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GEOGRAPHY OF THE HIMALAYA

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INDIA—THE LAND AND PEOPLE

GEOGRAPHY OF THE HIMALAYA

74167

S. C. BOSE



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NATIONAL BOOK TRUST, INDIA
NEW DELHI

December 1972 (Pausa 1894)

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अवधि संख्या दिनांक 3/9/87
निर्देश संख्या 9/5-4261
338-8
नई दिल्ली

केन्द्रीय प्रामाण्य रस्तकालय

Rs. 9.50

Sole Distributors

Thomson Press (India) Limited
19 Malcha Marg, Chankyapuri
New Delhi 21

PUBLISHED BY THE DIRECTOR, NATIONAL BOOK TRUST, INDIA, NEW DELHI-16
AND PRINTED AT THE CRESCENT PRINTING WORKS (P) LTD., NEW DELHI-1.

PREFACE

HIMALAYA HAS BEEN supposed to be the Abode of gods from time immemorial. In the Himalaya there are hundreds of temples and shrines sacred to the Hindus and other religions. Among the famous Himalayan shrines of the Hindus are Badrinath, Kedarnath, Joshimath, Gupta Kashi, Uttarkashi, Gangotri, Yamunotri, Vaishno Devi, Manikaran, Amarnath Cave, Muktinath and Pashupatinath. There are also numerous Buddhist monasteries all over the Himalaya, especially in the higher snowy regions. Some of these are very famous, such as Tawang in Arunachal Pradesh, Bodhnath, Swayambhunath and Thyangboche in Nepal and Hemis in Ladakh.

The Himalaya has always exercised a spell over poets, painters, sages and saints. It has been the cradle of everything precious in India's heritage. The Himalaya offers a landscape painted almost to perfection with the careless strokes of the Master-Painter. Yet little is known to the common man about this breath-taking landscape and its colourful, brave and honest people. Like the designs in a kaleidoscope, the landscape, the customs of the people, their houses and dress change from valley to valley.

An attempt has been made in this book to acquaint the general reader with this mountain world. I have depended very much upon my own extensive field studies.

The first few chapters which are of a general nature, deal mainly with the physical features of the mountainous terrain. The later chapters give regional details, which are largely based upon field-study.

A number of photographs taken by me illustrate the book. Panoramic sketches of peaks and a few simple maps further enhance the value of this volume.

The interest of the public in the Himalaya has been rapidly increasing. The number of tourists visiting beauty spots and cultural centres, pilgrims visiting sacred places, mountaineers attempting to scale the snowy peaks, scientists in quest of high altitude phenomena like glacial behaviour and Himalayan orogeny, is fast growing. The book will be specially helpful to them and also to students of geography.

I am thankful to my wife Shrimati Sucharita Bose who often accompanied me in my travels, and my mountaineer son, Sujit Bose, who gave me much information about high altitude areas.

I am also thankful to the Chairman, Dr. B. V. Keskar and the Director Shri K. S. Duggal of National Book Trust for publishing this book and giving me an opportunity to present in a simple, readable form the facts collected by me in my travels in the Himalaya.

S. C. BOSE

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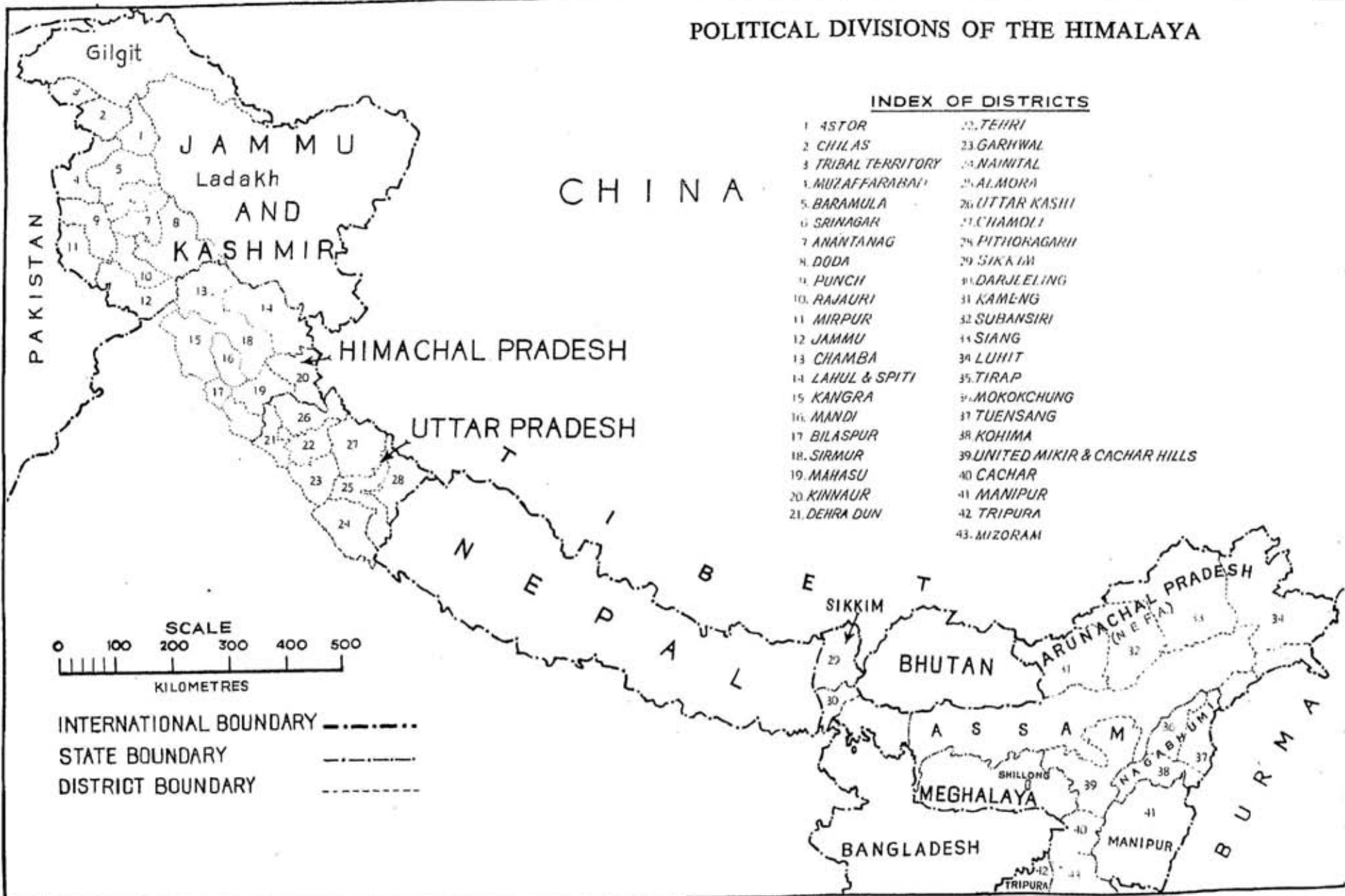
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POLITICAL DIVISIONS OF THE HIMALAYA





I BIRTH OF THE HIMALAYA

ITS LOCATION AND CONTRIBUTION TO INDIA

RISE FROM THE OCEAN

"OH ! MOTHER INDIA ! the day on which you emerged from the blue ocean, what a day of ecstasy it was, what a day of joy." Thus wrote the Bengali poet D. L. Roy in praise of Mother India. His idea originated in a fact of geophysics. For nearly all of the northern part of India at one time lay under the sea.

In the beginning, it was believed that land consisted of one single continent called Pangaea by Wagener, a German scientist. Some hundred million years ago, this continent started cracking in the middle, the crack running from east to west. The sea, named the Tethys Sea, entered the widening crack. Thus two continents were formed, Angara Land to the north and Gondwana Land to the south. The Deccan plateau was a part of Gondwana Land.

The rivers of both these continents flowed into the Tethys Sea. They brought great amounts of silt, mud and sand which dropped to the bottom of this ancient sea. In time tremendous quantities of these sedimentary deposits accumulated there and the sea bottom started sagging owing to the great weight of the sediment.

GEOSYNCLINE

This sagging trench in the sea bottom has been termed as a "Geosyncline". It was in such a geosyncline that the great pile of sedimentary rocks which today constitute the Himalaya were deposited.

The great weight of the sedimentary deposits began to produce heavy stresses and strains in the earth's crust. It is believed that great geodynamic forces pushed the continents

closer. Angara Land started moving towards the south owing to what is called crustal shortening, a process resulting from a gradual cooling and contractions of the earth. The geosynclinal sag started buckling upwards, as the pressure of the southward sliding Angara Land increased. There occurred a general rise of the sea bottom.

According to Wegener great volcanic activity followed in Gondwana Land at that time. Cracks developed in this continent, and it slowly broke up into a number of large pieces which started drifting apart. In the Indian region, the Tethys Sea still lapped the northern edge of the Deccan Plateau block where also cracks had developed. Two big cracks formed along the lines, where the rivers Narmada and Tapi flow today. All these happenings were related to the birth of the Himalaya, prior to its emerging out of the sea.

The Himalayan orogeny or mountain building is supposed to have started about fifty million years ago. The shortening of the distance between the edges of Gondwana Land and Angara Land naturally crumpled the sedimentary beds, which slowly folded and reared up their heads. This movement continued in spasms for a very long period, and it is believed that it is still continuing, though very slowly.

During this period, called the Tertiary period by geologists, there were three major upheavals caused by three pushes. They not only caused the folds, but also inclined them down southwards as the pushes came from the north. Such bent down folds have been called recumbent folds. The great pressure further cracked the folds along their axes, and the upper portions slid southwards over the lower portion. These movements are called overthrusts. Thus the structure of the Himalaya became extremely complex. It took a very long time for the geologists to unravel the mysteries of these folds.

The Tethys Sea persisted north of the central Himalayan Axis, often called the Tibetan Zone, up to nearly the end of the Tertiary period. The younger sedimentary deposits which are found in an unbroken series in the Tibetan Zone

are absent in the Himalayan ranges which were by then above the sea.

INDOBRAHM

A narrowing sea separated the newly emergent Himalaya from the Deccan Plateau block. The axis of the Aravalli mountains running from south-west to north-east passing through Delhi divided this sea into two gulfs, the Sindh Gulf and the Bengal Gulf. Later these gulfs filled up and in their place, a river called Indobrahm by the geologists flowed from east to west. A further rise in the Aravalli axis made this ancient river break into two, the Indus (Sindhu) and the Ganga.

SIWALIKS

Meanwhile, a small fold buckled up south of the foothills of the Himalaya which was made up of young marine deposits, soft sandstone, shales and conglomerates. Today it is called the Siwalik Range, which is prominent at many places as near Hardwar. Between this range and the Himalayan foothills lie parallel longitudinal valleys called Duns. Dehra Dun is a good example of such a valley. At other places the Siwalik Range does not appear as a separate range and merges with the Himalaya. Here it is buried underneath the Himalayan recumbent folds.

SYNTAXIS

The present shape of the Himalayan ranges in the form of large arcs is due to the form of the northern edge of the plateau which is today covered by alluvial soil. It is clear that the Himalayan folds wrapped around two horns of the plateau, one of them being visible in the Kirana Hill in Sargodha district in Pakistan and the other in Meghalaya or the Shillong Plateau. There are three arcs, the central one being the highest, bulging southwards and the other two inwards, i.e., the western arc in Pakistan bulging eastwards

and the eastern one along the Assam-Burma border bulging westwards. The sharp bending of the folds around the horns is called Syntaxis. The two pivots of Syntaxis are near Nanga Parbat in Kashmir and Namcha Barwa north of Assam.

An interesting point to note during the rise of the Himalaya is the persistence of two basins, one in Tibet and the other in Kumaon in which were deposited thick beds of shales.

While the Himalaya was rising, there was also volcanic activity in the Himalayan region. Great quantities of molten rock material called magma were injected into the folds. At places it came out and formed trap rocks, such as the Panjal traps in Kashmir. But generally it solidified at great depth in a crystalline form—called granite—while still buried. Granite is also found in the old crust of the earth. But this injected granite is young in age. In general the Central Himalayan Axis, which has many towering peaks, is formed of granite. However, a good portion of the granite was caught in the Himalayan folds, and owing to pressure and heat it melted and recrystallized. Here the crystals were arranged in layers, often contorted in the process called metamorphism. Such rocks having larger crystals are called gneisses, and those with finer crystals and thin layers, schists and phyllites. They occur abundantly south of the Central Axis.

Further, many kinds of very old sedimentary and metamorphosed rocks, much older than the Himalayan sediments are also found in patches in the Himalaya.

The oldest of these rocks are called Dharwarian, as they are found in Dharwar district in Mysore. They were also deposited in other parts of the Deccan Plateau, and some were enmeshed in the Himalayan folds. Other similar rocks are called, according to their age, Cuddapah, Vindhyan and the coal-bearing Gondwana rocks.

As the Himalaya rose higher and higher, rain, snow and wind started rubbing away the surface. In this manner the buried granites and gneisses were exposed and moulded into high peaks.

LOCATION

Poet Kalidasa perhaps conceived the Himalaya to be a much larger mountain than its present restricted form. He believed that the mountain stretched from coast to coast, which may perhaps mean from the Atlantic to the Pacific from the Pyrenes in the west to Chin Ling Shan in the east. His famous *shloka* in the *Kumarsambhawa* describes the Himalaya in the following lines :

अस्त्युत्तरस्यां दिशि देवतात्मा
हिमालयो नाम नगाधिराजः ।
पूर्वापरी तोयनिधी वगाह्य
स्थितः पृथिव्या इव मानदण्डः ।

“There is a mountain in the north, ensouled by Divinity, named Himalaya, the king of all mountains. Stretching from east to west coasts, it is located on the earth as a measuring rod.”

Swami Vivekananda expounds this *shloka* as follows :

“Important words in the verse are *Devatatma* (ensouled by Divinity) and *Manadanda* (measuring rod). The poet implies and suggests that the Himalaya is not a mere wall accidentally constructed by nature. It is ensouled by Divinity and is the protector of India, and her civilization not only from the chill, icy blasts blowing from the Arctic region, but also from the deadly and destructive incursions of invaders. The Himalaya further protects India by sending the great rivers such as the Sindhu, the Ganga and the Brahmaputra perennially fed by melting ice, and irrespective of the monsoon rains. *Manadanda* implies that the poet affirms that the Indian civilization is the best of all human civilizations and forms the standard by which all other human civilizations, past, present and future, must be tested. Such was the poet’s lofty conception of patriotism.”

In a restricted sense, the Himalaya forms the northern mountain wall stretching from Baluchistan to Burma through West Pakistan, Kashmir, Himachal Pradesh, Uttarakhand,

Nepal, Sikkim, Bhutan, Assam and the Naga Hills. These folded ranges and their extensions cut off India, Bangladesh and Pakistan from the rest of Asia. The mountain wall further forms part of a system of fold ranges radiating from the Pamir mountain knot. They are Kun-Lun, Sayan and Chin Ling Shan to the east, Tien Shan, Altay Yablonoy and Stanovoy to the north-east, and the Hindukush, Elburz, Toros, Dinarske, the Alps and the Pyrenees to the west. Among all these ranges, the Himalaya is the mightiest. The Himalaya proper is limited only to the mighty bulging arc of a snowy range between Nanga Parbat and Namcha Barwa. Upon it stand other great peaks such as Nun Kun, Kinnar Kailash, Chaukhamba, Kamet, Nanda Devi, Api, Dhaulagiri, Annapurna, Gosainthan, Gauri Shankar, Everest, Makalu, Kanchanjangha and Chomolhari and so forth.

Political Location

External boundaries of no less than seven countries touch or pass through the northern mountain wall. They are Pakistan, Afghanistan, the U.S.S.R., China, India, Nepal and Burma.

Near the Pamir Knot in the north-west, international borders of five nations come close to one another. The Pamir lies in the U.S.S.R. Immediately south of it are the Wakhan finger of Afghanistan and the northern tip of West Pakistan. To the east of them are the Chinese province of Sinkiang and the Indian State of Jammu and Kashmir, where we have Gilgit which is at present under Pakistani occupation.

The whole of this region has an extremely rugged topography and is very sparsely populated. There are difficult trails over high passes between one part and the other. Recently Pakistan with the help of the Chinese has built a motorable highway across this inaccessible area through Gilgit and Hunza.

The rest of the northern frontier of India from Ladakh to Arunachal Pradesh more or less passes close to the northern face of the Himalaya. To the north of the border lie Sinkiang and Tibet in China.

However, in the middle of this area lies the Himalayan kingdom of Nepal covering the central Himalayan ranges and some famous peaks such as Dhaulagiri, Annapurna and Sagar-matha or the Everest.

At the eastern extremity of the Himalaya lies Burma, beyond the syntaxial bend around the Namcha Barwa peak.

All along the Himalaya Lamaistic Buddhism prevails from Leh to Towang, while in the south Hinduism is predominant. In the west, however, Muslim culture has penetrated Kashmir.

It has been said that the Himalaya is a meeting-place of three sovereign States. More correctly, it is a meeting-place of seven sovereign States.

In a more restricted sense, only the central arc of the Himalaya between the two syntaxial bends at Nanga Parbat and Namcha Barwa is the Himalaya proper. However, the two wings in the west from Baluchistan to Nanga Parbat, and in the east bending southwards from Namcha Barwa to Naga and Mizo Hills are described in Chapter II dealing with physical features, as they are all folded ranges caused by the movement of Angara Land southwards pressing against the Gondwana Land and the upheaval of the thick beds of sediment at the bottom of the Tethys Sea.

In the following detailed regional study only that portion of this great complex of mountain ranges is considered which lies in India from Jammu and Kashmir to Arunachal Pradesh and the Mizo Hills. Nepal, however, is included in this description.

CONTRIBUTION TO INDIA

Cultural Heritage

Without the Himalaya India would have been a different country, with perhaps a different history too. This mountain range has formed an effective barrier against invasions from the north. It has also cast a spell over our poets including Kalidasa and Rabindranath Tagore and over

our sages and saints. It has cradled everything precious to India's heritage: it has been a nursery of peace and religion, has a breath-taking landscape, as if painted to perfection by the Master Painter. It is a place of pilgrimage for Hindus and Buddhists alike. Thousands of pilgrims visit the shrines of Kedarnath, Badrinath, Amarnath, Pashupatinath, Gangotri, Yamunotri, Manikaran, Vaishno Devi and others every year. Buddhists have built famous monasteries such as Hemis, Bodhnath, Shwayambhunath, Thyangboche, Lachen, Towang, etc. Famous fairs are held in the valleys of the Himalaya such as the well-known one of Kulu and those at Bageshwar and Jauljibi.

Many spots of scenic beauty such as Khajiar, Valley of Flowers, Gulmarg, Pahalgam, etc., are visited by tourists. People from the hot plains flock during the summer months to the Himalayan hill stations—the Vale of Kashmir, Dalhousie, Kulu, Manali, Dharamsala, Simla, Kasauli, Mussoorie, Nainital, Ranikhet, Darjeeling, etc. The more adventurous trek to spots like the Kolahoi glacier, the Pindari glacier, Sundardhunga, Rohtang, Lahul, Spiti, Baspa, Harkidun, Sandakphu, Phalut and Zemu. The number of tourists is increasing year by year and mountaineers from all over the world come to scale the great Himalayan peaks.

Snow-melt Water

But the major benefit provided by the Himalaya is the supply of water through its melting snows during the dry months of May and June. The higher reaches of the Himalaya are perpetually covered by snow. On the slopes towards the south the snow-line—the line from where the snow begins—is roughly at a height of 5,000 metres. It is slightly lower in the west and higher in the east. On the northern slopes the snow-line is still higher as also beyond the central axis of the Himalaya. During bad weather in the winter months, there is fresh snowfall in the mountains owing to disturbances created by mild cyclones coming from the west. Snowfall is common in

Kashmir at a height of 1,600 metres, but is uncommon in the Eastern Himalaya even at a height of 2,000 metres. The first snow starts melting in April and supplies much water to the Himalayan rivers in May and June. Since snow melts very slowly, the snow reserves of the Himalaya act like a huge reservoir supplying water continuously.

Rain Water and Soil

The great height of the Himalaya allows little moisture to escape northwards during the rains brought on by the monsoon from the south. In fact, the maximum rain belt is below 3,000 metres, and regions above and beyond get very little rain. All the rain water runs into the Himalayan rivers which bring large amounts of sand and silt to the plains. In fact, all the northern alluvial plains, stretching from the Punjab to Bengal and Assam, are made of alluvium brought down from the Himalaya. The major contribution of the Himalaya to India is that it covers the land with fresh fertile soil and pours water over it.

Water Power

There is much potential power in the falling water of the Himalayan rivers. Much of it is running to waste. The first major power station was built by the British near Mandi in the Beas Valley; but the biggest was constructed after independence at Bhakra on the river Sutlej. As our limited resources of coal are consumed, the Himalaya will in time become a major power supplier when the falling waters of its rivers are harnessed.

Resources

Among the most valuable resources of the Himalaya are forests which supply a great variety of timber. Apart from resin which is tapped from pine, there are many other minor forest resources including medicinal plants, such as cinchona,

ipecac, raulphia and so forth. Plantations of tung trees yield lacquer. Tea is also a very important product.

Much fruit grows in the Himalaya. There are extensive orchards in Ramgarh near Nainital and Kotgarh beyond Simla. Kulu is known for its apple gardens and Kashmir is famous for fruits and nuts. Coal, bauxite, copper and some other minerals are also found in the Himalaya. In time more minerals may be discovered.

Defence

From time immemorial the great mountain wall of the Himalaya has defended us from enemies from the north. Today, owing to the development of science and technology, the Himalaya is no more impregnable. Yet movement is difficult and at many places impossible. It is a natural defence line.

II PHYSICAL FEATURES : MASS, EXTENT AND ALTITUDE

MASS

KALIDASA who described the Himalaya as a "measuring rod" did not perhaps know its other aspects which made it an instrument for mass measurement. The theory of isostasy was first put forth by survey measurement in the Indo-Gangetic plain in 1859. It was found that the differences of latitude between two stations here as found by astronomical observation and by triangulation did not tally. It was thought that the mass of the Himalaya attracted the plumb line to create this anomaly. Pratt calculated this effect by taking the average density of the rocks of the Himalaya as 2.7. The result showed a much greater attraction. The theory of isostasy, namely, that the upstanding masses of mountains had roots of lighter material to compensate the pull, was advanced. Thus the great mass of this mountain helped in solving an intricate problem relating to vertical distribution of density. This further led to the finding of a solution for vertical movements, such as uplift or sinking of portions of land masses.

EXTENT

The length of the Northern Mountain Wall, extending from near Gwadar on the Makran coast in the west to the Mizo Hills in the east, is nearly 5,000 kilometres. Of this the western wing in Baluchistan and Trans-Sindhu (Indus) up to the syntaxial bend at Nanga Parvat is 1,500 kilometres. The eastern wing from Namcha Barwa to the Mizo Hills is 1,000 kilometres and the Central Himalayan arc 2,500 kilometres.

ALTITUDE

The average altitude of the western wing is 2,000 metres. It is 1,500 metres in the eastern wing and 6,000 metres

in the Central Arc. In this arc there are many peaks which rise above 8,000 metres and which are higher than any other peak in the world, the highest being Mount Everest or Sagarmatha or Chomo-Lung-Ma, 8,848 metres high. The second highest peak of the world is Mount Godwin Austin or K₂, which is 8,611 metres high and situated in Baltistan in the Karakoram range. Both these peaks are made up of limestone. The third highest peak is Kanchanjanga, 8,598 metres high, situated on the Sikkim-Nepal border. The fourth peak in order of merit is Makalu, near Everest in Nepal, its altitude being 8,500 metres. Other important eight-thousanders are Gasherbrum and Saltoro in the Karakoram Range, Nanga Parbat in Kashmir and Dhaulagiri, Annapurna, Gosainthan, Manaslu and Cho-oyu in Nepal.

There are a very large number of peaks above 7,000 metres. In Karakoram they are Rakaposhi, Dast-i-Ghil Sar, Haramokh, Masherbrum, Golden Throne, Terem Kangri, Kula Kangri and Saser Kangri. The highest peak of Pakistan, Tirichmir, is also a seven-thousander, though there is another peak above 7,000 metres near it, named Sad Istragh. Nun Kun in Kashmir is also above 7,000 metres. In Kumaon-Garhwal Nanda Devi, Kamet, Kedarnath, Chaukhamba, Trisul and Dunagiri and many others are above 7,000 metres. In Nepal there are many peaks above 7,000 metres such as Api, Saipal, Himalchuli, Gauri Shankar and Kabru. In Sikkim such peaks are Talung, Pyramid peak, Jonsong peak and Pauhunri and on the Tibet-Bhutan border Chomolhari rising (7,314 metres high). The list of peaks above 7,000 metres and 8,000 metres is not yet complete. Many satellites of big peaks such as Lhotse and Nuptse near Mt. Everest reach comparable heights.

MOUNTAINEERING

Tenzing Norgay and Edward Hillary were the first to climb Mt. Everest; however, many climbers died while trying to climb this peak. Earlier attempts made from the north

side from Tibet along the Rongbuk glacier failed. Irwin and Mallory, two British climbers, disappeared above 8,000 metres, very near the peak; perhaps they climbed it, but could not return. Later on, a new route was discovered from the south in Nepal, north of Namche Bazar, the home of the sherpas who act as porters in climbing expeditions. The route goes over the Khumbu glacier and climbs a dangerous ice fall to enter an amphitheatre surrounded by giant peaks, the Everest, the Lhotse and the Nuptse. A col between Everest and Lhotse, called South Col has to be climbed, from where a final attempt is made. Among later climbers was Barry Bishop, an American geographer. Nearly all the major peaks have now been climbed by people of various nationalities including the British, Americans, Swiss, Italians, Austrians, Germans, Argentinians, Japanese and others.

The great sport of mountain climbing is now developing in India and we have a number of mountaineering institutes at Darjeeling, Uttar Kashi and Manali, where young men and women are given training. Young men have also formed various clubs to foster mountaineering.

Among Indian climbers may be mentioned Gurdial Singh and Nandu Jayal who joined climbing expeditions of Europeans. Moddie, Hari Dang and others became mountaineers of international repute. Commander M.S. Kohli, Nawang Gombu, Cheema and Col. B.S. Jaiswal succeeded in climbing Mt. Everest as members of an entirely Indian team. Leaders of some successful private expeditions are Rani Bhagwandas and Sukumar Roy. Sujit Bose led two major expeditions to Nilkanth and Chaturangi. Other mountaineers are Amulya Sen, Chanchal Mitra and Nimai Bose.

THREE DIVISIONS

To describe the physical features of the Northern Mountain Wall of the Indian sub-continent, it may be convenient to divide it into three divisions :

- (i) Western Hills and Ranges

- (ii) Central Mountain Arc
- (iii) Eastern Hills.

These may be further subdivided into sub-regions. The most dominating of these three divisions is the Central Mountain Arc.

Western Hills and Ranges

Though these hills and ranges are mainly located in West Pakistan, they form an essential part of the Northern Mountain Wall.

They spread from the Makran coast of Baluchistan to the syntaxial bed at Domel and Nanga Parbat in Kashmir through Baluchistan and the north-western border districts of Pakistan.

A range of hills runs parallel to the Arabian Sea coast. It is called the Makran coast range. The trend of parallel east-west ridges has produced a characteristic pattern of T- or L-shaped peninsulas similar to the land forms found along Dalmatia on the east coast of the Adriatic Sea east of Italy. The most conspicuous T-shaped peninsula is Gwadar. The hills are dry and have no vegetative cover.

The ranges of Baluchistan fan out from Quetta and Kalat to the west and south. The ridges are formed by folding. In general, the upfolds or anticlines are ridges and the downfolds or synclines are valleys.

Along the northern border of Baluchistan are the Chaghai Hills running east-west. On the eastern border is the Kirthar Range running north-south. In between are valleys and marshy depressions or playas, a feature of arid and semi-arid regions. The largest of these depressions is Hamun-i-Mashkel in the north-west.

The river Dasht empties itself into the Arabian Sea at the south-western corner of Baluchistan. It has a peculiar drainage pattern called trellised type. The Dasht and its tributaries Kech and Nihing flow from east to west through valleys with rectangular bends, where the streams run north-south.

The river Mashkel and its tributaries empty themselves into the marshes of the same name.

One range extends east-west along the northern border of Baluchistan from Quetta to Zahidan. On it are situated a number of peaks. Two of them, Ziarat and Zargun, both above 3,500 metres are near Quetta. Further west is the depression of Hamun-i-Lora into which the river Pishin Lora falls. The border range further west is named Chagai Hills, whose average height is 2,000 metres. It is a water-parting between Zirreh, a depression in the north, and Mashkel in the south. The highest peak here is Koh-i-Sultan (2,332 m). At the western end is Koh-i-Malik Siah (1,646 m), which stands at the junction of Baluchistan, Afghanistan and Iran. Other ranges fanning out from the Quetta pivot are the Ras Koh, the Siah Range, the Central Makran Range, the Makran Coast Range, the Pab Hills and the Kirthar Range. Here between the ranges are the valleys of Hingol and Hab. The highest peak of the Kirthar Range is Kutte-ji-Qabar (2,100 m). The ranges of Sulaiman and Bugti make southward loops, and between them is the Sibi re-entrant, through which the railway line and the road to Quetta climb up near the Bolan pass. North of Quetta along the border are the Toba Kakar Hills. Here the railway line goes up to the border at Chaman beyond the Khojak pass. South of this range is the Zhob valley which turns round Takht-i-Sulaiman (3,600 m) to join the Sindhu (the Indus). Beyond this valley is the northern half of the Western hills and ranges, lying across the former North-West Frontier Provinces.

Zhob cuts a transverse gorge in the Sulaiman Range. Here it is joined by the river Gomul leading to the Gomul pass, through which the road from Dera Ismail Khan goes to Ghazni. Further north the rivers Tochi and Kurram cut similar transverse gorges in the Sulaiman Range leading to the Tochi and Kurram passes on the border. In these valleys is located the Bannu plain.

The river Kabul, draining Afghanistan over the plateau

of Kabul, flows from west to east transverse to the grain of the country. However, its subsequent tributaries Konar and Swat flow north-south parallel to the hill ranges. The road to Kabul and the railway to the frontier at Landi Khana run along the Kabul valley through the famous Khyber pass.

Contrary to the grain of the country, the Salt Range near Attock runs east-west. So does Safed Koh south of the Kabul valley. The two trends of hills north-south and east-west result in complex physical features. Safed Koh culminates in the Sikaram peak (4,780 m) in the Parachinar bulge.

North of the Kabul valley the topography is more rugged. The area is inhabited by frontier tribes. The rivers Konar and Swat are enclosed by high mountain ranges of Chitral. The valleys are deep and the ranges are occasionally snow-covered, including Tirichmir (7,450 m), the highest mountain of Pakistan. Chitral is very remote. The deep furrow of the river Sindhu cut into the mountains is connected to the Swat valley by the Malakand pass.

Further north is the wild Yarkhun valley surrounded by snowy peaks. To its north-west the watershed is along the crest of the Hindukush Range on the slopes of which a number of glaciers feed the river. To the south-east the watershed is between this valley and the valley of Gilgit. This is also very remote, high and glaciated. A part of it is the habitation of the picturesque Kafir tribe.

The Yarkhun valley ends at the Pamir Knot from where high mountain ranges run in various directions. This is a highly strategic place. Five countries lie very near one another here, Pakistan in the Yarkhun valley, India in the Gilgit valley, Afghanistan in the Wakhan finger, the U.S.S.R. in the Pamirs drained by the Murghab and China in the upper Zarafshan valley. Routes lead from one country to the other over forbidding passes such as the Barogh pass across the Hindukush Range from Pakistan to Afghanistan, the Mintaka

pass across a route from Gilgit and Hunza to Zarafshan, and the Khunjerab pass across which a new road has been built by the Chinese into Hunza and Gilgit in Kashmir.

The Central Mountain Arc

The Northern Mountain Wall extends from Makran in Baluchistan to Arakan in the Burma border region. Its central portion is the Central Mountain Arc.

At the two ends of the Central Arc are the formidable peaks of Nanga Parvat in Kashmir and Namcha Burwen in Tibet in the bend of the Brahmaputra river, the great arc between them being called the Great Himalaya. There are many subsidiary ranges both north and south of it, which are included in the Central Arc. The Central Mountain Arc may be further subdivided into Western, Middle and Eastern.

Karakoram Range

This range is included in the Central Arc. It lies in Kashmir north of the Great Himalaya. At least ten of its peaks rise above 7,000 metres, the highest being Mt. Godwin Austin or K₂ which has an altitude of 8,611 metres, being the second highest peak in the world. Another peak Gasherbrum is 8,100 metres high. Other important peaks are Dast-i-Ghil Sar (7,885 m), Masherbrum (7,850 m), Rakaposhi (7,788 m), Saser Kangri (7,672 m), Terem Kangri (7,500 m) and Golden Throne (7,200 m). The whole range, unlike the Himalaya, stands over a high region more than 3,000 metres high. Thus the peaks do not look as tremendous as those of the Himalaya. However, the Karakoram range is broader and colder, owing to higher latitude, and hence even trails do not cross it. To the east the range is more subdued, as it loses height while the Ladakh plateau on which it extends gains height to the east. Thus its relative height decreases further.

The glaciers of Karakoram are some of the largest mountain glaciers in the world. They are totally covered by surface moraines, the material coming from tremendous frost-shattering

and disintegration of rock walls containing the glaciers. Some grass and stunted conifers may grow on the moraines, where shepherds put up their camps. The forests and the shepherds' settlements move slowly with the glaciers, hardly 50 centimetres per day. Tributary glaciers descending steeper slopes may move faster.

The glaciers have for some time been slowly melting away, and are retreating. This is proved by abandoned lateral moraines in the form of walls of morainic material, standing away from and parallel to the glaciers, old terminal moraines below the present snouts, and glaciated valley forms further down.

Siachen the longest glacier is 70 kilometres long. From its snout rises the river Nubra, which joins Shyok before joining the Sindhu (Indus) river. Other giant glaciers are Baltoro, Biafo and Hispar in the valley of North Shigar. The valleys of Nubra, Shyok and Shigar rivers are choked with old glacial till, morainic debris and outwash material from the present snouts of the glaciers. This is specially so on the northern slopes of the Karakoram Range, where glaciers flatten out and discharge streams, laden with outwash, over huge accumulations of moraines and talus cones.

A strange phenomenon of periodicity in glacial movements is observed in the Shyok river valley. Here a glacier named Chong Kumdan has descended into the river and formed an ice-dam across it a number of times, impounding a lake behind it, named Gapshan Lake. The dam has then disintegrated. Kenneth Mason fully studied this phenomenon. The last formation of the ice-dam was in 1923-24. Mason predicted the next advance for 1970.

Gilgit Valley

This valley lies in the north-western corner of the State of Jammu and Kashmir. It drains a fertile basin about 2,000 metres high, surrounded by high mountains, which culminate in Rakaposhi (7,788 m) in the east, supposed to be the western end of the Karakoram Range.

Gilgit joins the Sindhu (Indus) near Bunji at an altitude of about 1,400 metres. The river Gilgit is bound by fertile terraces about five kilometres wide and 40 kilometres long.

To the west of Gilgit are the wild mountains of Kafiristan bordering Chitral in Pakistan and the Wakhan finger of Afghanistan. It is inhabited by the Kafir tribe.

To the north-east of Gilgit is the Hunza valley, a secluded region of extraordinary beauty lying under the shadow of Rakaposhi.

The river Shigar and its tributaries rise from large glaciers in the Karakoram Range. The volume of water in Shigar depends on melting ice. A hot sun may cause a miniature flood. A feature of the valley is elongated gravel-filled basins which are true glacial rock basins excavated by past glaciers. Lower down in Baltistan the river flows on broad gravel beds, while the enclosing rocky slopes are covered by talus cones formed by the disintegration of rocks.

Further east are the remote valleys of the Nubra and the Shyok. The latter river has an elbow in the high, flat, desolate, wind-swept plain of Depsang. There is a similar wasteland called Lingtzi Tang south of Depsang. Here in these high cold plains, the last spurs of the Karakoram gradually subside. In between them are the shallow valleys of Chip Chap, Galwan and Chang Chen Mo, all falling into the Shyok.

The whole of this high portion of Ladakh is four to five thousand metres high. Besides these valleys, there are many salt-encrusted lakes scattered over it. They contain little water, but have much salt and soda deposits. The region is covered by gravels, boulders and human and animal skeletons. An area in the north is aptly named as the Soda plain. Another portion of this region is called Aksai Chin. A caravan route follows Nubra and Shyok to cross over to Singking over the Karakoram pass (5,576 m), which is perhaps the highest pass in the world. Between the Shyok and the Sindhu (Indus), there is a range called Kailash, which

extends into Tibet, where the famous dome-shaped Mount Kailash, believed to be the abode of Shiva, is situated, north of lake Manasarowar.

North of the Kailash Range across the border is Pangong Lake, an elongated depression filled by gravels and moraines. Its shape suggests that at one time it was a river joining the Shyok. It has been separated from it by huge glacial deposits. Approximately along the Sindhu (Indus) runs the Ladakh Range which is crossed and re-crossed by this river at Thangra, Khartaksho and Bunji.

South of the Indus are the valleys of South Shigar and Zaskar, through which passes the Zaskar Range. It is a very desolate and remote region, much more cut up than Ladakh and covered by numerous glaciers. The eastern part of this region is called Rupshu, where there is a salt-encrusted lake called Tso-Morari.

South of Zaskar is the Great Himalayan Range which starts from Nanga Parvat and runs in a mighty curve towards the south-east into Himachal Pradesh. There are a number of important passes across it. Burzil leads to the Astor valley and Gilgit. Zoji La (3,529 m) above Sonamarg leads to Leh and Bara Lacha La again leads to Leh from Lahul.

South of the Central Himalayan Range is the Pir Panjal Range rising from four to five thousand metres. Between it and the Himalaya is the enchanted vale of Kashmir which was once a lake. It has an oval shape and is about 130 kilometres long and 30 kilometres wide. Older lake deposits called Karewas form terraces 100 to 200 metres high all round the vale. They have been washed away from the centre, where the river Jhelum and its tributaries meander. There are many beautiful lakes in the valley including the Wular Lake 12 kilometres long. There are marshes at Haimgam and Anchar. The exposed flat bottom of the ancient lake forms the vale today. Pir Panjal is cut across by the river Jhelum below Baramulla and by the river Chenab below Kishtwar, a flat terrace hanging high up above the gorge of

the river. The crest of the Pir Panjal is generally made up of volcanic rocks. The highest peak is Tatakuti (4,742 m) and the next highest is Brahma Sakli (4,705 m). There are many glacial lakes called tarns near the top. Alapathri is one of them. The meadows of Khilanmarg and Gulmarg are the tongues of glacial debris made by past glaciers. The range merges with the Himalaya near Deo Tibba in Himachal Pradesh. Between it and the Himalaya is the high valley of Lahul drained by the rivers Chandra and Bhaga, which join to make up the river Chandrabhaga or Chenab. The Chandra rises from a glacial lake called Chandra Tal. To go to Lahul one has to cross the Pir Panjal by the Rohtang pass (4,361 m).

The river Ravi rises in the snow peaks of Bara Bangahal in Chamba, and the river Beas from a glacial lake near Rohtang.

The last snow range is Dhaula Dhar running parallel to the Pir Panjal south of it. Both these ranges enclose the attractive Kulu valley in Himachal Pradesh. The Beas cuts a fantastic gorge through Dhaula Dhar at Larji. A smaller and more or less continuous range about 2,000 metres high runs south of the snowy ranges. It is known as the Ranjoti Range in Kashmir, the Nag Tibba Range in Himachal Pradesh and the Mussoorie Range in Uttar Pradesh. It is generally known as the Lesser Himalaya.

Synclinal valleys called duns occur at the foot of these last ranges, followed further south by a more or less continuous anticlinal range named the Siwalik Range. It is well marked in Kashmir, the Punjab and Himachal Pradesh and is observed at Hardwar, where the Ganga cuts through it.

Thus, in Kashmir there are at least ten parallel ranges as follows :

(1) The Aghil; (2) the Karakoram; (3) the Kailash; (4) the Ladakh; (5) the Zaskar; (6) the Great Himalaya; (7) the Pir Panjal; (8) the Dhaula Dhar; (9) the Lesser Himalaya; and (10) the Siwalik.

Chamba and Kulu

Further east in Himachal Pradesh and Uttar Pradesh, the ranges north of the Great Himalaya Range lie outside India.

Dhaulta Dhar is visible very clearly from Dalhousie in north-west Punjab. Here there are magnificent deodar forests which cover the hills. On the way from here to Chamba terraces on the Ravi, one passes Khajiar, a spot of great natural beauty. There is a circular lake, which is an old tarn or glacial lake and is set in the middle of a meadow surrounded by tall, dark green pines. There is a floating island of reeds in the lake, which is a natural bird sanctuary.

In Kangra, the snowy Dhaulta Dhar is visible from the plains. Some of its 5,000-metre peaks stand straight above Dharamsala, a pine-clad hill station hardly 500 metres above the Kangra plain.

Along the road and railway to Joginder Nagar in Kangra, the topography consists of low, tangled hills covered by scrub jungles. Near Mandi the Beas valley is broad, but there are a number of strike vales such as those of Uhl and Rana Khad. Near Mandi there is a lake named Rawalsar in the hills above the town. Seven islands of reeds float in it. Above Mandi the Beas cuts an awe-inspiring gorge in the Dhaulta Dhar at Larji and Aut. Further up there are broad terraces of Kulu. Above Bashisht the valley is glaciated, and shows truncated spurs and is U-shaped. There is a rock cliff below Koti, which has been cut into a narrow I-shaped gorge, hardly 10 metres wide and 300 metres deep. It is a major rock step. Further the valley is again an open U, where the road climbs in a zigzag manner to the Rohtang pass across the Pir Panjal.

Sutlej Valley

The river Sutlej rises from Manasarowar in Tibet and crosses the Indian border at the Shipki pass. It is joined from the north by the river Spiti. This river has a very high and remote basin of rugged, snowy topography. It can

be reached only through passes above 5,000 metres high. Geologists call Spiti a museum of geological formations. Here one finds a continuous record of sedimentary rocks not found elsewhere in the Himalaya. The Sutlej valley is crossed by the Great Himalaya Range near Chini and Kalpa. The highest peak here is Kinnar Kailash nearing 6,500 metres. East of this point the landscape consists of a cut up high-level plateau with Pooh at the centre. A tributary from the south is the river Baspa, which rises in a glacier descending from the Nela pass. In the past the glacier came down below Sangla village, where its terminal moraine is found today. A lake which formed at its back is now nearly drained out. Today the small lake is enclosed by a double terrace. Sangla is situated on another old terminal moraine. The valley here has an open aspect and is surrounded by snowy peaks. East of Nela pass are the basins of the Jadh Ganga and the Bhagirathi. To the south is the high valley of Tons, which joins the Yamuna. The Sutlej is crossed by the Dhaula Dhar above Rampur. West of this town there are wide terraces of the Sutlej up to Tattapani, where hot water oozes out from sands on the bank of the Sutlej. The terrace of Bilaspur further down is now drowned by the Govind Sagar reservoir above the Bhakra dam. Here the river has a sharp U-shaped bend, enclosing the Solasinghi Range. Further down is the Siwalik Range. Old alluvial deposits spread from Nangal up to Chandigarh.

Simla Hills

The Simla Hills stand on the water-parting between the Sutlej and the Giri, a tributary of the Yamuna. South of Simla is the Panchmunda ridge, which is crossed by a railway through a tunnel at Barog. A series of fissure springs occur at its flank. The first ridge above Kalka rises abruptly to Kasauli, a pine-clad hill station. The highest point here is Druid's Peak (1,927 m). South of this ridge are wide gravel fans of eroded material. Lastly comes

the Siwalik Range. South of it streams issue from gravels. They are called 'Chua' or 'Cho' and are similar to the streams of Bhabar in Uttar Pradesh near Haldwani.

Yamuna Valley

East of the Simla Hills is the Yamuna valley, which has two tributaries, the Tons and the Giri. The Yamuna rises from a hot spring just below the Bandarpunch (6,387 m) group of snowy peaks. Waterfalls from melting ice drop into narrow U-shaped gorges below.

This area is dominated by the granite peak of Chaur (3,647 m). From it the Nag Tibba Range runs east to Nag Tibba peak (3,002 m). It runs through the region called Jaunsar-Bawar and culminates in limestone peaks of Deoban (2,951 m) and Kharamba (3,071 m). Further south is the Mussoorie Range. The rivers Yamuna, Tons and Pabar cut through these ranges and join at Kalsi. Further down, the Giri joins the Yamuna at Paonta. There are numerous river terraces along them at Tiuni and other places. From here starts the longitudinal valley of Dehra Dun lying between the Mussoorie Range and the Siwalik Range. It is drained by the Asan westwards into the Yamuna and by the Song eastwards into the Ganga. The Siwaliks have a rugged cut-up face to the south and a gentle slope to the north. Near Dehra Dun a small stream at Guchhupani or Robber's Cave cuts a cleft in the rocks containing lime. Small stalactites and stalagmites are found here and at Tapkeshwar.

Gangotri and Bhagirathi Valley

The Ganga valley drains a very large portion of Uttarakhand in Uttar Pradesh. The upper part of the Ganga called Bhagirathi rises in the ice caves of Gaumukh in the snout of the Gangotri glacier. This glacier is 30 km long and two to four km wide. It starts from the eastern face of the Chaukhamba peak (7,138 m) and is fed by a system

of tributary glaciers, namely, Chaturangi, Rakta Baran, Swet Baran, Nilambar, Pila Pani, etc., denoting various colours. This system of glaciers lies in a basin about 5,000 metres high. It is surrounded by high peaks, the highest being Chaukhamba. Other peaks are the Bharte Khunta, Kedarnath, Satopanth, Vasuki, Sumeru, the Bhagirath group of peaks and Shivling. This last is a striking pinnacle of rock and ice. It has been called Matterhorn in a nightmare and is still unscaled. The Bhagirathi valley up to twenty kilometres below Gaumukh is choked with glaciated boulders and gravel. Near Chirbas is a huge platform of boulders. Pillars, twenty to thirty metres tall, made up of a glacial material called boulder clay, and topped by giant boulders stand as sentinels, watching over this valley of the gods. The valley is flanked by jagged snowy peaks. The Gangotri temple stands at the end of this portion of the valley.

Beyond this point the Bhagirathi cuts a fantastic gorge among granites of the central axis of the Great Himalaya. Glistening granite walls enclose the gorge; mythologically speaking, it is said that Bhagirath meditated on the glacial terrace of Tapoban near the base of Shivling, until the Bhagirathi issued forth. Blowing a conch-shell, he proceeded across the Himalaya, which rifted apart to allow the Bhagirathi to follow him. Nearly at the end of the gorge, the Jadh Ganga or the Janhavi joins the Bhagirathi. It drains the high basin of Nilang. One can cross into the Baspa valley from this place across the Nela pass. North of it is the Jelukhaga pass on the Tibetan border.

A pair of rock basins filled with gravel occurs in the Bhagirathi valley a few kilometres below at Dharali and Jhala. From here up to Bhatwari one sees glaciated valley features, such as truncated spurs, hanging valleys, etc. Below Bhatwari are wide terraces extending along Uttarkashi, Dharasu and Tehri. In the Tehri terrace there is a classical example of an incised meander at Malideval. The Bhagirathi

has cut into its old flood plain and its rocky base in the form of an omega. This is a sign of an uplift. Here there are four clear-cut terrace levels, which prove that uplift has taken place four times. Further down at Dev Prayag, the Bhagirathi joins the river Alakananda and is called the Ganga below this point.

The Alakananda

The Alakananda rises from the snout of the twin glaciers of Bhagirath Kharak and Satopanth, which rise from the eastern snow slopes of Chaukhamba. The glaciers are covered by pinkish moraines, the lateral moraines being clearly marked as long conical ridges 100 metres high. The nascent river cuts a gorge across an old grassed terminal moraine two kilometres away. Here from two sides descend the waterfalls Vasudhara and Sahasradhara. Further down the river runs in a gorge cut into old ground moraines and is flanked by glacial terraces. To the south of the river are two beautiful peaks, the Nilkanth and the Narayan Parvat. Further down is the Nar Parvat in which there is a hanging glacier named Kuber.

At the end of this gorge, the Saraswati river drops into it as a hanging valley. Here is a natural bridge, a huge boulder lying across the river, called Bhim Shila. It is supposed to have been put in this position by Bhim, while the five Pandavas were on their way to heaven. The steps which are like the ice formations of the Satopanth glacier are supposed to be the stair case to heaven. The Saraswati rises near the Mana pass on the border. The Alakananda flows past the Badrinath temple, where there is a big hot water spring. Around Badrinath is a large basin-shaped amphitheatre. Further down the gorge is U-shaped. Numerous waterfalls descend into it from both sides.

The Khiraon Ganga rises from a glacier of the same name on the western slope of the Nilkanth and joins the Alakananda below Hanuman Chatti. Here glacial debris has formed a triangular plain area.

Further down Bhyundar the Ganga joins from the north. It is fed by snow fields around Rataban, Saptshrung and other peaks. Here is the famed valley of flowers around Hem Kund. Below Joshi Math, the Dhauli Ganga comes down from the Niti pass to join it. Between Mana and the Niti pass (5,068 m), there are a number of big peaks. The tallest among them is Kamet (7,756 m). Many big glaciers are cradled between the peaks. Slightly above Chamoli, the Birahi Ganga joins the Alakananda. In its upper reaches a beautiful lake named Gohna was created by a big landslide. Its dam collapsed in August 1970, and the lake suddenly became empty, resulting in a devastating flood.

The Pindar Ganga and Nanda Devi

At Karna Prayag, the Alakananda is joined by the Pindar Ganga, which rises from the Pindari glacier on the eastern flank of the great peak, Nanda Devi (7,816 m). This peak is surrounded by a snowy rampart enclosing the Nanda Devi sanctuary. It could not be penetrated till 1935, when Tillman succeeded in reaching it from a pass at Lata Kharak. Nanda Devi is surrounded by an array of glittering peaks such as Trisul (7,196 m), Duna Giri, Nanda Ghunti, Mrigathuni and Maiktoli.

The Pindari glacier is anchored between the Nanda Devi and Nanda Kot peaks. It is only eight kilometres long, but has a steep gradient and breaks into fissures and crevasses in the lower portion. Its top is a col named Pindari Kanda, or Traill's pass over 5,000 metres high. Near the snout there is a big abandoned lateral moraine to its east grassed on the outer side. A magnificent view of the glaciers and the snowy peaks around is obtained from the top of this morainic ridge. The Pindar river has cut a gorge in thick glacial deposits up to nearly ten kilometres, with the result that spacious glacial terraces spread on both sides of the gorge. Further down from Phurkia up to Khati, one notes numerous

waterfalls, hanging valleys, and tremendous rock cliffs, as the one at Dwali. They are spurs truncated by an old giant glacier which has now melted away. All along this route, one notices the outer cliff-like face of the sanctuary wall. The view is specially magnificent from Phurkia.

The Sundardhunga is a small tributary of the Pindar, joining it below Dhakuri. It is approached by a difficult route passing through the high villages of Wachham and Jatoli. Beyond is a dense forest of tree Rhododendrons called Dhunyadhong. The forest above 3,000 metres is a grassy terrace called Sundardhunga. It is faced on all sides by tremendous cliffs behind which snowy peaks raise their heads. This basin was a glacial lake in the past caused by the obstruction of an old moraine, which has been cut by it in recent times. Here one has magnificent views of the great snowy rampart of the Nanda Devi sanctuary, if one climbs up another one thousand metres to Baloni Bugiyal. One may also climb straight up to Maiktoli Bugiyal, a small CWM or glacial basin surrounded by two glaciers which descend from two snowy peaks, the Maiktoli and the Panwali Duar. Avalanches continuously thunder down into the CWM. Here the Sundardhunga stream issues from the snout of the Burgha glacier. A large snake-like abandoned lateral moraine comes down in the basin. One also sees many old medial moraines and a terminal moraine cut up into mounds. The scene is further dominated by large stone pillars called gendarmese. Two of the glaciers produce ice falls.

The Pindar river turns west and joins the Alakananda at Karna Prayag. On its north there is a steep rise to the edge of the sanctuary, where rise the cones of Nanda Ghunti, Trisul and Mrigathuni. On this slope is situated the glacial lake of Rupkund, which has come to light with the discovery of human skeletal remains. It appears that a big pilgrim party camped here on an old morainic deposit which being loose perhaps collapsed and buried the entire party.

South of the Pindar river there is a limestone ridge

spreading eastwards from Joshimath. It is crossed by the Kuari pass from Ranikhet, a favourite trekking route. A road now crosses it at Gwaldam.

The river Sarju rises from its southern slopes and drains towards Kali Nadi on the Nepal border. A tributary of the Sarju named the Gomati meanders through a circular plain around Baijnath. The route to the Pindari glacier from Almora goes along the valley of Someshwar. The broad terraces around Someshwar have been caused by the stay of the Kosi at the same level for a pretty long time to allow it to produce a broad flood plain. From Someshwar one climbs to Kosani, from where one has a magnificent view of the snows, descends into the Gomati basin and reaches Barari on the new road to Shama. A mule track leads to Pindari *via* Loharkhet, Dhakuri, Khati, Dwali and Phurkia. Another road goes from Bageshwar to Tejam from where one can approach the Milam glacier and the group of Panchuhli peaks. Trisuli, a perfect snow pyramid, is also situated here. There are many other glaciers in this area.

The large circular depression around Baijnath is a paradox. It is made up of deposits, perhaps formed in a lake bottom, which are now being eroded. An escape route of the past lake can be noted in the Gomati valley below. Extensive terraces are found from here to Kapkot and Vani. Terraces are well developed around Bageshwar.

The Mandakini Valley

The Mandakini river rises near the Kedarnath temple, which stands on a flat platform of moraines. The snowy rampart at its back is the outer face of the southern part of snowy ranges surrounding the Gangotri glacier system. The Kedarnath peak is 6,940 metres high. On its western flank there is a small glacier named Chorabari, hardly seven kilometres long. It gives rise to the Mandakini river. Like the Pindar, this river also cuts a gorge through glacial debris, which forms terraces. Springs fed by melting snows ooze out

from gaping holes in the loose morainic material of the walls of the gorge. There is a large abandoned lateral moraine behind the Kedarnath temple, similar to the one found near the Pindari glacier. All this evidence again shows that the Mandakini valley was in the past filled by a huge glacier which has now melted away. Waterfalls and cliffs are again found in the valley up to Gouri Kund, a hot spring. At Son Prayag, the Mandakini falls into a tributary river which geographers call a discordant junction, a sign of past glaciation.

Between Badrinath and Kedarnath, there is a lone peak nearly 4,000 metres high. Upon it is situated the temple of Tungnath, which is slightly higher than the Kedarnath and Badrinath temples.

Below Rudra Prayag, there are incised meanders in the Alakananda valley and well-developed terraces. Above this point the high terrace of Gauchar is so spacious that an air landing strip has been built upon it. There is a huge terrace at Srinagar also. Terraces spread up to Kirtinagar. Here again four levels of terraces can be recognized, as in the Bhagirathi valley, pointing to at least four regional uplifts in the Himalaya.

The Ganga below Kirtinagar passes through a gorge covered by a dense tropical jungle. It issues out of the Himalaya at Rishikesh. From here is visible Narendra Nagar perched on a ridge more than a thousand metres high.

At Hardwar the Ganga cuts across the Siwalik range. This gap can be clearly seen from a distance, with the temples of Manasa and Kali on both sides of the valley.

The Bhagirathi and Yamuna Valleys

The Bhagirathi takes its rise from Gaumukh, while the Yamuna rises at Yamunotri, both the points being hardly seventy kilometres apart. But they flow nearly 1,000 kilometres to join at Prayag. Here the colour of the waters of the two rivers is very distinct. The Ganga water is yellowish

grey and the Yamuna water is blue. At Prayag they can, therefore, be easily distinguished. Perhaps this has something to do with the place and mode of origin of the two rivers. The Bhagirathi rises from the snout of the Gangotri glacier at Gaumukh. The Gangotri glacier and its tributary glaciers cover a big area studded with and surrounded by snowy peaks. Frost erosion here supplies a big quantity of eroded material to the nascent Bhagirathi. The supply of water is also plentiful. Much of this material is transported and it gives the water a yellow and grey colour. The river also receives the waters of the Alakananda and other tributaries, which also bring much fluvio-glacial debris.

On the other hand, the Yamuna at its source gets only the snow-melt waters of Bandarpunch. Thus the water has distinctly much less detrital material in it and, therefore, its colour is blue.

Owing to the larger volume of water, the Bhagirathi has an open U-shape, but the Yamuna has a very narrow U-shape for six kilometres up to Janaki Chatti.

Another remarkable difference is the amount of glacial debris and morainic material found in the two valleys. Paradoxically, it is much more in the Yamuna valley. As the transporting agent is water, the larger amount of water in the Bhagirathi valley has washed away much glacial debris. Only boulders have been left behind. They may be called skeletal moraines. The boulder clay earth pillars between Gangotri and Gaumukh are the last remnants of true moraines.

In contrast there are vast deposits of moraines in the Yamuna valley. A huge triangular-shaped morainic platform presenting a 70-metre-high scarp towards the valley and a front of about two kilometres stands just below Janaki Chatti. Above it spread the apple orchards and potato and barley fields of Kharsali.

Smaller patches of this material are found up to a few more kilometres further down.

One may conclude that the amount of glacial debris present

today in the high Himalayan valleys is inversely proportional to the number and size of glaciers which feed the river today.

The Lake Land of Kumaon

Kumaon, like Mussoorie, is in the Lesser Himalaya. Here is situated another pretty Himalayan hill station, Nainital, which is located in a depression around a lake of deep blue water. Other lakes in this area are Bhim Tal, Naukuchia Tal, Sat Tal, Garal Tal and Khurpa Tal. To these may be added Sukhe Tal, a lake with no water, near Nainital.

A common structural feature of the Himalayan folded rocks is the 'overthrust'. Folds in the north have fallen over folds in the south. In this manner, limestone rocks have been overthrust on the Siwalik rocks around Nainital. The Siwalik range below the foothills is absent in Haldwani, or the plains below Nainital. The limestones, on the other hand, have lent characteristic land-forms to the area. One of these, in all probability, are lakes which have definitely been accentuated by limestone solution in rain water. The sudden height of the Nainital area, and the craggy formation of the Deopatha peak is also due to limestones. The China peak above the lake is made up of limestones. Sukhe Tal, a dry depression, must have holes in its bottom to allow water to flow down in a subterranean passage to the Nainital Lake somewhat below it. The lakes have no valley forms and are pure depressions. The great depth of Nainital and Khurpa Tal shows that they are solution lakes. Another theory of the formation of lakes is glaciation. But this is incorrect as no other glacial features are seen in the area. Yet another theory attributes the formation of lakes to a faulted shatter zone. However, the effect of limestones on landforms cannot be denied.

In the valleys around this area terraces and detrital cones called fans are common, specially in the valleys below Ranikhet.

East of Nainital, Almora and Chamoli are the hills and valleys of Pithoragarh. The river Kali Sarda here forms the border between India and Nepal. In the extreme north-east is the Lipu Lekh Pass which leads to Manasarowar and Kailash.

A number of valleys run north-west from Kali and some of them as Darma Ganga valley reach glaciated regions and snowy areas. The Sarju coming from Loharkhet and Bageshwar also falls into the Kali. There are a number of bowl-like features on the slopes above the Kali, where towns are located, such as the basins of Champawat and Pithoragarh.

MIDDLE HIMALAYA

The middle part of the Himalayan mountain arc may be supposed to be limited to the Nepal Himalaya. Here the Great Himalaya spreads more or less along the northern border of Nepal from the Nampa (6,750 m) and Api (7,132 m) peaks in the west to Kanchanjanga in the east. The river Kali forms its western boundary, and Mechi its eastern boundary. There are small areas north of the central axis here and there, such as those at Manangbhot. This part of the northern mountain wall may be further sub-divided into the Ghaghra basin in western Nepal, the Gandak basin in central Nepal and the Kosi basin in eastern Nepal.

The Great Himalaya extends from the Nanda Devi group of peaks into Nepal, where the highest peak is Api (7,132 m). To the east is Dhaulagiri (8,172 m) and Annapurna (8,078 m). Between these two peaks is the gorge of Krishna Gandaki providing a great contrast in altitude. Further east is Mt. Everest (8,848 m), the highest peak in the world and Kanchanjanga (8,598 m).

In the middle of Nepal, there is a continuous range running from west to east called the Mahabharat Lekh. The hills and valleys lying between the Great Himalaya and the

Mahabharat Lekh are somewhat less rugged. They have been called 'Midlands' by Tony Hagen.

South of this range, the hills drop to longitudinal valleys like the Duns of India. They have generally been called Bhitri Madhesh. Kamla, Narayani, Chitawan, Dang and Rapti are some of them.

South of Bhitri Madhesh, the Siwaliks are very clearly developed, specially in the west and the middle. They are called the Churia or Churia-Muria hills here. South of these ranges are Bhabar—like boulder wastes followed by Tarai forests which are being cleared gradually for cultivation.

Thus there are eight longitudinal belts in Nepal as follows :

(1) The Trans-Himalayan belt. This is found only in isolated patches in Nepal, the biggest being Manang Bhot,

(2) The Great Himalaya range running continuously along snowy peaks,

(3) The Midlands of Tony Hagen,

(4) The Mahabharat Lekh,

(5) Bhitri Madhesh,

(6) The Churia-Muria hills,

(7) The Bhabar lands,

(8) The Tarai forests.

The three river basins of Nepal are described below :

The Ghaghra Basin

This basin occupies the western part of Nepal. The longest river of this basin is the Karnali, which rises in the springs of Mapcha Chungo south of Manasarowar in Tibet. Being a tributary of the Ganga, it is taken as one of the four major antecedent rivers and is responsible for including Ganga in this category, the other three being the Sindhu, the Sutlej and the Brahmaputra. The Karnali flows south of Gurla Mandhata (7,728 m) and then enters Nepal.

A branch of the Ghaghra named the Seti rises near Api. The Karnali twists peculiarly by flowing east, then cutting a

gorge and flowing west joins the Seti. A large river, the Bhari, receives water from melted snows from the Dhaulagiri massif. Thus the Ghaghra has a very large basin, which supplies much water from melted snows. It is a major tributary of the Ganga. It pierces the Churia range below Gaundakanda and comes down to the plains as the Girwa and the Kauriala, which is known as the Ghaghra further down.

The Gandak Basin

The main river of this basin is the Kali or Krishna Gandaki, which rises north of the Great Himalayan axis beyond Manang Bhot, and pierces the Himalaya in a fantastic gorge at Dana only 1,200 metres high, cradled between two great eight-thousander massifs Dhaulagiri and Annapurna.

At Manang Bhot, the altitude is high, but the topography is subdued, similar to a Tibetan landscape. The Gandak cuts a gorge through young sedimentary rocks deposited in some ancient lake.

Large snowy groups of high peaks here are called 'Himal', such as the Himal of Dhaulagiri, Annapurna, Manaslu and Ganesh.

The Annapurna Himal consists of four large peaks in a high range. One of its southern spurs stands as a beautiful silvery horned peak, named the Machhapuchhare or 'Fish tail' mountain. From it descends the Seti Gandak which drains the vale of Pokhara, which is also an old lake-bed where limy deposits occur. The Seti cuts steep gorges in these deposits, and has underground passages. There is also a limestone cave named Mahendra Gupha. Granite and gneissic boulders are found scattered about in the valley, which were carried by past glaciers.

An important tributary of the Gandak is the Marsiandi which flows north of the Annapurna Himal and turns south between it and Manaslu (8,150 m). Here it joins the Trisuli which comes from Ganesh Himal. The combined

Gandak now cuts through Mahabharat Lekh and flows in the longitudinal valley of Chitawan. It comes out of the Churia range at Valmiki Nagar where a barrage has been built across it.

The Vale of Kathmandu

This is a small circular basin, which was a lake in the past. It is drained by the Baghmata river. Old lake deposits are found as terraces all round the valley. The airport of Gau-char is built upon such a terrace. The past lake was drained out when the river Baghmata cut a gorge at Chhobar through hard rocks. In mythology it is said that the God Manjusha cut this gorge with his sword, so that the lake emptied through it. He then presented this new land to the king of Nepal.

Layers of sand in these old lake deposits contain water from which springs come out.

The Kosi Basin

Three snow-fed rivers join above the Chatra gorge to form the Sapt Kosi or Kosi. They are the Sun Kosi, the Arun and the Tamur. The Sun Kosi rises beyond the snowy Himal of Gosainthan (8,031 m). The Indrawati after draining the eastern outer rim of the vale of Kathmandu joins it. Further down, the Bhola Kosi joins it, bringing the snow-melt waters of Cho-Oyu (8,171 m) and Gouri Shankar (7,145 m). It is then joined by the Dudh Kosi which drains the highest snow massif of the world, Mahe Langur Himal, which contains Mt. Everest (8,848 m). Contrary to previous belief, the top of this mountain is made up of limestone, while the lower portion is crystalline rock. Tony Hagen, a Swiss geologist, suggests that this limestone at one time covered the major peaks of the Himalaya. It has, however, been eroded and only its remnants are found on the tops of a few high peaks, Everest being one of them. The majority of other high peaks are made up of granite.

Below Everest is a giant amphitheatre-like bowl of ice walls called CWM by the Swiss. Surrounding it are two more peaks Lhotse and Nuptse. From the CWM drops an ice fall which gives rise to the Khumbu glacier. Here is another beautiful pyramidal peak, Amadablam. Further down is the Sola Khumbu valley above which the monastery of Thyangboche stands on a huge platform made up of morainic material.

East of the Everest massif is another fantastic gorge cut by the Arun river, which has a fairly large basin in Tibet revealing its antecedent nature. A tributary of the Arun is the Barun, which rises from the Barun glacier descending from Makalu (8,500 m), the fourth highest peak of the world. Both the Arun and the Barun have glaciated U-shaped valleys into which numerous waterfalls from hanging valleys scatter their cool spray.

The Tamur, the eastern tributary of the Kosi, rises from the western flank of the Kanchanjangha group of peaks called Kumbhakarn Himal. In the Kosi valley Mahabharat Lekh is easily recognized, but, Bhitri Madhesh and the Churia range are absent, as they are buried under over-thrusting rocks.

The combined river Kosi is a mighty river, when it issues out of the Chatra gorge, and comes to the plains. Here a barrage has been built across it at Hanuman Nagar.

A number of small rivers, including the Mechi, the easternmost river along the border of Nepal, flow into the river Mahananda.

EASTERN HIMALAYA

The western boundary of this region is the Singalila range anchored on Kanchanjangha, and the river Mechi, both running along the eastern border of Nepal. The eastern boundary ends at the sharp bend of the river Brahmaputra around Namcha Barwa (7,755 m) in Tibet.

It covers the Himalaya which spreads into Sikkim, Darjeeling, Bhutan and Arunachal Pradesh, previously called the North-East Frontier Agency or NEFA.

Sikkim and Darjeeling Himalaya

This area is mainly drained by the river Tista and its tributary the Rangit. Two transverse ranges running north-south enclose it. They are Singalila in the west and Dongkya in the east. Here the Great Himalaya runs from west to east from Kanchanjangha to Chomo Lhari (7,314 m). It lies near the northern border of Sikkim, though a small portion in the east in the Chumbi valley, which forms part of Tibet. In fact, the Chumbi valley is the only area south of the Great Himalaya which belongs to Tibet.

The highest portion of Sikkim is in its north-west. A large number of seven thousanders stand here, with Kanchanjangha (8,598 m), the third highest peak in the world, as the centre piece. From Darjeeling the Kanchanjangha group looks like a magnificent backdrop consisting of Jano, Kabru (7,338 m), Pandim (6,709 m), Narsing (5,831 m) and Siniolchu (6,815 m). Tourists visiting Darjeeling gather in the cold morning hours on the top of the Tiger Hill (2,567 m), 11 kilometres away, to watch the phenomenon of pinking on the snow as the sun rises from the plains of Cooch-Bihar. The great height of the peaks which can be watched easily from a convenient view-point from the plains is unique. Even before the sun pops out of the horizon, its pink rays colour the white peaks one after another according to their altitude. If one is lucky, one can also see a portion of the Everest range, including Mt. Everest and Makalu to the west. All this pinking is seen even when it is somewhat dark in mist shrouded Darjeeling below.

Along the north-south Singalila range, the peaks from north to south are the Jonsong peak (7,442 m), the Pyramid peak (7,365 m), the Kanchanjangha, the Kablru and so on. On the same range further south are the peaks of Singalila (3,679 m), at the north-western corner of Darjeeling district, Phalut (3,596 m), Sandakphu (3,323 m) and Tanglu (3,063 m). Perhaps the most

remarkable view of snowy ranges is obtained from Sandakphu revealing a complete array of peaks of the Everest and Kanchanjanga groups.

The Great Himalaya runs eastwards from Kanchanjanga to Kangchanyao (6,889 m), Pauhunri (7,128 m) at the northern end of the Dongkya range and Chomo Lhari across the Chumbi valley.

A number of glaciers descend from the eastern slopes of Kanchanjanga into Sikkim. The biggest of them is Zemu, from whose snout above Lachen Gompha (monastery) rises the Tista. It is joined by the Lhonak river from the north. The river Lachung rises from Pauhunri and joins the Tista at Chumthang.

A magnificent view of the Kanchanjanga group of peaks called Kumbhakarn Himal, is obtained from Singhik rest-house only 2,000 metres high, perched on a ledge over the roaring torrent of the Tista a thousand metres below. The distance of Kanchanjanga from Singhik is about 40 kilometres as the crow flies. It is seen from the Talung valley which ends in the Talung glacier and the Talung peak (7,351 m). From here one can also view the jagged snowy ridge top of Dongkya 25 kilometres away up the Tista, which bends here to the north-east. Straight north one can also see Lama Anden (5,867 m) south of Lachen.

There is a striking contrast between the deep gorge bottom of the Tista and the enclosing mountains including the Kanchanjanga group. Within a few kilometres of the rise of the Tista from the Zemu glacier snout, it drops to 1,000 metres near Singhik and Mangan in Central Sikkim.

The Dongkya range along the eastern border of Sikkim is lower and has an average height of 4,500 metres. A number of passes lead to the Chumbi valley across it. Two important ones are Jelep La and Nathu La, about 4,000 metres high.

The mountains of south-eastern Sikkim, and also the eastern slopes of the Singalila range, the northern face of the Ghoom ridge and the western slopes of the Darjeeling spur,

drain into the great Rangit river, a large tributary of the Tista. From the north, it is fed by glaciers on the southern slopes of the Kanchanjanga group of peaks. River terraces are very well developed in the lower portions of the rivers of Sikkim.

The hills of Darjeeling are divided into two parts by the deep gorge of the Tista. To the east of the gorge are the Kalimpong hills rising to a peak 3,200 metres high. Rivers radiate in all directions from it, ultimately draining into the Tista. To the west of the Tista gorge, the highest peak is the well-known Tiger Hill (2,567 m). From it also spurs radiate in many directions: the Darjeeling spur to the north, the Takdah spur to the east, the Dow Hill ridge to the south ending in the plains of Siliguri, and the Ghoom ridge to the west anchoring in the Singalila range near Manebhanjang and Sukia Pokhri. South of the Ghoom ridge the Balason river, fed by rain water, flows southwards into the Mahanadi, which is also of a similar nature and which rises from the Dow Hill. The two combined rivers join the Mechi and are thereafter called the Mahananda.

Bhutan Himalaya

Much of this portion of the northern mountain wall is unexplored. The Great Himalaya range runs along its northern border eastwards from Chomo Lhari (7,314 m) to Kulha Kangri (7,541 m), the highest peak in Bhutan. It goes out of Bhutan and continues in the North-East Frontier Agency or Arunachal Pradesh.

There are no large river basins in Bhutan as in Nepal. The biggest river is the Manas in the east, which flows into the Brahmaputra. Little is known about the physiography of the upper reaches of this river.

On the western border the river Amo Chhu enters Bhutan from the Chumbi valley in a deep gorge. It flows out of Bhutan to the plains of Jalpaiguri as the Torsa, which has earned a bad name, having been called 'turbulent', as it

becomes a ferocious torrent during the rainy season and causes widespread destruction.

Further east the Paro Chhu joins the Wong Chhu at, what has been called, the 'confluence' by the road-builders of Bhutan. It then proceeds to the plains as the Raidak. The next great gorge is that of the Mo Chhu, which flows past Punakha deep in the mountains, and comes out into the plains as the Sankosh.

The northern half of Bhutan is fully glaciated. There are numerous amphitheatres and glacial basins, some of which are exposed lake bottoms.

Assam Himalaya

The Great Himalaya range further east runs along the northern borders of Arunachal Pradesh. In fact, at many places the Mac Mahon Line, which is the border, runs along its crest. It may be supposed to end in the massif of Namcha Barwa (7,755 m), surrounded on three sides by the great bend of the Brahmaputra, whose fantastic gorge has yet to be negotiated by man. In spite of its being in Arunachal Pradesh, it is called the Assam Himalaya. Facts about its physiography are little known so far. At present it is being studied for strategic reasons. A conspicuous feature is the Apatani plateau, which is fairly level and well irrigated by the Apatani tribal people.

There are a few parallel ranges south of the main range, but they often run in a confused manner. They are cut up in pieces by north-south-flowing rivers. There is no counterpart of the Siwalik range here.

A number of rivers flow across the Mac Mahon Line into Tibet. The source streams of the Manas also have penetrated Tibet. Here Bum La, a pass on the frontier, leads to the high valley of Tawang (3,050 m) with its famous monastery. South of this valley is the Middle Himalaya range on which is situated the Se La pass about 5,000 metres high. South of it again is the Lesser Himalaya range with

the Bomdi La pass about 3,000 metres high. Further south are the foothills.

East of Tawang are the high valleys of the Bichom and the Tenga. The river Kameng rises in the Kangto group of peaks on the border and joins the Bichom before coming down to the plains.

The Middle Himalaya continues across the Subansiri basin up to the upper Debang valley.

Subansiri is a major tributary of the Brahmaputra. It is an antecedent river as it has a big catchment area in Tibet. It crosses the frontier at Migyitun near Longju. Two of its tributaries the Yume Chhu and the Chayal Chhu also enter Tibet.

The river Brahmaputra enters India after making two sharp bends in the north-east. Here it is called the Dihang or Siang. Near Sadiya two more rivers, the Debang or Sikang and the Lohit join it. The latter again enters Tibetan territory near Rima.

Thus there are at least four antecedent rivers penetrating the Assam Himalaya and going into Tibet, the Manas, the Subansiri, the Brahmaputra and the Lohit.

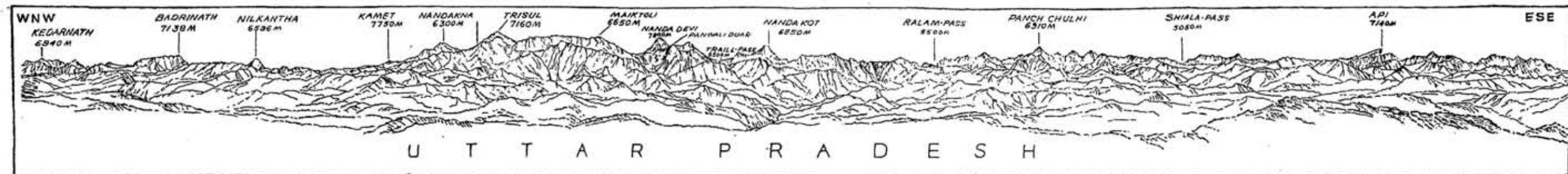
THE EASTERN HILLS AND RANGES

These hills and ranges run in an NNE-SSW trend and gradually curve out to the SSE as the Arakan Yoma in Burma. They may be supposed to begin from the Noa Dihing, a tributary of the Brahmaputra, and continue as the Naga Hills, Manipur and Mizo Hills. The Meghalaya plateau and the Mikir Hills may also be included in them.

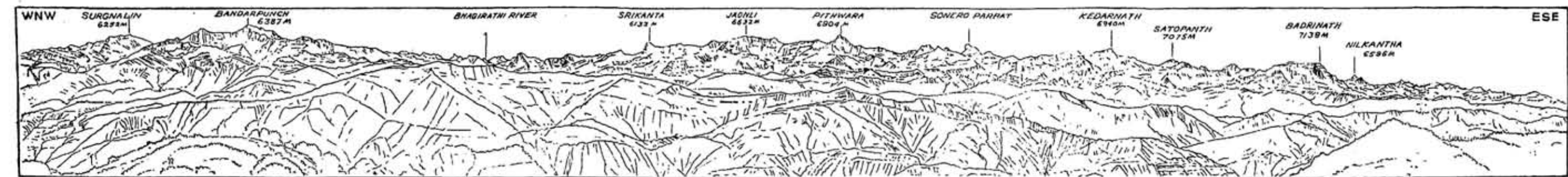
Patkai and Nanga Hills

These hills run along the Indo-Burma border in a north-east-south-west direction. The highest point is a peak 3,856 metres high in a finger-like protrusion of Indian territory towards the south-east. The average height of the ridge tops, however, is about 2,000 metres.

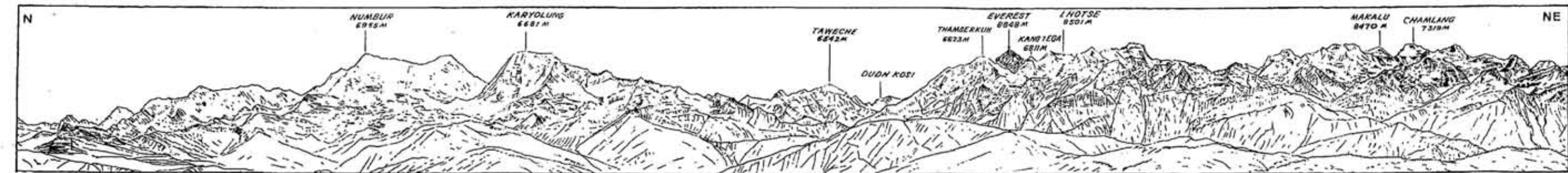
The hills broaden out towards the south around Kohima,



PANORAMA OF EASTERN KUMAON HIMALAYAS



PANORAMA OF CENTRAL KUMAON HIMALAYAS



PANORAMA OF EASTERN NEPAL HIMALAYAS



where their height increases. The highest peak here is Japvo (2,995 m). East of Kohima is the Mol Len peak, 3,104 metres high. These hills consist of a number of narrow ridges and valleys. Though the general height of this place is not much, the gorges are so deep and the ridges so sharp-crested, that it has a very rugged appearance. They are covered by dense forests as the rainfall here is heavy.

The Vale of Manipur

This is another exposed lake bottom. It consists of a flat plain of deposition surrounded by hills on all sides. Perhaps the Logtak lake and marshes are remnants of the past lake. The flat basin is drained by the river Manipur southwards. It joins the river Myittha in Burma which flows northwards to join the Chindwin. While the basin has an altitude of about 1,000 metres, the surrounding hills run up to about 2,000 metres.

The Mizo Hills

Here longitudinal ridges and valleys packed in narrow lines predominate. Such a structure is said to be of the Appalachian type which is found in the U.S.A. This type of topography prevails in the adjacent parts of Pakistan and Burma. The drainage pattern consists of parallel lines with transverse connections. The rivers often change direction completely, like the Manipur river mentioned earlier. Such a pattern is called 'trellised'. The ridge crests in Mizo are about 2,000 metres high and the valley bottoms 500 metres. The grain of the country is north-south.

The rivers to the north flow into the Surma, and those to the south flow into the Kaladan and on to Burma. The river Karnaphuli to the west has a nearly perfect trellised pattern of drainage. It flows into Bangla Desh.

The highest peak of this area is Nauzuarzo (2,140 m). The Mizo Hills are also densely forested. There are dense jungles of bamboo in the valley bottoms.

The Mikir Hills

This hill is the result of erosion from all sides, and its separation from the adjacent Meghalaya plateau, both of which are made up of the same type of ancient, igneous, crystalline rocks. The two rivers which are responsible for this erosion are the Dhansiri and the Kopili. The highest peak of the hills is Dambukcho (1,363 m) in the centre of the hills. The Mikir Hills are a result of what geographers call 'circumdenudation'.

III. CLIMATE, VEGETATION AND SOILS

THE CLIMATE of the northern mountain wall of the Indian sub-continent is extremely varied, largely due to variations in altitude and aspect. A few examples will illustrate the point.

Altitude

The snowy and intensely cold arctic climate of the Everest area may be contrasted with the pleasant temperate climate in the Arun Gorge just below it. By the side of the hot tropical valley of the Tista are cold snowy wastes of Kanchanjangha. The climate changes within a few kilometres.

Poet Kalidasa's description of the Himalaya at one place in the *Kumar Sambhava* is significant :

आमेखलं सञ्चरतां घनानां,
छायामधः सानुगतां निषेव्य ।
उद्वेजिता वृष्टि भिराश्रयन्ते,
पूरङ्गणि यस्यातपवन्ति सिद्धाः ॥

"After enjoying the cool shade under the cloud around whose girdle the saints, being troubled by rain, take refuge in the sun-drenched high peaks above."

While sitting in the sun at Tungnath, a lone peak about 4,000 metres high lying in the Badri-Kedar region, one can sometimes note an electric storm passing down below in the valley, and rising upwards to the higher slopes. Instead of rains there may be snowfall white-washing the rocky ramparts as it passes by. While it may have rained heavily in the valley below and snowed further up, the higher peaks may still be bathed in sun-light.

Thus the most important factor controlling the climate and weather types in the Himalaya is altitude. Applying the principle of lapse rate, the low valley bottoms below

600 metres have a hot and moist tropical climate. It gradually cools further up till at 2,000 metres the climate is cool temperate. Higher up, it may be cold temperate up to 3,000 metres. Further up, the cold increases till one reaches the snow-line, which depends mainly upon altitude. The climate here changes from Arctic to Polar as the altitude rises. Other factors present will be indicated later.

The following observations of Dr Fritz Muller in the Everest region from the plains of Purnea to the Khumbu glacier are noteworthy. "The result showed an unexpected aridity in the Everest region. The precipitation at 5,300 metres from April 12 to November 26 was only 39 cm here as compared to 199 cm at Chisapani and 225 cm at Sirha on the Ganga plains." Rainfall is also controlled by altitude.

Transversely, it goes on increasing with height up to an optimum at about 2,500 metres. It then starts decreasing. Indeed the rainfall is low beyond the Middle Himalaya and very low beyond the Great Himalaya. Lahul is dry, but Ladakh is very dry. Thus altitude controls not only temperature but also rainfall.

Aspect

The second most important factor is perhaps aspect. The south-facing slopes are more sunny and get more rain. The lower slopes behind high ridges fall in the rain shadow. Darjeeling gets less rain and is less misty than Ghoom, which is higher. More rain and snow fall on the southern ranges. There is more dessication further north. Paradoxically, therefore, the lower ranges have a lower snow-line and the higher ranges in the north have a higher snow-line. Also in each individual range the snow-line is higher on the southern aspect because of the sun shining there.

In the Bhagirath Kharak glacier valley, on one side there is the northern face of Balakun, which is nearly frozen. But the southern face of Devdekhane has a milder climate with

some grass and junipers. There snow-melted water, and a great variety of mosses occur.

At a triangular spot at the junction of the Satopanth and Bhagirath Kharak glaciers, the aspect is very sunny, and so it has a warm temperate climate.

Summer Monsoon

Seasonal winds are very important, specially because they carry moisture. In summer the monsoon from the south-west brings the chief amount of moisture. Its direction makes the eastern Himalaya rainier. Assam, Bhutan, Sikkim and the Darjeeling Himalaya are very rainy. The rainfall is medium in Nepal less in Uttarakhand, and lesser in Himachal Pradesh. Kashmir is fairly dry. The more one moves westwards and northwards, the total amount of rainfall as well as the duration of the rainy season decreases.

Winter Monsoon

In winter the north-east land monsoon, the same as the north-east trade wind which blows normally all over the globe in these latitudes, establishes itself. It has more or less a northerly direction and blows with great velocity in the regions 3,000 to 5,000 metres high. In particular it blows with the speed of a gale along mountain passes, through which it finds an escape. This wind which is well-known in the Rohtang pass blows away men and sheep crossing the pass, and rattles down the Beas valley shaking even the rafters of the Koti Rest House.

Western Disturbances

In winter also the global westerly wind of mid-latitudes now and then establishes itself, specially in the western parts of the mountain wall. With it are associated shallow cyclonic depressions which move westwards. They conduct moisture in the Himalaya, more in the west and less in the east and are called Western Disturbances. To the lower regions they bring some

rain, but higher up they produce much snowfall. Sometimes they create blizzards, dislocating air traffic and closing the high passes. Their approach is heralded by warm winds from the south-east. Cirrus and cirro-cumulus clouds appear, changing to grey skies filled with stratus. This is followed by drizzling rain in lower altitudes, sleet higher up and snowfall further up. If the depression is strong, there may be very heavy snowfall. At the end come freezing cold blizzards and strong northerly winds. The intensity of the Western Disturbances decreases as we go eastwards, and precipitation from them is very little in the Assam Himalaya.

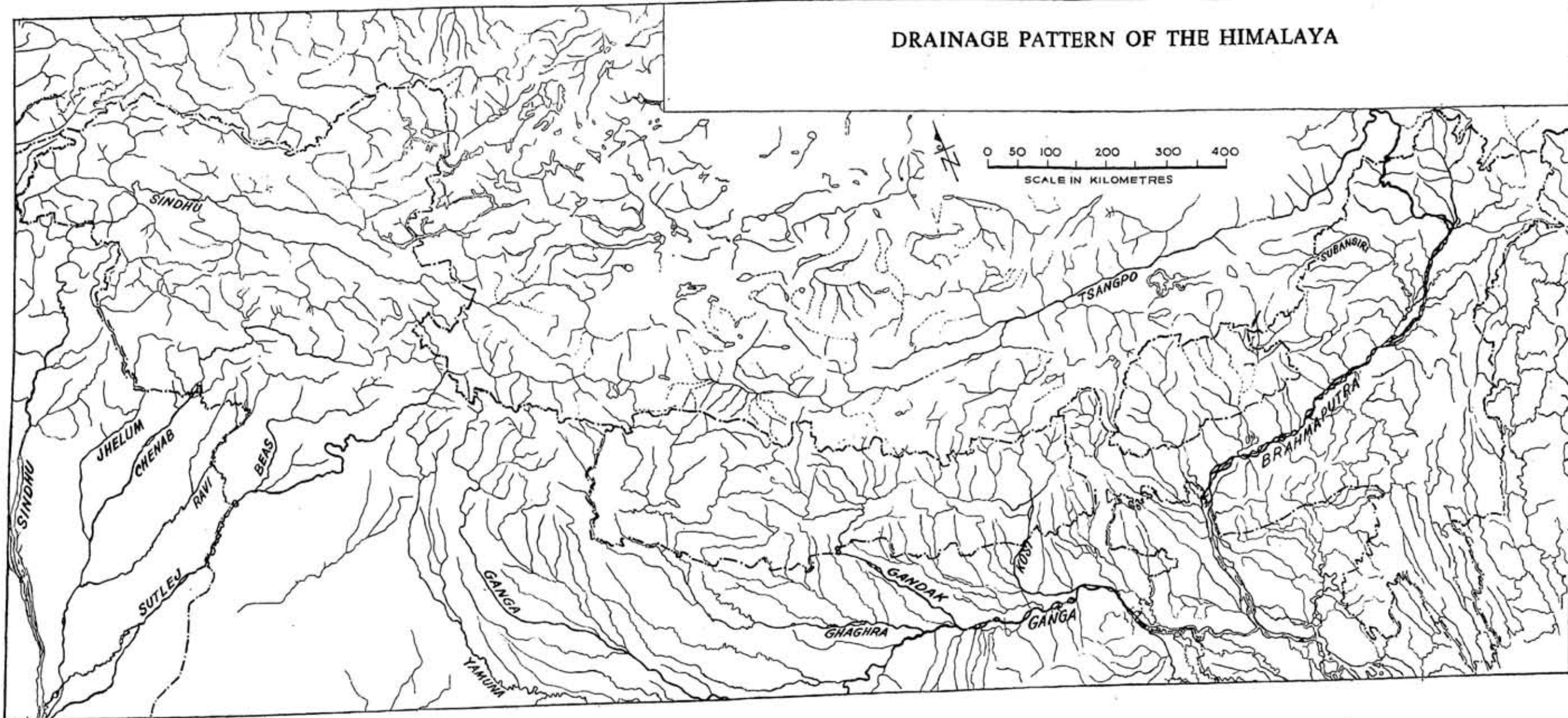
Gravity Winds

The vertical movements of air produced by change of temperature as the day advances, are called gravity winds. They are very important as far as the Himalaya is concerned. Tourists visiting hill stations anxious to view the snowy ranges in the distance must be up early. After the downward movement of air after sunset, clouds and mists roll down the slopes into valley bottoms and *khads*. Sometimes one may observe a white cloud sailing across a ridge in the evening, and being caught by the ridge as it descends, so that it rolls back downwards. Usually by midnight the mists roll down in the *khads* to sleep for the night in the valley bottom, so to say and the skies become clear and starry.

As morning breaks the mists warm up and start ascending like white balloons. They soon cover up the snow views in the distance, and late risers miss the glorious scene. Of course, there are two variations, one when there is too much rain and mist and the high clouds never clear up. The other is when it is exceptionally dry and there are few balloon-like clouds. Snow views may then be had throughout the day.

By evening katabetic winds or down-flowing gravity winds, made heavy by cooling start rolling down the valleys just like water. They come down as gushing cool air, especially at points where the gorges open out on the plains. Sometimes

DRAINAGE PATTERN OF THE HIMALAYA





the gorge at Butwal in Nepal sends hats flying and even blows away tin roofs and walls of houses.

As the day advances, the anabetic or up-flowing winds start ascending. At about noon, they are seen rushing up the valleys furiously. One may notice this phenomenon at Badrinath. It produces some cloudiness in the afternoon, specially in the pre-monsoon period.

At very high altitudes above 7,000 metres, sometimes winds of extraordinary velocity blow. They produce white plumes on the tops of high peaks, such as the plume of Mt. Everest. Most probably the plumes consists of cold, dry, powdery snow blown by the wind. Another conjecture is that strong winds produce a vacuum on the leeward side, which sucks up snow powder. It is also possible that they are produced by jet streams of wind, which are supposed to occur at high altitude.

The Cycle of Seasons

The march of the seasons in the Himalaya may now be summarized.

In April the weather is very clear, especially in the east. The air is cold and dry. The sun is bright and the nights are clear and starry. Frost is common. Even a little amount of moisture may condense into mist and fog, followed by frost. The fall of temperature at night and the attainment of the dew-point according to the amount of moisture present is the determining factor for the weather. On the whole the weather is clear and bright.

In May and June, especially in the western half of the Himalaya, the dust from the hot plain rises and covers the sky. Visibility is poor and even at Kathmandu it is quite warm. There are convectional and orographic storms accompanied by thunder and lightning. After almost every evening, one can see lightning on the horizon towards the north near the snowy ranges. A heavier storm may come down to the hill station when the dust is cleared and visibility improves temporarily to give bright snow views.

Such a weather continues till the arrival of the monsoon. There is a great amount of snow-melted water in June in snow-fed rivers. The river Baspa in the Sutlej valley is in high flood in June and so are many other snow-fed mountain streams. This is also the time for avalanches as bases of snow accumulation become slippery due to melting.

From July to September, there is heavy rain. In August the snow is the least. Fresh snow may fall at the end of September. There is very heavy rain in the east and it gradually decreases in the west. The famous Amarnath Yatra in Kashmir takes place in August, when the chance of a snow fall is the least. However, there are exceptions. Bad weather killed a large number of pilgrims on the Mahagunas pass in August 1970. However, this is rare.

In October, the weather clears up in the west, and November is very sunny and bright in the east. It is the best month for visiting Darjeeling. By December the northern dry wind is well established all over the Himalaya, but in the west it is affected by occasional Western Disturbances. At this time up to February, the Western Himalaya gets its maximum snowfall.

By March the weather starts improving again.

Climatic Regions

These regions are more or less altitudinal, running in narrow belts from east to west. Five such belts may be recognized as follows :

- (1) Below 800 metres—warm tropical,
- (2) 800 to 1,200 metres—warm sub-tropical,
- (3) 1,200 to 2,400 metres—cool temperate,
- (4) 2,400 to 3,600 metres—cold temperate,
- (5) Above 3,600 metres—arctic.

These five belts may be divided into three grades by grouping them into western, central and eastern parts. This makes fifteen divisions. The eastern parts have more rain and less snowfall. The snow-line here is higher than in the

west. Darjeeling above 2,000 metres has rarely a snowfall whereas it is common at such a height in the Western Himalaya, where Simla has a heavy snowfall at the same altitude. The western part has also a higher latitude and so it is colder, with a lower snow-line, in spite of the fact that it is drier.

The central portion is intermediary.

The following figures of average monthly rainfall and temperature for four stations further illustrate the great climatic variation in the Himalaya.

The first station is Leh in the western zone in the highest belt. Its monthly average temperature in centigrade and monthly rainfall in millimetres is given below :

	<i>Jan.</i>	<i>Feb.</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
Temp.	8.2	7.3	7.6	6.1	9.9	14.3
Rainfall	10.2	7.6	7.6	5.1	5.1	5.1
	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
Temp.	20.3	16.1	12.1	5.9	5.7	5.5
Rainfall	12.7	8.7	7.6	5.1	5.1	5.1

The height of Leh is 3,522 metres.

The average annual temperature is 10°C and the total annual rainfall 84 mm.

The second station is Simla in the western zone at an altitude of 2,130 metres. The rainfall is here given in centimetres :

	<i>Jan.</i>	<i>Feb.</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
Temp.	5.5	5.5	10	15	18	20
Rainfall	9.0	9.2	8.2	6.7	9.7	22
	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
Temp.	18.1	18	16.6	14.4	10.1	11.1
Rainfall	52.7	51.7	18.7	3.5	1.2	3.2

The average monthly temperature of Simla is 13.3°C and the total annual rainfall is 198.2 centimetres.

The third hill station is Darjeeling in the eastern zone at the same altitude as Simla, i.e., 2,130 metres.

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	<i>Jan.</i>	<i>Feb.</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
Temp.	4.4	5.5	10	13.3	14.4	15.5
Rainfall	1.5	2.7	4.5	9.5	21.7	62.2
	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
Temp.	16.6	16	15	13	9	5.5
Rainfall	80.7	65.2	46	11.2	2	.5

The average monthly temperature is 14.4°C, which is slightly higher than Simla, making Darjeeling slightly warmer.

The total annual rainfall is 307.7 centimetres.

The fourth station is Cherrapunji further east and south in the eastern hills and ranges. Its altitude is 1,310 metres. It is the rainiest place in India :

	<i>Jan.</i>	<i>Feb.</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
Temp.	11.7	13	16	18	19	20
Rainfall	1.7	5.7	20.5	78.2	127.2	259
	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
Temp.	20.5	20.5	20.5	19	16	13
Rainfall	268.7	203.7	123.5	42	5.7	.7

The annual rainfall is 1,142 centimetres. The average monthly temperature is 17°C.

NATURAL VEGETATION

In the Himalaya the climate changes from tropical to temperate and finally to the tundra type near the snow-line as nowhere else. The natural vegetal cover here, therefore, is unique. Such extensive stands of pines, deodars, beaches, rhododendrons and birches are not available anywhere else in India.

These vegetational belts are generally arranged altitudinally, but there is a distinct change from west to east as moisture increases.

SUB-TROPICAL SEMI-DESERT VEGETATION

In the north-west in the Kashmir, Kabul and Kunar valleys where much of the area is bare rock and gravel,

sub-tropical semi-desert vegetation occurs. It consists of dry thorny bushes, shrubs and trees. Such vegetation reaches up to about 2,000 metres on Nanga Parbat and occurs at the foot of the Salt range, and on both sides of the Siwalik range in Jammu and Kashmir. It spreads in the east up to Hoshiarpur and Ambala, where acacia (*babul*) grows up to a height of five to ten metres. Rainfall in the west of this region is 13 to 16 centimetres and up to 25 centimetres in the east. The dry vegetation consists of acacia and similar vegetation like *Prosopis spicigera* and *Zizyphus jujuba*. Such vegetation occurs in some well-defined habitats like dry river valley beds, rock scree and heavily-croded foothills.

SUB-TROPICAL EVERGREEN FORESTS

This vegetation occurs just above the previous type, roughly from 500 to 1,500 metres. It is a low sort of forest of trees and shrubs with small and evergreen leaves and thorn shrubs. It occurs in the Jhelum, Chenab and Sutlej valleys. There is a rainfall of 80 centimetres in such forested areas. The floristic composition is *Olca cuspidata*, *Dodonaea viscosa*, *Pistacia integerrima*, *Carissa spinarum* and *Acacia modesta*. At some places, *Nerium odorum* or *Oleander* is found.

Artemisia Steppe

This vegetation generally occurs in dry conditions. From a distance, slopes appear to be sprinkled all over with shrubs of *Artemisia maritima*, *Eurotia* and *Kochia*. It is mainly distributed in the north-west parts of the Himalaya. On slopes exposed to the south, *Artemisia* penetrates far into the regions of moist coniferous forests, as in the valleys of the Kishenganga and the Sindhu in Kashmir. On the northern slopes, it goes up to 3,000 metres on the Nanga Parvat and 4,200 metres on the southern slopes where it merges with the moist Alpine belt.

Steppe Forest

This is transitional vegetation between steppe country and forest proper. The chief trees here are Juniper, pine and oak. They occur in gorges where rivers cut through the main ranges, such as those of the Sindhu (Indus), the Sutlej, the Kali Gandak and so on. The forests are of light and open communities. Sometimes there are aromatic shrubs and a thin grass cover. Some associations are *Pinus gerardiana*, *Pinus excelsa*, *Quercus ilex*, *Artimisia maritima* and *Rosa webbiana*. On Nanga Parvat they are found between 2,000 and 3,000 metres on the northern slope and 4,000-4,200 metres on the southern slope. In the east, this forest consists of *Pinus khasya*, which seems to be a man-made association, resulting from the burning of forest for *Jhoom* cultivation as in the Luhit valley. The oakwood of *Quercus ilex* is used for tool-making.

FOREST OF PINUS ROXBURGHII

Pure stands of these pines are very common in the western Himalaya between 1,000 and 2,000 metres. This pine dominates the type to the exclusion of any other associate. It is a light green open forest, 20-30 metres high. There are only a few shrubs in the undergrowth. Grass appears during the monsoon. Just before the rains there is a thick cover of pine needles on the ground which is very slippery. Forest fires are a common feature during winter when the vegetation is dry. The resin in the trees makes it inflammable. This pine has a tendency to spread at the cost of other trees. Therefore it is often called a fire climax. Pines are slowly replacing oaks. Resin is tapped extensively in this forest. Large areas in southern Kashmir and the Murree hills are covered by *Pines roxburga*. Dharamsala, Kangra, Kulu, lower areas of the Simla hills, the Giri and Tons valleys are full of these pines. They are found extensively in the Yamuna, Bhagirathi and Alakananda valleys up to nearly 2,000 metres. Extensive pine forests occur in Ranikhet and

Almora. In Nepal they are found in the west and centre in the Ghaghra and Gandak valleys.

There are some patches of oaks, such as *Quercus incana* and *Q. dilatata*, but they are heavily lopped.

Forests of Cedrus Deodara

This is another tree which occurs widely above the pine belt in the western Himalaya and spreads in the east up to eastern Nepal. It is also found in association with other trees in the ranges and high valleys of Kashmir, Chamba, Kulu, Simla, Kinnaur, Jaunsar-Bawar around Kanasar and Kharamba, the upper valleys of the Ganga, Ghaghra, Gandak and Kosi.

In Kashmir and Kinnaur are found Chilghoza pines, whose cones give the Chilghoza nut. There is a scattering of *Cedrus Lebani*. A conspicuous tree of this species in the Baspa valley in Kinnaur has a girth of eleven metres.

In the vale of Kashmir are broad-leaved deciduous trees such as walnut and chestnut (Pangar). The stately Chinara is worth mentioning. Willow is grown in marshy areas for supplying cane. Mulberry for rearing silk worms grows in Kashmir. Poplars grow in many situations in Kashmir and other western valleys. Walnut and chestnut are also found in the Bhagirathi, Alakananda and Pindar valleys. Thin bamboo thickets called Ningala are extensively found here, specially in Almora.

Deodar which can stand snow cover grows in high and inner Himalaya. The tree often attains a height of 20 metres, as at Manali, Lakar Mandi, Khajiar, Baspa and other places. Pure stands occur between 2,000 and 3,000 metres. Rain in winter and snow-melted water in summer sustain them.

Rhododendron trees with their scarlet bloom in May occur in association in Simla, Chakrata and the Ganga valley. There is tree rhododendron forest at Dhuniadhong in Sundardhunga valley.

In eastern Himalaya in Arunachal, the forests are mixed.

There is much oak, pine and rhododendron in Sikkim and Bhutan. On limestone outcrops occur giant trees called *Cupressus torulosa* which attain a height of 45 metres.

Evergreen Mountain Forest

This type of forest occurs around Darjeeling, Sikkim and Bhutan between 1,800 and 2,500 metres, and perhaps in NEFA. It is a dense evergreen forest up to 30 metres high with a closed canopy. Branches and trunks are thickly covered by moss, orchids and swaying garlands of lichen. These forests are perhaps the darkest and gloomiest in India. In them are found oaks of many types, magnolia and rhododendrons. One can see them in the Ghoom-Sukia-Pokhri road, specially near the Nepal border. Pines are absent. Higher up are cedrus, larches, etc. Pure stands of *Cryptomeria japonica* have been planted here successfully. Above 2,500 metres are pure stands of rhododendrons.

Tropical Deciduous Forests

These are better known as terai forest which spread below the foothills along the plains. The commonest tree here is *Shorea robusta* or Sal. There are other tropical deciduous trees such as *Bombax malabaricum* (Simul) as in the Chauka valley in Bahraich, *Dalbergia sissoo*, *Terminalia tomentosa* and so on. Big grasses and bamboos occupy clearances.

Sub-Alpine Vegetation

In the west these forests are dominated by *Betula utilis*. There are dwarf trees, birches and conifers rising above them, mainly abies. Birches are found up to 4,000 metres in the Arau valley in Kashmir, the Bhagirathi valley above Gangotri and some other such situations. Junipers and rhododendrons occur fairly extensively. This vegetation is the uppermost limit of the tree-line (Nanga Parvat—3,900 m and Langtang Nepal—4,200 m).

In the east there are extensive stands of dwarf rhododendrons which sometimes entirely cover the area, as around the Chhangu Lake in Sikkim.

Alpine Scrub and Meadow

This vegetation occurs below the snow-line and is very similar in the west and the east. Generally there is scrub in the northern aspect and grass in the southern aspect. There are many plants growing in rocky fissures and chasms and many types of sweet edible berries, which also occur in the lower levels. Some medicinal plants and much Guggul occur, as in Pindari and Nilkanth. Guggul is used to produce incense and is found extensively. Alpine grasses provide highly nutritive grazing-grounds. Mamla grass grows from 4,000 to 5,000 metres in the Bugiyals in these regions. At the upper limit of the grasslands occurs Guggul, a scented shrub.

There is a great variety of flowers in the Alpine meadows, as in the Valley of Flowers. Amongst the herbs a good number are well-known as they are popular garden flowers. They are Gentiana, Primula, Iris, Saxifraga, Geranium, Aster, Thymus, etc. Medicinal plants are Pulsatillum, Aconitum and many others. Climatic conditions of the type occur at Leh in Ladakh and Poo in the Sulej valley.

SOILS

The soils of the Himalaya are extremely varied. They depend upon various factors. Altitude and vegetation cover are very important. Slope and aspect are of great importance. In higher altitudes glacial action, past and present, has to be taken into account.

In the lowermost areas, where plains meet hills, there are vast deposits of gravel and coarse sand. At places where the rivers flow, there are strips of alluvial soil. At some places red loams prevail.

In the tropical forests soils are leached, but are often rich in humus, though in the A-horizon there is much oxidization.

In the middle and lower ranges there are strips of alluvium along river-beds. River terraces have good alluvial soils. Forests of pines and conifers develop acidic soils and podzols. Oak forests produce brown forest soils. Marshy areas develop peaty soils. Slope and erosion are very important here. Steep slopes have immature or thin rocky soils.

In higher areas are fluvio-glacial soils on terraces. In glaciated areas are found boulder clay and out-wash soils. In cold areas near the snow-line, the soils are immature. Soil study in the Himalaya has been meagre and patchy.

IV. RESOURCES

THE HIMALAYA HAS A great variety of resources, but they have yet to be fully tapped. They consist of water power resources, minerals, grasslands, forests, agriculture and horticulture. Many of these are controlled by the environment which consists of altitude, aspect, slope, ruggedness, climate and so on.

High Level Grasslands

In general the land above 5,000 metres in the Himalaya mainly consists of rock and ice. There are some patches of grass where the aspect is favourable. Sheep, goats and cross-breeds of yaks graze in these places during summer. 'Guggul' the scented shrub grows wild and is collected to produce incense. Another shrub called 'Kuth' is cultivated in Lahul and its roots are sent to Hongkong for making medicines. 'Mamiri' a kind of root is also collected in Uttarakhand. An ashy material called 'surma' made from it for application to the eyes is sold in Badrinath. Ratan-jyot, another shrub is collected in Yamunotri region. Perhaps there are great varieties, of medicinal shrubs in high Himalaya whose use is now not available to us. Researches are being carried out in this direction and more knowledge about them is being obtained. Some leading Ayurvedic firms have got interested in collecting them for medicinal purposes.

Between 4,000 and 5,000 metres where the cold is too much for trees to grow grassland are found. Since the grasses are very nutritious flocks of sheep, goats, cattle and a few horses are kept in these grasslands during summer. Many semi-nomadic tribes such as the Gujars of Kashmir are engaged in this activity.

High level sheep give very good quality of wool. The best type of wool is called 'pashmina' in Kulu and Kashmir. A great variety of woollen goods are produced from wool, obtained throughout the Himalaya. Government is developing many sheep-breeding farms, where new varieties of sheep are being introduced.

Between 4,000 and 5,000 metres, high level grasslands are found extensively. They are called 'Margs' in Kashmir, 'Thach' in Kulu and 'Bugiyal' in Uttarakhand. They were partly covered by birch and juniper in the past near pilgrimage routes and centres. They have been cut to provide firewood. Lakshmi Ban, a birch and juniper forest near the source of the Alakananda, Chir Bas and Bhuj Bas, which are forests of pine and birch on the way to Gaumukh, a birch forest below the snout of the Kolahoi glacier in Kashmir, and the birch belt below Baloni in Sundardhunga are proofs that such forests can be usefully grown. Birch bark is used as a substitute for paper.

Sheep and goats are not much used for mutton and meat. Recently with the increase in tourist traffic, mountaineers and adventurous holiday-makers, the price of meat has gone up. The Gujars in Kashmir supply sheep and goats for meat at tourist centres like Pahalgam. The military personnel now stationed near the borders are also supplied sheep and goats for meat, as at a point near Mana above Badrinath.

The dairy industry can also be developed in the High Himalaya on the lines of Switzerland. Buffalo milk in western Himalaya from the Gujars can produce good quality cheese and butter. Now only a very poor quality cheese is being made. *Ghee* is also produced. Much milk is consumed by the shepherds themselves. They also supply milk to the towns of Kashmir, including Srinagar. The Gujars of the Bhagirathi valley migrate to the forests of Rishikesh in winter to supply milk to Hardwar and Dehradun.

High Level Agriculture

This is practised by the semi-nomads of Ladakh, Lahul, Nilang, Mana, etc. The most common grain grown is barley. A kind of grain called 'phabra' is also grown extensively. Both these grains thrive at an altitude even above 4,000 metres. Potato is grown, as also some wheat. This kind of agriculture is only meant to meet local needs.

Forests

An imaginary line may be drawn in the Himalaya between the grasslands and the forests called the tree-line above which trees do not grow. The tree-line runs approximately at an altitude of 3,500 metres. Near this line at many places are found rhododendrons. Higher up there are bush rhododendrons and lower down tree rhododendrons. Their only economic use is the supply of firewood, though they are well-known for their bright-coloured flowers. Scarlet rhododendrons are most commonly found in Sikkim and Uttarakhand. Near the Chhangu Lake in Sikkim and high up near Tunganath there are violet rhododendrons. They bloom in May and June, when tourists arrive. Tree and bush rhododendrons occur extensively in the Sundardhunga and Sukram valleys.

Tall, dark green deodars, firs and junipers and many other varieties of conifers which supply huge quantities of timber are found below the tree-line. In Kashmir they occur extensively around and above Pahalgam, around the meadow of Gulmarg and nearly everywhere else. Mixed up with them are found chestnuts and walnuts. The wood of the later is used for carving beautiful designs.

There are dense well-developed forests in Dalhousie and along the road to Chamba. In the Kulu valley there are giant deodars around Manali. The Beas and Sutlej valleys provide much timber. In the latter sky-line logging has been introduced and timber moves on hooks over wires. This type of transport is increasing in popularity.

In Kinnaur a kind of conifer yields 'chilgoza', a tasty

nut obtained from its fruit. On the way to the Baspa valley there is a dense forest, where giant *Cidrus Lebani* are found. One of these trees has a girth of 11 metres. Dense forests in Narkanda, Jubbal, Kanasar and Kharamba provide much timber.

Uttarakhand has dense forests near Jangal Chatti below Tunganath. But at many places there has been deforestation. Sky-line logging has been introduced in the Yamuna valley. There are dense forests here as well as in the Bhagirathi valley. In the upper valleys are found birches, which yield a kind of paper called 'Bhurja Patra' on which scriptures were written by saints in the olden times. There are dense birch forests above Gangotri, the Arau valley and many other places.

In the Darjeeling hills, *Criptomaria japonica* has been planted extensively and has proved a great success.

Though there is some exploitation of forests in Nepal, those of Bhutan and Arunachal have still remained largely virgin. They supply softwood, which can easily be made into pulp, though this is yet to be done. At present they provide softwood timber and some hardwood timber.

In the lower altitudes from 1,200 to 2,200 metres, the most common conifer in western Himalaya is the chir pine or *Pines roxburga*. Mixed up with these pines are oaks, such as *beaches* or *Quercus incana* and *Q. dilatata*. Besides yielding timber the pines from Kashmir to Uttarakhand yield resin from which turpentine oil is obtained. The resin is collected by tapping and sent to the plains to turpentine factories and is used in the paint industry. The chir pine grows very easily, and its extent is expanding. In fact, it has been said that it is expanding at the expense of oaks, which yield better timber and enrich soils more. It is high time that pulp from pines is used for making paper. In Meghalaya a new kind of pine called *Pinus khasia* grows extensively. It gives timber but does not yield resin.

Potatoes

This tuber is grown very extensively throughout the Himalaya in Kashmir, Kulu, the Simla Hills, Uttarakhand, Nepal and Sikkim. Besides supplying local needs, it is sent in large quantities to the plains. In autumn potato seed is sent down for cultivation in winter in the plains. Its cultivation is gradually increasing.

Government is doing much to improve its cultivation. Potato cultivation is rather damaging to the soils, and special care should be taken to stop loss of soil by erosion.

Fruits

Much temperate fruit is grown in the Himalaya, though its production can be easily multiplied tenfold.

In cooler and higher areas apples and pears are grown, while softer fruit such as apricots, peaches and plums are grown in slightly warmer areas.

Kashmir has been well-known for centuries for her orchards. A great variety of apples grow here and are sent to the plains. Apples are picked in autumn. A quantity is stored in pits filled with snow during winter for preservation. They are marketed in early summer. Apple orchards are owned by big and small landowners. They grow around the Wular lake, where Sopor is a big collection and despatch centre. Soft Kashmiri pears which are juicy and have an excellent flavour are also grown in large quantities. But as they rot easily, their export is limited. Peaches, plums, apricots and grapes are grown in great abundance. In autumn there is such a glut of fruit production, that a part of it, which cannot be marketed, is lost.

In the Kulu valley apples are not yet grown universally as in Kashmir, though the Government is trying hard to introduce apples in villages. There are a number of very big orchards owned by a Britisher named Major Banon who settled here. Other members of his family have also acquired orchards, which are located in Manali, Katrain,

etc. The apples are of great variety and superior quality and find a ready market all over India. Other soft fruits are also being grown here. Parsimone has been introduced and is grown in large quantities. A large orchard is located in Khajiar in Chamba.

The Simla Hills have developed fruit culture in the last two decades. Kotgarh has become a great fruit-growing centre. Orchards are spreading all over a mountain spur over hundreds of hectares. Apples, pears, peaches, apricots, plums and cherries are grown. Much fruit is sold in towns in the Simla Hills, mainly in the markets of Simla. A large surplus is despatched to the plains. Much is being done to improve the quality of fruit.

High up in Kinnaur in the Sutlej and Baspa valleys also fruits are grown including apricots of a specially good quality, and plums and peaches and wild and cultured grapes. 'Angoori' a kind of liquor, is prepared from grapes. Fruit culture is developing in Kinnaur and new orchards are being set up, as a result of the building of the new road with increasing prospects of export.

Nainital and Almora are rapidly becoming large-scale producers of fruit. At Ramgarh there is a great concentration of orchards including those owned by many retired people. They often let them to contractors for management, as the chief motive is immediate profit. Various fruits are grown including apples, pears, peaches, plums, apricots and strawberries. Ramgarh orchards spread over many hectares. There is a small plant for canning fruit and making preserves and juices. One can drink bottled fruit juices at the factory stall.

Fruit gardens are developing around Bhim Tal.

At Ranikhet the Government Chaubattia gardens produce fruit and also sell plants for spread of fruit culture in the adjoining hills. They also have a fruit-canning and juice-making plant. Apricots are grown in Jaunsar-Bawar. Fruit farms are being developed near Jubbal, where there are many

peach orchards. Oranges are grown at Shama in the Sarju valley. Efforts are being made to grow pears here by grafting on wild trees. A new fruit culture station is being developed below Dhakuri at Karmi. But people in general are slow to take to fruit cultivation.

A new area is being developed near Mussoorie where orchards are being planted. The idea is to create a fruit belt in the hills of Uttar Pradesh.

Very little has so far been done to spread fruit culture in Uttarakhand. A European who settled in Harshil on the way to Gangotri planted apple orchards there. They have been maintained in this area and neighbouring villages also raise some apples. Wild apricots grow in the Bhagirathi and Yamuna valleys, a fact which shows that abundant fruit can be grown in these areas. On the route to Badrinath, a few shops sell citrus fruit grown by some lone farmers in Joshimath. At one place on the way to Kedarnath, there is a peach garden. It is really sad to find shortage of fruits and vegetables on these routes which are visited by thousands of pilgrims.

In high areas raspberries, gooseberries and blackberries grow wild.

In Nepal fruits are grown for local use. Oranges grow in the Pokhara valley.

Sikkim produces apples at higher elevations and very good oranges in lower altitudes. Darjeeling oranges are well-known for their sweetness and flavour. Plums grow in Kalimpong. Honey is produced in some places in the Darjeeling Hills.

In Meghalaya near Shillong, plums are grown and exported. Some attempts are being made to grow more fruits here. The lower valleys grow very good qualities of oranges. Pineapples there are well-known for their juiciness. Honey is produced in orange orchards. A large modern pineapple canning plant is being constructed in the vicinity.

There is little fruit culture in Arunachal, Nagaland and the Mizo Hills.

Needless to say that though the Himalaya is giving us much fruit of a varied nature and good quality, the output could easily be increased tenfold and even a hundredfold. Temperate fruit, a health-giving food can be grown in the Himalaya. It is high time that horticulture in this region is paid due attention.

Nuts

Kashmir, again, is a leading producer of nuts in India. A superior quality of almond called 'Kagzi Badam' is grown. Almond orchards are often located on Karewa deposits in the vale of Kashmir. Walnuts are raised in large quantities in the Kulu valley and the Simla Hills. 'Chilghoza' is collected from a special kind of pine in Kinnaur and also in Kashmir. There are many varieties of nuts.

There is great scope for increased production of nuts in the Himalaya and introduction of new varieties.

Vegetables

In the plains of India cauliflowers, and cabbages which grow in winter are called winter vegetables. But in the cool hills they grow in summer and are increasingly sent to the plains during the hot weather.

Vegetables are grown in huge quantities in the vale of Kashmir, specially in the floating gardens of the Dal Lake. All sorts of temperate vegetables are grown, as there is a ready market among Indian and foreign tourists. The vegetables are cheap and can be easily exported to the plains. However, the long road drive of more than 300 kilometres is prohibitive.

Vegetables grown around Simla are exported to Chandigarh, Delhi and other Punjab towns. They consist of cauliflowers, cabbages, turnips, carrots, tomatoes, peas, etc.

In Kumaon cultivation of vegetables is on the increase. Besides supplying vegetables to hill resorts, much surplus is exported to the plains. Delhi is a big purchaser of the

winter vegetables from Simla and Nainital. Other big towns of the plains like Lucknow and Kanpur also purchase them.

It may, however, be said that there is great scope for raising vegetables in the hills for the markets on the plains. Perhaps the production of vegetables can be increased tenfold very easily. Their sale will bring money to the poor hill people.

Darjeeling is a great producer of vegetables. There the list is similar to that of Simla. Peas of good quality are specially important. Squash, which practically grows wild on creepers, is sold at a good price in Calcutta, which is a big consumer of Darjeeling winter vegetables. Traders have been very active in promoting the expansion of the vegetable industry. There are collecting depots in Ghoom and Darjeeling from where the vegetables are packed and despatched.

Similar to the idea of a fruit belt, there can easily be a vegetable belt between 1,200 and 2,000 metres all along the Himalaya in its western and eastern wings.

Cereals

These are not a speciality of the hills. They are grown for local consumption. Their cultivation is difficult and the environment does not favour the raising of cereals, as it does fruits, nuts and vegetables. There is little plain area in the hills and costly terracing is necessary.

Cereals are mostly grown in the middle levels between 1,000 and 2,000 metres.

The choice of the crop depends upon slope, soil type, water supply and aspect. Paddy and wheat are grown on the best type of land sometimes both these crops are grown in the same field in summer and winter.

Paddy is grown in flat valley bottoms and very carefully made terraces below springs and hill streams. In the flat exposed lake bottoms, as in the vale of Kashmir, Kathmandu, Pokhara and Manipur, paddy is a leading cereal. Paddy is more important in the eastern Himalaya.

Wheat is often grown in paddy-fields in winter in the western Himalaya. A kind of spring wheat is grown in some places at an altitude of 2,000 to 2,500 metres. Wheat is sown just before the oncoming of winter, when snow falls on the seeds and keeps them preserved during winter. In spring the snow melts and wheat sprouts. Such a practice is seen at levels above 2,000 metres, as in the upper Pindar valley.

A very important cereal in the Himalaya is maize. Maize was the main cereal of American Indians and the U.S.A. today is the chief producer of it. The plant was introduced into India from the U.S.A. The climate of the plains of India, however, has no similarity with the maize belt of the U.S.A. which prefers a cool damp climate. This is exactly the climate to be found in the hills of India.

Next to rice this is the second leading cereal of the vale of Kashmir. Here it is grown in raised alluvial banks where paddy will not grow, and on eroded Karewa beds and gentle hill-slopes.

Maize is a very important crop in the Kulu valley, the Simla Hills and the Kumaon hills. It is also grown in the Darjeeling Hills and Meghalaya. Production of maize should be further increased. The orange-coloured cobs of maize left drying on slanting roofs of cottages make the scene in the Himalaya very colourful. Extensive terraces growing maize are noted near Ranikhet, Almora and Shama.

Another crop which lends colour to the landscape is Chua, which has a bright red hue. It is a kind of millet of high altitudes. It grows in Chamba, Kulu and Uttarakhand. Madua too with its yellow flowers is an important millet crop which grows in middle latitudes. Phabra, giving a deep yellow tint to the scene, grows at even higher altitudes. Barley and wheat also grow here. All these millets are grown in the upper Yamuna valley at Kharsali and in villages near it. Chua and Madua are very common in the western Himalaya.

Very little jowar or bajra is grown in the hills.

Tea

This is a special crop introduced by the British. Tea is grown extensively in Darjeeling. Here the lands of the local people were acquired by the British at nominal prices and converted into tea-gardens. The local people had to become labourers on the tea-gardens. Tea in Darjeeling grows from 1,000 metres to 2,000 metres. At the lower limit the quality of the tea is poor, and it is best at the highest elevations, where its flavour is best. The Happy valley tea-garden is well-known for its quality tea. The optimum development of tea-gardens is at a level of about 1,600 metres.

It may, however, be pointed out that more tea is grown in the plains of North Bengal and in the Brahmaputra valley in Assam, where it grows on raised alluvial banks and hummocky gravel mounds.

Some tea grows in Beninag in the Almora district and at Palanpur in Kangra. The climate and the environment in many areas of the Himalaya are very good for growing tea. But a glut in production will harm the industry and result in falling prices. However, the consumption of tea is increasing in the country, thereby leading to an expansion of tea production.

Saffron

This is a very special crop which grows only in the vale of Kashmir. It consists of the red inner petals of a purple flower which blooms in the moonlit nights of October or nearabout this time. The flowers are carefully picked and dried. The inner red petals are then removed. It is used as a colouring and flavouring condiment. The plant very much resembles an onion plant. It grows on the Karewa mounds of Pampur, hardly 15 kilometres from Srinagar. In full bloom the undulating fields of Saffron look like a sea of purple waves for great distances. It also grows on the terrace of Kishtwar in the gorge of the Chenab. As its

production is very limited and the demand very high, it is very costly. Attempts should be made to grow it on a wider scale.

Tropical Forests

Cultivation disappears and forests dominate below 1,000 metres generally. They are of a tropical nature and are very different from the temperate forests discussed earlier. However, they are sources of good quality hardwood timber. Sal, shisham and teak are some very important varieties. Much bamboo also grows. There is a dense undergrowth which makes exploitation difficult. Besides great quantities of timber these forests also yield firewood.

Animal Products

Mention has already been made of sheep, goats and buffaloes kept by semi-nomadic people. The Bhots tend yaks and cross-breeds. They supply wool, meat and some dairy products. Efforts are now being made to develop them on modern lines. There are sheep-breeding farms in Himachal Pradesh and Kumaon where better quality sheep are being bred. Dairy products can easily be increased and improved in quality.

Some attempts are being made to develop fisheries. Trout fish have been developed in farms in Kashmir and Kulu and then introduced into hill streams to breed and develop. Much more can be done to develop fish in hill streams and lakes.

Feeble attempts have been made to develop production of silk. Only in Kashmir has there been an early development of silk production. Mulberry trees have been planted to feed silk cocoons. Silk production is gradually increasing. Government is now helping in the development of silk.

Fur-bearing animals are hunted in Kashmir. Gloves, caps and coats are made of fur. But this industry caters chiefly to tourists. It can be developed much more.

Musk, a highly prized scent, is procured from the belly of the musk deer found on high altitudes. Musk is collected by hunting them in Uttarakhand. It is also collected in Sikkim. But as the musk deer is becoming rare, its shooting has been declared illegal.

Mineral Products

The structure and topography of the Himalaya is not conducive to the discovery and exploitation of minerals. The structure, with its overfolds and thrusts is so complex that it is extremely difficult to locate rich pockets of minerals.

Copper is known to occur in Almora and Sikkim. It was exploited in small quantities in the past. Attempts are being made by geologists in both these places to estimate the quality and quantity of the occurrence of copper ore.

Coal is found in Riasi in Kashmir, where it is being raised for local use. Coal is also extracted near the foothills of Darjeeling near Mal and Bagrakot. They are inferior quality coals and, at best, they can be used locally. There are coal mines in the foothills near Margherita in the extreme north-east corner of the Brahmaputra valley. The occurrence of coal in the Himalaya is on the whole scrappy and of inferior quality.

Soap stone occurs extensively in the Sarju valley in Almora district. A large-scale survey is being carried out to estimate its quantity and quality, so as to start exploitation.

Trace occurrences of some other minerals have been found, but only an intensive survey can yield appreciable results. Gold occurs in Ladakh, but not much has been done regarding it.

Salt and borax are obtained from lakes in the Trans-Himalayan areas of Ladakh and Rupshu.

A kind of black sticky substance is obtained from high rocks which is called 'Shilajeet'. It is supposed to be a very good tonic.

V. THE PEOPLE

THE HIMALAYA is the abode of a great variety of people. They include unsophisticated people of the secluded valley bottoms and exposed lake beds, the semi-nomadic pastoral tribes and even head-hunters among a few tribes of Arunachal and Nagaland. The topography of the Himalaya precludes quick movement and intermingling. It is because of these reasons that quaint customs have developed in various pockets. Usually the environment has made the people of the Himalaya cheerful, happy, simple, honest, courageous and resourceful. However, the culture changes from one type to another across mountain barriers.

The culture of the plains of the Punjab including dress and language has spread up to the southern face of the Pirpanjal range in Kashmir. North of this range the vale of Kashmir has totally different customs, language and culture. The Muslims of Kashmir do not observe 'parda' among their women. The Borkha body cover is now being used as a fashion in Srinagar. The rural people rarely use it.

A similar example is that of the Kulu valley. Here the Dhaola Dhar range acts as a cultural barrier. Before the building of the motor road through the Larji gorge, the Kulu valley was remote and isolated. Hence it developed a culture of its own, where each village has its own deity. The Gaddi semi-nomadic Hindus inhabit this valley.

However, a number of dominating cultural flows may be recognized. The two main types of currents are the Tibetan culture of Lamaism, with a Buddhistic religion from the north and the Hindu culture from the plains of India. A third inflow of culture is the Muslim-Persian influence from the west, which is dominating in Kashmir, and has more or less spread up to Kinnaur in the Sutlej valley. The Sindhu-Ganga watershed beyond is also a cultural divide.

The Kashmiris, the Chambials, the Gaddis and the Kinnauras have aquiline noses, a fair complexion and a tall stature. They grow and eat fruit, curds, *panir* (cheese) and meat. On the east of the divide, the Garhwalis and the Nepalese have round faces and snub noses and are short-statured in general. They neither grow nor eat temperate fruit. The people of Bawar, however, are an exception. They have aquiline noses, fair colour and Aryan features.

A very fine example of the intermixture of cultures is provided by polygamy and polyandry. While polygamy is practised by Muslims, polyandry is prevalent in areas where Lamaism prevails. While Ladakhis are polyandrous, the Muslims of Gilgit are polygamous. The Baltis of Baltistan lying between Ladakh and Gilgit are monogamous in general. There are many varieties of polyandry in the high regions of the Himalaya. In Lahul, the society is matriarchal. A woman may have a large number of husbands who work for her. In the great Dussehra festival at Kulu in the autumn, groups of gaily-dressed Lahuli women come for fun and frolic, but few Lahuli men visit the fair. One or two may come with groups of women as guards and workers.

In Jaunsar-Bawar there are polyandrous Hindus. It is the result of a strange intermixture of cultures. Here all the brothers of the family have one wife, who is married to the elder brother. The custom may be compared to the legend of the *Mahabharata*, where the five Pandava brothers had one wife, Draupadi. The economic factor behind this custom is that it protects property from division. It also controls birth.

In the eastern Himalaya, many tribal people of the hills have a matriarchal society. The Manipuris who practise Vaishnavism are matriarchal. Usually men do no work. Their main duty seems to be to marry a Manipuri girl.

Women with children on their backs are seen in the morning wending their way to the market with commodities for sale on their head. Here they sit for the whole day to sell their products. The special products of Manipur are

handloom textiles, all woven by Manipuri women. The yarn now comes by air from mills in Bombay and Ahmedabad. Throughout the eastern Himalaya, it is a must for women to know to spin and to weave. The Manipuris are an artistic people. The songs, dances and dramas of Manipur are famous.

A strange Manipuri community, perhaps unique in India, lives on floating houses built on rafts in Logtak Lake to the south of Imphal. Fishing, fish-curing by salt and sunlight and collecting water-chestnuts (*Singharas*) is their sole activity for livelihood.

In the hills south of Manipur live the Mizos and in the west live the Kukis. Both dress strangely and have strange customs.

North and west of the vale of Manipur live the Nagas. There are a number of sects among them. Each sect has developed in a secluded region. Two leading sects are the Angami Nagas and the Sema Nagas. Each sect has developed its own culture. Some of the Nagas are still ferocious head-hunters and fighters. Though society in Manipur is matriarchal, it is not so among the Nagas. The Nagas relish dog meat. Dogs are all eaten up. Dog meat and live dogs are sold in the market. In some sects in the past a man became eligible for marriage only when he had got a human head. These customs are slowly disappearing.

In Arunachal Pradesh there are a large number of tribes such as the Daflas, the Apatanis, the Abors and the Mishmis, who have been practically untouched by civilization. The policy of the British was not to disturb them. Some of them hunted human heads for sport. Others remained completely naked. The Indian Government has been trying to make contacts with them slowly. After the Chinese incursion of 1962 roads are being built in this remote area. Army units are staying at some places. The Government has opened schools, dispensaries and development offices. Contact with these remote people is slowly increasing. Their habits and customs will be slowly

undergoing a change in future due to intermixture with the people of the plains.

Lamaism is prevalent in the whole of Bhutan and is also found in the northern parts of Arunachal Pradesh, as at the famous Towang monastery. Sikkim is largely Lamaistic, which includes the Maharaja.

The original people of Darjeeling are the Lepchas. They build their huts on stilts and have strange customs. There are Bhots and Tibetans living here. The Nepalis have settled in Darjeeling and Sikkim in large numbers. The Bengalis have also penetrated these areas. While the Bhots and the Tibetans practise Lamaism, the Nepalis and the Bengalis are Hindus.

In Nepal, there is a mixture of Rajputs from the plains. The Gorkha sect of Nepal is well-known for its great fighting qualities. The Gorkhas have proved their skill as soldiers in the most modern form of warfare. They are utterly fearless. The Nepalis are known for their honesty. Many Nepalis work as day and night guards in the plains, though they do other types of work also. They are often popularly addressed by the honorific 'Bahadur' (meaning brave).

The Dotial porters of Nepal do brisk business in Garhwal, where they carry goods for pilgrims visiting religious places of Uttarakhand. The Dotials are strong, sure-footed, honest and dependable. On the other hand, the Garhwali porters engaged in the same trade are slow and not so dependable. Garhwalis some times do not like to work. They prey upon the pilgrims and devise various means to extract money from them. They could easily grow fruit and vegetables, eat them and sell them to the pilgrims. Women and children ask for thread and needle from pilgrims. They set up small temples of Garud, Hanuman, Narayan or Ganesh on the pilgrim routes where pious pilgrims place some coins. The Brahmins among the Garhwalis act as Pandas or religious guides to the pilgrims. They also provide shelter to them. The Chatti system,

where pilgrims stayed free of cost on the condition that they purchased their rations from the Chatti-owner, is fast disappearing as roads are built to the mountains. Wayside hotels and tea-shops are increasing in number. The hill people of Uttarakhand are known for their straight-forward dealings and honesty, specially on pilgrim routes. Theft is almost unknown even today. It is a usual custom to deposit extra articles in Chattis before one climbs up. One may be sure of their safety. Perhaps in time vices will creep into these valleys.

A noticeable change in culture is noted in Kinnaur in the Sutlej valley above Simla. The Kinnauras are Hindus. They are supposed to be the same as the Kinnaras of the Puranas. The Kinnauras have their village deities (*gram devtas*) like those of the people of Kulu. Much fruit is grown including grapes, from which Angoori, a kind of wine, is made. The Kinnauras have quaint dresses. Both men and women have a similar dress. Their only distinction is the well oiled moustache of the man and the pig tail of the woman.

The Gaddis of Kulu are semi-nomadic. They roam about in high pastures with their sheep and goats in summer. They are distinguished by a long rope tied round their waste. They are cheerful and courageous.

In Jammu and Kashmir, a variety of people live. In Ladakh are found the Ladakhis who follow Lamaism. Hemis, a famous monastery, is situated here. The cultural landscape is adorned by Manis (burial statues) and Gomphas (monasteries). Barley is their main crop. It provides food, and also drink when fermented. They produce little fruit or vegetables. They dry small pieces of meat in the sun for preservation as food. They keep sucking small cubes of yak cheese which rubs off their teeth. This practice is found among the Bhots and Tibetans all over the Himalaya. Yak cheese cubes are sold in the markets of Darjeeling.

In the vale of Kashmir live the Kashmiris, a peace-loving, cultivator class who often live in boats in lakes and rivers.

They are great artists and produce many kinds of art goods. While they make them in winter when they live indoors, the valley being covered with snow, they sell them in summer to tourists. North of the vale live the Baltis and various other groups of Muslims. In the mountains surrounding the vale live the semi-nomadic Gujars who are sturdy and courageous. They keep animals, specially buffaloes.

In the south the Jammu Hills are inhabited by the Dogras, who are Rajputs who had invaded Kashmir in the past. They have been the ruling class for long. The Maharajas of Kashmir were all Dogras. There are some Kashmiri Pandits who act as Pandas at religious centres, specially at Amarnath, the sacred cave of the snow deity. The Pandits are intellectuals and hold Government posts. Many Kashmiri Pandits have migrated to the plains of India and have held high positions there. The late Jawaharlal Nehru was one of them.

The above description proves that the Himalaya is inhabited by a great variety of colourful people. Some more details of the semi-nomadic tribes follow.

THE SEMI-NOMADS OF THE HIMALAYA

All over the world, a mountainous environment often forces people to move up and down the hills in summer and winter. It specially forces shepherds to move up or down with their flocks of animals. Geographers call this practice transhumance. The Himalaya is no exception to this rule. However, a great a variety of practices are observed among the Himalayan semi-nomads, who live under varying physical conditions in different Himalayan valleys. The environment has made them self-reliant, sturdy, simple and gay. Sophistication has not yet touched them.

Their peaceful manner of living, however, is being slowly changed due to changing circumstances. There is occurring a slow but sure penetration of modern civilization in their midst. The increasing political tension between India and

her two neighbours Pakistan and China has made the Himalaya a very sensitive and strategic area. Roads are being built fast to our borders to supply the needs of our border outposts. With road development the secluded valleys of the mountains are coming in closer contact with the plainspeople. The seasonal influx of tourists, hikers, mountaineers, scientists and pilgrims is increasing fast day by day. All this is bringing changes among the semi-nomadic tribes of the Himalaya.

The Gujars of Kashmir

These people are found in the mountains surrounding the vale of Kashmir. They have permanent dwellings among giant deodars at their upper limit, near the tree-line. The huts are made of logs which go to make the walls as well as the roof, which slants backwards towards the rising slope of land. There is a half-opening in front looking towards the downward slope. The huts are very sturdy and can resist heavy snowfall or even avalanches. Their design has been adopted by the ski club at Khilanmarg above Gulmarg. The Gujars live in these huts in summer and go down to lower regions and even to the plains in winter with large herds of buffaloes which they keep. They walk very fast in their annual moves. They camp in the foot-hills and plains for the entire duration of winter.

The Gujars are Muslims. Their dress is somewhat similar to the Pathans of the plains. Their language is also somewhat akin to Punjabi. They are brave but hot-tempered. They sell milk and cheese in the towns of Kashmir. They keep a few sheep and goats.

The Gujars are often unaware of the Cease-fire Line between India and occupied Kashmir. Their buffaloes are even more innocent and often stray to the wrongside of the line, producing border incidents.

During the influx of large numbers of pilgrims on the occasion of the pilgrimage to Amarnath during the August

full-moon, the Gujars supply milk, cheese (*panir*), meat and even porters. Their mules and ponies are, however, not trustworthy as they are not properly trained. The habits of the Gujars are thus changing though slowly.

Gujar huts are scattered all over the high valleys of Kashmir. Clusters of huts are seen only near large meadows.

Some Gujars have migrated to the Bhagirathi valley. Here they live with their buffaloes in high ranges and the Yamuna and Tons valleys. The Hindus living lower down do not purchase milk from them, but they buy *Ghee* or clarified butter. The Gujars of the Bhagirathi valley migrate to the plains of Rishikesh in autumn. As they move with their large buffalo herds at this time, they nearly choke the roads. Attempts have been made to settle them in the plains, but they have not succeeded. Accustomed to living in the hills in summer, they will fall prey to diseases if they are forced to stay in the plains. The problem of choking roads can be easily solved by asking the Gujars to use forest trails during their seasonal migrations. You can easily recognize a Gujar by his peculiar dress in the Bhagirathi valley, as it is the same as in Kashmir. They also speak the same language.

The Gaddis of Kulu Valley

These gay and happy semi-nomads inhabit the slopes of snowy ranges of Dhaola Dhar and Pir Panjal in the upper Beas valley. Unlike the Gujars of Kashmir, who are Muslims, the Gaddis are Hindus. Their environment is nowhere near the borders of India. So there are no political tension and no military camps in this place.

The Gaddis have permanent villages in the valley bottoms, where they engage in agriculture. The womenfolk remain in the villages, while their men roam with their sheep and goats in the higher meadows during summer. Here they live a very hard and adventurous life and have often to scare away leopards and bears who may come to attack their sheep. Their faithful sheep dogs are of great help to them.

A famous fair is held in Kulu on a terrace in the Beas valley every year during the Dussehra. The Gaddis who love fun and frolic, flock to this fair with their village gods who are supposed to come to the fair to pay their homage to the chief God Raghunathji of Kulu.

There is much social mixing and trade during the fair. The Gaddis sell their wool and woollen goods. Apples of Kulu are also displayed in the fair. Jaunty Kulu caps are much in demand by tourists. The Gaddis in return purchase cigarette-lighters, torches and even transistors. This is the result of contact with the plains civilization. But the Gaddis love their traditional way of life. Some Gaddis have migrated to the Bhagirathi valley. They can be easily recognized by the long rope they tie round their waists.

The Kinnauras of Sutlej and Baspa

These are the inhabitants of the newly-constituted Kinnaur district. Mention has been made earlier of them. Their life has been much disturbed by the fact that Kinnaur is contiguous to the border of India. A road has been built to Shipki pass, which has used many fertile terraces which had cultivated fields and orchards. The remaining ones are often occupied by military camps. Tourists also visit this valley.

The Kinnauras have their own colourful customs and habits.

They build their villages on knife-edged ridge-tops. They have their village deities. Their village is dominated by a palace or a temple. It has a square where the village folk assemble. There are some advantages of the ridge-top position. It is safe from avalanches. Water and cold air drain off easily, and it is defensive. The Kinnauras are fond of growing fruit, nuts and grapes. They also grow grains. Young men roam with sheep and goats in the high meadows.

Some Bhots live among them and both the sects live amicably, mixing with each other.

In the square of Sangla village in the Baspa valley, there is a temple of Nag Devta and also a huge prayer-wheel. The Kinnauras sacrifice sheep and goats before the gods. Their heads are hung on the temple gates. Previously the temple and its offerings belonged to the landlord. But this custom is now disappearing. There are a development block, a school, a sheep breeding farm and a trout culture station at Sangla. Near Chini, the chief village of Kinnauras, a new capital of the district is being constructed at Kalpa. The Kinnauras are fast changing their habits.

The Jadhs of Nilang

The main area where the Jadhs live is the basin of the Jadh Ganga or Janhavi. It is a northern tributary of the Bhagirathi, which it joins in its granite gorge below Bhairon Chatti. Here the village of Nilang is inhabited by the Jadhs. The area is nearly 3,500 metres high. The Jadhs mainly tend flocks of sheep and goats. They are Hindus. But some Bhots have settled in this area after the Chinese incursion, and there has been some mixture of Jadhs and Bhots. Nilang is a compact village. The Jadhs do not live scattered about like Gujars. They cultivate barley, wheat, phabra and potatoes. The Jadhs of Nilang have a permanent village named Barari near Harshil at a lower level. Nilang is totally vacated during winter, when the Jadhs move down to Barari. Young men move down further with their sheep to the warmer valleys. Old men, women and children stay in Barari during the cold season. Here they make woollen goods.

Some Jadhs have become servants of the richer Bhots. A few Bhots have also married Jadh girls. The Bhots are Buddhists but eat beef. The Jadhs, being Hindus, do not touch it. Hence the Jadhs who have got mixed with the Bhots are treated as outcasts.

Nilang is very close to the border of India and hence has a strategic importance. A road has been built connecting Nilang and there are defence posts here today. All these

factors are changing the habits of the Jadhhs and the Bhots. These semi-nomads who love to walk long distances may now even ride passenger buses. The Jadhhs have also learnt to prepare tea like the Bhots. Brick type of tea—salt and yak butter is pounded in a bamboo cylinder with hot water and poured out. Many Bhots have taken to the Punjabi attire—*Salwar* and *Kurta*, because it is more convenient in the warmer valleys. The Bhots also do some trade.

The Bhagirathi valley is a melting-pot of all kinds of semi-nomads, Jadhhs, Bhots, Gujars and Gaddis.

The Marchyas of Mana

These Himalayan semi-nomads form a small group, which in many ways is similar to the Jadhhs. Their chief centre is the big village of Mana situated on a slope of stabilized debris, three kilometres above Badrinath in the Alakananda valley. In winter they move down to Joshimath and Chamoli and the village lies empty and is covered by snow. Men move further down in the warmer valleys with their flocks of sheep and goats. The Marchyas are Hindus. Some Bhots also are found here. Both of them were engaged in some trade across the border with Tibet, but after the Chinese invasion in 1962, this has stopped.

There are many factors which are changing the habits of Marchyas. A road has been built to Badrinath and has been extended as a jeepable road past Mana into the Saraswati valley. There are several military posts all along it up to the Mana pass on the border. The seasonal influx of pilgrims to Badrinath is continuously increasing with the building of the road. There is a great rush of tourists also. Mountaineers visit the area to climb peaks like Nilkanth and Chaukhamba. Mana has been made a development block and a school for children has been opened here. All this has naturally influenced the activities of the Marchyas. There are extensive high-level meadows around Mana where menfolk are engaged in grazing sheep, goats, and yak cross-breeds. They now

sell the animals for meat to the people from the plains. They are actively engaged in the transport trade. They supply ponies for this purpose to pilgrims, tourists and others. They work as guides and porters for mountaineers. So they are getting 'civilized' very slowly.

Yet they observe some old and quaint customs. Of the twin glaciers which form the Alakananda, the southern one is known as Satopanth or the way to 'Swarga' or heaven. The last portion of the glacier is steep and, due to the breaking up of ice, looks like a giant staircase ascending to heaven on the top of the Chaukhamba or Badrinath peak. The Pandavas are supposed to have come this way, and after bathing in the Vasudhara falls ascended Swarga. Here at the base of the mountain is a glacial lake named Satopanth tal. The Marchyas take their dead to this tal. When the breeze is favourable, the body floats upwards towards Swarga on the peak. In fact, this happens practically every day when the Katabetic wind blows up the valley. The body is then taken back after this and cremated at Keshav Prayag, the confluence of the Saraswati and the Alakananda just below Mana village.

The Marchyas are also cultivators. They grow wheat, barley, potatoes and phabra. Their womenfolk work in fields.

Anwals of Pindar Valley

The Anwals are semi-nomads by profession. Any hillman who engages himself in the work of herding in high pastures during summer becomes an Anwal. He has few animals of his own, and so he tends the sheep of others, for which he is paid in cash and kind. The 'Pradhan' of the village arranges the whole affair. At the advent of summer, owners of animals and would-be Anwals go to him. He arranges deals and charges some fees for his services. The price of the work is arranged, which consists of wheat flour, ghee, gur, salt, etc. The Anwal then takes his flock of animals, mainly sheep, to high pastures called Bugiyals. His area is often demarcated by a rivulet. The Anwal is not responsible

for the loss of a sheep, if it is killed by a leopard or a bear. But he must produce a part of the body of the sheep, say the tail, to the owner as proof of death of the animal.

The Anwals build stone huts at great heights for shelter. They keep sheep dogs to help them.

This system of Anwals is very well organized and continues even today. But some changes have occurred. A landlord of Loharkhet has engaged a family on pay to work for him as Anwals permanently. He provides them board, lodging and some cash. Payment for herding in cash instead of in kind may start sooner or later. Meanwhile the area where the Anwals work is being visited by tourists to the Pindari glacier, Sundardhunga and Rupkund. The Anwals may get some service from them.

There is a great religious bias in the Bugiyal country full of legends of the Goddess Nanda Devi. It forbids the Anwals to take women with them to the grazing-lands. The Anwals are sturdy and excellent mountain-climbers. They build low stone-walled huts even at levels of 5,000 metres, using birch logs and mamla grass for roof.

The Johris of Milam Valley

This area is also called Malla johar. Routes from here lead over the Unta Dhura pass and the Kungri Bingri pass to Tibet. The Johris had, therefore, combined herding with trading. The Johris have two sets of villages, Talla and Malla, with the same name. They mean 'lower' and 'higher'. Each family has one house in a 'Talla' and another in a 'Malla' village. While the lower set of villages is located at a height of about 1,500 metres, the higher set is at 2,500 metres. Near the source of Ghorī Ganga river there is a group of these villages, which are solidly built of stone. The biggest among them is Milam, a compact village of 500 houses. The broad glacial terraces produce potatoes and barley. They are found at a height of about 4,000 metres. In the past, the Johris had many sets of seasonal migrations. With

the advent of summer they made several trips between Talla and Malla villages. Their womenfolk moved to the Malla villages. The trips were needed to move to the Malla villages commodities to be sold in Tibet. There was a final movement with the commodities loaded on ponies across the border to Tibetan markets, where goods were sold and purchased. Woollen goods, musk, precious stones etc., were purchased. Needles, match-boxes, sugar and textiles were sold. The return to Malla villages was to be completed before the summer ended and the passes were closed. In this last journey, women stayed in their village. At the beginning of winter there was a general trek of the whole family to the Bhabar lands around Haldwani. Here the families stayed for winter. The Johris hold a right to stay in certain fixed portions of Bhabar lands. At this time, the menfolk visit the plains markets to sell Tibetan goods. They even go so far as Delhi and Bombay. In early summer they return to the Talla villages.

This arrangement has changed much after the closure of trade with the Chinese. Also the Johris may find markets for the sale of the woollen goods they make in Almora and Nainital.

Flocks of sheep and goats owned by the Johris invariably follow them in their treks. Even they carry salt, wool, sugar and grain in small bags called 'Karbozas.' During autumn before the snowfalls, the Anwals and Johris move down with their flocks of sheep carrying potatoes to shops in the lower areas. The Johris lead a hard and adventurous life.

New changes are also coming in the lives of the Johris. Munsiri has been made a development block. A small power-generator has been installed. Schools have been set up in this remote area. A road has been constructed up to it. To give alternate employment to the Johris, the Government has been helping in developing cottage industry, such as making blankets called Thulmas, small carpets called Chutkas, wooden and cane goods and deer skin products.

More power-stations are being set up. Irrigation canals, electrical water-lifting pipes, and a network of roads are being made. Attempts are being made to encourage fruit culture by help from Chaubattia to grow fruit-gardens for apples, pears, peaches, apricots and plums. A citrus station has been established at Hawalbagh near Almora under the guidance of the famous botanist, Bashi Sen. The habits of the Johris are bound to change. Many Johris own big shops in Munsiri and other places.

It is very interesting to study the slow changes occurring in the habits of the Himalayan semi-nomads. This will be very helpful in the future planning and development of these regions for the advancement of the gay and robust people of the area. A study of the nomadic mind should be taken up by psychologists, anthropologists and folklorists to know these people intimately. Geographers should study their environment and their interaction with it.

The slow changes occurring among the semi-nomads as discussed above should be allowed to take their natural course. They may be helped to come into close contact with modern cultural developments by improving communications, increasing educational facilities supplying electric power, developing local arts and crafts, finding a market for these products and helping agriculture and horticulture by establishing research farms and model orchards. Work has already started on these lines after independence.

VI. RURAL AND URBAN SETTLEMENTS

PEOPLE living in the remote valleys of the Himalaya and in high glaciated regions and Alpine pastures may safely be called 'naturvolk' or the people of nature. They and their ancestors have been living in the thick of nature for centuries. It is but natural that they show an uncanny skill in choosing correct sites for their settlements. The people from the plains who may have to choose sites for constructing new buildings for the Government may make mistakes in their choices. It is very important to have a correct appraisal of the environment to choose correct sites for new settlements and buildings.

An interesting example of wrong judgment is provided by the building of a rest house near the Pindari glacier at a wrong place. The last rest house on the way to this glacier is Phurkia, about eight kilometres away from it. The Phurkia rest house is situated among huge boulders, resting precariously on the slope. The yawning gorge of the Pindar river is right below the rest house. It seems that the building may topple over any moment into the gorge. But it has not done so, because it is located on firm rocks. Further up, the slopes are made of loose morainic material. From Phurkia the view is also not clear, as here the gorge is narrow. To a casual visitor a broad terrace about two kilometres away seems to be a much better site. It would have given a much better view, and would have been nearer to the Pindari glacier. The Public Works Department officers also decided to have a new rest house on this terrace. It was built, but an avalanche destroyed it after only one year. The bungalow was literally shot down into the gorge below. This showed that this site was an avalanche route. Also the area was made up of loose morainic material. Strangely enough it was decided to have another bungalow at the same site, perhaps to meet the same fate sooner or later.

A similar mistake has been made in siting Kalpa, the new headquarters of the newly constituted district of Kinnaur. Kalpa has been located a couple of kilometres from Chini, the old Kinnaura village. It is situated on a gentle slope. But the accumulation of snow at this great height is natural, and in spring and early summer the snow accumulations slide downwards. Damage has already been caused to some buildings. Chini is, however, situated on a steep knife-edged spur away from the danger of avalanches.

Moreover, the location of Kalpa, high up above the Sutlej gorge along which the road runs is also not correct. It is too high and makes transportation difficult. There is already a proposal to change the capital from Kalpa to Peu, five kilometres below and nearer the main road below. This situation perhaps is much better in all respects than Kalpa.

Another example of wrong siting is provided by the rest house at Tola on the route to Milam. It had a site exposed to valley winds. It was simply blown away. A very good site existed only a kilometre away behind a spur.

Choice of village sites is controlled by many factors, physical as well as cultural. Among physical factors the greatest control is exercised by land-forms, which are favourable for settlement. River terraces, gentle slopes, flat drained-out lake bottoms, a stable cone-like feature made by accumulation of eroded material from above, glacial terraces and glaciated basins form areas where villages are located. Availability of agricultural land, good soil and easy supply of water for drinking and irrigation are other physical factors. Among cultural factors are religious centres, temples, route centres, passes, river junctions and Chattis and other centres along the routes.

River Terraces

These are definitely the most popular sites for location of villages in the Himalaya. They are found commonly

between one and two thousand metres above sea-level. The climate here is mild. Terraces are made up of fertile alluvial soil. Springs and streams above supply water for irrigation. Roads can also be built along the terraces. The streams are dammed above the terrace-level, and channels are built to divert the waters to the fields on the terraces. Villages are located on slopes at the upper edges of the terraces or on mounds.

Terraces are very common in nearly all Himalayan rivers. In the Chenab valley, besides the hanging terrace of Kishtwar, there are a series of terraces further down in the valley where occur chains of big villages, such as Doda, Babhor, Jadhpur, Jatheli, Mandi and Barhut on the northern bank of the Chenab, and Khateni, Mangala, Diron, Hiran and Jangalwar on the south bank. A motor road passes over the southern terrace and joins the Pathankot-Srinagar Road at Batoti. The terraces are nearly four kilometres wide.

The river Neru comes from the fertile bowl of Bhadarwah to join the Chenab at Doda. It has also well developed terraces very near the level of the river, so that villages on them can be easily irrigated from river water brought from above.

In the Maran valley north of the Chenab, there are similar features. Here are some isolated flat basins, where villages are located in complete isolation such as Lopor and Janatpor.

In the Ravi valley, terraces are very well developed, specially around Chenab. Rice is grown on the terraces.

The terrace of Kulu in the Beas valley is very broad and fertile. It provides location for the great Dussehra fair of Kulu and also an air-landing strip nearby.

In the Sutlej valley, terraces are very well developed around Rampur. There are numerous villages located on the terraces. Beyond Tattapani, the terrace of Bilaspur has been drowned by the Govind Sagar reservoir.

Similar terraces occur in the Tons, Giri and Yamuna valleys. There are good terraces below Jubbal on the Pabar river, and along to Tiuni on the Tons and further down. In the Yamuna valley terraces are well developed near Barkot, which is situated on a double terrace. The village of Kuthnaur is located on a hanging terrace.

In the Bhagirathi valley, very well developed terraces occur from Bhatwari to Tehri. Villages are located all along these terraces, and the road to Gangotri passes along them. The terraces are covered by fertile cultivated fields.

In the Alakananda valley terraces spread from Pipalkothi to Kirtinagar. The terrace of Gauchar is notable. Also the wide terrace at Srinagar is very well developed.

There are terraces in the Sarju valley at Bageshwar, Kapkot and Vani. Throughout Nepal terraces occur in all important valleys. In the eastern Himalaya terraces occur in the Tista and other valleys.

Instances of terraces can be multiplied. They provide a linear settlement pattern developed along rivers like chains, connected by roads and tracks. While the flat terrace lands are cultivated, the houses are located on their fringes on higher slopes, or in hollows cut by streams.

EXPOSED LAKE BOTTOMS

In the Himalaya are found a number of flat basins, which are exposed lake bottoms. With their level topography and fertile soils, they are densely populated. The most notable of such basins is the valley of Kashmir. It is a densely populated patch with numerous villages scattered all over the area. Villages are located on mounds. The valley is surrounded by terraces like formations of lake deposits called Karewas. On their top villages are found at places where irrigation is possible. Also villages are found at the bases of Karewa cliffs, where streams come out of them, such are the villages of Martand and Tanmarg.

The Vale of Kathmandu in Nepal is of a similar nature. It is the most densely populated area in Nepal. The settlement pattern is similar to that in Kashmir. Villages are located near springs found at the junctions of sand and clay layers. The Vale of Pokhra in western Nepal is also an exposed lake bottom twelve kilometres by six kilometres in size. Here is the big village of Pokhra with its wide tree-lined avenue nearly eight kilometres long. It is lined by two streams on two sides and a raised platform in the centre for weary travellers to sit and rest. Shops and houses line both sides of the avenue. Temples decorate the centre of the avenue. It is an ideal settlement pattern of a flat-bottomed valley.

The Vale of Manipur is another densely populated lake bottom in the eastern wing of the northern mountain wall.

Examples of other densely populated flat-bottomed basins are the bowl of Baijnath below Kosani, the Mandi basin in the Beas valley and the Baspa basin in the Sutlej valley.

Glacial Terraces

These terraces occur at an altitude of three to four thousand metres, and are utilized for locating villages. The big village of Kharsali in the Yamuna valley is a good example of such location. The Kedarnath temple and the village attached to it are also situated on a large glacial terrace. The Thyangboche monastery is located on a glacial terrace below Mount Everest.

Glacial terraces are also used as temporary settlements. The terraces at Zojpal, Sheshnag and Panchtarni on the way to Amarnath are used for such purpose.

Glaciated Valleys

These valleys are found below the glaciated terraces. Their shape is like a U. Here settlements are found near the flat bottoms of valleys. The villages are connected by routes along the valleys, which are enclosed by high cliffs, produced

by the truncation of spurs by past glaciers. Above the spurs are found shoulders of gradual, gentler slopes. Here again villages are situated. Cultivation is practised by terracing the slopes. Sonamarg in Kashmir and Bashisht in Kulu are examples.

Amphitheatres

In the high Himalaya, where glaciation has taken place earlier, amphitheatre-like features are found. Settlements are found inside them. The Badrinath temple and the settlement attached to it are found in a giant amphitheatre. The village of Mana slightly above this place is also situated in a bowl-like feature. The village of Beef just below Kharsali in the Yamuna valley is also located in an amphitheatre.

River Confluences

In the higher Himalayas, much debris is deposited at river junctions so that a flat triangular area is produced. This can be irrigated easily. Such places become good spots for settlements. The best example is that of the big village of Padam in the Rupshu valley in Jammu and Kashmir. Here again the attractive resort of Pahalgam is located on a triangular-shaped flat area at the junction of the Arau and Sheshnag rivers. Hanuman Chatti on the way to Badrinath is near the triangular flat area at the junction of the Khirao Ganga and the Alakananda. Many other examples can be cited.

River confluences are also supposed to be sacred, and are called Prayags, where settlements are often found. Such spots are supposed to be holy. Temples are located here and people settle at the junctions of rivers. Devprayag is situated at the confluence of the Bhagirathi and the Alakananda. Rudraprayag is located where the Mandakini joins the Alakananda. Again Karnaprayag is located at the junction of the Pindar and the Alakananda. Vishnuprayag is situated at a point below Joshimath where the Dhaoli Ganga meets the Alakananda.

Water Supply

This is a very important factor for the siting of villages in the Himalaya, where there is often scarcity of water. Sites near springs are very common.

In the Vale of Kashmir, villages are found near volcanic springs. They are giant springs coming out of limestone caverns, such as those at Verinag, Anantnag and Martand. Mention has already been made of spring locations in the Vale of Kathmandu at the junctions of sandy layers and clays. Masonry tanks are built around the springs with crocodile or lion heads discharging water. Springs are located in a line between Dagshai and Sabathu in the Simla Hills. Villages are located along this line, called the pipe-line. Water is collected by a pipe and supplies water to Sabathu, Dagshai and Solon.

Hot Springs

They also provide sites for villages in the Himalaya as waters are health-giving. Also hot water is good for bathing, washing clothes and cleaning pots. Bashisht village in the Kulu valley is a good example. Gangnani in the Bhagirathi valley, Gouri Kund in the Mandakini valley, the Badrinath temple itself and the temple of Yamunotri and Janaki Chatti are all near hot springs. The hot springs may be charged with sulphur. They may be also radio-active. Muktinath in Nepal north of Dhaulagiri is a well-known hot spring.

Often religious spots are located near springs, such as Yamunotri and Badrinath, already mentioned. Near Jammu, the temple of Vaishno Devi is situated near a spring.

Sites that are free from Natural Calamities

Villages are located in places which are not prone to suffer natural calamities. Areas troubled by landslides, rock-falls, floods, avalanches, etc., are avoided.

The situation of the temple of Badrinath is not good in one way, as it is situated below an avalanche slope. It has been destroyed now and then by avalanches falling from the

higher slopes of Narayan Parvat. The settlement is now being developed on the other side of the river over which a new bridge has been constructed. The temple cannot be shifted on this side as it stands upon a hot spring, and the site is considered sacred.

Village Kamru situated on a sharp ridge-top in the Baspa valley is quite safe from avalanches. The situation of Chini is similar. Village Chaura at the border of the Kinnaur district is also located on a sharp spur-top.

Twin Villages

The villages Talla and Malla in the Milam valley have already been mentioned. Even the resort of Nainital has twin quarters, Talli and Malli. Semi-nomadic people often have such villages. The village of Barari belonging to the Jadhs in the Bhagirathi valley may be taken as the twin to Nilang village higher up. Many Jadhs have two houses, one in Barari and the other in Nilang.

Junctions of two Physiographic Regions

Many settlements have grown up in such an environment—Kathgodam, Kalka, Koilabasa, etc., may be taken as examples of such locations, where hills meet plains. The location of Jammu is also of the same type.

Sites of Cultural Importance

Such sites are found along routes, passes, road junctions, river-crossings, etc. Settlements also grow near sacred spots such as Gangotri, Kedarnath, the Hemis monastery and so on.

Urban Settlements

There are few urban settlements in the Himalaya of any importance. They may be divided into a number of types.

Modern Hill Resorts

Such towns are modern and were developed by the British, who liked to escape the heat of the plains during summer. The Governors and Viceroy's shifted their offices to the hills in summer. The families of Britishers lived in hill stations. Many cantonments were attached to hill resorts where British soldiers lived to avoid heat. The locations of such towns do not depend much on topographic factors. Simla, the biggest of such hill stations, is situated on a sharp ridge joining two peaks, Jako and Prospect Hill. The city spreads on the gentle, southern sunny slopes. It is reached by a hill railway and a road, nearly eighty kilometres long. Water supply is difficult, but it has to be arranged by pumping up water by electric power. Movement in the town is along steep up and down roads. The main advantage is the low temperature due to altitude. Other hill stations are also located in this area, such as Kasauli, Solon, Dagshai, Sabathu and so forth. Dalhousie was also a big hill station developed by the British. But after the partition of India, its extreme situation has made it less important. Dharamsala under the shadow of snowy Dhaola Dhar is another British hill resort.

Mussoorie, called the queen of all hill stations, is located on a 2,000-metre high limestone ridge rising abruptly above the Doon valley, from where it is reached by a serpentine road.

Nainital is a British-made hill station with a difference. It is located in a depression filled with a blue lake. But Ranikhet near it is situated on a ridge-top. Both have cantonments attached to them.

The biggest hill resort in the east is Darjeeling developed on a sharp spur, it has a protected position behind the Ghoom ridge. Shillong in the eastern hills is spacious, as it spreads over a rolling plateau. It is the capital of the new state of Meghalaya.

Old Towns and Princely Capitals

Old hill towns were located very often on wide terraces which provided space for an ideal location for the growth of the town. Food could be grown in adjoining terraces. Many small Himalayan kingdoms had their capitals located in such places. The sites are definitely better than the sites of British towns.

Chamba is situated among wide terraces of the river Ravi, Kulu is located on a wide terrace of the river Beas. Bilaspur was again situated on a terrace of the Sutlej. But it is now drowned in the waters of the Govind Sagar.

Old capitals of kingdoms are also found in exposed lake bottoms. They have developed as cultural centres of the kingdoms. Srinagar is the capital city of Jammu and Kashmir. It is also the centre of Kashmiri culture. Similarly, Kathmandu is the capital city and cultural centre of Nepal. Again, Imphal in an exposed lake bottom is the centre of Manipuri culture. Some towns are located in bowl-like water gathering basins at the sources of streams, which were perhaps glacial amphitheatres in the past. The towns of Pithoragarh and Champawat in Uttarakhand, and Jubbal in Himachal Pradesh have such situations.

The Optimum Belt

The most important factor in the development of rural and urban settlements in the Himalaya is altitude. Even the various favourable topographic land-forms have some relation with altitude. The following altitudinal zones may be easily recognized.

(i) *0 to 1,000 metres* : Here the topography is rough. There are deep gorges and sharp water partings. The area is covered with tropical forests infested by wild animals including elephants and tigers. The climate is warm and humid. There are few settlements of any importance.

(ii) *1,000 to 2,500 metres* : This may be called *the optimum belt* in the Himalaya. River terraces are very well developed. Upon them are located villages and towns. The climate is cool and comfortable. Cultivation can be easily carried out on terraces and gentle slopes. There are fewer forests. The majority of the people of the Himalaya live in this belt.

(iii) *2,500 to 3,000 metres* : This belt is extremely rugged. It is cooler and is generally covered by coniferous forests. But there are some villages with cultivation in favourable places. River gorges are deep and often U-shaped cliffs of truncated spurs and thundering waterfalls provide awesome grandeur.

(iv) *3,000 to 4,000 metres* : This belt is inhabited by semi-nomades, who are shepherds and traders. There is much grazing in alpine meadows. There are some temporary summer dwellings. The few settlements are found on glacial terraces and amphitheatres.

(v) *4,000 to 5,000 metres* : This belt is cold, rocky and snowy. There may be a few pastures in favourable spots. There are generally no permanent settlements. Only semi-nomads visit there areas now and then.

(vi) *Above 5,000 metres* : These are rugged empty regions of rock, ice and glaciers.

VII. TRANSPORT DEVELOPMENT

MOUNTAIN TOPOGRAPHY has always been against development of transport, and the Himalaya, the biggest mountain of the world, naturally, has poorly developed communications. The development of routes becomes difficult if the terrain becomes rugged. The deep gorges of these ranges, the dizzy heights of peaks, the dense forests, the rock cliffs and snow-covered regions at high altitudes all go against the development of transport. Some of the highest mountain passes of the world are found in the Himalaya. All the passes in the central axis of the Great Himalaya range are over 3,000 metres high. So the routes have to rise over three to four thousand metres, and even more. The passes remain open only for a part of the year.

Before 1945 there was not a single motorable or jeepable road across the Himalaya. A jeepable road was built up to Nathu La in Sikkim and the Chinese in the meantime built a road up to Nathu La from the Chumbi valley. This was the first motorable road across the Himalaya.

The Chinese again built a road across the high north-eastern plateau of Ladakh. The Indians also built roads up to this line beyond Leh.

Lastly, the Indians built the Tribhuvan Rajpath from the plains of India to Kathmandu and the Chinese built a road from Kathmandu to Lhasa *via* Kodari. This is perhaps the best road across the Himalaya now.

More and more roads are being built by Indians up to the border passes at Shipki, Mana, Niti and so forth. The Chinese are also building corresponding roads. But often these roads are extremely difficult to maintain, and are impassable in winter, when snow piles upon them. The roads will take much time to stabilize. Big landslides often constitute temporary blocks on the roads.

There are only three narrow-gauge railways which go into the Himalaya. One of them is the line from New Jalpaiguri to Darjeeling, a very popular railway for tourists. It makes a number of loops to climb the mountain. The second hill train connects Kalka with Simla. It is a better-laid and maintained line. It passes through more than 100 tunnels, the biggest being the Barog tunnel, more than a kilometre long. The third railway line does not climb so much. It connects Pathankot with Jogindernagar where a hydro-electric power station is situated.

There are but few plans to build railways in the Himalaya, as they are very costly to construct and maintain. In fact, the existing hill trains are often run at a loss. There is a proposal to build a railway from Jammu into Kashmir up to Udhampur. It will have strategic importance. But perhaps electrically driven railways are the answer.

The rising strategic importance of our northern borders and our continuing tension with our neighbours in the north and the west have resulted in a phenomenal development of roads in the Himalaya. However, it was soon noted that the strategic roads resulted in much economic stimulation in isolated Himalayan valleys. So this gave further impetus to building more roads, strategic as well as non-strategic. Remote places are now linked by a network of roads. The road-heads are gradually advancing and proving a boon to the stagnant mountain regions. The economy of the Himalayan valleys is being vitalized. Along the roads come traders from the plains to purchase hill products and sell plains commodities. This is making the hill people more active.

Modern means of communication are also being introduced. There are ropeways at some places, such as the Tista valley ropeway. The first passenger rope-car was built from Darjeeling to Pull Bazar. A rope-car is to be built up to Khilanmarg in Kashmir. A fine ropeway has been built from the Mall to Gun Hill in Mussoorie.

Sky-line logging has been introduced in many mountain valleys by which timber is transported down by attaching it to hooks, which run over wires. It is well developed in the Sutelj valley and has been introduced in the Yamuna, Tons and Sarju valleys.

Air services operate only in Nepal, Kashmir, Kulu and Manipur. Both Nepalese Airways and Indian Airlines connect Kathmandu with the cities of India. There is an air port at Gauchar near Kathmandu. Pokhra in western Nepal is connected to Bhairawa near the Indian border. Both have landing-strips. Pokhra is connected with Kathmandu. There is an air landing-strip at Simra on the plain near the Raxaul railhead in India. Simra is only half an hour's flight from Kathmandu.

Srinagar in Kashmir is connected to Delhi, Pathankot and Jammu by air. A weekly air service operates between Srinagar and Leh. There is an air service connecting Calcutta with Imphal, the capital of Manipur, *via* Agartala and Silchar. A seasonal air service operates between Delhi and the Kulu valley. The plain touches down at Chandigarh and flies to Bhuntar near Kulu. Transport packet planes are also used here.

There are some air landing-strips in Arunachal. Supplies are also air-dropped.

Air transport should develop further. The air landing-strip at Gauchar in the Alakananda valley may operate a seasonal air service. Helicopter flights should also be operated for the benefit of civilians.

Roads are the most important type of transport in the Himalaya, and railways, ropeways and airways are only developed a little.

In Kashmir, Srinagar is joined to Pathankot *via* Jammu. This is the only road from the plains to the valley. So it has to be well maintained. The road climbs over two passes, first over Dhaola Dhar at Patni, then down into the Chenab valley at Ramban, and up again to Banihal and across the

Jawahar tunnel, which has been pierced in the Pir Panjal range to maintain traffic during winter, when the pass above is under heavy snow.

The previous road to Kashmir is now cut into two by the Cease-fire Line at Uri. It comes from Rawalpindi in Pakistan, climbs to Murree and then goes down to the Kohala bridge over the river Jhelum on the border. However, the occupying Pakistani army controls it up to Uri. From here the road continues along the Jhelum valley to Baramula and Srinagar.

There is a track from Poonch to Srinagar across the Pir Panjal pass. It is actually the first Moghul road to Kashmir over which horse-carts used to ply in the past. It should be developed again. A new road joins Poonch with Jammu. So it will provide an alternate route to the valley.

There are many roads in the Vale of Kashmir joining Srinagar with Gulmarg, Chandanwari (beyond Pahalgam), and around Lake Wular *via* Bandipur and Sopor. Roads also go to the Lolab valley and Yusmarg.

An important road has been constructed from Srinagar to Leh *via* Sonamarg, Zojila, Dras, Kargil and the Khalatse bridge over the Sindhu (Indus). Leh is joined by a jeepable road to the Kulu valley *via* Bara Lacha La, Keylang, the Rohtang pass and Manali.

There is very great development of roads in Himachal Pradesh. A road climbs from Pathankot to Dalhousie. At Banikhet, five miles below it, a road leads to Chamba.

The Kulu valley road is very important. It runs from Pathankot *via* Kangra to Baijnath, Jogindernagar, Mandi, Kulu, Manali and Rahla below the Rohtang pass. From here a jeepable road goes to Keylang and Leh.

From Mandi a road goes to Simla.

Simla is a big road junction. From Kalka a road comes to Simla and proceeds as the Tibetan Highway *via* Kufri, Narkanda, Rampur, Tapri, Karchham, Poo and on to the Shipki pass on the border. From it a road climbs to Kalpa

and another goes to the Baspa valley. This road is a masterpiece of engineering. In many sections it passes along grooves and tunnels cut in solid rock. The fourth main road runs from Simla to Chakrata and on to Mussoorie. It goes down to the Giri valley from Theog on the Simla-Shipki Road. It then climbs to Khara Pathar near Jubbal and descends to Pabar and the Tons valley at Tiuni. On the other side, the road proceeds to Kanasar, Deoban and Chakrata. From here roads lead to Mussoorie and Dehra Dun.

Other main roads serve the pilgrim centres of Uttarakhand. A new road runs up the Yamuna valley to Barkot and on to Gangani and further up to Hanuman Chatti. Barkot is joined to Dharasu in the Bhagirathi valley. From Barkot another road goes across the Yamuna into Jaunsar-Bawar via Parola, Jarmola and Hanol to Tiuni.

The Bhagirathi valley road starts from Rishikesh to Narendranagar and on to Tehri. Chamba on this road is joined to Mussoorie. From Tehri the road proceeds to Dharasu, Uttarkashi, Bhatwari, Harshil, Jangla and Nilang. A path proceeds to Gangotri and Gaumukh. This is also being converted into a motorable road.

The road to the Alakananda valley also starts from Rishikesh. It proceeds up the Ganga valley to Devprayag and then along the Alakananda to Srinagar, Rudraprayag, Karnaprayag, Joshimath, Vishnuprayag and Badrinath. From here a jeepable road goes to the Mana pass. To this road there are many branches. One road goes from Rudraprayag towards Kedarnath along the Mandakini valley up to Rampur. It will proceed up to Kedarnath.

At Karnaprayag a road bifurcates to the Pindar valley and crosses Gwaldam to reach the basin of Baijnath, which is on the Almora-Shama Road.

A road from Joshimath goes towards the Niti pass. At Srinagar a road climbs to Pauri and goes to the plains at Kotdwara. It joins Lansdown, a cantonment.

The roads in Kumaon start from Kathgodam. Here the roads are very well developed. A beautiful road climbs to Nainital from Kathgodam. Another road goes to Bhim Tal. From Nainital a road goes to Bhowali, Garam Pani, Khairna, Ranikhet and Almora. There is a connecting short-cut road between Khairna and Almora. Also Bhowali is joined to Bhim Tal. From this road, a road goes to Ramgarh and Mukteshwar.

From Almora one road goes to Kosani, Garur, Baijnath, Bageshwar, Barari and Shama. Another road from Almora goes to Rameshwar and Ghat.

Another road joins Ranikhet with Ramnagar Mandi on the plains. From this road, a road goes to Karnaprayag.

Yet another road starts from the Tanakpur rail-head to Chalti, Champawat, Ghat, Pithoragarh, Ascot, Dharchula and Tawaghat. Again Ascot is joined to Bageshwar *via* Didihat and Thal. From Thal a road goes to Munsiri. So there is a very good network of roads in Uttarakhand. More roads are being built here. It is interesting to note that one can now travel by road from the Nepal border to Kashmir through the mountains. One can start from Pithoragarh and go *via* Ghat, Almora, Baijnath, Gwaldam, Karnaprayag, Devprayag, Tehri, Chamba, Mussoorie, Chakrata, Tiuni, Simla, Mandi, Keylang, Leh, Kargil, Sonamarg and Srinagar to Jammu.

In Nepal much road building activity is going on. The first road to Nepal was built by India from Raxaul and Bhainsi to Kathmandu. This road has been extended to Lhasa *via* Kodari. Another road has been completed from Sunauli on the Indian border *via* Bhairawa, Butwal and Tansen to Pokhara. Another road goes to Dhankuta from Purnea. There is a plan to build a lateral road in Nepal from east to west *via* Ilam, Dhankuta, Okhaldhunga and Ramechhap to Kathmandu. It then proceeds westwards to Trisuli, Gorkha and Pokhara. There are many roads in the Vale of Kathmandu to Patan (Lalitpur), Bhadgaon (Bhaktapur), Chhobar, Trisuli and Sundarjal.

In Darjeeling and Sikkim, the starting point is Siliguri. From here a road goes to Darjeeling. A road from Ghoom goes to Sukia Pokhri. From here a jeepable road goes along the Nepal border to Manebhanjang, Tanglu, Sandakphu and Phalut. Another jeepable road runs down to the Tista bridge *via* Mongpu, from where the road descends into the Tista valley. Yet another jeepable road descends to Manjhitar, which is joined to the Tista bridge along the Rangit valley route.

The other road from Siliguri goes to Sevoke on the Tista and then crosses the Tista bridge to ascend to Kalimpong. Another road enters Sikkim along the Tista river and then climbs to Gangtok. Yet another jeepable road proceeds to Nathu La and Jelep La. A beautiful new road called the North Sikkim Highway has been constructed to Mangan, Singhik and Lachung.

In Bhutan there is only one road. It starts from the Indian border at Phuntsoling to a place called Confluence. It then bifurcates to go to Paro and Thimpu. More roads are being built.

Many roads have been built in Arunachal Pradesh for development purposes. One road proceeds from Tezpur to Bomdi La.

There are roads to Zero, Along and Walong. More and more roads are being constructed here gradually. Meanwhile they are opening up this stagnant and remote area.

There are a good number of roads in the eastern hills. The famous Burma Road, which was built during the World War II has now gone out of commission. It starts from Ledo and ends in the Patkai Hills.

A new road has been built to Mokokchung in Nagaland. The old road starts from Dimapur to Kohima and Imphal. From here it extends to Moreh on the Burma border. From Silchar there is a road to Aijal in the Mezo Hills.

The above description shows that there has been a very rapid development of roads in the Himalaya. One can now



PLATE 1—*Three Gujar Women outside a typical Gujar hut made of solid of wood at Baisaran above Pahlgam in Kashmir.*

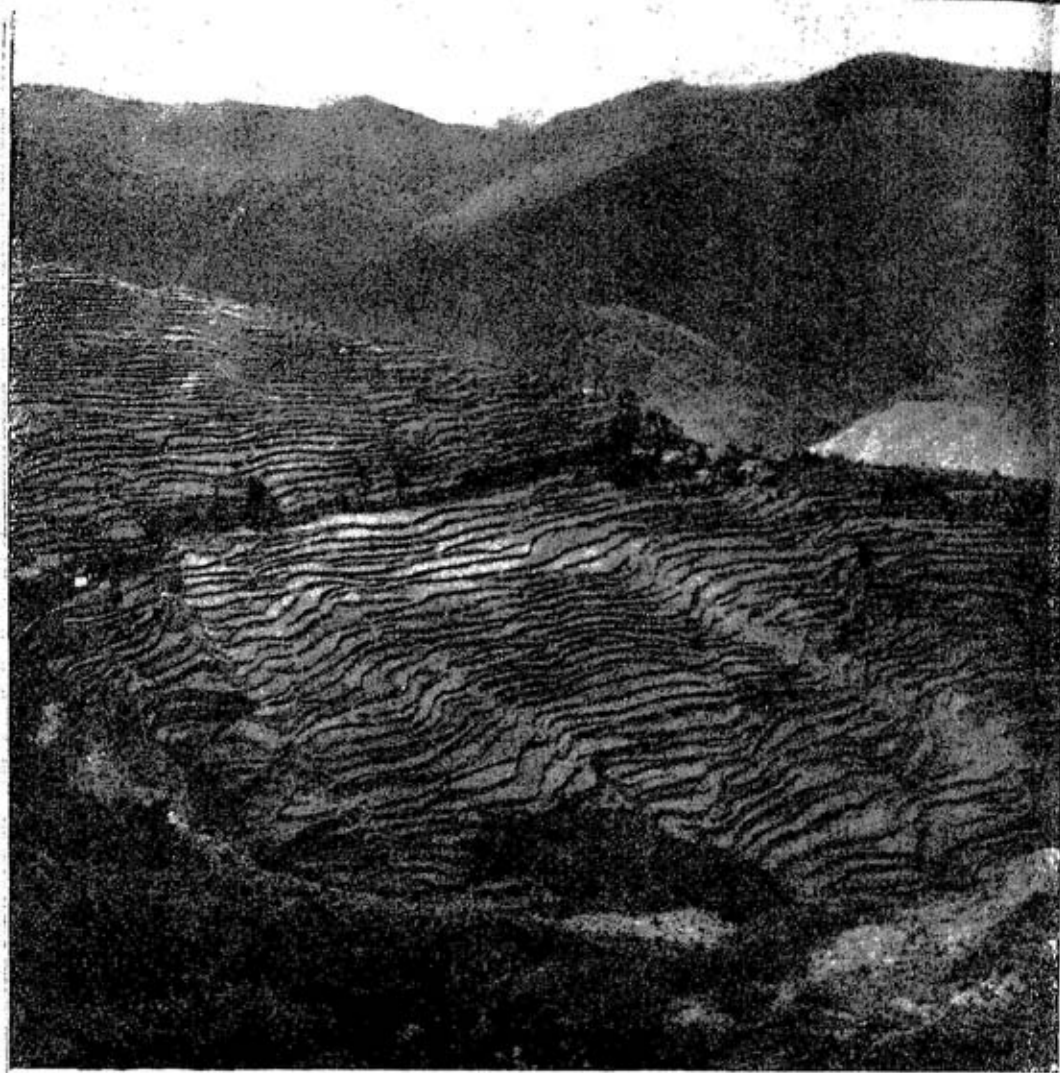


PLATE 4—*Terraced fields for growing maize in Paniali near Ranikhet.*

travel by road to distant, remote and high areas. Not long ago pilgrims to Badrinath had to walk long distances, but now they can go to this place by means of buses and cars.

Nevertheless, much more can be done. Electric traction can be easily introduced after developing hydro-electric power. Unless there is further development of transportation, resources of the Himalaya cannot be fully or satisfactorily utilized.

The above description of the road network proves that tremendous efforts have been made to open up this rugged region. The development of communications has stimulated the interest of the plains people in the mountains. Scores of tourists and traders visit remote places. The increasing cultural contacts are educating the hill people.

The great physical barriers have been overcome. Though usually the roads are built along the valleys, they often climb up high snowy ranges, which have acted as barriers of culture.

The border roads also have a great strategic importance, and finance is provided for extending and maintaining them. Meanwhile the States are also interested in opening up the stagnant economy of remote valleys and spending more money than the expected return, as the main aim is development.

VIII. POWER AND INDUSTRY

THE HIMALAYAN REGION is a backward area in regard to power and industry. In spite of the fact that it has an immense potential for developing hydro-electric power, only a small fraction of it has so far been developed.

There are good resources to develop industries. Wood and wood pulp, resins, wool, silk, skins and hides, fruits, etc., can provide a good base for industries based on forest, animal and horticultural produce.

The hillman is clever, intelligent, industrious and withal honest. He has proved his skill in many ways. He can easily develop as an industrial worker. So there should be no shortage of skilled labour in the Himalaya.

The hillman is poor and has little capital. But the people from the plains or even the hill people who dwell in the plains and are rich, should be able to supply capital for starting small industries. The Government can also help.

Transportation has developed to some extent, and this can be easily developed further.

But industry has yet to come to the hills. People are still lethargic in regard to industrial development.

A sorry case is the attempt to develop an industrial estate on the broad terrace at Tehri. The accommodation built by the Government is lying unused. If a reservoir is constructed in the Bhagirathi valley near Tehri as proposed, the industrial estate is in danger of being washed away.

Big industry has developed only in the adjacent plains. Hill products are brought here to be used in industrial plants, such as pulp and paper factories, and in turpentine oil and catechew factories. There is a big industrial complex near Nangal, where heavy water and fertilizers are being produced by using power from the Bhakra project.

The first hydro-electric power-station built in India is a small power-house at Chhidrapong in a gorge below Darjeeling. It supplies power to the town and its neighbourhood.

A bigger power-house was built at Jogindernagar near Mandi on the way to the Kulu valley. Here a reservoir has been built on the river Uhl, a tributary of the Beas, which runs through a high longitudinal valley. The water-divided between the Beas and the Uhl has been pierced by tunnels, through which the penstock pipes come out and drop down about one thousand metres to the power-house at Jogindernagar in the Beas valley. This is a novel and successful scheme, planned and executed by the British. Power production began in 1935. The present capacity of the station is 48 mw. Another 48 mw can be produced. But demand for power should be developed. At one time this project supplied power to the whole of north-eastern Punjab. Lahore was lighted by power from Jogindernagar. Power supply, later on, was stopped from going to Pakistan. Also due to the creation of the Bhakra power production units, the supply lines of Jogindernagar had to be re-adjusted to supply power to its neighbourhood and towards the north.

Another old hydro-electric power-station is situated below Baramula near Mahora in the Jhelum valley in Kashmir. It produces only 3.2 mw of power. Further, it was severely damaged by invaders from Pakistan just after partition. It has, however, been developed to produce more power, the ultimate capacity being 10 mw. Another power-station has been developed at Gandarbal on the Sind river, which produces 7.5 mw of power. There is a hydro-electric power potential all round the Vale of Kashmir, which is yet to be developed and utilized.

Some other old hydro-electric power-stations are small units established by the British in hill resorts like Nainital, Almora, Ranikhet, Mussoorie and Simla.

The stage for big power development arrived only after independence. The Bhakra-Nangal project on the river

Sutlej was the first such big station in India. There is a big U-shaped meander of the Sutlej here, the core being a ridge. The ridge and the two legs of the river have a longitudinal alignment. The dam is built above the bend of the 'U'. It is 225 metres high, thus being the tallest dam in the world. The Govind Sagar reservoir behind the dam is 80 kilometres long and has submerged the town of Bilaspur. Thirteen kilometres below Bhakra, a barrage has been built at Nangal. Two power plants each producing 48 mw at Ganguwal and Kotla were the first to be completed near Nangal. Two big generating stations have been completed just below the Bhakra dam, each with a capacity of 600 mw. These are the biggest power units in India. Another big project linked with Bhakra is being completed in the Beas valley, where a dam is being constructed at Pong. A link power canal is being constructed from the Beas to the Sutlej, joining it above Govind Sagar. There will be one more big power-station on this canal. The water escaping from the power-houses is being used for irrigation in the plains of the Punjab and Rajasthan.

Another big hydro-electric project is being completed in the Tons valley, a tributary of the Yamuna. The Tons has a steep gradient and has an S-shaped course just above its confluence with the Yamuna. An underground tunnel is being bored in a straight line descending from the top of the 'S' to its bottom, making the gradient of the falling water steeper. The penstock pipes have been put in this tunnel.

They are seen on the surface at the top and the bottom, and also in the middle, where they cross the middle of the 'S'. Three power-stations are to be built at these three places. At the top a dam and a reservoir are being constructed at Koti. A barrage across the Yamuna has been constructed at Dak Pathar, from where a power canal emanates. Two small power-stations have been built over it. The total power to be generated in this project will be 324 mw.

Another big hydro-electric power project is under construction on the river Ramganga near Ramnagar Mandi at Kalagarh. After completion, it will produce 135 mw of power.

The Sarda canal cut in the Sarda river within sight of the Himalaya near Tanakpur has a medium-sized power plant at Lohia Head. It produces 41.4 mw of power.

A small power-station has been constructed at Pathri below Hardwar on the Upper Ganga canal. It produces 21.2 mw of power. Small power stations have been constructed at Bageshwar and a few other places. There is a scheme to construct one at Badrinath.

All the above-mentioned power plants are located in western Himalaya.

In Central Himalaya a very small power-station has been constructed near Valmiki Nagar where the Gandak Barrage has been constructed. The power will be given to Nepal. In the Kathmandu valley there is a power-station at Sundarjal. A bigger power-station is being constructed at Trisuli by Indian help.

There is only one power project of some importance in eastern Himalaya at Jaldhaka. The total capacity of this plant will be 24 mw when completed. But it is rather an unfortunate project. It has twice been very heavily damaged by floods. It is located in the Jalpaiguri district of West Bengal. The power is badly needed for saw-mills and tea-gardens.

The above description of power production in the Himalaya seems to be quite impressive. It may be safely said that development of power is proceeding great speed. Some big projects are also under active consideration. One of these is the Bhagirathi project, which envisages the building of a high dam in the gorge above Devprayag. It may submerge Tehri and its fertile terraces. But the power produced will be about a million mw.

In the eastern hills a project is under consideration in the

river Kopili, which if completed, may produce 390 mw of power.

The power potential of the Himalaya is very high indeed due to supply of water from rain and melting snows, and also due to rugged topography. But the generation of power should also aim at its proper and useful consumption. This will happen only if this area is industrialized.

It seems unfortunate that the big hydro-electric power project reservoirs often submerge precious lands in the Himalaya in the optimum belt. A case in point is the submerging of Bilaspur town and the fertile terrace lands around it. This feature may repeat itself in the Bhagirathi valley project. It will be better if the big projects can be broken into a chain of smaller stations, and that utmost care is exercised in doing so, so that fertile terrace lands may not be submerged. The new Bilaspur town on the slopes above Govind Sagar is a poor substitute for the beautiful town which is now under water, and where fish swim in submerged places and temples.

Development of power has taken place mainly in the west and very little has been done in the east. However, there is more rain in the east and so there is a greater potential. In fact, the power potential of the great river Brahmaputra in its gorge can supply cheap power to the whole of Assam, Nagaland, Manipur and Agartala. But it has yet to be harnessed.

The whole of this north-east Indian region has very poorly developed industries and the demand for power is low. This is one reason why this great potential is going to waste. The existence of mineral oil and power production from it is also a retarding factor. But oil is needed elsewhere in India and so it need not stand in the way of hydro-electric power development.

Mention may also be made of the great potential of the river Kosi and its tributaries in central Himalaya. A big project was proposed on this river in the Barahakshetra

gorge, where a high dam was to be constructed. If constructed, it might have been a rival to the Bhakra project. But it was never completed. A poor substitute is a barrage over the Kosi at Hanumannagar to control its floods and irrigate land. No power is produced. But in time Kosi will also be harnessed to produce power.

INDUSTRY

Industry is very poorly developed in the Himalaya. It is said that environmental factors are against industrial development here. But if we consider the example of the highly industrialized country of Switzerland in a similar environment, we may visualize a time when the Himalaya will be industrialized to the same level.

The most important modern industry in the Himalaya today is the tea industry. There are quite a large number of factories in Darjeeling district which produce tea. Many of these are modern and well-equipped factories. Darjeeling tea is famous all over the world for its fine flavour. It is the black variety of tea. The scope for the further development of this industry is limited, as Darjeeling tea is costlier than Assam tea. The market for this tea will have to be explored to make further expansion possible. It is true that the tea-drinking habit is on the increase in India. Darjeeling brands of tea such as 'Happy Valley', 'Lopchu', 'Single', etc., are in great demand in far-off areas too.

The fruit preservation industry is yet in its infancy in the Himalaya. It is high time that this industry is further developed. Credit should be given to the Uttar Pradesh Government for having given a good start to this industry. There is a small factory at Ramgarh and another at Chaubatia which manufacture fruit juices, jams and jellies. They are tinned and exported to the plains. This can also be done in Sikkim, Darjeeling, and Shillong to preserve orange juice in bottles. Kulu should have a factory for making apple juice and jelly. It is really painful to note that the Vale of Kashmir has yet

to have a factory to tin its great and varied fruit production including apples, pears, peaches, plums and apricots.

The fruit-canning industry will help the export of these preserves to the plains, which will stimulate greater production of fruit. Kotgarh in the Simla Hills may have a good fruit tinning plant for peaches, pears, plums, apricots and apples. This industry will save much fruit from rotting. Cherries can also be tinned profitably.

There is a great potential in the Himalaya for developing this industry, and there is a great demand of this product. However, fruits jams, jellies, juices, etc., made in India are now meeting local needs.

Silk-rearing is practised in the Vale of Kashmir, where silk-reeling and weaving is done in a mill. The Kashmir silk industry is very old. The Kashmiris are also very good at embroidery by means of coloured silk thread. Sericulture should be practised more and more in secluded mountain valleys as is done in France, Italy and Japan. Mulberry plantations can be grown on slopes to feed silk-worms. There is great scope for this industry in the Himalaya.

Forests provide softwood for making pulp. Pinewood can easily supply this commodity as in Norway, Finland and Canada. Some paper is made from pinewood pulp in a Saharanpur Paper Mill. With hydro-electric power and pine pulp, the Himalaya should become a great producer of paper. India does not produce enough paper for her needs, which are increasing. It is very necessary to develop this industry in the Himalaya. It is strange that our planners have not given sufficient attention to this fact.

Manufacture of light furniture can also easily develop in the Himalaya with its supply of many kinds of timber. The Dehra Dun Forest Research Institute has done much to demonstrate the various uses of forest produce. But very little has been done yet on commercial lines to produce marketable goods.

Forests produce raw material for turpentine oil, matches

catechew and many other useful products. At Mongpu near Darjeeling, there is a factory producing quinine from a cinchona plantation. Tung trees are also grown here from which lacquer is produced.

There is a great variety of herbs and medicinal plants in the Himalaya from which a drug industry can develop. There is a plantation of *Serpentaria raulphii* from which drugs are made at Rangpo. This side of the industry can be greatly developed, for which much research is necessary.

There is a good production of milk and dairy products in the Himalaya. But there are only some local sales of milk, butter, cheese and *ghee*. No attempt has been made to commercialize these products. We may copy Switzerland to set-up co-operative creameries near our high-level pastures, when electricity is freely available.

It may be generalized that industries of various types have been developed very little and there is a great potential for them.

COTTAGE INDUSTRY

It is this type of industry which has been developed to some extent. The Government has taken many steps to do so. There are training schools to which are attached production and sales units. The trainees earn while they learn.

The Vale of Kashmir is a very important producer of cottage industry art products. The Government of Kashmir helps a lot in this respect. Tourists purchase these goods in Kashmir. There is a Government Art Emporium not only in Srinagar but also in all important cities of India. Exhibitions are also organized from time to time.

The products are of great variety. Walnut furniture, silk cloth and silk embroidery, papier mache art goods, products of fur, art products of wool such as carpets, *namda*, *gabba*, clothing, shawls, pashmina etc., precious stones and jewellery, wicker-work, etc. Kashmir art possesses exquisite beauty. Shawls are so fine that they can be passed through a ring.

In Himachal Pradesh, woollen products including blankets, woollen cloth, Kulu caps, pashmina, etc., are made. There is a Government co-operative store even in far-off Chini in Kinnaur. The markets of Simla are full of cottage industry products. In the fair at Kulu, the Government helps in the sale of such products.

In U.P. there are many training centres for developing cottage industry and co-operative stores for their sales. The products include woollen goods such as *thulma*, a kind of blanket, *chutka*, a kind of carpet, *pankhi*, a kind of shawl, wooden products such as sticks, sports goods, etc., ashwood (*Angu*) being used for some such goods. Wooden toys, wicker products, deer skin goods, etc. There are training-cum-sales centres at many places in the interior, such as Bageshwar and Kapkot. Shops in Nainital sell such art goods. Walking-sticks of hill wood are great favourites with tourists.

In Nepal cottage industry is very well developed. Wooden, metal and cotton dolls and toys are made there. Brass and bronze goods are made in Patan and Bhadgaon. Exquisite models of the Pashupatinath temple are made.

In Darjeeling, a large training centre has been organized for refugee Tibetans. Here woollen cloth and apparel, carpets, scarfs, embroidery products, dolls, etc., are made and sold. A similar centre has been developed in Gangtok.

Manipur is very important as a producer of cotton and woollen handloom products. Brightly-coloured cotton textiles and apparel are made and sold in Manipur and Nagaland.

All this points to the great importance of cottage industry in the Himalaya. It is fairly well developed. Finally, it may be suggested that jewellery, watch-making, etc., can also be developed in the Himalaya as such an industry does not require transport of bulky goods. But little has been done in developing this industry and there is an immense scope for its development. The hill man has shown that he is industrious, artistic and laborious.

IX. REGIONAL GEOGRAPHY— WESTERN HIMALAYA

IN THE FOLLOWING CHAPTERS, a description of the regional geography of various administrative units of the Himalaya is given. It is divided into three parts, the Western, the Central and the Eastern Himalaya.

JAMMU AND KASHMIR

In the western part of the Himalaya, the mountain state of Jammu and Kashmir forms the northernmost State of India. It lies roughly between 32° - $10'$ and 37° - $10'$ North latitudes and 72° - $30'$ and 80° - $30'$ East longitudes.

The eastern, northern and western borders of the State form the international border of India. To the east and north of the State lies Tibet. To the west of the border is Pakistan. A very small portion of the border in the north touches Afghanistan. To the south is Himachal Pradesh and a very small part of the border separates the Punjab.

The State has an extremely rugged topography and, in general, a very high altitude. Much of the northern part of the State is covered with snow and rock and is uninhabited.

Trans-Himalayan Region

The river Sindhu (Indus) and its tributary the Gilgit divide the State diagonally into two parts. To the north of the Sindhu furrow lies the trans-Himalayan portion of the State. It is covered by a series of ranges, the Aghil range forming the northernmost boundary. South of it is the mighty Karakoram range with its large glaciers and high peaks, which include the big glaciers Baltoro, Biafo and Siachen, and the peaks Godwin Austen (K_2), Masherbrum and Rakaposhi. South of the range are the Kailash and the Ladakh ranges.

The river Shyok, its tributary the Nubra and the river North Shigar rise from the Karakoram glaciers to join the Sindhu. The Soda plain in the north-east is drained northwards by the Qara Qash. Another part north of Karakoram is drained by the Shaksgam into the river Yarkand. The river Gilgit and its tributary the Hunza drain the north-western part of the State.

Much of this Trans-Indus region is a cold rocky waste and is very thinly populated. In its eastern half, the inhabitants are Ladakhis, who are Buddhists. They follow Lamaism.

A number of desolate high plains cover the north-eastern part of Ladakh. They are nearly desolate and only wild asses inhabit them. Their names are Depsang plains, Soda plains, Aksai Chin, Lingzi Tang and Chang Chenmo. Through them pass a number of caravan routes. Salt-encrusted lakes are found in these plains, the biggest being Pangong Tso. Leh, at a height of 3,522 metres, is the capital of Ladakh. It is a very important route centre. It is joined by a road to Srinagar. There is also an air service between Leh and Srinagar. Perhaps the most desolate and high caravan route of the world goes north of Leh to Sinkiang in China. It climbs three very high passes, Khardung La (5,602 m) over the Ladakh range, Saser La (5,382 m) over the Karakoram range and the Karakoram pass (5,575 m) over the Aghil range. A very important route passes along the Sindhu valley through Leh to Gilgit in the west and Manasarowar and Kailash in the east. A jeepable road goes south from Leh through Zaskar and Rupshu to Lahul and Kulu.

This area has become very important strategically. The Chinese built a road across the high plains joining western Tibet with Sinkiang. For this purpose they occupied a large portion of the salt plains named above. The Indian army had to move forward and stop them from further advance. Our jawans are here even today, facing the Chinese army. A number of forward army posts have to be

maintained here in spite of extreme cold. One of these bases is at Chushul north of the Ladakh range which can be crossed by two high passes, Khardung La and Tsaka La, which latter is slightly lower. Chushul gets its supplies mainly by air. Another post is far north at Daulat Beg Oldi which guards the Karakoram pass.

The central portion of this Trans-Himalaya region is called Baltistan, where Muslim Baltis live a very hard life. Their main occupation is herding. They cultivate some barley in the Sindhu valley, where stands their capital, Skardu. Baltistan today is under the occupation of Pakistan, which infiltrated into this area through the Sindhu gorge at Rondu. West of the Sindhu is the vale of Gilgit. This is also occupied by Pakistan. A part of the Gilgit basin has a low altitude of about 1,500 to 2,000 metres. The climate here is very bracing. River terraces are well developed and provide space for cultivated fields, fruit-gardens, villages and roads. Here is situated Gilgit town which has now been connected by a good road to Abbotabad in Pakistan.

The beautiful and remote valley of the Hunza lies north of Gilgit. It was approachable by a dangerous jeepable road along the Hunza gorge. But today a new motorable road passes through it to Gilgit and Pakistan. Here two small towns of Baltit and Nagar are situated in a green oval-shaped valley below towering snowy peaks including Rakaposhi (7,788 m). The people here had little contact with the outside world. The seclusion of the valley, for all practical purposes, was complete. The people are happy, contented, tough and hardy. They work as high-level porters for mountaineers. From here the new road goes north to the valley of the Shaksgam. Two Mirs administer the valley. The Mir of Hunza has his capital at Baltit on the sunny side of the valley. Here there are many fruit-gardens. The Mir of Nagar governs the southern cold part of the valley below the shadow of Rakaposhi.

The area south of the Sindhu furrow up to the axis of the Great Himalaya range is very remote and desolate. Only the valley of the Astor river to its west is quite attractive. This river rises from the northern slopes of Nanga Parvat (8,126 m), but drops rapidly to 1,000 metres to join the Sindhu below Bunji. The average altitude of the valley is two to three thousand metres. It is well forested. Astor is a beautiful village set amidst enchanting scenery. A route from the Vale of Kashmir over the Burzil pass (4,200 m) enters the valley from the south and passes on to Bunji and Gilgit. North of Burzil is the great desolate plain of Deosai. It is high, cold and uninhabited, where wild grasses grow in marshes. Only wasps and bears live here. People believe that it is haunted by ghosts.

The southern part of Baltistan lies south of Skardu. It is drained by the South Shigar river, which is fed by glaciers. The area is remote, high and desolate. There are a few villages in valley bottoms. A route through this area joins Srinagar with Skardu. There is a motorable road from the Vale of Kashmir via Bandipur and the Razdan pass to the Gurais valley and Minimarg. From here the route runs north to Skardu.

East of Baltistan is Zaskar, a wild glaciated region. A very important strategic road has been built across it, joining Srinagar and Leh. It passes through two big villages, Dras and Kargil, in this region. The eastern part of Zaskar is extremely rugged and full of medium-sized glaciers. Here the big village of Padam on a river junction is a route centre.

Rupshu is situated further east of Zaskar. To its north is a plain called More. There is also a small internal drainage basin with a salt encrusted lake, Tso Morari, in the centre. A new jeepable road has been built through Rupshu, joining the Kulu valley with Leh and passing through Lahul. The inhabitants here follow Lamaism, like the Ladakhis.

Hanle, further east on the border, is very remote and rugged. The Ladakh range passes through its middle. It is very sparsely populated.

The Great Himalaya Range

This range is anchored at its western end in the Nanga Parvat (8,126 m) peak. A large glacier named Rakiot descends steeply from the peak towards the Sindhu gorge. It is broken into blocks and icefalls. It is badly crevassed. The peak is made up of granites, gneisses, phyllites, etc. The range is crossed below Nanga Parvat by the Burzil pass.

The range runs from north-west to south-east in this State. It is again crossed at Zoji La above Sonamarg. Here is another limestone peak named Kolahoi (5,425 m). Slightly further east is the famous dolomite cave of Amarnath, where dripping water freezes into pillars of ice, held sacred by Hindus, who flock to the cave on the full moon of August to worship this sign of Shiva. The route starts from Pahalgam in the Vale of Kashmir. One has to trek over 50 kilometres over a wild glaciated region. At Chandanwari 15 kilometres from Pahalgam is the first camping ground of pilgrims. One has to cross the East Liddar or Sheshnag river here by a natural snow-bridge and then ascend a steep rock-cliff called Pissoo Ghati. It is actually the face of a spur truncated by some ancient glacier. Above is the glacial terrace of Zojpal, which is a grazing-ground of the Gujars. It serves as a good camping-ground for pilgrims to Amarnath. Further up one reaches the Sheshnag Lake from which rises the river of this name. The lake has been produced by plugging of its outlet by morainic material. The hollow has also been caused by glacial action producing an amphitheatre-like feature called a cirque. A terrace named Wavjan above the Sheshnag lake provides the third camping-ground. An old abandoned end moraine lies across the valley here, which slices it in the middle. One comes across many snow-bridges and ice-fields on this route. Higher up there is a beautiful polished rock-bowl or cirque, with many-coloured bands of folded rocks. One has then to cross the watershed between the Sheshnag and Sindh valleys by the 4,400-metre-high Mahagunas pass. The last camping ground is a desolate

circular flat plain called Panchtarni, surrounded by snowy ranges. It is the exposed bottom of a lake which filled a large cirque in the past. The nascent river Sindh crosses it in the middle. Broad terraces of moraines spread on all sides. Water from melted snows gushes out from many springs at the edge of the terrace. From here one has to climb steeply along a tributary called Amarganga which is choked with snow and glacial debris. The cave is inside a steep cliff. It is very large and has a cubical shape. It is nearly 4,000 metres above sea-level.

Pahalgam is situated at the junction of the Sheshnag (East Liddar) and the Arau (West Liddar) rivers. The last village in this valley is Arau, 11 kilometres away. The Kashmiri village stands in the centre of a green meadow, surrounded by snowy peaks and forests. The Gujars live in their log huts around Arau, and higher up in the valley. The Arau rises in the Kolahoi glacier which is reached by climbing through forests and meadows to the Liddarwat Rest House, standing on a meadow above 3,000 metres. The glacier snout from here is eight kilometres away below the Kolahoi peak.

There is one more important peak in the Great Himalaya named Nunkun (7,135 m) further east. The great range further east enters Himachal Pradesh.

The Vale of Kashmir

This enchanting valley, sometimes called 'Heaven on Earth', lies between the Great Himalaya range in the north and the Pir Panjal range in the south. It is a nearly flat valley with an oval shape, spreading 200 kilometres from north-west to south-east. It is a drained-out lake-bottom, with a lip at Baramula. It has been compared to a diamond ring with a green stone set in the middle.

The lake deposits called Karewas spread in terraces all round the valley. They are being washed away from the central portion by the river Jhelum and its tributaries.

There are many large and small lakes and marshes in the valley. Far from being the remnants of a past lake, they have been perhaps created by a slight rise of the region near Baramula, so that the outlet has been choked. Just behind this point is the Wular lake, the largest natural lake of India. It is 12 kilometres long and about 5 kilometres wide in the north.

The isolation of the valley has been responsible for the development of Kashmiri culture, which is remarkably different from the Punjabi culture.

The traditional source of the river Jhelum is at Verinag at the base of the Pir Panjal range, where a large spring is enclosed in a noble structure of historic interest. The water is channelled into a beautifully laid out terrace garden built by the Moghuls. Important tributaries of the Jhelum are the Liddar and the Sindh. There are many good roads in the valley, the most important being the Srinagar-Banihal-Jammu road.

The Kashmiris are peace-loving agriculturists. They are mainly Muslims, but a good number of them are Hindus, many of whom have settled in the plains of India. The famous lawyer Pandit Motilal Nehru was one of them, whose illustrious son Jawaharlal, and his daughter Indira have been the Prime Ministers of India. The last rulers to rule Kashmir were a clan of the Dogra Rajputs.

Kashmiris are famous producers of art goods, such as carpets, woollen and fur garments, silverware, papier mache, stone jewellery, wood-carving, wicker-work, silk embroidery, etc. During summer the Kashmiris work for tourists and make a living. Many of them possess beautifully decorated house-boats where tourists stay. The decorated *Shikara* boats transport tourists in rivers and lakes, including Bod Dal and Lokut Dal. Dungha boats take tourists to the Wular lake or the Manasbal lake. Here a garden was laid out by Akbar. *Shikaras* carry them to Chashma Shahi, Nishat and Shalimar Gardens. Others work as guides.

They also work as porters and pony suppliers. At this time art goods are sold to tourists. In the month of May, when it is very hot in the plains, tourists flock to the vale of Kashmir. This is the season of flowers. Apple, pear and peach trees are in full bloom. There is much winter snow in the high valleys. It starts melting in May and June. It is minimum in August, when there is no fresh snowfall. At this time large numbers of Kashmiris work for pilgrims who visit the Amarnath cave. There is a great demand for porters, ponies and Dolis (a kind of a sedan-chair). They also supply other comforts. One can hire tents, light furniture utensils and lanterns at very reasonable cost in Pahalgam. There is a second influx of tourists in September-October, when the monsoon withdraws and it is bright and sunny. But fresh snow and bad weather may begin any moment. During the full moon of October, saffron flowers are in full bloom, at Pampur, making the undulating land a sea of violet flowers.

As winter advances, the tourists leave. The Kashmiris celebrate their own festivals. Marriages also take place at this time.

In winter Kashmiris work indoors and make art goods. A strange custom with them is the use of a fire-pot called *Kangri*, which is hung on the bare body inside loose woollen garments. This keeps them warm. At the approach of winter, they collect fire-wood and fodder. They also purchase and stock rice.

Rice and maize are the two main cereal crops in the valley. Fruit-gardens are found near villages. Walnuts are grown to give nuts and supply wood for carving. Almonds are also grown.

Many Kashmiris live on water in many kinds of boats. Medium-sized boats are called *Dunghas*. The *Shikaras* are very light, and are used for quick transport, while large boats carry goods such as sand, stone and bricks. Timber is floated in rivers. Water bodies thus play an important part in the life of the Kashmiri.

A great variety of trees are grown for beauty and utility. The most common and prominent is Poplar. It lines the roads of Kashmir, imparting great beauty to the scene. Willows are grown to provide cane for wicker-work. Mulberries are cultivated to supply leaves for feeding silk cocoons. Walnuts give fine grained wood. But the Chinara in its majestic form and beauty is the symbol of Kashmir. The design of its leaves is copied in Kashmiri art.

Srinagar is the capital of Jammu and Kashmir. The centre of the town is very much congested. Wood is largely used in house construction. Even slanting roofs are made of wood shingle. The river Jhelum passes through the heart of the city in a U-shaped bend, and there are seven bridges across it which have used a lot of timber in their construction. At the end of the town is a dam, which keeps the water deep. Boats have to pass through locks when they move out to the Dal Lake or to Shadipur. The lakes and the Moghul Gardens are visited by tourists. Two lone hills dominate the scene. One is the Shankaracharya Hill, with a temple on its top. The other is the Hari Parvat with a fort.

The spring of Anantnag, the Achhibal Garden with its fountains, the Verinag Garden, the ruins of the Sun Temple of Martand, the ruins at Avantipur and many such attractions are spread all over the valley.

Pahalgam is a beautiful spot with a bazar at the confluence of the rivers Sheshnag and Arau. The majestic pines and deodars, the high meadows, the snowy ranges and the frothing blue waters of the two rivers make Pahalgam a great attraction for tourists. From here the way to Amarnath follows Sheshnag, while a path up the Arau leads to the Kolahoi Peak and Glacier.

Gulmarg is another resort of great beauty. It is a vast, rolling, green meadow on the top of an old glacial deposit. The meadow is surrounded by tall deodars backed by the snowy Pir Panjal range. One may climb up to the Khilanmarg meadow above the tree-line, which has been developed

for golf and winter sports. More adventurous tourists may climb up to the crest of the range to have a look at a frozen glacial lake or 'tarn' called Alapathri.

Special tourists buses ply all over the vale of Kashmir along fixed routes.

Baramula is an old Kashmiri town at a point where the Jhelum escapes from the Wular Lake and descends in a gorge to reach the plains of Pakistan.

Sopor and Bandipur are two small towns at the southern and northern ends of the Wular Lake. Many people here are engaged in catching fish and drying some of them. Water-chestnuts (*Singharas*) are also collected from the lake. All around the lake are apple orchards.

Besides fish, the Kashmiris dry vegetables of all kinds for use during winter, when cultivation is not possible.

In spite of such a good environment, giving such a great variety of resources and in spite of the traditional skill of the Kashmiri in producing art goods, the socio-economic condition of the people is low. It is not surprising therefore, that both the Union and the State Government have given the highest priority in their policies to accelerate socio-economic development.

The Pir Panjal Range

Among ranges south of the Great Himalaya, the Pir Panjal range is the most prominent. In fact, it looks more prominent than even the Himalaya, as it is nearer to the plains and shows the majesty of a snow-covered range to the casual traveller first. The view from the Patni Pass near Batote is breath-taking, specially in May.

The range spreads from the Kishanganga gorge to Deo Tibba in Himachal Pradesh, where it merges with the Great Himalaya range. It leaves Kashmir at the border of Chamba. It is pierced by the rivers Jhelum and Chenab in tremendous gorges at Uri and Kishtwar. The latter gorge is a remarkable physical feature. The gorge bottom is about

one thousand metres high. On both sides of it the Pir Panjal range rises to Naginsheru (4,089 m) in the east and Piparan (4,041 m) in west. The terrace of Kishtwar hangs like a ledge in the gorge one thousand metres above the river-bed.

In Kashmir the lowest pass across the range is Banihal (2,832 m). But the road to Srinagar pierces the range by a tunnel named Jawahar Tunnel about 500 metres below the pass. The high peaks here are Tatakuti (4,742 m), Brahma Sakli (4,705 m) and Apharwat (4,143 m) which can be easily climbed from Gulmarg and Khilanmarg.

Structurally, the Pir Panjal range is quite distinct from the Himalaya. It is a much younger range. It was uplifted to its present great height only 'recently', called by geologists the Pleistocene age. Its rise cut off the river Jhelum and produced a lake called Karewa lake by geologists. Deposits in the bottom of this lake, now drained, are called Karewas. There was a lot of volcanic action in the range, and volcanic rocks such as agglomeratic slates are found here. During the glacial epoch, this area became very cold and large glaciers developed. They have left much morainic material on its northern slopes, which are generally gently sloping towards the Vale of Kashmir. The southern slopes are extremely rugged.

The Siwalik Foothills

This portion of the Jammu and Kashmir State lies south of the Pir Panjal range. The region may be taken to start from Domel at the sharp bend of the river Jhelum, where it is joined by the Kishanganga and to end at Kathua on the Punjab border. In the south near Kathua, the plains extend into Jammu and Kashmir for about 15 kilometres. At Mirpur the hills come near the border. The area is cut up by ravines. The Siwaliks here consist of low longitudinal hill ranges and Dun-like valleys in between them. At places there are gorges cut across the ranges. At many places there are broad river terraces as those at Udhampur.

There are a number of higher ridges between the Siwalik ridge and Pir Panjal. One such striking ridge called Ranjoti is made up of limestones. In the east beyond Riasi is a more conspicuous range which proceeds into Himachal Pradesh as the Dhaola Dhar range.

The Jhelum runs along the western border of the region from Domel to Kohala bridge on the river, over which the Rawalpindi-Srinagar Road runs. The river runs along the border of Pakistan up to Mirpur. The angle between the Jhelum bend is drained by a number of small rivers, the most important being Poonch, which joins the Jhelum near Mirpur. Further east is the basin of Munawar Wali Tawi, which is made up of two streams, the Naushahra Tawi and the Thande Pani Wali Tawi. The Chenab after escaping from Pir Panjal and Dhaola Dhar spreads out in a big fan in the plains. There are many broad stream beds full of boulders rather than water. The boulders are not the creation of the present cycle of erosion, but have been fetched from old boulder beds.

While the higher areas are covered by chir pines (*Pinus roxburghii*), the lower areas consist of dry forests of acacia, neem and thorny bushes. On the higher slopes maize is grown in terraces. Millets are the main crop in the lower bouldery land. Agriculture on the whole is poorly developed.

This region has been a buffer area between the attractive Vale of Kashmir and the hot plains of the Punjab. Roads through this region run to Kashmir, such as the old Moghul road from Poonch and the present road from Jammu, the new railway terminus.

Jammu is the leading town of the region. It is the second biggest town of the State. Many Government offices are located here. It may be called the winter capital of the State. Jammu has many temples and has a religious importance. Situated at the junction of the plains and the hills, it has become an important market of exchange of plains and hills commodities. Much fruit passes through this town to the plains. Salt, kerosene and textiles pass to the hills from

the plains. Jammu has a university. The road from the Punjab to Kashmir passes through Jammu. Another lateral road joins Jammu with Poonch and it has a strategic importance.

The road actually joins Poonch with Uri through the Haji Pir pass on a spur of the Pir Panjal, which is in a bulge of the previous Cease-fire Line.

Poonch is situated on a terrace. Hot and cold water springs nearby supply water. Other towns of importance are Akhnur, Riasi, Mirpur and Bhimbar. The last two are on the border and so occupied by Pakistanis.

Some coal is found near Riasi, where some industry can be developed. Limestone and bauxite are also available.

Administrative Set-up

The State was invaded by what have been called 'raiders' or 'Qabailis' just after independence. This led to military action between the Indian and Pakistani armies, which was halted at the instance of the United Nations Organization. A Cease-fire Line was fixed between the two armies. This left a good amount of the territory of the State under the control of Pakistan. This Line ran from near Akhnur northwards up to near Keran on Kishanganga giving to Pakistan a strip nearly 25 kilometres broad and 250 kilometres long. It consists of a rugged, dry, sparsely populated area. From Keran the Cease-fire Line turns east at right angles, passes through Minimarg in the Gurais valley and ends in the snows of the Karakoram range. North of this line Gilgit, Hunza and Baltistan are under the Pakistanis. The only good area here is the valley of Gilgit. The rest of it is too high and too cold to be habitable.

The Chinese have occupied the north-eastern area of the State approximately east of a Line joining Chushul with the Karakoram pass. The Chinese-occupied area is a desolate cold and bleak rolling plain nearly 5,000 metres high. It is more or less an empty land.

The State had to modify slightly her district boundaries to adjust them with the Cease-fire Line. During the war in December, 1971 India made a number of dents in this Line, specially near Kargil. So the old Cease-fire Line is no more, and the situation is fluid. India has asked Pakistan to have bilateral talks for settlement of the issue. The present break-up of the State into districts is as follows :

1. *Ladakh*

This is the largest district in area, but not in population. Its capital is Leh. As has been stated earlier, nearly a half of its eastern part is occupied by the Chinese. It is a cold and dry region, producing hardly anything for export except some salt and borax. The Ladakhis are Buddhists and practise Lamaism.

2. *Srinagar*

This district is small but the most prosperous and densely populated part of the State, as it covers the central portion of the Vale of Kashmir. It has a nearly flat topography, and is very fertile. It produces much fruit. The art goods of this district are famous for their beauty and elegance.

3. *Baramula*

This is also a fairly densely populated district. It has a rugged mountainous border on the north and the west. A small portion of the vale of Kashmir, including the Lolab valley is included in this district. Baramula is an old Kashmiri town at a strategic point where the Jhelum escapes from the flat valley into a gorge.

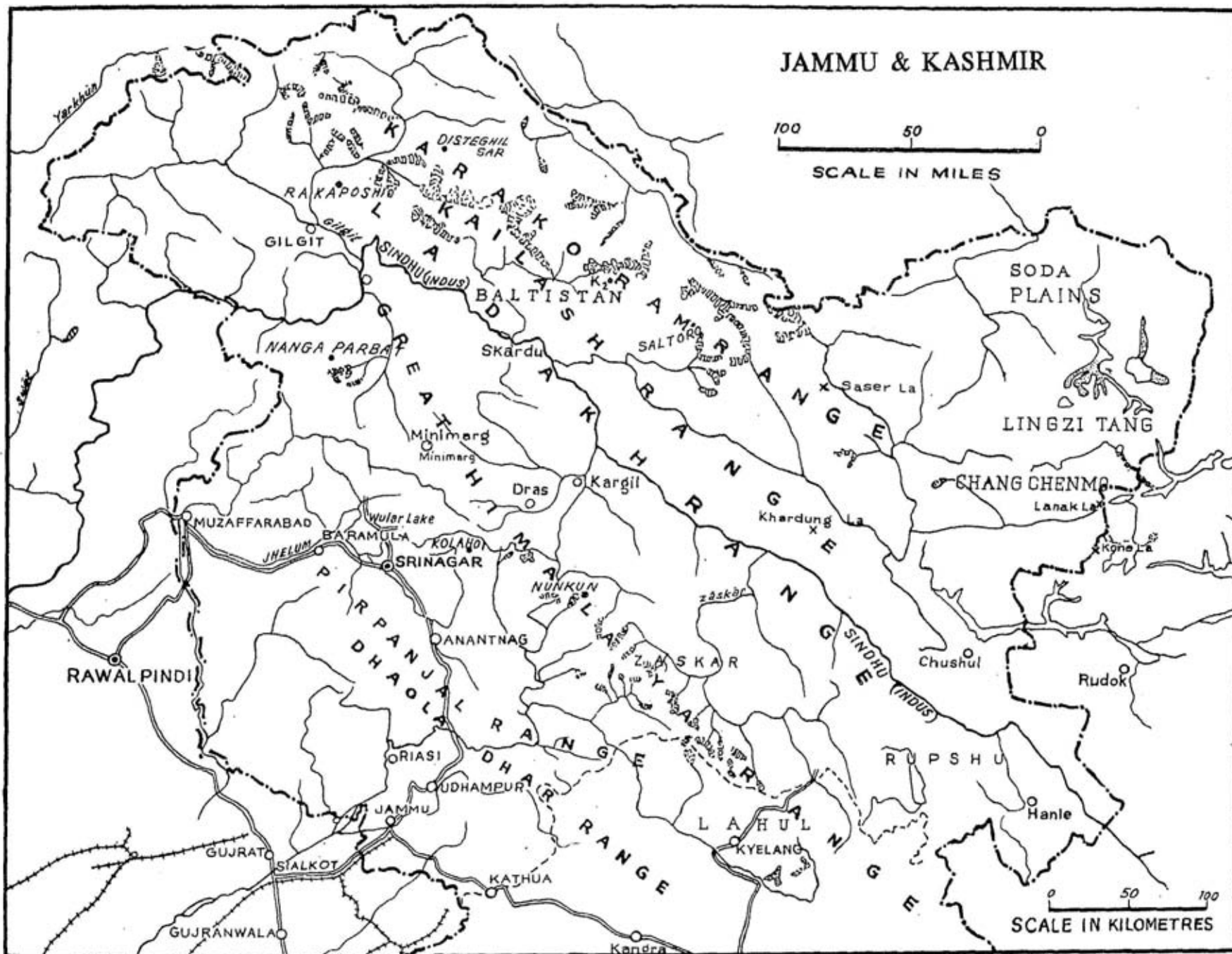
4. *Anantnag*

This district covers the western part of the Vale of Kashmir. It is also densely populated. Anantnag is a straggling Kashmiri town, built around a temple from whose bottom a voclusion spring gushes out. The road to

JAMMU & KASHMIR

100 50 0

SCALE IN MILES



0 50 100

SCALE IN KILOMETRES



Pahalgam passes through Anantnag. There are many spots of tourist attraction such as the Achhibal gardens, Kokar Nag, the Martand temple, etc., near Anantnag.

5. *Doda*

This is the second largest district covering a large portion of the Chenab valley in the State. The terrace town of Kishtwar in the Chenab gorge grows some fruit. Doda is a town in the valley. Bhadarwah is another important town. It is much forested and produces timber, which is floated down the river to Akhnur. Towns and villages are located on river terraces along the Chenab.

6. *Udhampur*

This district lies south of Dhaola Dhar. It has a low altitude and is warm. The topography is mild, Udhampur is a town through which the road from Jammu to Srinagar passes. Chineni and Kud are two big villages. Much Anardana (sour pomegranate seeds) is the principal fruit raised.

7. *Poonch*

This district is also south of the Pir Panjal range. It spreads up to the temporary Cease-fire Line. The Jammu-Poonch-Uri Road passes through it. While the higher slopes of hills have pine forests, the lower slopes are covered by dry scrub jungle. Poonch town is situated on a terrace in the Poonch river valley. It has great strategic importance at present.

8. *Jammu*

This is an important district south of the Dhaola Dhar. Part of it is a plain. It is the home of Dogra Hindus. Jammu is the second biggest city of the State. Jammu is joined to the rail-head at Pathankot. A part of the district consists of the open valley of Tawi, which is covered by fertile soils, and produces wheat,

9. *Kathua*

This is a small district consisting mainly of plains spreading between the Ravi and the Tawi. Its border in the south is contiguous to Gurdaspur district of the Punjab. It also touches Pakistan at its south-western corner.

HIMACHAL PRADESH

Himachal Pradesh was created after independence by joining a number of princely States in the hills. The areas belonging to Patiala near Simla and the British governed Kangra and other small pockets remained in the Punjab. But only recently after the creation of Haryana, the hill areas of Patiala, Simla and Kangra were made over to Himachal Pradesh. Chamba, which was separate from the rest from the State, has now been joined to it by the inclusion of Kangra.

The State is very rugged and mountainous. It spreads in the north up to its border with Tibet, and so its strategic importance is great. In the north-west, it has a common border with Kashmir. In the south, lie the plains of the Punjab. Kinnaur, Spiti and Lahul are very high. There are numerous snowy peaks here from which descend a number of glaciers. In Lahul the Chandra and Bhaga rivers take their rise and pass out into Kashmir as the Chandra-bhaga or Chenab river. The next big river in the State is the Ravi, which rises in the snowy region of Bara Bangahal in the Dhaola Dhar range. The Ravi flows through Chamba into the plains of the Punjab near Pathankot.

The Dhaola Dhar range passes right through the middle of Himachal Pradesh. Near Dharamsala, it is so near the plains that one can look at its snowy peaks rising practically straight up from the plains. It runs eastwards and ends in the Sindhu-Ganga watershed south of the Baspa valley. South of it are the Giri, Pabar and Tons valleys, all being the tributaries of the Yamuna. East of the Tons is the Uttarakhand region of Uttar Pradesh. The rivers have

very well developed terraces, which are cultivated and are populated. The Dhaola Dhar is pierced by the deep gorges of the Beas and the Sutlej.

The Pir Panjal range also extends into Himachal Pradesh and ends in the Deo Tibba peak where it merges with the Great Himalaya. From the glaciers on the south face of the Pir Panjal and a small glacial lake, the river Beas takes its rise, and flows east past Mandi into the Punjab.

The common border with Tibet lies in the Sutlej basin. The Spiti, a northern tributary of the Sutlej, has a high, snowy and desolate basin. It joins the Sutlej just below the Shipki pass on the border. Further down is the glaciated high basin of the Baspa which joins the Sutlej near Karchham. The Sutlej rises in Tibet from Lake Manasarowar and enters India near Shipki. It passes by Rampur and then flows through a deep gorge north of the Simla ridge. Here there is an interesting hot spring. One has only to dig the sand near the bank of the Sutlej and obtain hot water, which floats over the cold water of the Sutlej. One can mix both these waters in a pit to get water of the required warmth. Further down the river flows into the Govind-sagar reservoir above the Bhakra Dam. The Sutlej enters the Punjab below it.

Himachal Pradesh is thus drained by four rivers of the Punjab, namely, the Chenab, the Ravi, the Beas and the Sutlej.

High up north of Lahul the boundary of the State with Kashmir is formed by the Great Himalaya range, which is crossed by the Bara Lacha La (Pass). The climate of Himachal Pradesh is cold and bleak in Lahul, Spiti and to a large extent in Kinnaur. The rest of the area generally has a good and comfortably cool climate. Many Rajput princes flocked to these hills and established small kingdoms, such as Chamba, Bilaspur, Mandi, Jubbals and Sirmur. So this lower area is well populated and has many towns large and small due to its salubrious climate. Very strong cold

and dry northern winds blow in Lahul and Spiti during winter. The wind is very fierce through the Rohtang pass. In this season, western disturbances produce snowfall and blizzards. In summer the rains are not so heavy as in the Eastern Himalaya.

Chamba

This is the westernmost district of Himachal Pradesh. The river Chenab runs through it in the north and the river Ravi in the south. The Chenab valley is very cold and desolate. Its regional name is Pangi. The people of the valley are called Pangiyals. They are robust, gay and hard-working. Unlike the Lahulis, they are Hindus. They do herding and mainly graze sheep. The two ranges north and south of Pangi are the Great Himalaya and the Pir Panjal. A number of peaks here are nearly 6,000 metres high. Many small glaciers descend from the enclosing ranges into the valley. There are stunted forests in the valley bottoms, while above them are high-level meadows. The area is sparsely populated.

The Ravi valley lies between the Pir Panjal and the Dhaola Dhar. It has a lower level excepting the source region. The topography is extremely rugged with high serrated ridges and deep gorges. River terraces are very well developed between 1,000 and 2,000 metres. Hence the valley is fairly well populated. The people who inhabit this valley are called Chambials. They are very fair and have attractive features. Some observers call them the most beautiful race in India.

The town of Chamba is situated on a very broad and flat terrace cut into two by the Ravi. While the town, including a beautiful temple and the big palace of the Maharaja, now a Government office, lies on the eastern terrace, paddy and other grains are grown on the western terrace. Chamba is joined to Banikhet by a motor road, which is situated eight kilometres from Dalhousie. An old mule

track joins Chamba with Dalhousie through Khajiar, a small village situated near a meadow, with a lake in the centre and dense forests around. There is a floating island in the lake. A big orchard of apples and other fruits has been developed here.

Lahul and Spiti

This district was previously included in the Kangra district of the Punjab. Physically it is divided into two parts. Lahul is drained by the Chandra and the Bhaga, which rise here and join below Keylang, the capital. Lahul is very dry and cold. It is surrounded by high mountains on all sides, the Great Himalaya to the north, the Pir Panjal to the south and the Spiti-Chandra watershed to the east. Lahul is higher and colder than Pangi. There are many glaciers and high peaks in Lahul. The biggest glacier is Bara Shigri.

A jeepable road passes through Lahul which starts from Rahla, enters Lahul by the Rohtang pass, goes through Lahul through Khoksar and Keylang and crosses out by the Bara Lacha La.

Lahul is inhabited by Lahulis who are Buddhists and follow Lamaism. Their features are Mangoloid, like those of the Ladakhis. They practise polyandry. A woman has several husbands, who work for her. She is the owner of all property. Large bands of Lahuli women visit the Dassehra fair at Kulu. Only a few men accompany them as servants.

The main occupation of the Lahulis is sheep-rearing. Wool is their main product. They grow some barley and millets. Kuth, the root of a plant, is collected for export to Hongkong, where it is used for making some medicines. Keylang is a collecting and despatching centre of Kuth.

Spiti is remoter than Lahul. Though the river Spiti flows into the Sutlej, the passage to Spiti is *via* Lahul over some very difficult terrain. Communications are being improved in Spiti with great difficulty. The altitude is very high and the Spiti valley is very cold. From the snowy

ranges surrounding Spiti, glaciers descend into the valley. The Great Himalaya range passes south of Spiti. The highest peak is Shilla (7,025 m). The people of Spiti like the Lahulis follow Lamaism. A famous monastery named Dankar Gampa is situated in Spiti. Here there are some big villages such as Hansi in the upper valley and Kaurik further down.

Kangra

This district may also be divided into two parts. Kangra proper is in the foothills. It has a low altitude and is covered by scrub jungle and some forest.

Dharamsala, the headquarters of Kangra district, is a fine hill-station situated on the pine-clad slopes of the Dhaola Dhar whose snow-peaks rise above it. In the plains and low hills below is Kangra town and a bit further south of the Beas river is Jwalamukhi, where an eternal flame burns in a temple. Akbar was so impressed by this natural phenomenon, that he covered the roof of the temple by gold sheets. The flame is from escaping natural gas. A geological survey of the area has been carried out, but little oil or gas has been found. Unless large reservoirs of gas are located, exploitation of this mineral is not worthwhile.

The town of Baijnath is situated on a slightly raised area. The ground is undulating and covered by scrub. But much lowland produces high quality rice. At Palampur nearby there are some tea-gardens. The river Beas has incised meanders here. A railway and a road follow the Beas valley. The railway goes up to Jogindernagar, where there is a hydro-electric power-station, the water rushing down from a reservoir at Barot in the Uhl river through penstock pipes going down nearly a thousand metres. Tourists may arrange to go up to Barot by an electric trolley which climbs steeply.

The road extends beyond to Mandi and past the Larji gorge to the Kulu valley.

Kulu

The Kulu valley begins at Aut on the northern end of the gorge. This is the second portion of Kangra. The Beas here flows amidst broad cultivated terraces, about a thousand metres above sea-level. Here there is an air-strip at Bhuntar where tourists may fly from Delhi and Chandigarh. Kulu is famous for its Dassehra fair, which is one of the largest hill fairs in the Himalaya. The centre piece of the fair is a tent in which the God of Kulu, Raghunathji, is brought. Gods from all over the valley are carried to the fair to pay their homage to Raghunathji. Hill men, mainly the semi-nomadic Gaddis, come with their gods in procession, blowing trumpets, beating drums and dancing. At night they are seen descending along hill trails in torchlight processions. There is much dancing and rejoicing in the fair. Relatives meet one another. Some marriages are also arranged during it.

The main function of the fair is the sale of hill and plains commodities. Traders from the plains open stalls to sell textiles, cigarettes, electric torches, transistors, jewellery, mirrors, shaving sets and so forth. The hill people sell wool and woollen goods. Jauntily coloured Kulu caps are much in demand by visiting tourists. Government-sponsored exhibitions are also arranged. A fruit exhibition, specially of apples, is a great attraction. The fair ends by the sacrifice of a buffalo by the stroke of a sword by the Raja of Kulu. The fair grounds can be easily reached by flying to Bhuntar from Delhi or Chandigarh.

The Kulu valley is famous for its scenic beauty. Here there are many small towns such as Katrain, Nagar and Manali where tourists stay in cottages during summer.

Trout fishing has been introduced in the river.

There are many apple and other fruit gardens near Manali, which are mainly owned by British settlers, one of them being Major Banon, who owns a very big orchard.

A tributary of the Beas is the river Parvati which rises in a glacier in the Pir Panjal range. The valley is glaciated, and

so has waterfalls and truncated cliff-faces on its sides. It is visited by pilgrims to the famous shrine of Manikaran in the valley. Here there are a series of hot springs, the one at Manikaran being so hot that food can be cooked in it. Manikaran is reached easily by a jeep road from Kulu or the Bhuntar air-strip.

Malana, a small village in a secluded valley, has earned some fame for its free and independent nature. It has its own upper and lower houses which govern the village and lands attached to it. They also administer justice. The overall lord of the village is Zamlu, the village-god, who passes orders in a dispute through his chief priest. Fees for the settlement of disputes are given in kind, such as sheep, goats or drinks. Malana is practically cut off from the rest of the world. Its people live in complete peace and happiness.

Other places of interest are the temple of Hirimba in a dense deodar forest near Manali and the village of Bashisht where there is a hot spring having curative properties.

Mandi

This district previously belonged to a Raja. It is a fine town on the bank of the Beas. The hills around are clad in pines. Between Mandi and Sundargarh, there is a large plain, which has grain fields and orchards. Near here up in the hills is the strange lake of Rawalsar with seven floating islands, which can be moved by prayer, it is claimed. Here there is a Hindu temple, a Lahuli monastery and a Sikh Gurdwara. The road from the plains to the Kulu valley passes through Mandi.

Bilaspur

This district, at a lower level, was also a small princely State in the past. Its headquarters, Bilaspur, located on a large terrace, has been sunk in the reservoir above Bhakra. A new town, an apology for the old one, has been built on the slopes above the reservoir. The Mandi-Simla road

through Bilaspur had to be re-aligned as the reservoir filled up and submerged part of the hill road.

Kinnaur

This is a newly constituted border district in the high Himalaya. The gorge of the river Sutlej divides it into two parts. To its north is Spiti, and to its south the Baspa valley. A small portion near the border is beyond the Great Himalaya, where the people are Buddhists. Here is the village of Pooh on the road to the Shipki pass. This area is cold and desolate. The Himalaya here rises in the Kinnar Kailash group of peaks, seen in a brilliant dazzling array from Chini, the biggest town of Kinnaur which is located on a sharp spur hanging two-thousand metres above the Sutlej gorge. The new capital Kalpa is being built about three kilometres from it. Perhaps the site is too far up, above the road along the Sutlej. There is a proposal to shift the capital to Peu further down.

The slopes around Chini and Kalpa are covered by chilghoza pines. Chilghoza, a kind of seed nut, which is very tasteful, is exported from here to the plains. There are fruit gardens in Peu.

The Government is doing much to improve the conditions of the Kinnauras. At Chini there is a co-operative store, selling woollen goods such as blankets, shawls, carpets, caps, etc. There is a sheep-breeding station near Karchham and a fish-culture centre at Sangla high up in the Baspa valley. Fruit-farming is also being developed. Grapes grow in abundance in Kinnaur.

Unfortunately the roads are often being built along river terraces at the cost of old orchards.

The Kinnauras have a fair complexion and sharp features. Are they the Kinnaras of the Puranas? They are quoted as such by Kalidasa in his description of the Himalaya in *Kumar Sambhava*.

Today the Kinnauras dress in loose home-made dull, grey-coloured, gown-like woollen coats. Both men and women

don gay Kinnar caps, which are similar to the Kulu caps. Menfolk grow prominent moustaches and display them. They are fond of flowers and stick roses in their caps. They are Hindus and have their village gods. Their villages are often located on steep knife-edged spurs.

A beautiful motor road named Tibetan Highway has been built from Simla to Shipki along the Sutlej valley. From it a branch road ascends from Karchham to Sangla in the Baspa valley. Another branch roads ascends to Kalpa and Chini through Peu.

Mahasu

This is the most developed district of Himachal Pradesh, as it includes the Simla Hills; it is the most populated part of Himachal Pradesh. It was largely developed by the British. Its capital is Kasumpti, a suburb of Simla.

Simla at one time was the summer capital of India when the Viceroy of India resided here. It was also the summer capital of the Punjab. After independence, Simla belonged to the Punjab, which allowed the Himachal Pradesh Government to locate its offices here. After the creation of Haryana, Simla was transferred to Himachal Pradesh and is its capital now. Simla was developed by the British. Today it is a congested hill town though administratively covering a large area. It has a very good market and a large number of fashionable shops. Besides the administrative offices of Himachal Pradesh Government, it has many public schools and colleges having a British origin and tradition.

The previous Viceregal Lodge has now been converted into an advanced research institute under the Central Government. Simla is full of all types of hotels to cater to various grades of tourists who come to it, or move to distant areas like Kinnaur and Kulu through it. Simla has a skating ring. In winter Kufri, some distance away from Simla, is visited for winter sports. There is a race-course at Anandale below the town. Simla has many beautiful walks through attractive

surroundings, giving beautiful views of the snows of the Dhaola Dhar range. The town is also a big export market for potatoes, fruits and walnuts. The town is a big junction of hill roads. It is also connected to the Kalka broad-gauge railway terminus by a hill-railway, using diesel engines. Simla is also an important cantonment station.

In Mahasu the countryside is also being developed. The Kotgarh area is a great producer of fruits, including apples, pears, peaches, plums, apricots and cherries. There are Government potato farms, sheep-and poultry-breeding centres, and training centres for cottage industry. There are many dense pine forests, as the one at Narkanda, which supply timber.

In the Simla Hills, there are many other small towns, to each of which practically a cantonment is attached. Chail is a small hill-station developed by the former princely State of Patiala. Taradevi near Simla has a big dairy farm. Solon is well known for its brewery. It is also a market for walnuts, potatoes, 'Anardana', and apricots. Kasauli has a Pasteur institute which produces vaccines against mad dog-bite and also treats patients for hydrophobia. Another institute produces other vaccines. Kasauli is reached by a branch road from the Kalka-Simla road. A twelve kilometre bridle path also joins it to Kalka. Dharampur has a good hospital for tuberculosis. In Sanawar there is an English style school. Dagshai and Sabathu are two small towns and cantonments.

Chir pines clothe the Simla Hills, which yield resin and soft timber. Apricots and walnuts grow all over the hills. Maize and paddy are the two leading grains. Vegetables and Simla variety of green chillies are extensively grown in the Simla Hills to be sold to tourists and others in the towns, specially Simla itself. Vegetables are also exported to the plains towns, including Delhi.

The Sutlej gorge below Simla is quite fertile. It is dotted with numerous villages. Well developed terraces are

cultivated. Rampur here is an important sub-divisional town. It has a market for local produce.

Sirmur

This is a small district at the southern end of Himachal Pradesh. Its capital is Nahan. It was a small princely State in the past.

Sirmur is drained by the river Giri which flows through its middle and joins the Yamuna. The altitude of Sirmur is low, and the lower valley bottoms have tropical forests. The higher ridges are covered by chir pines.

Nahan is connected to Hardwar and Solon by a good road. Nahan is situated in a Dun-like valley in the south.

UTTARAKHAND AND FOOTHILLS OF UTTAR PRADESH

The portion of the Himalaya which lies in Uttar Pradesh consists of the three newly-constituted border districts included in Uttarakhand and five other districts adjoining the plains which spread from Dehra Dun to Nainital.

Here rise the rivers the Yamuna and the Bhagirathi as also their tributaries. The region has been considered sacred due to this reason. The four great sacred temples of Yamunotri, Gangotri, Kedarnath and Badrinath are situated in Uttarakhand.

The Great Himalaya range runs nearly along the border of the country in this region. There are no other snowy ranges. There are many major peaks in this part of the Himalaya, the highest being Nandi Devi (7,817 m).

In the extreme west is the Bandarpunch (6,387 m) group of peaks, from which rise the Yamuna and the Tons. Further east is the basin of the Gangotri glacier and its tributary glaciers, the Chaturangi and others. The snout of the Gangotri discharges the Bhagirathi river, which is joined by the Jadh Ganga or Janhavi 27 kilometres below.

Snowy ramparts and peaks surround these glaciers which include the Kedarnath peak (6,940 m) to the south and

the Chaukhamba or Badrinath peak (7,138 m) to the south-east. Just below the Kedarnath peak rises the Mandakini from the Chorabari glacier. From the outer eastern slopes of the Chaukhamba peak rise the twin glaciers of Bhagirath Kharak and Satopanth, whose common snout gives rise to the Alakananda on the bank of which is situated the Badrinath temple.

There is a big group of high peaks east of the Saraswati, a tributary of the Alakananda. They include Kamet (7,747m), the highest of these peaks. The Dhauli Ganga gorge separates them from the Nanda Devi group of peaks, to east of which the Pindari glacier gives rise to the Pindar river. Further east there are more snowy peaks such as the Trisuli and Panchulhi group. There are many medium-sized glaciers here. The Milam glacier is situated east of the Nandakot peak. The valley of Kali or Sarda forms the boundary of the region, which ends on the Nepal border.

The Great Himalaya here is quite formidable, as the above description shows. Below the snows and glaciers there are many high-level pastures here called Bugiyals.

There are deep glaciated gorges below this level, where one meets rock cliffs and waterfalls created by the truncation of spurs and valleys by ancient glaciers. Here the mountains are deeply forested by pines and oaks.

Between 1,000-and 2,000-metre levels are river terraces. This is the optimum belt where villages, towns and cultivated fields are located. In the Uttar Pradesh Himalaya, there are many fine hill-stations and cantonments established by the British. Today they are flourishing hill-resorts. A description of the districts follows.

Uttarkashi

This is the newly-constituted westernmost district of the Uttarakhand sub-division along the Indian border. Its capital is the sacred town of Uttarkashi on the bank of the Bhagirathi on the way to Gangotri. The motor road

from the plains has now extended beyond to Bhairon Ghati from where Gangotri is about seven kilometres away. But the road climbs to Nilang in the Jadh Ganga valley. Here are a number of passes such as the Thaga La, the Jelukhaga and the Muling La on the border. The Nela pass to the west leads to the Baspa valley.

In summer thousands of pilgrims trek to the shrines of Gangotri and Yamunotri; and this brings in much money to the local people. This sustains the economy of the district. Uttarkashi has a mountaineering institute, which gives practical training in mountain climbing. The shops in the bazars of Uttarkashi cater to the needs of pilgrims, tourists and mountaineers. The hills are deeply forested. But there is much cultivation on the terraces.

Further up at Bhatwari there is a college. The town is developing fast. From here a route goes to Trijugi Narayan on the Kedarnath route. Here an eternal fire burns in a temple. After Bhatwari, the terraces disappear and the valley becomes narrow and congested, with waterfalls and truncated spurs. But again at Jhala village one meets two open elongated basins in which the river does not froth as at Gangnani below, but meanders sluggishly over gravel beds. The basins are the result of the scooping of rocks by past glaciers. In this open area are the villages of Harshil and Dharali, famous for their apple-gardens, first started by British settlers. A suburb of Harshil is Barari, a permanent settlement of semi-nomadic Jadhs of the Nilang valley. Large wild apricot (Khowani) trees, walnut (Akhrot) and chestnut (Pangar) trees are found here. Improved varieties can be easily planted to provide fruits and nuts. From near Harshil a route goes to Kharsali in the Yamuna valley.

From Jangla one can observe a tremendous gorge cut by the Bhagirathi in granites across the central Himalayan axis. The snowy peaks of Jaonli and Gangotri are situated on this axis. Here below Bhairon Ghati the deep blue frothing waters of the Jadh Ganga or Janhavi join the Bhagirathi.

Beyond the gorge, the valley again widens out. Here is the temple of Gangotri dedicated to Mother Ganga. The valley is choked by glaciated boulders. Groups of pillars of boulder clay, topped by boulders, stand on the slopes indicating the level of the bed of the past giant glacier. They are in the process of destruction by erosion. They look like giants watching the valley of the gods. The slopes are clothed with birch trees (*Bhurja Patra*) up to a place called *Bhuj Bas*. Their trunks are wrapped in a paperlike tissue which was used for writing scriptures and books by saints in olden times. Earlier there is a patch of pines at *Chir Bas*. The occurrence of chir pines at such a high altitude is indeed surprising. At the end of the valley is the snout of the Gangotri glacier called *Gaumukh*. It is a hundred-metre-high wall of grey snow from the top of which moraines regularly crash down. The waters of the *Bhagirathi* gush out from blue ice caves in the ice wall. Above *Gaumukh* one can look at the majestic peak of *Shivling* (6,541 m) a spire of snow and rock, at the base of which the legendary *Bhagirath* worshipped *Shiva* on a glacial terrace called *Tapoban*. The composition of the scene is such that the mythological story seems real and probable. This place is on the northern slopes of the Great Himalaya. It may be supposed that the granite gorge in its axis was created by the gods. As *Bhagirath* advanced, blowing his conch-shell, the mountain rifted apart.

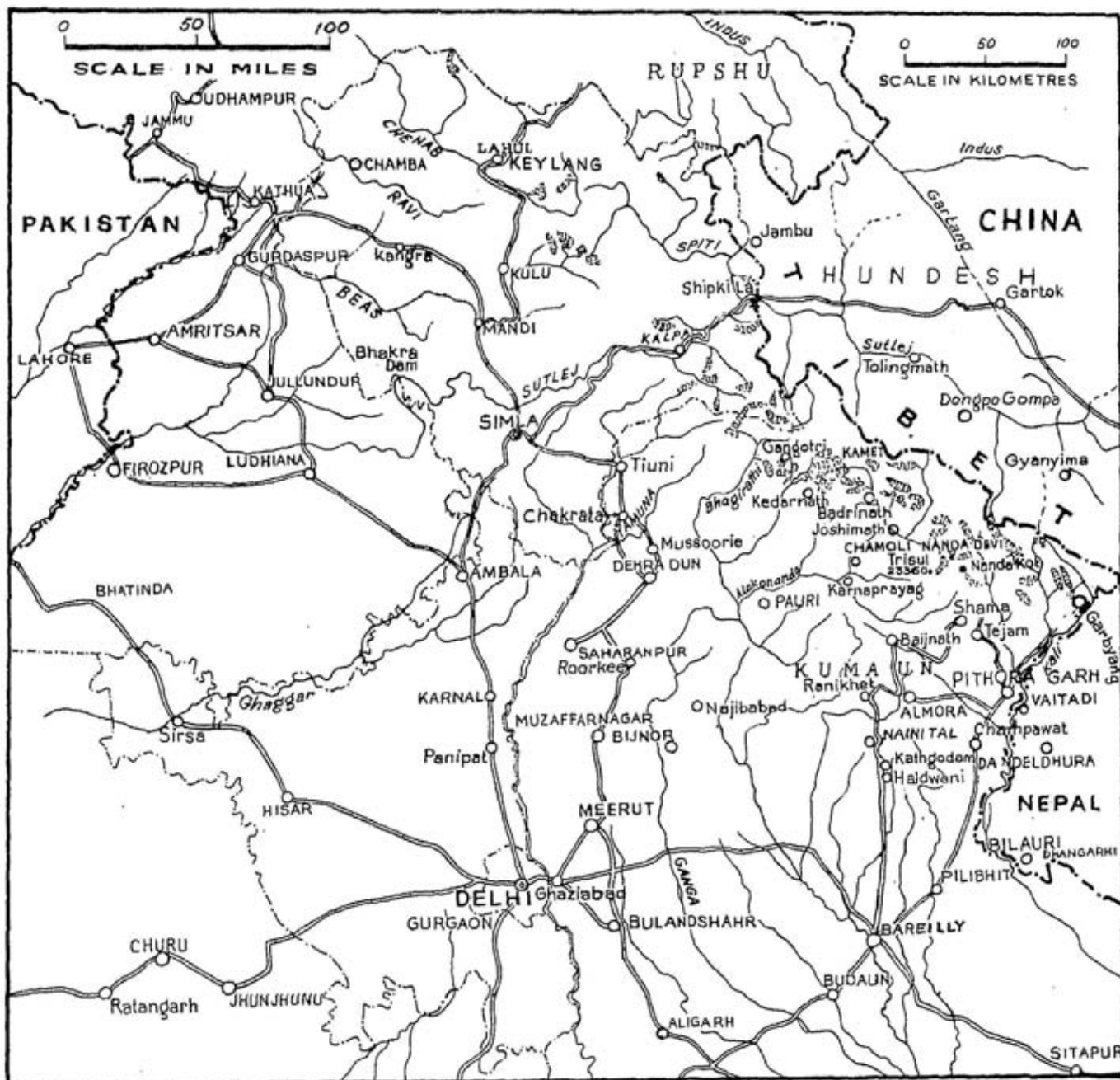
To the west of the *Bhagirathi* valley is the *Yamuna* valley. From terraces of *Dharasu* on the motor road the *Bhagirathi* valley, a link road climbs up the watershed and descends into the *Yamuna* valley at *Barkot*, which is a big road junction and potato market. The road crosses the *Yamuna* and enters *Jaunsar-Bawar*. A new road comes up from the plains along the *Yamuna* valley to *Barkot* and ascends to *Hanuman Chatti*. It can be easily extended beyond up to *Kharsali*, only eight kilometres below the temple of *Yamunotri*. The snowy *Bundarpunch* group of peaks stands as a backdrop at the end of the valley.

Fields spread along the valley and on terraces. They grow paddy and maize in the lower levels and barley, wheat and phabra at higher elevations. Wild walnuts and apricots grow in the valley. Much potato is being grown and exported. Potato-laden mule caravans come up to Barkot or the motor road-head. Even sheep and goats carry potatoes from higher fields at Kharsali. The semi-nomadic people of the valley are now engaged in this trade. Apples are also being grown at Kharsali. This big village spreads over a large platform of glacial material which is situated about a hundred metres above the valley bottom. The adjacent village of Beef grows red-tufted chua, a kind of millet and yellow-flowered phabra. After collecting the grain, the rest of the plant is used as fodder, which is in great demand during winter, when these villages are covered by snow. Women are busy collecting and stocking fodder in autumn.

Above these villages, the Yamuna flows in a deep U-shaped gorge on which cliffs close in from both sides. Waterfalls thunder down into the valley. The path to the temple of Yamunotri ascends in numerous zigzag bends over such cliffs for nearly five kilometres. The cliffs have been created, as usual, by past glaciers. The temple of Yamunotri stands near a hot spring, which spurts steaming water in geyser force. Pilgrims cook their food in it. A magnificent waterfall drops more than two-thousand-metres from the snows of Bunderpunch into the valley at this point. This is supposed to be the traditional source of the Yamuna. 'Ratanjot', a herb claimed to be good for eye diseases is obtained here. Wild chestnuts, walnuts and apricots grow in the valley in abundance.

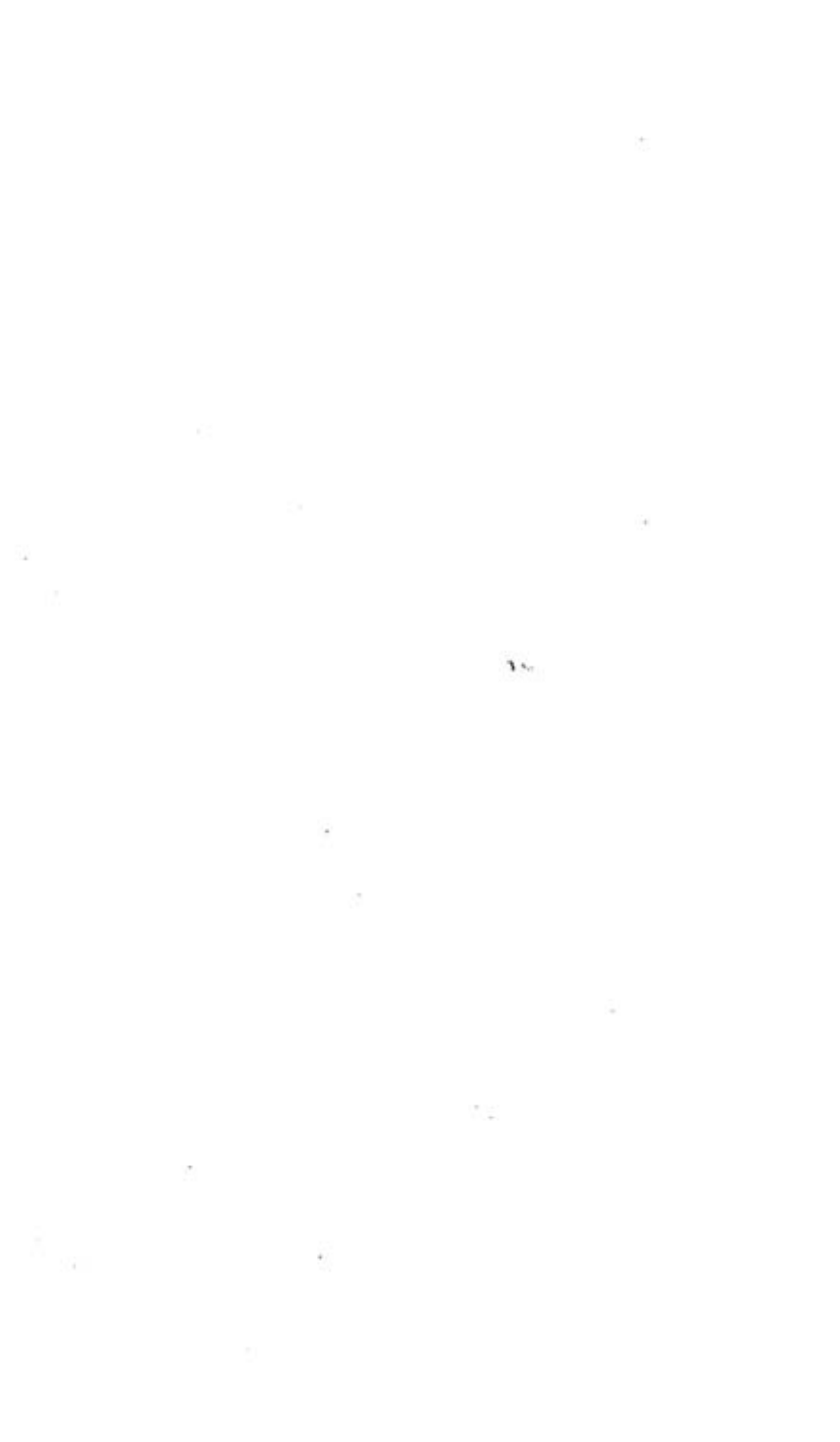
To the west of the Yamuna is the valley of the Tons, a tributary of this river. It collects the waters of Har Ki Dun, a high-level meadow surrounded by glaciers, and the Bunderpunch glacier. Further down, the area is known as Jaunsar-Bawar. This area for long remained isolated as no

HIMACHAL PRADESH & UTTARAKHAND



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important pilgrim route passed through it. Though the people of this area are a healthy and cheerful lot, they have maintained a fossil culture in their marriage custom. All the brothers of a family have one common wife. This has resulted in loss of fertility in women and decrease in their number, leading to continuation of fraternal polyandry. This custom derives from the *Mahabharata*, where Draupadi was the common wife of the five Pandava brothers. This system is gradually being modified, as the standard of living increases.

At one time it was thought that this race would become extinct. In any case, it has helped in checking the population growth. Economically, it has been good as it has helped to keep holdings undivided.

The people grow a variety of crops such as paddy, maize and fruits in medium altitudes, and wheat, barley and potatoes higher up. Millets like Chua (chulai) and Madua are also grown.

The people of Hanol, a small village on the river Tons, are Bajgis or dancers, who serve the temple of Mahasu Devta. Catching fish from rivers by poisoning them by the bark of a tree called 'Timur' is prevalent. Chakrata, an important cantonment, is the gateway to Jaunsar-Bawar from the south. Now a trunk road has been built through this area joining Simla with Chakrata via Tiuni. Many branch roads are being constructed. One of these joins Tiuni on the trunk road with Hanol, Parola and Barkot. Across the Tons at Hanol, there is a curative hot spring at Thadiar.

Chamoli

This is the middle district of the three border districts. It is covered largely by the basin of the Alakananda, the leading tributary of the Bhagirathi, which it joins at Dev Prayag. Two famous shrines of the Hindus, Kedarnath and Badrinath, are located in this district. Kedarnath is situated below the snowy peak of the same name near the source of

the river Mandakini, which joins the Alakananda at Rudra Prayag. The Badrinath temple is built on a big hot spring near the bank of the Alakananda ten kilometres below its source, is the snout of the twin glaciers Satopanth and Bhagirath Kharak near Vasudhara falls. On both sides of Badrinath are two peaks called Nar Parvat and Narayan Parvat (5,965 m). But just west of the temple stands the majestic silvery spire of Nilkanth (6,596 m).

Motor-buses and cars now go up to Badrinath, while they go up to Son Prayag near Rampur on the way to Kedarnath, which is about twentyfive kilometres from here. A motor road now links the two roads from Gupta Kashi to Chamoli. On the way is the lone peak of the Tunganath temple situated higher than Kedarnath or Badrinath. Ukhimath near Gupta Kashi and Joshimath on the way to Badrinath are also important religious spots. Other temples are at Trijuginarayan near Son Prayag on the way to Kedarnath and Madhya Maheshwar to the north-east of Gupta Kashi.

The district of Chamoli is thus full of shrines where thousands of pilgrims flock during summer. The people of this area have got the habit of earning, in some way or another, from the pilgrims. Panda Brahmins act as guides, helpers and performers of *puja* (worship). Much of their old influence has declined. Small and big temples are scattered all along the route, where people give coins for worship. There are places to stay called *chattis*. But this system is also disappearing as people travel by buses. There are food shops only at places, especially at the gates where the buses stop.

A centre of attraction is the valley of flowers in the Bhyundar Ganga valley. Here there is a glacial lake named Hemkund which is sacred to the Sikhs. There is a Gurdwara nearby at Lokpal. It is a steep climb to this place from the road to Badrinath down below. Perhaps to call it the valley of flowers is an exaggeration, as flowers are found in high meadows everywhere in the Himalaya at elevations of between three and four thousand metres.

Another beauty spot was the Gohna lake in the Birahi Ganga valley, a few kilometres beyond Chamoli. The lake was formed by a big landslide, which choked the valley. Trout was cultured in the lake. The dam, however, gave way in 1970, resulting in a devastating flood. The Gohna lake disappeared.

Chamoli originally was a *chatti*-type group of huts on the bank of the Alakananda at the junction of mule tracks to Badrinath and Kedarnath. The river was crossed by a slender rope-bridge. Later on a motor road was built by the British from Rishikesh to Chamoli, but it ended at a point about a hundred metres above Chamoli Chatti. The road gradually extended to Pipalkothi, 16 kilometres away. A new settlement grew near the motor road. It was then decided to make Chamoli the capital of the new district. The choice was not good. It would have been better to develop the new capital on the extensive terrace of Gauchar, which has even an air-landing strip. Chamoli is on a steep hillside, and there is no flat area. So the top of a hill nearby was flattened by bulldozers. The new capital was constructed up here. The road which was built from Chamoli to Gupta Kashi required a new motor road bridge over the Alakananda which was completed. Later on the mistake of choosing Chamoli as a site for the district headquarters was realized and it was shifted to Gopeshwar on the Chamoli-Gupta Kashi road.

The Upper Pindar-Ganga valley is also included in the Chamoli district. A road runs from Karna Prayag to Gwaldam in the valley. This extends to Almora. Land-use in Chamoli district has great variety. There are high-level grasslands for grazing below the snow-line. Brightly-coloured flowers adorn them during early summer. Further down are rhododendrons, which also flower in May and June in many hues, mainly scarlet. Further down are dense deodar forests. Then come Chirpines and beaches. Cultivation includes phabra, barley and chua at high levels. Further down are

potatoes, maize and lastly paddy. Very little effort has been made to grow fruits and vegetables yet.

Pithoragarh

This district has its northern border along Tibet and the eastern border along Nepal. To the west are the Chamoli and Almora districts. The district steeply slopes towards the Nepal border, which consists of the deep gorge of the Kali and Sarda rivers. A number of glaciated valleys including Darma Ganga and Ghorī Ganga run from the snowy border in the north-west towards the south-east. They finally plunge into the Kali Ganga. As the altitude drops, there is the usual change in vegetal cover and agricultural practices.

A road runs from the Tanakpur rail-head in the plains to Pithoragarh and beyond *via* Ascot to Dharchula and Tawaghat. Further up is the Lipu Lekh pass near the border which has been the traditional route to sacred Mount Kailash (6,714 m), supposed to be the abode of Shiva, and Lake Manasarowar in Tibet.

Pithoragarh has been well developed. It has new administrative buildings and a new Government college. It is an important hill roadways station.

Below Ascot at Jauljibi on the bank of the river Kali a very big hill fair is held. It is nearly as important as the Kulu fair. It is significant socially and economically. The fair has lost much of its importance now, as the trade across the border to Tibet has stopped. Previously it was a leading market for rare commodities brought by Joharis and Darma Bhots from Tibet.

Garbyang and Dharchula are too big villages on the route to the Lipu Lekh pass. A road bifurcates from this road at Oglā and proceeds to Thal and Munsiri *via* Didihat. Munsiri is being rapidly developed. It is a block headquarters. From here a pony road ascends along the Ghory Ganga to Milam. It is a big market for woollen goods.

Dehra Dun

This district is westernmost among the foothill districts. It includes the Dehra Dun valley, famous for producing high quality scented table rice. Here there are some tea-gardens. The valley contains many valuable forests. The lichi fruit of Dehra Dun are known for thier good quality. Other plains fruits including mangoes are also produced.

The city of Dehra Dun is perhaps the biggest foothill city. It has the Survey of India office located here. The All India Forest Research Institute is also situated here. Dehra Dun has many military installations and offices, and many good educational institutions. The Oil and Natural Gas Commission and Marine Survey offices are also located here. The city spreads on the water parting between the Ganga and the Yamuna. There are limestone quarries nearby. There are many limestone kilns. There are some natural beauty spots near Dehra Dun. Guchhupani, an I-shaped gorge of lime-impregnated rocks, is one of them. There is a sulphurous hot spring at Sahasradhara. At the Tapkeshwar temple, there are small stalactites. Dehra Dun is a beautifully laid-out city.

At the point in the Dun valley where the Ganga issues out of the Himalaya is the holy town of Rishikesh. Near it a new anti-biotic chemical factory has been located. At the western end of the Dun valley is the Dak Pathar barrage on the Yamuna. The Yamuna hydel project on the Tons is under construction here. One road from here goes to Chakrata, a British-built cantonment, and beyond into Jaunsar-Bawar and Simla *via* Tiuni. Another road runs along the Yamuna valley to Barkot. The holy city of Hardwar is situated at the gap in the Siwalik range, where the Ganga cuts through it. Hardwar has a heavy machinery plant. The Upper Ganga canal also takes its start from here. The focus of worship is the Har-ki-Pauri and its temples. Kumbha Mela, one of the biggest religious fairs in India, is held here by turns.

Above Dehra Dun fifty kilometres away is the beautiful hill resort of Mussoorie, again developed by the British. It spreads on a limestone ridge rising straight up from the flat Dun valley above 2,000 metres. It has a cantonment on the Lal Tibba peak. One can have a good view of snows from here. Mussoorie is joined by a lateral road to Chakrata on one side and Chamba in Garhwal on the other. Along the latter road a new fruit belt is being developed by the Government. Being near Delhi, with which it is connected by fast trains and a regular direct bus service, Mussoorie is visited in summer by a huge throng of holiday-makers. A new attraction of Mussoorie is the ropeway car, which ascends Gun Hill, from where one can have a good view of snow-clad peaks.

Dehra Dun is the most advanced and best developed district of the U.P. foothills.

Tehri

Previously a princely state, it is now a district with its capital at Narendranagar, built by the past Raja on a peak rising straight up to nearly 1,500 metres above Rishikesh. Another town is Tehri on the Bhagirathi. There are well developed terraces, which are well cultivated. Forests cover gorges and steep hill-sides. Chir pines and beeches constitute the main trees. The road to Gangotri climbs steeply from Rishikesh to Narendranagar. It descends again in a gorge and then goes up and down through Chamba to the terraces of Tehri and on to Dharasu.

Garhwal

This is another foothill district south-east of the Tehri district. Its capital is Pauri, an old town, at a height of nearly 2,000 metres. Pauri can be reached from the Kotdwara rail-head. From Pauri the road zigzags down to the terraces of Srinagar on the road from Rishikesh to Badrinath. A branch road from the Kotdwara road goes to Lansdowne, a cantonment built by the British.

The hills here are covered by chir pines and beaches.

Almora

This is an old district, the northern part of which was sliced to fashion the Pithoragarh district. Almora is the capital of this district. It is an old town on the top of a ridge. Its bazar on a stone-paved road is full of goods from the plains and hills where tourists rub shoulders with hill people. Almora is a starting-point for expeditions to the snowy mountain-peaks beyond or to the less ambitious treks to the Pindari, Sundardungha and Milan glaciers. Some adventurous people trek to Rupkund, a small glacial lake, where a large number of dead bodies were discovered. It is situated on the southern slopes of the snowy ridge joining the Trisul and Maiktoli peaks. The botanical garden of Bashi Sen is an attraction of the town. Hills around Almora are fully terraced for cultivation of maize, potatoes and paddy. Almora town is a very important road junction. The first road was from Kathgodam *via* Ranikhet. A short-cut road has now been built from Garam Pani and Khairna climbing up along the Kosi valley. A road goes north to Kausani and farther on to Shama and Gwaldam *via* Garur.

Kausani is well-known for its snow views. Below it is the flat basin of the Gomati, where at Baijnath there are some ancient temples, pointing to the past prosperity of this basin. It is well cultivated. The road follows Garur to the Sarju valley and Bageshwar. This town is also being developed. A small hydro-electric power unit has been installed here. It has a crescent-shaped terrace near it. Irrigation canals and roads have been built around it. Cottage industry goods made here at a Government training centre include sticks and sports goods of Ash wood (Angu), deer skin and wicker products, woollen goods including 'thulma' blankets, 'chutka' carpets and 'pankhi' shawls. A very big fair is held on the banks of the Sarju in Bageshwar in November.

The valleys near Almora produce much fruit and vegetables. There is a citrus fruit research station at Hawalbagh. Some orchards including those of apples are developed around Binsar, about thirty kilometres north of Almora. From here a view-point offers a dazzling panorama of snowy ranges. A road has been built from Almora to this place. A road also goes to Rameshwar and on to the Ghat bridge on the Sarju river on the road to Pithoragarh.

The hills around Almora are densely clothed with chir pines which yield resin. At Bageshwar soap-stone is found and quarried.

Much development is taking place through German collaboration in the field of agriculture, horticulture, etc.

Nainital

This district is well-known for its beautiful lakes and hill-stations around them. The lower part of it contains a narrow belt of Terai forests and Bhabar lands, strewn with boulders. Chir pines cover the higher hills, while at the capital town of Nainital there are deodars.

There are many good roads in this district. The Kathgodam-Nainital Road is a very fine hill road. From it the main road winds its way to Bhowali, Kainchi, Garam Pani, Ranikhet and on to Almora. From Bhowali one road goes to Bhim Tal and Naukuchia Tal, and another to Ramgarh and Mukteshwar. A road from Bhim Tal descends to Kathgodam. A new road is being constructed from Kaladunghi in the plains to Nainital. It will come from the Khurpa Tal side.

Fruit culture has reached an advanced stage in this district. There are extensive orchards at Ramgarh which produce apples, pears, peaches, plums, apricots, etc. There is a big Government garden at Chaubatia near Ranikhet, producing fruit and distributing grafts of fruit trees. There are fruit preserving units at Ramgarh and Chaubatia. The orchards are also spreading around Bhim Tal. Much fruit is exported to the cities of the plains including Lucknow, Kanpur and Delhi.

Chir pines clothing the hill-slopes give resin, which is collected and sent to the plains for processing. Vegetables are grown around the towns, specially near Nainital.

Nainital is a first-class, fashionable hill-resort built around the blue waters of a lake of the same name at a level above 2,000 metres. Yachts with white sails and many-coloured boats float in the lake. Ponies of all kinds are available to carry people to various view-points, the most popular being China peak, which is made up of limestones. Other view-points are 'Land's End', where one has a view of the plains, 'Tiffin Top', the second highest peak and Khurpa Tal. A feature of geographical importance is Sukha Tal, a hollow with a dry bed. It is a limestone feature, as the water at its bottom goes underground in solution holes. At the upper end of the lake there is a flat ground produced by erosional materials which have slid down from China peak. This is the play-ground of Nainital.

Nainital has a well-equipped observatory, which is used as an artificial satellite-tracking station.

Ranikhet is a beautiful hill-resort and a cantonment. It is set amidst chir pine forests. The hill slopes around Ranikhet are often well-terraced for cultivation. In the valley bottom are found river terraces, which are cultivated.

There is a tuberculosis sanatorium at Bhowali. Netaji Subhash Chandra Bose at one time stayed here for cure. Mukteshwar is important for manufacturing sera for cattle diseases.

Nainital district is very well developed.

X. CENTRAL HIMALAYA—NEPAL

THE PORTION OF THE HIMALAYA lying in Nepal may be called Central Himalaya. It spreads from about 80°E longitude to 88°E longitude. The country has a rectangular shape. It is about 600 kilometres long from east to west and 200 kilometres broad. The area is 157,850 square kilometres.

Nepal is an independent State. It has a buffer position between two big countries, India and China. Its position and its mountainous character have some similarity with Switzerland in Europe.

The central axis of the Great Himalaya passes very near the northern boundary of Nepal. Only small patches of the country are north of this axis, such as Mustang Bhot.

The second conspicuous range or the Middle Himalaya is fairly continuous. It is called the Mahabharat Lekh. South of it are the Dun-like valleys called Bhitri Madhesh. Further south is the Siwalik range, which is fairly continuous except in the east. The name of the range here is Churia or Churia Muria.

Nepal has a population a little less than 10 million made up of a variety of races. In the north and east live the Bhotias, the Tamangs, the Limbus, the Rais and the famous Sherpas of Sola Khumbu. In the central belt live the Newars. In the western part of the belt live the Magars, the Kiratis, the Gurungs and the Sunwars. In the Terai belt lower down are found the Dhimals and the Tharus. Indians including Marwaris, Sikhs and people of the north Ganga plains also live in Nepal.

Nepal has many air-fields such of Gauchar (Kathmandu), Gorkha, Pokhra, Lumbini (Bhairawa), Simra (Biratnagar), Janakpur, Bhadrapur, Rajbiraj, Nepalganj, Dang and Bharatpur.

The Nepal Himalaya can be described in three sections according to the three main river basins of the Ghaghra, the Gandak and the Kosi.

Ghaghra Basin

This basin lies in the western part of Nepal west of Dhaulagiri Himal (8,172 m). The longest tributary of this river is Karnali which rises in the springs of Mapcha Chungo in Tibet near Manasarowar. This part of the river is antecedent, i.e., the river is older than the Himalaya. As the mountain rose from the bed of the Tethys Sea, the river kept to its course by cutting through the rising mountain. It seems that many tributaries of the Ganga are antecedent such as the Krishna Gandaki in Mustang Bhot and the Arun in the Kosi basin.

Near Karnali, just north of Simikot, a stream has been shown in a broken line north of the Nepal border flowing into Manasarowar past the eastern flank of the giant peak of Gurla Mandhata (7,728 m). Swami Pranavananda, a well-known explorer of the Manasarowar region, claims that the upper portion of this river cannot flow in the direction shown, because of the extension of a high spur from Gurla Mandhata over which the Swami walked. So there is no other way for this part of the stream but to enter Nepal as another antecedent river and join the Karnali west of Simikot.

The high snowy region near Simikot is named Humla. The two high peaks here are Api (7,132 m) and Nampa (7,035 m). After escaping south from Humla, the Karnali is joined by a large glacier-fed longitudinal tributary the Panjang, running south of the Nepal border. The people of this valley are Bhots, who are semi-nomads. Some barley grows in the Panjang valley. Yaks, sheep and goats are kept by the Bhots. The Panjang rises near Chharkabhotgaon and flows past Phijorgaon to join the Karnali, after flowing about 200 kilometres. The places mentioned are large villages.

South of Phijorgaon is a high snowy peak rising to 7,043 metres. North of the Bhot village of Mugu is the Namja pass (4,944 m), which leads to the upper Tsangpo valley in Tibet.

The Karnali then flows south past Raskot to join a tributary from its east, along which a path leads to Jumla, a small town in the valley. Further down near Dailekh, another small hill-town, the Karnali makes a peculiar twist. It first flows eastwards north of the Mahabharat Lekh in a longitudinal course. It then cuts a gorge through this range and turns west. This twist may have been caused by the sudden rise of the Mahabharat Lekh in tertiary times, which nearly succeeded in cutting off the upper Karnali valley, as did the Pir Panjal range in Kashmir to cut off the Jhelum. It is possible that before the Mahabharat Lekh rose to its present height, the Karnali flowed here straight southwards, and had no twist in its course. All this upper portion of the Karnali is very remote and full of snowy ranges and virgin forests. There is little development and little exploitation of this region.

The river Seti, an important western tributary, is fed by snow-fields and glaciers around the twin peaks of Api and Nampa. The leading town in this valley is Silgarhi. Higher up there are two big villages, Thalara and Talkot. The Seti joins the Karnali south of the Mahabharat Lekh below the gorge which it cuts through this range. The cultural landscape of the Seti valley is similar to that of the upper Karnali.

West of the Seti, the land slopes westwards to the border with India along the Kali river, and the waters of its streams ultimately flow into the Ghaghra through the Kali and the Sarda rivers. Two towns in this area are Vaitadi and Dandeldhura. They are connected by tracks going down into the gorge of the Kali river and ascending in India to Pithoragarh and Champawat.

On the southern border in the Terai area are the two Nepali towns of Bilauri (Kanchanpur) and Dhangarhi. They

are connected to the Indian rail-head at Gauri Phanta. Here is a Dun-type of valley of the river Kauriala, running along the southern border. Much timber comes to India from this region.

After joining the Seti, the river Karnali again turns eastwards. Here it is joined by a very large tributary the Bheri, which brings much snow-melted water from the Dhaulagiri Himal (snow massif). A northern tributary of the Bheri rises from the seven-thousand-metres peak near Phijorgaon. Another tributary rises twenty kilometres east of Chharkabhotgaon, flows south of it, and takes two right-angle turns to the south and the east. Here it receives snow-melted water from the northern face of the Dhaulagiri Himal. The area around Chharkabhotgaon is open, high and bleak. As it is north of the Great Himalaya axis, geologically it resembles the Tibetan zone, as noted in Spiti. The people follow Lamaism. Monasteries, Manis and fluttering flags are an essential part of the cultural landscape. Villages are far apart but big, and houses are made of stone blocks, as they must to keep out cold and wind. Here are situated two large villages, Tibrikot and Jajarkot. Near the latter village, another east-west flowing tributary joins the Bheri. Near its source is the village of Dharpatan, and further down is Rukumkot, a small town. The area is cold and very isolated. Movement is only along difficult mountain routes. The Bheri now cuts through the Mahabharat Lekh in a gorge. Thirty kilometres east of this gap is the town of Salyana.

The strong trend of rivers and ranges running in parallel lines (longitudinal trend), from W-N-W to E-S-E as noted to the north of the Mahabharat Lekh, is more pronounced south of this range. Here the Siwalik range is very prominent, and sometimes it is a double range. The Dun-like longitudinal valleys are also very clearly marked. The river Karnali and a tributary joining it at the point where it turns sharply from a west-flowing course to the east and the lower portion of the Bheri flowing westwards form together a very prominent

Dun-type valley nearly 180 kilometres long. The combined river is called the Chauka. It is now a mighty river. It cuts through the Siwaliks and flows southwards.

South of the longitudinal Bheri valley is the second and lower branch of the Siwalik range running in the same parallel direction. South of this range is another Dun-like parallel valley of the river Babai running between the towns of Bijauri and Kumbher which are situated on higher ground. This river turns to the south near the border and joins the Chauka.

An important tributary of the Ghaghra is the Rapti, which however joins it at Barhaj in the plains of Uttar Pradesh, after flowing past Balrampur and Gorakhpur, two towns in the plains. The Rapti has more or less a zigzag course in three sections. The upper section is cool and mountainous. Here the river runs in a longitudinal valley from W-N-W to E-S-E. Its altitude from its upper reaches downwards changes from 3,000 to 1,500 metres. There are two towns here, Libanggaon and Pyuthan.

The second reach of the valley of the river is called Rapti Dun, the river flowing from E-S-E to W-E-W up to Nepalganj, a big market town on the border. Here the river turns again E-S-E presenting an elbow towards Nepalganj. It now enters the plains of India. Much timber comes from Nepalganj. A number of Indian rail-heads tap Nepalese timber all along this south-western border. The rail-head to the west is Tanakpur. Eastward from here, the other rail-heads are Gauri Phanta, Chandan Chauki, Kauriala Ghat, Katarnia Ghat, Nepalganj Road, Jarwa and Nautanwa. The leading commodity which comes from Nepal is timber. Other commodities are sandal wood, 'Tejpat', a kind of scented leaf, used as a condiment, honey, broom-sticks called 'Phool Jharu', 'Ghee' or clarified butter, ginger and 'haldi', a condiment which imparts yellow colour to food, catechu and so forth.

Many of the commodities listed above come from Koilabasa, a small border village at the mouth of a small stream

which flows south of the Dundwa range, a longitudinal spur of the Siwalik range. A motor road has been built from Koilabasa to Dang in the Rapti Dun, across the Dundwa range. People from nearby towns in Uttar Pradesh who visit Koilabasa purchase honey, ginger, ghee and 'phool' broom-sticks. Timber from here goes to the Jarwa rail-head.

Further east a number of small rivers come down from the Siwalik range and flow down to the plains to join the Rapti. Here there is a gap in the Siwalik range south of a small town named Butwal at the junction of the hills and the plains. Here the gorge of a river opens out on the plains, which are very fertile. They produce paddy, maize, jowar and sugarcane. Oilseeds are also produced. Butwal is a market town. Twenty kilometres south of Butwal is the border town of Bhairawa, which is growing rapidly. There is an airport at Bhairawa from where there are regular flights to Pokhra and on to Kathmandu. A new motor road to Tansen and Pokhra has been completed. Bhairawa is a busy market town. It is important for the sale of foreign goods such as watches, pens, cameras, transistors, tape-recorders and woollen, cotton, rayon and nylon textiles. These goods are often smuggled into India from here. Such type of trade is going on in many border towns.

A few kilometres west of Bhairawa is the famous Lumbini Garden, the birth-place of the Buddha. It is visited by Buddhists from all over the world. Pilgrims come from Japan, Thailand, Burma, Ceylon and Ladakh. Lumbini is reached by bus or car from Naugarh in India.

In the plains much forest has been cut down for cultivation. Houses are made of timber and straw. They have slanting roofs. The living quarters are on the upper decks. Usually, a part of this deck is kept open as a verandah. This arrangement is adopted for fear of wild animals and snakes.

In the Duns and in forest clearings all over this area are found a primitive Indo-Nepalese people called the Tharus. They are fair-complexioned and have Mongoloid features.

Women wear very attractive, coloured clothes and ornaments. The Tharus drink and dance. The women do not observe purdah. One may enter their homes without notice. Their customs are changing slowly. The Tharus bury their dead, but rich Tharus prefer a cremation.

The Tharus have their tribal gods. Before marriage, a couple must appease the village god.

A Tharu dwelling consists of a very large single hut, whose floor is divided into a number of compartments for sitting, sleeping, cooking, eating etc. They make ropes, seats, umbrellas, etc., from local straw. They have common village wells, where water is lifted by levers. The villages are nucleated. In the forests nearby are to be found wild animals including tigers. The Tharus are fearless and are good hunters.

Often a whole village works as a single unit for agricultural work, house building, hunting, fishing and even in marriage ceremonies. All the marriages are performed on a single day.

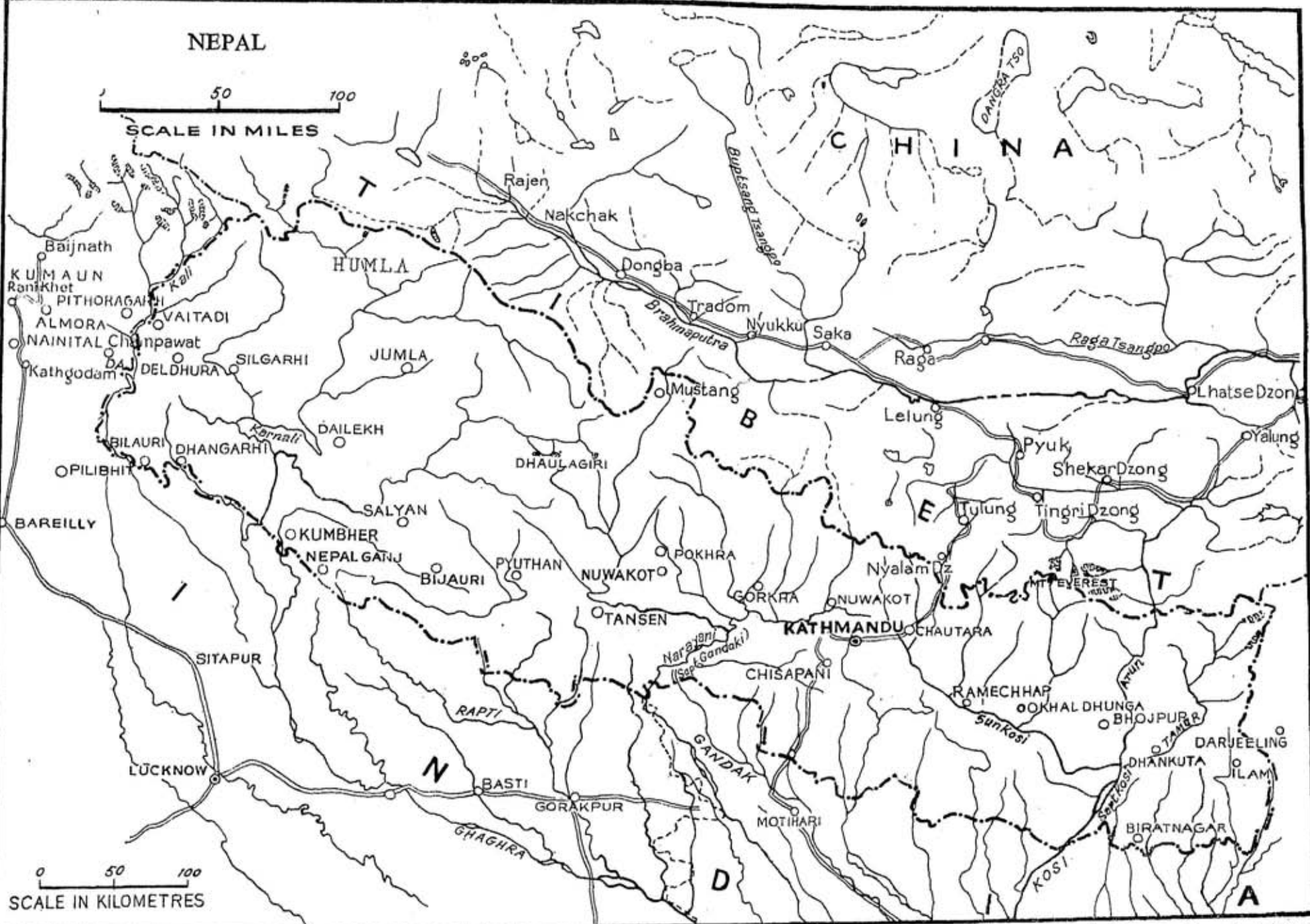
Gandak Basin

This basin roughly covers the central portion of Nepal. In the north it spreads up to Mustang Bhot, in the west it is anchored in the Dhaulagiri massif and in the east it goes up to Kathmandu.

The main river Gandak rises near Mustang Bhot at a point slightly beyond the border in Tibet. It is called the Krishna Gandaki here. Further down, it flows in a fantastic gorge between two eight-thousand-metres Himalas—the Dhaulagiri and the Annapurna (8,078 m). The gorge is cut by the river across the Great Himalaya and hence the northern portion beyond the gorge may be antecedent. The geology of this area is also of the Tibetan zone-type, with a complete series of mesozoic and tertiary rocks. Here is Muktinath, a sacred place near a hot spring. Further north is Mustang Bhot. The pilgrim route to Muktinath passes through astonishingly beautiful scenery. The route

NEPAL

50 100
SCALE IN MILES



0 50 100
SCALE IN KILOMETRES

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starts from Butwal from where one may easily go by bus or by motor car up by to Tansen. From here a mule-track drops to Riri Bazar in the Kali Gandaki valley. It goes north along the valley to Baglung, Beni and Dana. Here a route comes from Pokhara, crossing Modi Khola, a stream rising in the Annapurna Himal, among glaciers on its southern face between Annapurna I and Machhapuchhare (6,998 m). This high valley is completely glaciated. The track then climbs up to nearly 3,000 metres over the watershed between the Modi Khola and the Krishna Gandaki, and drops down to Dana. The deep gorge through the central Himalayan axis occurs between Dana and Lete. The route gradually ascends to Tukucha and Kagbeni, where gradually the scenery changes to a gorgeous open aspect with many coloured sedimentary rocks seen all round showing various geological structures. This is due to the Tibetan zone-type of geology in this area. In its final stage the route climbs steeply along a tributary to Muktinath, east of which hardly six kilometres away is a snowy range running south to join a spur descending from Annapurna I. Another high-glaciated valley here is Mirist Khola collecting its waters from an amphitheatre-like feature surrounded by three seven-thousanders and the eight-thousander Annapurna I to the east. The Mirist Khola joins the Krishna Gandaki below Dana. Another high valley is Rahughat Khola which rises from the southern glaciers on Dhaulagiri (8,172 m), and meets the Kali or Krishna Gandaki above Beni. Near Riri Bazar, the river is better known as the Kali Gandaki. Here it has a very sharp bend. Riri Bazar is a gap town in a high ridge running parallel to the Mahabharat Lekh just north of it, where the Kali Gandaki cuts through it. Together with the valley of the Andhi Khola, a tributary of the Kali Gandaki, the two rivers run nearly thirty kilometres from east to west to find this gap and turn sharply to flow from west to east for about one hundred kilometres to cut through the main Mahabharat Lekh range, and flow into the Duns north of

the Churia (Siwalik) range. This peculiar pattern around Riri Bazar proves that the rising Mahabharat Lekh and its associate ranges forced the river, as they rose, to turn and twist a lot to find and maintain the gap through the rising ranges.

Pokhra Valley

This is a valley of great beauty lying in the shadow of the mighty snow range of Annapurna Himal. On a clear day one looks at this dazzling spectacle hardly fifty kilometres away to the north, as if rising halfway up to the heavens. There are four major peaks of Annapurna. No. I is at the western end rising to 8,078 metres. The Himal extends eastwards to peak No. III, peak No. IV and finally to peak No. II. The snowy range extends farther to the east and south as the Lamjung Himal. Spurs from Annapurna I and III run southwards enclosing the valley of the Modi Khola. Both the spurs are crowned by snowy peaks, the most spectacular among them being Machhapuchhare which is on a spur from Annapurna III. It is nearer to Pokhra, being about thirty kilometres away, and though it is lower, it looks higher and more imposing than the Annapurna peaks. Its shape like a pyramid is also very striking. Its Nepalese name in English means 'Fish-tail'. This horned peak has been compared by Tony Hagen, a Swiss geologist, to the famous Matterhorn peak in the Alps.

A tributary of the Kali Gandaki named the Seti Khola forms the main stream draining the Pokhra valley. It rises among the snows of Annapurna III. The Mardi Khola which rises from Machhapuchhare, joins the Seti Khola in extensive terrace-lands surrounding the flat Pokhra valley. Both the streams have a very steep gradient until they arrive in the Pokhra valley.

The flattish valley is the exposed bed of a past lake, which was formed by a natural dam created by the rise of the Mahabharat Lekh and its associated ranges on the northern

flank. The dam site was about six kilometres south of Rupakot Tal. The river ultimately escaped from here by cutting through this obstruction. Today one observes horizontal beds of conglomerates, limy shales and marls covering the surface of the valley. They are lake-bottom deposits. Another feature of the valley is the occurrence of big and small boulders of crystalline rocks, mainly gneisses and schists, often embedded in the soft lake deposits. They seem to have been carried down by glaciers and rivers from the surrounding slopes into the valley. When the lake drained out, these bouldery materials lay on the exposed floor. Here the new drainage pattern formed is naturally very young, and therefore we find a number of lakes scattered at the edges of the valley. In time they will drain out. The biggest lake is Phewa Tal about five kilometres long. Other lakes are Begnas Tal and Rupakot Tal.

There are many river terraces developed in the valley. The Seti shows some pseudo-limestone features when it flows through limy deposits. One notes a long tunnel-like cave below paddy and maize fields about six kilometres north of Pokhara. It has been named Mahendra Gupha. Further down, the river has a fantastic gorge section hardly twenty metres wide and 200 metres deep. After flowing through open terraces, the river again creates an awe-inspiring gorge and disappears for some time underground.

The old village of Pokhara has an ideal settlement pattern developed in the past. It is an extra-broad avenue with two drains of sparkling water on two sides. Here Nepalese women wash their utensils and clothes. Ducks flutter about in the water. Rows of houses and shops stand behind the drains. The Nepalese are fond of flowers and they grow them in pots and tins geraniums, marigolds, dahlias and poppies. In the centre of the avenue runs a metre-high platform with large trees growing on it, and quaint Nepalese temples built in the centre of the avenue. Weary travellers often rest here. The plan of Pokhara is a creation the Newars.

Much of the material of house construction is obtained from the erratic boulders of gneisses and schists. The latter specially split into glittering slabs of many hues. They are used for making floors, door-steps, roofs and so forth. The more solid slabs of stones make walls. Stones are also used for making fences for fields and orchards. Timber is used for making doors, windows and rafters. An extra large boulder lying in the northern suburb of Pokhra is worshipped by the people.

Pokhra is being rapidly modernized. It has an airport connecting the town to Bhairawa on the plains and to Kathmandu. Some new hotels have been constructed to accommodate the rising number of tourists, who come to see the snowy ranges reflected in the lakes. This enchanting spectacle is enhanced in moonlight. There are bungalows built by Nepalese princes on the shore of Phewa Tal. One of these has been converted into a big hotel.

Pokhra is a fertile valley. While paddy grows on lower terraces, maize grows on higher lands and terraced slopes. Pokhra has many orange orchards and the fruit is of very good quality. So it has been called the valley of oranges. Bananas, papayas and mangoes are also planted in the valley. Oilseeds are cultivated and are pressed for oil by hand-driven crushes.

Pokhra has now some schools, a Government college and a hospital. The new motor road connecting Sunaoli on the Indian border with Pokhra *via* Tansen has been completed. It will bring cement from India for new construction. Trade with India both ways will increase. Care should be taken not to take up flat agricultural land for building purposes. The mountainous terrain of the Himalaya has but very little flat land, and it should be spared for agriculture. The old villages in the area are located on mounds and high ground.

The Seti joins the Modi Khola after escaping from the Pokhra valley, and the combined stream joins the Marsyandi river to join the Kali Gandaki, which now becomes a powerful

stream and cuts through the central range of Mahabharat Lekh.

The Marsyandi river has a major portion of its upper basin north of the central Himalayan axis represented by Annapurna and Lamjung Himals. North of the valley along the border is the Manaslu Himal, whose highest peak is 8,150 metres high. The valley is very high cold and dry, as it is situated north of the Great Himalaya. The area is called Manang Bhot. The Bhotias inhabit this area as in many other high and remote regions of the Himalaya, and again Gomphas, Manis and fluttering prayer flags form part of the cultural landscape. The villages are compact and the houses are sturdily built of stones. The Bhotias tend yaks, sheep and goats. Barley is their staple food. There was much salt trade along this route *via* Mustang Bhot. It has now stopped.

Further east is the valley of Chepa Khola, a high valley draining from snowy ranges, of which the highest peak is Himalchuli (7,864 m). Gorkha, an important town of central Nepal, stands on the Darondi Khola another high hill stream. Both these Kholas (streams) are tributaries of the Marsyandi.

The Gandak basin extends still further east, where the Trisuli river is its easternmost tributary, which extends right up to the Kathmandu basin, and north of it. The Trisuli and its tributary the Burhi Gandaki have their upper courses beyond the Great Himalaya across the border in Tibet. The Government of India has constructed a twenty megawatt hydro-electric power-station on the Trisuli. For this purpose, the project site has been connected to Kathmandu by road. The Trisuli lower down joins the Marsyandi. Wide terraces occur in the Trisuli valley at a lower level.

The combined river Gandak, after cutting across Mahabharat Lekh, flows through a forested Dun-type valley. It cuts through the Churia (Siwalik) range at Tribeni. In the Dun, the Gandak is called the Narayani, as ammonite fossils are

found here, which are supposed to be sacred and are worshipped as Shaligram Shila. They are brought down along the river from the Tibetan Zone. Longitudinal rivers join the Narayani both from the west and the east along which the dun valleys extend. The eastern Dun is named Chitawan Dun. It is very well developed, and extends beyond Bhensi, on the Tribhuvan Rajpath. The Duns here are forested. Villages are located in forest clearings.

A small river the Son Bhadra runs along the Nepal-India border and joins the Narayani at Tribeni on the opposite Nepalese bank. There are river-cut cliffs in the Churia range, which show steeply dipping sedimentary rock-beds of sandstones, shales and conglomerates. A sacred spot in this gorge is 'Gaj-Grah', where large holes are seen in sandy rocks on the bank of the river. It is supposed that the holes are the foot-marks of 'Gaj' or elephant who was caught by a crocodile, and was helped by Narayana. In fact, the holes are just pot-holes produced by small pebbles which circulate in the eddies of the river. Pot-holes develop in many rivers in such a situation, as at Gokak Falls in the Ghataprabha valley in Mysore State.

On the Indian side of the river is Bhainsa Lotan, which has been renamed Valmikinagar, as remains of an ancient establishment have been found in the jungle nearby, which indicate that the sage Valmiki had his ashram here. Two lobes of ranges extend eastwards from here, enclosing a small dun. The upper lobe is called the Someshwar range. Originally, there was a canal-head at Bhainsa Lotan, but it has been replaced by a new large barrage across the Narayani. From it canals have been taken out on both sides, irrigating a large area in Bihar, Uttar Pradesh and Nepal. A small amount of hydro-electric power is also being produced. This project has been built by India. The power-station has been given as a gift to Nepal.

A very large fair is held at Tribeni and Valmikinagar on the occasion of the full moon in January. People take a dip

in the cold current of the sacred river on this day. Nepalese and Indian village folk mix together in the fair. 'Tejpat', sandalwood, Shaligram Shilas, oranges and a variety of tit-bits are sold in the fair. Nepalese women purchase glass and plastic bangles and other cheap jewellery.

There are many food shops and magic and other entertainment shows. There are dense forests all round this area infested by tigers and other wild animals. People make log fires to drive away the cold. A pall of smoke hangs over the fair at night. Thousands of people attend the fair.

The Vale of Kathmandu

This basin is a circular, flat area with a radius of about twenty kilometres. It is drained by the river Baghmata and its tributaries, which flow into the Ganga in the plains of Bihar. The Kathmandu basin is also an exposed lake-bottom.

There was a time less than 20 years ago when cars were taken to the valley on the shoulders of men. But the construction of the Bhainsi-Kathmandu motor road has now flooded Kathmandu with modern cars, passenger-buses, taxis and jeeps. Many motor roads have been built in the valley, spreading out from Kathmandu to Patan, Bhaktapur, Pashupatinath, Bodhnath, Swayambhunath, Dakshin Kali, Chhobar, Sundarijal, Balaju Garden and Trisuli.

The valley basin for some time was a lake, produced by the damming of the Baghmata river near Chhobar by the rising of the range. The river then cut through this obstruction, which is formed of crystalline limestones, and escaped through the Chhobar gorge. According to legend, the God Manjushree cut the gorge by his sword to drain off the lake and presented the exposed valley to the King of Nepal. The lake-bottom deposits are found all round the valley as terraces of gravel, sand and clay. They are being washed away from the centre by the Baghmata. The sands in these deposits contain water, while the clays retain it. At the junction of these two, with clay at the bottom, a series of springs occur.

They are surrounded by stone basins where water may be put through the mouth of a stone lion or crocodile. The water is used for drinking, bathing, washing and even irrigation, specially of paddy seedlings in May and June, just before the onset of the monsoon.

The valley is about 1,600 metres high and has a mild climate. The summers are rather warm and some days may even be sultry. A day in June may have a minimum temperature of 40°C, the average being 25°C. December, January and February have their minimums below zero and the valley has snowfall now and then. The total annual precipitation is 115 centimetres.

The valley is densely populated, and forests have been cut down to make way for cultivation. From Thankot, when one enters the basin after climbing its containing hill ranges, one has a grand view of the city, a great agglomeration of grey, brown houses. Modern buildings are rearing their heads among quaint pagodas and temples.

Kathmandu is the present capital, while Patan and Bhaktapur (Bhadgaon) are old capitals. The basin is the melting-pot of Nepalese culture.

Surrounded by green hills and mountains with snow-capped peaks glistening to the north and the east, the valley is indeed beautiful. From some points on the rim of the basin, one can look at Sagarmatha (Mt. Everest), the highest peak in the world (8,848 metres high).

We may call the valley a land of temples and pagodas. They represent some of the finest specimens of Hindu and Buddhist architecture. In the very heart of the town, one may step off the main thoroughfare into narrow streets untouched by time. Here each door and window is exquisitely carved with flowers, birds and auspicious symbols. Here pagoda vies with pagoda, water sings in ornately carved fountains and pools, stone lions squat in the shade of ancient palaces, while atop high stone pillars, brass made Malla rulers kneel in perpetual homage to thier own favourite deities. Massive stone

arches and monolithic and intricately carved platforms hold giant bronze bells. Nearly all this is the work Newars.

In Kathmandu, as one enters the old square of Hanuman Dhoka, one feels as if one has gone back a thousand years in time. The fantastic structures are mainly wooden, as is Nautalla Durbar, a nine-storey wooden palace. There are a gigantic figure of Kal Bhairab—the God of Terror—statue of Raja Pratap Malla, with his four sons on a stone pillar, and the usual Big Bell and the Big Drums. These percussion instruments were used to convey messages. A strange custom is the 'living Goddess', a virgin girl chosen for this purpose. A special house is allotted to her family, just near the Nautalla Durbar.

Kathmandu is gradually expanding and changing into a modern city. It has an airport at Gauchar, which is visited by international aircraft. It is the centre of the Royal Nepal Airways, which connect it with Gorkha, Pokhara, Lumbini (Bhairawa), Nepalganj, Dang, Simra, Bharatpur, Biratnagar and Janakpur.

A modern university has been established here. There is a beautifully laid out garden and playfield. The Vale of Kathmandu is the centre of Nepalese culture.

The basin of Kathmandu is an open rolling landscape of wide terraces and old lake bottom deposits forming higher terraces. Above them rise forested peaks on all sides. Lush green paddy fields spread in all directions. Oil seeds and pulses are also grown. The Chinese built Kathmandu-Kodari road runs from here to the east, while the Indian built Tribhuvan Rajpath and Trishuli road go to the south and the west. A new Chinese built lateral road is nearing completion. It joins Kathmandu with Pokhara.

The Kosi Basin

The basin of the great Kosi river covers one-third of Nepal in the east, the Gandak covering the central part and the Ghaghra the western, which have been described earlier. In

one way, the Kosi basin is unique as it drains the highest peak of the world, Mt. Everest, and its great neighbours, Kanchanjanga, Makalu, Lhotse, Cho Oyu and others.

The combined Kosi, a mighty river, cuts a gorge through the Siwalik range at Chatra, where the temple of Barahakshetra is situated. At one time, there was a plan to build a high dam here, similar to Bhakra, to generate electric power, irrigate lands in Nepal and Bihar and, above all, to control the devastating floods of the Kosi. The Kosi has been called Bihar's river of sorrow, as it has gradually shifted its channel to the west, leaving a belt of sand-covered tract to its east. At present a barrage at Hanumannagar and lateral dams have provided partial protection.

Twelve kilometres north of the Chatra gorge meet the three main tributaries of the Kosi. The river from the west is the Sun Kosi from the north the Arun and from the east the Tamur.

The Kathmandu-Kodari road climbs the rim of Kathmandu basin at Dhulikhel, a small platform from where a magnificent view of the snowy peaks is obtained. From here the road crosses over to the Indravati valley. This river drains the eastern slopes of the Kathmandu basin into the Kosi. Terraces are widely developed here. The altitude is low and mango trees and bananas are grown in the area. The road crosses the Indravati-Sun Kosi divide and then slowly climbs the Sun Kosi valley, where again wide terraces are developed. Here the Chinese are building a ten megawatt hydro-electric station. The last big Nepali village near the border is Barabise on the bank of Sun Kosi. Here the roofs of the houses are less slanting. They are made up of stone slabs. Beyond Barabise, though less than 2,000 meters altitude the valley shows clear signs of glaciation in the past. A U-shaped, truncated spur cliffs and waterfalls appear. The road then follows a tributary of Sun Kosi northwards into Tibet beyond Kodari.

The lateral highway running east-west through Nepal, which is being gradually developed as a motor road joins

Kathmandu with Ramechhap and proceeds to Dhankuta and Ilam Bazar on to the border of Darjeeling district at Simana Basti near Sukia Pokhri.

The road has been motorized in patches, and is yet largely a mule track. The basin is thus very remote. A few tracks and some roads run south from the lateral road through Bhitri Madhesh and Tarai forests to the plains of Bihar. The most important of such roads is the Purnea-Dhankuta Road. From Dhankuta a track goes north along the Dudh Kosi, which drains the Everest region. High up here is Namche Bazar, the home of Sherpas, the brave and sturdy mountain porters, who have earned much praise by working in mountaineering expeditions. It is also the ancestral home of Tenzing Norgay, the Sherpa who first climbed the Everest with Sir Edmund Hillary.

The Everest region is the highest in the world, including Lhotse and Makalu, it is called the Mahalangur Himal. The Everest is called Sagarmatha by the Nepalese.

The northern face of the Everest slopes towards Tibet. Over it descends the Rongbuk glacier to the Rongbuk monastery. The southern face is towards Nepal. Here Everest, Lhotse and Nuptse surround an ice basin, called an amphitheatre or cirque by geographers. But a Swiss expedition to the Everest called it the CWM. From it a jagged icefall descends to the Khumbu glacier. Expeditions to climb Mt. Everest earlier followed the northern route along the Rongbuk glacier. But for some time past the route followed is by the Khumbu glacier, the icefall, the CWM and then a climb to the South Col, a saddle over 8,000 metres high, between the Everest and Lhotse. From here a spur leads to the top of the Everest. All the recent successful expeditions have followed this route.

Strangely Mt. Everest is one of the few peaks in the Himalaya which is made up of limestone. Below the limestone are crystalline metamorphosed rocks. Being a sedimentary rock, limestone shows that the ancient sea once covered the rising Himalayan folded rocks.

There are signs that the Khumbu glacier is shrinking. Below the snout of Khumbu is the famous Thyangboche monastery.

The shepherd tribes in these cold high regions do some trade across the frontier. Jhabbus or cross-breeds between oxen and yaks are taken to Tibet for sale as they are very hardy. The people here grow barley. Their main food is Sampa or roasted barley. They drink a kind of wine made from barley.

The Arun, the central river of the Kosi trinity has a large portion of its upper course in Tibet. It then cuts one of the most fantastic gorges through the central Himalayan axis between the Everest and Makalu towering on both sides. While on both sides are these cold icy peaks, the gorge at a height of about 3,000 metres has a pleasant temperate climate. Mountaineers engaged in climbing the high peaks often retreat to this gorge for rest.

The river Barun, with glaciated landscape of sliced spurs and waterfalls on the sides of a U-shaped valley, takes its rise in the Barun glacier descending from Makalu.

All this area is supposed to be the haunt of the abominable snowman, about which there are many fantastic stories. But its existence is yet in doubt. An expedition by Sir Edmund Hillary in its search proved fruitless. It is perhaps a large bear whose foot-prints are enlarged by melting snow.

The eastern tributary of the Kosi is the Tamur, which drains the western slopes of Kanchanjanga massif called Kumbhakarna Himal, and the western flanks of the Singalila range.

South of the Tamur the Mahabharat Lekh is quite prominent. The three rivers the Sun Kosi, the Arun and the Tamur join together to form the great Sapta Kosi river, which escapes through the Chatra gorge to the plains of north Bihar.

Ilam Bazar is the chief town of eastern Nepal. It has an easier access to Darjeeling than to Kathmandu. There is much trade between this area and Darjeeling. The chief

products exported from eastern Nepal to Darjeeling are potatoes and potato seeds.

Climatically, this region was specially studied by Fritz Müller who found 'unexpected aridity' in the Everest region. The total rainfall at 5,300 metres height from April 12 to November 26 was only 39 centimetres on the Khumbu glacier, as compared to 199 centimetres at Chisapani in the Mahabharat Lekh and 225 centimetres at Sirha on the Ganga plain in north Bihar.

Large areas of eastern Nepal are isolated and culturally stagnant. Improved communications can alone develop this region.

XI. EASTERN HIMALAYA

Darjeeling and Sikkim Himalaya

LONGITUDINALLY the Northern Mountain Wall can be divided broadly into three parts, western, central and eastern. Nepal constitutes the central portion, while the eastern portion spreads eastwards from Darjeeling and Sikkim.

This portion of the Himalaya is a distinct physical unit as it is bounded by two north-south-running ranges, which are uncommon in the Himalaya. To the west is the mighty Singalila range which runs south from the Kanchanjangha massif, and lies between Nepal and this region. In the north, this range is crowned by snowy peaks. The Singalila peak (3,679 m) stands at the tri-junction of Nepal, Sikkim and Darjeeling. Further south on this range are Phalut (3,596 m), Sandakphu (3,323 m) and Tanglu (3,063 m), famous tourist spots, visible clearly from Darjeeling town. Sandakphu is connected with Darjeeling by a jeepable road which is being extended farther north. As one ascends by this road, one passes through changing vegetation planted *Criptomaria japonica*, fir, spruce, deodar, oaks, rhododendrons and finally Alpine grasses.

To the east is the Dongkya range forming part of the border between India and Tibet and extending south along the Bhutan border. In the north it culminates in a 7,134-metres-high peak. The average height of the range is over 5,000 metres. Across it lie the strategic passes of Nathu La (4,450 m) and Jelep La across which the roads enter the Chumbi valley of Tibet.

Sikkim, lying between the Singalila and Dongkya ranges to the west and the east, has its northern border along Tibet, coinciding roughly with the central Himalayan axis running between Kanchanjangha and Chomolhari (7,314 m) on the Bhutan-Tibet border. The eastern half of this part of the

Himalaya lies north of the Chumbi valley in Tibet. This is the only part of the Himalaya which lies exclusively in Tibet. The Chumbi valley south of it is again the only south sloping valley, which takes its rise from the Himalaya and lies in Tibet. Here the Chinese have a strategically favourable position. The Chumbi valley has militarily been called a dagger thrust south towards India. The southern boundary of Sikkim consists of the deeply cut valley of the Tista and its tributaries.

Nearly two-thirds of Sikkim consists of very high mountains perpetually covered with snow from which descend glaciers like Zemu and Talung. These regions have practically no human habitation. Only nomadic tribes visit them in summer with their yaks and sheep. The lower portions of Sikkim are mainly forested. Villages are situated generally between altitudes of 1,000 and 2,000 metres on river terraces and gradual slopes.

Gangtok, situated at an altitude of 1,770 metres, is the capital of Sikkim and the seat of the Maharaja of Sikkim. It is an important market centre for grains, vegetables, fruits, hides and skins, and wool. It is a beautiful hill-station connected to Siliguri by a very good motor road. From here the road climbs to Nathu La up to the Tibetan border. It has a vital strategic importance. On this route is the glaciated lake of Chhangu, which empties itself into a waterfall over a morainic (glacial material) plug into the valley below. The hills all round are covered with bush rhododendrons. Farther up are more glaciated lakes. In lower altitudes are tree rhododendrons in which scarlet flowers bloom in May. There are dense forests of deodars, junipers and spruce. The natural vegetation of Sikkim is beautified by a great variety of orchids.

A new motor road has been built towards the north from Gangtok. It is named the North Sikkim Highway. From Gangtok it winds up the Tista river valley to Mangan, Singhik and Lachung. Singhik is a famous beauty spot.

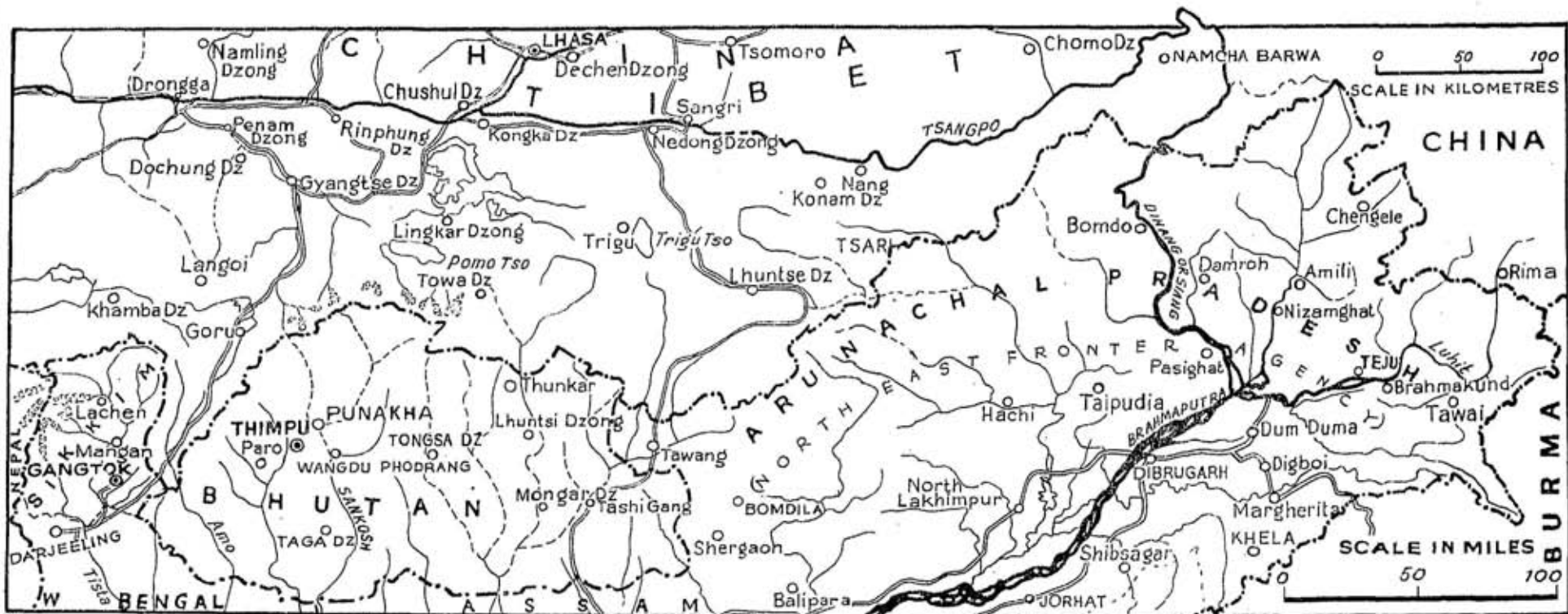
From here astounding snow views are obtained of Kanchanjanga up the Talung valley and of the Dongkya range up the Tista valley. The Lama Anden peak (5,867 m) is visible in the middle. The road ascends northwards towards snowy regions. Here lies the enchanting lake of Tso Lhamo or the Lake Goddess. This part of Sikkim is inhabited by Sikkim Bhotias and Tibetans who have settled here. Lamas twirling prayer wheels are seen here now and then. The religion is Lamaistic Buddhism. Yak milk is used to prepare solid hard cubes of cheese, which people chew frequently, so that their teeth are worn out by constant rubbing.

In south Sikkim the valley bottoms are often 1,000 metres above sea-level. Here there are dense tropical and subtropical forests. The few villages located on river terraces grow paddy and tropical fruit. In slightly higher areas, large quantities of high quality oranges are grown. They are exported wherever transport is available. Some efforts are being made to make orange squash. Much more in this line has to be done to save excess production.

Darjeeling Hills

Darjeeling district, included in West Bengal, largely consists of Himalayan foothills. The southernmost area around Siliguri consists of plains. The district mainly lies south of the Rangit river gorge. To the west is the southern extension of the Singalila range. In the centre is Tiger Hill (2,567 m). Spurs from it run in four directions. To the north is the Darjeeling spur, upon which spreads the famous mountain resort, a paradise for tourists. It is a creation of the British. In Jala Pahar and Kata Pahar is located the cantonment, where British soldiers stayed in the past. It remained a British Gurkha training centre even after independence for several years. To the south is the Dow Hill spur, where Kurseong, some big schools and a forest office are situated. The spur descends to the plains. To the east is the Takdah spur on which lies the Mongpu cinchona plantation. Here

EASTERN HIMALAYA



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the tung oil tree, ipecac and other medicinal plants are being grown. There is a quinine-making plant here. The western spur of Tiger Hill descends to Ghoom and extends further as a 2,500-metre-high knife-edged ridge which joins the Singalila range near Manibhanjan below Sukia Pokhri.

The three leading products of Darjeeling are tea, timber and potatoes. Except in the area east of the river Tista, tea-gardens extend all around Darjeeling and Kurseong. High-level Darjeeling tea has a unique flavour. The Happy Valley Tea Garden and the adjoining factory are well-known for quality. The Lopchu Tea Estate and Singel and Ambhulia Tea Gardens at Kurseong are also well-known.

Timber is exported from forests in the mills. *Criptomaria japonica* is being grown in plantations around Darjeeling. In time the regenerated forests will become a steady source of timber.

Potatoes and potato seeds are grown and exported to the plains from Darjeeling, Kalimpong and Sikkim. Many varieties of vegetables such as cabbages, cauliflowers, fresh beans, peas and squash are being increasingly sent to the plains. Calcutta is a good market for them.

A good road and a toy railway connect Darjeeling with Siliguri. The road to Gangtok has a branch to Kalimpong. There are many other roads in places around Darjeeling, such as the road to Sukia Pokhri and Manibhanjan, a branch road to Mirik, the roads to Takdah, Mongpu and Tista Bazar, and other roads to Manjhitar, Bijan Bari and Pul Bazar.

Darjeeling is a leading tourist centre in the Himalaya. Its unique importance is due to the fact that one can view, if lucky, the highest mountain-peak of the world, Mt. Everest. One has to be present before sun-rise on the top of Tiger Hill eight kilometres away on a clear morning. Three peaks are noted like ice-cream cones behind the Singalila range to the west. The one in the centre is Mt. Everest. But the Kanchanjangha group of peaks to the north is much more

impressive. The peaks are Kanchanjangha (8,585 m), Kabru (7,338 m), Pandim (6,709 m), Narsing (5,831 m), Siniolchu (6,815 m) and Jano in Nepal. The early red rays of the rising sun in the plains of Cooch-Bihar kiss the silvery peaks of the Himalaya one after another, the highest peak Kanchanjangha coming first. This phenomenon is again unique, as nowhere in the world are so many peaks above 6,000 metres so near the plains.

Tourists may also visit the Tonglu (3,063 m), Sandakphu (3,323 m), Phalut (3,596 m) and Singalila (3,679 m) peaks on the Singalila range, from where a full view of the Everest range is obtained. There are good Government rest-houses at all these places.

Trips to Manjhitar, Tista Bazar, Mongpu, Kalimpong and other places are also very enjoyable. There is a ropeway to Pul Bazar from Darjeeling. The trip in the toy train through the tea-gardens is also very exhilarating.

Kalimpong is situated east of the Tista gorge. It is a nice hill-resort, and was very much liked by Rabindranath Tagore. The old wool route from Tibet reached here through Jelep La (pass). A ropeway connects it with the Tista valley below which carried wool in the past. The wool trade has now stopped after the Chinese occupation of Tibet.

Areas below 1,000 metres are covered by dense tropical forests. Here one can see rhinoceros and tiger, if lucky, in the Jaldhaka sanctuary. There is a hydro-electric power-station on the Jaldhaka river. Extensive tea-gardens again appear in the plains and mildly rolling uplands and gravel beds. Oranges also grow extensively in the low, warm valleys.

BHUTAN

This State in the Himalaya joins Sikkim to the east. Until recently there was no motor road in Bhutan. The late Prime Minister of India Jawaharlal Nehru had to go to Bhutan through Nathu La and Chumbi valley in Tibet on

horseback to Ha Dzong and Paro in Bhutan. Today the Government of India has built a good motor road from Phuntsoling on the border to Paro. A branch road from it, taking off at a point called 'the confluence' extends to Thimpu, the present capital and on to Punakha.

The Bhutan Himalaya consists of a great arc of snowy ranges in the north from which descend snow-fed rivers. The arc spreads from Chomo Lhari (7,314 m) in the west to Kulha Kangri (7,541 m) in the centre and on to the east. Here the rivers flow through glacial features such as amphitheatres, truncated spurs, waterfalls and U-shaped valleys. The area is cold and nearly uninhabited, except for a few Dzongs (forts) and monasteries. Further down are found small basins in the valleys, which were perhaps lake bottoms in the past. Paro, Thimpu and Punakha are located in such basins. Passing farther south the rivers have dug fantastic gorges through the ranges before going out to the plains.

In the west is the gorge of Amo Chhu, whose upper portion lies in Tibet in the Chumbi valley. On entering India, it is called the Torsha. It is a very turbulent river. When in floods, it is very ferocious.

Farther east are the twin rivers Paro Chhu and Wong Chhu, which join at a place named 'the confluence'. The combined river runs down to the plains as Raidak. The basins of Paro and Thimpu are located in the upper portions of these rivers.

The next valley is that of Mo Chhu, where lies the small basin of Punakha surrounded by towering ranges. Mo Chhu is known as Sankosh in the plains of India. All these valleys lie in western Bhutan, which is being developed by the new roads.

Eastern Bhutan is still very isolated and the valleys here are little known. However, they join together to form the Manas river in Assam. A number of remote places lie in these valleys named Tongsa Dzong, Byakar Dzong and Tashi

Gang. There is a plan to construct a lateral highway through them to Wangdu Phodrang and Thimpu. New roads built here are the Samdrup-Jongkhar-Tashi Gang Road, the Hathi-san-Tongsa Road and the Sarbhang Road.

Besides the new roads there are helipads (landing-grounds for helicopters) at Paro and Thimpu with flights between them and Hasimara.

Three new towns are being developed under an Indo-Bhutanese agreement. One of them is Thimpu, the new capital. Earlier Thimpu consisted of only a few huts. But today it is taking on a modern look. Plans were prepared by the Institute of Technology, Kharagpur. The National Assembly and the Secretariat have already been completed. Schools, hospitals, residential quarters, shopping and recreation centres are gradually coming up. Thimpu basin at an altitude of 2,500 metres is surrounded by rock walls rising to 4,000 metres. It is about 30 kilometres south-west of the old capital of Punakha.

The second town is Paro, over 2,000 metres high. Here also the old Dzong has been renovated and new schools, residential houses, markets, etc., have been constructed.

The third town is Phuntsoling at the border, from where the new road starts. Situated on the bank of the Torsa, it is being developed as a trade and commerce centre. It has Government offices, residential buildings, a rest-house, hotel and shopping stalls.

A fleet of some forty vehicles plies between Siliguri and Dalsingpara in India and Paro and Thimpu in Bhutan.

Two small hydro-electric power-stations have been set up at Thimpu and Paro, producing four mw of power each. 25 mw of power is being given free by India to Bhutan from Jaldhaka. Work is going on in Chhukha Dzong Power Station to produce 200 mw of power. Bhutan has an immense potential of power in its rivers. When developed, this power may even be sold to India.

Mineral extraction of coal, dolomite, gypsum and graphite

is taking place after a survey by Indian geologists. In future, Bhutan is sure to produce more minerals.

Small industries are also being developed. At Samchi, near the south-eastern border of Bhutan, a distillery and fruit preserving plant are working. Other small-scale industries of Bhutan, which include textiles, wood and paper craft, leather and metalware are also being modernized. Plants for fertilizers, cement, paper and plywood may soon be set up.

Bhutan will in the near future be a modern hill state, if progress continues at the present rate.

THE ASSAM HIMALAYA

Further east of Bhutan, the Himalaya spreads through Arunachal Pradesh to the great bend of the Brahmaputra around the Namcha Barwa (7,756 m) massif. During British rule, this area was a forbidden country where a variety of tribes lived in remote valleys. The British policy was not to disturb these tribes. They had no educational facilities, nor was modern transport developed in this region. The few people inhabiting this area lived a very primitive life. After independence, the Government wanted to develop this region. In the beginning the tribal people showed some resistance. The people recognized only the laws of nature. They even did not think that killing human beings was a crime. They rather thought it to be good sport. The Chinese penetration of Tawang south of Bum La hastened the opening up of this region. Military out-posts were constructed which were first supplied provisions by air. Roads were built rapidly, and with this came slow aculturation. Schools, hospitals and roads are now being built here.

Arunachal Pradesh consists of snowy peaks in the north and rugged mountains and valleys in the south. Unlike the western part of the Himalaya in Kashmir, where there are many ranges both north and south of the Great Himalaya, the eastern part consists of fewer ranges, the northernmost being the Great Himalaya itself. In its western part here

there are the Kangto group of peaks. Kangto being 7,089 metres high. There are three more snowy peaks all on the border. Just as in the west the Great Himalayan arc in the east practically ends in the Namcha Barwa (7,756 m) peak around which the Brahmaputra (or Dihang or Siang) takes a sharp turn. It however, lies beyond the India border.

The Himalayan folds here also take a sharp bend, almost 360°, as they do around Nanga Parvat in the west. A noteworthy feature in this part of the Himalaya is that four rivers cut through the Himalaya and penetrate Tibet. This is because they are supposed to be older than the mountain, and have maintained their course as the mountain folded upwards. Though the border here is generally along the watershed, it cannot be so where these rivers penetrate the border. The first penetration is that of the Manas near Bum La (pass), 4,331 metres high. It is through this gap that the Chinese army entered India in 1962. The second river is the Subansiri and its two tributaries, the Yame Chhu and the Chayul Chhu, which cut across the Himalaya near Longju and have a big basin in Tibet around Lhungtse Dzong. The third river is the Brahmaputra which rises near Manasarowar and travels nearly 1,200 kilometres before entering India. The fourth such river is the Lohit, which enters India near Rima and joins the Brahmaputra near Sadiya. It is worthwhile to note that the Chinese entered India both near Longju and Rima.

In the north-west corner of Arunachal Pradesh is the longitudinal valley of the Tawang, a tributary of the Manas. Here is situated the famous monastery of Tawang which fell to the advancing Chinese in 1962. South of the Tawang valley is a Middle Himalayan range, which is crossed by Tse La (4,740 m). South of this range is the valley of the river Kameng, which takes its rise from the Kangto peak. It joins its longitudinal tributary, Bichom, south of Tse La. Farther south is Bomdi La on the last range before the plains. South of it again is the longitudinal valley

of Tenga. A road has now been built in this region from Tezpur to Tawang across Bomdi La and Tse La. The Kameng farther south takes a sharp bend to the west, and then comes out on the plains.

East of the Kameng valley is the basin of the Subansiri, which runs through the Miri Hills and Dafla Hills, the abode of Miri and Dafla tribes. Among the hills and valleys on the right bank is Zero, the chief town of this region. Around Zero the area is comparatively level. It is inhabited by the Apatani tribes who are expert cultivators. They have also constructed a good irrigation system. Zero has an air-landing strip. The Apatanis have no currency. Their wealth is measured by the number of cattle called Mithun one possesses.

The Abor Hills consist of the watershed between the Subansiri and the Brahmaputra. The chief town of this region is Along. All these areas are being gradually developed. Roads are being constructed and schools and hospitals are also being constructed. Farther east is the great gorge of the Brahmaputra ending near Pasighat, the gateway to eastern Arunachal Pradesh.

East of the Brahmaputra gorge is the valley of the Dibang or Sikang a tributary of the Brahmaputra. It is entered through Nizamghat in the south. It is densely forested.

The railway from the plains ends at Dangari, from where a good road leads to the Luhit valley through Sadiya, the navigation head on the Brahmaputra.

The road ascends the Luhit valley to Walong and beyond. The river enters Tibet below Rima. Further down the valley is Parasuram Kund, a religious centre. Here along the border there are some important passes such as Diphu (4,353 m), Kunjawng (2,929 m), Hpungan (3,072 m) and Chaukan (2,432 m) at the tip of Chaukan finger of the Indian territory pointing to the south-east. The highest peak of this region rises to 4,578 metres between Luhit and Noa Dihing. From the Chaukan finger, the Indian border runs

to the south-west along the Patkai range, which is crossed by the Burma Road, which starts at Ledo and goes into the Chindwin valley in Burma. It was built during the second World War but has now fallen into disrepair. This part is called Tirap and is included in Arunachal Pradesh.

EASTERN HILLS AND RANGES

This hilly region is not included in the Himalaya. But as it forms the eastern portion of the mountain rim of India, it has been briefly described here. Three political units cover this region, Nagaland, Manipur and the Mizo Hills.

Nagaland

This hill State was previously included in Assam, but in December 1963, it was inaugurated as the sixteenth State of the Indian Republic. It is proposed to change its name to Naga Bhumi.

Nagaland consists of densely forested hills and is inhabited by Naga tribes along the north-eastern border of India. It is divided into three districts, Tuensang, Mokokchung and Kohima. Previously Nagaland was a paradise for head-hunters but now it is improving gradually under the new dispensation.

The Nagas generally live a primitive life. They still gather a part of their food by hunting. *Jhoom* or shifting cultivation, where virgin forests are burnt down to make temporary fields, is followed today; permanent rice-fields now occupy the valley bottoms. Other important crops are potatoes, maize and vegetables. Naga villages are nucleated, the homesteads being built close to one another; they are located on hill-tops or at places high up, from where a clear view is obtained of the surrounding area, so as to defend themselves from enemy tribes. Previously the villages were walled in by logs, and had a strong entrance gate. But the old culture has changed slowly. Missionaries working among the Nagas have also played an important part in changing them. Many

of them are now educated. There is an important road linking Assam with Manipur which passes through Nagaland. It starts from the Dimapur railway station and passes through Kohima and Mao to Imphal. Other roads have also been constructed including one to Mokokchung.

The highest peak in Nagaland is Saramati (3,826 m) on the border. East of Kohima is the Mol Len peak (3,104 m) and to its south is Japvo (2,955 m).

Kohima, the capital of Nagaland, situated on a saddle, is 1,463 metres high. Hence it has a pleasant climate. It is a developing town. It has a large modern hospital and a big school. The old village is perched on a peak, while the new bazar spreads on the saddle.

Manipur

This border State was previously ruled by a Raja. It is now being developed rapidly. In the centre of Manipur is a flat valley inhabited by the attractive Manipuris who are Vaishnavite Hindus. They are known for their dances and songs. Yet this art is slowly dying as a result of competition with the cinema. The society is matriarchal and the woman is the owner of property. The husband goes to the house of the bride. He does no work. But these customs are slowly changing. Manipuri women are experts in spinning and weaving. There are many small rivers and a large lake called Logtak in the valley. Some Manipuris live in floating houses in the lake. They collect water chestnuts and catch fish. Though the Manipuris are vegetarians, they eat fish. The valley is about a thousand metres high and has a pleasant climate.

The road from the Dimapur railway station *via* Kohima reaches Imphal, the capital. The road further extends to Palet and Moreh on the Burma border. It then crosses to Tamu in Burma and reaches Mandalay. The road, if developed, may provide an overhand connection with central

Burma, and may carry much traffic. Imphal will provide a very good staging centre. Another road joins Imphal with Silchar.

Imphal is connected to Calcutta by air *via* Agartala. The seat of the Raja in the past, Imphal, is the cultural centre of the Manipuris. At one time it boasted of several theatres, where plays were enacted almost daily. Imphal is well-known for its colourful Holi festival. The Vale of Manipur is a drained-out lake-bottom. The marshes and the lake of Logtak are its remnants. The Vale is surrounded by higher ranges rising to 2,000 metres. Various tribes inhabit them, including the Nagas in Ukhrul in the north. In the south live the Kukis.

Mizo Hills

This hilly area consists of narrow hills and valleys running north-south. The rivers run in the same direction, producing a peculiar pattern of drainage consisting of north-south and south-north valleys joined here and there by transverse east-west gorges. The region drains north into the Surma river, south into the Kaladan and west into the Karnaphuli.

Aijal is the capital of the Mizo Hills. It is joined by a good road to Silchar. It lies very near the Tropic of Cancer.

The Mizos are the chief tribal people of the valley. They use spears, bows and arrows for hunting. Much bamboo grows in the Mizo Hills. It is used in house-building. Utensils are also made from bamboos. Bamboo buckets store water.

The forest wealth is little exploited. The area is developing very slowly due to its remote position.

The highest peak of the Mizo Hills is Nauzuarzo (2,140 metres high).

XII. THE HIMALAYA IN ITS PRESENT AND FUTURE CONTEXTS

THE FORMIDABLE ARC of the Himalaya stretching from west to east to the north of India is by far the highest mountain in the world. It boasts of a dozen eight-thousander peaks, which are all higher than any other peak in the world. While there are just a few seven-thousanders in the Andes in South America, there are none elsewhere in the world except in the Himalaya, where about fifty peaks attain this height.

Sport and Science

Mountaineers from all over the world flock to the Himalayan peaks to scale them. Many brave souls still give their lives in such attempts. Modern techniques, including oxygen for breathing, light but strong and cold-resisting equipment and specialized food, and the great courage and endurance of the men and women engaged in this sport have hardly left any peak unclimbed. Yet attempts are made to climb them by alternative routes. High altitude scientific studies in the secluded snowy valleys of the Himalaya are being organized.

In 1970 there was a successful attempt on Annapurna I in the Nepal Himalaya by an alternative route by a British team. One of the members died in this attempt. Earlier the mountain was climbed by the French. In the same year the Japanese attempted to climb Mt. Everest by a new route. In 1970 a programme of scientific research was initiated in the Sundardungha valley south of Nanda Devi in Garhwal by the University of Calcutta.

The lure of the mountains continues and will continue. It is encouraging to note that Indians, both men and women, are taking part in this sport in large numbers. Our late Prime Minister Jawaharlal Nehru encouraged this sport by opening the first Mountaineering Institute in Darjeeling, where veteran mountaineers like Tenzing, Nandu Jayel and Kumar have been imparting training to young boys and girls. Since then two more such institutes have been established at Manali in the Kulu valley and at Uttarkashi in Garhwal. Scientific researches are being carried out near Gulmarg.

Transport

The Himalaya is a store-house of immense resources yet untapped. With the building of roads both strategic and non-strategic, the secluded valleys of this mighty mountain are opening up and exploitation is becoming easier.

A lateral highway in the mountain from Nepal to Kashmir is no more a dream. It has now taken concrete shape. Some of the connecting links are yet unmetalled, and perhaps a few road bridges have to be constructed. But soon these roads will have black surfaces. A marvel of engineering is the new Mussoorie-Simla Road. Except for a bridge on the river Tons at Tiuni in the interior of Jaunsar-Bawar, one can travel by public buses all along this road. A number of branch roads connect this main artery with the interior and remote valleys. The alignment of this road is Mussoorie-Chakrata-Kanasar-Saura-Tiuni-Khara Pathar-Chhaila Theog-Simla. On the branch roads run jeeps, trucks and power-wagons called Gaddus. They transport timber, potatoes, fruit, resin, dairy products and other forest produce and bring back cement, coal-tar, hardware, cloth, kerosene, petrol, salt and foodgrains. As this trade increases, profits will flow into the mountain villages. The mountain people will then have a greater incentive to produce more to be able to purchase more.

Horticulture

A tenfold increase can easily be made in the production of temperate fruit in the Himalaya. The construction of roads will help transport fruit. Fruit preservation plants should be put up. The hill men are learning to grow fruits and sell it. While going on a morning walk at any hill-station, one may see hundreds of hill men moving from the valleys and forests to the town with basket-loads of fruit, apricots and chilloos in Chakrata and Mussoorie or oranges in Darjeeling and Shillong. The fruit belt in U.P. is extending. Apple-gardens are increasing in Ramgarh, Harshil, Kotgarh. Kulu and Kashmir. Hill grapes are sweet and their produce has not increased as it should. Peaches and plums are raised in new gardens, as even in remote Jubbal. Cherries are grown in limited areas around Simla and Mussoorie. Goose-berries, raspberries and black-berries can also be developed on a large scale. They grow wild at many places. Tourists in many secluded valleys may pick up and eat fruit as they walk. People of the plains are consuming more and more of hill fruit. The Government is already doing a lot in this direction.

Aromatics

Peppermint (*Podina*) grows wild in the Himalaya and its exploitation should increase. There are many other scented bushes such as lavender which could be grown at suitable places. At high levels of about 4,000 metres, Guggul a kind of incense, grows wild. Its exploitation can increase further. Other scented shrubs are Nair and Pati.

Nuts and Saffron

A great variety of nuts grow in the Himalaya such as walnuts, almonds and chilghoza. The latter comes from a kind of pine in Kinnaur and also from Kashmir. This pine should be planted in suitable areas. Almonds grow in Kashmir, but can be surely grown in other suitable places also in the Himalaya. The very costly condiment called

saffron (Kesar) consists of the orange-coloured stigmas of large purple flowers which bloom in October-November. Near Pampur in the Vale of Kashmir saffron fields present a beautiful scene of rows of purple flowers sprouting from the ground. There are hardly any leaves. But the cultivation of saffron is very limited. Efforts should be made to extend its production in other areas.

Tea

Tea has perhaps reached a saturation point in production. Rise in production can only be made by a rise in consumption. There are many areas in the Himalaya suitable for growing good quality tea, such as in Almora, where a few gardens exist. Much effort is made to propagate the use of tea by the Government as well as by private agencies. Much money is spent for this purpose at home and abroad. And yet the scope for increase of tea production is limited.

Medicinal Plants

There are many medicinal plants which grow in the Himalaya. Many of them are not yet properly known. Feeble efforts are being made to exploit them. Farms in the Darjeeling Hills are raising some of these plants which include Cinchona, Serpentina (sarpagandha), Ipecac, etc. There is a good scope to develop them.

Dairy Farms

Dairy, wool and other animal products such as furs and skins are produced here and there. There are some Government dairy farms and sheep-breeding centres. But the trade is mainly in the hands of semi-nomadic tribes such as the Gujars, the Gaddis and the Jadhs. Scientific development of the vast alpine pastures has yet to come, and when it does, there will be good production of butter, ghee, cheese etc. Efforts need to be made to start this industry.

Poultry and Fisheries

There is great scope for developing poultry and fisheries in the Himalaya. Modern poultry farms are being developed at many places by the Government. It is expected that hill people will take to poultry farming which will bring them handsome profits. Rivers and water reservoirs are being stocked with fish. Trout fish culture is found in the Vale of Kashmir, Kulu, the Baspa valley in the Sutlej basin and some other places. Apiaries have been established at some places, such as Darjeeling and Kalimpong, where honey is produced. There is much scope for this industry. The hill people should take to bee-keeping. A good deal of propaganda work is called for to make the hill people conscious of then new economic activities.

Forests

Forestry is gradually improving and much is being done to maintain and exploit the forests by the forest department. Afforestation is being carried out and soil erosion is being kept in check. Scientific extraction of timber is being done. Transportation facilities of timber are increasing. Sky-line logging in which timber is transported along wires is increasing.

Minor forest produce such as resin, catechew and gum are being produced. Resin production is increasing fairly rapidly. One may well visit the museum attached to the Forest Research Institute in Dehra Dun to gauge the amount of work being done to develop forests.

Water Power

The Himalaya is a great potential source of power. Only a fraction of it has so far been utilized. The earliest major power-station in the Himalaya was built at Jogindernagar in the Beas valley. Some development has taken place in Kashmir at Mahora and Gandarbal, and Jaldhaka in West Bengal. In Uttar Pradesh, water from the Ganga generates

power at Pathri and in the Ganga canal grid system. More power is produced by the Sarda Canal at Lohia Head (Khatima). Large power-stations are being constructed in the Yamuna valley by utilizing the water of the Tons river. The Ramganga project is also under construction. The most successful Himalayan power-station has, however, been built at Bhakra on the river Sutlej. There are many other small power plants supplying local needs of hill towns. It is thus clear that major rivers of the Himalaya like the Ganga, the Ghaghra, the Gandak, the Kosi, the Tista, the Manas, the Subansiri and the Brahmaputra still await prospecting and development for the source of energy.

It can be envisaged that in time Himalayan rivers will substantially supply the power needs of north India. Within the Himalaya too power may also be used to develop wood based industries and for traction it can be used to run railway trains and trolley cars, as in Switzerland.

Hill Resorts

Himalaya has many hill-stations and resorts. Yet the number of tourists and pleasure-seekers is increasing so rapidly that they are overcrowded during the summer. Hotel charges are exorbitant, and one should arrange some accommodation before one goes to Simla, Nainital or Darjeeling during a 'season'. Clearly there is scope for developing more hill-stations. A high-level resort near the snowy peaks of the Dhaola Dhar above Dharamsala will pay dividends. This is a unique situation as snow-covered ranges are so near the plain of Kangra.

It is a surprise to see Chakrata streets being lit by gas-lamps. This fine hill-station has no electricity and no hotels. Perhaps a civil hill-station can easily be developed near the military station. In the lakeland of the Kumaon, Himalaya one hill-station at Nainital is hardly sufficient. It is possible to develop a good hill-station at Naukuchia Tal.

Beauty Spots

There is a scope for developing numerous beauty spots to attract tourists. Such are the valley of flowers in Garhwal, Rawalsar near Mandi and Khajiar in Chamba. There are places in the Himalaya, where comparatively level areas exist. Such are Baijnath in the valley of the Gomati, the plain between Mandi and Sundargarh and the basin of Jubbal town. These places can be developed as resorts for those who do not like heights and slopes. A few glaciated valleys above 3,000 metres could also be developed for more adventurous people, such as the valley of Har-ki-Dun, beyond Jaunsar-Bawar, and the valley of Gori Ganga on the way to Milam.

One can envisage a day when transport will be further developed and there will be new tourist resorts, and the Himalaya will become a tourist paradise not only for Indians but also for foreigners, like Switzerland.

Pilgrim Centres

The Government is doing well in extending roads to religious places in the Himalaya such as Badrinath, Kedarnath, Gangotri and Yamunotri. Buses now go up to Badrinath. The road-head to Kedarnath has reached Son Prayag beyond Rampur to Kedarnath. From Rampur the Kedarnath temple is hardly 15 kilometres away. The gradient beyond Son Prayag is very steep. Beyond Rambara the last five kilometres have soft glacial gravel and the altitude is nearly 3,800 metres. Perhaps a jeep road can be built right up to Kedarnath, in view of the above-mentioned difficulties.

The road has advanced to the confluence of the Bhagirathi and the Jadhganga, only 10 kilometres short of Gangotri. There will be no difficulty in the road advancing along this small distance, as the gradient is slight. The track to Gaumukh should be further improved, so that people could go safely. Shelters should be built at Chirbas, Bhujbas, Gaumukh and Nandanban above the snout of the Gangotri

glacier. These shelters should be stacked with firewood and kerosene. The mule path to Amarnath should be made jeepable. A shorter route should be developed from Baltal on the Sonamarg-Zoji La Road. Shelters should be built at Zojpal, Sheshnag and Chandanwari camping grounds. The route may then be used throughout summer. The route to the Rupkund lake should be improved and provided with shelters.

The People

Himalaya is the abode of a great variety of colourful people. Many of them are semi-nomads. With the development of roads and increase of tourists visiting them, they are slowly changing. The establishment of military posts and bases near the border has also influenced them. Schools are being built in remote areas, where the hill people are being educated through Hindi and English mediums. The trader has arrived among them. The tribes of Jaunsar-Bawar are today using terylene shirts, while women use colourful satin scarves as their head-gear. The nomads do not hesitate to use cheap and quick bus transport. For their sheep and goats the military personnel offers a good market for meat. Their pack ponies carry goods for pilgrims. They also work as porters for mountaineering expeditions. This change is fast affecting the lives of these simple people from Ladakh to Arunachal Pradesh. Modern civilization and education are bound to change them, perhaps slowly. Many will regret their abandoning the traditional way of life.

The transistor has brought them into contact with the outside world. They are fond of listening to lilting cinema songs. They use cigarette-lighters and electric torches.

Some of the strange customs of the hill people are also changing. It is reported that the custom of fraternal polyandry in Jaunsar-Bawar is being gradually given up. According to one educated villager, half of it is gone, and it

may completely disappear after one more decade. Under this custom, the eldest brother can alone marry, and the wife is shared by all the other brothers. Today he can marry more wives and distribute them to his brothers, so that each brother may have a single wife. Advanced and educated people among them have given up this peculiar type of polyandry.

There is a village named Malana in the Kulu valley up in the mountains. The people of Malana manage their own affairs completely. The lower house of justice consists of all the adults of the village, where disputes are settled. If not, the upper house of selected elders is approached. For this there is a fee in kind, such as a goat or poultry or wine. If the dispute remains unsolved, the final appeal is made to the village god Zamlu, who speaks through his priest. This final decision is binding on all. The people do not use money. Malana villagers have still resisted any change in their simple way of life. But a time may come when they may have to adopt the ways of modern life.

The sacrifice of goats and buffaloes before their gods is still practised. This is done in the famous Kulu fair, where the Maharaja of Kulu sacrifices a buffalo with a single stroke at the end of the fair. Animal sacrifice is common in Kinnaur, Jaunsar-Bawar and Kulu. Here it is a daily affair in the temple of Hirimba, the demon-wife of Bhima, situated in Manali. Buffaloes and goats are sacrificed in the Sarju valley and in Nepal. However the number of animals sacrificed is decreasing and it may disappear in time.

Large hill fairs are held in Kulu, Bageshwar and Jauljibi. They are an essential feature of hill economy. Here the hill people meet traders from the plains. There is much buying and selling. The fairs also provide social contacts. Sometimes marriages are also arranged. There is much entertainment, which includes dances by the hill folk. The Chachari dance of the Sarju valley is very attractive. The Ghanyali witch dance is also practised here.

Defence

The problem of defence of the northern borders has completely changed with the advance of science in general and of military strategy in particular.

The topography has now been better studied and our military personnel are getting training in acclimatization and warfare in the high terrain. In acclimatization, the most important point is the study of the effect of altitude with consequent lack of oxygen. Experiments are being carried out to find its influence on our Jawans. Effects of alcohol and drugs on human beings at high altitude are being studied. Thus such scientific studies are also helping our defence in the Himalaya.

Supply is a very important point in defence. Besides roads, air transport has been significantly developed. There are special transport planes and high-level helicopters. Telephones and wireless have been well developed to provide easy communication. In the trackless regions of the Himalaya, transport is provided by mules.

Studies in terrain evaluation are also being carried out.

Much has been done for our national defence in the north, yet much more remains to be done.

Electrification—A Futuristic Prospect

Many aspects of the Himalayan scene and the rapid changes occurring in them have been discussed in the previous pages. Perhaps the greatest change may be brought about by electricity. A futuristic picture of the Himalaya may well be imagined, when electricity becomes the slave of the hill people.

It has already been stated that the Himalaya is a storehouse of electric power. Only a little of it has been tapped. Much more remains to be harnessed.

While all trains in Japan and Switzerland run by electricity produced in the hills, this is not the case in the Himalaya.

Only three hill trains run, mainly on coal, enter the Himalaya. They are the Pathankot-Jogindernagar line, the Kalka-Simla line and the Siliguri-Darjeeling line. A few diesel engines are used on the Kalka-Simla line. A time may come when there will be many electrified railway lines in the Himalaya. They may run to the Vale of Kashmir, to Chamba and the Kulu valley, to the shrines of Uttarakhand and to the lake-land of Kumaon. Later on, they may be developed in Sikkim, Bhutan and Arunachal Pradesh. Nepal may follow us and produce a network of electrified railway lines.

A few ropeways over which rope-cars run have been recently built. There is one in Darjeeling, which descends to Pul Bazar. A pretty rope-car entertains visitors to Mussoorie, taking them up to Gun Hill from the Mall. It is a beautifully built Japanese ropeway. In Japan there are many such rope-cars carrying passengers and tourists to beauty spots. As in Switzerland electric rope-cars could, in the Himalaya run over glaciers from which passengers can have an enchanting view of glacial landscapes.

One would imagine that in this biggest mountain of the world there would be many such ropeways to carry tourists and passengers to beauty spots, which are otherwise unapproachable. There may soon be rope-cars covering the Gangotri glacier system.

Electricity may also revolutionize industrial development sky-line logging has been introduced at some places. But electric power may make it universal, so that transport of timber from distant forests may become easy. Forest-based industries will then develop fast, again with the help of electric power. Timber and its products, wood pulp, paper, plywood etc., can develop tenfold, if not more.

Electricity may be used in establishing co-operative dairying and preserving the products. Electricity will also develop fruit preservation.

In short, electrification may change the face of the Himalaya in time.

Cultural Heritage

Some are apprehensive that modern technology in the Himalaya may destroy the ancient culture. Where will our hermits go for meditation in the solitude of the Himalaya? Where will people from the plains seek peace? But we should not forget that the vast rugged and snowy regions of the Himalaya will always have many remote valleys in the high glaciated regions, which will provide seclusion and quiet in out-of-the way places, which will ever be peaceful. Here our saints will always retreat for meditation. The cultural heritage of the Himalaya will ever remain as it is today, though perhaps in the remoter and higher valleys.

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