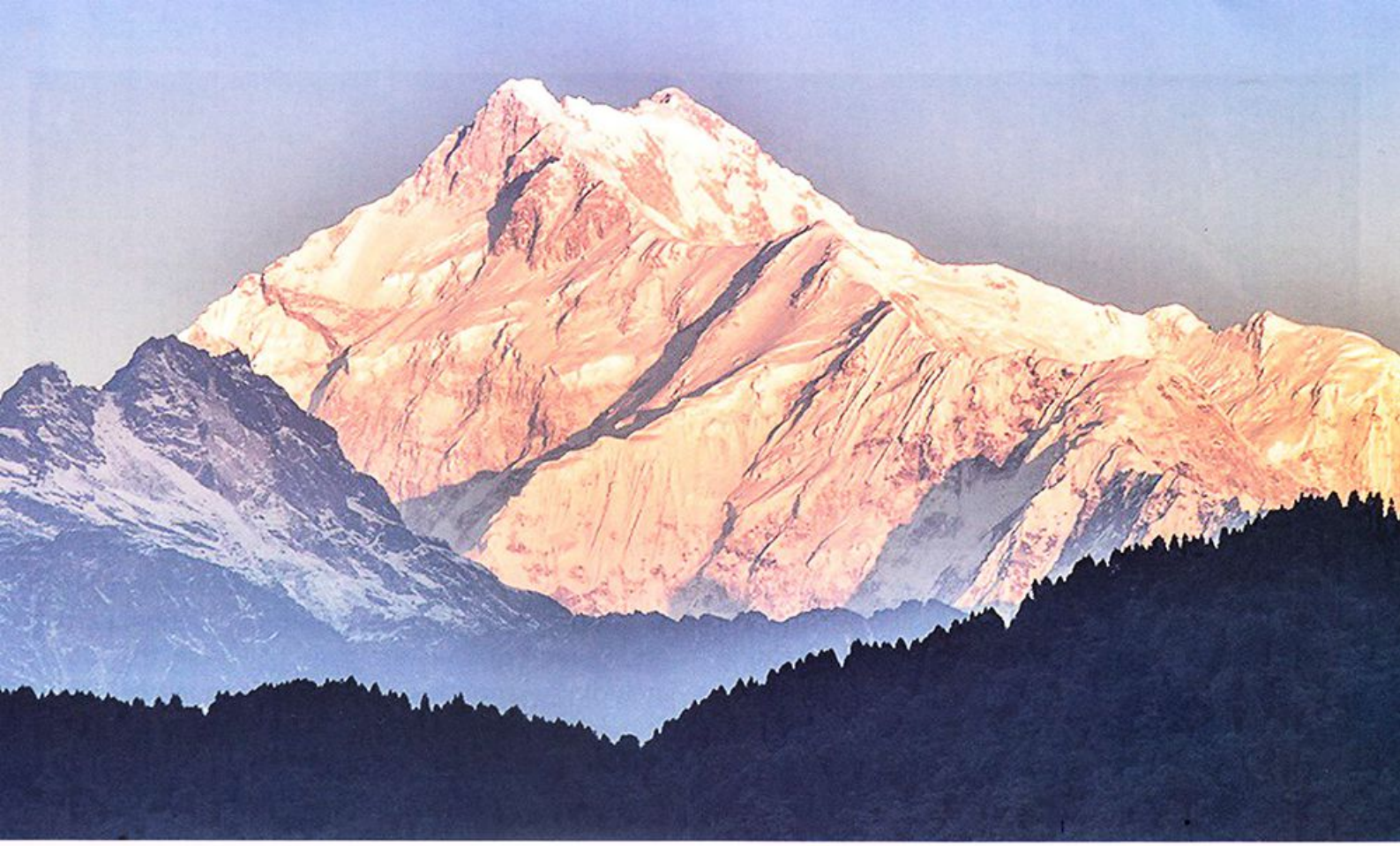


GEOLOGICAL ECOSYSTEM

ABHINAV OM KINKER | The author is Senior Geologist, Geological Survey of India, State Unit: MP, Jabalpur. Email: abhinav.kinker@gsi.gov.in

India is the fifth largest country in the world and has rich geographical and geological diversity, ranging from the mighty Himalayas which are one of the highest mountain ranges in the world to low-lying coastal plains overseeing the vast Indian Ocean. Its geological terrain has rocks, ranging from the Achaean age, formed billions of years ago, at the beginning of the formation of Earth, to riverine alluvium deposited just a few thousand years back.

The geographical landscape of India is marked by the majestic Himalayas in the north which has played a significant role in the unique cultural evolution of the Indian subcontinent. To the south of the Himalayas, lies the vast alluvial tract formed by rivers originating from the Himalayas such as Ganga, Yamuna, Ravi, Sutlej, Gandak, Kosi, Tista, Brahmaputra, etc. The Ganga and Brahmaputra River systems are one of the most fertile regions in the world and are home to a significant portion of India's population. Most of India's geographical area is covered by peninsular plateau which extends from central to southern parts of the country. It is a large, elevated, rugged terrain dissected by numerous big rivers such as Narmada, Godavari, Krishna, and Kaveri which are much older than the Himalayan rivers. Bordering the peninsular plateau and running parallel to India's western and eastern coasts are the Western and Eastern Ghats, which are

Jim Corbett National Park

Kaziranga National Park

known for their rich and unique biodiversity and picturesque landscape. India has a long coastline of about 7,500 km, bordered by the Arabian Sea to the west, the Indian Ocean to the south, and the Bay of Bengal to the east. This coastline has fertile coastal plains, sandy beaches, rocky shores, and coastal wetlands, occupied by mangrove forests. The Thar Desert is located in the northwest part of India which is a vast arid region with rolling sand dunes, sparse vegetation, and distinctive fauna. India also has several island groups, the most prominent being the Andaman and Nicobar Islands in the Bay of Bengal and the Lakshadweep Islands in the Arabian Sea. These islands have rich marine biodiversity and are of great strategic importance to the country.

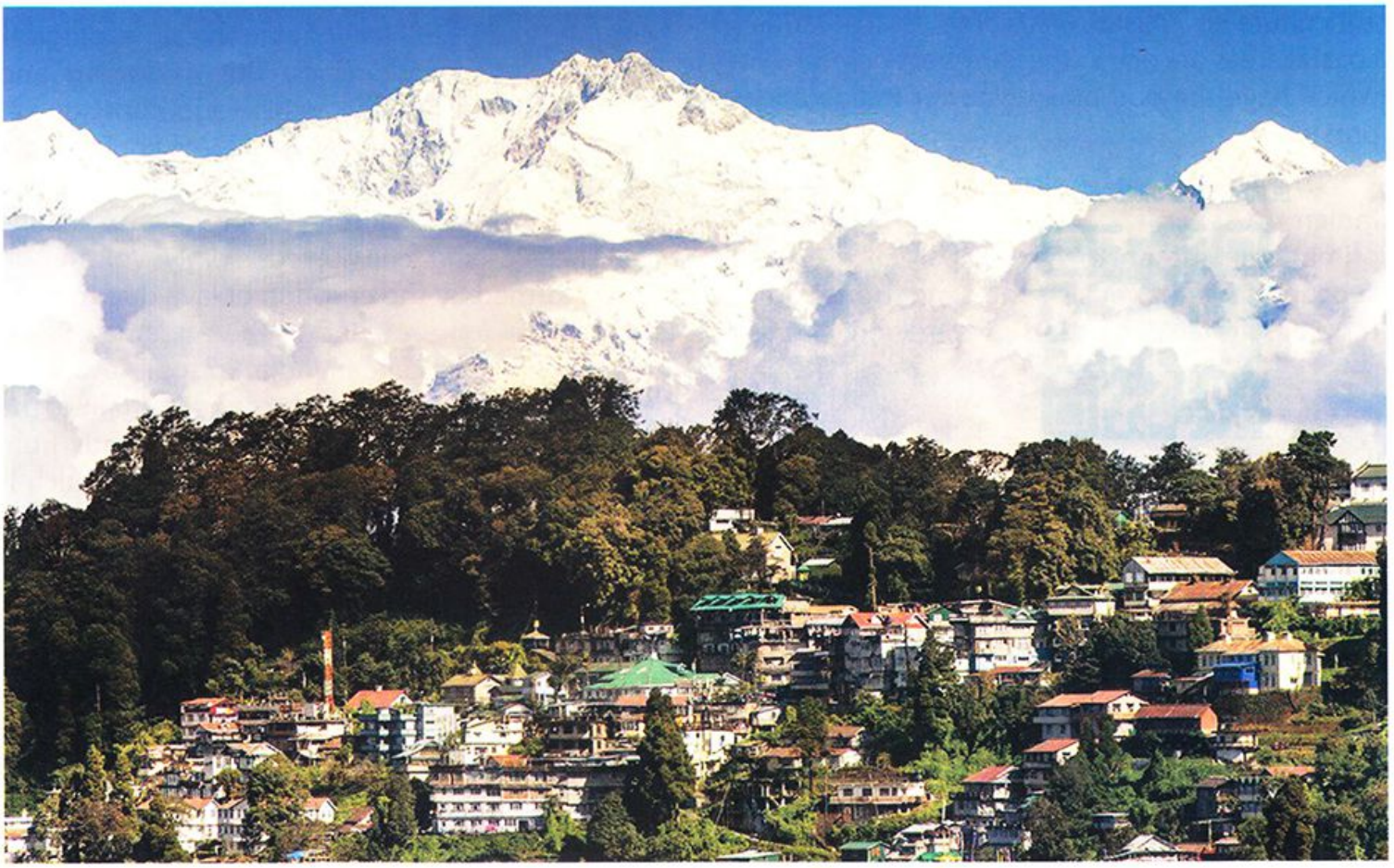
The Himalayas, the highest mountain range in the world, separates the Indian landmass from the Tibetan Plateau. It has been formed by the collision of the Indian plate with the Eurasian plate, resulting in the formation of a large fold mountain system, running along the northern fringes of the Indian sub-continent. It runs from west-northwest to east-southeast direction in the form of an arc for about 2,400 km, extending across five southeast Asian countries. Its width varies from 350 km in the west to 150 km in the east. The Himalayan terrain comprises high snow-clad peaks, deep valleys with steep-sided slopes, and glaciers. Physiographically, the Himalayas consist of four parallel mountain ranges namely, the Shivalik Hills, the Lower Himalayan Range or Himachal, the Great Himalayan Range or Himadri, and the Tibetan Himalayas from south to north. The Great Himalayas are home to some of the highest peaks in the world such as Mount Everest, Kanchenjunga, Nanga Parbat, etc. Several glaciers are present within the range, including Gangotri Glacier and Satopanth Glacier. The Himalayan glaciers are the source of fresh water for the rivers of northern India, providing water to the majority population of the country. The region is still geologically active, with potential for geothermal energy resources. Hot springs and geothermal anomalies have been identified in various areas, indicating the presence of subsurface heat sources that could be harnessed for power generation.

The **Northern Plains** also referred to as 'Great Plains of India', is one of the most extensive alluvial tracts in the world. It runs for roughly 2400 km from west to east and stretches 240 to 320 km from north to south. In some parts, the depth of the sediments is as much as 2000 to 3000 m. It has formed from sediments brought by rivers, originating from uplifting Himalayas, and deposited in a foreland basin. Though it has a low elevation with a general slope from northeast to southwest and south, there are some diverse relief features in the vast Northern Plains. As the rivers originating from the Himalayas descend the hills, their velocity decreases and as a result, they dump much of their denser and coarser sediment fraction along the foothills in a narrow, porous, thin strip called Bhabar which is around 8 to 16 km wide. The streams go underground in the Bhabar belt because of its porosity. The Terai belt is located south of the Bhabar belt where streams go underground in the Bhabar belt resurfaces. It is a poorly drained, wet, marshy, and densely forested narrow track, running parallel to Bhabar stretching for roughly 15-30 km. The densely forested Terai

region has diverse flora and fauna and houses some of the famous national parks such as Jim Corbett National Park in Uttarakhand and Kaziranga National Park in Assam. Another relief feature of the Northern plains is Bhangar, which is an older alluvium that forms a terrace above the floodplain. It is frequently covered in calcareous stone-like pebbles known as 'Kankar'. The flood plains along the riverbanks are formed by Khadar, which is made up of newer alluvium, replenished every year. The northern plains provide fertile alluvial soil which supports agricultural activities and sand is used as construction material for building purposes. The sand deposits of the plains are excellent aquifers that provide water for drinking and agriculture.

The rivers of northern plains are laden with sediment deposits, their sediment load at the mouth forms the largest delta in the world called **Sundarbans**. It is marked by a complex network of tidal waterways, mudflats, and small islands of salt-tolerant mangrove forests and presents an excellent example of ongoing ecological processes. The mangrove forest presents a natural barrier against tropical cyclones and tsunamis. The area is known for its wide range of fauna, including many bird species, the Bengal Tiger, and other threatened species such as the estuarine crocodile and the Indian Python.

The **Peninsular Plateau** is the largest physiographic entity of the Indian landmass. It has a table-land type of topography, marked by elevations of about 900-1200 m above mean sea level, dissected by numerous rivers, forming broad valleys. It presents a rugged terrain with residual hills, formed by weathering of mountain chains formed millions and billions of years ago. The plateau stretches from the Aravalli Range in the west to the Chota Nagpur Plateau in the east. It comprises important mountain ranges of Central India such as Vindhyans, Satpuras, Mahadeo, Maikal and Sarguja ranges as well as the Western and Eastern Ghats. It mainly comprises hard crystalline rocks of igneous and metamorphic origin. It is rich in mineral resources, which is critical for India's economic development. It contains mineral deposits, such as iron, bauxite, mica, gold, copper, manganese, etc. It is home to well-known mines like Kolar, Hutti, Bailadila, Singhbhum, Korba, Malanjkhand, etc. Most of the Gondwana coal deposits of India are found in the Peninsular Plateau. The region has



Mt. Kanchenjunga

Radhanagar Beach, Andaman and Nicobar Islands

abundant reserves of limestone which is a key raw material used in the cement industry. The Deccan basalts of the peninsular plateau are being quarried at many places to be used as road metal. The plateau also has deposits of various other mineral commodities such as chromite, lead, zinc, gypsum, etc. In addition to rich mineral resources, the region also supports ample crop production. A large part of the plateau is covered with fertile black soil which is extremely useful for growing cotton. Some low-hilly regions of peninsular India are suitable for the cultivation of crops like tea, coffee, rubber, etc. The fertile coastal plains formed from alluvium brought by rivers, draining peninsular India support agriculture in coastal areas. The beach sands of coastal areas are rich in thorium-bearing monazites which have the potential to power India's nuclear projects.

The **Thar Desert**, also known as the 'Great Indian Desert', is a vast arid region, located primarily in the northwestern part of the Indian subcontinent. It consists of sand dunes, rocky terrain, salt flats, and sparse vegetation. The sand dunes, known as 'bhakhar', can reach heights of up to 150 m and constantly shift with the wind. The desert also features dry riverbeds called 'nullahs', which occasionally fill with water during the monsoon season. Despite its harsh conditions, it supports a unique ecosystem with specialised plant and animal species adapted to desert life. The region is rich is oil reserves and is home to one of the largest onshore oil fields in India in Barmer Basin. The region also has one of the largest salt marshes in the world called the 'Great Rann of Kutch'. Kutch is one of the major salt-producing districts in India.

Lakshadweep Islands

India is surrounded by numerous islands, each with its own unique geographical, ecological, and cultural characteristics. The **Andaman and Nicobar Islands** form an archipelago, consisting of around 572 islands, out of which only about 37 are inhabited. These islands are known for their pristine beaches, lush tropical forests, and diverse marine life. These island chains are mainly volcanic in origin, formed by the eruption of lava due to plate movements. Barren Island in the Andaman Sea is the only active volcano in India. Episodic lava flows are responsible for the highly rugged terrain of the island. Another prominent group of islands from the west coast of India is **Lakshadweep**, which is an archipelago of 36 islands. These are mainly coral islands with unique marine flora and fauna. The Andaman & Nicobar and Lakshadweep islands are also tourist hotspots of India, fostering the tourism industry in India.

India is endowed with great mineral wealth and is one the largest producers of coal, iron ore, bauxite, manganese, mica, and zinc in the world. Geological ecosystems have not only played a major role in defining India's mineral wealth but also have shaped its unique geographical landscape. ❑