LIVE

CLASS 11th GEOGRAPHY

BACKLOG MARATHON

SERIES

1. Geography As a Discipline
2. The Origin and Evolution of The Earth
3. India Size and Location
4. Interior of the Earth
5. Distribution of Oceans and Continents



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GEOGRAPHY



IS LOVE

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Geography
AS A DISCIPLINE

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Geography as a discipline

Relation between Physical Geography and Natural Sciences:

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Approaches to study Geography:

Branches of Geography (Based on systematic approach):

Branches of Geography (based on Regional approach)



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Introduction

What is geography?

Earth is our home ➤ It is made up of various physical features. ⇒ Description of the Earth

+

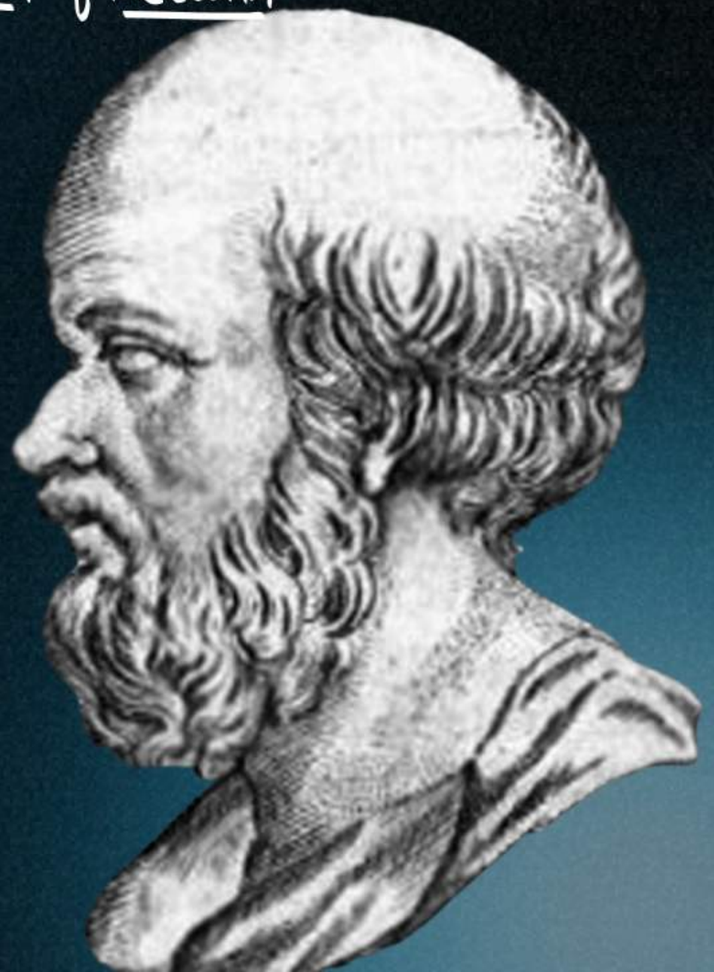
There are variations in its social and cultural feature too.

We can say, The physical environment has provided the stage, on which human societies enacted the drama of their creative skills with the tools and techniques which they invented and evolved in the process of their cultural development.

In very simple words, it can be said that geography is the description of the earth as a abode of human beings.

The term geography was first coined by Eratosthenes.

Greek word Geo (Earth) + Graphos (Description)



Introduction

Geography and its relation with other discipline.

Reality is always multifaceted and the 'earth' is also multi-dimensional.

Many disciplines from natural sciences such as geology, pedology, oceanography, botany, zoology and meteorology and a number of sister disciplines in social sciences such as economics, history, sociology, political science, anthropology, etc. study different aspects of the earth's surface.

Geography ➤ Different from other sciences in its subject matter and methodology but at the same time it is closely related to other disciplines.

Introduction

The geographical phenomena (Physical and Human)

Not static but highly dynamic.

Understand with the help of primitive society and present societies.

Primitive human society

- Directly dependent on their immediate environment.
- Geography, thus, is concerned with the study of Nature and Human interactions as an integrated whole.

Present human society

- Has passed the stage of primitive societies.
- Present societies have modified their natural environment by inventing and using technology and thus, have expanded the horizon of their operation by appropriating and utilising the resources provided by nature.
- Role of technology.

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Introduction

Geography as a discipline is concerned with three sets of questions:

What?

Some questions are related to the identification of the patterns of natural and cultural features as found over the surface of the earth.

Where?

Some questions are related to the distribution of the natural and human/ cultural features over the surface of the earth.

Why?

The third question is related to the explanation or the causal relationships between features and the processes and phenomena.

- **These questions provided inventorised information of what features and where located.**
- **These two questions did not make geography a scientific discipline till the third question was added.**

Relation Between Physical Geography & Natural Sciences

- Traditional physical geography is linked with geology, meteorology, hydrology and pedology (soil=pedos).
- Geomorphology, climatology, oceanography and soil geography respectively have very close links with the natural sciences as they derive their data from these sciences.
- Bio-Geography is closely related to botany, zoology as well as ecology as human beings are located in different locational niches.
- The problem of converting geoids into 2-D can be tackled by projections constructed graphically or mathematically.

Geography and Social Sciences

Every discipline has a philosophy which is raison d'etre (most important purpose: French) for the discipline. All natural and Social sciences have a strong interface with Geography, and all subjects have spatial aspects attached to them.

I Branches of Geography

Approaches to Study Geography



There are mainly two types of approaches to study Geography:

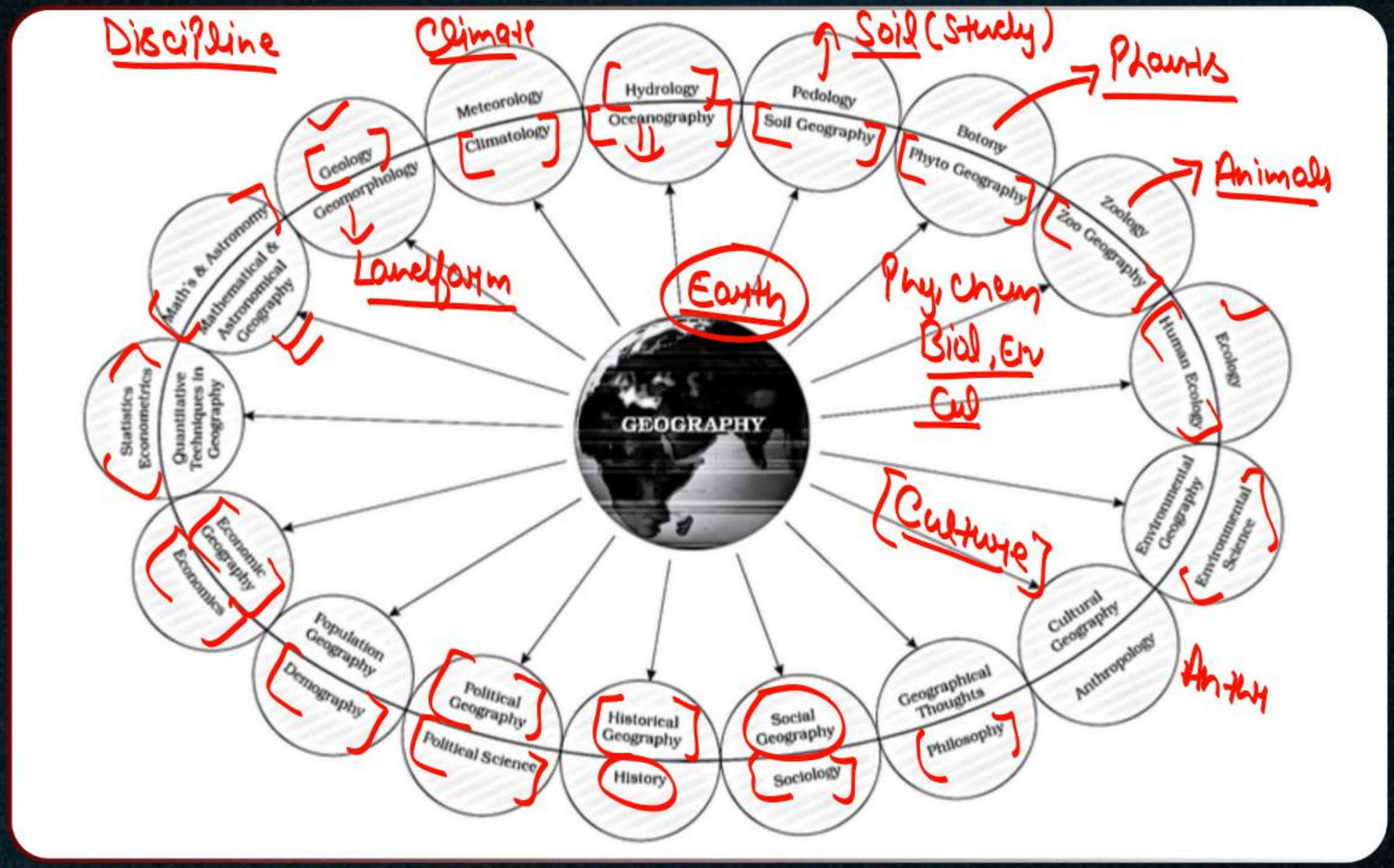
- **Systematic Approach:** This approach is the same as that of general geography. It was introduced by Alexander Von Humboldt (German 1769-1859). A phenomenon studied over the world as a whole, and then identification of topologies or spatial patterns etc.
- **Regional Approach:** Karl Ritter (German 1779-1859): According to the regional approach, the world is divided into regions at different hierarchical levels and then all geographical phenomena in a particular region are studied. These may be natural, political or designated regions. The phenomena in a region are studied in a holistic manner – searching for unifying factors.

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Approaches to Study Geography

Dualism is the main characteristic of geography. Depends the aspect emphasised in the study.



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Branches of Geography (Based on Systematic Approach)

The major approaches to study geography have been

H:W Difference

I. Systematic approach

The systematic geography approach is the same as that of general geography. This approach was introduced by **Alexander Von Humboldt**, a German geographer (1769-1859).

II. Regional approach

Regional geography approach was developed by another German geographer and a contemporary of Humboldt, **Karl Ritter** (1779-1859).

Differences? Explain?

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Branches of Geography (Based on Systematic Approach)

Systematic approach

A phenomenon is studied world over as a whole, and then the identification of typologies or spatial patterns is done.

Explain

Studying natural vegetation

The study will be done at the world level as a first step. The typologies such as equatorial rain forests or softwood conical forests or monsoon forests, etc. will be identified, discussed and delimited.



Alexander Von Humboldt

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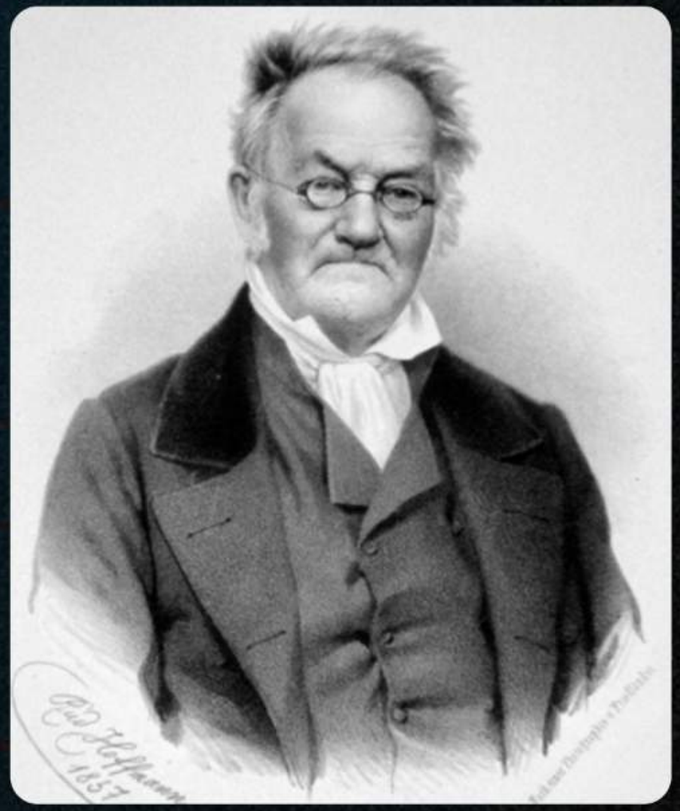
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Branches of Geography (Based on Systematic Approach)

Regional approach

The world is divided into regions at different hierarchical levels and then all the geographical phenomena in a particular region are studied.

These regions may be natural, political or designated region. The phenomena in a region are studied in a holistic manner searching for unity in diversity



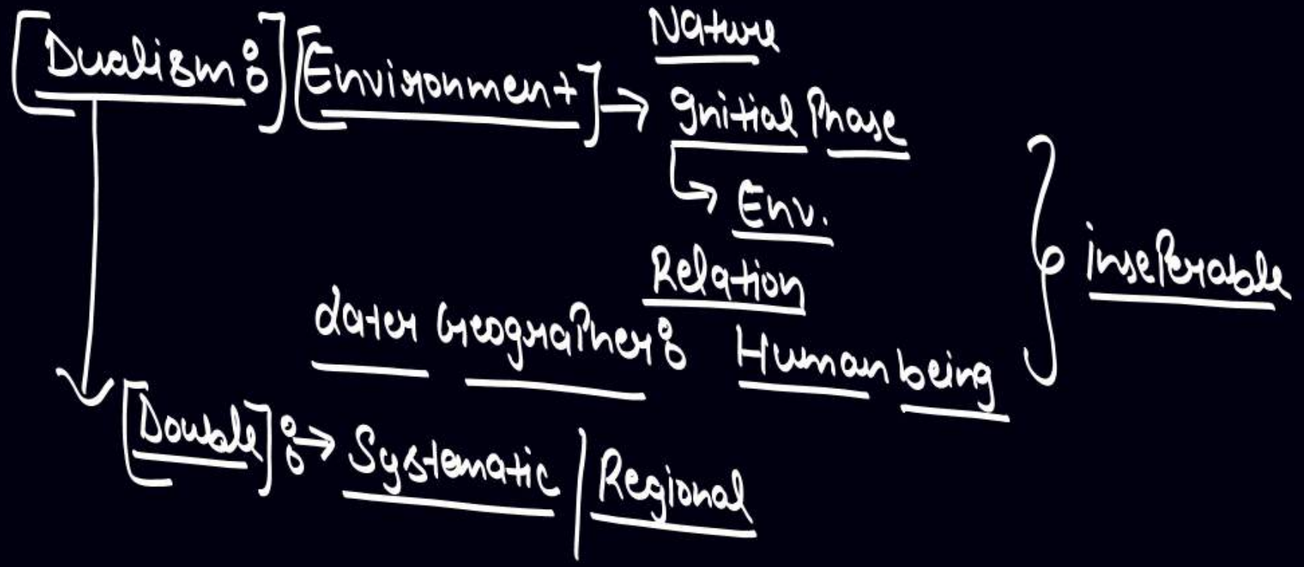
Karl Ritter

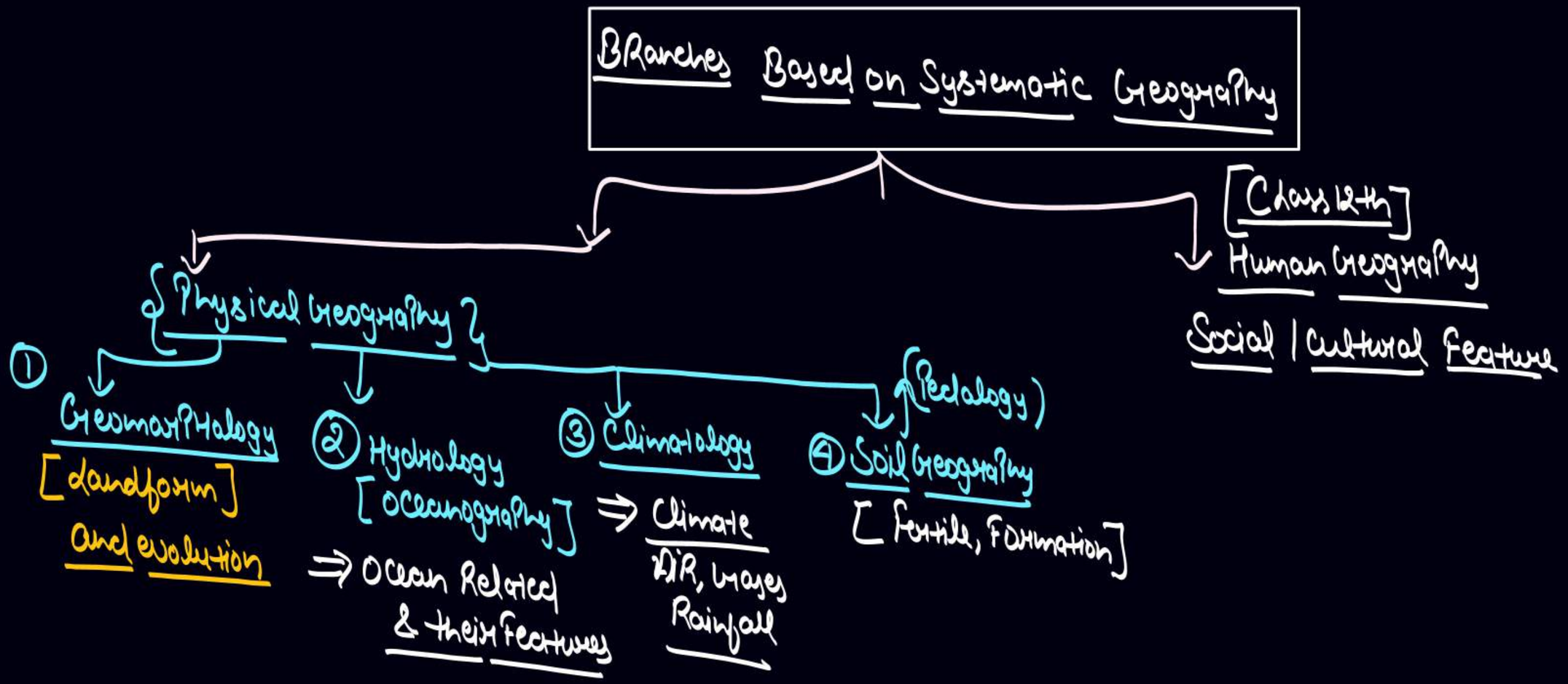
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Branches of Geography (Based on Systematic Approach)

- **Physical Geography:** Includes the study of the lithosphere, Atmosphere, Hydrosphere and Biosphere.
- Geomorphology: devoted to the study of landforms, their evolution and related processes.
- Climatology: Study of the Structure of the atmosphere and elements of weather and climates and climatic types and regions
- Hydrology: Study the Realm of water over the surface of the earth including oceans, lakes, rivers and other water bodies and its effect on different life forms including human life and their activities.
- Soil Geography: a study of the process of soil formation, soil types, their fertility status, distribution and use.


[Dualism of] [Environment] → Nature
Initial Phase
↳ Env.
Relation
dates Geographers & Human being
} inseparable
[Double] of → Systematic / Regional


Branches Based on Systematic Geography
Physical Geography
[Class 12th]
Human Geography
Social / Cultural Feature
①
Geomorphology
[landform]
and evolution
② Hydrology
[Oceanography]
⇒ Ocean Related
& their Features
③ Climatology
⇒ Climate
Wind, Waves
Rainfall
④ Soil Geography
(Pedology)
[Fertile, Formation]

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Branches of Geography (Based on Systematic Approach)

- **Human Geography:** Social/Cultural geography: It is thestudy of society and its spatial dynamics as well as cultural elements contributed by society.
- Population and Settlement Geography: Itstudies population growth, distribution, density, sex ratio, migration, occupational structure etc. Settlement geography studies the characteristics of rural and urban settlements. Demography
- Economic Geography: Studies economic activities of the people indulging agriculture, industry, tourism, trade, transport, infrastructure and services etc.
- Historical Geography: studies the historical processes through which the space gets organised. Every region has undergone some historical experiences before attaining its present-day status. The geographical features also experience temporal changes and these form the concerns of historical geography.

Branches of Geography (Based on Systematic Approach)

- Political Geography: looks at the space from the angle of political events and studies boundaries, space relations between neighbouring political units, delimitation of constituencies, and election scenarios and develops a theoretical framework to understand the political behaviour of the population.

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Branches of Geography (Based on Systematic Approach)

Ye: Branch

- **Biogeography:** It isan interface between physical and human geography.
- Plant Geography: studies the spatial pattern of natural vegetation in their habitat.
- Zoo Geography: Spatial patterns and geographic characteristics of the animal and their habitat.
- Ecology/Ecosystem: scientific study of habitats characteristic of species.
- Environmental Geography: concerns with environmental problems: land degradation, pollution and concerns for conservation.

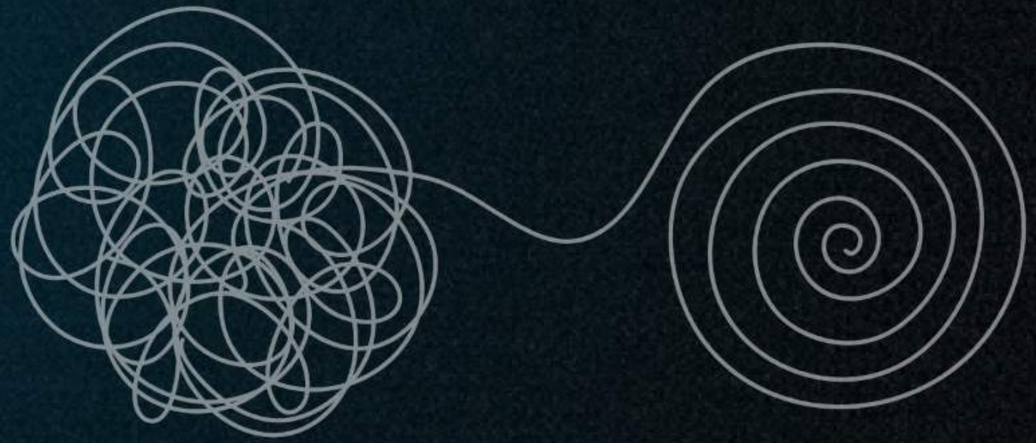
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Branches of Geography (Based on Regional Approach)

Regional Analysis:

- Philosophy:
  - Geographical though
  - Land and Human interaction/Human Ecology



Methods and Techniques

- Cartography including Computer cartography
- Quantitative Techniques/ Statistical techniques
- Field Survey Methods
- Geo-informatics comprising techniques: Remote sensing, GIS, GPS etc.

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Recall systematic approach

Branches of Geography (Based on Systematic Approach)

1. **Physical Geography**
2. **Human Geography**
3. **Biogeography**

Human Geography

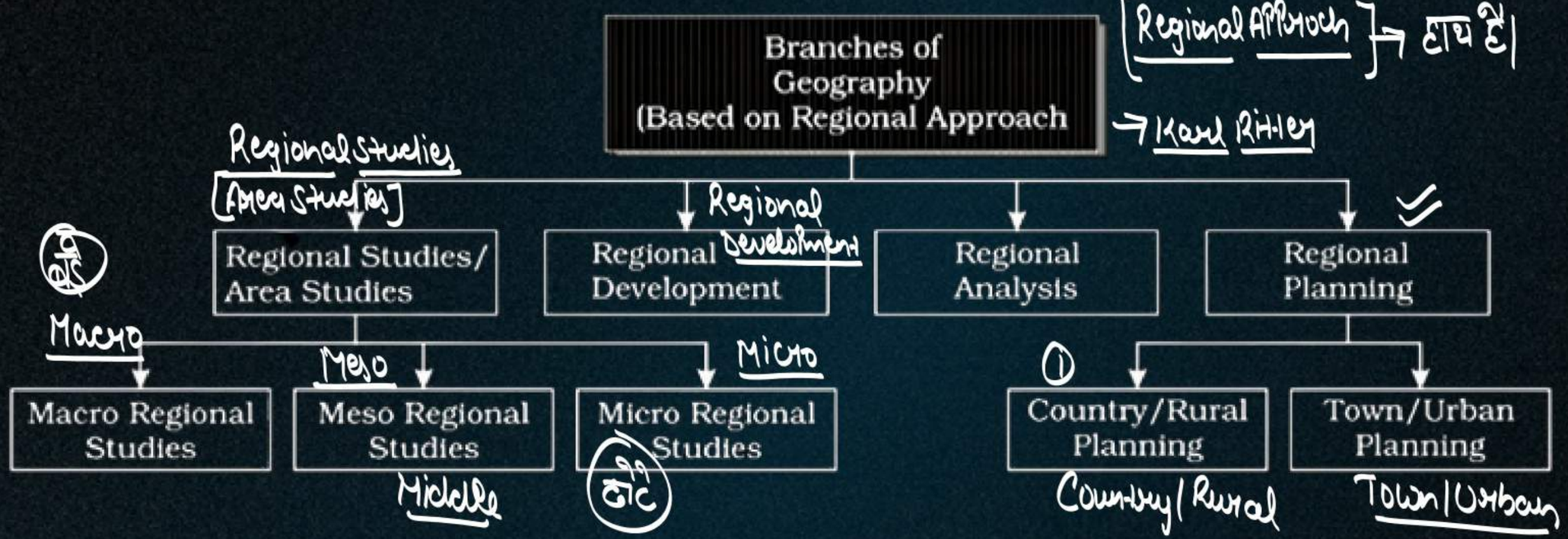
- Social/Cultural Geography encompasses the study of society and its spatial dynamics as well as the cultural elements contributed by the society.
- Population and Settlement Geography (Rural and Urban). It studies population growth, distribution, density, sex ratio, migration and occupational structure etc. Settlement geography studies the characteristics of rural and urban settlements.
- Economic Geography studies economic activities of the people including agriculture, industry, tourism, trade, and transport, infrastructure and services, etc.
- Historical Geography studies the historical processes through which the space gets organised.
- Every region has undergone some historical experiences before attaining the present day status. The geographical features also experience temporal changes and these form the concerns of historical geography.
- Political Geography looks at the space from the angle of political events and studies boundaries, space relations between neighbouring political units, delimitation of constituencies, election scenario and develops theoretical framework to understand the political behaviour of the population.

Biogeography

- The interface between physical geography and human geography has lead to the development of Biogeography which includes:
- Plant Geography which studies the spatial pattern of natural vegetation in their habitats.
- Zoo Geography which studies the spatial patterns and geographic characteristics of animals and their habitats.
- Ecology /Ecosystem deals with the scientific study of the habitats characteristic of species.
- Environmental Geography concerns world over leading to the realisation of environmental problems such as land gradation, pollution and concerns for conservation has resulted in the introduction of this new branch in geography.

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Physical Examency

Q:- What is Physical Geography and it's Importance?

Q:- MCQ: Regional / Systematic [Difference]

Founder

① Ecological Balance

② Soil [Time]
Soil Profile

③ Rain [agriculture]

④ Climate [Type — Cloth
Food
Habitat]

⑤ Temperature & Precipitation → Groundwater (Un Recharge

improve Humandive

V.V.IMP

Geography is concerned with description & explanation of differentiation of Earth's surface

— Richard Hartshorne

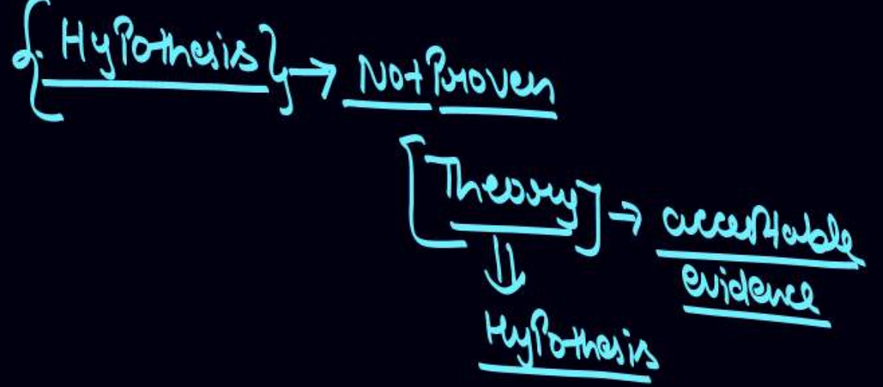
IMP

Hetheno — Geography studies the different phenomena usually related to different part of the Earth

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The Origin and EVOLUTION OF THE EARTH


{Hypothesis} → Not Proven
[Theory] → accountable evidence
Hypothesis

Introduction

hypothesis

Early theories V/S Modern theories

- A large number of hypothesis were put forth by different philosophers and scientists regarding the origin of the earth.

⇒ In 1755, German philosopher Immanuel Kant gave Nebular hypothesis.

Mathematician Laplace revised it in 1796 (Laplace Nebular Hypothesis)

⇒ In 1905, Chamberlain and Moulton gave Planetesimal hypothesis.

Sir James Jeans and Sir Harold Jeffrey supported this arguments. ➤ Tidal hypothesis

Binary theories

⇒ In 1950, Otto Schmidt in Russia and Carl Weizascar in Germany somewhat revised the ' nebular hypothesis'.

Immanuel Kant : Nebular Hypothesis : 'Kant' liquid → solid

Motionless

① Initially a [Primordial Matter] [Exist]

Nebula : → [Cloud of gases]

① Hydrogen & ② Helium

[Cold, Solid, Motionless]

② Rotating Body

③ Disk-shaped

④ Initially (Movement) X NO

⑤ Movement (Rotation)

⑥ 9-Ring [Planet]

Criticisms ⇒
① 9 Planet
② Origin
③ Hot (हुआ कैसा)
④ Rings (9 Planet)

Matematician daPlace (1796) ⇒ ① Revise
↑ Nebula (origin)
↳ जो Mistake
Initial (Immanuel Kant)

① Nebula ⇒ Cold × Hot
② Motionless × Motion
③ Rotatory Body

Immanuel Kant
[9 Ring] → [9 Planet]

Anomaly ⇒
↳ Shape ×
Size ×

Introduction

Nebular Hypothesis

⇓

- Immanuel Kant gave the hypothesis in 1755.
- Nebula : Cloud of dust and gas (Hydrogen and Helium)

⇓

- The hypothesis considered that the planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating.
- Role of gravity.
- Counter argument.



Immanuel Kant

Introduction

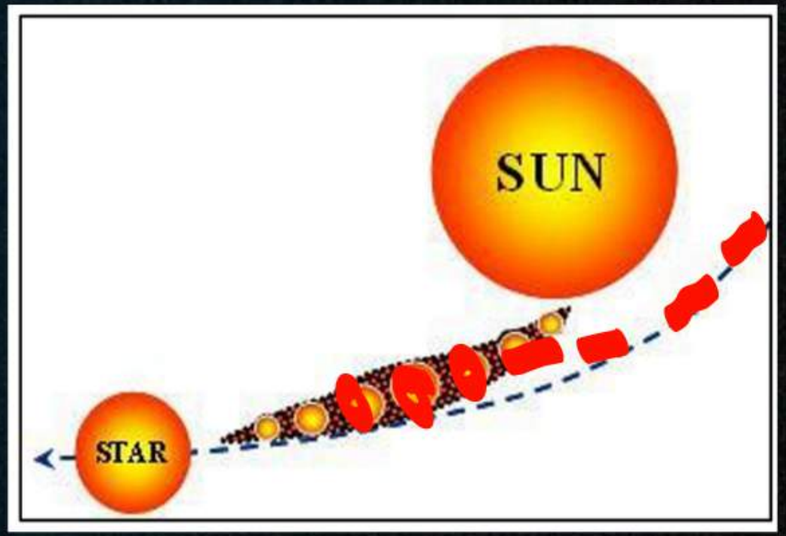
(1900) →

- In 1905, Chamberlain and Moulton gave planetesimal hypothesis.
- Wandering star (intruding star) approached the sun.
- As a result, a cigar-shaped extension of material was separated from the solar surface.
- As the passing star moved away, the material separated from the solar surface continued to revolve around the sun and it slowly condensed into planets.

⇓

Supported by James Jeans and later Sir Harold Jeffrey.

Tidal Hypothesis



Why these theories are known as binary theories?


Nebular Hypothesis
Role (Nebula)
Shift
Planetesimal Hypothesis

Introduction

- In 1950, Otto Schmidt in Russia and Carl Weizascar in Germany somewhat revised the 'nebular hypothesis', though differing in details.

Revise





Particle Collide

⇒ Surrounded by Nebula (hydrogen, helium and dust).

⇓

The friction and collision of particles led to formation of a disk-shaped cloud and the planets were formed through the process of accretion.

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Introduction

Early theories এইগুলা এখন এ্যাবা ✗

⇓

They have shaped our thinking about the origin of planets but these theories are not widely accepted now, hence remained a part of reference.

⇓



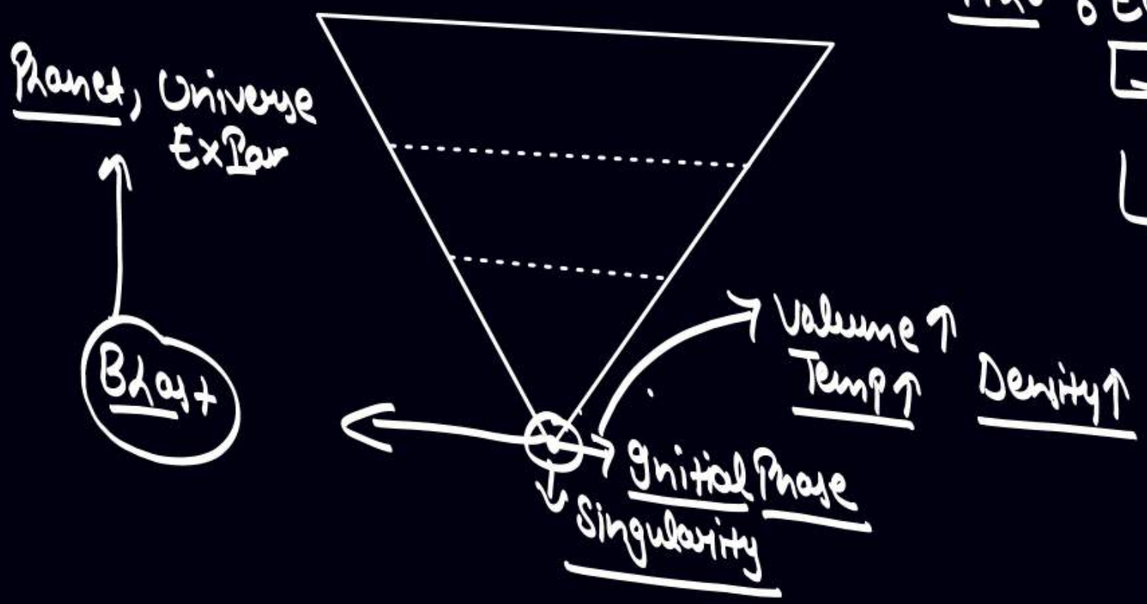
Explains the origin of planets (with assumptions) ✓ ⇒ Not the universe. ✓ ⇒ Solution

However, scientists in later period took up the problems of origin of universe rather than that of just the earth or the planets.

Modern Theories :-> [Origin of Universe] ->

1920 : Edwin Hubble -> Universe Expanding Hypothesis

[Big-Bang Theory] -> Most Acceptable -> U.T, H.Y, Final School



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Physical Features of Earth

The shape of the earth is '**Geoid**' as the earth is slightly flattened at the poles, the linear distance of a degree of latitude at the pole is a little longer than that at the equator.



Theories on Origin of the Earth

Gaseous Hypothesis by Immanuel Kant:

- According to this theory primordial matter existed which was of solid state and gas and (0C) cold. It was motionless in the beginning with no kinetic energy.
- After some time these primordial matter started to collide with each other due to their mutual gravitational attraction, with generated heat and random motion.
- Due to random motion and more heat, the rate of collision increased, increasing rotatory motion, which changed their state from solid to gaseous state.

Theories on Origin of the Earth

Gaseous Hypothesis by Immanuel Kant:

- With heat increasing, the size of the nebula also increased. It started to spin very rapidly and an irregular ring was separated from it, which was later divided into nine-parts. It started spinning too fast that centripetal force exceeded centrifugal force.
- The matter of each ring aggregated at one point to form a core which grew as a planet in due course of time.
- By repetition of the same process rings were separated from newly formed planets and materials separated from them formed satellites.



IMMANUEL KANT

Theories on Origin of the Earth

Significance:

- Kant's hypothesis was the first hypothesis which tried to explain the existence of the universe.
- It paved the way to Laplace's hypothesis.

Nebular Hypothesis of Laplace 1796

- Nebular hypothesis is totally based on Immanuel Kant theory of gaseous hypothesis, but Laplace countered the three main backdraws of Kant's theory with his hypothesis.
- He assumed that there was a huge and hot gaseous nebula in space from the very beginning.
- This nebula was rotating (spinning) on its own axis (opposite to existence of scattered solid particles& gas together).
- Nebula started to cool down from the very beginning due to radiation of heat from its outer surface. It also started contracting due to cooling (explained conservation of angular momentum).
- Due to contraction its angular speed increases and consequently one circular ring separates from the core. These rings further condensed to form planets.

Planetesimal Hypothesis of Chamberlin

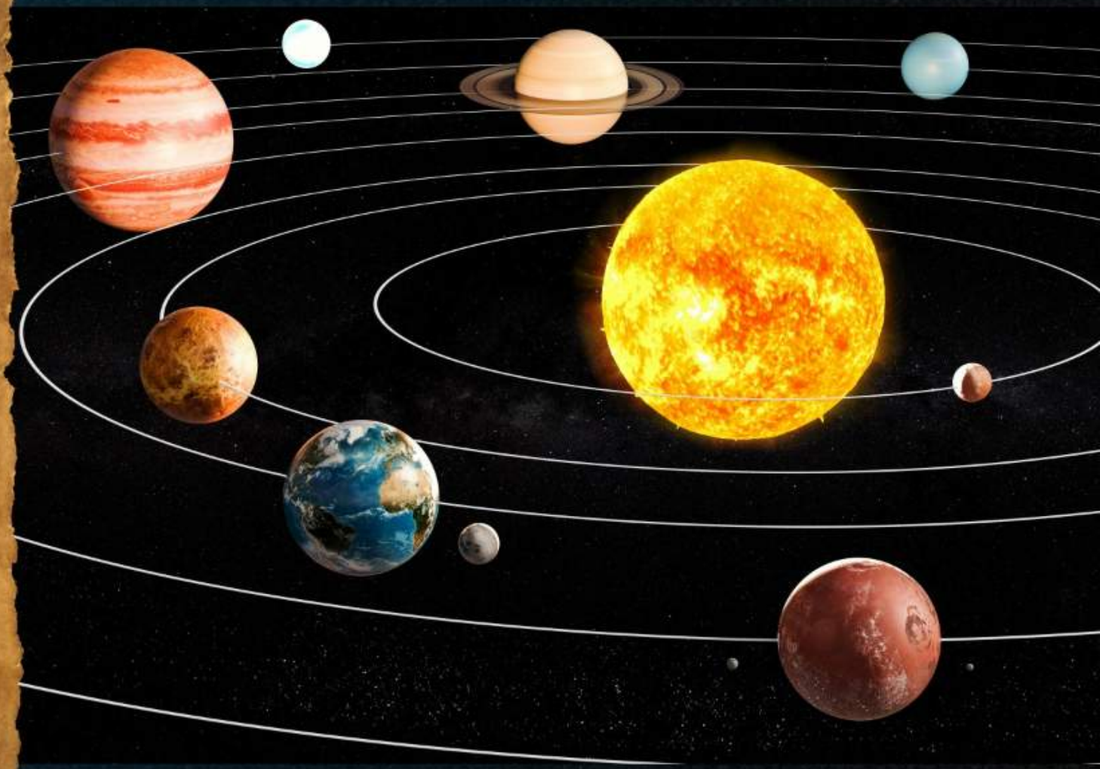
- It was given by T.C Chamberlin and Forest Ray Moulton.
- According to Chamberlin, initially there were

  - Proto sun
  - Companion star Proto Sun - It was formed of very small particles which were cold and solid.
  - Companion star or intruding star - When companion star used to come very close to proto sun, the smaller cold particles of proto sun used to get detached from it due to strong gravitational field of comparison star, these small particles were called planetesimal.

Planetesimal Hypothesis of Chamberlin

Formation of Planets

- When these small planetesimals were detached from the proto sun, the bigger particles started to solidify and hence formed the nucleus for planets. Small planetesimals started to add to the nucleus and grew to form planets.
- External force (cause of ejection) - It was tidal force which was responsible for ejection of cold particles from proto sun.



Formation of Planets

The following are considered to be the stages in the development of planets:

- (i) The stars are localised lumps of gas within a nebula. The gravitational force within the lumps leads to the formation of a core to the gas cloud and a huge rotating disc of gas and dust develops around the gas core.
- (ii) In the next stage, the gas cloud starts getting condensed and the matter around the core develops into smallrounded objects. These small-rounded objects by the process of cohesion develop into what is called planetesimals. Larger bodies start forming by collision, and gravitational attraction causes the material to stick together. Planetesimals are a large number of smaller bodies.
- (iii) In the final stage, these large number of small planetesimals accrete to form a fewer large bodies in the form of planets.

Planetesimal Hypothesis of Chamberlin

Evolution of Earth and other Planets

- Some planetesimals vanished after disassociation from proto sun. Others remained near it and started revolving around. The companion star vanished into space Gradual disposition of small particles formed the planets and the Earth.

Planetesimal Hypothesis of Chamberlin

Evolution of Earth's atmosphere

- When Earth grew in size it became successful in capturing free atmospheric molecules.
- Occluded gases of planetesimals captured by the nucleus of the earth provided CO2, H2O, and N2.
- Volcanic eruptions provided oxygen.

Planetesimal Hypothesis of Chamberlin

Origin of heat

- **There were three main reasons due to which heat was produced according to Chamberlin:**
- Due to mutual collision of planetesimals.
- Due to increase in pressure, due to increase in size.
- Due to molecular reaction.

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Big-Bang Theory

Big-Bang theory was based on evidence received from COBE (Cosmic Background Explorer).It explained that the universe contained many millions of galaxies, each galaxy having thousands of stars and each star having planets around them.

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Big-Bang Theory

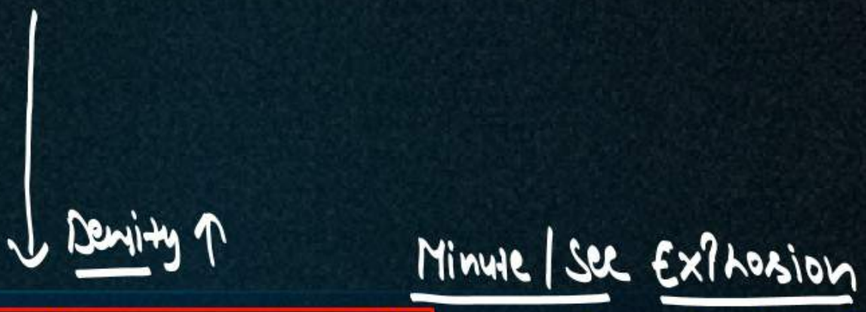
Theory:

- A Belgian priest named Georges Lemaitre first suggested the big bang theory in the 1920s, when he theorized that the universe began from a single primordial atom. The idea received major boosts from Edwin Hubble's observations that galaxies are speeding away from us in all directions, as well as from the 1960s discovery of cosmic microwave radiation—interpreted as echoes of the big bang—by Arno Penzias and Robert Wilson.

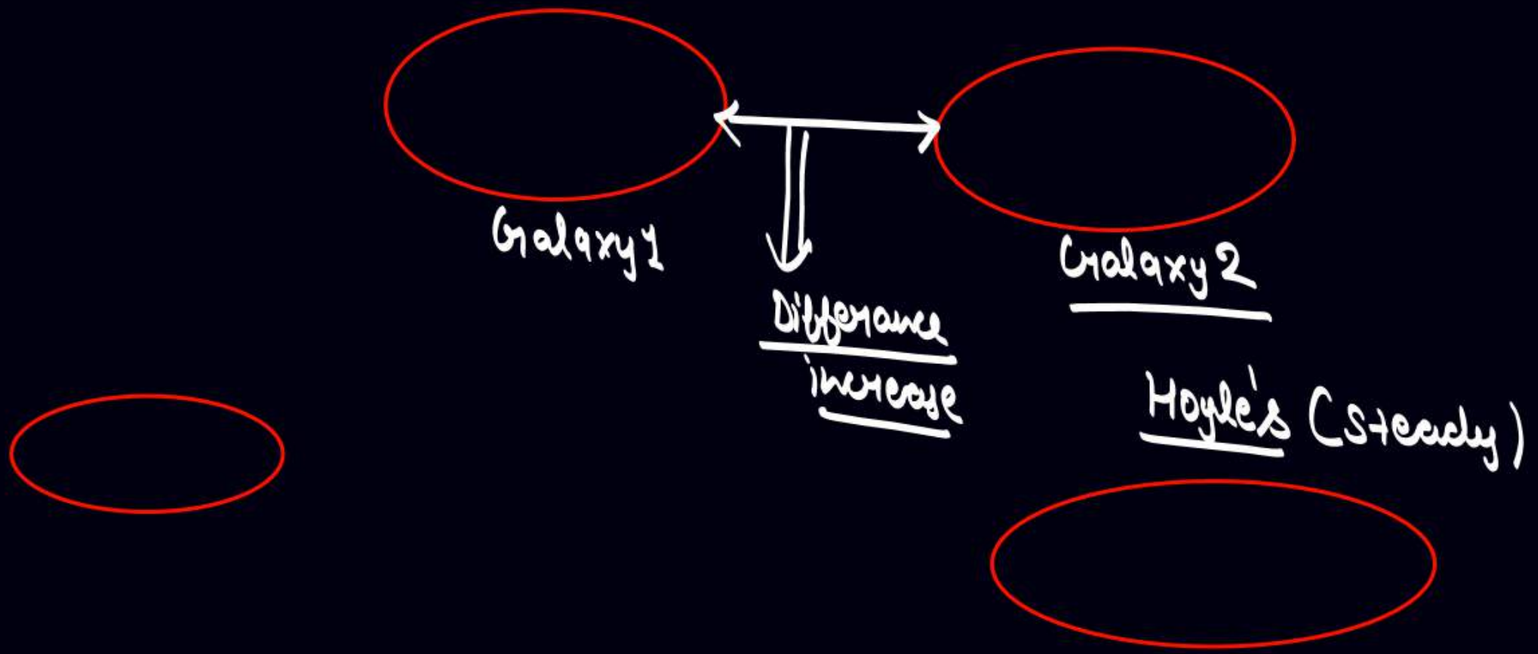
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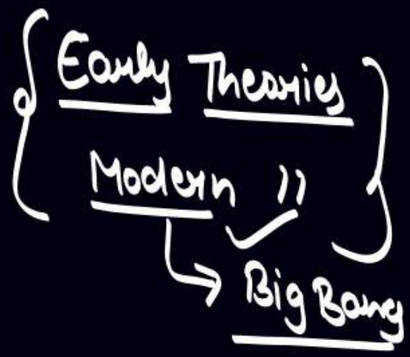
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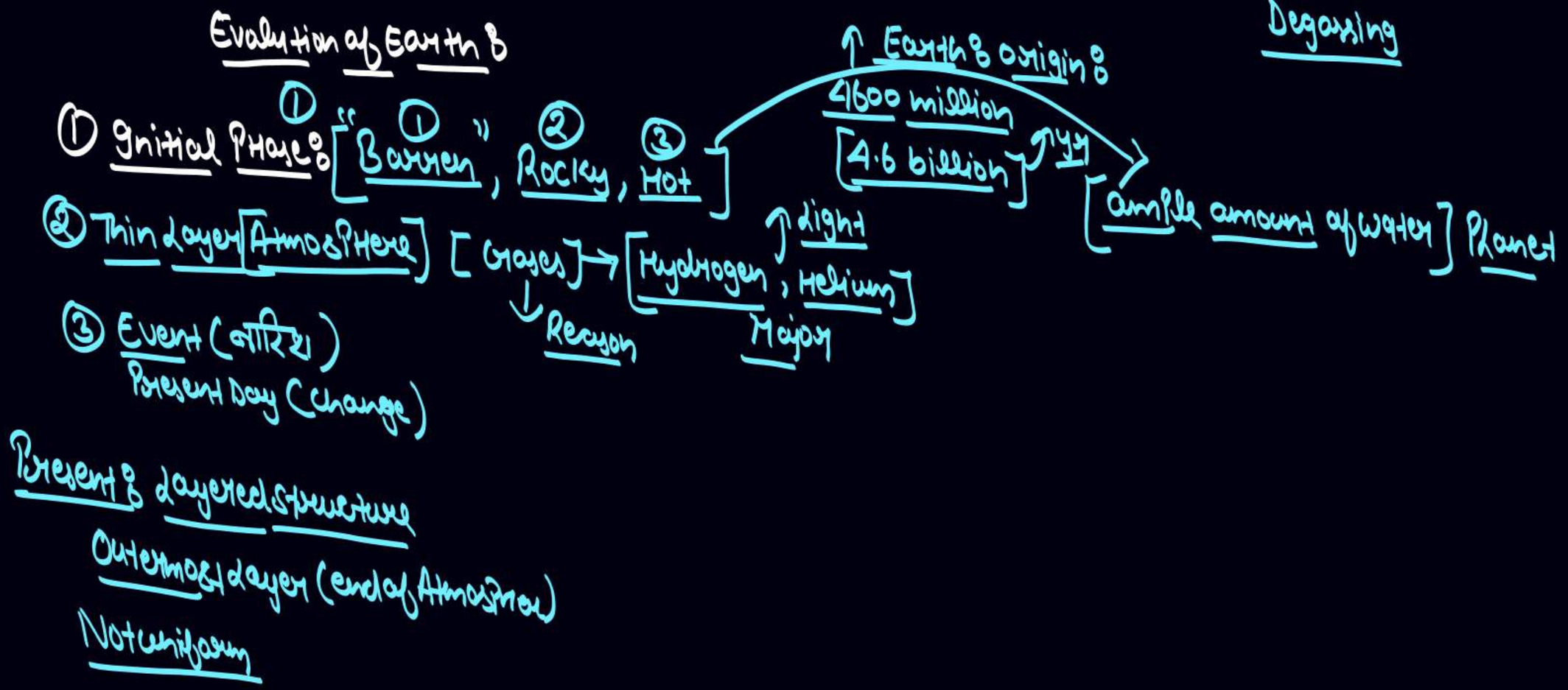
Big-Bang Theory



- In the beginning, all matter forming the universe existed in one place in the form of a “tiny ball” (singular atom) with an unimaginably small volume, infinite temperature and infinite density.
- At the Big Bang the “tiny ball” exploded violently. This led to a huge expansion. It is now generally accepted that the event of big bang took place 13.7 billion years before the present. The expansion continues even to the present day. As it grew, some energy was converted into matter. There was particularly rapid expansion within fractions of a second after the bang. Thereafter, the expansion has slowed down. Within first three minutes from the Big Bang event, the first atom began to form.
- Within 300,000 years from the Big Bang, temperature dropped to 4,500K (Kelvin) and gave rise to atomic matter. The universe became transparent.


Galaxy 1
Galaxy 2
Difference increase
Hoyle's (Steady)


Early Theories
Modern
Big Bang


Evolution of Earth
① Initial Phase
① "Barren"
② Rocky
③ Hot
↑ Earth's origin
4600 million
4.6 billion
yr
Degassing
ample amount of water
Planet
② Thin layer Atmosphere
Gases
Reason
Hydrogen, Helium
Major
light
③ Event (घटना)
Present Day (change)
Present's layered structure
Outermost layer (end of Atmosphere)
Not uniform

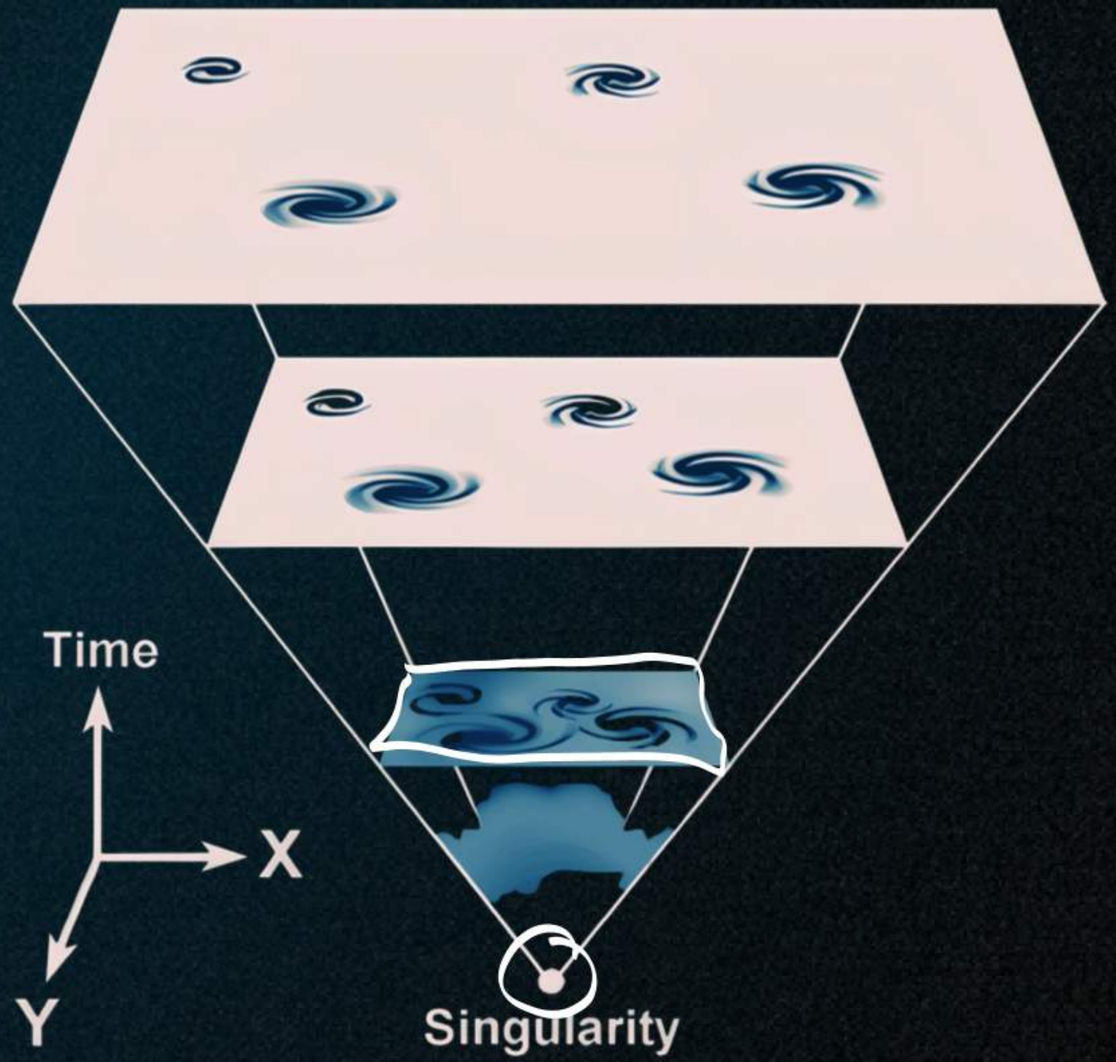
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Big-Bang Theory

[Explosion:]

CBSE:
- Method ≡
- Mold ≡ X
- रटना



Formation of Moon

Modern theory

Modern theory states that formation of moon is the recent of giant impact or big splat. Shortly after formation of Earth a body of mass equivalent to three times the mass of Mars collided with the Earth which led to formation of the Moon. During the formation of moon earth was slightly heated. It happened due to the process of differentiation. The earth forming material turned into a different layer.

Solar System

- Our solar system consists of our star, the Sun, and everything bound to it by gravity — the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune, dwarf planets such as Pluto, dozens of moons and millions of asteroids, comets and meteoroids. The solar system also includes the Kuiper Belt that lies past Neptune's orbit. And beyond the fringes of the Kuiper belt is the Oort Cloud. This giant spherical shell surrounds our solar system.
- Solar system consists of the sun (the star), 8 planets, moons, millions of smaller bodies like asteroids and comets and huge quantities of dust-grains and gases.

Solar System

- Alternatively, the irstfour are called **Terrestrial**, meaning earth-like as they are made up of rock and metals, and have relatively high densities. The rest four are called **Jovian or Gas Giant planets**. Jovian means Jupiter like. Most of them are much larger than the terrestrial planets and have a thick atmosphere, mostly of helium and hydrogen.
- All the planets were formed in the same period sometime about 4.6 billion years ago.

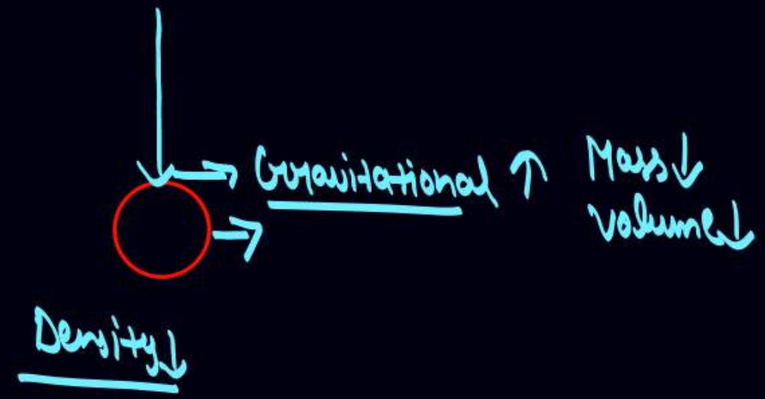
Density ↑ Gravitational Force ↑

The Star Formation

Initial Earth / universe Density

- The distribution of matter and energy was not even in the early universe. These initial density differences gave rise to differences in gravitational forces and it caused the matter to get drawn together. These formed the bases for development of galaxies. A galaxy contains a large number of stars. Galaxies spread over vast distances that are measured in thousands of light-years. The diameters of individual galaxies range from 80,000-150,000 light years. A galaxy starts to form by accumulation of hydrogen gas in the form of a very large cloud called nebula. Eventually, growing nebula develops localised clumps of gas. These clumps continue to grow into even denser gaseous bodies, giving rise to formation of stars. The formation of stars is believed to have taken place some 5-6 billion years ago.

4.6


Gravitational ↑
Mass↓
volume↓
Density↓

The Star Formation

9.461 × 10^{12} km

- A light year is a measure of distance and not of time. Light travels at a speed of 300,000 km/second. Considering this, the distances the light will travel in one year is taken to be one light year. This equals to 9.461×1012 km. The mean distance between the sun and the earth is 149,598,000 km. In terms of light years, it is 8.311minutes.



light 1 साल में travel
↓ ↓
3 lakh/sec 1 light year



→ Large Body

{Formation of Planet}

Formation of Planet

① Stars ⇒ localised dump of Gases. [With Nebula] → Gases (मिलकर)
[Gases Mixed]

② ⇒ [Gravitational Force ↓  Depth ↓ Dust cloud  Rotating Disc → Cohesion force

[Core] → Develop

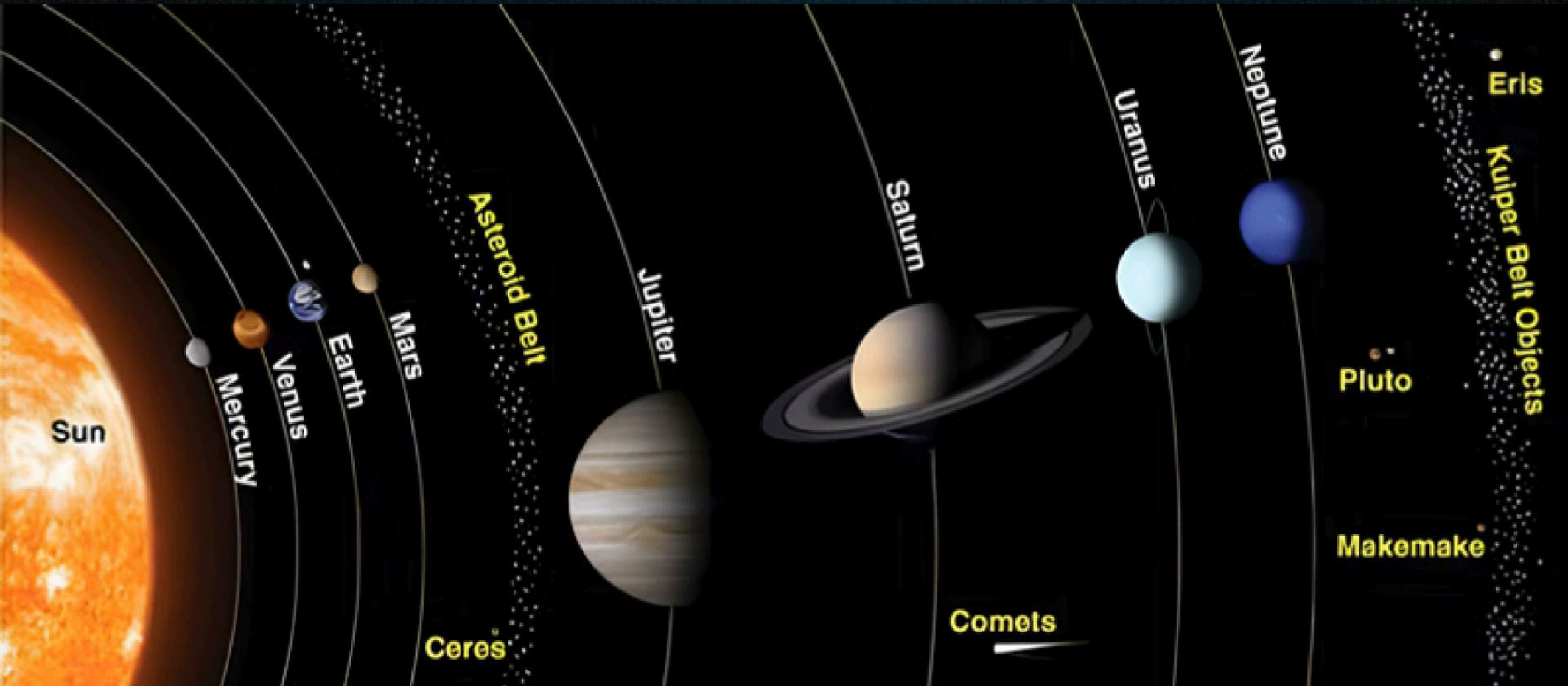
③ Gases cloud (condense) → Matter → Cohesion ⇒ Process (Planetismal) → Planet Formation

④ Small Planetismal Bodies ↑accretion accumulate to form large Bodies which are called as Planets.

↓

Large Bodies

Structure


Sun
Mercury
Venus
Earth
Mars
Asteroid Belt
Ceres
Jupiter
Saturn
Uranus
Neptune
Eris
Kuiper Belt Objects
Pluto
Makemake
Comets

Structure

- Meanwhile, materials we are used to seeing as ice, liquid or gas settled in the outer regions of the young solar system. Gravity pulled these materials together, and that is where we find gas giants Jupiter and Saturn and ice giants Uranus and Neptune.

Moons

- There are more than 150 known moons in our solar system and several more awaiting confirmation of discovery. Of the eight planets, Mercury and Venus are the only ones with no moons. The giant planets grab the most moons. Jupiter and Saturn have long led our solar system's moon counts. Pluto, smaller than our own moon, has five moons in its orbit, including the Charon, a moon so large it makes Pluto wobble. Even tiny asteroids can have moons. In 2017, scientists found asteroid 3122 Florence had two tiny moons.

Planets

Interesting Planet Facts

- Mercury – The smallest and fastest planet, it zips around the Sun in only 88 Earth days.
- Venus – Venus' thick atmosphere makes it the hottest planet in our solar system.
- Earth – The only planet in our solar system with liquid water on the surface.
- Mars – Mars was a wet and warm planet billions of years ago.
- Jupiter – The largest planet, its dark red spot is a storm larger than Earth.

Planets

Interesting Planet Facts

- Saturn – Saturn has the brightest, most massive and most complex ring system of any planet.
- Uranus – Uranus is tipped on its axis by almost 90-degrees.
- Neptune – Neptune was the first planet discovered through mathematical calculations, rather than observation.

Facts About Solar System

By size

- Small planets: Mercury, Venus, Earth, Mars. (The small planets have diameters less than 13000 km.)
- Giant planets: Jupiter, Saturn, Uranus and Neptune. (The giant planets have diameters greater than 48000 km. The giant planets are sometimes also referred to as gas giants.)

Facts About Solar System

By position relative to the Sun

- Inner planets: Mercury, Venus, Earth and Mars.
- Outer planets: Jupiter, Saturn, Uranus, Neptune.
- The asteroid belt between Mars and Jupiter forms the boundary between the inner solar system and the outer solar system.

Facts About Solar System

By position relative to Earth

- Inferior planets: Mercury and Venus. (Closer to the Sun than Earth. The inferior planets show phases like the Moon's when viewed from Earth.)
- Superior planets: Mars to Neptune. (Farther from the Sun than Earth. The superior planets always appear full or nearly so.)

Tidal Hypothesis

- The solar system was formed from the sun and another intruding star.
- In the beginning the sun was a big incandescent gaseous mass of matter.
- Beside the sun there was another star bigger than the sun called the intruding star.
- The primitive sun was stationary and was rotating on the axis and the primitive star was moving around the sun in such a way that it was destined to come near it.
- There was a great impact of the tidal force of the intruding star on the surface of the primitive sun.
- James Jeans postulated that the massive gravitational force of an intruding star forced the material of the primitive sun to come out which became the building materials of the future planet.

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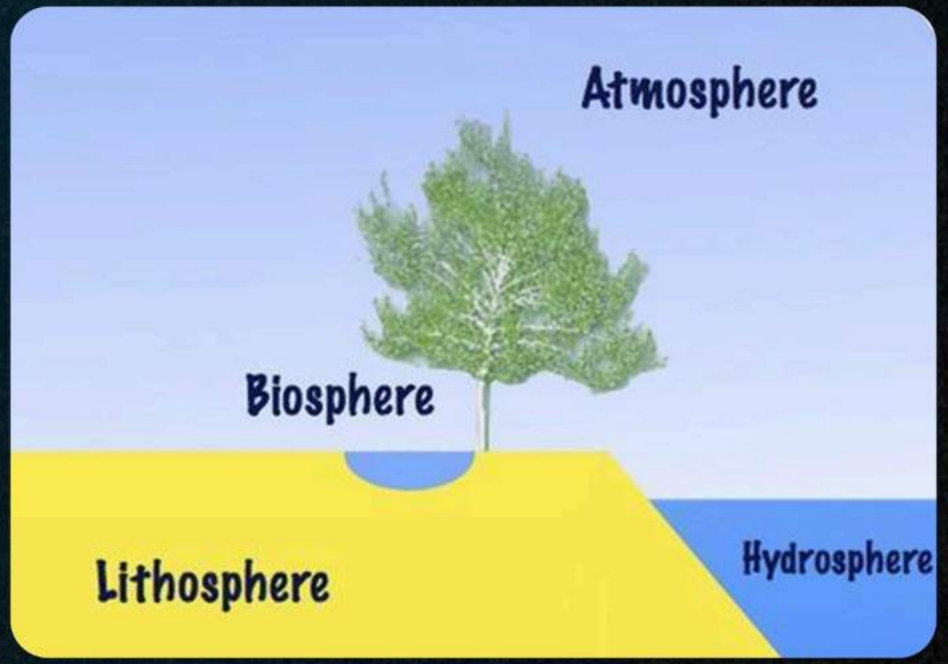
Next Toppers

Evolution of the Earth

Earth

Lithosphere | Atmosphere | Hydrosphere

Evolution



BACKLOG MARATHON SERIES

Next Toppers

Evolution of Lithosphere

Earth ⇒ In its primordial stage.

⇓

Volatile state

} **Explain**

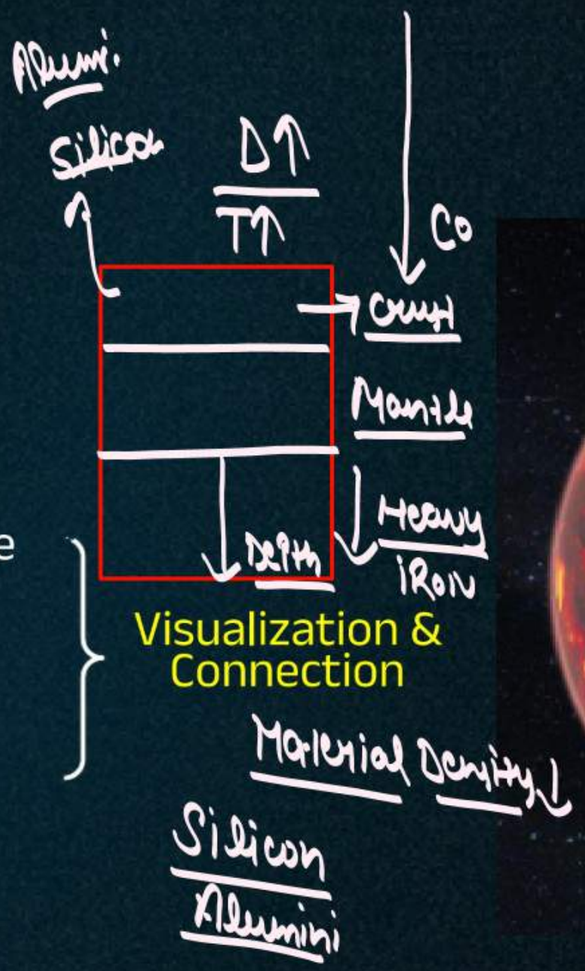
- Due to gradual increase in density the temperature inside has increased.
- As a result the material inside started getting separated depending on their densities.

⇓

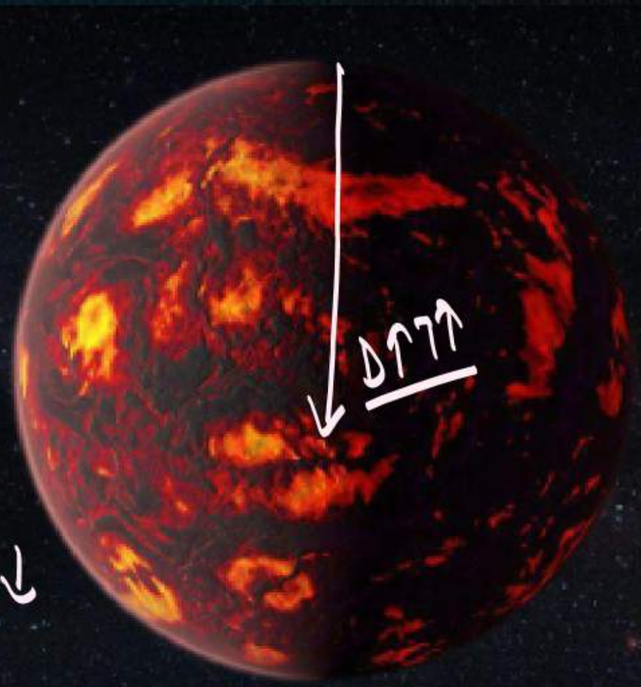
Impact

⇓

This allowed heavier materials (like iron) to sink towards the centre of the earth and the lighter ones to move towards the surface.



Visualization & Connection



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Next Toppers

Evolution of Lithosphere

Time ⇒ [Cooling] ⇒ [Solidification] ⇒ [Condensation into small size.]

Development of outer surface (crust).



Crust → Lithosphere

Solid Lithosphere

Mantle Upper Portion Weak

Asthenosphere Liquid

Solid

गर्म → ठंडी

ठंडी Solid

Magma

Liquid

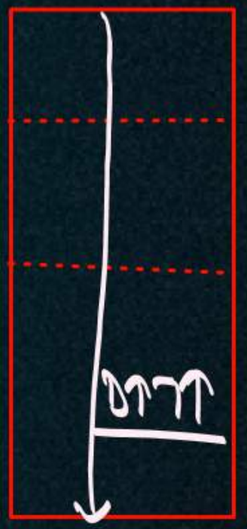
Evolution of Lithosphere

Chang es in Lithosphere during the formation of moon

- Earth was further heated up.

Process of differentiation

- The earth forming material got separated into different layers.
- We have layers like the crust, mantle, outer core and inner core.
- From the crust to the core, the density of the material increases.



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Next Toppers

Evolution of Atmosphere and Hydrosphere

Atmosphere



Hydrosphere



Evolution of both the sphere is interrelated.

⇓

Explain

- The present composition of earth's atmosphere is chiefly contributed by nitrogen and oxygen.

⇓

Is it same since beginning?

Evolution of Atmosphere and Hydrosphere

- There are three stages in the evolution of the present atmosphere.

First stage

- The first stage is marked by the loss of primordial atmosphere.
- Hydrogen and Helium (early atmosphere)
- Stripped off as a result of the solar winds.



Evolution of Atmosphere and Hydrosphere

Second stage

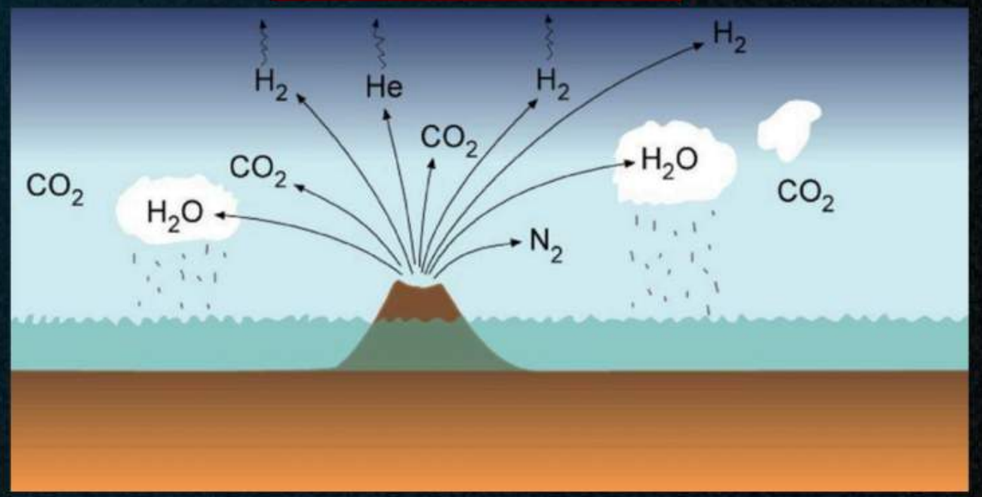
- In the second stage, the hot interior of the earth contributed to the evolution of the atmosphere.

Hot interior ⇒ Cooling process ⇒ **Gases and water vapour were released from the interior solid earth.**

⇓

⇐ **Degassing**

The early atmosphere largely contained water vapour, nitrogen, carbon dioxide, methane, ammonia and very little of free oxygen. The process through which the gases were outpoured from the interior is called degassing.



[Composition of Atmosphere]

[Process of Photosynthesis.]

Early Atm [Hydrogen, Helium]

CO_2 → Atmosphere ← T.L

↓

Dissolved

[Rainwater]

[Deposition] → ocean

Earth's ocean

500 million yrs

4000 million - 3800 million

[Origin of life]

① Modern Scientist's Chemical Reaction

① [Complex Organic Molecule]
⇓
একত্রিত (assemble)

Convert

3000 Million yr.

3800 million (life)

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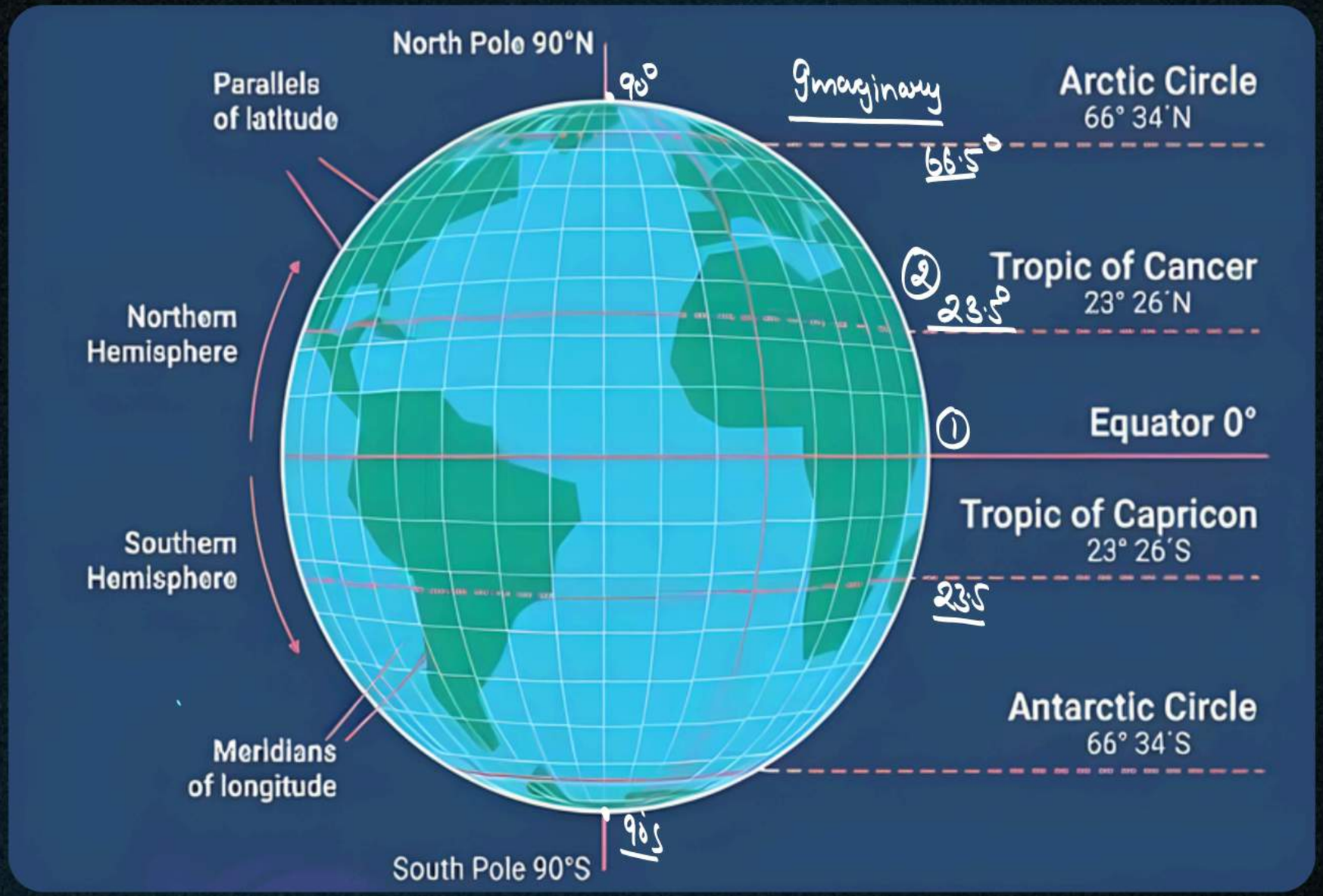
Next Toppers

50sec 5Min

India - LOCATION

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Next Toppers

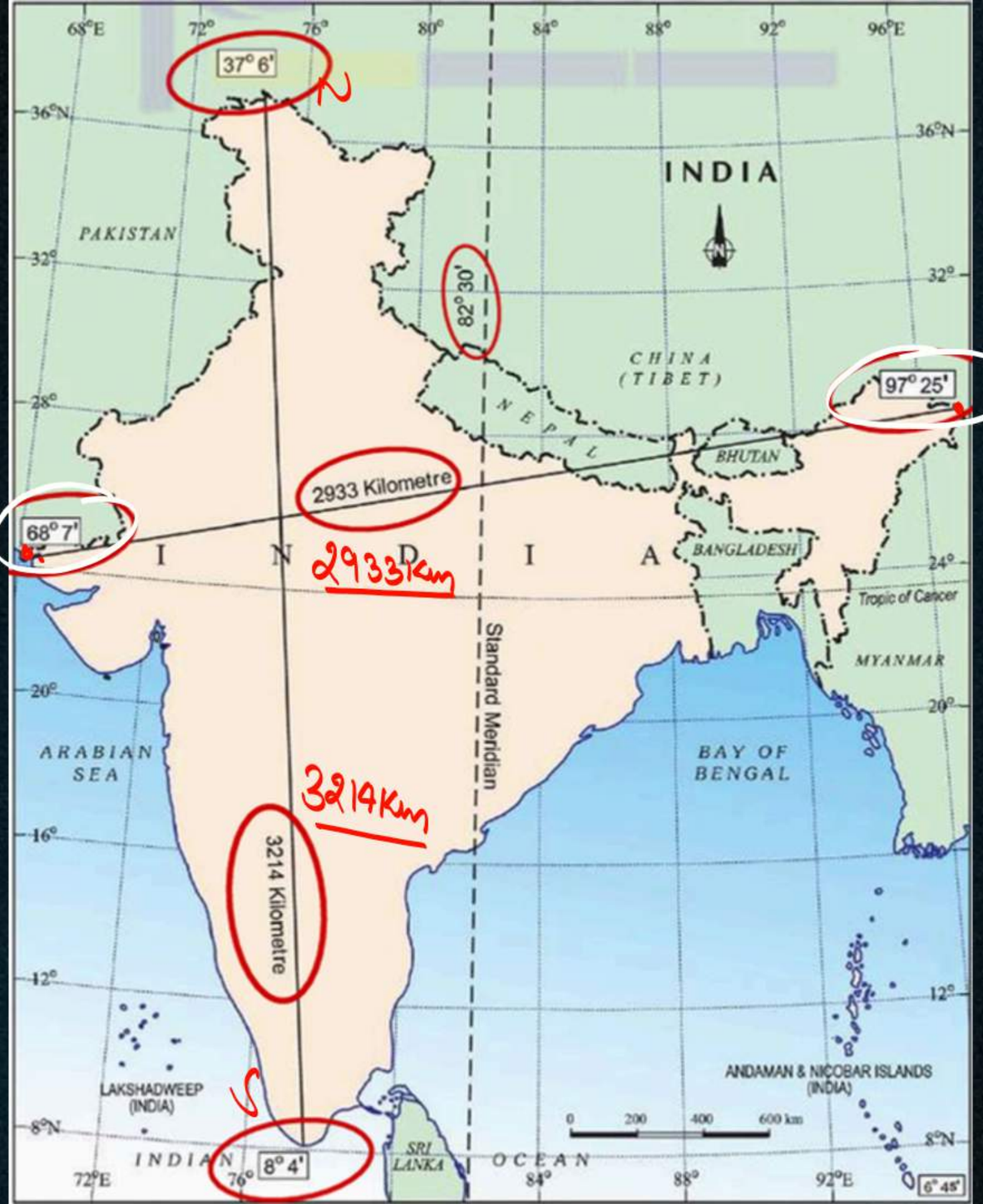


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Next Toppers

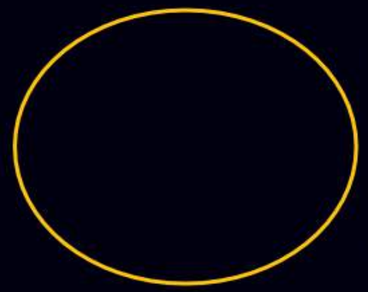
Total length
15,200km

30° Degree



India latitude: 8° 4' 37° 6' N

Longitude: 68° 7' — 97° 25' E



~~30~~ 15°
~~180~~
~~360°~~
~~24 hr~~
~~12~~ ~~2~~

1 hr = 15°

60 min = 15°

1° = Min ?

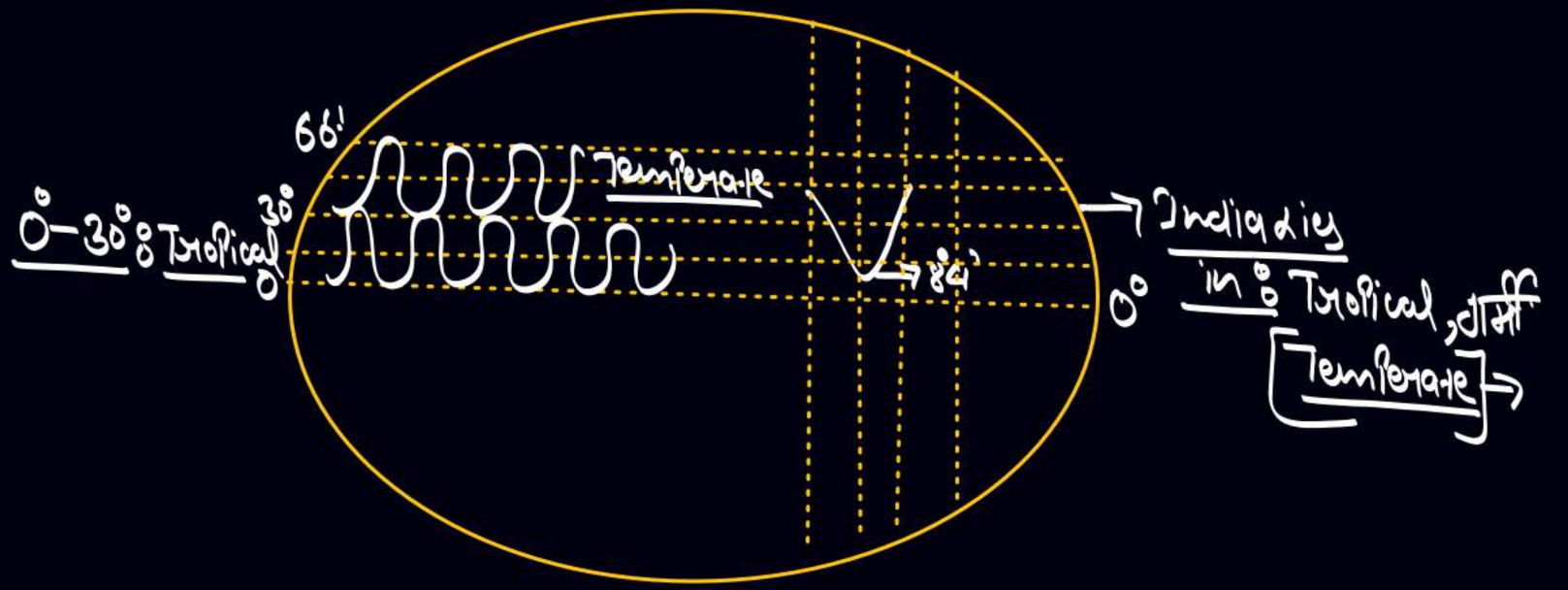
$\frac{60}{15}$ = 4 min

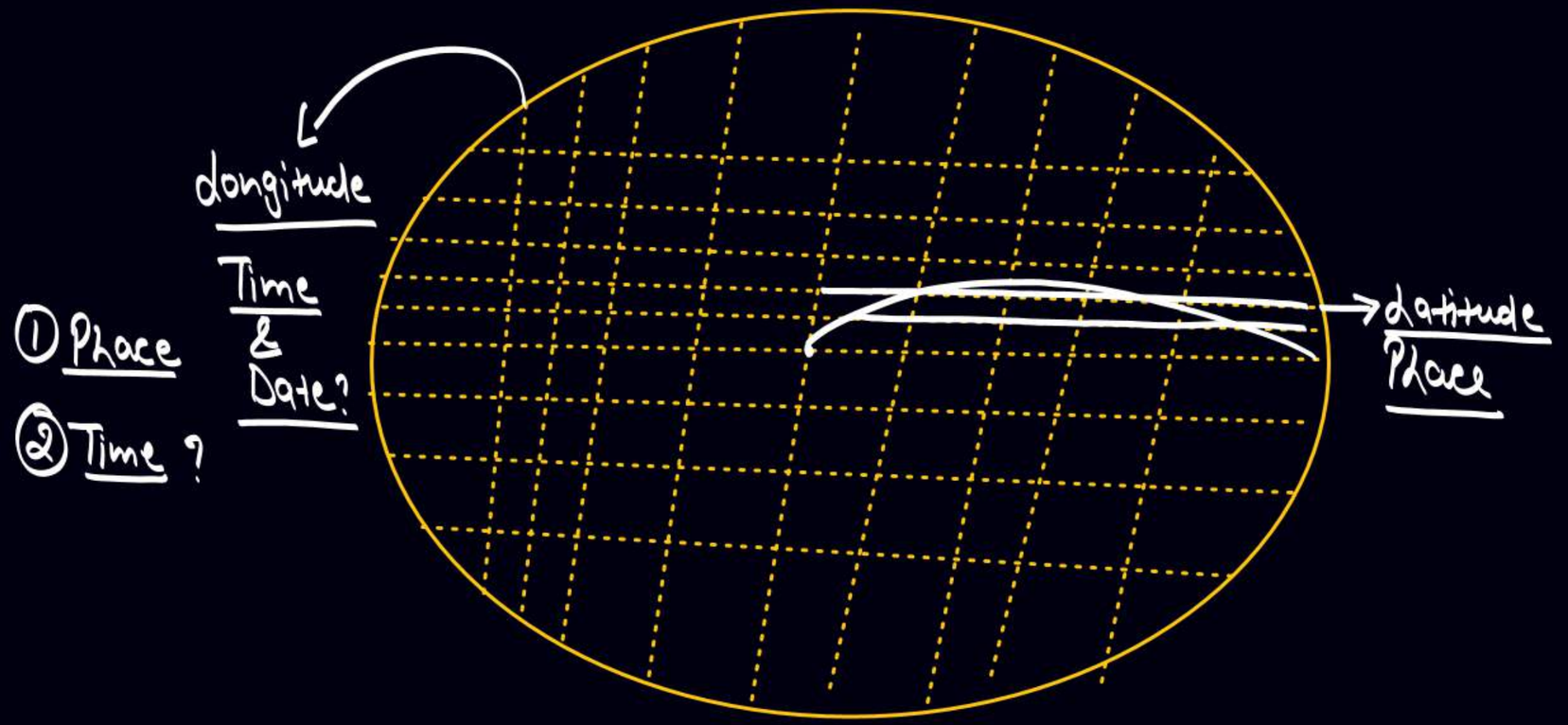
2 hr = 30°

1° = 4 min

Greenwich / Arunachal

2 hr (earth / axis)


66½°
Temperate
0°–30° Tropical
30°
84°
0°
Indian dry
in Tropical, तापमी
Temperate


dongitude
Time
&
Date?
① Place
② Time ?
dattitude
Place

BACKLOG MARATHON SERIES

Next Toppers

Introduction

- The mainland of India, extends from Kashmir in the north to Kanniyalaumari in the south.
- Arunachal Pradesh in the east to Gujarat in the west.
- India's territorial limit further extends towards the sea upto 12 nautical miles (about 21.9km) from the coast.

Statute mile = 63,360 inches

Nautical miles = 72,960 inches

1 Statute mile = about 1.6 km (1.584 km)

1 Nautical mile = about 1.8 km (1.852 km)

Introduction

- Latidunal and longitudinal extent of India, they are roughly about 30 degrees.
- Whereas the actual distance measured from north to south extremity is 3,214 km, and that's from east to west is only 2,933 km.

From the values of latitude, it is understood that

- The southern part of the country lies within the tropics .
- The northern part lies in the sub tropical zone or the warm temperate zone .

This location is responsible for large variations in large forms, climate, soil types and natural vegetation in the country .

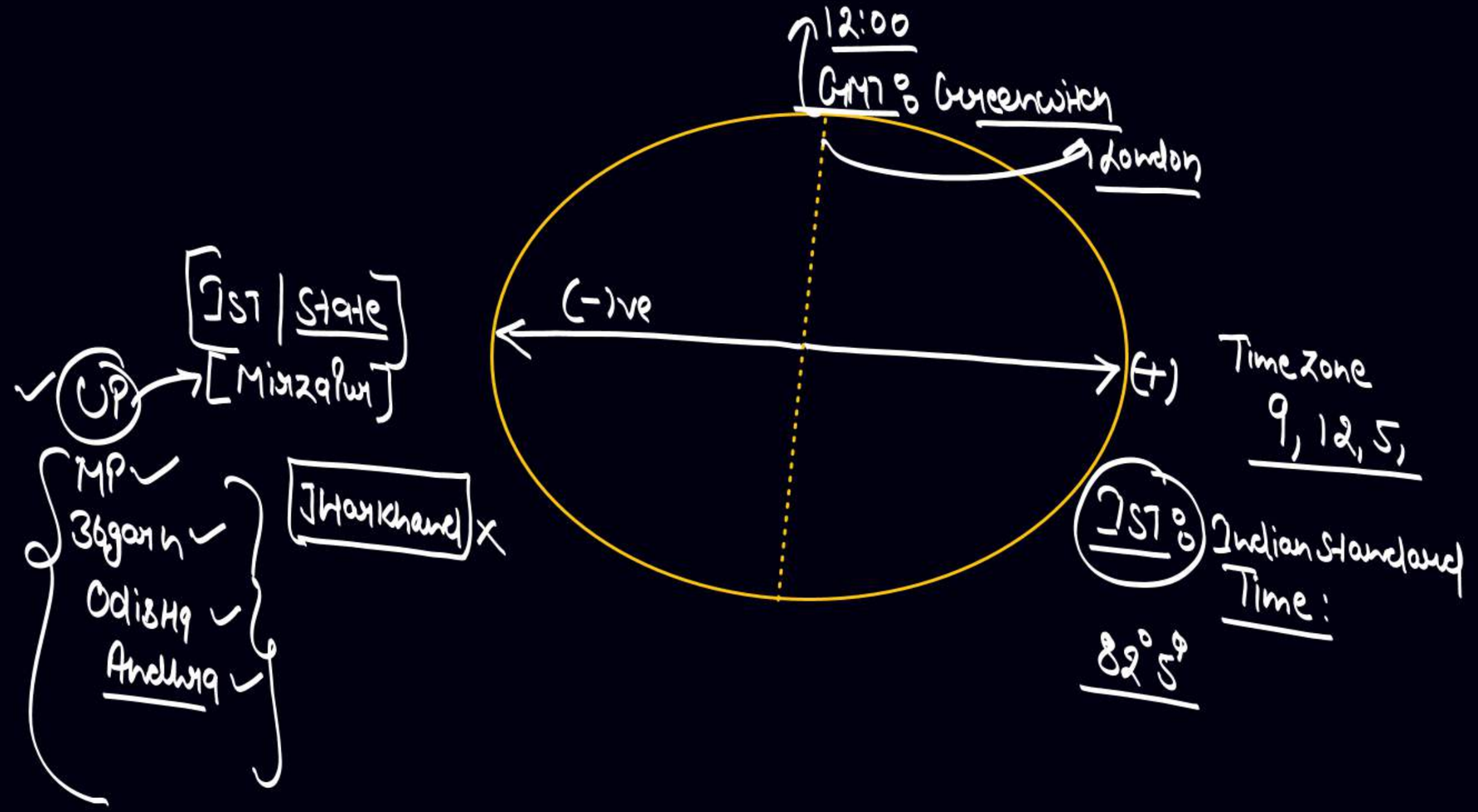
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Next Toppers

Time Difference

While the Sun rises in the northeastern state about two hours earlier as compared to Jaisalmer, the watches in Dibrugarh, Imphal in the east and Jaisalmer, Bhopal or Chennai in the other parts of India show the same time.




12:00
GMT
Greenwich
London
IST | State
UP
Mirzapur
(-)ve
(+)
Time zone
9, 12, 5,
MP
Bihar
Odisha
Andhra
Jharkhand
IST
Indian Standard Time:
82° 5'

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Next Toppers

Concept of IST and GMT

GMT (Greenwich Mean Time)

IST (Indian Standard Time)

IST is based on longitude 82.5°, which Passes through Mirzapur, near Allahabad in Uttar Pradesh.

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Next Toppers

India in the World

- India has area of 3.28 million sq.km.
- Accounts for 2.4% of the world's land surface area.
- Stands as the Seventh largest country in the world.

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Next Toppers

India in the World

10 largest Russia Countries

Area:

Pop: China
India

1. Russia
2. Canada
3. USA
4. China
5. Brazil
6. Australia
7. India
8. Argentina

Messi ♡

Kazakhstan

Sudan

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Next Toppers

India Size

The Size of India has endowled her with great physical diversity.

- Mountains ①
- Rivers ②
- Green forested hills ③
- Plateau ④
- Deserts ⑤
- Passes ⑥



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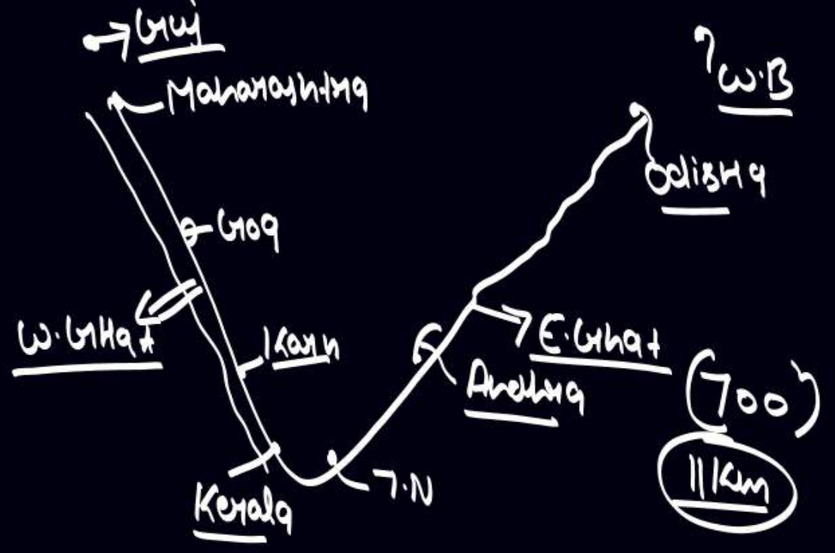
Next Toppers

India Size

India is Bounded by-

- Himalayas is in the north.
- Hindukush and Sulaiman ranges in the north-west.
- Purvachal hills in the north-east.
- The large expanse of the Indian Ocean in the south.




Maharashtra
Goa
Karnataka
T.N
Andhra
Odisha
W.B
(700)
11 km

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Next Toppers

India Size

It forms a great geographic entity known as the Indian subcontinent.

It includes the Countries- Pakistan, Nepal, Bhutan, Bangladesh and India.



India Size

- The Himalayas, together with the other ranges, have acted as a formidable physical barrier in the past.

Except for few mountain Passes Such as:

- The Khyber ✓
- The Bolan ✓
- The Shipkila ✓
- The Nathula ✓
- The Bomdila ✓

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Bomdila



Khyber



Bolan



Nathula



Shipkila

Next Toppers

India Size



- Country has a Coastline of 6,100 km in the mainland and 7,517 km in the entire geographical coast of the mainland plus the island groups Andaman and Nicobar located in the Bay of Bengal and the Lakshadweep in the Arabian Sea.
- Thus India as a country, is a physically diverse land providing Occurence of varied resources.

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Next Toppers

India and Its neighbours

- India is located in the south-central part of the continent of Asia.
- Bordering the Indian ocean and its two arms extending in the form of Bay of Bengal and the Arabian Sea.

- **Land neighbouring countries:**
  - **Pakistan**
  - **Afghanistan**
  - **China**
  - **Bangladesh**
  - **Nepal**
  - **Bhutan**
  - **Myanmar**

- **Sea neighbouring Countries:**
  - **Sri Lanka**
  - **Maldives**

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Next Toppers

India and Its neighbours

- Sri Lanka is seperated from India by the Gulf of Mannar and Palk Strait.

Gulf

- The water body almost surrounded by land with a narrow mouth opening.

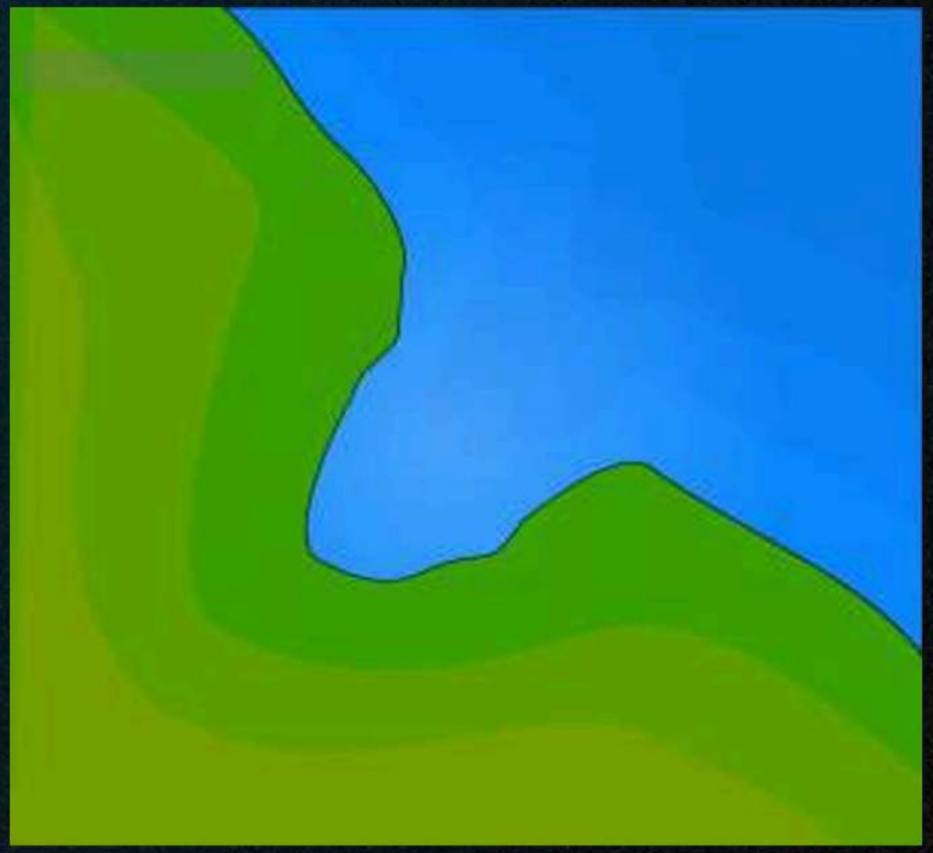


India and Its neighbours

Bay

- A large body which is partially surrounded by land with a wide mouth opens to water.





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Next Toppers

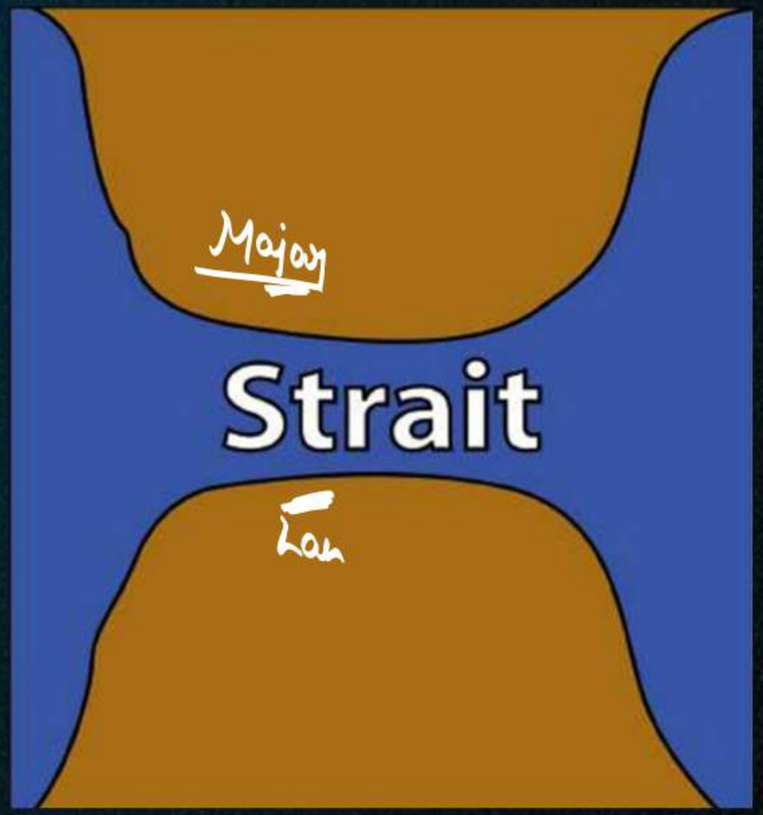


India and Its neighbours

Strait

- It is naturally formed narrow passage of water that connects two larger water bodies.





India and Its neighbours

Difference between Gulf and Strait

Gulf	Strait
Gulf sea is that a portion penetrates of the the land	Strait is a narrow passage of water that connects large bodies of water
Gulf connects the land and the sea.	Strait connects two larger water bodies.
Gulf is is always a natural formation.	Strait can be man-made, and such a structure is known as canal.
Gulf Serves as an excellent location for harbours.	Strait cannot act as harbours.

Tags: Northern Point
Southern ,,
Western ,,
Eastern?

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Next Toppers

CH8 ④

Interior of THE EARTH

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Next Toppers

Introduction

What do you imagine about the nature of the earth?

↓

How to know about interior of the earth?

Configuration of the surface of the earth

↓

Product of the processes operating in the interior of the earth.

पृथ्वी (अन्दर) **Explain**

↓

Endogenic and Exogenic processes

↓ (बाहर)

A proper understanding of the physiographic character of a region remains incomplete if the effects of endogenic processes are ignored.

Sources to Study the Earth's interior

The sources which provide knowledge about the interior of the earth may be classified into 2 sources Sources

- **Direct Sources:**
- These materials are available normally at the surface of the earth.
- Some examples are:
- Surface Rock:
- It is readily available on the surface of the Earth. It can be used to know the form of material upto a certain depth.

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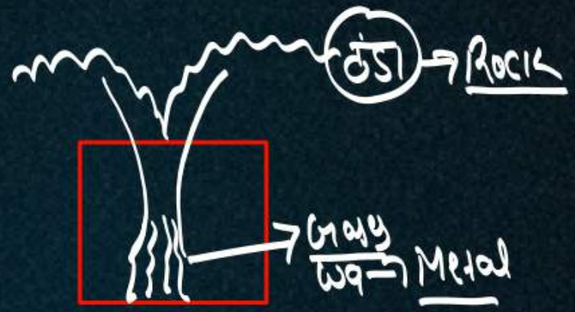
Next Toppers

Direct Sources

I. Surface rocks →

↓

The most easily available solid earth material.



Explains the nature of the earth.

+

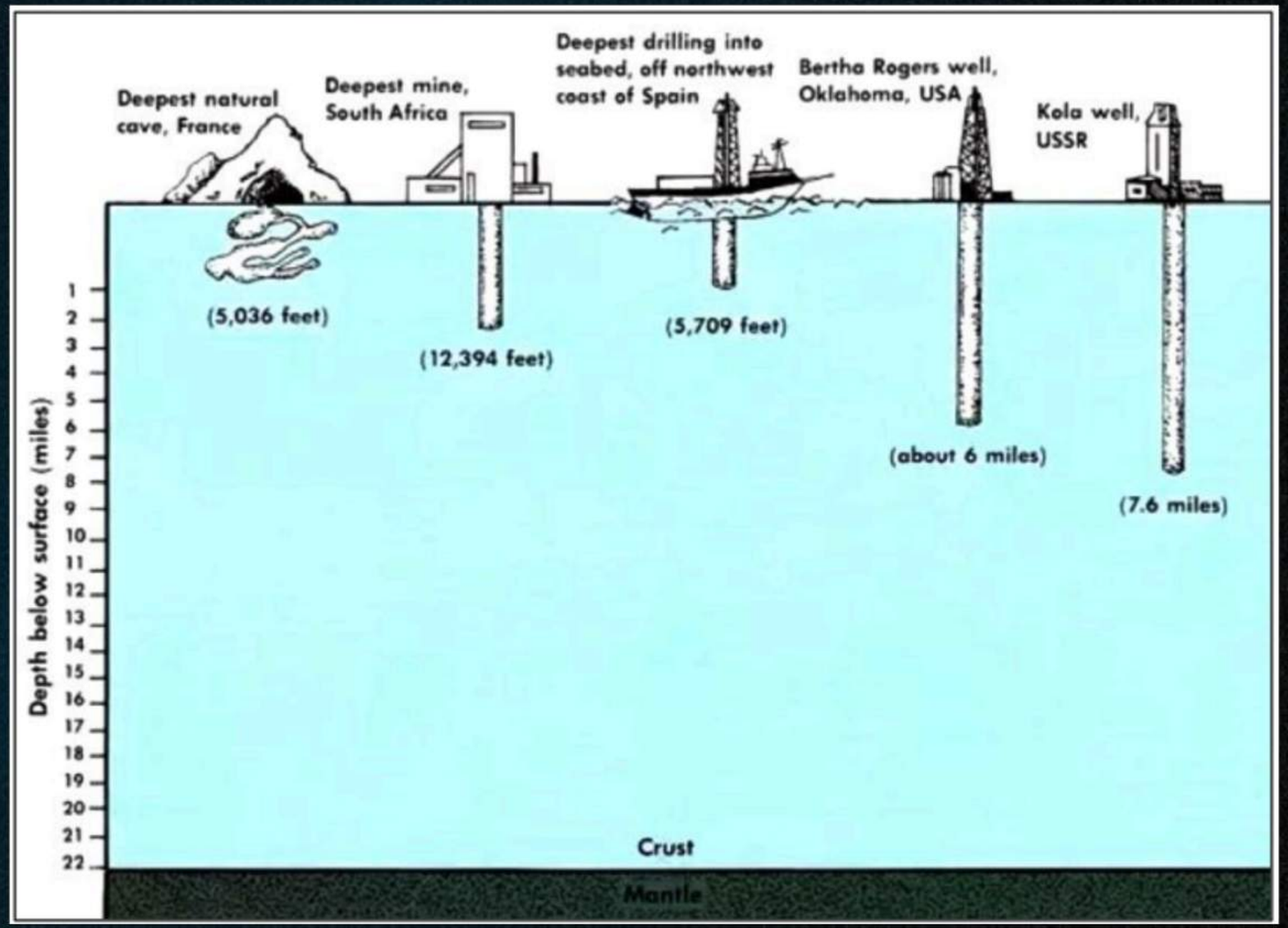
II. Mining rocks → **Relate**

- Gold mines in South Africa are as deep as 3 - 4 km. (3-4km)
- Besides mining, scientists have taken up a number of projects to penetrate deeper depths to explore the conditions in the crustal portions.
- "Deep Ocean Drilling Project" and "Integrated Ocean Drilling Project".
- The deepest drill at Kola, in Arctic Ocean, has so far reached a depth of 12 km.

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Next Toppers

Direct Sources



Sources to Study the Earth's interior

Metal dight

भारी → Depth (Density)

3. Volcanoes:

- It can be analyzed after eruptions.
- They come from under great depths, hence give more insight on the type of materials below.
- However, accuracy cannot be predicted at all times.

Material obtained from mining and drilling areas:

- Reveals the nature of material at a certain depth.
- Analysis of these materials show that pressure and temperature increase towards the interior of the earth.
- Also, density of the material increases from the surface to the interior bottom.
- Other sources can be Deep Ocean Drilling, Integrated Ocean Drilling Project, etc.

Sources to Study the Earth's interior

- **Indirect Sources:**

1

- Temperature and seismic variation:
- Scientists use technologies like gravitation, magnetic and seismic knowledge to study the interior of the earth.

- Meteorites:
- These are considered an indirect source for the study of the earth's interior, as scientists assume they were once part of a planet.

- Gravitational force:
- Differences in gravitational value show uneven distribution of mass within the earth.

Sources to Study the Earth's interior

- **Magnetic force:**
  - Magnetic survey reveals the distribution of magnetic materials within the earth.

- **Seismic knowledge:**
  - It provides information on the state of the interior of the earth (solid, liquid, or gaseous).

BACKLOG MARATHON SERIES

Next Toppers

Indirect Sources

Gravitational force (g)

↓

- Not the same at different latitudes on the surface.
- It is greater near the poles and less at the equator.

Why

↓

This is because of the distance from the centre at the equator being greater than that at the poles.

+

- The uneven distribution of mass of material within the earth influences this value.

↓

Concept of Gravity Anomaly →

Gravity anomalies give us information about the distribution of mass of the material in the crust of the earth.

Gravity anomaly

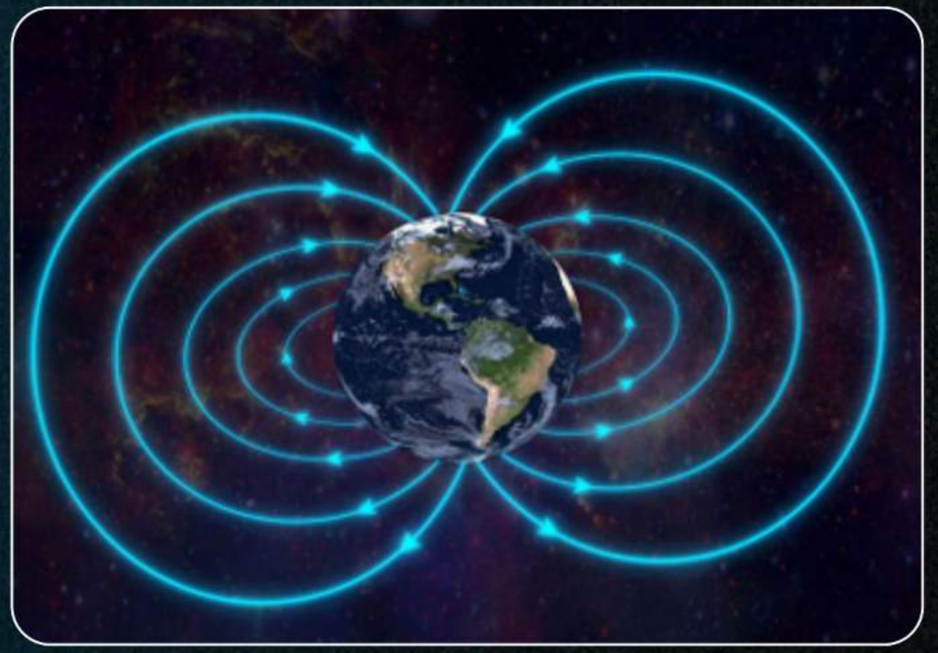
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Indirect Sources

Magnetic fields

- Magnetic surveys also provide information about the distribution of magnetic materials in the crustal portion, and thus, provide information about the distribution of materials in this part.



Seismic activity

Seismic activity is one of the most important sources of information about the interior of the earth.

→ **Explain**

Earthquake

Seismic waves → **Earthquake** → **Provides a complete picture of layered interior.**

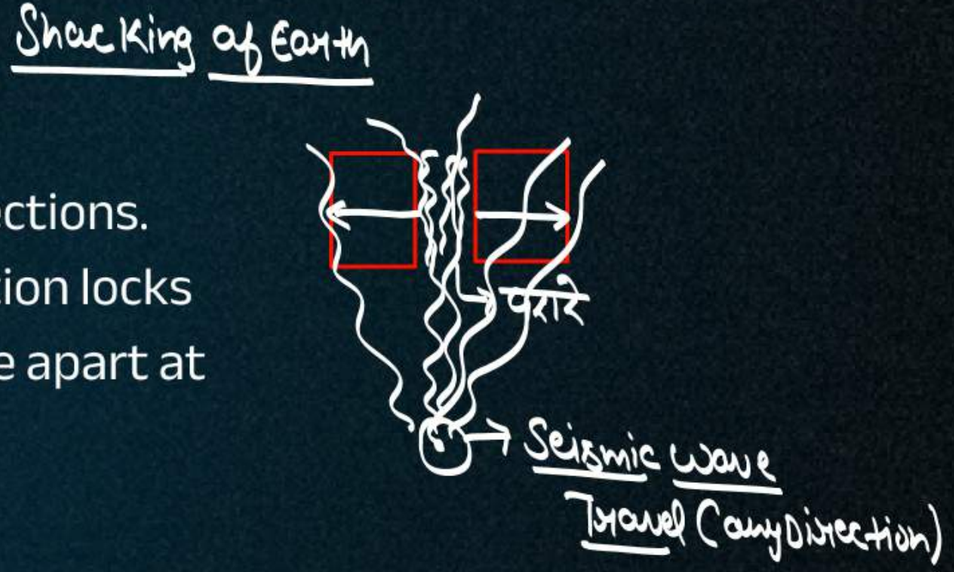
↓

An earthquake in simple words is shaking of the earth. It is a natural event. It is caused due to release of energy, which generates waves that travel in all directions.



Earthquake

- The release of energy occurs along a fault.
- Rocks along a fault tend to move in opposite directions.
- As the overlying rock strata press them, the friction locks them together. However, their tendency to move apart at some point of time overcomes the friction.



Blocks get deformed and eventually, they slide past one another abruptly.

→ **Release of energy** → **Earthquake**

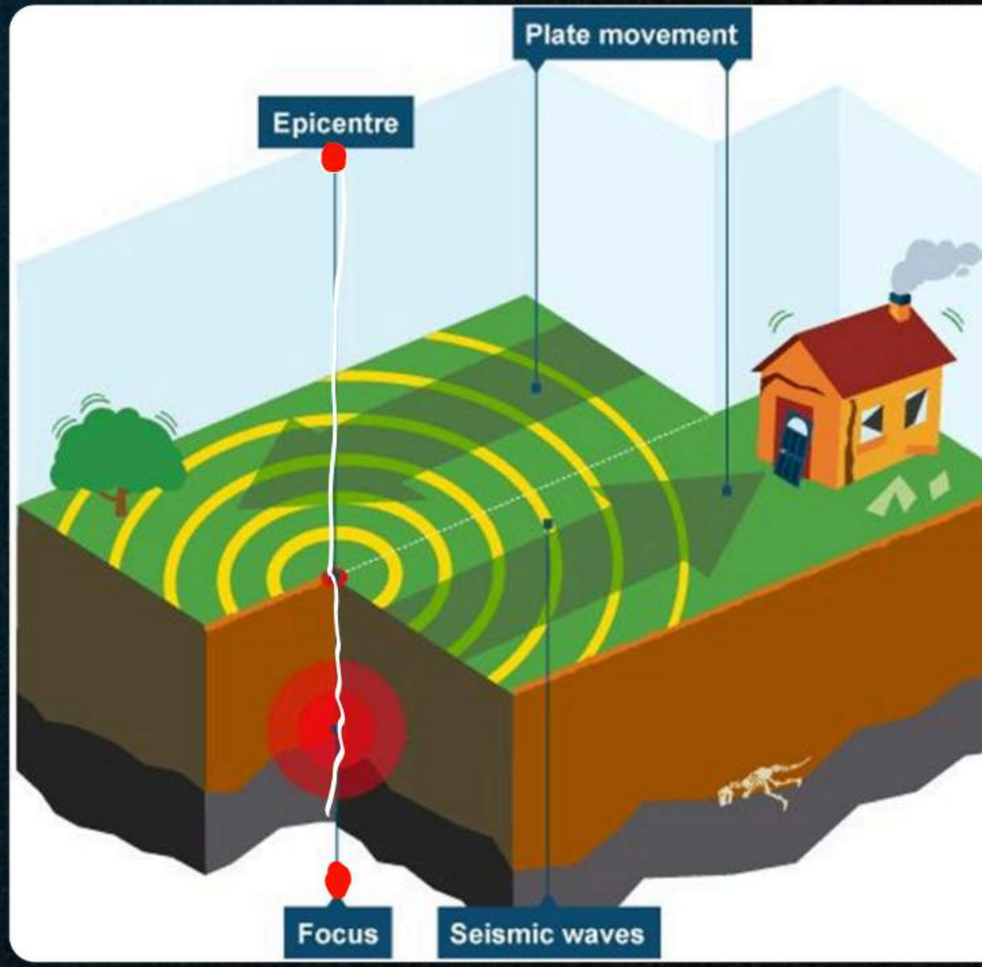
Earthquake

Focus

- The point where the energy is released is called the focus of an earthquake, alternatively, it is called the [hypocentre.]

Epicentre

- The point on the surface, nearest to the focus, is called epicentre. It is the first one to experience the waves. It is a point directly above the focus.



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Next Toppers

Earthquake Waves

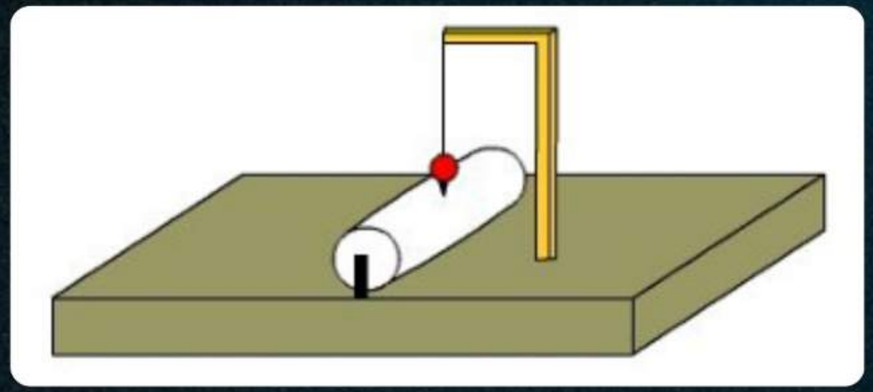
Natural Earthquakes → Takes place in **lithosphere**.

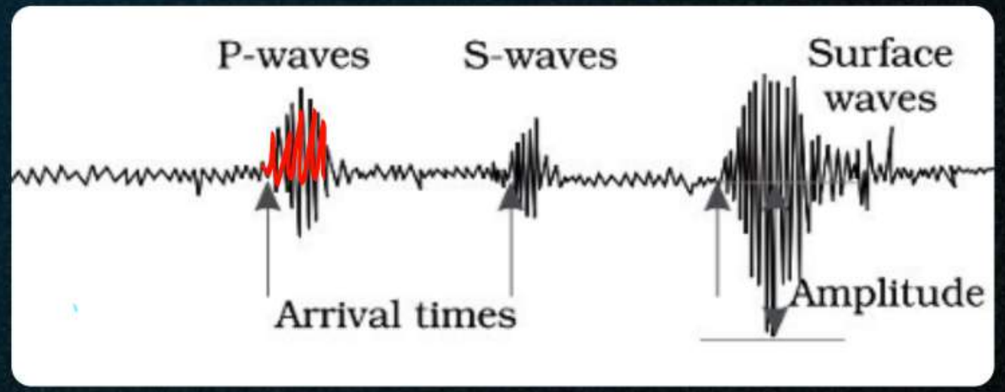
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Portion of depth upto 200 km from the surface of the earth.

An instrument called '**seismograph**' records the waves reaching the surface.

→ Seismograph

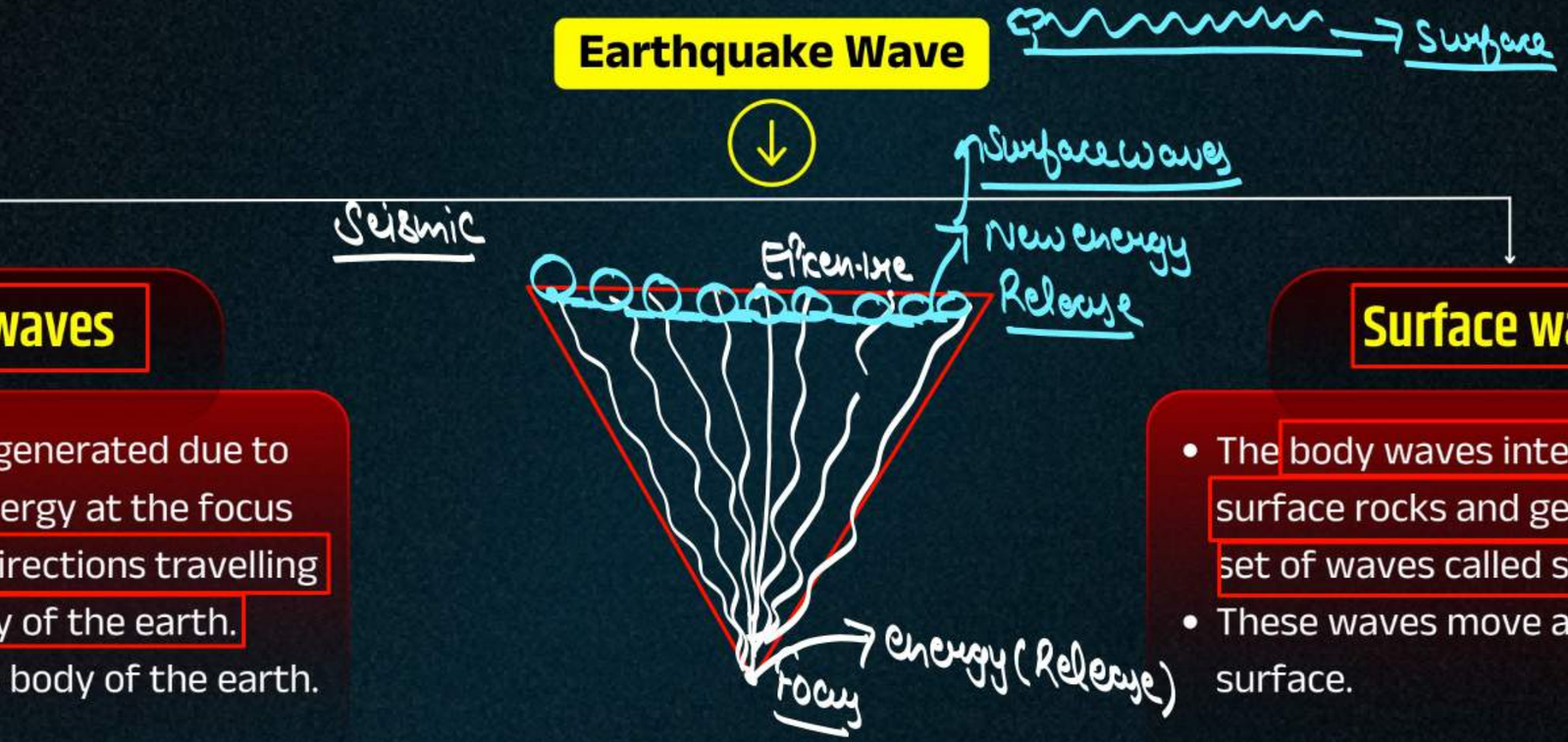




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Earthquake Waves

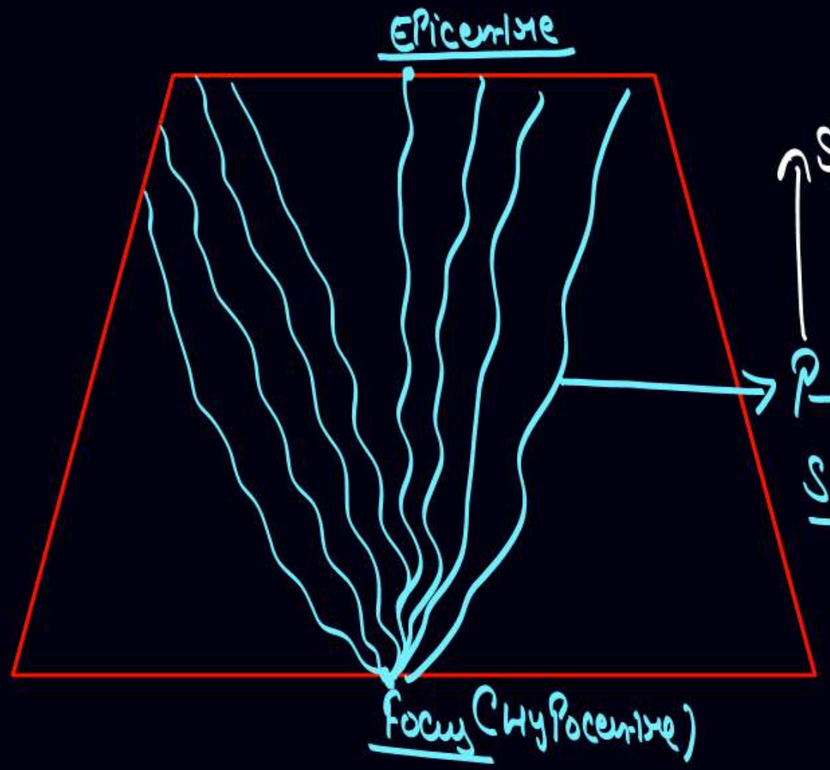


Body waves

- Body waves are generated due to the release of energy at the focus and move in all directions travelling through the body of the earth.
- Waves inside the body of the earth.

Surface waves

- The body waves interact with the surface rocks and generate new set of waves called surface waves.
- These waves move along the surface.



Sound-wave (Solid, liquid, Gas)

वृद्धतरंग ×

P-waves ⇒ Primary waves → Fastest (सबसे पहले) Hit Surface

S-waves ⇒ Secondary waves → [Solid]

[They Hit the Surface Just after Primary wave.

BACKLOG MARATHON SERIES

Next Toppers

Earthquake Waves

Emergence of shadow zone

Seismograph → Recording of earthquake waves.

↓

However, there exist some specific areas where the waves are not reported.

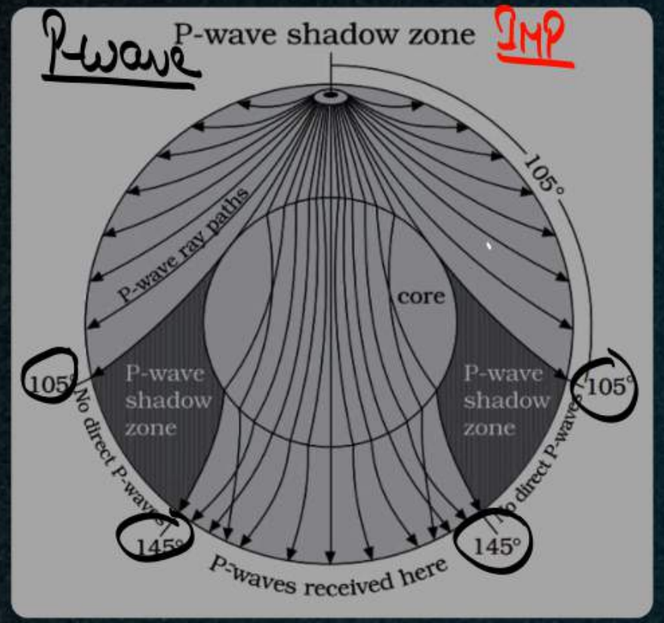
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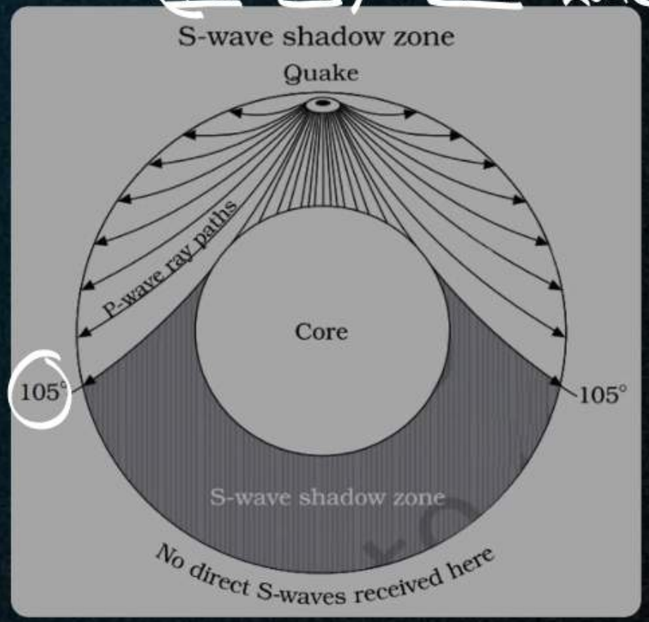
Shadow zone

Jis jagah me waves nahi travel kar pate
Shadow Zone

105° – 195°

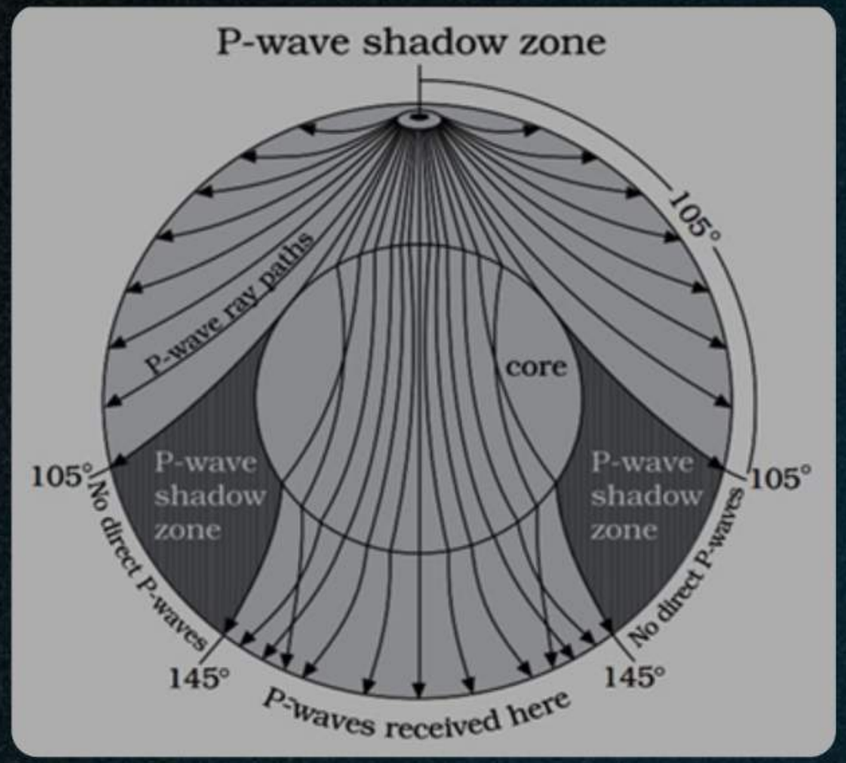
(105° – 105°) → Shadow Zone.

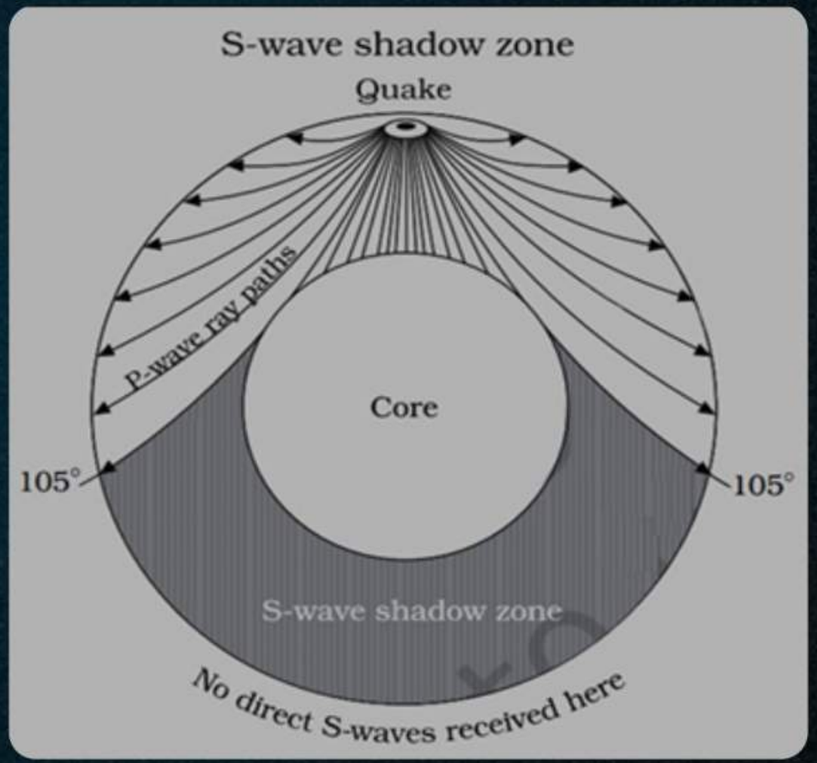




Earthquake Waves

Earthquake Have their own shadow zone, depending in the epicentre.





Earthquake Waves

- It was observed that seismographs located at any distance within 105° from the epicentre, recorded the arrival of both P and S-waves.
- However, the seismographs located beyond 145° from epicentre, record the arrival of P-waves, but not that of S-waves.



- **A zone between 105° and 145° from epicentre was identified as the shadow zone for both the types of waves.**

Earthquake Waves

Shadow zone of S-waves

- Entire zone beyond 105° does not receive S-waves. → Observation

- The shadow zone of S-wave is much larger than that of the P-waves.
- The shadow zone of S-waves is not only larger in extent but it is also a little over 40 percent of the earth's surface.

Shadow zone of P-waves

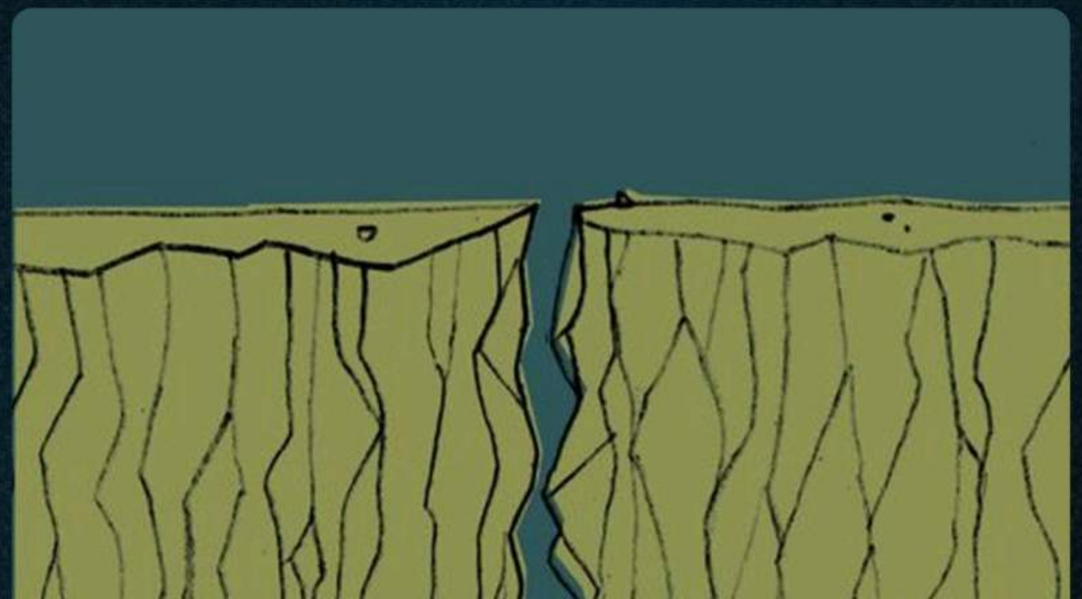
- It appears as a band around the earth between 105° and 145° away from epicenter.

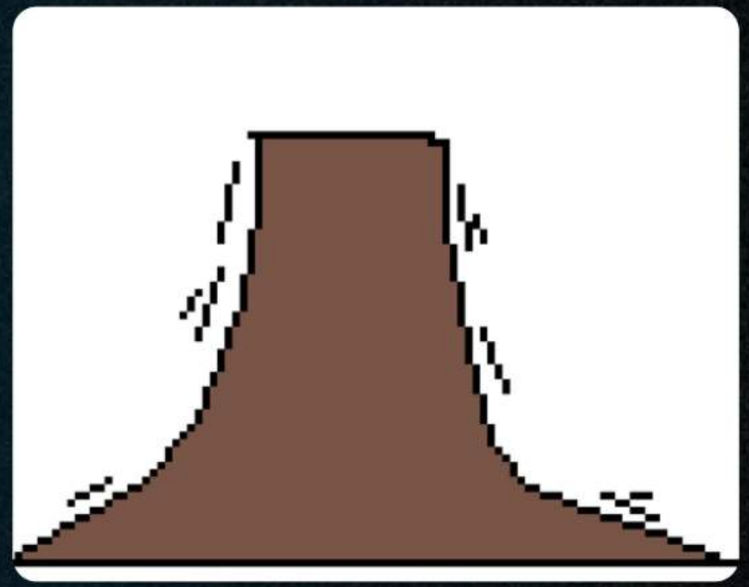
BACKLOG MARATHON SERIES

Next Toppers

Types of Earthquakes

- The most common ones are the tectonic earthquakes. (1)
- These are generated due to sliding of rocks along a fault plane.
- A special class of tectonic earthquake is sometimes recognised as volcanic earthquake. However, these are confined to areas of active volcanoes.





Types of Earthquakes

- In the areas of intense mining activity, sometimes the roofs of underground mines collapse causing minor tremors. These are called collapse earthquakes.

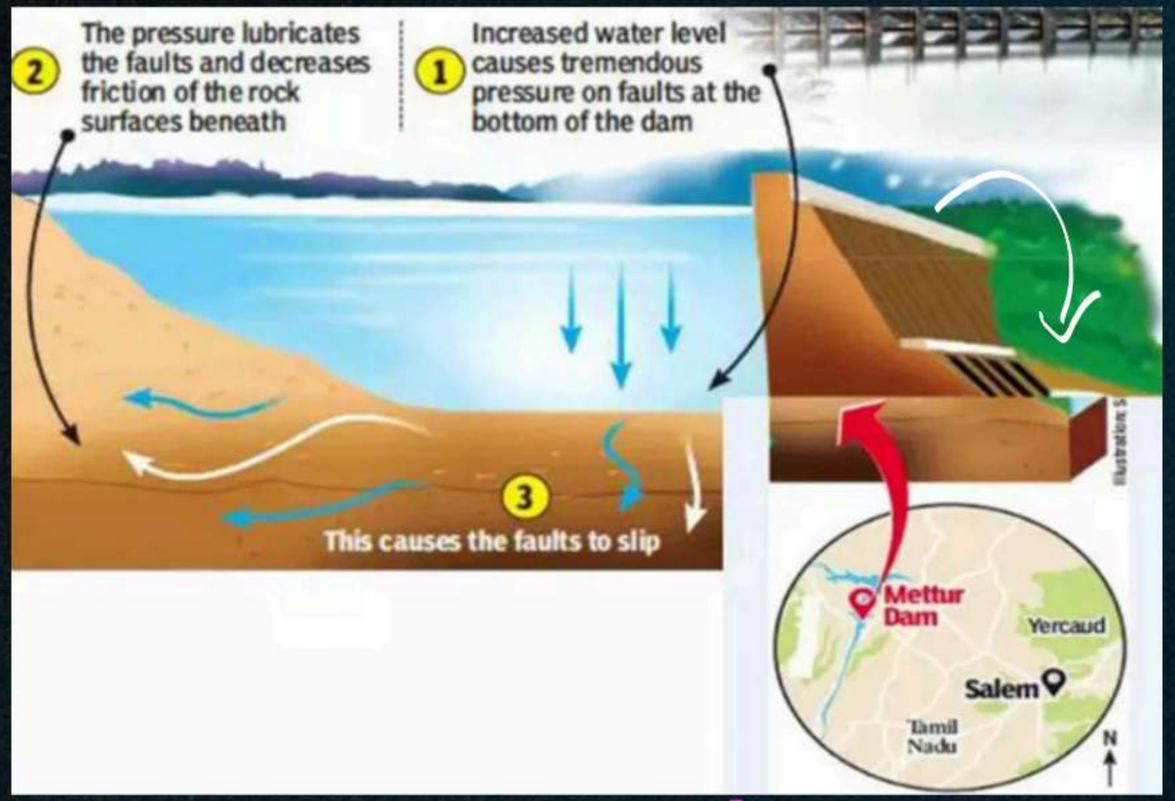




- Ground shaking may also occur due to the explosion of chemical or nuclear devices. Such tremors are called explosion earthquakes.

Types of Earthquakes

- The earthquakes that occur in the areas of large reservoirs are referred to as reservoir induced earthquakes.





Measuring Earthquakes

- They are scaled either according to the Magnitude or intensity of the shock.

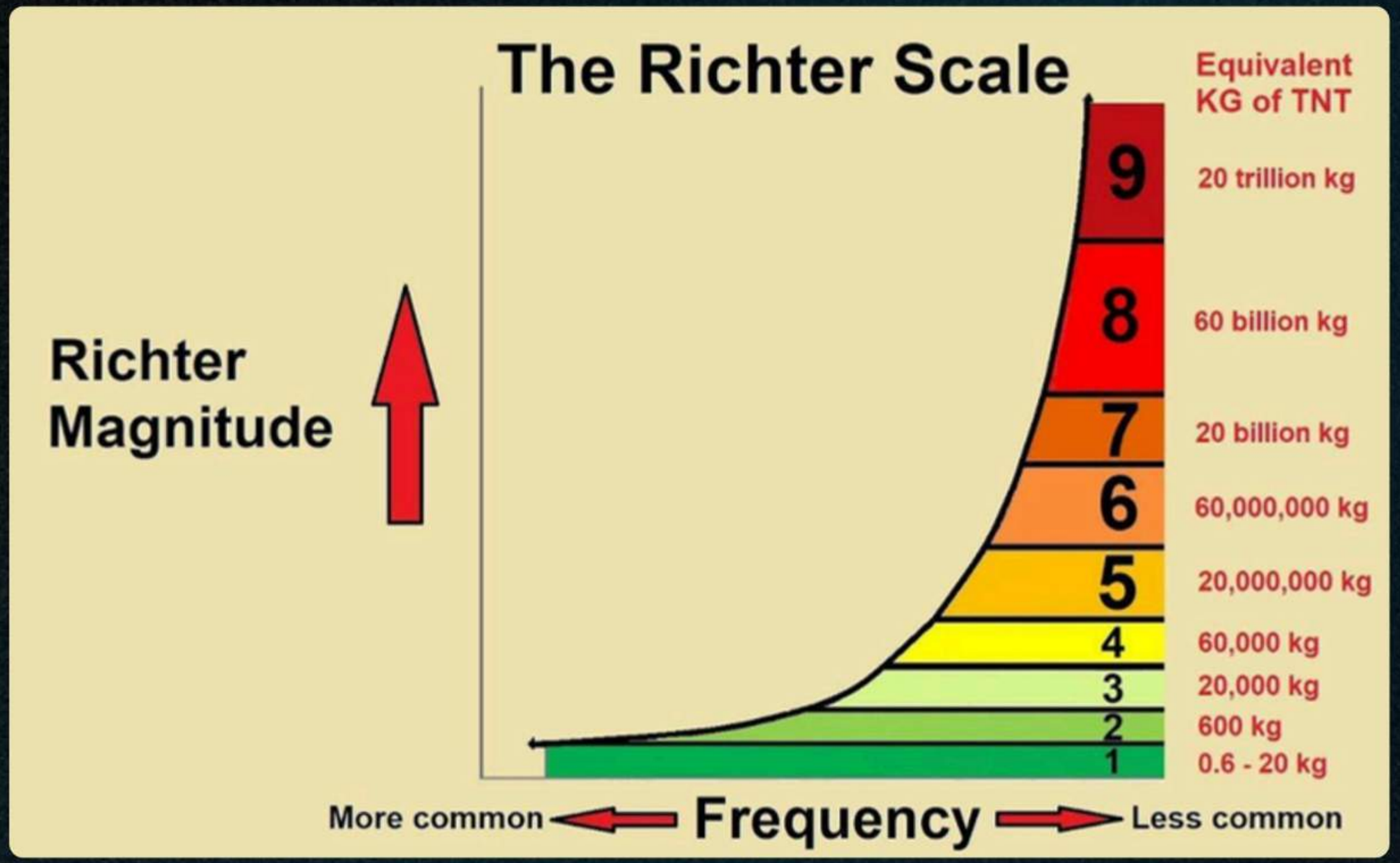
Magnitude ⇒ 0 - 10

- The magnitude relates to the energy released during the quake.

Measures on the **Richter scale.**

- The magnitude is expressed in number, 0 - 10.

Measuring Earthquakes



Measuring Earthquakes

Intensity → 1-12 → Mercalli

- It takes into account the visible damage caused by the event.
- The intensity scale is named after Mercalli, an Italian seismologist.
- The range of intensity scale is 1 - 12.

Intensity



Giuseppe Mercalli

Measuring Earthquakes

E arthquake is a natural hazard. The following are the immediate hazardous effects of earthquake:

- Ground Shaking
- Differential ground settlement
- Land and mudslides
- Soil liquefaction
- Ground lurching
- Avalanches
- Ground displacement
- Floods from dam and levee failures
- Fires
- Structural collapse
- Falling objects
- Tsunami

Measuring Earthquakes

- Ground Shaking
- Differential ground settlement
- Land and mudslides
- Soil liquefaction
- Ground lurching
- Avalanches

Have bearings upon landforms.

- Ground displacement
- Floods from dam and levee failures
- Fires
- Structural collapse
- Falling objects
- Tsunami

Effects causing immediate concern to the life and properties of people in the region.

BACKLOG MARATHON SERIES

Next Toppers

Structure of the Earth's interior

It is divided into three broad layers: crust, mantle and core.

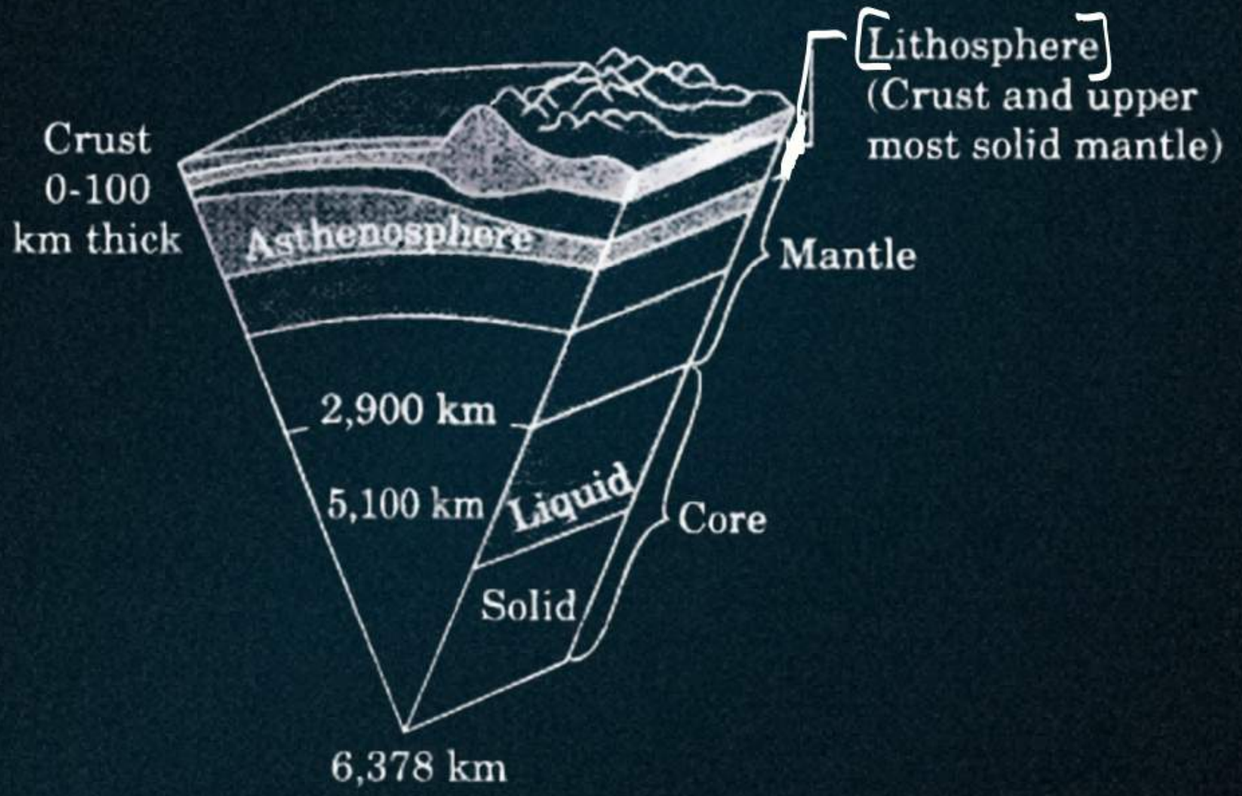
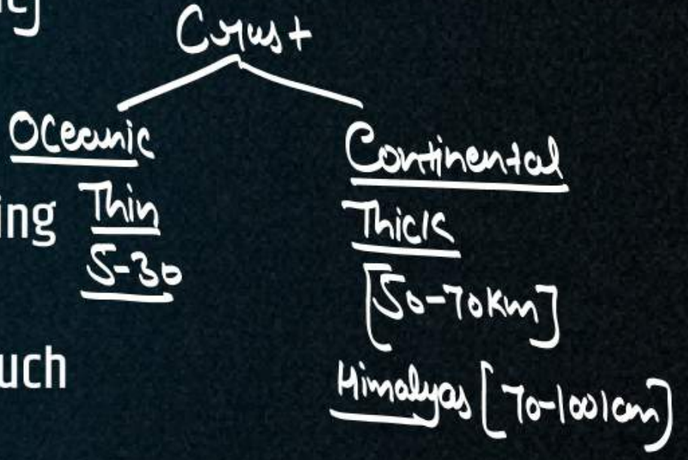


Fig: The interior of the earth

Crust

- **Meaning of crust in science-** The crust is the outermost solid part of the earth and is a thin layer with a total thickness of 30-50 km.
- **Thickness:**
- It varies between oceanic and continental areas, with oceanic crust being thinner (5-30 km) and continental crust being thicker (50-70 km).
- In areas of major mountain systems, the continental crust can be as much as 70-100 km thick (e.g., in the Himalayan region).
- The crust is only 0.5-1.0% of the earth's volume and less than 1% of its mass.



Crust

Temperature:

- It increases with depth, reaching 200-400°C near the mantle-crust boundary.
- In the higher region of the crust, the temperature increases by up to 30 degrees Celsius per kilometer.

SIAL
Crust + Silica + Aluminium

Material:

- The crust's outer layer is made of sedimentary material, and beneath it are acidic crystalline, igneous, and metamorphic rocks.
- Basaltic and ultrabasic rocks make up the lowest layer of the crust.
- The lighter silicates, silica + aluminum (sial), make up the continents, while the heavier silicates, silica + magnesium (sima), make up the oceanic crust.
- The lighter (felsic) sodium potassium aluminum silicate rocks, such as granite, make up the continental crust. The oceanic crust is made of thick (mafic) iron magnesium silicate igneous rocks like basalt.

Crust

The most abundant elements of the Earth's Crust

Element	Approximate % by weight
Oxygen (O)	46.6
Silicon (Si)	27.7
Aluminum (Al)	8.1
Iron (Fe)	5.0
Calcium (Ca)	3.6
Sodium (Na)	2.8
Potassium (K)	2.6
Magnesium (Mg)	1.5

Lithosphere

- The lithosphere is the earth's rigid outer layer, with a thickness of 10 to 200 km.
- It consists of the crust and the upper part of the mantle.
- The lithosphere is divided into tectonic plates.
- Plate tectonics cause large-scale changes in the earth's geological structure (such as folding and faulting).
- The sources of heat driving plate tectonics are primordial heat from the planet's birth and radioactive decay of elements such as uranium, thorium, and potassium in the earth's crust and mantle.

Asthenosphere

Mantle (weak)

- The asthenosphere lies below the lithosphere, with a depth ranging from 80-200 km.
- The asthenosphere is soft and plastic, allowing the rigid lithosphere to move easily over it.
- The asthenosphere is viscous, brittle, and ductile with a higher density than the crust.
- It is the primary source of magma during volcanic eruptions.
- The lithospheric shell is divided into large pieces called lithospheric plates.
- These plates can separate or collide, leading to geological changes such as ridge formation.

Mantle



- The mantle is the portion of the earth's interior beyond the crust.
- The mantle extends from Moho's discontinuity (35 km) to a depth of 2,900 km and makes up 83% of the earth's volume and 67% of its mass.
- The upper part of the mantle is called the asthenosphere, which is completely solid.
- The crust and uppermost part of the mantle together make up the lithosphere, which has a thickness of 10-200 km.
- The lower mantle extends beyond the asthenosphere and is in a solid state.

Mantle

Silica + Magnesium

- The density of the mantle is higher than the crust and ranges from 3.3 to 5.5.
- The mantle is mostly made up of silicate minerals rich in iron and magnesium.
- Temperatures in the mantle range from 200°C at the upper crustal border to almost 4,000°C at the core-mantle boundary.
- The mantle has convective material circulation due to temperature differential and this causes the motions of tectonic plates at the surface.
- Seismicity in the mantle is inhibited by high pressure, but earthquakes have been detected in subduction zones as far as 670 km below the surface.

Core

- The core is made up of nickel and iron and is sometimes referred to as the NIFE layer.
- The core-mantle boundary is located at a depth of 2900 km.
- The core lies between 2900 km and 6400 km below the earth's surface.
- The outer core is liquid and the inner core is solid.
- The density of the core is higher than the mantle and varies from 5.5 to 13.6 g/cm^3.
- The volume and mass of the core make up 16% and 32% of the total volume and mass of the earth, respectively.
- The Gutenberg discontinuity is a sudden change from 5.5 gm/cm^3 of the mantle to 10 gm/cm^3, located at the core-mantle boundary.
- The core is divided into two parts: the outer core and the inner core.

NIFE → Centre of Earth

Core

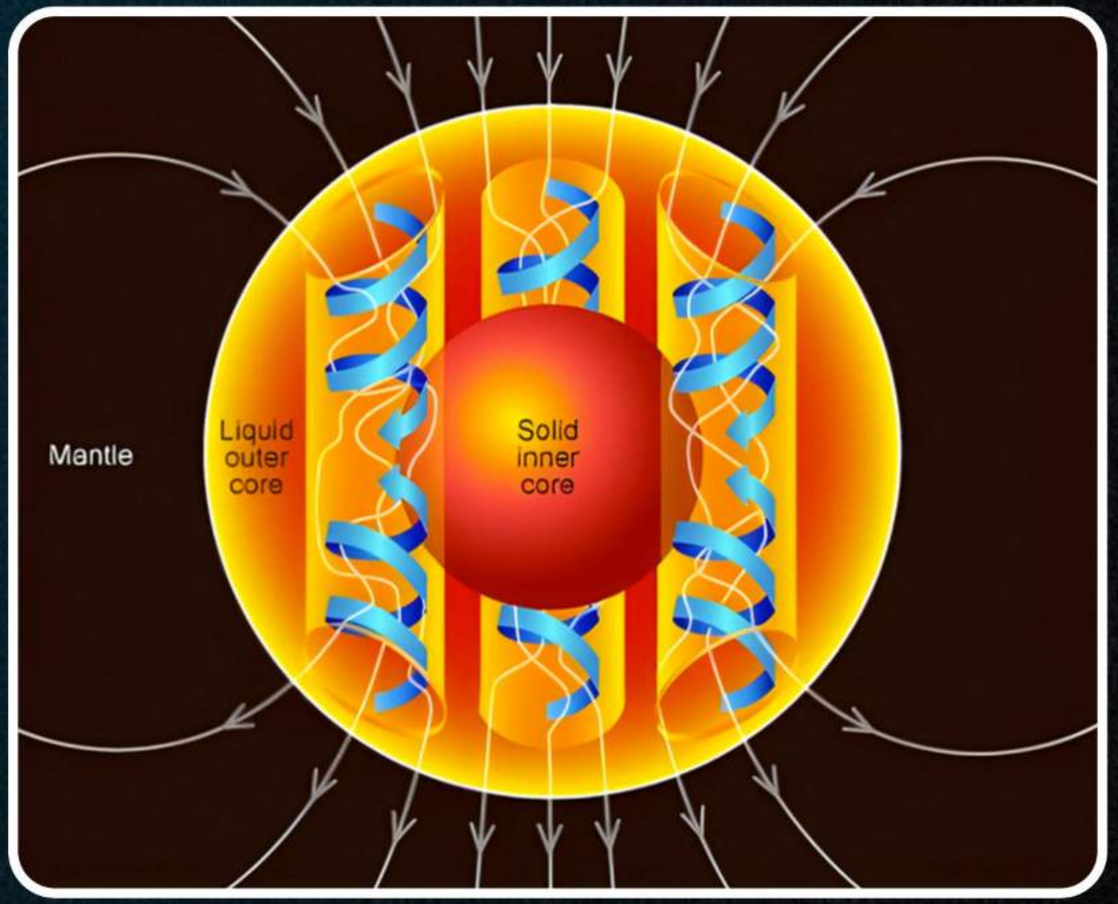
Outer core:

- The outer core is located between 2900 and 5100 km below the Earth's surface.
- Made up of iron, nickel, and trace amounts of lighter metals.
- Liquid due to insufficient pressure to solidify.
- Earth's magnetic field is believed to be created by convection in the outer core and the Coriolis effect according to dynamo theory.

Core

Inner core:

- The inner core is located from the earth's center to 5100 km below the surface.
- It is solid and can transmit shear waves.
- The rotation of the inner core is slightly faster than the surface.
- The solid inner core is too hot to maintain a persistent magnetic field.
- The core (inner core and outer core) makes up 16% of the earth's volume and 33% of its mass.



Core

Seismic Discontinuity

- Discontinuity refers to a sharp boundary between layers in the earth's internal structure. Across these boundaries, seismic waves undergo significant changes in terms of their direction and speed.

Core

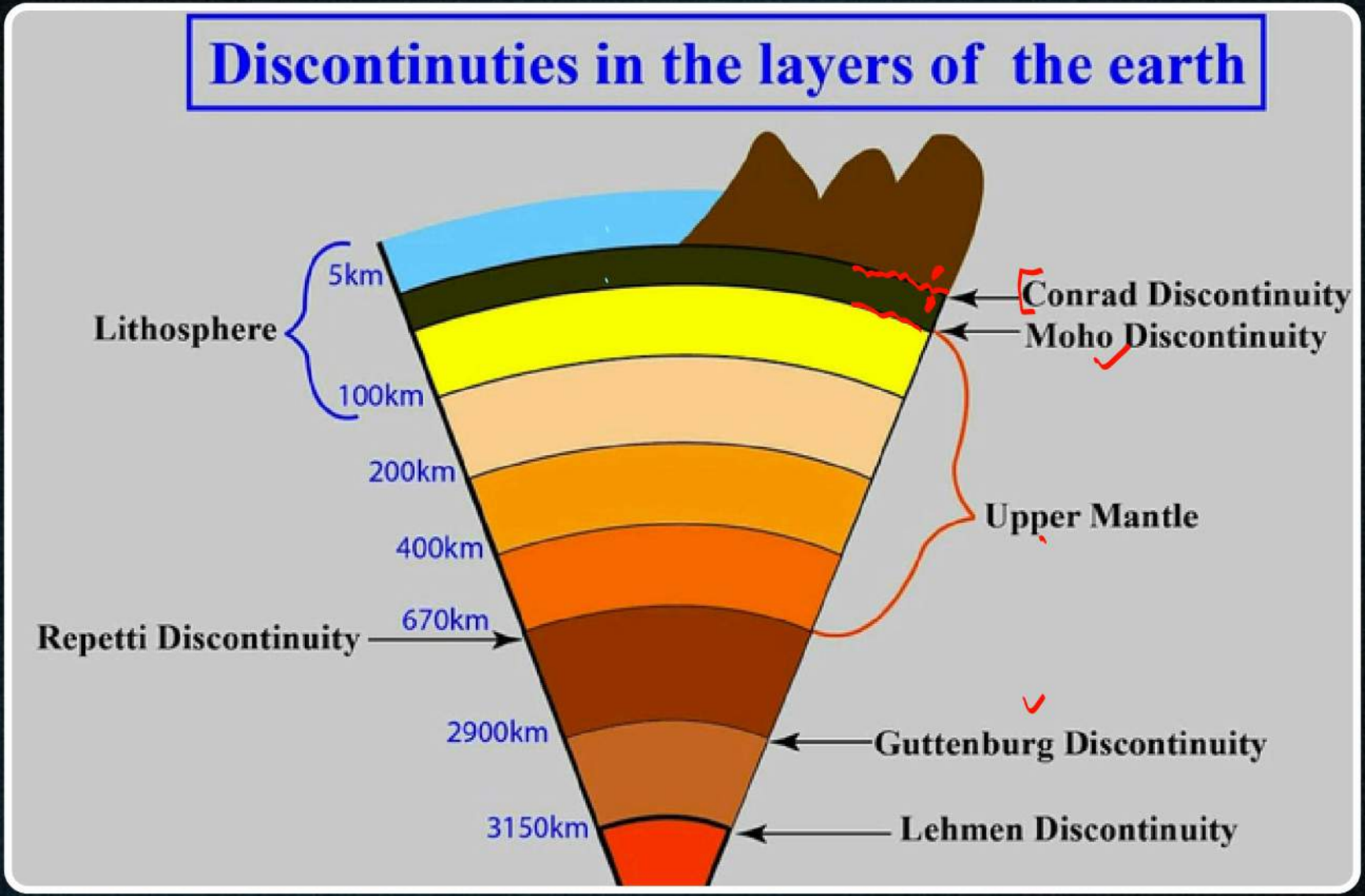
There are 5 layers:

1. Conorod Discontinuity – between upper and lower crust.
2. Mohorovicic Discontinuity (Moho) – separates the crust from the mantle, its average depth being about 35 km.
3. Repiti Discontinuity – between the upper and lower mantle.
4. Gutenberg Discontinuity – lies between the mantle and the outer core. Below 2900 km from earth's surface.
5. Lehman Discontinuity - between inner and outer core.

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Core



Earth's Chemical Composition

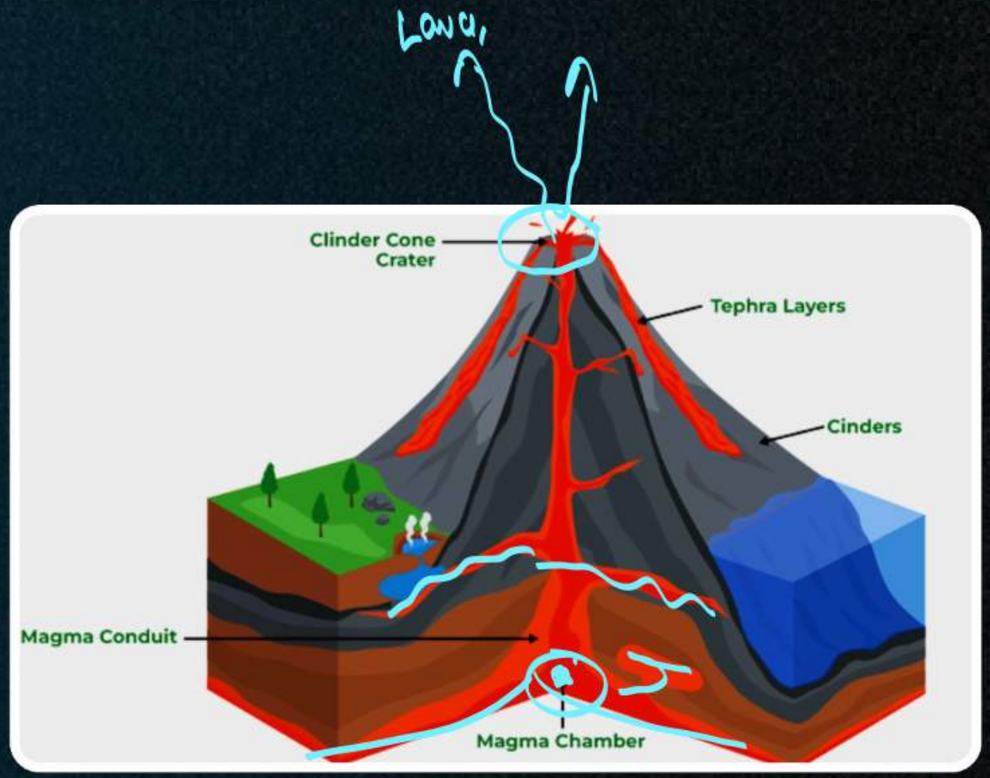
- Earth's mass is approximately 5.97×1024 kg (5,970 Yg).
- It is composed mostly of iron (32.1%), oxygen (30.1%), silicon (15.1%), magnesium (13.9%), sulfur (2.9%), nickel (1.8%), calcium (1.5%), and aluminum (1.4%), with the remaining 1.2% consisting of trace amounts of other elements.

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Volcanoes & Volcanic Landforms

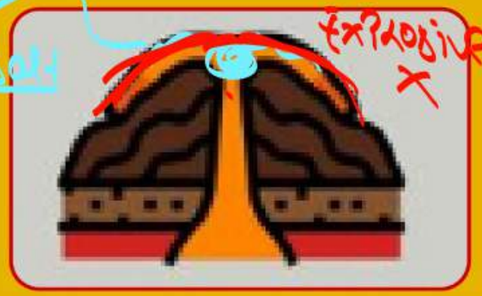
- A volcano is a place where gases, ashes and/or molten rock material - lava - escape to the ground.
- A volcano is called an active volcano if the materials mentioned are being released or have been released out in the recent past.
- The layer below the solid crust is mantle.
- It has higher density than that of the crust.
- The mantle contains a weaker zone called asthenosphere.
- It is from this that the molten rock materials find their way to the surface.



Volcanoes

Types of Volcanoes

SHIELD VOLCANOES
Large broad slopes, fluid lava flow





Mauna Loa, Hawaii

COMPOSITE VOLCANOES
Steep and symmetrical, explosive eruptions





Mayon, Philippines

LAVA DOMES
Small with steep sides, oozes viscous lava





Showa Shinjan, Japan

CINDER CONES
Smallest, single vent, erupts cinders, ash, and rocks





Sunset Crateona

Volcanoes

- Volcanoes are classified on the basis of nature of eruption and the form developed at the surface. Major types of volcanoes are as follows:

Shield Volcanoes

- Barring the basalt flows, the shield volcanoes are the largest of all the volcanoes on the earth. The Hawaiian volcanoes are the most famous



Figure . Shield Volcanoes

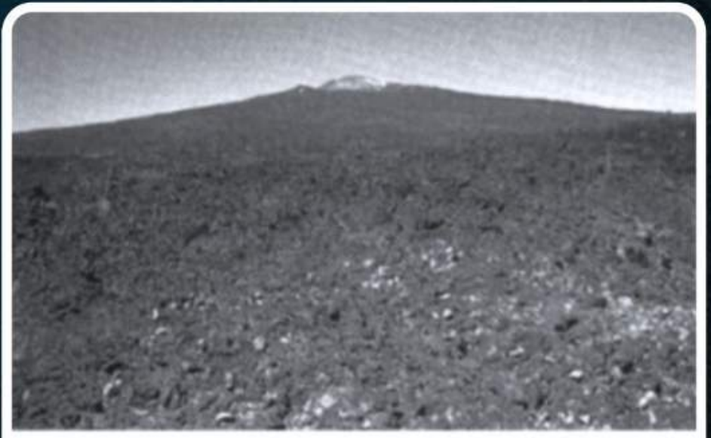


Figure . Cinder Cone

Volcanic Landforms

VOLCANIC DOMES

- Domes, are formed by relatively smoll bulbous masses of love too viscous to flow ony great distance On extrusion, the love piles over and around its vent and o dome grows largely by expansion from withat.
- As it grows, its outer surface cools and hardens, then shatters, spilling loose fragments down its sides.

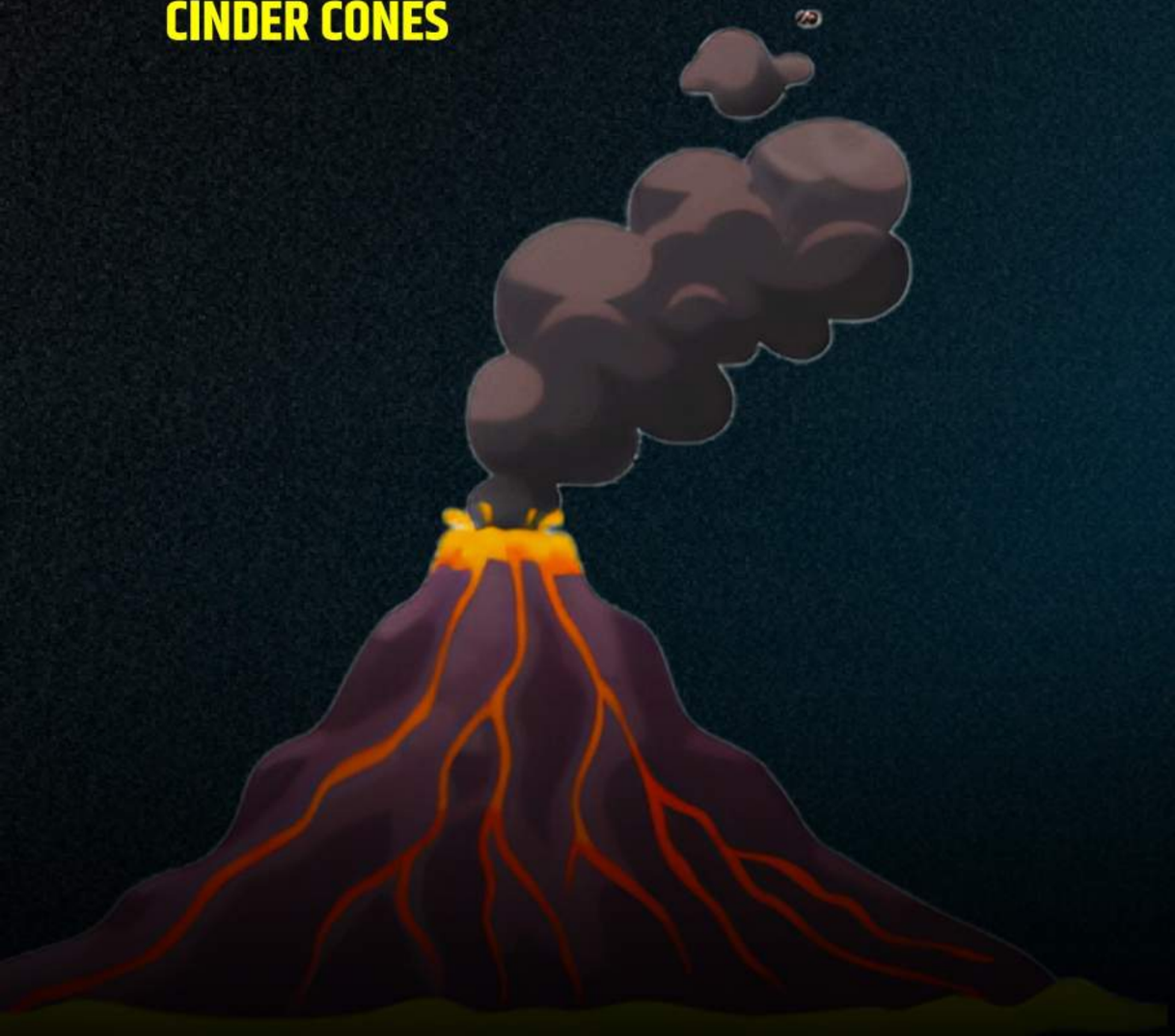


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Volcanic Landforms

CINDER CONES



BACKLOG MARATHON SERIES

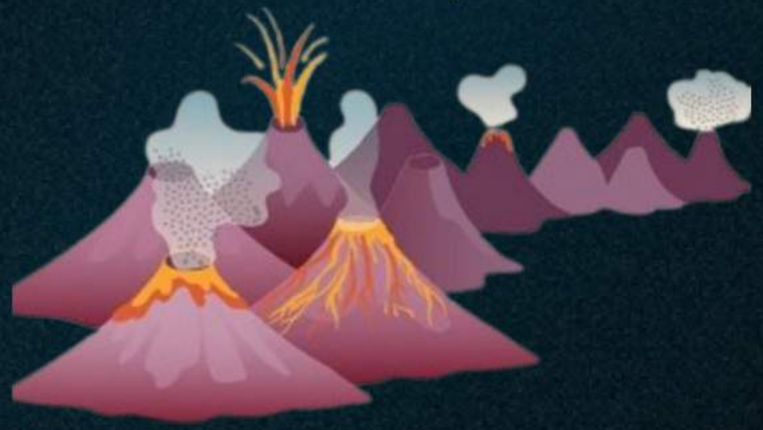
Next Toppers

Volcanic Landforms

There are around 1,500 potentially active volcanoes around the world



About 50-70 volcanoes become active every year

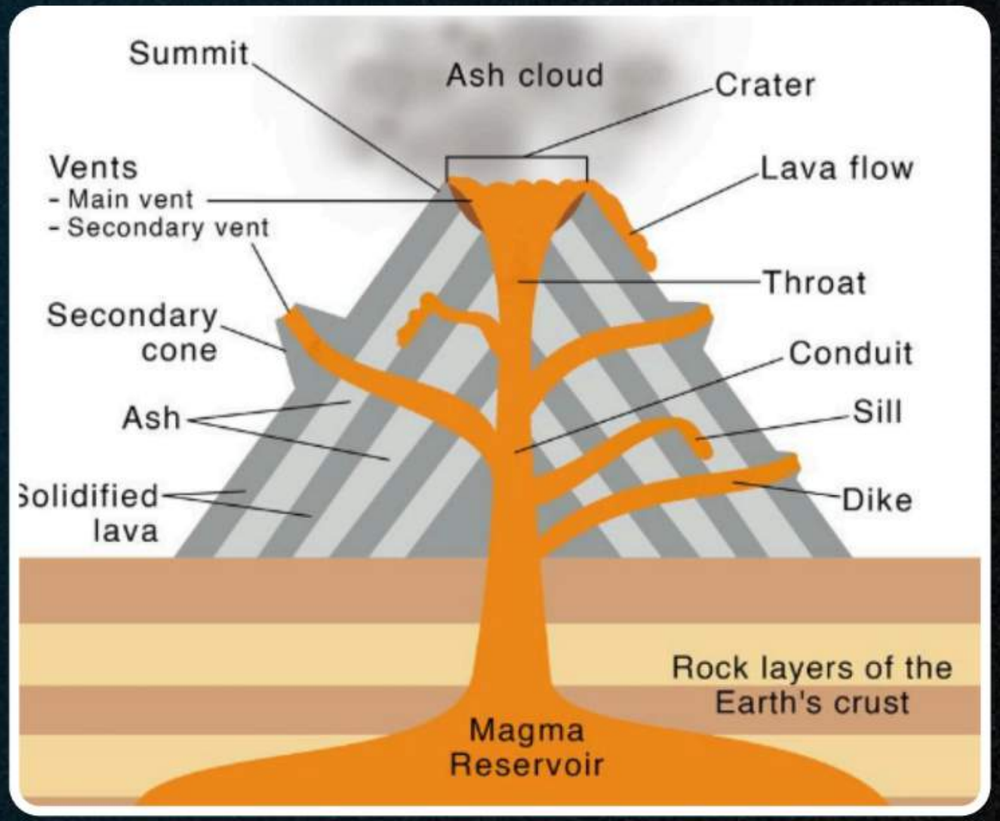


On average, there are 20 volcanoes actively erupting on any particular day



Parts of a Volcano

- These volcanoes are mostly made up of basalt, a type of lava that is very fluid when erupted. For this reason, these volcanoes are not steep.
- They become explosive if somehow water gets into the vent; otherwise, they are characterised by low-explosivity.
- The upcoming lava moves in the form of a fountain and throws out the cone at the top of the vent and develops into cinder cone.



Composite Volcanoes

- These volcanoes are characterised by eruptions of cooler and more viscous lavas than basalt.
- These volcanoes often result in explosive eruptions. Along with lava, large quantities of pyroclastic material and ashes find their way to the ground.
- This material accumulates in the vicinity of the vent openings leading to formation of layers, and this makes the mounts appear as composite volcanoes.



Figure . Composite Volcano

Caldera

Caldera → I am not a volcano

- These are the most explosive of the earth's volcanoes.
- They are usually so explosive that when they erupt they tend to collapse on themselves rather than building any tall structure.
- The collapsed depressions are called calderas.
- Their explosiveness indicates that the magma chamber supplying the lava is not only huge but is also in close vicinity.



Flood Basalt Provinces

- These volcanoes out pour highly fluid lava that flows for long distances. Some parts of the world are covered by thousands of sq. km of thick basalt lava flows.
- There can be a series of flows with some flows attaining thickness of more than 50 m. Individual flows may extend for hundreds of km.
- The Deccan Traps from India, presently covering most of the Maharashtra plateau, are a much larger flood basalt province.
- It is believed that initially the trap formations covered a much larger area than the present.



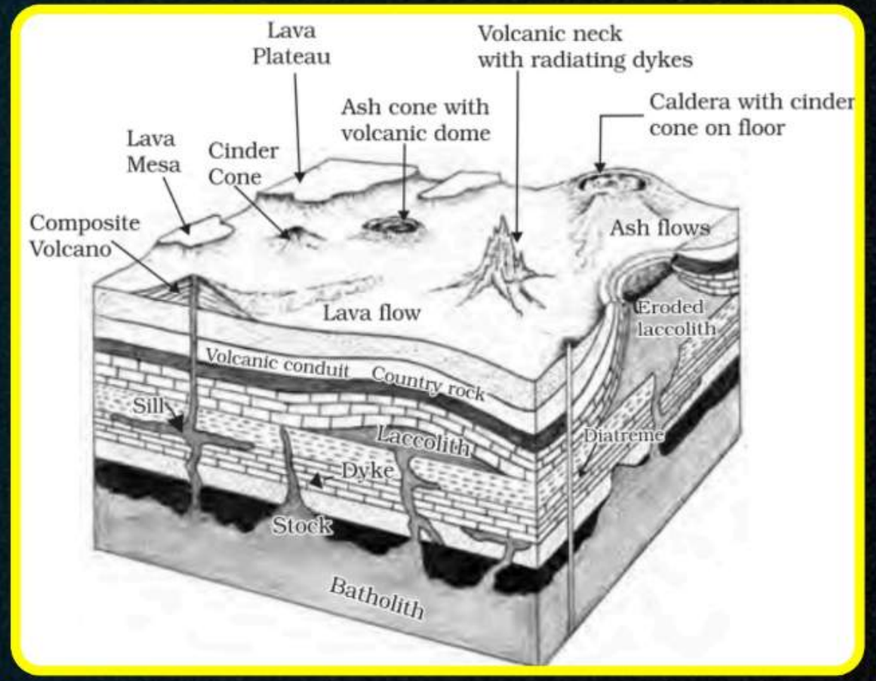
Volcanic Landforms



Intrusive Forms

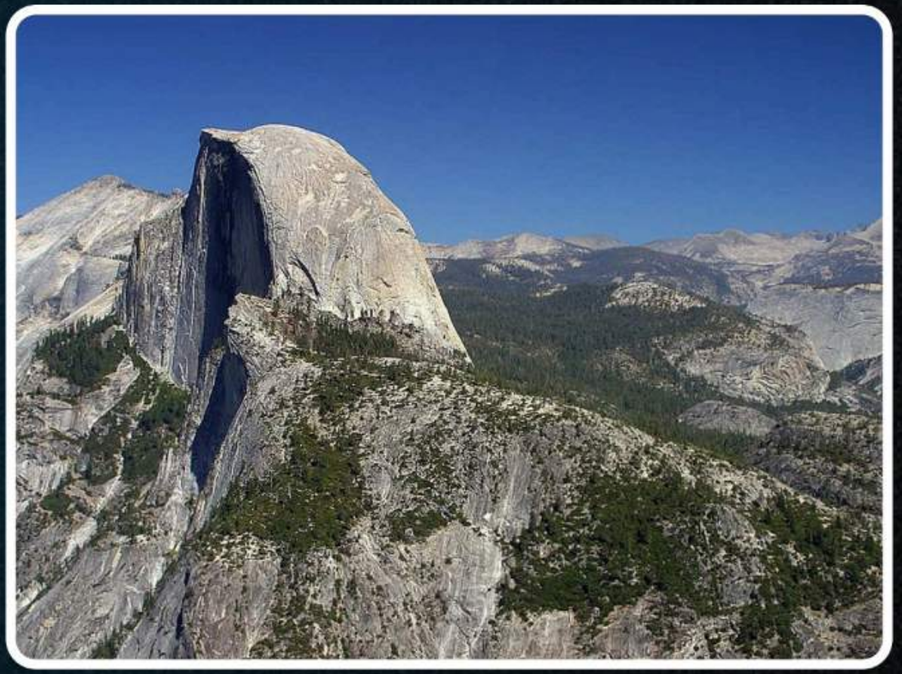
Ex-Lusive

- The lava that is released during volcanic eruptions on cooling develops into igneous rocks.
- The cooling may take place either on reaching the surface or also while the lava is still in the crustal portion.
- Depending on the location of the cooling of the lava, igneous rocks are classified as volcanic rocks (cooling at the surface) and plutonic rocks (cooling in the crust).
- The lava that cools within the crustal portions assumes different forms. These forms are called intrusive forms. Some of the forms are shown in Figure.



Batholiths

- A large body of magmatic material that cools in the deeper depth of the crust develops in the form of large domes.
- They appear on the surface only after the denudational processes remove the overlying materials.
- They cover large areas, and at times, assume depth that may be several km.
- These are granitic bodies. Batholiths are the cooled portion of magma chambers.



Lacoliths

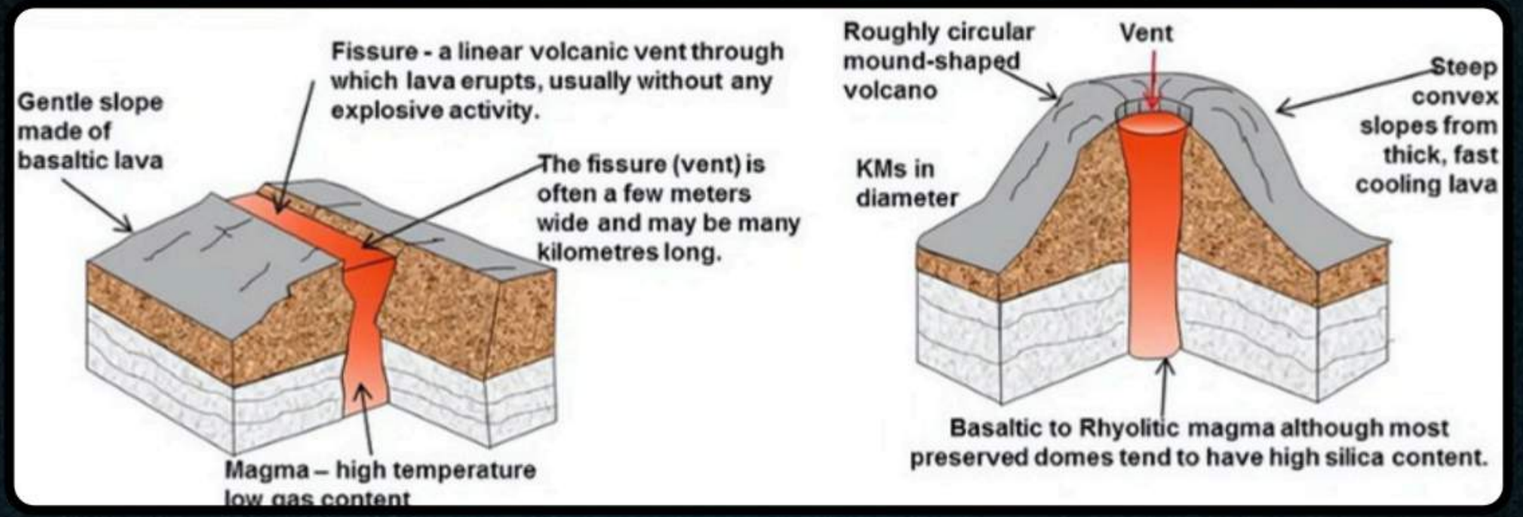
- These are large dome-shaped intrusive bodies with a level base and connected by a pipe-like conduit from below.
- It resembles the surface volcanic domes of composite volcano, only these are located at deeper depths.
- It can be regarded as the localised source of lava that finds its way to the surface.
- The Karnataka plateau is spotted with domal hills of granite rocks. Most of these, now exfoliated, are examples of lacoliths or batholiths.

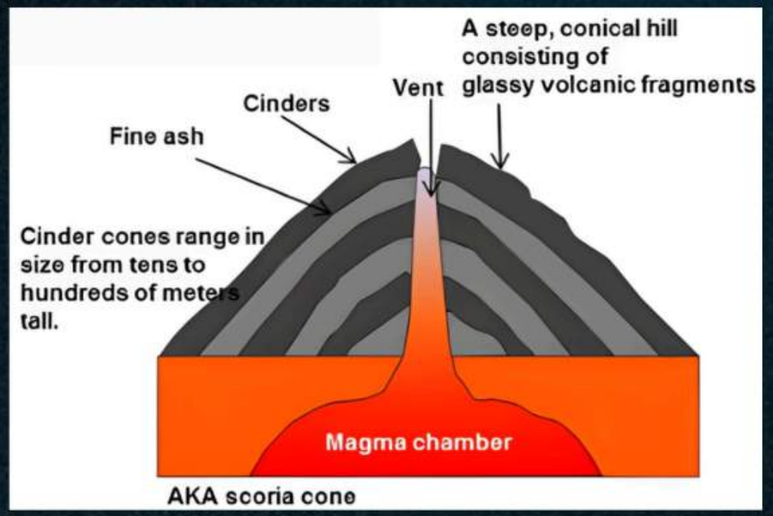


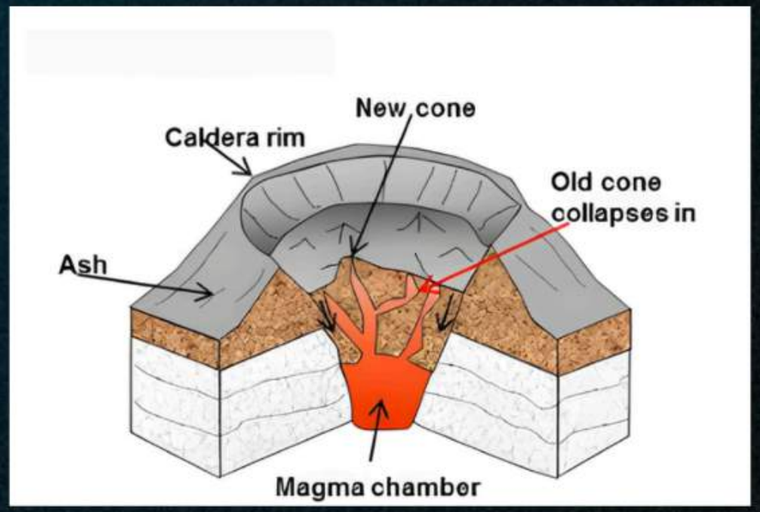
Lapolith, Phacolith & Sills

- As and when the lava moves upwards, a portion of the same may tend to move in a horizontal direction wherever it finds a weak plane.
- It may get rested in different forms. In case it develops into a saucer shape, concave to the sky body, it is called lapolith.
- A wavy mass of intrusive rocks, at times, is found at the base of synclines or at the top of anticline in folded igneous country.
- Such wavy materials have a definite conduit to source beneath in the form of magma chambers (subsequently developed as batholiths). These are called the phacoliths.
- The near horizontal bodies of the intrusive igneous rocks are called sill or sheet, depending on the thickness of the material. The thinner ones are called sheets while the thick horizontal deposits are called sills.

Lapolith, Phacolith & Sills







Lapolith, Phacolith & Sills

Dykes

- When the lava makes its way through cracks and the fissures developed in the land, it solidifies almost perpendicular to the ground. It gets cooled in the same position to develop a wall-like structure.
- Such structures are called dykes. These are the most commonly found intrusive forms in the western Maharashtra area.
- These are considered the feeders for the eruptions that led to the development of the Deccan traps.

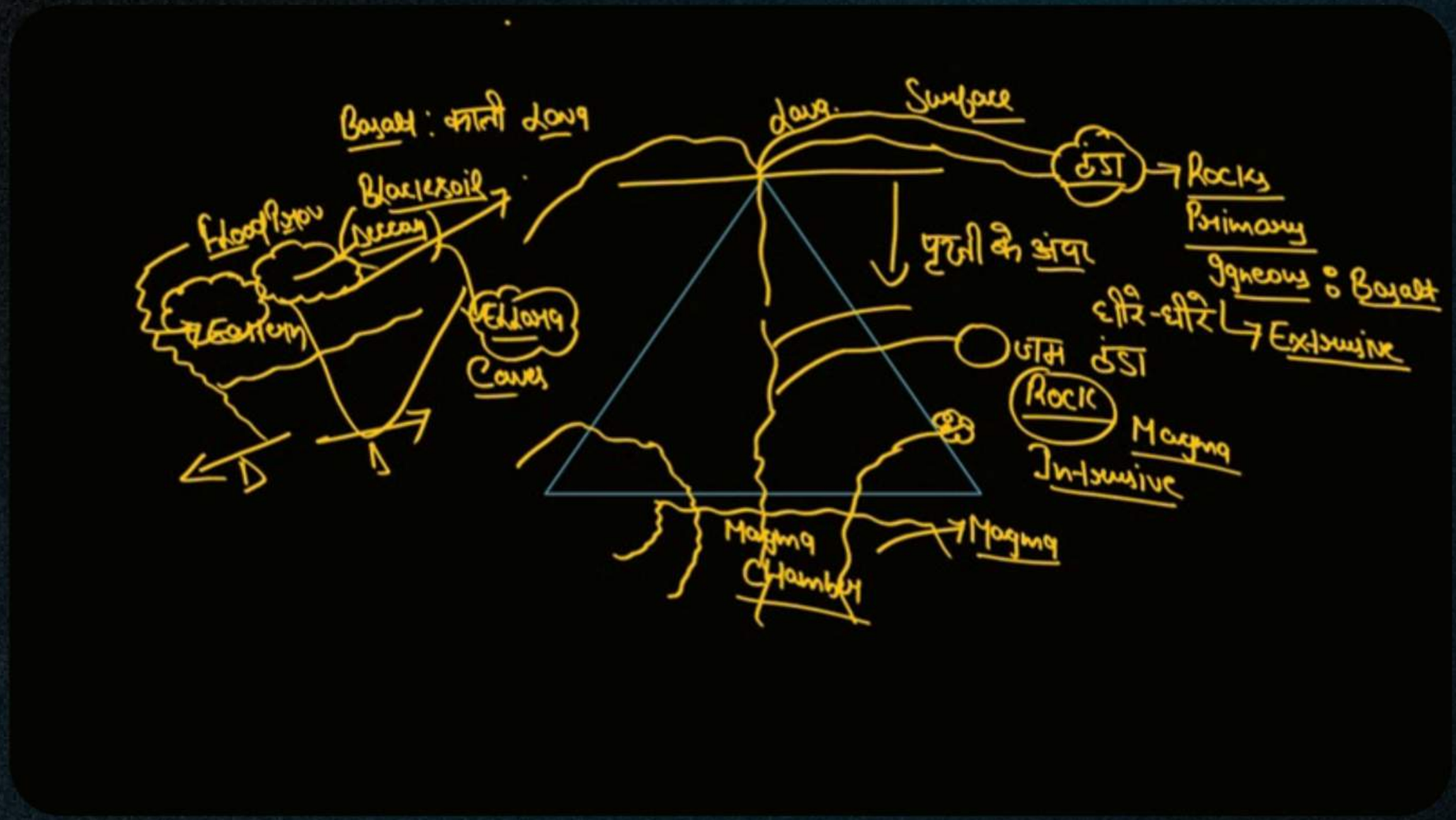
Volcanoes & Volcanic Landforms

- The material in the upper mantle portion is called magma.
- Once it starts moving towards the crust or it reaches the surface, it is referred to as lava.
- The material that reaches the ground includes lava flows, pyroclastic debris, volcanic bombs, ash and dust and gases such as nitrogen compounds, sulphur compounds and minor amounts of chlorene, hydrogen and argon.

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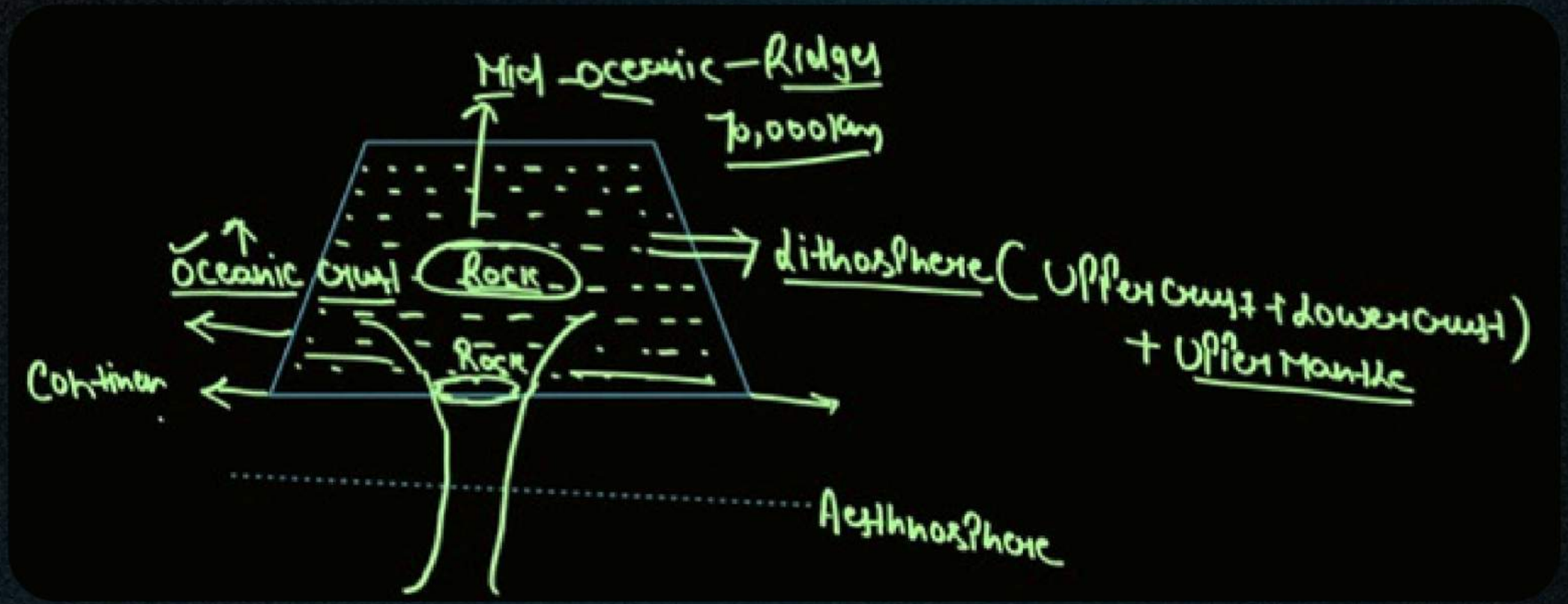
Volcanoes & Volcanic Landforms



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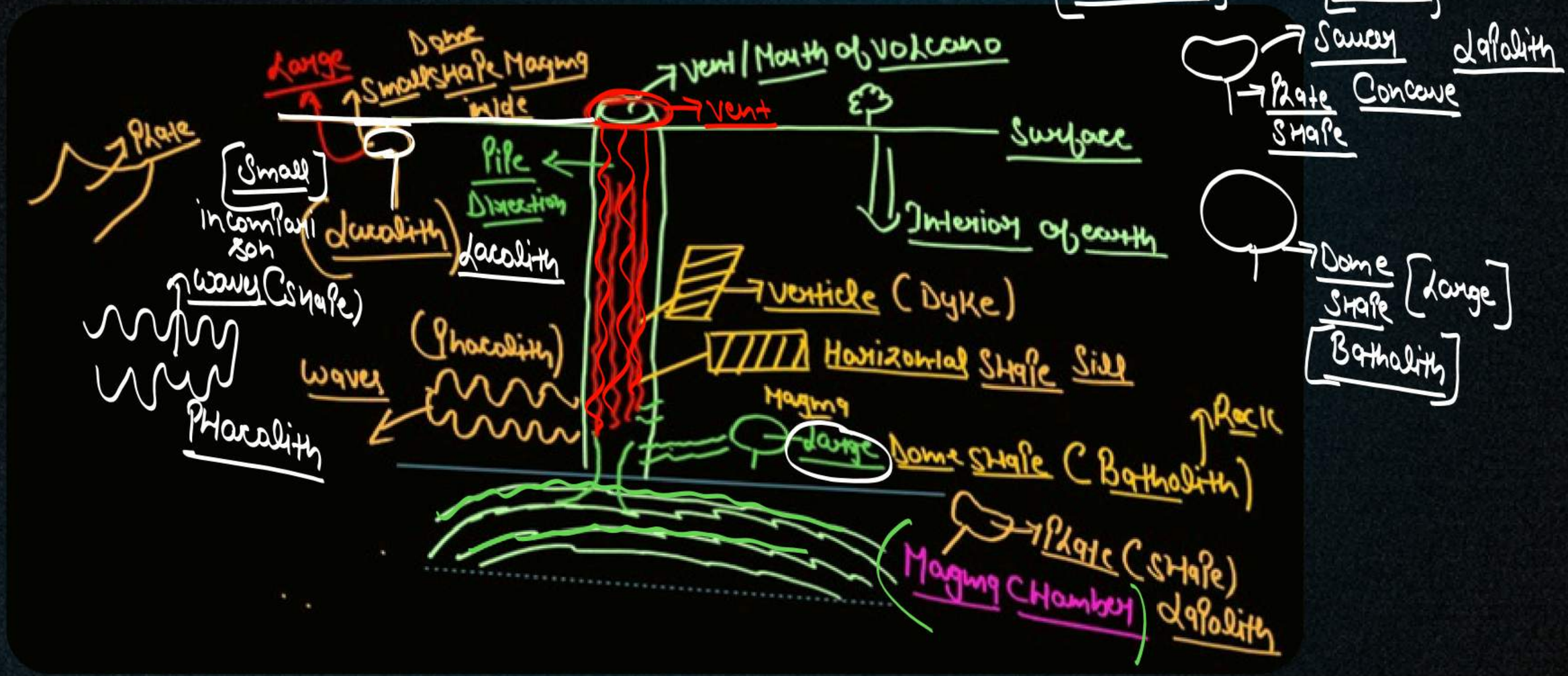
Volcanoes & Volcanic Landforms



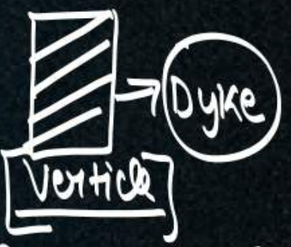
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Volcanoes & Volcanic Landforms







The Earth’s Volcanoes

- Discover more about the most well-known manifestation of geothermal energy.

Volcanoes

- A volcano is formed when hot malten rock, ash and goses emerge from a fracture in the Earth's crust.
- Mogma and leve ore two sides of the same cain. Molten rock is colled magma while it is located. under the Earth's crast, and lova when it surfaces. Magma vises because it is lighter than the solid rocks sumending it.
- An eruption is on outflow of lovα During an eruptiast, in addition to lava, gases and pyroclastic material ore released into the air. These include ash, lapillus and volcanic bombie (also called lava bombs) of various sizes.

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Distribution of OCEANS AND CONTINENTS

BACKLOG MARATHON SERIES

Next Toppers

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- **Continental Drift Theory, 1912:**
- **Evidence in support of Continental drift:**
- **Post-Drift Studies:**
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- **Plate Tectonics:**
- Types of Plate Boundaries
- Movement of the Indian Plate
  - **Movement:**
- **Role of plate tectonics in the Distribution of Earthquakes and Volcanoes:**
- Tectonic activity at Converging plates
- Tectonic activity at Diverging plates
- Relation between Volcanoes and earthquakes

Introduction

- Continents cover 29% of the surface of the earth, and the remainder is under oceanic waters. The position of Continents and Oceans bodies has not been constant but has changed in the past. This chapter deals with the various theories related to the movement of the ocean and Continents.
- For a long time, many geographers have been amazed by the symmetry of the coastlines on either side of the Atlantic Ocean. As early as in the 16th century, Abraham Ortelius, a Dutch mapmaker, proposed the possibility of the two Americas, Europe and Africa, to be once joined together. Antonio Pellegrini in the 19th century, drew a map showing the three continents together.
- However, it was Alfred Wegener who gave the systematic theory of the movement of the continent.

Continental Drift Theory, 1912

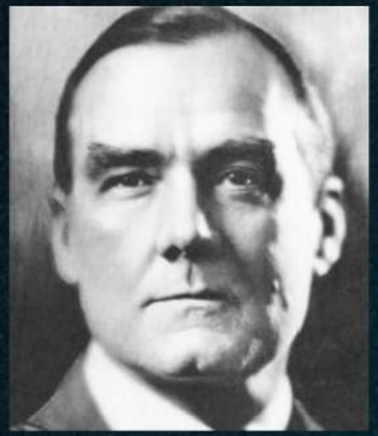
- **It was proposed by Alfred Wegener**, a German meteorologist, as a comprehensive argument of **Continental drift**. It is regarding the distribution of oceans and continents:
- **Proposition**: A Supercontinent named **PANGAEA** (meaning all earth) and a mega ocean **PANTHALASSA**, (meaning all water) existed initially. Pangaea split into two large masses: **Laurasia** and **Gondwanaland** forming northern & southern components. These further broke into many pieces.
- **Forces responsible for the drift:** His explanation was based on the following forces:
- **Pole fleeing forces**: It is related to the rotation of the earth. It causes outward acceleration experienced by an object moving in a circular path. It leads to the drift of continents towards the equator.

Continental Drift Theory, 1912

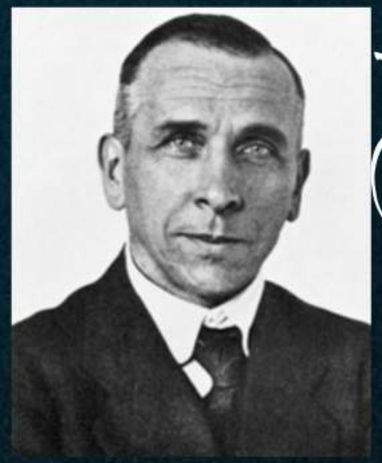
I. Abraham Ortelius → A Dutch map maker, who first proposed such a possibility as early as 1596.



II. Antonio Pellegrini → Drew a map showing the three continents together.



III. Alfred Wegener → A German meteorologist who put forth a comprehensive argument in the form of "the continental drift theory" in 1912.



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Continental Drift Theory, 1912

The continental drift theory → According to wegener.

↓

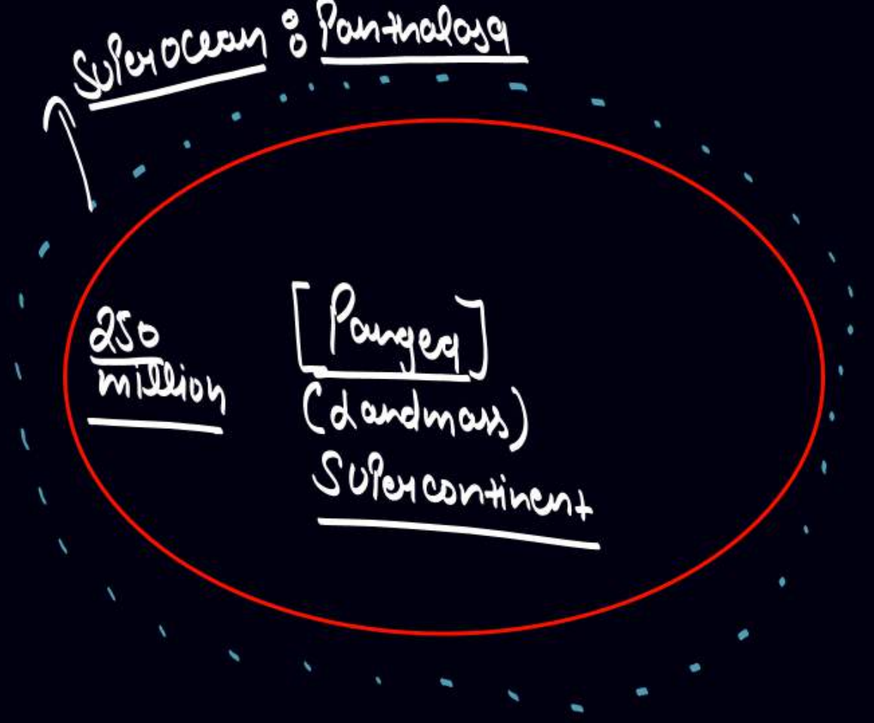
All the continents formed a single continental mass and mega ocean surrounded the same.

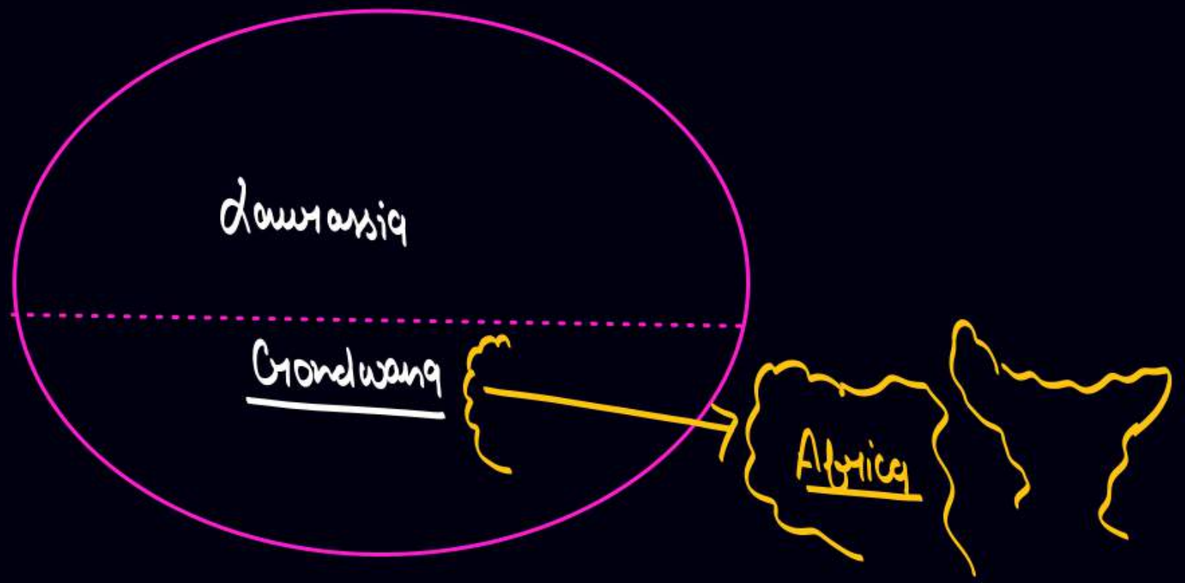
↓

- Super continent = PANGAEA (All earth)
- Mega ocean = PANTHALASSA (All water)

↓

- He argued that, around 200 million years ago, the super continent, Pangaea, began to split.
- Pangaea first broke into two large continental masses as Laurasia and Gondwanaland forming the northern and southern components respectively.
- Subsequently, Laurasia and Gondwanaland continued to break into various smaller continents that exist today.


Superocean
Panthalasa
250 million
[Pangea]
(Landmass)
Supercontinent


Laurasia
Gondwana
Africa

Evidence in Support of Continental Drift



By the mid-20th century, a variety of new evidence was gathered in support of continental drift, as mentioned below:

- **Matching the continent (Jig-Saw-Fit):** There is a remarkable match in the shorelines of Africa and South America. A map produced using a computer programme to find the best-fit Atlantic margin was presented by Bullard in 1964. The match was tried at a 1000-fathom (6 feet depth of water) line instead of the present shoreline.
- **Rocks of the Same Age across the Ocean:** Radiometric dating methods have helped in correlating rock formation across different continents. For example, the Belt of ancient rocks of 2000 million years ago from Brazil's coast matches with those in West Africa.

Evidence in Support of Continental Drift

- **Tillite:** It is the Sedimentary rock formed out of deposits of glaciers. The Gondwana system of sediments from India is known to have its counterparts in six different landmasses in the Southern Hemisphere: Africa, Falkland Island, Madagascar, Antarctica and Australia. At the base, the system has thick tillite indicating extensive and prolonged glaciation.
- **Placer Deposits:** The presence of Gold placer deposits on Ghana's coast and the absolute absence of source rock help in deducing that the gold deposits of Ghana are derived from the Brazil plateau.
- **Distribution of Fossils:** Identical species of plants and animals adapted to living on land and freshwater are found on either side of marine barriers.

Force for Drifting

Pole-fleeing Force

↓

It relates to the rotation of the earth. → Responsible for bulge at the equator.

The Tidal Force

↓

Tides develops in the oceanic waters due to the attraction of the moon and the sun.

Wegener believed that these forces would become effective when applied over many million years.

↓

Most of scholars considered these forces to be totally inadequate.

Post-Drift Studies

Evidences for continental drift theory

- Evidence collected from the continental areas in the form of distribution of Flora and Fauna or deposits like tillite.
- Discoveries during the post-World War II period added new information to geological literature.

Post-Drift Studies



- Continental drift theory was unable to counter the criticism of the forces responsible for the movement of the continent. Several discoveries during the post-World War II period added new information to geological literature.
- **Conventional Current Theory**: It was given by **Arthur Holmes** in 1930. It discussed the possibility of a system of **convectional currents** operating in the Mantle portion. It is generated due to radioactive elements causing thermal differences. However, it was not fully accepted.
- **Mapping of the Ocean Floor**: The Ocean floor is not just vast and plain but full of relief. Expeditions provided a detailed picture of the ocean relief and indicated the existence of submerged mountain ranges as well as deep trenches. Thus, it has various reliefs similar to continents.

Post-Drift Studies

- Mid-oceanic ridges were found to be most active in terms of volcanic eruptions.
- Dating of rocks from oceanic crust revealed much younger than continental areas.
- Rock equidistance from the ridge on either side has remarkable similarities in terms of age and constituents.



Post-Drift Studies

- **Distribution of Earthquake & Volcanoes: along belts:**
  - **Atlantic Ocean:** symmetrically from along the coast – along mid-ocean ridges. These areas feature shallow earthquake zones hinting towards a thinner crust in these areas.
  - **Deep earthquake zones:** Alpine and Himalayan system, rim of Pacific Ocean. The Rim of the Pacific is called the '**Rim of Fire**' due to active volcanoes in the sea.

The Continental Drift Theory

Piecing It All Together



PERMIAN

250 million years ago

The Atlantic and Indian oceans did not exist, and all the continents were configured into the universal landmass of Pangaea. The land was surrounded by one global ocean, called Panthalassa.

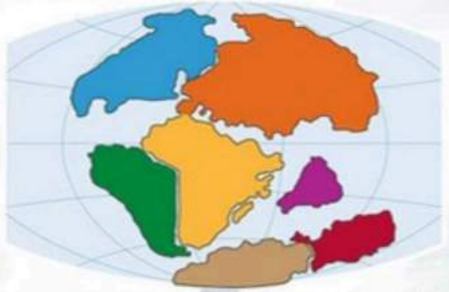


TRIASSIC

200 million years ago

The breakup of Pangaea began. Rifts formed, splitting West Gondwana from East Gondwana. India separated from Antarctica. Laurasia split from South America and Africa.

Two hundred and fifty million years ago, the land masses of Earth were clustered into one supercontinent called Pangaea. As millions of years passed, Pangaea broke apart, and large pieces of land slowly moved away to form the continents as we know them today.



JURASSIC

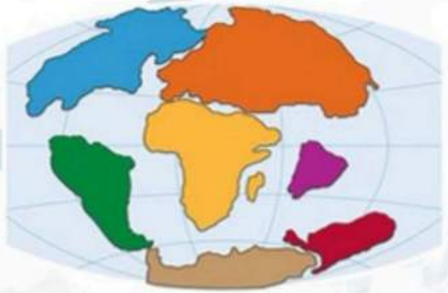
145 million years ago

Seafloor spreading further opened the central North Atlantic and Indian oceans. At the end of the period, a new rift split South America from Africa.



PRESENT DAY

New Zealand is split from Australia's east coast. The North and South Atlantic oceans are more open. Africa is slightly north, and India is joined with Asia.



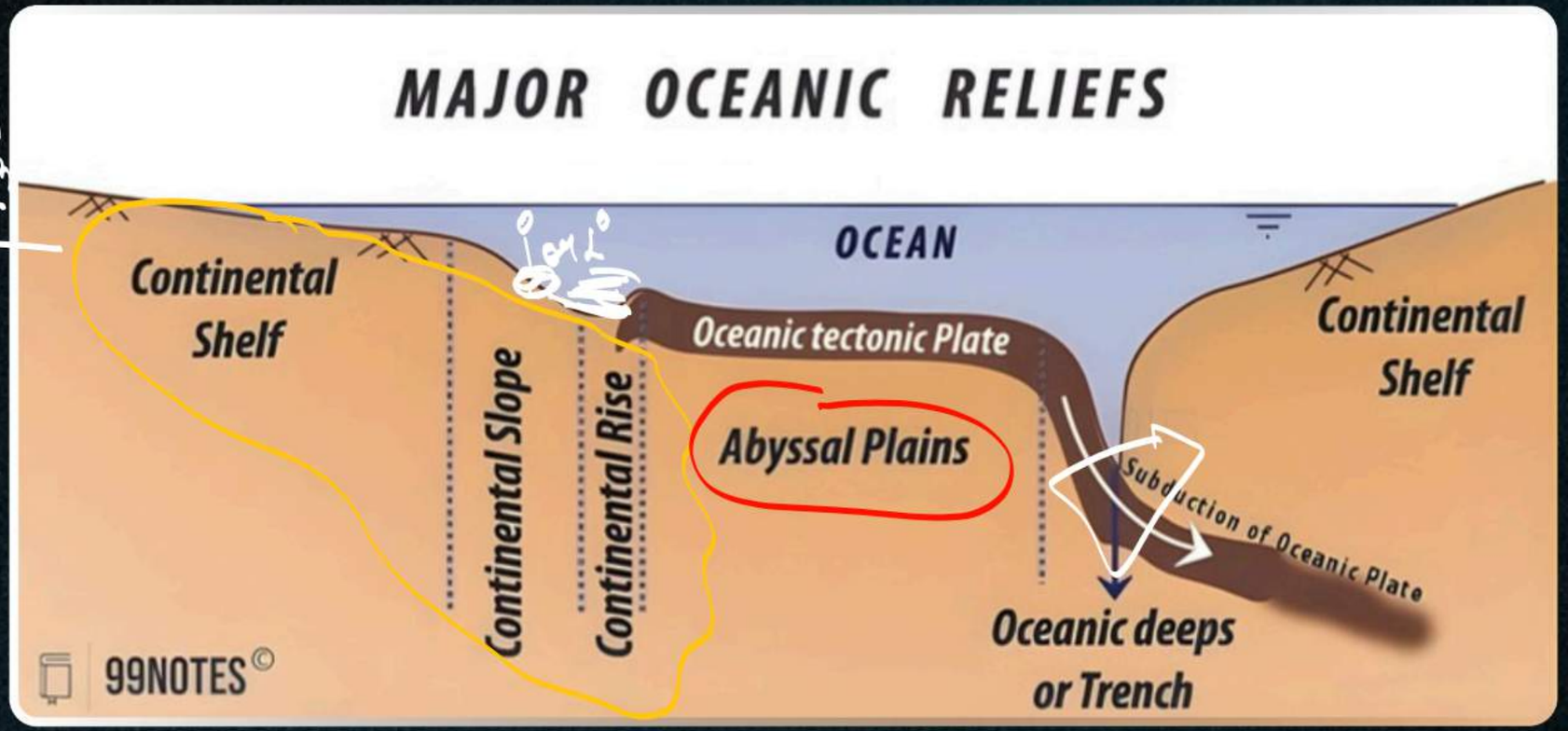
CRETACEOUS

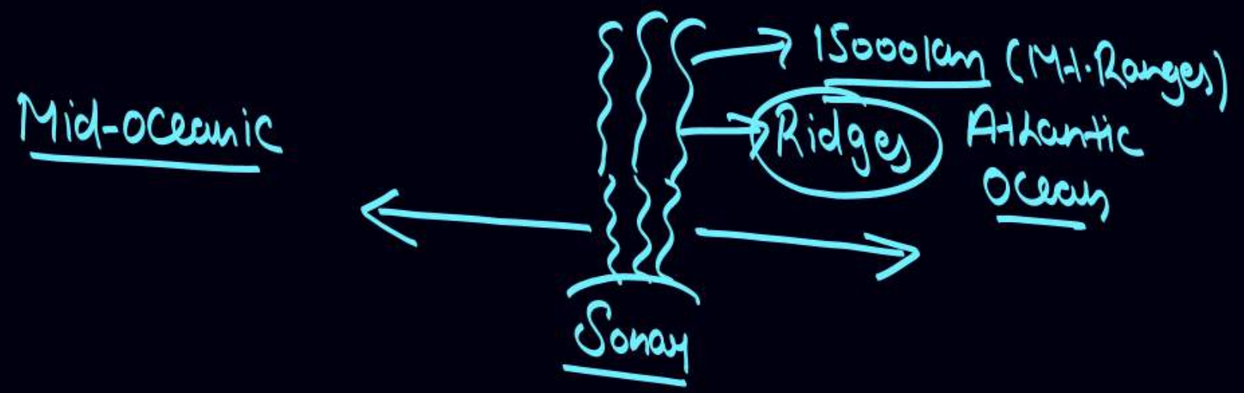
65 million years ago

The movement continued. Madagascar drifted away from Africa, which continued its move north. The northward drift of India continued, and Australia split from Antarctica.

Ocean Floor Configuration

- There are four main features of the ocean floor which include (1) continental shelf, (2) continental slope, (3) continental rise, and (4) abyssal plains.




Mid-oceanic
15000km (Mt. Ranges)
Ridges
Atlantic
Ocean
Sonar

Ocean Floor Configuration

- There are various minor oceanic reliefs such as Mid Oceanic ridges. We shall study them in chapter 13 in detail. The Mid-Oceanic ridges are a series of parallel underwater mountain ranges; The crustal plates split at these places spewing volcanic material from the centre, creating these parallel ranges. The study of these mid-oceanic ridges gives us an amazing insight into the tectonic plates.

Sea Floor Spreading Theory

Over the years, the Mapping of Ocean floor and Palaeomagnetic studies of rocks from oceanic regions revealed:

1. **Volcanic eruptions all along mid-oceanic ridges** are common and they bring huge amounts of lava to the surface.
2. **Rocks equidistance from ridges** show remarkable similarities in terms of formation period, chemical composition Magnetic Properties. The rocks nearest are the youngest and have normal polarity.
3. **Ocean crust rocks are much younger than continental** as the age of the oceanic rocks is nowhere more than **200 million years**. Whereas, the age of Continental rocks sometimes dates back to 3200 million years.

Sea Floor Spreading Theory

4. **Sediments on the ocean floor are unexpectedly thin** thus it is not as old as continents.
5. Deep trenches have deep-seated earthquake occurrences. Mid-oceanic ridges have Earthquake foci at shallow depths, again hinting that the oceanic crust is much thinner.



Hess's Hypothesis (1961)

The above factors led Hess to believe that the "sea floor is spreading".

- Hess argued that constant eruptions at the crest of oceanic ridges cause the rupture of the oceanic crust and the new lava wedges into it, pushing the oceanic crust.
- He further maintained that the ocean floor that gets pushed due to volcanic eruptions at the crest, **sinks down at the oceanic trenches** and gets consumed, as shown in the figure on the next page.

It is therefore clear that there are large segments of the earth's crust that move continuously in an everchanging process of formation and destruction. This finally led to the popularity of the tectonic Plate theory, which is the best description of the crust that we have today.

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Plate Tectonics

Plate tectonic [Lithospheric]

- It is a geologic process in which tectonic plates large slabs of Earth's lithosphere split apart from each other. **In 1967, McKenzie and Parker, and also Morgan** independently collected available ideas and came out with other concepts termed Plate Tectonics.
- It is an improvement over the Continental drift theory (CDT) as it has combined CDT with seafloor spreading theory with the convectional current theory.
- **Tectonic Plate:** It is a lithospheric plate, a massive irregularly shaped slab of solid rock composed of continental and oceanic lithosphere.

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Plate Tectonics

Continental Drift → Post Drift Studies

↓

Sea floor spreading theory

It was in 1967, McKenzie and Parker and also Morgan, independently collected the available ideas and came out with another concept termed Plate Tectonics.

What is tectonics?

↓

A tectonic plate (also called lithospheric plate) is a massive, irregularly-shaped slab of solid rock, generally composed of both continental and oceanic lithosphere.

Plate Tectonics

→ Tect onics plate → Part of lithosphere.

↓

- Lithosphere include crust and top mantle.
- Its thickness range varying between 5 and 100 km in oceanic parts and about 200 km in the continental areas.

How to identify whether a plate is continental plate or oceanic plate?

↓

A plate may be referred to as the continental plate or oceanic plate depending on which of the two occupy a larger portion of the plate.

EXAMPLE

Pacific plate = Oceanic plate

Eurasian plate = Continental plate

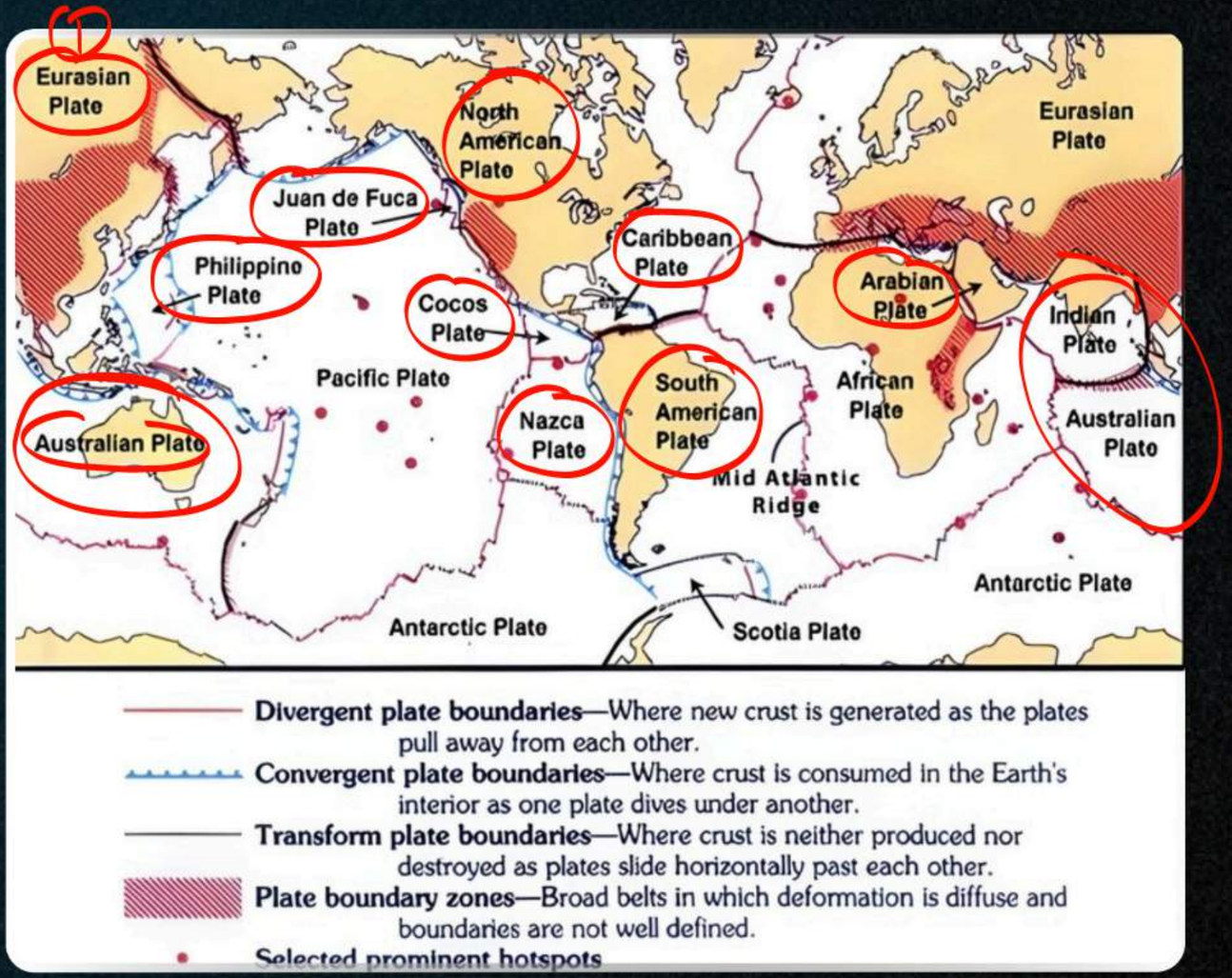
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Plate Tectonics

7 Major Plates

- Plates move horizontally over the asthenosphere as rigid units (Crust + Top Mantle) with thicknesses between 5-100 km in oceanic parts and about 200km in continental areas.
- The plate may be Continental or Oceanic depending on which of the two occupies a larger portion. For Example; the Pacific plate is **Oceanic** and the Eurasian plate is **Continental**.



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Types of Plate Boundaries



- The tectonic plates continuously move to induce earthquakes and volcanoes. All the major earthquakes and volcano zones lie on these boundaries. Following are the three types of plate boundaries based on the interaction of different plates:
- **Divergent Boundaries:** Where new crust is generated as plates pull away from each other. Sites at boundaries are called spreading sites. For example, the Mid-Atlantic Ridge, as shown in the diagram above.
- **Convergent Boundary:** Where the sinking of a plate occurs it is called a Subduction zone. There are 3 ways of convergence as follows:
  - **Between oceanic and continental plates.** Ex: South American and Nazca plate.
  - **Between two oceanic plates.** Ex: Philippines and Pacific.
  - **Between two continental plates.** Ex: India and Eurasian.

Types of Plate Boundaries

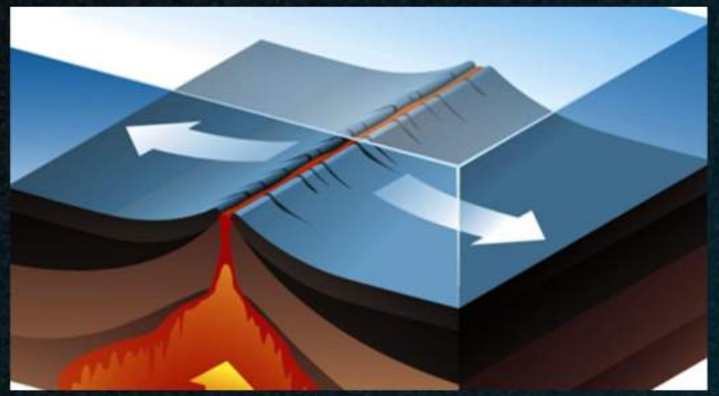


- **Transformation boundaries:** Crust is neither produced nor destroyed as plates slide horizontally past each other.
- Through Palaeomagnetic data, positions held by each of the present continental landmasses in different geological periods have been determined. We now know that **Pangaea** was a result of the converging of different continental masses that were part of one or the other plates. The rotation of the earth also has its effect on separated blocks of the plate portions.

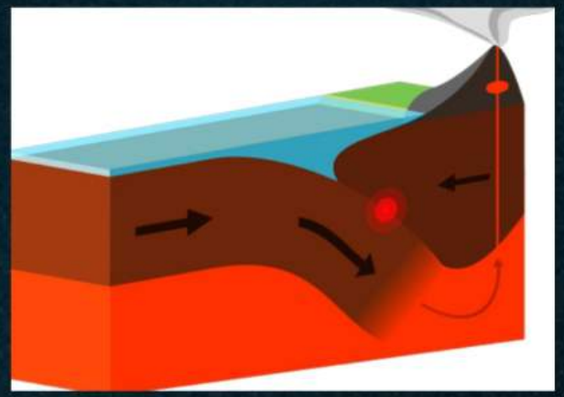
Types of Plate Boundaries

There are three types of plate boundaries

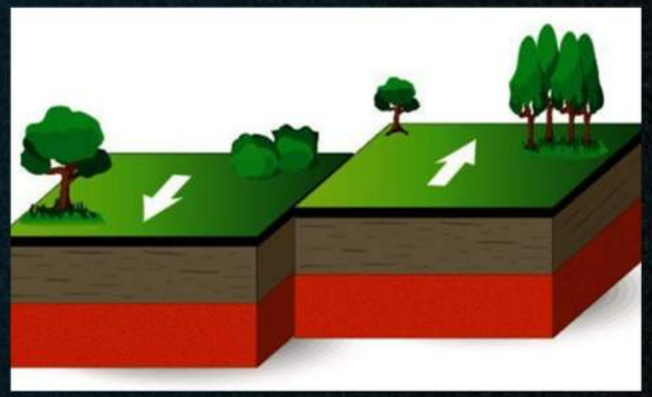
Divergent Boundaries



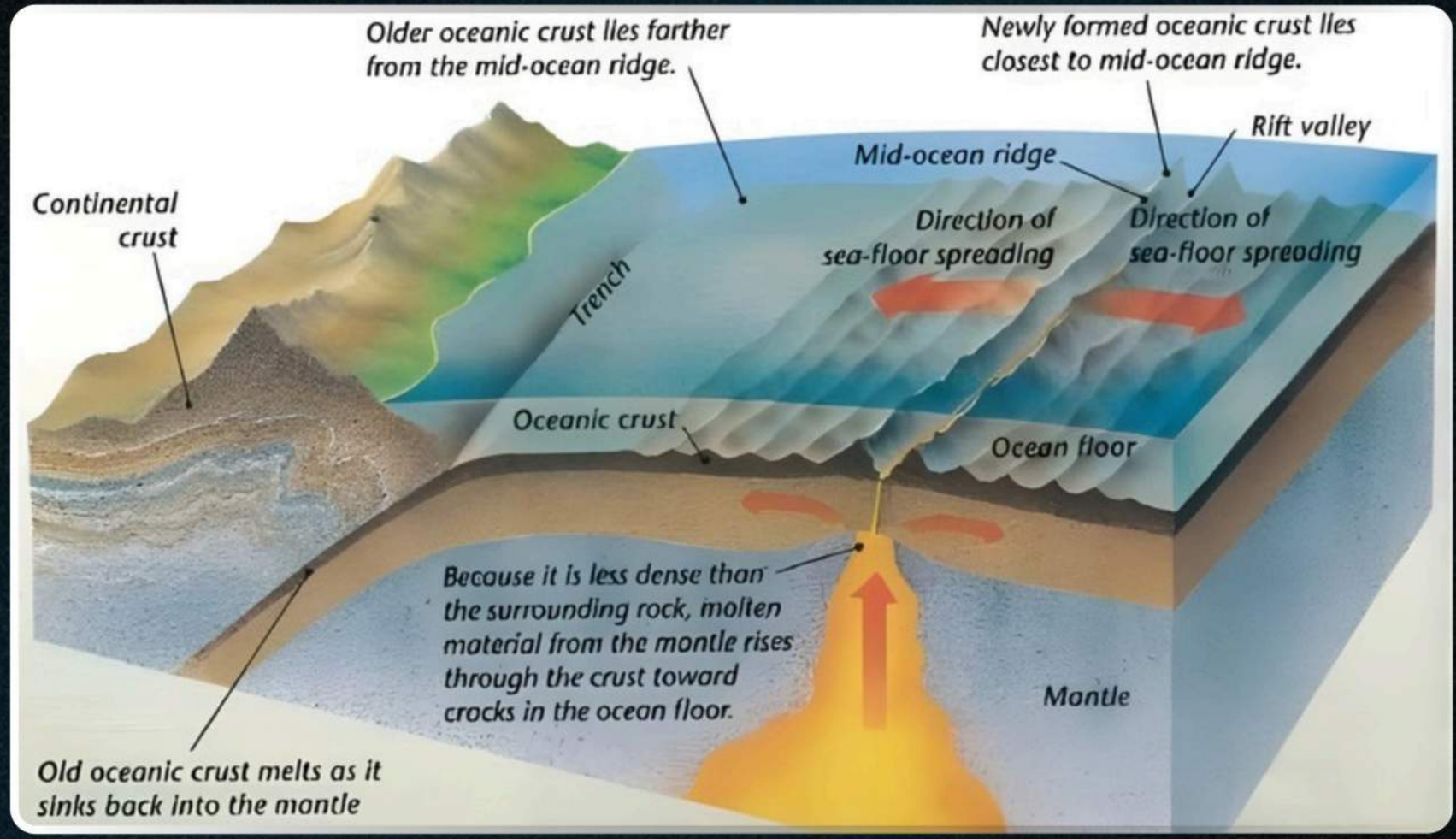
Convergent Boundaries



Transform Boundaries



Types of Plate Boundaries



Types of Plate Boundaries

- **Rate of plate movement:** Strips of reverse and normal magnetic fields that parallel the mid-oceanic ridges help scientists determine the rates of plate movement.
- Arctic Ridge has the slowest rate at 2.5 cm/year,
- The East Pacific Rise near Easter Island (South Pacific- 3400km West of Chile) has the fastest rate of movement at 15cm/year.
- **Force for plate Movement:**
- The mobile rock beneath the rigid plates is believed to be moving in a circular manner. The heated material rises to the surface, spreads begins to cool, and then sinks back into deeper depths. This cycle is repeated over and over to generate what scientists call a **convection cell or convective flow**. The slow movement of Hot, the softened mantle is the driving force behind the movement.

Types of Plate Boundaries

- **Heat within the earth comes from two main sources:**
- Radioactive decay and Residual heat.

Movement of the Indian Plate

- **Indian plate** includes Peninsular India and Australian continental portions.
- **Northern plate boundary** – continent convergence.
- **Eastern plate boundary** – Rakhine Yoma Mountains of Myanmar towards the island arc along Java Trench. The eastern margin is a spreading site lying in the east of Australia in the form of an Oceanic ridge in South West Pacific Ocean.
- **Western plate boundary** – It follows the Kirthar Mountains of Pakistan. Further extends along the Makarana coast and joins the spreading site from the Red Sea Rift Southeast along the Chagos Archipelago.
- **Southern plate boundary** – Situated between Indian and Antarctic plates, which are divergent.

Movement

- India was a large Island situated off the Australian coast in a vast ocean called the **Tethys Sea**, separated from the Asian continent until **225 million years** at the time **Pangaea broke**.
- It collided with Asia about 40-50 Million years ago causing rapid uplift of the Himalayas.
- **140 million years ago** India was 50^0 Two major plates were separated by the Tethys Sea and the Tibetan Block (Closer to the Asiatic mass).
- A major event occurred that was **outpouring lava formation of Deccan Traps** started somewhere around **60 million years ago** & continued for a long period.

Role of plate tectonics in the Distribution of Earthquakes & Volcanoes

- **Plates are thought to float on the molten mantle** continuously converging diverging or rubbing against each other.
- Moving away from oceanic ridges where new plate material is produced and moving past each other or colliding along plate boundaries. Earthquakes and volcanoes are related to this movement.
- Volcanoes, however, only occur at constructive and destructive plate margins. A lot of volcanic activity occurs in the '**ring of fire**'. The 'Ring of Fire' is a group of volcanoes that are located along the plate margin of the Pacific plate.

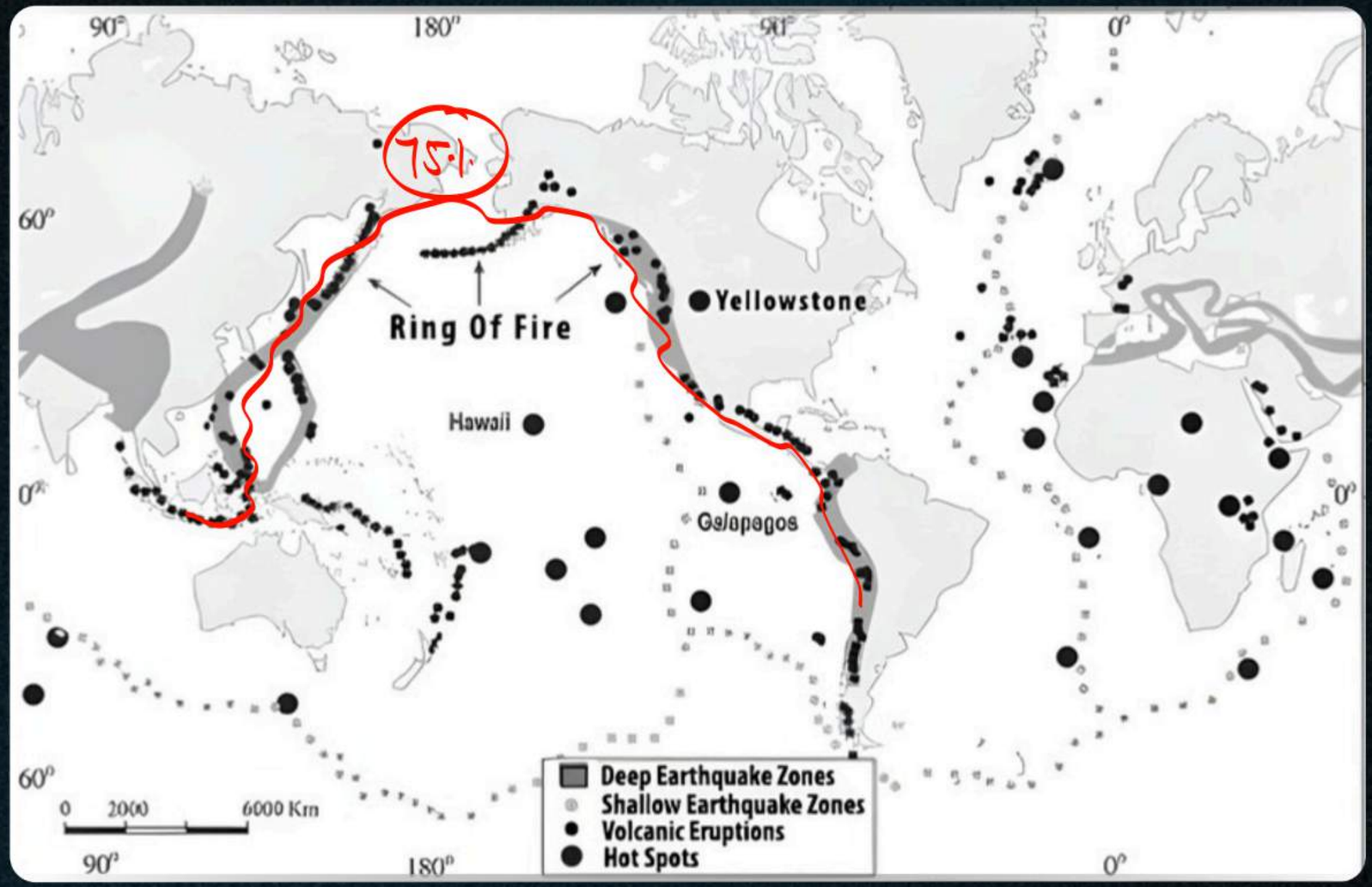
Tectonic Activity at Converging Plates

- At a convergent junction, movement is not continuous but intermittent. The colliding plates continuously get pressed against each other and energy keeps building up. Once enough energy is built up to overcome the frictional forces between the plates, the plates move. Generally, one plate subducts under the other. The subducting plates melt into the mantle,
- The region of Subduction is associated with **volcanoes and earthquakes**.
- At continent and continent convergence zones, only earthquakes occur. For example: Alpine and **Himalayan systems**.
- At places where at least one oceanic plate is involved in the subduction, volcanic activities are common along with earthquakes. Here, we must remember that the oceanic plate is heavier and therefore easily subducts below the continental place.

Tectonic Activity at Converging Plates

- **Reason for the Earthquake in such zones:** When the moisture-laden crustal plate comes in contact with the Mantle, the moisture expands due to high temperature and leads to explosive rupture on the plate boundaries. **This causes volcanos** and is associated with **Deep earthquake zones**.
- **Examples:** Krakatoa volcano in Indonesia.
- The **Pacific Ring of Fire** – a chain of earthquake and volcanic activity around the edge of the Pacific Ocean, generates 75% of the world's volcanoes and 80% of the world's earthquakes.

Tectonic Activity at Converging Plates



Movement of the Indian Plate

Indian Plate

The Indian plate includes Peninsular India and the Australian continental portions.

Plate Boundaries

- The subduction zone along the Himalayas forms the northern plate boundary in the form of continent - continent convergence.
- In the east, it extends through Rakim Yoma Mountains of Myanmar towards the island arc along the Java Trench.
- The Western margin follows Kirthar Mountain of Pakistan.
- In the South, the boundary between India and the Antarctic plate is also marked by oceanic ridge (divergent boundary) running in roughly W-E direction and merging into the spreading site, a little south of New Zealand.

Movement of the Indian Plate

India → Was a large island situated off the Australian Coast.

↓

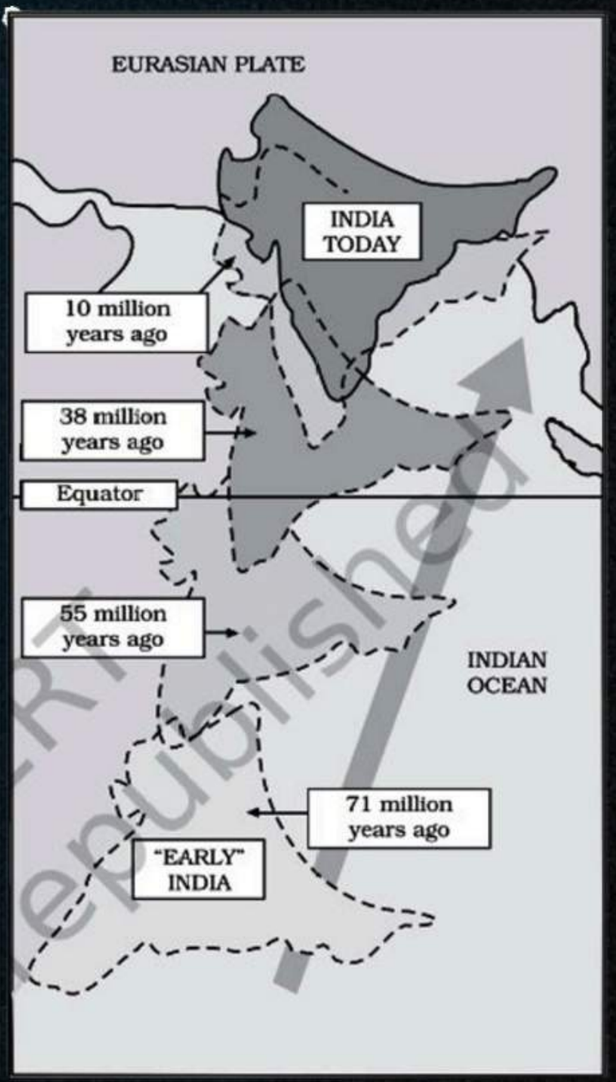
The Tethys sea separated it from the Asian continent till about 225 million years ago.

↓

- India is supposed to have started her northward journey about 200 million years ago at the time when Pangaea broke.
- India collided with Asia about 40-50 million years ago causing rapid uplift of the Himalayas.

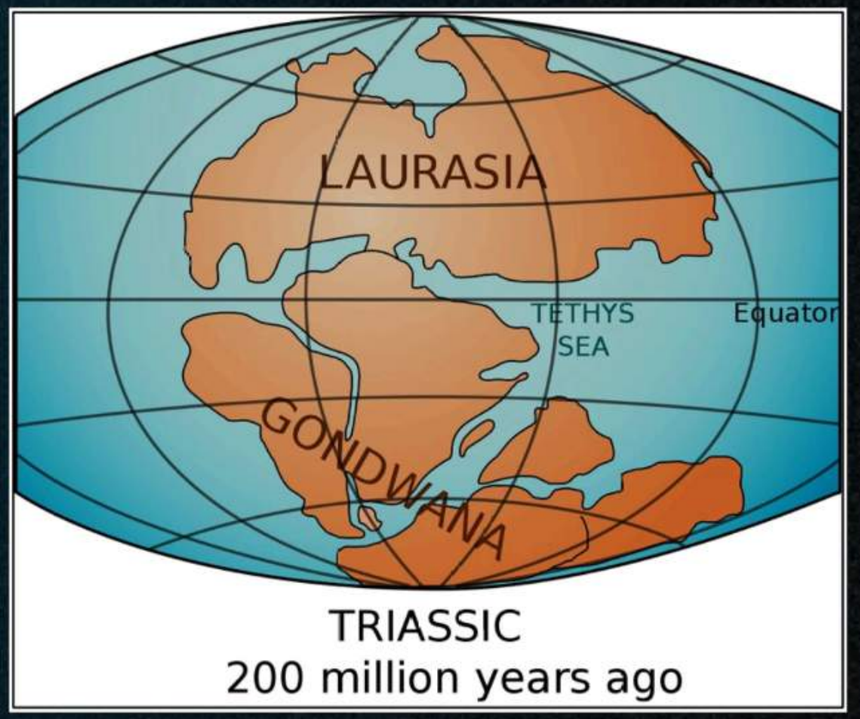
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Analyse the figure



Movement of the Indian Plate

- The two major plates were separated by the Tethys Sea and the Tibetan block was closer to the Asiatic landmass.
- During the movement of the Indian plate towards the Eurasian plate, a major event that occurred was the outpouring of lava and formation of the **Deccan Traps**.
- From 40 million years ago and thereafter, the event of formation of the Himalayas took place. Scientists believe that the process is still continuing and the height of the Himalayas is rising even to this date.



THANK YOU

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