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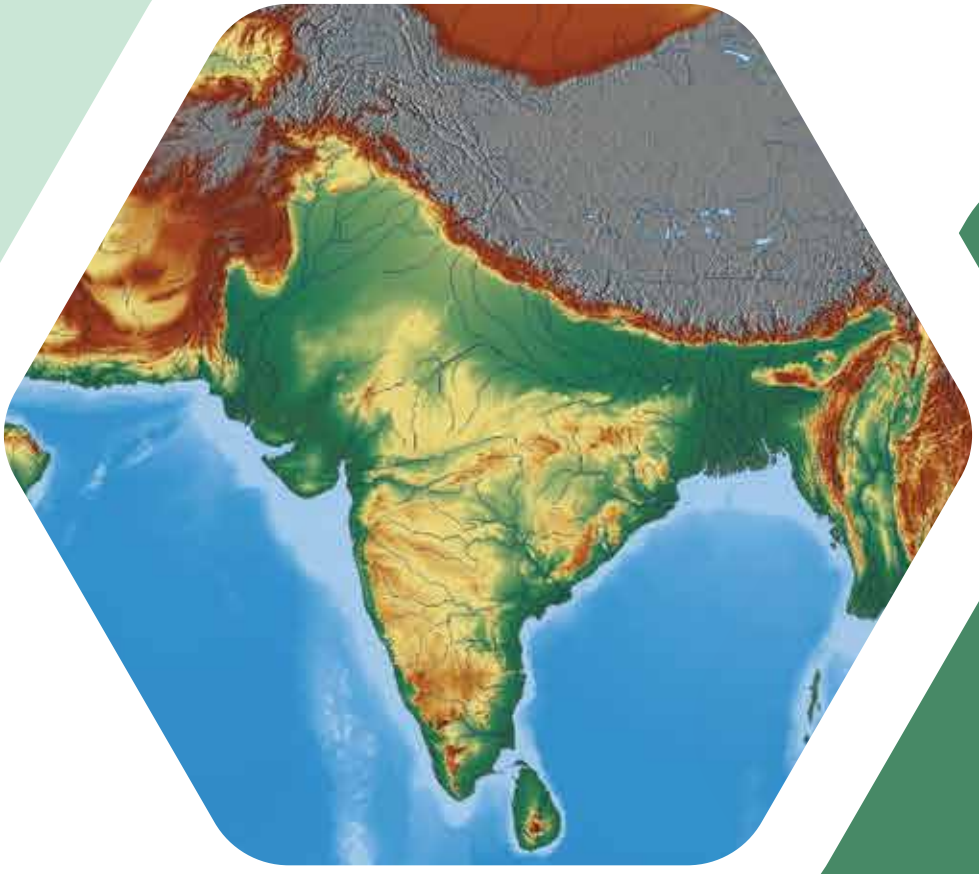


INDIA PHYSICAL GEOGRAPHY

for Civil Services Exam

CONTENTS

INDIA PHYSICAL GEOGRAPHY

UNIT
1

HIMALAYAN REGIONAL GEOGRAPHY

CHAPTER
1.1

HIMALAYAN PHYSIOGRAPHY

- The Himalayas form the highest mountain range in the world, extending 2,500 km over northern India. Bounded by the Indus River in the west and the Brahmaputra river in the east. The three parallel ranges, the Himadri, Himachal and Shivaliks have deep canyons gorged by the rivers flowing into the Gangetic plain.

■ Parts of Northern Mountain Complex

- Himalaya is the highest mountain range of the world. It extends in the shape of an arc for a distance of about 2500 km from west to east along the northern boundary of India between the Indus gorge in Jammu and Kashmir in the west and Brahmaputra river in Arunachal Pradesh in the east. The breadth of the Himalayas ranges between 400 km in the west to 150 km in the east. The area covered by this mountain system is about 5 lakh square km. It has three major ranges.
- These ranges are separated by deep valleys and plateaus. The southern slopes of Himalayas facing India are steeper and those facing the Tibetan side are generally gentler. In the east, Himalayas rise almost abruptly from the plains of West Bengal and Assam. That is why two of the highest peaks of Himalayas, Mt. Everest (in Nepal) and Kanchenjunga are not very far from the plains.
- On the other hand, the western part of Himalayas rises rather gradually from the plains. Hence, the higher peaks in this part are farther from the plains and a number of ranges lie between the plains and high peak. The high peaks of this part such as Nanga Parbat, Nanda Devi and Badrinath are very far from the plains.

The Anatomy of the Northern Mountain Complex

- Geological mapping in various parts of the Himalaya over the past century has led the geologists to divide these mountains into six major longitudinal zones or northwest-northeast trending belts. The six zones of the Himalayans are described below from north to south.

The Trans-Himalaya

- Geologically speaking, the Trans-Himalaya is made up of granitic and volcanic rocks formed from 110-40 million year ago (Ma). These igneous rocks intruded the metamorphic and sedimentary rocks of the southern Tibetan block.
- The Trans-Himalaya is geographically divided into several areas: Kohistan (to the west of Nanga Parbat), Ladakh (between Nanga Parbat and the Karakoram strike-slip fault), Kailash, Gangdese, Lhasa (all in southern Tibet), and Mishimi (to the east of Namche Barwa).

Main ranges:

Zaskar range

- Nanga Parbat (8126 m) and Deosai mountain are important parts of it.
- Situated on the western part of the Greater Himalaya and to the south of Trans Himalaya.

- It is part of the Tethys Himalayas. It extends from Uttaranchal to Jammu and Kashmir, Ladakh.

Location of ranges of Trans Himalayas from North to South	
Karakoram range	N
Kailash range (Tibet)	
Ladakh range	
Zaskar range	S

Ladakh Range

- It is about 300 km long and its average elevation is 5800 m.
- Rakaposhi – Harmosh ranges are extension of it.
- South of Ladakh range Indus originates & meets with 'Shyok River'.

Karakoram range

- Northern most range of trans-Himalayan ranges are called Karakoram range. They are known as Krishnagiri range. It acts as frontier between India & China.
- Extend from the Pamir, east of the Gilgit River, 600 km long and the average width - 120-140 km.
- Abode of largest glaciers in India.
- Siachen, Baltoro, Biafo, and Hisper glaciers.
- Highest peak (in India): K^2 or Godwin Austen (8611 m).
- Other important Peaks: Gasherbrum I or Hidden Peak, Broad Peak and Gasherbrum II.
- In the northern limit of Karakoram range lies the Pamir, the Aghil Mountains, and the Yarkand River and in the southern limit lies the River Indus and its tributary Shyok.

Kailash range

- It is also called Gangdise in Chinese.
- Kailash range is offshoot of Ladakh range.
- Highest peak is mount Kailash (6714 m).
- Indus river originates from northern slope of Kailash range.

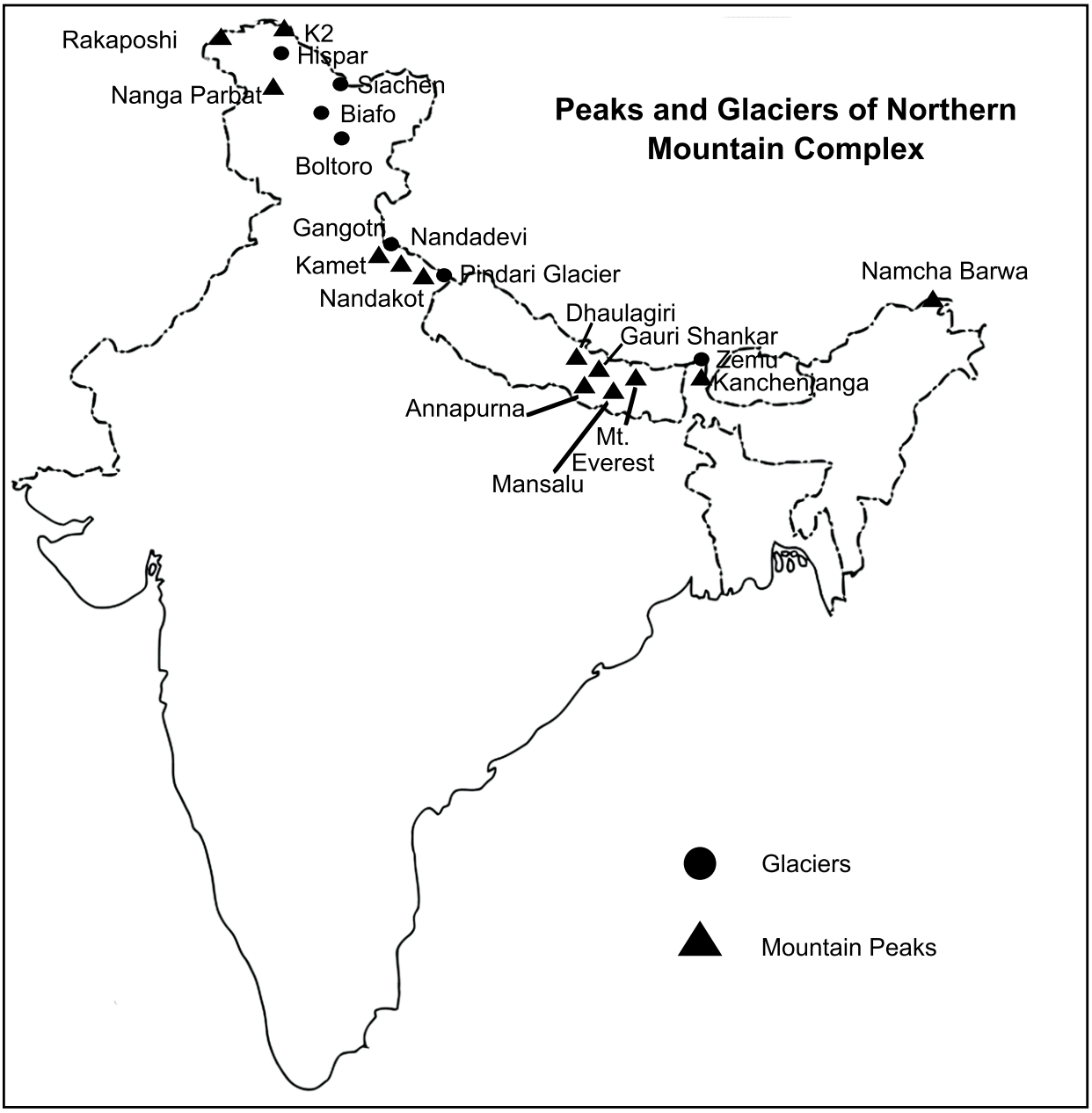
The Indus-Tsangpo Suture Zone

- A 'suture zone' is a tectonic line along which two continental plates collide and join each other. Prior to the collision, an ocean separates the two continents but it gradually shrinks as the ocean floor subducts beneath one of the continents.
- The collision thus occurs after the intervening sea completely subducts and disappears, and the moving continental plates crash into each other. The Indus-Tsangpo Suture Zone marks the boundary between the Indian and Asian plates. Here, we find ocean-floor volcanic rocks, subduction-related high-pressure metamorphic rocks (greenschist rocks), and deep-sea sediments of the Tethys Ocean.

The Tethyan (Tibetan) Himalaya

- This zone consists of Cambrian through Eocene sediments (sandstone, shale and limestone) which were deposited on the continental shelf of the Tethys Ocean. These sedimentary rocks contain many kinds of fossils including the Cretaceous-age ammonite fossils which are called 'shaligram shila' in Nepal and are used as amulets (dark stones devoted to Lord Shiva) by the Himalayan Hindus. Since most of this zone lies within southern Tibet, it is also sometimes called the Tibetan Himalaya. In northwest India, the Tethyan sediments are exposed in Kashmir, Zanskar, Chamba, and Spiti**.**
- **With a width of about 100 km, the Tethys Himalaya is the widest zone of the Himalaya.** The stratigraphic thickness of sediments in this zone reaches up to 12 km. Within the Tethyan Himalaya, there

is also a series of dome-shaped structures made up of Cambrian-age (about 500-450 Ma) granite gneiss or Miocene-age (18-9 Ma) white granites (leucogranites), collectively referred to as the North Himalayan Granite Gneiss Domes. These rocks and structural domes have been uplifted by a thrust fault called the North Himalayan Thrust, situated at their base. Further south, the Tethys Himalaya is separated from the Higher Himalaya by a major normal fault called the **South Tibetan Detachment.**



The Higher (Greater) Himalaya or Himadri

- The Higher Himalaya, the backbone of the Himalayan mountains, is made up of 10-20 km-thick metamorphic rocks (schist and gneiss) and granites situated at altitudes of 3000 m to over 8000 m. These rocks are Proterozoic-Cambrian age (2,000-500 Ma) and belong to the continental crust of the Indian plate.
- In addition we also find white granites (leucogranites) of Miocene-age (24-17 Ma) in the upper parts of the Higher Himalaya. The South Tibetan Detachment constitutes the northern boundary of the Higher Himalaya where the highest summits of the Himalaya (over 7000 m) lie. Along its southern boundary, the Higher Himalaya is thrust over the Lesser Himalaya along the Main Central Thrust.

Important Peaks of Greater Himalayas

Peaks	Height	Country/States
Mount Everest	8850m	Nepal
Kanchenjunga	8598m	India
Lhotse	8501m	Nepal-China
Makalu	8481m	Nepal-China Border
Dhaulagiri	8172m	Nepal
Manaslu	8156m	Nepal
Cho oyu	8153m	Nepal/China Border
Nanga Parbat	8126m	India
Annapurna	8091m	Nepal
Gosainath	8008m	Tibet, China
Pangma	8013m	China/Tibet
Nandadevi	7816m	India/Uttarakhand
Kamet	7756m	India/Uttarakhand
Namcha Barwa	7756m	India
Gurla Mandhata	7728m	Nepal

The Lesser (Lower) Himalaya or Himachal

- To the south of the Higher Himalaya (the Main Central Thrust) lies the Lesser Himalaya which consists of metamorphosed sedimentary rocks (quartzite, marble, slate, phyllite, schist and gneiss) and minor volcanic and granitic rocks of Proterozoic-Cambrian age (2000-500 Ma). In a plate-tectonic setting, the Lesser Himalaya, like the Tethyan Himalaya and the Higher Himalaya, belongs to the northern margin of the Indian plate.
- With elevations of 2000-3000 m, the Lesser Himalaya is home to many hilly resorts and forests. In Nepal, the Lesser Himalayan zone geographically corresponds to the Mahabharat Range. The southern boundary of the Lesser Himalaya is the Main Boundary Thrust which has uplifted this zone atop the Sub-Himalayan (Siwalik) rocks.
- Ranges such as Pir Panjal, Dhauladhar, Nag Tibba, Musoorie, Mahabharata Lekh, Kumaon Hills, are part of Middle Himalayas. Many important valleys such as Kashmir valley, Kulu valley and Kangra valley is located in this range.
- Middle Himalayas are marked by meadows which are called 'Bugyal'or 'Payar' in Uttarakhand and 'Marg' in Kashmir. Ex: Gulmarg and Sonmarg are such meadows.

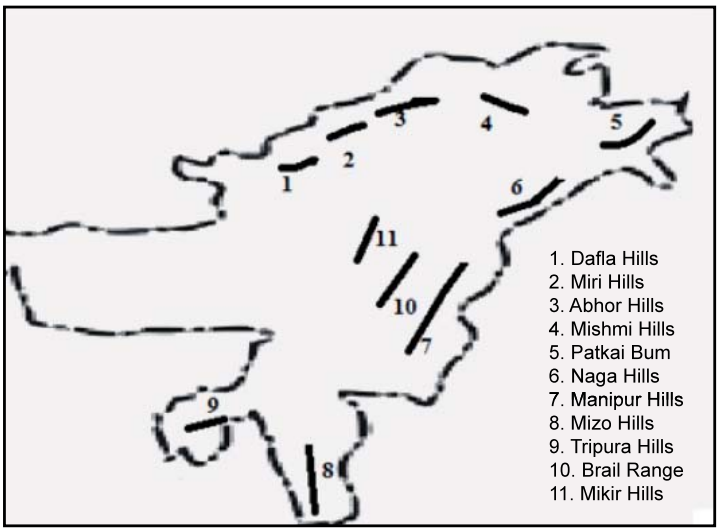
The Sub-Himalaya or the Siwalik Range

- The Sub-Himalaya (or the Outer Himalaya) geographically corresponds to the Siwalik range (or the Churia range in Nepal) - foothills ranging in elevation from 250-800 m. This zone is made up of 10-km thick succession of sandstone and mudstone shed from the Himalayan mountains, and carried and deposited by rivers, especially since the Miocene (over the past 24 million years). These sediments have yielded abundant fossils of mammals (elephants, horses, etc.), who then lived in the Himalayan forests. The Siwalik foothills were uplifted approximately one million years ago along high-angle reverse faults (still active), called the Himalayan Frontal Fault (or Thrust). The Himalayan Frontal Fault marks the boundary between the Siwalik Range and the north Indian plains. These faults are often concealed under an apron of debris, called Bhabhar, washed down from the hillsides.
- As the Himalayan Frontal Fault began uplifting the Siwalik range, a series of river valley were formed within the Sub-Himalayan zone; these tectonic basins are called dun (doon), and some well-known examples include Dehra Dun in India and Chitwan in Nepal.
- Jammu hills, Dafla, Miri , Abhor, Mishmi and Churia Ghat Hills (Nepal) are part of the outer Himalayas. Dhang and Dudhwa Range of Nepal are part of Shiwaliks.

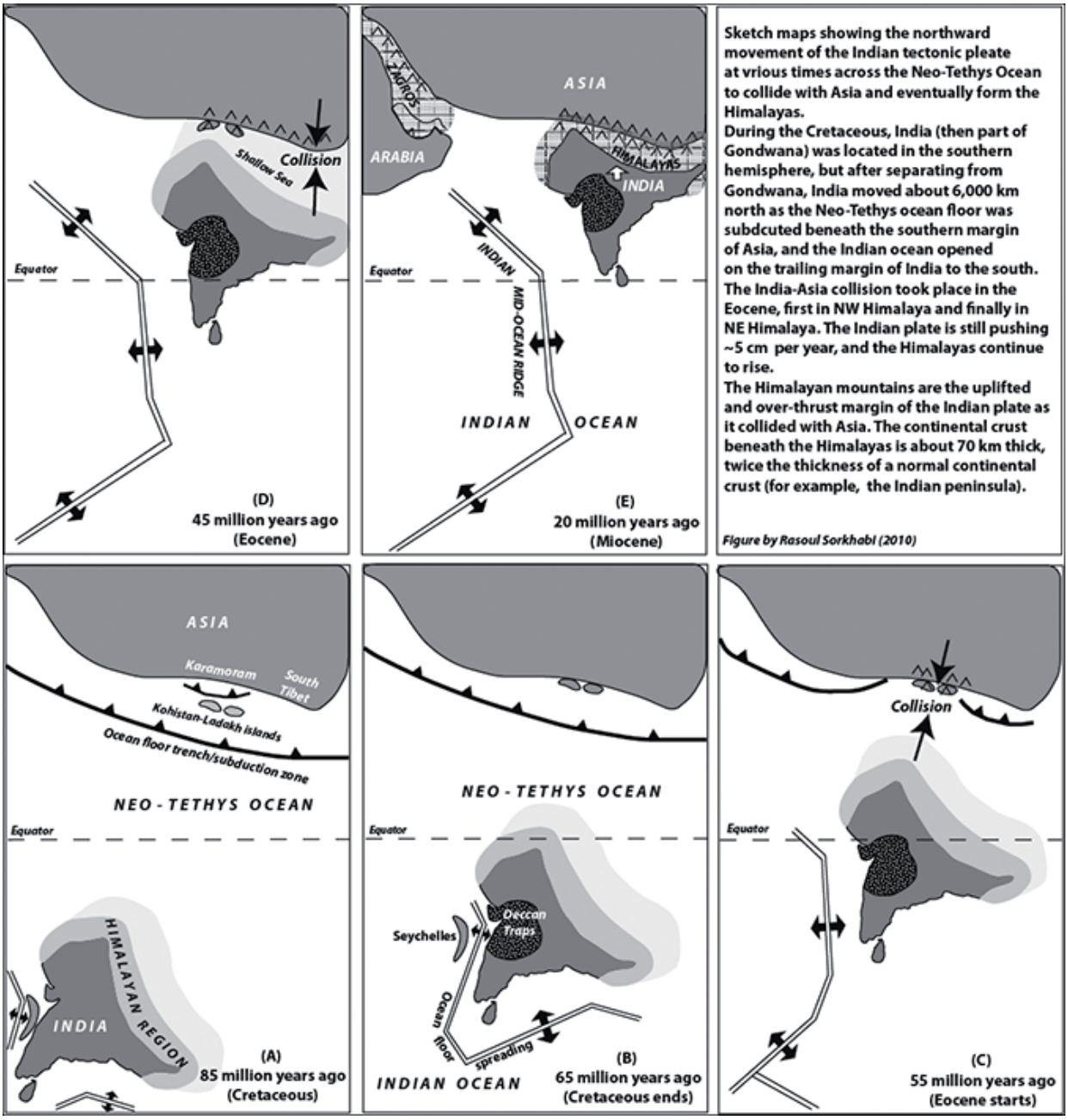
Eastern Hills or Poorvanchal

- Poorvanchal hills are eastern hills which formed during the formation of Himalayas.
- They form discontinuous ranges from North to South. Hills of Poorvanchal include Patkai Bum (Arunachal Pradesh), Naga Hills (Nagaland), Manipur Hills (Manipur), Mizo Hills (Mizoram), Tripura hills (Tripura), Barail range (Assam) and Mikir Hills (Assam).
- The Purvanchal Mountains are composed largely of strong sandstone geological formations.

The Evolution of the Himalaya



- About 500 million years ago, a supercontinent comprised by Australia, Antarctica, India, Africa, and South Africa, was assembled in the southern hemisphere. Geologists have called it Gondwana, after the Gond tribes in central India, where the sediments of this supercontinent were first studied in the late nineteenth century. The Paleo-Tethys Ocean bordered the northern margin of Gondwana.
- India together with Madagascar was drifted away from Africa in the late Jurassic (about 165 Ma); afterwards, India was separated from East Antarctica at about 135 Ma and began its northward journey across the Neo-Tethys Ocean, at the same time as the Indian Ocean was opening behind India. Around 85 Ma, a further split occurred between India and Madagascar.
- As India drifted northward, the Neo-Tethys ocean floor began to subduct beneath the southern margin of Asia (along the Karakoram and Tibet). This usually happens because the oceanic crust (mainly basalt) is heavier than the continental crust (mainly granite), and if pushed the oceanic crust subducts into an oceanic trench. The subducting slab then partially melts (dehydrates), and produces a large volume of granitic and volcanic rocks in the form of an island arc (Aleutian type) or a continental margin igneous belt (Andes type).



- The Himalayas are products of 55 million years of tectonic compression and structural deformation. Examination of geochronologic, structural, petrologic and sedimentary data from various parts of the Himalaya indicates that at least five major episodes or phases were milestones in the geologic history of these mountains. Even before the India-Asia continental collision, tectonic deformation was taking place in the leading margin of the Indian plate, near the Neo-Tethys subduction zone and the continental margin of southern Tibet. However, the Himalayan drama began after the collision.

Phase 1. The Trans-Himalayan Uplift (55-35 Ma)

- It is conceivable that the first mountain range to emerge was the Trans-Himalayan igneous arc, and that the Indus and Tsangpo were the first rivers to arise and transport sediments in the Eocene period. Geochronologic analyses of granites from the Trans-Himalaya indicate that these rocks rapidly cooled and eroded at about 40 Ma. And, there are basins in the southern front of the Trans-Himalaya filled with continental sediments (for example, in Kargil, Kailash and Lhasa).

- Mapping in southern Tibet reveals the existence of a south-directed thrust fault called the Gangdese Thrust, probably part of a deep-seated structure responsible for the uplift of the Trans-Himalaya.

Phase 2. The Eo-Himalayan Phase: The Tethyan Himalaya Uplift (45-35 Ma)

- Partly concurrent with and partly after the uplift of the Trans- Himalayan range, tectonic deformation also affected the Tethyan Himalaya. Interestingly, the Tethyan sediments in most of the Himalaya have escaped metamorphism (they are still sedimentary rocks) but they are highly folded and faulted. The emergence from the sea and folding of these sediments probably occurred shortly after the India-Asia collision and continued for millions of years. The North Himalayan Thrust and the uplift of the granite gneiss domes within the Tethyan Himalaya began during this phase (40-35 Ma). The Eocene-age tectonic deformation in the Himalayan region may be called the 'Eo- (early) Himalayan' episode.
- Since the India-Asia collision occurred in a diachronous (variabletime), oblique manner, both the Trans-Himalayan and Eo-Himalayan events first began in the northwestern Himalaya (in Pakistan and Ladakh) around 55-45 Ma, and then affected the eastern parts of the Himalaya at 35 Ma.
- The fact that the Trans-Himalaya and the Tethyan Himalaya were uplifted prior to the Higher Himalaya is evident from the 'antecedent' (flowing before) pattern of many of the Himalaya river (the Indus, Satluj, Ganga, Kali Gandaki, Arun and Brahmaputra); these river courses rise behind the Higher Himalaya (predating its uplift) and cut deep gorges through it to flow southward.

Phase 3. The Neo-Himalayan Phase: The Higher Himalayan Uplift (24-17 Ma)

- During the early Miocene (24-17 Ma), the Higher Himalayan rocks, which were then buried 20-25 km deep and metamorphosed and partially melted under temperatures of 600-800 degrees Celsius and pressures of 6-10 kilobars, began a rapid uplift along the Main Central Thrust.
- Concurrent with the activity of this fault, the Tethyan Himalayan zone was detached from the Higher Himalaya along a normal fault, named the South Tibetan Detachment.
- This fault, which runs parallel to the Main Central Thrust and forms the northern boundary of the Higher Himalaya, caused tectonic extension (spreading), gravitational gliding and back-folding of sediments in the Tethyan Himalaya (the down-thrown block), while uplifting and exhuming the Higher Himalayan rocks (the upthrown block).
- Moreover, a series of white granites (leucogranites) formed during 24-17 Ma were emplaced and rapidly uplifted along the South Tibetan Detachment. These granites constitute the core or the summit of the highest peaks in the Himalaya including Manaslu and Annapurna in Nepal and Badrinath and Shivling in Kumaun. It is interesting that these granites are located along the upthrown edge of the South Tibetan Detachment, indicating that their formation (possibly by decompressional melting of deeply buried rocks) and exhumation to the surface were related to the activity of this fault.
- With the uplift of the Higher Himalaya beginning in the early Miocene, increasing amounts of sands were deposited not only in the Siwalik and Indus-Ganga basins but were also transported by rivers to the Arabian Sea (forming the submarine Indus Fan) and the Bay of Bengal (the Bengal Fan).

Phase 4. The Lesser Himalayan uplift (11-7 Ma)

- During the late Miocene (11-7 Ma), sedimentation rates in the Siwalik basin drastically increased, and the mineral kyanite which, in the Himalayan region is found only in the Higher Himalayan metamorphic rocks (to the north of the Main Central Thrust), first appeared in the Siwalik sediments.
- The data indicate rapid erosion of the Himalaya at that time. There is also limited geochronologic evidence from Pakistan that the Main Boundary Thrust began its activity in the late Miocene.

- **Phase 5. Neotectonics: The Quaternary Phase (2.6-0 Ma)**
  - The uplift of the Siwalik range along the Himalayan Frontal Fault over the past one million years, geochronologic evidence of rapid erosion from various parts of the Higher Himalaya (Nanga Parbat, Zanskar, Gangotri, Khumbu Himal, Namche Barwa, etc.), presence of active faults and large earthquakes, deep and narrow gorges in the Higher Himalaya, uplifted terraces of young sediments, and enormous amounts of coarse-grained fluvial sediments in the Quaternary record of the Himalayan foreland basins all testify to the intense neotectonics in this region.

■ Regional Divisions of the Himalayas

- The Punjab/Himalaya (560 km long between the Indus and the Satluj rivers)
- The Kumaun Himlaya (320 km long between the Satluj and the Kali rivers),
- The Nepal Himalaya (800 km long between the Kali and the Tista rivers).
- The Assam Himalaya (720 km long between the Tista and Brahmaputra rivers).

Regional division of Himalayas		
Division Name	**Location**	**Length**
Punjab Himalayas	Between Indus and Satluj rivers	560 km
Kumaon Himalayas	Between Satluj and Kali rivers	320 km
Nepal Himalayas	Between Kali & Tista river	800 km
Assam Himalayas	Between Tista & Bheema River	720 km
		***See Figure on next page**

Longitudinal Division of Himalayas		
Division Name	**Location**	**Length**
The western Himalayas	Between the Indus river to Kali river In States of Jammu & Kashmir, Himachal Pradesh and Uttarakhand	880 km
The central Himalayas	Between Kali river and Tista river It extends from Nepal to Sikkim	800 km
The Eastern Himalayas	Between the Tista and the Brahamputra It extends from Arunachal Pradesh to Bhutan	720 km

■ Important Passes of Himalayas

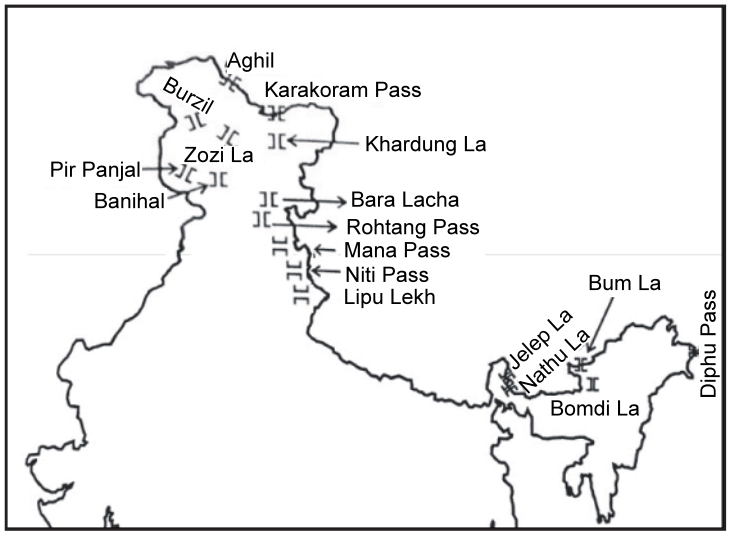
Jammu and Kashmir, Ladhakh

- **Mintaka Pass -** It lies near the tri-junction of India-China and Afghanistan border and joins north Kashmir with China.

- **Banihal Pass -** It is situated at an elevation of 2832 m across the Pir-Panjal Range. It remains snow covered during winter season and cannot be used as a transport route in that season. To provide round-the-year transport facilities between Jammu in South and Srinagar in the north, a tunnel named as The Jawahar Tunnel (after Pandit Jawaharlal Nehru, the first prime minister of India) was inaugurated in December, 1956. Another 11 km long tunnel provides railways link between Banihal and Kazigund. It was thrown open to railway transport in July, 2013.
- **Khardung La -** This pass is situated at an altitude of 5602 m near Leh in the Ladakh range. Te world's highest motorable road passes through this pass. However, this road remains closed in winter due to heavy snowfall.
- **Lanak La -** Located near the border between India and China at an altitude exceeding five thousand meters in the Akasai-Chin area of Jammu and Kashmir, this pass provides passage between Ladakh and Lhasa. A road to connect Xinjiang Province with Tibet has been constructed by the Chinese.
- **Pir-Panjal -** Lying across the Pir Panjal range, it had been a traditional pass on the road and provides the shortest and the easiest metalled road between Jammu and Kashmir Valley. But this route had to be closed down as a result of partition of the subcontinent.
- **Zoji La -** It is located at an altitude of 3850 m above sea level and provides an important road link between Srinagar on one side and Kargil and Leh on the other side. The road passing through this pass has been designated as National Highway (NH-1 D). Border Road Organization (BRO) is responsible for maintaining the road and clearing it off snow during winter. In spite of all these efforts, the road through this pass remains closed from December to mid-May.

Himachal Pradesh

- **Bara Lacha La -** This mountain pass is situated at an altitude of 4883 m and provides passage between Himachal Pradesh and Jammu and Kashmir. National highway connecting Mandi in Himachal Pradesh with Leh in Jammu and Kashmir passes through this pass. Being situated at high altitude, it remains snow covered in winter and is not used as a transport route.
- **Debas Pass -** Situated at an elevation of 5270 m above sea level in the Greater Himalayas, it provides a link between Kullu and Lahul and Spiti districts. It offers a much easier and shorter alternative route to traditional Pin-Parbati Pass route between Kullu and Spiti.
- **Rohtang Pass -** It is located at an altitude of 3979 m and provides road link between Kullu, Lahul and Spiti Valleys. Border Roads Organisation (BRO) is responsible for constructing and maintaining roads in this area. Rohtang pass is a great tourist attraction and traffic jams are very common because this route is widely used by military, public and private vehicles.



- **Shipki La -** It is located at the Indo-China border at an altitude of over 5669 m in Kinnaur district provides a road connection between Himachal Pradesh and Tibet. It remains snow bound for most of the winter season and is not available for transport. River Satluj enters India near this pass.

Uttarakhand

- **Lipu Lekh -** Situated near the trijunction of Uttarakhand (India), Tibet (China) and Nepal borders, in Pithoragarh district, it provides a link between Uttarakhand and Tibet. This pass is used by pilgrim to Kailash-Mansarovar. Use of this pass becomes difficult due to landslides in the rainy season and avalanches in the winter season.
- **Mana Pass -** Situated a little north of the holy place of Badrinath at an elevation of 5610 m near the indo-China border in the Greater Himalayas, this pass connects Uttarakhand with Tibet. It remains closed for six winter months in the year due to heavy snowfall.
- **Mangsha Dhura -** Situated at an Altitude of over five thousand meters at the Indo-China border in the Greater Himalayas in Pithoragarh district, this pilgrims going to Kailash-Mansarovar. Landslides during the rainy season and avalanches during the winter season pose great threat to pilgrims using of this route.
- **Niti Pass -** Located at an altitude of 5068 m at the Indo-China border across the Greater Himalayas, this pass joins Uttarakhand with Tibet. It remains snow covered and hence closed to traffic from November to mid-May.

Sikkim

- **Nathu La -** Situated at an altitude of 4310 m on the Indo-China border, it forms part of an offshoot of the ancient Silk Route. It connects Sikkim with Tibet and is an important trade route between India and China. It was closed after the Chinese aggression on India in 1962 but was reopened in 2006 as the governments of the two countries decided to enhance their trade through land routes.
- **Jelep La -** It lies at the Sikkim-Bhutan border at an altitude of 4538 m and passes through Chumbi Valley. This pass provides an important link between Sikkim and Lhasa.
- **Naku La-** It is a pass at a height of more than 5,000 metres above Mean Sea Level (MSL) in the state of Sikkim.

Arunachal Pradesh

- **Bom Di La -** Situated at an altitude of 4331 m near the eastern boundary of Bhutan in the Greater Himalayas, this pass connects Arunachal Pradesh with Lhasa. It is snowbound in winter and remains closed for traffic.
- **Dihang pass -** Situated at an elevation of more than 4000 m it provides passage between Arunachal Pradesh and Myanmar.

■ Significance of Himalayas

Tourist Abode

- The Himalaya exercise a dominating influence on the meteorological conditions of India as over its physical geography, vitally affecting its air and water circulation system and, through these, the distribution of life. The high snowy ranges have moderating influence on the temperature and humidity of northern India. When the neighbouring lands are suffering from scorching heat in summer, the lower and upper ranges of the Himalaya, because of their height, enjoy a very cool and pleasant climate. Owing to the intense heat in the plains, India has developed a number of hill stations, especially on the Siwalkis, which lies at about 2,000-2500 meters except for the minor ones at 1,000-1,600 meters in Central India. These attract a large number of tourists during spring and summer season. The enchanting beauty of the people, the prospects of living in luxurious houseboats, the scenic beauty all round, the facilities for skiing and skating, mountaineering have all conspired together to make Kashmir valley a paradise among the world's famous tourist resorts. Other valleys of similar importance are the Kishtwar, the Chamba, the Kulu, the Kangra and many others.

Climatic Influence

- The Himalaya mountain isolate the deeper interior of Asia from the influence of warm air from the south, and it protects India from the cold blizzards generated by the continental winter high pressure system of north eastern and central Asia.
- To the Himalaya India owes the prominent features of the climate. By reason of its altitude and situation directly in the path of monsoon, it is most favourable condition for the precipitation of all their contained moisture either rash rain or snow. It intercepts the monsoon clouds advancing from the southern seas, and precipitates heavy rains on the India plains.

Birth Place of rivers

- Snow fields and glaciers of enormous magnitude are nourished on the higher ranges which, together with the rainfall in the middle Himalaya feed a number of perennial rivers which course down to the plains in hundreds of fertilizing tributaries. The Sacred Rivers along with numerous tributaries have their sources here. Without Himalaya, India would have been a bleak country with no big rivers and no rainfall.

Source of Fertile Soil

- Running water and forest have been constantly eroding the great Himalaya ranges. This debris, after being removed by numerous rivers, is ultimately deposited over the great plains of northern India. The fertile plains of the Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and Assam have all been the product of this eroded material producing a wide variety of agricultural crops.

Richness of Fauna and Flora

- The Himalayan region is very rich in animal and forest resources. In the front of the outer Himalaya lies the Tarai Jungle, the abode of many wild beasts like yak, leopard, bear, and sambhar on the west-panthers and tigers in the central parts; and elephants, tigers and mithuns on the east. These attract a larger number of hunters and provide good game. Besides owing to a variety of climatic conditions the Himalaya is rich in forest resources. On the lower reaches are largely found the tropical and subtropical forests yielding good timber, while on the middle and upper reaches are found the coniferous and deciduous soft and hard woods, yielding wood for match sticks, paper pulp resin, turpentine oil, and various medicinal herbs, etc.

Source of water supply and Hydroelectricity

- The Himalaya gives birth to mighty rivers whose waters have been utilized for purposes of irrigation and latterly for power. The Yamuna Canal and the harnessing of the Sutlej and other fiver Punjab rivers made India dependent more than ever on the resources of the Himalaya. The economy of the Punjab and the western desert region of Rajasthan and western region of U. P. became related to the flow of water from these mountains. Now, new centers of pilgrimage are springing up in these parts. These are the sites where large projects (known as the multipurpose schemes) have been and are being developed. The Mandi project was the first attempt in this line; the post independence schemes, the Bhakra Nangal, the Kosi, and the Rihand dam project have the generation of electric power as one of their main purposes. Tons, Ram Ganga, Sharda, Gandak and many other Himalayan rivers are being harnessed. Huge potential of power resources awaits exploitation.

Storehouse of Mineral Resources

- The Himalaya region contains commercially valuable minerals. Copper, lead, zinc, bismuth, antimony, nickel, cobalt and tungsten are known to occur in both the eastern and western Himalayan and more than 100 different localities. The Himalaya promise gold, silver and precious and semi precious stones (including sapphires, beryl, and kynite), limestone, bauxite, gypsum, bentonite and magnesite. Coal and petroleum are other mineral fuels founded in the region.

Other Economic Resources

- On the lower slopes of the Himalaya (particularly in Kashmir and Himachal Pradesh) green pastures have made sheep and goat rearing an important occupation of the Gadi shepherd, Sericulture is also carried on. Pashmina wool is obtained from Kashmir. With the integration of these areas into larger viable units after India's Independence, the layout of the roads (Jammu-Srinagar and India Tibet Road) and railways and the establishment of other modes of the communications in this region have paved the way for economic development of some of these regions. By and large, the vast wealth of the Himalayan region lying in is rivers and forests and its minerals, remains yet to be fully exploited.

■ Research in Third Pole Area

Researchers have found that 509 glaciers in 'Third Pole' disappeared in last 50 years.

About:

Third Pole

- The region encompassing the Himalaya-Hindu Kush mountain range and the Tibetan Plateau in Central Asia is referred as the ***'Third Pole'*** because it has the largest ice storehouse after north and south poles.
- This remote polar region is expanded in 100,000 sq km with some 46,000 glaciers.

Effects of Global Warming in the region

- Recent findings suggest that ***temperatures there have increased by 1.5°C in the last 50 years*** and it is more than double the global average.
- Like Arctic and Antarctic, the Third Pole is also sensitive to global warming.
- ***The rate at which the glaciers are melting has almost doubled since 2005.***
- Recent, research reveals that over ***509 small glaciers*** disappeared in the past 50 years and even the biggest ones are shrinking rapidly.
- 226 glaciers in ***China's Tiger Valley region have lost 27 sq km of ice in the past 48 years.***
- In the wider area of the Qilian Mountains, home to 2,684 glaciers, the impact has been catastrophic.
- Research shows that the ***melting of glacier is happening much faster than anticipated.***

Causes of rapid melt of glaciers

- One of the reasons for accelerated melting is the temperature that has been increasing at a much faster rate in the Qinghai Tibetan Plateau in China.
- Dust and pollution from car exhausts and coal burners are also triggering climate change impact.
- Black carbon particles and dust settle on the glaciers, causing it to absorb the sun and heat, unlike the white ice that reflects them away.

Significance:

- Third pole directly supports 120 million people through irrigation systems.
- About 1.3 billion (one-fifth of the world's population) people indirectly benefit through river basins in China, India, Nepal, Pakistan and Afghanistan.
- This polar region is source of 10 of Asia's largest rivers, including the ***Yellow and Yangtze river (China), the Irrawaddy (Myanmar), the Ganges and the Mekong have their origin.***

- Melting of vast stores of permafrost does threaten water security in future, while currently more amount of water is flowing causing flood in different regions.
- The impact of the changes in the Third Pole can be influence global weather patterns such as monsoons and the El Nino.
- Further, it can also cause water sharing conflict in the region

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