



# CSIR

**COMBINED ADMINISTRATIVE SERVICES  
EXAMINATION (CASE)**

**SECTION OFFICER (GEN/F&A/S&P) AND ASSISTANT  
SECTION OFFICER (GEN/F&A/S&P)**

**PAPER – 2 || VOLUME - 10**

**Geography of India**



# COMBINED ADMINISTRATIVE SERVICES EXAMINATION (CASE – 2023)

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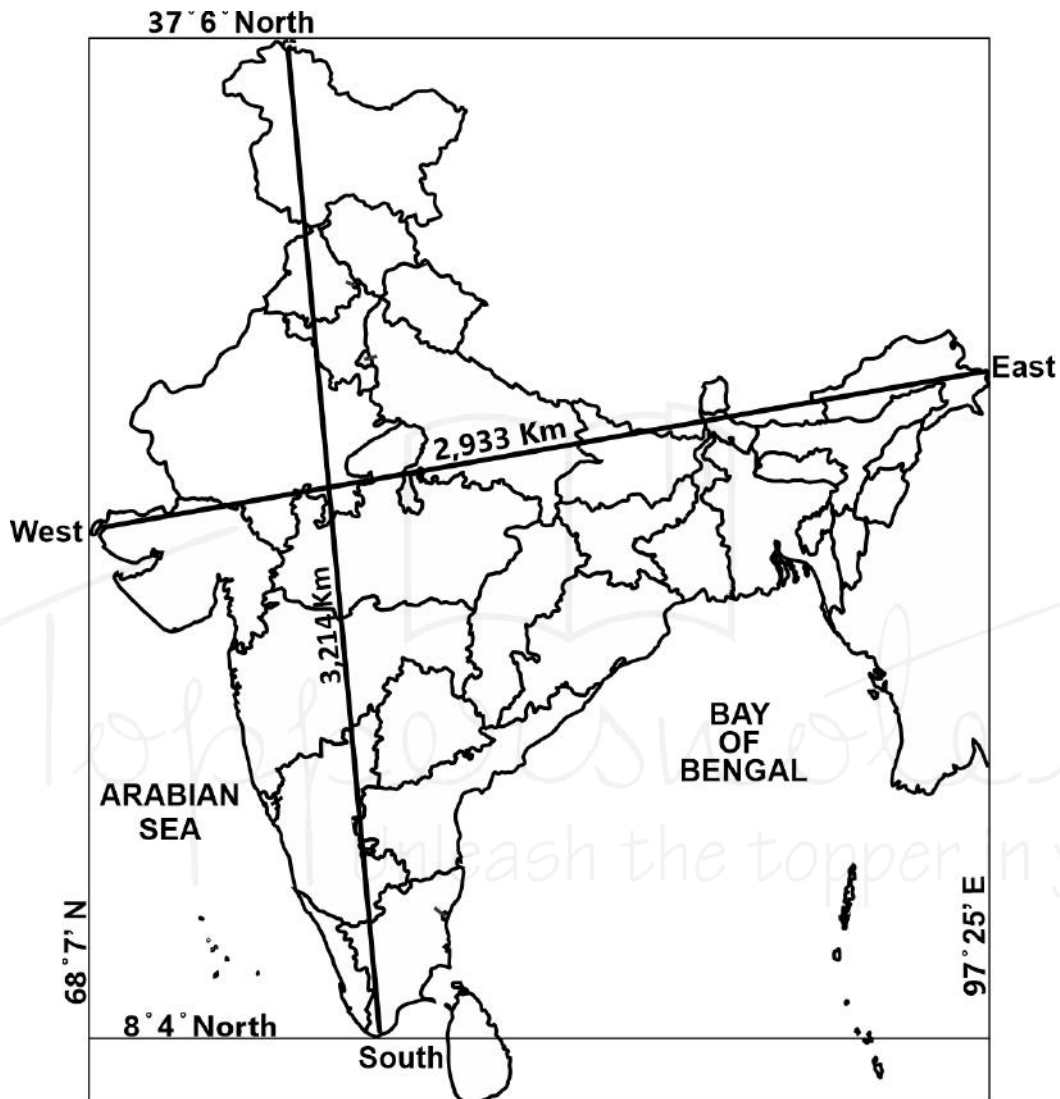
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# 1 CHAPTER

## 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.

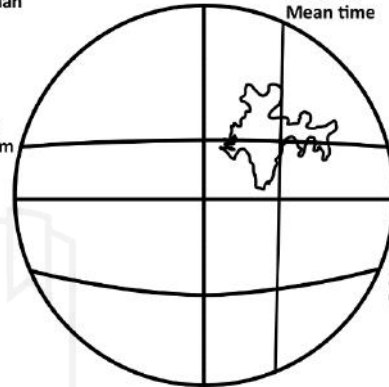
States of Tropic of Cancer

1. Gujrat
2. Rajasthan
3. MP.
4. CG.
5. JH.
6. WB.
7. Tripura
8. Mizoram

82°5' E min. India Standard Time (IST) or Indian Mean time

IST Passes Through States

1. UP.
2. MP.
3. CG.
4. Odisha
5. AP.



23° 1/2 Tropic of Cancer, 8 stat

23° 1/2 S Tropic of Capricone



# 2 CHAPTER

# Geological Structure and Rock Systems of India

## Geological History of India

- **Precambrian Era:**



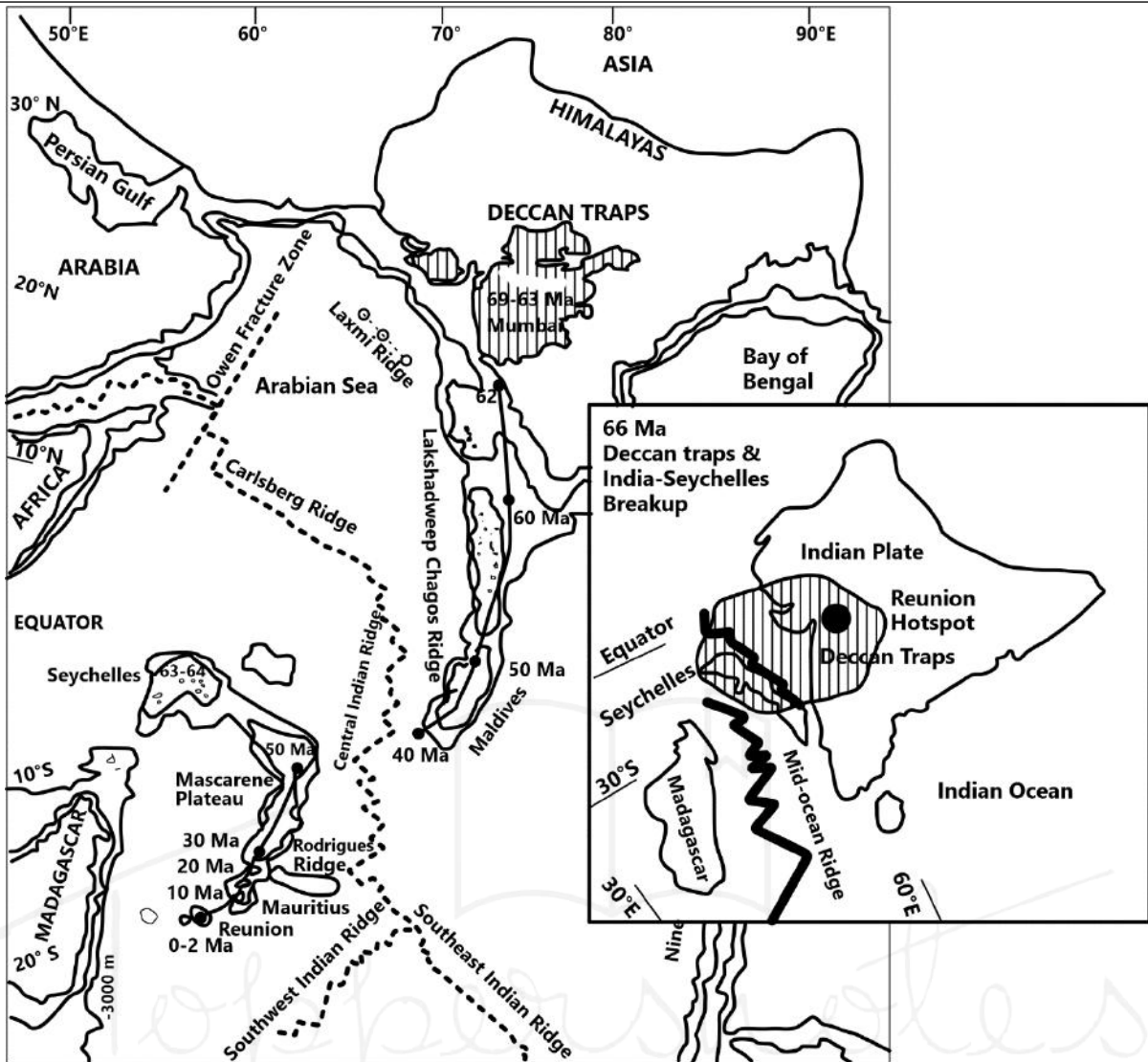
- **Peninsular India** (oldest crustal block of India) formed due to
  - **Collision of 3 Proto Continents: Aravalli, Dharwad, Singhbhum.**
  - **Formation of 3 Lineaments: Narmada, Son and Godavari**
  - **Folding of Geosynclines** of Protocontinents, **mountains formed:** Aravalli, Vindhya, Satpura, Eastern Ghats, Bijawal

- **Paleozoic Era:**

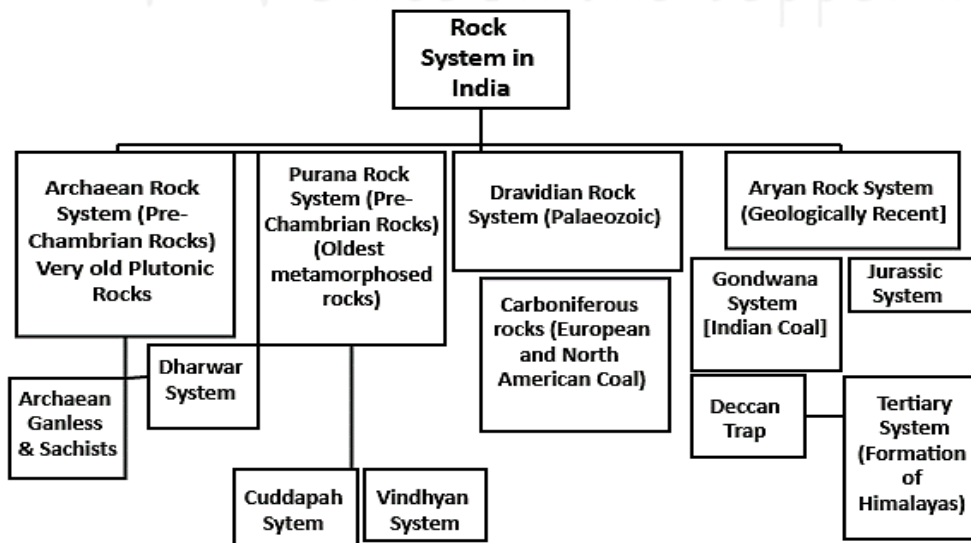
- United land mass **Pangea** broke
- **India - part of Gondwana Land**
- **Faulting of Damodar and Mahanadi** occurred
  - **Submergence of forest:** Coal Reserves formed
- **Western coast** cracked

- **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).

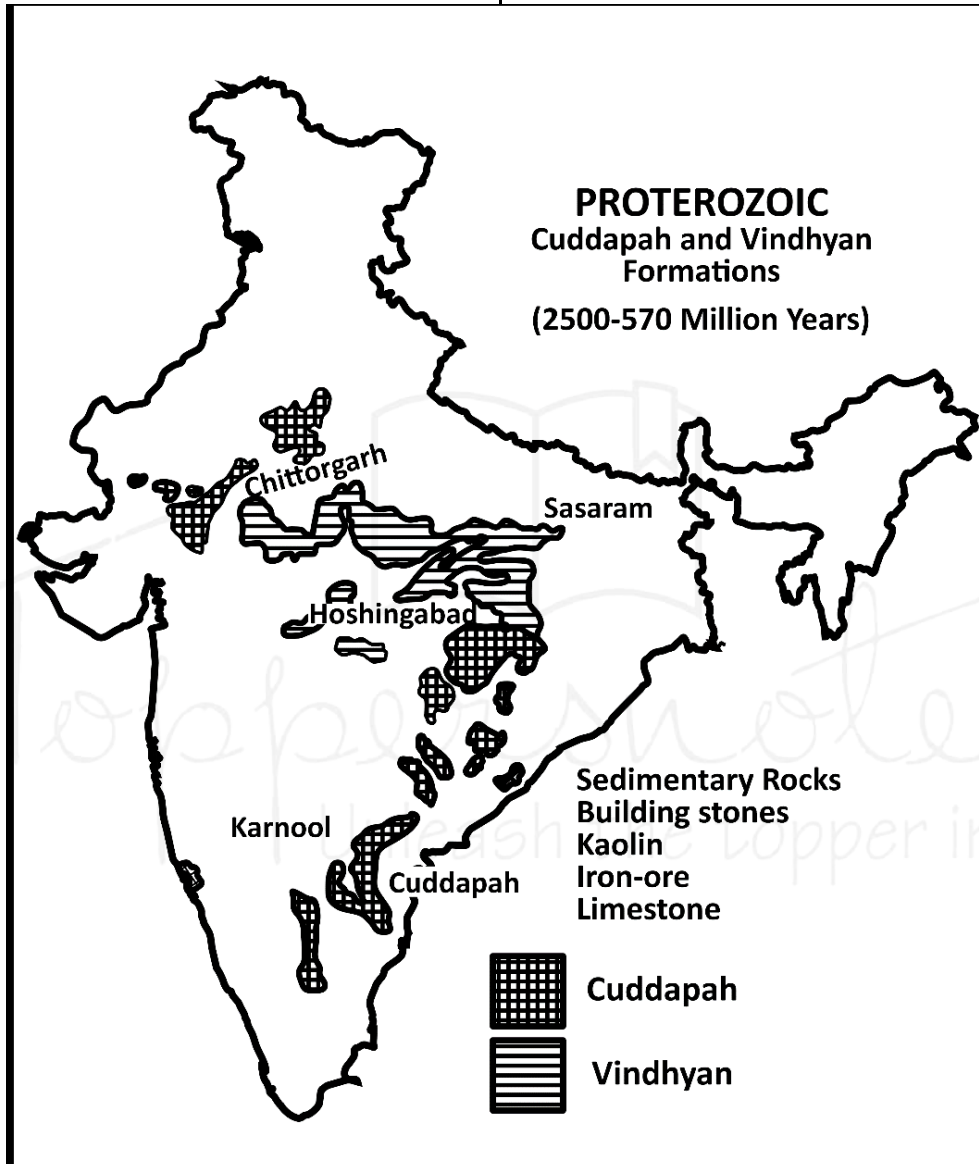
- **Contain gneisses** (granite, gabbro etc.) and **schists** (mica, chlorite, talc etc.)
  - **Bundelkh and gneiss** is the **oldest** one.
- **Mineral composition:** iron, manganese, copper, bauxite, gold, lead, mica, graphite etc.
- **Distribution:** Aravalli hills and South-eastern parts of Rajasthan, 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 Rewa** 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. **Vindhyan 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 (Umara in Rewa).
  - **Abundant fossils.**
  - **Include** shales, sandstones, clays, quartzites, slates, salts, talc, dolomite, marble, etc.
- **Distribution:** Pir-Panjaj, 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.
- **Shivalik System** - Middle Miocene to Lower Pleistocene: Consists of boulders, Conglomerates beds, Gravels, Sandstones, shales and clays; Richly fossiliferous

# 3 CHAPTER

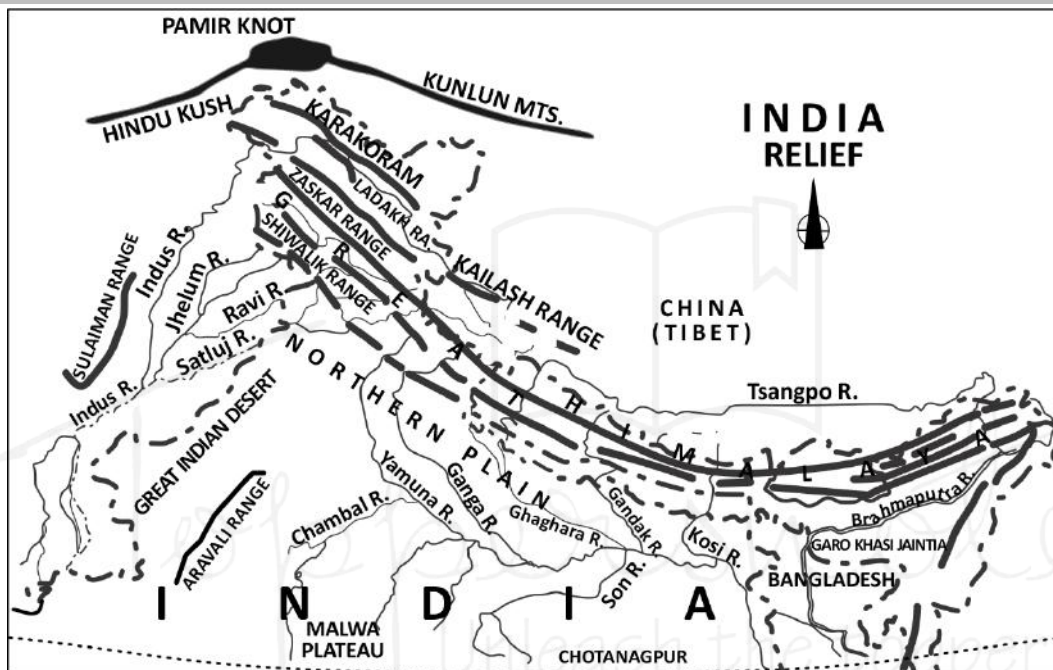
# Physiographic Divisions of India



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).

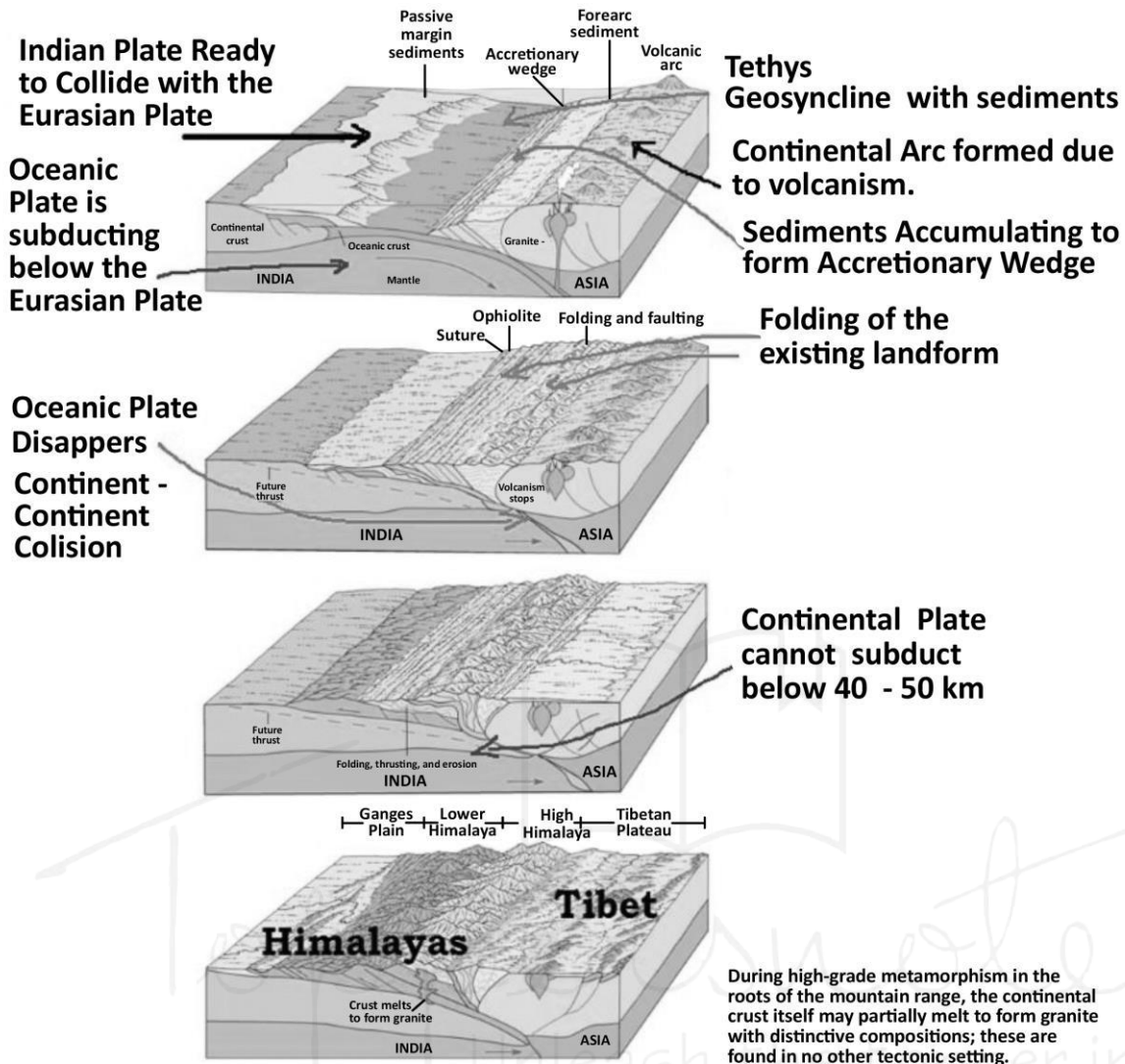
### Physical Features

- 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:

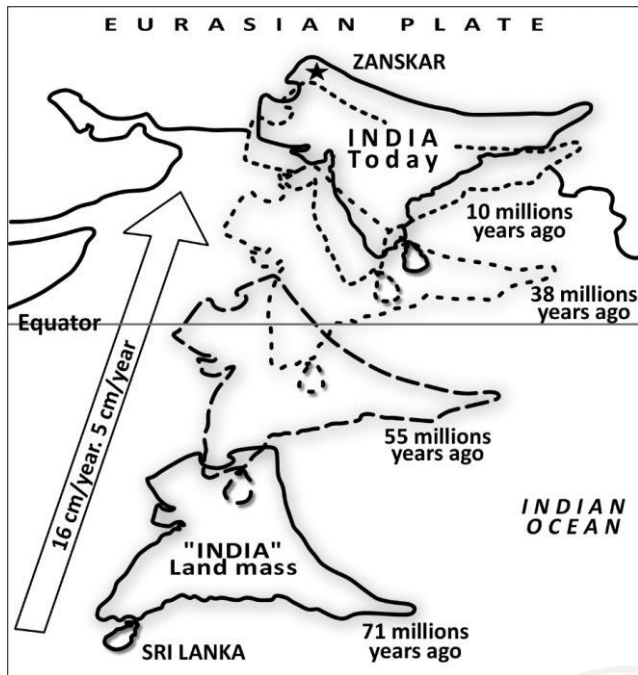
- 200 million years ago the supercontinent Pangea started to disintegrate into smaller continents.
  - Northern part - Laurasia or Angaraland
  - Southern part - Gondwana land.
- A vast empty space was formed b/w Laurasia and Gondwana Land.
- Rivers from Laurasia and Gondwanaland → eroded material and 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.

### 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 ☐ Shivalik foredeep created.

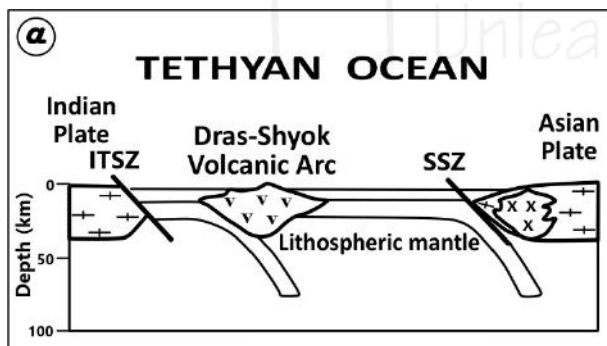
### Suture zone

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

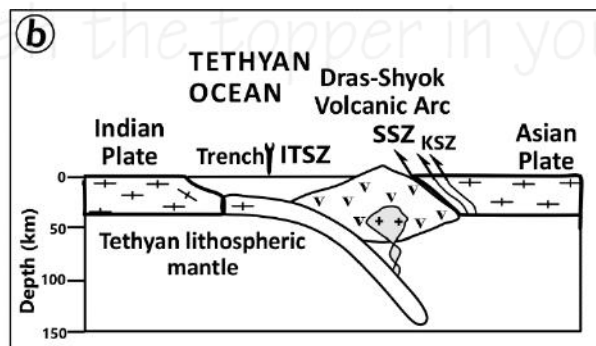
### Indus- Tsangpo Suture Zone

- 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

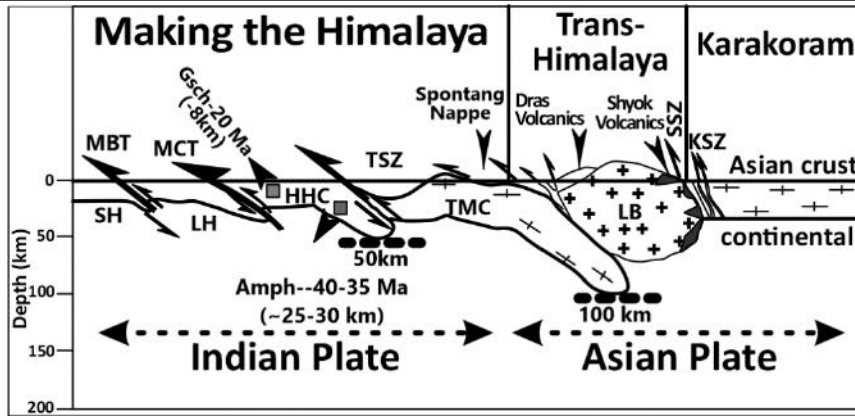
### ● Phase 3



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

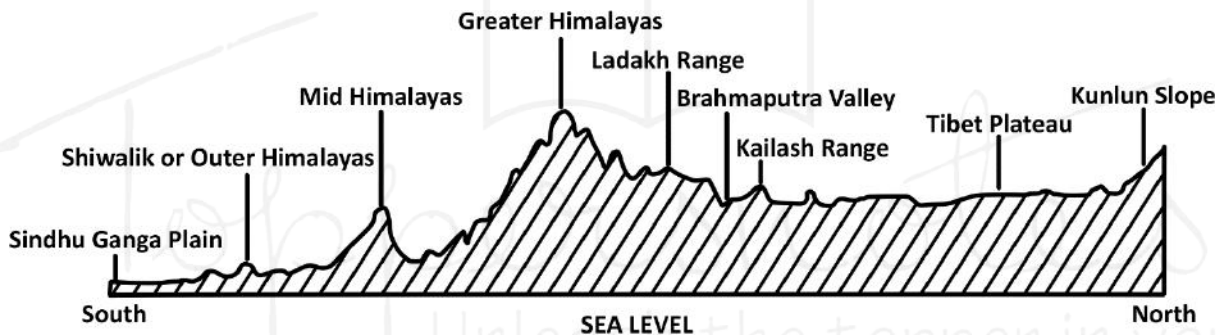


- West → pressure and compression were gradually released
- East → squeezing of Tethys sediments.
- Drass volcanic arc
- Phase 4



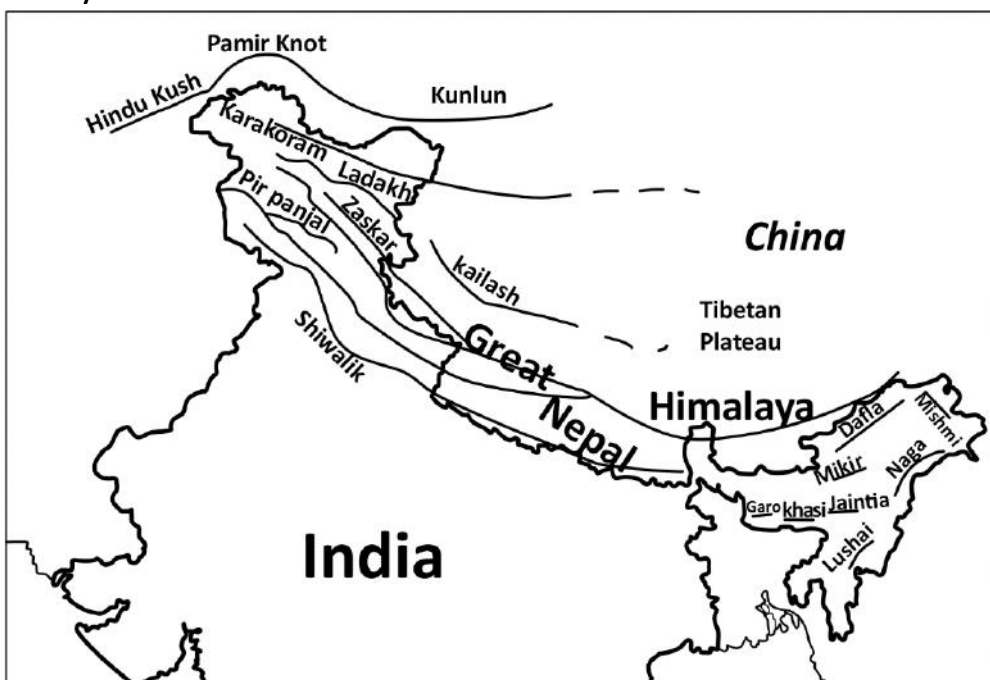
- Continued rotation → greater compression → major thrust in sediments of Murree foredeep → greater Himalayas (30-35 million years ago)
- Compressional thrust line - Main Central Thrust (MCT)- separates greater and lesser Himalayas
- Phase 5
  - Sediments deposited in Shiwalik foredeep
  - Further movement → rise of lesser Himalayas (Miocene period)
- Compressional thrust line along which the lesser Himalayas were lifted - Main Boundary Thrust.
- Phase 6
  - Shiwalik foredeep → sedimentation by Himalayan rivers.
  - Partial filling of Shiwalik foredeep along the Himalayan Frontal Fault (HFF) → Shiwalik 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 Kailas 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 **Shivaliks** 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
Dafla, Miri, Abor and Mishmi Hills	Arunachal Pradesh
The Dhang Range, Dundwa Range	Uttarakhand
Churia Ghat Hills	Nepal