



# UPSC – IAS

Civil Services Examinations

Union Public Service Commission

**General Studies**

Paper I – Volume 6

**Indian Geography**



# UPSC CSE – IAS

## PAPER - 1 VOLUME – 6

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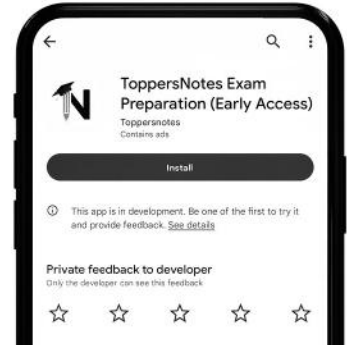
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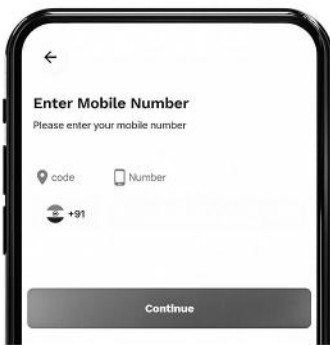
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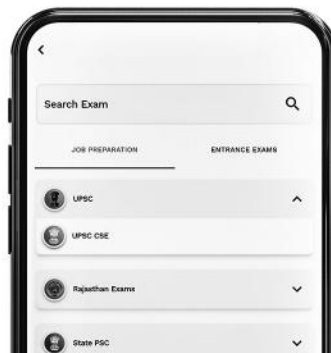
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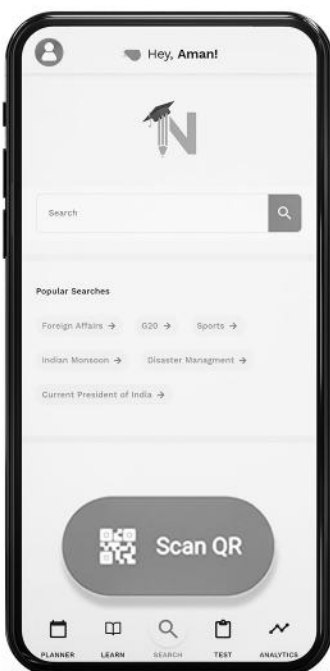
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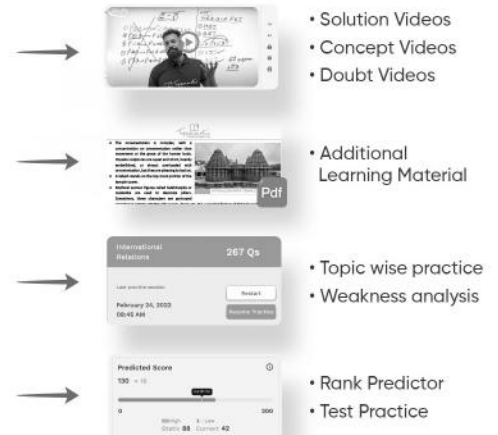
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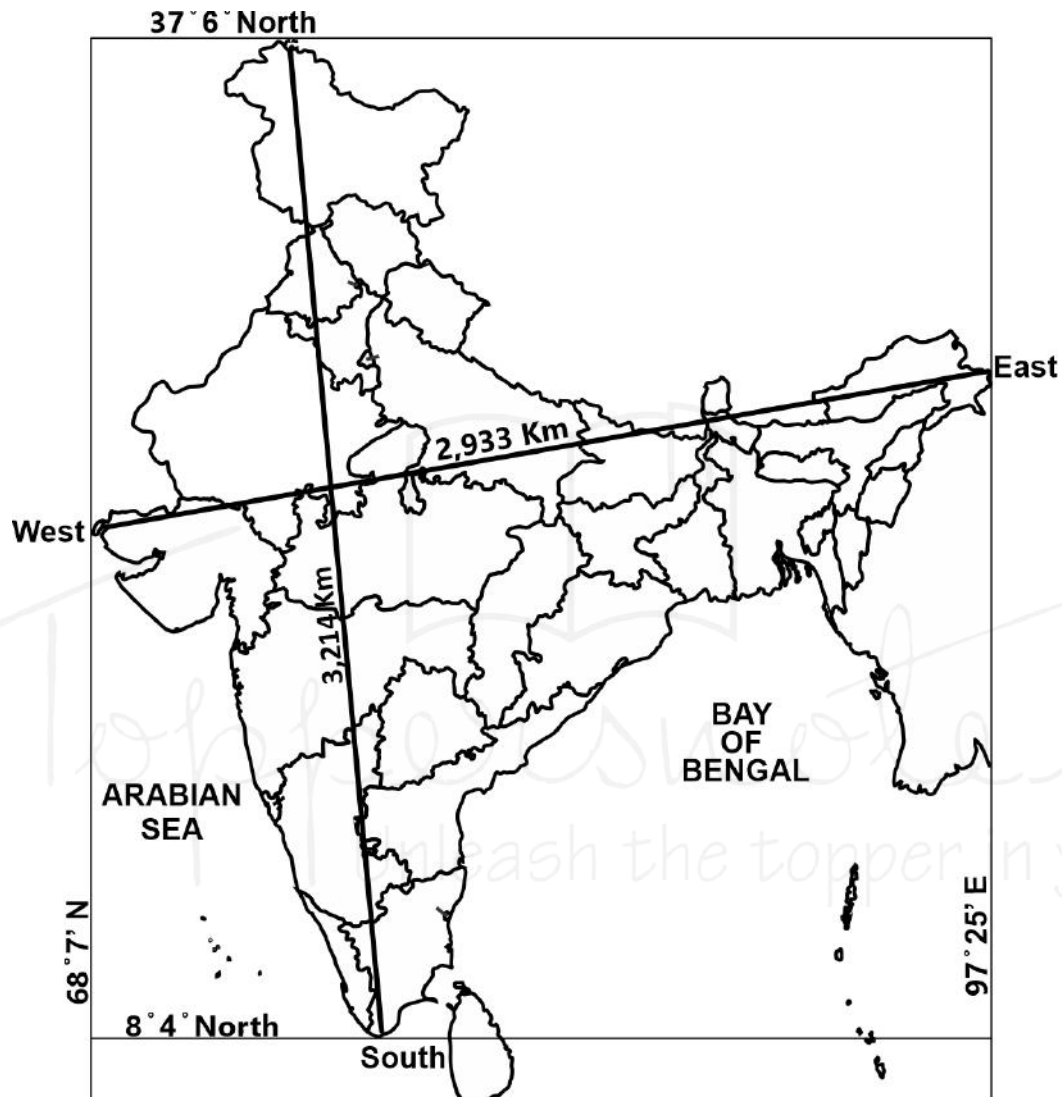
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# 1 CHAPTER

## India -Size and Location



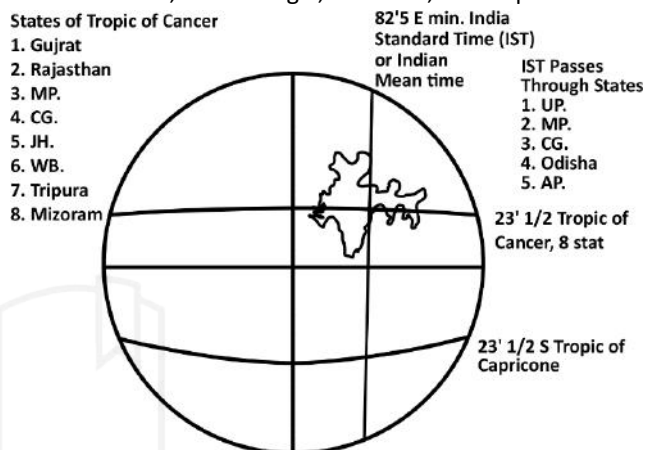
- Situated in the **northern hemisphere** (8°4'N to 37°6'N and 68°7'E to 97°25'E)
- **Bounded by**
  - **North:** the Great Himalayas
  - **West:** Arabian Sea
  - **East:** Bay of Bengal
  - **South:** the Indian Ocean.
- **7th largest country** in the world.
- **Northernmost point:** Indira Col
- **Southernmost point:** Indira Point in the Andaman and Nicobar Islands.
- **Easternmost point:** near Kibithu in Anjaw district of Arunachal Pradesh
- **Westernmost point:** Sir Creek in Kutch, near the "Guhar Mota" in Gujarat.
- **Length:** 3214 Km
- **Width:** 2933 Km (longitudinal difference: 30° or 2 hours)
- **Area:** 32,87,263 sq. km (**2.42% of the world**)
- **Population:** 2nd largest country in the world (**17.5% of world's population**)
- **Total land boundary**=15,200 km.
- **Total Sea boundary**= 7516.5 Km (without islands 6100 Km)
- **Border Countries:**
  - **North-west:** Afghanistan and Pakistan
    - India-Pakistan border: Radcliffe line

- Pakistan-Afghanistan border: Durand Line.
- **North:** China, Bhutan and Nepal
- India-China border: McMahon line.
- **East:** Myanmar, Bangladesh (India has longest boundary with Bangladesh)
- **South:** Sri Lanka separated by Palk Strait and Gulf of Mannar.
- **States sharing International borders:**
  - **Bangladesh:** total boundary= **4096km**
    - **5 States:** West Bengal, Mizoram, Meghalaya, Tripura, and Assam
  - **China:** Total boundary= **3488km**
    - **3 States and 1 UT:** Himachal Pradesh, Uttarakhand and Sikkim and Ladakh
  - **Pakistan :** Total boundary= **3323km**
    - **4 States and 1 UT:** Jammu and Kashmir, Punjab, Gujarat, Rajasthan and Ladakh
  - **Nepal:** Total boundary= **1751km**
    - **5 States:** Uttar Pradesh, Bihar, Uttarakhand, Sikkim, West Bengal
  - **Myanmar:** Total boundary= **1643km**
    - **4 States:** Arunachal Pradesh, Manipur, Mizoram, and Nagaland
  - **Bhutan:** Total boundary= **699km**

- **4 States:** Arunachal Pradesh, Assam, Sikkim, and West Bengal
- **Afghanistan:** total boundary= **106km**
- **1 UT:** Ladakh

### Indian Standard Meridian

- **82°30'E** Meridian crossing through **Mirzapur, UP** is India's Standard Meridian.A
- **Ahead of mean time by 5 hours and 30 minutes.**
- **Tropic of cancer (23°30'N) passes through** - Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Mizoram, and Tripura.



# 2 CHAPTER

## Geological Structure and Rock Systems of India

### Geological History of India

- **Precambrian Era:**



- **Peninsular India** (oldest crustal block of India) formed due to

- **Collision of 3 Proto Continents:** Aravalli, Dharwad, Singhbhum.
- **Formation of 3 Lineaments:** Narmada, Son and Godavari
- **Folding of Geosynclines** of Protocontinents, **mountains formed:** Aravalli, Vindhya, Satpura, Eastern Ghats, Bijawal

- **Paleozoic Era:**

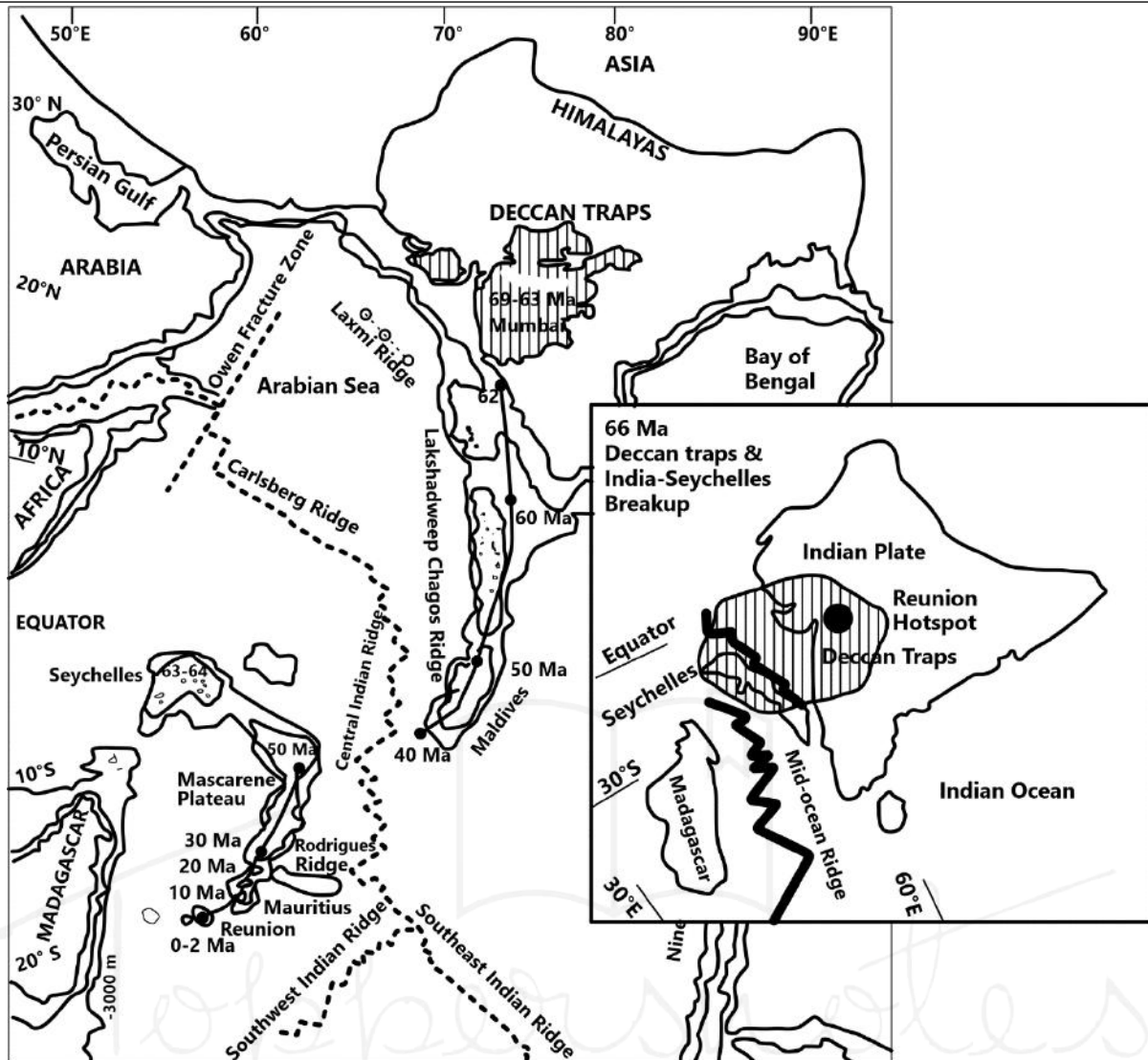
- United land mass **Pangea** broke
- **India - part of Gondwana Land**
- **Faulting of Damodar and Mahanadi** occurred
  - **Submergence of forest:** Coal Reserves formed
- **Western coast** cracked

- **Mesozoic Era:**

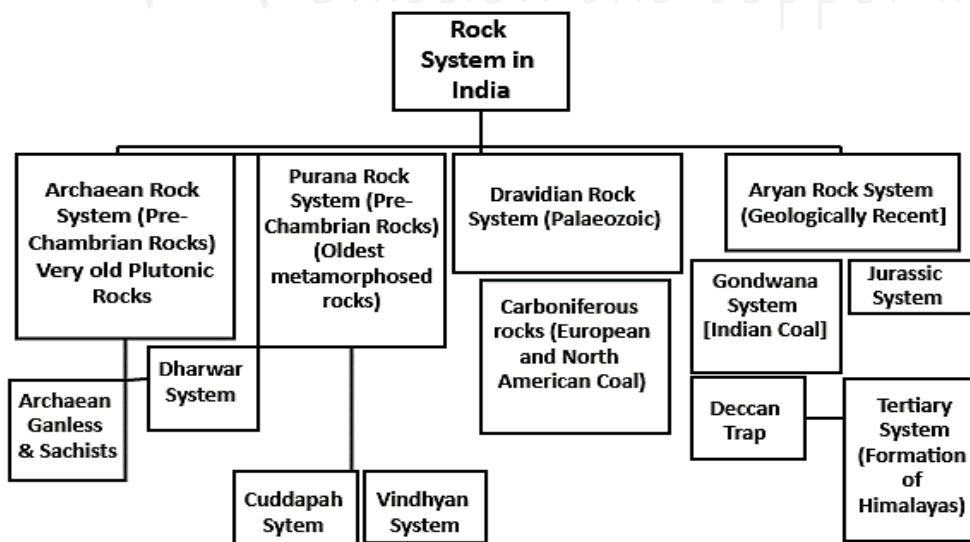
- **Indian plate** started moving **northwards**
- **Reunion hotspot** activity occurred = **Deccan trap** formed

- **Cenozoic Era:**

- **Tertiary Period:** **Collision b/w Indian and Eurasian Plate** = **Formation of Himalayas**
  - **Eocene:** Greater Himalayas
  - **Miocene:** Lesser Himalayas
  - **Pliocene:** Shiwaliks
- **Submergence of Western Coast** = **Formation of Western Ghats**
- **Tilting of Indian Plate** = **flow of rivers west to east**
- **Quaternary Period:**
  - **Formation of North Indian Plains** (deposition by rivers)



## Rock System of India



### Archean Rock System

- Early Precambrian Era
- Form core of the Indian Craton (Block of Indian Subcontinent of Gondwanaland).

#### • Features:

- oldest rock system of the Indian subcontinent
- formed when magma solidified = NO fossils (Azoic), crystalline and consist of **sheet-like layers** (foliated).

- **Contain gneisses** (granite, gabbro etc.) and **schists** (mica, chlorite, talc etc.)
  - **Bundelkh and gneiss** is the **oldest** one.
- **Mineral composition:** iron, manganese, copper, bauxite, gold, lead, mica, graphite etc.
- **Distribution:** Aravalli hills and South-eastern parts of Rajasthan, Deccan plateau, northeast of India, Karnataka, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Odisha, Chotanagpur plateau in Jharkhand
- **Two systems-**
- 1. **Archaean Gneiss and Schist:**
  - **Bengal Gneiss**
    - aka **Khondolites** after Khond Tribes in Koraput and Balangir district
    - **first identified in Medinipur** of West Bengal.
    - **Distribution:** Eastern Ghats, Odisha, Manbhum and Hazaribagh district of Jharkhand; Nellore district Andhra Pradesh; Salem district of Tamil Nadu; Son valley, Meghalaya plateau and Mikir hills.
  - **Bundelkh and Gneiss**
    - **Features:**
      - ✓ **coarse grained**, looks like granite.
      - ✓ **criss-crossed structure** characterized by Quartz veins.
  - **Distribution:** Bundelkhand (U.P.), Baghelkhand (M.P.), Maharashtra, Rajasthan. Andhra Pradesh and Tamil Nadu.
- **Nilgiri Gneiss (aka Charnockite series; named after James Charnock)**
  - **Features:**
    - **plutonic rock** intruding into other Archaean rocks.
    - **bluish-grey to dark color** rock
    - **medium to coarse grained** structure.
  - **Distribution:** South Arcot, Palani hills, Shevaroy hills, Nilgiri hills.
- 2. **Dharwar System**
  - **Features:**
    - **Oldest metamorphosed rocks** of India.
    - Formed as a **result of the erosion and sedimentation** of Archean system rocks
    - **Azoic**, because either **no origin of species** during their formation or **destruction of fossils** with the passage of time.
    - **Mineral Composition:** **metallic** minerals like iron, gold, copper, manganese etc.
  - **Distribution:** Aravallis, Chotanagpur plateau, Meghalaya, southern Deccan region from Karnataka to the Kaveri valley, districts of Bellary, Shimoga, Sasar mountain range in Jabalpur and

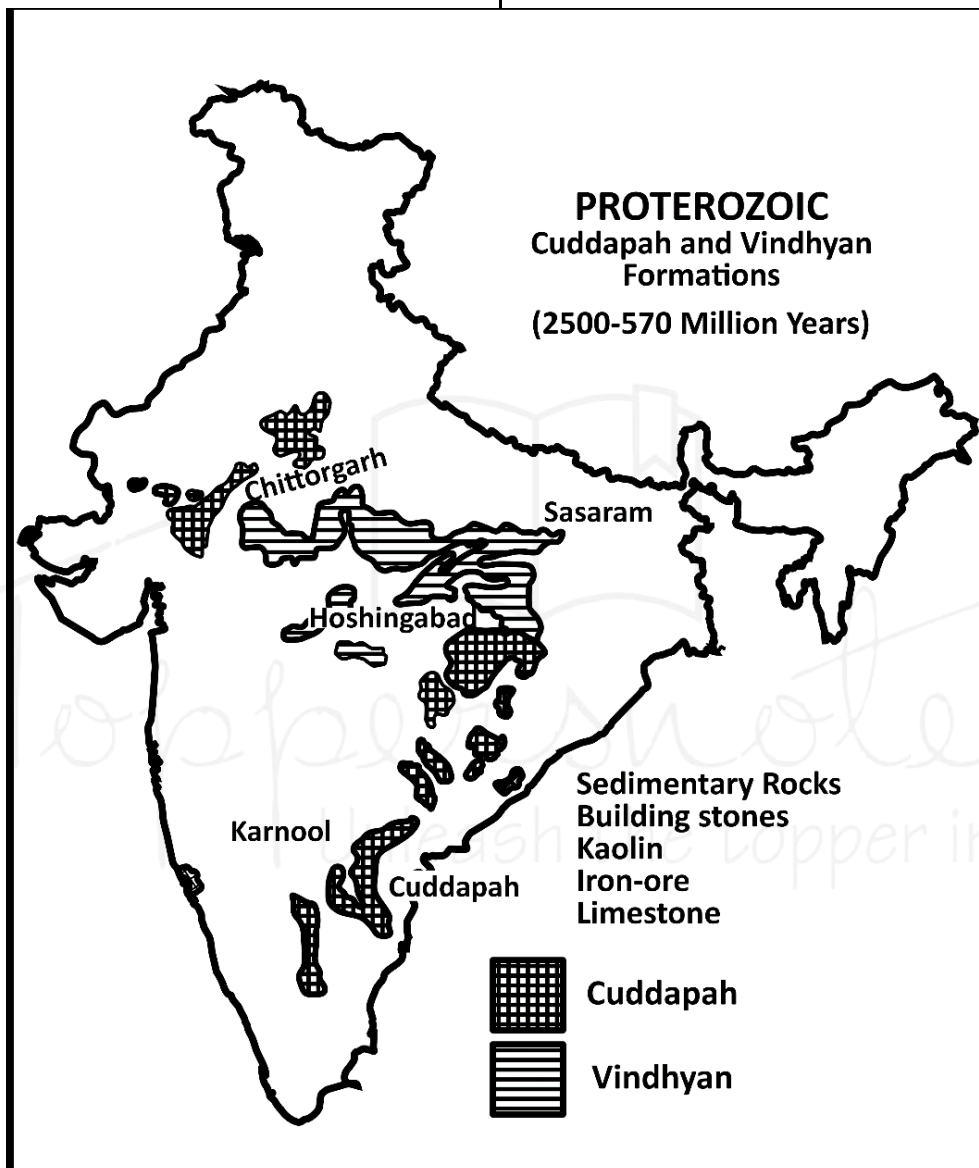
- Nagpur and the Champaner mountain range in Gujarat, in the Himalayan ranges of Ladakh, Zaskar, Garhwal and Kumaon, and the long range of Assam plateau.
- **Classification** of various series based on the region and the metal content:
    - **In Extra Peninsular India:**
      - ✓ **Rajasthan Series**
      - ✓ **Vaikertata Series:**
        - ☞ **Kumaun and Spiti;**
        - ☞ Slate, Schist, dolomite and Limestone
      - ✓ **Dialing Series:**
        - ☞ **Sikkim and Shillong;**
        - ☞ Signs of **Igneous intrusion;** Quartzite, Phyllite, Hornblende schist.
    - **In Peninsular India:**
      - **Champion Series:**
        - ✓ Named after Champion reef in Kolar Gold Field of Mysore;
        - ✓ occurs in **Kolar and Raichur district.**
        - ✓ Famous for **Gold deposits**
      - **Champner Series:**
        - ✓ Outliers of the Aravalli system spread in **Vadodara;**
        - ✓ Rich in Quartzite, Conglomerates, Phyllites, Slates and Marbles (green variety).
      - **Closet Series:**
        - ✓ Occurs in **Balaghat** and **Chhindwara** district of Madhya Pradesh;
        - ✓ Rich in Copper Pyrite, quartzite and other magniferous rocks
      - **Chilpi Series:**
        - ✓ Occur in **Balaghat** and **Chhindwara** district of Madhya Pradesh;
        - ✓ Rich in grit, Phyllite, quartzite, green stones and magniferous rocks
      - **Iron-ore Series:**
        - ✓ Occur in **Singhbhum** (Jharkhand), **Bonai**, **Mayurbhanj** and **Keonjhar** district (Odisha);
        - ✓ Rich in **Iron ore** deposits
      - **Khondalite series:**
        - ✓ Occur in **Eastern Ghat** of **North Krishna River basin;**
        - ✓ Rich in Khondalite, Kodurites, Charconites and gneisses.
      - **Rialto Series (Delhi Series):**
        - ✓ Stretch over in **Delhi** (Majnu-ka-Tila) to **Alwar** (Rajasthan);

- ✓ **Rich in Marbles.**
- ✓ Makrana and Bhagwanpur are known for high quality marbles.
- **Sakoli Series:**
  - ✓ Occur in **Jabalpur** and **Rewas** districts(MP);
  - ✓ Famous for Mica, also rich in dolomite, schist and Marble.
- **Sausar series:**

- ✓ Occur in **Nagpur, Bhandra** district of Maharashtra and **Chhindwara** district of Madhya Pradesh;
- ✓ Rich in quartzite, mica-schist, marble and magniferous rocks.

### Purana Rock System

- **Upper Precambrian** 1400-600 million years.
- **Two divisions:**



#### 1. Cuddapah System:

- **Features:**
  - Formed by the **erosion and deposition of Archean and Dharwar rocks**
  - **Sedimentary in nature**
  - **Formed** when **sedimentary rocks** like sandstone, limestone etc., and clay were **deposited in synclinal folds**
  - **Named after** the Cuddapah district of Andhra Pradesh

- **Mineral Deposition:** rich in shale, slate, quartzite, iron ore (Inferior quality), manganese, asbestos, copper, nickel, cobalt, marble, jasper, building stones, and stones however they are of low quality.
  - contain **large deposits of cement grade limestones**
- **Distribution:** Andhra Pradesh, Chhattisgarh, Maharashtra, Tamil Nadu, Delhi, Rajasthan, and lesser Himalayas.

● **In Peninsular India:**

State	Series	Features
<b>Andhra Pradesh</b>	Papaghani Series	<ul style="list-style-type: none"> <li>● Location: Papagni river basin;</li> <li>● Quartzite, shales, slates and lime stones</li> </ul>
	Cheyyar Series	<ul style="list-style-type: none"> <li>● Location: Cheyyar river basin;</li> <li>● Shales and quartzite</li> </ul>
	Nallamalai Series	<ul style="list-style-type: none"> <li>● Location: Nallamalai hills;</li> <li>● quartzite and shales</li> </ul>
	Krishna Series	<ul style="list-style-type: none"> <li>● Location: Krishna basin;</li> <li>● quartzite and shales</li> </ul>
<b>Madhya Pradesh and Chhattisgarh</b>	Bijawar Series	<ul style="list-style-type: none"> <li>● Location: Bijawar district (MP)</li> <li>● sandstone, quartzite and some volcanic rocks still, dykes (parental rocks of diamonds).</li> </ul>
	Gwalior Series	<ul style="list-style-type: none"> <li>● Location: Gwalior district (MP);</li> <li>● Shales, limestone, sandstones, quartzite overlain by shales, hornstone, jaspers and basic volcanic rocks</li> </ul>
	Rajpur Series	<ul style="list-style-type: none"> <li>● Location: Chhattisgarh;</li> <li>● limestone, sandstones, quartzites.</li> </ul>
<b>Karnataka</b>	Kailagi Series	<ul style="list-style-type: none"> <li>● Location: Bijapur district;</li> <li>● ferrous rocks, quartzite, shale.</li> </ul>
	Pakhal Series	<ul style="list-style-type: none"> <li>● Location: Godavari region;</li> <li>● quartzite, shale and siliceous limestone</li> </ul>
	Penganga Series	<ul style="list-style-type: none"> <li>● Location: Penganga rivers Wardha district of Maharashtra;</li> <li>● Limestone, Shales and Slates</li> </ul>
<b>Delhi</b>	Ajabgarh Series	<ul style="list-style-type: none"> <li>● Location: Alwar, Delhi and Gurgaon;</li> <li>● quartzites and slates, granites with veins of pegmatites.</li> </ul>
	Rialto Series	<ul style="list-style-type: none"> <li>● Location: Ladar (Gujrat) Delhi, and Alwar region;</li> <li>● rich in Marble</li> </ul>

● **Extra Peninsular India:**

- Kashmir, Shimla and Nepal Himalayas (Pirpanjal, Ramban and Kishtwar, Dogra)

2. **Vindhayan rock system:**

- Named after the Vindhya mountains
- Extends from **Rajasthan to Bihar** in saucer shape.
- **Ancient sedimentary rocks superimposed** on the Archaean base.
- **Unfossiliferous rocks** and covered by the Deccan trap.
- **Devoid of metalliferous minerals**
- **Provides large quantities of** durable stones, ornamental stones, limestone, pure glass making sand etc.
- **Diamond bearing regions** from which **Panna and Golconda diamonds** have been mined.
- Divided into various series based on the region and the metal content:
  - **Lower Vindhyan System**
    - **Semri Series:** Son river valley of Bihar; Sandstone

- **Kurnool Series:** Kurnool district, Gulbarga and Bijapur district; limestone,
- **Bhima Series:** Bhima river basins of Gulbarga and Bijapur district;
- **Malani Series:** Malani hills, Rajasthan; rhyolites and tuffs.
- **Upper Vindhyan System**
  - **Kaimur Series:** Bundelkhand, Baghelkhand and Kaimur hills; sandstone and shales.
  - **Rewa Series:** Rewa district, MP; sandstone, shales, conglomerates-diamondiferous.
  - **Bhandar Series:** Madhya Pradesh; sandstone, shales, conglomerates-diamondiferous
- **In Extra Peninsular India**
  - **Dogra Slates** of Kashmir,
  - **Chails and Simla slates** of Shimla hills,
  - **Attock Slates** of Punjab
  - **Haimanta System** of rocks in the Central Himalayas of Kumaon

## Dravidian Rock System

- **Paleozoic era**
- **Features:**
  - aka **Carboniferous rocks System** due to **high quality Coal formation** in the World.
  - **Found in the extra-Peninsular regions** of the **Himalayas** and the **Gangetic plain** and are very little in the Peninsular shield (Umaria in Rewa).
  - **Abundant fossils.**
  - **Include** shales, sandstones, clays, quartzites, slates, salts, talc, dolomite, marble, etc.
- **Distribution:** Pir-Panjal, Handwara, Lider valley, Annatnag of Kashmir, Spiti, Kangra and Shimla region of Himachal Pradesh and Garhwal and Kumaon of Uttarakhand
- **Divided into** following based on their period of formation:
  1. **Cambrian System:**
    - **Fossiliferous rocks** containing fossils of Corals, Foraminifera, sponges, worms, gastropods, trilobites and brachiopods etc.
    - **Distribution:**
      - **Salt Range** containing the Salt Marl and Saline Series of **Punjab** (Purple sandstone, greenish shale)
      - **Spiti area** contains Haimanta System (Slates, quartzite, shales, dolomite etc.)
      - **Kashmir Valley** (slates, foliated shales, limestone, soft quartzites etc.)
  2. **Ordovician system:**
    - **Distribution:** Northern Kumaon-Shimla regions in the Lidar valley
    - **Contains** shales and pink quartzites, sandstone, conglomerates.
  3. **Silurian System:**
    - **Distribution:** Spiti region (shales, limestone, dolomite).
    - **Contains** Red Crinoidal limestone of Griesbach and Zaskar Range.
  4. **Devonian system:**
    - **Distribution:** Muth Quartzites of Spiti, Kumaon and Kashmir.
    - **Contains** Limestones with brachiopods and corals
  5. **Lower and Middle Carboniferous system:**
    - **fossiliferous limestone**, shale and quartzite.
    - **Mount Everest** is composed of **Upper Carboniferous limestones.**
    - **Distribution:** Himalayan region in Kashmir (extended in Spiti to Kashmir).
    - **k/a Lipak series** (dark colour of limestone and shales) and **PO Series** (dark colour shales and quartzites); Lipak + PO = Kanwar system.

## Aryan Rock System

- **Upper Carboniferous period** to recent times
- **Types:**
  1. **Gondwana Rock System:**
    - **Features:**
      - Derives its **name from Gond tribe** of Telangana and Andhra Pradesh
      - **Formed by deposits in synclinal troughs** on ancient plateau surface.
      - **Contains huge carbon deposits** within them.
      - **Largest source of coal** in India (98% of India's coal reserves).
      - **Much younger than the Carboniferous coal** and has low carbon content
      - **Mineral Deposits:** iron ore, copper, uranium and antimony, Sandstones, slates and conglomerates
    - **Distribution:** Raniganj, Jharia regions of Jharkhand, Damodar valley, Pench valley in Chhattisgarh & Madhya Pradesh, Godavari valley in Telangana and Rajmahal hills of West Bengal.
    - **In Extra Peninsular India:**
      - **Lower Gondwana rocks** (shale)- Kashmir, Gulabgarh pass, Zewar, Zowar, Kunamu Bren etc.
      - **Coastal Gondwana: - Coromandel coast:** Cuttack (Odisha), Rajahmundry, Ongal (Andhra Pradesh), South Krishna (Tamil Nadu); Rocks consist of clay, grit, shales, sandstone, conglomerate.
    - **In Peninsular India:**
      - **Lower Gondwana System**
        - ✓ **Talchir series:** **Oldest formation-** Odisha, Rajasthan
      - contains coal seams, shales and sandstones
        - ✓ **Damuda series:** Named after **Damodar river**; outcrops found in **Mahanadi and Godavari river Valleys**; contains seams **coal**, found as Barakar Coal field (grit, sandstone, shale), Gridih, Jharia coal fields (Karharbari Stage), Raniganj coalfields (Iron ore, shales)
        - ✓ **Panchet series:** Named from **Panchet hills** south of Raniganj. **Youngest formation of lower Gondwana System**; Rocks containing **green sandstone (feldspar grains** in sandstone reflect cold climate), **shale and devoid of coal.**
      - **Upper Gondwana System**
        - ✓ **Mahadeva series:** **Named after Mahadev hills, stretched in Mahadev and Pachmarhi Hills** of the Satpura range; **Rocks consist of** clay, sandstone and shales.

- ✓ **Rajmahal series:** Named after Rajmahal hills; **stretches towards** the northern part of the east coast of Peninsular India from the Godavari Valley to the Rajmahal hills;
- ✓ **Jabalpur series:** spread in Satpura and Madhya Pradesh; **consist of** sandstone, clays, limestone and shale with few coal seams and lignite.
- ✓ **Umaia Series:** rocks of **upper gondwana** found near Umta village Gujarat; **consists of** Sandstone, Conglomerate.

## 2. Jurassic rock system:

- Witnessed **marine transgressions on both west and east coasts.**
- **Shallow water deposits** in Rajasthan and Kutch region in the west and Guntur and Rajahmundry areas of Andhra Pradesh.
- **Prominent deposits:** limestone, shale, sandstone etc.

- **Distribution:** Spiti Shales, Laptal Series of Kumaon, Mount Everest Region, sub-Himalaya of Garhwal, Kutch and Rajasthan areas

## 3. Deccan Trap

- From the **end of the Cretaceous till the beginning of the Eocene**
- Volcanic deposits have **flat tops and steep sides**
- **Continuous outpouring of magma**, from the fissures over the Indian plate led to the **formation of a layered structure called the Deccan Traps.**
- **Distribution:** Kutch, Saurashtra, Maharashtra, Malwa plateau and north Karnataka.
- **Thickness decreases from west to east**, with around 3000m in the west to just 150m in the east, and around 800m in the south.
- **Weathering and erosion** formed the **Black Cotton soil or Regur.**

Group	Found in	Intertrappean beds	Layers of volcanic ash
<b>Upper Trap</b>	Maharashtra and Gujarat	Present	Present
<b>Middle Trap</b>	Central India and Malwa	Very rare to absent	Present
<b>Lower Trap</b>	Central India and Tamil Nadu	Present	Very rare to absent

## Cretaceous rock system:

- **Foraminifera** play an important part in **Cretaceous stratigraphy.**
- **contain** lime stones, sandstones and shales.
- **Distribution:** Himalayan ranges, Central Tibet, Kashmir, Ahmednagar, Kutch, Narmada Valley, Trichinopoly, Ariyalur and Rajamahendri areas.

## 4. Tertiary rock system:

- **Contains fossils** of species with living representatives
- **Distribution:** Sutlej-Ganga-Brahmaputra plains and Karewas of Kashmir

## • Divided into:

- **Eocene System:** Found in Jammu and Kashmir, Himachal Pradesh, Rajasthan, and Gujarat and in the North eastern part of India.
- **Oligocene and Lower Miocene System:** Found in some parts of Assam, Kashmir (b/w Indus and Chenab), Shimla area etc.
- **Shiwalik System** - Middle Miocene to Lower Pleistocene: Consists of boulders, Conglomerates beds, Gravels, Sandstones, shales and clays; Richly fossiliferous

# 3 CHAPTER

## Physiographic Divisions of India

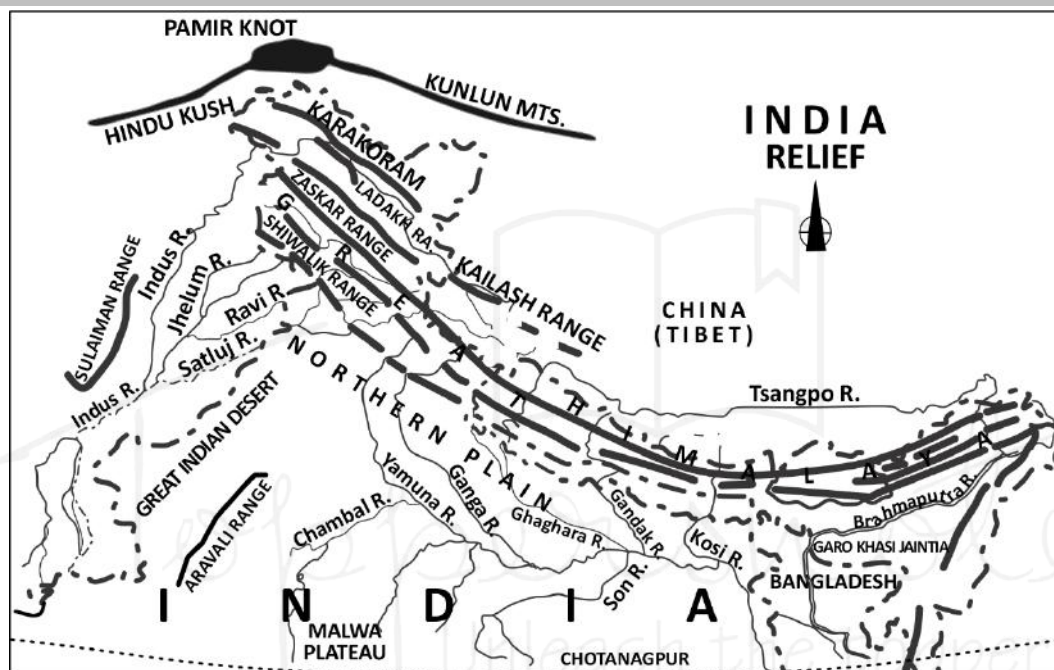


On the basis of physical features, India is divided into 6 physiographic divisions:

1. Northern and North-eastern Mountains
2. Northern Plain

3. Peninsular Plateau
4. Indian Desert
5. Coastal Plains
6. Islands

### Himalayan Mountains



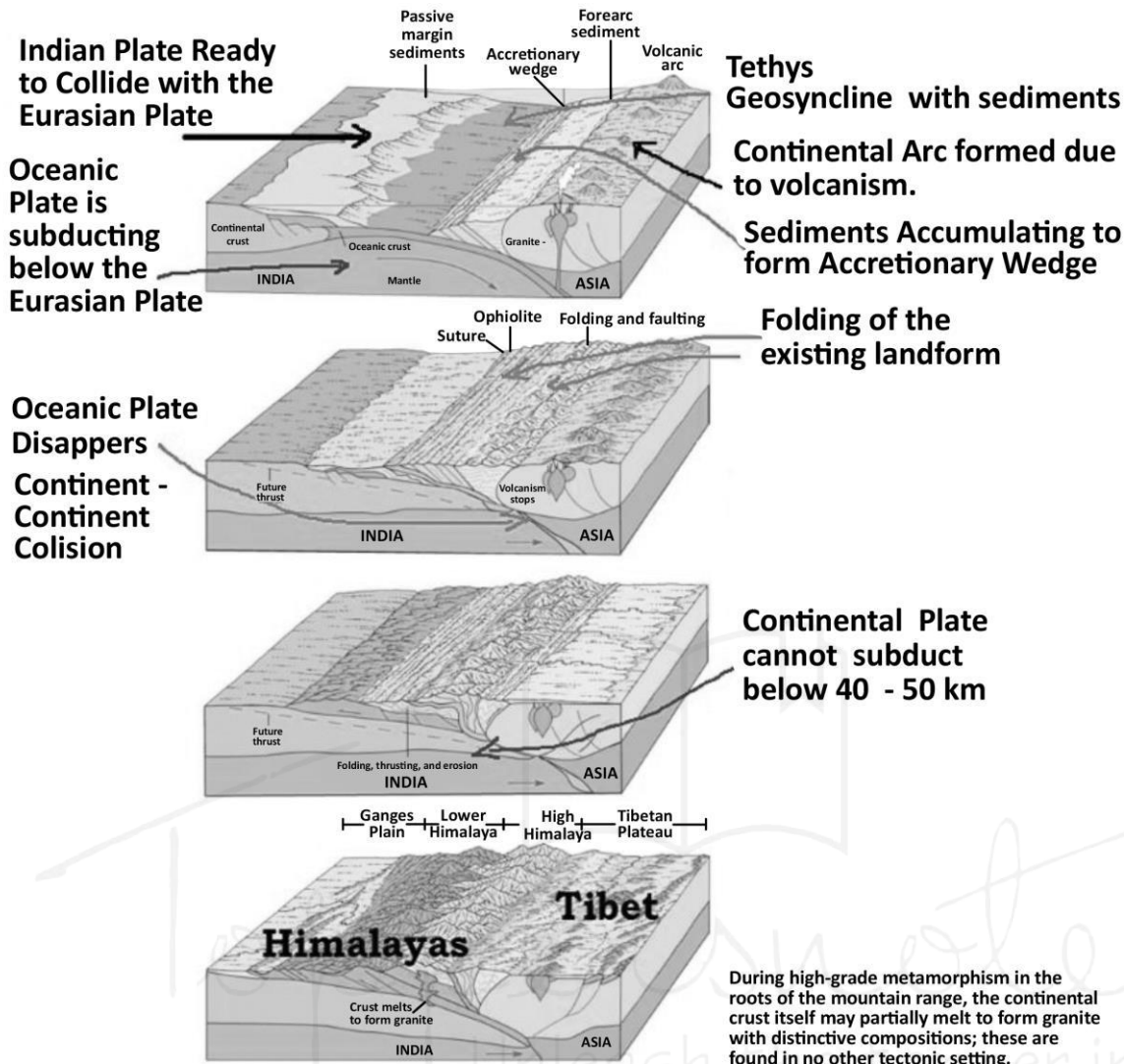
- **Highest and the youngest fold mountain ranges** of the world.
- **One of the highest earthquake-prone regions** of the world.
- **Length:** runs **west-northwest to east-southeast** in an arc **2,500 km long**.
  - **Western anchor:** Nanga Parbat (lies just south of the northernmost bend of the Indus river)
  - **Eastern anchor:** Namcha Barwa (lies immediately west of the great bend of the Yarlung Tsangpo River)
- **Width:** 400 km - 150 km (West- east).

### Physical Features

- **Soaring heights, steep-sided jagged peaks, valley and alpine glaciers** often of stupendous size
- **Topography** deeply cut by **erosion**, seemingly **unfathomable river gorges**, **complex geologic structure**, and **series of elevational belts** (or zones)
- **Greater part of the Himalayas** lies below the snow line.
- The **mountain-building process** that created the range is still active.
- **Considerable stream erosion** and **gigantic landslides**.

## Formation of Himalayas

2 theories:



### 1. Geosyncline Theory of Formation of Himalayas:

- 200 million years ago the supercontinent Pangea started to disintegrate into smaller continents.
  - Northern part - Laurasia or Angaraland
  - Southern part - Gondwana land.
- A vast empty space was formed b/w Laurasia and Gondwana Land.
- Rivers from Laurasia and Gondwanaland → eroded material and debris ☐ poured it into the Tethys sea.
- Deposition for millions of years till Cretaceous period ☐ bed of the Tethys sea started to rise ☐ formation of three successive ranges of the Himalayas.
  - First uplifting during Eocene Period ☐ formation of Greater Himalayas.
  - Second uplifting during Miocene period ☐ formation of Lesser Himalayas

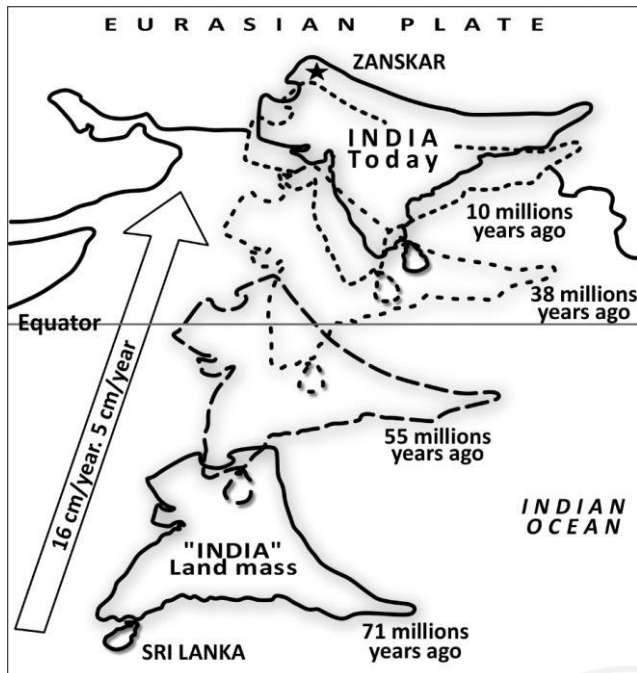
- Third uplifting during Pliocene period ☐ formation of Shiwaliks.

- Theory supported by Argand, Kober and Suess.

### 2. Plate Tectonic Theory:

- Himalayan ranges were formed when the Indian plate was driven northwards and pushed beneath the Eurasian plate.
- Tethys started contracting about 65 to 70 million years ago.
- About 30 to 60 million years ago, the two plates came closer and Tethys sea crust began to fracture into thrust edges.
- Enormous pressure forces from this shock caused a gigantic mountain uplift.
- Further north, behind the front line, the Eurasian plate raised over 2.5 million sq km forming the Tibetan Plateau (average altitude > 4000m)
- About 20 to 30 million years ago, the Himalayan ranges started emerging.

## Stages of Himalayas formation



- Himalayas comprise at 3 three ranges running more or less parallel to one another.
- Supposed to have emerged out of the Himalayan Geosyncline, i.e. the Tethys Sea in 6 different stages following one after the other:
- **Phase 1**
  - 100 million years ago
  - Cretaceous Period → Indian plate located b/w  $10^{\circ}$ - $40^{\circ}$  S over the reunion hotspot

- Movement increased when plate came closer to the equator (14cm/yr) → squeezing of the Tethys.

### • Phase 2

- 71 million years ago
- Gondwana plate drifted towards North East
- Northwestern part: Aravalli series collided with Eurasia.
- Indus – Tsangpo Suture Zone- line of collision b/w the Tibetan Plateau and the Indian Plate - compressional tectonic fault line.
- Plate began to subduct → crust doubling below Tibet → high plateau (thickness 60km).
- Southern front of ITSZ → Murree Foredeep formed and further south → Shiwalik foredeep created.

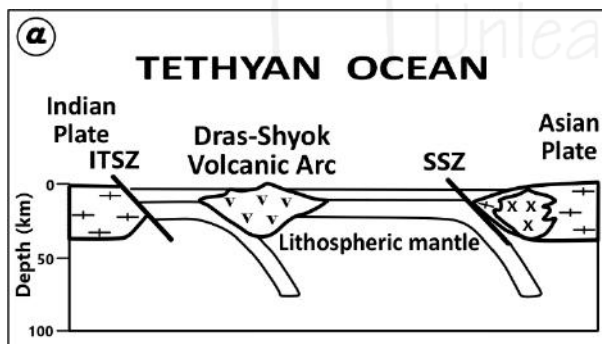
### Suture zone

- A linear belt of intense deformation, where distinct tectonic units with different plate tectonic, metamorphic, and paleogeographic histories join together.

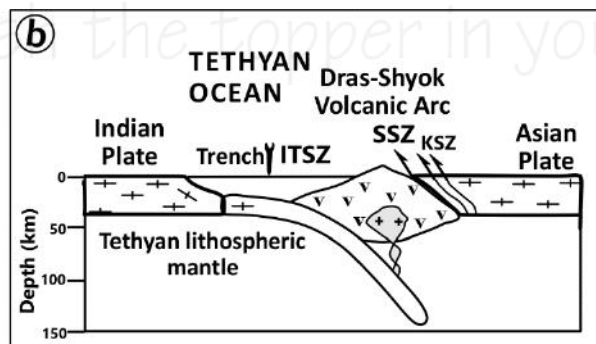
### Indus- Tsangpo Suture Zone

- A compressional fault line that extends from the Indus gorge to the Tsangpo gorge almost for 3200 km.
- Represents the zone of plate collision where rocks are crushed, pulverized and mostly Paleozoic and ancient rocks are found.
- Currently, river Indus and river Tsangpo flow through the reverse faulted line of discontinuity

### • Phase 3

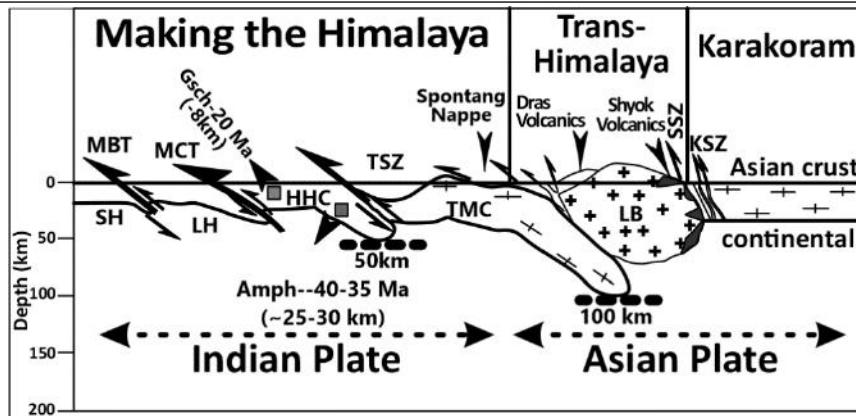


- Oligocene period - Drass volcanic area formed.
- Tethys crust → volcanic eruptions.
- Anti-clock wise rotation of plate → Drass became Pivotal Axis.



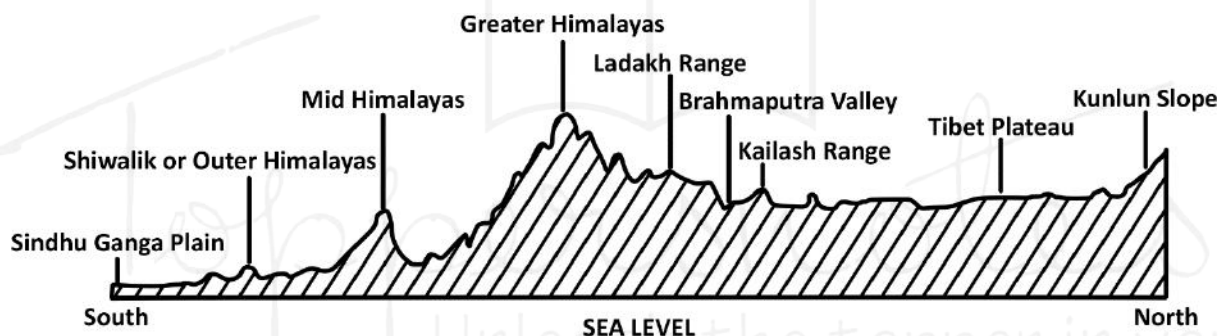
- West → pressure and compression were gradually released
- East → squeezing of Tethys sediments.
- Drass volcanic arc

### • Phase 4



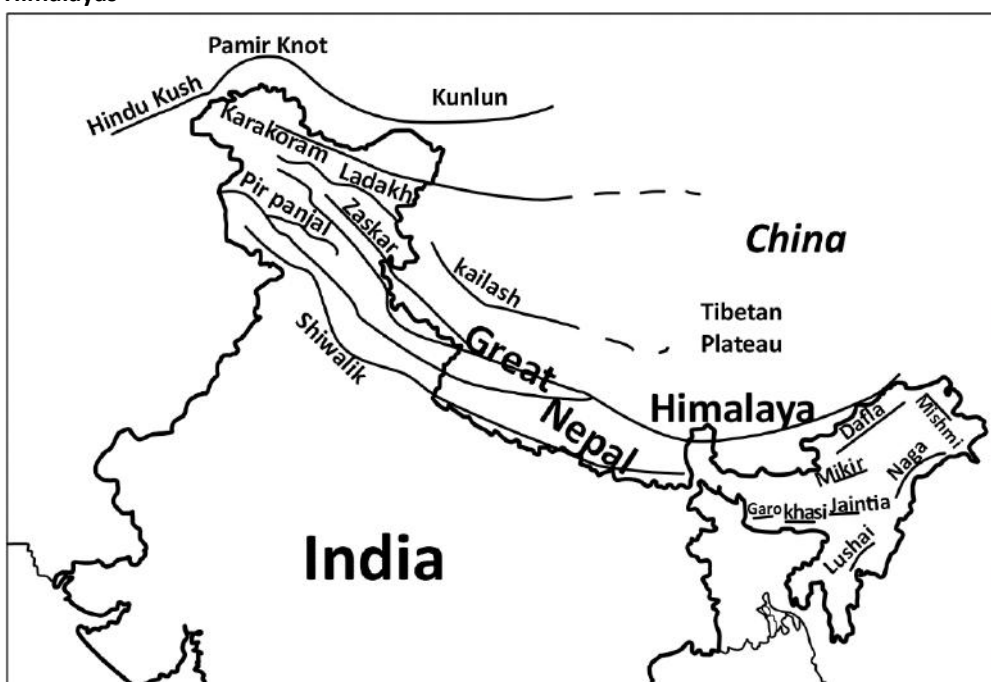
- Continued rotation & greater compression & major thrust in sediments of Murree foredeep & greater Himalayas (30-35 million years ago)
- Compressional thrust line - **Main Central Thrust (MCT)**- separates greater and lesser Himalayas
- **Phase 5**
  - Sediments deposited in Shivalik foredeep
  - Further movement & rise of lesser Himalayas (Miocene period)
- Compressional thrust line along which the lesser Himalayas were lifted - **Main Boundary Thrust**.
- **Phase 6**
  - Shivalik foredeep & sedimentation by Himalayan rivers.
  - Partial filling of Shivalik foredeep along the **Himalayan Frontal Fault (HFF)** & Shivalik ranges & partially folded sedimentary range.

### Sub Divisions of the Himalayas



Himalayan Mountain Complex: Cross Sectional View from South to North

### North-South of Himalayas



## 1. Trans-Himalayan Ranges:

- **Location:** North of the Great Himalayas
- aka **Tibetan Himalaya** because most of it lies in Tibet.
- **Lifted much before the Himalayas** b/w Jurassic and Cretaceous
- **Geologically not a part of the Himalayas.**
- **Start from Pamir Knot.**
- **Godwin Austen/ K2/ Qogir** (8,611 m) - **second highest peak in the world / highest peak in the Indian Union** found in Karakoram Range
- **Length- 1,000 km** in east-west direction.
- **Average elevation - 5000 m** above mean sea level.
- **Average width - 40 km- 225 km** (extremities - central part).
- **Siachen glacier** - highest battlefield.
- **Glacier Baltaro**- largest mountain glacier from Karakoram range.
- **Karakoram pass** - connects the **Aksai Chin** which is an erosional plateau of average height 5000m.
- **Main ranges:**
  - **Karakoram Range :**
    - **Northernmost range** of the Trans-Himalayan Ranges in India
    - aka **Krishnagiri range**
    - Extends eastwards from Pamir for about 800 km.
    - **Average elevation - 5,500 m** and above.
  - **Ladakh range :**
    - **North of the Zaskar Range**
    - **Highest point** - Rakaposhi
    - Lies to **north of Leh.**
    - **Merges with the Kailash range** in Tibet.
    - **Important passes** - Khardung La, and Digar La.
  - **Zaskar Range**
    - A mountain range in the **union territory of Ladakh.**
    - **Separates Zaskar from Ladakh.**
    - **Average height** - about 6,000 m.
    - Acts as a **climatic barrier protecting Ladakh and Zaskar from monsoon** - pleasantly **warm and dry climate** in the summer.
    - **Major passes**- Marbal Pass, Zojila Pass - extreme northwest .
    - **Major rivers**- Hanle River, Khurna River, Zaskar River, Suru River (Indus), and Shingo River.
  - **Kailash Range**
    - **Offshoot of the Ladakh Range.**

- **Highest peak** - Mount Kailash (6714 m).
- **River Indus** originates from the **northern slopes of the Kailash range.**

### Ladakh Plateau

- **Cold desert**
- Lies to the **north-east of the Karakoram Range.**
- **Dissected into** a number of plains and mountains - **Soda Plains, Aksai Chin, Lingzi Tang, Depsang Plains and Chang Chenmo.**
- **Northwestern part** - **Deosai mountains** are the end of the Trans-Himalayan region

## 2. Great Himalaya:

- aka **Himadri.**
- **Average height** - 6000 m
- **Average width** - 25 km
- **Extension** - Mt. Namcha Barwa to Nanga Parbat (2400 km)- one of the longest-running fold mountain ranges in the world.
- **Features:** High relief, deep gorges, vertical slopes, symmetrical convexity, and antecedent drainage.
- **Terminates abruptly** at the **syntaxial bends.**
  - **Nanga Parbat** - north-west
  - **Namcha Barwa** - north-east.
- **Composed of metamorphic and sedimentary rocks.**
- **Core - Batholith** representing the intrusion of Magma (Granitic Magma)
- **Have asymmetrical folds** due to high compression and they **have fractured rocks** in the **eastern part.**
- **14 of the 28 tallest peaks** in the world (> 8000 m) are situated here.
- **Major passes** - Zojila Pass (connects Srinagar with Leh), Shipki La Pass, Burzil Pass, Nathu La Pass etc.
- **Major glaciers** - Rongbuk glacier (largest in the Himadri), Gangotri, Zemu etc.
- **Separated from lesser Himalayas** by longitudinal valleys filled with sediments k/a **Doons.**
  - Eg. Patli Dun, Chaukamba Dun, Dehra Dun etc.

## 3. Middle/ Lesser/ Himachal Himalaya:

- **Most rugged** mountain system.
- Lies **b/w** the **Shiwaliks** in the south and the **Greater Himalayas** in the north.
- **Composed of highly compressed and altered rocks.**
- **Average altitude** - 3,700 - 4,500 metres.
- **Average width** - 50 to 80 Km.

- **Pir Panjal range - longest**
  - **Extends from Jhelum - upper Beas river** for over 300 km.
  - Rises to 5,000 metres and contains **mostly volcanic rocks**.
  - **Passes :**
    - Pir Panjal Pass (3,480 m), the Bidil (4,270 m), Gulabgarh Pass (3,812 m) and Banihal Pass (2,835 m).
    - **Banihal Pass**- Jammu-Srinagar highway and Jammu-Baramulla railway.
  - **Rivers :**
    - **Kishanganga**, the **Jhelum** and **Chenab**.
  - **Important Valleys**
    - **Valley of Kashmir**-
      - ✓ b/w the **Pir Panjal** and the **Zaskar Range** (average elevation- 1,585 m)
      - ✓ **Composed** of alluvial, lacustrine [lake deposits], fluvial [river action] and glacial deposits. {Fluvial Landforms, Glacial Landforms}
      - ✓ **Jhelum River meanders** through these deposits and cuts a **deep gorge** in Pir Panjal through which it drains.
    - **Kangra Valley** -
      - ✓ **Extends from** the foot of the **Dhauladhar Range to the south of Beas**.
    - **Kulu Valley**
      - ✓ In the **upper course of the Ravi**
      - ✓ A **transverse valley**.
- **Most important range** - Dhauladhar and Mahabharat ranges.
- **Includes** famous valley of Kashmir, the Kangra and Kullu Valley in Himachal Pradesh.
  - Well **known for its hill stations**.
- **Cut across by the Jhelum and Chenab river**.
- **Dhauladhar ranges** - extension of Pir Panjal into Himachal Pradesh - cut across by the river Ravi.
- **Mussoorie ranges** - divide the waters of Sutlej and Ganga

- Have **steep, bare southern slopes** [ prevents soil formation] and more **gentle, forest covered northern slopes**.
- **Uttarakhand**- marked by **Mussoorie and Nag Tibba ranges**.

Important ranges of Lesser Himalayas	Region
<b>Pir Panjal Range</b>	J&K (south of Kashmir Valley)
<b>Dhauladhar Range</b>	Himachal Pradesh
<b>Mussoorie Range and Nag Tibba Range</b>	Uttarakhand
<b>Mahabharat Lekh</b>	Nepal

#### 4. Sub-Himalayas/ Shiwaliks:

- aka **Outer Himalayas**.
- **b/w Great Plains and Lesser Himalayas**.
- **Altitude**- 600-1500 metres.
- **Length**- 2,400 km - **Potwar Plateau to Brahmaputra valley**.
- **Southern slopes** - steep
- **Northern slopes** - gentle.
- **Width** - 50 km - 15 km (Himachal Pradesh - Arunachal Pradesh).
- **Almost unbroken except** for 80-90 km - **valley of Tista and Raidak River**.
- Covered with **thick forests** from North-East India up to Nepal.
- **Southern slopes** in **Punjab** and **Himachal Pradesh**- almost **NO forest cover**.
- **Highly dissected** by seasonal streams - Chos.
- **Valleys** - part of **synclines** and **hills** - part of **anticlines**
- **Different names:**

Region	Name of Shiwaliks
Jammu Region	Jammu Hills
Dafra, Miri, Abor and Mishmi Hills	Arunachal Pradesh
The Dhang Range, Dundwa Range	Uttarakhand
Churia Ghat Hills	Nepal