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Volume – 8

Geography and Geology of the World and India

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Geography and Geology of the World and India

Volume – 8

1 CHAPTER Earth

Geographical Coordinates: Latitudes and Longitudes

- Shape of Earth- 'Geoid'

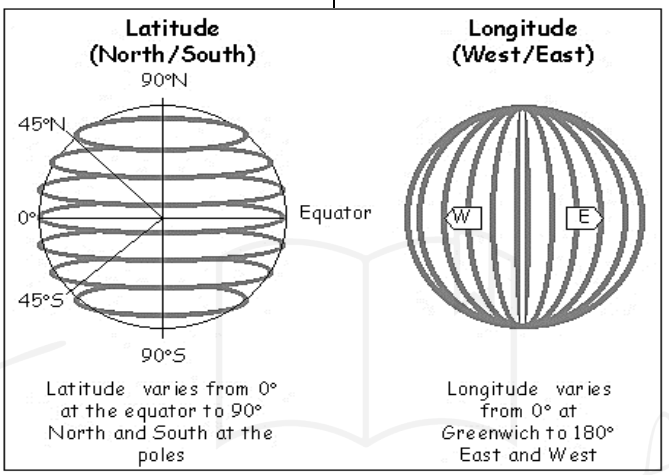


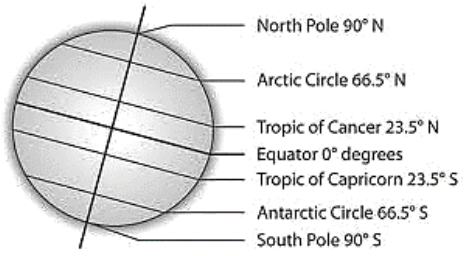
Fig : Latitudes and Longitudes

- Latitudes and longitudes are **imaginary lines** used to **pinpoint** a **location** on the globe.
- **Eg:** The location of New Delhi is 28° N, 77° E.

Latitudes

- Angular distance of a place on the earth's surface from the earth's centre.
- **Equator**:Another imaginary line running on the globe; divides it into two equal parts.
  - **Northern Hemisphere:** Upper half of the earth
  - **Southern Hemisphere:** Lower Half of the Earth
- **Parallels of Latitude :** All parallel circles from the equator up to the poles.
- Latitudes are **measured** in **degrees**.
- **Equator- zero** degree **latitude**.

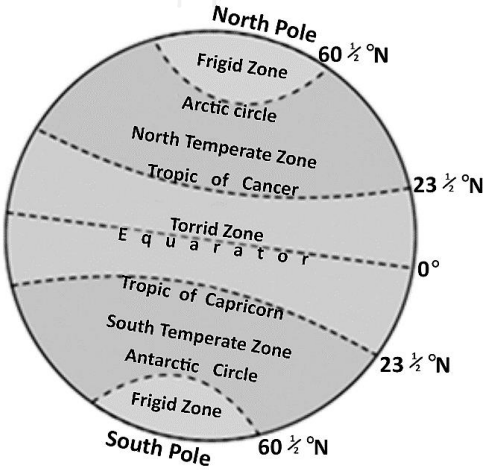
Important Parallels of latitude:



- **Arctic Circle: 66½° N** in the Northern Hemisphere
- **Tropic of Cancer: 23½° N** in northern hemisphere
- **Tropic of Capricorn: 23½° S** in southern Hemisphere
- **Antarctic circle**: **66½° S** in Southern hemisphere

 # Latitudinal Heat zones of Earth/ Tropics

- Receive **maximum heat.**

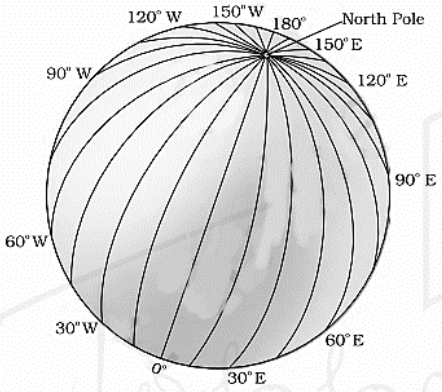


- **Bordered** on **north** by the **Tropic of Cancer** and on **south** by the **Tropic of Capricorn**
- Define the **northern and southern extremes of places where the sun passes directly overhead seasonally.**

- On all latitudes between the Tropics of Cancer and Capricorn, the midday sun is exactly overhead at least once a year.

Longitude

- An **angular distance along the equator** measured in degrees east or west of the Prime (or First) Meridian.
- Represented by a **sequence** of **semi-circles** that go from **pole to pole** and pass **across** the **equator**- aka **meridians**.
- **Function**: to **calculate local time** in relation to G.M.T. or Greenwich Mean Time, often known as World Time.
- **1884** - **meridian passing** through the **Royal Astronomical Observatory** at **Greenwich**, near **London** was chosen as **Zero meridian or Prime meridian**.



Important Meridians

- **Prime Meridian:**
  - **0° longitude,** - count **180° eastward** and **180° westward** from it.
  - The Prime Meridian and 180° meridian **divide the earth into two equal halves,** the **Eastern** Hemisphere and the **Western Hemisphere**

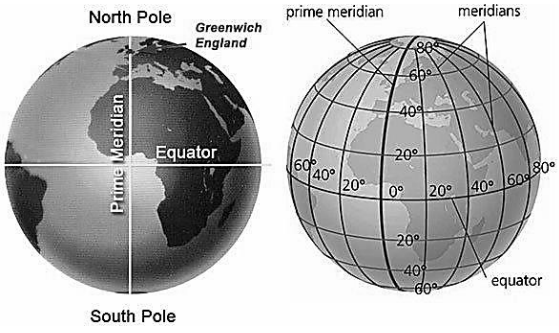


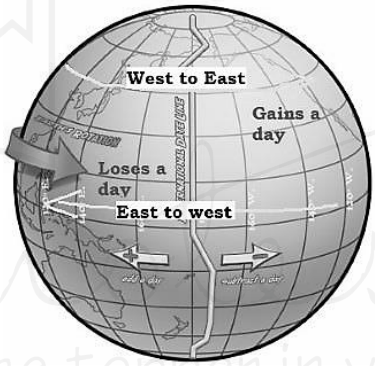
Fig: Prime meridian

- **International Date Line:**
  - Represented by a **180° longitude**.
  - **Time at this longitude** is exactly **12 hours from the 0 degree longitude, irrespective** of **westward or eastward side** from the **Prime Meridian**.
    - **Eastern side**:Time increases (**12 hours < time at 0° longitude**.)
    - **Western side** : Time decreases (**12 hours > Prime Meridian**)

In the **mid-Pacific**, the International **Date Line bends** from the regular 180° meridian at the Bering Strait, Fiji, Tonga, and other islands t**o avoid day-and-date confusion** in some of the island groupings that are cut through by the meridian.

Longitudes and time:

- **Earth rotates 360 degrees in a day or 24 hours 15 degrees in 1 hour** or **1 degree in 4 minutes.**
- Earth **rotates from west to east, local time advances** by **one hour every 15⁰ eastward.**
- M**oving westwards delays local time by one hour.**



- **Locations east of Greenwich see the sun sooner and gain time**, whereas **locations west of Greenwich see the sun later and lose time.**

DST (Daylight Saving Time)

- **Change in standard time that allows people to make better use of daylight.**
- **Clocks** are usually **set forward one hour towards the start of spring** and **backward one hour in the autumn.**

Chaibagaan Time

- **150 years ago**, **British colonialists instituted** "chaibagaan time" or "bagaan time," a **one-hour ahead of IST time schedule followed by tea plantations.**
- This was done **in order to increase productivity by making better use of daytime.**
- For the **past 66 years, Assam, along with the rest of India, has followed the International Standard Time (IST).**

Comparison of the Meridians of Longitude and the Parallels of Latitude

Parallels of Latitude	Meridians of Longitude
Angular distance of a point north or south of the equator, measured in degrees.	Angular distance measured in degrees along the equator- measured from 0° to 180° east or west of Greenwich (0°).
Parallel to the equator.	Converge at poles.
Appear as circles on a globe.	Appear as circles running through the poles.
Distance between two latitudes- 111 Km.	Distance varies Equator - 111.3 miles ; Poles- 0 km
Equator at 0 degrees; Poles at 90 degrees.	Total 360 degrees of longitude (180 degrees east and west of the Prime Meridian in each direction).
Used to demarcate temperature zones.	Used to calculate the local time wrt Prime Meridian time.

Motions of Earth

Earth's Rotation:

- On its axis (tilted at a 23.5° angle with the normal (90°) , or a 66.5° angle with the orbital plane).
- 1 rotation- 24 hours.
- The orbital plane is the plane in which the Earth orbits the Sun.
- Rotation from west to east on its axis resulting in creation of day and night.

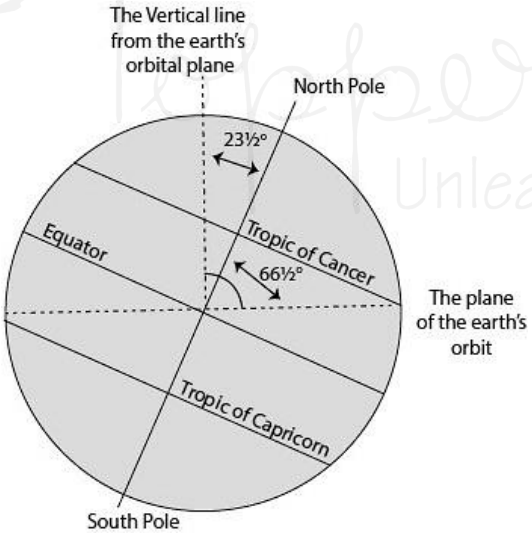


Fig. : Inclination of Earth's axis and the orbital plane

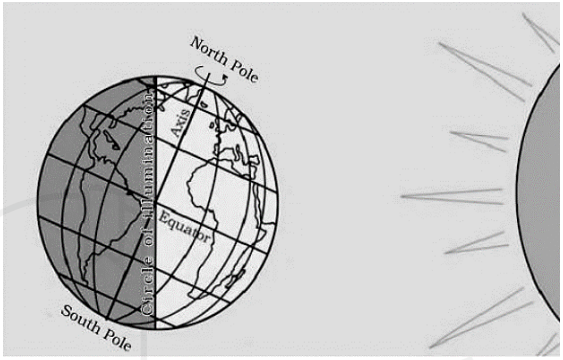


Fig : Day and Night on the Earth due to Rotation

Circle of illumination- circle on the globe that separates day from night.

Effects of Rotation of the Earth

- Causes days to turn into nights.
- Difference of one hour is created between two meridians.
- Change in the direction of wind and ocean currents.
- Regular Tides.

Earth's Revolution

- Revolves in an elliptical orbit as it circles around the sun.
- One complete round takes 365¼ days or a year.

Leap year :

- Six hours saved every year are added to make one day (24 hours) over a span of four years.
- Added to the month of February.
- Thus every fourth year, February is 29 days instead of 28 days.
- Total days- 366.

Effects of Earth's Revolution:

- Seasons change due to the change in the position of the earth around the sun.

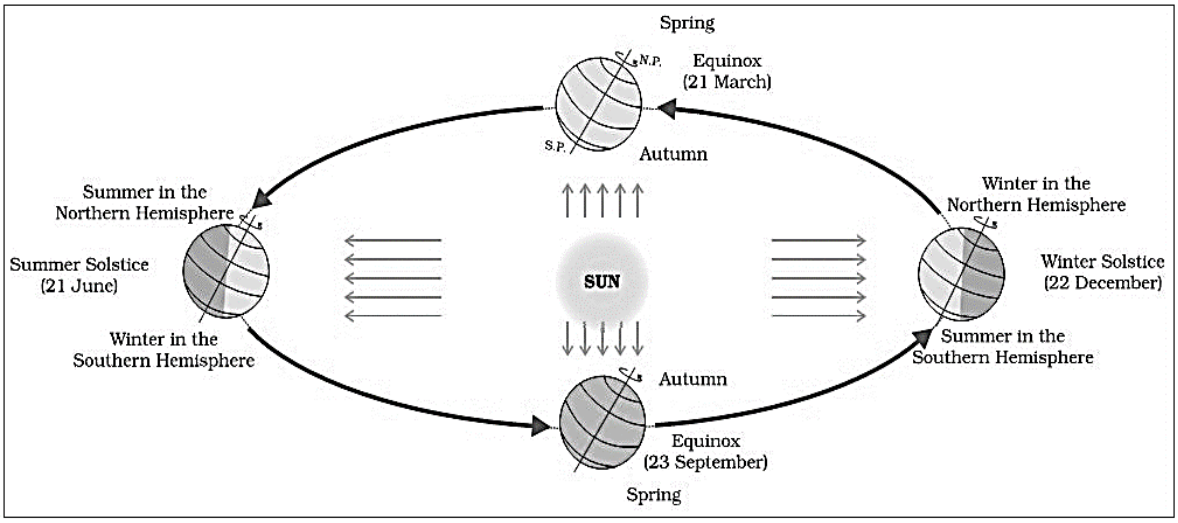


Fig: Revolution of earth and Seasons

Solstice:

1. Summer Solstice:
   - Northern hemisphere is inclined towards the sun on June 21st.
   - Rays of the sun fall directly on the Tropic of Cancer - excessive heat in the region.
   - Poles/ nearby locations receive less heat - sun's beams are slanted.
   - Areas beyond the Arctic Circle - six months of uninterrupted daylight - north pole is tilted toward the sun.
   - 21st June- longest day and shortest night- sun shines on the maximum part of the northern hemisphere;it is summer in the areas north of the equator.
   - Conditions reversed in southern hemisphere. There is a winter season in the area.The days are shorter than the nights.
2. Winter solstice:
   - Tropic of Capricorn receives direct sunlight on December 22nd - south pole tilts towards the sun.
   - Sun's rays fall vertically near the Tropic of Capricorn (23½° s).
   - Southern hemisphere experiences summer, with longer days and shorter nights. In the northern hemisphere, the opposite is true.

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Equinox:

- Equator receives direct sunlight on March 21st and September 23rd.
- Neither poles slant towards the sun in this position, the entire earth has equal days and nights.
- Northern hemisphere- autumn season on September 23rd
- Southern hemisphere - spring season .
- March 21st- spring in the northern hemisphere and Autumn in the southern hemisphere.

2 CHAPTER Internal Structure of Earth

Source of study Interior of Earth

1. Indirect Sources:

A. Increase in pressure and temperature with depth:
- The earth's **diameter and gravity help** in **determining pressure** inside the earth.
- **Volcanic eruptions ,hot springs, geysers indicate** an extremely **heated interior**.

B. Seismic waves
- Theses are divided into **3 broad categories:**

i. Primary **waves**
- aka **longitudinal or P-waves.**
- Travel **fastest** through **solid** materials.
- Also **pass through liquid** materials but **speed decreases.**

ii. Secondary **waves**
- aka **transverse waves or s-waves.**
- **Cannot pass liquid** materials.

iii. Surface **waves**
- **aka long period waves or s-waves.**
- **Affects only the surface** of the earth.
- Die **out at a smaller depth**

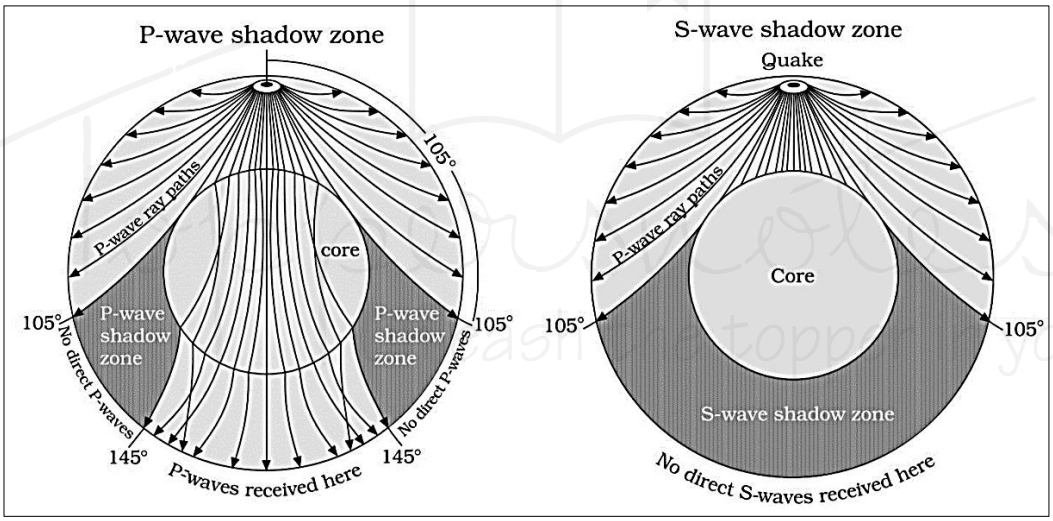


Fig : Paths followed by P and S Waves

Shadow zone:
- **Area** of earth **between 105^0 and 145^0 angular distance**.
- **S waves are completely halted** by the **liquid core,** whereas **P waves are distorted** (refracted) by the liquid core, **resulting in the shadow zone.**

C. Meteorites
- Meteorites **and Earth born from same nebular cloud**- likely to have a **similar internal structure.**
- When **meteoroids fall to earth**- **outer layer burnt** due to extreme friction - **inner core exposed.**
- Heavy material composition of their cores **confirms the similar composition of the inner core of the earth.**

D. Gravitation
- Differs **according to the mass of material.**
- Influenced **by** uneven distribution of mass of material within the earth k/a **gravity anomaly.**
- Gives information about the distribution of mass in the crust of the earth.

E. Magnetic field
- Geodynamo **effect** helps scientists understand **what's happening inside the** Earth's **core.**
- **Shifts in the magnetic field** also provide **clues** about **inaccessible iron core**.

2. Direct sources

A. **Deep earth mining** and drilling
B. **Volcanic eruptions**

Based on the above theories :

- **Earth's interior** is made up of **multiple concentric layers**, with the **crust, mantle, and Core** being significant due to their distinct physical and chemical features.
- The **crust** is a **silicate solid**, the **mantle** is a **viscous molten rock**, **core** is a de**nse solid.**

Division of Earth's Layers

1. Chemical Layers:

- **Crust**
  - **Outermost layer of the earth.**
    - **Depth - 16 km–40 km.**
    - **Thicker at continents** (30-40 km) and t**hinner underneath the ocean basin** (5-10 km.)
    - **Continental Crust:** Mainly **Granitic** in nature.
    - **Oceanic Crust :** Mainly **Basaltic** in natur

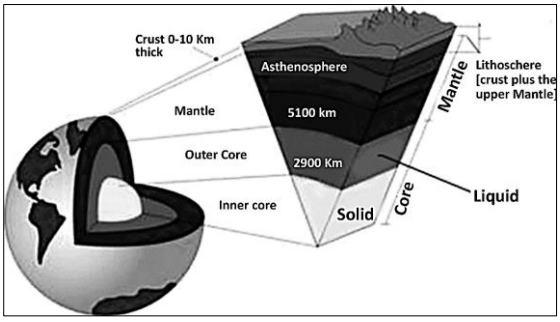
Table : The Major Elements of the Earth's Crust

S.No.	Elements	By Weight (%)
1.	Oxygen	46.60
2.	Silicon	27.72
3.	Aluminium	8.13
4.	Iron	5.00
5.	Calcium	3.63
6.	Sodium	2.83
7.	Potassium	2.59
8.	Magnesium	2.09
9.	Other	1.41

- **Mantle**
  - I**ntermediate layer below the crust**.
  - **Depth- 2900 km depth.**
  - Composition- **Dense and rigid rocks** having predominance of minerals like **magnesium and iron**.
- **Core**
  - A **dense metallic** core lies at the **planet's center.**
  - **Innermost layer** of earth.
  - **Divided** into **2 parts- outer and inner core**

2. Mechanical / Physical layers:

- **Lithosphere**
  - **Rigid outer part** of earth.
  - **Thickness - 10-200 kms.**
  - Includes **crust** and the **upper mantle.**
  - **Broken into tectonic/ lithospheric plates.**
- **Asthenosphere**
  - **Upper portion of the mantle** (astheno means weak).
  - **Lies just below the lithosphere** extending up to **80-200 km.**
  - **Highly viscous, mechanically weak** and **ductile.**
  - **Density > crust.**
  - **Main source of magma** that finds its way to the surface during volcanic eruptions.
- **Mesospheric mantle**
  - part of the mantle **below lithosphere and asthenosphere**
  - aka **lower mantle,**
  - Represents approximately **56% of Earth's total volume.**
  - **Depth- 660 to 2900 km**
- **Outer core**
  - **Depth- 2900 km -5100 km** below the earth's surface.
  - **Composition- Iron + nickel (nife)** and trace amounts of lighter elements.
  - **Less pressure** - so it is **liquid** even though it has a composition similar to the inner core.
  - **Density -** 9.9 g/cm3 to 12.2 g/cm3.
  - **Temperature -** 4400 °C - 6000 °C
  - **Dynamo theory -** convection currents + Coriolis effect = **Earth's magnetic field.**
- **Inner core**
  - **Depth- 5100 km** below the earth's surface.
  - **Composition- Iron** (80%) and some **nickel** (nife).
  - **Solid due to high pressure.**
  - **Rotates slightly faster wrt rotation of the surface.**
  - Too hot to hold a permanent magnetic field.
  - **Density - 1**2.6 g/cm3 to 13 g/cm3.
  - **16 %** of the earth's **volume**
  - **33%** of earth's **mass**.
  - **Temperature- 6000° C.**



ISOSTASY:

- *Literal meaning - **"stage of balance".***
- ***Mechanical stability between** the earth's **crust and mantle** on the rotating earth.*
- ***Maintains an equilibrium state** between buoyancy force and gravitational force.*
  - *Buoyancy force - pulls the crust upward*
  - *Gravitational force - pushes crust downward.*

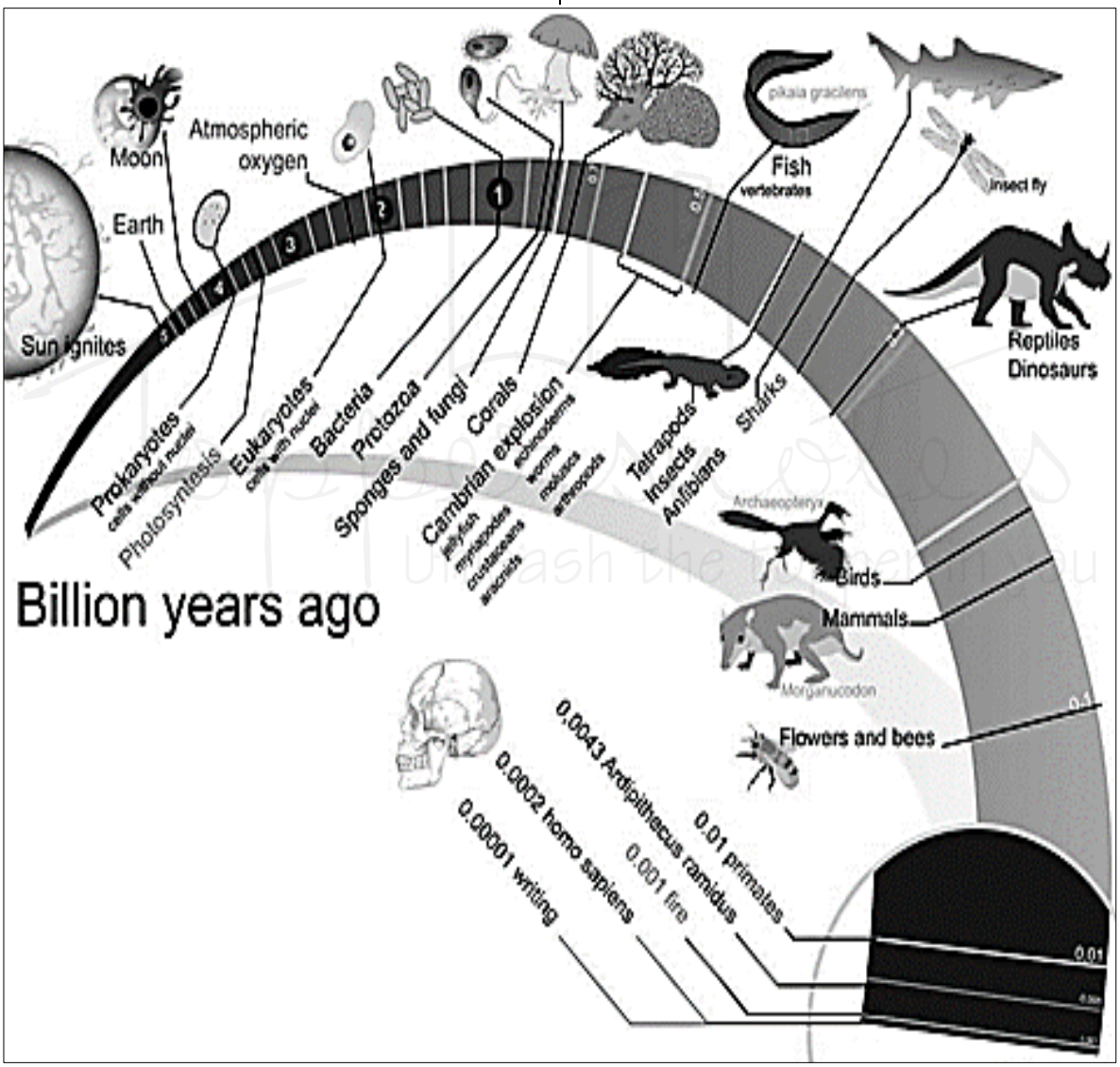
Seismic Discontinuities

- **Regions inside earth** where **seismic waves behave** a lot **different** compared to the surrounding regions **due to a marked change in physical or chemical properties.**
  - **Conrad discontinuity**
    - zone between **upper crust and lower crust.**
  - **Mohorivic discontinuity**
    - Zone that **separates the crust from the upper mantle.**
    - Can be detected by a sharp increase downward in the speed of earthquake waves there.
  - **Repiti discontinuity**
    - Zone between **upper** mantle **and lower mantle.**
  - **Gutenberg discontinuity**
    - Zone separating the **lower mantle from the core.**
    - **Depth -** ~ 2,900 km.
  - **Lehmann discontinuity**
    - Zone separating **solid inner core** from the **liquid outer core.**

3 CHAPTER Geological Time Scale

Geological Time Scale

- **System of chronological measurement** that **describes the timing and relationships between events** that have occurred throughout Earth's history.
- Developed by **studying rock layers and fossils** worldwide.
- **Radioactive dating** helped determine the **absolute divisions in the time scale.**

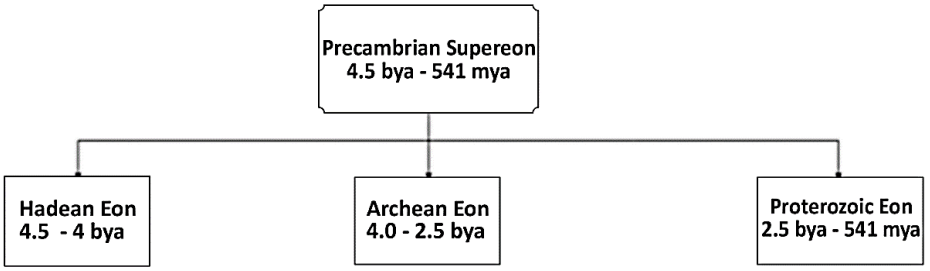


- **Divided** into :
  SuperEon → Eon → Era → Period → Epoch

Table : Geological time scale

Eons	Era	Period	Epoch	Age/years Before Present	Life/ Major Events
Phanerozoic	Cainzoic (from 65 million years to the present times)	Quanternary	Holocene Pleistocene	0-10,000 10,000 – 2 million	Modern Man Homo Sapiens
		Teritary	Pliocene Miocene Oligocene Ecocene Palaeocene	2-5 million 5-24 million 24-37 million 37-58 million 57-65 million	Early Human Ancestor Ape : Flowering Plants and Trees Anthropoid Ape Rabbits and Hare Small Mammals Rats - Mice
	Mesozoic 65-245 million Mammals	Cretaceous Jurassic Triassic		65 – 144 Million 144-208 Million 208-245 Million	Extinction of Dinosaurs Age of Dinosaurs Frogs and Turties
	Palaezoic 245-570	Permian Carboniferous Devonian Silufian Ordovician Cambrian		245 – 286 Million 286 – 360 Million 360 – 408 Million 408 – 438 Million 438 – 505 Million 505 – 570 Million	Reptile dominante replace amphibians First Reptiles Vertebrates : Coal beds Amphibians First trace of life on land Plants First Fish No terrestrial Life Mariane Invertebrate
Proterozoic Archean Hadean	Pre-Cambrian 570 Million – 4800 Million			570 – 2500 Million 2500 – 3800 Million 3800 – 4800 Million	Soft-bodies arthropods Blue green Algae Unicellular bacteria Ocean and Continents form – Ocean and Atmosphere are rich in carbon dioxide
Origin of Starts Supernova Big Bang	5000 – 13700 Million			5000 Million 12000 Million 13700 Millon	Origin of the sun Origin of the universe

Precambrian Supereon



Hadean Eon (4.5–4 bya)

- represents the **time before a reliable (fossil) record of life.**
- Extremely **hot temperatures**
- **Earth was molten -** frequent collisions with other bodies, extreme volcanism and the abundance of short-lived radioactive elements.
- **Moon was formed** by a giant impact collision with a planet-sized body named Theia - ~ 4.5 bya.
- **Large number of asteroids** collided with the early terrestrial planets.
- **Volcanic outgassing -** created primordial atmosphere and then the ocean.
- Almost **no oxygen.**
- **Earth cooled-** formation of a solid crust- hot volatiles - **heavy CO_2 atmosphere with hydrogen and water vapour.**

Archean Eon (4.0 - 2.5 bya)

- Beginning of life on Earth - **evidence of cyanobacteria** (3500 mya).
- **Life is limited to simple single-celled organisms** lacking nuclei k/a Prokaryote.
- **No oxygen;** atmospheric **pressure - 10 to 100 atmospheres.**
- Formation of **continents.**
- **Oldest rock formations** during the archean era.
- Numerous **lava eruptions.**
- **Oceans were acidic** due to dissolved carbon dioxide.
- **Liquid water present.**
- The **earliest identifiable fossils- stromatolites-** microbial mats formed in shallow water by cyanobacteria.

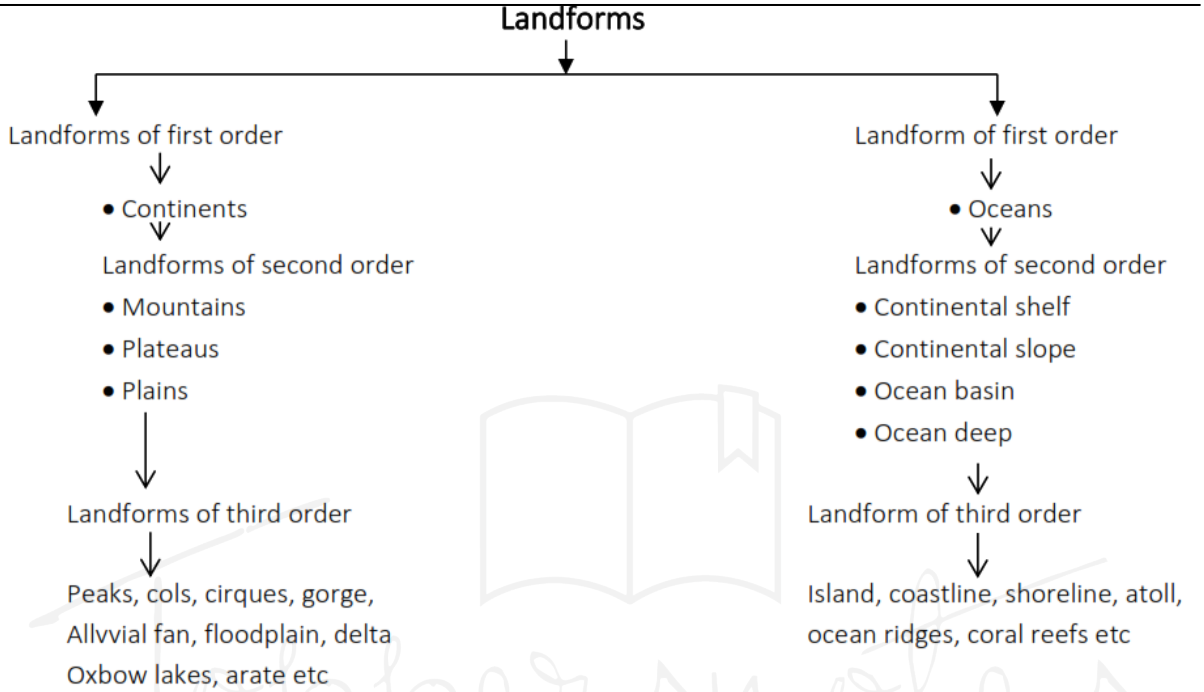
Proterozoic Eon (2.5 bya - 541 mya)

- **Last eon of Precambrian "supereon".**
- **Appearance of oxygen i**n Earth's atmosphere .
- Bacteria began producing oxygen, leading to the **sudden rise of life forms.**
- **Eukaryotes** (having a nucleus), emerged, including some forms of **soft-bodied multicellular organisms.**
- Earliest forms of **fungi developed.**
- **First symbiotic relationships** between **mitochondria** and **chloroplasts** (found in plants and some protists only)
- **Early and late phases underwent Snowball Earth periods** (the planet suffered below-zero temperatures, extensive glaciation and as a result drop in sea levels).
- **Tectonically very active .**
- Featured the **first definitive supercontinent cycles and modern orogeny** (mountain building).
- **43% of modern continental crust developed** (39% - Archean, and only 18% in the Phanerozoic).
- Late Proterozoic - **Rodinia supercontinent** (~1000–750 Ma).

Phanerozoic Eon

- **First fossils of** animals such as **trilobites** appeared.
- **Life** remained mostly **small and microscopic.**
- **Plant life appeared on land.**
- **Complex life,** including vertebrates, began to **dominate the Earth's ocean.**
- **Pangaea formed** - later broke into Laurasia and Gondwana.
- **Life expanded to land** - plants, insects, animals, birds and fungi began appearing.
- **Modern animals**—including humans—**evolved** at the most recent phases of this eon (2 million years ago).
- Divided into **three eras:**
    - **Palaeozoic-** era of **arthropods, amphibians, fishes, and the first life on land;**
    - **Mesozoic-** rise, reign of **reptiles**, climactic **extinction of the non-avian dinosaurs,** the **evolution of mammals and birds;** and
    - **Cenozoic**- rise of **mammals**.

4 CHAPTER Broad Physical Features – World



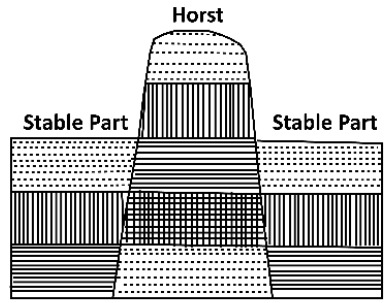
Mountains

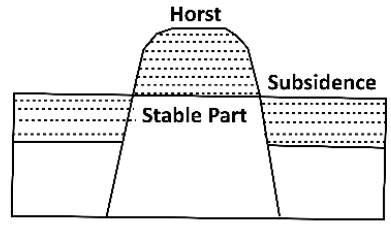
Classification of Mountains

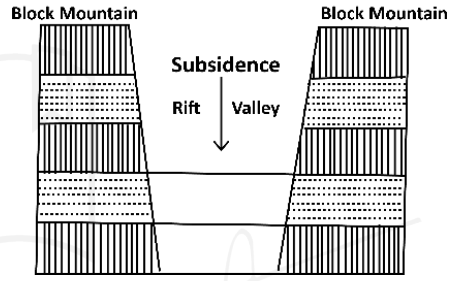
1. On the basis of height
   - **A.** **Low mountains**: 700 -1,000 m.
   - **B.** **Rough mountains**: 1000 m - 1,500 m
   - **C.** **Rugged mountains**: 1,500 - 2,000 m.
   - **D.** **High mountains:** > 2,000 m.
2. On the basis of location
   - **A.** **Continental mountains**
     - a. **Coastal mountains**: Nearby **Coasts**.
       - **Examples:** Applachians and Rockies (North America), Alpine (Europe), Western and Eastern Ghats of India etc.
     - b. **Inland mountains:** On **main landform**
       - **Examples:** Ural Mountains (Russia), Vosges and Black Forest block mountains (Europe), Himalayas, Aravallis, Satpura etc. (India), Kunlun, Tienshan, Altai etc. (Asia) etc.
   - **B.** **Oceanic mountains**
     - a. Mostly **below the water surface, some** can be found **above** also.
     - b. **Majorly** on continental **shelves** and ocean **floors**.
     - c. **Example**: Mauna Kea volcanic mountain of Hawaii Island , Antilean Mountain system
3. On the basis of mode of formation
   - **A.** **Circum-erosional or relict mountains:**
     - The **remnants of old fold mountains**
     - **Formation:** A result of **denudation**
     - **Eg:** Vindhyachal ranges, **Aravallis**, Satpura, Eastern Ghats, Western Ghats etc.

B. Original or tectonic mountains:
- Formation: Due to tectonic forces
- These can be further divided into 4 types:
  I. Folded Mountains
    - Formation: when two or more of Earth's tectonic plates are pushed together by compressive forces generated by endogenetic forces of earth.
    - Location: Convergent plate Boundaries
    - Characteristics:
      - Youngest mountain group.
      - Fossils present.
      - Concave slope on one side and convex slope on the opposite side.
      - Earthquake prone
      - Most numerous and the most significant.
      - Have abundant mineral resources such as tin, copper, gold, and other metals.
      - Area of volcanic activity.
    - Types:
      - Young folded mountains:
        - ✓ Least affected by denudation
        - ✓ Eg: Rockies, andes, Alps, Himalayas.etc
      - Mature folded mountains:
        - ✓ Affected by denudation.
        - ✓ Characterized by mono clinical ridges and valleys.
      - Old folded mountains:
        - ✓ Extremely affected by the denudational process.
        - ✓ Eg: Aravalis, Vindhyanchal etc.

  II. Block/ Fault-Block/ Horst mountains







  - Formation: By tensile and compressive forces by endogenic factors.
  - Location: Between two faults or on either side of a rift valley or a graben.
  - Eg: The Vosges mountains (in France) and the Black Forest (in Germany) etc.
  - Characteristics:
    - Formed when the earth's crust between two fault lines is pushed to rise up (owing to horizontal pressure from either side).
    - Eg: Satpura range is a horst and the rivers Narmada and Tapi flow along the rift valleys on either side
    - Generated when a portion of the earth's crust collapses along two fault lines due to divergent pressures.

        - Eg: River Rhine (Germany) flows along a rift valley and the Black Forest and Vosges represent the block mountains or horst on either side of it
        - Characterised by steep slopes and flattened summits.
        - Moderate size and lack peaks.
    - Types:
        - Tilted block mountains: one steep side represented by fault scarp and one gentle side.
        - Lifted block mountains: Flattened summits of tabular shape and very steep side slopes represented by two boundary fault scarps.

Origin: 2 theories

A. Fault Theory:
- opinion that block mountains are formed due to faulting.
- Formed in a number of ways:
    - Due to upward movement of the middle block between two normal faults.
    - When the side blocks of two faults move downward whereas the middle block remains stable at its place
    - When the middle block between two normal faults moves downward.

B. Erosion theory:
- Opinion that these mountains were not formed due to faulting and tilting, rather they were formed due to differential erosion.
- The mountains, after their origin in the Mesozoic era, were subjected to intense erosion.
- Consequently, differential erosion resulted in the formation of existing denuded Great Basin Range mountains.
- Not acceptable to most of the scientists since they believe that denudation may modify mountains but cannot form a mountain

III. Dome Mountains
- Formation: By magmatic intrusions and upwarping of the crustal surface.
- Location: In a region of flat-lying sedimentary rocks is warped or bowed upward making a structural dome.
- Eg: Normal domes, Lava domes, Batholithic domes, Laccolithic domes, Salt domes etc.

IV. Mountains Of Accumulation/ volcanic mountains:
- Formation: Due to accumulation of volcanic materials.
- Eg: cinder cones, composite cones, acid lava cones, basic lava cones etc

4. On the Basis of Period of Origin

I. Precambrian Mountains:
- belong to the Precambrian period,
- subjected to upheaval, denudation and metamorphosis. So, the remnants appear as Residual Mountains.
- Ex: Laurentian mountains, Algoma mountains etc.

II. Caledonian Mountains:
- Belongs to late Silurian and early Devonian periods.
- Ex: The Appalachians, Aravalli and Mahadeo Hills etc.

III. Hercynian Mountains:
- Belongs to Upper Carboniferous to Permian period in Europe.
- Ex: mountains of Vosges and black forest, Altai, Tianshan Mountains of Asia, Ural Mountains etc.

IV. Alpine System:
- Belongs to the tertiary period
- Ex: Rockies of North America, Alpine mountains of Europe, Atlas Mountains of North-Western Africa, Himalayas of the Indian subcontinent, etc.

Major Mountains of the world:

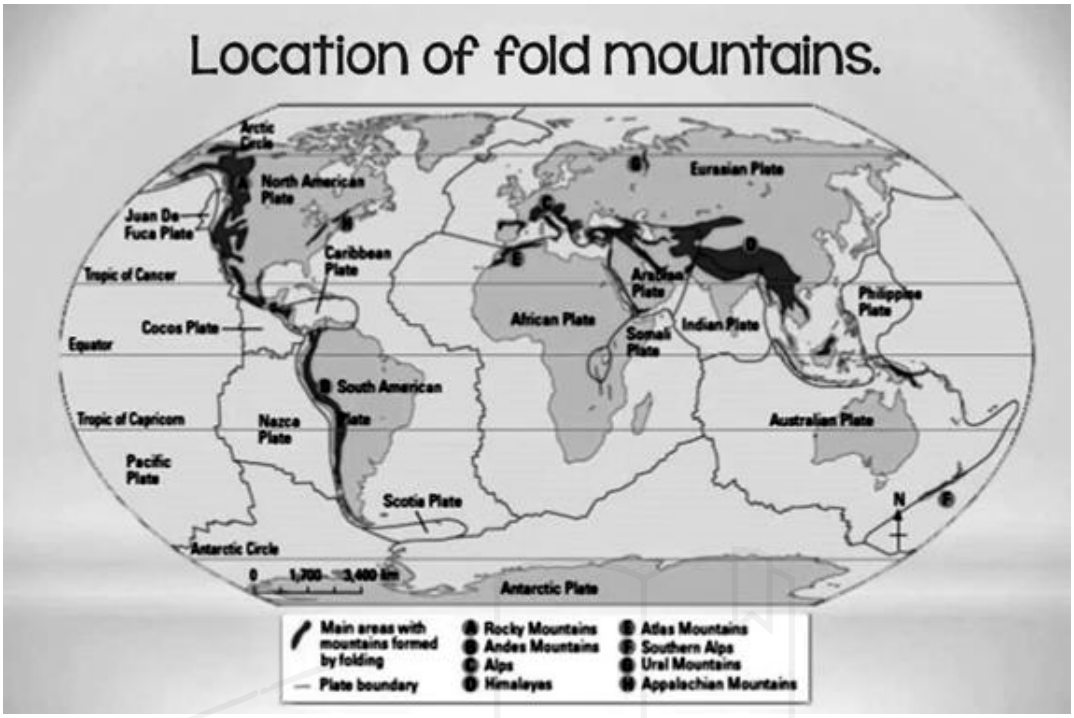


Fig: Location of Fold Mountains

S.No.	Mountain Range	Important/ Higest Peaks	Location	Description
1.	Rocky Mountain	Mt. Elbert (highest peak in the Rockies)	North America	It is one of the longest fold mountains in the world and extends from Canada to western US (New Mexico State)
2.	Appalachain Mountains	Mt. Aitchell, North Carolina, US (higest peack of Appalachian Mountains)	North America	It is fold mountain with rich in mineral resources.
3.	Alphs	dMont Blanc (French – Italian Border)	Europe	It is a folded mountain and source for river like Danube, Rhine etc.
4.	Sierra Nevada	Mt. Whitney	California, USA	Habitat for many Red Indian tribes
5.	Alaska Range	Mt. McKinley	North America	Mt. McKinley highest peak in North America
6.	Altai Mountains	Belukha mountain	Central Asia	Young folded mountain which extends from Kazakhstan to northern China.
7.	Andes Mountains	Mt. Aconcagua	South America	Longest Mountain chain in the world
8.	Atlas Mountains	Mt. Toubkal	Northwestern Africa	Young fold mountain spreading over Morocco and Tunisia.
9.	Drakensberg Mountains	Mt. Lesotho	South Africa	Young folded mountain

10.	Caucasus Mountain	Mt. Elbrus	Europe	Located between the Black sea and the Caspian sea
11.	Ural Mountains	Mt. Narodnaya	Russia	This mountain range act as a boundary between Europe and Asia.
12.	Hindukush Mountains	Mt. Trich Mir	Pakistan and Afganistan	Folded mountain with rugged topography which makes it difficult for transportation.
13.	Himalyas	Mt. Everest	Asia	Young fold mountains in Asia which separates.
14.	Arakhan Yoma	Mt. Kennedy peak	Myanmar	It extends from north to south direction. Shifting cultivation is practiced.
15.	Kunlun Mountains	Mt. Muztag	North of Tibetan plateau and western China	It is one of the young folded mountains.
16.	Vosges	Mt. Grand Ballon	Eastern, France, Europe	Famous for the cultivation of grapes and manufacture of wines
17.	Great Dividing Range	Mt. Kosciuszko	Australia	This range is the source for the rivers Darling and Murray.

Plateaus

- A **raised area** with terrain that is **levelled on top.**
- Features a **big top surface area** and a **steep side slope**.
- aka **High plains or tablelands**
- Cover **~ 18% of land**
- F**ound** on **every continent** and **cover 1/3rd of the Earth's surface**.
- **Young or old**- **Deccan plateau** - **old**
- **Tibet Plateau- highest**
- Have **abundance** of **mineral** resources.
- **Formation:**
  - F**orm over millions of years** as fragments of the Earth's crust collide, melt, and gurgle back to the surface.
  - **Some** were created **by** a **single process**
  - **Others- several processes** over the course of Earth's history.

Major Process of Plateaus Formation:

- **Volcanism**: from eruptions that occurred during the Cenozoic or Mesozoic.
  - **Eg: Deccan Plateau**, Columbia Plateau(US),Laurentian plateau or The **Canadian Shield** and the Siberian Traps of Russia.
- **Crustal shortening** : **Thrusting of one block of crust over another** and occurrence of **folding**.
  - **Eg:** Tibet Plateau, plateaus in North Africa, Turkey, Iran.
- **Thermal expansion**: R**eplacement** of cold **mantle lithosphere by** hot **asthenosphere**.
  - **Eg: Ethiopian Highlands** (Africa), Yellowstone Plateau(US),Massif Central (France)

Classification of Plateaus

1. **Intermontane Plateaus**
   - **Intermontane: Area between two mountains.**
   - **Occurrence**: Majorly **bordered by mountain ranges** (usually fold mountains) or are partially or completely **enclosed inside** them.
   - **Highest** Plateaus on the planet.
   - **Features**: Almost **horizontal rock layers** that are uplifted to **great heights by the earth's vertical movements.**
   - **Eg**: **Tibetan Plateau** , **Bolivian plateau** etc.

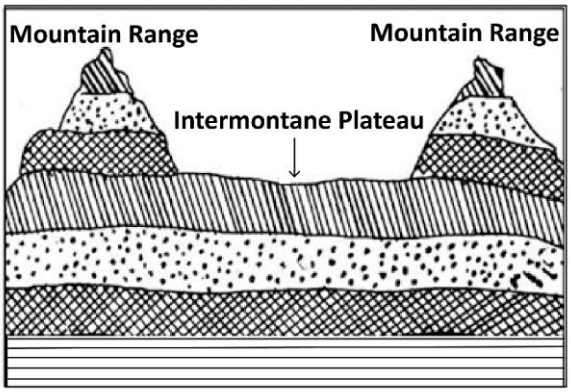


Fig: intermontane plateau

2. Piedmont Plateaus
   - **Piedmont**: **Mountain foot.**
   - **Occurrence**: **Foot of a mountain** and are **bordered by a plain on one side or a sea/ocean.**
   - aka **Plateaus of denudation as p**laces **formerly** high to the **level of mountains** but have now been **reduced to the mountain's foot level** due to numerous agents of **erosion**.
   - **Examples**: The **Malwa** Plateau (India), **Patagonian** plateau (Argentina) etc.

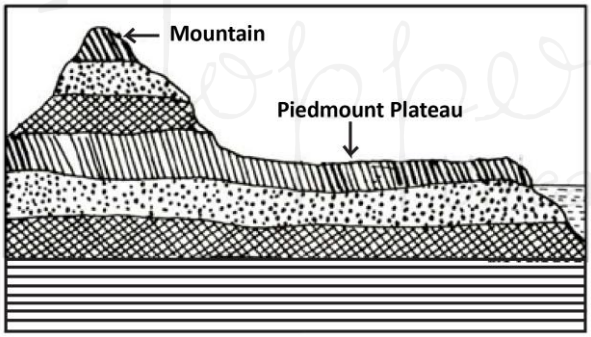


Fig: Piedmont plateau

3. Continental Plateaus
   - aka **Plateaus of Accumulation.**
   - **Occurrence**: **Bordered** on **all sides** by the **plains or seas**, forming **away from mountains.**
   - **Formation:** Due to either a large-scale **continental uplift** or the **spread** of horizontal **basic lava sheets** (less viscous) that entirely cover the old landscape.
   - **Feature:** In contrast to the neighbouring plain or sea, these plateaus have a **sharp elevation** (i.e. more steepness on sides).
   - **Eg:** The **Maharashtra** Plateau, **Antarctic** Plateau or **Polar** Plateau in East Antarctica

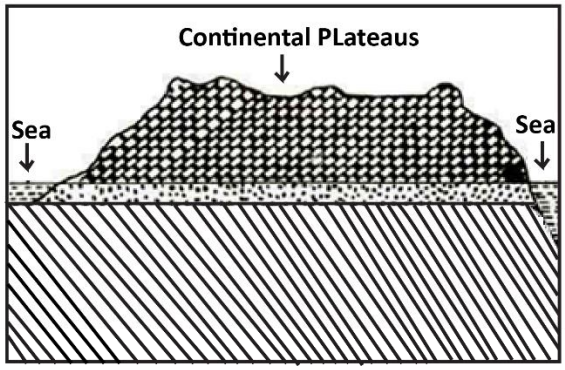


Fig: The Continental PLateaus

4. Volcanic Plateaus
   - **Formation:** by **volcanic activity.**
   - **Types:**
     - **Lava plateaus:** Generated **by extremely fluid basaltic lava** flowing through a series of vents without causing violent explosions.
     - **Pyroclastic plateaus:** Formed by **massive pyroclastic flows** and are underlain by pyroclastic rocks.
   - **Eg**: **Antrim** plateau (Ireland), The **Deccan** Plateau (India), The **Columbia** Plateau (US) etc.

Pyroclastic flow: A fast-moving river of hot gas and volcanic materials that flows out from a volcano at rates of up to 700 km/h on average.

5. Dissected Plateaus
   - **Dissected : Area** that has been **severely eroded** such that the relief is sharp.
   - **Formation**: Due to **upward movement** in the Earth's **crust** caused **by** the slow **collision** of **tectonic plates**.
   - **Feature**: The region will **appear to be mountainous**.
   - **Examples**:**Ozark Plateau** (US),Hornsby Plateau (Australi The **Deccan Plateau** (India) etc.

Major Plateaus of the world

Fig: Distribution of Plateaus across the world.

- Tibetan Plateau
  - Highest and largest plateau in the world
  - aka 'roof of the world'.
  - Formed due to collision of the Indo-Australian and Eurasian tectonic plates.
  - Sufficiently high enough to reverse the Hadley cell convection cycles.
  - Covers- Autonomous Tibetan Region, Qinghai Province of Western China, and a part of Ladakh in Jammu and Kashmir.
  - Surrounded by mountains to the south by the Himalayan Range, to the northeast by the Kunlun Range, and to the west by the Karakoram Range.
- Columbia – Snake Plateau
  - River Columbia and tributary Snake meet in this plateau.
  - Bordered by the Cascade Range and Rocky Mountains and divided by the Columbia River.
  - Formed as the result of volcanic eruptions with a consequent coating of basalt lava (Flood Basalt Plateau).
- Colorado Plateau
  - Western part of U.S.A.
  - Largest plateau in America.
  - Divided by the Colorado River and the Grand Canyon.
  - Example of intermontane plateau. Mesas and buttes are found here at many places [Arid Landforms].
  - Known for the groundwater which is under positive pressure and causes the emergence of springs called Artesian wells.
- Deccan Plateau
  - Forms most of the southern part of India.
  - Bordered by two mountain ranges, the Western Ghats and the Eastern Ghats.
  - Includes the Deccan Traps - largest volcanic feature on Earth.
  - Made of multiple basalt layers or lava flows, the Deccan Traps covers 500,000 square kilometers in area.
  - Known for containing some unique fossils.
  - Rich in minerals- mica and iron ore in the Chotanagpur region, and diamonds, gold and other metals in the Golconda region.
- Kimberley Plateau
  - Lies in the northern part of Australia.
  - Made of volcanic eruption.
  - Minerals- iron, gold, lead, zinc, silver and diamond are found here.
- Katanga Plateau
  - In Congo.