THE GEOGRAPHICAL JOURNAL

VOLUME XCVI

JULY TO DECEMBER

1940

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL

EDITED BY THE SECRETARY

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE LONDON S.W.7

EDWARD STANFORD LTD. 12 LONG ACRE W.C.2

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GEOGRAPHICAL JOURNAL

Vol XCVI No 1 R.G.S. *July 1940*

BOTANICAL AND GEOGRAPHICAL EXPLORATION IN THE ASSAM HIMALAYA

F. KINGDON WARD

Meeting of the Society, 30 October 1939

GEOGRAPHICALLY Assam is the valley of the Brahmaputra between its exit from the hills and its right-angled turn to the south, in Bengal: a triangular or funnel-shaped plain lying on its side, with its mouth gaping open to the west, corked at its apex by a knotted mass of mountains. A trident of rivers enter the apex and unite to form the Brahmaputra. North and south the Assam valley is bounded by converging ranges of mountains: those to the south are the Naga Hills, separating Assam from Burma; those to the north are the Assam Himalaya, forming the ramparts of Tibet.

In the first decade of the present century the Assam Himalaya were still an almost mythical region; geographers did not know what became of the Great Himalayan range east of Bhutan, or even whether it continued as a well-knit range. It was unlikely that it ended abruptly in Bhutan, but precise knowledge was lacking. Looking northwards from Kohima in the Naga Hills in winter, one can see across the plain of Assam and the Brahmaputra a distant line of snow peaks, over 21,000 feet high. These are the Assam Himalaya, seen obliquely, so that they quickly fade out of the picture; they do not stretch squarely across the horizon.

Opposite the Bay of Bengal the Himalaya reach their southernmost limit, and from a general north-west–south-east alignment gradually turn north-east, and trend clear away from the plains. If we try to pass along the foot of the mountains, we shall find it a more exacting task going east than it is going west. The reason is that owing to the funnel shape of the valley the monsoon rushes up it like a tidal bore in a narrowing estuary, and the rainfall increases rapidly eastwards, till at the foot of the Abor and Mishmi Hills beyond Sadiya it exceeds 200 inches. The deep screen of lesser ranges between the edge of the plain and the main crest-line, drained by the Subansiri river and its tributaries, also adds to the difficulties of eastern Himalayan exploration; as a climax, these foothills are inhabited by quite unreliable tribes. Hence

east of the Bhutan frontier there is only one road from the plains of India over the Himalaya on to the Tibetan plateau, in a distance of 250 miles, although between the point where the Subansiri breaks through and the Dihang gorge there are numerous passes over the main range, locally used for a few months in the year. The main range in the last 150 miles of its north-eastward extension is surprisingly low, until suddenly elevated in the towering spire of Namcha Barwa. The presence of these numerous flat low gaps in the range, of which the Doshong La is a good example, testify to the work of glaciers, and prove conclusively that the eastern Himalaya has been a very wet area since before the Pleistocene ice age.[1]

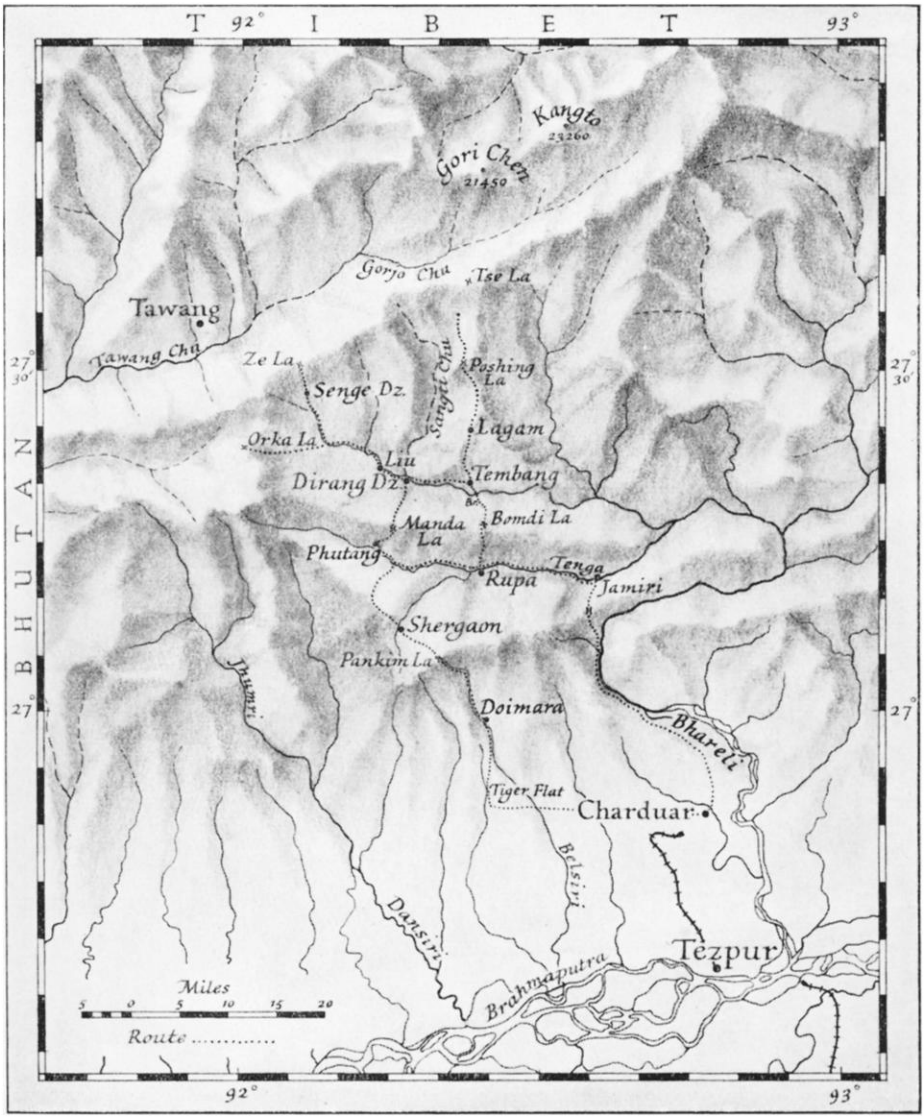
It was not till the twentieth century that explorers became aware of the easy route into Tibet referred to above. It had been assumed, not without reason, that the dual obstacles of savage tribes and fanatical monks would bar approach from this direction: it was known that the mysterious monastery of Tawang exercised its authority for some distance to the east of Bhutan. Actually, a strip of country about 40 miles wide between the Bhutan frontier and the Bhareli river, where the rainfall is comparatively low, is inhabited, not by savage tribes, but by a people allied to the Bhutanese called Mönba, and their offshoots, Sherdukpen and others; while the hostility of the monks of Tawang appears to have been exaggerated. This strip of country, lying to the south of the main Himalayan chain and reaching almost to the edge of the Assam plain, is called Mönyul and has long been under the influence of the Tibetan church. Nevertheless it was only gradually, through the explorations and influence of a number of political officers (notably Colonel F. M. Bailey, Captain Nevill, Dr. Norman Bor, I.F.S., and Captain G. S. Lightfoot) that this route became established and in a sense opened up to the botanical explorer.

While geographically Assam is a well-defined monsoon region, consisting of the plains valley of the Brahmaputra, politically as a province of the Indian Empire it is less natural and more unwieldy, including mountains as well as plains. A frontier there had to be, and it could not be on the edge of the plain; that might conceivably imply an unfriendly power surrounding the province on three sides. Therefore it had to be in the mountains. In India we have always gone far back into the mountains in search of a frontier, until we came to the highest range of all, the actual crest-line and watershed of which was selected as the frontier. But watersheds, especially in the eastern Himalaya, are often cut through by rivers, thereby losing some of their status. The passes over a mountain range also present difficulties if both sides wish to control them.

In the *Journal* for November 1936 I described my journey across southern Tibet, which I reached *via* Mönyul; but of Mönyul itself I said little, as I passed rapidly through the country. It is of that region, on the southern slopes of the eastern Himalaya, between the plains and the Tibet plateau, that I am going to speak here.

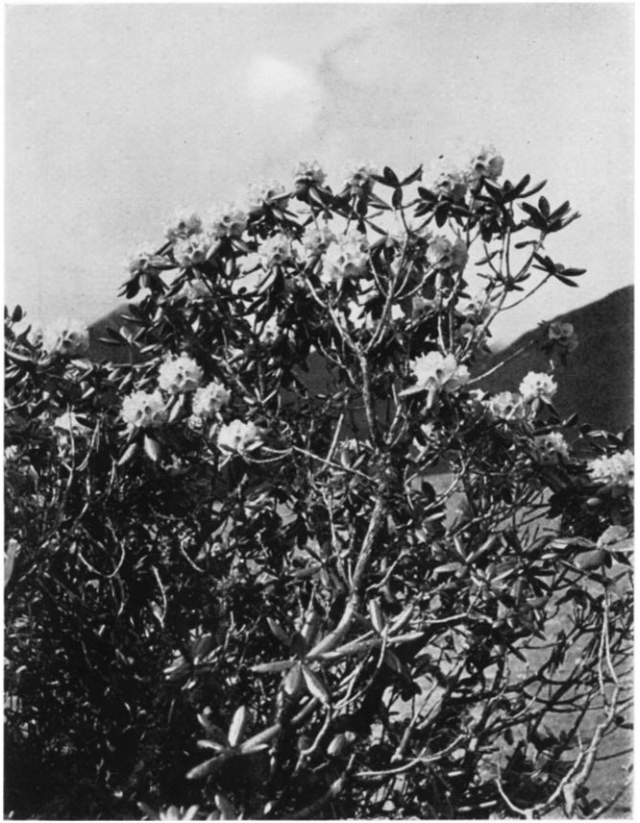
In April 1938 I started from Tezpur, an arid dusty town on the Brahmaputra, shorn now of its shoddy splendour as an Ahom capital. A rickety lorry

[1] Several of these passes have been explored by Mr. F. Ludlow and Captain George Sherriff.



Sketch-map showing the route followed by Mr. Kingdon Ward

Carved monastery window, Dirang Dzong



Rhododendron aganniphum

carried me and my belongings along the 21 miles of dirt road to Charduar, an outpost at the foot of the hills. The scenery is flat and uninteresting: paddy fields and tea gardens. Charduar, with its satellite station Lokra, is the headquarters of the Balipara Frontier Tract, one of three hill regions which surround the head of the Assam valley and through which passes the *de facto* frontier.

The Balipara Frontier Tract differs from the other two frontier tracts in the large proportion of unadministered to administered territory, which is about 5 : 1. But if the whole of Mönyul is considered part of the tract, only about a tenth of the area, lying on the plain, is administered. Between administered and unadministered territory a frontier known as the "inner line" is drawn. The hill tribes may cross the inner line on to the plains for purposes of trade, or to work; but no plainsman, whatever his creed, colour, or race, may cross the inner line and enter the hills without the written permission of the political officer. This is to avoid incidents with the tribes, who, as already remarked, are unreliable.

Charduar consists of the political officer's bungalow and a small village. There is a detachment of Assam Rifles at Lokra, 2 miles away; the whole is surrounded by paddy fields, tea gardens, and jungle. By the end of April the weather is very hot on the plain; the Himalaya are generally cloud-capped, but occasionally the snows show up, nearly 100 miles away, the peak of Gori Chen, 21,450 feet, conspicuous through the gap made by the Bhareli river.

The Assam Himalaya comprise a series of parallel ranges of ascending magnitude, all trending north-east–south-west. They may be divided into outer, middle, and inner ranges, with their corresponding longitudinal valleys. North of Charduar the outer range is comparatively high, in some places reaching 9000–10,000 feet, with the result that the valleys immediately behind the ridge are much drier than one would expect them to be so close to the plains. The outer ridge here, sometimes called the Akha ridge, for a length of 30 or 40 miles is high enough to break the force of the monsoon and act as a rain-screen; and whereas the rainfall on the south side is 90–120 inches, on the north side it is barely half that. It is through this "dry gap" that the Mönyul–Tibet road referred to passes. Farther east, and westwards towards Bhutan and Sikkim, where rivers have cut their way back through the middle and inner ranges, and even through the main Himalayan range itself, the outer ranges are lower, and the rainfall becomes heavier rather than lighter as one penetrates deeper into the mountains. In fact there is no lessening of the rainfall until the main crest-line itself is crossed, and at the extreme eastern end of the Himalayan chain even this forms a very imperfect rain-screen, the rainfall north and south of the main range being much the same.

I left Charduar on April 27 for the five days' march over the outer range to the first village in Mönyul. There is a dry-weather motor road westwards along the foot of the hills for 24 miles; but the Belsiri river is not bridged, and from this point it is necessary to go on foot. The baggage is carried by coolies.

Turning north from a camping-ground on the edge of the plain, called Tiger Flat, the path joins a valley which enters the hills. By the end of the third day's march from Charduar we had ascended 2000 feet, following the rocky bed of a

torrent; we were then in the evergreen rain-forest which grew rapidly more temperate as we continued to climb. On the fourth night we camped a little below the Pankim La, the first Himalayan pass, about 9000 feet. All round us was a forest of magnificent trees, including oaks, maples, hollies, birch, magnolia, *Michelia*, and rhododendron, while a little higher along the ridges grew hemlock spruce. The big trees were thickly felted with moss, and from every limb sprang flowering shrubs, especially *Rhododendron Lindleyi*, now in fine bloom, as well as masses of ferns and orchids. The rainfall here exceeds 100 inches, and the air is always cool and moist. In three days we had passed from monsoon to moist evergreen temperate forest.

Crossing the pass next morning we came suddenly into forests of blue pine (*Pinus excelsa*) and deciduous oak, freshly clothed with young foliage; and descending through open glades, sprinkled with woodland flowers, reached cultivated fields and a village. We had descended barely 2500 feet from the pass, and were in a much drier country of wide elevated valleys and wooded rounded hills.

Shergaon, though not strictly a Mönba village (the inhabitants call themselves Sherchokpa), is under the influence of the Tibetan church. The natives speak a dialect of their own, and build curious three-storied houses, the ground floor of stone used as stables, the first floor of timber, where the family dwell, the second floor and roof of bamboo matting; the top floor is the storeroom and general junk cupboard: a loft rather than a room.

From Shergaon, using ponies as well as coolies, we crossed three more ranges of hills. The path, though generally steep and sometimes precipitous, was comparatively good. In these dry inner valleys, at 7000 feet I found the ugly little *Primula filipes* abundant on shady banks. For a century, since it was first discovered by Griffith in Bhutan, this plant has puzzled botanists; there is very scanty material of Griffith's collecting, and nobody seems to have met with it since his day. But gardeners would not say thank you for it. On the Manda La, crossed on the third day from Shergaon, I noticed a mixture of Sikkim and Bhutan plants, including such species as *Bryocarpum himalayicum* (in flower), *Primula Whitei* (almost over), and *Cathcartia villosa* (flowering in July), and Chinese plants like *Rhododendron euchaites* and *R. megeratum*, both in bloom. It is possible to say with fair accuracy now how far westwards in the Himalaya the Chinese flora penetrates; it is much more strongly represented east of the Bhutan frontier than west of it, although there is of course a certain uniformity in the alpine flora of the entire western China–Himalayan–Tibetan area, which I have named the Sino-Himalayan.

The Manda La is a long cross-ridge about 10,000 feet high. It is covered with forests of silver fir (*Abies Delavayi*) and tree rhododendron (*R. Falconeri*). From the north end of the ridge I had a glimpse of the snow-covered mountains of the Bhutan frontier to the west. A long steep descent brought us to a deep dry valley through which one of the headwater streams of the Bhareli flows eastwards. At the confluence of the torrent from the Manda La with this river stands the big village of Dirang Dzong, headquarters of the local administration of Mönyul. Here I made my base for six months' botanical work, occupying the travellers' rest-house, a barn-like stone-and-timber building with two non-communicating compartments. I was free to travel

westwards and northwards to the passes into Bhutan and Tibet, and eastwards to the edge of the jungle leading into tribal country.

In the course of the summer and autumn I made the following journeys: to the Poshing La *via* Tembang and Lagam, returning by the Sangti Chu (May 12–27); to the Orka La, on the Bhutan frontier (June 3–18); to Phutang *via* the Manda La, direct to Rupa (Dukpen), north over the Bomdi La, across the Dirang Dzong river to Tembang, Lagam, Poshing La, and back by Dirang Dzong as before (July 6–24); to Senge Dzong and the Tse La (August 14–30); to the Orka La as before (September 24–October 4); to Phutang, Rupa, and down the river to Jamiri, thence south to the Bhareli and Charduar (October 20–31).

The political status of Dirang Dzong is ambiguous. The surrounding country is ruled by two Tibetan *dzongpöns*, appointed from Tawang, who live in the "fort," a large white building perched on a hillock overlooking the village. They collect the taxes, listen to complaints, and maintain law and order without the help of a single soldier or policeman. In fact there is no visible force in Mönyul. Two abstract ideas, public opinion and custom, operate on the side of peaceful routine; and the church helps to restrain men from running amok. The Mönbas, who seem never to have struck a blow for themselves, are almost servile. They have definitely thrown in their lot with Tibet, and where Tibet cannot help them—as for instance against the Akha tribes to the east—they buy immunity. The Bhutanese ignore them; the Tibetans rule them; the Akhas fleece them; and the British have, or had up to quite recently, forgotten them. The *de facto* rulers of Mönyul are the Tibetan *dzongpöns*, but the Akha chiefs also pay periodical visits and collect the anti-aggression taxes for themselves, which the Mönbas pay as the price of immunity from tribal raids. The *dzongpöns* meanwhile hold aloof, feeling that so long as the Mönbas pay their Tibetan taxes, what they pay to the Akhas is none of their business. The Akha taxes are probably pre-Tibetan. After the Tibetan Church has had its share, what is left is the Mönba's own. He probably sees very little real money; but he appears to have enough to eat, lives in a substantial, if dark and comfortless, house, and enjoys life. Trade is carried on almost exclusively by the Bhutanese and Tibetans; the Mönba is a peasant or a herd. The Akhas do not appear to penetrate farther west than Dirang Dzong.

The principal crops are barley, which ripens in June, followed by maize, ripe by September, followed by a winter crop of buckwheat. Very poor crops of barley are raised, the attacks of "smut" being serious. But great pains are bestowed on the maize crop. A very little rice is grown at certain villages, as at Liu, and in the Sangti valley. Chilis are also extensively grown.

The cottage industries are weaving, paper-making, and wood-turning. There is a certain amount of building, carpentry, carving, leather work, and metal work, all rather crude but a great advance on anything the Akha tribes are capable of. The arts come from Tibet, and are in the hands of the priesthood. The only pastime is fishing, with rod, line, and noose. There are plenty of snow trout in the Dirang Chu.

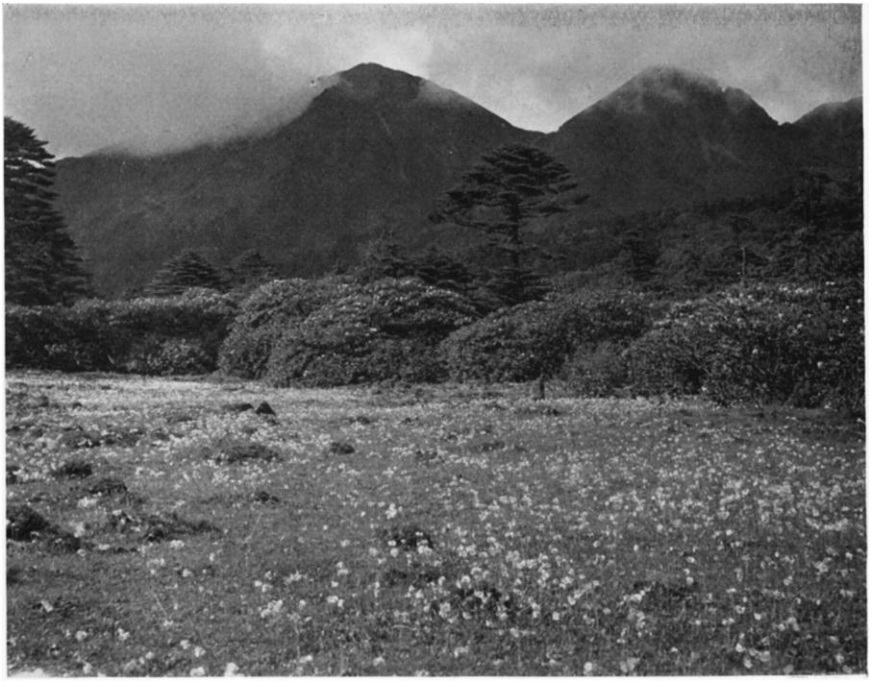
My first journey was to the Poshing La (11,950 feet) to see the rhododendrons in bloom. Twelve miles east of Dirang, on the left bank of the river, is

Tembang, a fortified village perched on a precipitous spur. It is, or ought to be, an outpost, guarding the upper valley from Akha raids. The position looks impregnable, and the village is surrounded by a wall, approached only from two directions by flights of steps. But the Mönbas are too timid to hold the fort, and tribal chiefs stroll insolently through the village collecting tribute. From Tembang we turned north towards the snowy range, and climbed to the small wooden monastery of Lagam (9200 feet), on a spur. This is the last habitation until two high passes have been crossed to reach Mago. The forest round Lagam is beautiful, and here is the mixture of Chinese and Himalayan species to which reference has already been made. The rhododendrons include *R. Griffithianum*, *R. euchaites*, and the epiphytics, *R. Boothii*, *R. micromeres*, *R. Lindleyi*, and *R. bullatum*. There are also *Illicium*, *Michelia*, maples, oaks, laurels, and birch. The only common conifer is the weeping blue pine, *Pinus excelsa*, and this is dominant or comparatively rare according to local conditions. At this altitude the rainfall is, if not heavier, at least more persistent than lower down, with the result that there is a large epiphytic flora, including shrubs like *Eriobotrya* and *Pentapterygium* as well as numerous ferns and orchids. This forest, between 6000 and 9000 feet, may be called warm-temperate pine forest. *Lilium nepalense* var. *concolor* is found locally on bracken-clad slopes where the undergrowth is periodically fired to encourage pasture and keep down the forest, and pine is dominant but scattered. We spent the night at Lagam, and I noticed dusty but still gorgeous tragopan skins hung up in the monastery.

On May 16 we climbed the steep rocky path towards the Poshing La in pouring rain, and after ascending 1000 feet came in quick succession first into hemlock and then into silver fir forest: the first silver firs are met with at about 10,500 feet. We were now amongst tree rhododendrons of many species, and although at the lower levels some were already past their best, the total effect was magnificent; above 11,000 feet they were only just beginning to flower, and at 12,000 feet still in bud. The crimson scarlets of *R.R. Hookeri*, *barbatum*, and *arboreum*, the creams, and yellows of *R.R. Falconeri*, *sidereum*, and *grande*, the last three named with immense leaves, and the orange of *R. Keysii* inflamed the sombre forest of silver fir. We camped on a grassy alp where the ridge had been cleared of forest, with a deep pool of water on one side. The weather was very wet, but early the next morning, before the valleys warmed up, causing the cloud to rise, we enjoyed an extensive view. Eastwards we could see the mountains towards the Subansiri, southwards the plains were visible beyond the ridges we had crossed, and westwards the Ze La above Senge Dzong, and the Bhutan frontier.

After resting a day to botanize, we crossed the rocky Poshing La on the 18th. The gneiss cliffs of the pass are stark naked, but the dry stony bed of a torrent which formerly flowed from a glacier in the valley above was filled with interesting plants. Above 11,000 feet two tree rhododendrons, *R.R. Wightii* and a big-leafed species allied to *R. grande*, with magnificent heads of flowers in all shades of cerise and carmine, replaced the other species. *R. fulgens* (crimson) formed impenetrable thickets, but *R. Thomsonii* (blood red) and *R. campylocarpum* (sulphur) were not so common. The only undershrub species in flower was the pink *R. glaucum*. An unusual plant, mostly seen

Lilium Wallichianum, above Dirang Dzong



Meadows of Primula Dickieana at 13,000 feet

Dirang Dzong

Orka La: the last tree

clinging to some crag, was a pink-flowered form of *R. lanatum*. Normally this species has yellow flowers, but at the Poshing La, and in the next valley, at Mago, they were never anything but pink. When I visited the Orka La a fortnight later, I found *R. lanatum* even more abundant, but there the flowers were never anything but the typical yellow. The two varieties seem never to mix. The local distribution of rhododendron species in the eastern Himalaya is indeed puzzling. For example, at the Poshing La I collected about twenty-five species, but the common *R. campanulatum* was not one of them. In the next valley, at Mago, and at the Orka La, it is abundant. It seems to be missing also at the Ze La.

Enough has been said about rhododendrons to suggest that there are more species in the Assam Himalaya than in Sikkim and Bhutan together. In fact the number steadily increased as we went eastwards and the rainfall and humidity increased, reaching a maximum probably in the neighbourhood of the Tsangpo gorge. We camped at a clearing called Samjung (12,850 feet) in the valley north of the Poshing La, and a few miles south of the Tse La. It was very much colder here than on the ridge south of the pass, and scarcely a rhododendron was in bloom. So we recrossed the pass next day and returned to the other camp on the alp. The stream which flows past Samjung rises at the Tse La, and is the source of the Sangti Chu. Below Samjung it flows in a deep gorge, and for this reason one must cross the spur and descend by a ridge. Formerly a glacier from the Tse La flowed past Samjung and down the south face of the Poshing La, in the valley to the east. As the ice retreated however the stream found it easier to cut a valley for itself round the west side of the spur. It is because it was formerly a river bed that the south side of the Poshing La is so difficult.

We spent a few days at the alp, where it rained persistently. It was still early for alpine flowers, but the rare *Primula Wattii* (like a woolly grape hyacinth) was just coming into bloom, and on the gneiss cliffs grew a delightful primula with white or navy blue flowers, and wash-leathery leaves. Starting down on May 25 in a deluge, and taking the short cut to the Sangti river, we reached Dirang Dzong on the 27th. There are six or eight villages up the Sangti Chu, the two largest being Sating on the right, Pootung on the left bank. At a village called Kaso there is a cantilever bridge, and there is another just above the Dirang Chu confluence. The total number of houses in the valley is about a hundred, and the total population 400–500.

On June 3 we set out for the Orka La, a pass used by traders coming from eastern Bhutan. The main path goes straight up the ridge from Dirang Dzong, but it is very steep for the first 2000 feet. Instead, we went up the main valley to Liu, a village containing almost as many houses as Dirang. The houses are closely packed, but higher up the slope is a small and picturesque monastery where I was given accommodation.

Next day we ascended several thousand feet to a Drokpa village of six or eight bamboo huts, in an extensive artificial pasture in the midst of forest. There is no cultivation, for though the altitude is not much more than 8000 feet the local crops will not ripen at this height. In Tibet, crops are grown at very much higher altitudes; but there the climate is dry. The slopes have been extensively cleared to encourage grazing; but the chief result of cutting

and burning the forest is to prepare the ground for large invasive weeds rather than grass. True there are impenetrable thickets of *Arundinaria*; but this is not a grass fit for grazing by cattle. Elsewhere one sees colonies of fern and of an immense leafed Composite. No experiments or continuous observations as to the effects which follow the destruction of high-altitude vegetation seem to have been undertaken. An important problem is the investigation of the effect of deafforestation at 9000–12,000 feet in the eastern Himalaya, where the total number of grazing cattle, sheep, goats, and ponies is high. It would appear that in many places the forests are destroyed without any corresponding advantage resulting. Indeed positive harm may be done to the grazing it is intended to promote. Thus the ground sometimes becomes waterlogged owing to the absence of trees to take up the moisture: with the result that certain species of primula, notably *P. Dickieana* and *P. Kingii*, which cattle will not eat, take complete possession of the ground. The seres which follow the destruction of climax vegetation in the alpine region vary. Grass may be encouraged for a time, but this appears to be a very temporary and unstable phase.

From this Drokpa village we had a fine view of the main snowy range to the north. The Drokpa are a sturdier, better dressed, and better looking people than the Mönba peasants. In every Drokpa village one finds one or more summer resident monks from the monastery under whose wing the territory lies. They are permitted to marry.

Our third day's climb was a short one. Crossing a ridge, we joined the direct path to Dirang Dzong, and ascended through a forest of silver fir and rhododendron to a large shallow basin-shaped marsh, where we camped on a low mound. The marsh was crimson with myriads of plants of the tiny jewel-like *Primula Kingii*, almost touching one another. Interspersed with them, and few by comparison, were scattered plants of the even smaller *P. glabra*. Round the fringes of the marsh, irises were coming up, under the shadow of big rhododendron bushes, *R. fulgens*, *R. campanulatum*, and *R. Wightii*.

The fourth day's climb up the steep ridge to a pasture above the tree-line near the pass was longer. This was on a ridge at the head of the valley, altitude about 13,000 feet. Tufts of dwarf rhododendron, like large comfortable hassocks (the pink *R. anthopogon* and the purple *R. fragariflorum*), competed with pasture consisting largely of *Primula Dickieana*. Where the ground was marshy the primula formed almost solid sheets; but on drier ground the rhododendrons held their own. In some places the cutting and burning of the forest had encouraged scrub or dwarf rhododendron, and a sere consisting almost entirely of one species (*R. aganniphum*) had resulted. As the scrub, growing 6 or 8 feet high, was cut and burnt, large colonies of *Meconopsis grandis* had sprung up, though this poppy, so abundant just here, is actually a rare and extremely local Himalayan species.

One further example of the changes induced by upsetting the climax balance of vegetation may be given. The narrow paths through the fir forest followed by cattle are thickly bordered by two species of primula, the yellow-flowered *P. strumosa* and the violet *P. Gambleiana*. Both species are rare and scattered as a rule; but large concentrations occurred wherever the yak passed to and fro. Superficially alike, except in flower colour, these two species

growing cheek by jowl, rarely cross, or at least the hybrid offspring, if they come up, rarely survive. On the exposed slopes, which are always steep, even precipitous, few trees hold their own, and here there was a certain amount of pasture. This was partly due to the fact that the dominant alpines were not June-flowering primulas, but autumn-flowering gentians (*G. amoena, G. gilvostriata, G. Szechenyi*). In fact the spring growth is very scanty, and the cattle not unnaturally prefer the lush marshes which they are rapidly transforming into fields of solid primula. The occurrence in the eastern Himalaya of *Primula Clutterbuckii*, which H. M. Clutterbuck discovered in the Mishmi Hills, Assam frontier, when we were exploring there in 1928, came as a surprise. It was far more abundant here than it was in the Mishmi Hills, and a stouter, better looking plant altogether. I might also mention an Androsace, like *A. sarmentosa.*

I ascended to the Orka La one day. Its altitude is 13,617 feet, according to Ludlow and Sherriff. The view into Bhutan is restricted, and Sakden, the highest village, a few miles down the valley, is not visible. Just below the pass on this side is a glacier lake, and there is a second lake up a branch valley. These glacier lakes lie in deep basins and have no shore, hence no wading birds are seen on them; I saw a pair of Brahminy duck one day, but nothing else. There are several kinds of pheasants lower down in the rhododendron forest.

The weather during the first half of June was bad, with a continuous gale blowing sheets of rain across from Bhutan. Descending by the direct path to Dirang Dzong, I found *Rhododendron cinnabarinum* and *R. Keysii* in full bloom, and on the rocky slope between 8000 and 10,000 feet a large variety of shrubs. These included *R. euchaites*, and lower down, *R. polyandrum*, one of the latest to flower, *Buddleia Colevillii, Neillia thyrsiflora, Litsaea, Cinnamomum, Cotoneaster, Spiraea, Viburnum, Salix*, and several others. The only large tree was a species of juniper, with an occasional larch or hemlock spruce at the higher level. It is from the rootstock of this juniper that the wooden cups are turned on the village lathe.

On July 6 I crossed the Manda La to Phutang, with the Political Mission which was on its way back to Charduar from Tawang. As usual, it was very wet on the high range, but comparatively fine in the deep valleys on either side. The magnificent *Lilium giganteum* was in flower near the pass, and in the forest the epiphytic *Rhododendron camelliaeflorum.*

From Phutang I turned east down the Tenga river, another tributary of the Bhareli, to Rupa (Rupraigya), reached in two days. On the second day we entered a fine limestone gorge, and here I first saw the beautiful *Lilium Wallichianum* in bloom on the grassy hillsides. We passed through patches of climax forest in the gullies where no fire had ever reached, and I noticed such trees as *Albizzia, Cedrela, Carpinus viminea, Acer, Schima Wallichii, Ilex, Ficus.* Later we found almost pure stands of old *Rhododendron arboreum*, with an undergrowth of bracken and grass, but hardly any shrubs. From Rupa I turned north again, and reached a small Khoa village hidden away in the mountains. The Khoas are a tribe split off from the Akhas, for whom they work. On the following day we crossed the ridge, camping in the forest at about 9000 feet, opposite to, but considerably higher than, Tembang. On

the third day we only got as far as a village on the right bank of the Dirang river, and several hundred feet above it; and on the fourth day, crossing the river by cane suspension bridge, we climbed about 2000 feet to Tembang.

Collecting a fresh team of coolies, we followed our previous route *via* Lagam to the Poshing La. The rhododendrons, with few exceptions, were now over—it was the middle of July—but the alpine vegetation was at its best, and in a trip to the pass between two bouts of fever I found several interesting plants including *Cremanthodium*, *Meconopsis sinuata*, *Nomacharis nana*, and *Omphalogramma*—perhaps *O. Elwesiana*, a rare Sikkim plant. Strange to relate, while we were camped near the pass the weather suddenly turned fine, and we were favoured with magnificent views. On the way down we camped on a grassy alp called Dongri, at about 10,000 feet altitude, surrounded by a forest of silver fir, hemlock, and rhododendron, mixed with *Magnolia globosa*, whitebeam (*Pyrus*), *Sorbus*, and other deciduous trees.

At sunrise the next morning the sky was perfectly clear, and to my surprise I had a splendid view of snow peaks forming a continuous range behind the Poshing La. They towered above the tree-clad range in the foreground, bearing 17° at one end, 28° at the other, *i.e.* about north-north-east from Dongri. Between the farthest forested ridge and the snows yawned a wide chasm, from which cloud was beginning to rise. These peaks may stand on the main Himalayan range, east of Gori Chen, which is 35 miles distant. But they seemed to me to be not more than 20 miles off, and may stand on the ridge crossed by the Tse La, at the source of a river which flows from the north to join the Bhareli some miles east of Tembang. If that is so they have not been intersected, and in fact are quite unknown; which seems rather improbable.

Round Dongri grow large bushes of a handsome Berberis with holly-like leaves, and big yellow flowers named *B. dasyclada*. In the forest grow numbers of the geranium-leafed *Primula Normaniana*, with mop heads of purplish pink flowers. Like *P. Clutterbuckii* it was first discovered in the Mishmi Hills. On the way down to the Sangti Chu I found a colony of *Lilium nepalense*. Most of them were over, but a few late ones were still in bloom and very beautiful they looked. There were not more than a hundred plants scattered over an acre or two of steep hillside; I never saw this plant again. *L. Wallichianum* on the other hand was common everywhere in the dry Dirang valley, as well as round Rupa.

In the middle of August I left Dirang to visit the Ze La, a pass on the main road to Tawang and Tibet, between the Orka La and Poshing La. The road goes up the valley to Liu, then climbs steeply to a village called Nyukmadong, and to Senge Dzong on a spur. From Senge Dzong it is a straight ascent of 4000 feet to the Ze La. We camped nearly level with the pass on August 19, at an altitude of about 13,600 feet. The Ze La is almost always enveloped in cloud, and during the week we spent here it was extremely wet. Often when the neighbouring ranges are clear the Ze La is hidden by cloud.

Above the pass the gneiss cliffs are rather bare, but on the sheltered side, in crevices, I found two tiny primulas and the sky-blue *Meconopsis bella*, with many other plants.

Returning to Senge Dzong I stayed a few days, and here I found an unusual-looking shrub, with bright brick-red flowers in poker-shaped heads, probably

a species of *Phlomis*. On the sunny slope below the ridge, a bright yellow-flowered orchid blazoned the rocks, and there was also a curious species of *Codonopsis*. From Senge Dzong we returned to Nyukmadong, and thence back to Dirang. There is a path over the mountains from Nyukmadong to Mago, but a heavily laden man cannot use it. I decided to stay in Dirang Dzong till the weather, now at its worst, improved; it was September 23 before we started on a second trip to the Orka La. Throughout September and October several species of clematis were flowering profusely, but there was not much else in the valley, which was drying up fast. At the end of the month we had sharp frosts in the alpine region, and the monsoon in the inner valleys had slackened off. The gentians were amongst the few plants in flower at this season, and they made a wonderful show on the alpine turf slopes.

On October 20 we started south for the plains, camping the first night just over the Manda La in order to collect rhododendron seed; next day we descended to Phutang. Following the small road westwards, as in July, we reached Rupa two days later. *Cypripedium Fayerianum* was in full flower on the limestone cliffs, to which it seems to be confined; and on these sun-baked well-drained slopes were equally large colonies of *Bergenia ligulata*, a big leathery-leafed saxifrage. The most direct route to Charduar from Rupa is *via* the Piri La and the village of Doimara, inhabited only between December and March by the Sherdukpen tribes. But Doimara is three marches from Charduar, and as the rainy season was not yet over on the plains, the people would take me no farther than there. I was in a hurry to get back to join another expedition, and did not fancy being dumped in the jungle at Doimara with no certain means of moving my kit from there. So I gave up the idea of crossing the Piri La and chose the route *via* Jamiri and the Bhareli river.

The Tenga valley east of Rupa is filled with pine-oak forest, like the country to the west. For a whole day we marched across one grassy terrace after another. Then on the second day, within the space of a few miles, pine-oak forest gave place to thick evergreen jungle. We had crossed an invisible line, beyond which the rainfall suddenly increased.

Jamiri is an Akha village of half a dozen long bamboo huts. But though the people are tame they are not very helpful, and are inclined to make all sorts of excuses for not supplying coolies if they can help it. However after a day's delay and much arguing, transport was supplied and we crossed in two marches the low ridge which separated us from the main Bhareli river. We were now in dense subtropical evergreen rain-forest, of pure Indo-Malayan type. The pass is hardly more than 6000 feet, and apart from several handsome species of begonia on the rocks, there were few flowers. On the fourth day from Jamiri we crossed the "inner line" at Bhalakpung, and reached the motor road 24 miles from Charduar, where we arrived on November 1, after an absence of just over six months.

My botanical collections from the Assam Himalaya (Balipara Frontier Tract) amount to nearly a thousand species, including an unknown number of new species, also numerous plants of horticultural worth, of which seeds were obtained. Particularly interesting was the discovery of many Chinese species so far west on the Himalayan chain. It is clear that Assam and north Burma

form the connecting link between the more strictly Himalayan element as in Sikkim, and the purely Chinese element developed in Yunnan; so that such plants as *Magnolia globosa*, *Rhododendron euchaites*, *R. bullatum*, *R. megeratum*, *Primula Wattii*, *P. Dickieana*, *Clethra Delavayi*, and many others bridge the gap. The Chinese element increases steadily east of the Bhutan frontier, and by the time north Burma is reached forms a large proportion of the vegetation, in spite of a high degree of endemism. Indeed the degree of endemism between the eastern Irrawaddy basin and the Lohit is probably higher than in any other section of this country of equal area. It includes high mountains with very heavy precipitation, and a perpetually humid atmosphere; the mountains are under snow for from four to six or eight months.

In most parts of Mönyul the rock is schist or gneiss, the latter forming the bulk of the high Ze La range. But in the south-east, between Phutang and Jamiri, and particularly in the Tenga valley, a hard light grey mountain limestone, weathering almost chalk white, is exposed. Here the streams flow in deep gorges. The flora of this limestone belt is noticeably different from that of other parts; and yet few of the plants appear to be confined to limestone, though their association may be characteristic of it. Above 12,000 feet glacier action is manifest, as at the Orka La, Ze La, and Poshing La. The river pattern appears to be consequent upon the glaciation of the eastern Himalaya. At first sight it looks complicated, but that is because many of the streams flow in deep gorges, which are quite impassable, so that the routes have to cross the ranges. It is the roundabout routes which are complicated, not the river system.

The Ze La range itself, and the country beyond it, is unsurveyed, and so also is some of the country to the south-east. The chief difficulty for the surveyors has been the courses of the rivers, which cannot be followed by the eye even from the highest peaks so far attained. Many peaks on the Ze La range and on the lesser ranges to the south have been fixed; but where the draughtsmen have had to guess the courses of the rivers, they have generally guessed rong. The river pattern of Mönyul may be briefly explained as follows:

The Ze La range, which strikes north-east–south-west, forms the water-parting between the eastward and westward flowing rivers. This Ze La range is an offshoot of the main Himalayan chain.

The eastward-flowing rivers rise on the southern flanks of the Ze La range, and flow to the Bhareli, which takes an easterly course, and joins the Brahmaputra above Tezpur. The westward-flowing rivers rise on the northern flank of the Ze La range, and flow westwards or south-westwards to the Manas, which itself flows southwards through Bhutan to join the Brahmaputra opposite Goalpara.

The westward-flowing rivers, as soon as they reach the forest zone, plunge into impassable gorges. (In the alpine region they flow in comparatively wide open valleys.) This is where they are *crossing* the Ze La range, which blocks their way to the south. The eastward-flowing rivers, having to cross no such obstacle, continue to flow in open valleys, although there are short gorges in the limestone districts.

Formerly all these inner Himalayan valleys north of Phutang were occupied

at their heads by glaciers. As the glaciers retreated they left as a legacy to the rivers which had sprung from them their wide shallow furrows. Gradually these streams cut for themselves V-shaped channels in the wide U-shaped furrows which they had inherited. This they were able to do easily, being charged with glacier grit: moreover their beds were steep, and the intense melting of the ice in summer, combined with the monsoon rain, gave a powerful volume of water. The country was then more like a plateau than it is to-day, and early Palaeolithic man, if he dwelt here, would have had no difficulty in crossing from valley to valley. There could have been little forest.

DISCUSSION

Before the paper the PRESIDENT (Field-Marshal Sir PHILIP CHETWODE) said: Mr. Kingdon Ward, who is going to lecture to us this afternoon, needs no introduction. He is a well-known botanist and a Gold Medallist of the Society, and has given us many papers upon the Burmese and Chinese borders of Tibet. During his last journey he went a little farther west and is now going to tell us of six months' experience in the Assam Himalaya.

Mr. Kingdon Ward then read the paper printed above, and a discussion followed.

The PRESIDENT: I am not going to call upon many speakers because I feel sure nobody wishes to stay late owing to the black-out. Perhaps Colonel Bailey will say a few words?

Colonel F. M. BAILEY: Mr. Kingdon Ward referred to the danegeld which the people of Dirang Dzong had given. My experience of that part of Tibet is that the Tibetan is the easiest person in the world from whom to extract taxes. He complains a good deal, but he pays. If you visit a village and ask an inhabitant to whom he pays the taxes, he will reply: "Well, there is the big landlord; every year we have to send him a yak and a pony. Then there is the monastery. We have to send them so many loads of butter and so many muskpods and other things for making incense. Then the white people come from over the border and we give them something too, usually salt. We have none ourselves, but we mix what we can get with sand and other things. Life is very difficult because of the terrible taxation under which we suffer."

I envy Mr. Kingdon Ward the weather which resulted in the wonderful photographs we have seen this afternoon. Many years ago I visited Dirang Dzong from the north, but was unable to take any photographs comparable to his. I experienced the most frightful rain during the whole period of my stay.

The PRESIDENT: I now ask you to thank the lecturer not only for his interesting lecture, but for what were some of the most fascinating photographs we have seen here, especially those of the plants: one could hardly believe the flowers were real.