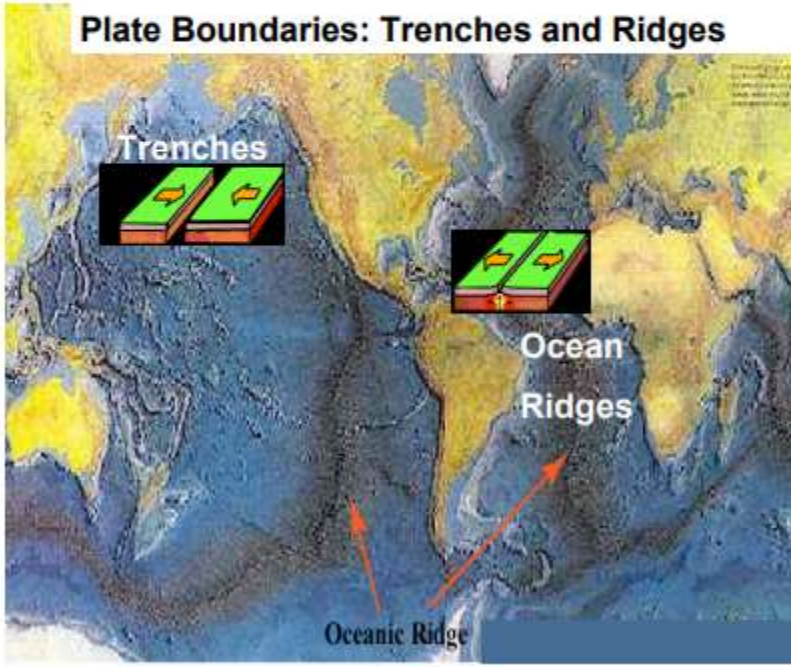



Plate movement: 1 cm/yr up to 15 cm/yr, with 5 cm/yr being typical.

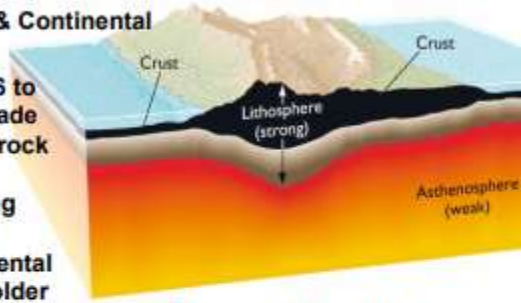






## Crust: Oceanic & Continental

- Oceanic Crust
- is thin, only about 6 to 11 km deep, and made of relatively dense rock called basalt
- the rocks are young compared with the rocks of the continental crust, and are not older than 200 million years.

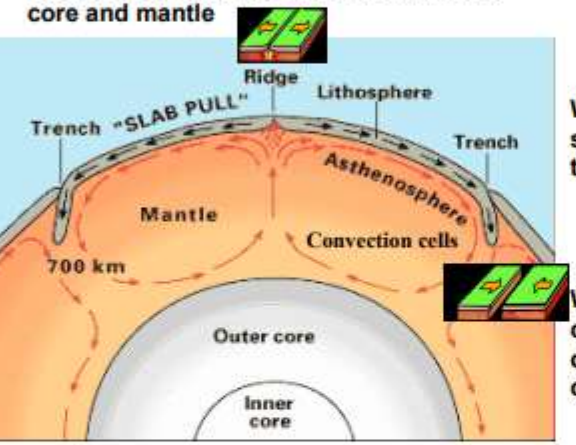


# Driving forces for Plate Motion

Convection cells within the upper mantle (asthenosphere) drag the plates along laterally.

Heat Sources: Original accretion from formation of the Earth

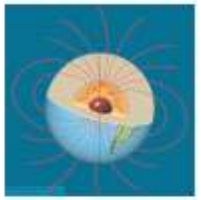
Radioactive decay of U, Th, and K in the core and mantle




Where convection rises sea floor spreading takes place.

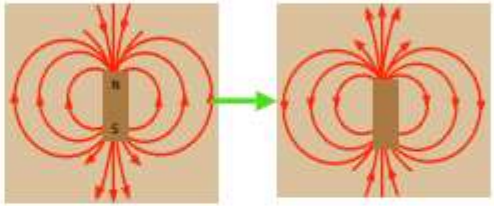
Where the convection cells descend they drag crust down, causing subduction

## Geomagnetic Reversals

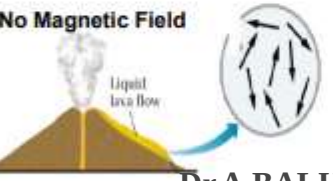


- The strength of Earth's magnetic field has rapidly decreasing over the past 2000 years.

We are in a period of a magnetic reversal – a change in the direction of the magnetic field



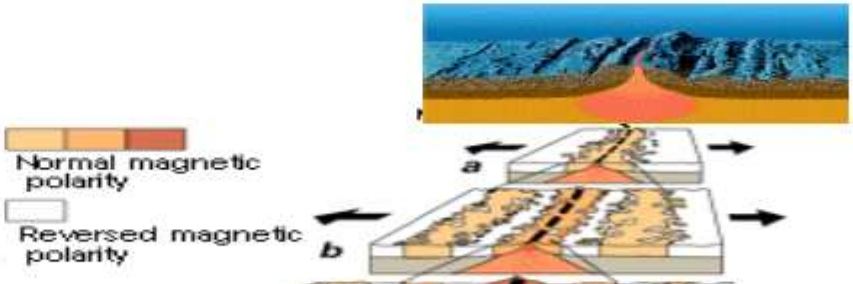

- The mean time between reversals being roughly between 200,000 and 500,000 years with individual reversal events taking only a couple thousand years
- The last reversal was 780,000 years ago




## Magnetic Record in Rocks

Arrows indicate magnetic domains which are regions in which the magnetic fields of atoms are aligned--- magnetic domains are miniature magnets



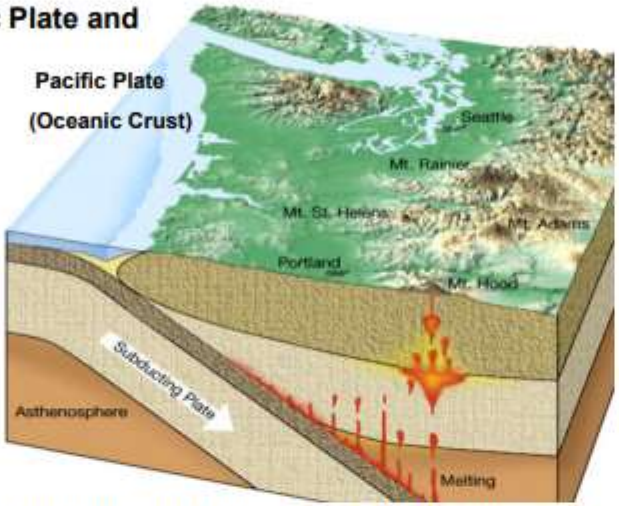



Chp7b.ppt

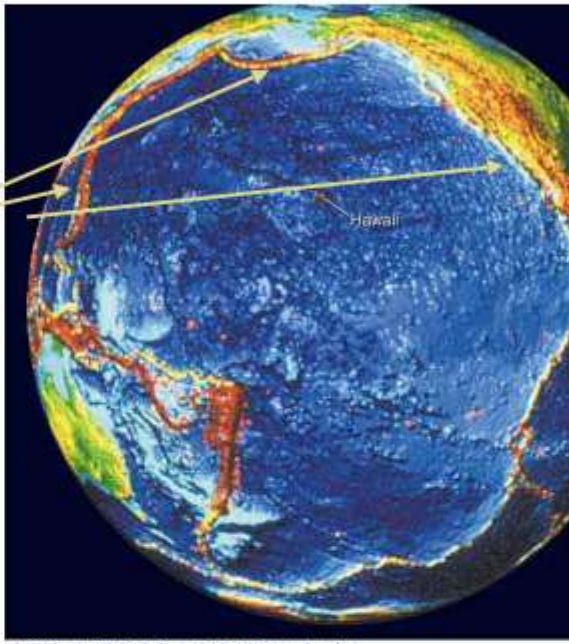
gon.edu/phys600/Chp7b.pdf

**Boundary: Pacific Plate and American Plate**

**Where plates are moving towards one another at their boundary the Oceanic lithosphere is subducted**




**Subduction zone and the Ring of Fire**






✓**The rocky lithosphere comprises both the crust and part of Earth's upper mantle. It is typically between 50 and 100 km thick.**

✓ **Below it lies the asthenosphere, a relatively soft part of the mantle over which the lithosphere slips.**

**Boundary: India Plate-Asia Plate**





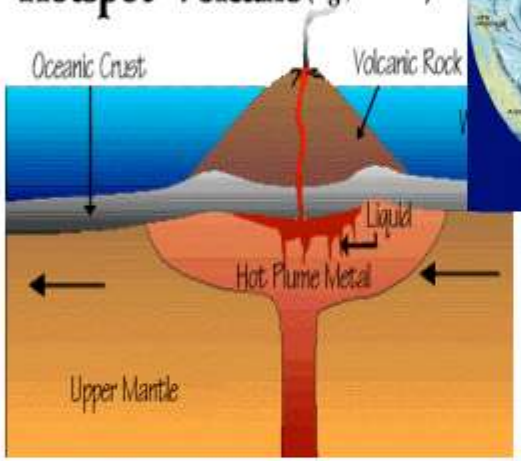
the Eurasian plate. The impact causes Earth's crust to buckle and fold, thrusting up the Himalayan mountain range

destroyed as the plates slide horizontally past eac
such as the San Andreas fault.

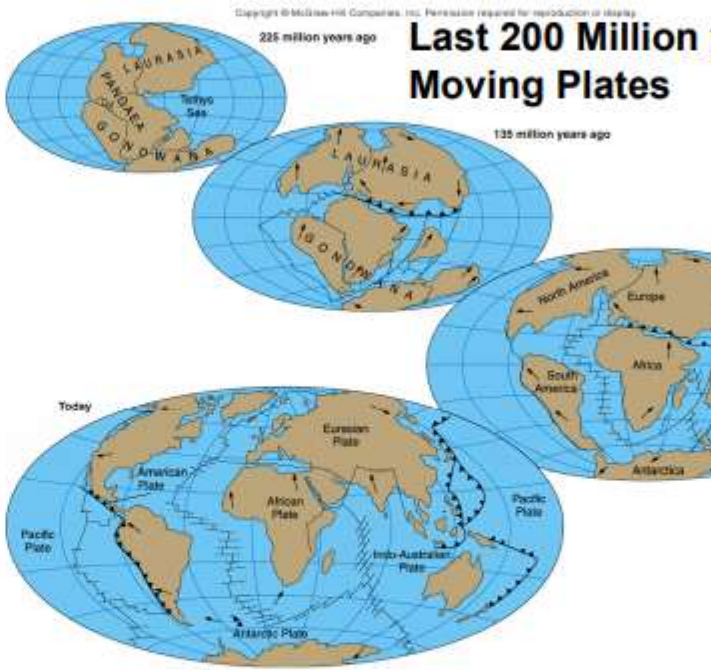
Volcanoes are produced at Plate Boundaries

And over Plates moving over hot spots

"Hotspot" Volcano (e.g., Hawaii)




Moving plates over hot spots produce chains of volcanoes



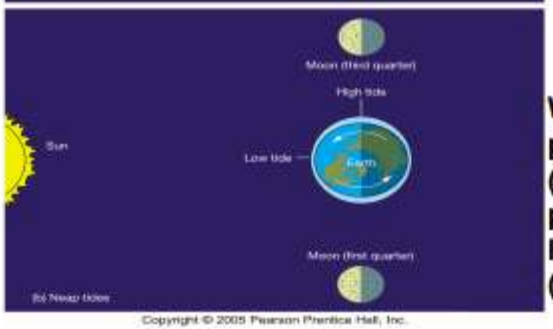

Tides caused by the gravitational pull of the Sun and Moon



$$F = \frac{G M_{moon} m}{r^2}$$

not as strong as the moon, however it moderates the height of the tides


When the Sun & Moon pull in the same direction (new & full phases) high tide is higher than usual (spring)



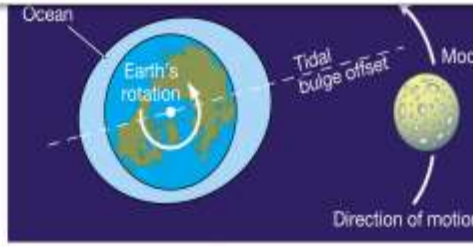

When the Sun & Moon pull at right angles (first & last quarter phases) high tide is lower than usual (neap)



There is friction between the ocean and the seabed as the Earth turns out from underneath the ocean tidal bulges. The friction acts like a brake . This effect slows the Earth's rotation a tiny amount.

The Day is getting gradually longer by 0.0023 seconds per century.

The increase in the Earth-Moon distance is about 3.8 cm per year.

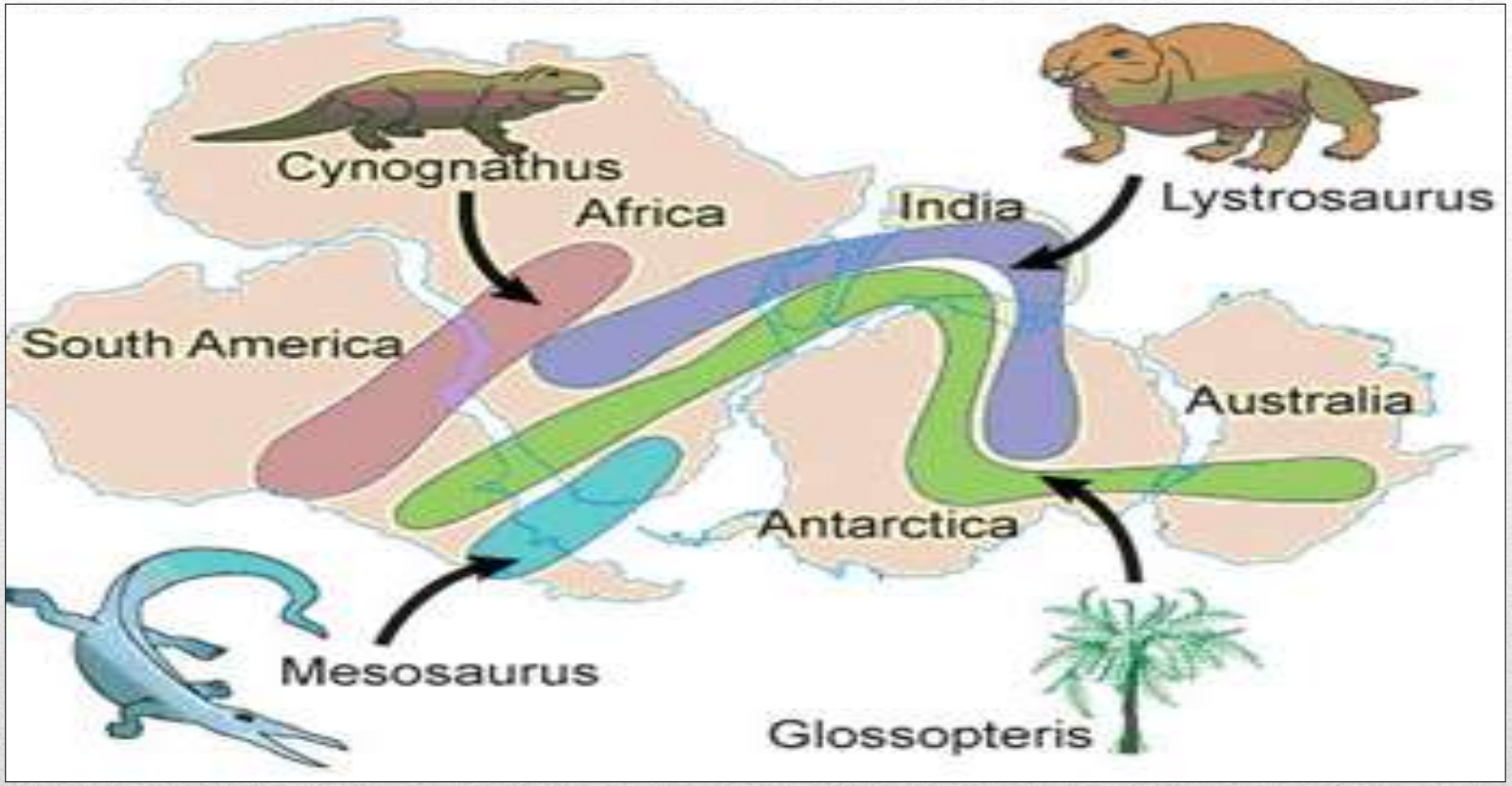



Another effect is that the ocean bulge leading the Moon causes a small net forward tug. It forces the Moon into a slightly larger orbit .

**Moonrise 4 Billion years ago**


## What is special about the Earth

1. its precisely-tuned amount of water, not too much to cover the mountains, and not so little that it's a dry desert.
2. Has held on to its oceans while those on other planets freeze or fry
3. Plate tectonics allows for the carbon-silicate cycle to operate over geological timescales. The carbon-silicate cycle keeps the level of carbon in the atmosphere so the surface temperature around that of liquid water.
4. An atmosphere of nitrogen/oxygen and LIFE.




**Fossil-** A trace of an ancient organism that has been preserved in rock.

# Evidence From Fossils

Dr.A.BALUKKARASU

- As a continent moves **toward the equator**, its climate becomes **warmer**. As a continent moves **toward the poles**, its climate becomes **colder**.
- The continent carries with it the fossils and rocks that formed at its previous locations.
  - For example, fossils of tropical plants are found on Spitsbergen, an island in the Arctic Ocean. When these plants lived about 300 million years ago, the island must have had a warm and mild climate. According to Wegener, Spitsbergen must have been located closer to the equator.

# Evidence From Climate

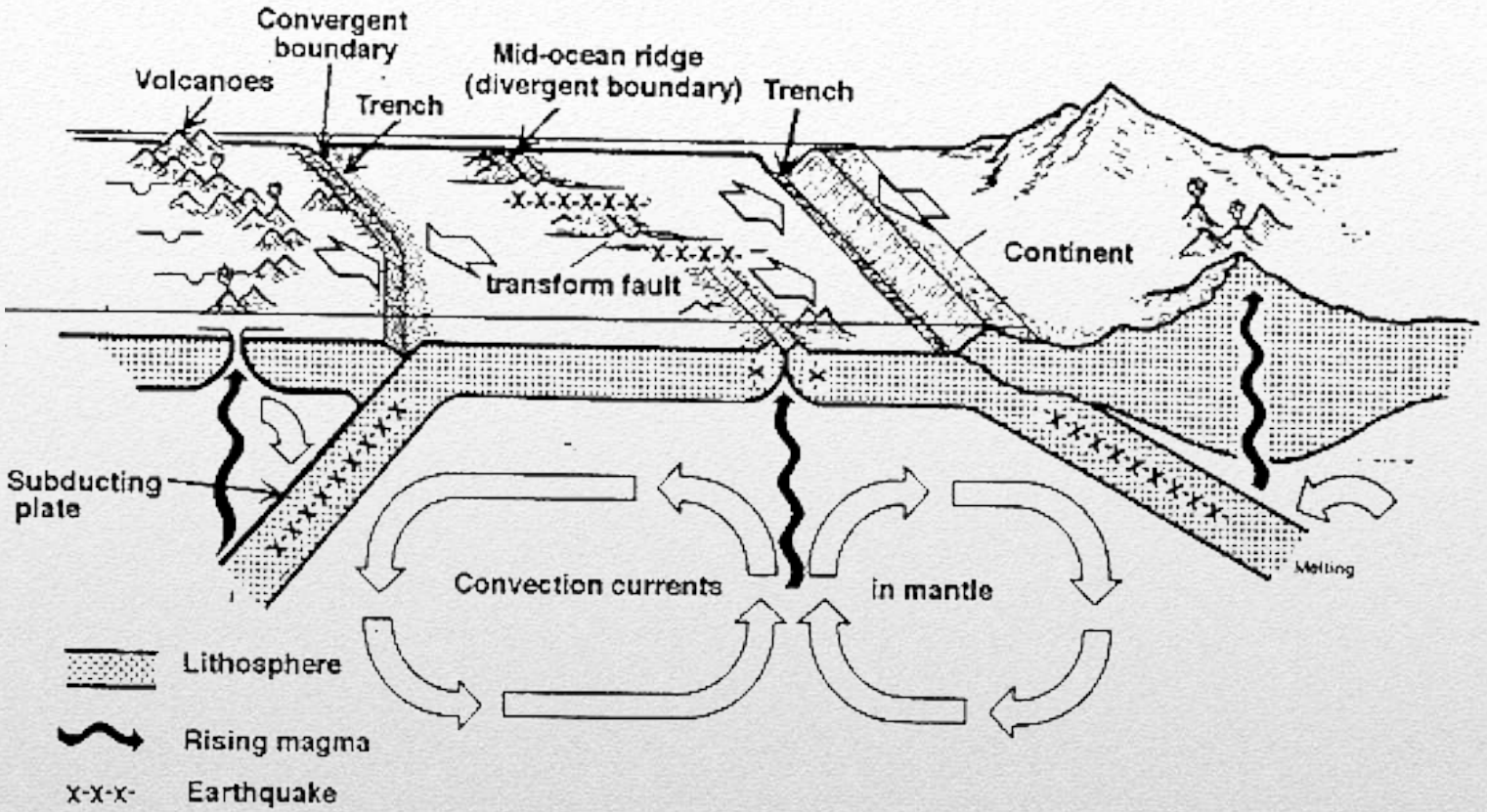
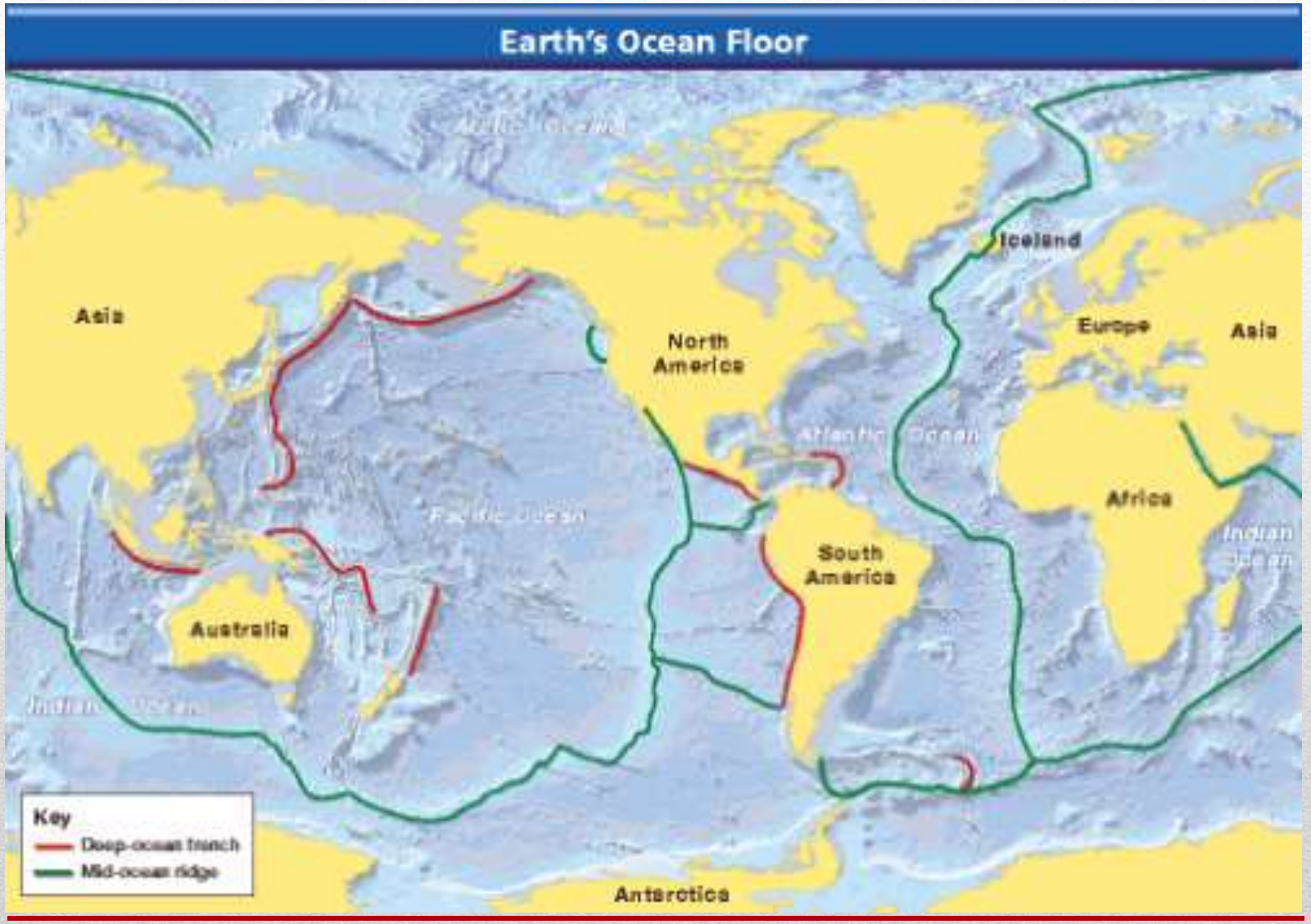



**Figure 2.** Sea-floor spreading. Modified from NSTA/FEMA (1988).

# Sea-floor Spreading




Dr.A.BALUKKARASU

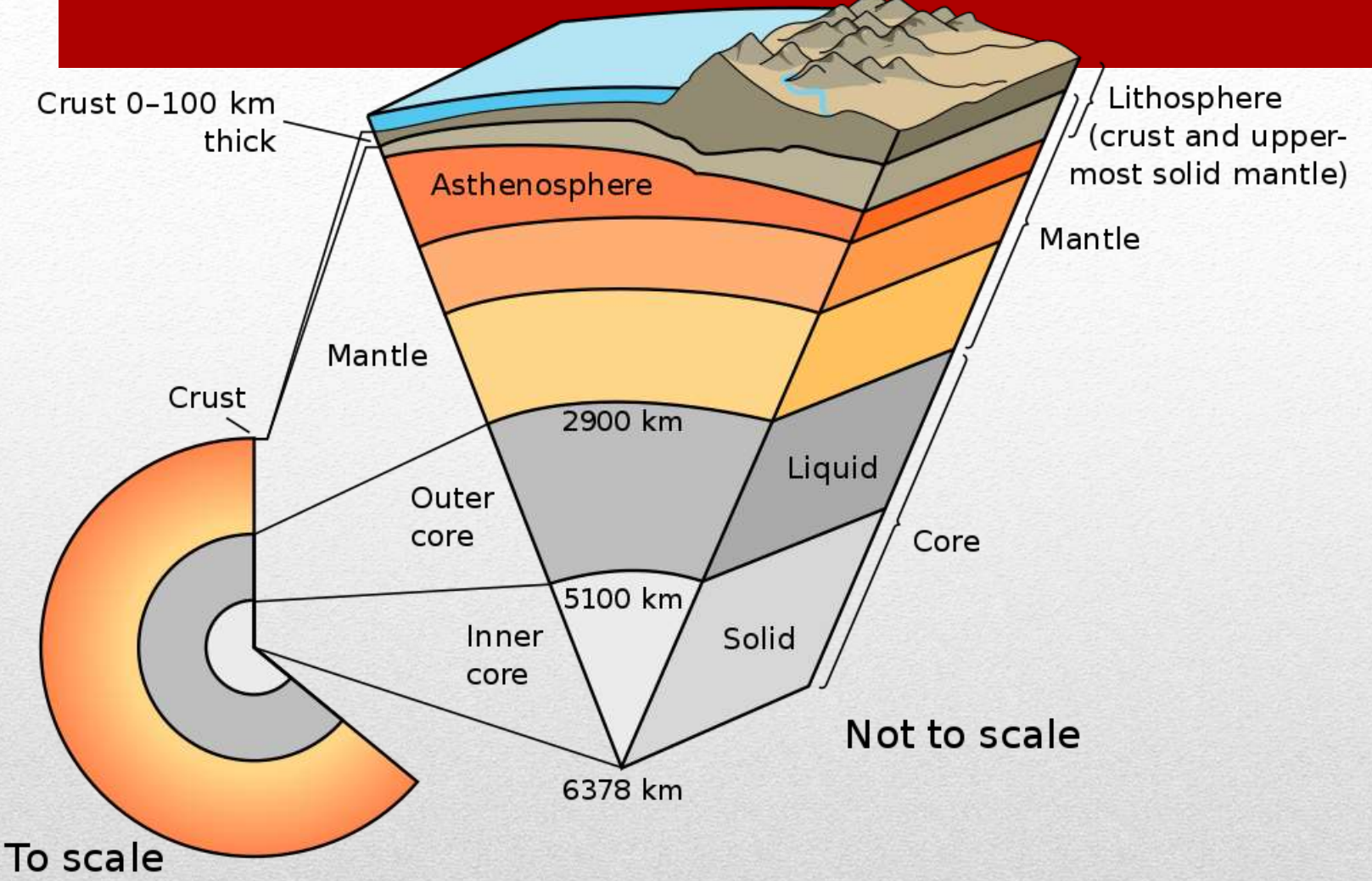
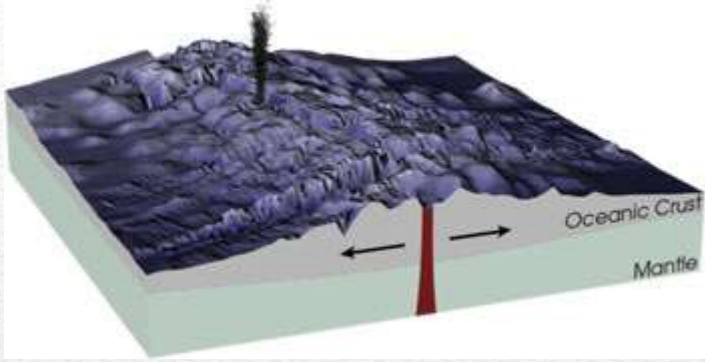



Diagram of the internal layering of the Earth showing the lithosphere above the asthenosphere (not to scale)

- **Mid-ocean ridge-** An undersea mountain chain where new ocean floor is produced; a divergent plate boundary.




# Mid-oceanic ridge, including a black smoker

- **In sea-floor spreading**, the sea floor spreads apart along both sides of a mid-ocean ridge as new crust is added. As a result, the ocean floors move like conveyor belts, carrying the continents along with them

# Sea-Floor Spreading

# Evidence

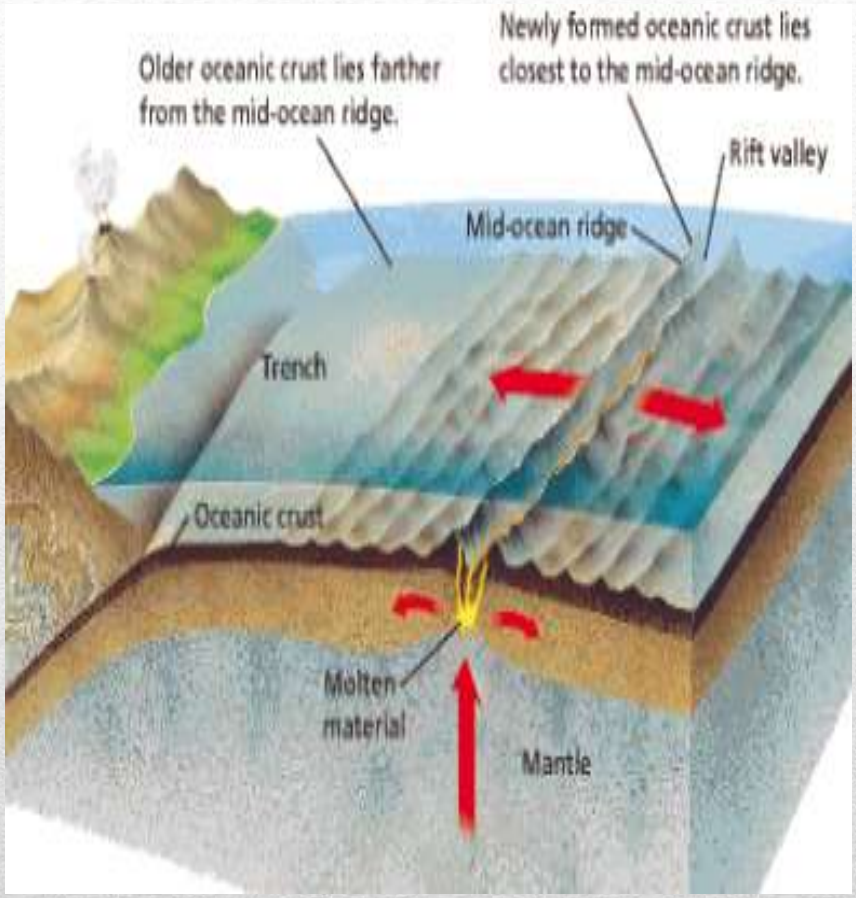
- Sea-floor Spreading was proposed by Harry Hess in 1960
- Supported by evidence from:
  - Molten Material
    - Strange, pillow like rocks that can only be formed from molten were found on the sea floor
  - Magnetic Stripes
    - The rock on the ocean floor follows the pattern of Earth's magnetic field
  - Drilling Samples
    - Scientists determined the age of rocks from drilling samples and found that younger rocks were always found at the center of the ridge due to molten erruptions


**Sea-Floor Spreading** Molten material erupts through the valley that runs along the center of some mid-ocean ridges. This material hardens to form the rock of the ocean floor

- You may be wondering how the ocean floor can just keep spreading
  - The ocean floor doesn't actually spread, but rater plunges into deep trenches and sinks back into the mantle
- **deep-ocean trench**-a deep valley along the ocean floor beneath which oceanic crust slowly sinks toward the mantle.

# Deep-ocean Trenches

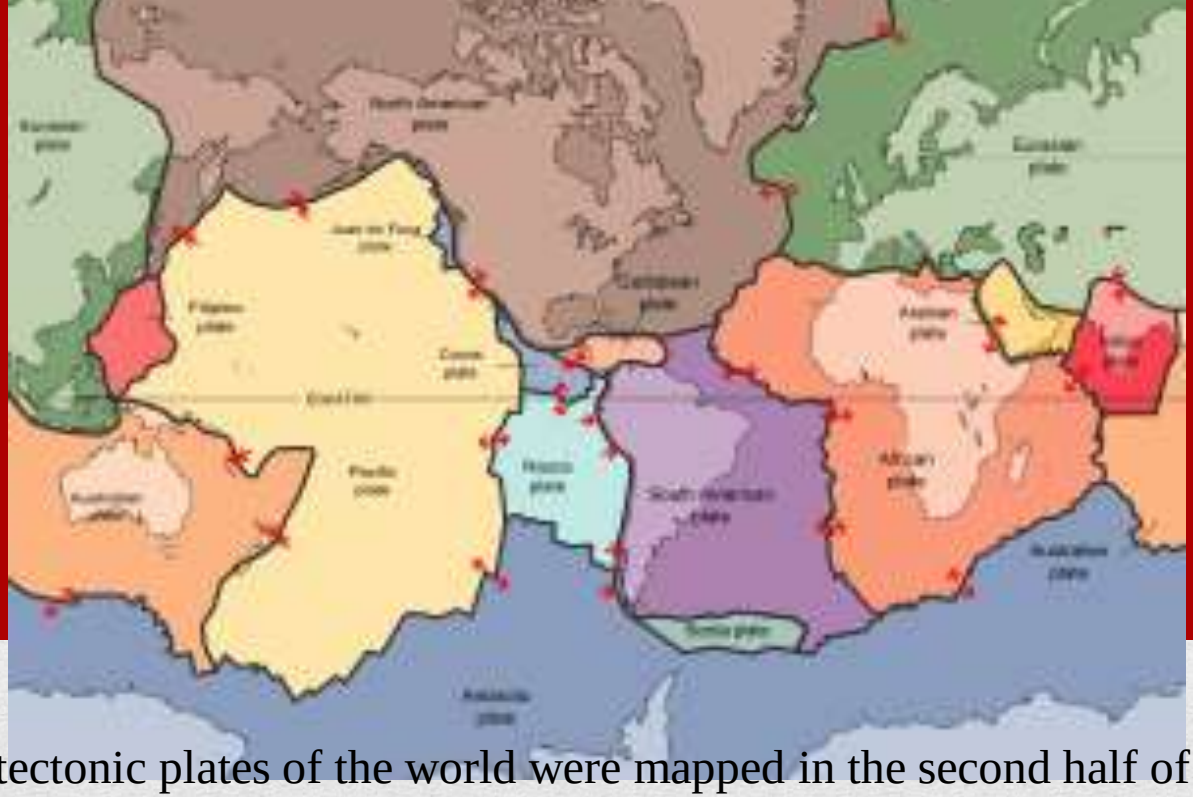
- **Subduction**- the process by which oceanic crust sinks beneath a deep-ocean trench and back into the mantle at a convergent plate boundary.




# Subduction

- Subduction and sea-floor spreading can change the size and shape of the Earth's oceans
- Generally, the sea floor is renewed every 200 million years
- The Pacific Ocean covers nearly 1/3 of our planet and is shrinking!
- The Atlantic Ocean is expanding –it has less trenches than the Pacific

# Interesting Facts



The tectonic plates of the world were mapped in the second half of the 20th century

# THE EARTH IS MOVING!

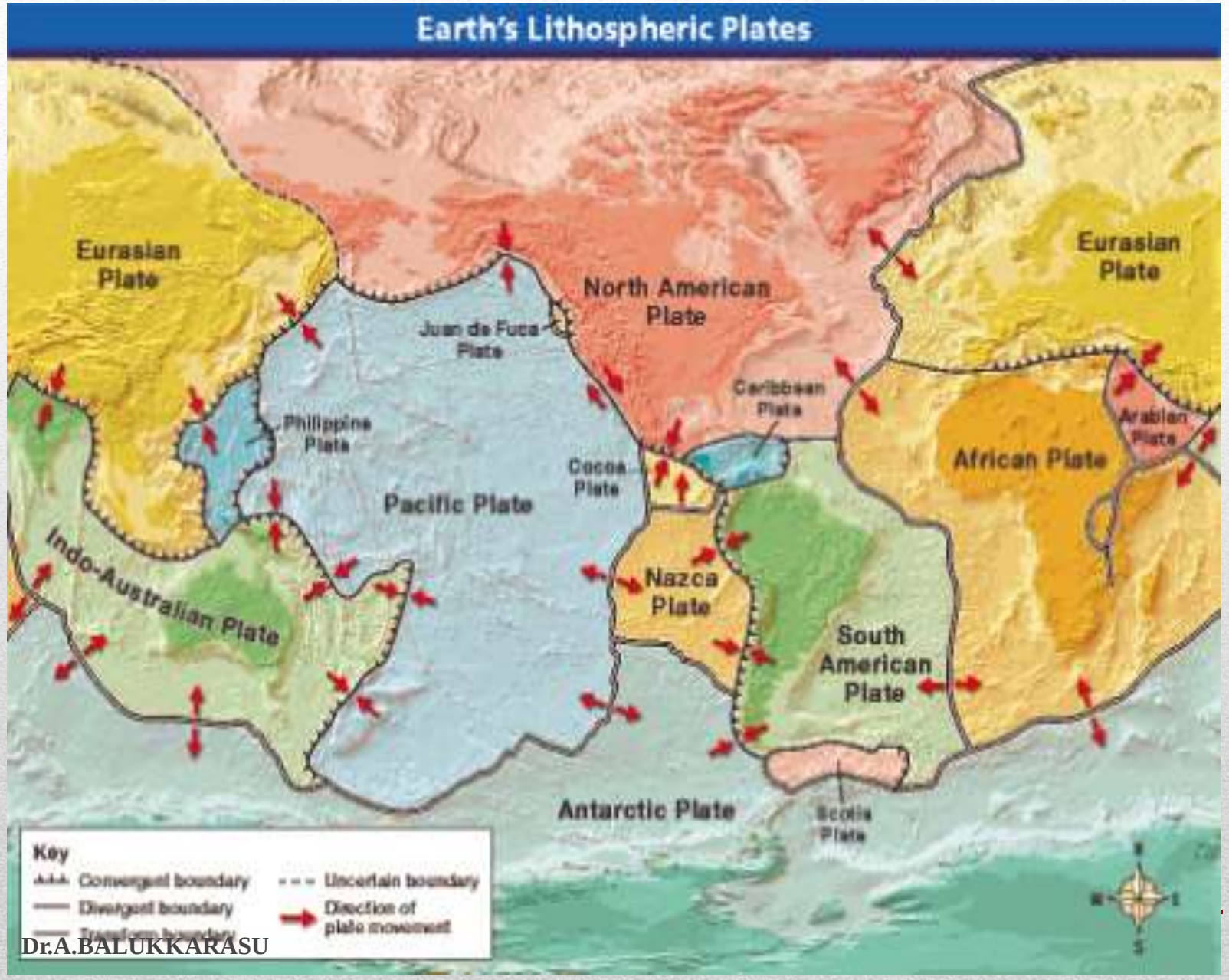
## The Theory of Plate Tectonics

- The theory of Plate Tectonics explains the **formation, movement, and subduction** of Earth's plates
- The theory that…
  - **pieces of Earth's lithosphere are in constant motion, driven by convection currents in the mantle**

# The Theory

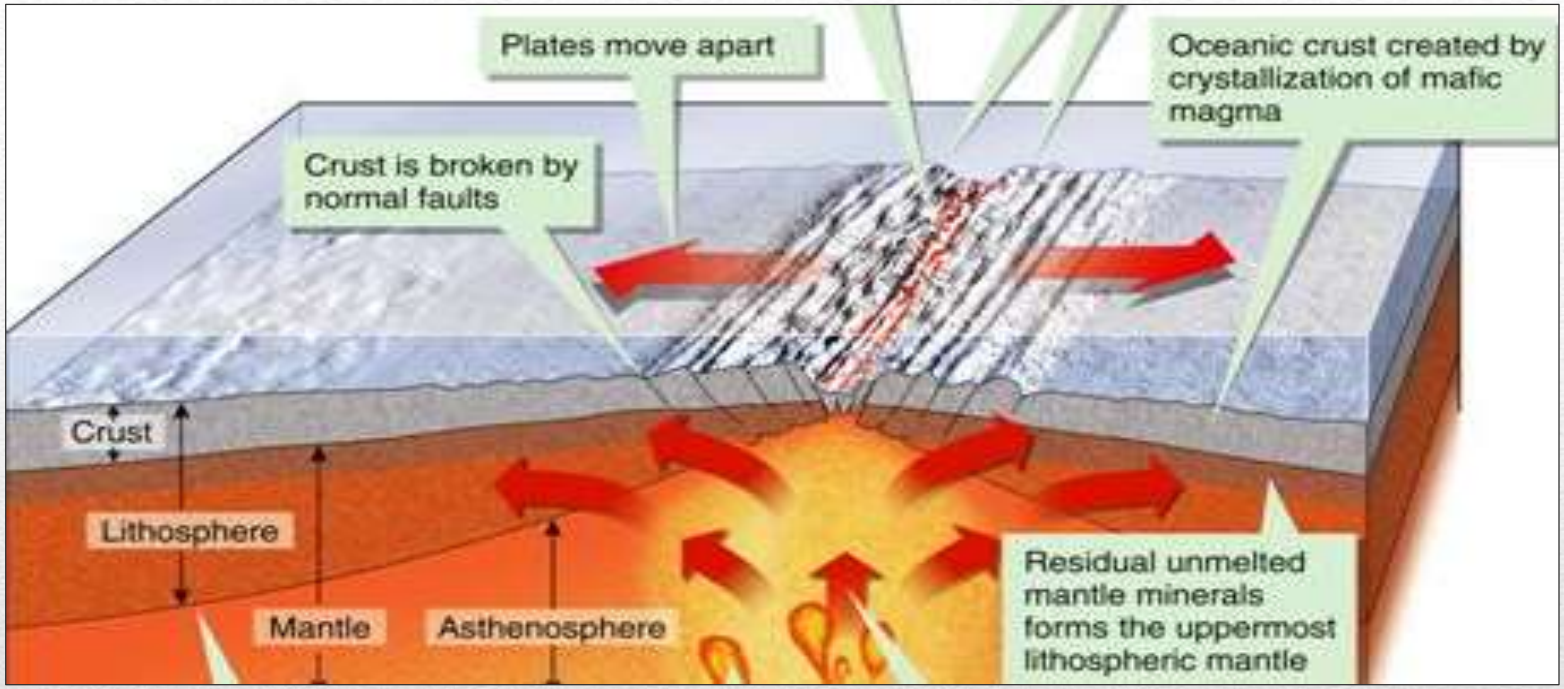
- **Plate**-A section of the lithosphere that slowly moves over the asthenosphere, carrying pieces of continental and oceanic crust.
- **Scientific theory**- A well-tested concept that explains a wide range of observations.
- **Faults**- breaks in the Earth's crust were rocks have slipped past each other

# Need to Know Definitions


Earth's Lithospheric Plates
Eurasian Plate
North American Plate
Juan de Fuca Plate
Philippine Plate
Pacific Plate
Cocos Plate
Caribbean Plate
Eurasian Plate
Arabian Plate
African Plate
Indo-Australian Plate
Nazca Plate
South American Plate
Antarctic Plate
Scotia Plate
Key
Convergent boundary
Divergent boundary
Uncertain boundary
Direction of plate movement


# Types of Plate Boundaries

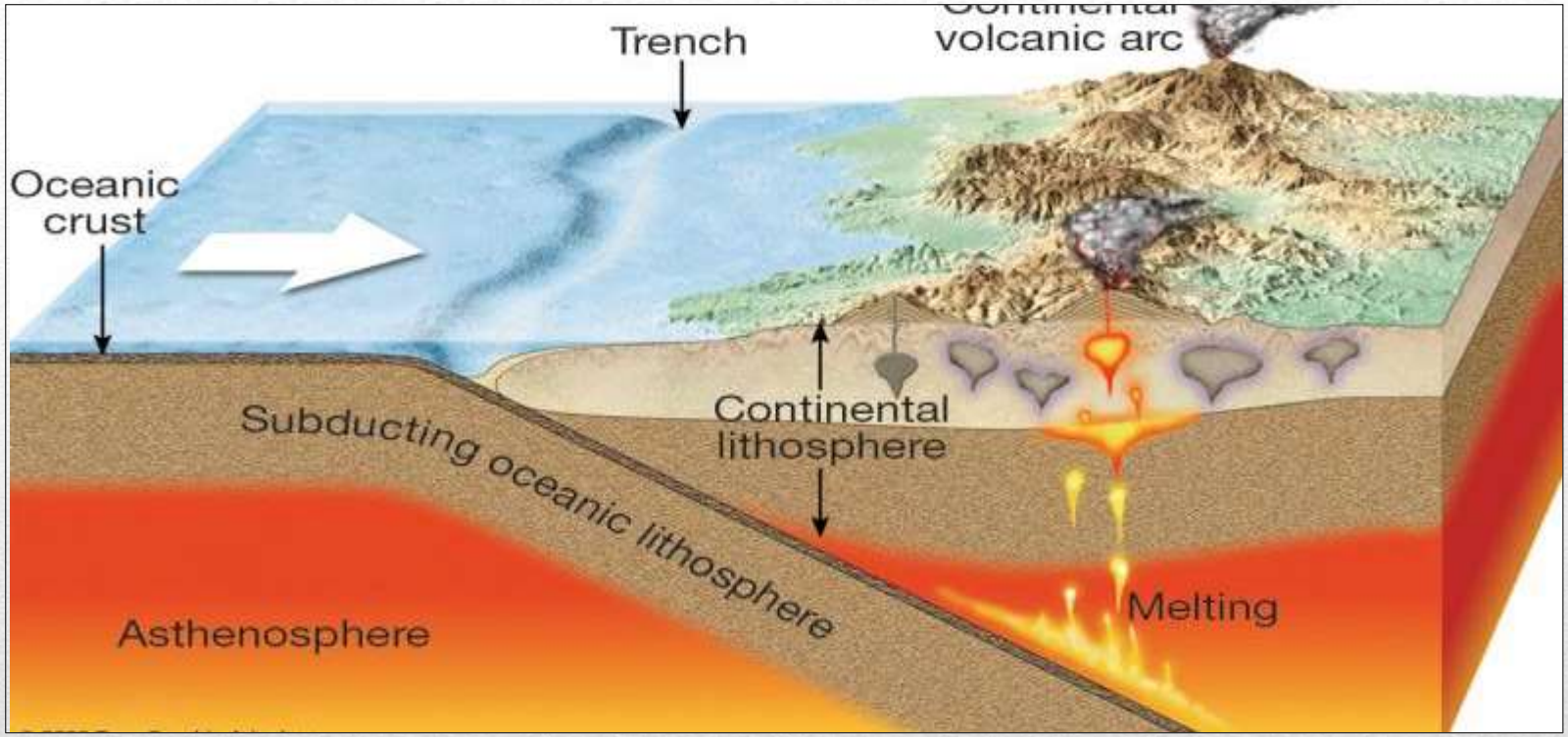
Dr.A.BALUKKARASU




**A place where two plates move apart.**

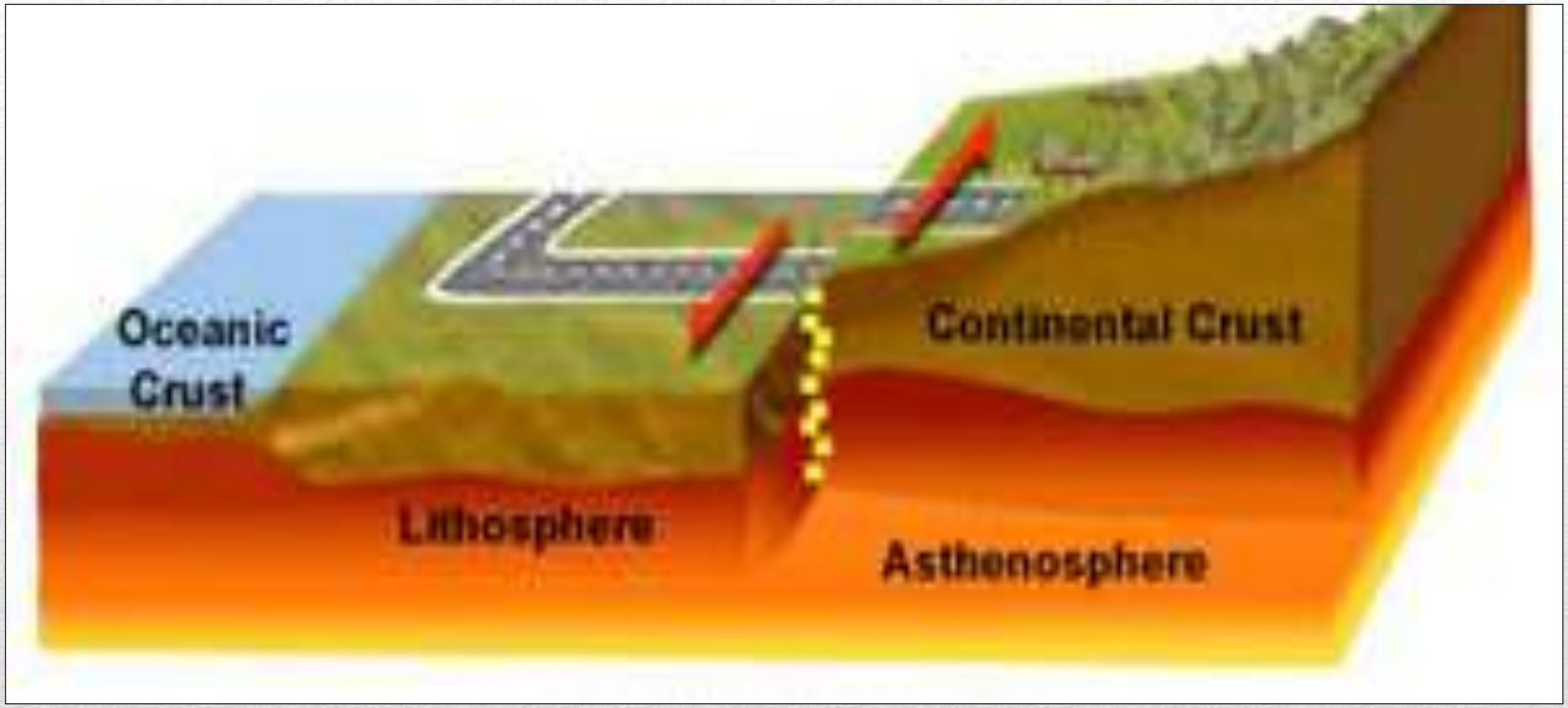
- **Most divergent boundaries occur along mid-ocean** ridges

# Divergent




The place where two plates come together resulting in a collision

# Convergent

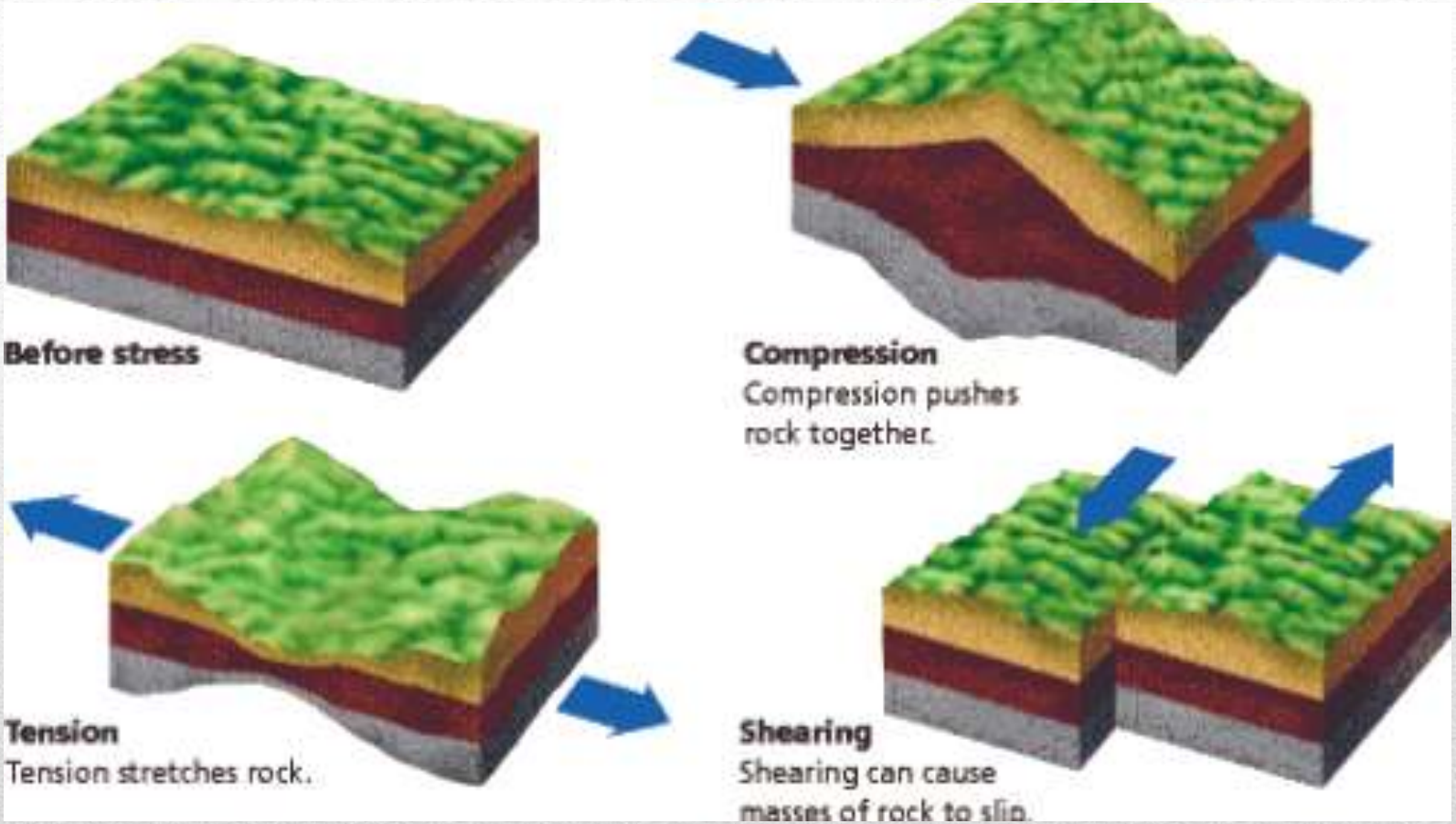



**The place where two plates slip past each other**

# Transform

# EARTHQUAKES AND VOLCANOES

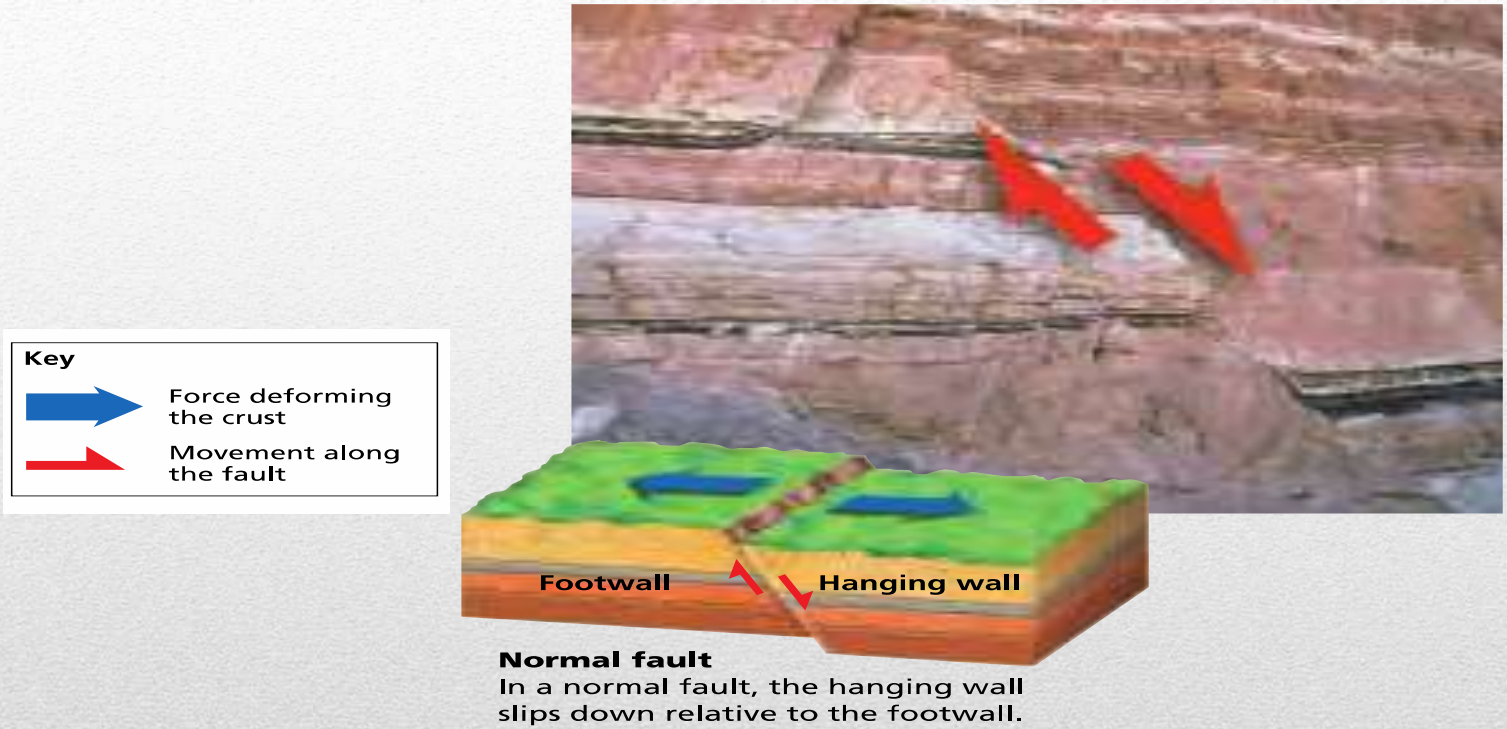
Dr.A.BALUKKARASU


Before stress
Compression
Compression pushes rock together.
Tension
Tension stretches rock.
Shearing
Shearing can cause masses of rock to slip.

# Stress

- **When enough stress builds up in rock, the rock breaks, creating a fault**

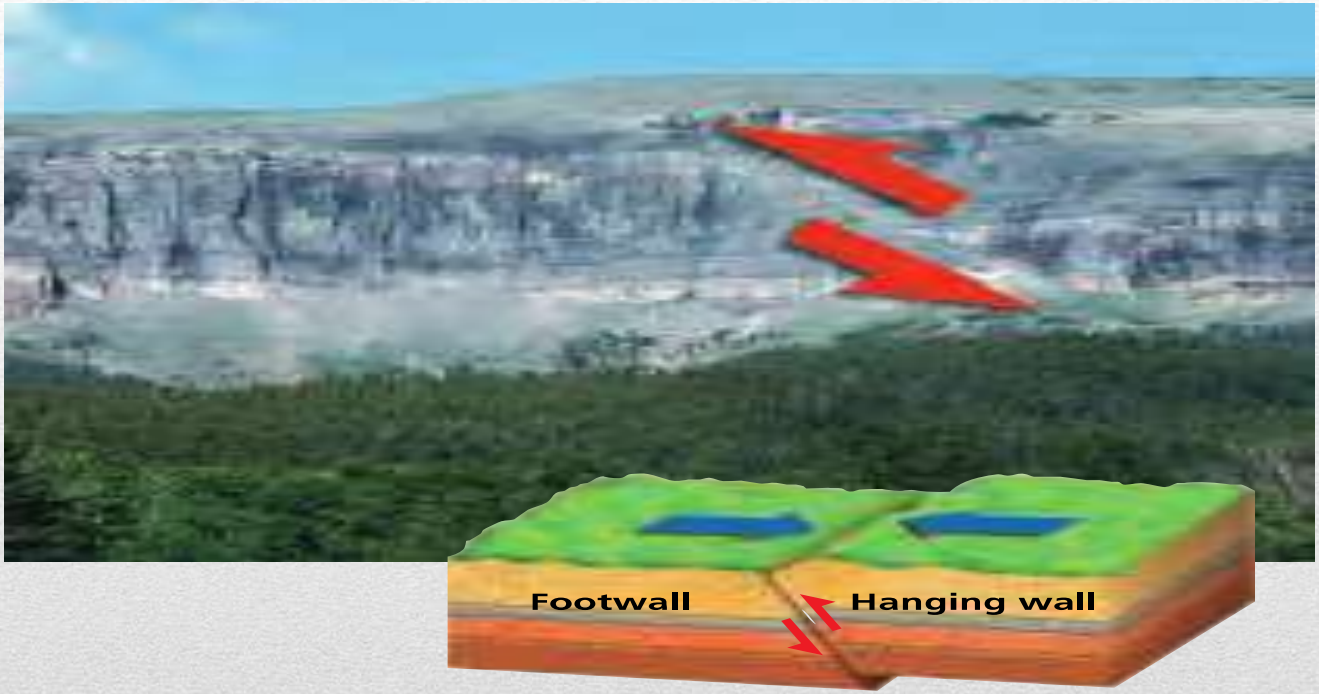
# Faults




**Normal fault**
In a normal fault, the hanging wall slips down relative to the footwall.

# Normal Fault

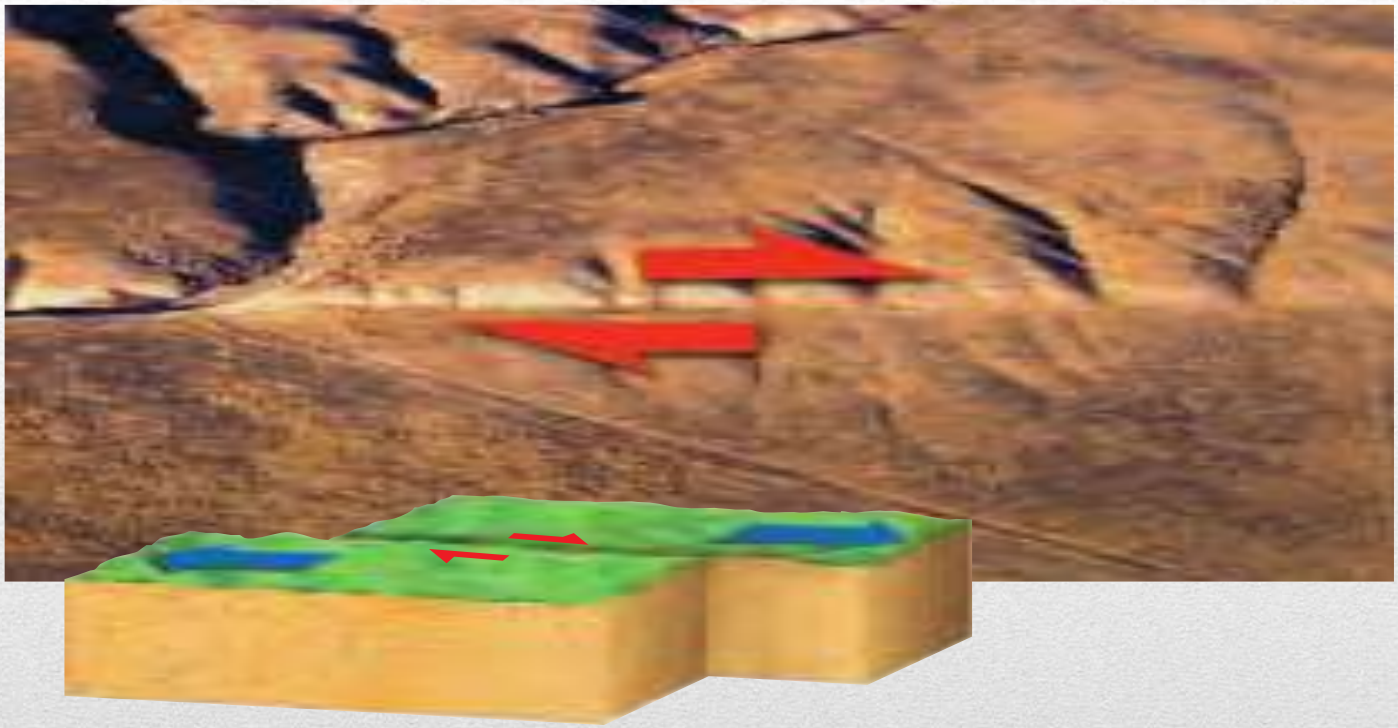
Dr.A.BALUKKARASU




**Reverse fault**
In a reverse fault, the hanging wall moves up relative to the footwall.

# Reverse Fault

Dr.A.BALUKKARASU



**Strike-slip fault**
Rocks on either side of a strike-slip fault slip past each other.

# Strike-slip Fault

Dr.A.BALUKKARASU

# Volcanoes

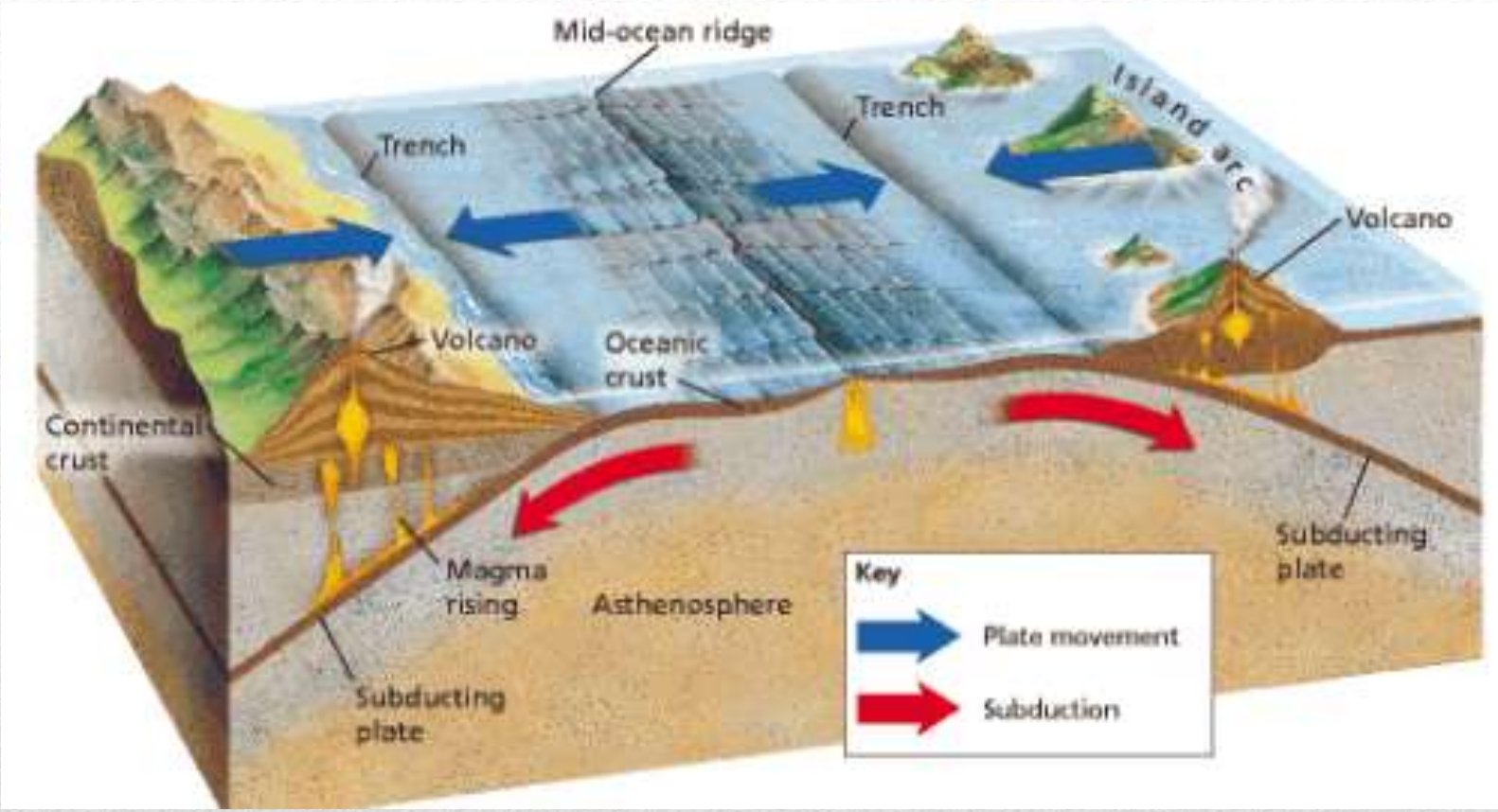
Dr.A.BALUKKARASU

- Volcano- A weak spot in the crust where magma has come to the surface
- Magma- The molten mixture of rock-forming substances, gases, and water from the mantle
- Lava- Liquid magma that reaches the surface; also the rock formed when liquid lava hardens.

# Vocabulary

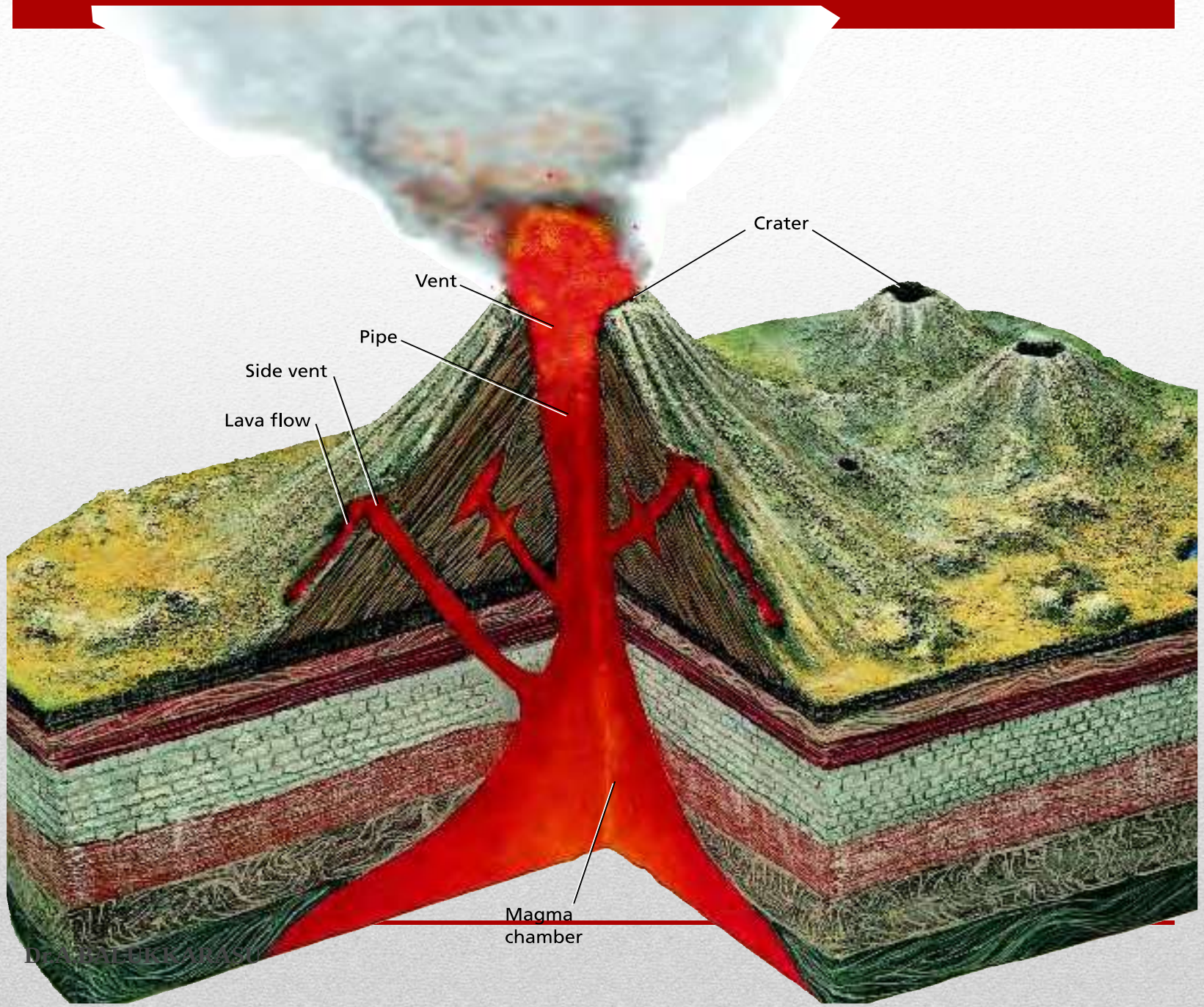
- At plate boundaries, huge pieces of the **crust diverge (pull apart) or converge (push together).** As a result, the crust often fractures, allowing magma to reach the surface. **Most volcanoes form along diverging plate boundaries such as mid-ocean ridges and along converging plate boundaries where subduction takes place.**

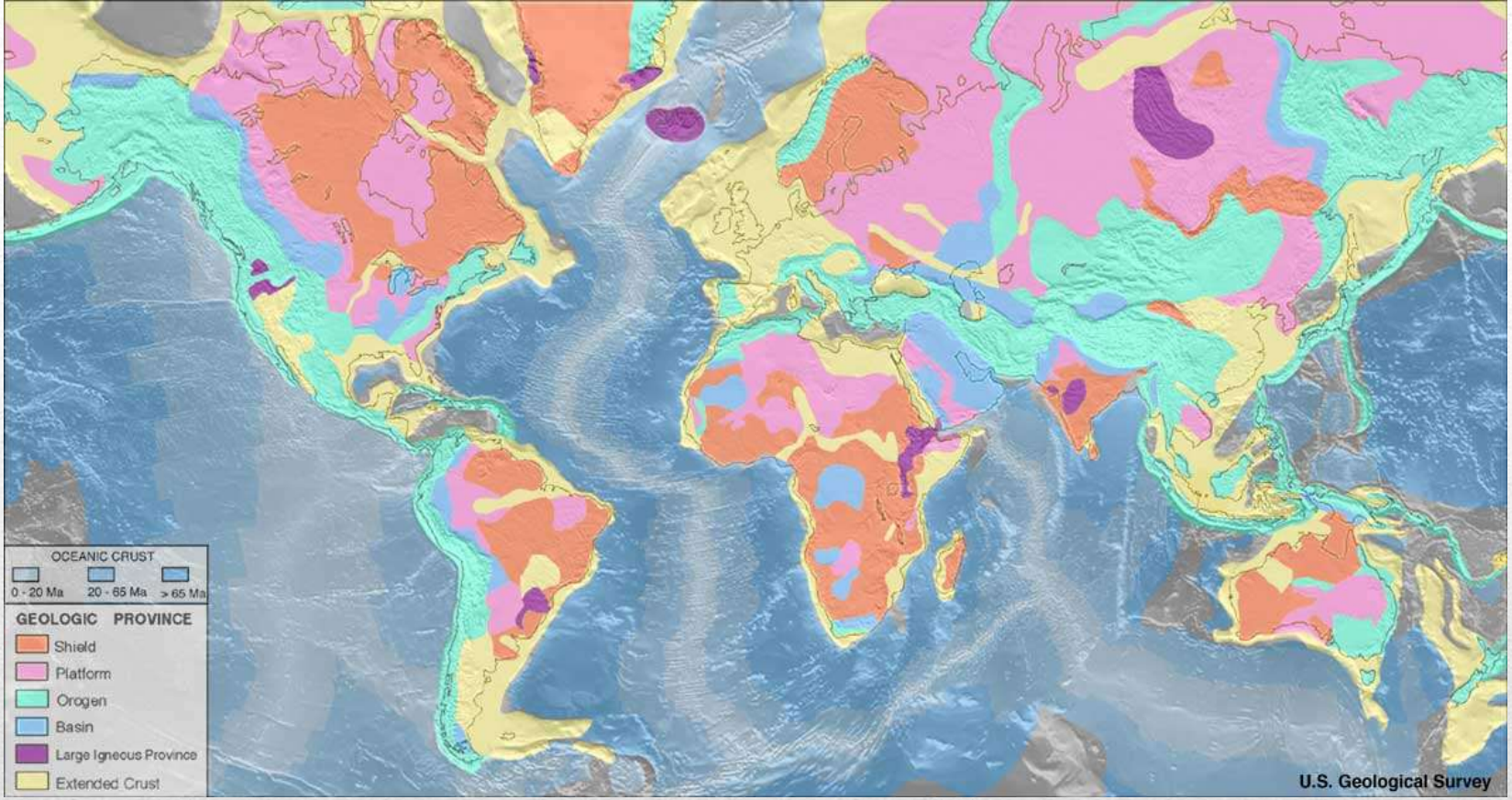
# Read This and apply your mind.




# Volcano Formation at Converging Boundaries

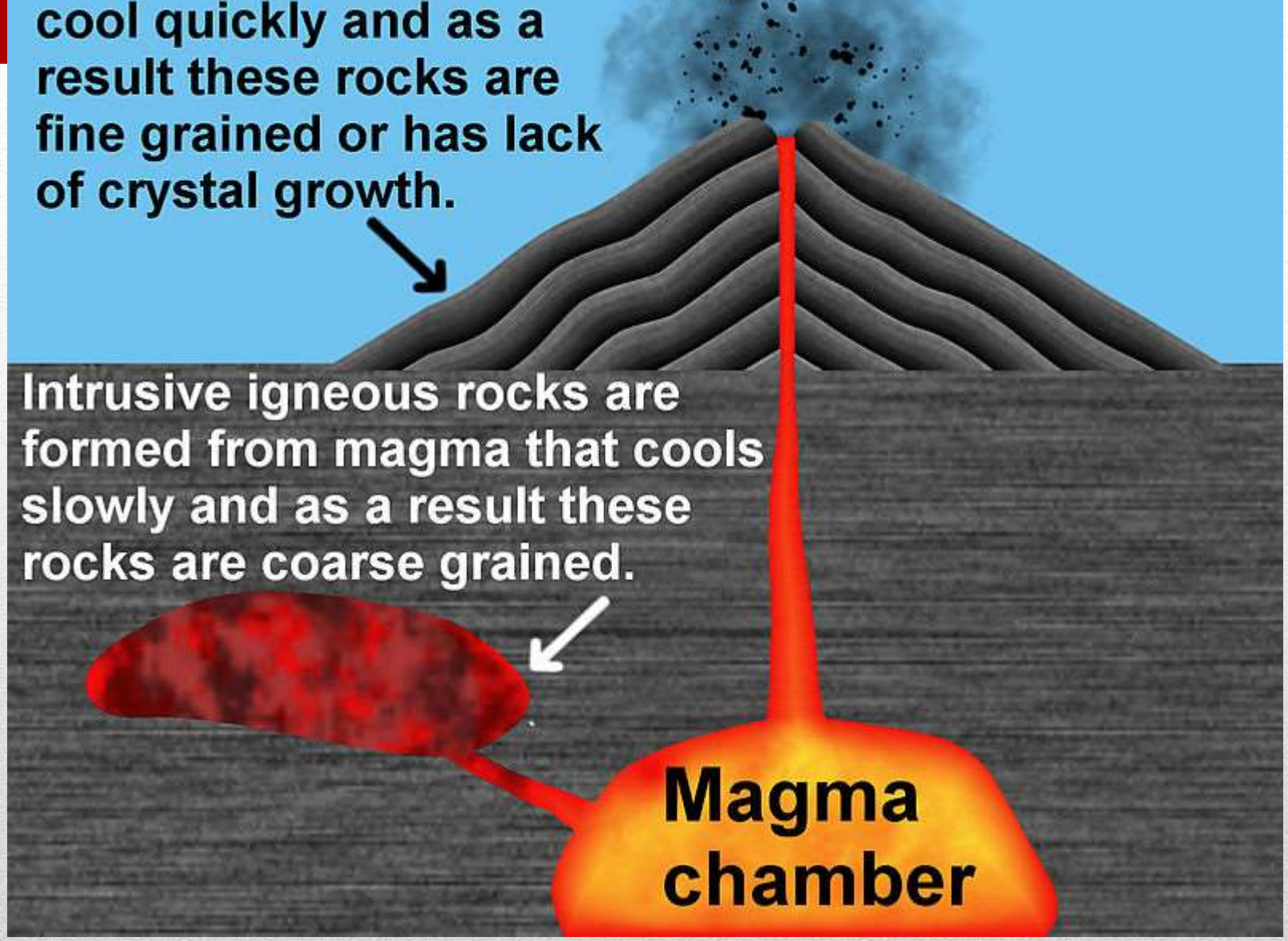
Dr.A.BALUKKARASU


Crater
Vent
Pipe
Side vent
Lava flow
Magma chamber



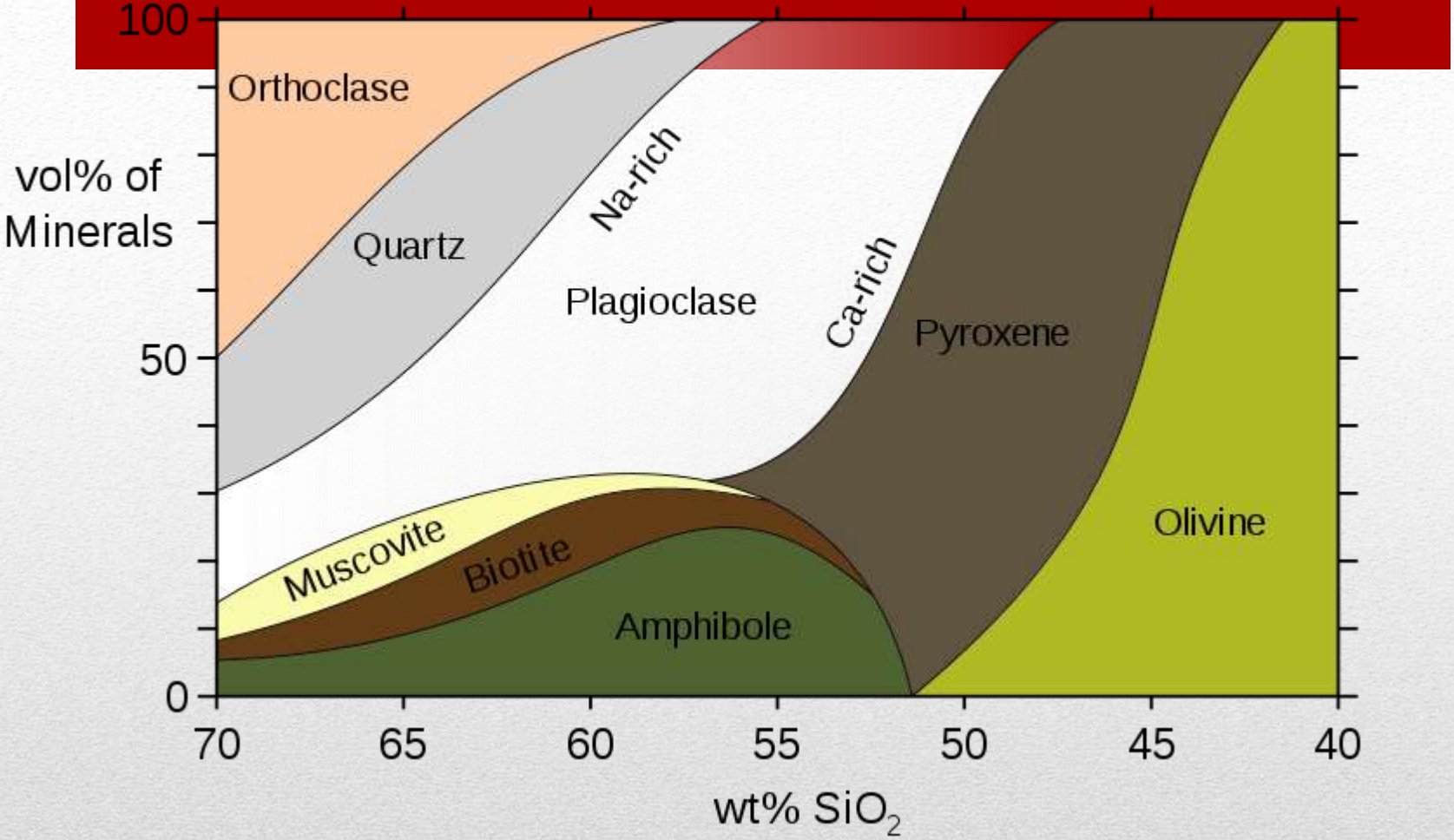

USGS - https://earthquake.usgs.gov/data/crust/maps.php

Map of world geologic provinces Shield Platform Phanerozoic orogen Basin Large igneous province Extended continental crust Age of Oceanic crust: 0–20 Ma 20–65 Ma >65 Ma Important note: These geologic province map depicts only features approximately 150 km across and greater due to the fact that the resolution of the maps should be consistent with the resolution of the seismic refraction data. For example, the young uplifted blocks of the Variscan Orogen in Central and Western Europe such as the Rhenish Massif or the Massif Central are not depicted as 'orogens' but as part of the 'extended continental crust' in the western half of Europe.

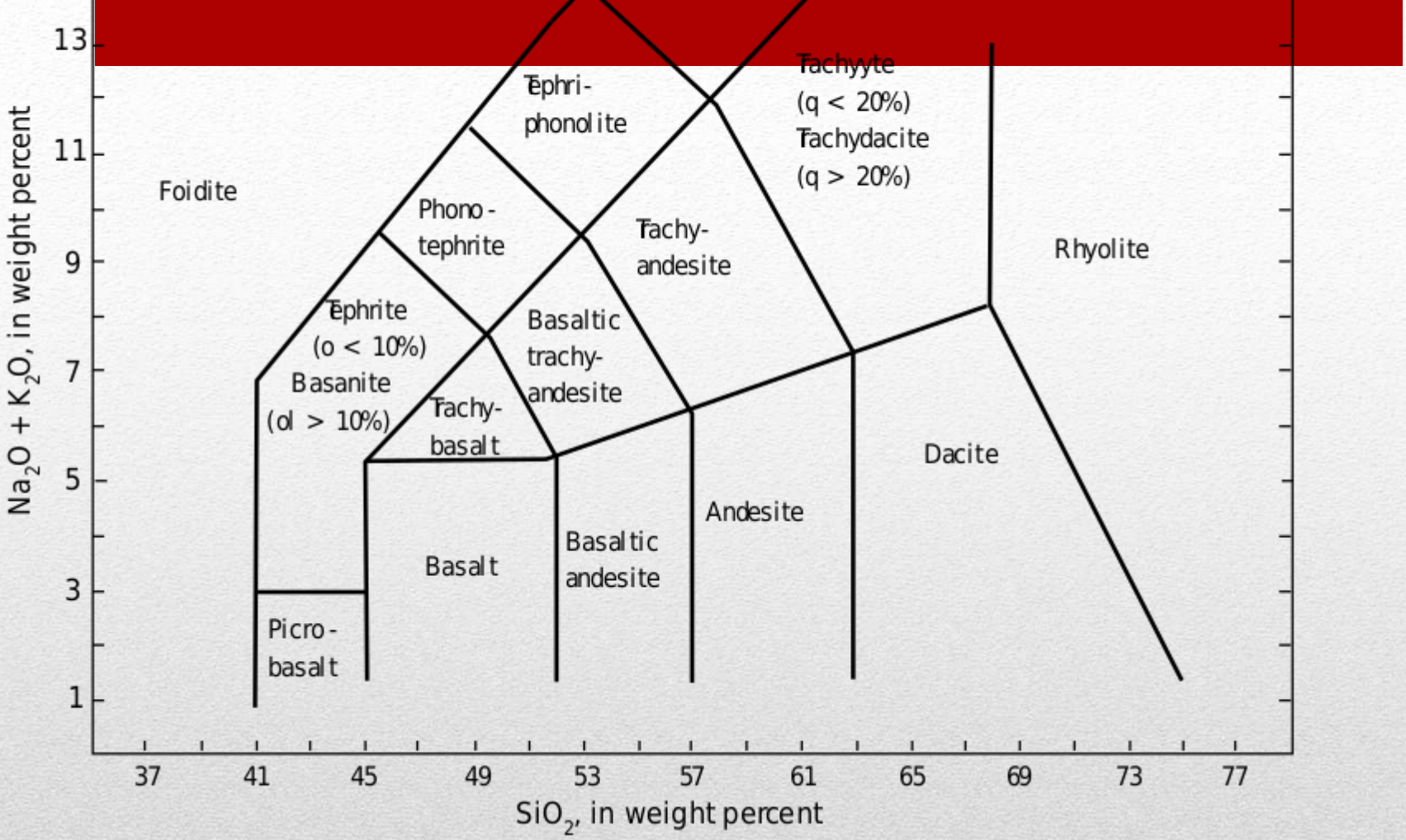

cool quickly and as a result these rocks are fine grained or has lack of crystal growth.
Intrusive igneous rocks are formed from magma that cools slowly and as a result these rocks are coarse grained.
Magma chamber

Close-up of granite (an intrusive igneous rock) exposed in Chennai, India

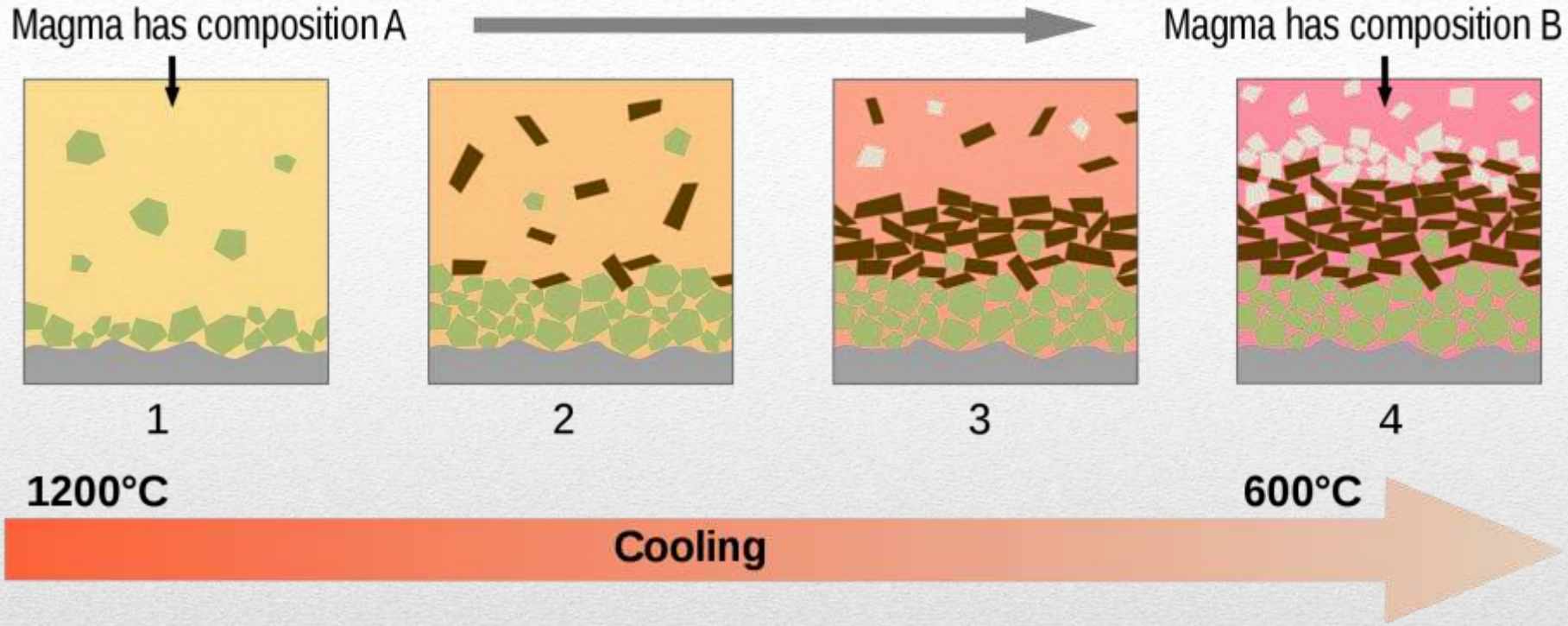
Extrusive igneous rock is made from lava released by volcanoes




Basic classification scheme for igneous rocks on their mineralogy. If the approximate volume fractions of minerals in the rock are known, the rock name and silica content can be read off the diagram. This is not an exact method, because the classification of igneous rocks also depends on other components than silica, yet in most cases it is a good first guess.




Total alkali versus silica classification scheme (TAS) as proposed in Le Maitre's 2002 Igneous Rocks - A classification and glossary of terms. Total alkali ($Na_2O + K_2O$) versus silica ($SiO_2$), or TAS, classification system of igneous rocks. After Le Maitre (2002).




Schematic diagrams showing the principles behind fractional crystallisation in a magma. While cooling, the magma evolves in composition because different minerals crystallize from the melt. **1**: olivine crystallizes; **2**: olivine and pyroxene crystallize; **3**: pyroxene and plagioclase crystallize; **4**: plagioclase crystallizes. At the bottom of the magma reservoir, a cumulate rock forms.

- When classifying rocks, geologists look at:
  - Mineral composition
  - Color
  - Texture

# Classifying Rocks

# What is a rock?

- Rock- a solid mixture of minerals and other materials.
  - Some rocks can be made of just one mineral, but most are mad of many minerals
  - Most rocks are made up of a combination of 20 common minerals know as rock forming mineral

This picture shows the many minerals that can be found in granite


# Granite

Dr.A.BALUKKARASU

## Grain Size

Fine grain

Slate

Coarse grain

Diorite

No visible grain

Flint

## Grain Shape

Rounded grain

Conglomerate

Jagged grain

Breccia

## Grain Pattern

Nonbanded

Quartzite

Banded

Gneiss

# Texture

- Texture- The look and feel of a rock's surface, determined by the size, shape, and pattern of a rock's grains
- Grains- The particles of minerals or other rocks that give a rock its texture.
  - Geologists look at grain shape, size, and pattern

- Geologists classify rocks into three major groups:
  - igneous rock
  - sedimentary rock
  - metamorphic rock

**Rock or stone is a natural substance, a solid aggregate of one or more minerals or mineraloids**

- A type of rock that forms from the cooling of molten rock at or below the surface.

# Igneous Rock

Dr.A.BALUKKARASU

- A type of rock that forms when particles from other rocks or the remains of plants and animals are pressed and cemented together.

# Sedimentary Rock

# Types of Sedimentary Rocks

- **There are three major groups of sedimentary rocks:**
- **Clastic rocks**
  - **Formed when fragments are squeezed together**
- **Organic rocks**
  - forms from remains of organisms deposited in thick layers.
- **Chemical rocks**
  - forms when minerals crystallize from a solution.

- A type of rock that forms from an existing rock that is changed by heat, pressure, or chemical reactions.

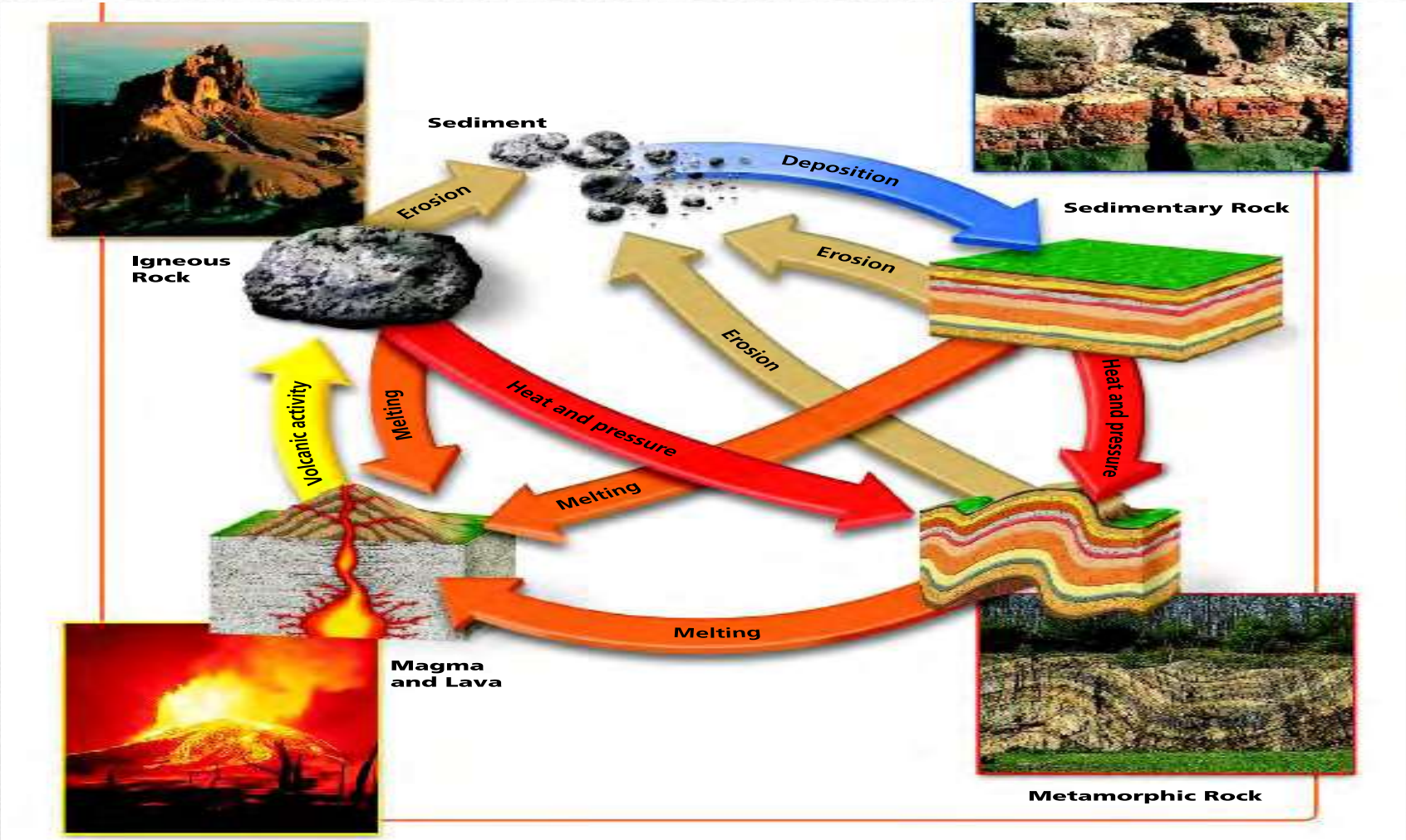
# Metamorphic Rock

- Foliated
  - have grains arranged in parallel layers or bands
- Non-Foliated
  - Have grains arranged randomly

# Types of Metamorphic Rocks

- Rock cycle- A series of processes on the surface and inside Earth that slowly change rocks from one kind to another

# The Rock Cycle




# THE ROCK CYCLE

Dr.A.BALUKKARASU

**Answer All Questions**. (10×2=20)

1. What is Ring of Fire?
2. What role does Silica play in magma?
3. What is the difference between a conduit and a vent on a volcano?
4. What is the difference between magma and lava?
5. The Earth's crust contains the oceanic crust, how big is the oceanic crust?
   a).It covers 2/3 of the Earth. b).It covers ½ of the Earth c).It covers 1/3 of the Earth. d).It covers ¾ of the Earth.
6. What are Seismic Waves?
7. How are the Size and Strength of an Earthquake Measured?
8. What are the Destructive Effects of Earthquakes?
9. Under what conditions will magma be very thick and sticky?
10. Differentiate between: (a) Crust and Mantle

**PART-B**

**Answer All Questions ( 5X5=25)**

11. Explain density and movements of the earth.

OR

Write about the gravitational field of the earth.

12. Describe the structure of the earth with a neat sketch.

OR

Describe the origin of earthquake.

13. Write about the drainage types with neat diagrams.

OR

Write about the seas and oceans and their geological activities.

14. Write about geological action of wind and its cycle.

OR

Write about origin and different types of lakes.

15. Describe the submarine canyon.

OR

Explain the application of geology with other sciences.

**PART-C**

**Answer Any three Questions (3X10=30)**

16 .Discuss the Origin and age of earth with various hypothesis.

17. Describe the types and causes of volcanoes with neat diagrams.

18. Explain the coastal dynamics.

19. Describe the ground water origin, solution caves, cavities and geyser.

20. Explain the mountain building activities.

**Answer All Question**

•Define Epigene?

•Application of physics in geology is called? How.

• Write the planets of solar system in order?

•What is absolute and relative age determination?

•What are the major parameters used to divide Earth interior into crust, mantle and core?

• The point of earthquake occurred below the earth surface is known as _____ and the point vertically on the earth surface is known as _____.

•Define erosion?

•What is sub marine canyon?

•Water present below the earth surface is called? How it is happened.

•Match the following

| | |
|---|---|
| (i) Limestone | (a) Lacustrine |
| (ii) Sand dune | (b) Geyser |
| (iii) Lake | (c) Karst topography |
| (iv) Hot spring | (d) Barchan |

**Part B (5 X 5 = 25)**

**Answer All Questions**

**Each answer should be about 100 words**

- a. Discuss various branches of Geology

OR

b. Describe the relation of geology and society

12. a. Define Gravitational field of earth?

OR

b. Discuss the Earth's age determination methods

13. a. Describeinterior of the Earth?

OR

b. Brief note on Isostasy

14. a. Describe types of drainage pattern?

OR

b. Brief notes on marine deposits

15. a. Short note on origin of lakes

OR

b. Discuss about the underground water.

**Part C (3 X 10 = 30)**

**Answer any THREE Questions**

**Each answer should be about 500 words**

16. Discuss the scientific applications of geology.
17. Explain origin of Earth and various hypothesis.
18. Describe the types and causes of Volcanoes.
19. Discuss the geological action of sea and ocean.
20. Write essay on cycle of erosion.

**PART- A – (10 X 2 = 20)**

**Answer All Question**

1. First layer of Earth on which we live is known as
2. What are the two important movements of the earth?
3. What role does Silica play in magma?
4. What is sea floor spreading?
5. What is the difference between magma and lava?
6. Under what conditions will magma be very thick and sticky?
7. Differentiate between: (a) Crust and Mantle
8. Define Earth's body waves.
9. Define "Moho" discontinuity.
10. Define Gutenberg discontinuity.

**PART-B**

**Answer all Questions. (2×5=10)**

11. Explain the density and movements of the earth.

**OR**

Explain continental drift theory.

12. Describe the structure of the earth with neat sketch.

**OR**

Describe the origin of earth.

**PART-C**

Answer all Questions. (2×10=20)

13. Describe the Geological Time Scale **(Compulsory)**

14. Describe evolution of Earth.

OR

Explain the plate tectonic theories with neat sketch.

(10 x 2 = 20 Marks)

*Answer all questions*

*Each answer should be in about 50 words*

- Define mineral.
- What is the difference between Oceanic and continental crust?
- Name the planet of our solar system which possesses the highest density.
- What is a dwarf planet?
- What is Gutenberg's Discontinuity?
- What is meant by earthquake epicenter?
- Under what conditions will magma be very thick and sticky?
- What are the major elements in Earth's crust? Write in decreasing order.
- What are hotspots?
- Define Orogeny

**Section – B**

(5 x 5 = 25 Marks)

*Answer all questions*

*Each answer should be in about 100 words*

•a) Give an account on absolute dating.

(or)

b) Discuss briefly about the relation of Geology with other sciences.

•a) Discuss the gravitational field of the Earth.

(or)

b) Give an account on the components of our solar system.

•a) Write short notes on various types of volcanic eruption.

(or)

b) Elaborate the earthquake belts of our planet.

•a) Give a short account on chemical weathering.

(or)

b) Describe the depositional landforms formed by wind.

•a) Discuss any two important theories relating to isostasy.

(or)

b) Describe the submarine canyon.

**Section – C**

(3 x 10 = 30 Marks)

*Answer any **three** questions*

*Each answer should be in about 500 words*

- Describe the salient features of the Geological Time Scale.
- Elaborate the hypotheses relating to the origin of the solar system.
- Discuss the interior of the Earth with a neat sketch.
- Elaborate the landforms formed due to river action.
- Describe the various types of plate boundaries with neat sketches.