NORTHEAST INDIA DRAINAGE

 **The entire North-East of India is drained into the Bay of Bengal, largely through the two principal rivers of the region, Brahmaputra and Barak, ﬂowing through Bangladesh. The drainage of a small area of Manipur, in its eastern part, ﬁnds its way into Chindwin, a tributary of Irrawaddy, which ﬂowing by Yangon (Rangoon) traverses its delta and falls into the Gulf of Martaban, a part of Andaman Sea. Another area not included in the catchment of either of these two principal rivers is the southern part of Mizoram, drained principally by Kaladan, which falls directly into the Bay of Bengal, on the west coast of Myanmar at Sittwe (Akyab). Though the catchment of Brahmaputra extends into Tibet and Bhutan, besides India, much of the rain falling in the North-Eastern states ﬁnd its way in the territorial waters of either Bangladesh or Myanmar before being discharged into the Bay of Bengal. The Brahmaputra with over two dozen tributaries, joining from north as well as from south, has a total drainage area of 651,334 km2 of which 178,000 km2, i.e. about 27 %, lies in North-East India. About 70 % of the area of North-Eastern states lies in the catchment of Brahmaputra. A mighty river, ﬂowing for over 1,000 km in India, Brahmaputra has a mean annual discharge of 38,000 cusecs and carries an annual suspended load of 800 million tons.**

 **North-East India is the rainiest region of India. All the seven states of the North-East (Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram and Tripura) together receive 696,876 × 106 m3 of rain (696.876 km3) which amounts to 17.42 % of the total rainfall received in India. With only 7.72 % of the area of the country and more than 17 % of rainfall, North-East has more than its fair share of water resource that the country can garner. This enormous amount of rainfall, largely received during the 4 months of monsoon, is drained off by two major river systems, the Brahmaputra and the Barak, which, together, dispose of around 84 % of the total rainfall of the area. A small fraction is drained off by the river Chindwin ﬂowing beyond the eastern borders of the country, in Myanmar, through its tributaries that collect water from the eastern border regions of Nagaland and Manipur, while others, speciﬁcally the south- ﬂowing streams of Meghalaya, descend on to the Bangladesh plain. Some rivers of Tripura and Mizoram directly join the sea, ﬂowing through Myanmar. Much of the rainfall (about 70 %) of the region is collected by Brahmaputra directly, or through its tributaries, ﬂowing through Arunachal Pradesh, Assam – north of the Barail range – and down the Bhutan hills and others descending from western Nagaland and the northern part of Meghalaya. Flowing through western Assam and touching Dhubri, the river joins the sea after collecting waters of Ganga and other rivers in Bangladesh. The Barak system, on the other hand, receives over 11 % of the total rainfall of the North-East and drains the region south of the Barail range, collecting waters from west Manipur, north Mizoram and Cachar. Flowing through Bangladesh and taking another name, Surma, it ﬁnally joins Meghna that ﬁnds its way into Bay of Bengal.**

1. Drainage Network of the Region

T he entire North-East region is drained into the Bay of Bengal, largely through the two principal rivers of the region, Brahmaputra and Barak, ﬂowing through Bangladesh. The drainage of a small area of Manipur, in its eastern part, ﬁnds its way into Chindwin, a tributary of Irrawaddy, which ﬂowing by Yangon (Rangoon) traverses its delta and falls into the Gulf of Martaban, a part of Andaman Sea. Another area, not included in the catchment of either of these two principal rivers, is the southern part of Mizoram, drained principally by Kaladan which falls directly into the Bay of Bengal on the west coast of Myanmar, at Sittwe (Akyab). Though the catchment of Brahmaputra extends into Tibet, Bhutan and Sikkim, besides India, much of the rainwater, falling in the North-Eastern Indian states, ﬁnds its way in the territorial waters of either Bangladesh or Myanmar before being discharged into the Bay of Bengal. The Brahmaputra drains the entire Arunachal Pradesh, through its tributaries emerging from the Himalayas or from the eastern hills. In its journey of over 1,000 km in the Indian territory, it collects a large number of tributaries, both from north and south, and develops a large catchment that extends into four states, Arunachal Pradesh, Assam, Meghalaya and Nagaland. A major part of the other two states, viz. Manipur and Mizoram, and roughly half the area of Tripura are drained into Barak. Both the major rivers have a large number of tributaries. Brahmaputra has over two dozen tributaries joining the river from the north as well as the south. Of these, the most important ones, that add enormous discharge and sediment load to the river, are the Arunachal Pradesh rivers. These, emerging from the Himalayas, traverse through 150–200 km of hilly terrain over steep gradient, experiencing heavy rainfall, and covered with enormous weathered mantle. The huge discharge of Brahmaputra during the rainy season and the resultant ﬂoods are caused essentially by the tributaries arriving from the north and east. Some of these rivers, like Subansiri, develop even a delta at their conﬂ uence with the main river. The excessive sediment transported by them is also responsible for the creation of several small and large islands, including the wellknown Majuli river island. Among the north bank tributaries, one may count, from east to west, Lohit, Dibang (the north–south transverse course of Brahmaputra itself in Arunachal Pradesh, locally known as Siang or Dihang, and ﬂowing for over 170 km, before it turns westward, at 90°, to resume its course in Assam as Brahmaputra) and further west Subansiri and its tributaries and ﬁ nally Kameng, as the principal tributaries of Brahmaputra. Further west, in Lower Assam a number of streams debouching from Bhutan Himalayas run a short north–south course before joining Brahmaputra. These include from east to west, Barnadi, Pagladiya, Manas, the river after which Manas sanctuary is named, Champamati, Saralbhanga and ﬁnally Gangadhar, the westernmost tributary of Brahmaputra. Of the tributaries joining Brahmaputra from the south, Noa Dihing and Burhi Dihing, the two branches of a single river, ﬂowing subparallel to Brahmaputra, Disang, Dikhu, Dhansiri and Kopili are the main ones. With the exception of Kopili, which occupies a fracture zone, most other tributaries of Brahmaputra follow a general constructional slope. Parts of some of these tributaries are guided by some lineaments, like Disang keeping its course to the Naga–Disang thrust. Some of the northern sub-tributaries of Brahmaputra follow a west–east course contrary to the general north–south alignment. This has been noticed even by early explorers. Two of the principal tributaries, i.e. Subansiri and Kameng, have several sub-tributaries ﬂowing in a west–east direction for over 100 km. Kamla, an important tributary of Subansiri, with a sub-tributary, Kurung, has a clear west–east alignment. Similarly, Tenga, an important tributary of Kameng, runs a long course of almost 80 km from Bhutan border on the west to a point, about 25 km west of Seppa town, before it joins the Kameng. Both these cases of east–west ﬂowing sub-tributaries are explained with reference to the thrusts between the middle and higher Himalayas, giving rise to a furrow- like structure parallel to the Himalayan range, subsequently occupied by rivers.

1.1 Brahmaputra and Its Drainage Characteristics

 The river Brahmaputra, the principal river of the North-East and one of the mightiest rivers in the world, in terms of its length, catchment and discharge, emerges from the Trans-Himalayan region. Though Brahmaputra ranks thirteenth in length among the rivers of the world, in terms of discharge, it is the third important river, with a mean discharge of 38,000 m3s−1, following Amazon and Congo in that order. This is 4.1 % of the total mean discharge of all the rivers of the world. The river carries annually 800 million tons of suspended load, which works out to 1,250 tons of sediment per km2 of drainage area. With a length of 2,897 km from its source in the Himalayas to its conﬂ uence with Ganga, a drainage basin of 640,000 km2 and 24 major tributaries, it is the largest river of the Indian subcontinent. The river is known to the Tibetans as Tsangpo, to the Chinese as Ya-lu-t’sang-pu, to the Indians as Brahmaputra and in Bangladesh it is called Jamuna.

 The river emerges from the Chema-yungdung glacier (30°-31′ N and 81°-10′ E) about 100 km southeast of the lake Manasarovar. The three head streams of the river are the Kubi, the Angsi and the Chema-yungdung. In Tibet, the river runs for approximately 1,200 km and has a shallow channel unlike Indus and Sutlej, which have cut deep channels in western Tibet. It ﬂows at an altitude of 4,534 m ASL at Drongpa Tradun and at 3,610 m at Shigatse (Zhigatse). After passing Pi (Pe) in Tibet, the river turns North-East and ﬂows through a succession of narrow gorges between the massif of Gyala Peri (7,150 m) and Namcha Barwa peak (7,756 m ASL). Skirting past Namcha Barwa (Namcha Barwa is located in the loop of Brahmaputra), the river ﬂows in a deep gorge, believably 5,000 m deep, turns south-west, and cutting across the Himalayas, enters Arunachal Pradesh near Korbo (3,262 m in close proximity) as Dihang river. The Dihang runs for 240 km in an incised valley before it enters the plain at Pasighat where it takes a westward turn, assuming the commonly recognised name Brahmaputra. Down Pasighat, the river ﬂows E–W in Assam for over 700 km before it turns south at Dhubri and enters Bangladesh. Known as Jamuna in Bangladesh, it collects the waters of Padma, a distributary of Ganga and other rivers, before debouching into the Bay of Bengal. The estimated length of the different segments of Brahmaputra varies, but a best estimate, according to the present author, is as follows:

 Segment of Brahmaputra Length (km)

l. Tibet 1,400

2. Arunachal Pradesh 260

3. Assam 770

4. Bangladesh 450

Total 2,880

 The Brahmaputra ﬂows in a west–east trough, collecting tributaries, both from the north and the south. In Tibet, it ﬂows at an altitude of 4,500 m ASL, in a shallow trough, in the rain shadow of the Himalayas. The height of the thalweg at Drongpa Tradun, at 30°0′ N and 83°59′ E, is 4,524 m ASL, while at Shigatse 29°10′ N and 89°0′ E, it is 3,609 m. The height of the riverbed further east, before it skirts Namcha Barwa at Gyala Peri, is only 2,440 m implying a very deep gorge. The longitudinal proﬁ le of the river in Tibet does not show a signiﬁ cant gradient. From Drongpa Tradun, about 180 km down the source of Brahmaputra, located at a height of 4,525 m ASL to Shigatse (3,609 m ASL), about 450 km down Drongpa Tradun, there is a drop of over 900 m, but from Shigatse to Gyala Peri where the thalweg has a height of 2,440 m ASL, the drop is more than 1,150 m. This is the steep upper end of the gorge that skirts Namcha Barwa. The longitudinal proﬁ le of Brahmaputra in Tibet appears to have two segments which represent two concave proﬁ les developed during two different erosional phases or have resulted from the structural inﬂ uence in two different lithological provinces. Lhasa (29°42′ N and 91°08′ E) at a height of 3,659 m ASL, 45 km north of Brahmaputra, receives a mean rainfall of 388 mm with a maximum in July and August. In its upper half the river is overlooked by a highway (H. No. 219 of China and further down no. 318), which at Chushul turns North-East to link Lhasa and the territory beyond. At Cyemdrong (Kyemdrong), about 200 km upstream of Namcha Barwa, the river takes a turn towards North-East and, ﬂowing for about 200 km, skirts the Namcha Barwa peak (7,756 m) trough a gorge, 5,000 m below the adjacent peak, turning again southwest-ward to cross into Indian territory through a succession of rapids and falls. The meeting of the two concave proﬁles, the end of the gently sloping one, starting from the source region, and the beginning of the lower one starting from Shigatse, is marked by a braided channel, suggesting a change of gradient. In fact, the appearance of braided channels in the course of Brahmaputra in Tibet is suggestive of either a change in hydrological regime because of the conﬂuence of some tributary or a change in the structure of the terrain. Down Chemnak (94°30′ E) located on the bank of the Brahmaputra, the river starts incising its course vigorously, and ﬂowing in a gorge, skirts Namcha Barwa before it turns southwest and enters Indian territory at 95°05′ East, the nearest settlement being Korbo at a height of 3,267 m ASL. In Arunachal Pradesh, the river has a course of 260 km. From 776 m at Korbo, the settlement near the entry point of Brahmaputra, the river forms a steep concave proﬁle and enters the plain at Pasighat (157 m ASL), thus descending over 600 m in a distance of 230 km. This is the most signiﬁ cant stretch of Siang from the point of view of energy generation. India has planned a couple of mega hydroelectric projects in this zone. Known as the Upper and Lower Siang projects, these are meant to harness almost a third of the hydroelectric power potential of the state of Arunachal Pradesh. The energy planners of India may be revising the location and evaluated energy potential of the river after the construction of Zamu dam in Tibet. From Pasighat in Arunachal Pradesh, the river ﬂows in a plain for 35 km to the south, before it receives two prominent tributaries, the Dibang and the Lohit from the north-east and east in the neighbourhood of Sadiya (134 m ASL). Receiving the discharge from the tributaries and sub-tributaries and their headwaters, extending up to the international border with China, Myanmar and beyond, the river assumes its mighty appearance down Sadiya. At Sadiya, an enormous discharge of water from the large catchments is funnelled into Brahmaputra. In Arunachal, Brahmaputra is known as Dihang or Siang, but down Sadiya, it attains its widely recognised name, the Brahmaputra. From Sadiya, turning southwest-ward, the river runs for 720 km in Assam, in what is known as Assam valley or Assam proper (Fig. 5.2a, b) . This stretch of the river is the most signiﬁcant part and could be called the cradle of Assamese culture. The Brahmaputra is the lifeline of Assam providing abundant supply of water, important avenue for ﬁsheries and other aquatic life, a splendid and economic means of transport and easy connectivity over ﬂat terrain. But, notwithstanding the contribution to the economy and culture of the people of the region, it also brings miseries and causes loss of life and property whenever it swells beyond its bank and inundates large part of the plain. Thus, the river is also a curse for Assam, almost as much as it is a boon. The longitudinal proﬁle of the river from Dibrugarh to Dhubri presents an imperceptible slope. The 720 km of the course of Brahmaputra, in Assam, is marked by braided channels; sandbars, sometimes with permanent large islands and shoals; and a width ranging from 3 km near Guwahati to 7 km at Dhubri. The sediments supplied by the tributaries in Assam, like Subansiri or Kameng, add to the already heavy load of sediments brought from the upper part of the catchment. This additional load of the river, already overcharged with sediments, creates a situation where the river dumps its excess load, giving rise to sandbars and islands. The river changes into an intertwined braided river with sandbars, shoals and islands. The island of Majuli, 70 km long and 10–15 km wide, developed on the mouth of Subansiri that has dumped enormous amount of sediment load at its mouth, blocking its own conﬂuence and developing another channel subparallel to Brahmaputra, to join the latter about 70 km downstream at Subansirimukh. Braiding of the channel, meandering of the tributaries, emergence of islands and distributary channels, as a result of blocking of the mouth of the tributaries, is a common phenomenon in Brahmaputra. Distributary channels, ﬂowing in downstream direction, are common in the case of most of the important tributaries, though it is most noticeable in the case of Subansiri, on the northern side, and Kalang on the southern bank of Brahmaputra. Right across Tezpur where Kameng joins Brahmaputra, Kalang, a distributary channel, bifurcates from Brahmaputra on its left bank and joins the river about 25 km downstream near Guwahati. A cross proﬁle of Brahmaputra is marked by a ﬁrst distributary channel, followed by Chapari , swampy island, often covered with 2–3 m tall grasses, one of the braids, a shoal, another channel and ﬁnally another braid or the outer channel and ﬁnally the ﬂood plain of the river. Only at a few points like Tezpur (Silghat), or Guwahati (Saraighat) or at Goalpara, the river ﬂows in a narrow and relatively deeper channel. The braiding and the width of the channel increase in the western part of Assam, where the river gets further charged with an excessive load transported by tributaries, particularly those descending from Bhutan hills. Manas emerging from Bhutan Himalayas is one such river. The tributary streams that join Brahmaputra after it debouches in the plain of Pasighat join from both sides north and south. In the eastern part, the Siyom, a tributary subparallel to the main river Siang, joins the latter before it emerges from the hills. The Dibang and the Lohit, converging from the north-east and east, join Siang further west, and the latter assumes the name Brahmaputra. The main tributaries from the north, all of them transverse to the Brahmaputra, emerging from the Himalayas and ﬂ owing through Arunachal territory are Subansiri and Ranga with large number of sub-tributaries, and further west Jia Bharali, Dhansiri (right bank tributary), Puthimari, Pagdaliya, Manas, Champamukhi, Saralbhanga and ﬁnally Sankosh that forms the border between Assam and Bengal. West of Dhansiri, most of these northern tributaries of Brahmaputra originate deep inside Bhutanese territory at altitudes ranging from 5,000 to 7,000 m ASL. The southern tributaries of Brahmaputra, recounted from east to west, include Burhi Dihing, Disang, Dikhu, Jhanzi, Kakadanga, Dhansiri, Jamuna and Kopili. Of these Burhi Dihing, Noa Dihing, Dhansiri and Kopili are more voluminous in their discharge. The ﬁrst three of these rivers originate from Naga Hills, but Dhansiri, Jamuna and Kopili originate from the northern slopes of Barail range. There are also few rivers from the northern half of Meghalaya that join Brahmaputra. Some of these rivers, particularly Burhi Dihing, Dhansiri and Kopili, are highly meandering and navigable for a large part of their course.

* 1. Barak River and its tributaries

esides Brahmaputra, the other important river system in the North-East is Barak, earlier known a Surma. It is the most important east–west ﬂowing river, south of Barail range. Barak, like Brahmaputra, has two major segments, the north–south segment ﬂowing largely in the western part of Manipur and the east–west segment occupying southern Assam, commonly known as Cachar plain. The river, originating in the mountainous complex on Nagaland–Manipur border, ﬂows south in a synclinal depression until it reaches the Mizoram border; it is joined by the river Tuivaw ﬂowing northward. The river turns westward almost at right angle, near Jirighat. Draining the Cachar plain and the three districts of Cachar (Silchar), Hailakandi and Karimganj, the river divides itself into two branches, the northern branch known as Surma that ﬂows by Sylhet City in Bangladesh and the southern one called Kushiara that also ﬂows southwest-ward to ﬁnally combine with other streams to be merged into the Meghna river. Surma, of which the Indian segment is known as Barak, has a total length of 890 km. But Barak, from its source in northern Manipur hills on the border of Nagaland till it enters Bangladesh, has a length of 396 km. It has a catchment of 28,567 km 2 in the North-East Indian states, collecting water from western Manipur, northern Mizoram, Cachar, Hailakandi and Karimganj districts, and a very small area of North Cachar Hills. T he river has a very peculiar course and appears to have formed by joining different stretches of various rivers through river capture. Originating from North Manipur hill complex (1,871 m) close to Nagaland border, the river runs in NE– SW direction for a distance of 150 km in a narrow often deeply incised valley till Tipaimukh (it should be Tuivâimuka) on Manipur–Mizoram border where it is joined by north-ﬂowing Tuivai river from Mizoram. After its conﬂuence with Tuivai, the river turns northward with a very acute bend, and runs for 35 km before it is joined by the river Jiri coming from north, at Jirimukh, and then turns westward into Cachar plain. While the course of Barak up to Tipaimukh appears natural, as it ﬂows in a synclinal depression, the sudden turn westward appears far from natural. What appears certain is that it is the Tuivai, which following a synclinal depression with a plunge toward north, captures Barak that ﬂ ows all through Manipur and continues northward till it is captured at Jiribam, by the headwaters of a west-ﬂowing river, assuming the name Barak. The westward ﬂow of Barak, from Jirimukh to Silchar and beyond, is sluggish as the river ﬂows on a much gentler slope, creating the Cachar plain. The river Barak to Cachar is as important as Brahmaputra to Assam. Both the rivers have developed similar plains, east–west aligned, perfectly ﬂat but relatively narrow. Barak is, however, much smaller. B arak receives a number of tributaries, from the north as well as south. While Makru and Jiri, both west of Barak, are the tributaries that join the river from Manipur, Tuivai joins it from Mizoram and a number of tributaries, namely, Sonai, Rukri, Dhaleswari and Langai, join it from the south in Cachar, Hailakandi or Karimganj district (Photo 5.2 ). An important feature of Barak’s course is its transverse ﬂow to parallel and subparallel to late Tertiary ridges that form the undulating terrain of Mizoram, Cachar and even Tripura. It cuts across these ridges on their northern ends where they either disappear and are buried or they assume a very low proﬁle. This explains partly the high banks of the river, which are not in Quaternary alluvium but remnants of earlier periods.

* 1. Other River Systems of North East India

ost rivers of the North-East join one or the other of these two major rivers, i.e. Brahmaputra and Barak, yet there are few rivers in eastern Nagaland, eastern Manipur, southern Mizoram and Tripura which either join some other river in Myanmar or Bangladesh or ﬂow directly into the sea. The largest river in Nagaland is Diyung or Tapu, which ﬂows north from the central hill complex in a syncline, cuts across the ridge on the west, turns south and ﬁnally joins Dhansiri, a tributary of Brahmaputra, joining the latter at a point, south of Golaghat. Another tributary of Dhansiri is Diphupani or Diphu, which originates from the neighbourhood of Mt. Japvo and, moving swiftly in a hilly terrain, joins Dhansiri, about 8 km north of Dimapur. The other rivers, moving northward as tributaries or sub-tributaries of Brahmaputra, are Disang, Jhanzi and Dikhu, all joining Brahmaputra as its tributaries. Dikhu passes by Sibsagar, the erstwhile capital of the Ahom kings, during medieval period. A very small part of Nagaland, in the southeast, is drained to Chindwin river in Myanmar. The most important of the Nagaland rivers, draining into Chindwin, is Tizu which, with its tributary river Zungki, crosses the international border with Myanmar, about 20 km south Saramati (3,826 m), the highest point on Indo-Myanmar border, and joins Chindwin at Tamanthi. In Manipur, the divide between Barak basin lying in India and the Chindwin in Myanmar is formed by a north–south longitudinal ridge, which is also the site of the main route between Nagaland and Manipur, joining Kohima with Imphal. The rivers in the eastern third of Manipur, particularly south of 25° north, ﬁ nd their way in the cross-border region of Myanmar and join Chindwin. The western part of Manipur is characterised by parallel and subparallel streams, sometimes capturing the neighbouring streams by a vigorous headward erosion of their tributaries, which breach a low divide and change the orientation of the streams. The western border of Manipur is demarcated by three rivers, Jiri in the northern part, Barak in the centre and Tuivai (Tuivaw) in the southern part. In Manipur, Jiri, Makru, Barak and Irang or Tuilong are the three principal rivers – all of which ﬂow southward and, through a series of capture, end up in Barak river, which moves westward ﬂowing east–west through Cachar. In Mizoram, the northern half of the region is drained by three important rivers. From west to east, these are Dhaleswari, Sonai and Tuivel, all joining Barak after ﬂowing over 100 km to the north. All these rivers are remarkably straight, without any meandering. The border of Mizoram with Myanmar is formed by two rivers, Tio or Tyao in the north and Tuipui or Boinu in the south. Like Mizoram–Myanmar border, Mizoram–Bangladesh border is also formed by a river course or a ridge. The most important river in south Mizoram is Kaladan, which collects the waters of the southern part of the state and joins the Bay of Bengal at Sittwe in Akyab Creek, in Myanmar. In Tripura, while the river Gomti ﬂ ows westward, another river Feni, ﬂowing southward, ﬁnds its way into the sea. The Meghalaya plateau falls into the catchment of two river systems. The northern part of the plateau is drained into Brahmaputra through its tributaries, while the drainage of the southern half ﬁnds its way into Surma–Meghna catchment in Bangladesh. The streams ﬂowing to the south are characterised by falls as a result of retreating nick points in the longitudinal proﬁles of these rivers. Invariably, these rivers have to cut through the fault escarpment, associated with Dauki fault, on the edge of the plateau, to join the river Surma in Bangladesh. In the process, they make deep gorges in the plateau, close to the escarpment. The divide line between the northerly and south-ﬂowing rivers is a little indented. In the centre of the plateau, it moves northward. This arched divide line passing from east to west, joining the highest points on the plateau, has shifted to the north because of greater relief energy available to the south-ﬂowing streams as a result of the fault escarpment, over which they ﬂow to negotiate the base level, over 1,000 m lower, in Bangladesh. It is also likely that the headwaters of some of the north- ﬂowing streams are pirated by the rivers ﬂowing southward. The main rivers ﬂowing southward, from west to east, are Simsang-Someswari, Krishiang-Jadukala, Shella and Umsohung, while those ﬂowing north, counted from west to east, are Ghagua, Krishnai, Dudhani, Umkhri, Umian, etc. All these rivers while descending from the plateau make falls, which are more numerous in the course of south ﬂowing rivers. Some of the south-ﬂowing streams, occasionally ﬂowing through limestone terrain, develop blind valleys witnessed during the dry season. Generally, ﬂowing over steep gradients – though part of the streams may ﬂow over ﬂat terrain for a short stretch of 15–20 km – these rivers seldom, if ever, experience ﬂoods, but are not always easy to cross in their lower stretches, on the margin of the plateau, where they make gorges, rapids and falls, and are deeply entrenched. A noticeable characteristic feature of some of the valleys, on the plateau, is their broad, trough-like cross proﬁles. Sufﬁciently deep, yet broad and open, they unmistakably suggest a glacial valley, a palaeoclimatic remnant of the late Quaternary. It is not inappropriate to imagine such a relief carved out either by glaciers or even by an alternative sequence of glacial and pluvial phases. Several ﬂat surfaces on the northern face of the plateau, notably at Umsang and Nongpoh, suggest a scooping by glaciers.