



UPSC – IAS

Civil Services Examinations

Union Public Service Commission

General Studies

Paper I – Volume - 6

INDIAN GEOGRAPHY



G.S. PAPER – 1 VOLUME – 6

INDIAN GEOGRAPHY

S.No.	Chapter Name	Page No.
1.	India -Size and Location	1
	• Indian Standard Meridian	
2.	Geological Structure and Rock Systems of India	3
	• Geological History of India	
	• Rock System of India	
	○ Archean Rock System	
	○ Purana Rock System	
	○ Dravidian Rock System	
	○ Aryan Rock System	
3.	Physiographic Divisions of India	12
	• Himalayan Mountains	
	○ Physical Features	
	○ Formation of Himalayas	
	○ Stages of Himalayas formation	
	○ Sub Divisions of the Himalayas	
	○ Glaciers and Snowline	
	○ Important Passes of Himalayas	
	• Great Plains of India	
	○ Origin of the Great Plain of India	
	○ Formation of Northern Plains	
	○ Divisions of the Great Plains	
	○ Regional Classification of Great Plains	
	○ Significance of Plains	
	• Coastal Plains	
	○ Eastern Coastal Plains	
	○ Western Coastal Plains	
	○ Importance of the long Indian Coastline	
	○ Comparison of the Western Coastal Plains and Eastern Coastal plains	
	• Indian Desert	
	○ Sandy Thar Desert	
	○ Cold Desert	
	○ White Salt Desert of Kutch	
	• Peninsular Plateau	
	○ Features	
	○ Central Highlands	
	○ Deccan Plateau	
	○ Northeastern Plateau/ Meghalaya Plateau	
	○ Western Ghats	
	○ Eastern Ghats	
	○ Major mountain Passes in Deccan Plateau	
	○ Significance of the Peninsular Region	

- Islands of India
 - Andaman and Nicobar archipelago
 - Lakshadweep Islands
 - Islands Off Mumbai
 - Islands off Andhra Pradesh
 - Islands Off Tamil Nadu
 - Islands off Gujarat
 - Islands of West Bengal
 - Other Islands of India

4. **Volcanism and Earthquake**

68

- Volcano
 - Volcanoes in India
- Earthquake
 - Earthquake in India
 - Earthquake Zones (Seismic Zones) of India

5. **Indian Drainage System**

75

- Types of Drainage Patterns
 - Concordant Drainage Pattern
 - Discordant or Insequent Drainage Pattern
 - Dendritic Drainage Pattern
 - Parallel Drainage Pattern
 - Trellis Drainage Pattern
 - Rectangular Drainage Pattern
 - Radial Drainage Pattern
 - Centripetal Drainage Pattern
 - Angular Drainage Pattern
 - Barbed Drainage Pattern
 - Annular Drainage Pattern
 - Deranged Drainage Pattern
- Drainage system of India
 - Himalayan Drainage System
 - Peninsular River System or Peninsular Drainage
- River Regime
- River Capture
- Shifting Courses of Rivers
- Interlinking of rivers
 - National River Linking Project (NRLP)
- Lakes
 - Classification of Lakes
 - Important lakes of India
- Water Resources of India
 - Water resources
 - Types of Water resources
 - Depletion of Water table
 - International Agreement for Surface Water Resources
 - National Water Policy 2012
- Inter-State River Water Disputes
- Watershed Management
- Rainwater harvesting
- Waterfalls

6. Climate of India

137

- Seasons in India
- Factors Influencing Indian Climate
- Indian Monsoon
 - Classification
 - Mechanism
 - Phases of Indian Monsoon
 - Rainfall Distribution in India
 - Variability in Annual Rainfall
 - Impact of Monsoons on Life in India
- Climatic Regions of India
 - Koppen's Classification of Indian Climate
 - Stamp's & Kendrews's Classification
 - RL Singh's Classification
 - i. Trewartha Climatic Classification of India
- Drought
- Floods

7. Natural Vegetation of India

173

- Forests in India
- Grasslands in India
- Problems of Indian Forests
- Conservation of Forests
- Social Forestry
- Species of Trees and their Utility
- Role Of Forest In Climate Change
- Wildlife
 - National Parks in India
 - Wildlife Sanctuaries
 - Tiger Reserves in India
 - Biosphere Reserves in India
 - Conservation of Wildlife
 - Ramsar Convention on Wetlands
- Coral Reefs
 - Distribution of Coral Reefs in India

8. Soils in India

187

- Types of Soils in India
 - Alluvial Soil
 - Black Soil
 - Red Soil
 - Laterite Soil
 - Forest Soil/ Mountain Soil
 - Desert Soil
 - Saline and Alkaline Soil
 - Peaty and Marshy Soil/ Bog Soil
- Problems of Indian soil
- Soil Conservation

9.	Natural Resources of India	195
	<ul style="list-style-type: none"> • Types of Non-Renewable Resources <ul style="list-style-type: none"> ○ Coal ○ Crude Oil ○ Natural Gas • Mineral Resources <ul style="list-style-type: none"> ○ Major Mineral regions of India ○ Key Mineral Resources in India ○ Problems of Mining Industry • Biotic Resources In India <ul style="list-style-type: none"> ○ Breeds of Cattles and Buffalo ○ Goat Breeds ○ Sheep Breeds ○ Government initiatives 	
10	Energy resources	235
	<ul style="list-style-type: none"> • Conventional Sources <ul style="list-style-type: none"> ○ Hydro Electricity ○ Thermal Power • Non-conventional sources <ul style="list-style-type: none"> ○ Solar Power ○ Wind Energy ○ Nuclear Energy ○ Ocean Energy ○ Tidal Energy ○ Geothermal Energy ○ Bioenergy • Energy Crisis • India's Energy Consumption • Energy Security • Government Initiatives for Energy Conservation 	
11.	Industrial Regions of India	260
	<ul style="list-style-type: none"> • Major Industrial Regions of India <ul style="list-style-type: none"> ○ Mumbai-Pune Industrial Region ○ Hugli Industrial Region ○ Bangalore-Tamil Nadu Industrial Region ○ Guharat Industrial Region ○ Chotanagpur Industrial Region ○ Gurgaon-Delhi-Meerut Industrail Region • Minor Industrial Regions • Mjor Industries in India <ul style="list-style-type: none"> ○ Cement Industry ○ Textile Industry ○ Sugar Industry ○ Petrochemical Industry ○ Footloose Industry ○ Heavy Industry ○ Drugs and Pharmaceutical Industry ○ Knowledge Based Industry 	

12. Transportation in India

270

- Road Transport
 - Indian Classification of Roads
 - Important National Highways
 - Expressways
 - International North-South Transport Corridor
 - Major Initiatives for Road Transport
- Rail Transport
 - Railway Zones and their headquarters
 - Dedicated Freight Corridor
 - Government Initiatives for Rail Transport
- Water Transport
 - Types of Waterways
 - National Waterways of India
 - Ports in India
- Air Transport
 - Current Schemes related to Aviation Sector

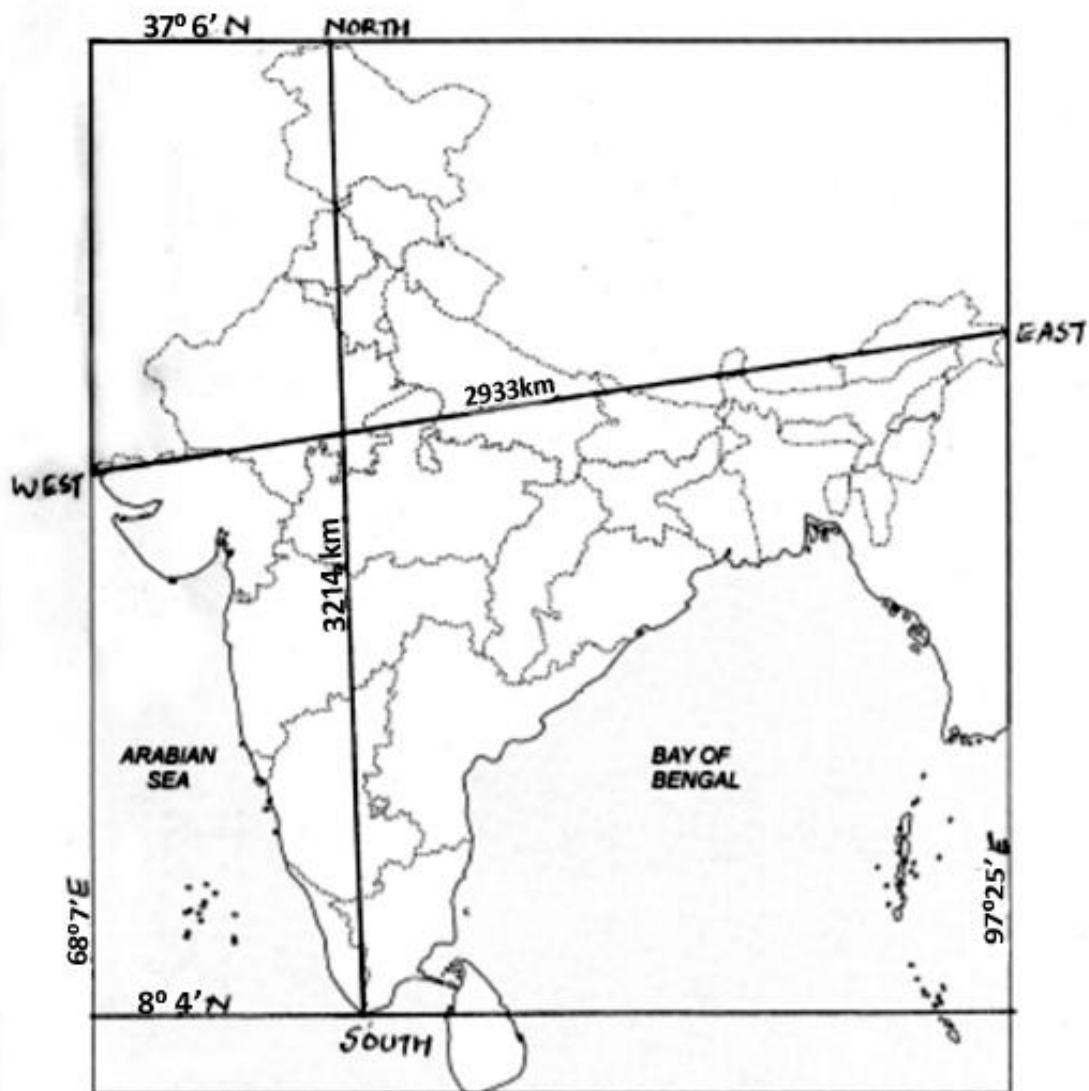
13. Agriculture

287

- Types of Agricultural Revolution in India
- Cropping System and Cropping Pattern in India
 - Cropping System
 - Cropping Pattern
- Farming Systems
 - On the basis of Economy of Agriculture
 - On the Basis of Source of Moisture for Crops
- Cropping Seasons in India
- Crop Classification
 - Based on the Type of Produce
 - Based on Climate
 - Based on Growing Season
 - Based on Life of Crops/Duration of Crops
 - Based on Water Availability
- Important Crops of India
 - Major food crops of India
 - Pulses
 - Major Cash Crops of India
 - Oilseed crops of India
 - Plantation Crops
 - Spices

1 CHAPTER

India -Size and Location

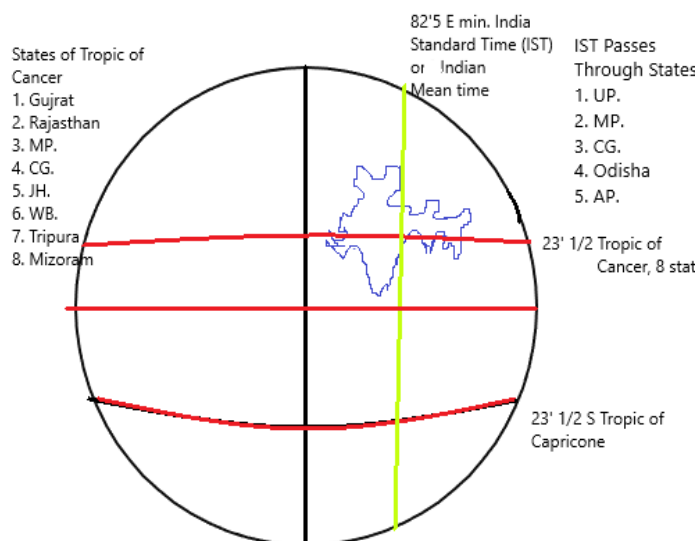


- Situated in the **northern hemisphere** ($8^{\circ}4'N$ to $37^{\circ}6'N$ and $68^{\circ}7'E$ to $97^{\circ}25'E$)
- **Bounded by**
 - **North:** the Great Himalayas
 - **West:** Arabian Sea
 - **East:** Bay of Bengal
 - **South:** the Indian Ocean.
- **7th largest country** in the world.
- **Northernmost 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: 30⁰ 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.
- **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



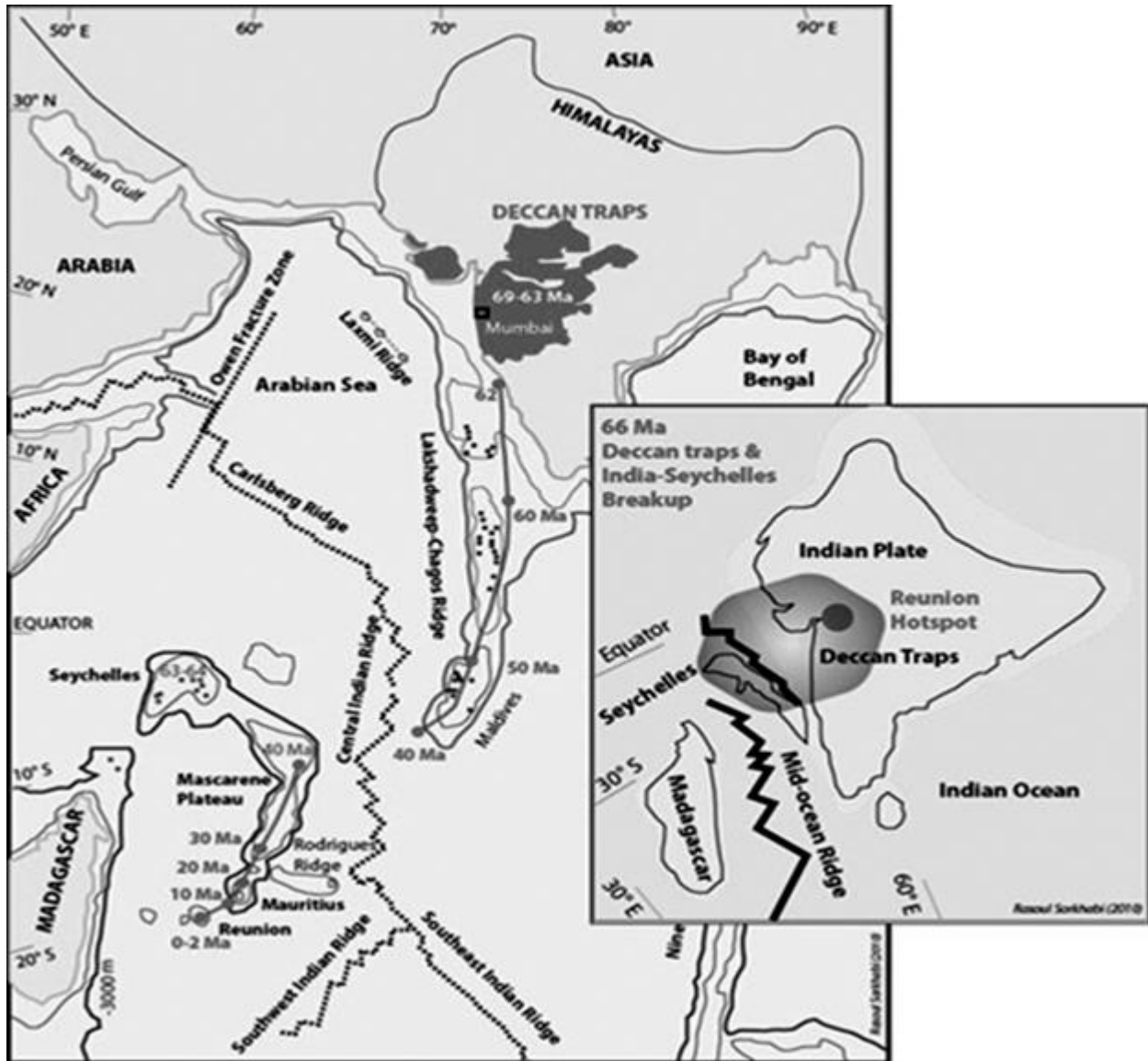
Geological History of India

- **Precambrian Era:**

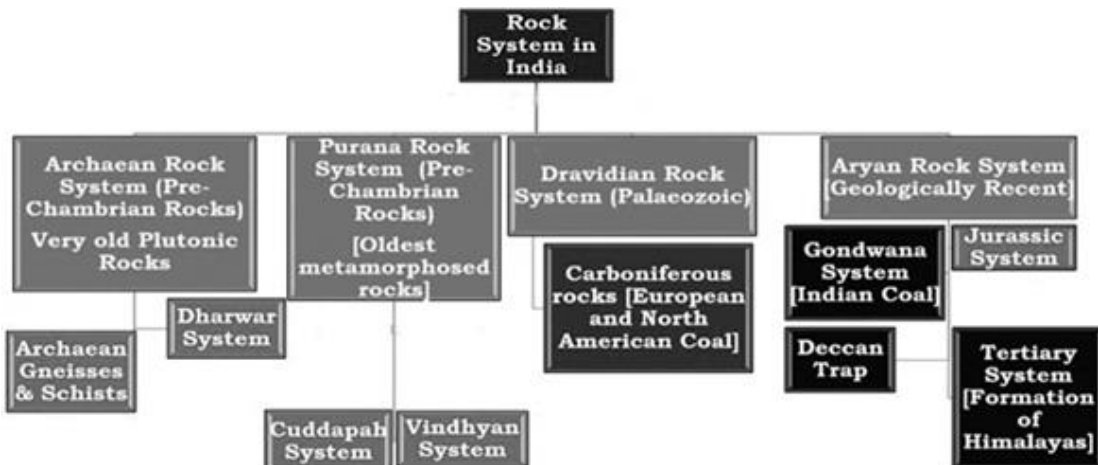


- **Peninsular India** (oldest crustal block of India) **formed** due to
 - **Collision of 3 Proto Continents: Aravalli, Dharwad, Singhbhum.**
 - **Formation of 3 Lineaments: Narmada, Son and Godavari**
 - **Folding of Geosynclines** of Protocontinents, **mountains formed:** Aravalli, Vindhya, Satpura,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



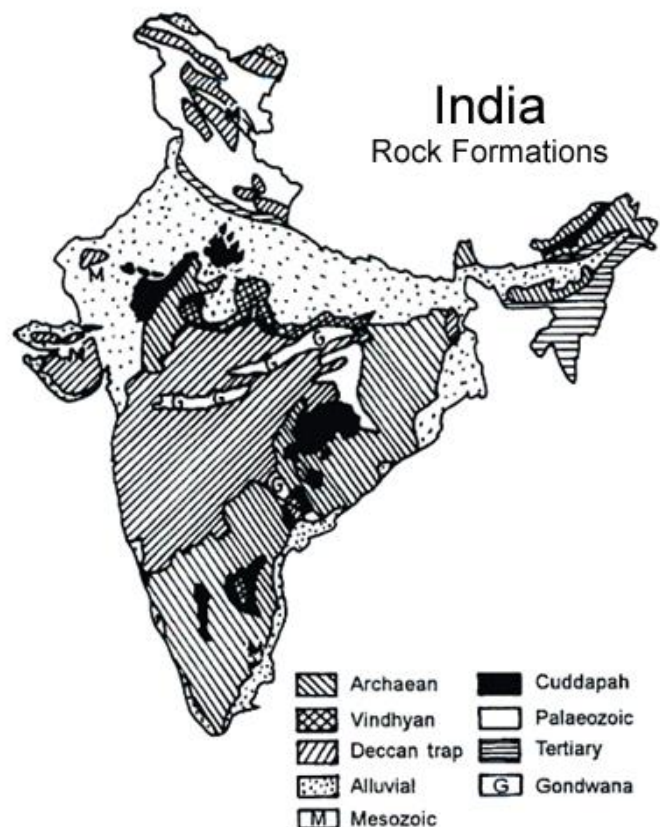
Archean Rock System



- **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.



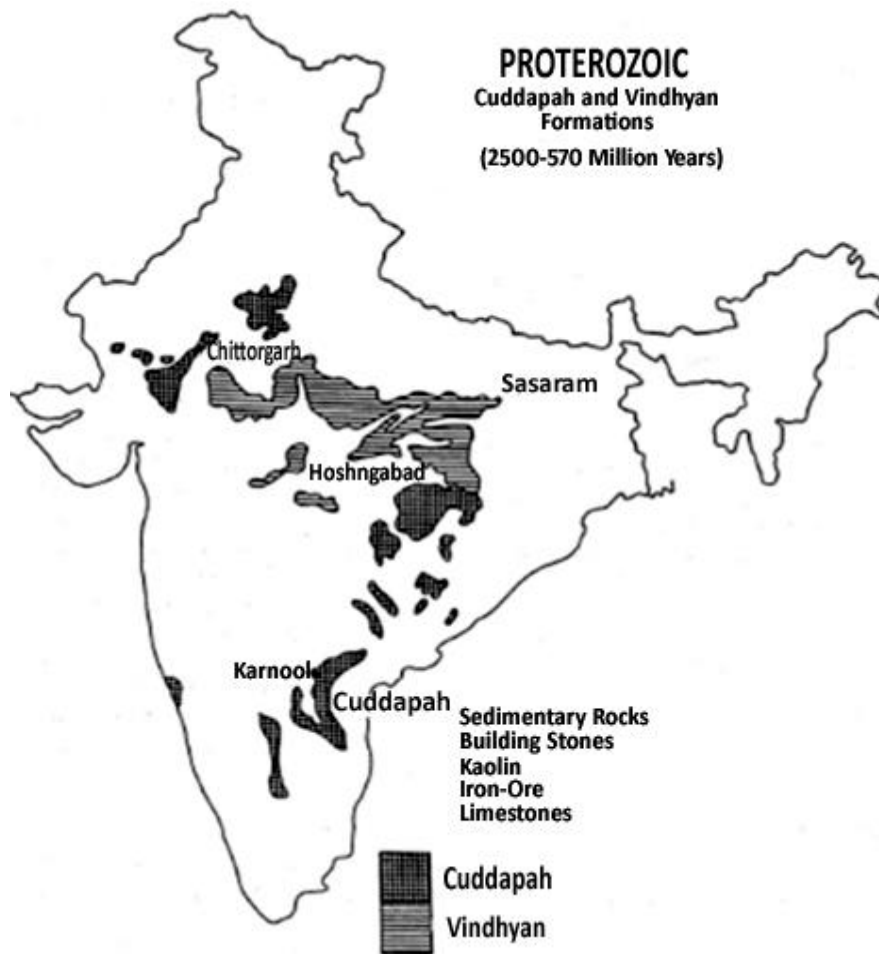
2. Dharwar System

- **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 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
Andhra Pradesh	Papaghani Series	<ul style="list-style-type: none"> • Location: Papagni river basin; • Quartzite, shales, slates and lime stones
	Cheyyar Series	<ul style="list-style-type: none"> • Location: Cheyyar river basin;

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

- **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 (Umaria in Rewa).
 - **Abundant fossils.**
 - **Include** shales, sandstones, clays, quartzites, slates, salts, talc, dolomite, marble, etc.
- **Distribution:** Pir-Panjal, Handwara, Lidar valley, Anantnag 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:** 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 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
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.
 - **Shivalik System** - Middle Miocene to Lower Pleistocene: Consists of boulders, Conglomerates beds, Gravels, Sandstones, shales and clays; Richly fossiliferous

3

CHAPTER

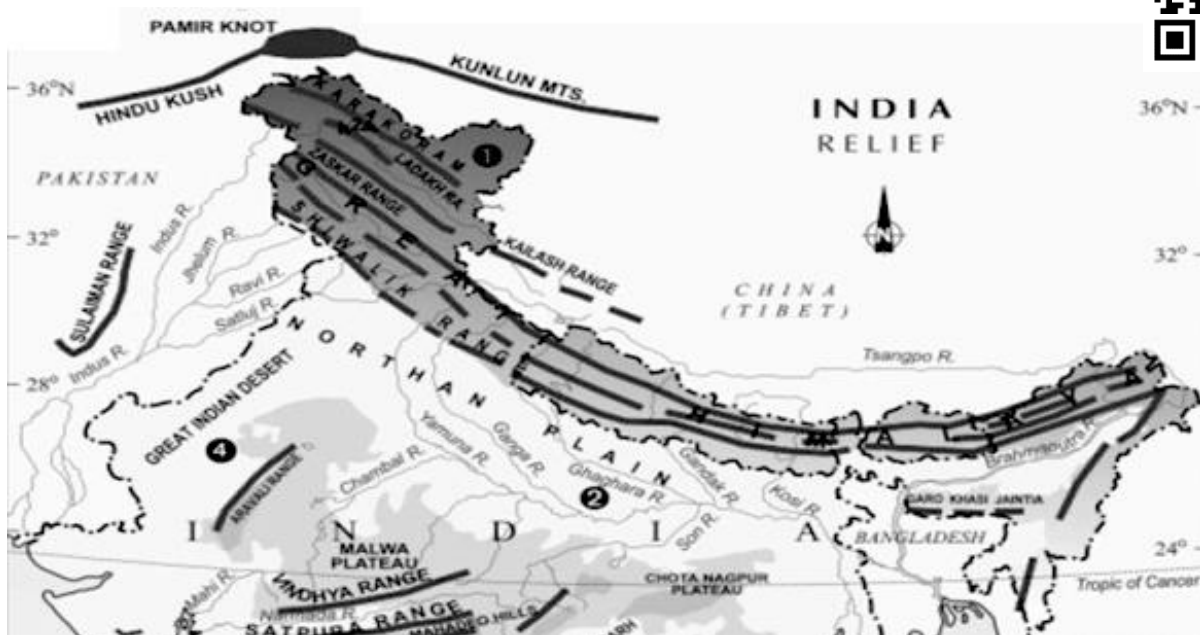
Physiographic Divisions of India



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

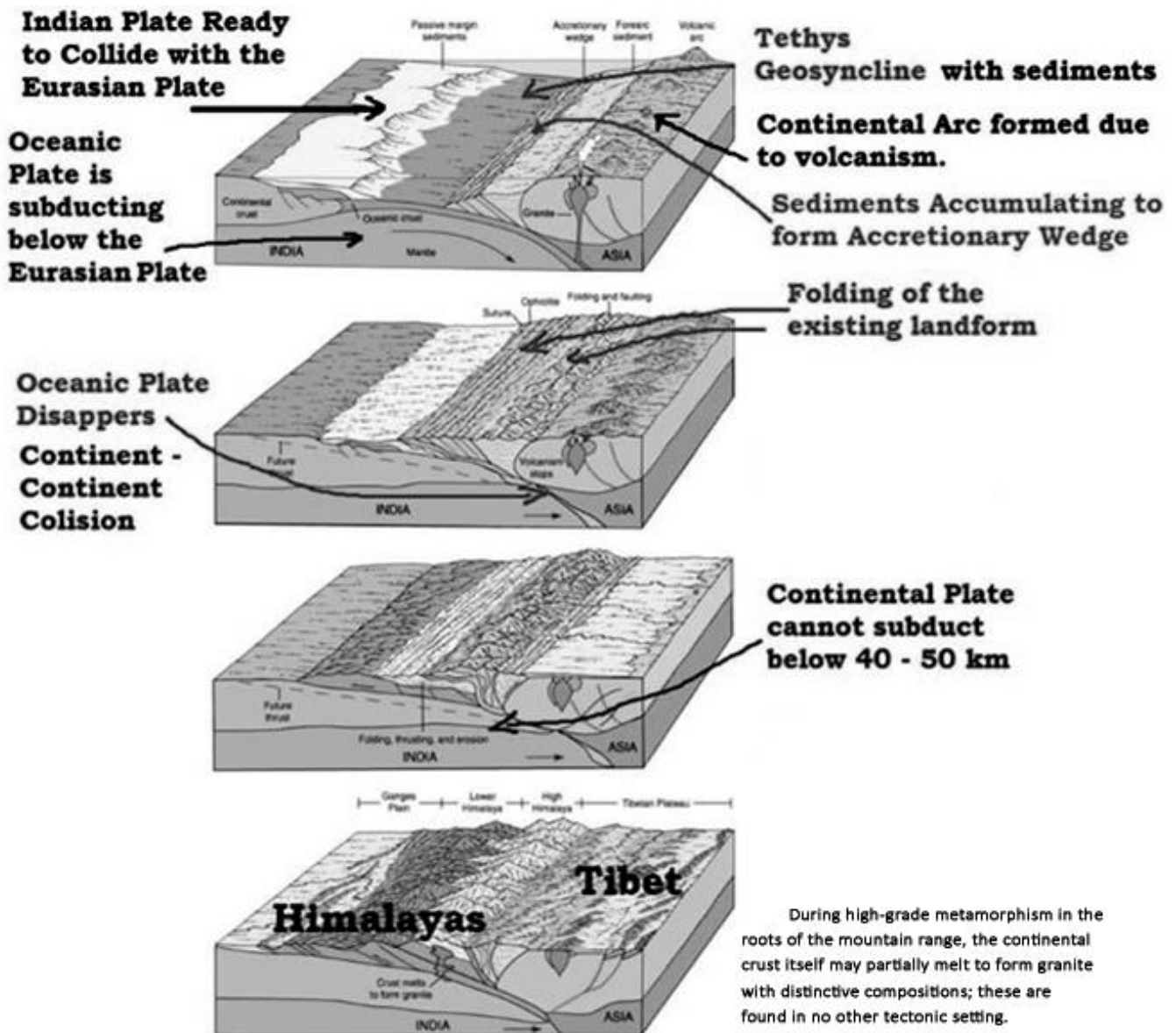


- **Topography** deeply cut by **erosion**, seemingly **unfathomable** river gorges, **complex geologic structure**, and **series of elevational belts** (or zones)
- **Greater part of the Himalayas** lies below the snow line.
- The **mountain-building process** that created the range is still active.
- **Considerable stream erosion** and **gigantic landslides**.



Formation of Himalayas

2 theories:



1. Geosyncline Theory of Formation of Himalayas:

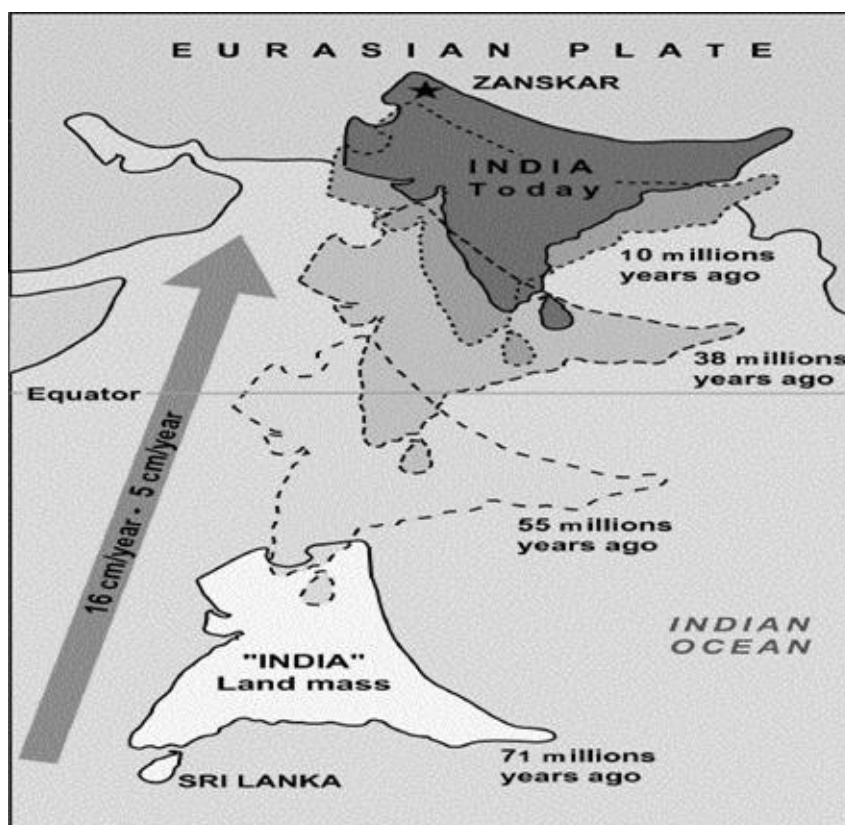
- **200 million years ago** the supercontinent **Pangea** started to disintegrate into smaller continents.
 - **Northern part** - Laurasia or Angaraland
 - **Southern part** - Gondwana land.
- A vast **empty space** was formed **b/w Laurasia and Gondwana Land**.
- **Rivers from Laurasia and Gondwanaland** → 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 **Shivaliks**.
- Theory supported by **Argand, Kober and Sues**.

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°-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.

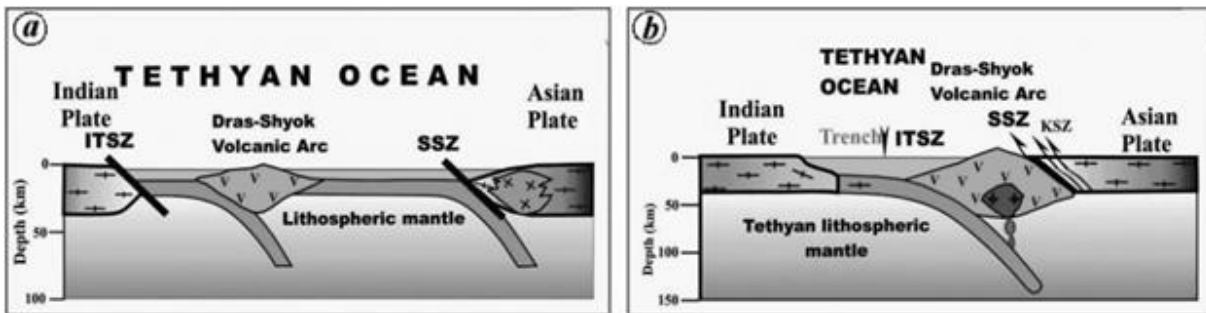
Suture zone

- 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**

