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UPSC - IAS

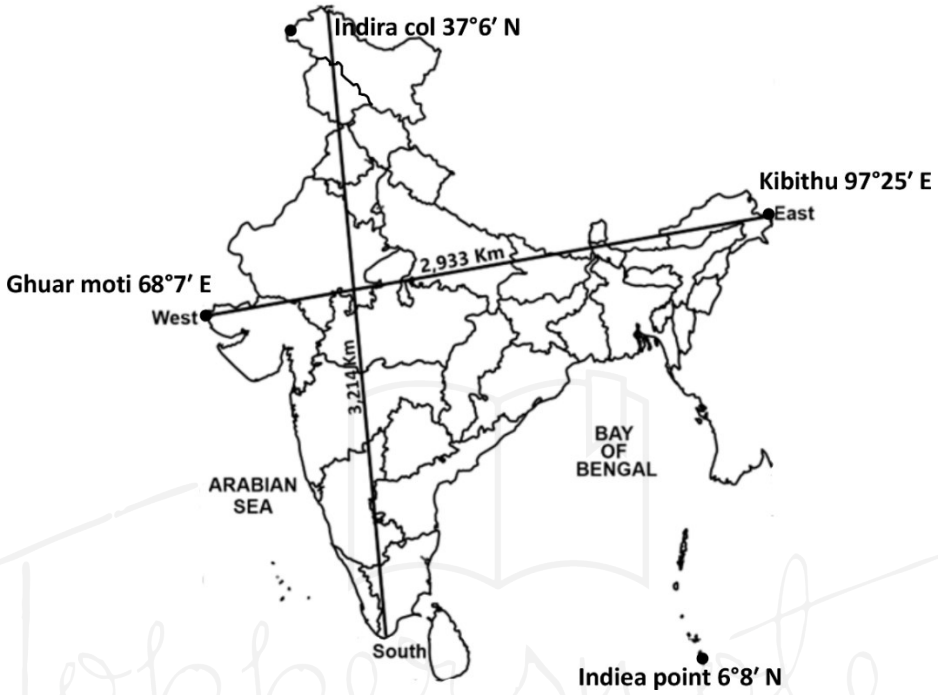
Civil Services Examinations

Indian Geography

SIERRA INNOVATIONS

Indian Geography

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: 30^0 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 andPakistan
    - India-Pakistan border: Radcliffe line
    - Pakistan-Afghanistan border: Durand Line.
  - **North**: China, Bhutan andNepal
    - 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, andAssam
  - **China**:Total boundary=**3488km**
    - **3 States and1 UT:** Himachal Pradesh, UttarakhandandSikkim andLadakh

- **Pakistan** : Total boundary= **3323km**
  - **4 States and1 UT:** Jammu andKashmir, Punjab, Gujarat, Rajasthan andLadakh
- **Nepal**: Total boundary= **1751km**
  - **5 States:** Uttar Pradesh, Bihar, Uttarakhand, Sikkim, West Bengal
- **Myanmar**: Total boundary= **1643km**
  - **4 States**: Arunachal Pradesh, Manipur, Mizoram, andNagaland
- **Bhutan**: Total boundary= **699km**
  - **4 States**: Arunachal Pradesh, Assam, Sikkim, andWest Bengal
- **Afghanistan**:total boundary= **106km**
  - **1 UT:** Ladakh

Indian Standard Meridian

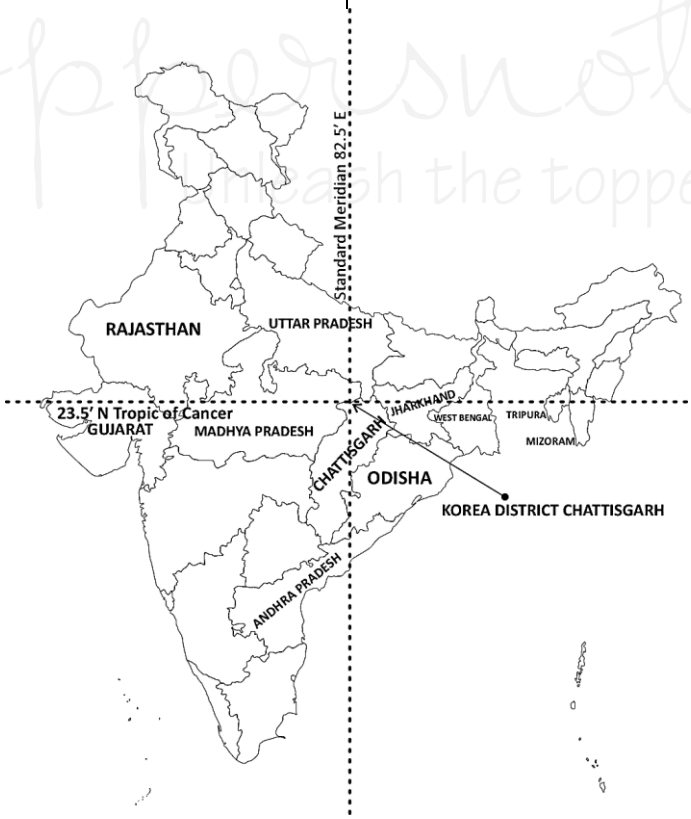
- 82°30'E Meridian crossing through Mirzapur, UP is India's Standard Meridian.
- IST passes through Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Odisha, Andhra Pradesh.
- Ahead of Greenwich mean time by 5 hours and 30 minutes.
- There is a gap of approximately 1 hour and 45 min between Dibrugarh in Assam and Dwarka in Gujarat.

Should India have two time zones?

- India extends from 68°7'E to 97°25'E, representing a time difference of almost two hours from the geographic perspective.
- Over the years, there has been a widespread demand for two separate time zones in India.
- The demand circles around the argument that early sunrise in the Northeast causes the loss of many daylight hours by the time offices or educational institutions open. Moreover, early sunset, for its part, leads to higher consumption of electricity.
- People against the idea of two time zones in India, on the other hand, cite impracticability particularly the risk of railway accidents, given the need to reset times at every crossing from one time zone into another.
- Many countries like, USA, China, France, Australia, UK, Canada etc follow more than one time zone.

Tropic of Cancer

- Tropic of Cancer passes through 8 states in India.
- Mahi River is the only river in India that cuts the Tropic of Cancer twice.
- Udaipur city in Tripura is the nearest city to the tropic of cancer.



Dispute between India and its neighbourhood

India-Nepal

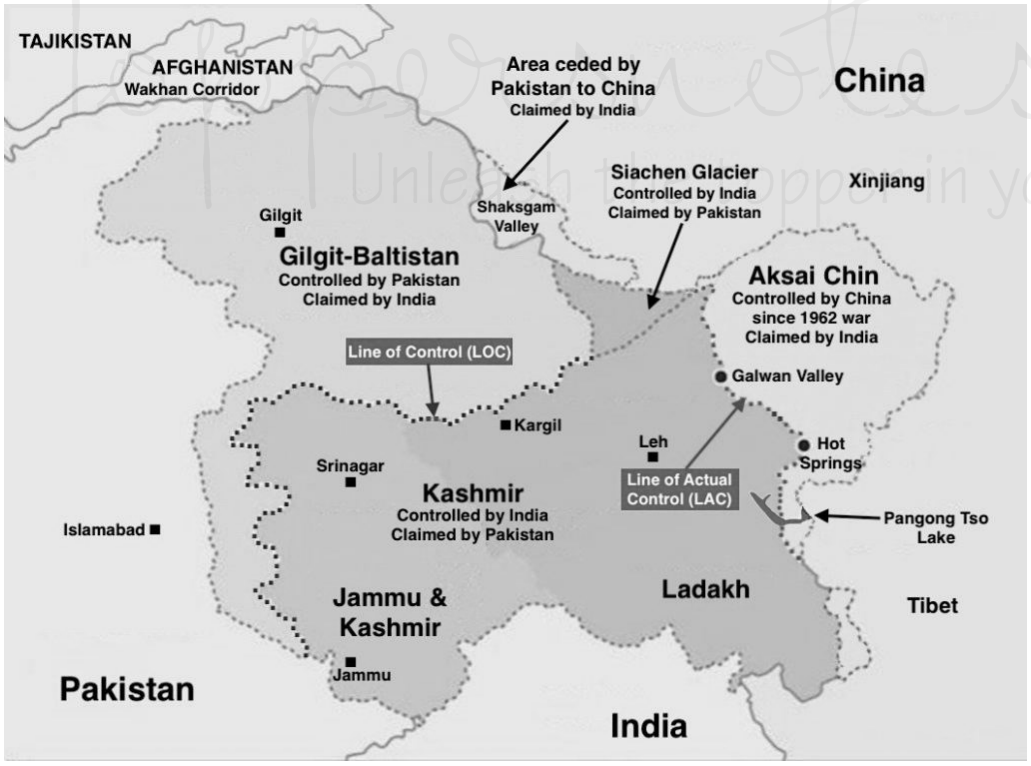
- India and Nepal have border disputes over **Kalapani - Limpiyadhura - Lipulekh trijunction between India-Nepal and China** and **Susta area (West Champaran district, Bihar).**

India-Pakistan

Jammu and Kashmir

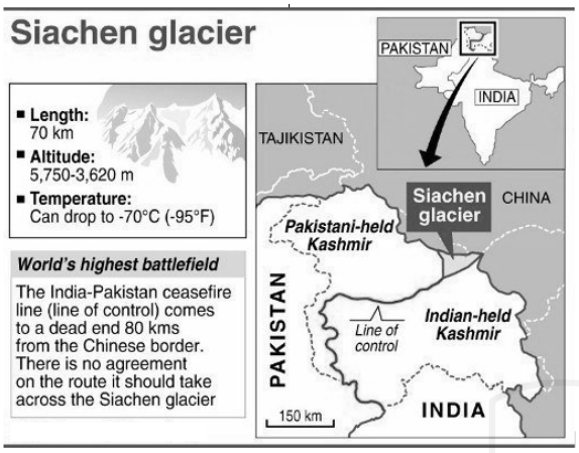
Pakistan-occupied Kashmir and Gilgit-Baltistan:

- Pakistan is in the illegal and forcible occupation of approximately 78,000 sq. km of Indian Territory in Jammu and Kashmir. In addition, under the so-called Sino-Pakistan Boundary Agreement of 1963, Pakistan illegally ceded 5,180 sq. km in Pakistan Occupied Kashmir to China.



Siachen Glacier:

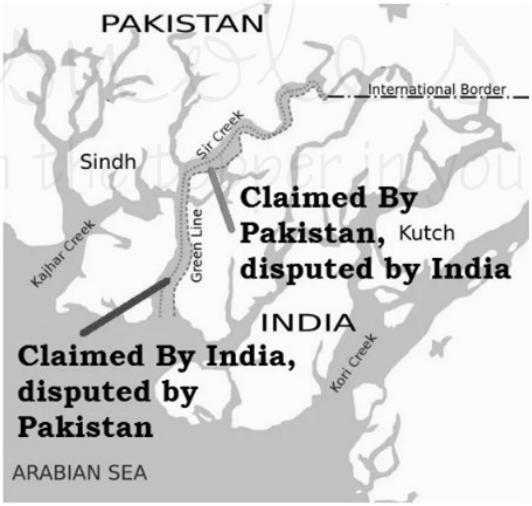
- The Siachen Glacier is located in the eastern Karakorams in the Himalayas just east of the Actual Ground Position Line between India-Pakistan. The entire Siachen Glacier, with all major passes, is currently under the administration of India since 1984 (Operation Meghdoot).

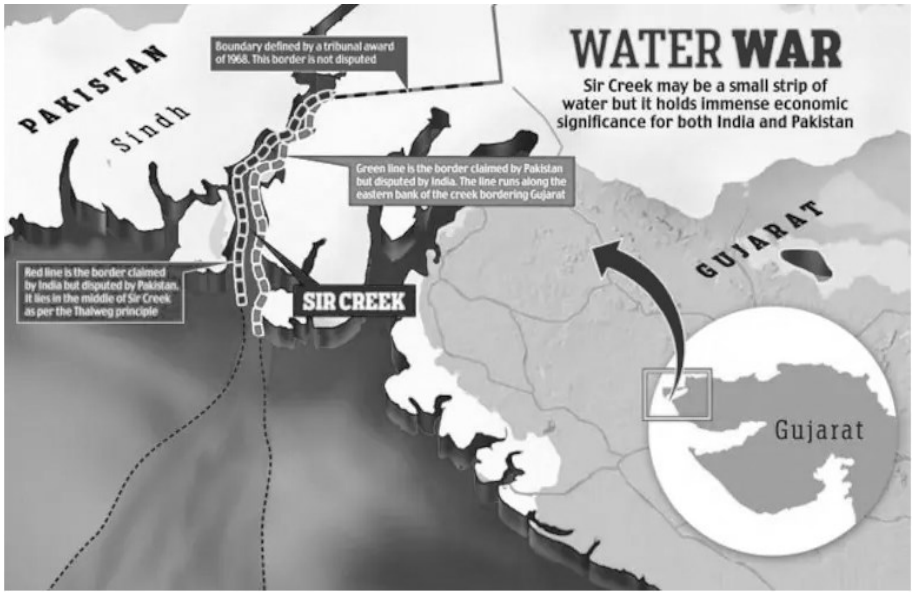


THE HIGHEST BATTLEFIELD	
Siachen is one of the largest glaciers after the two polar regions	
• The glacier is located in the eastern karakoram Range. It is 75 km long and 2 to 8 km wide • In local Balti language, 'sia' means 'rose', and 'chen' means 'place'; Siachen means the 'place where roses bloom'. • Naib Subedar Bana Singh was awarded Param Vir Chakra for capturing Pakistan's Qaid Post in 1987. The post was later renamed Bana Post. • More than 5,000 soldiers hold the front line at Saltoro ridge.	• The army has laid a 67-km-long pipeline to supply kerosene to its posts. • The Indian Army launched Operation Meghdoot in 1984 to capture Siachen. • The 110km line beyond NJ9842 is called Actual Ground Position Line. • Daily costs incurred by the army for sustaining operations at Siachen are estimated to be more than Rs 6 crore. • The highest helipad in the world, Sonam (20,997 ft), is maintained in Siachen by India

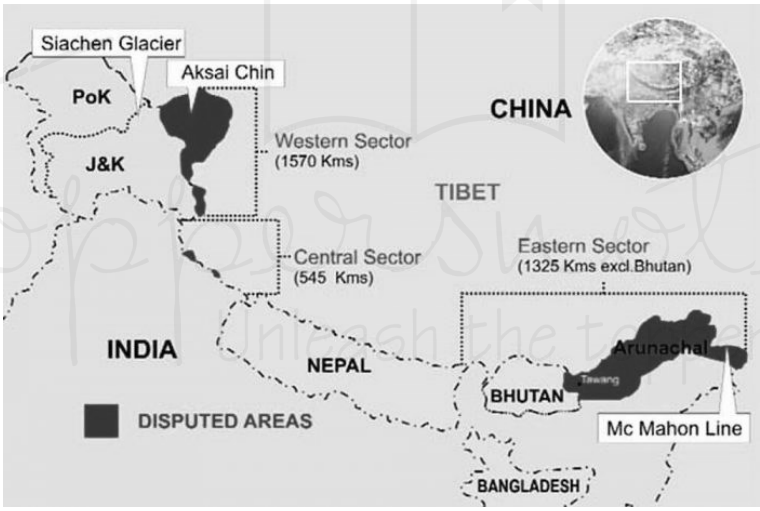
Sir Creek:

- Sir Creek is a 96km estuary that lies between Kutch in Gujarat and Pakistan's Sindh province.
- The Indo-Pakistan international border starts from the point where coming from the Arabian Sea Sir Creek joins the land mass. This area had not been demarcated as it had not been properly surveyed due to its being somewhat desolate and inhospitable. Nonetheless, taking advantage of a 1914 Bombay Government Resolution that sought to demarcate Sir Creek between Sindh and Kutch divisions of the Bombay state as an internal administrative measure, Pakistan began to lay claim over the entire Creek. Their maritime boundary now needed to be settled as per international norms, mainly the Thalweg Doctrine, which follows the meridian principle.
- Pakistan does not agree with India since an acceptance of these provisions would lead to redrawing of the maritime boundary in the area, re-delineation of the Exclusive Economic Zone and other fishing areas in the Arabian Sea.
- This could be detrimental to Pakistani hopes as it anticipates the presence of hydro-carbon resources in the area.





India- china



Western sector

- There is a territorial dispute over Aksai Chin. India claims it as part of erstwhile Kashmir, while China claims it is part of Xinjiang. The dispute over Aksai Chin can be traced back to the failure of the British Empire to clearly demarcate a legal border between China and its Indian colony.
- During the time of British rule in India, two borders between India and China were proposed- Johnson's Line and McDonald Line. The Johnson's line (proposed in 1865) shows Aksai Chin in erstwhile Jammu and Kashmir (now Ladakh) i.e. under India's control whereas McDonald Line (proposed in 1893) places it under China's control.

Eastern sector:

- This boundary line is called McMahon Line.
- China considers the McMahon Line illegal and unacceptable claiming that Tibetan representatives who had sig ned the 1914 Convention held in Shimla which delineated the McMahon line on the map were not having rights to do so
- There is no dispute in middle sector

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, Singhbum.

GEOLOGICAL HISTORY OF INDIA

Pre-cambrian era

Aravali + Dharwad + Singhbum → India main landmass

↓

Proto-continent

Geosynclines (Elongated valley at border of continent)

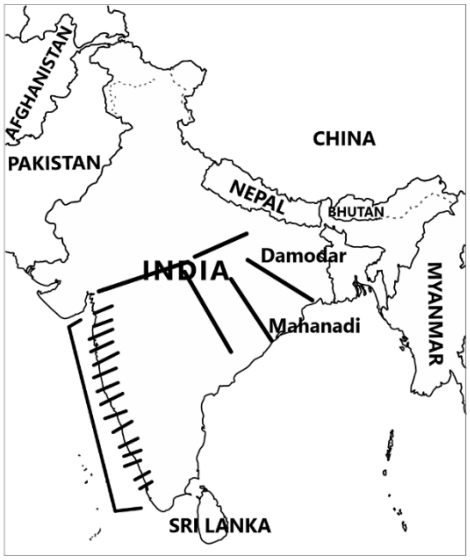
↓ found at margin of proto-contenent

↑ deposition collected in valley & form mountain

↓

- Aravali
- Vindhyan
- Satpura
- Eastern Ghat
- Bijawal

    - Formation of 3 Lineaments: Narmada, Son and Godavari
    - Folding of Geosynclines of Protocontinents, mountains formed: Aravalli, Vindhya, Satpura, Eastern Ghats, Bijawal



GEOLOGICAL HISTORY OF INDIA

Border region of proto-continent → lineaments (Narmada + Son + Godavari)

In Gondwana time → Reactivation of lineament

↓

Faulting developed

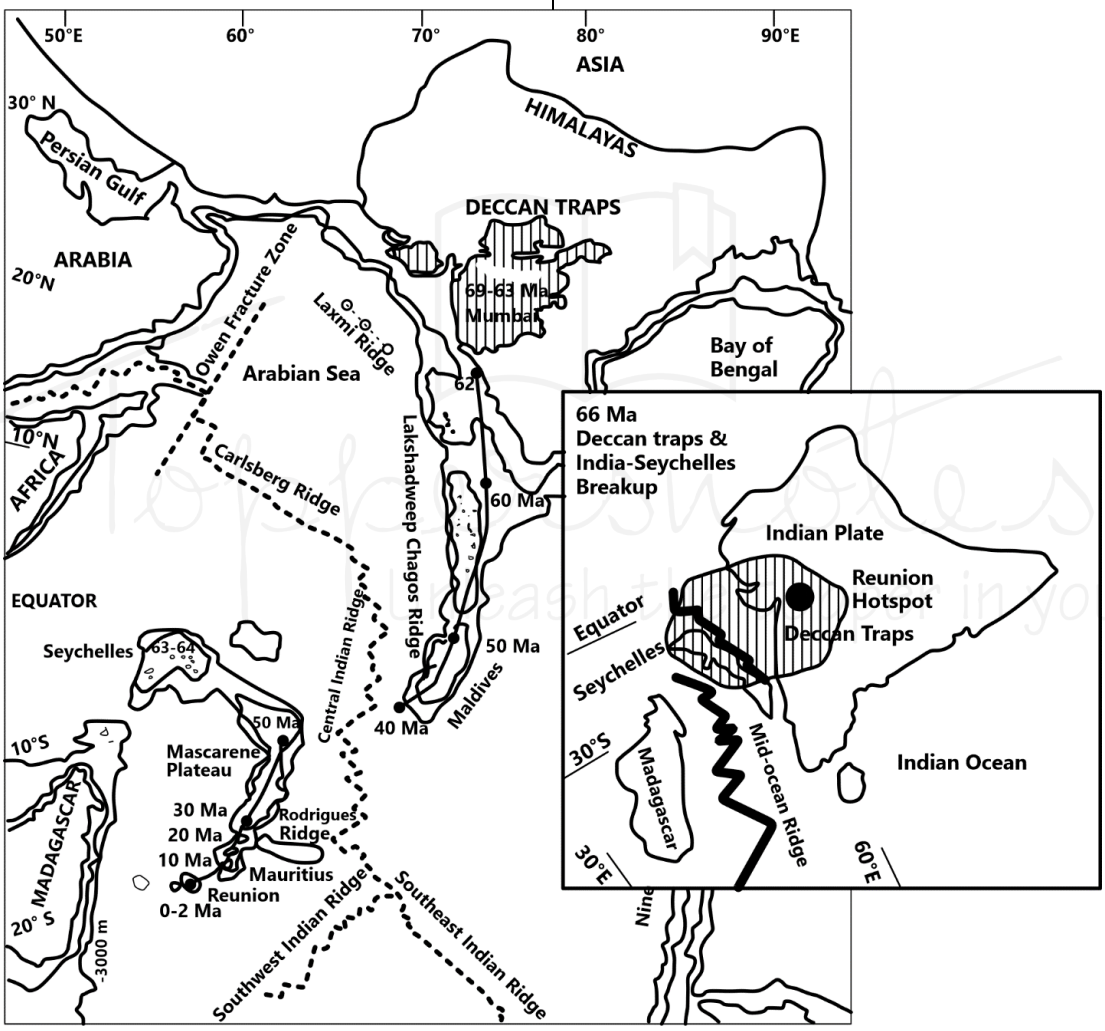
↓

Mahanadi & Damodar river in rift valley

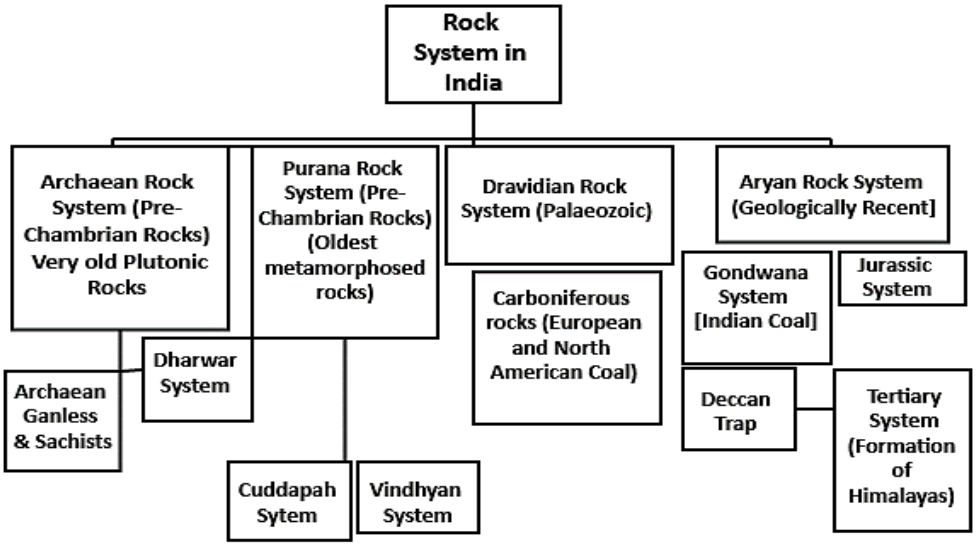
↓

Submergence of rift leads to coal deposit

- 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

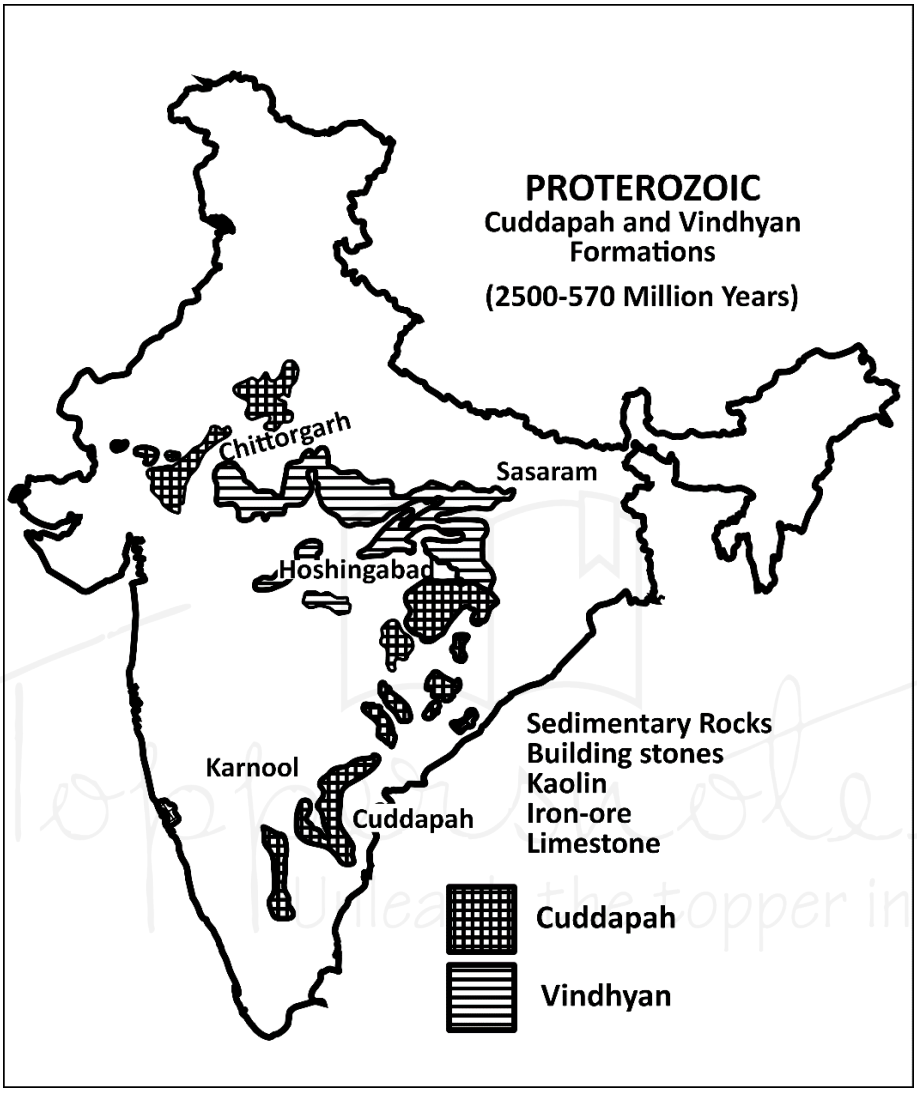
- Early Precambrian Era
- Form **core of the Indian Craton** (Block of Indian Subcontinent of Gondwanaland).
- **Features**:
  - **oldest** rock system of the Indian subcontinent
  - **formed when magma solidified** = **NO fossils** (Azoic), crystalline and consist of **sheet-like layers** (foliated).
  - **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
- <u>Two systems-</u>

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 Rews** 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

- **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., andclay 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
Andhra Pradesh	Papaghani Series	• Location: Papagni river basin; • Quartzite, shales, slates and lime stones
	Cheyyar Series	• Location: Cheyyar river basin; • Shales and quartzite
	Nallamalai Series	• Location: Nallamalai hills; • quartzite and shales
	Krishna Series	• Location: Krishna basin; • quartzite and shales
Madhya Pradesh and Chhattisgarh	Bijawar Series	• Location: Bijawar district (MP) • sandstone, quartzite and some volcanic rocks still, dykes (parental rocks of diamonds).
	Gwalior Series	• Location: Gwalior district (MP); • Shales, limestone, sandstones, quartzite overlain by shales, hornstone, jaspers and basic volcanic rocks
	Rajpur Series	• Location: Chhattisgarh; • limestone, sandstones, quartzites.
Karnataka	Kailagi Series	• Location: Bijapur district; • ferrous rocks, quartzite, shale.
	Pakhal Series	• Location: Godavari region; • quartzite, shale and siliceous limestone
	Penganga Series	• Location: Penganga rivers Wardha district of Maharashtra; • Limestone, Shales and Slates
Delhi	Ajabgarh Series	• Location: Alwar, Delhi and Gurgaon; • quartzites and slates, granites with veins of pegmatites.
	Rialto Series	• Location: Ladar (Gujrat) Delhi, and Alwar region; • rich in Marble

- 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 Zanskar 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**: Ranigunj, 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 andGuntur 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
Upper Trap	Maharashtra and Gujarat	Present	Present
Middle Trap	Central India and Malwa	Very rare to absent	Present
Lower Trap	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

Year		2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023	
Pre	Mains	2	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	3	-	2	-	3	-

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. In dian Desert
5. Coastal Plains
6. Islands

GEOLOGICAL HISTORY OF INDIA

Himalaya formation

Indian plate → **Tethys sea plate** ← **Eurasian plate**

Indian plate → (Tethys sea plate subduction) Collision ← **Eurasian plates**

↓

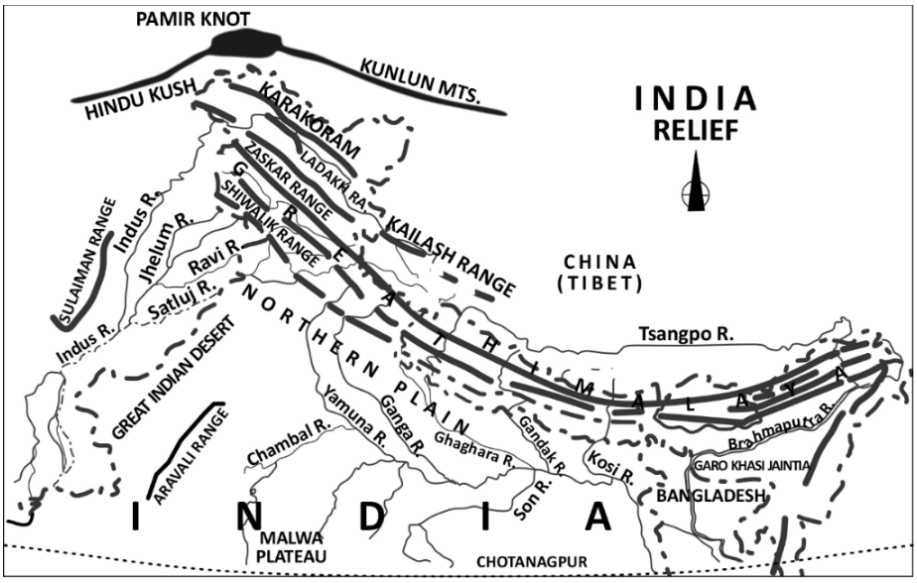
Formation of Himalaya

Collision of Indian + Eurasian plate — 1st at north-west

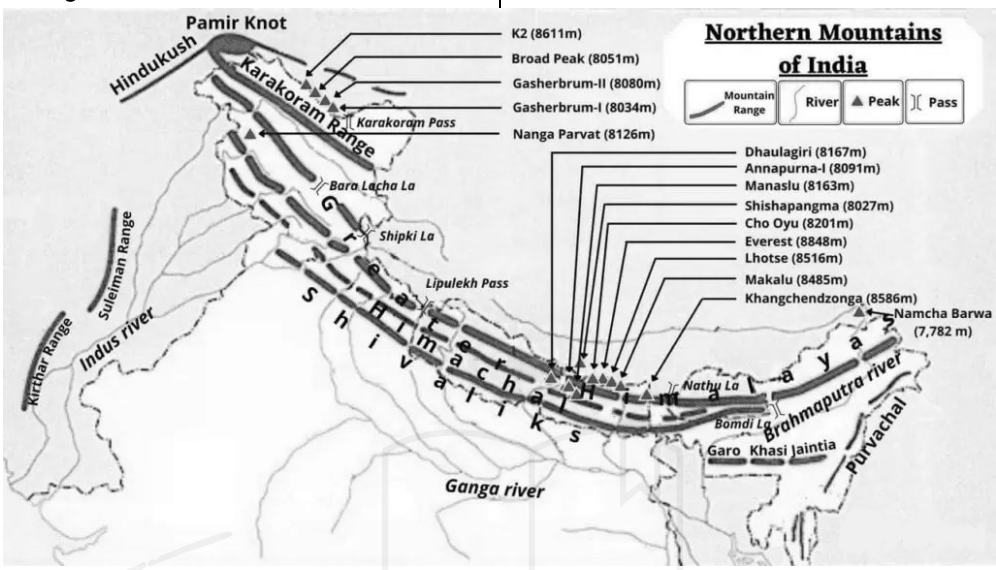
↓

Indian peninsula slope tilted toward west-east

Himalayan Mountains



- **Highest andthe 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).

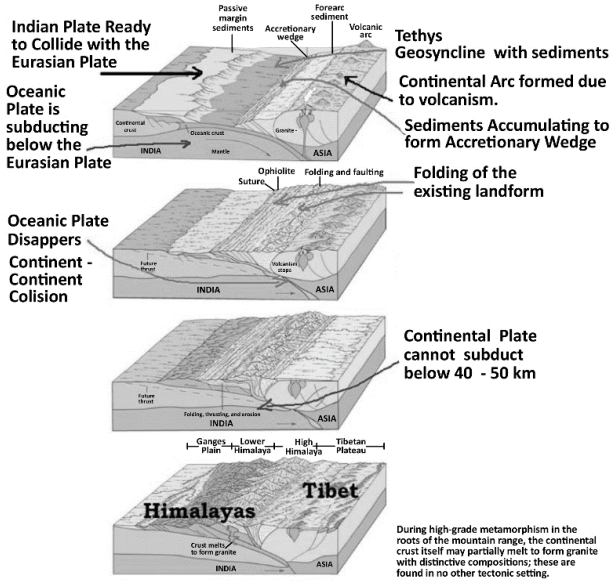


Physical Features

- **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

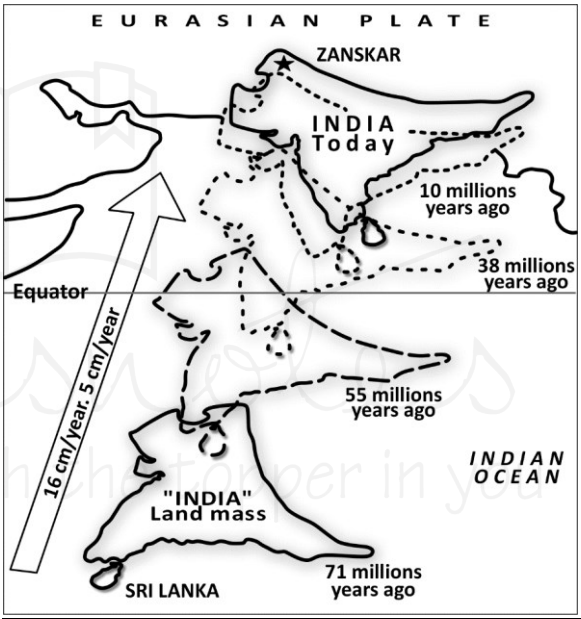
2 theories:



1. Geosyncline Theory of Formation of Himalayas:
   - 200 million years ago the supercontinent Pangea started to disintegrate into smaller continents.
     - Northern part - Lauratia 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 andSuess.
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 andTethys 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

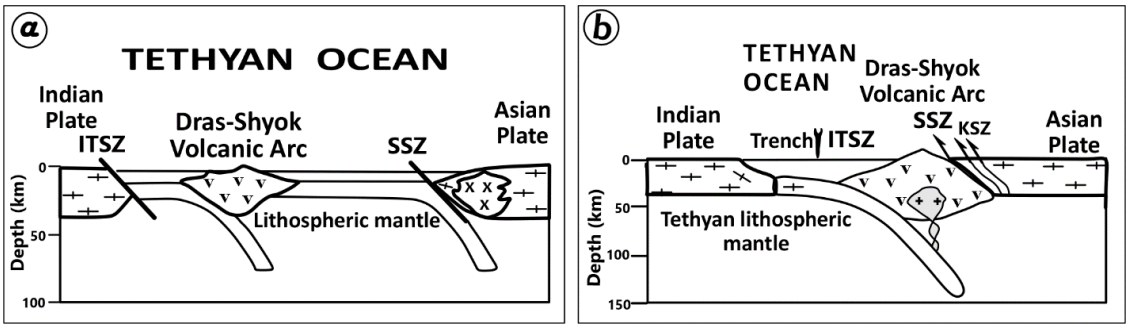
- Himalayas comprise at 3 three ranges running more or less parallel to one another.
- Supposed to have emerged out of the Himalayan Geosyncline, i.e. the Tethys Sea in 6 different stages following one after the other:
- Phase 1
  - 100 million years ago
  - Cretaceous Period → Indian plate located b/w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



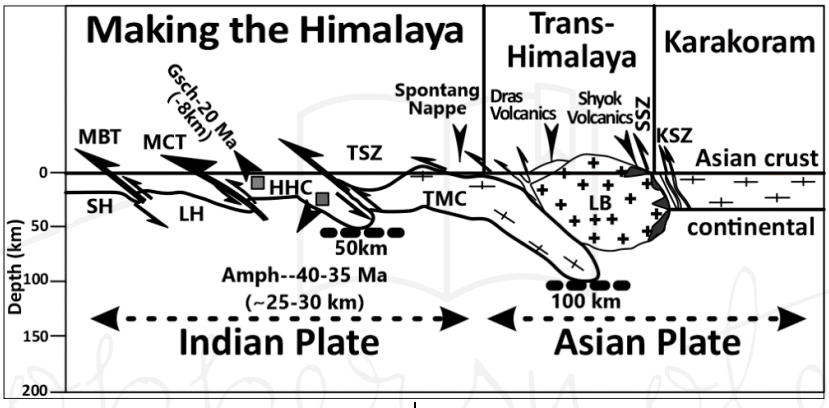
Suture zone
- A linear belt of intense deformation, where distinct tectonic units with different plate tectonic, metamorphic, and paleogeographic histories join together.

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

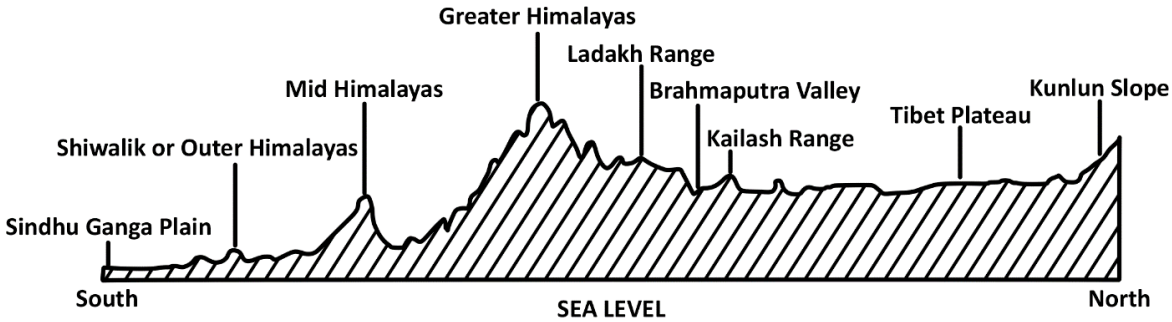


  - Oligocene period - Drass volcanic area formed.
  - Tethys crust → volcanic eruptions.
  - Anti-clock wise rotation of plate → Drass became Pivotal Axis.
  - West→ pressure and compression were gradually released
  - East → squeezing of Tethys sediments.
  - Drass volcanic arc
- Phase 4



  - 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 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