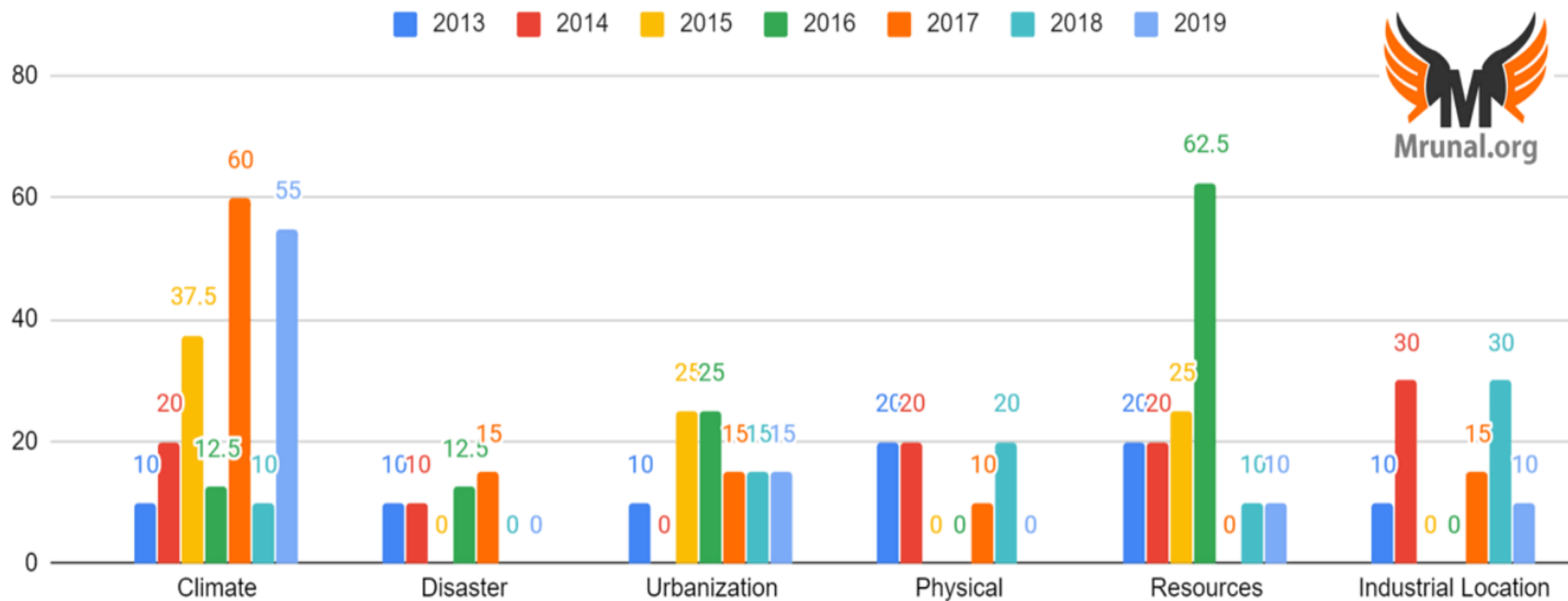
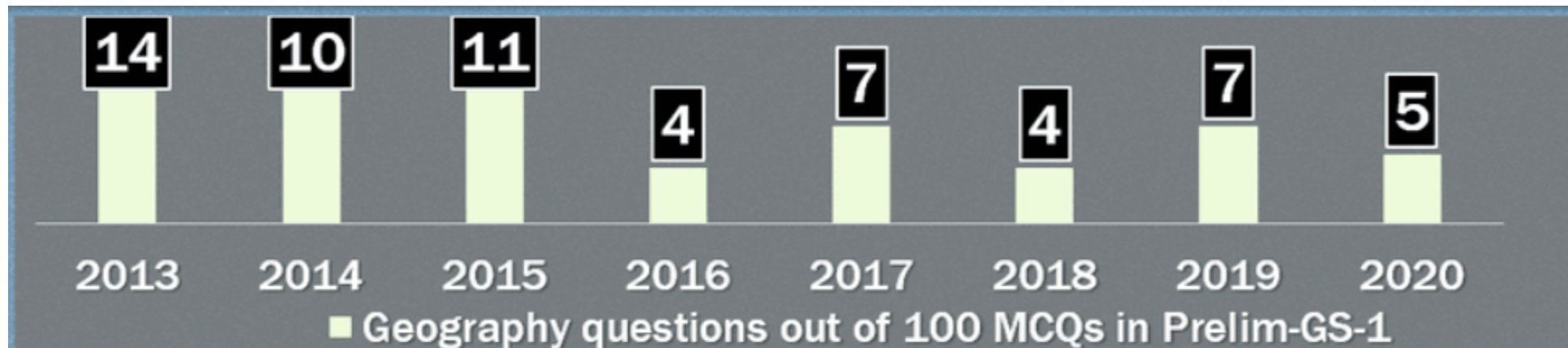
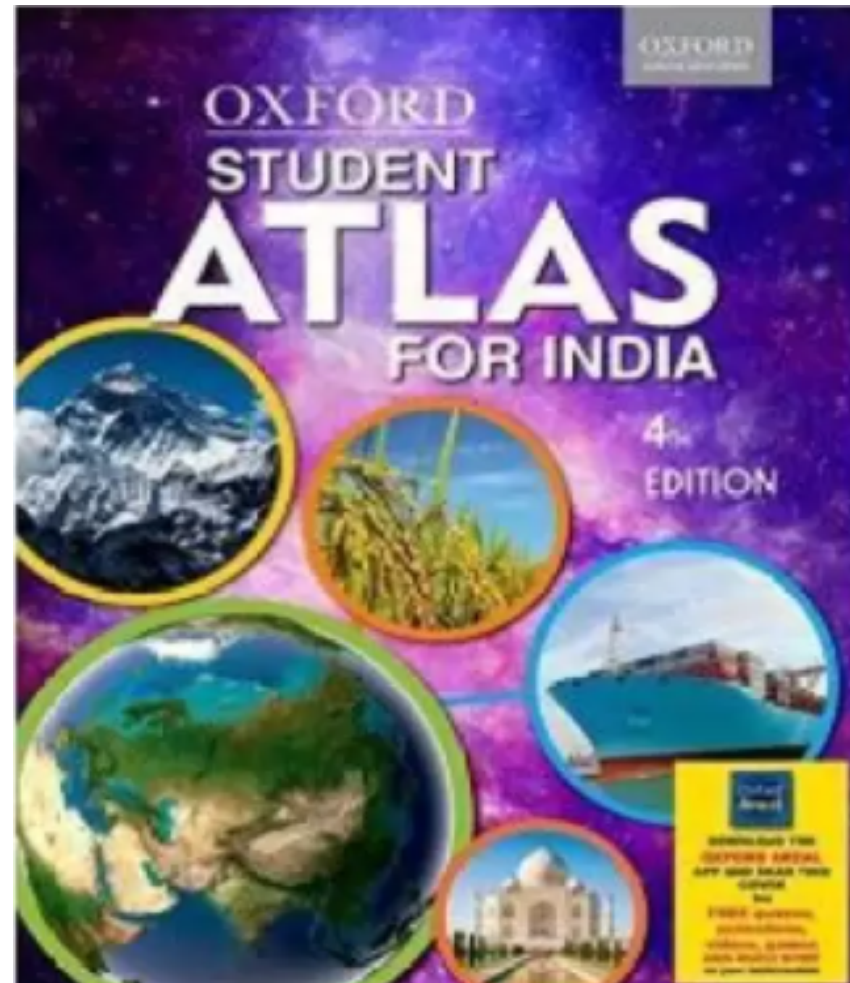
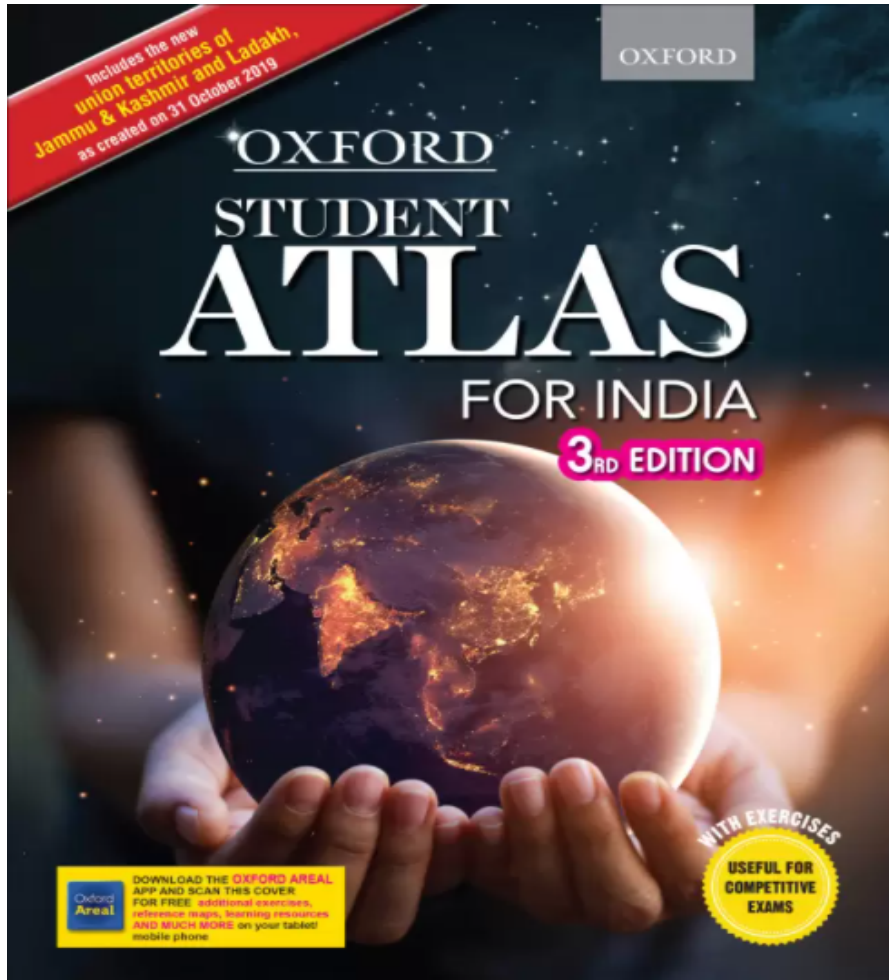


Paper I - (200 marks) Duration : Two hours

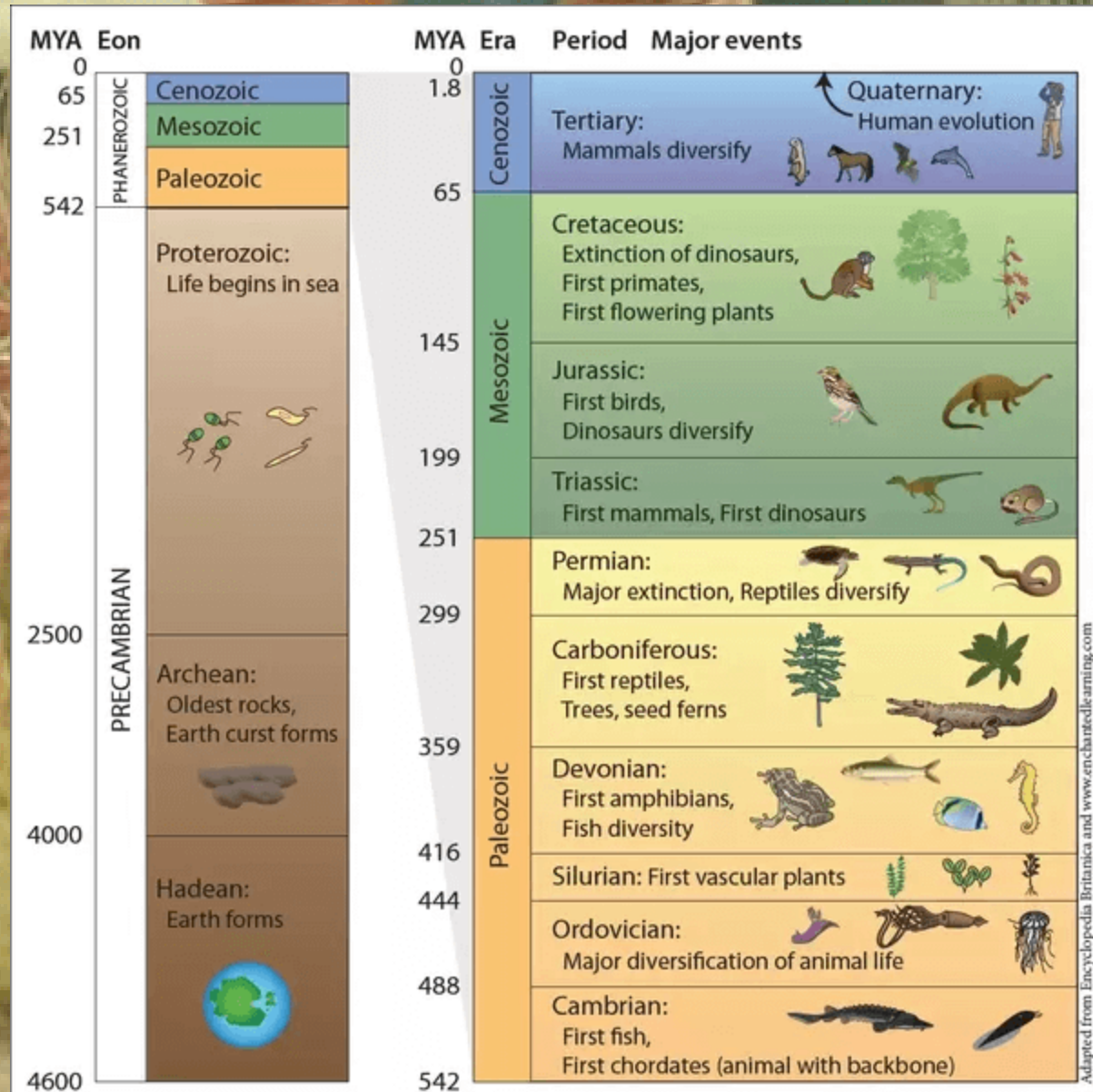
- ✚ Current events of national and international importance.
 - ✚ History of India and Indian National Movement.
 - ✚ Indian and World Geography - Physical, Social, Economic Geography of India and the World.
 - ✚ Indian Polity and Governance - Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.
 - ✚ Economic and Social Development Sustainable Development, Poverty, Inclusion, Demographics, Social Sector initiatives, etc.
 - ✚ General issues on Environmental Ecology, Bio-diversity and Climate Change - that do not require subject specialization.
 - ✚ General Science.
-
- Salient features of world's physical geography.
 - Distribution of key natural resources across the world (including South Asia and the Indian sub-continent); factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India)
 - Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., geographical features and their location- changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.

- Major crops—cropping patterns in various parts of the country, – different types of irrigation and irrigation systems –storage, transport and marketing of agricultural produce and issues and related constraints; e-technology in the aid of farmers
- Issues related to direct and indirect farm subsidies and minimum support prices; Public Distribution System- objectives, functioning, limitations, revamping; issues of buffer stocks and food security; Technology missions; economics of animal-rearing.
- Food processing and related industries in India- scope and significance, location, upstream and downstream requirements, supply chain management.
- **Infrastructure: Energy, Ports, Roads, Airports, Railways etc.**





GEOLOGICAL TIME SCALE



Adapted from Encyclopedia Britannica and www.enchantlelearning.com

CLASSIFICATION

- EON → ERA → PERIOD → EPOCH

PRE-CAMBRIAN ERA

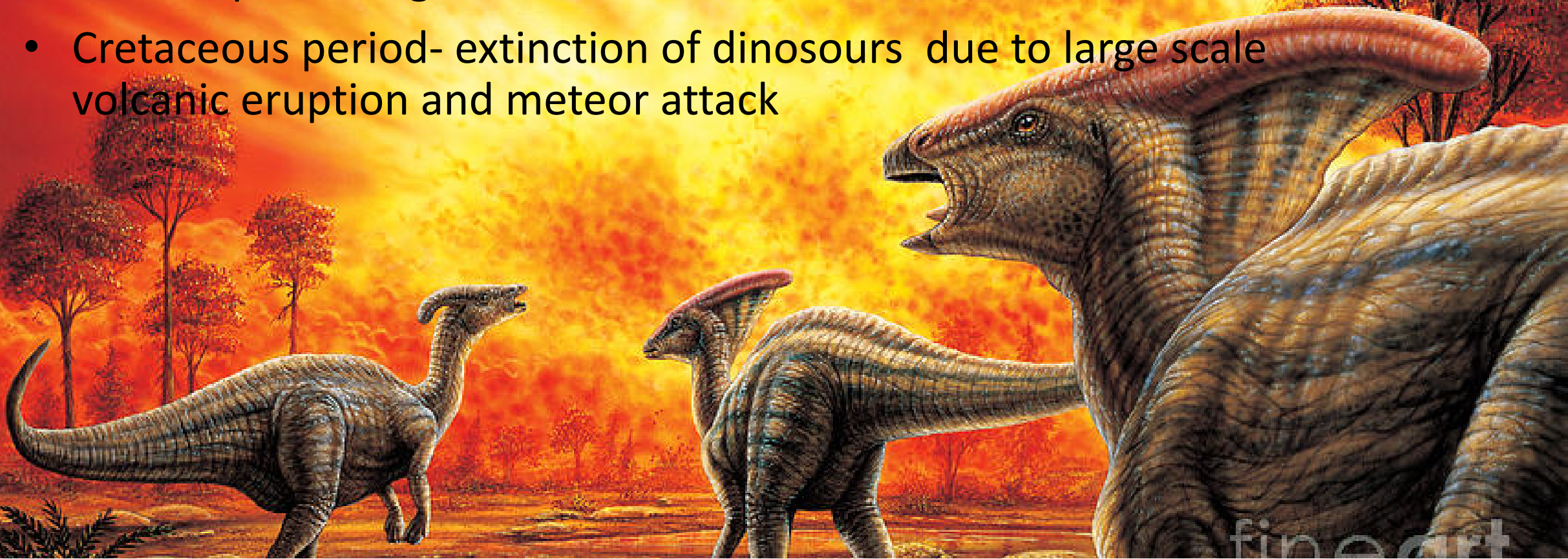
- Origin of earth around 4.5 billion years ago (bya)
- At 4.5 bya, Earth was rich in Hydrogen, helium, carbon dioxide and nitrogen (oxygen was absent).
- Features- formation of oceans, origin of life in form of anaerobic respiration (unicellular bacteria), formation of ARAVALLI (oldest fold mountain in world)

PALAEOZOIC ERA

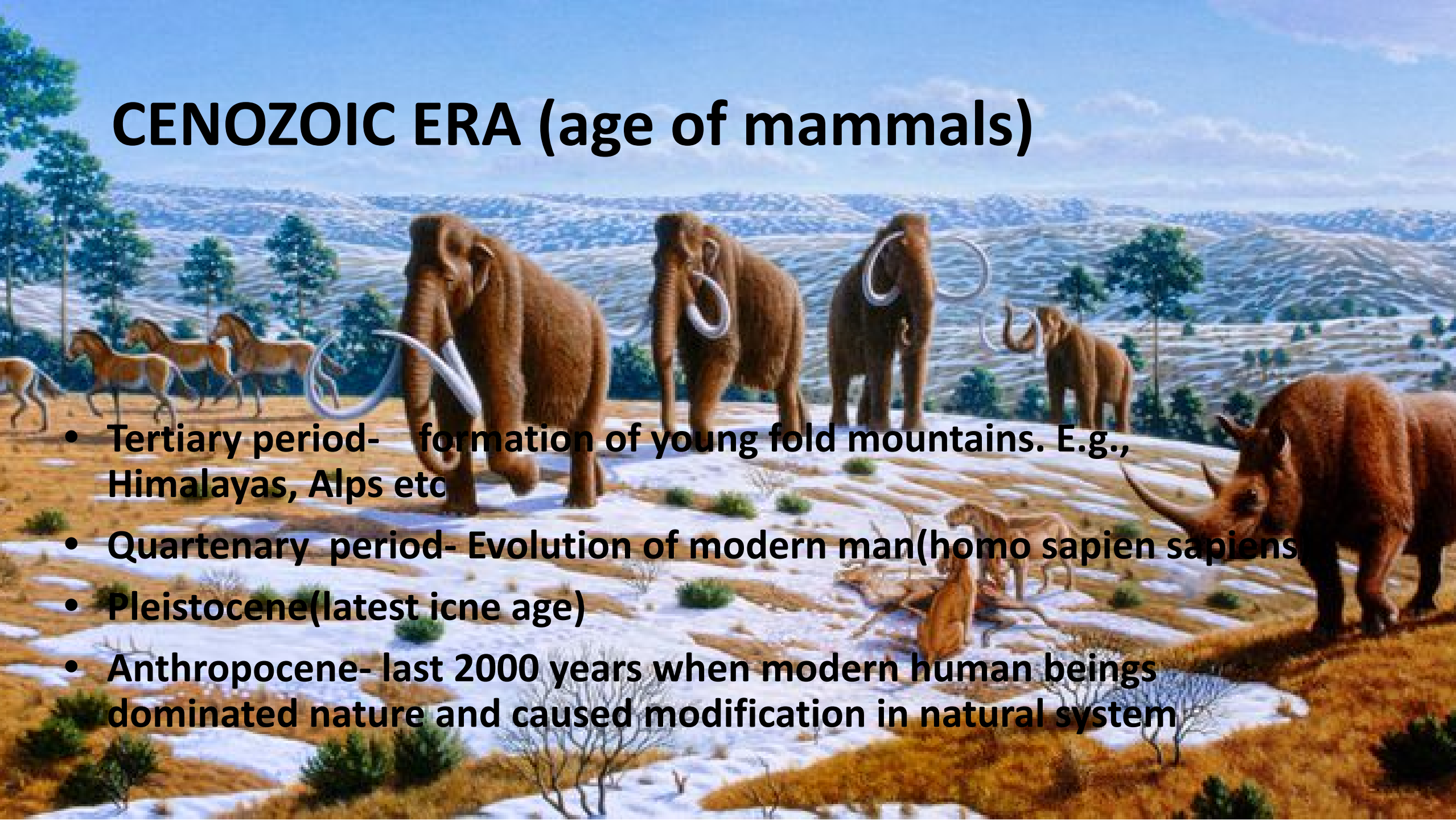
- **Cambrian-** period of marine invertebrate(no life on continents)
 - Ordovician-** First fish
 - Devonian-** age of fishes
- **Carboniferous-** most of the coal belongs to this period, **INDIAN COAL** belong to **GONDWANA PERIOD**(later part of carboniferous period)
 - **PERMIAN PERIOD**

MESOZOIC ERA

- Triassic period
- Jurassic period- age of dinosaurs
- Cretaceous period- extinction of dinosaurs due to large scale volcanic eruption and meteor attack



CENOZOIC ERA (age of mammals)

- 
- Tertiary period- formation of young fold mountains. E.g., Himalayas, Alps etc
 - Quaternary period- Evolution of modern man(homo sapien sapiens)
 - Pleistocene(latest icne age)
 - Anthropocene- last 2000 years when modern human beings dominated nature and caused modification in natural system

Which one of the following sets of elements was primarily responsible for the origin of life on the Earth? (2012)

- (a) Hydrogen, Oxygen, Sodium
- (b) Carbon, Hydrogen, Nitrogen
- (c) Oxygen, Calcium, Phosphorous
- (d) Carbon, Hydrogen, Potassium

From the point of view of evolution of living organisms, which one of the following is the correct sequence of evolution?

- (a) Otter – Tortoise – Shark
- (b) Shark – Tortoise – Otter
- (c) Tortoise – Shark – Otter
- (d) Shark – Otter – Trotoise

The term “Sixth mass extinction/ sixth extinction is often mentioned in the news in the context of the discussion of

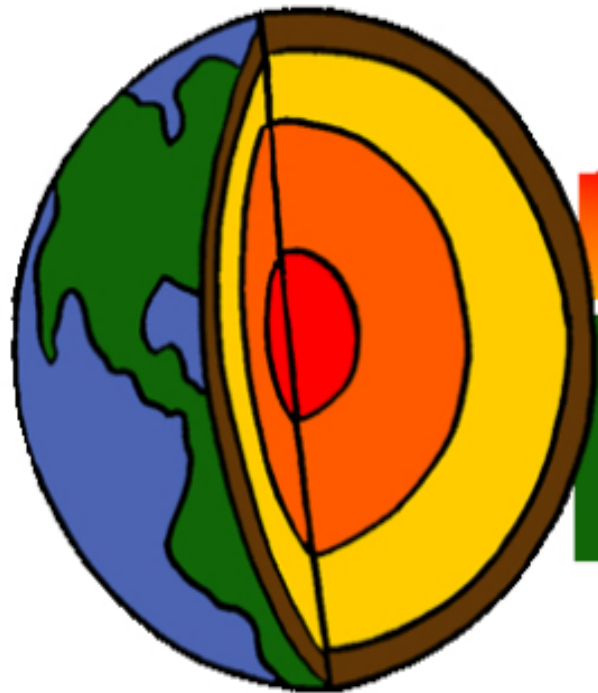
- (a) Widespread monoculture practices in agriculture and large-scale commercial farming with indiscriminate use of chemicals in many parts of the world that may result in the loss of good native ecosystems.
- (b) Fears of a possible collision of a meteorite with the Earth in the near future in the manner it happened 65 million years ago that caused the mass extinction of many species including those of dinosaurs.
- (c) Large scale cultivation of genetically modified crops in many parts of the world and promoting their cultivation in other parts of the world which may cause the disappearance of good native crop plants and the loss of food biodiversity.
- (d) Mankind’s over-exploitation/misuse of natural resources, fragmentation/loss of natural habitats, destruction of ecosystems, pollution and global climate change.

Consider the following statements:

1. The Earth’s magnetic field has reversed every few hundred thousand years.
2. When the Earth was created more than 4000 million years ago, there was **54% oxygen** and **no carbon dioxide**.
3. When living organisms originated, they modified the early atmosphere of the Earth.

Which of the statements given above is/are correct?

- A. 1 only
- B. 2 and 3 only
- C. 1 and 3 only
- D. 1, 2 and 3



Layers of the
EARTH

Sources to study the interior

```
graph TD; A[Sources to study the interior] --> B[Direct Sources]; A --> C[Indirect sources];
```

Direct Sources

- By digging through the earth
- Deep mines
- projects to penetrate deeper depths such as “Deep Ocean Drilling Project” and “Integrated Ocean Drilling Project”.
- Volcanic eruptions: by analysing the molten material.

Indirect sources

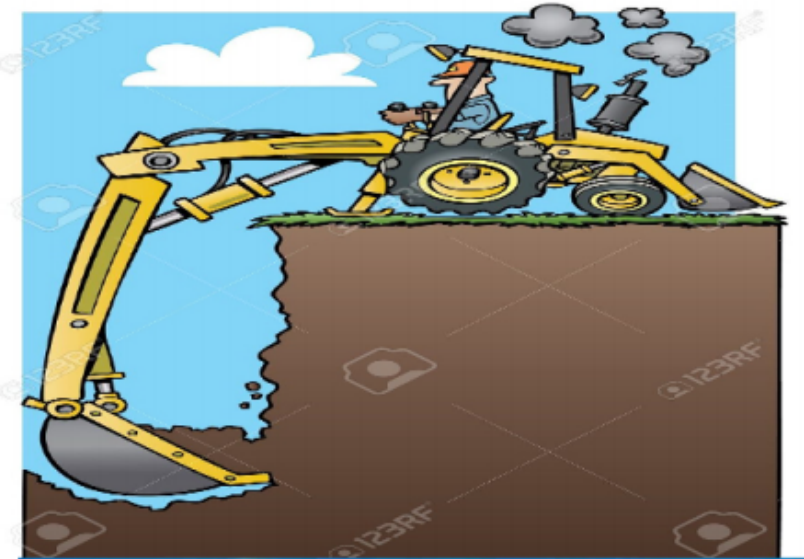
- Studying pressure and temperature
- Studying density inside the earth
- Meteors that reach the earth
- Study of Sismic waves

Direct sources

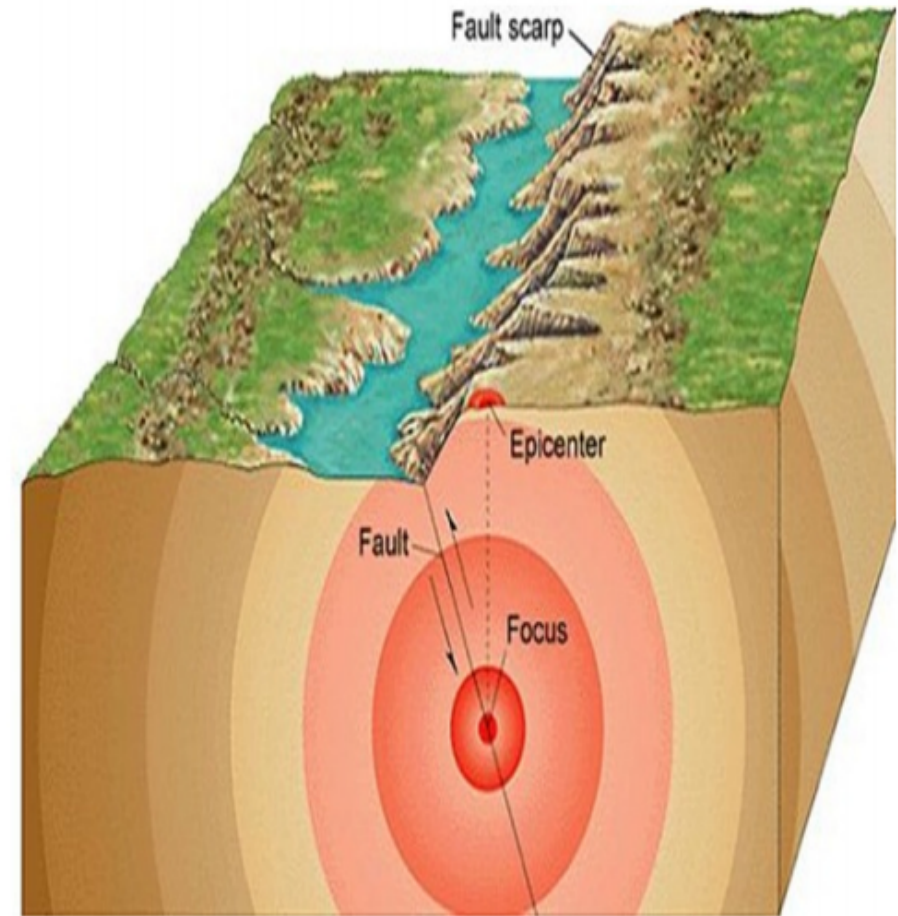
The earth's radius is 6,370 km. therefore its impossible to reach centre of the earth to collect samples.

The deepest mine in the world (in South Africa) is just 3.9 km deep

In ocean drilling project we have just reached upto 12kms.



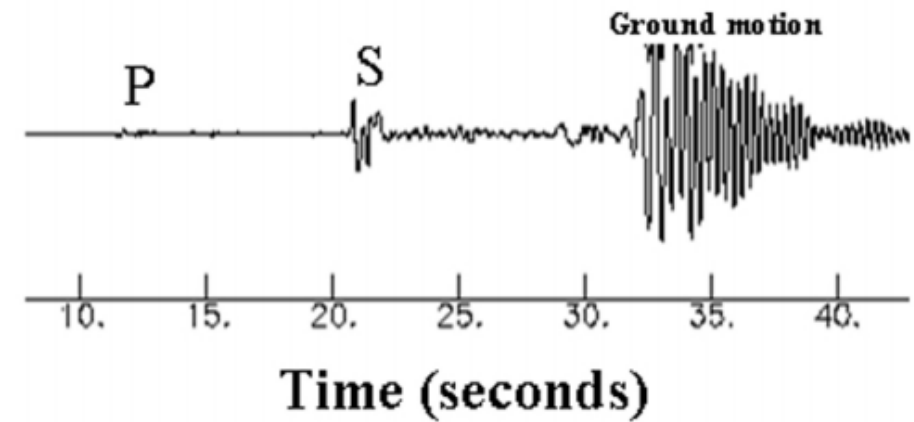
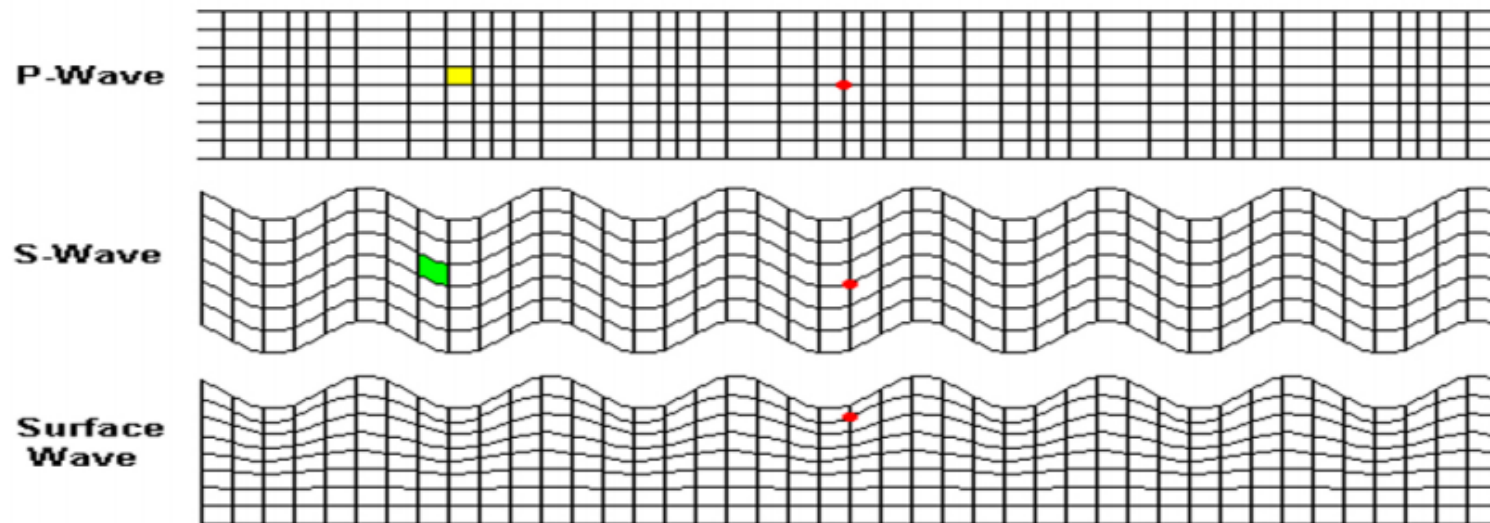
- Seismic waves are the waves which are generated during earth quake.
- These are recorded with help of instrument known as Seismograph.
- Earth quake is shaking of earth, during which energy waves are generated that travel in all directions
- The point where earth quake occurs is known as focus or Hypocentre which is always inside the earth
- The point on the surface, nearest to the focus, which is first one to experience the waves is called epicentre.



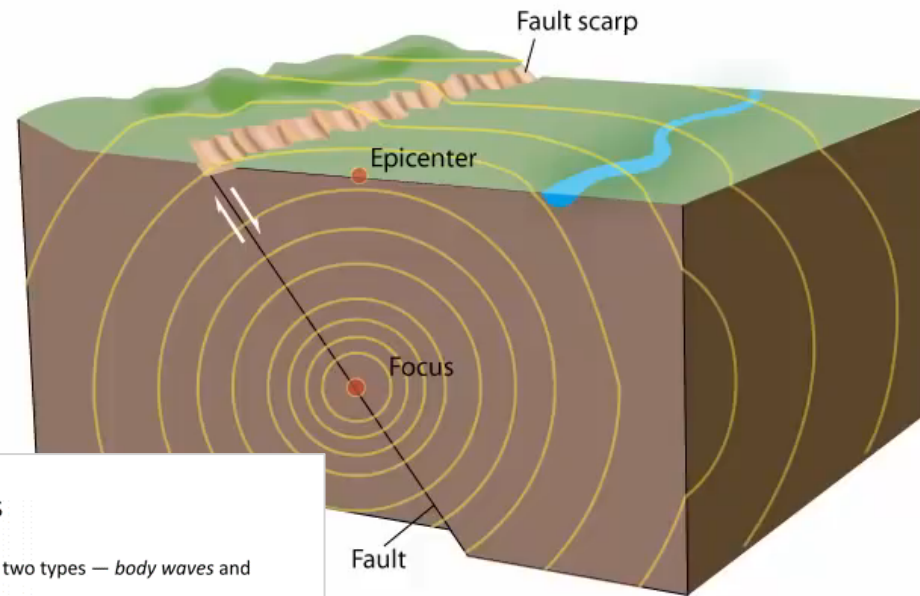
Types of Seismic waves

- Earthquake waves are basically of two types — *body waves* and *surface waves*.
- Body waves are generated due to the release of energy at the focus & travel through the body of the earth.
- Body waves after interacting with surface rocks generate surface waves.
- There are two types of body waves called Primary waves(P-waves) and Secondary waves (S-waves).

- P- waves are similar to sound waves. *Means they can travel through gaseous, liquid and solid materials.* As they travel with faster speed they are first waves to arrive at surface. P-waves vibrate parallel to the direction of the wave leading to stretching and squeezing of the material
- S- waves are next waves to arrive at the surface. *Interestingly S-waves can travel only through solids.* They vibrate perpendicular to the direction of propagation creating crest and troughs in materials through which they pass.
- Surface waves (L-waves) are slowest of all seismic waves. These are most violent and destructive of all waves



SEISMIC WAVE

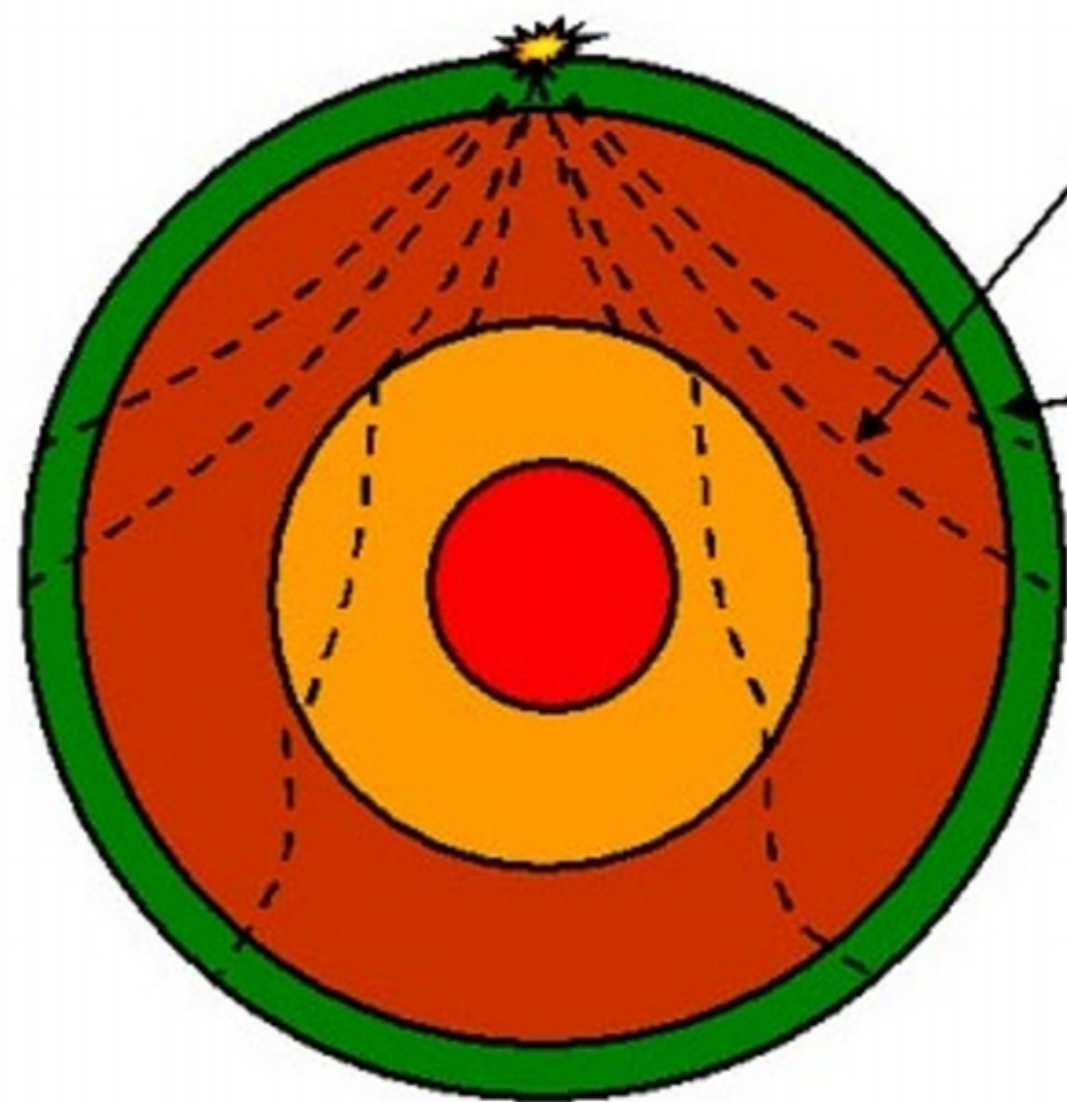


Types of Seismic waves

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Role of Seismic Waves:-

- Best way to know the interiors of the earth is to study the seismic waves.
- Three waves :- P- Waves, S- Waves and L- Waves are generated during earthquakes. In previous lesson we have studied the characteristics of these waves. Let us revise.
- The velocity of these waves changes while passing through different mediums. Denser the medium greater will be the velocity.
- They refract or reflect as they go through medium of different densities. Hence their direction also changes



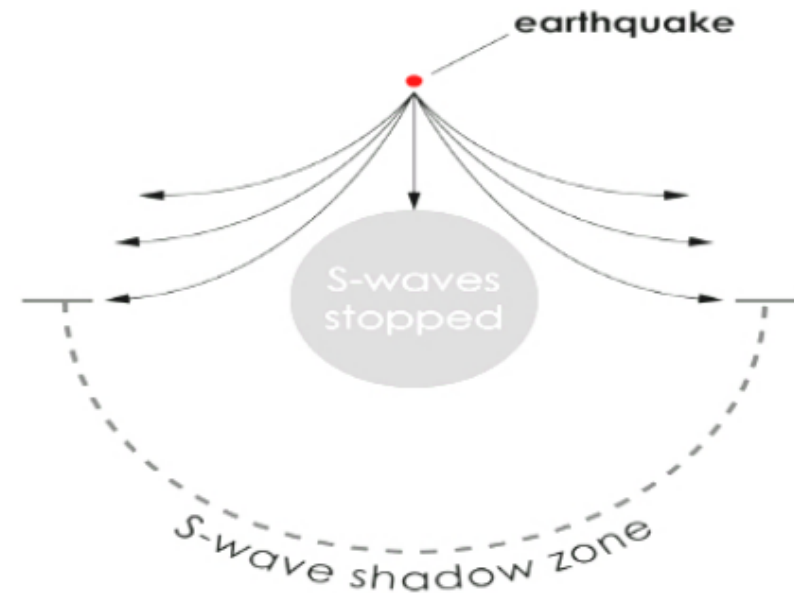
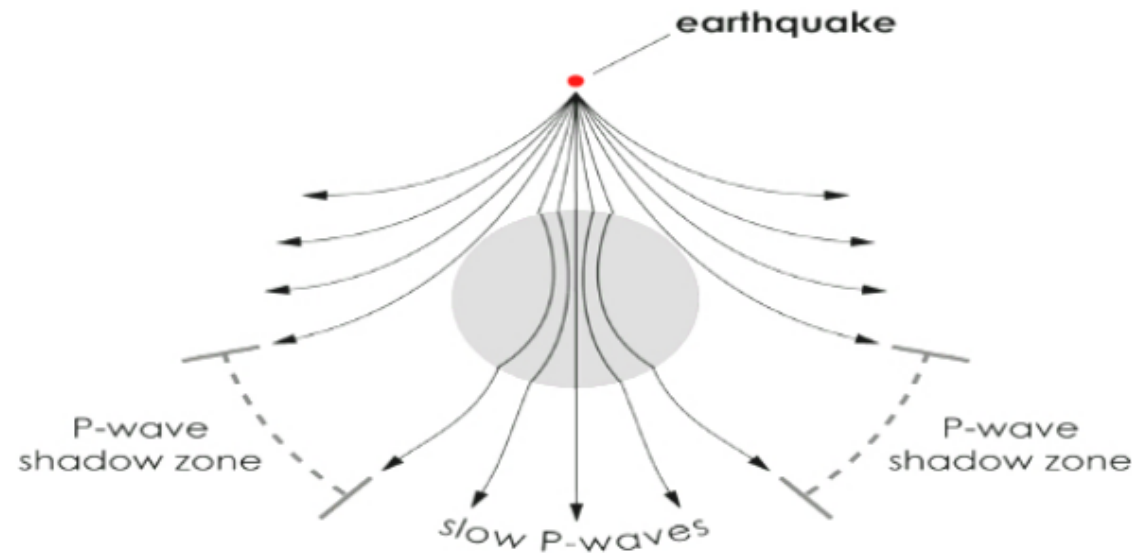
S waves will only travel through a solid

P waves travel through the Earth and are refracted when they pass through a medium

The paths of these waves are curved because density is gradually changing

What can we conclude by looking at diagram?

1. P and S- waves pass through both the outer layers of the earth
2. P- waves pass through inner layer but S- waves do not pass through the inner layers of the earth.
3. There is change in direction of waves while passing through different layers of the earth.
4. There are some areas where the seismic waves are not reported. These are known as SHADOW ZONES.



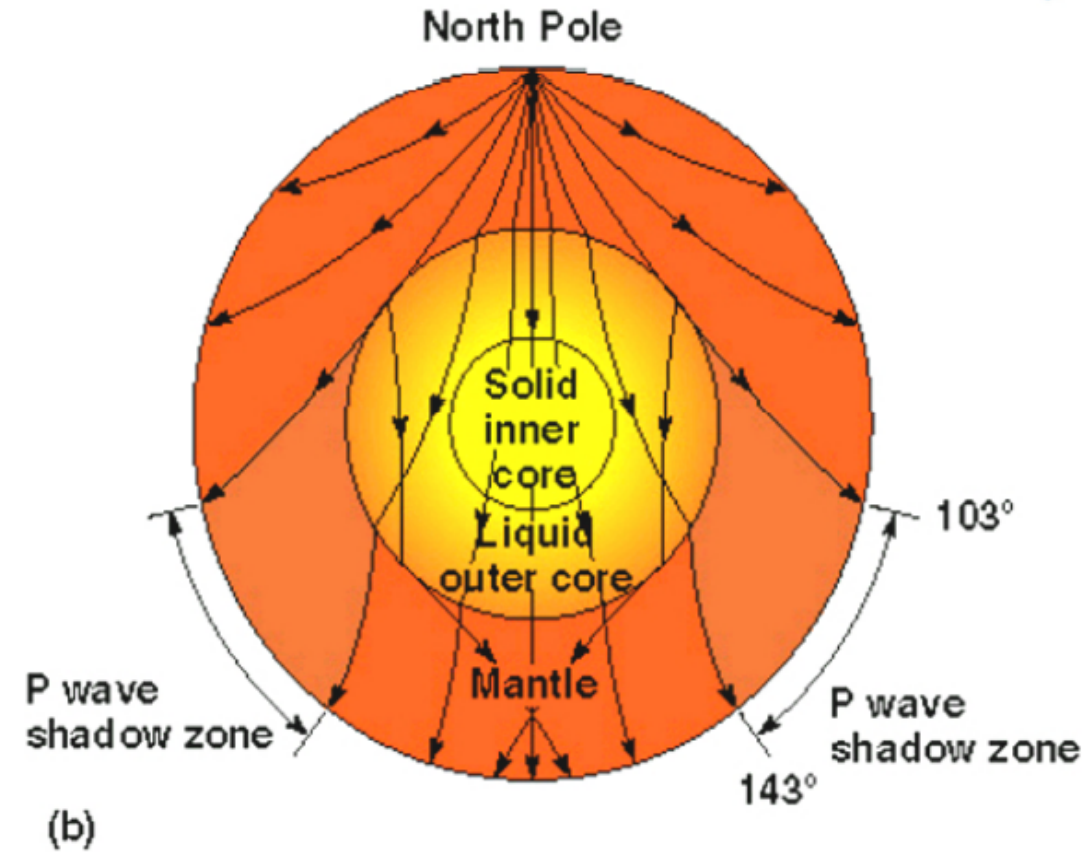
- What is Shadow Zone?

Areas where Seismic waves are not located are known as Shadow Zones. There are two types of shadow zones

- a) P waves shadow zone
- b) S waves shadow zone

- P wave shadow zone appears as a band around the earth between 105° and 145° away from the epicentre.

- The shadow zone of S-waves is beyond 105° .



- Thus by knowing the properties of the waves we divide the earth into

A. Crust

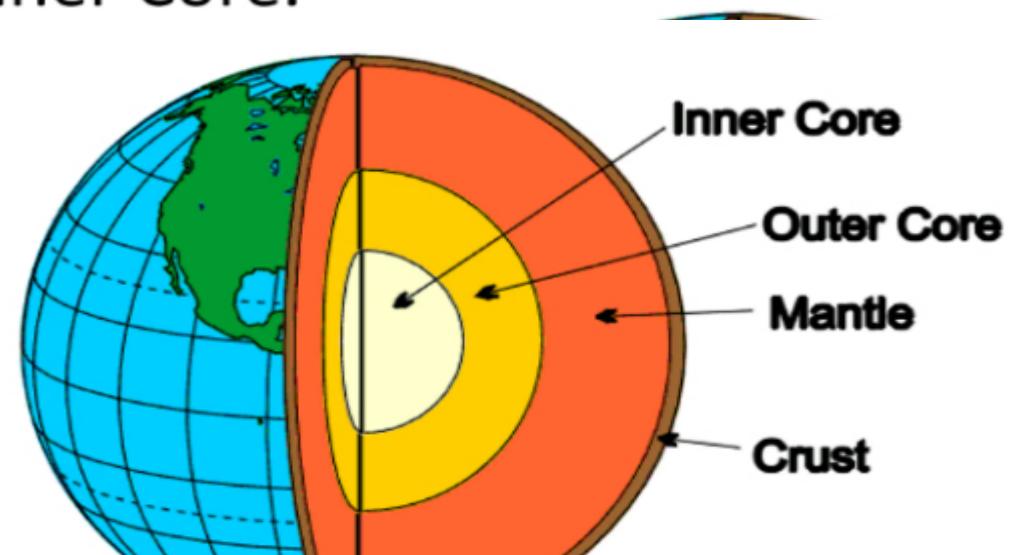
B. Mantle

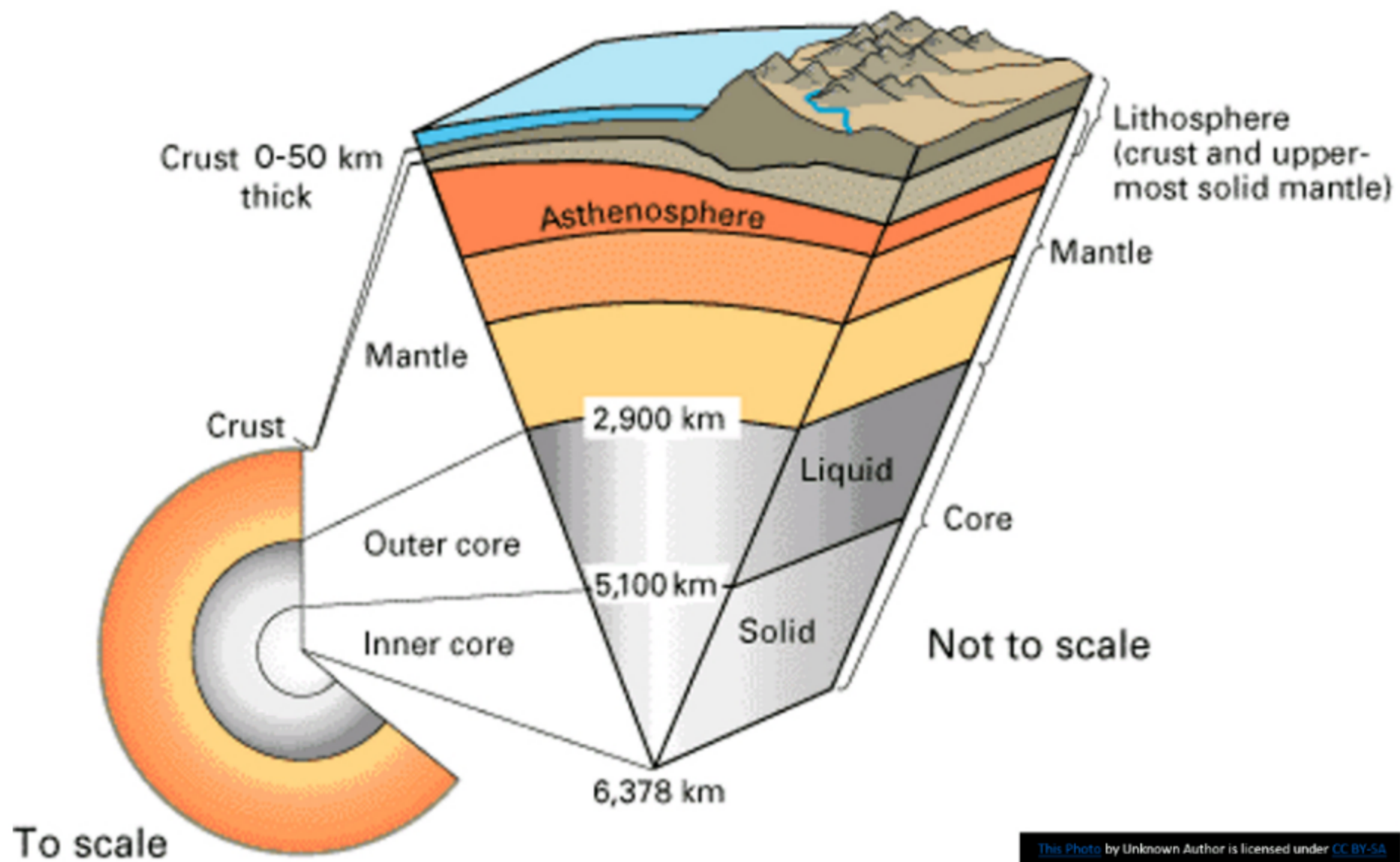
C. Core

Crust is further divided into Continental Crust and Oceanic Crust.

Mantle is further divided into Upper Mantle and Lower Mantle

Core is divided into Outer Core and Inner Core.





CRUST:-

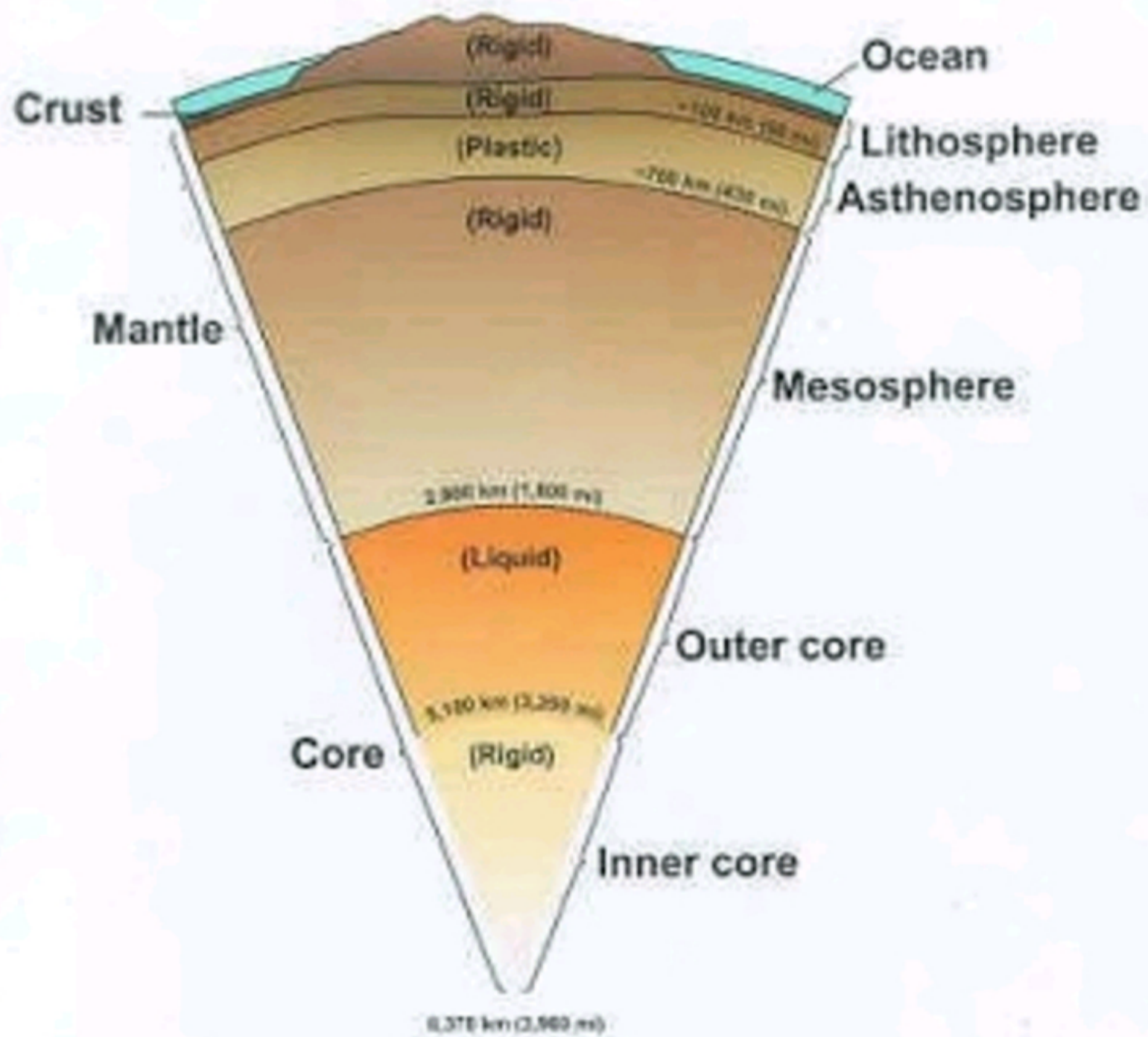
- It is the outermost solid part of the earth. It is divided into Oceanic Crust and Continental Crust.
- The mean thickness of oceanic crust is 5 km whereas that of the continental crust is around 30 km. The continental crust is thicker in the areas of major mountain systems. It is as much as 70 km thick in the Himalayan region.
- The continental crust is made up of lighter rocks composed of SILICA and ALUMINIUM (SIAL) having average density of 2.7gm/cm cube. Mostly composed of GRANITIC rocks.
- The oceanic crust is made up of denser rocks composed of SILICA and MAGNESIUM (SIMA) having average density of 3 gm/cm cube. Mostly BASALTIC rocks.

MANTLE:-

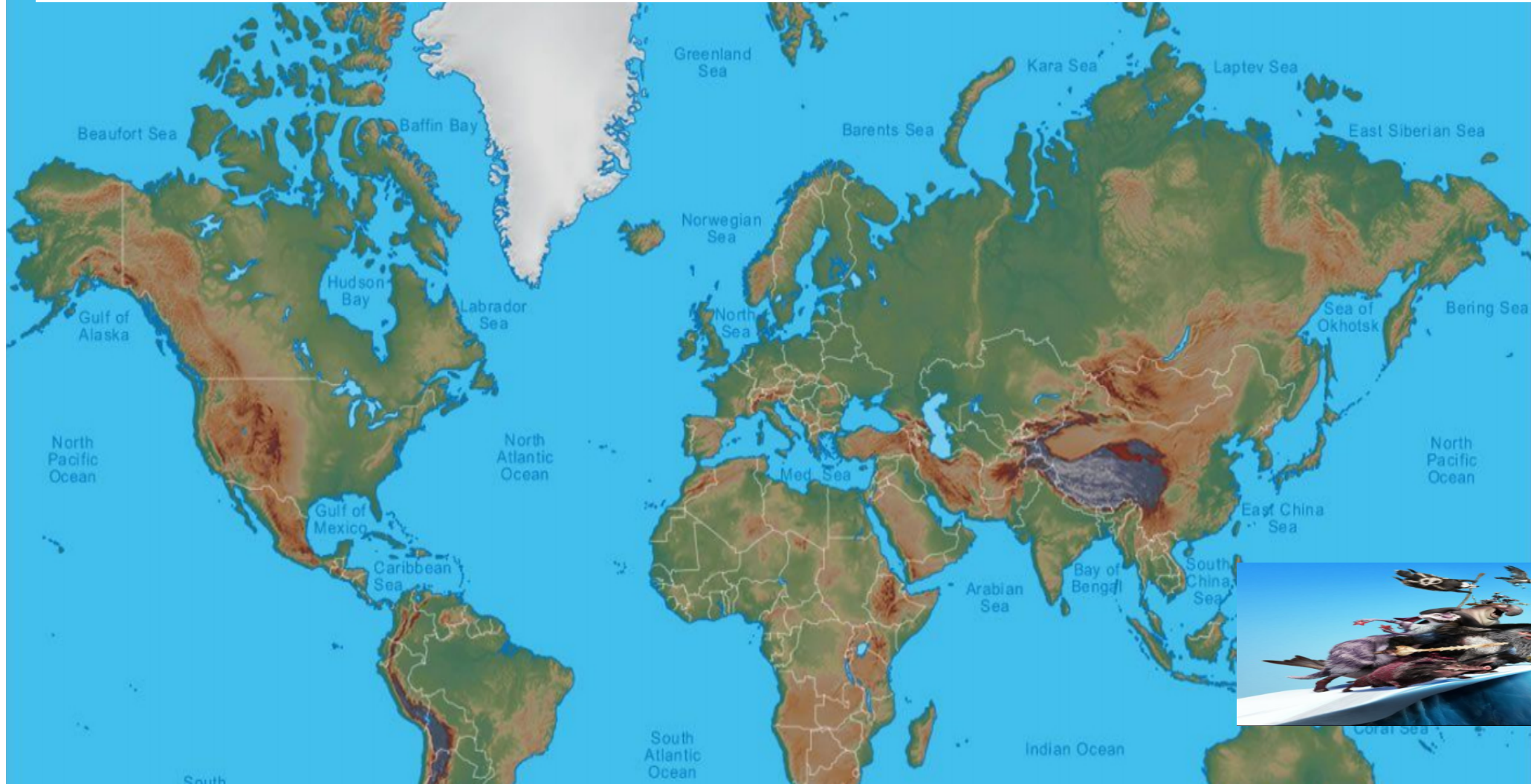
- The portion of the interior beyond the crust is called the mantle.
- **Mohorovicic (Moho) discontinuity** forms the boundary between crust and mantle.
- The mantle extends from Moho's discontinuity to a depth of 2,900 km. The upper portion of the mantle is called *asthenosphere*. extending upto 400 km it is zone of weak rocks. Asthenosphere is main source of magma.
- Mantle is denser than crust (3.4 gm/cm cube).
- The *crust* and the *uppermost part of the mantle* is *lithosphere*.

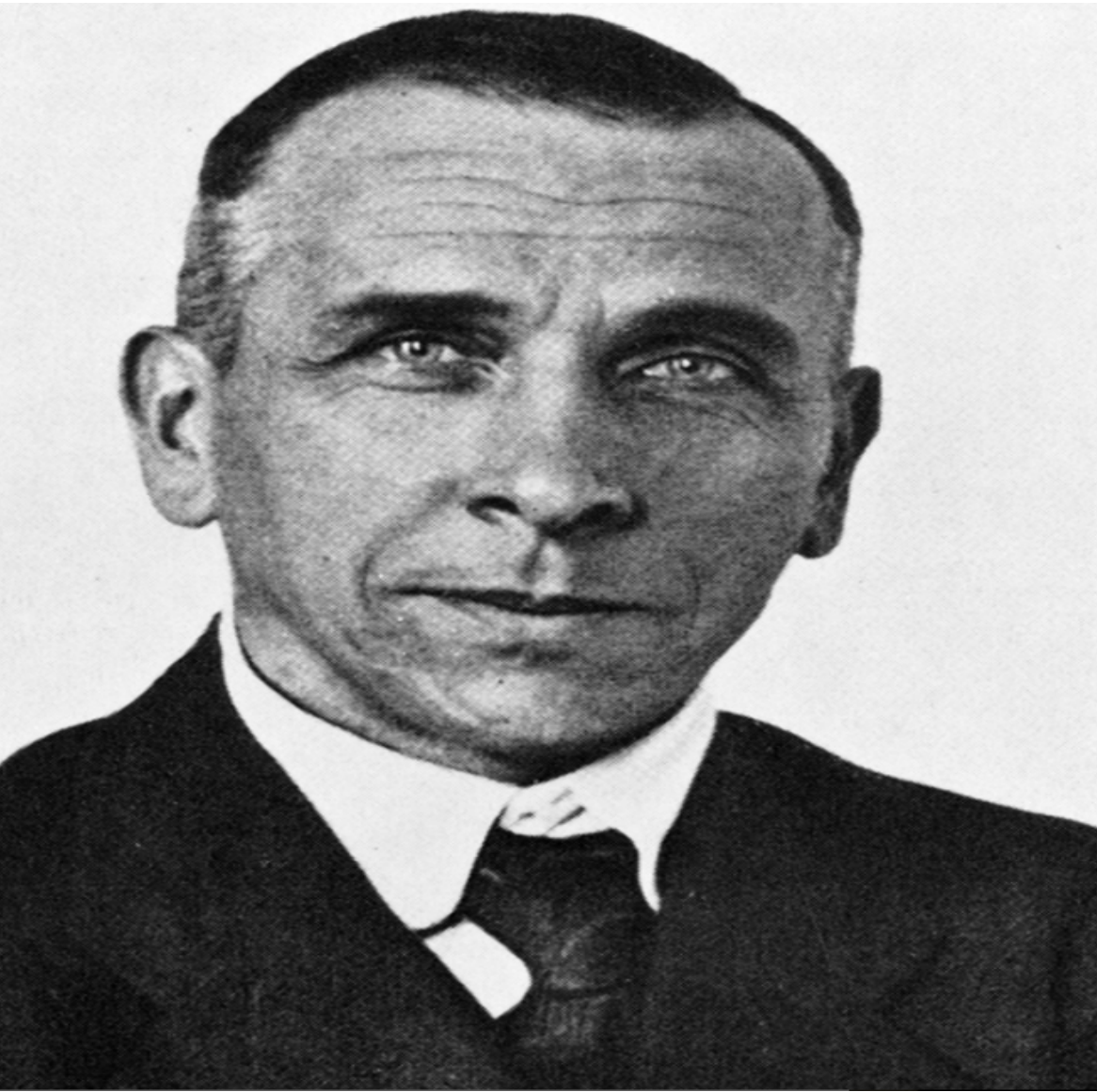
CORE:-

- Lies between **2900 km and 6400 km** below the earth's surface.
- **Gutenberg Discontinuity** lies between core and mantle. The core is divided into outer and inner core.
- S waves do not pass through outer core. WHY? Outer core is liquid. This liquid nature of outer core is responsible for magnetic property of earth.
- Inner core is solid. The core is made up of very heavy material mostly constituted by nickel and iron. It is sometimes referred to as the *nife* layer.



Continental Drift Theory

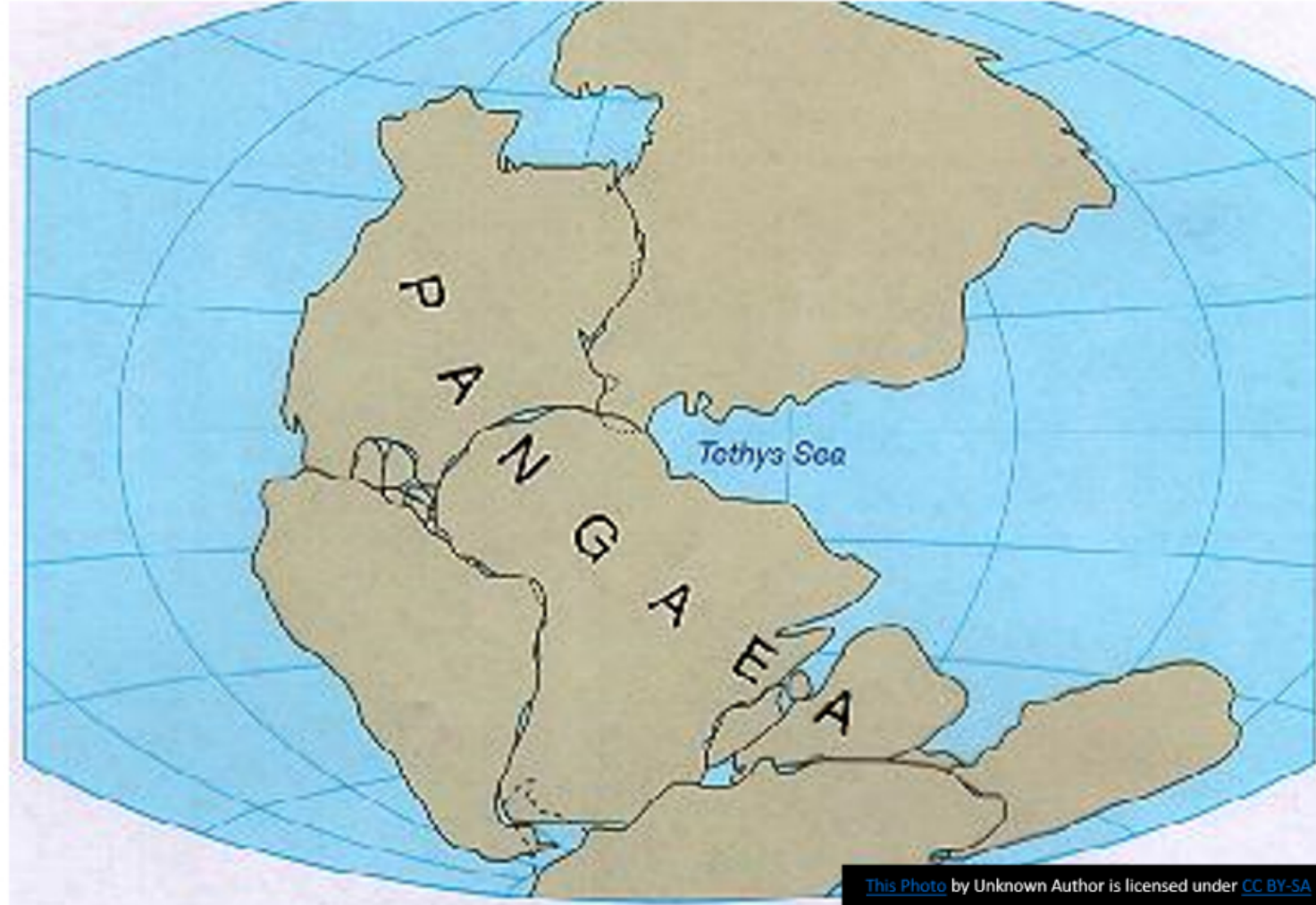




Alfred Wegner

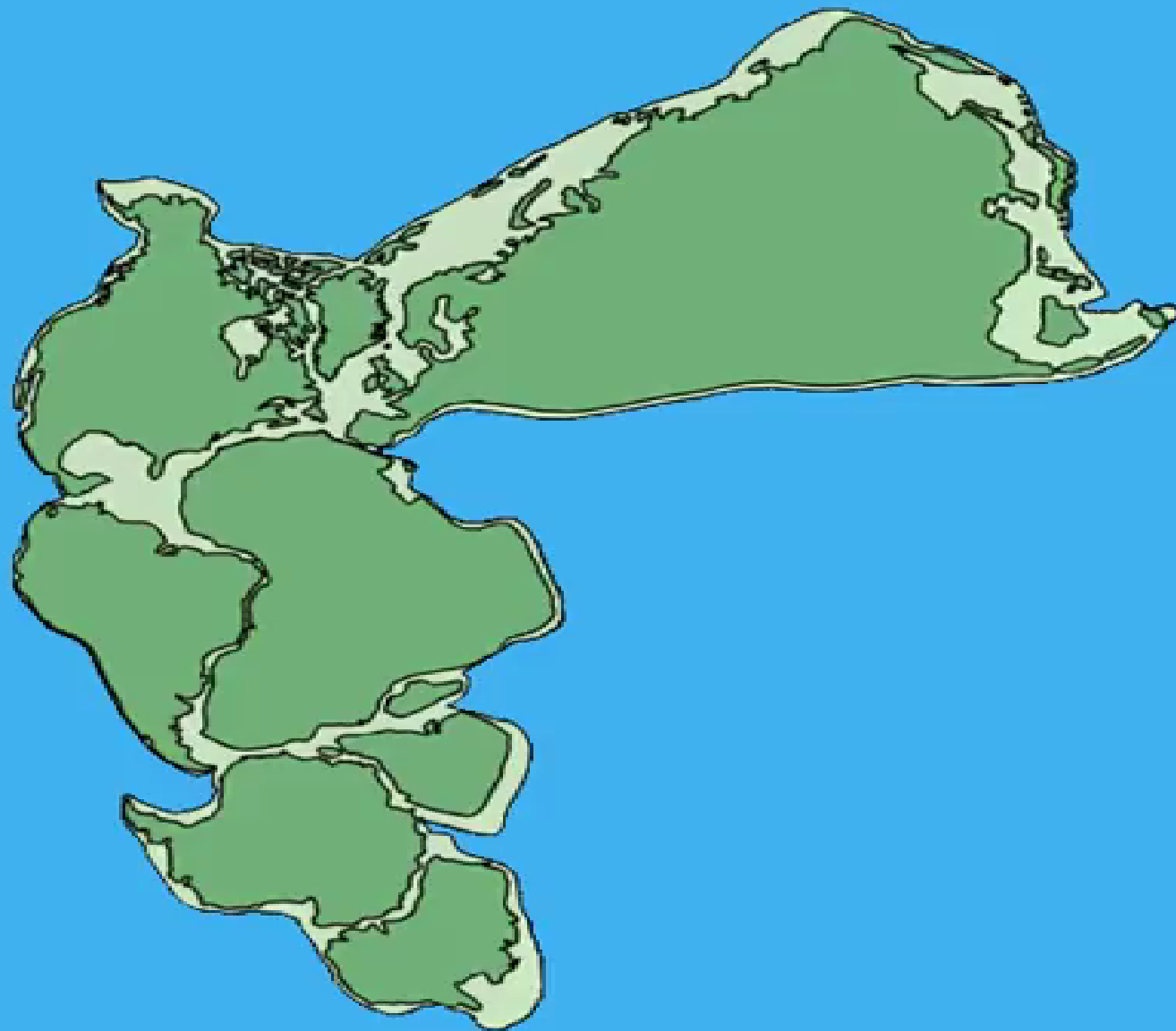
- Given by Wegner in 1912.
- He assumed that SIAL made up of Continental Mass drifting over SIMA..

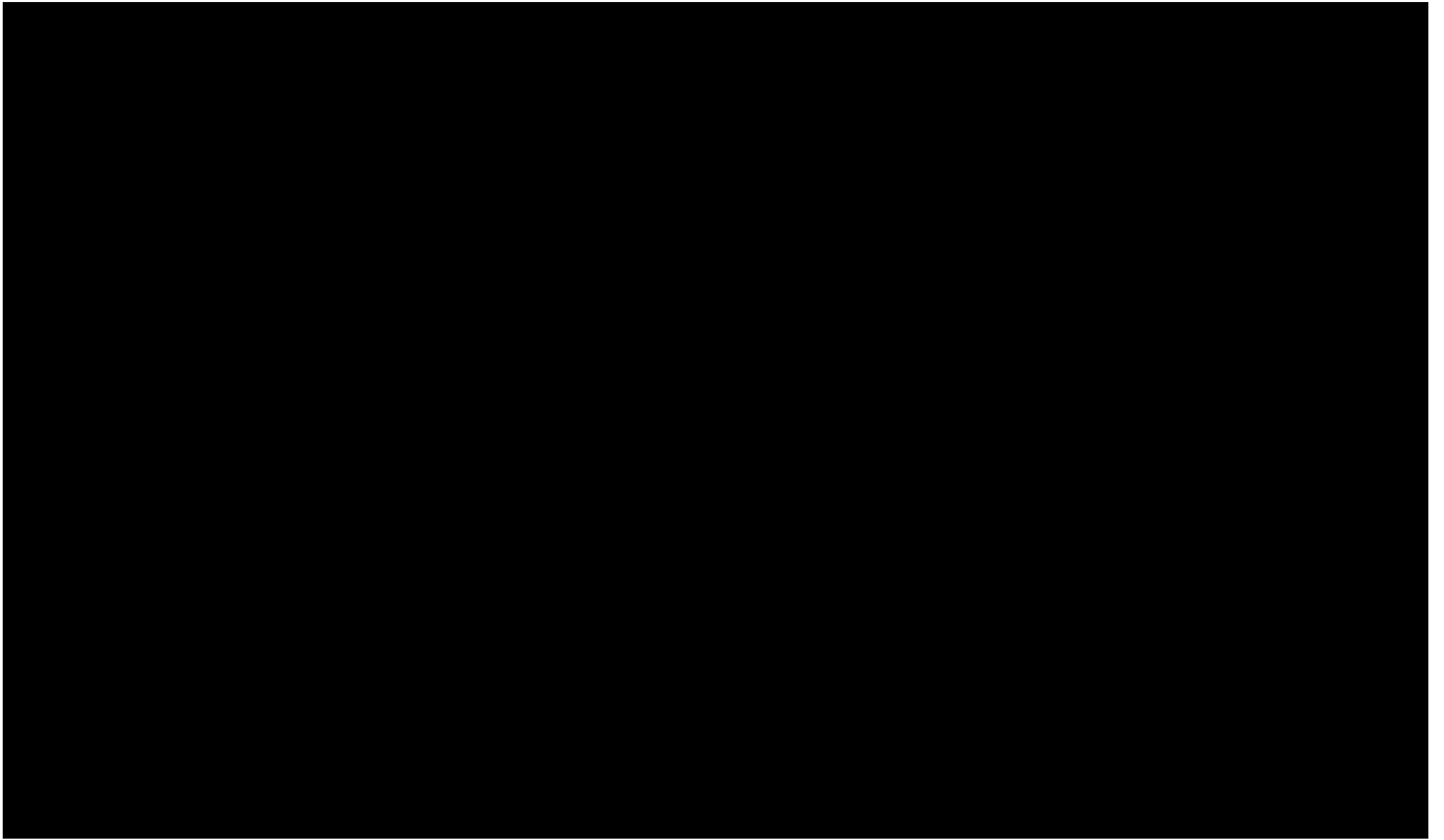
- He assumed that all the landmasses were once united to form one supercontinent known as PANGAEA.
- This supercontinent was surrounded by super ocean known as PANTHALASA



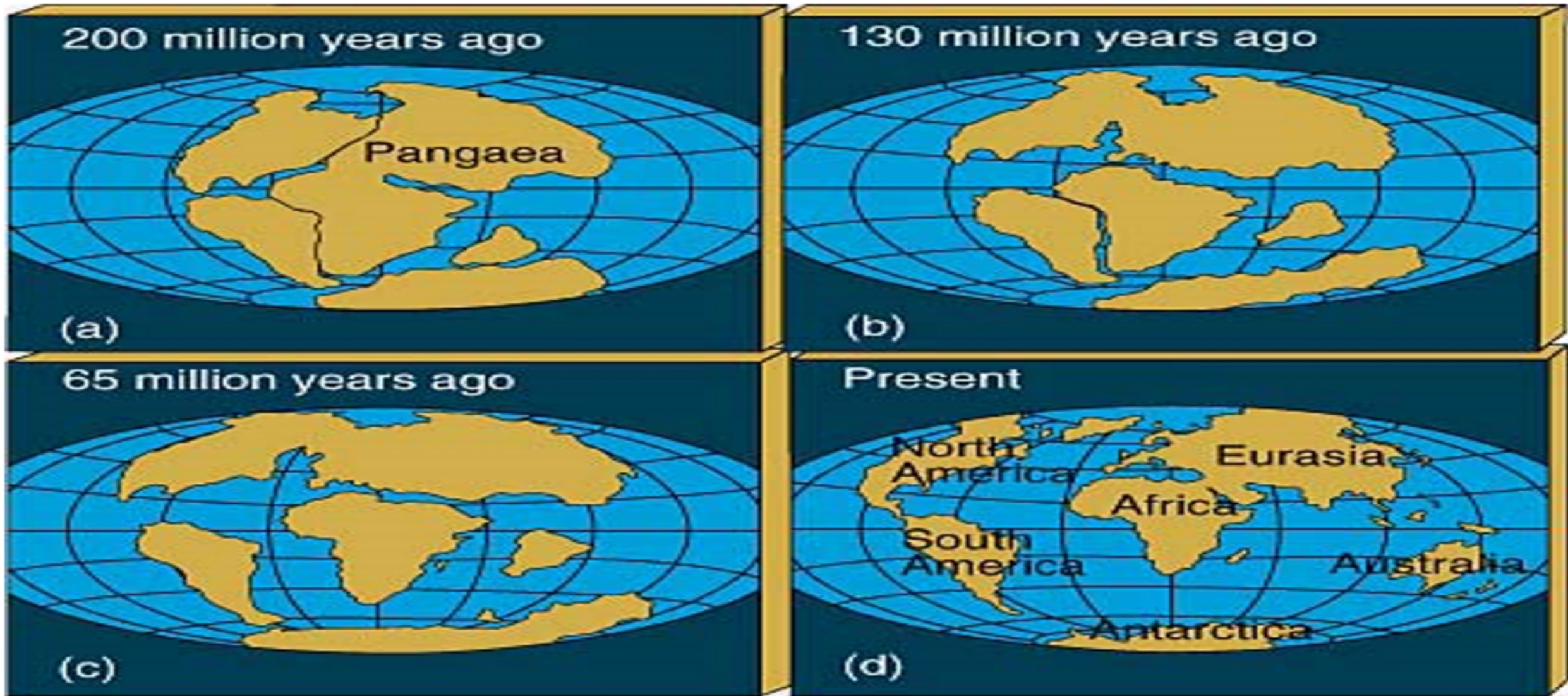
- Subsequently Laurasia and Gondwanaland further broke into different landmasses.
- Laurasia : North America, Europe and Asia (Eurasia)
- Gondwanaland : South America, Africa, Peninsular India, Australia and Antarctica.
- Westward movement of both North and South America resulted in opening of Atlantic Ocean.
- Northward movement of Peninsular India resulted into Opening of Indian Ocean.
- Panthalasa was reduced in size to form present day Pacific Ocean.
- Mediterranean Sea is remaining part of Tethys Sea.

180
million
years
ago





- Thus we have present day arrangement of Continents.



Evidences to support CDT:

1. Jig- Saw fit of the continents:

Continents of South America and Africa fit into each other.

2. Geological evidence shows similarity between rocks between the opposite coast of Atlantic. There is similarity between rocks on east coast of Americas and west coast of Europe and Africa.

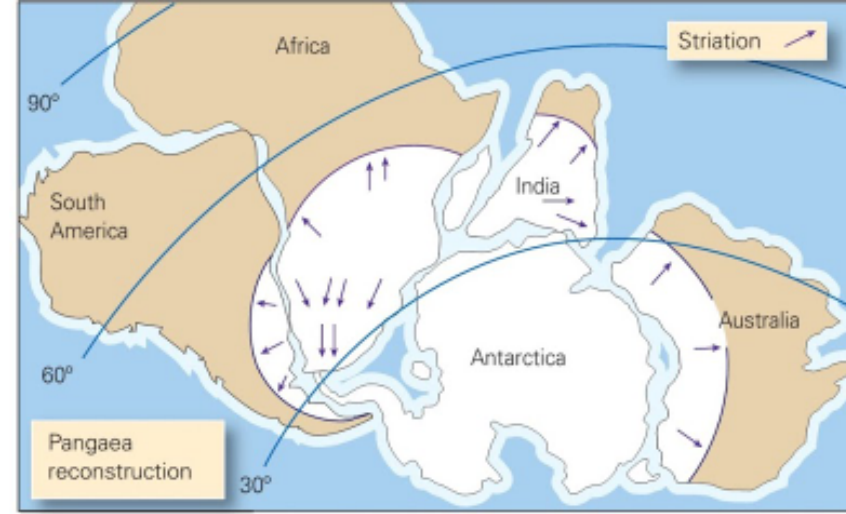
3. Similarity in the fossils and vegetation found on eastern coast of South America and Western coast of Africa.

4. The distribution of GLOSSOPTERIS flora in India, South Africa, Australia, Antarctica etc proves that these landmass were united.

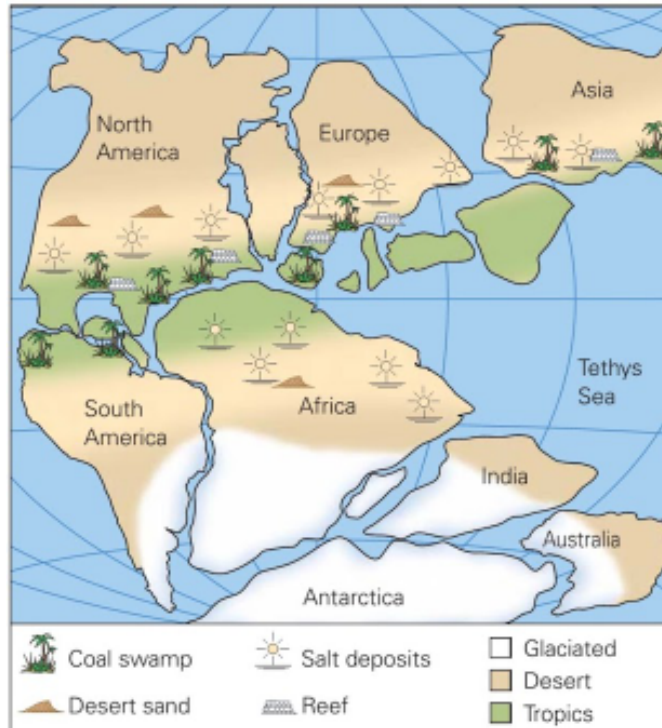
5. Similarly there are evidences of glaciation in Brazil, Peninsular India, Australia etc... So what?

6. Behavior of animals: Animals in Africa, Europe have tendency to run westwards when their population is increased. Eg Lemmings.

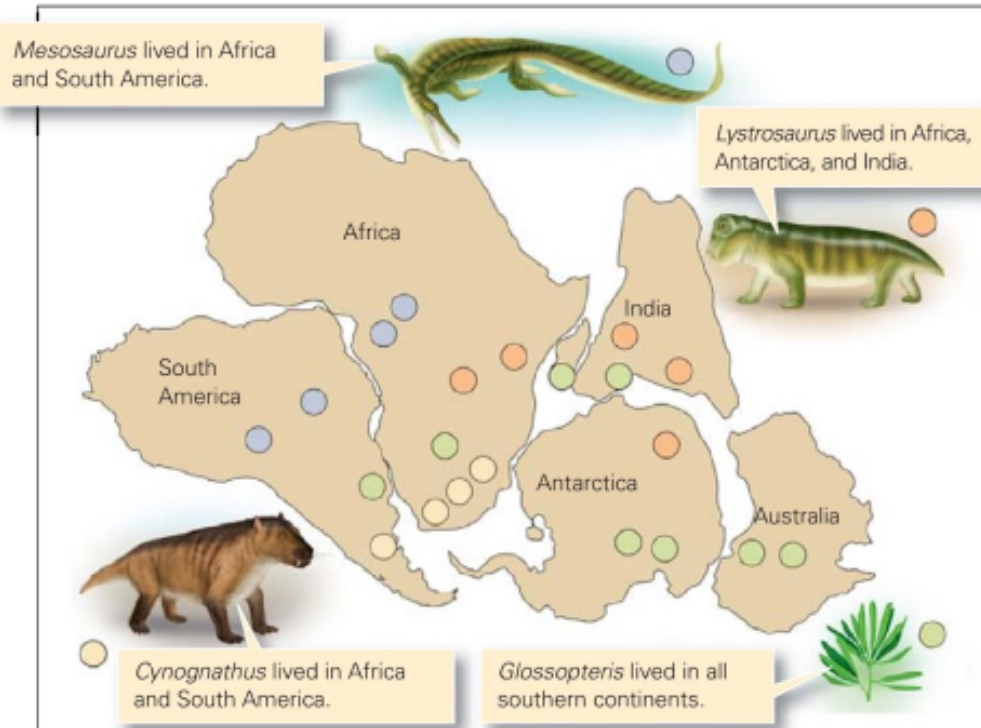




(a) The distribution of late Paleozoic glacial deposits and striations on present-day Earth are hard to explain. But on Pangaea, areas with glacial deposits fit together in a southern polar cap.



(b) The distribution of late Paleozoic rock types plots sensibly in the climate belts of Pangaea.



(c) A plot of fossil localities shows that Mesozoic land-dwelling organisms occur on multiple continents. This would be hard to explain if continents were separated.

⊗ LIMITATIONS OF CONTINENTAL DRIFT THEORY :-

Ⓐ When Continental Drift theory starts?

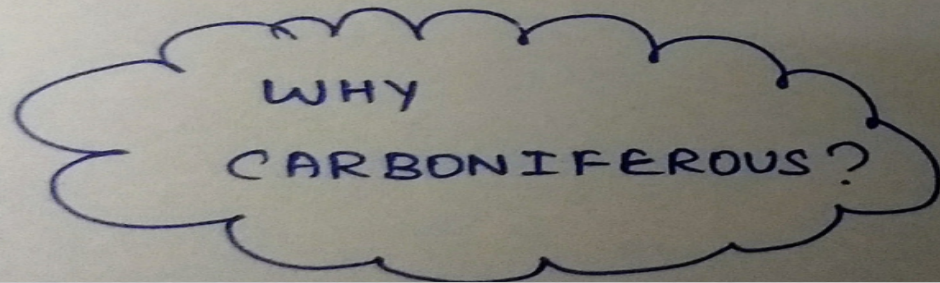
⇓
CARBONIFEROUS PERIOD.

⇓
360 million years ago

But age of the earth is around 4.5 B

WHY PANGAEA WAS UNITED in the
Pre-carboniferous period.

Ⓑ TRIGGER or DRIVING FORCE for RIFTING of
continents in Carboniferous is not explained
by WEGNER.



Ⓒ FORCES Responsible for drifting?

① GRAVITATIONAL FORCE

② TIDAL FORCE.

Which of the following phenomena might have influenced the evolution of organisms?

1. Continental drift 2. Glacial cycles Select the correct answer using the code given below. (2014)

(a) 1 only (b) 2 only (c) Both 1 and 2 (d) Neither 1 nor 2

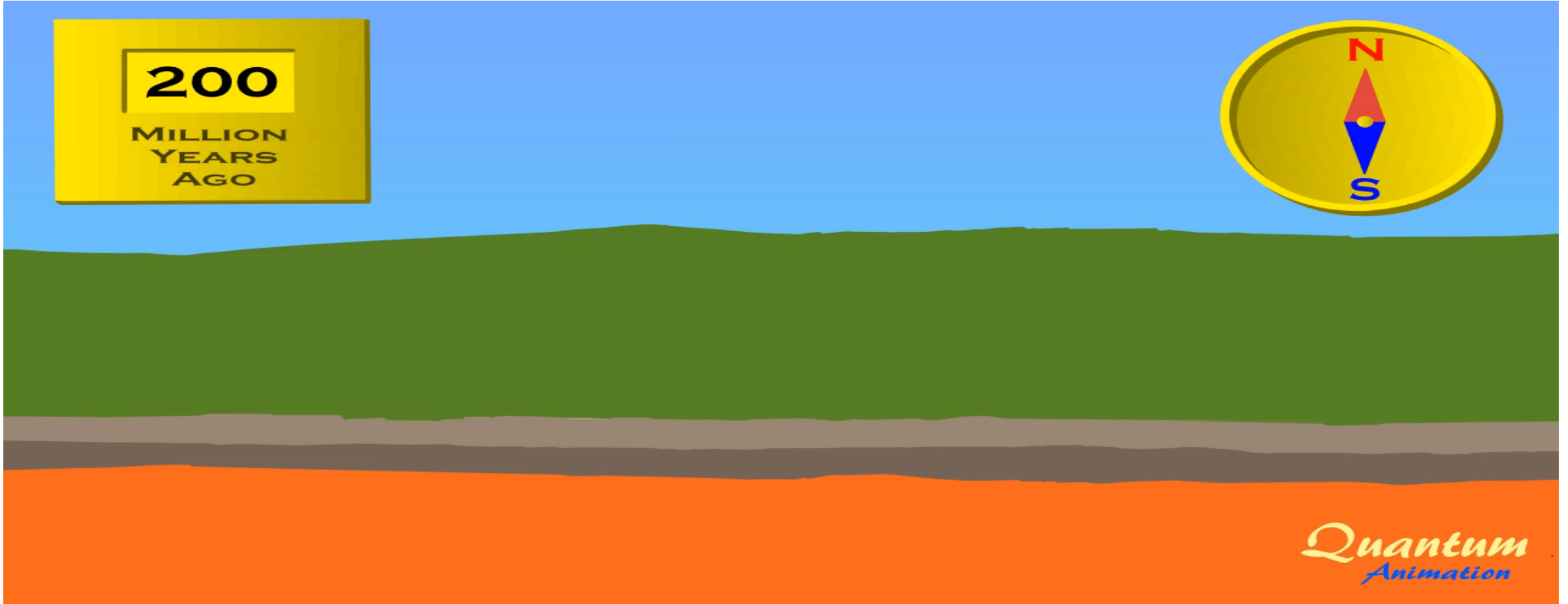
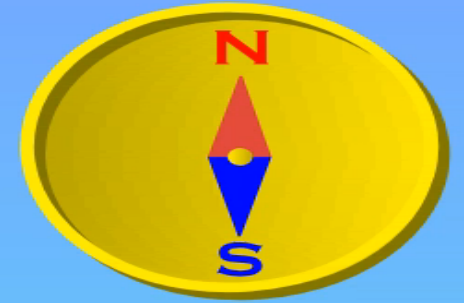
Q. What do you understand by the theory of 'continental drift'? Discuss the prominent evidences in its support.(UPSC 2013)

Sea Floor Spreading

Harry Hess

200

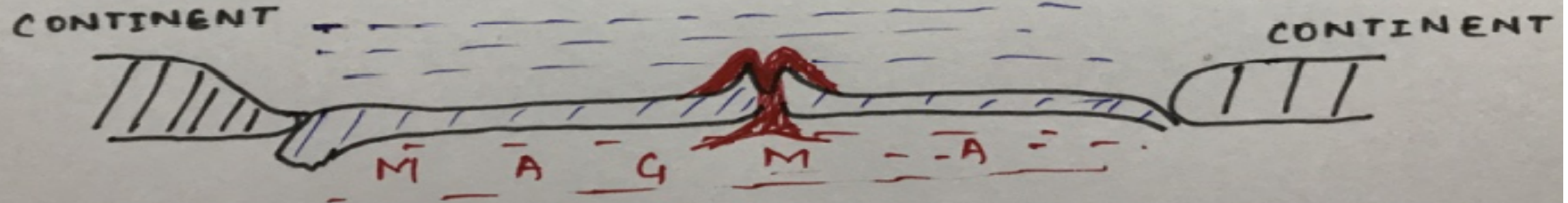
MILLION
YEARS
AGO



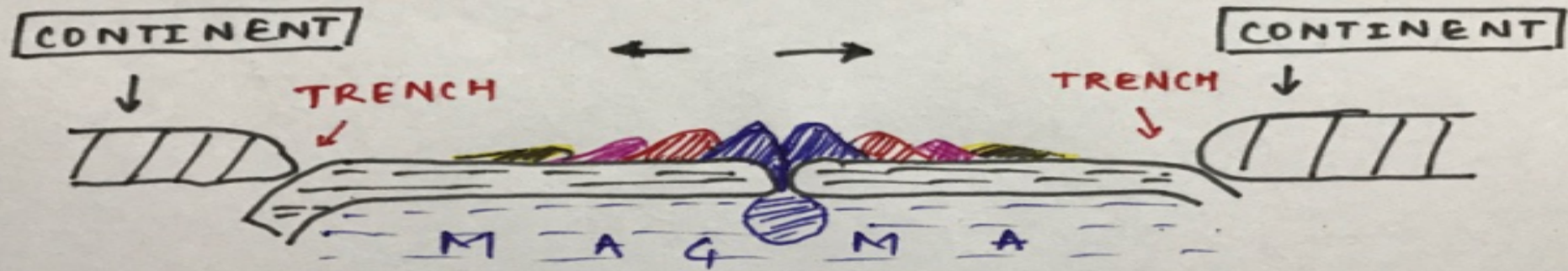
Quantum
Animation

ACCORDING TO HARRY HESS :-

- ① OCEAN BOTTOM FLOORS ARE NOT STATIC. These are spreading.
- ② WHY? Due to HOT CONVECTIONAL CURRENTS ARISING FROM MANTLE.
- ③ Convectional currents spreads the Ocean floor at MID-OCEANIC RIDGE (MOR)



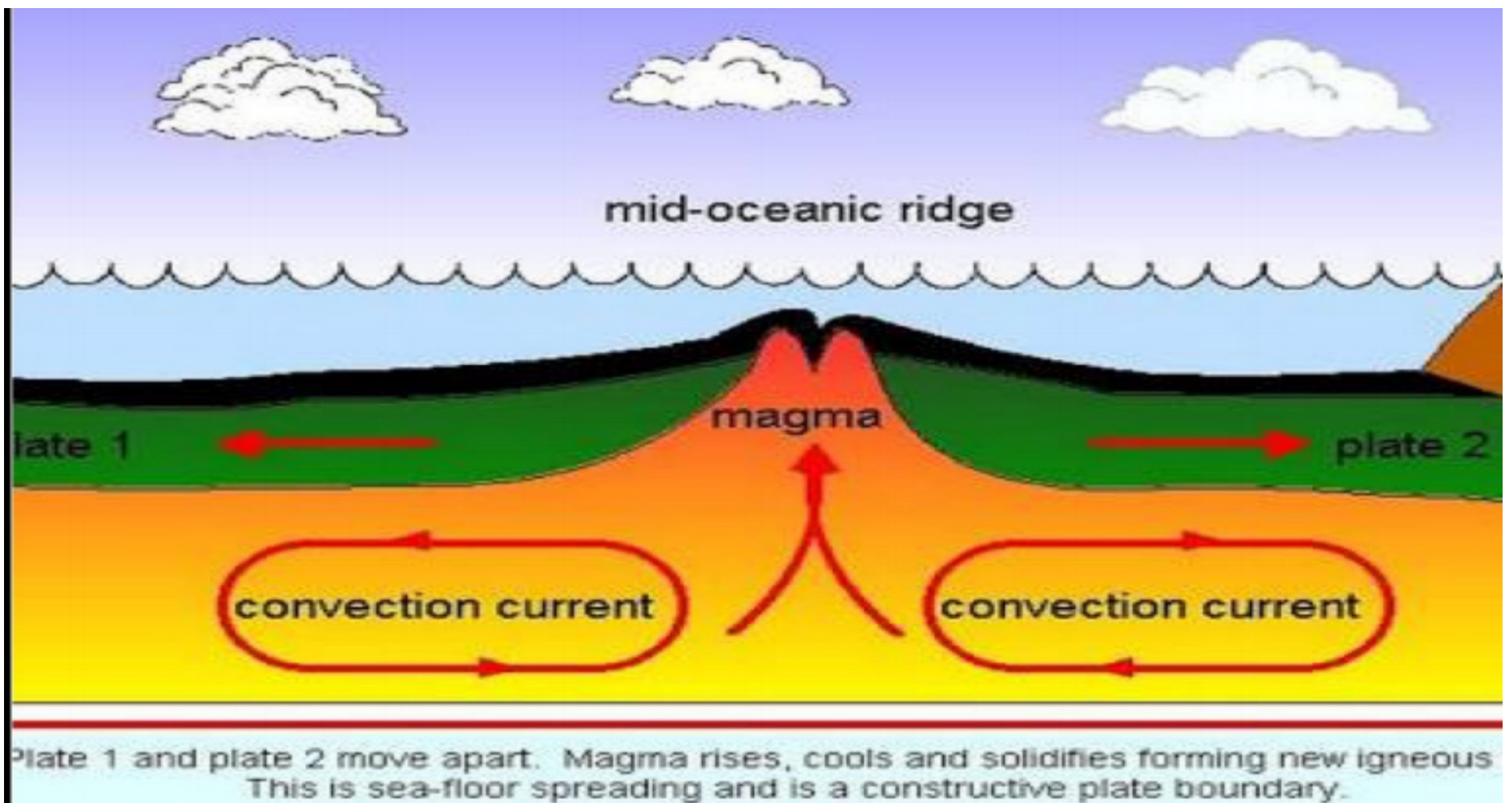
④ As the sea-floor spreads new Mid-Oceanic Ridge is continuously created at divergent boundary.



⑤ THUS NEW OCEANIC CRUST IS CREATED ALONG MID OCEANIC RIDGE

⑥ SO WHAT HAPPENS TO OLD CRUST?
It is destroyed along the margins of
Continent. →

OCEANIC
TRENCHES



EVIDENCES

- Presence of mid-oceanic ridge which is the longest mountain system on the Earth running unbroken for 78000 km.
- The rocks of same ages at an equal distance away from the ~~same~~ mid-oceanic ridge.
- Greater oceanic temperature at the top of mid-oceanic ridge becoz of volcanic eruption (fissure type).
- Presence of trenches which are always paralleled to continental margins esp fold mountains.
- Alc to the conventional theories, the age of the oceanic crust and continental crust should be same but recent findings have reported that the continental crust is about 4.2 bn years old while oceanic crust is only few million years old.
- Sediments on oceanic crust are unexpectedly very thin.
- **Palaeomagnetism** it is the field which deals with ~~studying~~ studying the magnetic properties in older rocks.

Define mantle plume and explain its role in plate tectonics (2018)