

**NEXT IAS**

**INDIAN GEOGRAPHY  
&  
DISASTER MANAGEMENT**

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**Indian Geography & Disaster Management**

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# **PART-I** **INDIAN** **GEOGRAPHY**

# CHAPTER 1

# INDIA: SIZE AND LOCATION

## 1.1 Introduction

India is a land of diversity not only because of its cultural variability in all its regions but also because of the varying characteristics of the land. The landmass of India extends from the sub-zero glaciers of Kashmir to the tropical and hot climate of Tamil Nadu. Such vast contrast in climate and temperatures can be experienced in many regions of India like the Great Himalayas in the north, fertile soil of Great Plains, dry subtropical Thar Desert in the west, tropical eastern and western Coastal Plains and many more.

These features have contributed for considering India as the subcontinent as it possesses all the characteristics of a continent.

## 1.2 Size and Extent

In terms of area, India is the seventh largest country in the world. This area also includes the unlawful occupation of India's land by Pakistan and China. Thus, besides being known for its diversity, India has also been known for its vastness.

India is a vast country with her mainland extending between latitudes  $8^{\circ}4'N$  and  $37^{\circ}6'N$  and longitudes  $68^{\circ}7'E$  and  $97^{\circ}25'E$ . It covers an area of 32,87,263 sq. km from the snow covered Himalayan from north to the southern tip of Kanyakumari.

The latitudinal and longitudinal extent of India is about  $30^{\circ}$  and measures about 3,214 km from north to south between the extreme latitudes and about 2,933 km from east to west between its extreme longitudes. India lies entirely in the northern hemisphere.

Even though the longitudinal and latitudinal extent of mainland India is almost the same (i.e., about  $30^{\circ}$ ), there is a huge difference between the area encompassed by the north-south extent and that of east-west extent. This difference is because the distance between the longitudes decreases towards the poles whereas the distance between the latitudes remains the same everywhere.

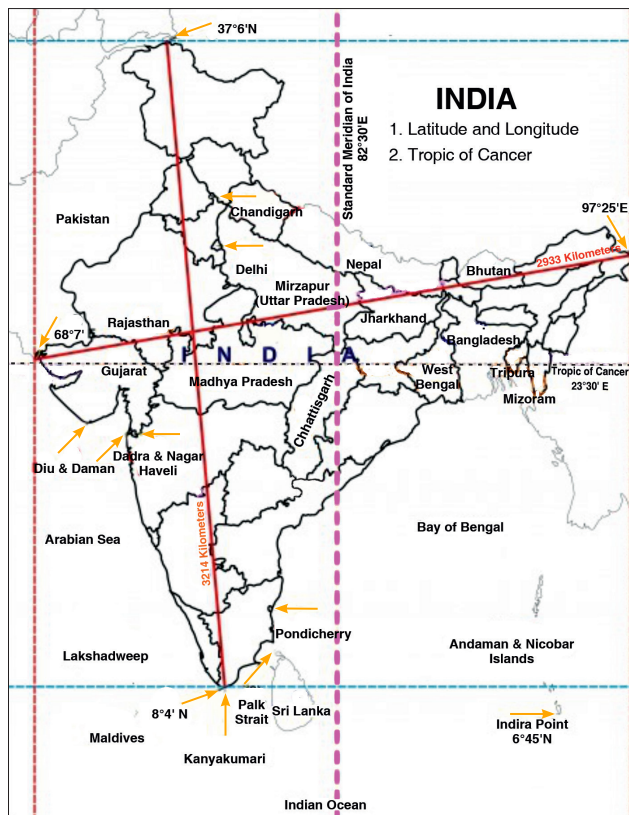


Fig. 1.1: Latitudinal and Longitudinal Extents of India

The Tropic of Cancer passes through eight states of India namely: Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram. *Udaipur city of Tripura* is the closest to the Tropic of Cancer. The *Sun Temple of Modhera* in Gujarat is located on the Tropic of Cancer.

### Some Important Facts

- The northernmost point of India is *Indira Col* in Ladakh.
- The southernmost point of India is *Pygmalion Point* or *Indira Point* in Andaman and Nicobar islands, it is located at  $6^{\circ}46'N$  latitude and  $93^{\circ}49'E$  longitude.
- Similarly, the westernmost point of India is *Ghuar Mota* in the Kutch region of Gujarat. It is located near the disputed Sir Creek and the Koteshwar temple, at  $23.713^{\circ}N$  and  $68.032^{\circ}E$ .
- *Kibithu* in Arunachal Pradesh is the Easternmost point of India.

<b>Total Area</b>	32,87,263 sq. km
<b>Latitude</b>	8°4' N to 37° 6' N
<b>Longitude</b>	68° 7' E to 97° 25' E
<b>North to South</b>	3214 sq. km
<b>East to West</b>	2933 sq. km

The Tropic of Cancer (23° 30'N) passes through the middle of the country dividing India's mainland into almost two equal parts. The northern part lies in the *sub-tropical zone* and the southern part lies in the *tropical zone*. This makes the northern part of India to experience cold winters and hot summers while the southern part of India experiences hot and humid weather throughout the year.

### Position of India

The area of temperate part of India (lying to the north of the Tropic of Cancer) is considered twice the area of tropical part. But India has always been treated as a tropical country for two different reasons:

- **Physical Geographical Reasons:** The country is separated from the rest of Asia by the Himalayas. Its climate is dominated by the tropical monsoons and the temperate air masses are blocked by Himalayas. The entire area south of the Himalayas is essentially tropical from climatic point of view. Although the night temperatures in winter at several places in North India may come down to the level of those prevailing in temperate lands, yet clear skies and intense insolation raise the day temperatures to a tropical level.
- **Cultural Geographical Reasons:** Settlements, diseases, agricultural and primary economic activities of India are tropical in nature.

### Impact of Large Latitudinal and Longitudinal Extent

- **Climatic Diversity:** The large latitudinal and longitudinal extent ensure climatic diversity in India. The area south of the Tropic of Cancer is referred to as the southern half of India. It has tropical climate because Sun rays strike the Earth's surface nearly vertically at noon. The ocean on the both sides of the peninsular landmass help keep the temperature warm. Toward the north of Tropic of Cancer, the remaining half of India experiences subtropical climate. The reason behind this is that here Sun rays strike relatively in an oblique manner. Consequently, this part of India receives lesser amount of insolation and has a cold climatic season, unlike the southern part.
- **Length of a Day:** The difference between days and night goes on increasing from the equator towards

the poles. The day and night in southern-most part of India is almost of equal duration with the difference being only 45 minutes. This difference between day and night in the northern part of India steadily goes on increasing till it becomes as much as 5 hours in Ladakh.

- **Timeline:** The Earth takes 24 hours to rotate on its axis. The longitudinal expansion is 360°, which the Earth covers in 24 hours, thereby covering 15° of longitude in one hour. As the longitudinal extent of India is nearly 30°, it takes nearly 2 hours to cover India from its east to west extremities.

Now, as the Earth rotates from west to east, the Sun appears to emerge first on the eastern horizon. Since Arunachal Pradesh is towards the east of India, it is the first state to witness the sunshine in India while Saurashtra in Gujarat is the last to witness the sunrise about 2 hours later.

This difference in real local time zone created a problem of administrative coordination. Therefore, the time of longitudinal middle of India at *82°30'E longitude near Allahabad is taken as a Standard Meridian Time (SMT) of India*. It means that when its noon in Allahabad, the time for whole of India is taken as noon. As far as the International Standard Time (Greenwich Meridian Time) is concerned, the difference between it and Indian Standard Time (IST) is around 5.30 hours.

## 1.3 Coastline of India

India has the longest coastline on the Indian Ocean. According to Ministry of Earth Sciences, India has a coastline of about 7516.6 km of which about 5423 km is shared by nine states and two union territories on the mainland and about 2093.6 km is shared by the island territories.

Among states, Gujarat (1214.7 km) has the highest coastal length and the Andaman and Nicobar (1962 km) has the highest coastal length among Union Territories.

State and UT	Length of Coastline (km)
Gujarat	1214.7
Andhra Pradesh	973.7
Tamil Nadu	906.9
Maharashtra	652.6
Kerala	569.7
Odisha	476.4
Karnataka	280
Goa (Daman & Diu)	160.5
West Bengal	157.5



State and UT	Length of Coastline (km)
Andaman & Nicobar Islands	1962
Lakshdweep Islands	132
Puducherry	30.6

## Territorial Waters of India

A **baseline** is the line along the coast from which the seaward limits of a state's territorial sea and certain other maritime zones of jurisdiction are measured. Normally, a sea baseline follows the low-water line of a coastal state. When the coast is deeply indented, has fringing islands or is highly unstable, straight baselines may be used. The **territorial waters** extends up to 12 nautical miles from the baseline.

The **Contiguous Zone** of India extends up to 24 nautical miles from the baseline. In this zone, India has the right to exercise the necessary control i.e. prevent infringement of its customs, fiscal rights immigration and other regulations over the territorial sea.

The India's **Exclusive Economic Zone (EEZ)** adjacent to the territorial sea extends up to 200 nautical miles from the baselines from which the breadth of the territorial sea is measured. In the exclusive economic zone, India has rights for the purpose of exploring, exploiting, conserving and managing natural resources.

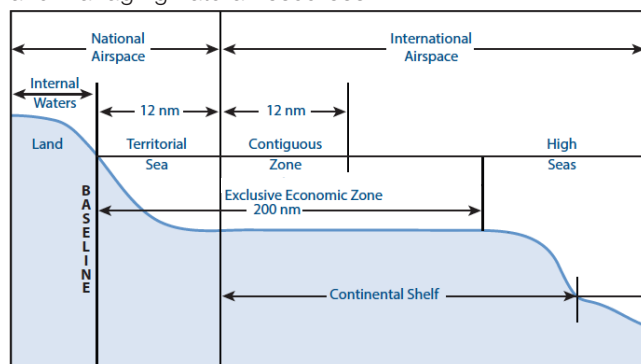


Fig. 1.2: Legal Maritime Boundaries

## 1.4 Islands of India

### Andaman and Nicobar

The main island that come under the Andaman and Nicobar Islands are - North Andaman, Middle Andaman, South Andaman, Little Andaman, Car Nicobar and Great Nicobar.

The Port Blair, the capital of Andaman and Nicobar island situated in Middle Andaman. The Indira point is the southernmost point of India is the southernmost point of Great Nicobar. The Barren island which is India's only **Active Volcano** situated in east of Middle Andaman. The

Narcondam island is a volcanic island. The 10 degree channel separate Andaman from Nicobar.

The **Duncan Pass** separates South Andaman in the north, from Little Andaman in the south. **The Grand channel** is between Great Nicobar and Sumatra (Indonesia). The Andaman and Nicobar Islands are also known as Emerald Island.

Channel	Separates
Coco Channel	Separates Myanmar from Andaman and Nicobar Island Group
Duncan passage	Separates little Andaman from south Andaman
10-degree channel	Separates Andaman group from Nicobar group
9-degree channel	Separates Minicoy from rest of Lakshadweep
8-degree channel	Separates Lakshadweep group from Maldives
6-degree channel	Separates India's great Nicobar island from Sumatra island of Indonesia

### Lakshadweep

In the Arabian Sea, there are three groups of islands. Amindivi Islands, Laccadive Islands (consisting of five major islands including Kavaratti) and Minicoy. At present these islands are collectively known as Lakshadweep.

The Lakshadweep Islands are a group of 36 small islands. They are widely scattered about 200-500 km south-west of the Kerala coast. Amindivi Islands are the northernmost while the Minicoy island is the southernmost.

All are tiny islands of coral origin and are surrounded by fringing reefs. The Andrott is the largest Island and the Minicoy is the second largest. Most of the islands have low elevation and do not rise more than five meters above sea level (extremely vulnerable to sea level change). Their topography is flat and relief features such as hills, streams, valleys, etc. are absent

## 1.5 India's International Borders

India has a land frontier of about 15,106.7 km and shares its land boundaries with seven countries namely: Pakistan and Afghanistan in the northwest; China, Nepal and Bhutan in the north and Myanmar and Bangladesh in the east.

Two island countries, namely Sri Lanka and Maldives are India's southern neighbours across the sea. Sri Lanka is separated from India by a narrow channel of sea formed

by the *Palk Strait* and Maldives is separated from the Lakshadweep by the *Eight degree Channel*.



**Fig. 1.3:** International Land borders of India

India's Borders with Neighbouring Countries			
Country	Border Length (km)	Bordering States	Border Disputes (if any)
<b>Bangladesh</b>	<b>4096.70</b>	West Bengal, Mizoram, Meghalaya, Tripura, Assam	The implementation of the Land Boundary Agreement (between India and Bangladesh) of 1974 and its Protocol of 2011 has settled all outstanding land boundary issues between India and Bangladesh. The award rendered by Arbitration Tribunal for Delimitation of Maritime Boundary between India and Bangladesh on July 7, 2014 has settled maritime boundary between India and Bangladesh.
<b>China</b>	<b>3488</b>	Ladakh, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh	Indian territory under the occupation of China in Ladakh is approximately 38,000 sq. kms. In addition, under the so-called <i>China-Pakistan "Boundary Agreement"</i> signed between China and Pakistan on 2 March 1963, Pakistan illegally ceded 5,180 sq. kms. of Indian territory in <i>Pakistan Occupied Kashmir (POK)</i> to China.
<b>Pakistan</b>	<b>3,323</b>	Jammu & Kashmir, Ladakh, Punjab, Rajasthan, Gujarat	Pakistan is in illegal and forcible occupation of approximately 78,000 sq. kms of Indian Territory in Jammu and Kashmir. The International Boundary in the <i>Sir Creek</i> area and International Maritime Boundary line (IMBL) between India and Pakistan have not been demarcated.
<b>Nepal</b>	<b>1,751</b>	Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Sikkim	India and Nepal share an open border. Nearly 98% of the boundary strip maps have been agreed to and finalised in 2007. The matter regarding formal signing of boundary strip maps is being pursued with Government of Nepal.
<b>Myanmar</b>	<b>1643</b>	Arunachal Pradesh, Nagaland, Manipur, Mizoram	There is no border dispute between India and Myanmar. There are, however, nine unresolved Boundary Pillar (BPs) along the India-Myanmar Border in the Manipur Sector. Also, the India-Myanmar border has the <i>free movement regime</i> which allows the tribes living along the border to travel 16km across the boundary without visa restriction.

India's Borders with Neighbouring Countries			
Country	Border Length (km)	Bordering States	Border Disputes (if any)
Bhutan	699	Assam, Sikkim, West Bengal, Arunachal Pradesh	Nil
Afghanistan	106	Ladakh (POK)	Nil
<b>Total</b>	<b>15106.7</b>		

Important Border Lines of India with its Neighbours		
Borders Line	Countries	Facts
Line of Control (LOC)	India and Pakistan	<ul style="list-style-type: none"> <li>Military control line.</li> <li>Also called Cease-fire Line.</li> </ul>
McMahon Line	India and China	<ul style="list-style-type: none"> <li>Boundary line between north-eastern India and China. (It is disputed by Chinese government).</li> </ul>
Line of Actual Control (LAC)		<ul style="list-style-type: none"> <li>Border line</li> <li>Also called as boundary line of India and China in east and west.</li> </ul>
Radcliffe Line	India and Pakistan, India and Bangladesh	<ul style="list-style-type: none"> <li>Boundary line</li> <li>Drawn after the independence of India and Pakistan.</li> <li>It separates both west and east Pakistan (Now Bangladesh).</li> </ul>
Palk Strait	India and Sri Lanka	<ul style="list-style-type: none"> <li>Water body of narrow channel</li> </ul>
Chicken's Neck or Siliguri Corridor	Narrow region of Indian state West Bengal	<ul style="list-style-type: none"> <li>Connects the north-eastern states to rest of India.</li> <li>Neighboring countries Nepal, Bhutan and Bangladesh surround this region.</li> <li>Politically sensitive for its proximity to different international borders.</li> </ul>
Akhnoor Dagger	Pakistan	<ul style="list-style-type: none"> <li>Narrow strip of Pakistani territory which extends into the Indian state Jammu and Kashmir.</li> <li>Very sensitive land as it can effect movement of army in the area.</li> </ul>

■■■■



## TRY SOME PRELIMS PREVIOUS YEAR QUESTIONS

1. Among the following cities, which one lies on a longitude closest to that of Delhi?

(a) Bengaluru (b) Hyderabad  
(c) Nagpur (d) Pune

Ans. (a)

(2018)

2. Consider the following statements:

- The Barren Island volcano is an active volcano located in Indian territory.
- Barren Island lies about 140 km east of Great Nicobar.
- The last time the Barren Island volcano erupted was in 1991 and it has remained inactive since then.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 and 3  
(c) 3 only (d) 1 and 3

Ans. (a)

(2018)

3. Which of the following is geographically closest to Great Nicobar?

(a) Sumatra (b) Borneo  
(c) Java (d) Sri Lanka

Ans. (a)

(2017)

# CHAPTER 2

## GEOLOGICAL STRUCTURE & DIVISION

### 2.1 Introduction

India is a country with oldest geological features. It has a very unique geological and structural conditions of almost all ages of the geological time scale. All kinds of rock masses, mineral deposits, mineral fuels including coal and oil resources occur in India.

The Geological structure comprises the arrangement and deposition of rocks in the Earth's crust. It plays a crucial role in geographical study. The Geological structures are usually result of the powerful tectonic force that occurs within the Earth's crust.

The study of Geological structures helps us in understanding the composition and structure of rocks which further determine the characteristics of soils and availability of mineral resources. For example, Archean rocks of the Bundelkhand region of India are rich in mineral resources.

It also plays a vital role in the development of agriculture, industries, transport and communication, assist in developing land uses, determining quality of ground water and predicting disaster like Earthquake, volcanoes, landslide and floods etc.

### 2.2 Geological Time-Scale

The Geological Time Scale is a record of Earth's Geologic history based on radiometric dating and the record of ancient life preserved in layers of rocks. The geological timescale is broken up into larger and smaller subdivisions which help us understand how the various historical events fit together.

Geologists divide the 4.6-billion-year existence of Earth into slices of time such as Eon, Era, System/Period, Series/Epoch, and Stage/Age.

Eons are divided into Eras, Eras into Periods, Periods into Epochs, and Epochs into Ages.

It is the classification which shows the events such as the break-up of continents, dramatic shifts in climate, and even the emergence of particular types of animals and plant life in the whole geological history of Earth.

In the last 2000 years, modern human-being have dominated on the Earth and have caused modification of the atmosphere by deforestation, agricultural activities, changing landscape, burning of fossil fuels and modification of micro climate etc. This period has been classified as **Anthropocene Period**.

Geologists have classified the past 4,200 years as the Meghalayan Age (Based on Mawmluh caves of Meghalaya). It is the most recent unit of the Geologic Time Scale (holocene epoch) in the 4.6 billion-year history of the Earth. It stands for the age which experienced an abrupt mega- drought and cooling around the globe. It resulted in the collapse of civilisations in Egypt, Greece, Syria, Palestine, Mesopotamia, the Indus Valley, and the Yangtze River Valley. The evidence of the 4,200-year climatic event has been found on all seven continents.

#### MAWMLUH CAVE, MEGHALAYA

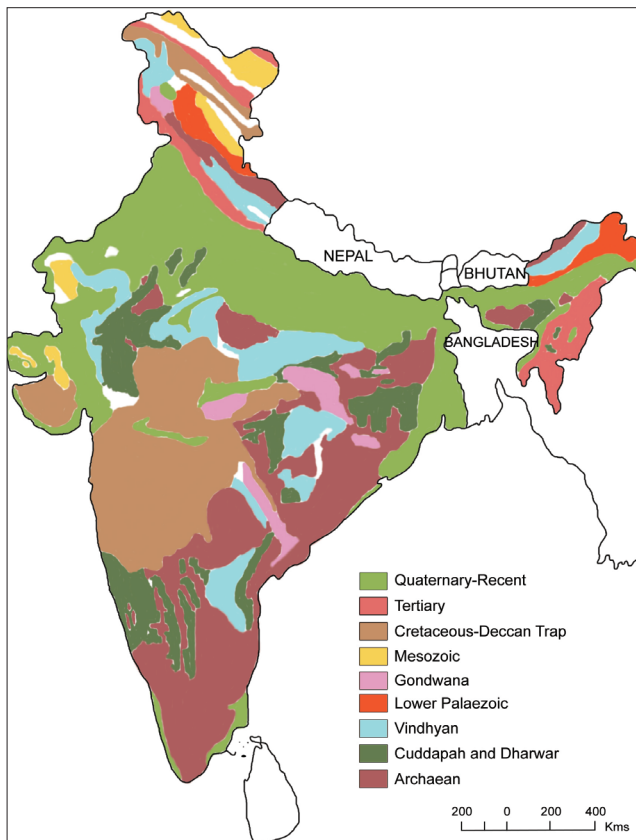
Located at an elevation of 1,290 metres, Mawmluh cave is one of the longest and deepest caves in India. The caves provide important record of Holocene - palaeoclimate and palaeomonsoon, since they are not subjected to diagenesis, erosion and terrestrial deposits. The conditions here were suitable for preserving chemical signs of oxygen transition in ages.

### 2.3 Geological History of Indian Rock System

Geologically, India represents a monumental assemblage of rocks of different characters belonging to different ages, ranging from Pre-Cambrian to recent times.

#### Major Events in The Geological History of India

- The Peninsular India was a part of the old landmass since the formation of the Earth's Crust.
- The upheaval of the Himalayas in the tertiary period.
- The aggradational formation of the Indo-Gangetic plain during the Pleistocene period. It continues till today through sedimentation in the floodplains of the rivers and the lower part of the Gangetic plains.



**Fig. 2.1:** Geological Division of India

The Indian Peninsula has not undergone marine submergence since the Cambrian period and is not much affected by tectonic forces. In contrast, the extra-peninsular region has its origin in the Tethys Sea and is prone to tectonic forces resulting in devastating Earthquakes. It is a weak and flexible portion of the Earth's crust which has been folded, faulted and over-thrust.

Geological Survey of India has classified the rock systems of the country into following four major divisions.

- The Archaean rock system.
- The Purana rock system.
- The Dravidian rock system.
- The Aryan rock system.

### The Archaean Rock System

The Archaean era also referred to as pre-Cambrian period span from formation of Earth (4.5 billion years ago) to beginning of Cambrian period of the Paleozoic Era. It constitutes about 86.7% of Earth History.

There are two types of the Archaean Rock System as given below:

#### Archaean System

The term 'Archaean', refers to the oldest rocks of the Earth's crust. Some of them represent portions of the first formed crust called primordial crust, which was formed by the consolidation from the gaseous or molten state.

Archean rocks are devoid of any form of life i.e., they are all azoic or unfossiliferous. Thus, the Archaean rocks form the foundation of all the great ancient plateau and the core of all the great folded mountain ranges of the world.

The most common Archaean rock covering about two-third of the peninsular surface is the gneiss. The Archaean rocks cover a wide area in Odisha, Meghalaya, Madhya Pradesh, Chhattisgarh, Chotanagpur plateau of Jharkhand and Aravalis.

#### Economical Significance

The Archaean Rocks are the repositories of the mineral wealth of India. These rocks are rich in ferrous and non-ferrous minerals like iron ore, copper, manganese mica, dolomite, lead, zinc, silver and gold etc.

#### Dharwar System

These are the first metamorphosed sedimentary rock systems known in the Indian Geological Time scale. In India, these rocks were studied for the first time in the Dharwar district of Karnataka. This rock system is largely composed of Igneous Debris, Schists and Gneisses.

#### Distribution of Dharwar Rock System

- The Dharwar and Bellary districts of Karnataka are extending up to the Nilgiris and Madurai districts of Tamil Nadu.
- The central and eastern parts of the Chotanagpur Plateau, Meghalaya Plateau and Mikir Hills.
- The Aravallis, from Delhi to the south of Alwar and the Himalayan region.

#### Economical Significance

Dharwar rocks are highly metalliferous, rich in iron ore, manganese, lead, zinc, gold, silver, dolomite, mica, copper, tungsten, nickel, precious stones and building materials.

#### The Purana Rock System

In India, the word 'Purana' has been used in place of Proterozoic. This rock system is divided into the Cuddapah System and Vindhyan System.

#### Cuddapah/Kadapa System

It is named after the district of Cuddapah in Andhra Pradesh, Cuddapah system consists of sedimentary-metamorphic formations.

#### Area of Distribution

- The Cuddapah and Kurnool districts of Andhra Pradesh.
- The state of Chhattisgarh.



- Delhi-Rajasthan (South of Alwar).
- The Lesser Himalayas in the extra-Peninsular region.

### Economical Significance

The principal rocks of the Cuddapah System are sandstones, shales, limestone, quartzites slates. It consists of inferior quality of iron-ore, manganese ore, asbestos, copper, nickel, cobalt, marble, jasper, building material and stones for interior decoration.

### Vindhyan System

It derives its name from the Vindhyan Mountains. These mountains form a dividing line between the Ganga Plain and the Deccan Plateau.

This system covers an extensive area from Chittorgarh in Rajasthan to Sasaram in Bihar. It has enormous sedimentary deposits.

In some tracts, the Vindhyan rocks are buried under the Deccan lava. The Great Boundary Fault (GBF) separates the Vindhyan System from the Aravallis for a distance of about eight hundred km.

### Economical Significance

The Vindhyan System well known for Red-sandstone, Building Material, Ornamental Stone, Conglomerates, Diamondiferous and Raw Materials for Cement, Lime, Glass and Chemical Industries.

In certain places these rocks yield inferior, quality of iron ore and manganese. The well known diamond mines of Panna and Golconda lie in the Vindhyan System.

The historical buildings of Qutab Minar, Humayun's Tomb, Fatehpur Sikri, Agra Fort, Red Fort, Jama-Masjid, Birla Mandir, the Buddhist Stupa of Sanchi, etc. have been constructed from the red-sandstone obtained from the Vindhyan Ranges.

### The Dravidian Rock System

The Palaeozoic Era includes the Ordovician, Silurian, Devonian, Carboniferous and the Permian periods of the Standard Geological Time Scale. It is known as the 'Dravidian Era' in the Indian Geological Time Scale.

It marks the beginning of life on the Earth's surface. The formations of this period are almost absent in the Peninsular India except near Umaria in Rewa. Some traces of these rocks are found in Pir-Panjal, Spiti, Kangra, Shimla region (Himachal Pradesh), and Garhwal and Kumaun (Uttarakhand). It was during this period that the *Pangaea* was broken and the *Tethys Sea* came into existence. The Dravidian Rock System consist of Shales, Sandstones, Clays, Quartzites Slates, Salts, Marble, etc.

### The Aryan Rock System

The Aryan system includes the rock formations ranging from the upper carboniferous to recent. They are fairly

preserved in the peninsular India and are found in a perfect sequence in the Himalayan region along the entire northern border. The Aryan Rock sub-divided into the following: Gondwana System, Deccan Trap, Tertiary Rock System and Quaternary Rock System.

### Gondwana System

The Gondwana rock system consists of more than 95% of the coal of India. It also provides resources like iron-ore, limestone, sandstone, raw material for ceramic industries.

India's best and largest coal deposits are found in Gondwana system mainly in the Damodar valley of West Bengal and Jharkhand, the Mahanadi valley of Orisha and Chhattisgarh, the Godavari valley of Andhra Pradesh and Satpura basin of Madhya Pradesh.

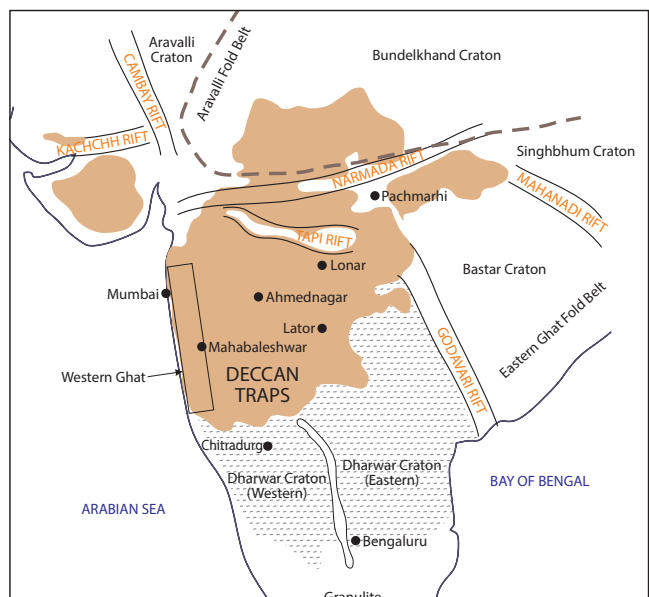
### Economical Significance

The Lower Gondwana rocks are found in the Talcher, Panchet and Damuda series. Most of the good quality coal deposits (bituminous and anthracite) of India are found in Gondwana formations. Moreover, iron ore occurs in the iron-stone shales of Raniganj coalfields. In addition to coal and iron, kaolin, fireclay, sandstone and grits are also found in the Gondwana formations.

### Deccan Traps

Towards, the end of the Cretaceous period the Indian peninsula was affected by intense volcanic activity. During this period, an enormous quantity of basaltic lava was erupted, which led to the formation of Deccan Lava Plateau.

The Deccan lava covers Gujarat (Kutch, Kathiawad), Maharashtra, Madhya Pradesh (Malwa Plateau), Chhattisgarh, Jharkhand, northern Andhra Pradesh and north-western Karnataka.



**Fig. 2.2: Geology of Peninsular India**

### Economical Significance

The basalt of the Deccan Trap is used for the construction of roads and buildings. Moreover, quartz, bauxite, magnetite, agate and semi-precious stones are also found in these traps. It is also rich in magnesium, carbonate, potash and phosphates.

### The Tertiary Rock System

This period also referred as '*The Age of Mammals*'. This period witnessed two significant events i.e.,

- (i) Final breaking of Gondwana land
- (ii) Formation of young fold mountains like Himalaya.

During the early Tertiary Period, as India collided with Tibet, the sediments which had been accumulating in the Tethys basin had begun to rise by a slow rise of the ocean bottom. The upheaval of the Himalayas altered the old topography of the subcontinent.

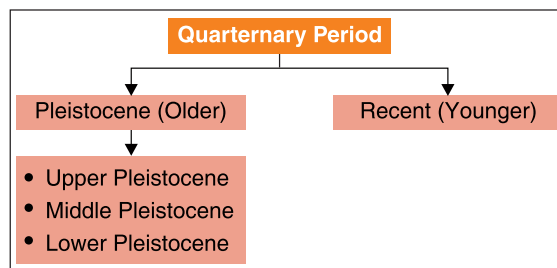
### Phases of Himalayas Formation

- **Phase-I (Eocene-Oligocene):** This phase witnessed upheaval of the *Greater Himalayas*.
- **Phase-II (Miocene):** It was followed by a more intense movement of the Indian Plate which resulted in the folding of *Lesser Himalayas* or the *middle Himalayas*.
- **Phase-III (Pliocene):** The third upheaval took place during this phase which resulted in the folding of *Shiwaliks* or the *Outer Himalayas*. There is enough evidence to prove that the Himalayas are still rising.

In the Peninsular region, the Tertiary System occurred on the coast of Kutch, Kathiawar, Konkan, Malabar, Nilgiris, and the Eastern Ghats.

### The Quaternary Rock System

Quaternary is the name proposed for very recent deposits, which contain fossils of species with living representatives. Quaternary Period is said to have just begun, it has two divisions without a clear cut boundary between them.



The older is the Pleistocene which is marked by cold climate and glaciations, whereas the younger division is called as Recent.

The first glacial and inter-glacial periods belong to the lower Pleistocene in Kashmir.

The Karewas of Kashmir are supposed to be the second Inter-glacial period. The alluvial deposits of the Narmada are also of the same period.

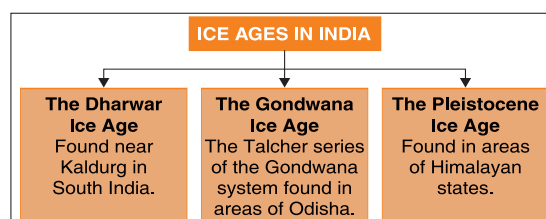
The most important, extensive and recent deposits in India are the Indo-Gangetic alluviums filling the great depression between the foot of the Himalayas and the northern edge of the Peninsula.

The older alluvium called *Bhangar* is of middle or Upper Pleistocene. The newer alluvium occupies the lower areas of the river valleys prone to annual floods is called *Khadar* and belongs to the Upper Pleistocene Period.

## 2.4 Ice Ages in India

During the Pleistocene period, the Earth passed through an Ice Age whose impact was noticed in the Himalayan region due to its high altitude and more northerly location.

Before, the Pleistocene period conclusive evidences are available for the occurrence of two other Ice Ages in India viz. Dharwar Ice Age and Gondwana Ice Age.



Rock Systems			
System	Rock Types	Minerals	Region
Archaeon	Bengal Gneiss, Nilgiri Gneiss and Bundelkhand Gneiss	Rich in ferrous and non-ferrous minerals like iron ore, copper, manganese, mica, dolomite, lead, zinc, silver and gold Mineral composition varies from granite to gabbro. Schists - mostly crystalline, include mica, talc, hornblende, chlorite,	Areas of Rajasthan, Bundelkhand, Maharashtra, Chhattisgarh, Jharkhand, Odisha, Andhra Pradesh and Tamil Nadu etc.

Rock Systems			
System	Rock Types	Minerals	Region
<b>Dharwar</b>	Igneous Debris, Schists and Gneiss.	Rich in iron ore, manganese, lead, zinc, gold, silver, dolomite, mica, copper, tungsten, nickel, precious stones	Dharwar and Bellary districts of Karnataka, Central and eastern parts of the Chotanagpur Plateau, Meghalaya Plateau and Mikir Hills, The Aravallis, Rialo (Delhi series), from Delhi to the south of Alwar and the Himalayan region.
<b>Cudappah</b>	Sedimentary and metamorphic formations sandstones, shales, limestone, quartzites slates	Iron-ore, manganese ore, asbestos, copper, nickel, cobalt, marble, jasper, building material and stones for interior decoration ore	Cuddapah and Kurnool districts of Andhra Pradesh, Chhattisgarh, Rajasthan-Delhi to the south of Alwar, the Lesser Himalayas in the extra-Peninsular region.
<b>Vindhyan</b>	Metamorphic rocks Red-sandstone, Sandstone	Inferior, quality of iron ore and manganese	Areas of Chittoragarh in Rajasthan to Sasaram in Bihar.
<b>Gondwana</b>	Metamorphic Rocks	In addition to coal and iron, kaolin, fireclay, sandstone and grits	Found in the Talcher, Panchet and Damuda series. Raniganj, Jharia, Karanpur, and Bokaro of the Damodar basin in Odisha, and the Pench valley in Chhattisgarh and Madhya Pradesh, the Jhingurda coal seam (Chhattisgarh). Damodar and Son valley region.
<b>Deccan</b>	Igneous rocks, Plutonic rocks such as gabbro and granite.	It is also rich in magnesium, carbonate, potash and phosphates	Maharashtra, Gujarat, Madhya Pradesh, Chhattisgarh, Jharkhand, Orissa, and Karnataka.
<b>Tertiary</b>	Sedimentary Rocks	Included mammals, plants and invertebrates, Also called as 'the Age of Mammals'	Himalayan region and North-east states.